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Exploring the Role of Fathers in Non-Cognitive Skill Development over the Lifecourse

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NON-TECHNICAL SUMMARY

Recent research in economics has been increasingly concerned with the role that non-cognitive or socio-emotional abilities play in the development of human capital. This has led to a renewed interest in how such abilities are formed, and how effective interventions can be developed. One specific non-cognitive skill –internal locus of control (sometimes referred to as self-efficacy)– has been in the academic spotlight because it is a powerful predictor of a range of life outcomes. Locus of control describes a person's belief about the control they possess over their life's outcomes.

Using British cohort data, this study extends existing research on the lifelong patterns of development and early-life determinants of internal locus of control. We focus on the predictive role of parental interest in education (as reported by teachers) because of its policy relevance. Getting parents engaged with their children's schooling has been the focus of many school reform programs, and considerable evidence points toward the positive relationship between parental involvement and school achievement outcomes.

We find that both mothers' and fathers' involvement in education are important predictors of internality in childhood, independent of a wide range of socio-economic, family structure, parental, and individual characteristics. However, only fathers' involvement continues to predict internality into middle age, but only for women and socio-economically disadvantaged individuals. The magnitude of these effects is comparable to that of important socio-economic background factors and considerably larger than that of other parental behaviours. Importantly, father's involvement in the education of the child boosts the probability of lifelong internality by 20 percent, and protects against lifelong externality.

These findings may be of considerable relevance to policy design. The well-founded relationship between parental school involvement and children's educational success may be at least partially explained by its impact on children's non-cognitive skill development. Both schooling and parenting inputs play an important and interactive role in children's non-cognitive skill development. When parents are strongly engaged in their children's education, children may have more effective school interactions, greater consistency between home and school, and higher quality support to get the most out of their education, learning that they have a greater capacity to control their educational and broader life outcomes. Through such processes, parental school involvement may boost the role that education plays in non-cognitive skill development.

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Abstract

Internal locus of control (LOC) is a highly beneficial non-cognitive skill, yet its long-term formation process remains poorly understood. Using British cohort data, we examine the role that fathers play in LOC maturation from childhood into middle age; a machine-learning algorithm is used to identify the most common LOC maturation types. Estimating a standard skill production function, we find that father's, but not mother's, interest in their child's education at age 10, as assessed by the child's teacher, predicts internality in middle age for female and socioeconomically disadvantaged children. Father's interest increases the probability of lifelong internality by 20%, and protects against lifelong externality. Parental engagement in children's education is a malleable factor, and thus is a promising target for public policy.

Keywords: non-cognitive skills; locus of control; father school involvement; lifecourse dynamics; British Cohort Study 1970

1 Introduction

The increasing representation of non-cognitive, or socioemotional, abilities in economic models of human capital production has garnered renewed interest in the dynamic processes that determine their formation and the potential for their enhancement through targeted interventions, particularly in childhood (Kautz et al., 2014) and adolescence (Schurer, 2017b). One specific non-cognitive skill – internal locus of control (also commonly referred to as self-efficacy) – has been in the academic spotlight because it is a powerful predictor of a range of life outcomes.[1] Locus of control (referred to as LOC from here onward) describes a person's belief about the control they possess over their life's outcomes. Internally-oriented individuals have strong expectations about the causal link between their investments of effort and the outcomes they experience. Externally-oriented individuals, on the other hand, tend to attribute life's outcomes to factors beyond their control, such as luck, fate, or other people (Rotter, 1966).

This study first aims to identify and describe the most common internal LOC maturation pathways from childhood into middle age. To the best of our knowledge, no other study has traced control beliefs longitudinally over such a long period. Our second aim is to examine the role of parental behavior in predicting control orientation, both in childhood and middle age. We focus in particular on fathers' – relative to mothers' – interest in their child's education to understand whether this important parental time investment holds predictive value beyond the influence of socioeconomic status, past control beliefs, and a range of other family background and individual factors. Finally, we aim to determine whether parental educational involvement is related to the likelihood of adhering to more adaptive life-long patterns of internality – and whether there are differential impacts of mother's and father's involvement upon these maturation pathways.

Following its early conceptualization by Rotter (1966) in the context of social learning theory, an extensive literature has amassed demonstrating the diverse individual and societal benefits associated with internality. Internally-oriented individuals tend to invest more heavily in various aspects of their human capital, and thus perform better in the labor market (see Cobb-Clark, 2015, for an overview). They achieve higher levels of education (Coleman and Deleire, 2003;

[1] A landmark study by Heckman et al. (2006) showed that a summary non-cognitive skill measure derived from self-efficacy and self-esteem personality questionnaires was at least as important as cognitive skills in determining a range of life outcomes including educational and labor market outcomes. A series of studies that followed and the role of non-cognitive skills in shaping lifetime opportunities were elegantly summarised in Almlund et al. (2011).

Hadsell, 2010), invest more heavily in their children's cognitive development through active play (Lekfuangfu et al., 2017), and earn significantly higher wages (Schnitzlein and Stephani, 2016; Heineck and Anger, 2010; Duncan and Morgan, 1981; Andrisani, 1981, 1977). Internally-oriented individuals are also more likely to pursue healthy lifestyles (Cobb-Clark et al., 2014; Chiteji, 2010) and save money for a rainy day (Cobb-Clark et al., 2016). Moreover, internal control beliefs seem to provide a form of "psychological insurance," helping individuals cope more effectively in the face of certain negative life events (Buddelmeyer and Powdthavee, 2016); this effect has been observed among workers who seek to find re-employment after job loss (Caliendo et al., 2015; McGee, 2015) and employed workers who experience episodes of ill health (Schurer, 2017a). LOC could be a good proxy of what the field of positive psychology would term resilience.

Despite the diverse positive outcomes associated with internality, the determinants underlying its formation and lifelong maturation processes remain poorly understood—though such research is pertinent for identifying the childhood factors that compromise optimal skill development (and thus later life outcomes) and informing the development of better intervention strategies to boost the skills of children in disadvantaged environments. Non-cognitive abilities are generally understood as the product of a complex combination of social learning processes and parental investments in child development, as well as genetic factors, education, and other aspects of the environment in which a child is raised. Early stocks of non-cognitive (and cognitive) skills feed into the production of later ones, such that compromised skill formation early on can hinder skill development processes down the track (e.g., Cunha et al., 2010).

Evidence consistently demonstrates a positive association between socioeconomic status (SES) and internality; yet this is of little practical or theoretical use without a clear understanding of the mechanisms driving this relationship—SES manifests in many aspects of child development, including educational opportunities, health, neighborhood context, exposure to stress, and parental socioemotional investments. Given their importance for skill development during the critical period of early childhood, parenting behaviors in particular have received attention both for their role as a transmission mechanism of socioeconomic disadvantage, and as a target of intervention to break cycles of intergenerational disadvantage. Such interventions fundamentally assume that although better socioeconomic conditions are conducive to better parenting, effective parenting can occur despite conditions of disadvantage, fostering resilience to overcome socioeconomic bar-

riers to successful life outcomes (Heckman, 2008). To date, research on the parental and broader socio-experiential determinants of LOC has often been limited by significant methodological issues, frequently neglected to examine the role of fathers alongside that of mothers, and rarely gone beyond the short-term dynamics of how parenting factors influence LOC maturation well beyond childhood.

In the context of education, parental interest and involvement are often considered a 'discourse of convenience' because they may represent a multitude of behaviors related to supporting a child's learning (Mattingly et al., 2002; Grolnick et al., 1997; Fishel and Ramirez, 2005). Nevertheless, research consistently shows that children whose parents are more involved in their education perform better across a vast range of educational outcomes (Castro et al., 2015; Wilder, 2014; Huat See and Gorard, 2015). It is plausible that strong involvement in education is an important time investment that parents can make to foster their children's non-cognitive skill development—that need not depend on their own education level and other socioeconomic characteristics (Reynolds, 1992), and which can help to "close demographic gaps in achievement" (Hill and Tyson, 2009). Our interest in this specific parenting behavior is motivated by its strong policy relevance. Parent involvement can be strengthened through initiatives within the schooling system, and getting parents more engaged with their children's schooling has been an integral component of many school reform policies, particularly in the US and UK (see, for example, Mattingly et al., 2002; Wilder, 2014; Huat See and Gorard, 2015; Jeynes, 2012, and references contained within). Yet, the impacts of these policies on children's non-cognitive skill development over the lifecourse have rarely been examined.

To achieve our research aims, we use longitudinal data sourced from the 1970 British Cohort Study (BCS) to follow the control beliefs of 6,566 individuals across three life stages spanning 32 years: childhood (age 10), young adulthood (age 30), and middle age (age 42). Focusing on a single birth cohort enables separation of the aging effect from likely cohort and period effects to study the dynamics in LOC (see Schurer, 2015; Dohmen et al., 2016, for a discussion of these issues in the context of risk preferences). We use a machine-learning algorithm, often employed in decision-tree analysis (Kass, 1980; Biggs et al., 1991), to identify and describe the most common LOC maturation pathways over the lifecourse, and study their early-childhood predictors. We then apply the human capability production framework to model the determinants of middle age

control beliefs – and LOC maturation pathways – as a function of past control beliefs, parental behaviors, and socioeconomic opportunities that shape a child's life (Todd and Wolpin, 2003; Cunha and Heckman, 2008; Cunha et al., 2010; Fiorini and Keane, 2014). Importantly, we utilize a teacher-reported measure of parental interest in education to avoid some of the bias associated with parent self-report measures (e.g., Reynolds, 1992).

2 Literature Review

The past 40 years have witnessed an extraordinary academic interest in the determinants and maturation processes of locus of control tendencies. This section will review the key insights and unanswered questions from this literature, and outline where and what we contribute to this literature.

2.1 Dynamics in locus of control perceptions

Early work focused on the likely maturation pathways from childhood into young adulthood from a theoretical perspective. Some hypothesized that children score unrealistically high on internality, and then readjust their perceptions as they grow older, while others hypothesized that children start out with externality, but become more internal over time (see Weisz and Stipek, 1982, for an overview). Although an empirical question, in the absence of long-term follow-up data, research could only answer this question by exploring age-gradients in LOC, relying on cross-sectional data. Numerous studies found an inverse-U-shaped age profile in LOC, whereby internality is lowest for the young, highest in middle-age, and low again for the older age groups (see Mirowsky and Ross, 2007; Ross and Mirowsky, 2002; Mirowski, 1995, for US data). The problem with age gradients estimated from cross-sectional data is that such analysis does not allow to separate out aging from cohort effects (see Dohmen et al., 2016; Schurer, 2015, for recent applications to risk preferences). It is possible, for example, that older cohorts born before various emancipation movements in the 1960s—i.e., the civil rights and women's movements, both of which influenced the culture of individual empowerment—may have already been more externally-oriented during their youth relative to cohorts born later (Doherty and Baldwin, 1985).

