Family poverty and trajectories of children's emotional and behavioural problems: The moderating roles of self-regulation and verbal cognitive ability
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Abstract:	Socio-economic disadvantage is strongly associated with children's emotional (internalising) and behavioural (externalising) problems. Self-regulation and verbal cognitive ability have been related to children's emotional and behavioural resilience to socio-economic disadvantage. Despite being inter-related, self-regulation and verbal cognitive ability have not been examined jointly as promoting resilience in young children. This study investigated the roles of self-regulation and verbal cognitive ability in children's emotional and behavioural resilience to family socio-economic disadvantage from early to middle childhood (ages 3, 5, and 7 years; N = 16,916; 49% girls). Using multivariate response growth curve modelling, we found that the relationship between socio-economic disadvantage and internalising problems was stronger for children with lower verbal cognitive ability. Also, poor children with high and low levels of self-regulation showed a widening gap in both emotional and behavioural problems over time. Poor and non-poor children alike benefited from self-regulation, but poor children appeared to be more vulnerable to low self-regulation. Self-regulation and verbal cognitive ability seem to be important protective factors for young children growing up in poor families.

Family Poverty and Trajectories of Children's Emotional and Behavioural Problems: The

Moderating Roles of Self-regulation and Verbal Cognitive Ability

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Abstract

Socio-economic disadvantage is strongly associated with children's emotional (internalising) and

behavioural (externalising) problems. Self-regulation and verbal cognitive ability have been related

to children's emotional and behavioural resilience to socio-economic disadvantage. Despite being

inter-related, self-regulation and verbal cognitive ability have not been examined jointly as

promoting resilience in young children. This study investigated the roles of self-regulation and

verbal cognitive ability in children's emotional and behavioural resilience to family socio-economic

disadvantage from early to middle childhood (ages 3, 5, and 7 years; N = 16,916; 49% girls). Using

multivariate response growth curve modelling, we found that the relationship between socio-

economic disadvantage and internalising problems was stronger for children with lower verbal

cognitive ability. Also, poor children with high and low levels of self-regulation showed a widening

gap in both emotional and behavioural problems over time. Poor and non-poor children alike

benefited from self-regulation, but poor children appeared to be more vulnerable to low self-

regulation. Self-regulation and verbal cognitive ability seem to be important protective factors for

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Keywords: emotional and behavioural problems, self-control, self-regulation, socio-economic

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Family Poverty and Trajectories of Children's Emotional and Behavioural Problems: The

Moderating Roles of Self-regulation and Verbal Cognitive Ability

The association of socio-economic disadvantage (SED) with children's emotional

(internalising) and behavioural (externalising) problems is well-known (Ackerman, Brown, & Izard,

2004; Bradley & Corwyn, 2002; McLoyd, 1998). Children living in poverty at any point in early life,

but particularly those exposed chronically to disadvantage (National Institute of Child Health and

Human Development Early Child Care Research Network, 2005), are at risk of emotional and

behavioural problems. Low-income families are more likely to experience stress, which affects

parental mental health (Kiernan & Huerta, 2008). If mental health is compromised, parents may

resort to less optimal parenting practices (e.g., harsh discipline), adversely affecting their child's

adjustment. There is also evidence in support of family investments, including the provision of

stimulating home learning experiences, mediating the effect of poverty on child behaviour (Kiernan

& Huerta, 2008).

However, there is also great variability in outcomes for children exposed to family SED (Kim-

Cohen, Moffitt, Caspi, & Taylor, 2004). Research has shown that some children escape the

consequences of such contextual risk. Such 'resilience' may be due to certain individual

characteristics, family qualities or environmental influences, likely working together to forge

resilience through a dynamic process (Rutter, 2013). Two child-level protective factors associated

with better than expected emotional and behavioural outcomes in poor children are verbal cognitive

ability (Flouri, Mavroveli, & Tzavidis, 2012) and self-regulation (Lengua, 2003; Lengua, Bush,

Long, Trancik, & Kovacs, 2008). However, little is known about how these factors influence

pathways of psychopathology during early-to-middle childhood. There is also a need to examine

self-regulation in a larger, more representative sample of children and their families, as relevant

research findings are based on smaller samples. It is also important to examine the protective role of

self-regulation in resilience among younger children. Self-regulation is more malleable than verbal

cognitive ability, particularly in the early years (Heckman, 2006), and, as such, a clearer target for intervention. Finally, it is important to disentangle any unique protective effects of self-regulation and verbal cognitive ability, as self-regulation is related to cognitive ability (McClelland et al., 2007; Shamosh & Gray, 2008), particularly verbal in early childhood (Roben, Cole, & Armstrong, 2013). Cole, Armstrong, and Pemberton (2003) proposed several ways that language may support self-regulation skills in young children. For example, expressive language provides children with a socially acceptable way to communicate their needs, and language enhances children's abilities to understand thoughts and feelings.

Verbal cognitive ability and self-regulation

Verbal cognitive ability, a strong predictor of emotional and behavioural adjustment in children (Bornstein, Hahn, & Suwalsky, 2013), is related to socio-economic status (Pungello, Iruka, Dotterer, Mills-Koonce, & Reznick, 2009), and has been associated with better than expected emotional and behavioural adjustment in disadvantaged children. One reason for expecting a moderating (or 'protective') role for verbal cognitive ability is that poor children with more advanced language skills may be more successful at accessing resources or eliciting responses from their environments, which tend to be relatively low in cognitive stimulation (Hoff, 2003). Another is that verbal cognitive ability is related to intelligence, the aptitude to assess and handle problems of adversity (Masten et al., 1999). Children with higher ability may be better equipped to find solutions for stressful situations or even to avoid them.

Self-regulation is the capacity to direct and focus one's actions and/or attentions to meet one's goals. It may also refer to delay-of-gratification, conscientiousness, self-discipline, and executive function. Underlying each of these constructs is the notion of effortful regulation of the self by the self (Duckworth, 2011), reflecting the ability to act purposefully in modulating thoughts, emotions and behaviour. Self-regulation develops rapidly in the early years of life, and more slowly into adulthood (Eisenberg, Valiente, & Eggum, 2010), is moderately stable within an individual over

time (Kochanska, Murray, & Harlan, 2000), and is compromised under highly adverse conditions

(Banfield, Wyland, Macrae, Munte, & Heatherton, 2004). Self-regulation and its related skills

influence positive development in a child depending on her biology and environmental exposures

(Eisenberg, Spinrad, & Eggum, 2010). Early self-regulation has been linked to positive outcomes

such as academic readiness and success (Blair & Razza, 2007), empathy, compliance, and social

competence (Eisenberg et al., 2003; Lengua, 2003). It has also been negatively associated with child

mental health problems, particularly externalising difficulties (Eisenberg, Spinrad, et al. 2010;

Lengua, 2003). Childhood self-regulation has been related to adult outcomes as well, such as

physical health, substance abuse, criminal offending (Moffitt et al., 2011), and psychiatric disorders

(Caspi, Moffitt, Newman, & Silva, 1996). Importantly, it has also been found to explain part of the

effect of contextual risk on adjustment. Doan, Fuller-Rowell, and Evans (2012), taking a summative

index of exposure to stressors such as poverty, overcrowding and family disruption, showed that

self-regulation helped to explain how cumulative risk affected adolescents' later externalising

(although not internalising) problems. The relatively low self-regulation in poor children has been

related to household chaos (Hardaway, Wilson, Shaw, & Dishion, 2012) and compromised parenting

behaviours, including more negative affect, inconsistent discipline, lower responsiveness and less

support for autonomy (Lengua, 2009), which are more common among poor families. While self-

regulation may explain part of the association of SED with child adjustment problems, it may be

particularly important for reducing socio-economic inequalities in adult (Chen, 2012) and child

(Lengua et al., 2008) mental health. Lengua et al. (2008) found that effortful control moderated and

weakly mediated the effect of socio-economic, material, and environmental risk on changes in

children's internalising and externalising problems in a small community sample of 189 children,

followed from age 8-12 years. Whereas efforts to control situations are associated with positive

outcomes in general, self-regulation (efforts to control oneself) may be particularly beneficial for

those in poverty, who are more likely to encounter recurrent and less controllable stressors.

