Early Years Policy

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One of the key challenges for schools in addressing inequality of educational attainment, and promoting social mobility, is that substantial gaps in school readiness are already present at school entry. In the US, studies have found that roughly half the gap in school achievement between less advantaged and more advantaged children is already present when children start school (see e.g. Phillips, Crouse, and Ralph, 1998). Sizable gaps in school readiness among young children have been documented in the UK as well (see e.g. Feinstein, 2003). The presence of such large gaps even before children start school has prompted a great deal of interest in the role that early years policy might play in narrowing these gaps. If schools are to promote equality of educational achievement, surely it would help if children were able to start school on a more equal footing.

The interest in the early years has also been spurred by new research and scholarship in fields such as neuroscience, developmental psychology, and economics. The release of the National Academy of Sciences report *From Neurons to Neighborhoods* (Shonkoff and Phillips, 2000) brought new attention to research on early brain development and the importance of experiences in the early years for child health and developmental outcomes. At the same time, economist James Heckman was emphasizing the importance of the early years for human capital formation, arguing that investments made in the early years would lay the foundation for learning in those years and in the future (Heckman and Lochner, 2000). Heckman has also joined with developmental psychologists in emphasizing that both cognitive and non-cognitive aspects of development are consequential for later life chances (see e.g. Carneiro and Heckman, 2003).

A further impetus for the growing interest in early years policy is the availability of rigorous evidence that high-quality interventions can improve child development in the early years. Random assignment studies (the "gold standard" of empirical research) of programs such as Perry Preschool, Abecedarian, Infant Health and Development, and Nurse-Family Partnerships have found that high-quality early years programs can improve child health and development for disadvantaged children, in both cognitive and non-cognitive domains (see reviews in Karoly et al., 1998; Karoly, Kilburn, and Cannon, 2005). These results provide grounds for optimism that well-crafted policies could play a role in narrowing gaps in school readiness.

At the same time, however, there are clearly some limits to what early years programs can accomplish. Some portion of the differences that emerge in the early years will be due to factors that are not readily altered by policy. A further challenge is that not all early years programs are equally effective, high-quality programs are not inexpensive, and even the most promising model programs may not work as well when delivered on a large-scale. There are also thorny issues to be grappled with regarding the extent to which such programs are best delivered universally or targeted to disadvantaged groups.

In this paper, we use three types of evidence to analyze the role that early years policy might play in narrowing educational attainment gaps. We begin by documenting how large the gaps in school readiness are between low-, middle-, and high-income children in the US and the UK, drawing on data from new large and nationally representative birth cohort studies. To briefly preview those results, we find that sizable income-related gaps in school readiness are already present in both countries before children enter school.

We then go on to decompose the gaps in school readiness (drawing on the very detailed data from the US cohort) to identify the factors that account for the poorer scores of low-income children, as well as those that account for the better scores of high-income children. No one factor drives these results. Rather, a host of differences – in factors such as parenting style and the home environment, maternal and child health, early childhood care and education, and maternal education and other demographic factors – together help explain why low-income children come to school less ready to learn, and why high-income children come to school with an advantage.

What role could early years policy play in tackling these types of differences? We consider this question in the final section of the paper. Drawing on the best available evidence -- emphasizing results from random assignment studies where available -- we discuss what policy reforms would be most effective in helping to close early gaps. To play a role in closing early gaps, policies must 1) effectively address a factor that is consequential for early gaps and 2) do more to improve the school readiness of disadvantaged children than more advantaged children (because they are targeted to disadvantaged children, or, if programs are universally available, because they address gaps in access to beneficial services or have a greater impact on outcomes for disadvantaged children). We identify a number of promising programs that have the potential to meet these criteria.

I. How large are the gaps in early childhood?

We use data from two nationally representative birth cohort studies to document the magnitude of the gaps in school readiness in the US and the UK. For the US, we use data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B), which

gathered data on over 10,000 children born in 2001, with interviews at roughly 9 months, 2 years, and 4 years post-birth. For the UK, we use data from the Millennium Cohort Study (MCS), which collected data on over 19,000 children born in 2000 and 2001, with interviews at 9 months, 3 years, and 5 years post-birth. Both surveys over-sampled some populations of interest, but when properly weighted, the data are nationally representative of all families with newborns.[1] Not all children remain in the sample for all waves, and in addition, some children have missing data on cognitive or behavior outcomes. [2] For the US, we are able to use a total of 8,903 children in constructing our income groups and a slightly smaller sample of 7,960 in analyzing cognitive and behavior outcomes. For the UK, we use a total of 13,423 children in constructing our income groups and a sample of 10,476 in our analysis of cognitive and behavior outcomes.

Income-related gaps

Because our main focus is on income-related gaps in school readiness, we begin by dividing our samples into groups defined by family income over the course of early childhood (i.e. averaged over the three survey waves). Specifically, we divide families into income quintiles, with the first quintile defined as the families with incomes in the bottom fifth of the income distribution for all families with newborns, the second quintile defined as families with incomes in the second to bottom fifth, and so on.[3]

[1] The survey weights, which we use in all our analyses, also correct for attrition (i.e. the loss of some families to follow-up).

[2] Cases that are missing cognitive or behavior outcome data differ somewhat from the cases that remain in the sample and have complete outcome data; in particular, they are disproportionately likely to be from racial/ethnic minority groups or immigrant groups.

[3] Our income measures are standardized for family size and composition. For the US, we use the income-to-needs ratio, which standardizes the family's income relative to the official US poverty threshold for a family of a given size and composition. For the UK, we follow the convention for that country which is to standardize family incomes by family size and composition using the OECD equivalence scale. Then, to facilitate comparison with the US, we relate the family's equivalized income to an absolute poverty line (defined as 60% of median equivalized income before housing costs in 1996/97, uprated only for inflation).

Table 1 shows the income/needs ratios and illustrative family income data for the quintile groups in the US. The bottom quintile has gross family incomes (i.e. incomes before taxes) that place them below the official US poverty line,[4] and the income for an illustrative family – with two parents and two children – is less than $16,500 (in 2001 dollars).[5] The middle-quintile families have incomes ranging from 1.5 to 2.5 times the poverty line, with our illustrative family having an income of between $27,800 and $45,600. In contrast, families in the top quintile have incomes more than 4 times the poverty line, and the illustrative family has an income in excess of $76,500.[6]

Table 2 provides comparable data for the UK. We have used an absolute poverty line and expressed income in gross terms for the UK to make the analysis as comparable as possible to the US. It is important to note that this absolute poverty line is set at a higher level in the UK than it is in the US.[7] It is apparent from this table that the income distribution is less skewed in the UK than it is in the US. Particularly notable is the lower

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There are some missing data on income in the surveys. The US survey imputes missing values for income and we use those in our analysis. The UK survey does not impute missing values for income so we carry out our own imputation so that we can include the full income distribution in defining our quintiles. It should also be noted that the income measures are not completely comparable across the two datasets; in the US data, families report their gross annual income, whereas in the UK survey, families report their net annual income. In Table 3, for illustrative purposes only, we convert net income summary statistics for the UK to gross income using the formula Net=Gross-0.3(Gross-5000).

[4] As detailed in the prior note, this is defined using an absolute poverty threshold that varies by family size and composition.

[5] As shown in Table 1, this translates to an income of less than £10,300 (in 2001 pounds) when adjusted for purchasing power parity (PPP); see notes to Table 1 for details.

[6] These income figures may seem low, but it is important to keep in mind that they refer not to all families but rather to families with newborns, who tend to be younger and to have lower incomes than other families.

[7] The UK mainly uses a relative poverty line. When it does use an absolute line, it defines absolute poverty as income below 60% of what median income was in 1996/1997 (uprated for inflation). The US poverty line is lower as a percent of median income. For this reason, poor and near-poor families have higher gross incomes in the UK than they do in the US (see Tables 1 and 2). Differences in disposable income, however, will be much less marked because of the higher average tax rate in the UK. The OECD tax database gives an average tax rate for a married one-earner couple with two children of 23.2% in the UK in 2001, compared with only 8.5% in the US.

median income of the top quintile group in the UK (and their lower median income/needs ratio) as compared to the income of the top group in the US.

Descriptive statistics (in Table 3 for the US and Table 4 for the UK) provide an indication of how much the income groups vary in terms of some basic demographic characteristics that might matter for school readiness. It is clear that the bottom income quintile is disadvantaged along a number of dimensions, while the families in the top income quintile benefit from many advantages.

How much does school readiness vary across these income groups? Figure 1 shows the income-related gaps for 4 year old children in the US in five measures of school readiness – literacy, mathematics, language, conduct problems, and attention/hyperactivity – all scored in terms of percentile scores that range from 1 to 100.[8] As is evident from the figure, there are sizable income-related gaps in all three cognitive measures. Children in the lowest-income families (quintile 1) score on average at the 34th percentile in literacy and the 35th percentile in language, 13 points lower than their middle-income peers (quintile 3), and at the 32nd percentile in math, 16 points lower than the middle-income group. In contrast, children in the highest-income families (quintile 5) have average cognitive scores at the 67th to 69th percentile, 19 to 22 points higher than the middle-income group and 32 to 37 points above the lowest-income group.

[8] The language, literacy and math scores are all derived using IRT methods from items selected specifically for the ECLS-B. The language assessment includes measures of receptive and expressive vocabulary; the literacy assessment includes measures of letter recognition, early reading skills, and phonological awareness (among other items); and the math assessment tests skills such as counting, number sense, geometry, and patterns. The conduct problems score comes from the mother's report of aggressive or acting-out behavior problems. The attention/hyperactivity score also comes from mother's report and measures problems with paying attention, sitting still, or concentrating on tasks. Children ranged in age from 3 to 5 at the time of assessment, although 80% were age 4; scores on all measures are standardized for the child's age before conversion to percentiles. All outcomes have a (population) standard deviation of 28.9.

Gaps in behavioral dimensions of school readiness exist but are much less pronounced. The lowest-income children score 6 points higher on conduct problems and 3 points higher on attention/hyperactivity than the middle-income children, while the highest-income group scores 4 to 8 points lower (keeping in mind that on these behavior problem measures, lower scores are better as they indicate fewer problems).

Figure 2 provides information on income-related gaps in child outcomes for the UK. The measures for the UK sample differ somewhat from those available for the US sample. The measures of vocabulary, available at both ages 3 and 5, are highly comparable with the language test administered to the US cohort. The only available UK measure that is comparable with literacy and mathematics, however, is the school readiness composite administered at age 3.[9] Although the overall income gradients in the three cognitive measures are similar to those seen in the US, three differences are worth noting. The first is that the gaps in scores between the bottom income quintile and the middle income quintile are slightly larger in the UK than in the US, in large part because the scores of the middle quintile are slightly higher. The second is that the gaps between the top quintile and the middle quintile are smaller, in large part because the scores of the top quintile are not as high as they are in the US. Third, comparing the top quintile to the bottom quintile, the gaps in scores are lower than they are in the US, ranging from 23 to 31 points. These differences make sense given that, as discussed earlier, the income

[9] Vocabulary is measured using the British Ability Scales Naming Vocabulary sub-scale at both 3 and 5. Six sub-scales from the Bracken School Readiness Assessment were used in the derivation of a school readiness composite score. These included knowledge of letters and numbers, and counting (similar to the ECLS-B assessments), and also knowledge of shapes, sizes, colors, and comparisons. Scores were age standardized and converted to percentiles in the same way used for the US data. Population standard deviations are 28.9 for school readiness and hyperactivity/attention, 28.8 for the two vocabulary measures, and 29.1 for conduct problems.

distribution in the UK is less skewed and in particular has lower median incomes in the top quintile.