To overcome these issues, more recent studies have employed representative, longitudinal

data to follow the control beliefs of adolescents (but not children) and adults over time periods of four to 12 years (Elkins et al., 2017; Cobb-Clark and Schurer, 2013; Specht et al., 2013; Lachman, 2006; Lewis et al., 1999; Lachman and Leff, 1989; Doherty and Baldwin, 1985). While these studies convey different messages about the stability of control perceptions, there seems to be agreement that adolescents tend to increase in internality over time. For instance, in a representative Australian youth sample (ages 15-24), Elkins et al. (2017) report a marginal reduction in external control tendencies over an eight-year window, with more pronounced changes observed for adolescents (< age 18) relative to young adults. Similarly, in a sample of 14-22 year olds from the NLSY, Lewis et al. (1999) found that internal control tendencies increase in adolescence, but decrease in young adulthood over a 12-year time window.[2]

Studies focusing on the LOC maturation process of adults arrive at very different conclusions. Lachman (2006) and Lachman and Leff (1989) find that control perceptions are stable in older age over a five-year window. Cobb-Clark and Schurer (2013), using a representative sample of Australians, find that the very old age groups (over 70) increase in externality, while working-age groups (ages 25-60) do not change their LOC scores over a four-year window. In contrast, Specht et al. (2013), who exploited a six-year window for a comparable German sample, demonstrate increasing internality for age groups up to age 40, decreases for age groups up to age 60, and increases for older age groups.[3] No empirical evidence exists on the LOC maturation process from childhood into middle age.

2.2 Determinants of locus of control perceptions

A rich body of empirical evidence exists on the likely predictors of LOC. An important insight from this literature is that children from higher-education backgrounds – that are not necessarily of higher income – are more likely to express internality (e.g. Wickline et al., 2011, for age 10).[4]

[2] They argue that a reversed trend occurs because the youngest sample members (age 14) were lowest in internality in the first measurement period and therefore able to experience the largest increase.

[3] The findings in Specht et al. (2013) may be driven by the utilization of LOC measures that were differently coded in the two measurement periods. Thus, changes in LOC may be the result of coding differences and not of differences in personality change.

[4] Early work in the 1970s found that a socioeconomic gradient in internal control beliefs already existed among young school children (see Stephens and Delys, 1973, for a review of this literature). Stephens and Delys (1973) found that pre-Kindergarteners from disadvantaged backgrounds attending Head Start schools were more likely to report external control tendencies than middle class children from Montessori and cooperative nursery schools. In contrast, Bartel (1971) found that control perceptions did not differ between socioeconomic groups before entering

Lewis et al. (1999) explain that well-educated parents value "self-reliance, personal responsibility, and personal development" in their children and reward independence, while parents from disadvantaged backgrounds teach their children obedience and conformity (see also Gerris et al., 1997; Kohn, 1969; Mirowsky and Ross, 1998; Whitbeck et al., 1997).

Lekfuangfu et al. (2017) recently suggested that the link between parental education and children's LOC tendencies may operate through a transmission of parental internality tendencies by investing in their child. The study first derives a theoretical model that describes how LOC shapes parental expectations about how likely it is that their investments will improve their child's development. The model is tested using high-quality cohort data from Britain (ALSPAC); the authors find that mothers with high levels of internality – measured while the baby was in utero – believe that stimulating the child is important for their development (among others); they also spend more time on active, stimulating play with their babies (ages 0-1) and infants (ages 4-5) and are married to fathers who also spend more time on active play. These findings suggest that maternal LOC beliefs affect time investment, over and above the influence of parental education.[5]

What we also know is that parenting styles – the manner in which a parent expresses expectations, rules, and emotional responses to her child – are likely to play a fundamental role in children's LOC development (Carton and Nowicki, 1994). A series of studies have demonstrated a strong link between internality and non-authoritarian parenting styles, which are characterized by greater warmth, consistent contingent reinforcement, encouragement of achievement and autonomy, and supportiveness. In contrast, authoritarian and inconsistent parenting styles, characterised by harsh discipline, excessive control, over-protectiveness, and inconsistent reinforcement, have been linked to external control beliefs (see McClun and Merrell, 1998; Gordon et al., 1981; Carton and Carton, 1998; Carton and Nowicki, 1996, 1994; Katkovsky et al., 1967; Moilanen and Shen, 2014; Lynch et al., 2002; Spokas and Heimberg, 2008; Wickline et al., 2011).

Studies on the parental determinants of LOC have often examined short-term LOC dynamics or are cross-sectional in design, making it difficult to ascertain the direction of influence (e.g. Wickline et al., 2011). Most also suffer from limitations driven by reliance on parentsal self-report

first grade, but reported that substantial differences emerged by the sixth grade, an effect they suggest is driven by differences in the social control exerted by schools.

[5]These findings are in line with previous studies suggesting that highly-educated parents do not only spend more time with their children but spend their time on activities believed to be more productive or "developmentally effective" (Kalil et al., 2012).

of their own behaviors (leading to concerns about social desirability bias) or retrospective 'perception of parent' data collected from adult subjects, although some notable exceptions employ observational methods—e.g., Carton and Carton (1998); Crandall and Crandall (1983); Gordon et al. (1981); Carton et al. (1996). A common methodological strategy is to ask young adults (typically high school or undergraduate college students) to contemporaneously complete a LOC measure and report their perceptions of their parents' attitudes or behaviors (e.g., Macdonald, 1971), an indirect method that has led to concerns about poor correspondence between actual childhood experience and how these experiences are perceived in adulthood (see Carton and Nowicki, 1994, for a review of these issues).

Many studies have focused on maternal parenting factors only, despite the important, and sometimes qualitatively distinct, role fathers may play in children's behavioral, social, and psychological development outcomes (see Sarkadi et al., 2008; Flouri and Buchanan, 2003; Cabrera et al., 2000). There is evidence that children from father-absent homes tend to be more externally-oriented compared to those from intact families (Lancaster and Richmond, 1983; Duke and Jr., 1976; Bain et al., 1983).[6] Yet, few studies have explained why fathers' presence plays an important role in a child's development, which could be occurring either through a socialization or an income channel. An exception is Kalil et al. (2016), who exploit parental death as exogenous variation in the years of presence of fathers. The authors find that father presence strongly affects the intergenerational correlation of educational attainment and conclude that the mechanism is likely to operate through a better nurturing environment in the home, and not through the income channel. This conclusion is in line with evidence provided in Flouri and Buchanan (2004), who find that early father involvement in the education of the child predicts educational attainment over and above the influence of parental socioeconomic status and maternal investments.

Finally, whilst several studies have explored how parents' activities relate to LOC orientation (see examples above as well as, e.g., Taris and Bok, 1997; Williams and Radin, 1999; Ahlin and Lobo Antunes, 2015), few have explicitly examined whether LOC is predicted by parental involvement in the specific domain of child's education, despite its strong relationship to academic achievement (Hill and Taylor, 2004; Flouri, 2006). The few exceptions focus on the role of parental

[6] Hofferth (2006) discusses the evidence on the positive association of non-traditional family structures – families that are not composed of married-biological-parents – and children's behavior problems.

involvement, usually assessed by the child, on young children's motivations including LOC, and how these motivations mediate the impact of parental involvement on school achievement (e.g. Grolnick and Slowiaczek, 1994; Taris and Bok, 1997; Ross and Broh, 2000). In a review of the literature, Gonzalez-DeHass et al. (2005) suggest that parental involvement may proxy effective school interaction of parents with teacher, enhancing children's sense of control over their own school outcomes. None have explored how parental involvement shapes LOC maturation patterns over the lifecourse.

In what follows, we address some of the gaps identified in the previous literature by investigating the maturation process of control perceptions and its associated parental determinants over a window of 32 years. We contribute to the literature by describing the most common LOC maturation pathways and by quantifying the likely influence of both mother's *and father's* involvement in their child's education, as reported by the teacher when the child was ten years of age. We focus on parental involvement because it can be understood as a parental time investment that has proven to be malleable in interventions and thus can be the focus of policy measures. The high quality of our longitudinal cohort data allow us to carefully condition the analysis on early-life socioeconomic opportunities and other parental behaviors.

3 Data: The 1970 British Cohort Study

The 1970 British Cohort Study (BCS) began with an at-birth survey of around 17,000 individuals born between the 5th and 11th of April 1970 in England, Scotland, Wales and Northern Ireland. The overall catchment area was estimated to cover 95-98% of all births. Originally designed to study perinatal mortality and the provision of ante- and post-natal services (Chamberlain, 1975), the BCS was subsequently expanded and now includes eight major follow-up surveys: 1975, 1980, 1986, 1996, 2000, 2004, 2008 and 2012. In addition to the original birth cohort, the three major childhood surveys (age 5, 10 and 16) include any children who were born outside of the country during the reference week but who were identified from school registers at later ages. These childhood surveys collected detailed information from parents (typically cohort members' mothers) and teachers on the cohort member's health and behavior, as well as family demographics and SES. Cognitive ability was also assessed in these surveys via a range of tests administered by the survey interviewers. The four major adult surveys collected information from cohort members

on employment, income, education, health, relationships and attitudes.

Our analysis is based on data from the 1970 (birth), 1975 (age 5), 1980 (age 10), 2000 (age 30), and 2012 (age 42) surveys. Although LOC tendencies were recorded in six sweeps at ages 10, 16, 26, 30, 34, and 42, we focus our analysis on age 10 (childhood), age 30 (young adulthood), and age 42 (middle age) LOC outcomes. This is because some young adulthood measures of LOC were limited to one question only, and a teacher strike that interfered with data collection in 1986 heavily compromised the quality of the age 16 data.

Restricting the sample to cohort members with non-missing information on LOC measures at ages 10, 30, and 42, we are left with a sample of 6,566 cohort members. To retain the maximum number of observations, missing control variables were recoded as 0, and these observations were flagged with dummy variables. A full list of variables and their summary statistics is reported in Table A.1 (Online Appendix).

3.1 LOC measures

Childhood (Age 10) LOC is measured by the CARALOC questionnaire, which was initially piloted on 800 children to test and confirm its reliability, uniqueness and discrimination (Gammage, 1975). The measure is a modified version of the children's LOC scale developed by Nowicki and Strickland (1973), which has demonstrated validity (Furnham and Steele, 1993) and has been employed in well over a thousand research studies to date (Wickline et al., 2011). The children were asked to respond to the following 16 questions with either a "yes", "don't know", or "no":[7]

1. Do you feel that most of the time it's not worth trying hard because things never turn out right anyway?
2. Do you think that wishing can make good things happen?
3. Are people good to you no matter how you act towards them?
4. Do you usually feel that it's almost useless to try in school because most children are cleverer than you?
5. Is a high mark just a matter of luck for you?
6. Are tests just a lot of guesswork for you?

[7]Note: The full CARALOC questionnaire contains 20 items, with five "distractors". We have retained distractor item 12 based on a factor analysis because it improves the scale's Cronbach's alpha (see Ogollah, 2010).

