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The many dimensions of child poverty: Evidence from the UK Millennium Cohort Study

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ABSTRACT

In this paper we use a multidimensional framework to characterise child poverty in the UK. We examine the interdependencies amongst the different dimensions of multidimensional poverty, and the relationship of multidimensional poverty with income poverty. We also explore the links between multidimensional poverty, income poverty, and children's cognitive and non-cognitive development. Our findings suggest that multidimensional poverty identifies many but not all of the same children classified using standard income poverty measures, although multidimensional poverty is rather more persistent over time than income poverty. Multidimensional poverty also has a detrimental impact on children's development over and above the negative impact of income poverty.

Keywords: child poverty; multidimensional poverty; income poverty; child development.

JEL classification codes: I32, J13, J62

1 Introduction and background

The *Child Poverty Act 2010* enshrined in law the commitment to end child poverty in the UK by 2020 in recognition of the widespread consensus that the implications of living in poverty are much more severe and lasting for children than for adults (Notten and Roelen, 2011a, 2011b). Children who grow up in poverty have poorer health and educational outcomes, both in the short-term and in the long-run (UNICEF, 2012). Growing up in poverty puts children at risk of permanent disadvantage, perpetuating an intergenerational cycle of disadvantage (Blanden et al., 2007, 2013). In April 2011, the Government published its Child Poverty Strategy (DfE/DWP, 2011)[1] which re-iterated its commitment to reduce child poverty in the UK, but at the same time argued that income-based measures of poverty do not capture the full impact of poverty. It suggested that a wider definition of poverty may be more appropriate and relevant, and proposed 10 broader indicators of poverty together with the measures of income poverty from the *Child Poverty Act 2010*.

In November 2012, the DfE/DWP launched its consultation on *Measuring Child Poverty* with its aim to develop a "multidimensional measure of child poverty ... wider than income alone to reflect changes across a range of dimensions ... that taken together, will reflect the reality of growing up in poverty in the UK today." (p.15). The consultation suggested eight dimensions for consideration: income and material deprivation, worklessness, unmanageable debt, poor housing, parental skill level, access to quality education, family stability, and parental health.

This recent policy debate on whether traditional income-based measures of poverty are really the best way of thinking about poverty, or whether the focus should be on what makes people poor, and what it means to be poor, is also reflected in the academic literature. It has long been stressed by scholars that individuals' well-being is intrinsically multidimensional (Townsend, 1979; Streeten, 1981; Sen, 1985) and there also now exists an increasing body of evidence in support of this view (Bradshaw et al., 2007; Tomlinson et al., 2008; Oroyemi et al., 2009; Nolan and Whelan, 2011). Consequently, societal measures of inequality and poverty should also reflect this multidimensionality. The poor themselves define their well-being and

[1] DfE: Department for Education, UK; DWP: Department of Work and Pensions, UK.

deprivation as multifaceted, with both monetary and non-monetary dimensions (such as life expectancy, literacy, housing quality etc.) regarded as important (Narayan et al. 2000). A richer understanding of the impact and longer-term implications of poverty and deprivation can, therefore, only be gained from careful consideration of these multiple dimensions.

For child poverty, specifically, another key criticism of income-based measures comes from the inherent assumption that higher household income is both necessary and sufficient for the provision of greater levels of material resources for children. However, differences over time and both within and between countries in such things as the provision of public goods, transfers (including subsidies for health and child care), housing costs, pre-school education provision, inter-temporal fluctuations in household savings and debt, and non-market attributes (Bourguiguon and Chakravarty, 2003), mean that there is no simple relationship between contemporary household income and the resources available to a child (Ringen, 1988). Further, income-based poverty measures, calculated from household income, ignore the intra-household distribution of resources (Ravallion, 1996) and this becomes especially important when we consider children who have no command over the distribution of resources available within a household. There may be households which are not income-poor, but insufficient resources are allocated to the children, and thus the children could be 'deprived'.

Along with the acknowledgement that poverty – however measured – does matter for children's well-being and life chances, there is also increasing evidence that it is the *persistence* of poverty that matters even more (Barnes et al., 2010; Schoon et al., 2010, 2012). In a recent paper (Dickerson and Popli, 2014), we compared and contrasted the impact of being in poverty (as measured by the conventional threshold in the UK of 60% of median equivalised household income) at any point in time with that of being *persistently* in poverty, in order to examine the cumulative impact of multiple and continuous periods of income poverty on the cognitive development of children. Our findings revealed that children born into poverty have significantly lower cognitive test scores, and that continually living in poverty in their early years in particular has a significant cumulative negative impact on their cognitive development.

The main aim of this paper is to bring together these two concepts – *multidimensional*

poverty and *persistent poverty*. To our knowledge, there exists no previous study for the UK which combines these two concepts in a systematic and rigorous way as is undertaken here. We investigate the different dimensions of child poverty in the UK at a given point in time and changes in it over time. We explore the interdependencies of the different dimensions and their co-relation with the more conventional measure of income poverty. Income poverty, as measured in the UK, is a measure of relative poverty, and as such, it captures what is considered as a 'normal' or 'acceptable' standard of living in society. As incomes increase over time, what is 'normal' also changes and a relative income poverty measure will capture this. In contrast, a deprivation index, based on child-specific needs, captures the deprivation faced by children and is closer to being an absolute measure of poverty (although is time-specific); it captures the 'basic' living standard in terms of access to amenities and resources. While there will be a degree of overlap between relative and absolute measures of poverty, it is possible that children can be in relative income poverty but not absolutely deprived (and vice-versa). We also examine the transitions (or dynamics) in income poverty and multidimensional poverty over time in order to see whether similar households/children are identified as being persistently in poverty. Finally we explore the relationship between multidimensional and income poverty, and the cognitive and non-cognitive development of children.

2 Measurement of multidimensional poverty

We use existing definitions of multidimensional poverty (Bourguiguon and Chakravarty, 2003; Atkinson, 2003; Alkire and Foster, 2011) to robustly measure multidimensional child poverty in the UK at a given point in time, and also its change over time.

Following Alkire and Foster (2011), our measure of multidimensional poverty is calculated as a weighted average of D different dimensions of deprivation: $x \equiv (x_1, x_2, ..., x_D)$. These dimensions can include social and economic deficiencies, as well as subjective and/or psychological indicators. x_d is defined such that a higher value indicates higher levels of deprivation. For each dimension, a threshold, $\pi \equiv (\pi_1, \pi_2, ..., \pi_D)$, is defined such that an individual is classified

as deprived on that dimension if they are above the relevant threshold, i.e. if $x_d > \pi_d$. From this we define a function: $g_d \equiv \max[0, (x_d - \pi_d)]$, that captures the extent of relative deprivation in dimension d. Once we have the measure of relative deprivation in each dimension, these are combined to calculate a deprivation score, c_i, for every child in the sample as:

$$c_i = \sum_{d=1}^{D} w_d g_d$$

where w_d is the weight attached to each dimension, with $\sum_{d=1}^{D} w_d = D$. From the deprivation score for each child, we can then define the multidimensionally poor, MP_i, as those whose scores, c_i, exceed some chosen poverty cut-off, k:

$$MP_i = \begin{cases} c_i \text{ if } c_i \geqslant k \\ 0 \text{ if } c_i < k \end{cases}$$

Each dimension, d, can in turn be defined by multiple indicators. For example, if one of the dimensions of interest is 'housing quality', this can be defined by combining indicators on: the number of rooms available per person in the household, problems of condensation/damp, etc. We can therefore combine not only different dimensions, but also indicators within a dimension, with the weights for each indicator within a dimension appropriately defined.