The present study

To our knowledge, no study has yet investigated whether self-regulation can moderate the association between family socio-economic risk and the pathways of adjustment problems in younger children, and in a larger, more representative sample. Furthermore, as discussed, self-regulation and verbal cognitive ability have not been examined jointly, despite their interrelatedness, as promoting resilience to SED in young children. In this study, we addressed both issues, using large-scale longitudinal data from the UK's Millennium Cohort Study (MCS). We tested whether the association between family SED and problem behaviour (internalising and externalising) at 3, 5, and 7 years would be weaker in children with higher verbal cognitive ability and self-regulation. As socio-economic risk factors tend to cluster within individuals, we captured multiple family risk factors associated with poverty including overcrowding, lack of home ownership, low income, and receiving income benefits. We hypothesised that, both concurrently and over time, family SED would be related to more emotional and behavioural problems among children, and that their verbal cognitive ability and self-regulation would be associated with fewer of these problems. Also, given the associations of cognitive ability and self-regulation with resilience in older children, we expected the effect of socio-economic disadvantage to be diminished among younger children with greater ability and self-regulation, thereby equalizing outcomes among children unexposed and exposed to disadvantage. We also anticipated that verbal cognitive ability and self-regulation would play independent roles in resilience.

Our models adjusted for mother's education as a proxy for maternal cognitive ability and parental human capital, to avoid attributing to family SED that which is due to correlated determinants of both disadvantage and child outcomes. We also adjusted for maternal psychological distress, which is particularly prevalent among poor women with young children (Reading & Reynolds, 2001), and is also strongly related to child self-regulation (Feng et al., 2008) as well as externalising and internalising problems (Goodman & Gotlib, 1999). We also adjusted for lone

parenthood and home organisation. Lone parenthood is a strong correlate of both family poverty and

children's behaviour (Kiernan & Mensah, 2009), as well as self-regulation in children (Evans, 2003).

Home (dis)organisation has been related to family-level contextual risk, such as poverty, and to

children's cognitive ability (Deater-Deckard et al., 2009) and self-regulation (Evans, Gonnella,

Marcynyszyn, Gentile, & Salpekar, 2005). The child-level covariates were sex and ethnicity. Girls

are at lower risk of behavioural problems than boys (Egger & Angold, 2006), and show an advantage

in self-regulation (Matthews, Ponitz, & Morrison, 2009) and verbal cognitive ability (Wallentin,

2009). The main ethnic minority groups in the UK have similar or better mental health than white

British children for common disorders, and higher rates for some less common conditions

(Goodman, Patel, & Leon, 2008).

Method

Participants and Procedure

The Millennium Cohort Study (MCS; www.cls.ioe.ac.uk/mcs) is a longitudinal survey

drawing its sample from all births in the UK over a year, beginning on 1 September 2000. The

sample is disproportionately stratified to ensure adequate numbers in the four UK countries and

electoral wards with disadvantaged or ethnic minority populations (Plewis, 2007, for details).

Sweeps 1-4 took place when the children were 9 months, and 3, 5, and 7 years, with interviews of

18,532 families at Sweep 1, 15,448 at Sweep 2, 15,210 at Sweep 3, and 13,797 at Sweep 4 (Hansen,

2010). We used records for only the first-born among twins and triplets. We modelled trajectories of

internalising and externalising problems across the sweeps at ages 3, 5 and 7 years. Our analytic

sample (n = 16,916) comprised cohort members with at least one score for either externalising or

internalising problems.

Measures

Internalising and externalising problems were measured at ages 3, 5 and 7 with the

parent-reported Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The SDQ

is a 25-item scale measuring four domains of difficulties (hyperactivity, emotional symptoms, conduct problems, and peer problems) and prosocial behaviour. Item responses range from 0 to 2. In line with recommended practice (Goodman, Lamping, & Ploubidis, 2010), the internalising problems scale comprised the 10 items from the emotional symptoms and peer problems subscales, and the externalising problems scale was derived from the 10 items from the hyperactivity and conduct problems subscales. The five items of the peer problems subscale are: 'rather solitary, tends to play alone', 'has at least one good friend' (reverse coded), 'generally liked by other children' (reverse coded), 'picked on or bullied by other children', and 'gets on better with adults than with other children'. Scores for each 10-item scale may range from 0 to 20. In our sample, internal consistency was at acceptable levels, and in line with other SDQ research (Stone, Otten, Engels, Vermulst, & Janssens, 2010). Cronbach's alpha values across the three sweeps ranged from .61 (at age 3) to .72 (at age 7) for internalising, and from .78 (at age 3) to .80 (at age 7) for externalising problems.

Family poverty, operationalized as *socio-economic disadvantage (SED)*, was measured (as in Malmberg & Flouri, 2011) as the average of four binary indicators of the family's economic deprivation. Given incompleteness of measured family income, this SED score captures poverty and its associated material conditions more generally, providing a broader view of family-level socio-economic risk factors. The four items were overcrowding (>1.5 people per room excluding bathroom and kitchen), not owning the home, receipt of means-tested income support, and income poverty (below a line set as equivalised net family income at 60% of the national median). We created an average time-varying score of the four SED items (or of all valid items where any were missing) ranging 0-1.

Self-regulation was measured (at ages 3, 5 and 7) with a scale from the Child Social Behaviour Questionnaire (CSBQ), based on the Adaptive Social Behavior Inventory (Hogan, Scott, & Bauer, 1992). The CSBQ was developed and construct validated as part of the Effective Provision of Pre-

School Education project for England (Sammons et al., 2004) and Northern Ireland (Melhuish et al.,

2004). It has good internal consistency, established with samples of children aged 5. In the multi-

purpose MCS, the number of CSBQ items was restricted to five for each scale, completed by the

mother. Items, on 3-point scales, range from 1 to 3. The items ('likes to work things out for

himself/herself', 'does not need much help with tasks', 'chooses activities on his/her own', 'persists

in the face of difficult tasks', and 'moves to new activity after finishing task') measure children's

capacity for independently guiding and controlling their actions and behaviour. At each sweep, we

calculated an average time-varying score of items with valid data in each of the two scales.

Cronbach's alpha values ranged, across sweeps, from .57 (at age 3) to .66 (at age 7).

Verbal cognitive ability was assessed (at ages 3, 5 and 7) with measures from the second edition

of the British Ability Scales (BASII; Elliott, Smith, & McCulloch, 1996). At ages around 3 and 5,

the BASII Naming Vocabulary scale was administered to measure expressive language skills. At

around 7, the children completed the BASII Word Reading Achievement scale. We used normative

scores derived from the standard BASII tables. To facilitate cross-sweep comparisons, we converted

these reference-population-age-adjusted scores to z scores using, for each sweep, the full sample's

unweighted mean and standard deviation.

Key covariates were the child-level variables of sex and ethnicity, and the family-

level variables of maternal education, lone parenthood, home organisation, and maternal

psychological distress. Maternal education was measured by the highest academic

qualification achieved by the age 7 sweep. Lone parenthood, psychological distress and home

organisation (on a 1-item 5-point scale indicating the extent to which the mother thought the

home was organised) were measured at ages 3, 5 and 7. Psychological distress was measured

with the 6-item Kessler scale (Kessler et al., 2003), which assesses the experience of recent

non-specific psychological distress (α = .82-.84 across sweeps).

Analytic Strategy

After testing for bias in the selection of our analytic sample, we examined the shape of the average trajectories of externalising and internalising problems, which, as will be discussed below, was curvilinear. Next, we inspected the correlations between our main (risk, moderator and outcome) variables. Finally, longitudinal assessment of three time-points and two problem types allowed us to fit multivariate response growth curve models. Multivariate models involve more than one outcome being modelled simultaneously, normally by nesting responses within person. Therefore, in 3-level models, externalising and internalising difficulties (Level 1) were nested in occasions (Level 2) nested in children (Level 3). Our Levels 2 and 3 represent a traditional growth curve model where occasions are clustered within person. Modelling our two Level 1 units, one for the internalising problems score and one for the externalising problems score, simultaneously allowed for the investigation of the co-development of the two types of problem behaviour (Caron & Rutter, 2006). Although the two responses were at Level 1, they did not have a corresponding random effect at Level 1. Instead, the covariances of the random growth parameters for internalising and externalising problems were captured at Levels 2 and 3. We represented time at Level 2 to model individual trajectories of difficulties measured at three occasions around ages 3, 5 and 7 (by specifying a random slope on child's age). We modelled between-child differences in these trajectories at Level 3 to account for between-child variation in the growth parameters (i.e., intercept and linear slope). We fitted both fixed and random linear slopes, and we included a fixed quadratic term to account for the curved shape of children's average trajectories. However, with only three time-points of data, we were unable to fit quadratic random slopes to model the functional form of children's individual trajectories. The stratified sampling design of MCS was recognized by including the strata in all our conditional models. In Model 1 - unconditional - we investigated the average levels and change in externalising and internalising problems by regressing externalising and internalising problems on age in years (grand mean centred at age 5.21 years) and its square. Grand mean centring minimises the correlation between age and age-squared with the effect of

stabilising the estimation procedure (Raudenbush & Bryk, 2002). Model 2 added SED, the child and parent/family covariates, and the MCS design variables. In this model, we specified SED, maternal psychological distress, lone parenthood and home organisation to be related to the intercept and slopes (linear and quadratic) of externalising and internalising problems. Model 3 introduced the proposed moderators (verbal cognitive ability and self-regulation) allowing them to predict the intercept and slopes of both outcomes. Model 4 investigated the interaction between SED and both moderators. The full sequence of models estimated is outlined in Table 1. All were fitted in MLwiN 2.25.

