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The Impact of Maternal Beliefs on Child Skills Development from Early Ages to Adolescence

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The Impact of Maternal Beliefs on Child Skills Development From Early Ages To Adolescence*

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Abstract

Parental beliefs about the returns to investment play a key role in shaping how parents invest in their children, yet their long-term impact on child development is understudied. Using a value-added model in a nationally representative cohort study, we find that maternal beliefs about returns to investment, as measured by locus of control, positively influence children's socio-emotional skills from early childhood to adolescence. These beliefs have a negligible impact on cognitive skills and academic outcomes. Parental investment emerges as a key channel in this relationship, suggesting that maternal beliefs primarily shape children's non-cognitive development through differences in how parents engage with their children. We find that intergenerational inequality in child development is partly driven by the socio-economic gradient in maternal beliefs about the returns to investment.

JEL classifications: D10, D91, I24, J13, J24
Keywords: Parental Beliefs, Child Development, Locus of Control, Inequality

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1 Introduction

Research increasingly shows that early-life disadvantages can have long-lasting negative effects on life outcomes (García and Heckman, 2023; García et al., 2020). One consistently identified driver of these outcomes is parental pecuniary resources: parents with greater resources tend to invest more in their children, leading to higher human capital accumulation (Attanasio et al., 2020c, 2022; Carneiro et al., 2013). However, even among parents with similar resources, there is substantial variation in how much they invest in their children. This variation has prompted increasing interest in understanding the non-monetary factors that influence parental behavior (Cunha et al., 2010). One key factor is parental beliefs and specifically, beliefs about the returns to investing in children's development. Parents base their investment decisions on their expected perception of the returns to different types of investment. Several studies have demonstrated that these beliefs play a critical role in shaping parental investments (e.g., Attanasio et al., 2019; Bhalotra et al., 2024; Cunha et al., 2013, 2022). Yet, while experimental evidence shows that parenting programs can improve early childhood outcomes by shaping parental beliefs (Carneiro et al., 2024; List et al., 2021), evidence on how these beliefs affect children's outcomes as they grow older remains limited – largely due to a lack of longitudinal data linking parental beliefs to later child development. Indeed, the timing of parental inputs is critical in determining skills accumulation (Carneiro et al., 2021; Caucutt and Lochner, 2020; Cunha et al., 2010; Eshaghnia et al., 2024; Heckman and Mosso, 2014). In this paper, we examine the impact of maternal beliefs about returns to investment on children's socio-emotional and cognitive skills across several key developmental stages.

In the standard economic models of parental investments in child human capital developed by Becker and Tomes (1979, 1986), variation in parental investments is attributed to differences in parents' resources and preferences under perfect certainty. More recent frameworks incorporate imperfect information and highlight the role of beliefs in human capital accumulation (Delavande and Zafar, 2019; Delavande et al., 2022; Giustinelli, 2023) and more specifically, how parents perceive the returns to parental investments, in explaining variation in parental behavior and the intergenerational transmission of inequality (Cunha, 2014). These beliefs can be modeled as parents' perception of usefulness or productivity of their investments (Cunha et al., 2022; Hunt, 1961; Vygotsky and Cole, 1978). If parents believe that their investment matters for their children's skill development, then they invest more (Attanasio et al., 2019; Bhalotra et al., 2024; Cunha et al., 2013; Cunha, 2014; Cunha et al., 2022; Lekfuangfu et al., 2018). In this paper we model beliefs as perceptions of parents' own productivity, which reflects whether parents see their own efforts as effective in shaping child outcomes.

Our measure of maternal belief is Locus of Control (LoC), which reflects an individual's belief in their ability to influence the outcomes of events in their life (Rotter, 1966). Psychologists classify

individuals as having either an internal or external LoC. Individuals with an internal LoC believe that their actions significantly shape life outcomes, whereas individuals with an external LoC attribute outcomes primarily to external factors such as luck or fate. In this paper, we define higher internal LoC as high LoC. We develop a conceptual framework where parental investment is an important mechanism through which maternal LoC affects child development. This is supported by our empirical evidence showing that mothers with high LoC invest more in their children, leading to greater skill accumulation, and by previous findings showing that maternal LoC predicts parental investments during early childhood (Lekfuangfu et al., 2018). Mothers with a high LoC expect greater returns to their efforts, believing that their actions directly shape their children's development. As a result, they invest more intensively in their children's development than mothers with a low LoC.

LoC is established during early childhood and is shaped by early-life circumstances (Elkins and Schurer, 2020). Once established, LoC remains stable in adulthood (Elkins et al., 2017). Cobb-Clark and Schurer (2013) show that significant life events, such as changes in family structure, health, or employment, do not alter LoC in working-age individuals. The economic literature highlights the importance of LoC in shaping various investment decisions. A higher LoC has been linked to greater investment in one's human capital and job search (Caliendo et al., 2015, 2022; Coleman and DeLeire, 2003; Barón and Cobb-Clark, 2010; Hadsell, 2010; McGee, 2015).[1]

We use data from the Millennium Cohort Study (MCS), a nationally representative longitudinal dataset from the UK. The MCS offers two key advantages that make it particularly well-suited to our research question. First, its longitudinal design allows us to track children from infancy (9 months old) to adolescence (up to age 17), providing a unique opportunity to examine how maternal beliefs influence children's developmental trajectories and long-term skill accumulation. Second, the dataset is exceptionally rich, containing detailed information on parental beliefs, a crucial yet often-missing component in survey data. Our measure of maternal LoC is assessed in the first wave of the study, when the child is 9 months old, and the mothers in our sample are between 19 and 45 years old. The MCS also includes comprehensive measures of parental investments and various child outcomes, enabling us to rigorously investigate the potential pathways through which maternal beliefs shape different aspects of child development across various stages of childhood.

Estimating the impact of maternal LoC on children's skills is challenging because of the lack of data on all the inputs that are relevant for the production of skills. Without data on these inputs such as latent child ability, we run into the problem of omitted variable bias (Todd and Wolpin, 2003). Our approach is to use the panel structure of the data to implement a value-added (VA) model, where

[1]Other dimensions positively influenced by LoC are: health and well-being (Cobb-Clark et al., 2014; Clark and Zhu, 2024), technology adoption (Abay et al., 2017), savings and insurance choices (Cobb-Clark et al., 2016; Salamanca et al., 2020; Bonsang and Costa-Font, 2022), migration (Caliendo et al., 2019), prosocial behavior (Andor et al., 2022), and resilience to adverse events (Schurer, 2017; Buddelmeyer and Powdthavee, 2016).

unobserved inputs and underlying ability are accounted for by including children's lagged measure of skills as a proxy for unobserved characteristics (Todd and Wolpin, 2003, 2007; Fiorini and Keane, 2014; Keane et al., 2022; Nicoletti et al., 2024). By controlling for past skills, the VA model also accounts for the cumulative process of skill formation (Cunha and Heckman, 2008; Cunha et al., 2010). As a result, our estimates isolate the effect of maternal LoC on children's skill development by separating it from the influence of previously acquired skills and past inputs, such as parental investments. This allows us to clearly measure the contemporaneous impact of maternal beliefs on children's outcomes at different stages of their growth.

Our analysis reveals that maternal LoC positively influences children's socio-emotional skills and behavioral outcomes particularly during the pre-adolescent stage, while having a more limited impact on cognitive skills and test scores. A one standard deviation increase in maternal LoC improves the child's internalizing skills (which relate to managing symptoms such as anxiety and depression) by 4.1 to 8.2 percent of a standard deviation between ages 5 and 14. These effects are notable: the impact at age 5 is equivalent to about 20 percent of the difference observed in internalizing skills of children of mothers with and without a university degree. Another way to quantify the effect is to consider that the impact of maternal LoC is equivalent to about a quarter of the impact of the lagged skill on actual skill development. The positive impact of maternal LoC is found also in terms of a decrease in externalizing skills (which relate to aggressive behavior), an improvement in pro-social skills and school attendance.

The finding that parental beliefs influence socio-emotional skills but not cognitive skills is consistent with what we know about the nature of skill development, the relative importance of different skills, and the effectiveness of parenting practices. Parental inputs could be more relevant in shaping socio-emotional than cognitive skills as behavior is more malleable than cognition (Carneiro et al., 2003, 2013). Cognitive skills are highly adaptable in early childhood, particularly before the age of three, whereas non-cognitive skills remain flexible over a longer period, including adolescence and even adulthood (Almlund et al., 2011; Cunha et al., 2010, 2006; Hoeschler et al., 2018; Fagan et al., 2007). This distinction is crucial, as interventions targeting non-cognitive skills, such as the Perry Preschool program and Abecedarian, have been found to be the most cost-effective in fostering long-term success (Heckman et al., 2013; Conti et al., 2016). Strengthening socio-emotional skills not only enhances academic performance but also contributes significantly to socio-emotional development, whereas improvements in cognitive skills primarily impact academic outcomes without a comparable influence on the socio-emotional sphere (Cunha et al., 2010). Parenting practices have a more pronounced impact on socio-emotional skills than on cognitive skills, as these abilities are cultivated through observation and interaction rather than explicit instruction (Bernal and Keane, 2011; Del Bono et al., 2016; Doepke and Zilibotti, 2019). At later developmental stages, interactions

with peers and other social influences become increasingly relevant in shaping non-cognitive skills (Del Boca et al., 2017).

We test the robustness of our findings through multiple approaches. First, we challenge the VA model's assumption of constant depreciation of past inputs and skills by testing specifications that include additional past outcomes and contemporaneous characteristics, with consistent findings that support the model's stability (Todd and Wolpin, 2003, 2007). To further test the robustness to possible omitted variable bias, we follow Cattan et al. (2023a) and compare estimates of maternal LoC across VA models with and without a rich set of household controls. In another model we include a possible confounder, maternal cognitive skills (Caliendo et al., 2015). Findings are unaffected across all these specifications. Second, we address potential biases from measurement of children's skills and maternal LoC. As children's socio-emotional skills are reported by mothers, mothers with high LoC might assess their children's skills systematically differently from mothers with low LoC (Del Bono et al., 2024). Following Attanasio et al. (2020b), Heckman et al. (2022), and Heckman et al. (2013) we adjust for the influence of maternal LoC on reported children's skills. In another specification, we instead address potential measurement issues in maternal LoC by using different ways of aggregating the scores in the LoC questionnaire (Anderson, 2008; Caliendo et al., 2022). Findings remain robust across all these checks. Finally, to examine the absolute impact of maternal LoC and address potential attenuation bias in the VA model (McKinnish, 2008), we regress maternal LoC directly on socio-emotional skills, excluding the lagged outcome as a control. Using the bounding method proposed in Oster (2019), we find no evidence of significant endogeneity concerns in this model. By comparing the impact of LoC in the VA and in the non-VA model, we can conclude that maternal LoC has a meaningful positive impact on child development at different stages of children's development which goes beyond past inputs, including parental investments, and skills self-reinforcement over time.

We show that an important mechanism trough which maternal LoC affects child development is parental investments. We find empirical evidence supporting our conceptual framework where mothers with high LoC invest more in their children, leading to greater skill accumulation. First, we show that maternal LoC positively correlates with key early parental investments such as attending antenatal classes and breastfeeding duration. Furthermore, a one standard deviation increase in maternal LoC statistically significantly increases maternal beliefs about the relevance of stimulating the child for early child development by 5.6 percent of a standard deviation. Next, by employing the VA model, we examine the impact of maternal LoC on parental investments at different stages of children's development. We find that the impact of LoC on overall parental investment is statically significant and varies by age, ranging from 4.4 to 6.5 percent of a standard deviation for a one standard deviation increase in maternal LoC. Furthermore our findings reveal that mothers with high LoC not only invest more in their children compared to mothers with low LoC, but they also vary the type

of parental investment at different stages of children's development. At ages 3 and 11, maternal LoC influences educational investments, while at age 7, it affects recreational activities. The stronger impact on educational investments at age 11 aligns with this period marking a key academic transition from primary to secondary school. During this stage, children typically require greater parental support, as reflected in our measures such as helping with homework and attending parent-teacher meetings. The diversification of type of parental investment aligns with prior research showing that parents focus on foundational educational activities during early childhood but later shift towards recreational engagement and monitoring academic and social networks (Kalil et al., 2012). Overall, our findings provide evidence that maternal LoC influences children's skill development through contemporaneous parental investments, with the nature of these investments varying by the child's age. This underscores the importance of studying the impact of parental beliefs across different developmental stages to better understand the underlying mechanisms and how they interact with children's changing developmental needs.

We document that socio-economic differences in maternal LoC play a significant role in explaining socio-economic disparities in children's socio-emotional skills. We show that mothers from high socio-economic status (SES) generally have higher LoC compared to those from low SES. For example, even after controlling for various other factors, the difference in LoC between mothers with a university degree and those with qualifications below secondary school level amounts to approximately 54 percent of a standard deviation. These differences in maternal LoC align with existing evidence on perceived returns to investments being 23 to 34 percent lower among less-educated parents compared to their more-educated counterparts (Boneva and Rauh, 2018; Conti et al., 2022; List et al., 2021). Using a Kitagawa-Oaxaca-Blinder decomposition, we quantify the extent to which SES-based differences in maternal LoC contribute to disparities in children's socio-emotional skills (Blinder, 1973; Kitagawa, 1955; Oaxaca, 1973). We find that maternal LoC explains a meaningful portion of the SES gap in children's socio-emotional outcomes between the ages of 5 and 14. Specifically, SES differences in maternal LoC account for 14-18 percent of the explained SES gap in internalizing skills, 4-9 percent of the gap in externalizing skills, and 28-38 percent of the gap in prosocial skills.