From the individual deprivation scores, MP_i, we can then calculate the population average deprivation: $MPI = H \times A$; where $H = q/n$ and $A = \sum_{i=1}^{n} MP_i/Dq$; n is the population size; $q = \sum_{i=1}^{n} I(c_i \geqslant k)$ is the total number of children who are multidimensional poor i.e. for whom $MP_i \neq 0$ ($I(.)$ is an indicator function). H gives the incidence (head count ratio) of the multidimensional poor, and A gives the intensity of multidimensional poverty (amongst the poor).

Any measure of multidimensional poverty is sensitive to the underlying choices made by the researchers (UNICEF, 2012). These choices include: (i) the number and choice of dimensions (D); (ii) the weights (w_d) used to aggregate the dimensions to obtain the overall index; and (iii) the thresholds used both within a dimension (π_d) and the cut-off across dimensions (k) to define being in multidimensional poverty.

Consideration needs to be given first to what should or should not be included in the multidimensional measure. What is regarded as necessary/basic for children will depend on the aspirations and expectations both at the individual level and the societal level at any particular point in time. There have been numerous attempts in the literature to define the dimensions of poverty relevant to children. The choice of dimensions is, in most cases, driven by two factors. First, there are normative considerations: each dimension (and the indicator(s) used to define it) should reflect, in some way, the deprivations faced by the child in terms of limiting their ability to experience what society values as a 'good life'. Second, there are issues of data availability: the choice of dimensions is limited to what is available at any point in time; and also consistently available over time.

Gordon et al. (2003) present the first rigorous attempt at measuring the extent and depth of multidimensional child poverty for developing countries. Their analysis covered all countries of Latin America and the Caribbean, South Asia, the Middle East and North Africa, Sub-Saharan Africa, East Asia and the Pacific. The dimensions of deprivation they considered were: food; safe drinking water; sanitation facilities; health; shelter; education; information; and access to services. These dimensions have largely been accepted as standard in the literature for developing countries (Roche, 2013).

A series of studies have also focussed on European and other OECD countries (Bradshaw et al., 2007; UNICEF, 2007; OECD, 2009; Richardson et al., 2008; Nolan and Whelan, 2011). Notten and Roelen (2010, 2011a, 2011b) use the 2007 EU-SILC data to examine multidimensional child poverty in Germany, France, Netherlands, and the UK. Their choice of domains is: housing conditions; neighbourhood conditions; access to basic services (health and education); and financial means. Our choice of dimensions (discussed in detail in the next section) is in line with the existing literature for the European and OECD countries.

The relative importance given to different dimensions and indicators for each dimension (e.g. possessing all-weather shoes as compared to having annual holidays) is also a subjective judgement. The most common approach in the literature, which we follow here, is to use equal weights ($w_d = 1$). Justification for using equal weights comes from the ease of interpretation,

as argued, for example, by Atkinson et al (2002) in their work on social indicators in Europe. As an alternative to equally weighting all dimensions, weights can be based on 'social norms' (with weights calculated as the proportion of households currently possessing the particular dimension), or generated as factor loadings with multidimensional poverty treated as a latent continuous factor (see the discussion in Decancq and Lugo, 2013).

Finally, the thresholds for defining households in poverty or deprivation need to be delineated. Within a dimension, we set $\pi_d = 0$, such that any household deprived on one or more of the indicators is classified as deprived in that particular dimension. For the cut-off across dimensions (k), we report MPI for different values of k.

2.1 Dynamics of multidimensional poverty

Transition probabilities are used to capture the dynamics and persistence in both income poverty and multidimensional poverty (Apablaza and Yalonetzky, 2011). For example, for multidimensional poverty, over any two periods, we can calculate four different transition probabilities, given in the table below (similar probabilities can be calculated for income poverty):

	Period $t-s$	
Period t	Multidimensionally poor	Multidimensionally non-poor
Multidimensionally poor	$P_{p\|p}$	$P_{p\|np}$
Multidimensionally non-poor	$P_{np\|p}$	$P_{np\|np}$

where $P_{p|p}$ is the probability of being poor in period t, conditional on being poor in $t-s$; $P_{p|np}$ is the probability of being poor in period t, conditional on being non-poor in $t-s$; $P_{np|p}$ is the probability of being non-poor in period t, conditional on being poor in $t-s$; and $P_{np|np}$ is the probability of being non-poor in period t, conditional on being non-poor in $t-s$.

2.2 Subgroup decompositions

The index of multidimensional poverty, MPI, can be decomposed by population subgroups. Subgroup decompositions are important to capture the inequities of distribution across society

since different groups experience poverty differently. For example, we can examine lone parent households versus dual parent households, and calculate their relative contribution to the overall population multidimensional poverty. MPI can also be decomposed by dimensions to identify the relative contribution of different dimensions to the overall index; for details on how MPI is decomposed see Alkire et al. (2011).

We are not only interested in identifying the different subgroups of the population which contribute the most to overall MPI but, from a policy perspective, it is also important to identify the households which are most *at risk* of poverty. The literature distinguishes between poverty and 'at-risk of being in poverty', with the latter often also referred to as 'vulnerability' (Ravallion, 1988; Morduch, 1994; Dutta et al. 2011). Bane and Ellwood (1986) show that household formation decisions explain about 50% of the variation in the incidence of poverty in the US; these 'structural' factors are taken to indicate the risk of being in poverty. A more recent study by Worts et al. (2010), using US and UK data, discusses the concentration of the various risk factors, and their contribution to the persistence of poverty. The most commonly discussed risk factors in the literature are: lone parent household; long term unemployment; partners of the unemployed; young and the old; and race and ethnicity. In our analysis, we specifically explore worklessness, family stability (lone parent households), parental education, and ethnicity, and examine the impact of these different risk factors on the likelihood of a child growing up in multidimensional poverty.

3 Multidimensional poverty in MCS children

3.1 Data

To be able to combine the concepts of multidimensionality and persistence in child poverty we need a longitudinal data set that follows the same set of children from an early age, asking them similar (age appropriate) questions at different points in time. This is clearly very demanding in terms of data requirements. We use the UK Millennium Cohort Study (MCS), which is following a large sample of around 19,000 children born in 2000-01. The sample covers all the

four countries of the UK, but families living in areas with a high ethnic minority population and/or with high deprivation were oversampled.[2] The children were assessed, and their primary carer (in most cases mother/mother figure) interviewed, at four different points in time: when the children were 9 months old, 3 years old, 5 years old, 7 years old, and 11 years old. The father/father figure was also interviewed where present. The MCS collects information on a wide array of topics such as: family background, employment, income and poverty status of the household, housing conditions, neighbourhood, development of the children, etc..

The MCS surveyed 18,552 households for the first sweep; of these only 11,721 (61%) were productive in all four sweeps. Refusing to participate is the biggest reason for attrition. The refusal rates are higher for the 'disadvantaged' and 'ethnic minority' families, relative to 'advantaged' families, across all the four countries of the UK.[3] In our analysis, we use two sweeps of the MCS: sweep two (MCS2) when the children were 3 years old and sweep four (MCS4) when they were 7 years old. MCS2 is the first sweep available where we have the relevant information for the dimensions of child poverty, and MCS4 is the last wave for which the dimensions chosen are consistently available.[4] The sample used below comprises 11,499 children – these are the children who are in both sweeps and for whom we have complete information on all the variables utilised.