(Table 1)

Results

Bias Analysis

We investigated whether families in our analytic sample (n = 16,916) were different (at p < .05) from families not in the analytic sample (n = 2,328) on our study variables. Differences between the analytic and the non-analytic sample were small (Table 2). In the former, there was a slight over-representation of white children, and a slight under-representation of mothers with no academic qualifications. Controlling for these characteristics allowed us to factor out these specific biases related to missingness. Compared to their counterparts, children in the analytic sample also experienced less SED, and had higher self-regulation (at ages 3 and 5) and verbal cognitive ability.

(Table 2)

Descriptives

On average, emotional and behavioural difficulties decreased from age 3 to 5, and then increased slightly from age 5 to 7 (Table 2), although children varied in their slopes. Based on the correlations (Table 3), there was evidence for the expected covariation of childhood problems and for interrelationships between the risk, outcome and moderator variables. The moderator variables appeared to be generally promotive of adjustment. SED was related positively to internalising and

externalising problems, and negatively to verbal cognitive ability. SED was also associated (weakly)

with low self-regulation. Self-regulation, on average, did not change much in the school years.

(Table 3)

Model Results

As shown in Table 4, the unconditional model revealed that children in the analytic sample

decreased at a rate of -0.05 points in their internalising difficulties, and at one of -0.51 points in their

externalising difficulties, over a year around age 5. The quadratic terms imply that the downward

slopes were steeper before age 5, particularly for externalising problems. From age 3 to 4,

internalising problems fell by about one third of a point on the scale, and externalising by about 1.3.

Both internalising and externalising trajectories stopped falling after age 5 (at 5.5 and 6.4 years,

respectively), turning slightly upward before age 7. Compared to the within-child variance, that

between-child was quite large in externalising but not internalising problems, indicating that children

differed more in their externalising problems. The within-domain intercept/slope covariance showed

that those who at age 5 had higher externalising scores made larger reductions in externalising

difficulties on average from age 3 to 7. By contrast, those with more internalising difficulties at age

5 made, on average, smaller reductions in internalising scores from age 3 to 7. Externalising -

particularly conduct - problems, therefore, may be less 'fixed' than internalising problems. On the

other hand, internalising problems may be less sensitive to changes over time.

(Table 4)

Model 2 (Table 5) established the expected associations of SED and children's adjustment

difficulties. The contrast between having no SED to having all valid elements of SED was

significantly associated with higher difficulties at age 5, by 0.40 points on the internalising scale and

0.77 points on the externalising scale. SED was also significantly associated with the rate of linear

change in externalising problems, and the curvature of the slope of both problem types. As in Model

1, all covariances were significant and positive except for that between the slope and intercept for

externalising problems. Externalising problems decreased less over time in children who at age 5

had higher internalising scores. Similarly, internalising problems decreased less over time in children

with higher externalising scores at 5. The positive intercept and slope covariances further suggest

that internalising and externalising problems reciprocally reinforced each other. Model 3 (not

shown) established that ability and self-regulation were negatively associated with both types of

problems. Both self-regulation and ability were related to linear change in internalising problems.

Self-regulation was also related to linear change in externalising problems, and to age squared in

internalising problems. Neither protective factor fully attenuated the effect of SED.

The interactions included in Model 4 (Table 5) indicated that self-regulation moderated the

effect of SED on linear change in both problems. Verbal cognitive ability moderated the effect of

SED on the level of internalising problems. A significant interaction of SED and verbal cognitive

ability (not plotted) showed that children in poverty who have high ability have fewer internalising

problems at a given point in the trajectory than children in poverty with low ability. Among the non-

poor, ability seemed to differentiate children much less. In Models 3 and 4, the between-child

intercept variance became smaller than the occasion-specific variance, demonstrating that verbal

cognitive ability and self-regulation explained much of why children differed in their problems.

Additionally, the covariances between the intercept for one problem and the slope for the other

became negative in these models, indicating that the inclusion of ability and self-regulation more

than accounted for the common element in the otherwise unexplained error. Hence, ability and self-

regulation explained much of why children's internalising and externalising problems co-developed.

(Table 5)

To unpack the interactions between self-regulation and SED, we plotted the predicted

trajectories of problems estimated for illustrative cases with high and low self-regulation by

experience of SED (high vs. none, i.e., 'poor' and 'non-poor') throughout. The association of

poverty and both emotional and behavioural adjustment was dampened for children with high self-

regulation. For internalising problems (Figure 1), the highest scores, as expected, were for the poor

child (high SED throughout) with low-self regulation, although her fitted scores were within the

normal range of difficulties (under 4 out of 20). The gap between the high-SED child with and

without self-regulation widened over time, going from a difference of about three-fourths to two

points. The line for the poor child with high self-regulation dropped over time to meet the line for a

child with high self-regulation not in poverty, around age 6. On the other hand, the advantaged child

(no SED) with high self-regulation had a trajectory not so far below that of an advantaged child with

low self-regulation, at a roughly constant gap of around one point across time. Therefore, self-

regulation appears to differentiate poor children's internalising problems more than those of non-

poor children.

As for externalising problems (Figure 2), the high-risk group (high SED/low self-regulation)

had a level of problems nearing a score of 9 (out of 20) at age 3, a cutoff[1] for identifying borderline

abnormality based on recommended practice (Goodman, 1997). The average difference between the

two high SED groups also widened, as with internalising problems, but even more substantially to

over three points around ages 6 and 7, narrowing the gap between poor and non-poor children with

high self-regulation. The gap between the two non-poor trajectories was about twice the size shown

for internalising problems, but smaller than the widening gap between poor children with low and

high self-regulation.

(Figures 1-2)

Discussion

Socio-economic disadvantage (SED), self-regulation and verbal cognitive ability have all

been associated with emotional and behavioural problems in children. Self-regulation and verbal

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[1] A threshold of 4, 3, 3, and 6 have been set for 'borderline' cases and higher than these values for abnormal
cases in, respectively, emotional symptoms, peer problems, conduct problems and hyperactivity measured with
the parent version of the SDQ.

cognitive ability have also been related to better than expected outcomes in at-risk children. Yet little was known about the joint moderating role of these factors in the relationship between SED and trajectories of younger children's problems. In this study, we explored the roles of these two factors in young children's emotional and behavioural resilience to SED. We followed a large sample of 3-year-olds to age 7, and found that both verbal cognitive ability and self-regulation were independently associated to resilience in children living consistently in poverty and to changes in psychopathology across childhood. Though the estimated differentials were, at least initially, modest, children in persistent poverty with low self-regulation appeared to develop increasing internalising problems as they went into primary school. This confirms the results of the smaller scale study of older children by Lengua et al. (2008). With respect to externalising problems, although these fell in all children between ages 3 and 7, the gap among children in persistent poverty grew bigger between those with high and low self-regulation over time. The trajectories of internalising and externalising problems of poor children with high self-regulation appeared similar to those of non-poor children with high self-regulation, particularly as they got older. Importantly, the association of self-regulation with both emotional/behavioural adjustment and resilience to socio-economic disadvantage was robust even after controlling for factors related to both self-regulation and adjustment in children, such as verbal cognitive ability and the home lives of their families.

Only one of our 'cases', where high disadvantage and low self-regulation were combined at age 3, had an estimated level of problems near the cut-off for borderline abnormality, for externalising problems. But within the examples evaluated for 'poor children', the size of the gaps between a poor child with and without self-regulation was non-negligible. It ranged from 1-3 points (depending on age and problem type). Verbal cognitive ability also moderated the 'effect' of socio-economic disadvantage but only on internalising problems, in line with previous research (Flouri et al., 2012). However, verbal cognitive ability (along with self-regulation) explained much of why

children differed in their externalising and internalising problems, and, importantly, why children's externalising and internalising problems co-developed.