However, income-related differences in behavior problems are more pronounced in the UK than in the US. This finding seems to be mainly driven by the higher behavior problem scores of the bottom income quintile in the UK. We can only speculate as to the reasons for this. Given that our UK measure of behavior problems comes from age 5 when many of the children have already started school (as compared to the US measure which comes from age 4), the higher levels in the UK may reflect the emergence of larger gradients with age or may reflect adjustment difficulties low-income children have on starting school.[10]

Gaps associated with race/ethnicity and nativity

Although our focus is on income-related gaps in school readiness, other types of gaps in school readiness are of interest to policymakers and researchers. In particular, a good deal of attention in the US has been focused on black-white test score gaps and, more recently, immigrant-native gaps (see e.g. Jencks and Phillips, 1998; Rouse, Brooks-Gunn, and McLanahan, 2005; Magnuson, Lahaie, and Waldfogel, 2006; Magnuson and Waldfogel, in press).

In Figure 3, we show gaps in school readiness among US 4 year olds by race/ethnicity. The racial/ethnic gaps on the cognitive measures are sizable. Hispanic children score on average at the 33rd percentile in language and at the 39th and 40th percentile in literacy and math (respectively). Black children score better, averaging at the 42nd to 45th percentile across the three cognitive outcomes, but still lag behind non-

[10] The UK measure (the Strengths and Difficulties Questionnaire) like the US one is mother-reported, and the content of the two scales is highly similar.

Hispanic white children whose average scores range from the 55th to the 60th percentile. However, levels of behavior problems are nearly identical across the three groups.

Turning to immigrant-native comparisons, shown in Figure 4, the gaps in cognitive outcomes are small, except for language where as might be expected children of immigrants are 22 percentile points behind native children. Immigrant children also have slightly more behavior problems but the differences are small.

Comparable figures for the UK show Pakistani and Bangladeshi children lagging far behind white children in school readiness and vocabulary (Figure 5). Black children (a category that combines Black British children, children from the Caribbean, and children from Africa) also score lower than white children, particularly in vocabulary where they score at the 32nd and 33rd percentile at age 3 and age 5 respectively. In contrast, Indian children, while lagging in vocabulary at age 3, demonstrate a good deal of catch-up by age 5 and also score comparably to white children on school readiness at age 3. Behavior problem differences are less pronounced than the cognitive ones, but with some evidence of higher levels of behavior problems for Pakistani/Bangladeshi children than for children from the other groups.

Figure 6 shows immigrant-native gaps for the UK. Although immigrant children lag in vocabulary at age 3 and, to a lesser extent, at age 5, their school readiness at age 3 is comparable to that of native-born children. Immigrant children have if anything fewer behavior problems than native-born children although the differences are very slight.

These comparisons suggest that income-related gaps are not the same as racial/ethnic or immigrant-native gaps. In general, racial/ethnic minority or immigrant groups do not lag as far behind in cognitive measures of school readiness as the bottom

income quintile does.[11] This pattern of results reinforces the importance of looking at income-related gaps, as we do here.

II. What factors contribute to these gaps?

Having established that large income-related gaps exist in school readiness does not tell us what policies might be effective at reducing those gaps. The gaps shown in Figures 1 and 2 are raw gaps and are not adjusted for other factors that surely play a role in producing such gaps. Low-income families differ from middle- or high-income families along a number of dimensions. As discussed earlier, these families differ on a host of demographic characteristics (see Tables 3 and 4). And possibly even more consequential than these differences in demographic characteristics -- who parents are – are differences in parents' behaviors and the resources they bring to parenting -- what parents do. So we can not assume that increases in income by themselves would close all or even most of the income-related gaps that we find in the raw data.

To identify the factors that account for the income-related gaps in school readiness, we take advantage of the very detailed data in the US study, including direct observations of parenting style as well as measures of the home environment, maternal health and health behaviors, child health, and early childhood care and education, as well as family income and demographics. Focusing on the three cognitive outcomes (since the income-related gaps in the behavioral outcomes tended to be small), we use a two-step method to decompose the income-related gaps into the share accounted for by each of these major domains. In the first step, we use a simple regression model to estimate how much each of the contributing factors varies by income quintile; then, in the second step,

[11] An exception here is the Pakistani/Bangladeshi group in the UK, which has lower average cognitive scores than the bottom income quintile.

we estimate cognitive outcome regression models including controls for all the contributing factors as well as controls for demographic variables and income quintile.[12] Combining information from the two steps allows us to calculate how much each factor contributes to the overall income- related gap in a given outcome (as shown in Table 5 and Appendix Table 1; see also Figures 7, 8, and 9).

A few caveats are in order. First, as with all non-experimental data, we can not be certain that our estimates reveal causal effects, and our estimates may be biased if key explanatory factors are omitted. Second, as discussed earlier, we are able to include in these analyses only those cases for which child outcome data are available. Third, as we discuss further below, because our models are estimated over the full sample, they assume that factors have the same effect on outcomes for low-, middle-, and high-income children; if a given factor has a stronger effect on low-income children, our estimates will not identify that. Fourth, at present we have carried out these estimates only for the US data; thus, results for the UK could differ.

In spite of these limitations, these estimates provide an indication of the relative importance of various factors -- information that is useful for identifying policies that could play a role in closing gaps. And we would emphasize that these estimates are taken from models in which a very rich set of potential influences are included simultaneously, and hence allowed to "compete" with one another for explanatory power. In the sections that follow, we briefly report on the major domains that we find to be consequential in explaining the income-related gaps in the three cognitive outcomes. We focus in our discussion on the gaps in school readiness between low-income children (quintile 1) and

[12] Results of the two steps of the analysis are not shown here but are included in a more detailed companion paper (Waldfogel and Washbrook, 2008).

middle-income children (quintile 3), because these are the gaps that policies would be aimed at addressing, but we also show in Table 5 (and Appendix Table 1) information about the gaps between high-income children (quintile 5) and middle-income children (quintile 3), because these gaps also contribute to inequality of educational outcomes.

Parenting

Parenting differences between low- and higher-income families have been well-documented (see e.g. Hart and Risley, 1995; Lareau, 2003), and they are associated with sizable differences in cognitive development in our analyses as in prior research (see reviews by Desfarges, 2003; Brooks-Gunn and Markman, 2005). We consider two different parenting constructs: *parenting style* and the *home learning environment*.

Parenting style emerges as the single largest domain explaining the poorer cognitive performance of low-income children relative to middle-income children, accounting for 19% of the gap in mathematics (2.98 points of the 15.56 point gap), 21% of the gap in literacy (2.67 points of the 12.68 point gap), and 33% of the gap in language (4.38 points of the 13.31 point gap) (Table 5). A particularly important factor included in the parenting style domain is maternal sensitivity and responsiveness (what is sometimes called nurturance).[13] Developmental psychologists have long emphasized the importance of sensitive and responsive parenting for child development (see discussion in Bornstein, 1989; Shonkoff and Phillips, 2000; Waldfogel, 2006), and our detailed analyses (shown in Appendix Table 1) indicate that this one aspect of parenting style accounts for 11% of the gaps in literacy and math between low- and middle-income children, and 21% of the gap in language skills between these two groups.

[13] Other aspects of parenting included in this domain are knowledge of infant development, discipline, and rules; see Appendix Table 1.

The *home learning environment* is the second most important set of factors in explaining income-related gaps in school readiness. This domain is related to parenting style and we therefore include it under the overall rubric of parenting (following Brooks-Gunn and Markman, 2005). The home learning environment includes parents' teaching behaviors in the home as well as their provision of learning materials and activities, including books and CDs, computer access, TV watching, library visits, and classes. Together these aspects of the home learning environment account for between 16 and 21 percent of the gap in cognitive school readiness between low-income children and their middle-income peers (Table 5). Which particular factor matters most within this domain depends on the particular outcome. For instance, computer access explains 9% of the gap in literacy and math, but is less important for language (Appendix Table 1).

Of course, measures of parenting may at least in part reflect other differences between parents. Our models include controls for many other factors that are likely to be correlated with both parenting and child outcomes – factors such as maternal age, education, race/ethnicity, family size, and marital status. However, we do not have a control for maternal cognitive ability and our measures of parenting may in part be picking up the influence of that omitted factor.[14] At the same time, it is possible that poor-quality parenting is more detrimental for disadvantaged children or children who face other risks. If so, our results might under-estimate the influence of parenting in accounting for these gaps.

[14] In considering the influence of parental cognitive ability, it is important to keep in mind that although intelligence is fairly highly heritable at the *individual* level, this does not mean that *group* differences in cognitive ability are due to genetic differences (see discussion in Flynn, 2007). In addition, there is evidence that intelligence is less heritable – and influenced more by environmental factors – in low-income families, presumably because the resources that would allow for the full expression of children's genetic potential are less available than they are in more advantaged families (see Turkheimer et al., 2003).

Maternal health and health-related behaviors, and child health

In common with prior research (see e.g. Currie, 2005), we find that income-related differences in *maternal health and health-related behaviors* – including smoking, breastfeeding, prenatal care, depression, obesity, and overall health -- play a role in explaining current gaps in school readiness. However, the amount of the gap accounted for by these factors is much smaller than for parenting style or the home learning environment. Taken together, these maternal health and health-related behaviors account for only 4% to 7% of the gap in cognitive outcomes between low-income and middle-income children (Table 5). These figures may be an under-estimate if maternal health and health-related behaviors have stronger effects on low-income children than children overall.

Disparities in *child health* are a well-documented source of disparities in school achievement (see reviews in Currie and Madrian, 1999; Currie, 2005; Case and Paxson, 2006). Our analyses indicate that such disparities account for about 4% of the gap in school readiness between low-income and middle-income children in the US (Table 5). This figure is likely to be an under-estimate, because poor health may have a stronger effect on school achievement for low-income children than for their higher-income peers (see discussion in Case and Paxson, 2006). Nevertheless, in common with prior research (e.g. Currie, 2005; Reichman, 2005), we find that differences in child health are not a major factor in explaining gaps in school readiness.

Early childhood education and care

Given that the US has a largely private market in early childhood education and care (see e.g. Kamerman and Waldfogel, 2005), it is not surprising that large gaps in

enrollment exist between lower-income and more affluent children. As Esping-Anderson (2004) points out, in the absence of a publicly funded system, lower-income families will be constrained in their child care choices, while more affluent families will use their additional income to purchase higher-quality care and education. We consider two major domains of early childhood education and care: *Head Start* (a compensatory education program targeted to low-income children), and *all other types of child care*. Our estimates confirm prior research that finds low-income children less likely to be enrolled in school or center-based settings, although they are more likely to be in Head Start (see e.g. Meyers, Rosenbaum, Ruhm, and Waldfogel, 2004; Barnett and Belfield, 2006).