3.2 Dimensions of multidimensional poverty

For deprivation beyond income poverty, we consider a number of dimensions which capture both the psychological (subjective) and material deprivations faced by children. In line with the existing literature, the six different dimensions considered in this paper together with the indicators underlying each dimension are described in Table 1.

These dimensions and their constituent indicators reflect a range of deprivations which will affect a child's well-being and opportunities (the normative aspect, as explained above) and

[2] Weights to account for the differential sampling have been used in the analysis throughout.

[3] Ketende (2010) discusses in detail the response rates in MCS.

[4] The same questions are not asked in MCS5 (age 11), so we cannot construct the same dimensions. This is not surprising as many of the measures are age-specific. As a robustness check we also undertook the analysis using MCS3 (age 5) and the results presented below were not qualitatively different.

they are consistent with the literature cited above. Note that our choice of dimensions covers three of the eight dimensions indicated in the recent government consultation (i.e. income and material deprivation, unmanageable debt, and poor housing). The other five dimensions (worklessness, parental skill level, access to quality education, family stability, and parental health) do not define children who are deprived per se, rather they indicate children who are 'at-risk-of being deprived'; we discuss these separately below.

Table 2 presents the proportion of children deprived on each of the indicators and six dimensions over the two waves under consideration. The dimension for which most children are classified as deprived is financial constraints, for which more than 40% of children are classified as deprived. In turn, this can be seen to be particularly related to the high numbers of children who live in households who are in receipt of some form of income-related benefit – the 'benefit status' indicator reveals that more than 38% (35%) of children in MSC2 (MSC4) were living in households which received some form of benefit related to low household income, highlighting the financial constraints faced by the families of these children. As can be seen from Table 2, the number of children deprived on different indicators and dimensions has not changed significantly over time between MCS2 and MCS4, although it is not necessarily the same children who are deprived on each dimension in each sweep of course.

Table 3 presents the tetrachoric correlations[5] between the six different dimensions, both within and between waves. The top left quadrant of Table 3 shows the correlations between the different dimensions when the children are 3 years old. The highest correlation (0.61) is between financial constraints and material deprivation, and both of these dimensions are strongly correlated with poor housing. Parental involvement and child health have the weakest relationship with the other dimensions. The pattern is similar in MCS4 as can be seen in the bottom right quadrant of Table 3. Finally, the bottom left quadrant of Table 3 presents the relationship between the different dimensions over time. The diagonal correlations in this panel are all large in magnitude (with the exception of parental involvement), indicating a high degree of persistence in each dimension. The highest correlation is for the neighbourhood at age 3 and

[5] Tetrachoric correlations are calculated since all our dimensions are categorical (binary) variables.

7, reflecting low geographic mobility; this is also seen in the high temporal correlation for poor housing. The off-diagonal elements in the bottom left quadrant of Table 3 reveal that financial constraints has the strongest temporal relationship with the other dimensions, and parental involvement has the weakest. Taken together, these correlations reveal the importance of financial constraints as a signifier of other dimensions of deprivation, with the exception of parental involvement which seems to be fairly unrelated to other indicators of poverty.

3.3 Measuring multidimensional poverty

Table 4 presents the multidimensional poverty index (MPI), the multidimensional headcount (H), and the intensity of multidimensional poverty (A) for different poverty cut-off values (k) as described in section 2. We also calculate the average deprivation (AD) as the mean number of dimensions of deprivation for those classified as being in poverty. As in Tables 2 and 3 above, within each dimension, we set $\pi_d = 0$, such that if a child is deprived on one indicator within a dimension, s/he is classified as deprived on that dimension; and we have assigned equal weights[6] to each dimension ($w_d = 1, \forall\ d$), such that $\sum w_d = 6$.

For $k = 1$, such that if a child is deprived on any one of the six dimensions they are classified as being in poverty, 83% of children are classified as being in poverty in both MCS2 and MCS4. Using this threshold, on average, those in poverty are deprived on more than two dimensions. As the poverty cut-off, k, increases, the multidimensional headcount falls since fewer children will exceed the threshold and thus be categorised as being in poverty. At the extreme ($k = 6$), only 1-2% of children are deprived on all six dimensions.

There is little change in the calculated value of MPI over time. If we take the poverty cut-off threshold to be $k = 3$, then just over 30% of children are defined to be in multidimensional poverty in both MCS2 and MCS4; and, on average, children who are classified as being in poverty according to this threshold are deprived on 3.8 of the six dimensions.

[6]While the results reported in the paper use equal weights, as a robustness check, we experimented with frequency weights and weights obtained from factor loadings. Using different weights does not qualitatively or quantitatively change the results presented below (results available on request).

4 Multidimensional poverty and income poverty

In this section we examine the relationship between the dimensions of multidimensional poverty described in Section 3, as well as the aggregated MPI, and income poverty (IP), where IP is defined as households with income less than 60% of the median equivalised UK household income.

Table 5 presents the relationship between income poverty and the six dimensions of deprivation being considered. The first row of the table shows that income poverty (IP = 1) is around 22% in both sweeps of the MCS – i.e. more than 20% of children in the MCS are in poverty on this measure. Each of the cells in Table 5 then cross-classifies children in IP with poverty on each of the six dimensions of deprivation. Thus, in MCS2, 53% of children are neither income poor nor financially constrained, although 19% of children are both income poor and financially constrained. Indeed, as expected, the largest overlap of income poverty is with financial constrains; (19.2/22.4=) 86% of those who are income poor are also financially constrained in MCS2. Thus income poverty and financial constraints identify similar children. In contrast, in both waves, fewer than half of those who are income poor live in deprived neighbourhoods. Results for MCS4 are similar.

The off-diagonal elements in each cell in Table 5 reveal those children who are differentially identified by low income and the different dimensions of deprivation as being in poverty. For example, 24% of children are not income poor but are financially constrained in both MCS2 and MCS4, representing around 30% of households that are not income poor. Similarly the dimensions like child health and parental involvement identify as poor a large proportion of non-income poor households. These off-diagonal elements reveal the extent to which income poverty and the different dimensions of deprivation classify different children as being in poverty. Clearly, while there is considerable overlap, on each dimension there are 20-30% of children who are classified as poor on one measure but not on the other suggesting that the dimensions capture rather different experiences of deprivation than low income alone would reflect.

The measure of multidimensional poverty aggregates over the different dimensions into a single index MPI. Using a threshold of $k = 3$ (so that children are classified as multidimen-

sionally poor if they are deprived in three or more of the six dimensions under consideration) Table 6 shows the relationship between income poverty and multidimensional poverty. For MCS2, 62.4% of children are neither in income poor nor multidimensional poor, while 17.1% of children are both income poor and multidimensional poor. In each wave, around 5% of children are classified as income poor but not multidimensional poor, and 15% are multidimensional poor but not income poor. Thus, while income poverty and multidimensional poverty identify many of the same children as being in poverty or not in poverty, even where they differ in their classification, this differential classification seems to be quite stable over time. A comparable 4-fold typology is constructed for households across all EU countries by Nolan and Whelan (2011, Chapter 6) using the EU-SILC data. They also find a significant proportion of households which are only classified as poor on one but not both of the two poverty classifications, so this phenomenon is not limited just to the UK or to children.

4.1 Multidimensional poverty and income poverty over time

Taking the multidimensional poverty threshold cut-off to be $k = 3$, Table 7 presents the transition probabilities for multidimensional poverty while Table 8 gives the transition probabilities for income poverty. The degree of persistence in poverty over time is different for the two measures of poverty. In particular, there is a much higher persistence in multidimensional poverty than in income poverty: 59% of income-poor children at age 3 are still income-poor at age 7 (and 41% are not poor); in contrast, the persistence of multidimensional poverty is 69%. Transitions rates into multidimensional poverty are also higher than into income poverty, with 13% (9%) of those who are not multidimensionally (income) poor at age 3 moving into multidimensional (income) poverty by the age of 7.