This study makes three contributions to the growing literature studying the role of parental beliefs on children's skills accumulation. First, our study is the first to empirically demonstrate the impact of beliefs about returns to investments on children's development at different stages, from early childhood to late teenage years. Prior research focuses on how parental beliefs about the returns on investments influence their contemporaneous investment decisions. In the early childhood, studies focus on beliefs about returns to breastfeeding and playtime (Bhalotra et al., 2024), as well as to several other types of parental time investments (Carneiro et al., 2024; Conti et al.,

2022; Cunha et al., 2013, 2022; Lekfuangfu et al., 2018). During the schooling period, research focuses on beliefs about returns to health investments (Biroli et al., 2022) and human capital investments (Attanasio et al., 2019; Boneva and Rauh, 2018). The conclusion from this literature is that parents who believe that there are high returns to their investment invest more in their children. All of these papers focus on the correlation between parental beliefs and contemporaneously measured parental investments at a point in time, mainly when children are young, leaving some questions about whether these beliefs matter differently for parental investments and child development outcomes in children's different development phases, particularly as children grow older. This is due to lack of longitudinal data, as these studies often rely on data from interventions or *ad hoc* surveys.[2] The only exception to the existing studies is Carneiro et al. (2024) who provide the longest follow-up on how parental beliefs interact with parental investments and child development, evaluating a nationwide parenting intervention on children aged 0-6. They find that shaping beliefs about returns to investment improves the parental investment levels and children's socio-emotional and verbal skills. Complementing and extending their results, we show that parental beliefs influence child development from early childhood through adolescence by shaping how much time and what types of investments parents make. Our study adds to recent evidence that focuses on the relevant impact of parental pecuniary resources at later stages of child development (Carneiro et al., 2021; Eshaghnia et al., 2024) and prompts for further investigation on the importance of other types of parental inputs for child outcomes at different stages of child development.

Our second contribution is about generalizability of our results, as we study the importance of maternal beliefs using a nationally representative survey data – often other papers use data from a subgroup of population (e.g., Lekfuangfu et al., 2018) which makes it harder to generalize the results. This allows us to perform some relevant analysis by socio-economic groups. We advance the literature by going beyond documenting socio-economic differences in parental beliefs (e.g., Boneva and Rauh, 2018; Conti et al., 2022), as we show that these socio-economic differences in maternal beliefs mirror the socio-economic differences in children's development of socio-emotional skills. These findings highlight that socio-economic variation in maternal beliefs contributes to the persistence of socio-economic inequality across generations, emphasizing the need for parenting interventions to support social mobility in the long-run.

Finally, our study has important methodological improvement for policymakers. There is an ever increasing number of papers focusing on how to measure beliefs and their impacts on individuals' behavior, including their investment in children (Attanasio et al., 2019; Bhalotra et al., 2024; Biroli

[2]Longitudinal data collection is costly and requires tracking individuals over time, increasing the risk of attrition. While cohort or panel studies follow individuals longer, the often focus on entire households rather than children specifically, with few exceptions, such as the dataset we use. Moreover, many datasets come from specific subpopulations, making small or non-representative samples less useful for informing broader policy.

et al., 2022; Boneva et al., 2021; Boneva and Rauh, 2018; Carneiro et al., 2024; Cunha et al., 2013, 2022; Delavande et al., 2024, 2022; Delavande and Zafar, 2019; Lekfuangfu et al., 2018). With the exception of Lekfuangfu et al. (2018), all of these papers elicit beliefs in a context-specific way, as they use *ad hoc* surveys or interventions where researchers have the possibility to design their own survey instruments. However, this is not always possible, especially for policy makers who might need to understand the impacts of a policy without running additional surveys due to the constraints that they might be facing. In these cases, they would need to use surveys that are already available which might lack more-specific survey instruments to measure beliefs in specific contexts. Our study shows that a generalized belief, such as LoC, can also impact maternal investments in children and it can be a low-cost survey information to be used by researchers and policy-makers to understand the potential impacts of new policies or targeted interventions.

The structure of the paper is as follows. In Section 2 we describe the data, in Section 3 we present our empirical method. Section 4 discusses our empirical results and Section 5 presents the robustness analysis. Section 6 presents the findings on the mechanism, and Section 7 the findings on the decomposition analysis by socio-economic status. Finally, Section 8 concludes.

2 Data

We use data from the Millennium Cohort Study (MCS), a British cohort study that tracks the lives of more than 10,000 young people born across the UK in 2000/1. The MCS gathers information on children and their family approximately every other year, starting when the child is 9 months old and ending when they turn 17. By doing so, it covers all critical developmental stages. The dataset provides a wealth of information on cohort members' socio-emotional, cognitive, and behavioral development, as well as comprehensive data on economic circumstances, parenting, relationships, and family life. The extensive data on skills development makes MCS a perfect dataset to investigate the impact of maternal LoC on child development and the underlying mechanisms by which maternal LoC impacts child development.

In order to maintain a consisted sample across the several pieces of analyses performed in the paper, we implement several sample adjustments. First, we consider those cohort members and their families who reside in England during the initial wave of the MCS.[3] This is due to the fact that developmental children's stages and their perception by parents, might be influenced by the system of education. By considering those families residing in England, we study children facing the same system of education. This further allows us to investigate some additional outcomes to children's socio-emotional and cognitive skills, such as children's educational outcomes, which are

[3]The findings that we present in this paper are unaltered by whether we consider England only or the entire UK sample.

available for students in England through the link of the MCS with National Pupil Database. We then restrict our sample to be formed of singleton and we only include cases where the biological mother is the primary respondent, which accounts for 99 percent of the total sample. To account for potential confounding factors such as teen birth and late-stage motherhood, we further narrow our sample to include only those cases where the mother was aged 18-45 at the time of giving birth.

To examine the effect of maternal LoC on children's development, we focus on children whose mothers have a measure of LoC in the data, resulting in a loss of 339 observations or approximately 4 percent of the sample which is ultimately composed of about 8,000 cohort members. In Appendix Table B1, we present the mean and standard deviation of maternal characteristics, which serve as primary controls in the analysis (see Appendix Table C1 for the full list of controls), measured when the cohort member is 9 months old, separated by the subsample for which we have and do not have maternal LoC. The subsample for which maternal LoC is known is positively selected in terms of socio-economic characteristics.[4] However, we do not observe any differences in the characteristics of the cohort members, such as gender, except that children of mothers with known LoC are, on average, less likely to be born pre-term and weigh around 242 grams more at birth than their counterparts. They are also more likely to have started childcare at 9 months of age.

We retain all cohort members observed from the first wave to the one in which the outcome is measured, creating an unbalanced panel. To account for attrition and maintain the representativeness of the sample, we use the overall weight provided in the longitudinal file in our analysis. This weight considers both sampling and attrition in the seventh wave for the core sample in England who participated since the first wave.[5]

2.1 Main Variables

2.1.1 Maternal Locus of Control

LoC reflects an individual's beliefs about the degree of control they have over outcomes in their life (Rotter, 1966). It captures the extent to which individuals believe that their investment and behavior will have an effect; in other words, it represents a general measure of beliefs about the effectiveness of effort or returns to investment. It has been amply shown that individuals with a high LoC perceive their actions as strongly influencing outcomes and thus behave accordingly (see Caliendo et al., 2022, and the literature cited therein).[6]

[4]Mothers with known LoC are more likely to work in higher occupations, are slightly older, have higher education levels, and are less likely to be from an ethnic minority background. Additionally, in analysis not shown, we find that mothers with known LoC are more likely to be UK-born and to have conducted the interview in English.

[5]Results remain unchanged when replicating the analysis with wave-specific weights.

[6]Further, Caliendo et al. (2024) trough a lab experiment show that LoC is linked to a preference for agency, especially in women.

LoC has been shown to be formed during early developmental years and to remain stable throughout adulthood (Elkins et al., 2017; Elkins and Schurer, 2020; Sherman, 1984; Zumbuehl et al., 2021). For working age individuals several life events, whether positive or negative, such as alterations in health status, employment, or familial circumstances, have no significant bearing on an individual's LoC (Cobb-Clark and Schurer, 2013). In our sample, mothers' LoC is assessed when they are adults (aged 18-45) and their children, the cohort members, are 9 months old. Hence, their LoC should be stable and is assessed post-childbirth for all women.

Maternal LoC is derived from three questions about their ability to control events and is asked when the child is 9 months old. These are reported in Table 1, which demonstrates that while most mothers believe they can control outcomes, there is enough variation to investigate the impact of maternal LoC on child development. We re-code the answers so that a high degree of LoC is assigned a value of 2, "can't say" is assigned a value of 1, and a low degree of LoC is assigned a value of 0. To create a one-dimensional measure of maternal LoC, we compute the average value of the answers given to the three questions.

Table 1: Variables Used to Derive Maternal Locus of Control

	(1)
Category: Want	
I never really seem to get what I want	0.112
	(0.315)
I usually get what I want out of life	0.734
	(0.442)
Can't say	0.154
	(0.361)
Category: Run My Life	
Usually I can run my life more or less as I want to	0.840
	(0.367)
I usually find life s problems just too much for me	0.064
	(0.245)
Can't say	0.096
	(0.294)
Category: Control	
I usually have a free choice and control over my life	0.773
	(0.419)
Whatever I do has no real effect on what happens to me	0.100
	(0.300)
Can't say	0.126
	(0.332)
Observations	7,932

Notes: Means (and standard deviations) of each possible answer across the three questions of the Locus of Control (LoC) section titled "Want", "Run", and "Control". These questions have been asked in wave 1, when the cohort member was 9 months old, and are used to create the maternal LoC variable.

2.1.2 Outcomes: Children's Skills

We consider several dimensions of child development. Each of them is described below. All continuous outcomes are standardized within each wave to have the mean equal to zero and standard deviation equal to one.

Socio-Emotional Skills

We measure socio-emotional skills using the Strengths and Difficulties Questionnaire or SDQ (Goodman, 1997), which is a parental report on five domains of a child's emotional-behavioral development. We only consider responses from biological mothers. Given that mothers report the socio-emotional skills of their children, we take some steps to minimize two main issues. First, to limit classical measurement error in measurement of skills, we follow the literature (Achenbach, 1966; Attanasio et al., 2020a; Dickey and Blumberg, 2004; Weir and Duveen, 1981) and estimate three latent factor models to obtain three different dimensions of socio-emotional skills: externalizing skills (composed of the conduct and peer sub-domains), internalizing skills (composed of the hyperactivity and the emotional sub-domains), and prosocial skills. The externalizing skills category includes disruptive, hyperactive, and aggressive behavior, while the internalizing skills category includes anxiety, depression, and somatic symptoms. Prosocial skills refers to actions that benefit others or society, such as helping, sharing, and cooperating. To interpret all three skills dimensions in the same way, we reverse code the score of internalizing and externalizing skills so that a higher score represents fewer problems or better socio-emotional adjustment.

For the internalizing and externalizing dimensions we have ten items and for the prosocial dimensions we have five items from which we can nonparametrically identify the distribution of the latent variables. The latent factor model that we estimate is the following:

$$s_{ika} = \alpha_k + \lambda_k \psi_{ia} + \epsilon_{ika}, \tag{1}$$

where k represents a sub-domain of socio-emotional skills, α_k is the intercept, λ_k are the factor loadings, and ϵ_{ika} is the measurement error. From this linear factor model we can predict a factor score s_{ia} which represents the error-free latent factor ψ_{ia} for each child. In the measurement models we set one factor loading to 1 and the mean of the latent factor to 0 to achieve location and scale normalization (Carneiro et al., 2003).

Cognitive Skills

The cognitive skills of participants in the MCS study are assessed using a variety of age-appropriate measures from ages 3 to 17 through well established tests administered by the surveys' interviewers, providing a wide range of data. For example, different British Ability Scales are employed at ages 5, 7, and 11. Appendix Table C2 lists the specific measures used at each age. To create age-

specific cognitive indexes that account for all available measures, we utilize the method introduced by Anderson (2008).[7] This index groups the selected cognitive variables using an inverse covariance weighting scheme, which adjusts for highly correlated outcomes and ensures that measures across different scales can be compared in a consistent manner. In the analysis we further use alternative methods to group cognitive measures to test the robustness of our findings.

2.1.3 Other Outcomes: Education Outcomes

We have access to a wealth of information about students' academic progress through the English administrative data on education. We consider students' performances in English and Mathematics courses and unauthorized absences.

Maths and English Grades

In the English system of education, different stages are labeled Key Stages (KS) and at the end of these there are standardized national tests to examine students' knowledge. These tests are anonimized and externally graded. Here, we focus on the national standardized exams in English and Mathematics taken at age 7, 11, and 16.[8] Grades at different KSs are coded as a standardized continuous variable. In addition, we also create a dummy variable for "Good Score" as defined by the Department for Education's guidelines.[9]

School Attendance

School attendance is a relevant predictor of success in education and in the labour market (Cattan et al., 2023b). We measure whether children have low school attendance by the total number of unauthorized absences in each academic year. Unauthorized absences are instances of unexplained or unjustified absences from school, such as arriving late after the register has closed. We are particularly interested in unauthorized absences as authorized absences might relate to health problems or other significant events that might happen in children's lives which are unlikely to relate to their behavior or that of their parents. Information on unauthorized absences provides insight into a behavioral dimension (Gubbels et al., 2019) which is not reported by parents, at the contrary of the socio-emotional skills which are derived from the SDQ. Unauthorized absences are recorded yearly across primary and secondary schooling (between ages 7 and 16) and are coded as a continuous variable.