Our analysis shows that, although low-income children's enrollment in Head Start serves to narrow gaps in school readiness, their lower rates of enrollment in other types of beneficial preschool programs serve to widen gaps in school readiness. Differential enrollment in child care (other than Head Start) accounts for between 4% and 6% of the cognitive gaps between low-income and middle-income children; differential enrollment in Head Start, in contrast, *reduces* current gaps between low- and middle-income children by between 6% and 9% (Table 5).

However, it is important to note that these figures do not tell us what role *future* early childhood education and care policies could play in closing school readiness gaps. The numbers cited above (and shown in Table 5) indicate how much gaps in school readiness would close if children from the lowest quintile had the same enrollment pattern as children from the middle quintile have *currently*. But certainly more ambitious reforms could be modeled. For instance, we might ask how much of the school readiness gap would be closed if *all* low-income children were moved into Head Start or into pre-

kindergarten programs. Our estimates suggest that such reforms could close the gaps in school readiness between low-income and middle-income children by 20 to 50%.[15]

Even these numbers may still be under-estimates, because, as noted earlier, our models assume that the returns to enrollment in such programs are the same for all children. Prior research suggests that low-income children benefit more from high-quality programs than do their more advantaged peers (Magnuson and Waldfogel, 2005), and we find that to be the case in our data as well.[16] If we allowed for children in the lowest income quintile to have larger returns to Head Start or prekindergarten than do children overall, the amount of the gap in school readiness that would be closed by enrolling all low-income children in these programs would be somewhat larger.

A further caveat is that we do not have very good data on the quality of the programs in which children are enrolled. We know that program quality is uneven and that low-income children often attend low-quality care (Meyers et al., 2004). If quality improvements were implemented in early childhood care and education programs, the returns to them – and the share of the gap they would close – would be higher (Magnuson and Waldfogel, 2005). However, we acknowledge that achieving quality improvements in programs serving large numbers of children may be difficult, as well as costly.

Parental education

Consistent with prior research, maternal education emerges as a moderately important factor, explaining 10 to 15% of the gaps in literacy and math readiness between

[15] Specifically, our estimates suggest that enrolling 100% of children in the bottom income quintile in Head Start would raise their literacy scores by 2.6 points (closing 20% of the gap with middle-income children). Enrolling 100% of children in the bottom income quintile in prekindergarten would raise their literacy scores by 6.2 points (closing 49% of the gap with middle-income children). Magnuson and Waldfogel (2005) carry out similar estimates focused on racial/ethnic test score gaps.

[16] When we re-run our models including only the children in the bottom two income quintiles, preschool and prekindergarten programs have a larger effect on cognitive outcomes than they do in the models for the sample overall. The same is true for Head Start.

low- and middle-income children in our analysis (but only 2% of the language gap) (Table 5). It is important to note, however, that some of what is attributed to maternal education in models such as we have estimated here is likely to reflect the influence of other variables not measured in the model (for instance, the mother's intelligence, or aspects of her family background such as family wealth). We can therefore not assume that equalizing maternal education, even if it were possible, would eliminate all of the gap attributed to this factor.

Other demographic differences

With such detailed controls in the model for what parents do and for parental education, it is perhaps not surprising that other demographic differences (in race/ethnicity, family structure, nativity, family member disability, maternal age at birth, number of children in the household, and child gender) play a fairly limited role in explaining income-related gaps in school readiness. These other demographic factors combined explain 16 to 19% of the gaps between low-income children and their middle-income peers (Table 5). The specific demographic factors that matter vary somewhat depending on which cognitive outcome we consider. The most consistent effects are those associated with differences in family size, which account for between 6 and 12% of the gaps in cognitive outcomes between low-income and middle-income children (Appendix Table 1).

Residual (unexplained) component

Even with the inclusion of many controls for the factors discussed above (as well as dummy variables for missing data), sizable income-related differences in school readiness remain. For literacy, 19% of the gap in scores between the lowest-income and

middle-income children remains even after controlling for all the other factors discussed above; the same is true for 23% of the gap in language and 28% of the gap in math (Table 5).

A large literature has attempted to discern to what extent these types of income differences are causal (see e.g. Mayer, 1997). One consistent finding is that to the extent income does causally affect child health and development, its influence appears to be strongest in early childhood, perhaps because most of what children experience in those years occurs in the home or in settings close to home selected by their parents (whereas older children spend more time in school and with peers) (see e.g. Duncan and Brooks-Gunn, 1997).

In the absence of experimental data, we can not assume that all of the remaining income differences we find are caused by income. It is likely that at least some portion of what is attributed to income in our models reflects differences in omitted characteristics or experiences that are correlated with income but not caused by it. As mentioned earlier, one important omitted factor is parental cognitive ability. However, it is also likely that some portion of the residual difference does reflect a causal effect of income, perhaps operating through mechanisms such as parental stress or material hardship.

III. What role can policies play?

This section focuses on the major policy levers that might reduce inequality in school readiness, taking into account what we know about the sources of inequality in early childhood as well as the likely effect of specific policies. Implicit in the analysis is the idea that in order to reduce gaps in school readiness, policies 1) must be effective in addressing factors that are consequential in explaining the gaps and 2) must do more to

improve the performance of disadvantaged children than advantaged children (either because policies are targeted to disadvantaged children, or because policies provided universally close gaps in access to beneficial services or provide services that have a larger impact on the disadvantaged than the advantaged).

With this framework in mind, we now discuss each of the major early years policies that show promise to effectively address one or more of the factors that contribute to gaps in school readiness. To organize the discussion, we distinguish between five broad categories of programs: programs that provide support to parents during pregnancy and early childhood; programs that combine parent support and early child care and education for children age 0 to 2; early child care and education programs for children age 0 to 2; preschool programs for 3 and 4 year olds; and policies to raise the incomes of low-income families with young children (age 0 to 5). We also include a brief discussion of the role that school and higher education policies could play in closing parental education gaps among parents of young children.

It is important to keep in mind that effective programs may address multiple factors. For this reason, we organize our discussion by type of program, rather than by domain or factor addressed.

Programs that provide support to parents during pregnancy and early childhood

Although home visiting programs as a group have had a mixed record of success, one specific program -- the *Nurse-Family Partnership* program based in the US (but now being piloted in the UK) -- has been shown in a series of randomized trials to be successful in meeting its goals of improving prenatal health, reducing dysfunctional care of children early in life, and improving family functioning and economic self-sufficiency.

The program provides nurse home visiting to low-income first-time mothers, delivering about one visit per month during pregnancy and the first two years of the child's life. The program has been shown to improve nutrition and reduce maternal smoking during pregnancy, reduce preterm births, promote heavier birthweight, and also to reduce child abuse and neglect, as measured by reports of abuse or neglect, hospital emergency room visits for infants, and the number of visits specifically associated with an injury or ingestion (Olds et al., 2007). The program has also been found to improve parenting, increasing responsive and sensitive parenting as well as the quality of the home learning environment and parents' literacy activities, gains that have been translated to small improvements in behavioral and cognitive outcomes, but with larger effects for high-risk children (Olds et al., 2007).[17] Finally, the program also improves family functioning, delaying and reducing subsequent births to the first-time mothers served and increasing subsequent maternal employment (Olds et al., 2007). The success of this program, in contrast to other home visiting programs, has been attributed to the fact that it has developed a manualized intervention and that it uses highly trained nurses to deliver it. Cost-benefit analyses have found that the program, which currently costs $9,500 per family (Olds et al., 2007), saves on average $17,000 per family, with larger effects for high-risk families than lower-risk ones (Aos et al., 2004; see also Karoly et al., 1998; Karoly, Kilburn, and Cannon, 2005).

Similarly, although parent support and parent education programs often have weak results, some well-designed and intensive programs have proved effective (in

[17] Following the usual practice in the psychology literature (see Cohen, 1988), I use the term small to refer to effect sizes of 0.20, moderate to refer to effect sizes of 0.50, and large to refer to effect sizes of 0.80. The effect size is calculated by dividing the change associated with the program by the standard deviation of the outcome being considered.

randomized trials) at improving specific aspects of parenting and/or specific child outcomes. One parenting program with a strong evidence base is the *Incredible Years* program, which provides parent training for families with severely behaviorally disordered children. Such children are a small share of the population, but can be very disruptive both at home and in school settings. Incredible Years uses videotapes to teach parents how to manage difficult behavior and has been found to improve parents' ability to manage their children's behavior and to lead to improvements in both conduct disorder and attention (see e.g. Webster-Stratton, 1994; Sonuga-Barke et al., 2001; Jones et al., 2007). Positive impacts on behavior have also been found for the *Triple P-Positive Parenting Program* which like Incredible Years trains parents to better manage children's behavior (Sanders, 1999).

Another promising program – the *Play and Learning Strategies (PALS) program* – provides in-home training to parents of infants and toddlers focused on improving parents' responsiveness and sensitivity. The infant program includes 10 sessions; the toddler program is 12 sessions; and both programs use videotapes as a training tool. PALS has been found to substantially improve parents' responsiveness and sensitivity, their verbal encouragement of children, and their ability to maintain children's interest in activities, and these improvements in turn are reflected in small to moderate improvements in children's attention, use of language, and vocabulary scores (Landry, Smith, and Swank, 2006; Landry, Smith, Swank, and Guttentag, in press; Landry, 2008).

There are also some literacy programs that have been shown to increase parents' literacy activities with children and to improve children's literacy outcomes. In the UK, for instance, the *PEEP (Peers Early Education Partnership) program* aims to foster

reading readiness by providing parents with age-appropriate materials and supporting them in using the materials through either group sessions or home visits. A recent matched control study found that although children receiving PEEP started out with lower levels of literacy skills at age 2, they made greater gains than the control group on several measures of cognitive development between age 2 and age 4 or 5; they also had higher levels of self-esteem at age 5 (Evangelou, Brooks, Smith, and Jennings, 2005; see also results from an earlier study finding cognitive gains, in Evangelou and Sylva, 2003). The group who developed PEEP are now experimenting with additional models of service delivery. To reach parents who may not participate in formal programs, they are piloting a drop-in program delivered in a shopping center (see Evangelou, Smith, and Sylva, 2006). Another new program combines the Incredible Years intervention for behavior problems with an intervention designed to promote parents' support for reading; results from an experimental study find a significant effect of the intervention on parents' reading activities as well as children's reading and writing skills (Sylva et al., in press).

In terms of health- and nutrition focused programs, the *Special Supplemental Program for Women, Infants, and Children (WIC)* provides nutritional advice as well as help in purchasing healthy foods to low-income pregnant women and women with young children in the US. Although not all studies agree, the weight of the evidence indicates that WIC reduces low birthweight and improves child nutrition (see Bitler and Currie, 2005; see also review in Currie, 2003, 2006).[18] Since the WIC program is a capped appropriation (rather than an entitlement), there is scope for improving child health by expanding funding for WIC so that it covers all low-income children.

[18] Among other benefits, WIC provides infant formula, which may reduce breastfeeding. However, as Case and Paxson (2006) discuss, for those women who would not have breastfed anyway, the provision of formula benefits children by delaying the introduction of cow's milk and solid foods.