7. Are you often blamed for things which just aren't your fault?
8. Are you the kind of person who believes that planning ahead makes things turn out better?
9. When bad things happen to you, is it usually someone else's fault?
10. When someone is very angry with you, is it impossible to make him your friend again?
11. When nice things happen to you, is it only good luck?
12. Do you feel sad when it's time to leave school each day?
13. When you get into an argument is it usually the other person's fault?
14. Are you surprised when your teacher says you've done well?
15. Do you usually get low marks, even when you study hard?
16. Do you think studying for tests is a waste of time?

A child with an internal LOC would tend to answer "no" to all questions except item 10. Each answer corresponding to an internal control perception was coded to equal 1, uncertainty to equal 0, and external control perception to equal -1. We then summed the items across all 16 questions. Figure 1 describes the distribution of the continuous index, which is empirically bounded between -12 (strict externality) and 16 (strict internality). Figure 1 indicates that less than 13% of the cohort members scored higher than 10 on this index.

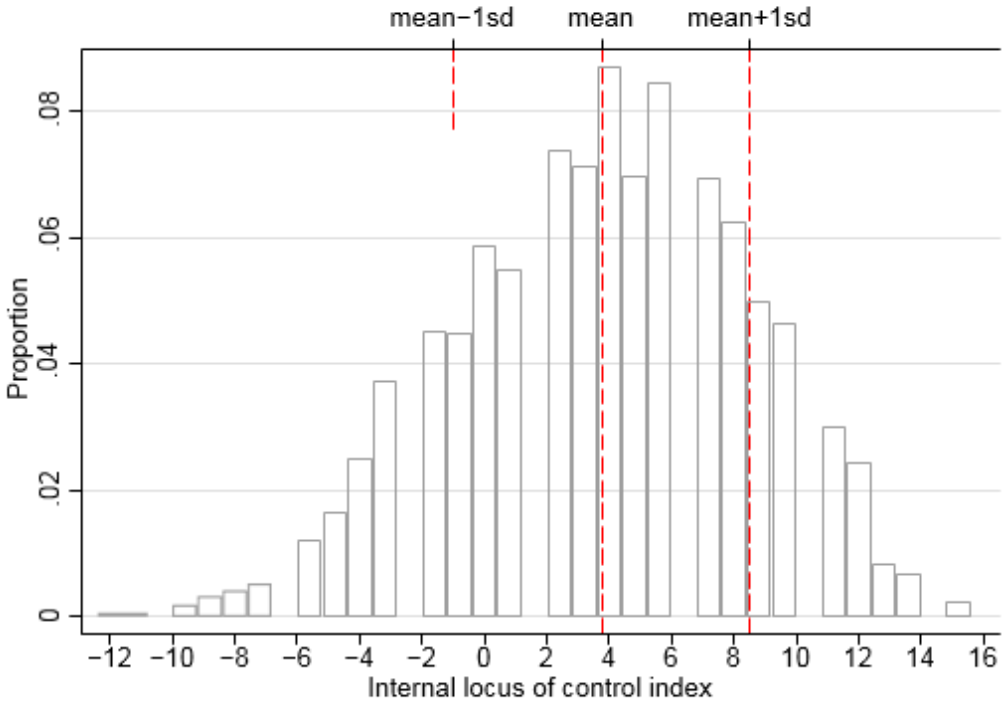

Figure 1: Distribution of internal locus of control at Age 10

Note: The Index is generated from summing the three possible answers to 16 questions on the CARALOC instrument. Indication of external locus of control tendencies is coded as -1, of internal tendencies as 1, and of uncertainty as 0.

Source: BCS 1970, Sweep Age 10 (N=6,566)

The adulthood measure of internal LOC at ages 30 and 42 is constructed from a three-item scale based on Rotter (1966)'s original LOC scale. The same items are included in a number of comparable longitudinal studies, including the Millennium Cohort Study and the National Child Development Study, and have been used to measure LOC (or self-efficacy) in numerous studies to date (e.g., Hertzman et al., 2001; Cutler and Lleras-Muney, 2010; Hatch et al., 2010; Hammond and Feinstein, 2005; Peruzzi, 2014). Cohort members were asked to choose between two options for each of the following items:

1. "I never really seem to get what I want out of life" *vs* "I usually get what I want out of life"
2. "I usually have a free choice and control over my life" *vs* "Whatever I do has no real effect on what happens to me"

3. "Usually I can run my life more or less as I want to" *vs* "I usually find life's problems just too much for me"

Answers indicating an internal control perception were coded to equal 1, and the alternative choices – which correspond to an external control perception – equal to 0. An index bound between 0 (strict externality) and 3 (strict internality) was constructed by summing the choice scenario answers. Figure 2 displays the distribution of this index at both ages 30 and 42. On this scale, almost 78% of the cohort members were classified as "strictly internal" in adulthood.

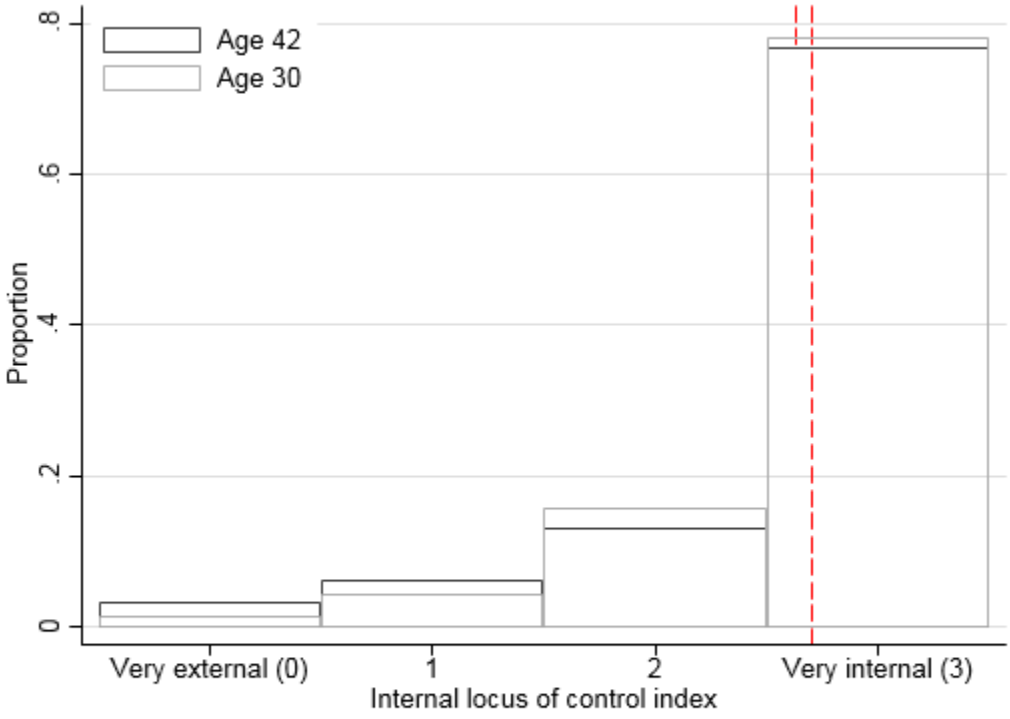

Figure 2: Distribution of internal locus of control at Age 30 and Age 42

Source: BCS Sweep Age 30 and Age 42 (N=6,566)

3.2 Classifying LOC maturation 'types'

Both the ordinal adult and continuous childhood measures of LOC are employed in a detailed analysis of LOC determinants in Section 5.3. However, to better understand long-term patterns of LOC maturation, we first identified the most common maturation pathways across the lifes-

pan. One approach in the literature is to classify individuals into internal or external control belief types according to arbitrary thresholds, to illustrate and simplify outcome differences across the extreme ends of the LOC distribution; however, no firmly established thresholds of classification exist. While some researchers have used cut-off values based on a specific percentile of the distribution,[8] this approach is not useful in our case because the proportion of individuals classified as internal would be arbitrarily influenced by the percentile cut-off value choice.

We instead use Chi-squared Automatic Interaction Detection (CHAID), a machine learning algorithm commonly employed in decision tree analysis to identify clusters. CHAID uses a recursive partitioning algorithm that searches for an optimal decision tree structure based on the correspondence between the dependent variable and a set of independent variables (Kass, 1980; Biggs et al., 1991). It seeks to increase the model's predictive power, simultaneously partitioning the dataset into clusters of observations based on predefined "splitting" variables. Its advantage over alternative decision-tree methods is its ability to build non-binary trees.[9]

The algorithm identifies clusters of observations, or pathway 'types', over the three LOC measurement periods (age 42, age 30, and age 10).[10] These are interpreted as different combinations of average LOC scores over the life course. Each pathway type thus reflects a certain pattern of maturation; for example, some types will be characterized by relatively low internality in childhood and high internality in adulthood, others may be characterized by stability in their relative position throughout the life course.

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[8]For examples: Lekfuangfu et al. (2017) distinguish between internal, external and neutral control tendencies using the upper and lower 25th percentile for cut-offs; Caliendo et al. (2015) use the median as a cut-off; Schurer (2017b) uses the upper 25th percentile as cut-off.

[9]We use the – chaid – program for STATA written by Joseph N. Luchman at Behavioral Statistics Lead. The algorithm considers three steps: Preparing predictors, merging categories, and selecting the split variable.

[10]We use age 42 LOC as dependent variable, and age 30 and age 10 LOC as independent variables. The decision tree is built on binary nodes, although we allow the algorithm to split age 10 LOC into three categories because the distribution of age 10 LOC is wider. The key conclusions of the analysis are not sensitive to this specification, but we are able to identify more nuanced maturation pathways. As a consequence, we obtain eight different maturation pathways instead of six.

3.3 Parental interest in child's education

We use a measure collected from teachers during the age 10 survey to gauge the degree of involvement parents have in a cohort member's education. Teachers reported the extent to which each parent appeared to be "concerned or interested" in the child's education on a scale from "very interested" to "uninterested." We transform this into a binary indicator to identify parents considered to be "very interested" relative to all others. One advantage of a teacher-reported measure is avoidance of social desirability bias associated with parent self-report; another is that teachers may provide a more reliable rating because they have experience with varying degrees of parental interest and involvement. Yet, teachers can only report based on their knowledge of, and experience with, a parent's school involvement behavior. This measure can only provide a broad indicator of parental school involvement as not all forms of parental educational interest and involvement are evident to teachers. Furthermore, it is possible that teacher ratings are subject to some degree of bias based on the teacher's knowledge of the child's school performance (Izzo et al., 1999). Numerous past studies have utilized teacher reports of parental involvement (e.g., Reynolds et al., 1992; Izzo et al., 1999; Flouri, 2006; Schoon et al., 2004; Osborn, 1990). There is evidence of poor correspondence between teacher and parent reports, with teacher reports often considerably better correlated with child outcomes (e.g., Reynolds, 1992).

3.4 Parental background variables

As highlighted in Section 2, socioeconomic status and many other parental behaviors predict LOC; we therefore control for these factors in the estimation model. To capture socioeconomic status, we use occupational class and education of each parent. The former is measured through a series of binary variables, ranging from "Unskilled" to "Professional." Mother's level of education was proxied by the age at which she completed her education and father's education was measured by three binary variables indicating whether the father has a degree, other qualifications, or no qualifications.