[7] This index has been employed to measure skills in other economics studies, such as Baranov et al. (2020) and Delavande et al. (2024).

[8] These correspond to key stages (KS) 1, 2, and 4. More specifically, these exams are the Standardized Assessment Tests (SATs) in KS1 and KS2, which correspond to the beginning and the end of primary school, respectively, and the General Certificate of Secondary Education (GCSE) in KS4, at secondary school. The grades obtained at age 11 are used for enrollment into selective schooling, and thus carry a influential effect on children's academic life. The grades obtained at 16, when mandatory formal education ends, are particularly important because they are used to predict A-Level grades which are required for university admissions. Some employers also require these exam grades when hiring.

[9] Achieved level 3 or above in SATs at KS1, achieved level 5 or above in SATs at KS2, and obtained A*-C GCSE at KS4.

3 Empirical Framework

Assume there are two dimensions of skills θ^k: $k \in C, NC$ where C stands for cognitive and NC for non-cognitive or socio-emotional skills. For each individual i, the production function of skill k at age a depends on: household's characteristics $\boldsymbol{H_i(a)}$, time-invariant innate ability of child μ_i and age-specific shocks η_{ia}.

$$\theta^k_{i,a+1} = F^k_a(\boldsymbol{H_i(a)}, \mu_i, \eta_{ia}) \tag{2}$$

where $\boldsymbol{H_i(a)} = (\boldsymbol{h_{i1}}, ..., \boldsymbol{h_{ia}})$ is a vector of the history of observed and unobserved household inputs. If we assume a linear production function, we can write the following two equations for $a = 1, 2$ (the k subscript is omitted for simplicity):

$$\theta_{i1} = \boldsymbol{h'_{i,1}}\beta^1_1 + \rho_1\mu_i + \eta_{i1} \tag{3}$$

$$\theta_{i2} = \boldsymbol{h'_{i,2}}\beta^1_2 + \boldsymbol{h'_{i,2}}\beta^2_2 + \rho_2\mu_i + \eta_{i2} \tag{4}$$

In such a setting, the main issue for identifying the impact of a particular household input on skills is endogeneity due to omitted variables: we do not observe the child's initial endowments or innate ability (μ_i), nor the entire history of parental and other inputs which determine skills ($\boldsymbol{H_i(a)}$), such as all parental relevant characteristics and time investment, school and neighborhood characteristics. Thus, there might be some variables not included in the model which are correlated with both the household characteristics and children's skills and not accounting for these characteristics could bias the estimated impact of the household input of interest on skills.

Value-added (VA) models have been proven to limit the issue of endogeneity due to omitted variables: by conditioning on the lagged skills, latent ability and lagged inputs are controlled for as long as the effect of lagged skills, observed, and unobserved inputs depreciate at the same rate over time (Todd and Wolpin, 2003, 2007). More specifically, the assumptions needed for estimating a VA model are the following: (i) the effect of both observable and unobservable lagged inputs depreciates at rate γ so that $\beta^1_2 = \gamma\beta^1_1$ (ii) the effect of lagged skills also depreciate at the same γ rate, so that $\rho_2 = \gamma\rho_1$, and (iii) η_{ia} is serially correlated at the rate γ, so that $(\eta_{i2} - \gamma\eta_{i1})$ are independently and identically distributed shocks. Thus, rearranging Eq. 4 and writing it in terms of θ_{i1}, we obtain the following equation:

$$\theta_{i2} = \gamma\theta_{i1} + \boldsymbol{h'_{i,2}}\beta^2_2 + \epsilon_{i2} \tag{5}$$

In our case, we aim to estimate how maternal beliefs about returns to investment, captured by

LoC, influence the development of children's observed skills, y_{ia}, using a VA model. This approach has been increasingly used in recent research to examine how specific parental or childcare factors affect children's skill formation (Del Bono et al., 2016; Anderberg and Moroni, 2020; Morando and Platt, 2022). To do so, we estimate the following equation:

$$y_{ia} = \alpha + \gamma y_{i,a-1} + \beta LoC_i + e_{ia}, \tag{6}$$

where $y_{i,a}$ represents either socio-emotional or cognitive skills measured at a specific age a, and $y_{i,a-1}$ represents the one-period lagged skill; e_{ia} includes both age-invariant and age-specific unobserved shocks. *LOC* is a continuous standardized measure where a higher value means that the mother believes that the returns to her actions are higher.

Estimating the unbiased impact of maternal LoC on skill development requires controlling for all relevant inputs affecting skills, so that $E(e_{ia}|LoC_i) = 0$. As explained above, controlling for the one-period past skill in a VA setting embodies the effect of unobserved endowment and past inputs on skills development and, as a result, it deals with the omitted variable bias issue. Controlling for the one-period past skill also serves to accounts for the cumulative process of skill formation (Cunha and Heckman, 2008; Cunha et al., 2010).

To further rule out some of the possible confounders in the relationship between skills and maternal LoC, we further augment the VA model in Eq.6 by conditioning on several baseline characteristics of the mother, of the household, and of the child such as marital status, mental health, physical health, level of education, reading and mathematical skills, natural father being in contact, number of siblings, number of people in the household, language spoken at home, etc. (For the full list of controls, see table footnotes.) These are all measured when the child is 9 months old and are listed in Appendix Table C1. Appendix Table B2 shows that after including the comprehensive set of controls listed in Appendix Table C1, LoC has enough variation left to identify the effect of interest.

This new specification is illustrated in the equation below:

$$y_{ia} = \alpha + \gamma y_{i,a-1} + \beta LoC_i + X_i'\delta + e_{ia} \tag{7}$$

where X_i represents a vector of household, maternal, and child's characteristics measured at 9 months which is the point in time when maternal LoC is measured.[10] Comparing the estimates obtained from Eq.6 and Eq.7 serves to check whether the identifying assumption for the VA model, i.e.

[10]We do not include contemporaneous household characteristics in the RHS of the equation as we are wary that this might absorb the direct effect of LoC as variables measured over 9 months may act as mediators of the effect of LoC on child development. We nevertheless test the robustness of this specification in Section 5, and find that including contemporaneous household and maternal characteristics does not affect the results.

$E(e_{ia}|Y_{i,a-1}, LoC_i) = 0$, holds (for a similar approach see Cattan et al., 2023a).[11] Furthermore, controlling for maternal characteristics, such as maternal physical and mental health, is important not only for decreasing the issue of omitted variable bias, but also to limit the issue of reporting bias. Certain outcomes, such as socio-emotional skills, are constructed from mother's responses and her health status could bias how she classifies, for example, her child's behavior (Del Bono et al., 2024; Kiernan and Huerta, 2008).

With the VA model, we test whether the *marginal returns* of children's skills to maternal LoC are heterogeneous across different developmental stages. We hypothesize that the marginal returns of maternal LoC on children's skill development follow an inverse U-shaped trajectory throughout childhood: returns to maternal LoC rise during early and middle childhood, then decline in later stages. This prediction derives from the expectation that maternal LoC affects child skills mainly through parental investment - as we outline in Appendix A1 - and aligns with previous findings on the changing influence of parental inputs across different stages of child development (e.g., Carneiro et al., 2021; Eshaghnia et al., 2024).

Parental investment in early childhood is widely recognized as crucial for child development (e.g., Heckman and Mosso, 2014). As children transition from early to middle childhood, the scope for parental involvement expands. Forms of parents-child interaction diversify and parents gain greater scope to adjust their resource allocation in response to their children's past developmental outcomes (Attanasio et al., 2020b; Del Bono et al., 2016; Nicoletti and Tonei, 2020).[12] During middle childhood, parental practices related to management and monitoring gain prominence, while the direct time investments that are more relevant in early childhood become less central (Kalil et al., 2012). We therefore expect the marginal influence of maternal LoC on child outcomes to increase from early through middle childhood, as this stage allows for greater responsiveness of parental investment. However, the effectiveness of maternal LoC may decline during adolescence, a period when external influences such as peers and teachers begin to play a more significant role in shaping youth outcomes (Del Boca et al., 2014, 2017). [13]

[11] We further challenge the validity of the assumption of constant depreciation of inputs and skills by implementing two different additional specifications as shown in Section 5.

[12] This broader scope is partly due to children's increasing ability to express their needs and emotions, facilitated by language development. As communication improves, parents can respond more effectively to their children's individual needs. Additionally, as children enter school, parents can influence their development through a wider set of channels, for example, by choosing schools or other structured environments where socialization occurs more formally than in early childcare settings.

[13] There are other factors that get prominence in adolescence. Adolescence coincides with a period when individuals begin to develop their own LoC. Research shows that LoC is transmitted across generations (Zumbuehl et al., 2021), suggesting that maternal LoC could influence child outcomes not only directly but also indirectly through the shaping of the child's own LoC. This intergenerational channel could lead to increasing marginal returns of maternal LoC during middle childhood. However, we cannot directly test this hypothesis, as we lack data on the children's own LoC. Moreover, developmental changes during puberty, particularly in the prefrontal cortex which affects behavior and decision-making, may alter how adolescents respond to parental inputs, further complicating the relationship (e.g., Crone, 2016; Steinberg, 2014).

4 Results

4.1 Effect of Maternal LoC on the Children's Skills Development

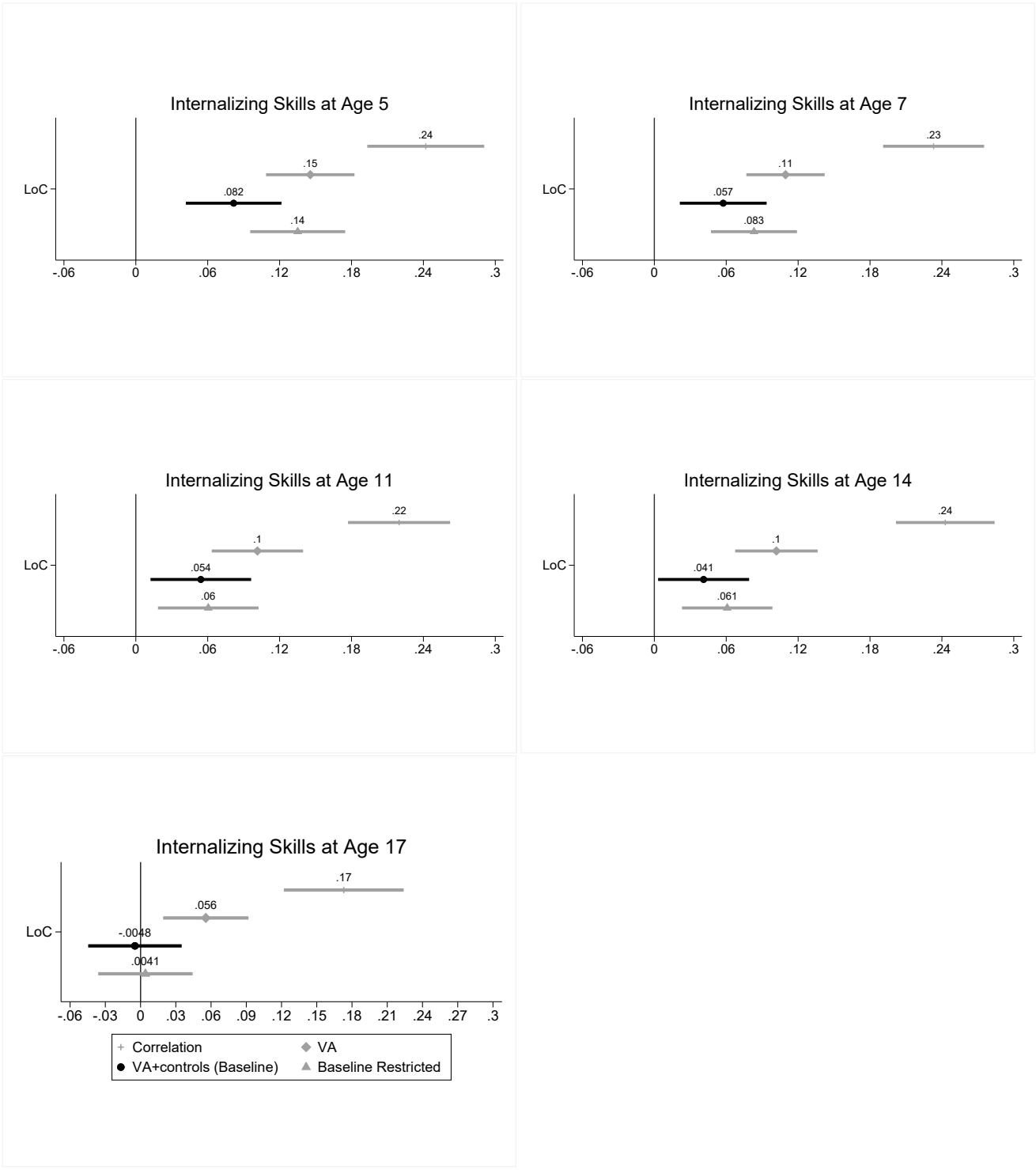
Socio-Emotional Skills

We start by studying the effects of maternal LoC on children's socio-emotional skills. We focus on three dimensions: internalizing, externalizing and prosocial skills. Recall that internalizing and externalizing skills have been re-coded so that a higher value means lower problems. Figure 1, Figure 2, and Figure 3 show that the correlation of maternal LoC with socio-emotional skills is positive and strong across all dimensions and ages ("Correlation"). For example, a 1 standard deviation increase in maternal LoC predicts about a quarter of a standard deviation of internalizing and externalizing skills from ages 5 to 14. When we implement a VA model by introducing the lagged outcome as a control variable ("VA"), the effect size of maternal LoC shrinks to half or less of the magnitude of the initial correlation size and the impact of maternal LoC at age 17 is not statistically significant anymore in any dimension of socio-emotional skills. Finally, when implementing the VA specification with controls ("VA+controls (Baseline)"), which is when rich baseline characteristics measured when cohort members are 9 months of age are controlled for, the effect size slightly decreases, although not in a statistically significantly different manner from the simple VA model. This suggests that controlling for the one-period lagged skills effectively captures unobservable characteristics which might be correlated with maternal LoC. Finally, the last estimate reported in the figures ("Baseline Restricted") is based on the baseline specification. However, in this case, the variable measuring children's socio-emotional skills has been adjusted to account for potential reporting bias associated with differences in maternal LoC. This adjustment and the results from this specification are discussed in greater detail in Section 5.