Table 9 examines the persistence of poverty across the two measures by combining the incidence of multidimensional poverty and of income poverty over time. As can be seen, 54% of children do not experience either multidimensional poverty or income poverty in either sweep of the data (i.e. 46% of children have at least some experience of poverty). 1 3% have persistent income poverty, and 22% have persistent multidimensional poverty. Finally, 10% of children

experience both persistent multidimensional poverty and persistent income poverty.

5 Decompositions and children at risk

5.1 Decompositions by dimensions and subgroup

The measure of multidimensional poverty can be decomposed by dimension, so that the relative contribution of each dimension to the overall MPI can be identified. Table 10 summarises the results of this analysis. As can be seen, in both waves, the most significant contribution to the overall MPI is the dimension capturing financial constraints which accounts for almost one quarter of the MPI. This is double the smallest contribution which is from neighbourhood.

A primary advantage of the measure of multidimensional poverty adopted in our analysis is that it can also be decomposed across different population subgroups. In Table 11, Panel A reports the MPI among single and dual parent/carer households in MCS2 and MCS4. Similar to the incidence of income poverty which is also presented in the final column of Table 11, the incidence and intensity of multidimensional poverty is much higher amongst single parent households. In MCS2, 77% of children in single parent households are multidimensionally poor as compared to 27% in dual parent households, and single parent households contribute disproportionally to the overall MPI. The corresponding figures for income poverty are 69% and 15% respectively. Thus, the incidence of multidimensional and income poverty is substantially greater amongst single parent households, with an incidence rate three to four times greater than for dual parent households on either measure.

The incidence of multidimensional poverty, H, is higher than the incidence of income poverty across all ethnicities (Table 11, Panel B), with Pakistani & Bangladeshi (P&B) and Black or Black British children having the highest incidence of both multidimensional and income poverty; however the gap between the two measures of poverty is greatest for Black or Black British children.

Table 11, Panel C shows the subgroup decomposition by workless households. Not surprisingly the incidence of both multidimensional and income poverty is significantly higher among

workless households compared with households which have at least one working adult. Further, while there seems to be little difference in the incidence of multidimensional poverty (85% in MCS4) and income poverty (86% in MCS4) for workless households, the incidence of multidimensional poverty (24% in MCS4) is almost double that of income poverty (13% in MCS4) for households with at least one working adult. Clearly, examining income poverty alone will not pick up the amount of deprivation faced by children living in households where at least one adult works.

In the final panel (Panel D) of Table 11, we examine subgroups defined by mother's education. The incidence of multidimensional poverty is more than three times greater among children with low educated mothers relative to those with highly educated mothers, although this is less than the differences in income poverty which are four or five times higher.

5.2 Children at risk of poverty

The subgroups identified in Table 11 above - lone parents, ethnic groups, workless households and those with low mothers' education - are often used to identify children at risk of poverty. However the membership of these subgroups often tends to be overlapping; it is quite possible that a child growing up in a single parent household is also in a workless household. To identify the impact of belonging to a specific subgroup (e.g. single parent) over and above the impact of being in another group (e.g. workless household) on the incidence of income poverty and multidimensional poverty, we estimate a set of logit regressions. These are presented in Table 12A. A child in a workless household has the highest relative odds of growing up in both income poverty and multidimensional poverty. Being in a single parent household and having a mother with low education also significantly increase the odds of being in both income and multidimensional poverty. All ethnic minority children have significantly higher odds of being in income and multidimensional poverty relative to white children with the single exception of Indian children, for whom the odds of being in multidimensional poverty are no different from those of white children. Pakistani and Bangladeshi children have the highest odds of growing up in income poverty relative to white children; while Black or Black British together with

the P&B children have the highest odds of growing up in multidimensional poverty relative to white children.

Table 12B gives the marginal risks of being deprived on the six separate dimensions of multidimensional poverty in MCS2 and MCS4. In this table, the dependent variables are the incidence of deprivation in each of the six dimensions of multidimensional poverty. In general, children growing up in workless households face the highest relative risk of being deprived on most dimensions in both years. However, children with low educated mothers face the highest odds of being in poor health, while Black or Black British, and P&B children face the highest odds of living in deprived neighbourhoods.

6 Poverty and child development

It has long been established that income poverty is detrimental to the development of children (Brooks-Gunn and Duncan, 1997; Duncan et al., 2010). In this section, we explore the relationship between multidimensional poverty and children's development; specifically we want to examine if multidimensional poverty has an impact on child development over and above any impact of income poverty.

Let child development at any given time t be defined as θ_t. θ_t is also often referred to in the literature as the ability (latent or observed) of the child. We are interested in the impact that income poverty and multidimensional poverty can have on θ_t. To do this we specify a dynamic model of child development as used by Cunha and Heckman (2008), such that:

$$\theta_t^k = \gamma_{1t}^k \theta_{t-1}^k + \gamma_{2t}^k IP_t + \gamma_{3t}^k MP_t + \gamma_{4t}^k X_t + \eta_t^k \tag{1}$$

where θ_t^k is the vector of child ability at time t, with $k = C, N$ such that θ_t^C is the cognitive development of the child and θ_t^N captures the non-cognitive abilities of the child; we consider two time periods, $t = 1$ when the children are 3 years old, and $t = 2$ when the children are 7 years old. Development (ability) is assumed to be dynamic in nature and, at any point in time, depends on: past ability θ_{t-1}^k; income poverty, IP_t; multidimensional poverty, MP_t; and a set of

control variables, X_t, that can affect ability formation such as the socioeconomic status of the parents. γ_{jt}^k, $j = 1, \ldots, 4$ are time-varying parameters to be estimated; and η_t^k is the normal error term, assumed to be independent across individuals and over time. We are particularly interested in the impact of MP_t over and above that of IP_t.

We further assume that these cognitive and non-cognitive abilities are latent, and are measured with error. For period $t = 1$ (MCS2) we do not have specific measures to identify the initial endowment, θ_0, and hence we assume that it depends in a linear fashion on a set of covariates, X_0, such that: $\theta_1^k = \gamma_{11}^k X_0 + \gamma_{21}^k IP_1 + \gamma_{31}^k MP_1 + \gamma_{41}^k X_1 + \eta_1^k$. For further details on model estimation and identification, see Dickerson and Popli (2014).[7]

The MCS records a number of standard tests of cognitive and non-cognitive development, at ages 3 (MCS2) and 7 (MCS4) years.[8] For cognitive development these are age-appropriate tests administered to the children themselves. In MCS2, children were assessed on two tests: the British Ability Scales (BAS) Naming Vocabulary test which is a verbal scale which assesses spoken vocabulary; and the Bracken School Readiness Assessment (BSRA) which is used to assess the conceptual development of young children across a wide range of categories (colours; letters; numbers/counting; sizes; comparisons; and shapes). In MCS4 children were assessed on three tests: the BAS Pattern Construction test (BAS-PC) where the child constructs a design by putting together flat squares or solid cubes with black and yellow patterns on each side; the BAS Word Reading test in which the child reads aloud a series of words presented on a card; and the Progress in Maths test in which a range of tasks covering number, shape, space, measures and data are assessed.