Maternal liberal parenting beliefs, derived from an index created from mothers' responses to a 16-item attitude questionnaire at age 5, was used to proxy maternal parenting style.[11] The index was constructed by averaging answers (some reverse coded) and standardizing the score such that the index was bound between 0 and 1, with larger values indicating more liberal parenting views (see Flouri and Hawkes, 2008, for an application). Overly authoritarian parenting styles, including physical abuse, have been linked to personality development and behavioral problems in children (see Fletcher and Schurer, 2017; McClun and Merrell, 1998, and references therein).

Maternal mental health was measured at age 5 by a nine-item subset of the 24-item Malaise Inventory developed by Rutter et al. (1970), a short version of the 196-item Cornell Medical Index of Health Questionnaire. The Malaise Inventory has been widely validated for identifying symptoms of anxiety and depression (see Johnston et al., 2013, for a discussion). A standardized index was created, with larger values signifying poorer mental health.

The following father information was collected via maternal report at age 10: how often away on Saturdays, smoking behavior, hostility, and ethnic background. Furthermore, we control for the presence of the father in the household at birth and age 5 and the father (figure)'s relationship to the child (biological, adoptive, step, cohabitee, etc); various studies have demonstrated that father family structure is related to child development outcomes (Hofferth, 2006) or educational attainment (Kalil et al., 2016).

3.5 Individual childhood factors

Individual child factors include gender, low birth weight (<2500 grams), breastfed for first seven days of life, and diagnosed abnormalities at birth, as well as a battery of early childhood (age 5) cognitive (Peabody vocabulary test, copy test, and drawing test) and non-cognitive (Rutter Behavioral Problem Index) tests—each standardized to mean 0 and standard deviation 1.

[11] Examples of items include "children should not be allowed to talk at the meal table", "unquestioning obedience is not a good thing in a young child", and "a well-brought up child is one who does not have to be told twice to do something."

4 Empirical framework

In this section we lay out the empirical framework through which we estimate the association between mother's and father's interest in the education of their child on internal LOC in childhood and young adulthood. Our analysis departs from the perspective that LOC at any age, a, is the result of a cumulative dynamic process, sometimes referred as a maturation process, that depends on past inputs, some fixed mental capacity, shocks and education opportunities (Todd and Wolpin, 2003; Cunha and Heckman, 2008; Cunha et al., 2010; Fiorini and Keane, 2014). The LOC production function of individual i at age a is:

$$LOC_{ia} = LOC_a[E_i(a), X_i(a), \theta_{i0}, \varepsilon_{ia}], \quad (1)$$

where $E_i(a)$ captures all education opportunities, $X_i(a)$ are all relevant family inputs including father's and mother's interest in the education of the child, θ_{i0} is the initial skill endowment and ε_{ia} is measurement error in skills or age-specific shocks, which are assumed to be independent of E, X, and θ. In this flexible specification, the impact of all inputs are allowed to vary by age. However, estimating this specification is not feasible, because information on all relevant, historical inputs and initial endowments in skills is usually not available, and this is so in our case.

To control for all historical inputs into the LOC production function and initial skill endowment, we condition the analysis on past values of LOC, an approach widely used in the literature to model NCS development for children and adolescents (see Fiorini and Keane, 2014; Bono et al., 2016; Elkins et al., 2017; Black and Kassenboehmer, 2017; Kassenboehmer et al., 2017). The key assumption of this approach is that the impact of each input – including parental time investments – is independent of the age at which the input occurs (see Fiorini and Keane, 2014; Todd

and Wolpin, 2003, for a discussion):

$$LOC_{i,t+2} = \alpha_1 LOC_{i,t+1} + \alpha_2 LOC_{i,t} + \alpha_3 F_{i,t} + \alpha_4 M_{i,t} + X'_{i,t}\beta + Z'_{i,t-1}\gamma + W'_{i,t0}\mu + \varepsilon_{i,t+2}. \quad (2)$$

The dependent variable is $LOC_{i,t+2}$ for individual i measured in time period $t+2$ (age 42), and the independent variables include observations from the past: $t+1$ (age 30), t (age 10), $t-1$ (age 5), and t0 (birth). The dependent variable is an ordered, categorical variable which can take four values $k \in \{0, \ldots, 3\}$ and is increasing in internal LOC. Age 10 and age 30 LOC ($LOC_{i,t}$, $LOC_{i,t+1}$) are used as proxies for all unobservable parental and educational inputs that occurred before the age of 10 and baseline endowments in skills (θ_{i0}). Of main interest are the coefficients on father's ($F_{i,t}$) and mother's ($M_{i,t}$) interest in the education of the child, a time input invested when the child was 10 years of age. α_3 and α_4 measure the effect of father and mother interest on LOC, *ceteris paribus*.

The vectors $X_{i,t}$, $Z_{i,t-1}$, $W_{i,t0}$ include baseline control variables that are likely to affect LOC but that may also be associated with parental time investments in the education of the child. These include parental socioeconomic status, parenting behaviors, and mental health measured at age 5 or age 10; and individual-specific characteristics measured at birth (e.g. health) or at age 5 (e.g. cognitive and non-cognitive skills). All variables are described in Section 3 and their summary statistics are listed in Table A.1.

The error term $\varepsilon_{i,t+2}$ is assumed to be the sum of remaining individual-specific heterogeneity (μ_i) and period-specific shocks ($\phi_{i,t+2}$). Given that we condition on past LOC and early life ability measures, we hope these controls proxy most of the unobservable variation in μ_i that may be correlated with parental time investments. $\phi_{i,t+2}$ remains a period-specific shock or measurement error in LOC. Under the assumption of zero remaining covariance between both components in $\varepsilon_{i,t+2}$ and parental investment, estimating α_3 and α_4 with ordinary least squares (OLS) would yield an unbiased impact estimate. Because the identifying assumption cannot be tested, we refrain from interpreting our estimation results as causal (a limitation which we will discuss in Section 6) but instead in terms of predictive power.

To estimate the parameters of the model, we use an ordered probit specification, which takes

account of the ordinal nature of the dependent variable. To be able to interpret the magnitude of the estimated coefficients, we calculate the marginal probability effects for the probability of scoring the highest category of LOC, which represents strict internality. For an overview of these standard models, see Cameron and Trivedi (2005).

We will use the same framework to estimate the relationship between age 10 LOC and parental time investment, which helps us to better understand the "initial conditions" of internal locus of control, and between lifelong (permanent) LOC tendencies and parental time investment. In the former case the outcome variable in Eq. 2 is replaced by $LOC_{i,t}$, which we assume to be a continuous measure, and thus the model is estimated with OLS. In the latter case, the dependent variable is a non-ordered, categorical variable that classifies sample members into one of eight LOC maturation types (see Section 3.2 for definition of this variable).[12] Marginal effects for the latter model are obtained from a multinomial logit model using standard methods (Cameron and Trivedi, 2005).

5 Estimation results

5.1 LOC maturation pathways

This section presents eight maturation pathways identified in our sample through the machine learning algorithm CHAID. Fig. 3 describes the maturation types by plotting the average LOC scores measured at each stage of the lifecourse (horizontal axis), for each identified pathway type (vertical axis). Depicted are the standardized (mean=0, SD=1) averages for internality scores, where a blue bullet point represents age 10 LOC, a red diamond age 30 LOC, and a green square age 42 LOC.

Pathway types 1, 2, and 3, collectively comprising 12% of the sample, are characterized by internality scores consistently below the mean across the whole life course, indicating an external LOC tendency. Types 5 and 6, collectively representing 9% of the sample, tend to have above-average internality scores in childhood—yet below average scores in both adulthood periods. In

[12] As is self-evident, these two model specifications do not control for $LOC_{i,t+1}$, $LOC_{i,t}$ on the right-hand side.

contrast, type 4 individuals (27% of the sample) tend to exhibit below-average internality scores in childhood and above-average scores in adulthood. Finally, type 7 (26% of the sample) and type 8 (25% of the sample) are characterized by very high internality scores in adulthood (almost maximum possible values), and above average childhood internality scores.

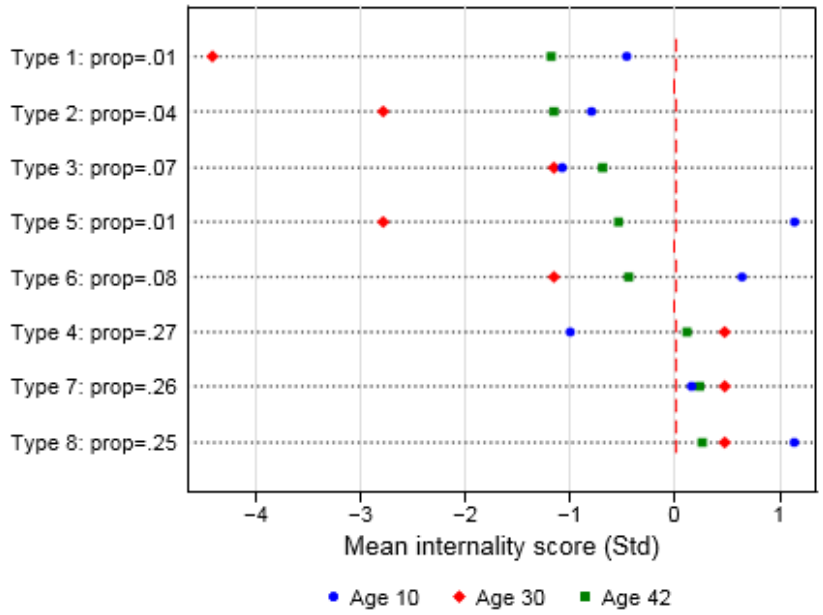

Figure 3: Reported are the standardised mean values of each locus of control measure across the life course, for different maturation pathway types in the sample. Blue circles represent the mean value of LOC for children measured at age 10; red diamonds represent the mean value of LOC for young adults measured at age 30; and green squares represent the mean value of LOC for middle aged adults measured at age 42. We estimated eight types of individuals using the Chi-square automated interaction detection (CHAID) method, a recursive partitioning algorithm that searches for an optimal decision tree structure based on the correspondence between the dependent variable and a set of independent variables. Details of the method are described in Section 3.2.

Source: BCS Sweep Ages 10, 30 and 42 (N=6,566).

Only 6% of the sample – including types 1, 2, and 5 – produced LOC scores that differed markedly between the two adulthood measures. The magnitude of these shifts is between 2 and 3 SD relative to the mean, always in the direction of increasing internality between age 30 and age 42. All other pathway types exhibited a high degree of relative stability in adulthood.

We thus summarize the most common observed maturation patterns as follows: types 7 and 8

have high lifelong internality; types 1 to 3 have lifelong externality; types 5 and 6 demonstrate a relative reversal whereby they are above-average in childhood but below-average in adulthood; and type 4 individuals exhibit the opposite pattern indicating low childhood internality and high adulthood internality. We will revisit these classifications in Section 5.4, where we discuss the association of parental involvement with the probability of each LOC maturation pathway.