Although we confirmed that poverty, as well as having its effect on children attenuated among families with very able or highly self-regulated children, also correlated with ability in children, we did not explore here the reasons why some poor children may have higher verbal cognitive ability or self-regulation. There is other evidence to suggest that poor resilient children were likely exposed to positive parenting practices (Blair & Raver, 2012) related to involvement, warmth and responsiveness, compared with their poor 'vulnerable' counterparts, despite being less likely to experience these than non-poor children. Future research should explore the role of parenting in mediating these moderator effects. Even without proposing a specific mechanism for these protective effects, our study findings have important implications. For example, our finding that verbal cognitive ability and self-regulation may be beneficial for children in poverty when it comes to internalising problems suggests targeting poor children who are at risk of developing anxiety and depression-related symptoms with interventions to raise their self-regulation and verbal ability.

Several limitations of the study deserve mention. First, this study is correlational and, as such, unable to prove that self-regulation or verbal cognitive ability caused children to be resilient to socio-economic deprivation. Second, some of these convergences could have been produced by regression to the mean, in which extremely high (and low) values affected by measurement error are likely to be closer to the sample mean at repeat assessments. This may apply particularly to the internalising scale which had low reliability at the first assessment, as did self-regulation. This suggests that, as with other child behaviour assessments in early childhood, the age 3 scales may have more measurement error. Measurement error at this age may also be due to parents' lack of consistent understanding about how children are meant to behave at this young age. Therefore, although our estimations of variable relationships at around age 5 and across ages 5 and 7 are based on sufficiently reliable assessments, results that refer to changes between 3 and 5 must be interpreted

with caution. Third, dropout of study participants is likely to be selective even after our allowance

for observed covariates. Fourth, with only three time-points of longitudinal data of emotional and

behavioural problems currently available for MCS, we were limited in our ability to model the

functional form of children's individual behaviour trajectories. Fifth, the reliance on parental reports

to assess children's emotional and behavioural problems and self-regulation means that correlations

between these measures are likely inflated by reporter bias. In addition, parents may not be a reliable

source on children's anxious and depressed feelings and behaviour (Stone et al., 2010). However,

eliciting reports from other informants such as teachers and the children themselves for the early

years would not have been possible. Finally, self-regulation in our sample did not change much with

age in school age children. This stability could reflect factors we were unable to control for in MCS,

such as parents' self-regulation, which may also keep high-risk families out of poverty.

The results of this study, nevertheless, add to the literature by identifying self-regulation and

cognitive ability as important for emotional/behavioural resilience over time to socio-economic

disadvantage among young children. Our findings, therefore, add to those of studies saluting the

value of self-control for positive outcomes in older children and adults (Chen, 2012; Lengua et al.,

2008; Moffitt et al., 2011). They also raise questions about whether self-control is associated with

children's resilience in other domains, and in the face of different risks. In addition, the finding that a

child's self-regulation was weakly related to her family's level of socio-economic deprivation

suggests that self-regulation, as measured in our study, might be primarily an individual factor

promoting positive outcomes in advantaged and disadvantaged circumstances alike (though

particularly in disadvantaged ones, as our findings showed). Therefore, self-regulation is likely to be

one part of the adaptive processes in a child's life that boost competence in the face of adversity.

Lastly, we found that, as poor children with low self-regulation age, they may have increasing

vulnerability to internalising and externalising problems. This emphasises the importance of

addressing self-regulation difficulties in poor children early.

References

Ackerman, B. P., Brown, E. D., & Izard, C. E. (2004). The relations between persistent poverty and

contextual risk and children's behaviour in elementary school. *Developmental Psychology, 40*,

367-377. doi: 10.1037/0012-1649.40.3.367

Banfield, J. F., Wyland, C. L., Macrae, C. N., Munte, T. F., & Heatherton, T. F. (2004). The

cognitive neuroscience of self-regulation. In R. F. Baumeister, & K. D. Vohs (Eds.), *Handbook*

of self-regulation: Research, theory, and applications (pp. 62-83). New York, NY: Guildford.

Blair, C., & Raver, C. C. (2012). Individual development and evolution: Experiential

canalization of self-regulation. *Developmental Psychology, 48*, 647-657.

doi:10.1037/a0026472

Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief

understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*,

647-663. doi: 10.1111/j.1467-8624.2007.01019.x

Bornstein, M. H., Hahn, C. S., & Suwalsky, J. T. (2013). Language and internalizing and

externalizing behavioral adjustment: Developmental pathways from childhood to

adolescence. *Development and Psychopathology*, *25*, 857-878. doi:

10.1017/S0954579413000217

Bradley, R. H., & Corwyn, R. F. (2002). Socio-economic status and child development. *Annual*

Review of Psychology, 53, 371-399. doi: 10.1146/annurev.psych.53.100901.135233

Caron, C., & Rutter, M. (2006). Comorbidity in child psychopathology: Concepts, issues and

research strategies. *Journal of Child Psychology and Psychiatry, 32*, 1063-1080. doi:

10.1111/j.1469-7610.1991.tb00350.x

Caspi, A., Moffitt, T. E., Newman, D. L., & Silva, P. A. (1996). Behavioral observations at age 3

years predict adult psychiatric disorders: Longitudinal evidence from a birth cohort. *Archives*

of General Psychiatry, 53, 1033-1039. doi: 10.1001/archpsyc.1996.01830110071009

Chen, E. (2012). Protective factors for health among low-socio-economic-status individuals. *Current Directions in Psychological Science, 21*, 189-193. doi: 10.1177/0963721412438710

Cole, P. M., Armstrong, L. M., & Pemberton, C. K. (2003). The role of language in the development of emotion regulation. In S. Calkins, & M. Bell (Eds.), *Child development at the intersection of emotion and cognition: Human brain development* (pp. 59-77). Washington, D.C: American Psychological Association.

Deater-Deckard, K., Mullineaux, P. Y., Beekman, C., Petrill, S. A., Schatschneider, C., & Thompson, L. A. (2009). Conduct problems, IQ, and household chaos: A longitudinal multi-informant study. *Journal of Child Psychology and Psychiatry, 50*, 1301-1308. doi: 10.1111/j.1469-7610.2009.02108.x

Doan, S. N., Fuller-Rowell, T. E., & Evans, G. W. (2012). Cumulative risk and adolescent's internalizing and externalizing problems: The mediating roles of maternal responsiveness and self-regulation. *Developmental Psychology, 48*, 1529-1539. doi:10.1037/a0027815

Duckworth, A. L. (2011). The significance of self-control. *Proceedings of the National Academy of Sciences, 108*, 2639-2640. doi: 10.1073/pnas.1019725108

Egger, H. L., & Angold, A. (2006). Common emotional and behavioural disorders in preschool children: Presentation, nosology and epidemiology. *Journal of Child Psychology and Psychiatry, 47*, 313-317. doi: 10.1111/j.1469-7610.2006.01618.x

Eisenberg, N., Spinrad, T. L., & Eggum, N. D. (2010). Emotion-related self-regulation and its relation to children's maladjustment. *Annual Review of Clinical Psychology, 6*, 495-525. doi: 10.1146/annurev.clinpsy.121208.131208

Eisenberg, N., Valiente, C., & Eggum, N. D. (2010). Self-regulation and school readiness. *Early Education and Development, 21*, 681-698. doi: 10.1080/10409289.2010.497451

Eisenberg, N., Valiente, C., Fabes, R. A., Smith, C. L., Reiser, M., Shepard, S. A., Losoya, A. H., Guthrie, I. K., Murphy, B. C., & Cumberland, A. J. (2003). The relations of effortful control

and ego control to children's resiliency and social functioning. *Developmental Psychology, 39*, 761-776. doi: 10.1080/10409289.2010.497451

Elliott, C. D., Smith, P., & McCulloch, K. (1996). *The British Ability Scales Second Edition (BAS II): Administration and scoring manual.* London: NFER-Nelson.