The non-cognitive development of children is assessed in the MCS using the Strength and Difficulty Questionnaire (SDQ), which is filled out by the mother of the child, at both age 3 and age 7. SDQ is a well-established instrument used to identify childhood behavioural problems in community settings (Goodman, 1997). It has a set of 25 questions assessing the child on five different dimensions with five questions each: emotional problems, conduct problems,

[7] One of the important explanatory variables in the model of child development is parental investment. We do not include this explicitly in our model as parental involvement is implicit in our measure of multidimensional poverty.

[8] See Hansen et al. (2012) for further details for the child assessment used in the MCS.

hyperactivity, peer problems and pro-social behaviour. All 25 questions can be answered as: 'certainly true' (score 2), 'somewhat true' (score 1), and 'not true' (score 0).

In vector X_0 which captures the initial conditions, we use: mother's education at birth; ethnicity of the child; and birth weight. The other control variables (X_t) are binary indicators for workless households and single parent households.

In Table 13 we report the impact of income poverty and multidimensional poverty on the cognitive and non-cognitive development of children. These are standardised coefficients. At age 3, multidimensional poverty had a significant and a negative impact on both the cognitive and non-cognitive development of children, over and above the impact of income poverty; the impact is much stronger for non-cognitive (social and behavioural) development than for cognitive development (test scores). By age 7, the impact of both income and multidimensional poverty is insignificant for cognitive development, but both continue to remain significantly negative for children's non-cognitive development. These findings are not surprising and consistent with the evidence presented elsewhere in the literature. The quality of family circumstances as captured by the different dimensions here can be as (if not more) important for children as the number of parents, their education and their income; further these circumstances matter more for the non-cognitive development of the children (Heckman, 2013).

7 Conclusions

In this paper, we construct a measure of multidimensional poverty from the MCS data for children age 3 and age 7, and compare and contrast this to a conventional relative income-based measure of poverty. Our results suggest that, while our measure of multidimensional poverty overlaps with the income poverty measure, there are 20-30% of children who are classified as poor on one measure but not the other. When we examine the different dimensions, then (not surprisingly) there is a significant overlap between income poverty, and financial constraints and material deprivation. However, it would appear that income poverty misses many of the children who are deprived on the dimensions of child health and parental involvement. It is

also apparent that there is rather more persistence in multidimensional poverty than there is in income poverty. Finally, multidimensional poverty has a negative impact on the development of children over and above the impact of income poverty.

Using relative household income as the measure of poverty has the key advantage of simplicity. Income is easily understood as a measure, and it is more readily available than any multidimensional index of poverty, including the one examined in this paper. Any multidimensional measure of poverty is necessarily more complex since it involves aggregating over a range of different (and subjectively selected) dimensions. There are also greater data requirements, especially if the intention is to measure multidimensional poverty consistently over time. However, it is clear that this appeal to simplicity as a justification for continuing to define poverty by a relative household income threshold alone is misplaced in the case of measuring and assessing the deprivation faced by children. Income poverty fails to adequately record the extent, persistence and degree to which children experience deprivation, perhaps in part because children have no control over the allocation of resources within the household. As shown in this paper, in order to assess deprivation amongst children, and the impact of that deprivation on children's cognitive and non-cognitive development, income poverty alone is insufficient – it needs to be supplemented by a consistent and rigorous multidimensional measure in order to identify all children experiencing poverty.

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References

1. Alkire S. and Foster J. 2011. Counting and multidimensional poverty measurement. *Journal of Public Economics*, vol. 95(7-8), pp. 476-487.

2. Alkire S, Roche JM, Santos ME, and Seth S. 2011. Multidimensional Poverty Index 2011: Brief Methodological Note. Oxford Poverty and Human Development Initiative.

3. Apablaza M, and Yalonetzky G. 2011. Measuring the dynamics of multiple deprivations among children: the cases of Andhra Pradesh, Ethiopia, Peru and Vietnam. Oxford Poverty and Human Development Initiative.

4. Atkinson AB, Cantillon B, Marlier T, and Nolan B. 2002. *Social indicators: The EU and social inclusion.* Oxford: Oxford University Press.

5. Atkinson AB. 2003. Multidimensional deprivation: contrasting social welfare and counting approaches. *Journal of Economic Inequality*, vol. 1, pp. 51-65.

6. Barnes M, Chanfreau J and Tomaszewski W. 2010. Growing up in Scotland: The Circumstances of Persistently Poor Children.

   http://www.scotland.gov.uk/Publications/2010/04/26095519/0

7. Bane, MJ and Ellwood, DT. 1986. Slipping into and out of Poverty: The Dynamics of Spells. *Journal of Human Resources*, vol. 21, no. 1, pp. 1-23.

8. Blanden J, Gregg P and Macmillan L. 2007. Accounting for intergenerational income persistence: non-cognitive skills, ability and education. *Economic Journal*, vol. 117, pp. C43-C60.

9. Blanden J, Gregg P and Macmillan L. 2013. Intergenerational persistence in income and social class: The effect of within-group inequality. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, vol. 176(2), pp. 541-563.

10. Bourguiguon F and Chakravarty S. 2003. The Measurement of Multidimensional Poverty. *Journal of Economic Inequality*, vol. 1, no. 1, pp. 25-49.

11. Bradshaw J, Hoelscher P and Richardson D. 2007. An index of child well-being in the European Union 25. *Journal of Social Indicators Research*, vol. 80, pp. 133-177.

12. Brooks-Gunn J, and Duncan GJ. 1997. The effects of poverty on children. *The Future of Children*, 7(2), pp. 55-71.

13. Cunha, F, and Heckman, J. 2008. Formulating, identifying and estimating the technology of cognitive and non-cognitive skill formation. *Journal of Human Resources*, 43(4), pp. 738-782.

14. Decancq K and Lugo M. 2013. Weights in Multidimensional Indices of Wellbeing: An Overview. *Econometric Reviews*, vol. 32(1), pages 7-34.

15. Dickerson A and Popli G. 2014. Persistent Poverty and Children's Cognitive Development: Evidence from the UK Millennium Cohort Study. University of Sheffield Discussion Paper Series, SERPS 2011023.

16. DfE/DWP (Department for Education/Department for Work and Pensions) 2011. *A New Approach to Child Poverty: Tackling the Causes of Disadvantage and Transforming Families' Lives*, CM 8061 April 2011.

17. Duncan GJ, Kathleen MZ and Kalil A. 2010. Early-Childhood Poverty and Adult Attainment, Behavior, and Health. *Child Development*, vol. 81(1), pp. 306-325.

18. Dutta I, Foster J, and Mishra A. 2011. On measuring vulnerability to poverty. *Social Choice and Welfare*, vol. 37(4), pp. 743-761.

19. Goodman R. 1997. The Strengths and Difficulties Questionnaire: A Research Note. *Journal of Child Psychology and Psychiatry*, vol. 38, pp. 581-586.

20. Gordon D, Nandy S, Pantazis C, Pemberto S and Townsend P. 2003. *Child Poverty in the Developing World*. Bristol: The Policy Press.

21. Hansen K. (ed.) 2012. *Millennium Cohort Study: First, Second, Third and Fourth Surveys: A Guide to the Datasets*, Seventh Edition. London: Centre for Longitudinal Studies, Institute of Education, University of London.

22. Heckman J. 2013. *Giving kids a fair chance: A strategy that works*. MIT Press.

23. Ketende S. 2010. *Millennium Cohort Study Technical Report on Response*, Third Edition. London: Centre for Longitudinal Studies, Institute of Education, University of London.