5.2 Parents' occupational class and interest in child's education

Fig. 4 depicts the proportion of children whose fathers and mothers are interested in their education, separately by occupational class (Table A.2, Online Appendix reports underlying sample numbers). It illustrates a close relationship between parents' occupational class and involvement in their child's education. Teachers were much more likely to report that parents of higher occupational classes were very interested in their child's education. For example, 70% of fathers and 86% of mothers of professional occupations were interested in their child's education compared to 18% of fathers and 36% of mothers in unskilled occupations. Despite the strong SES-gradient in parental involvement, these numbers mean that there is still one in five socioeconomically disadvantaged children whose fathers are interested in the education of the child. Children of semi-skilled fathers still have a 30% probability of having a father interested in their education. In contrast, among the very advantaged children, 30% have fathers who are not very interested in their education. This means that we have quite substantial variation within each occupational class that can be exploited in our empirical analyses.

Furthermore, across every category of occupational class, a considerably higher proportion of mothers were reported to be interested in their child's education than fathers–though mothers were much less likely to be in professional occupations. This disparity between mother's and father's involvement may be partially attributable to a pattern where mothers take greater responsibility for school-based contact (e.g., attending parent-teacher meetings), and thus are more likely to be recognized as being involved compared to the father. For most cohort members, however, either both parents were reported as very interested (40%), or both parents were reported as not very interested (43%). Only a small proportion (2%) had an very interested father only, while 16% had a very interested mother only.

These results align with those of previous studies (Kohl et al., 2000; Reynolds et al., 1992; Grolnick et al., 1997). It is possible that parents with higher-status jobs (and who typically have a greater level of education) are more involved in their child's education because they place a higher value upon their children's educational attainment and recognize the importance of encouraging, motivating, and supporting their child in this domain. Parents from lower SES backgrounds may be confronted with more barriers to active school involvement (Hill and Taylor, 2004), including employment conditions that do not support flexibility, different expectations about the value in engagement with their child's school and their capacity to effectively involve themselves.

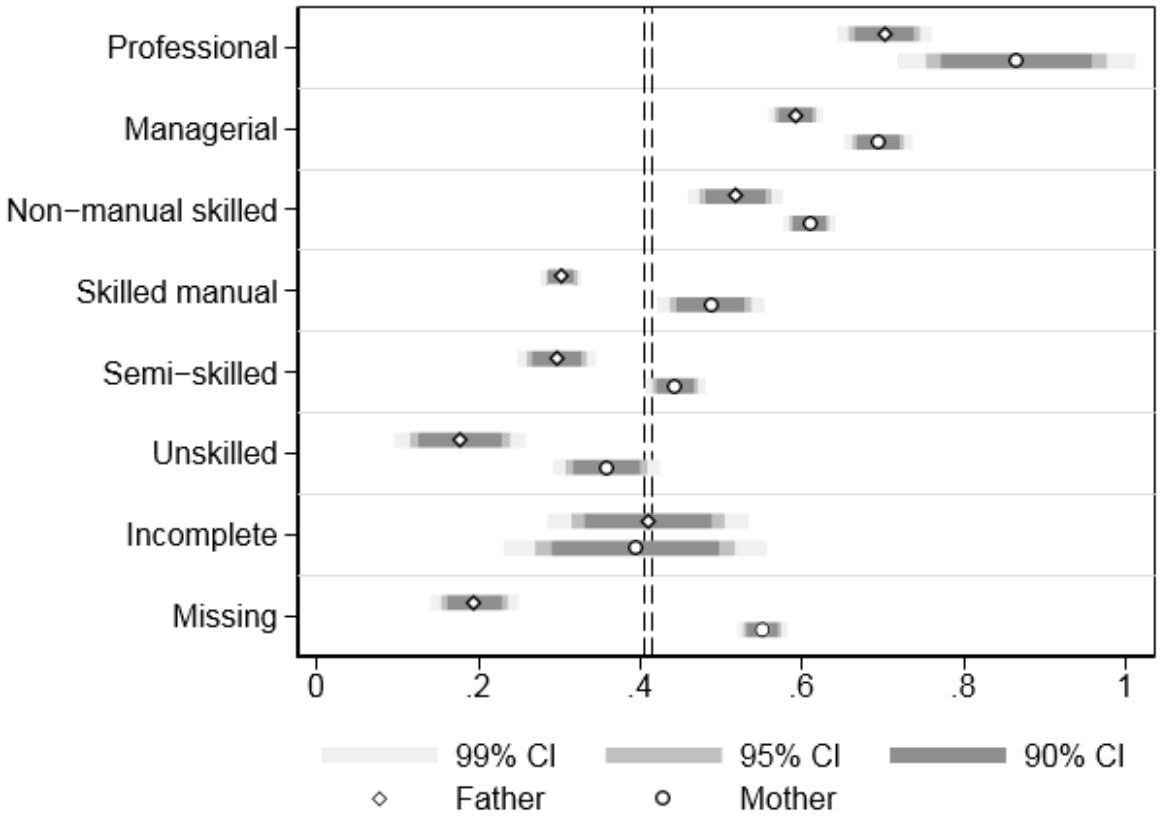

Figure 4: Proportion of parents who are very interested in the education of their child(ren) by occupational class measured by teacher report when the child was 10 years of age.

Source: BCS Sweep Age 10.

5.3 Predictors of internal control beliefs

5.3.1 Childhood

Table 1 presents regression results focusing on the early-childhood predictors of age 10 internality. The dependent variable is a standardized version of our continuous childhood control belief measure, and parameter estimates are obtained using ordinary least squares (OLS). Results are presented by gender and SES. To reduce the high-dimensionality of estimation results, we present and limit our discussion to the estimated coefficients of interest. The full list of controls and estimation results are presented in Tables A.1 and A.3 respectively.

Table 1: Predictors of internal locus of control beliefs at age 10, by gender and socioeconomic status (OLS): Selected parameters

	Pooled (1)	Female (2)	Male (3)	High SES (4)	Low SES (5)
Mother is very interested in education of child	0.123***	0.152***	0.093**	0.073	0.148***
	(0.031)	(0.041)	(0.046)	(0.076)	(0.039)
Father is very interested in education of child	0.182***	0.188***	0.176***	0.219***	0.167***
	(0.032)	(0.044)	(0.048)	(0.072)	(0.042)
Maternal age left education (Std)	0.077***	0.087***	0.063***	0.043*	0.094***
	(0.014)	(0.018)	(0.021)	(0.022)	(0.024)
Maternal views liberal parenting (Std)	0.087***	0.070***	0.110***	0.094***	0.084***
	(0.013)	(0.018)	(0.020)	(0.029)	(0.017)
Maternal mental health (Std)	0.007	0.017	–0.009	0.016	–0.003
	(0.014)	(0.019)	(0.021)	(0.033)	(0.017)
Father has no qualifications	–0.065**	–0.031	–0.094**	–0.179**	–0.043
	(0.027)	(0.038)	(0.040)	(0.074)	(0.033)
Father has a degree	0.174***	0.229***	0.116**	0.013	0.373***
	(0.039)	(0.054)	(0.057)	(0.072)	(0.075)
Observations	6566	3369	3197	1204	3951

Note: Dependent variable is Age 10 internal locus of control index standardized to mean 0 and standard deviation of 1. Average locus of control score in sample is 8, and 1 standard deviation is 3 units on an index that ranges between 0 and 16. Model includes a full set of control variables derived from birth, age 5 and age 10. Full estimation results are reported in Table A.3 in the Online Appendix.

* p < 0.1, ** p < 0.05, *** p < 0.01.

Source: BCS70, Sweeps Birth, Age 5, Age 10

The results of Table 1 demonstrate that parental interest in education predicts childhood internality independent of the influence of family structure; maternal, paternal, and individual child-

hood factors; and important socioeconomic indicators including parental occupational status and education. Overall, we find that children of parents very interested in their education are more internally oriented relative to children of parents who are not very interested. The magnitude of this association varies with gender and SES for mother's involvement (standardized coefficients range between 0.07 and 0.15 SD and drop from significance among high SES cohort members), although the differences across groups are not statistically significant. In contrast, father's involvement is a significant and stable predictor of internality across every group (standardized coefficients range between 0.17 and 0.22 SD), and the magnitude of this association with LOC is stronger than for mother's involvement, especially for boys and children from privileged backgrounds.

Overall, the association of parental involvement with age 10 internality is comparable in magnitude to that of SES-related parental inputs including father's education level and occupational status, and produces a considerably larger associations relative to maternal education, parenting style, and mental health.

5.3.2 Middle Age

This section considers the possibility that these same factors cast a long shadow over the maturation of internal control beliefs over the life course. Middle-age (age 42) control beliefs were measured on a four-point ordered scale (see Fig. 2); thus, we have estimated an ordered logit model with four possible outcomes ranging from "Strict externality" to "Strict internality". Table 2 reports the marginal probability effects of being strictly internal in middle age (about 77% of the sample reported strict internality at age 42) across a series of models. Model 1 includes only age 10 and age 30 control beliefs to determine the influence of past control beliefs on those of middle age. Model 2 adds individual childhood factors; Model 3 adds mother's interest in the child's education and other maternal factors; Model 4 contains the full set of variables, including father's interest and other paternal factors. Model 5 excludes age 10 and age 30 LOC measures, enabling us to determine whether the effect of parental variables on age 42 control beliefs runs solely through past control beliefs. Full estimation results are provided in Table A.4.

Table 2: Predictors of internal locus of control beliefs at age 42 (marginal probability effects calculated from Ordered Logit Models

	(1)	(2)	(3)	(4)	(5)
LOC Age 30 (Std)	0.105***	0.104***	0.103***	0.102***	
	(0.003)	(0.003)	(0.004)	(0.004)	
LOC Age 10 (Std)	0.043***	0.043***	0.038***	0.035***	
	(0.005)	(0.005)	(0.005)	(0.005)	
Mother is very interested in education child			0.030***	0.005	0.014
			(0.010)	(0.012)	(0.013)
Father is very interested in education child				0.036***	0.064***
				(0.013)	(0.015)
Control variables					
Past LOC	✓	✓	✓	✓	
Basic controls		✓	✓	✓	✓
Maternal controls			✓	✓	✓
Paternal controls				✓	✓
Observations	6566	6566	6566	6566	6566

Note: Marginal effects of the probability of being strictly internal at Age 42 are calculated on the basis of ordered logit coefficients. Each columns adds a set of control variables including parental interest in the education of the child. Full estimation results are reported in Table A.4 in the Online Appendix.

* p < 0.1, ** p < 0.05, *** p < 0.01.

Source: BCS70, Sweeps Birth, Age 5, Age 10, Age 30, and Age 42

As expected, age 10 and age 30 control beliefs significantly predict age 42 internality: a 1 SD increase in age 10 or age 30 internality is related to a 4%-point or 10%-point higher probability of being strictly internal at age 42, respectively. Relative to the base probability in the sample, the latter implies that a 1 SD increase in age 30 internality is associated with a 13% increase in the probability of being strictly internal at age 42, *ceteris paribus*.