Evans, G. W. (2003). A multimethodological analysis of cumulative risk and allostatic load among rural children. *Developmental Psychology, 39*, 924-933. doi: 10.1037/0012-1649.39.5.924

Evans, G. W., Gonnella, C., Marcynyszyn, L. A., Gentile, L., & Salpekar, N. (2005). The role of chaos in poverty and children's socioemotional adjustment. *Psychological Science, 16*, 560-565. doi: 10.1111/j.0956-7976.2005.01575.x

Feng, X., Shaw, S. D., Kovacs, M., Lane, T., O'Rourke, E. F., & Alarcon, H. J. (2008). Emotion regulation in preschoolers: The roles of behavioral inhibition, maternal affective behavior, and maternal depression**.** *Journal of Child Psychology and Psychiatry, 49*, 132-141. doi: 10.1111/j.1469-7610.2007.01828.x

Flouri, E., Mavroveli, S., & Tzavidis, N. (2012). Cognitive ability, area deprivation, and young children's emotional and behavioral problems. *Social Psychiatry and Psychiatric Epidemiology*, *47,* 985-992. doi: 10.1007/s00127-011-0406-4

Goodman, A., Lamping, D. L., & Ploubidis, G. B. (2010). When to use broader internalising and externalising subscales instead of the hypothesised five subscales on the Strengths and Difficulties Questionnaire (SDQ): Data from British parents, teachers and children. *Journal of Abnormal Child Psychology*, 38, 1179-1191. doi: 10.1007/s10802-010-9434-x

Goodman, A., Patel, V., & Leon, D. A. (2008). Child mental health differences amongst ethnic groups in Britain: A systematic review. *BMC Public Health, 8,* 258. doi: 10.1186/1471-2458-8-258

Goodman, R. (1997). The Strengths and Difficulties Questionnaire: A research note. *Journal of Child Psychology and Psychiatry, 38*, 581-586. doi: 10.1111/j.1469-7610.1997.tb01545.x

Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed

parents: A developmental approach to the understanding of mechanisms. *Psychological*

Review, 106, 458-490. doi: 10.1037//0033-295X.106.3.458

Hansen, K. (2010). *Millennium Cohort Study first, second, third and fourth surveys: A Guide to the*

datasets (5th ed.). London: Centre for Longitudinal Studies, University of London.

Hardaway, C. R., Wilson, M. N., Shaw, D. S., & Dishion, D. J. (2012). Family functioning

and externalizing behaviour among low-income children: Self-regulation as a mediator.

Infant and Child Development, 21, 67-84. doi: 10.1002/icd.765

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children.

Science, 312, 1900-1902. doi: 10.1126/science.1128898

Hoff, E. (2003). The specificity of environment influence: Socioeconomic status affects early

vocabulary development via maternal speech. *Child Development, 74*, 1368-1378. doi:

10.1111/1467-8624.00612

Hogan, A. E., Scott, K. G., & Bauer, C. R. (1992). The Adaptive Social Behavior Inventory (ASBI):

A new assessment of social competence in high-risk three-year-olds. *Journal of*

Psychoeducational Assessment, 10, 230-239. doi: 10.1177/073428299201000303

Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Gfroerer, J. C., Hiripi, E., Howes, M.

J, Normand, S-L. T., Manderscheid, R. W., Walters, E. E., & Zaslavsky, A. M. (2003).

Screening for serious mental illness in the general population. *Archives of General*

Psychiatry, 60, 184-189.doi:10.1001/archpsyc.60.2.184

Kiernan, K. E., & Huerta, M. C. (2008). Economic deprivation, maternal depression,

parenting and children's cognitive and emotional development in early childhood.

British Journal of Sociology, 59, 783-806. doi:10.1111/j.1468-4446.2008.00219.x

Kiernan, K. E, & Mensah, F. K. (2009). Poverty, maternal depression, family status and children's

cognitive and behavioural development in early childhood: A longitudinal study. *Journal of*

Social Policy, 38, 569-588. doi: 10.1017/S0047279409003250

Kim-Cohen, J., Moffitt, T. E., Caspi, A., & Taylor, A. (2004). Genetic and environmental processes

in young children's resilience and vulnerability to socioeconomic deprivation. *Child*

Development, 75, 651-668. doi: 10.1111/j.1467-8624.2004.00699.x

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood:

Continuity and change, antecedents, and implications for social development.

Developmental Psychology, 36, 220–232. doi: 10.1037/0012-1649.36.2.220

Lengua, L. J. (2003). Associations among emotionality, self-regulation, adjustment problems and

positive adjustment in middle childhood. *Journal of Applied Developmental Psychology, 24*,

595-618. doi: 10.1016/j.appdev.2003.08.002

Lengua, L. J. (2009). Effortful control in the context of socioeconomic and psychosocial risk.

Psychological Science Agenda, 23. Retrieved from

http://www.apa.org/science/about/psa/2009/01/lengua.aspx

Lengua, L. J., Bush, N., Long, A. C., Trancik, A. M., & Kovacs, E. A. (2008). Effortful control as a

moderator of the relation between contextual risk and growth in adjustment problems.

Development and Psychopathology, 20, 509-528. doi: 10.1017/S0954579408000254

Malmberg, L. E., & Flouri, E. (2011). The comparison and interdependence of maternal and paternal

influences on young children's behavior and resilience. *Journal of Clinical Child & Adolescent*

Psychology, 40, 434-444. doi: 10.1080/15374416.2011.563469

Masten, A. S., Hubbard, J. J., Gest, S. D., Tellegen, A., Garmezy, N., & Ramirez, M. (1999).

Competence in the context of adversity: Pathways to resilience and maladaptation from

childhood to late adolescence. *Development and Psychopathology, 11*, 143-169. doi:

10.1017/S0954579499001996Matthews, J. S., Ponitz, C. C, & Morrison, F. J. (2009). Early

gender differences in self-regulation and academic achievement. *Journal of Educational Psychology, 101*, 689-704. doi: 10.1037/a0014240

McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology, 43*, 947-959. doi: 10.1037/0012-1649.43.4.947

McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53,* 185-204. doi: 10.1037/0003-066X.53.2.185

Melhuish, E., Hanna, K., Quinn, L., Sylva, K., Siraj-Blatchford, I., Sammons, P., & Taggart, B. (2004). *The Effective Pre-school Provision in Northern Ireland Project: Technical Paper 11:Pre-school experience and social/behavioural development at the end of year 3 of primary school*. Belfast, N.I.: Stranmillis University Press.

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R., Harrington, H. L., Houts, R., Poulton, R., Roberts, B., Ross, S., Sears, M., Thomson, W. M., & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences, 108*, 2693-2698. doi: 10.1073/pnas.1010076108

National Institute of Child Health and Human Development Early Child Care Research Network (2005). Duration and developmental timing of poverty and children's cognitive and social development from birth through third grade. *Child Development*, 76, 795-810. doi: 10.1111/j.1467-8624.2005.00878.x

Plewis, I. (2007). *The Millennium Cohort Study: Technical report on sampling (4th ed.).* London: Centre for Longitudinal Studies, Institute of Education, University of London.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods (2nd ed.).* Newbury Park, CA: Sage.

Reading, R., & Reynolds, S. (2001). Debt, social disadvantage and maternal depression. *Social Science & Medicine, 53*, 441-453. doi:10.1016/S0277-9536(00)00347-6

Roben, C. K. P., Cole, P. M., & Armstrong, L. M. (2012). Longitudinal relations among language skills, anger expression, and regulatory strategies in early childhood. *Child Development*, *84*, 891-905. doi: 10.1111/cdev.12027

Rutter, M. (2013). Annual Research Review: Resilience--clinical implications. *Journal of Child Psychology and Psychiatry, 54,* 474-87. doi: 10.1111/j.1469-7610.2012.02615.x.

Sammons, P., Sylva, K., Melhuish, E., Siraj-Blatchford, I., Taggart, B, Elliott, K., & Marsh, A. (2004). *The Effective Provision of Pre-school Education (EPPE) project: Technical Paper 11: The continuing effect of pre-school education at age 7 years.* London: Institute of Education, University of London.

Shamosh, N. A., & Gray, J. R. (2008). Delay discounting and intelligence: A meta-analysis. *Intelligence, 36,* 289-305. doi: 10.1016/j.intell.2007.09.004

Stone, L. L., Otten, R., Engels, R. M. C. E., Vermulst, A. A., & Janssens, J. M. A. M. (2010). Psychometric properties for the parent and teacher version of the Strengths and Difficulties Questionnaire for 4-12 year-olds: A review. *Clinical Child and Family Psychology Review, 13*, 254-274. doi: 10.1007/s10567-010-0071-2

Wallentin, M. (2009). Putative sex differences in verbal abilities and language cortex: A critical review. *Brain & Language, 108*, 175-183. doi: 10.1016/j.bandl.2008.07.001

Table 1

Model Summary

Model	Variables
1 (unconditional)	Age (grand mean centred) in years and age squared
2	Model 1 + SED + SED x age + SED x age^2 + child background factors[a] + parent factors[b] + sam design variables ('stratum')
3	Model 2 + verbal cognitive ability + verbal cognitive ability x age + verbal cognitive ability x self-regulation + self-regulation x age + self-regulation x age^2
4	Model 3 + self-regulation x SED + self-regulation x SED x age + self-regulation x SED x age verbal cognitive ability x SED + verbal cognitive ability x SED x age + verbal cognitive ability SED x age^2

Note: SED = Socio-economic disadvantage (average score of the binary items of overcrowding, lack of home ownership, receipt of income support, and income poverty).

[a]Child background factors are sex and ethnicity.