Our preferred specification is the the VA model with controls as discussed in Section 3 and Table 2 reports the coefficients and standard errors of the LoC variable and of the lagged outcome of this specification to better analyze the effect size of the impact of LoC. We find that maternal LoC plays a crucial role in children's skills development until age 14. One standard deviation increase in maternal LoC increases the internalizing skills of the children by 8.2, 5.7, 5.4 and 4.1 percent of a standard deviation at ages 5, 7, 11, and 14 respectively while it also positively correlates with age 3 skills. When it comes to externalizing skills, we find similar results. Table 2 shows that 1 standard deviation increase in maternal LoC increases externalizing skills by 7.1, 4.6, 3, and 1.8 percent of a standard deviation at ages 5, 7, 11, and 14 (although the effect is not statistically significant at age 14), while it also positively correlates with age 3 outcome.

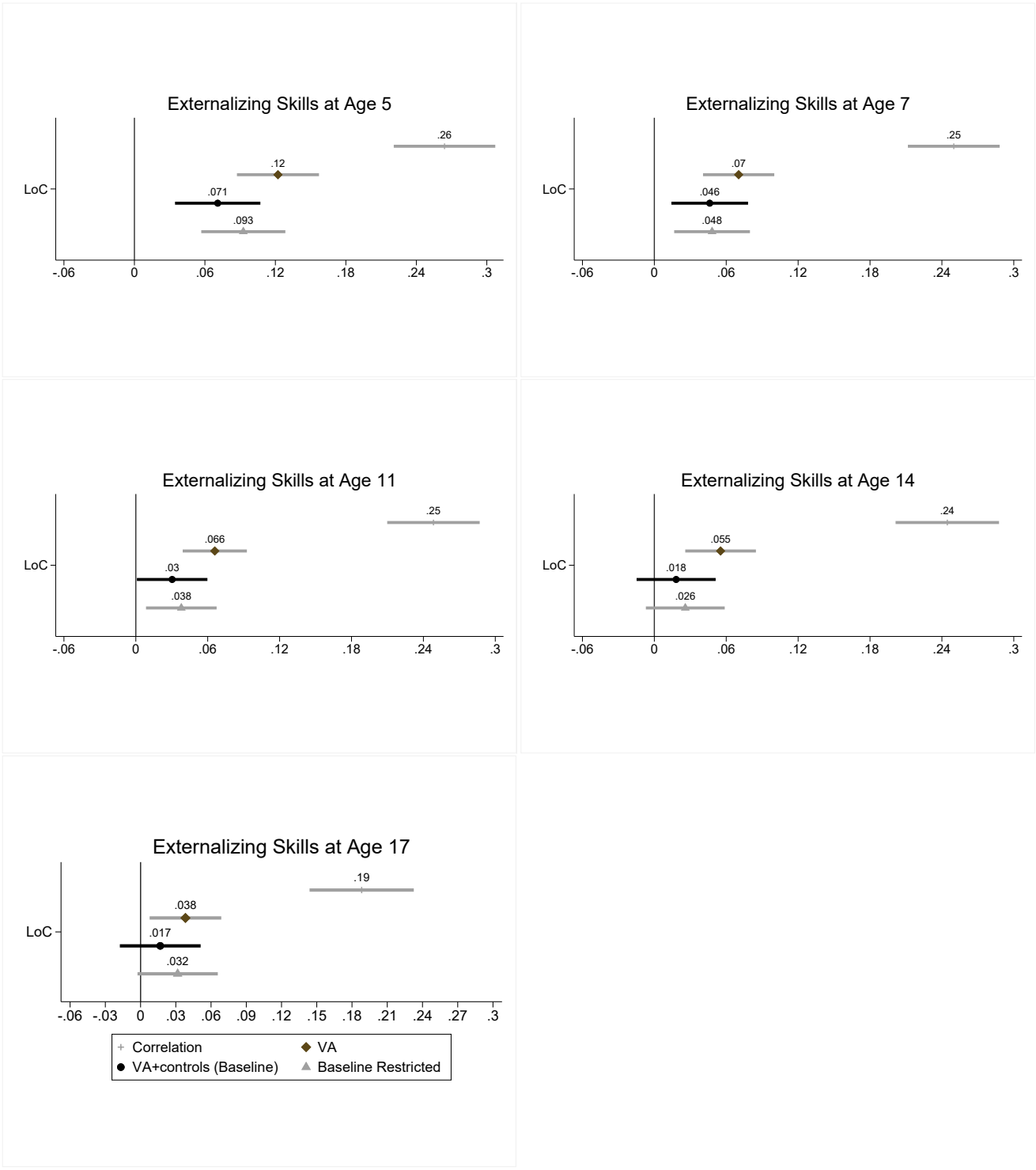
These results show that maternal LoC is useful in reducing the internalizing and externalizing issues that might affect several children's life outcomes. This suggests that mothers with high levels

Figure 1: Socio-Emotional Skills: Internalizing Skills



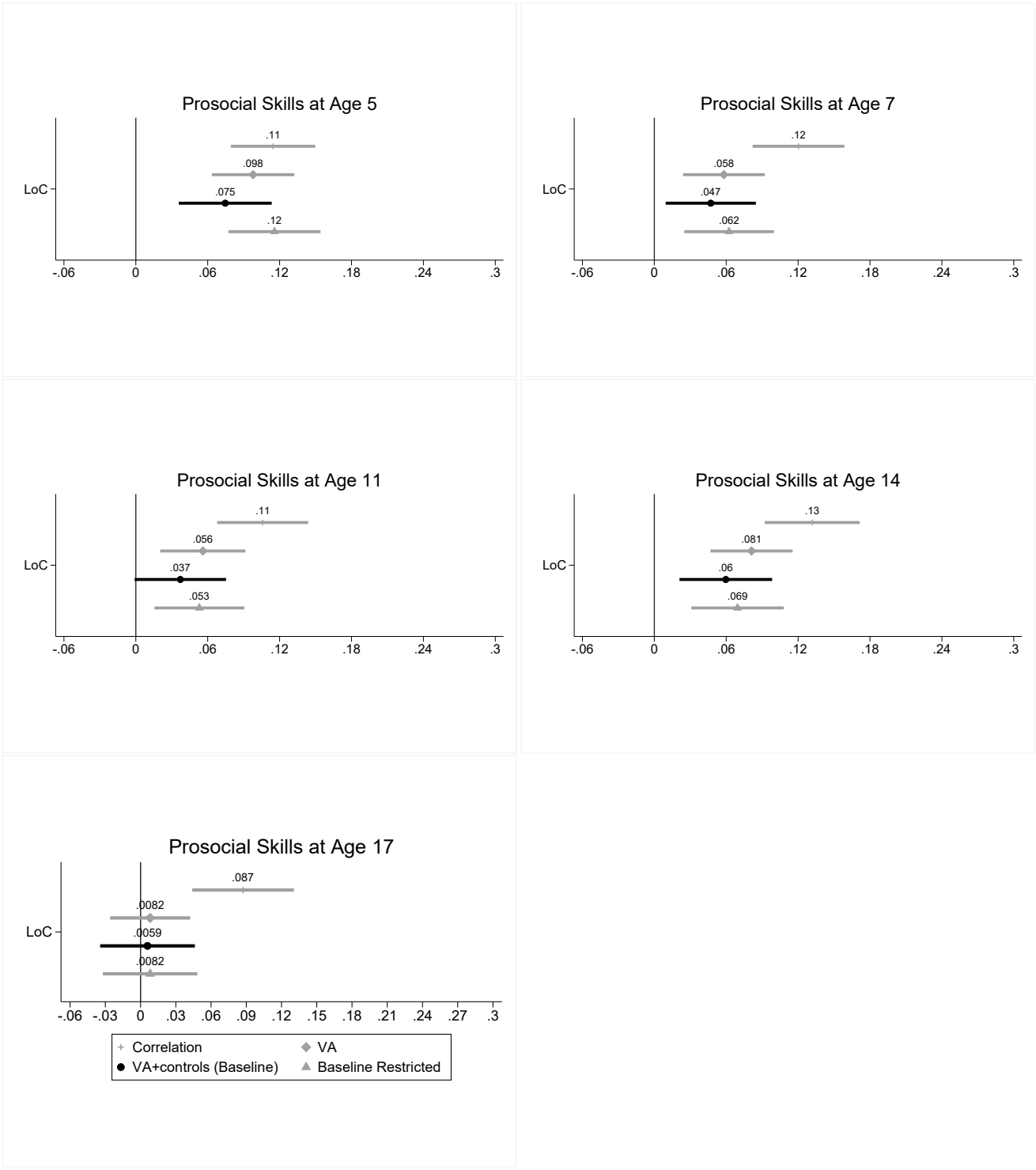
Notes: 95% confidence intervals. 'Correlation' includes only LoC in the RHS; 'VA' includes LoC and the 1-period lagged outcome (as shown in Equation 6); 'VA+controls' is the baseline specification (as shown in Equation 7) and it controls for 1-period lagged outcome and the full set of controls measured at 9 months of child age; 'Baseline Restricted' is the baseline specification where socio-emotional skills are derived from a latent factor model where parameters are restricted to be the same for mothers with a high/low LoC.

Figure 2: Socio-Emotional Skills: Externalizing Skills



Notes: 95% confidence intervals. 'Correlation' includes only LoC in the RHS; 'VA' includes LoC and the 1-period lagged outcome (as shown in Equation 6); 'VA+controls' is the baseline specification (as shown in Equation 7) and it controls for 1-period lagged outcome and the full set of controls measured at 9 months of child age; 'Baseline Restricted' is the baseline specification where socio-emotional skills are derived from a latent factor model where parameters are restricted to be the same for mothers with a high/low LoC.

Figure 3: Socio-Emotional Skills: Prosocial Skills



Notes: 95% confidence intervals. 'Correlation' includes only LoC in the RHS; 'VA' includes LoC and the 1-period lagged outcome (as shown in Equation 6); 'VA+controls' is the baseline specification (as shown in Equation 7) and it controls for 1-period lagged outcome and the full set of controls measured at 9 months of child age; 'Baseline Restricted' is the baseline specification where socio-emotional skills are derived from a latent factor model where parameters are restricted to be the same for mothers with a high/low LoC.

Table 2: Socio-Emotional Skills

	SDQ - int (Std)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Age 3	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.126***	0.082***	0.057***	0.054**	0.041**	-0.005
	(0.027)	(0.020)	(0.018)	(0.021)	(0.019)	(0.020)
Lagged		0.386***	0.495***	0.533***	0.563***	0.590***
		(0.023)	(0.020)	(0.021)	(0.018)	(0.017)
Observations	5179	4843	4646	4502	4289	3794

	SDQ - ext (Std)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Age 3	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.113***	0.071***	0.046***	0.030**	0.018	0.017
	(0.022)	(0.019)	(0.016)	(0.015)	(0.017)	(0.018)
Lagged		0.537***	0.648***	0.660***	0.687***	0.690***
		(0.017)	(0.015)	(0.014)	(0.015)	(0.015)
Observations	5179	4843	4646	4502	4289	3794

	SDQ - pro (Std)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Age 3	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.040*	0.075***	0.047**	0.037*	0.060***	0.006
	(0.021)	(0.020)	(0.019)	(0.019)	(0.020)	(0.021)
Lagged		0.325***	0.485***	0.446***	0.511***	0.563***
		(0.017)	(0.018)	(0.018)	(0.018)	(0.019)
Observations	5179	4843	4646	4502	4289	3794

Notes: Lagged variables corresponds to the variable in the previous wave. All the regressions control for maternal characteristics: marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Robust standard errors are shown in parenthesis.

of LoC are more likely to help (or more effective at helping) their children preventing or coping with issues such as anxiety and depression, and having good quality social relationships. This is likely to be driven by higher LoC mothers implementing higher intensity or higher quality parental investment (Del Bono et al., 2016) and is consistent with mothers with high LoC believing that they can change things happening in their lives and behaving accordingly in they way they bring their children up (Lekfuangfu et al., 2018).

The bottom panel Table 2 shows that maternal LoC positively affects ages 5, 7, 11, and 14

prosociality outcomes with similar effects to those on internalizing skills. A one standard deviation increase in maternal LoC increases prosociality by 7.5, 4.7, 3.7, and 6 percent of a standard deviation. Maternal LoC is an important factor determining child prosociality, possibly by improving the quality of the mother-child relation. Indeed, previous literature shows that children's prosocial skills are positively affected by the intensity of mother-child interactions (Kosse et al., 2020).

There are some common patterns across all three dimensions of socio-emotional skills. The effect of maternal LoC is particularly important at early ages with maternal LoC not showing any significant effect on any of the socio-emotional skills at age 17. This is not surprising given that during adolescence the direct impact of parental inputs becomes less important relatively to other factors (e.g., Carneiro et al., 2021; Del Boca et al., 2014; Eshaghnia et al., 2024). A null statistically significant impact of maternal LoC at age 17, however, does not exclude that socio-emotional skills in late adolescence are *indirectly* affected by maternal LoC through the self-production of those skills over time; indeed, both the magnitude and statistical significance of the coefficient of the lagged outcome (which is statistically significantly and positively influenced by maternal LoC) remain important in explaining the socio-emotional skills at age 17.