Smoking cessation programs for pregnant women are another promising policy. Randomized trials have shown that such programs reduce maternal smoking and also result in fewer low birthweight and preterm births (see reviews in Lumley, Oliver, Chamberlain, and Oakley, 2004; Case and Paxson, 2006).

Also relevant here are recent UK policy initiatives providing more income support to pregnant women and women with newborns through increased *maternity grants* and *baby grants* and extensions in the period of *paid maternity leave*. Although these initiatives have not yet been evaluated, prior evidence suggests that they should lead to improvements in maternal health and child health and development (see review in Waldfogel, 2004, 2006).

Programs that combine parent support and early child care and education (for children age 0 to 2)

Although prior comprehensive child development programs for low-income families with young children have had disappointing results, two relatively new programs – Early Head Start in the US and Sure Start in the UK – have shown some success in improving child health and development by providing comprehensive services to low-income families. Both programs combine parent support with early child care.

Early Head Start, established in 1995 as an extension of the long-established Head Start program for 3 to 5 year olds, is designed for low-income children age 0 to 2 and supports a variety of service delivery models including home-based parent support programs, center-based child care programs, and mixed-approach programs that combine parent support and child care. Early Head Start remains a small program, currently serving only 3 percent of eligible children in this age group (Schumacher and DiLauro,

2008). A random assignment study found that Early Head Start improved the quality of parenting (as measured by the emotional and support for learning subscales of the HOME) and also improved child test scores, behavior, and health, with the strongest effects generally found for the mixed-approach programs (Love et al., 2005). The magnitude of these gains was generally small, and a cost-benefit analysis has found that the cost of the program exceeds the benefits that have been documented to date (Aos et al., 2004). Nevertheless, Early Head Start is a potentially promising program and one that merits further development and experimentation.

Sure Start, begun as a pilot program for families in the lowest-income areas in 1999 and quickly expanded to other low-income communities, provides comprehensive services to families with children age 0 to 3. Sure Start is a community-based program – anyone residing in a Sure Start area can receive its services – and communities have a good deal of latitude in what services they offer, although all programs offer some core services such as outreach and home visiting as well as some child care (National Evaluation of Sure Start (NESS), 2008). Some Sure Start programs are led by health agencies and have a strong health focus, while others are led by social services agencies and have a stronger social services focus. Programs also vary in the extent to which they have emphasized the provision of center-based child care above and beyond what is already offered.[19] Since children were not randomly assigned to Sure Start, it has proved challenging to evaluate, and results from several rounds of evaluation studies have not always been consistent (see overview in NESS, 2008). However, the most recent evaluation evidence on established Sure Start programs – using propensity score

[19] It is important to note in this regard that all 3 and 4 year old children now have access to a free part-time nursery place as part of the UK's universal child care initiative.

matching to compare outcomes at age 3 for children in Sure Start areas to outcomes for children from non Sure Start areas – indicates that Sure Start is associated with improvements in 7 of 14 outcomes assessed, including improvements in two aspects of parenting (reductions in negative parenting, improvements in the home learning environment), three aspects of child behavior (social development, positive social behavior, independence/self-regulation), and two health outcomes (increases in receipt of recommended immunizations, reductions in accidental injuries) (although these two health effects may in part reflect over-time improvements rather than program effects) (NESS, 2008).

As part of the UK's Ten Year Childcare Strategy (see HM Treasury et al., 2004), Sure Start programs are now part of a broader initiative to have children's centers in every local community. These centers continue to offer Sure Start services to low-income families but also serve as a hub for child care and other services for young children and their families.

Early child care and education (for children age 0 to 2)

Programs that focus primarily on delivering early child care and education to infants and toddlers have received less attention than the parent support or comprehensive programs for this age group, or preschool programs for slightly older children. In part, this reflects the strong preference that many parents in both countries have for parental care or informal child care for children in this age group, as well as the sense of many practitioners and policy developers that programs for young children should support parents as well as deliver child care and education. The limited provision for this age group also likely reflects the often contested evidence as to how early child care and

education affects children age 0 to 2. In particular, while studies have shown that high-quality child care and education for infants and toddlers raises cognitive achievement, studies have also found associations between early and extensive child care and child behavior problems, particularly when care is of low-quality (see review in Waldfogel, 2006).

Useful policies in this area, then, would focus on improving the access of low-income children to high-quality care and education, by providing more support for low-income children to attend high-quality care and education and by implementing measures to improve the quality of care and education available to them (Waldfogel, 2006). As mentioned earlier, improving quality is challenging. In the US, there is a good deal of interest in *quality-contingent child care subsidy programs,* which provide higher subsidies for low-income families who use higher quality care and education. In both countries, there is interest in raising *regulatory standards* for early child care and education and in *monitoring* those settings more carefully. The UK is also piloting the expansion of *high-quality child care and education centers targeted to low-income 2-year-olds*.

One challenge to be grappled with here is whether such programs should be targeted to low-income children or available more universally. For this age group, given the limited amount of resources currently available to this sector (and in light of the strong preferences many families have to arrange their own care), it probably makes sense to focus on expanding quality-contingent support for low-income families, alongside continued efforts to improve the quality of provision for children in this age group.

Preschool programs (for children age 3 and 4)

For 3 and 4 year olds, there is strong evidence to support expansions in the US *Head Start* and *prekindergarten* programs, both of which have been shown to improve school readiness in rigorous studies. Studies of Head Start include: the recent random assignment study, which found that Head Start resulted in small gains in child cognitive development, behavior, and health (Puma et al, 2005; see discussion in Gormley, 2007; Ludwig and Phillips, 2007); two recent regression discontinuity studies, one of which found long-run health and educational benefits for children likely to have benefited from program expansions in the 1960s (Ludwig and Miller, 2007) while the other documented long-run health and behavioral benefits for a more recent cohort of children (Carneiro and Ginja, 2008); and several studies using sibling comparisons to establish long-run causal effects on outcomes such as increases in high school graduation and reductions in crime (Currie and Thomas, 1995, 1999; Garces, Thomas, and Currie, 2002). Studies documenting cognitive benefits of prekindergarten programs (with generally larger effects for disadvantaged children than for advantaged peers) include several state-level studies using regression discontinuity methods (Gormley and Gayer, 2005; Gormley, Gayer, Phillips, and Dawson, 2005; Wong, Cook, Barnett, and Jung, 2007) as well as observational studies using national data and rich controls (Magnuson, Meyers, Ruhm, and Waldfogel, 2004; Magnuson, Ruhm, and Waldfogel, 2007a and b). Head Start programs are on average more expensive than prekindergarten programs ($7,700 per child as compared to $3,500 per child, according to Gormley, 2007), in large part because prekindergarten programs often operate only part-day and only during the school year. However, gains in cognitive achievement associated with prekindergarten tend to be

larger than those associated with Head Start, probably because prekindergarten programs are operated by school departments (or supervised by them) and are staffed by teachers.

Here, as with younger children, the question arises as to whether such programs should be targeted to low-income children or available more universally. While we favor a targeted approach for younger children, we think the case is strong in favor of universal provision for 3 and 4 year olds. Evidence on state prekindergarten programs makes a compelling case that these programs can deliver high-quality services that promote school readiness, and with larger effects for disadvantaged children (see e.g. Magnuson et al., 2004). For this reason, we would emphasize universal provision of half-day prekindergarten for 3 and 4 year olds, retaining the Head Start program (with some quality improvements; see Currie and Neidell, 2003) to provide supplemental care and education services for low-income 3 and 4 year olds, as well as services for younger low-income children (through the Early Head Start program). We recognize that public funding for two years of prekindergarten for all children would be costly; however, all available evidence suggests that the benefits would more than outweigh the costs (see e.g. discussion in Gormley, 2007). An interim step would be to fund and provide universal prekindergarten to all 4 year olds, while ensuring that all low-income 3 year olds have access to either prekindergarten or Head Start. Another option would be targeting within a universally available program, using a sliding fee scale.[20]

The UK, of course, already provides universal nursery education for 3 and 4 year olds and is working on improving the quality, availability, and affordability of its

[20] Duncan, Ludwig, and Magnuson (2007) propose a sliding fee system whereby poor families would receive the program for free, near-poor families would pay one-third of the costs, moderate income families would pay two-thirds of the costs, and more affluent families (the top 40% of the income distribution) would pay the full costs.

provision as part of its Ten Year Childcare Strategy (HM Treasury et al., 2004). However, challenges remain (see discussion in Butt, Goddard, La Valle, and Hill, 2007; Waldfogel and Garnham, 2008). The quality of care in this sector still leaves much to be desired, and there is still evidence that low-income children are less likely than their higher-income peers to take advantage of the provision. There are also some questions as to whether the free offer is really free, with some parents reporting that they are paying for care that should be provided free under the universal nursery offer. There is also still the challenge of providing good-quality child care during the hours that parents are working and children are not in nursery care, particularly when parents work irregular or non-standard hours. Child care subsidy funding has been greatly expanded but low-income parents still report difficulty in finding affordable care. Policy recommendations to address these problems include: setting higher quality standards; expanding wrap-around care (that combines child care with the part-time nursery provision); developing new models of care for families where parents work irregular and non-standard hours; and increasing the generosity and ease of accessing child care subsidies for the lowest-income families (see e.g. Waldfogel and Garnham, 2008).

Also worth consideration is whether it might be worthwhile to more tightly link nursery provision with the primary schools, so that nursery programs for 3 and 4 year olds are either delivered in the schools or are supervised by them, as is the case with prekindergarten in the US. This is already happening in the UK, but further moves toward having nursery programs more tightly linked to schools, and indeed having more such programs located at the schools, would be a useful next step, as it would serve to align the preschool and primary schools curricula and also raise standards for teachers in

the nursery sector. At the same time, it would free up some existing community-based child care programs to provide more services to the under 3s.

Policies to raise the incomes of poor families

US and UK policies differ in this area (see discussion in Waldfogel, 2007). In the US, unconditional cash supports for low-income families with children have been curtailed, and the largest single income transfer program for low-income families is now the work-conditioned Earned Income Tax Credit (EITC). As a result, in the decade following welfare reform, the only low-income families who saw income gains were those where parents moved into the labor market or increased their work hours (or earnings). In the UK, in contrast, work-oriented welfare reform is just one part of a multi-pronged anti-poverty initiative, which also includes increases in unconditional cash benefits for families with children, with particularly large increases in both *universal child benefits* and *means-tested income support* for young children.

While it is too soon to tell the impact of these reforms on child health and development, analyses of expenditure data reveal striking differences across the two countries. In the US, where income gains have been tied to increased work, low-income families are spending more money on work-related items – such as adult clothing and transportation (Kaushal, Gao, and Waldfogel, 2007). In the UK, in contrast, where all low-income families with children have seen income gains in the form of increased child-related benefits (regardless of whether parents are working), low-income families are spending more money on child-related items – such as children's clothing, and books and toys – while reducing their spending on alcohol and tobacco (Gregg, Waldfogel, and Washbrook, 2005, 2006).