24. Morduch J. 1994. Poverty and Vulnerability. *American Economic Review*, vol. 84, no. 2, pp. 221-225.

25. Narayan D, Patel R, Schafft K, Rademacher A, and Koch-Schulte S. 2000. *Can Anyone Hear Us?* The World Bank (http://dx.doi.org/10.1596/0-1952-1601-6)

26. Nolan B and Whelan C. 2011. *Poverty and Deprivation in Europe*. Oxford, Oxford University Press.

27. Notten G and Roelen K. 2010. Cross-national comparison of monetary and multidimensional child poverty in the European Union: puzzling with the few pieces that the EUSILC provides. BWPI working paper.

28. Notten G and Roelen K. 2011a. Monitoring Child Well-being in the European Union: Measuring cumulative deprivation. Innocenti Working Papers 635, UNICEF Innocenti Research Centre.

29. Notten G and Roelen K. 2011b. The Breadth of Child Poverty in Europe: An investigation into overlap and accumulation of deprivations. Innocenti Working Papers 636, UNICEF Innocenti Research Centre.

30. OECD. 2009. *Doing better for children*. Paris, Organization for Economic Co-operation and Development.

31. Oroyemi PC, Crosier T, Damioli G, and Barnes M. 2009. Understanding Social Exclusion Across The Life Course: Families with Children. London: Cabinet Office

http://webarchive.nationalarchives.gov.uk/+/http://www.cabinetoffice.gov.uk/media/226107/famil children.pdf

32. Ravallion M. 1988. Expected Poverty Under Risk-Induced Welfare Variability. *Economic Journal*, vol. 98, pp. 1171-1182.

33. Ravallion M. 1996. Issues in measuring and modelling poverty. *Economic Journal*, vol. 106, pp. 1328–1343.

34. Richardson D, Hoelscher P, and Bradshaw J. 2008.. Child well-being in Central and Eastern European countries (CEE) and the Commonwealth of Independent States (CIS). *Child Indicators Research*, vol. 1(3), pp. 211-250.

35. Ringen S. 1988. Direct and Indirect Measures of Poverty. *Journal of Social Policy*, vol. 17, pp. 351-366.

36. Roche JM. 2013. Monitoring Progress in Child Poverty Reduction: Methodological Insights and Illustration to the Case Study of Bangladesh. *Social Indicators Research*, vol. 112, pp. 363-390.

37. Sen A. 1985. *Commodities and Capabilities*, North-Holland, Amsterdam.

38. Schoon I, Cheng H and Jones E. 2010. Resilience in children's development. In Kirstine Hansen, Heather Joshi and Shirley Dex (eds) *Children of the 21st century: The first five years*. Bristol: Policy Press.

39. Schoon I, Jones E, Cheng H and Maughan B. 2012. Family hardship, family instability, and cognitive development. *Journal of Epidemiology and Community Health*, vol. 66(8), pp. 716-722.

40. Streeten P. 1981. *First Things First: Meeting Basic Human Needs in Developing Countries*, Oxford University Press, New York.

41. Tomlinson M, Walker R and Williams G. 2008. Measuring Poverty in Britain as a Multidimensional Concept, 1991 to 2003. *Journal of Social Policy*, vol. 37, no. 4, pp. 597-620.

42. Townsend P. 1979. *Poverty in the United Kingdom*, London, Allen Lane and Penguin Books.

43. UNICEF. 2007. Child Poverty in Perspective: An Overview of Child Well-Being in Rich Countries, Innocenti Report Card 7. Florence: Innocenti Research Centre.

44. UNICEF. 2012. Measuring Child Poverty: New league tables of child poverty in the world's rich countries. Innocenti Report Card 10. Florence: Innocenti Research Centre.

45. Worts S, Sacker A and McDonough P. 2010. Falling Short of the Promise: Poverty Vulnerability in the United States and Britain, 1993–2003. *American Journal of Sociology*, vol. 116, no. 1, pp. 232-271.

Table 1: Dimensions of deprivation

Dimension:	**Indicators:**	**Description:**
D1: Financial Constraints (FC)	1. Benefit status	Household is defined as receiving benefits if it gets any of the following: working family tax credit, income support, housing benefit or council tax benefit.
	2. Managing financially	Mothers asked: 'How well managing financially?'. If either *finding it* ***quite*** *difficult* or *finding it* ***very*** *difficult*, then defined as NOT managing well financially.
	3. Behind with bills	Mothers asked if 'behind with bills'. There are 11 categories including: behind with electricity bill, behind with telephone bill, behind with loan repayments etc. If the respondent says yes to **any**, then the household is classified as 'behind with bills'.
D2: Material Deprivation (MD)	1. Whether child has weatherproof coat 2. Whether child has all-weather shoes* 3. Has annual holiday not staying with relatives	In MCS2, two questions are asked; first is 'Yes' or 'No'; those who say 'No' are then asked a further question with the options: 'We would like to have this, but cannot', and 'We do not want/need this at the moment'. In MCS4, for each of the three indicators, the mother could give one of three answers: 'We already have this', 'We would like to have this, but cannot', and 'We do not want/need this at the moment'. All who answered: 'We would like to have this, but cannot' are classified as deprived.
D3: Child Health (CH)	1. Overweight or obese‡	A child is classified as 'overweight or obese' if their recorded BMI is above the overweight cut-off which is age and gender specific.
	2. Limiting long standing illness	This is coded from two questions asked of the mother. 'Does the child have any longstanding illness?' and, 'Does the illness limit activity?' If the response is 'Yes' to both questions, then the child is classified as having 'limiting long standing illness'.
	3. Child exposed to smoking	Mother is asked: 'Does anyone smoke near the child?'

Table 1 (*continued*): Dimensions of deprivation

Dimension:	Indicators:	Description:
D4: Parental Involvement (PI)	1. How often read to the child	Classified as deprived on this indicator if no one reads to the child or the frequency of reading to child is once or twice a month or less.
	2. How often help child with: alphabet (at age 3), reading (at age 7)	Classified as deprived on this indicator if: Never/Occasionally/less than once a week (age 3); Never/Once or twice a month/Less often (age 7)
	3. Does the child have regular bedtime	Classified as deprived on this indicator if: never or almost never; sometimes.
	4. Meal time:	
	Does the child have regular mealtime (age 3)	Classified as deprived on this indicator if: never or almost never; sometimes.
	Who eats with child regularly (age 7)	Classified as deprived on this indicator is the child does not eat with Parent(s) and/or other children (brothers and sisters) in the family.
D5: Housing (HO)	1. Housing tenure type	Classified as deprived on this indicator if living in: Local Authority, housing association, living with parents, or living rent free.
	2. Overcrowding	Divide the total number of household members (people) by the number of rooms in the house (other than bathrooms/toilets/halls); House is considered overcrowded if people/rooms > 1.
	3. Problems with condensation/damp	Deprived if having a problem with damp.
D6: Neighbourhood (NH)	1. Index of Multiple Deprivation	The index of multiple deprivation (IMD) in the local area is constructed separately across the four countries of UK. MCS reports the distribution of deciles of this index. Household classified as deprived on this dimension if is in the bottom two deciles.

Notes to Table 1:

1. All the indicators are classified to capture deprivation.
2. * In MCS2, the question is ‘whether child has new properly fitted shoes’.
3. ‡ There are no underweight children in the sample.