Cognitive Skills

As in the case of socio-emotional skills, for cognitive skills we focus our discussion on the results based on the VA specification with added controls, which are presented in Table 3. Our results show that maternal LoC does not affect the cognitive outcomes of children: the coefficients are all positive but they are not statistically significant at standard levels.

An important aspect of our analysis is that our measure of cognitive skills are derived from different age-appropriate tests (see Appendix Table C2 for a list of the tests available). This means, the content of the tests and the latent cognitive skills they retrieve could differ across ages. To understand whether the use of different tests is the reason why we do not find any significant impacts of maternal LoC, we construct other indexers of cognitive skills by: i) considering only the scores derived from the same test at different ages (i.e., the British Association Scales), and ii) grouping the tests which are aimed at depicting the same type of cognitive skills, i.e. visual, crystallized, and quantitative ability.[14] We present the results in panels B and C of Table 3. The positive impact of maternal LoC on children's cognitive skills remains and all estimates are not statistically significant with the exception of age 7 quantitative ability: a one standard deviation increase in maternal LoC increases quantitative ability at age 7 by 4 percent of a standard deviation and this is statistically significant at 5% level. Overall, we conclude that there is no significant evidence of maternal LoC having a direct positive impact

[14]The grouping of tests under the three categories (visual, crystallised and quantitative abilities) is based on the work reported here: https://closer.ac.uk/research-fund-2/data-harmonisation/assessment-harmonisation-cognitive-measures-british-birth-cohorts/

on cognitive skills which is consistent with the literature that shows that cognitive skills are less correlated and less impacted by the maternal factors than non-cognitive skills (e.g., Carneiro et al., 2013).

Table 3: Cognitive Skills

Panel A: Cognitive Skills Index

	Cognitive Ability: Composite Index (Std)					
	(1) Age 3	(2) Age 5	(3) Age 7	(4) Age 11	(5) Age 14	(6) Age 17
LOC (Std)	0.007	0.024	0.022	0.019	0.000	0.026
	(0.016)	(0.017)	(0.015)	(0.017)	(0.018)	(0.019)
Lagged		0.434***	0.587***	0.326***	0.303***	0.236***
		(0.017)	(0.019)	(0.015)	(0.017)	(0.015)
Observations	5395	5197	5431	5314	4988	4850

Panel B: British Abilities Scale and Visual

	BAS				Visual		
	(1) Age 3	(2) Age 5	(3) Age 7	(4) Age 11	(5) Age 3	(6) Age 5	(7) Age 7
LOC (Std)	0.017	0.015	0.017	0.021	-0.011	0.026	-0.001
	(0.017)	(0.018)	(0.016)	(0.017)	(0.018)	(0.019)	(0.016)
Lagged		0.329***	0.550***	0.304***		0.300***	0.556***
		(0.016)	(0.019)	(0.016)		(0.019)	(0.016)
Observations	5303	5109	5431	5314	5015	4840	5396

Panel C: Crystallized Ability and Quantitative Ability

	Crystallized					Quantitative	
	(1) Age 3	(2) Age 5	(3) Age 7	(4) Age 11	(5) Age 14	(6) Age 3	(7) Age 7
LOC (Std)	0.007	0.010	0.029	0.020	0.000	-0.011	0.040**
	(0.016)	(0.015)	(0.018)	(0.017)	(0.018)	(0.018)	(0.018)
Lagged		0.471***	0.329***	0.277***	0.303***		0.371***
		(0.015)	(0.018)	(0.015)	(0.017)		(0.017)
Observations	5395	5197	5414	5297	4988	5015	4716

Notes: See appendix for a list of variables that are included in cognitive ability index in each wave. All the regressions control for maternal characteristics: marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Robust standard errors are shown in parenthesis.

4.2 Effect of Maternal LoC on Children's Outcomes Academic

In addition to the impact of maternal LoC on children's socio-emotional and cognitive skills, we also study its impact on several outcomes in the academic context: unauthorized absences and English and Mathematics test scores. While school attendance is a behavioral outcome and intrinsically more related to socio-emotional skills, test scores pertain more to the cognitive dimension. However, the distinction between the cognitive and non-cognitive spheres in educational outcomes is not so well defined. For example, better socio-emotional skills might translate into improved test scores as a student who has less issues such as depression or hyperactivity might find it easier to study for their exams and that might lead to improvements in test scores.

Table 4: Academic Outcomes

Panel A: Scores

	Scores					
	English			Mathematics		
	(1) KS1	(2) KS2	(3) KS4	(4) KS1	(5) KS2	(6) KS4
LoC (Std)	0.025**	0.015*	0.006	0.018	0.012	-0.001
	(0.012)	(0.009)	(0.009)	(0.012)	(0.008)	(0.008)
Lagged		0.731***	0.590***		0.730***	0.705***
		(0.011)	(0.010)		(0.009)	(0.008)
Observations	6,938	6,710	6,430	6,938	6,740	6,456

Panel B: Good Score

	Good Score					
	English			Mathematics		
	(1) KS1	(2) KS2	(3) KS4	(4) KS1	(5) KS2	(6) KS4
LoC (Std)	0.007	0.014***	0.004	0.006	0.008	0.008
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Lagged		0.482***	0.413***		0.537***	0.512***
		(0.012)	(0.012)		(0.011)	(0.011)
Observations	7,247	6,852	6,706	6,943	6,764	6,726

Panel C: Attendance

	Unauthorized Absences										
	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011	(6) 2012	(7) 2013	(8) 2014	(9) 2015	(10) 2016	(11) 2017
LoC (Std)	-0.009	-0.027**	0.025*	-0.039***	0.010	-0.028**	-0.027**	-0.029*	-0.005*	-0.036*	-0.007
	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.013)	(0.016)	(0.011)	(0.014)	(0.011)
Lagged		0.400***	0.434***	0.394***	0.434***	0.382**	0.294***	0.610***	0.602***	0.463***	0.659***
		(0.062)	(0.046)	(0.037)	(0.040)	(0.037)	(0.039)	(0.078)	(0.052)	(0.0548)	(0.047)
Observations	6,947	6,924	6,907	6,875	6,833	6,810	6,649	6,682	6,649	6,619	6,589

Notes: KS corresponds to Key Stage. KS1 exams are taken at age 7, KS2 exams are taken at age 11 and KS4 exams (GCSEs) are taken at age 16. Good score corresponds to having achieved level 3 or above in SATs at KS1, level 5 or above in SATs at KS2, and A*-C GCSE at KS4. All the regressions control for maternal characteristics: marital status, health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Standard errors (in parenthesis) are clustered at cohort member level.

Panels A and B of Table 4 shows that there is no impact of maternal LoC on Mathematics scores

but there are some effects on English score at KS2 at age 11. One standard deviation increase in maternal LoC is statistically significantly associated with 2.5 percent of a standard deviation higher English score at KS1 at age 7. When implementing the VA model at age 11, one standard deviation increase in maternal LoC increases the English score by 1.5 percent of a standard deviation, although this is statistically significant at 10% level. We repeat the analysis on test scores where the outcome is a dummy indicating whether the test scores are considered to reach a satisfactory level, i.e. "good score". Results are consistent with the one where we investigate continuous scores, although the effect of LoC on KS2 English is now statistically significant at 5% level.

School attendance is measured through the total number of unauthorized absences every year from 2007 to 2017, which corresponds to the period when children are 6 to 17 years old. Unauthorized absences are standardized to enable consistent comparison of the impact of maternal LoC across different outcomes. As shown in Panel C of Table 4 our results of the VA model with controls show that maternal LoC statistically significantly and negatively impacts unauthorized absences. This is consistent throughout the years, with the exception of 2009, 2011, and 2017. A one standard deviation increase in maternal LoC decreases unauthorized absences from a minimum of 0.5 to a maximum of 3.9 percent of a standard deviation in the period considered.

Overall, the findings on academic outcomes align with our earlier results on socio-emotional and cognitive skills, reinforcing the view that maternal LoC has a stronger influence on behavioral dimensions than on purely cognitive ones. Educational success is shaped by both cognitive and socio-emotional abilities (Heckman et al., 2006), with recent intervention-based studies emphasizing the particularly significant role of non-cognitive skills in explaining academic performance (Alan et al., 2019). Consistent with this, we observe that maternal LoC significantly affects unauthorized absences and performance in English, both closely tied to socio-emotional competencies. English achievement relies heavily on communication, interpretation, and critical thinking, which are supported by socio-emotional skills. In contrast, mathematics performance depends more on cognitive abilities such as logical reasoning, problem-solving, and abstract thinking.[15] Moreover, school attendance is positively associated with students' socio-emotional competence (Henry et al., 2012). This suggests that maternal LoC may influence some educational outcomes both indirectly, by fostering children's socio-emotional development (as shown in the previous section), and directly, through parenting practices, which have been shown to affect, for example, truancy behaviors (Escario et al., 2022; Gubbels et al., 2019).

[15] Duckworth and Seligman (2005) find that self-discipline, grit, and perseverance are more strongly associated with English grades than math grades. Similarly, Casey et al. (1997) show that verbal ability and self-esteem predict English performance, whereas math grades are more closely linked to mathematical ability.

5 Robustness Checks

The estimated impact of maternal LoC on child development could be biased if the regression is incorrectly specified or fails to control for all relevant variables. In this section, we provide several robustness checks to study the sensitivity of the results of our preferred VA model across different specifications and ways of constructing the maternal LoC and outcome measures. We also provide an alternative estimation to assess the overall effect of LoC on child development – that is, without adjusting for prior levels of the same skill in the earlier developmental stage.[16]

5.1 VA Assumptions

For the VA model to take care of the omitted variable issue we need (i) latent skills and (ii) lagged observed and unobserved inputs to geometrically depreciate at the same rate. To test the robustness of our findings to these assumptions, we relax the constant depreciation assumptions by implementing two different specifications. In the one-period lagged VA model with controls, we additionally condition on all sets of observed lagged skills and on current inputs. Given the reciprocity of unobservable to observable characteristics, if results are not affected, we can reasonably argue that the constant depreciation assumption plausibly holds also for unobservable characteristics (Altonji and Mansfield, 2018).

(i) Controlling for All Past Skills

We report the estimates of maternal LoC when explicitly controlling for all past skills in Appendix Figure B1 ("Baseline+All Outcomes"). This specification is used to test the constant depreciation assumption of outcomes in the VA one-period lagged outcome model with controls. Augmenting the VA specification with all past observable skills further allows us to consider that there might be some unobservable characteristics that are important in determining earlier and later outcomes but do not directly affect the one-period lagged outcome. For example, there could be some unobservable characteristics that are important for skills at ages 5 and 11, but not for skills at age 7. When estimating the impact of maternal LoC on skills at age 11 while conditioning on skills age 7 does not allow us to control for these unobservable variables, including all the lagged outcomes available allows us to actually account for these unobservable variables.

As we could expect, the precision of the estimated coefficient decreases when we have the entire observable story of past skills, especially at certain ages. However, the magnitude of the impact of maternal LoC is not importantly affected and none of the new estimates is statistically different from the baseline estimates, so the main findings of the baseline VA model are robust to this specification.

[16]Results are shown for socio-emotional skills outcomes as these are the outcomes where we find a relevant and statistically significant impact of maternal LoC. When we repeat the checks on the other outcomes, the main findings hold.

We take this as a suggestion that omitted variables should not be a relevant concern in the VA model and that the constant depreciation assumption holds.

Finally, the inclusion of all observed lags allows us to study the indirect effect of lagged outcomes of skill development. In Appendix Table B5 we report the estimates of past skills. For most of the outcomes, the one-lagged outcome as well as the previous lags are important predictors of current skills. For nearly all ages, *all* the previous lags are statistically significant. Even when we find no direct statistically significant effect of maternal LoC for socio-emotional skills at certain ages, the fact that such outcomes are affected by lagged outcomes, which are impacted by maternal LoC, highlights the relevance of maternal LoC in child development in the long-run.

(ii) Controlling for Contemporaneous Inputs

In our main specification, we control for a rich set of household, maternal and child characteristics that are measured when children were 9 months old. We do so to minimize the probability of having unobservables which are correlated to both LoC and child development. However, it is possible that some of these characteristics changed over time, such as maternal employment status. These changes might also affect the skills accumulation of children. As changes in such characteristics could act as mediators of the direct effect of LoC on child development, we do not include them in the main specification. To test whether the assumption of constant depreciation of inputs holds, we replicate the baseline VA model and additionally control for maternal and household characteristics at the time where the outcome variable is measured. Results are shown in Appendix Figure B1 ("Baseline+Cont. Inputs"). The new estimates of maternal LoC are not statistically different from those obtained in the baseline VA specification.

5.2 Skills Specification

(i) Reporting Bias

An important issue related to the maternal assessment of children's skills is reporting bias related to LoC endowment. Indeed, Del Bono et al. (2024) show that parental assessments of child non-cognitive skills are directly affected by parents' characteristics. In our case, maternal assessment of their children's skills could be affected by maternal level of LoC.[17] If this is the case, we would have a correlation between the measurement error of the skill equation (e_{ia}) and the treatment variable (LoC_i) in Eq. 7 and $\hat{\beta}$ could not be interpreted as the average treatment effect in the OLS. This is because the estimated parameter would be confounding the effect of maternal LoC on children's socio-emotional skills, which is what we are interested in estimating, with the effect of maternal LoC on maternal

[17] To establish whether there is any suggestion of maternal response to the SDQ being biased, we compare the scores obtained from the SDQ answered by mothers with the scores obtained by the SDQ answered by teachers for the available ages. We find positive correlation between mother- and teacher-assessed SDQ scores to always be statistically significant at 1% level and ranging between 0.34 and 0.60.

perception of their children's socio-emotional skills.