[b]Parent factors are lone parenthood (time-varying), lone parenthood x age, lone parenthood x age^2, home organisation (time-varying), home organisation x age, home organisation x age^2, maternal psychological distress (time-varying), maternal psychological distress x age, maternal psychological distress x age^2, and maternal education (by the age 7 sweep).

Table 2

Descriptives of Study Variables in the Analytic and Non-analytic Samples

	Analytic sample (n=16,916)[b]		Non-analytic sample (n=2,328)[b]		Test
	Categorical variables				
	N	%	n	%	F^a
Child					
Girl	8,288	49.12	1,061	45.41	7.64**
White	14,062	88.00	1,679	80.00	65.93***
Black/Black British	596	4.19	133	2.48	15.57***
Indian	430	1.60	67	.02	0.13
Pakistani/Bangladeshi	1,077	7.68	273	3.71	49.66***
Mixed	512	3.62	82	3.09	1.33
Chinese/other	230	.95	73	2.85	54.83***
Parent/household					
Mother's education[c]					
Higher degree	727	4.74	53	2.81	9.70**
First degree	2,094	14.58	152	7.92	53.87***
A-levels/DipHE	3,038	19.84	288	13.76	33.17***
GCSE a-c	5,389	34.41	697	32.07	2.81
GCSE d-g	1,691	10.43	262	12.49	5.02*
Other qualification	464	2.22	108	4.26	35.25***
No qualification	2,829	13.78	703	26.69	189.57***
Lone parenthood					
Age 3	2,679	14.95	61	31.78	17.34***
Age 5	2,996	17.81	34	26.63	3.45
Age 7	2,914	23.77	18	19.26	0.53
	Continuous variables				
	N	M(SD)	n	M(SD)	T
Child					
Internalising problems					

Age 3	14577	2.87(2.49)	-	-	-
Age 5	14681	2.50(2.52)	-	-	-
Age 7	13415	2.82(2.85)	-	-	-
Externalising problems					
Age 3	14594	6.75 (3.82)	-	-	-
Age 5	14648	4.81(3.43)	-	-	-
Age 7	13413	4.88(3.65)	-	-	-
Age (years)					
Age 3	15369	3.14 (0.20)	212	3.22 (0.31)	12.66***
Age 5	15102	5.21 (0.24)	142	5.17 (0.31)	1.54
Age 7	13765	7.24 (0.26)	92	7.23 (0.25)	0.01
Self-regulation					
Age 3	14824	2.46 (0.35)	13	1.74 (0.67)	13.84***
Age 5	14766	2.52 (0.35)	8	1.85 (0.15)	19.81***
Age 7	13484	2.50 (0.37)	4	2.53 (0.57)	0.01
Verbal cognitive ability					
Age 3	14441	0.06 (0.97)	128	-0.99 (1.21	46.57***
Age 5	14845	0.08 (0.97)	116	-1.28 (1.28	111.84***
Age 7	13325	0.02 (0.99)	87	-0.58 (1.08	29.60***
Parent/household					
Maternal psychological distress					
Age 3	12,449	5.36 (1.26)	8	2.94 (0.04)	0.06
Age 5	13,774	6.67 (2.41)	5	2.84 (0.04)	1.34
Age 7	12,159	2.40 (0.03)	1	4.00	3.61
Socio-economic disadvantage (SED)					
Age 3	15278	0.21 (0.29)	169	0.41 (0.37)	40.15***
Age 5	15049	0.21 (0.28)	116	0.43 (0.38)	29.16***
Age 7	13754	0.22 (0.28)	91	0.40 (0.32)	26.83***
Home organisation					
Age 3	15277	3.78 (0.96)	168	3.63 (1.05)	3.31
Age 5	15026	3.63 (1.06)	104	3.51 (1.27)	0.77
Age 7	13676	3.70 (1.08)	75	3.73 (0.96)	0.11

Note: *p < .05, **p < .01, ***p < .001.

[a]F (for categorical variables) = F statistic for design-based Pearson chi-square that is converted to F test to account for the MCS sampling design.

[b]The analytic sample comprised those children who, in at least one sweep, had data for the SDQ internalising scale or for the SDQ externalising scale. The non-analytic sample comprised children with no SDQ externalising or internalising. Proportions are weighted to account for sampling design and non-response in MCS. Ns are unweighted.

[c]A higher degree in the UK is equivalent in the US to any degree higher than bachelor's level. First degree = bachelor's degree. A Diploma of Higher Education (DipHE) is typically awarded after two years of full-time study at a university/college (akin to a two-year degree in the US). A-level (Advanced Level General Certificate of Education) exams, taken during secondary school (normally ages 17-18), are recognized as the standard for assessing the suitability of applicants for university study. A-level is loosely comparable with higher education qualifying exams in the US, such as the Scholastic Aptitude Test (SAT), the American College Testing (ACT), and Advanced Placement (AP) exams. The Scottish Advanced Higher is treated here as equivalent to A-level. The General Certificate of Secondary Education (GCSE) or Scottish Standard Grade is an academic qualification awarded in specified subjects during secondary school when pupils are 14-16 years of age, and often required for those proceeding to an International Baccalaureate or A-level qualification. Grades 'a-c' are higher than 'd-g'.

Table 3

Correlations among the Risk, Moderator and Outcome Variables in the Analytic Sample

	SED 1	SED 2	SED 3	Self-reg 1	Self-reg 2	Self-reg 3	Verb 1	Verb 2	Verb 3	Int 1	Int 2	Int 3	Ext 1	Ext 2	Ext 3
Socio-economic disadvantage 2	.53	1													
Socio-economic disadvantage 3	.45	.64	1												
Self-regulation 2	-.06	-.08	-.06	.34	1										
Self-regulation 3	-.06	-.08	-.08	.32	.50	1									
Verbal cognitive ability 1	-.29	-.24	-.21	.13	.16	.17	1								
Verbal cognitive ability 2	-.27	-.30	-.25	.11	.16	.16	.56	1							
Verbal cognitive ability 3	-.22	-.23	-.25	.07	.15	.24	.28	.35	1						
Internalising 2	.19	.21	.17	-.13	-.25	-.23	-.18	-.18	-.15	.49	1				
Internalising 3	.18	.20	.23	-.12	-.22	-.31	-.17	-.16	-.18	.42	.58	1			
Externalising 1	.26	.20	.17	-.23	-.28	-.28	-.22	-.20	-.23	.38	.30	.31	1		
Externalising 2	.21	.25	.20	-.19	-.40	-.34	-.21	-.20	-.27	.28	.40	.36	.61	1	
Externalising 3	.20	.21	.24	-.17	-.32	-.46	-.19	-.18	-.30	.25	.32	.45	.54	.71	1

Note: Tests are two-tailed. All coefficients are significant at p < .001.

Table 4

Model 1 (Unconditional Model) of Trajectories of Internalising and Externalising Problems in the Analytic Sample

	Internalising			Externalising		
	Coeff.	SE	95% CI	Coeff	SE	95% CI
Predictors			**Fixed effects**			
Constant	2.630*	0.021	[2.59, 2.67]	4.980*	0.028	[4.93, 5.04]
Age	-0.047*	0.006	[-0.06, -0.04]	-0.511*	0.008	[-0.53, -0.50]
Age^2	0.064*	0.004	[0.06, 0.07]	0.203*	0.005	[0.19, 0.21]
			Random effects			
Level 3 (child)						
Intercept	3.746*	0.056		8.632*	0.114	
Slope	0.160*	0.008		0.313*	0.011	
Intercept/slope covariance	0.187*	0.013		-0.116*	0.024	
Intercept(int/ext) covariance	3.108*	0.062				
Slope(int/ext) covariance	0.075*	0.007				
Intercept(int)/slope(ext) covariance	-0.025	0.017				
Intercept(ext)/slope(int) covariance	0.234*	0.019				
Level 2 (occasion)						
Slope	2.816*	0.035		3.783*	0.048	
Covariance (int/ext)	0.669*	0.030				

Note: *p* < .05. N = 14,221.