Given the sizable income gaps seen among families with young children, there is certainly scope for further income supports for low-income families. This is particularly true in the US, where such income supports are less generous and where income gaps are wider. The evidence from the UK's recent reforms is promising, in that it suggests that when benefits are labeled as being for children, parents do spend the increased income on the children.[21]

Policies to close gaps in parental education

There is also a considerable role for policy to play in promoting the education of the next generation of parents, as well as in attempting to redress inequality of education in the current generation. In the US, a good deal of attention is focused currently on reducing achievement gaps for students in primary and secondary school and in improving high school graduation rates (see e.g. Murnane, 2007). Such initiatives if successful would go a long way toward narrowing the gap in parental education in the next generation, as Brian Jacob and Jens Ludwig discuss in their paper for this summit. But they are not sufficient. Given the increased demand for skill in the labor market, a high school education is no longer adequate to ensure that parents can support a family above the poverty line. Therefore, further efforts to increase the college enrollment and completion of low-income youth are also needed, as Sarah Turner discusses in her paper. Similarly in the UK, policy initiatives to raise the school leaving age are certainly welcome, but must be pursued in tandem with efforts to raise the share of low-income youth going on to higher education.

[21] There is also promising evidence from US welfare to work experiments, showing that when such policies raise the incomes of families with preschool age children, those children make gains in school achievement (Morris et al., 2001).

IV. Conclusion

In their quest to close income-related gaps in school achievement, researchers and policymakers have begun to focus more attention on the sizable income-related gaps in school readiness that exist even before children enter school. Our analysis of contemporary birth cohort data from the US and UK suggests that this attention is warranted. In both countries, sizable income-related gaps in cognitive development are already apparent in early childhood -- before children start school.

Our analysis also sheds some light on what factors account for these gaps. Income-related differences in parenting style and the home learning environment appear to be the most consequential, together accounting for between a third and a half of the income-related gaps in cognitive performance between low-income and middle-income children in our decomposition using the US data. Other explanatory factors include differences in maternal health and health behaviors, child health, early childhood care and education, maternal education and other demographic differences, and income itself.

What policy levers could most effectively address these gaps in the early years? The good news here is that a number of promising programs have been shown to effectively address one or more of these factors. For instance, in the parenting domain, high-quality home visiting or parent training programs such as the Nurse-Family Partnership, PALS, and PEEP have been shown to be effective at improving parenting style and the home learning environment. Both Early Head Start and Sure Start, while posting somewhat modest effects, nevertheless have out-performed earlier efforts at comprehensive early child development programs. And, the track record for preschool programs (such as Head Start and prekindergarten in the US) is quite strong, and our

estimates suggest that expansions in those programs could make a substantial difference in narrowing the income-related gaps in school readiness that we have documented. Also good news is that the most effective programs often improve more than one set of factors. Some of the best parenting programs, for instance, also improve child health or maternal health behaviors (see, e.g., the evidence on the Nurse-Family Partnership).

Of course, policymakers need to know not just what programs are effective, but what their relative costs and benefits are.[22] Some programs that are effective in improving outcomes for disadvantaged children have also been found to be cost-effective (i.e. to return more in benefits than they cost), but others have not. Moreover, many programs have not had cost-benefit analyses because information to do so has been lacking. A full cost-benefit analysis is beyond the scope of this paper but would be a useful next step.

In the meantime, the analysis in this paper points to several very promising directions for policymakers to consider. Among these we would place the highest priority on 1) expansions in parenting-oriented programs, including those that target several aspects of parenting alongside other domains (programs such as the Nurse-Family Partnership) as well as those that focus more narrowly on specific aspects of parenting related to school readiness (programs such as PALS and PEEP); 2) continued efforts to develop and improve programs such as Early Head Start and Sure Start that have the potential to combine high-quality child care and family support for low-income children age 0 to 2; and 3) expansions in high-quality preschool programs for 3 and 4 year olds, housed in the schools or linked to them.

[22] See e.g. Karoly et al. (1998), Aos et al. (2004), and Karoly, Kilburn, and Cannon (2005) and also Brooks-Gunn, Magnuson, and Waldfogel (2008) who develop and apply a two-step method for estimating the long-run benefits of early childhood interventions when long-run program data are not available.

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Figure 1. Mean child outcome scores in the US cohort at age 4, by income quintile (N = 7960)

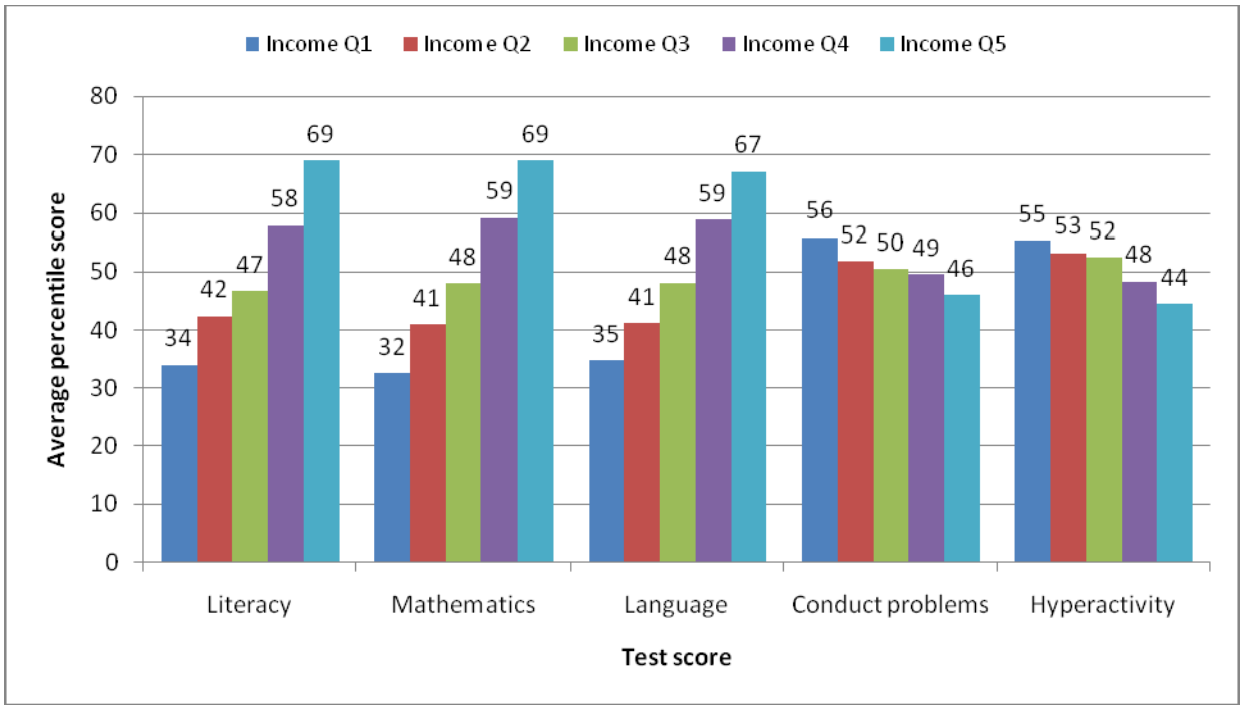

Figure 2. Mean child outcome scores in the UK cohort at ages 3 and 5, by income quintile (N = 10,476)

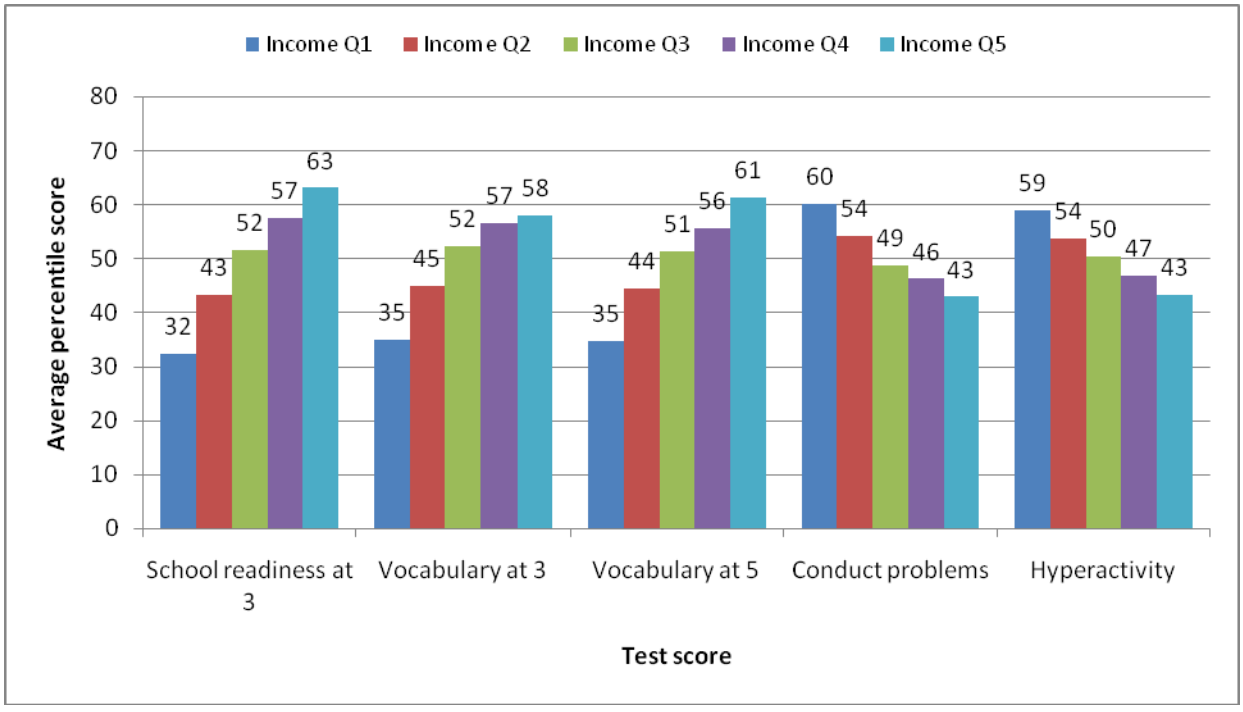

Figure 3. Mean child outcome scores in the US cohort at age 4, by race/ethnicity (N = 7960)