Table 2: Proportion of children deprived on different dimensions

Dimension:	Indicators:	MCS2 (%)	MCS4 (%)
D1: Financial Constraints (FC)	*1. Benefit status*	*38.6*	*35.5*
	2. Managing financially	*8.8*	*11.4*
	3. Behind with bills	*12.6*	*12.4*
	% Deprived on FC	44.1	42.3
D2: Material Deprivation (MD)	*1. Weatherproof coat*	*0.4*	*0.6*
	2. All-weather shoes	*0.8*	*2.0*
	3. Annual holiday	*23.6*	*24.6*
	% Deprived on MD	23.8	25.1
D3: Child Health (CH)	*1. Overweight or obese*	*22.7*	*19.2*
	2. Limiting long standing illness	*2.8*	*5.8*
	3. Child exposed to smoking	*14.9*	*11.3*
	% Deprived on CH	35.9	31.5
D4: Parental Involvement (PI)	*1. Read to the child*	*5.7*	*9.1*
	2. Help child reading	*31.4*	*35.9*
	3. Regular bedtime	*18.3*	*8.0*
	4. Regular meal time	*7.5*	*2.9*
	% Deprived on PI	47.6	45.8
D5: Housing (HO)	*1. Housing tenure type*	*21.5*	*19.2*
	2. Overcrowding	*6.5*	*7.1*
	3. Problems with condensation/damp	*13.4*	*13.6*
	% Deprived on HO[2]	32.2	31.1
D6: Neighbourhood (NH)	*1. Deprived neighbourhood*	*16.9*	*15.9*
	% Deprived on NH[2]	16.9	15.9
Income Poverty (IP)		22.4	21.5

Notes to Table 2:

1. We take $\pi_d = 0$, i.e. any household deprived on one or more indicators is classified as deprived in that particular dimension.
2. IP is defined as household income less than 60% of median equivalised UK household income.
3. Sample size N = 11,499 except for income poverty in MCS2: N = 9,910 and income poverty MCS4: N = 11,495.
4. Sample weights have been used throughout.

Table 3: Correlation matrix between the different dimensions

		MCS2 (Age 3)						MCS4 (Age 7)				
		FC	**MD**	**CH**	**PI**	**HO**	**NH**	**FC**	**MD**	**CH**	**PI**	**HO**
MCS2 (Age 3)	**MD**	0.61*										
	CH	0.23*	0.20*									
	PI	0.14*	0.16*	0.10*								
	HO	0.58*	0.57*	0.24*	0.16*							
	NH	0.50*	0.41*	0.19*	0.18*	0.54*						
MCS4 (Age 7)	**FC**	0.66*	0.55*	0.24*	0.15*	0.57*	0.49*					
	MD	0.52*	0.66*	0.20*	0.15*	0.50*	0.41*	0.64*				
	CH	0.23*	0.22*	0.58*	0.08*	0.23*	0.22*	0.25*	0.22*			
	PI	0.01	0.02	0.01	0.12*	0.00	-0.01	-0.01	0.01	-0.01		
	HO	0.57*	0.56*	0.24*	0.18*	0.83*	0.52*	0.58*	0.53*	0.27*	-0.01	
	NH	0.49*	0.42*	0.20*	0.18*	0.53*	0.97*	0.50*	0.41*	0.22*	-0.01	0.54*

Notes to Table 3:

1. Dimensions are: FC: Financial Constraints; MD: Material Deprivation; CH: Child Health; PI: Parental Involvement; HO: Housing; and NH: Neighbourhood.
2. Sample size: N = 11,499
3. * tetrachoric correlations are significant at the 1% significance level.

Table 4: Multidimensional Poverty Index (*MPI*)

	MCS2 (Age 3)				MCS4 (Age 7)			
Poverty cut-off (*k*):	***MPI=HA***	***H***	***A***	***AD***	***MPI=HA***	***H***	***A***	***AD***
1	0.365	0.825	0.443	2.431	0.347	0.828	0.419	2.313
2	0.301	0.546	0.551	3.161	0.280	0.524	0.535	3.076
3	0.223	0.335	0.664	3.893	0.203	0.314	0.645	3.793
4	0.146	0.190	0.769	4.572	0.128	0.170	0.752	4.466
5	0.077	0.087	0.876	5.246	0.057	0.065	0.871	5.212
6	0.021	0.021	1.000	6.000	0.014	0.014	1.000	6.000

Notes to Table 4:

1. Here we use $w_d = 1$, such that $\Sigma w_d = 6$; N = 11,499.
2. *H* = Multidimensional headcount; *A* = Intensity of deprivation; *AD* = average deprivation among the poor. See text for details
3. Sample weights have been used throughout

Table 5: Relationship between income poverty and the different dimensions

	MCS2 (Age 3) %		MCS4 (Age 7) %	
	IP = 0	IP = 1	IP = 0	IP = 1
Dimension:	77.6	22.4	78.5	21.5
FC = 0	53.4	3.2	54.9	2.8
FC > 0	24.2	19.2	23.6	18.7
MD = 0	66.8	9.9	65.5	9.5
MD > 0	10.8	12.5	13.0	12.1
CH = 0	53.2	11.3	56.6	11.9
CH > 0	24.4	11.1	21.8	9.6
PI = 0	43.4	9.6	42.3	11.9
PI > 0	34.2	12.8	36.2	9.6
HO = 0	61.7	7.0	62.0	6.9
HO > 0	15.9	15.4	16.4	14.6
NH = 0	70.3	13.7	70.8	13.3
NH > 0	7.3	8.7	7.6	8.2

Notes to Table 5:

1. IP: Income Poverty; FC: Financial Constraints; MD: Material Deprivation; CH: Child Health; PI: Parental Involvement; HO: Housing; and NH: Neighbourhood.
2. Sample sizes are MCS2: N = 9,910; and MCS4: N = 11,495.
3. Figures within each matrix may not add to 100% due to rounding.
4. Sample weights have been used throughout.

Table 6: Relationship between income poverty and overall *MPI* (*k* = 3)

	MCS2 (Age 3) %			MCS4 (Age 7) %		
		MP_i			MP_i	
	Overall	$MP_i = 0$	$MP_i > 0$	Overall	$MP_i = 0$	$MP_i > 0$
Not in income poverty (IP = 0)	77.6	62.4	15.2	78.5	63.0	15.5
Income poverty (IP = 1)	22.4	5.3	17.1	21.5	5.6	15.9

Notes to Table 6:

1. Sample sizes are MCS2: N = 9,910; and MCS4: N = 11,495.
2. Sample weights have been used throughout.

Table 7: Transition probabilities for Multidimensional Poverty (*k* =3)

		MCS2	
		Multidimensionally poor (MP > 0)	Multidimensionally not-poor (MP = 0)
MCS4	Multidimensionally poor (MP > 0)	$P_{p\|p}$ = 0.687	$P_{p\|np}$ = 0.126
	Multidimensionally not-poor (MP = 0)	$P_{np\|p}$ = 0.313	$P_{np\|np}$ = 0.874

Notes to Table 7:

1. Here we use $w_d = 1$, such that $\Sigma w_d = 6$.
2. Sample weights have been used throughout

Table 8: Transition probabilities for Income Poverty

		MCS2	
		Income poor (IP = 1)	Income not-poor (IP = 0)
MCS4	Income poor (IP = 1)	$P_{p\|p}$ = 0.591	$P_{p\|np}$ = 0.086
	Income not-poor (IP = 0)	$P_{np\|p}$ = 0.409	$P_{np\|np}$ = 0.914

Table 9: Multidimensional Poverty (*k* = 3) and Income Poverty over time

		MP incidence over time (%)			
		never poor	*poor in 1 wave*	*poor in both*	Total
Income Poverty over time (%)	*never poor*	53.8	11.5	5.6	71.0
	poor in 1 wave	4.7	4.6	6.5	15.8
	poor in both	0.9	2.3	10.1	13.2
	Total	59.4	18.4	22.2	100

Table 10: Contribution of each dimension to overall *MPI* (*k* = 3)

	MCS2		MCS4	
Dimension:	**Censored Headcount**	**% contribution**	**Censored headcount**	**% contribution**
FC	0.290	22	0.276	23
MD	0.193	15	0.196	16
CH	0.208	16	0.181	15
PI	0.230	18	0.184	15
HO	0.243	19	0.227	19
NH	0.141	11	0.128	11
Total		100%		100%

Notes to Table 10:

1. The dimensions are: FC: Financial Constraints; MD: Material Deprivation; CH: Child Health; PI: Parental Involvement; HO: Housing; and NH: Neighbourhood.
2. Sample weights have been used throughout.