Table 5

Fixed Effects Estimates and Variance Covariance Estimates (Models 2 and 4) of Trajectories of Internalising and Externalising Problems in the Analytic Sample

	Model 2 (N = 13,370)				**Model 4** (N = 12,783)			
	Internalising problems		**Externalising problems**		**Internalising problems**		**Externalising problems**	
Predictors	**Coeff.(SE)**	**95% CI**	**Coeff.(SE)**	**95% CI**	**Coeff.(SE)**	**95% CI**	**Coeff.(SE)**	**95% CI**
				Fixed effects				
Constant	2.963*(0.089)	[2.79,3.14]	6.420*(0.117)	[6.19,6.65]	4.968*(0.176)	[6.19,6.65]	11.594*(0.219)	[6.19,6.65]
Girl	-0.136*(0.032)	[-0.20,-0.07]	-1.012*(0.046)	[-1.10,-0.92]	-0.004(0.031)	[-1.10,-0.92]	-0.767*(0.043)	[-1.10,-0.92]
Age	-0.057(0.028)	[-0.11,-0.01]	-0.537*(0.036)	[-0.61,-0.47]	0.046(0.064)	[-0.61,-0.47]	0.131(0.080)	[-0.61,-0.47]
Age^2	0.067*(0.019)	[0.03,0.10]	0.246*(0.023)	[0.20,0.29]	0.216*(0.045)	[0.20,0.29]	0.256*(0.055)	[0.20,0.29]
Child's ethnicity (Ref: White)								
Mixed	0.105(0.098)	[-0.09,0.30]	-0.012(0.141)	[-0.29,0.26]	0.011(0.096)	[-0.18,0.20]	-0.087(0.133)	[-0.35,0.17]
Indian	0.569*(0.122)	[0.33,0.81]	0.181(0.173)	[-0.16,0.52]	0.493*(0.118)	[0.26,0.72]	-0.024(0.162)	[-0.34,0.29]
Pakistani/Bangladeshi	1.219*(0.097)	[1.03,1.41]	0.146*(0.138)	[-0.13,0.42]	1.100*(0.097)	[0.91,1.29]	-0.155(0.132)	[-0.41,0.11]
Black/Black British	-0.004(0.107)	[-0.21,0.21]	-0.785*(0.152)	[-1.08,-0.49]	-0.055(0.106)	[-0.26,0.15]	-0.867*(0.146)	[-1.15,-0.58]
Chinese/other	0.838*(0.173)	[0.50,1.18]	-0.276(0.246)	[-0.76,0.21]	0.628*(0.172)	[0.29,0.97]	-0.555(0.232)	[-1.01,-0.10]
Maternal education (Ref: No qualification)								
Higher degree	-0.907*(0.087)	[-1.08,-0.74]	-1.873*(0.125)	[-2.12,-1.63]	-0.698*(0.085)	[-0.87,-0.53]	-1.417*(0.117)	[-1.65,-1.19]
First degree	-0.980*(0.065)	[-1.11,-0.85]	-2.020*(0.092)	[-2.20,-1.84]	-0.780*(0.064)	[-0.91,-0.65]	-1.621*(0.088)	[-1.79,-1.45]
A-levels/DipHE	-0.820*(0.059)	[-0.94,-0.70]	-1.359*(0.084)	[-1.52,-1.19]	-0.670*(0.058)	[-0.78,-0.56]	-1.070*(0.079)	[-1.22,-0.92]
GCSE a-c	-0.607*(0.052)	[-0.71,-0.51]	-0.876*(0.074)	[-1.02,-0.73]	-0.517*(0.051)	[-0.62,-0.42]	-0.665*(0.070)	[-0.80,-0.53]
GCSE d-g	-0.254*(0.065)	[-0.38,-0.13]	-0.287*(0.093)	[-0.47,-0.11]	-0.181*(0.064)	[-0.31,-0.06]	-0.197*(0.088)	[-0.37,-0.02]
Other qualification	-0.440*(0.114)	[-0.66,-0.22]	-0.809*(0.162)	[-1.13,-0.49]	-0.384*(0.112)	[-0.60,-0.17]	-0.716*(0.153)	[-1.02,-0.42]

Maternal distress	0.134*(0.005)	[0.12,0.14]	0.146*(0.006)	[0.13,0.16]	0.127*(0.005)	[0.12,0.14]	0.133*(0.006)	[0.12,0.15]
Maternal distress x age	0.012*(0.002)	[0.01,0.02]	-0.008*(0.002)	[-0.01,-0.00]	0.010*(0.002)	[0.01,0.01]	-0.013*(0.002)	[-0.02,-0.01]
Maternal distress x age^2	0.002*(0.001)	[-0.01,0.01]	0.005*(0.001)	[0.00,0.01]	0.002*(0.001)	[0.00,0.01]	0.005*(0.002)	[0.00,0.01]
Lone parenthood	0.075(0.052)	[-0.03,0.18]	0.317*(0.065)	[0.20,0.44]	0.096(0.051)	[-0.00, 0.20]	0.312*(0.064)	[0.19,0.44]
Lone parenthood x age	0.083*(0.020)	[0.04,0.12]	0.052*(0.026)	[0.00,0.11]	0.075*(0.020)	[0.04,0.11]	0.025(0.026)	[-0.03,0.08]
Lone parenthood x age^2	-0.024(0.013)	[-0.05,0.01]	-0.031*(0.016)	[-0.06,0.00]	-0.023(0.013)	[-0.05,0.00]	-0.019(0.016)	[-0.05,0.01]
Home organisation	-0.136*(0.017)	[-0.17,-0.10]	-0.241*(0.020)	[-0.28,-0.20]	-0.123*(0.016)	[-0.15,-0.09]	-0.234*(0.020)	[-0.27,-0.20]
Home organisation x age	-0.007(0.007)	[-0.02,0.01]	0.024*(0.008)	[0.01,0.04]	-0.005(0.007)	[-0.02,0.01]	0.031*(0.008)	[0.02,0.05]
Home organisation x age^2	-0.003(0.004)	[-0.01,0.01]	-0.016*(0.005)	[-0.03,-0.01]	-0.004(0.005)	[-0.01,0.01]	-0.014(0.005)	[-0.02,-0.00]
Family SED	0.398*(0.080)	[0.24,0.56]	0.770*(0.103)	[0.57,0.97]	1.094*(0.440)	[0.23,1.96]	1.738*(0.550)	[0.66,2.82]
Family SED x age	-0.056(0.029)	[-0.11,0.00]	-0.132*(0.036)	[-0.20,-0.06]	0.600*(0.178)	[0.25,0.95]	0.524*(0.224)	[0.08,0.96]
Family SED x age^2	0.051*(0.019)	[0.014,0.09]	0.050*(0.023)	[0.01,0.10]	0.009(0.125)	[-0.24,0.25]	0.080(0.153)	[-0.22,0.38]
Self-regulation					-0.877*(0.062)	[-1.00,-0.76]	-2.172*(0.076)	[-2.32,-2.02]
Self-regulation x age					-0.039(0.023)	[-0.08,0.01]	-0.264*(0.029)	[-0.32,-0.21]
Self-regulation x age^2					-0.061*(0.016)	[-0.09,-0.03]	-0.015(0.020)	[-0.05,0.02]
Self-regulation x SED					-0.332(0.172)	[-0.67,0.01]	-0.395(0.212)	[-0.81,0.02]
Self-regulation x SED x age					-0.248*(0.070)	[-0.39,-0.11]	-0.254*(0.089)	[-0.43,-0.08]
Self-regulation x SED x age^2					0.017(0.049)	[-0.08,0.11]	0.043(0.060)	[-0.08,0.17]
Verbal ability					-0.055*(0.023)	[-0.10,-0.01]	-0.183*(0.028)	[-0.24,-0.13]
Verbal ability x age					0.010(0.009)	[-0.01,0.03]	0.000(0.011)	[-0.02,0.02]
Verbal ability x age^2					-0.014*(0.006)	[-0.03,-0.00]	-0.008(0.008)	[-0.02,0.01]
Verbal ability x SED					-0.200*(0.066)	[-0.33,-0.07]	-0.042(0.083)	[-1.65,-1.19]
Verbal ability x SED x age					0.044(0.027)	[-0.01,0.10]	0.051(0.034)	[-1.79,-1.45]
Verbal ability x SED x age^2					0.037(0.019)	[-0.00,0.07]	-0.008(0.023)	[-1.22,-0.92]