To solve this issue we rely on previous literature which explicitly models children's reported skills (Attanasio et al., 2020b; Heckman et al., 2022, 2013). More precisely, we divide mothers into two groups, depending on whether they have a high/low LoC based on the median value of LoC.[18] We then allow the intercept α_j in Eq. 1 to depend on maternal LoC level to capture the possibility that mothers with high LoC levels perceive their child's skills more positively compared to mothers with low levels of LoC. We also allow factor loadings λ_j to depend on LoC to deal with the fact that there is a higher likelihood of misreporting extreme behaviors - for example if children have very problematic emotional issues. We call this latent factor model of socio-emotional skills *restricted*. The estimates of LoC when using the restricted model to depict the latent socio-emotional skills are named "Baseline Restricted" in Figure 1, Figure 2, and Figure 3. Compared to the "Baseline model" in the same figures, the magnitude and statistical significance of LoC estimates slightly increase when we derive skills with the restricted latent model. Nevertheless, the estimated coefficients derived from the unrestricted and the restricted latent models are not statistically different from each other. We conclude that reporting bias should not be a serious issue in other context and, if anything, it results in biasing the impact of maternal LoC on children skills development downward.

(ii) Unstandardized Measures of Skills

Socio-emotional skills are standardized within each age. This approach may potentially fail to detect variations in these skills across different age groups. For example, there might be a decline in a specific skill from ages 7 to 11. However, due to children with mothers exhibiting higher LoC experiencing a smaller decline in such skill (compared to children with mothers with lower LoC), we could mistakenly interpret a positive coefficient as a positive impact of LoC on such skill. To investigate this possibility, we plot the trajectories of the raw socio-emotional skill scores (which are derived directly from the SDQ tests before any standardization or creation of latent factors) from ages 3 to 17 , see Appendix Figure B3. The trajectories of socio-emotional skills seem to follow a similar pattern among children with mothers having high and low levels of LoC: the trajectories are parallel with children with mothers with high LoC consistently experiencing higher levels of skills across all ages.

When we replicate the baseline VA model using the raw socio-emotional skill scores, see Appendix Table B6, the coefficient for maternal LoC consistently shows a positive value. This positive coefficient implies that when skills increase across different ages, the magnitude of improvement is greater for children whose mothers have higher LoC. Similarly, during ages characterized by decreases in

[18]Testing for measurement invariance supports that there is at least one item with the same factor loading and intercept between the groups of mothers with high and low LoC within each dimension (internalizing, externalizing and prosocial skills) and wave. In other words, we have partial metric invariance and partial scalar invariance so that the two distributions of children's skills reported by mothers with high/low LoC are comparable (Heckman et al., 2022).

skills, the reductions are less pronounced for the same group. Together, Appendix Table B6 and Appendix Figure B3, suggest that maternal LoC plays a significant role not only in instances of skill improvement but also when there is a decline. Maternal LoC has the ability to alleviate a portion of the reduction in child skills during such periods.

5.3 LoC Specification

(i) Possible Confounders

We might be concerned that given the positive association of LoC with cognitive ability, failing to control for it in an appropriate way could result in biasing the estimated effect of LoC. However, there is evidence that LoC is a separate determinant in, for example, job search behavior and performance in the job, above individual cognitive skills (see Caliendo et al., 2015, and literature cited therein). In our baseline specification we control for some measures of cognitive skills of mothers when the child is 9 months old. These are dummies on whether the mother has low reading and maths skills. As this is a crude measure with limited variation across the sample, we additionally include another measure of maternal cognitive skills collected when child is 14 years old.[19] This is the vocabulary test which consists in understanding the meaning of words. More specifically it is a shortened version (20 of original 75 items) of Closs (1976). We re-run the baseline VA model by additionally controlling for the score achieved in the cognitive assessment.[20] Appendix Figure B1 ("Baseline+Mat. Cogn.") shows that including maternal cognitive skills as a control does not qualitatively affect the main findings.

(ii) Alternative Measure of Maternal LoC

We further test whether the way in which the LoC measure is constructed could affect our findings. We build another measure of maternal LoC, by using the index method proposed by Anderson (2008). We present the result of this robustness check in Appendix Figure B2. Across the three dimensions of socio-emotional skills, none of the new estimates of maternal LoC is statistically different from the the ones obtained when using the average score LoC measure at all waves.

5.4 The Absolute Impact of Maternal LoC

The VA model examines whether the marginal effects of maternal LoC on children's skills vary from early childhood to adolescence. To understand the total impact of LoC on skills across ages, we estimate a model that omits lagged skills as a control variable. This also allows us to test the robustness

[19] Even if maternal cognitive skills are measured at a later time than LoC, there is evidence of stability of cognitive skills in adulthood (Almlund et al., 2011).

[20] This is available for 73.3% of the final analysis sample. Repeating the baseline estimates for the sample in which this cognitive score is available shows that findings are not affected by this sample selection. We also include an indicator on whether the task was impaired by some personal or external circumstances assessed by the interviewer (e.g., whether person has visual impairment) which affects 4.5% of mothers taking this test.

of the effect size of the maternal LoC coefficients as including the lagged outcome as control variable could potentially result in estimates that are biased towards zero because of the attenuation bias (McKinnish, 2008). Appendix Table B7 presents these results, indicating a consistently positive and statistically significant association between maternal LoC and socio-emotional skills across ages. Unlike the VA model, which mitigates endogeneity concerns through controls for lagged skills, this specification solely relies on controlling for a comprehensive set of covariates. Applying Oster bounds (Oster, 2019) to assess the robustness of our findings to omitted variable bias, we find evidence that rejects the presence of serious endogeneity issues, as indicated in Appendix Table B8. [21]

6 Maternal LoC and Parental Investments

Parents who believe that they can control the outcomes of events, i.e. parents with a high LoC, might believe that the more they invest in their children the better their outcomes will be. We illustrate this relationship in a conceptual framework in Appendix A1. In this section we test, firstly, whether higher maternal LoC positively correlates with antenatal, early, and late investment, and, secondly, whether it predicts higher intensity parent-to-child activities as captured by parent-child interactions, parental discipline, and household environment.

In columns 1-4 of Table 5 we report the coefficients of the correlation between maternal LoC and antenatal and early year investments when controlling for the usual set of characteristics. We find that maternal LoC predicts early investments. For example, a one standard deviation higher LoC is associated with a 2.3 percentage points (5 percent relative to the mean) higher probability of having attended antenatal classes and a 1.4 percentage points (16 percent relative to the mean) lower probability of consuming alcohol more than twice per month during pregnancy. There is no impact on ever tried breastfeeding but among the mothers who breastfed, the higher the maternal LoC, the longer the baby is breastfed, which is statistically significant at 1% level. These results are important as they show that parents who believe that they can control the outcomes of events are more likely to invest more in their children by attending antenatal classes which can improve the knowledge of mothers about parenting practices to improve child development. There is also evidence on the positive effects of breastfeeding (Borra et al., 2012; Del Bono and Rabe, 2012; Fitzsimons and Vera-

[21] In Appendix Table B8, δ represents the relative degree of selection on observed and unobserved variables. The first two columns show LoC estimates when δ is set to 1 and -1, respectively. These estimates indicate that LoC has a consistently positive effect on socio-emotional skills across all ages (except at age 17 in column 1), though the magnitude depends on the direction of the bias. For example, when the influence of unobservables and observables is the same, the impact of LoC on internalizing skills at age 5 is 4.5% of the standard deviation. However, if the influence of observables and unobservables goes in the opposite direction, the impact rises to 19.5%. The third column reports the value that δ should have for LoC estimates to be equal to zero. The effect of unobservables would need to be as much as and up to 3 times as important as the one of observables to reduce the coefficient of LoC to zero. This shows that most estimates are robust to possible confounding bias in unobservables.

Hernández, 2022) and length of breastfeeding (Kramer et al., 2008; Colen and Ramey, 2014; Carneiro et al., 2015; Victora et al., 2015) on child development.

Columns 5 and 6 of Table 5 report the correlation between maternal LoC and parenting beliefs and attachment.[22] One standard deviation increase in maternal LoC is associated with 5 percent of a standard deviation increase in beliefs that parents should be actively engaging with and supporting the baby to help their development which is statistically significant at 1% level. This result suggests that mothers with high LoC believe that their actions matter more for their child and, thus, we should expect them to exert more effort to support their development. Furthermore, maternal LoC is associated with stronger mother-baby attachment score, although this is not statistically significant.

Table 5: Correlation of Maternal LoC with Antenatal and Early Life Investment, Beliefs about Parenting, and Attachment

	(1) Antenatal Classes	(2) Alcohol Pregnancy	(3) Tried Breastfeeding	(4) Lenght Breastfeeding	(5) Parenting Beliefs Index (Std)	(6) Attachment Index (Std)
LOC (Std)	0.026**	-0.013*	-0.002	0.169***	0.056***	0.027
	(0.010)	(0.008)	(0.011)	(0.053)	(0.020)	(0.023)
Mean	0.37	0.10	0.77	3.17	0.02	-0.03
Observations	5,889	6,103	6,103	3,790	6,103	6,103

Notes: All outcomes are measured when the child was in the first sweep (9 months old). All the regressions control for maternal characteristics: marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Robust standard errors are shown in parenthesis.

We then turn into investigating the impact of maternal LoC on parental investments, parental discipline, and home environment, by implementing the VA model with controls on such outcomes which are measured across several children's developmental stages. As we do have several measures of parental inputs which reflect both the amount of time and the type of activities parents engage with their children (see Appendix Table C4), we construct indexes as in Anderson (2008), making use of all the information available. In addition, we implement a principal component analysis to separate these activities into educational and recreational investment (Del Bono et al., 2016). The rationale being that maternal LoC can be important for different types of activities depending on the age of the child (Del Boca et al., 2017; Kalil et al., 2012). When children get older, parents might be less likely to be able to help with their education if they do not have the specific knowledge required for their children's courses and might put more effort in recreational activities. Similarly, parents might see their educational investment as a substitute to formal education once the child starts school, and they might change the allocation of activities dedicated to education vs. recreation. Indeed, Greaves et al. (2023) provide evidence of this substitution effect. For parental investments, we consider activities

[22] Appendix C3 offers a detailed description of how these outcomes are constructed.

done by *both* parents. This is because, for example, mothers may spend less time on recreational activities with their child if the father already spends sufficient time doing so.

Table 6 shows that maternal LoC is a significant predictor of overall parental time spent with the children when they are 3. Moving beyond age 3, where we can study the impact of LoC on investments with a VA model, we see that a one standard deviation increase in maternal LoC results in a statistically significant increase in general parental investment at age 11, by a 5.3 percent of a standard deviation. In Panel A2 of Table 6, we present the results on parental investments in children separately for educational and recreational activities. Maternal LoC statistically significantly impact educational activities at age 5 and 11 and recreational activities at age 7. One standard deviation increase in maternal LoC increases educational activities at ages 5 and 11 by 4.4 and 6.5 percent of a standard deviation and recreation activities at age 7 by 4.6 percent of a standard deviation. Overall these findings point to an increasing influence of maternal LoC on parental investment over time.

In addition to parental investments, it could also be that maternal LoC affects the strictness of parenting which has been found to be important in affecting children's behavioral, cognitive, and non-cognitive outcomes (Doepke et al., 2019). In order to study this, we make use of the information about parental discipline. As in parental investments, we create an index (Anderson, 2008) to capture parental discipline at home. In the last part of Panel A2 of Table 6, we see that maternal LoC positively predicts discipline at home at age 3 and positively affects discipline at age 11. One standard deviation increase in LoC results in 4.4 percent of a standard deviation increase in parental discipline at home at age 11.

At age 11 parents particularly value educational activities and discipline as at this age KS2 exams, which are a milestone in the English educational system, take place. Indeed, the only statistically significant effect of maternal LoC on exams is found at age 11 in English. Furthermore, this is a developmental stage when most children experience puberty, often related to the rise of behavioral issues (DelGiudice, 2018). Thus, the finding that maternal LoC affects age 11 discipline is not surprising as parental discipline serves to limit children's disruptive behavior.

Parental inputs are reported by parents themselves, thus we use an additional measure that we derive from the interviewer observations which we label *home environment*. The interviewers who went to cohort members' homes to conduct the surveys were asked to take notes about the environment that children were exposed to. We make use of this unusual set of information and create a home environment measure. Here, our dependent variable is a noisy environment. As Panel B of Table 6 shows, maternal LoC coefficients are negative across all ages, signaling a more positive environment the higher the maternal LoC. For example, a one standard deviation increase in maternal LoC corresponds to a 3 percent decrease of a standard deviation in negative home environment at age 11. Nevertheless, none of the estimated coefficients is statistically significant at the standard level.