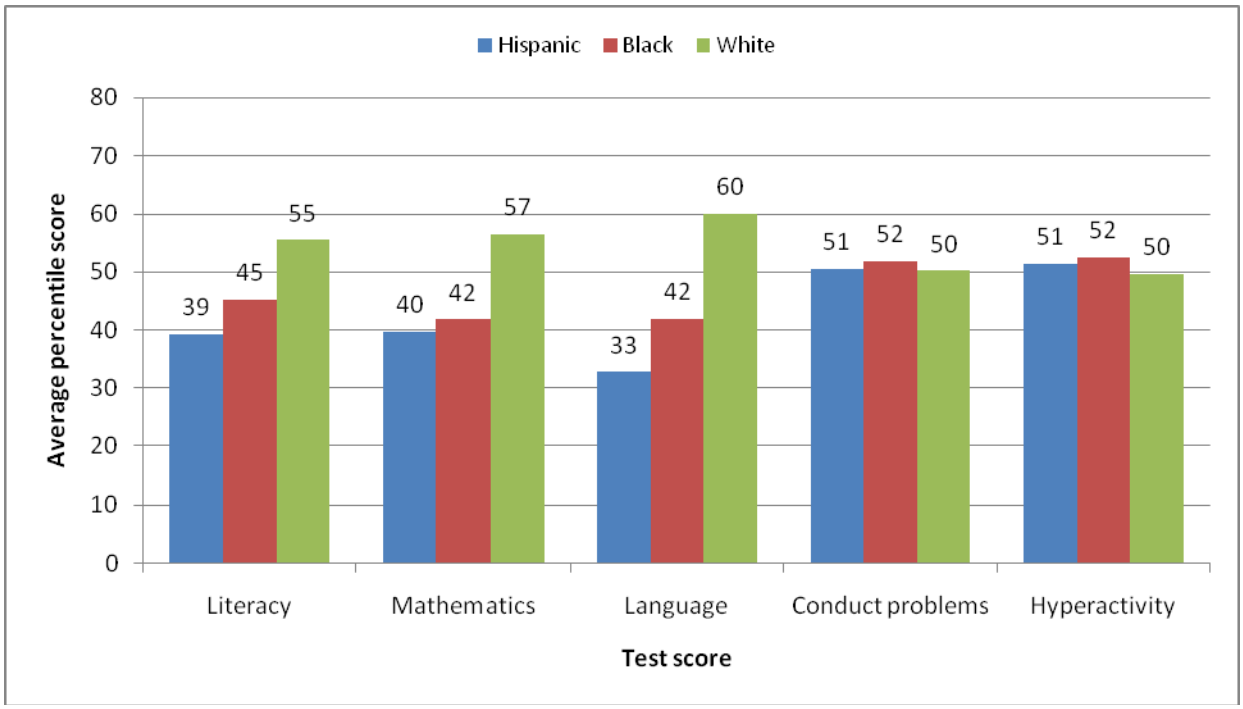

Figure 4. Mean child outcome scores in the US cohort at age 4, by mother's nativity (N = 7960)

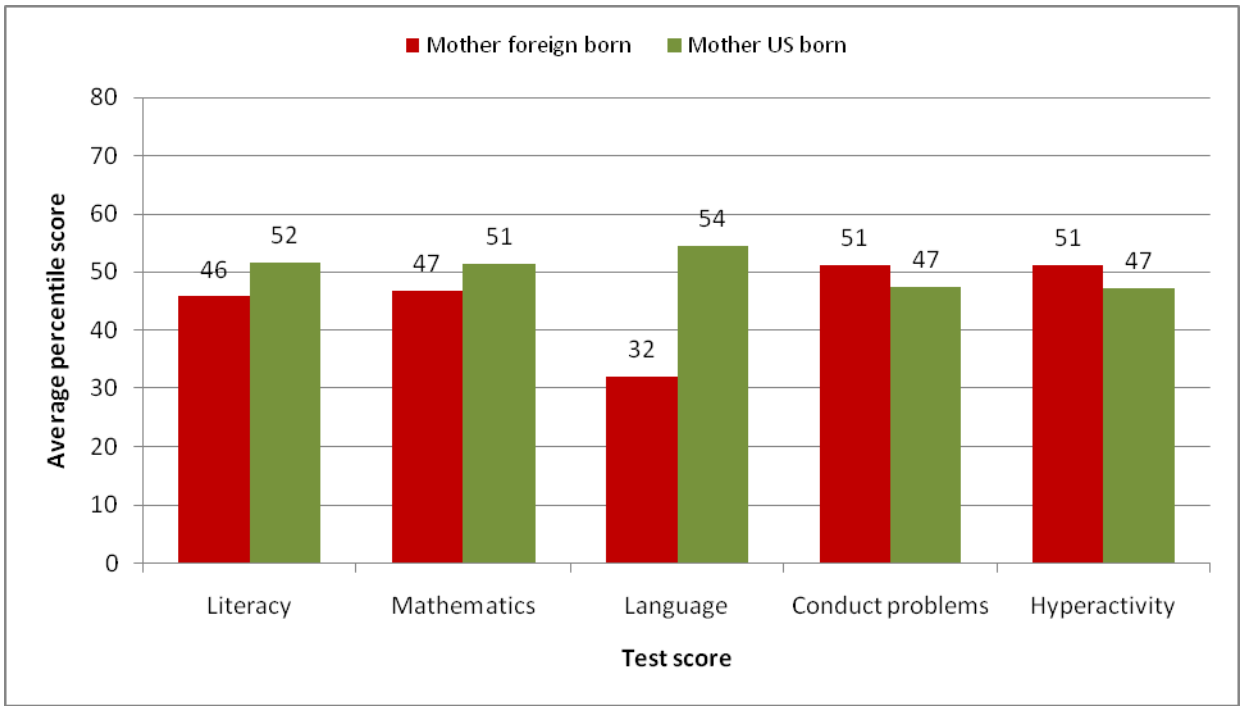

Figure 5. Mean child outcome scores in the UK cohort at ages 3 and 5, by race/ethnicity (N = 10, 476)

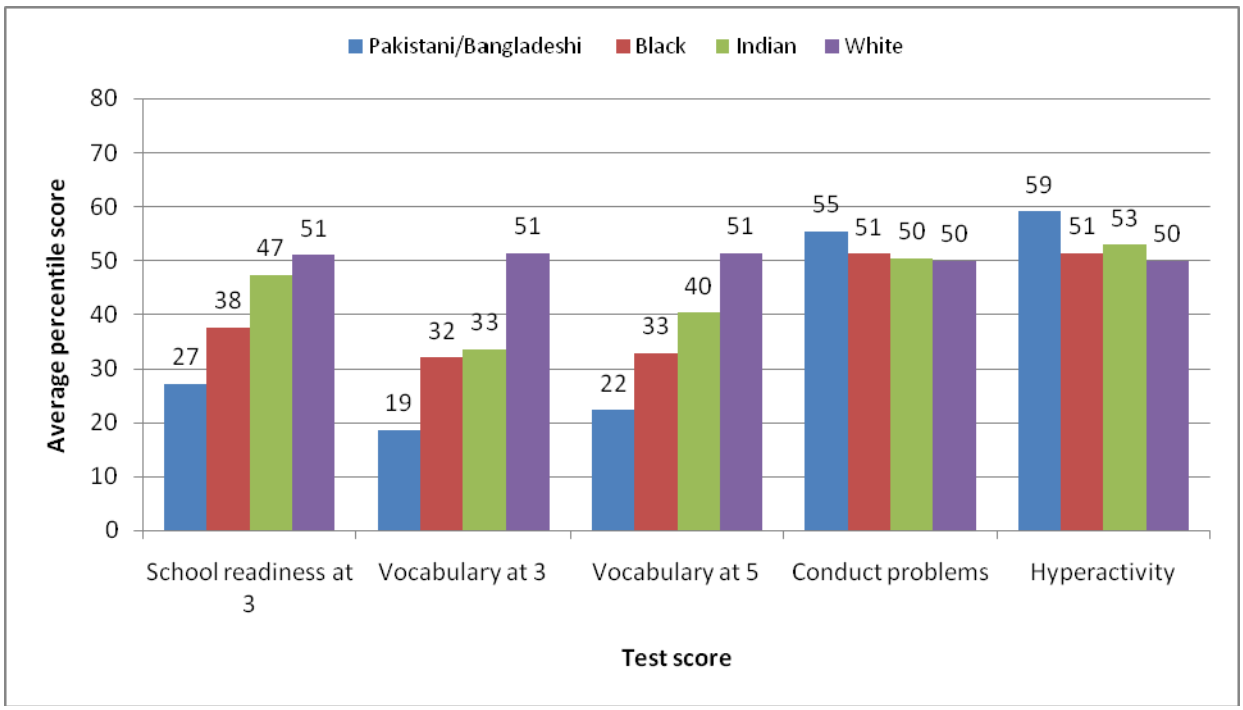

Figure 6. Mean child outcome scores in the UK cohort at ages 3 and 5, by mother's nativity (N = 10,476)