Model 4 demonstrates that father's educational involvement significantly increases the probability of strict internality at age 42 by nearly 4%-points ($p<0.001$), over and above the impact of maternal interest and maternal, paternal, and individual childhood factors. In contrast, the effect of mother's interest lost significance once father's involvement (and other paternal inputs) were accounted for. Model 5 excludes past LOC measures, which almost doubles the marginal probability effect of father involvement to 6.4%-points ($p<0.001$). Comparing the findings from Models 4 and 5 shows that the impact of father's involvement in education on adulthood LOC does not run solely through its impact on childhood or young adulthood LOC.

Table 3: Predictors of internal locus of control beliefs at age 42, by gender and socioeconomic status (marginal probability effects calculated from Ordered Logit Models

	Pooled (1)	Female (2)	Male (3)	High SES (4)	Low SES (5)
LOC Age 30 (Std)	0.102***	0.092***	0.111***	0.103***	0.103***
	(0.004)	(0.005)	(0.005)	(0.008)	(0.004)
LOC Age 10 (Std)	0.035***	0.030***	0.042***	0.059***	0.027***
	(0.005)	(0.007)	(0.007)	(0.011)	(0.007)
Mother is very interested in education child	0.005	–0.001	0.016	0.020	0.020
	(0.012)	(0.016)	(0.018)	(0.029)	(0.016)
Father is very interested in education child	0.036***	0.056***	0.013	–0.004	0.050***
	(0.013)	(0.018)	(0.020)	(0.029)	(0.019)
Observations	6566	3369	3197	1204	3951

Note: The results reported in this table are based on the benchmark specification, column (4) reported in Table 2. The benchmark model is re-estimated for female and male cohort members (columns (2) and (3)) and by high and low socioeconomic status of the father measured at age 5 (columns (4) and (5)). Marginal effects of the probability of being strictly internal at Age 42 are calculated on the basis of ordered logit coefficients. Full estimation results are reported in Table A.5 in the Online Appendix.

* p < 0.1, ** p < 0.05, *** p < 0.01.

Source: BCS70, Sweeps Birth, Age 5, Age 10, Age 30, and Age 42

Table 3 reports the marginal effects obtained from an ordered logit model for middle age control beliefs, separately by gender and SES, using the full model from Table 2 (Model 4) as the benchmark. We find that the impact of father's interest in education on middle-age internality is exclusive to female and low SES cohort members, for whom having an interested father increases the probability of strict internality by 6%-points and 5%-points, respectively.

It is possible that these factors help to explain not only the levels of control perceptions at any point in time, but also longterm (permanent) control perceptions. This issue is considered in the next section.

5.4 Parental interest in education and LOC maturation pathways

Our final analysis employs a multinomial logistic regression model, with the same full set of controls as the previous section, to estimate the impact of parental educational interest on the probability of a cohort member following a given lifecourse maturation pathway. The dependent variable includes eight different values, corresponding to each of our observed pathways (no ranking across pathways is assumed).

Fig. 5 illustrates the marginal probability effects for each type as described in Fig. 3. The marginal probability effects, illustrated for mother's and father's interest separately, can be interpreted as the change in probability of following a certain maturation process associated with having a parent very interested in education, relative to having a parent that is not.

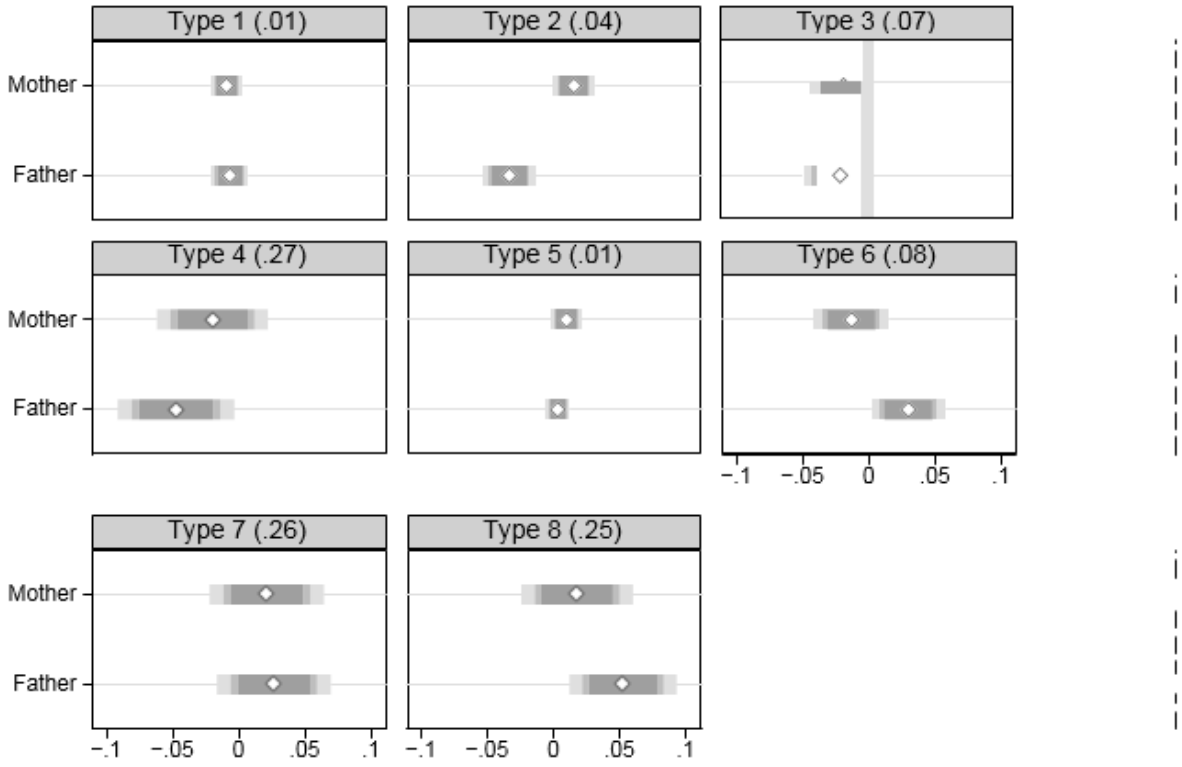

Figure 5: Relationship between parental interest in child's education (mother, father) and the probability of a specific permanent control belief type (Childhood-Age30-Age42). Reported are marginal probability effects obtained from a multinomial logit model estimated on 6,566 observations with a full set of control variables. Types 7 and 8 have high lifelong internality; types 1 to 3 have lifelong externality; types 5 and 6 demonstrate a relative reversal whereby they are above-average in childhood but below-average in adulthood; and type 4 individuals exhibit the opposite pattern indicating low childhood internality and high adulthood internality. Types 4, 7, and 8 constitute 78% of the sample. Light, medium, and dark shaded areas represent the 99% CI, 95% CI, and 90% CI, respectively.

Source: BCS Sweep Ages 10, 30 and 42.

We find a significant negative association between having a father interested in education and the probability of following maturation pathway types 2 and 3, both of which represent a tendency for relatively low lifelong internality. For example, cohort members with very interested fathers are more than 5%-points (p<0.001) – that is, over 100% relative to base probability – less likely to follow pathway type 2 (see first row, second panel in Fig. 5). Children of interested fathers were also significantly less likely to follow pathway 4 – a pattern of below-average childhood internality but above-average adulthood internality – by a magnitude of 5%-points, or 18% relative to base probability (p<0.001).

On the other hand, father's involvement was positively associated with the probability of following type 8 – high lifelong internality – by a magnitude of 5%-points (bottom-right panel, Fig. 5); in terms of mean levels in the sample, this implies an increase in probability of around 20% relative to those without an involved father (p<0.001). To a lesser degree, father's involvement was also positively associated with the probability of following type 6 (above-average childhood internality and below average adulthood internality). As can be seen in Fig. 5, the results obtained for mother's involvement were considerably more ambiguous. With the exception of type 2, the impact of mother's involvement either generally corresponded with the results for father involvement or were not significant.

Taken together, these findings suggest that individuals raised by fathers involved in their education are more likely to follow adaptive patterns of control belief maturation. In particular, they are considerably more likely to follow a pathway of high lifelong internality (i.e., type 8), and considerably less likely to have low internality scores in childhood (types 2, 3, 4). This pro- vides tentative evidence that fathers may play an important role in shaping not only childhood control perceptions, but also LOC maturation patterns over the whole life course. Again, these associations exist independent of the influence of SES and other family factors widely understood to influence the LOC construct.

6 Discussion and conclusion

An internal locus of control (LOC) is the generalized belief that one has control over the outcomes of one's own life; it is associated with important benefits across the domains of health, education, labor market, and social outcomes (Cobb-Clark, 2015). This study extended existing research on the lifelong patterns of development and early-life determinants of internal LOC—areas of research that have been relatively neglected despite their importance for the development of interventions to boost non-cognitive skills. We focused on the predictive role of parental interest in education (as reported by teachers) because of its policy relevance; getting parents engaged with their children's schooling has been the focus of many school reform programs, and considerable evidence points toward the positive relationship between parental involvement and school achievement outcomes.

Our results first suggest that individuals' can follow a number of different LOC maturation pathways between childhood and middle age. Eight maturation pathways were distinguished based on combinations of LOC scores over the life course. The observed pathways range from those characterized by lifelong internality – which could be considered a highly adaptive maturation pattern – to those characterized by lifelong externality – a pattern probably less conducive to positive life outcomes. Control beliefs were found to be highly stable between young adulthood (age 30) and middle age (age 42) for the majority of the sample, while a small minority (6%) exhibited large relative increases in internality between these two periods.

We found both mother's and father's involvement in education to be important predictors of internality in childhood, independent of a wide range of socioeconomic, family structure, parental, and individual characteristics. However, only father's involvement continues to predict internality into middle age (controlling for past LOC), an effect significant for women and socioeconomically disadvantaged cohort members. The magnitude of these effects is comparable to that of important socioeconomic factors such as parental education and occupational status, and is considerably larger than the impact of parental variables such as maternal mental health and parenting beliefs. Furthermore, father's educational involvement considerably increases the probability that an individual will follow a maturation process characterized by high lifelong

internality, and "protects" individuals from lifelong externality.

Though we cannot attribute causality, these findings, taken together, may be of considerable relevance to policy design. The well-founded relationship between parental school involvement and children's educational success may be at least partially explained by its impact on children's non-cognitive skill development (see, e.g., Gonzalez-DeHass et al., 2005). Both schooling and parenting inputs play an important and interactive role in children's non-cognitive skill development. When parents are strongly engaged in their children's education, children may have more effective school interactions, greater consistency between home and school, and higher quality support to get the most out of their education, learning that they have a greater capacity to control their educational, and broader life, outcomes. Through such processes, parental school involvement may boost the role that education plays in non-cognitive skill development. As suggested by Hill and Taylor (2004), parental school involvement enhances both "social capital" and "social control," improving the capacity of parents to effectively support their children's learning and building consensus about behavioral expectations and their enforcement. These conditions likely produce an environment conducive to the development of internal control perceptions.