Table 6: Parental Inputs

Panel A1: Parental Activities

	All Activities (Std)				
	(1) Age 3	(2) Age 5	(3) Age 7	(4) Age 11	(5) Age 14
LOC (Std)	0.024	0.029	0.030	0.053**	0.028
	(0.019)	(0.022)	(0.020)	(0.021)	(0.022)
Lagged		0.307***	0.440***	0.308***	0.227***
		(0.016)	(0.019)	(0.016)	(0.017)

Panel A2: Parental Activities - Sub-Categories

	Education Activities (Std)				
LOC (Std)	0.053***	0.044**	0.006	0.065***	
	(0.019)	(0.021)	(0.021)	(0.021)	
Lagged		0.259***	0.152***	0.102***	
		(0.017)	(0.018)	(0.014)	
	Recreation Activities (Std)				
LOC (Std)	0.002	0.025	0.046***	-0.024	
	(0.019)	(0.020)	(0.017)	(0.018)	
Lagged		0.241***	0.574***	0.361***	
		(0.016)	(0.015)	(0.015)	
	Parental Discipline (Std)				
LOC (Std)	0.064***	0.008	-0.019	0.044**	
	(0.019)	(0.021)	(0.022)	(0.021)	
Lagged		0.328***	0.156***	0.070***	
		(0.017)	(0.019)	(0.017)	
Observations	5548	5021	4525	4574	4599

Panel B: Home Environment

	Negative Home Environment (Std)				
	(1) Age 3	(2) Age 5	(3) Age 7	(4) Age 11	(5) Age 14
LOC (Std)	-0.028	-0.028	-0.029	-0.030	-0.010
	(0.024)	(0.021)	(0.019)	(0.022)	(0.019)
Lagged		0.107***	0.249***	0.146***	0.168***
		(0.019)	(0.017)	(0.017)	(0.019)
Observations	5262	4792	4703	4748	4620

Notes: All the regressions control for maternal characteristics: marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. Home environment measures come from interviewer observations. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Robust standard errors are shown in parenthesis.

Concluding, these findings suggest that the positive impact of maternal LoC on child development could partly be explained by parental investment. More specifically, the VA model estimates marginal returns of children's skills to maternal LoC. If parental investment is one of the mechanisms at play through which maternal LoC affects child development, we would expect that different levels of maternal LoC correspond to different levels of parental investment. Indeed, our analysis shows a positive impact of maternal LoC on parental investment. This, however, does not exclude the existence of increasing returns of skills to maternal LoC through other channels than parenting, such as through intergenerational transmission of LoC (Zumbuehl et al., 2021). While highlighting the need to explore other potential channels, these findings are important because they provide new insights into the long-term relationship between parental beliefs and child development, specifically showing that parental investment is a key mechanism through which these beliefs exert their influence.

7 Can Maternal LoC Explain Part of the SES Gradient in Child Development in Socio-Emotional Skills?

A common finding in the intergenerational transmission literature is that growing up in a low socio-economic status (SES) household negatively affects several lifetime outcomes. This is consistent with the socio-economic gradient in child development, where low SES children experience lower quality development compared to more advantaged children (e.g. Rubio-Codina et al., 2015). Understanding the relevance of maternal beliefs in determining this gradient is crucial for understanding the underlying process generating such inequality and hence for promoting social mobility through, for example, well-targeted interventions.

We first investigate and provide evidence that there is a socio-economic gradient in maternal LoC, for which higher SES is associated with higher LoC. The explanation behind this is that the more obstacles one encounters in life, the less likely they believe that they can change things around them.[23] Individuals from a low SES are more likely to experience obstacles in their lives since early years due to a lack of resources (e.g., financial, information, social network) and other factors (e.g., discrimination) that they face. It is very likely that this negatively affects their beliefs about their power to affect their destiny, and hence their LoC, compared to higher SES individuals.

Appendix Table B3 presents the differences in maternal LoC and gender of the child, socio-economic and ethnic backgrounds. It shows that there are important differences in LoC by ethnicity, socio-economic occupation, and level of education. For example, the higher the educational qualification, the higher the level of LoC. The difference between mothers with a degree and with

[23]The learned helplessness theory in psychology (Seligman and Beagley, 1975; Maier and Seligman, 1976) states that individuals who are constantly faced with negative events beyond their control can feel as if their efforts are useless.

a qualification lower than GCSE is about 79 percent of a standard deviation in LoC (column 7). Even after controlling for all the other characteristics (column 8), we see that this difference is only reduced to 54 percent of a standard deviation. Given the existence of an SES gradient in maternal LoC and the fact that the latter affects child socio-emotional development, as shown in the results above, we can test whether part of the SES gradient in child development can be attributed to differences in maternal LoC across different SES groups.[24] Indeed, there is evidence of low SES parents underestimating the returns to child investment to a higher extent than high SES parents (Attanasio et al., 2021; Cunha et al., 2022).

To explore the role of maternal LoC in explaining the SES gap in children's socio-emotional skills, we implement a Kitagawa-Oaxaca-Blinder decomposition analysis (Blinder, 1973; Oaxaca, 1973; Elder et al., 2010). This allows us to measure how much of the SES gap comes from a different distribution of individual characteristics (the explained part) between low and high SES households and how much of it derives from low and high SES households differing in the returns to these characteristics (the unexplained part). For this analysis we consider the household to be of a high SES when the mother has a tertiary education qualification.[25] Table 7 shows the results of the decomposition analysis. Across all ages considered, there is a statistically significant SES gradient, so that children from high SES background have significantly better socio-emotional skills by a magnitude of 0.20 and 0.29 (0.36 to 0.44) percent of a standard deviation for internalizing (externalizing) skills from age 5 to 17.

Maternal LoC consistently and statistically significantly explains the SES gap across all dimensions of socio-emotional skills except for when the child is 17. Even when compared to other relevant and statistically significant determinants of the SES gradient, maternal LoC explains a higher proportion of the explained gap. For example, conditional on several characteristics,[26] maternal LoC explains the SES gradient nearly twice the size of having the father who is a full-time resident at home. Maternal LoC accounts for a non-negligible part of the *explained gap* in internalizing (18-14 percent), externalizing (9-4 percent), and prosocial (38-28 percent) skills from age 5 to 14. The estimates on the unexplained part of the SES gap (not reported in Table 7) are not statistically significant in explaining the overall SES gradient, suggesting that what drives the SES gradient in the development of children's socio-emotional skills is the fact that mothers from different SES differ in their LoC level and not that returns to maternal LoC differ across households of different SES.

[24]Note that while LoC has a strong SES gradient, there is still enough variation in LoC within each SES category. This makes us confident that SES and LoC are only partially overlapping. The R^2 in the regression of LoC against SES (columns 3 and 4 in Appendix Table B3) is only about 5%. Furthermore, the standard deviation in LoC goes from 1 to 0.97 once we control for maternal education and it goes from 1 to .94 when we control for all SES variables available. This shows that LoC has enough variation to identify the effect of interest (see Appendix Table B2).

[25]Given that maternal LoC could be endogenous to maternal education, we implement an additional decomposition analysis, where maternal SES is defined by the cohort member's grandparents has a university degree. Results are shown in Appendix Table B4 and are consistent with the one reported in Table 7.

[26]These are maternal age, maternal ethnicity, maternal cognitive skills, child sex, whether living in London, and lagged skill.

Table 7: Decomposition Analysis: How Much of the SES Gap in Socio-Emotional Skills is Explained by SES Gradient in Maternal LoC?

	Internal					External					Prosocial				
	(1) Age 5	(2) Age 7	(3) Age 11	(4) Age 14	(5) Age 17	(6) Age 5	(7) Age 7	(8) Age 11	(9) Age 14	(10) Age 17	(11) Age 5	(12) Age 7	(13) Age 11	(14) Age 14	(15) Age 17
overall															
Low_SES	0.053***	0.034*	0.001	-0.020	-0.046**	-0.022	-0.022	-0.028	-0.019	-0.052**	0.001	0.009	0.023	0.029	0.011
	(0.019)	(0.018)	(0.018)	(0.019)	(0.020)	(0.020)	(0.019)	(0.018)	(0.019)	(0.021)	(0.019)	(0.018)	(0.018)	(0.018)	(0.020)
High_SES	0.260***	0.275***	0.226***	0.269***	0.239***	0.416***	0.395***	0.391***	0.376***	0.310***	0.074**	0.035	0.051	0.044	0.036
	(0.026)	(0.026)	(0.029)	(0.029)	(0.031)	(0.026)	(0.026)	(0.026)	(0.029)	(0.028)	(0.031)	(0.032)	(0.031)	(0.034)	(0.035)
Difference	-0.207***	-0.240***	-0.225***	-0.290***	-0.285***	-0.438***	-0.417***	-0.419***	-0.395***	-0.363***	-0.074**	-0.026	-0.028	-0.014	-0.025
	(0.032)	(0.032)	(0.035)	(0.035)	(0.037)	(0.032)	(0.032)	(0.032)	(0.035)	(0.035)	(0.037)	(0.037)	(0.036)	(0.038)	(0.040)
Explained	-0.185***	-0.176***	-0.178***	-0.192***	-0.243***	-0.318***	-0.349***	-0.319***	-0.338***	-0.306***	-0.084***	-0.069***	-0.072***	-0.068***	-0.018
	(0.021)	(0.021)	(0.021)	(0.024)	(0.026)	(0.024)	(0.025)	(0.025)	(0.026)	(0.028)	(0.021)	(0.023)	(0.021)	(0.023)	(0.026)
Unexplained	-0.022	-0.064**	-0.046	-0.098***	-0.042	-0.120***	-0.067***	-0.100***	-0.058**	-0.057**	0.011	0.042	0.044	0.053*	-0.007
	(0.029)	(0.027)	(0.031)	(0.029)	(0.029)	(0.027)	(0.024)	(0.023)	(0.025)	(0.027)	(0.034)	(0.031)	(0.031)	(0.032)	(0.033)
explained															
Lagged	-0.121***	-0.111***	-0.131***	-0.141***	-0.182***	-0.256***	-0.303***	-0.275***	-0.293***	-0.279***	-0.046***	-0.033*	-0.009	-0.019	-0.006
	(0.016)	(0.017)	(0.018)	(0.022)	(0.024)	(0.020)	(0.022)	(0.023)	(0.025)	(0.027)	(0.016)	(0.019)	(0.017)	(0.019)	(0.023)
LOC (Std)	-0.034***	-0.018***	-0.026***	-0.026***	-0.004	-0.027***	-0.016***	-0.016***	-0.013**	-0.004	-0.032***	-0.019***	-0.012**	-0.019***	-0.003
	(0.007)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)
CM: female	-0.000	0.000	-0.000	-0.001	-0.001	-0.002	0.000	0.000	0.000	0.000	-0.002	-0.000	0.000	0.001	0.001
	(0.001)	(0.000)	(0.000)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.004)	(0.003)	(0.004)	(0.002)	(0.002)
M: age	-0.011	-0.020***	0.000	-0.008	-0.026***	-0.016*	-0.022***	-0.012*	-0.026***	-0.009	0.000	-0.004	-0.033***	-0.021**	-0.009
	(0.010)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.007)	(0.007)	(0.008)	(0.008)	(0.010)	(0.008)	(0.009)	(0.008)	(0.009)
M: white	0.003*	0.001	-0.002	-0.000	-0.001	0.000	-0.001	-0.001	-0.000	0.000	-0.000	-0.001	-0.000	-0.000	-0.001
	(0.002)	(0.001)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
M: reading	0.003	0.000	-0.000	-0.000	-0.000	0.001	-0.000	-0.000	-0.000	-0.000	0.002	-0.002	0.001	0.001	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
M: understanding	-0.006**	-0.005*	-0.004	0.001	-0.007**	-0.004	-0.001	-0.003	-0.001	-0.007**	0.000	-0.001	-0.005	-0.001	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
M: maths	-0.001	0.001	0.000	-0.000	0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.001	-0.000	0.000	-0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
F: at home	-0.018**	-0.017***	-0.012**	-0.011**	-0.017***	-0.012**	-0.008	-0.011**	-0.007	-0.011**	-0.007	-0.008	-0.012**	-0.009*	0.001
	(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.005)	(0.005)	(0.005)	(0.007)
London	0.001	-0.006*	-0.003	-0.005	-0.004	-0.002	0.002	-0.002	0.003	0.003	0.002	-0.002	-0.003	0.000	0.002
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Observations	4899	4751	4627	4437	4251	4895	4752	4634	4427	4248	4945	4794	4652	4441	4258

Notes: 'CM' stands for cohort member, 'M' for mother, and 'F' for father. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level.

8 Conclusion

In this paper, we study the effect of a generalized maternal belief about returns to investment, specifically maternal Locus of Control (LoC), on child development. We focus on several dimensions of child development and implement a value-added model to study the impact effect of maternal LoC on child development. We study its effect on children's socio-emotional skills, cognitive skills, and academic outcomes.

Our results show that maternal LoC is an important driver of children's socio-emotional skills from age 5 to 14. The effects are similar in all three domains of our socio-emotional skills measure: internalizing, externalizing, and prosocial skills. Yet, there is no important effect on cognitive outcomes. When we examine academic outcomes, we find that there is some positive effect of maternal LoC on English score at age 11, but beyond this impact, there is no other impact on English score, nor on Mathematics score at any point of measurement. In terms of unauthorized absences, we find that maternal LoC has negative and significant impact across almost all ages which is consistent with the positive effect of maternal LoC on socio-emotional skills.

We, study one of the possible mechanisms through which maternal LoC might affect child development: parental investment. Our results show that maternal LoC positively affects parental investments in children until the age of 14 yet the domain of these investments vary by the age of the child. For example, while maternal LoC is important for educational investment at ages 5 and 11, it affects recreational investment at age 7, and parental discipline at age 11. Additionally, we provide evidence that differences in maternal LoC by socio-economic status can explain part of the SES differences in socio-emotional skill development by implementing the Kitagawa-Oaxaca-Blinder decomposition method.