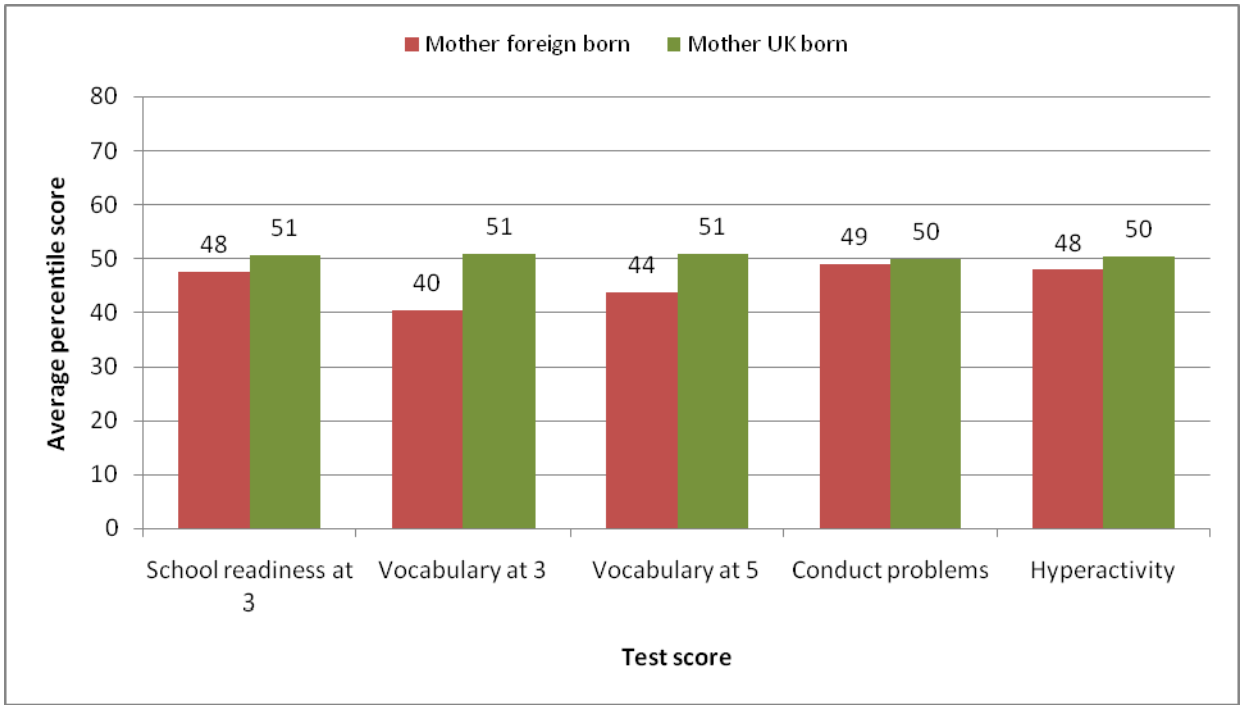

Figure 7. Decomposition of the gaps: Literacy outcomes

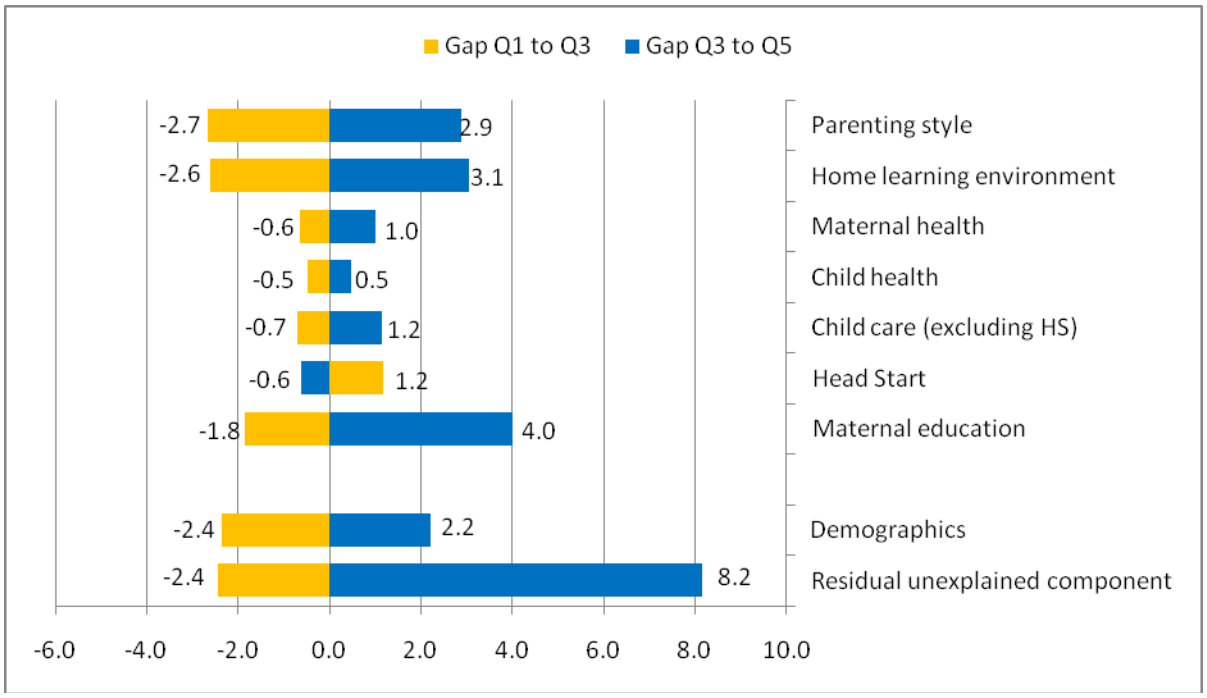

Figure 8. Decomposition of the gaps: Mathematics outcomes

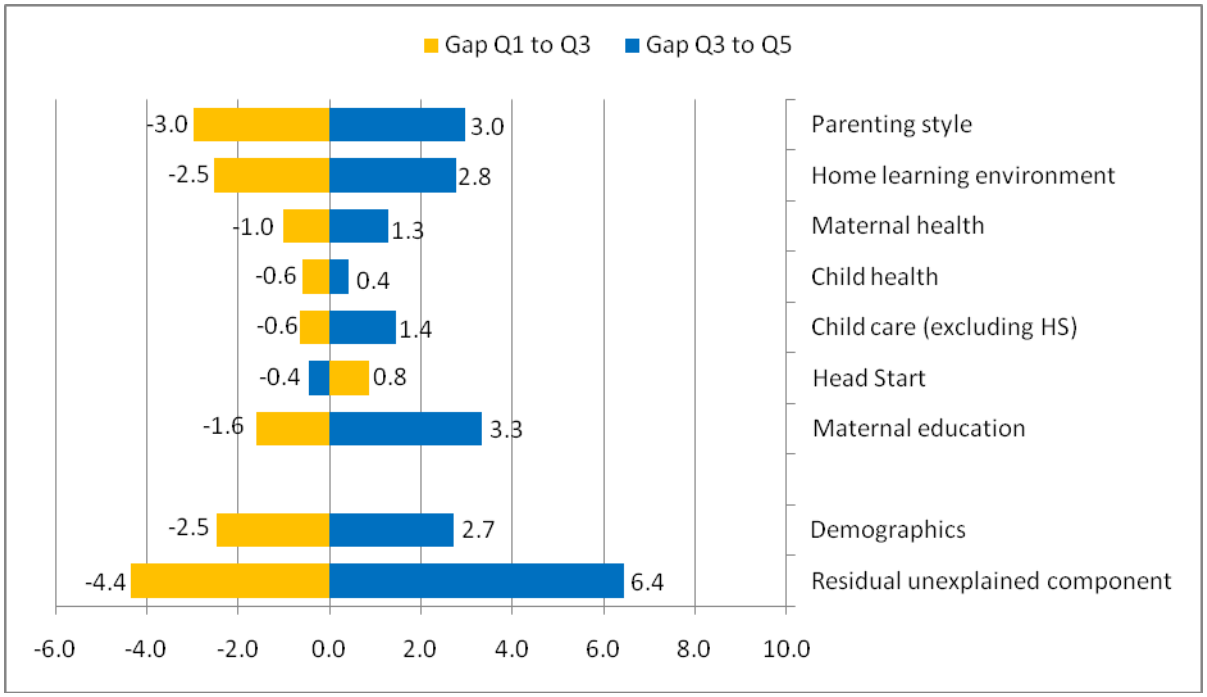

Figure 9. Decomposition of the gaps: Language outcomes

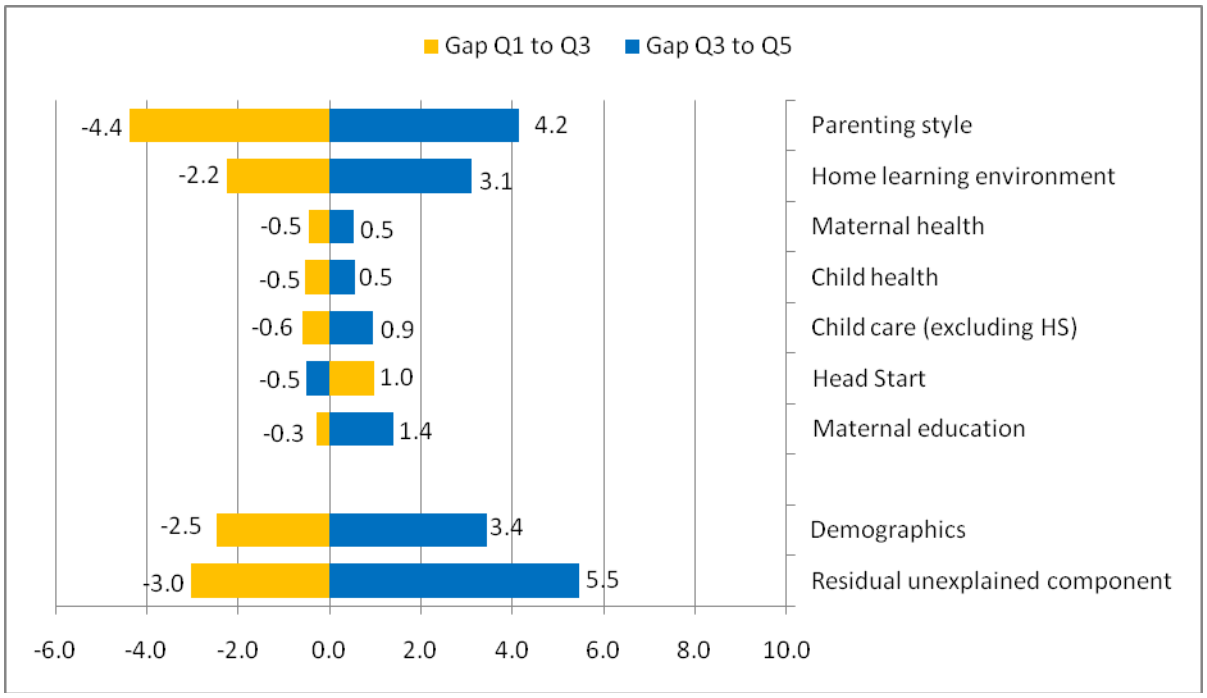

Table 1. Family income distribution of the US cohort

	Income/needs ratio		Example: 2-parent, 2-child family, 2001 US dollars (Gross income)		Example: 2-parent, 2-child family, 2001 GB pounds (Gross income)	
	Boundaries	Median	Boundaries	Median	Boundaries	Median
Q1	< 0.92	0.64	< 16 500	11 500	< 10 300	7200
Q2	0.92 - 1.55	1.23	16 500 - 27 800	22 000	10 300 – 17 400	13 800
Q3	1.55 - 2.54	1.99	27 800 - 45 600	35 800	17 400 – 28 500	22 400
Q4	2.54 - 4.26	3.29	45 600 - 76 500	59 100	28 500- 47 900	37 000
Q5	> 4.26	6.35	> 76 500	114 100	> 47 900	71 400

Table 2. Family income distribution of the UK cohort

	Income/needs ratio		Example: 2-parent, 2-child family, 2001 US dollars (Gross income)		Example: 2-parent, 2-child family, 2001 GB pounds (Gross income)	
	Boundaries	Median	Boundaries	Median	Boundaries	Median
Q1	< 0.89	0.63	< 22 600	15 100	< 14 100	9400
Q2	0.89 - 1.44	1.17	22 600 – 38 800	30 600	14 100 – 24 300	19 100
Q3	1.44 - 2.01	1.71	38 800 – 55 500	46 600	24 300 – 34 700	29 100
Q4	2.01 - 2.88	2.38	55 500 – 81 000	66 200	34 700 – 50 700	41 400
Q5	> 2.88	3.87	> 81 000	108 200	> 50 700	67 700

All estimates weighted to correct for non-random sampling.
Data reflect average annual income over the life of the child, adjusted for household size and expressed in 2001 prices.
US quintiles defined over gross household income divided by relevant poverty threshold.
UK quintiles defined over net household income equivalized using the modified OECD scale.
US poverty line for 2-adult, 2-child family in 2001 = 17 960 USD or 11 200 GBP (Gross income).
UK poverty line = 60% median equivalized disposable household income BHC in 1996/7. Amount for 2-adult, 2-child family is a net income of 20 500 USD or 12 850 GBP, approximately equivalent to a gross income of 25 900 USD or 16 200 GBP.
Currency conversion uses OECD PPP from 2001, 1 USD = 0.626 GBP.
UK gross income figures approximated using the formula: Net = Gross – 0.3(Gross – 5000)
All figures rounded to the nearest 100.