Like internality itself, both mothers' and fathers' school engagement is strongly associated with socioeconomic status; and thus, the children who stand to benefit the most from parental involvement are the least likely to experience it. We show, for example, that 70% of fathers and 86% of mothers in professional occupations were reported by teachers as very involved, compared to just 18% of fathers and 36% of mothers in unskilled occupations. Yet, parental involvement is a malleable factor that need not depend on parents' background, and which may be a productive investment that parents across the socioeconomic spectrum can make in their children's non-cognitive skill development (Reynolds, 1992; Hill and Tyson, 2009). Parental involvement has been successfully enhanced through school- and community-based programs, which can assist parents to understand the value of greater engagement with their child's education. Such programs should increasingly focus on helping to overcome socioeconomic barriers to involvement (Hornby and Lafaele, 2011), such as inflexible working conditions and expectations about the value of getting more involved. Moreover, our results suggest that fathers' school involvement may be a particularly productive target for intervention, especially for girls and socioeconomically disadvantaged children.

This study has important limitations. First, while teacher-reported measures of parental interest have considerable benefits over parental self-report or adult children's perception-of-parent measures, it cannot be a perfect gauge of parent behavior. Parent involvement in education takes many forms (e.g., homework support and supervision, talking to the child about school, encouraging achievement, working with the teacher to support learning, etc), some of which may not be evident to teachers. In addition, part of the disparity between mothers and fathers on this measure may arise from mothers (at any occupational level) taking on more of the school involvement activities that are visible to teachers. Ideally, we would use multiple sources of information to best understand this behavior. Second, our analysis does not enable us to draw causal inferences about the relationship between parental involvement and internality. For example, information on father's educational involvement may be a reflection of underlying factors such as family cohesion or other variables, though we have done our utmost to control for a wide range of relevant variables. More research is needed on the specific role of fathers in shaping the control beliefs and skills of children. Unfortunately, the absence of detailed father information is a typical shortcoming afflicting analyses with many major international cohort studies such as AddHealth, the Longitudinal Study of Australian Children, and the Millennium Cohort Study.

Despite these limitations, our study is the first to describe LOC maturation pathways from childhood into middle age and thus is able to describe permanent control tendencies. We are also the first to demonstrate the important role that fathers' involvement can play in shaping a highly-beneficial non-cognitive skill over the lifecourse. Our study highlights the individual and family determinants of LOC with an eye on their potential relevance to intervention strategies that focus on shaping "what parents do" (i.e., their parenting behaviors and investments) rather than (or regardless of) "who parents are" (i.e., a product of their socioeconomic background and other socio-experiential factors). Yet, in doing so, we do not wish to discount the pervasive structural conditions and barriers that drive socioeconomic inequalities underlying these disparities. Socioeconomic disadvantage produces a context whereby available opportunities and resources (material or otherwise) are reduced, and effective parenting becomes a more challenging and taxing exercise. Alongside interventions that boost the non-cognitive skills of children to enhance life outcomes, these structural barriers need to be addressed in the long term to treat the underlying sources of socioeconomic disparities in non-cognitive skills.

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APPENDIX FOR ONLINE PUBLICATION

Table A.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
LOC Age 42	2.637	0.752	0	3	6566
LOC Age 30	2.708	0.62	0	3	6566
LOC Age 10 - Summary of responses 1 versus 0	8.117	2.947	0	16	6566
LOC Age 10 - Summary of responses -1, 0, 1	3.755	4.768	-12	16	6566
Female cohort member	0.513	0.5	0	1	6566
Birth weight < 2500 grams	0.053	0.224	0	1	6311
Exclusively breastfed first 7 days	0.119	0.324	0	1	6137
Diagnosed abnormalities at birth	0.074	0.262	0	1	6545
rutter score based on simple summing	9.15	5.24	0	33.231	5553
Copy test Age 5 (Std)	0	1	-2.576	1.536	5560
Drawing objects test Age 5 (Std)	0	1	-3.34	3.524	5520
Picture Vocabulary test Age 5 (Std)	0	1	-3.102	2.407	5521
mothers age at completion of education	15.81	1.709	7	31	6089
authoritarian child rearing	0.07	0.998	-3	2.807	5581
malaise score	4.071	3.435	0	23	5517
Mother is very interested in education child	0.414	0.493	0	1	15669
No father in HH (Birth)	0.031	0.174	0	1	6163
No father in HH (Age 5)	0.053	0.224	0	1	5581
Father: Professional	0.059	0.236	0	1	6140
Father: Managerial	0.129	0.335	0	1	6140
Father: Non-manual skilled	0.137	0.344	0	1	6140
Father: Skilled manual	0.438	0.496	0	1	6140
Father: Semi-skilled	0.129	0.335	0	1	6140
Father: Unskilled	0.045	0.208	0	1	6140
Father: Other	0.032	0.176	0	1	6140
Father is often away Saturdays	0.095	0.293	0	1	6123
Father is sometimes away Saturdays	0.153	0.36	0	1	6123
Father is never away Saturdays	0.591	0.492	0	1	6123
Cigarettes smoked:father	7.431	10.989	0	66	5440
Father: biological Age 10	0.814	0.389	0	1	6566
Father: none Age 10	0.115	0.319	0	1	6566
Father: adopted/foster Age 10	0.019	0.137	0	1	6566
Father: step/cohabitee Age 10	0.046	0.208	0	1	6566
Father: grandfather/other Age 10	0.007	0.083	0	1	6566
Father has no qualifications	0.315	0.465	0	1	6566
Father has other qualifications	0.555	0.497	0	1	6566
Father has a degree	0.13	0.336	0	1	6566
Father is very interested in education child	0.405	0.491	0	1	6088
Father is hostile	0.002	0.039	0	1	6566
Father English/Irish	0.843	0.364	0	1	6566
Father of European origin	0.012	0.108	0	1	6566
Father Indian Bangl Pakistani West Ind	0.023	0.151	0	1	6566
Father other ethnicity	0.003	0.056	0	1	6566

Table A.2: Distribution of parental interest in education of the child by parental social class (Number of observations)

	Not very interested	Very interested	Total
Panel A: Father			
Professional	123	289	412
Managerial	574	832	1406
Non-manual-skilled	232	249	481
Skilled manual	1596	692	2288
Semi-skilled	413	174	587
Unskilled	121	26	147
Incomplete Information	62	43	105
Missing data	285	69	354
Total	3406	2374	5780
Panel B: Mother			
Professional	5	32	37
Managerial	244	553	797
Non-manual-skilled	607	945	1552
Skilled manual	194	184	378
Semi-skilled	664	528	1192
Unskilled	224	125	349
Incomplete Information	37	24	61
Missing data	779	955	1734
Total	2754	3346	6100

Note: This table describes the number of observations in each parental social class bracket, separately for parents that are very interested in the education of the child according to the teacher's assessment, and parents that are not. Teacher assessments and the Father and Mother social class brackets are collected in 1980, when the cohort member was 10 years old.

Source: BCS70, Sweeps Birth, Age 10

Table A.3: Predictors of internal locus of control beliefs at age 10, by gender and socioeconomic status

	Pooled (1)	Female (2)	Male (3)	High SES (4)	Low SES (5)
Female cohort member	–0.162***	0.000	0.000	–0.141***	–0.194***
	(0.024)	(.)	(.)	(0.052)	(0.030)
Birth weight < 2500 grams	–0.101*	–0.124*	–0.076	–0.066	–0.032
	(0.053)	(0.069)	(0.082)	(0.121)	(0.065)
Exclusively breastfed first 7 days	0.028	0.052	–0.005	–0.049	0.081
	(0.037)	(0.047)	(0.059)	(0.071)	(0.049)
Diagnosed abnormalities at birth	–0.069	–0.272**	0.215	–0.295	0.037
	(0.101)	(0.131)	(0.161)	(0.220)	(0.130)
Behav. problems Age 5 (Std)	–0.054***	–0.062***	–0.044**	–0.012	–0.056***
	(0.014)	(0.019)	(0.021)	(0.033)	(0.017)
Copy test Age 5 (Std)	0.143***	0.142***	0.142***	0.101***	0.170***
	(0.014)	(0.019)	(0.021)	(0.030)	(0.018)
Drawing objects test Age 5 (Std)	0.069***	0.058***	0.082***	0.072**	0.071***
	(0.014)	(0.019)	(0.020)	(0.030)	(0.018)
Picture Vocabulary test Age 5 (Std)	0.068***	0.093***	0.045**	0.084***	0.051***
	(0.013)	(0.018)	(0.019)	(0.030)	(0.017)
Maternal age left education (Std)	0.077***	0.087***	0.063***	0.043*	0.094***
	(0.014)	(0.018)	(0.021)	(0.022)	(0.024)
Maternal views liberal parenting (Std)	0.087***	0.070***	0.110***	0.094***	0.084***
	(0.013)	(0.018)	(0.020)	(0.029)	(0.017)
Maternal mental health (Std)	0.007	0.017	–0.009	0.016	–0.003
	(0.014)	(0.019)	(0.021)	(0.033)	(0.017)
Mother is very interested in education child	0.123***	0.152***	0.093**	0.073	0.148***
	(0.031)	(0.041)	(0.046)	(0.076)	(0.039)
No father in HH (Birth)	–0.032	0.007	–0.091	0.000	0.000
	(0.077)	(0.099)	(0.125)	(.)	(.)
No father in HH (Age 5)	0.004	–0.086	0.084	0.251	–0.132
	(0.081)	(0.107)	(0.125)	(0.253)	(0.100)
Father: Skilled manual	–0.115***	–0.126***	–0.103**	0.000	–0.069
	(0.031)	(0.041)	(0.046)	(.)	(0.059)
Father: Semi-skilled	–0.011	–0.041	0.019	0.000	0.037
	(0.042)	(0.057)	(0.064)	(.)	(0.065)
Father: Unskilled	–0.060	–0.131	0.036	0.000	0.000
	(0.062)	(0.083)	(0.094)	(.)	(.)
Father: Other	–0.111	–0.095	–0.156	0.000	–0.060
	(0.070)	(0.089)	(0.114)	(.)	(0.088)
Father is often away Saturdays	–0.271	–0.042	–0.540	–0.430	–0.170
	(0.267)	(0.097)	(0.366)	(0.634)	(0.306)
Father is sometimes away Saturdays	–0.320	–0.070	–0.605*	–0.166	–0.294
	(0.267)	(0.092)	(0.367)	(0.631)	(0.306)
Father is never away Saturdays	–0.340	–0.128	–0.577	–0.290	–0.311
	(0.267)	(0.085)	(0.366)	(0.628)	(0.306)
cigarettes smoked:father	–0.003**	–0.003	–0.003	–0.007**	–0.002
	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)
Father: none Age 10	–0.017	0.072	–0.086	–0.021	0.063
	(0.041)	(0.058)	(0.058)	(0.093)	(0.054)
Father: adopted/foster Age 10	–0.161*	–0.267*	–0.068	0.790*	–0.333**
	(0.090)	(0.139)	(0.119)	(0.437)	(0.169)
Father: step/cohabitee Age 10	–0.112*	–0.012	–0.213**	–0.224	–0.079
	(0.060)	(0.085)	(0.086)	(0.183)	(0.078)
Father: grandfather/other Age 10	–0.071	–0.160	0.331	–0.010	–0.102
	(0.141)	(0.158)	(0.306)	(0.436)	(0.162)
Father has no qualifications	–0.065**	–0.031	–0.094**	–0.179**	–0.043
	(0.027)	(0.038)	(0.040)	(0.074)	(0.033)
Father has a degree	0.174***	0.229***	0.116**	0.013	0.373***
	(0.039)	(0.054)	(0.057)	(0.072)	(0.075)
Father is very interested in education child	0.182***	0.188***	0.176***	0.219***	0.167***
	(0.032)	(0.044)	(0.048)	(0.072)	(0.042)
Father is hostile	0.115	0.260	0.042	–0.142	0.561
	(0.297)	(0.460)	(0.402)	(0.623)	(0.431)
Father of European origin	0.080	–0.047	0.208	–0.436	0.184
	(0.107)	(0.146)	(0.161)	(0.394)	(0.121)
Father Indian Bangl Pakistani West Ind	–0.303***	–0.366***	–0.237**	–0.696**	–0.162
	(0.081)	(0.119)	(0.112)	(0.298)	(0.108)
Father other ethnicity	–0.271	0.151	–0.566**	–0.803	0.078
	(0.202)	(0.304)	(0.274)	(0.504)	(0.293)
Observations	6566	3369	3197	1204	3951