Stratum (Ref: England-advantaged)								
England-disadvantaged	0.240*(0.045)	[0.15,0.33]	0.343*(0.065)	[0.22,0.47]	0.239*(0.044)	[0.15,0.33]	0.340*(0.061)	[0.22,0.46]
England-ethnic	0.227*(0.079)	[0.07,0.38]	0.135(0.113)	[-0.09,0.36]	0.191*(0.077)	[0.04,0.34]	0.081(0.106)	[-0.13,0.29]
Scotland-advantaged	-0.048(0.069)	[-0.18,0.09]	-0.074(0.099)	[-0.27,0.12]	-0.018(0.066)	[-0.15,0.11]	-0.009(0.092)	[-0.19,0.17]
Scotland-disadvantaged	-0.015(0.070)	[-0.15,0.12]	0.221*(0.101)	[0.02,0.42]	-0.006(0.068)	[-0.14,0.13]	0.260*(0.095)	[0.07,0.45]
NI-advantaged	0.010(0.083)	[-0.15,0.17]	-0.245*(0.120)	[-0.48,-0.01]	0.014(0.080)	[-0.14,0.17]	-0.190(0.112)	[-0.41,0.03]
NI-disadvantaged	0.136(0.070)	[-0.00,0.27]	-0.015(0.101)	[-0.21,0.18]	0.137(0.068)	[0.00,0.27]	-0.032(0.095)	[-0.22,0.15]
Wales-advantaged	-0.132(0.078)	[-0.29,0.02]	-0.119(0.112)	[-0.34,0.10]	-0.112(0.076)	[-0.26,0.04]	-0.072(0.105)	[-0.28,0.13]
Wales-disadvantaged	0.123*(0.057)	[0.01,0.23]	0.312*(0.083)	[0.15,0.48]	0.109(0.056)	[-0.00,0.22]	0.288*(0.078)	[0.14,0.44]
Random effects								
Level 3 (child)								
Intercept	2.646*(0.045)		6.276*(0.093)		2.349*(0.043)		5.154*(0.081)	
Slope	0.147*(0.008)		0.277*(0.012)		0.130*(0.007)		0.237*(0.011)	
Intercept/slope covariance	0. 170*(0.012)		-0.014(0.021)		0.126*(0.011)		-0.203*(0.019)	
Intercept covariance (int/ext)	1.642*(0.049)				1.099*(0.043)			
Slope covariance (int/ext)	0.061*(0.007)				0.035*(0.007)			
Intercept(int)/slope(ext) cov	0.058*(0.015)				-0.034*(0.014)			
Intercept(ext)/slope(int) cov	0.184*(0.017)				0.095*(0.016)			
Level 2 (occasion)								
Slope	2.534*(0.034)		3.523*(0.048)		2.467*(0.034)		3.445*(0.048)	
Covariance (int/ext)	0.613*(0.029)				0.578*(0.029)			

Note: *p* < .05. Maternal psychological distress, home organisation, lone parenthood, SED, self-regulation and verbal cognitive ability are time-varying. NI= Northern Ireland; cov = covariance; int = internalising; ext = externalising.
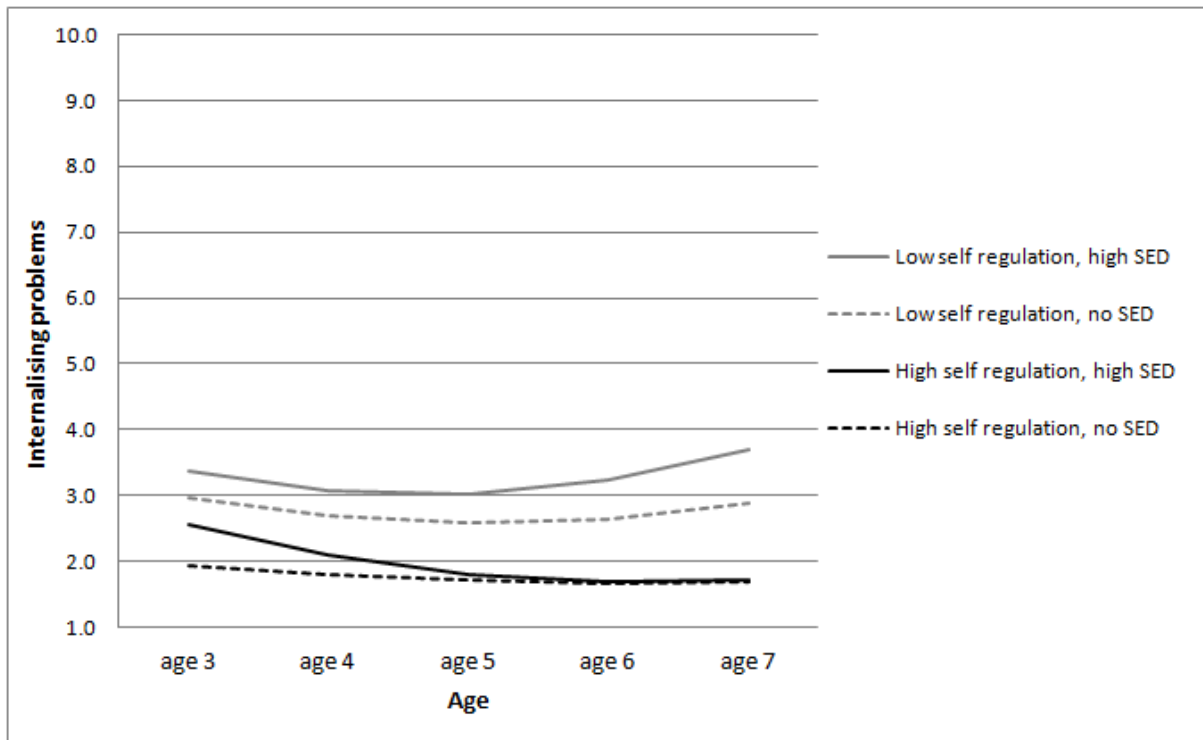
Figure 1. Predicted internalising score trajectories for children with high/low self-regulation by high SED/no SED (Model 4)

Note: High SED (socio-economic disadvantage) was having all four elements of SED held constant at each age. No SED was having none of the four elements at any age. High self-regulation was set at a score of 3 (referring to a response of 'certainly true' for each self-regulation item), and low self-regulation was set at a score of 2. The predictions are plotted for the reference group for each categorical variable (with one exception for mother's education set at mid-level) and at the mean of each continuous variable.
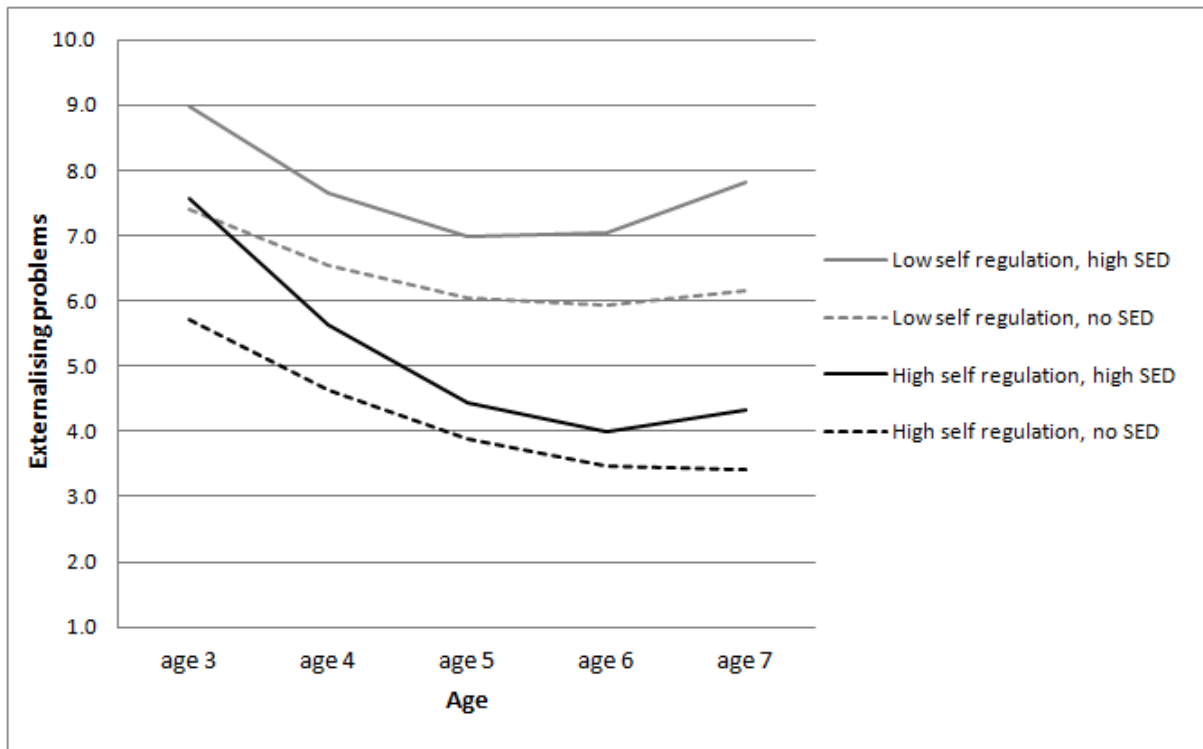
Figure 2. Predicted externalising score trajectories for children with high/low self-regulation by high SED/no SED (Model 4).
Note: See note to Figure 1.