Table 3. Demographic characteristics of the US cohort, by income quintile (weighted proportions, N = 8903)

Proportion with characteristic		Income/needs quintile				
	All	Lowest	Second	Middle	Fourth	Highest
White	0.54	0.25	0.41	0.52	0.71	0.79
Black	0.14	0.31	0.14	0.12	0.07	0.04
Hispanic	0.25	0.38	0.37	0.28	0.14	0.09
Asian	0.03	0.01	0.02	0.02	0.03	0.04
Mixed race	0.04	0.04	0.04	0.04	0.04	0.03
Other	0.01	0.02	0.01	0.01	0.01	0.00
Mother foreign born	0.21	0.30	0.30	0.18	0.13	0.12
Stable married	0.62	0.26	0.47	0.62	0.82	0.91
Stable cohabiting	0.06	0.10	0.11	0.06	0.03	0.01
Some single mother	0.18	0.29	0.25	0.20	0.10	0.06
Stable single mother	0.12	0.32	0.14	0.08	0.03	0.02
Other	0.03	0.03	0.03	0.04	0.02	0.01
Family member has disability	0.11	0.18	0.12	0.11	0.08	0.08
Maternal education (9 months)						
Less than high school	0.27	0.62	0.42	0.22	0.08	0.03
High school	0.22	0.24	0.30	0.29	0.17	0.08
Some college	0.27	0.13	0.24	0.37	0.37	0.23
Degree or more	0.24	0.01	0.04	0.12	0.38	0.67
Maternal age (at birth)						
Less than 20	0.11	0.23	0.17	0.12	0.03	0.01
20 to 24	0.25	0.34	0.38	0.31	0.18	0.06
25 to 29	0.26	0.22	0.23	0.30	0.32	0.26
30 to 34	0.24	0.14	0.14	0.18	0.31	0.41
35 or more	0.14	0.07	0.08	0.10	0.17	0.27
Under 18s in household (at 4 yrs)						
1	0.18	0.14	0.19	0.20	0.19	0.20
2	0.42	0.29	0.38	0.41	0.51	0.53
3	0.25	0.29	0.27	0.24	0.23	0.20
4	0.10	0.16	0.11	0.11	0.06	0.05
5 or more	0.05	0.13	0.05	0.04	0.02	0.01

Table 4. Demographic characteristics of the UK cohort, by income quintile (weighted proportions, N = 13,423)

Proportion with characteristic		Income/needs quintile				
	All	Lowest	Second	Middle	Fourth	Highest
White	0.90	0.77	0.89	0.94	0.96	0.93
Indian	0.02	0.03	0.02	0.01	0.01	0.02
Pakistani/Bangladeshi	0.03	0.11	0.03	0.01	0.00	0.00
Black	0.02	0.04	0.02	0.02	0.01	0.01
Mixed	0.03	0.05	0.03	0.02	0.02	0.03
Other	0.01	0.01	0.01	0.01	0.00	0.01
Mother foreign born	0.09	0.16	0.09	0.06	0.06	0.10
Stable married	0.65	0.29	0.57	0.73	0.81	0.88
Stable cohabiting	0.11	0.08	0.13	0.13	0.11	0.08
Some single mother	0.14	0.34	0.20	0.10	0.06	0.03
Stable single mother	0.06	0.24	0.05	0.01	0.01	0.00
Other	0.03	0.05	0.05	0.03	0.02	0.01
Maternal education (9 months)						
Below GCSE A-C	0.21	0.53	0.29	0.14	0.08	0.03
GCSE A-C	0.27	0.27	0.35	0.33	0.26	0.14
A-level	0.25	0.15	0.25	0.33	0.31	0.22
Degree or more	0.26	0.05	0.11	0.21	0.35	0.61
Maternal age (at birth)						
Less than 20	0.06	0.19	0.07	0.02	0.01	0.00
20 to 24	0.14	0.28	0.21	0.12	0.06	0.02
25 to 29	0.27	0.23	0.30	0.34	0.29	0.20
30 to 34	0.34	0.18	0.27	0.35	0.43	0.46
35 or more	0.19	0.11	0.14	0.17	0.21	0.32
Under 18s in household (at 5 yrs)						
1	0.15	0.18	0.12	0.13	0.16	0.16
2	0.50	0.33	0.45	0.53	0.59	0.60
3	0.24	0.25	0.28	0.26	0.20	0.20
4	0.08	0.14	0.12	0.06	0.05	0.03
5 or more	0.03	0.09	0.04	0.01	0.01	0.01

Table 5. Decomposition of the US income gradients in early childhood outcomes

	Language		Literacy		Mathematics	
	Q1	Q5	Q1	Q5	Q1	Q5
Total parenting style	-4.38	4.15	-2.67	2.87	-2.98	2.96
	[32.9]	[21.8]	[21.0]	[12.9]	[19.2]	[14.1]
Total home learning environment	-2.24	3.10	-2.62	3.05	-2.52	2.78
	[16.8]	[16.3]	[20.7]	[13.7]	[16.2]	[13.3]
Total maternal health & health behaviors	-0.47	0.52	-0.65	0.99	-1.00	1.28
behaviors	[3.5]	[2.7]	[5.1]	[4.5]	[6.5]	[6.1]
Total child health	-0.53	0.54	-0.48	0.48	-0.59	0.42
	[4.0]	[2.9]	[3.8]	[2.1]	[3.8]	[2.0]
Total child care (excluding HS)	-0.60	0.94	-0.72	1.16	-0.64	1.44
	[4.5]	[4.9]	[5.7]	[5.2]	[4.1]	[6.9]
Ever in Head Start	0.97	-0.51	1.17	-0.62	0.85	-0.45
	[-7.3]	[-2.7]	[-9.2]	[-2.8]	[-5.5]	[-2.1]
Mother's education	-0.29	1.41	-1.85	4.00	-1.62	3.34
	[2.2]	[7.4]	[14.6]	[18.0]	[10.4]	[15.9]
Total demographics	-2.48	3.43	-2.36	2.22	-2.47	2.71
	[18.6]	[18.0]	[18.6]	[10.0]	[15.9]	[13.0]
All missing dummies	-0.26	0.03	-0.07	-0.03	-0.24	0.01
	[1.9]	[0.1]	[0.5]	[-0.1]	[1.5]	[0.0]
Residual unexplained component	-3.04	5.45	-2.45	8.15	-4.36	6.44
	[22.8]	[28.6]	[19.3]	[36.6]	[28.0]	[30.8]
Total gap	-13.31	19.06	-12.68	22.27	-15.56	20.93
	[100]	[100]	[100]	[100]	[100]	[100]

Numbers show the gap with the middle income quintile associated with each group of factors in percentile scores. Numbers in brackets show the percentages of the overall raw gaps associated with each group. Gaps for the second and fourth income quintiles estimated but not shown. N = 7960.

Appendix Table 1. Detailed decomposition of the US income gradients in preschool outcomes

	Language		Literacy		Mathematics		Behavior	
	Q1	Q5	Q1	Q5	Q1	Q5	Q1	Q5
Total parenting style	**-4.38**	**4.15**	**-2.67**	**2.87**	**-2.98**	**2.96**	**-1.13**	**1.57**
Maternal sensitivity/responsiveness	-2.74	2.59	-1.44	1.38	-1.75	1.59	-1.46	1.41
Knowledge of infant development	-1.24	0.99	-0.74	0.59	-0.86	0.69	0.88	-0.70
Spanking	0.00	-0.01	-0.02	0.15	-0.04	0.13	-0.12	0.41
Rules	-0.40	0.59	-0.47	0.75	-0.34	0.54	-0.43	0.45
Total home learning environment	**-2.24**	**3.10**	**-2.62**	**3.05**	**-2.52**	**2.78**	**-3.08**	**5.04**
Home cognitive behaviors	-0.78	0.98	-0.81	1.03	-0.45	0.59	-2.01	2.41
Classes at age 4	-0.19	1.08	-0.20	0.84	-0.23	1.04	-0.53	2.09
Library visits	-0.20	0.31	-0.12	0.19	-0.07	0.11	0.01	0.00
Books & CDs	-0.54	0.28	-0.31	0.19	-0.35	0.24	-0.19	0.07
Computer access	-0.48	0.28	-1.11	0.54	-1.39	0.70	-0.29	0.12
TV watching	-0.04	0.17	-0.07	0.28	-0.03	0.10	-0.06	0.36
Total maternal health & health	**-0.47**	**0.52**	**-0.65**	**0.99**	**-1.00**	**1.28**	**-2.06**	**2.29**
Smoking	-0.05	-0.24	-0.19	0.14	-0.48	0.27	-0.28	0.34
Breastfeeding	0.00	0.05	-0.15	0.19	-0.22	0.25	0.29	-0.29
Prenatal care	0.11	-0.04	0.00	0.00	0.12	-0.05	-0.04	0.02
Depression	-0.13	-0.01	0.00	-0.04	-0.15	0.13	-1.62	1.54
Maternal BMI	-0.34	0.69	-0.20	0.54	-0.24	0.62	-0.09	0.17
Maternal general health	-0.05	0.08	-0.11	0.17	-0.03	0.05	-0.33	0.52
Total child health	**-0.53**	**0.54**	**-0.48**	**0.48**	**-0.59**	**0.42**	**-1.34**	**1.18**
Child health at birth	-0.07	0.13	-0.09	0.15	-0.15	0.26	-0.07	0.09
Later child health	-0.46	0.42	-0.39	0.33	-0.43	0.15	-1.27	1.09
Total child care (excluding HS)	**-0.60**	**0.94**	**-0.72**	**1.16**	**-0.64**	**1.44**	**0.07**	**-0.05**
Child care pre-4 yrs	-0.20	0.12	-0.09	-0.02	-0.17	0.45	-0.04	0.09
Child care @ 4 yrs	-0.40	0.82	-0.62	1.18	-0.46	0.99	0.11	-0.14
Ever in Head Start	**0.97**	**-0.51**	**1.17**	**-0.62**	**0.85**	**-0.45**	**0.05**	**-0.03**
Mother's education	**-0.29**	**1.41**	**-1.85**	**4.00**	**-1.62**	**3.34**	**0.12**	**-0.95**
Total demographics	**-2.48**	**3.43**	**-2.36**	**2.22**	**-2.47**	**2.71**	**1.60**	**-1.35**
Black	-0.96	0.40	1.08	-0.45	-0.07	0.03	1.29	-0.53
Hispanic	-0.62	2.05	-0.21	0.68	-0.33	1.09	0.06	-0.20
Other race/ethnicity	0.05	-0.10	-0.16	0.22	-0.10	0.18	0.03	-0.04
Family structure	0.79	-0.39	-1.19	0.69	-0.61	0.28	0.16	-0.26
Mother foreign born	-0.49	0.31	-0.02	0.01	0.13	-0.08	0.10	-0.06
Family member disability	-0.19	0.09	-0.22	0.11	-0.38	0.19	0.03	-0.02
Mother's age at birth	-0.26	0.71	-0.21	0.23	-0.13	0.44	0.23	-0.25
# Under 18s in hhold @ 4 yrs	-0.83	0.48	-1.48	0.84	-1.00	0.68	-0.37	0.22
Child female	0.04	-0.11	0.04	-0.12	0.03	-0.09	0.07	-0.21
All missing dummies	**-0.26**	**0.03**	**-0.07**	**-0.03**	**-0.24**	**0.01**	**-0.06**	**-0.02**
Residual unexplained component	**-3.04**	**5.45**	**-2.45**	**8.15**	**-4.36**	**6.44**	**0.51**	**-1.39**
Total gap	-13.31	19.06	-12.68	22.27	-15.56	20.93	-5.32	6.30

Numbers in bold represent group totals. Numbers shown are percentile scores.