Note: This table presents the full results of Table 1. The benchmark model has been re-estimated for female and male cohort members (columns (2) and (3)) and by low and high socioeconomic status of the father measured at age 5 (columns (4) and (5)). Children's index is increasing in internal locus of control at Age 10, standardized to mean 0, standard deviation 1). All continuous measures (cognitive test scores, Rutter behavioural index, mother's age when left education) are standardized to mean 0 and standard deviation 1. Average locus of control score in sample is 8, and 1 standard deviation is 3 units on an index that ranges between 0 and 16.

* p < 0.1, ** p < 0.05, *** p < 0.01.

Source: BCS70, Sweeps Birth, Age 5, Age 10

Table A.4: Predictors of internal locus of control beliefs at age 42 (marginal probability effects on the probability of being strictly internal calculated from Ordered Logit Models)

	(1)	(2)	(3)	(4)	(5)
LOC Age 30 (Std)	0.105***	0.104***	0.103***	0.102***	
	(0.003)	(0.003)	(0.004)	(0.004)	
LOC Age 10 (Std)	0.043***	0.043***	0.038***	0.035***	
	(0.005)	(0.005)	(0.005)	(0.005)	
Female cohort member		0.040***	0.039***	0.040***	0.036***
		(0.010)	(0.010)	(0.010)	(0.011)
Birth weight < 2500 grams		–0.004	–0.001	–0.007	–0.004
		(0.021)	(0.021)	(0.021)	(0.023)
Exclusively breastfed first 7 days		0.002	–0.001	–0.005	0.007
		(0.016)	(0.016)	(0.016)	(0.017)
Diagnosed abnormalities at birth		–0.057	–0.058	–0.031	–0.014
		(0.036)	(0.037)	(0.041)	(0.044)
Behav. problems Age 5 (Std)		–0.011**	–0.007	–0.006	–0.014**
		(0.005)	(0.006)	(0.006)	(0.006)
Copy test Age 5 (Std)		0.009	0.006	0.006	0.020***
		(0.006)	(0.006)	(0.006)	(0.006)
Drawing objects test Age 5 (Std)		–0.006	–0.005	–0.005	–0.001
		(0.006)	(0.006)	(0.006)	(0.006)
Picture Vocabulary test Age 5 (Std)		0.001	–0.002	–0.004	0.004
		(0.005)	(0.005)	(0.005)	(0.006)
Maternal age left education (Std)			0.009	0.002	0.007
			(0.006)	(0.006)	(0.007)
Maternal views liberal parenting (Std)			0.002	0.004	0.007
			(0.005)	(0.005)	(0.006)
Maternal mental health (Std)			–0.008	–0.006	–0.013**
			(0.006)	(0.006)	(0.006)
Mother is very interested in education child			0.030***	0.005	0.014
			(0.010)	(0.012)	(0.013)
No father in HH (Birth)				0.045	0.037
				(0.028)	(0.031)
Father: none Age 10				–0.020	–0.024
				(0.016)	(0.017)
Father: adopted/foster Age 10				–0.095***	–0.118***
				(0.033)	(0.036)
Father: step/cohabitee Age 10				–0.065***	–0.067***
				(0.020)	(0.022)
Father: grandfather/other Age 10				–0.098*	–0.066
				(0.053)	(0.059)
Father has no qualifications				–0.014	–0.026**
				(0.011)	(0.012)
Father has a degree				0.037**	0.041**
				(0.018)	(0.019)
Father is very interested in education child				0.036***	0.064***
				(0.013)	(0.015)
Father is hostile				–0.127	–0.166*
				(0.100)	(0.100)
Father of European origin				–0.084**	–0.101**
				(0.038)	(0.042)
Father Indian Bangl Pakistani West Ind				0.060*	0.019
				(0.034)	(0.036)
Father other ethnicity				–0.037	–0.004
				(0.086)	(0.097)
Observations	6566	6566	6566	6566	6566

Note: Marginal effects of the probability of being strictly internal at Age 42 are calculated on the basis of ordered logit coefficients. All continuous measures (cognitive test scores, Rutter behavioural index, mother's age when left education) are standardized to mean 0 and standard deviation 1.

* p < 0.1, ** p < 0.05, *** p < 0.01.

Source: BCS70, Sweeps Birth, Age 5, Age 10, Age 30, and Age 42

Table A.5: Predictors of internal locus of control beliefs at age 42, by gender and socioeconomic status (marginal probability effects on the probability of being strictly internal calculated from Ordered Logit Models)

	Pooled (1)	Female (2)	Male (3)	High SES (4)	Low SES (5)
LOC Age 30 (Std)	0.102***	0.092***	0.111***	0.103***	0.103***
	(0.004)	(0.005)	(0.005)	(0.008)	(0.004)
LOC Age 10 (Std)	0.035***	0.030***	0.042***	0.059***	0.027***
	(0.005)	(0.007)	(0.007)	(0.011)	(0.007)
Female cohort member	0.040***	0.000	0.000	0.101***	0.029**
	(0.010)	(.)	(.)	(0.020)	(0.012)
Birth weight <2500 grams	–0.007	0.002	0.004	–0.048	0.017
	(0.021)	(0.027)	(0.033)	(0.045)	(0.027)
Exclusively breastfed first 7 days	–0.005	–0.028	0.032	–0.033	0.029
	(0.016)	(0.019)	(0.026)	(0.027)	(0.022)
Diagnosed abnormalities at birth	–0.031	0.009	–0.091	1.839	–0.052
	(0.041)	(0.058)	(0.058)	(121.561)	(0.053)
Behav. problems Age 5 (Std)	–0.006	–0.002	–0.014*	–0.009	–0.011
	(0.006)	(0.007)	(0.008)	(0.013)	(0.007)
Copy test Age 5 (Std)	0.006	–0.003	0.017*	0.011	0.003
	(0.006)	(0.008)	(0.009)	(0.012)	(0.008)
Drawing objects test Age 5 (Std)	–0.005	–0.008	–0.005	–0.030***	0.004
	(0.006)	(0.008)	(0.008)	(0.012)	(0.007)
Picture Vocabulary test Age 5 (Std)	–0.004	–0.002	–0.004	–0.031**	0.002
	(0.005)	(0.008)	(0.008)	(0.013)	(0.007)
Maternal age left education (Std)	0.002	–0.007	0.006	0.009	0.007
	(0.006)	(0.008)	(0.009)	(0.010)	(0.011)
Maternal views liberal parenting (Std)	0.004	0.011	–0.004	–0.016	0.004
	(0.005)	(0.007)	(0.008)	(0.012)	(0.007)
Maternal mental health (Std)	–0.006	–0.013*	0.002	0.007	–0.005
	(0.006)	(0.008)	(0.008)	(0.013)	(0.007)
Mother is very interested in education child	0.005	–0.001	0.016	0.020	0.020
	(0.012)	(0.016)	(0.018)	(0.029)	(0.016)
No father in HH (Birth)	0.045	0.031	0.072	0.000	0.000
	(0.028)	(0.035)	(0.046)	(.)	(.)
Father: none Age 10	–0.020	0.023	–0.059***	–0.013	0.004
	(0.016)	(0.022)	(0.022)	(0.035)	(0.021)
Father: adopted/foster Age 10	–0.095***	–0.092*	–0.104**	1.821	–0.122**
	(0.033)	(0.047)	(0.047)	(264.388)	(0.060)
Father: step/cohabitee Age 10	–0.065***	–0.087***	–0.042	–0.051	–0.073***
	(0.020)	(0.027)	(0.030)	(0.057)	(0.027)
Father: grandfather/other Age 10	–0.098*	–0.103*	–0.083	–0.041	–0.133**
	(0.053)	(0.057)	(0.116)	(0.151)	(0.060)
Father has no qualifications	–0.014	–0.008	–0.020	–0.035	–0.013
	(0.011)	(0.015)	(0.016)	(0.026)	(0.013)
Father has a degree	0.037**	0.085***	–0.001	0.046*	0.082**
	(0.018)	(0.026)	(0.025)	(0.027)	(0.040)
Father is very interested in education child	0.036***	0.056***	0.013	–0.004	0.050***
	(0.013)	(0.018)	(0.020)	(0.029)	(0.019)
Father is hostile	–0.127	–0.295**	0.117	1.850	–0.198
	(0.100)	(0.119)	(0.158)	(382.727)	(0.159)
Father of European origin	–0.084**	–0.081*	–0.055	1.799	–0.080*
	(0.038)	(0.047)	(0.063)	(222.207)	(0.044)
Father Indian Bangl Pakistani West Ind	0.060*	0.073	0.050	0.133	0.040
	(0.034)	(0.048)	(0.049)	(0.151)	(0.045)
Father other ethnicity	–0.037	–0.140	0.109	1.825	–0.053
	(0.086)	(0.099)	(0.166)	(306.305)	(0.124)
Observations	6566	3369	3197	1204	3951

Note: The results reported in this table are based on the benchmark specification, column (5) reported in Table 2. The benchmark model is re-estimated for female and male cohort members (columns (2) and (3)) and by low and high socioeconomic status of the father measured at age 5 (columns (4) and (5)). Marginal effects of the probability of being strictly internal at Age 42 are calculated on the basis of Ordered Logit coefficients. All continuous measures (cognitive test scores, Rutter behavioural index, mother's age when left education) are standardized to mean 0 and standard deviation 1.

* p < 0.1, ** p < 0.05, *** p < 0.01.

Source: BCS70, Sweeps Birth, Age 5, Age 10, Age 30, and Age 42