Table 11: Subgroup Decomposition, *MPI* (*k* = 3) and IP

		%	*MPI= HA*	*H*	*A*	*AD*	% IP
Panel A: single and dual parent/carer households							
MCS2	Single parent households	13.4	0.548	0.769	0.712	4.160	68.6
	Dual parent households	86.6	0.172	0.268	0.643	3.773	15.2
MCS4	Single parent households	17.8	0.440	0.656	0.671	3.931	55.1
	Dual parent households	82.2	0.151	0.240	0.630	3.711	14.3
Panel B: Ethnicity							
MCS2	White	89.6	0.203	0.308	0.657	3.862	20.4
	Mixed	2.7	0.331	0.482	0.687	3.920	34.6
	Indian	1.7	0.204	0.323	0.632	3.704	24.3
	Pakistani and Bangladeshi	3.1	0.487	0.717	0.680	4.026	66.7
	Black or Black British	2.0	0.491	0.669	0.734	4.307	44.5
	Other	0.9	0.335	0.498	0.672	4.057	34.6
MCS4	White	89.6	0.185	0.291	0.638	3.760	18.9
	Mixed	2.7	0.298	0.437	0.681	3.943	31.5
	Indian	1.7	0.152	0.253	0.600	3.583	21.0
	Pakistani and Bangladeshi	3.1	0.445	0.659	0.676	3.987	71.0
	Black or Black British	2.0	0.442	0.647	0.684	4.068	43.6
	Other	0.9	0.302	0.471	0.642	3.833	39.1
Panel C: Workless Households							
MCS2	No working adult (workless)	12.5	0.653	0.888	0.736	4.323	89.7
	At least one working adult	87.5	0.160	0.256	0.625	3.679	13.1
MCS4	No working adult (workless)	11.6	0.601	0.850	0.707	4.157	86.1
	At least one working adult	88.4	0.150	0.244	0.614	3.626	13.0
Panel D: Mothers Education							
MCS2	High education (NQF 4+)	38.8	0.087	0.145	0.603	3.508	8.0
	Low education	61.2	0.307	0.455	0.675	3.970	32.0
MCS4	High education (NQF 4+)	38.7	0.080	0.137	0.583	3.437	6.3
	Low education	61.3	0.279	0.426	0.656	3.864	31.2

Notes to Table 11:

1. Here we use $w_d = 1$, such that $\Sigma w_d = 6$.
2. *H* = Multidimensional headcount; *A* = Intensity of deprivation; *AD* = average deprivation among the poor. See text for details.
3. Sample weights have been used throughout.

Table 12A: Risk of Income Poverty and Multidimensional Poverty: odds-ratio

	Dependent Variables			
	MCS2		MCS4	
Independent Variables:	IP	MP	IP	MP
Mother low education	4.05***	3.98***	4.76***	3.59***
Workless household	27.90***	9.71***	21.05***	7.95***
Single Parent	2.98***	3.21***	3.21***	3.14***
Ethnicity (base=White)				
Mixed	1.78***	1.83***	1.64***	1.72***
Indian	2.17***	1.30	1.82***	1.06
P&B	9.68***	5.23***	13.78***	4.48***
Black	2.13***	4.42***	3.04***	4.92***
Other	2.89***	2.49***	4.02***	2.64***
N	9,881	11,439	11,466	11,468

Table 12B: Risk of being deprived on the individual dimensions: odds-ratio

MCS2	Dependent Variable: censored dimensional headcounts					
Independent Variables:	**FC**	**MD**	**CH**	**PI**	**HO**	**NH**
Mother low education	4.04***	3.43***	3.15***	3.28***	4.05***	4.38***
Workless household	9.59***	5.78***	2.89***	3.34***	8.90***	4.41***
Single Parent	3.83***	2.36***	1.92***	1.54***	2.44***	1.37***
Ethnicity (base=White)						
Mixed	1.67***	1.68***	1.22	1.19	1.90***	1.65***
Indian	1.27	1.69***	0.60**	1.38*	1.11	1.51**
P&B	3.36***	3.52***	1.00	3.59***	2.61***	8.54***
Black	3.15***	4.48***	1.29	2.65***	5.69***	5.26***
Other	2.75***	3.25***	0.77	2.30***	2.43***	2.17***
N	11,439	11,439	11,439	11,439	11,439	11,439
MCS4						
Independent Variables:	**FC**	**MD**	**CH**	**PI**	**HO**	**NH**
Mother low education	3.83***	3.45***	2.98***	2.40***	3.77***	4.67***
Workless household	8.24***	5.83***	2.84***	2.15***	8.15***	3.61***
Single Parent	3.59***	2.44***	1.81***	2.02***	2.26***	1.71***
Ethnicity (base=White)						
Mixed	1.77***	1.61***	1.22	1.51***	1.66***	1.75***
Indian	1.04	1.23	0.54**	1.03	0.92	1.45**
P&B	3.45***	3.86***	1.36**	2.24***	3.15***	7.44***
Black	4.05***	4.30***	1.74***	1.59***	5.86***	6.13***
Other	2.59***	2.68***	0.77	2.06***	2.90***	2.25***
N	11,468	11,468	11,468	11,468	11,468	11,468

Notes to Table 12:

1. *** p<0.01, ** p<0.05, * p<0.10; Sample weights have been used in the analysis.
2. Base: white child in a dual parent household, where at least one adult works, and mother has high education.

Table 13: Cognitive and non-cognitive development and the incidence of income and multidimensional poverty

	MCS2		MCS4	
	Latent cognitive development	Non-cognitive development	Latent cognitive development	Non-cognitive development
	θ_1		θ_2	
θ_{t-1}			0.859***	0.748***
IP_t	-0.336***	-0.330*	0.022	-0.354**
MP_t	-0.404***	-2.212***	-0.004	-0.811***
Workless household	-0.279***	-1.405***	-0.030	-0.007
Single Parent	0.087**	0.057	-0.086**	-0.223
Initial conditions (θ_0)				
Birth weight	0.086***	0.486***		
Mother low education	-0.450***	-1.229***		
Ethnicity				
Mixed	-0.048	0.117		
Indian	-0.395***	-1.279**		
P&B	-0.915***	-1.623***		
Black	-0.567***	0.809**		
Other	-0.380***	0.035		

Notes to Table 13:

1. All the reported coefficients are standardized. For the continuous independent variables, the coefficient represents the change in the dependent variable associated with a one standard deviation (SD) change in the independent variable. For the binary independent variables the coefficient represents the change associated with a shift in the variable from 0 to 1.
2. Sample size: 9,844; CFI = 0.875; RMSE = 0.045.
3. *** p<0.01, ** p<0.05, * p<0.10; Sample weights have been used in the analysis.