To weaken the connection between maternal LoC and parental investments, interventions that inform about the significance and cost-effectiveness of such investments for child development hold promise (Carneiro et al., 2024; Edwards et al., 2007; Hutchings et al., 2007). This strategy would seek to diminish the impact of maternal LoC on child development, ensuring that variations in maternal LoC do not perpetuate inequality in children's skill development.

Our research provides evidence that a single parental generalized belief regarding returns on investment significantly shapes long-term child development. Further exploration is needed to comprehend how various parental generalized beliefs, such as growth mindset, and domain-specific beliefs, such as beliefs about own children's capabilities, influence child skills across different developmental stages, to understand the enduring effects of parental beliefs on life outcomes, such as university participation and labor market success. This paper advances the research field by examining the prolonged influence of maternal LoC on children's socio-emotional skills, which crucially contribute to shaping individuals' educational and labor market outcomes (Kosse and

Tincani, 2020; Woessmann, 2024).

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Online Appendix

Appendix A: Theoretical Model

Following Cunha et al. (2013) and Bhalotra et al. (2024) we develop a simple framework to show the relationship between maternal locus of control and parental investments. In our model, mothers have a fixed time endowment y_{it} at time t which is equal to the time they are awake in a day. We assume sleep time is exogenous to maternal beliefs and parental investments. Mothers divide their awake time into leisure time L_{it} and parental investment P_{it}. For simplicity, we assume that mothers' utility is additively separable and depends on leisure time L_{it} and parental investment P_{it}. While mothers do not directly drive utility from investment, they derive it through their children's skills denoted as S_{it}. As maternal investments are costly, they derive disutility from investing, $c(P_{it})$. Additionally, we have maternal beliefs that enter into the mothers' utility function. For beliefs, we use locus of control, denoted by I_i. Individuals with higher I_i are more likely to believe that they can change the outcomes of the events with their actions and $I_i \in [0, 1]$ where $I_i = 0$ indicates someone who has low LoC and $I_i = 1$ someone who has high LoC. LoC is fixed in the time considered as it is stable in adulthood (Cobb-Clark, 2015). Mother maximize their utility function by choosing P_{it}, which is given as follows:

$$U_{it}(S_{it}, P_{it}) = \alpha \ln(L_{it}) + \gamma S_{it} - \theta c(P_{it}) + \epsilon_{it} \tag{8}$$

$$\text{s.t } L_{it} + k_i P_{it} = y_{it}$$

where α is the utility value of log consumption, γ is the utility value of child skills, $c(P_{it})$ is the cost of maternal investments, k_i is the psychological (or time) cost of maternal investment and ϵ_{it} is unknown to the econometrician. We assume that k is lower for those with higher internal locus of control, as they will believe that there will be higher returns to their investment, so $\frac{\partial k_i}{\partial P_{it}} < 0$. Further, maternal investments at time t depend on maternal investments at time $t-1$, child skills at time $t-1$ as the feedback of investments in the form of skills development might impact maternal investments in the next period, and finally on locus of control.

$$P_{it} = P_{it}(S_{it-1}, P_{it-1}, I_i) \tag{9}$$

Children's skills at time t depends on the skills at time $t-1$ and maternal investments.

$$S_{it} = S_{it}(S_{it-1}, P_{it}) \tag{10}$$

Plugging these in, the mothers' maximization problem becomes:

$$U_{it}(S_{it}, P_{it}) = \alpha \ln(y_{it} - k_i P_{it}) + \gamma S_{it}(S_{it-1}, P_{it}) - \theta c(P_{it}(S_{it-1}, P_{it-1}, L_i)) + \epsilon_{it} \tag{11}$$

Based on existing evidence that parental investments improves child skills (e.g., Del Bono et al., 2016), we have $\frac{\partial S_{it}}{\partial P} > 0$. Further, we have $\frac{\partial P_{it}}{\partial I} > 0$ as the literature shows that the higher the maternal internal locus of control, the higher the maternal investment in children (Lekfuangfu et al., 2018). We further propose that for mothers that have a higher locus of control, they the psychological (or perceived monetary) cost of investing in their children is lower because they believe that the returns to these investments are higher, hence the cost-benefit ratio is lower. Using this argument, we propose $\frac{\partial c(P_{it})}{\partial I_i} < 0$.

Then, the first order condition equation 11 where the mothers' choose how much to invest in their children becomes:

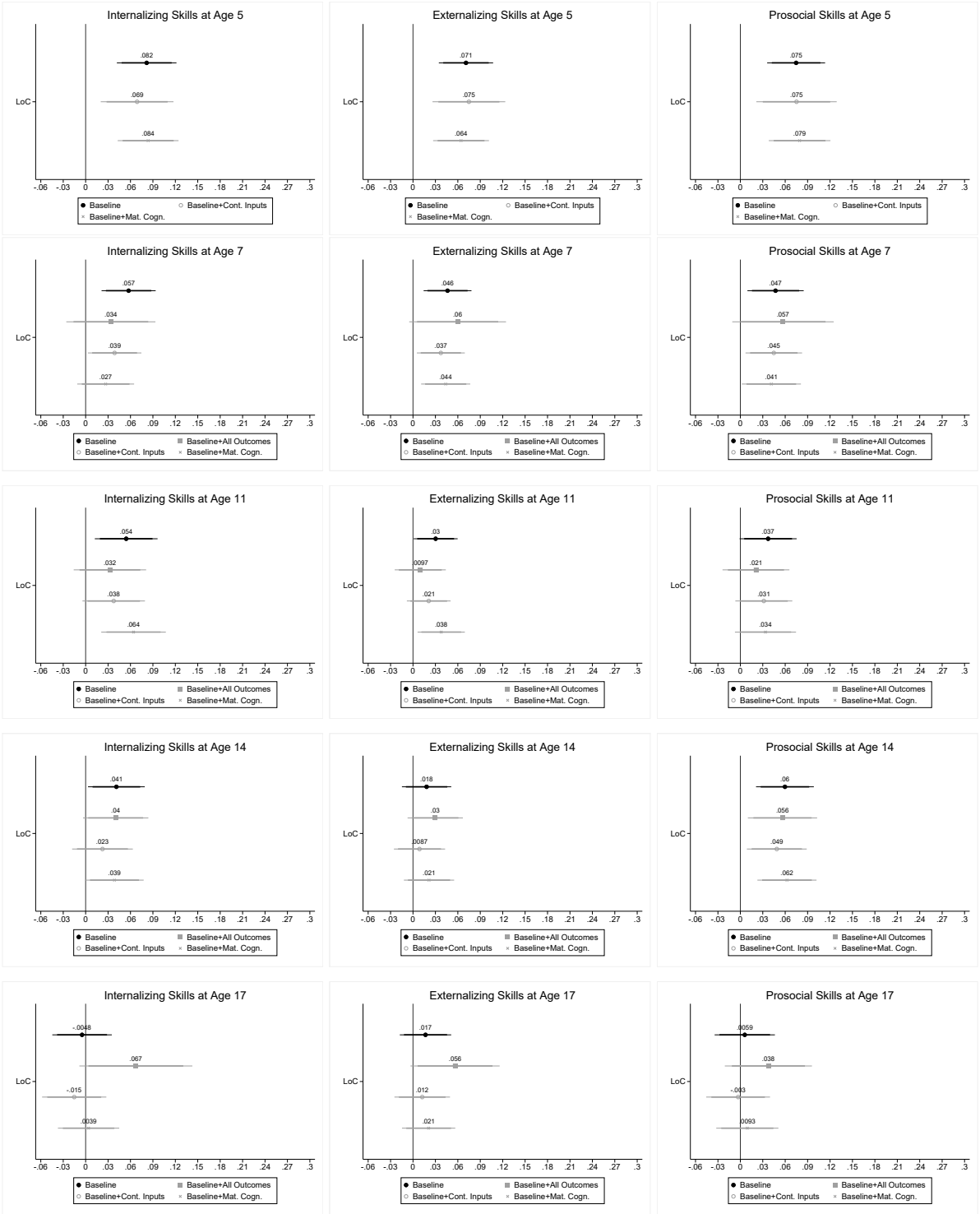
$$\frac{\partial U_{it}}{\partial P_{it}} = \alpha \frac{-k_i}{y_{it} - k_i P_{it}} + \gamma \frac{\partial S_{it}}{\partial P_{it}} - \theta \frac{\partial c_{it}}{\partial P_{it}} \tag{12}$$

The first item and third terms are negative, while the second term is positive. This implies that a mother will invest in their children as long as $\gamma \frac{\partial S_{it}}{\partial P_{it}} - \theta \frac{\partial c_{it}}{\partial P_{it}} > \alpha \frac{k_i}{y_{it} - k_i P_{it}}$.

Now, let's assume there are two mothers, M and N where $I_m > I_n$. Given that these mothers have different level of LoC, all three elements of equation 12 will differ. We know that the first and last element of the equation 12 will be lower in absolute terms (less negative) while the second element will be higher for M than N. Given these comparisons, we can conclude that the marginal returns to investing in children for mother M will be higher than that of mother N, i.e. $\frac{\partial U_{Mt}}{\partial P_{Mt}} > \frac{\partial U_{Nt}}{\partial P_{Nt}}$. This higher marginal utility (and overall utility) will lead to more parental investments by mother M than mother N, and the child of mother M will accumulate higher levels of skills than the child of mother N, all else being equal, as long as there are positive returns to parental investment, which is, again, more likely to be the case for mother M than it is for mother N. This conclusion is not unfeasible as it basically combines the findings of the literature that finds that the higher the internal locus of control of mother, the higher the investments in children (Lekfuangfu et al., 2018) and that higher levels of parental investments lead to higher levels of skills accumulation (Del Bono et al., 2016).

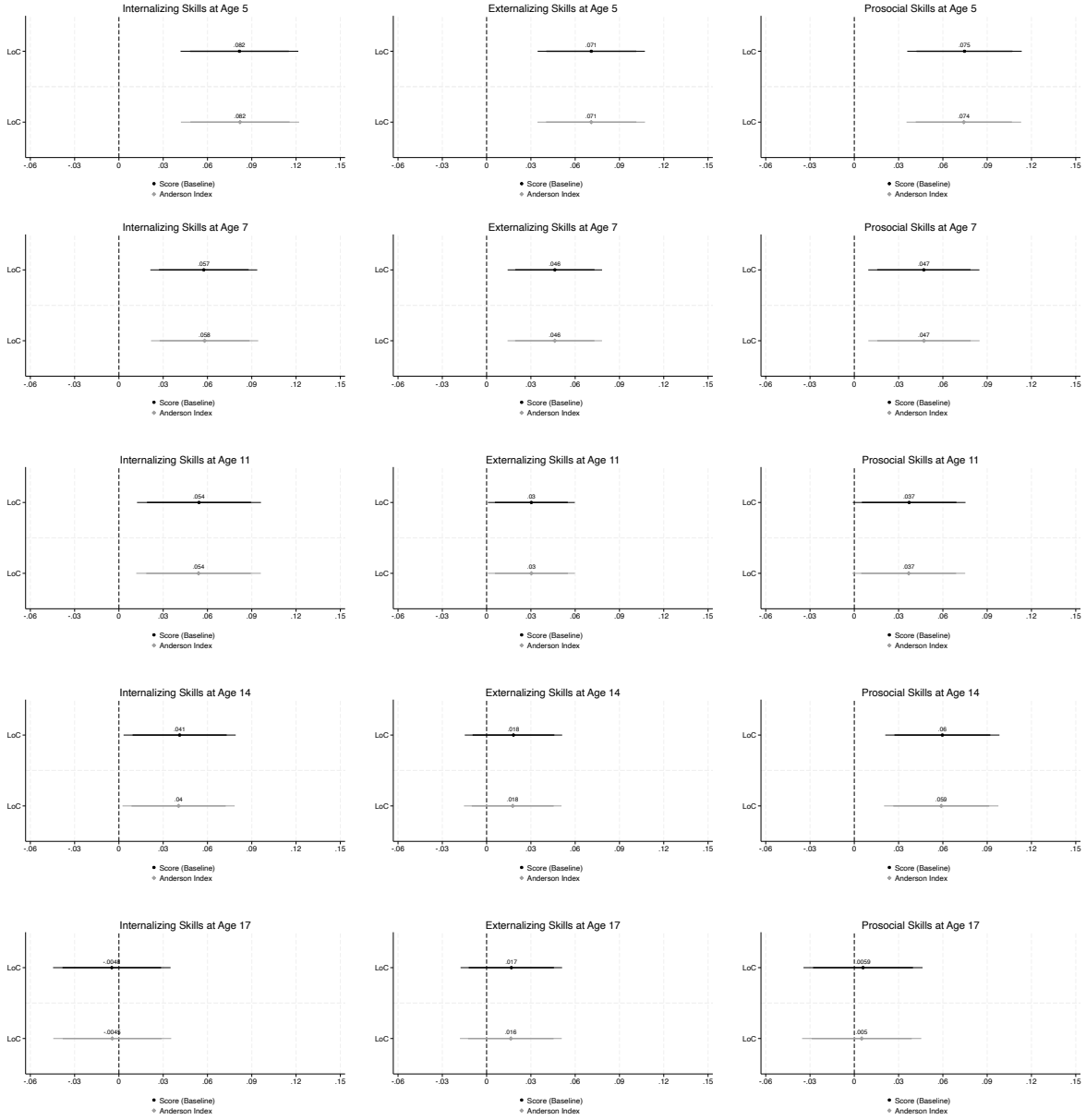
Appendix B: Additional Tables and Figures

Figure B1: Socio-Emotional Skills
Robustness Checks: Different Specifications



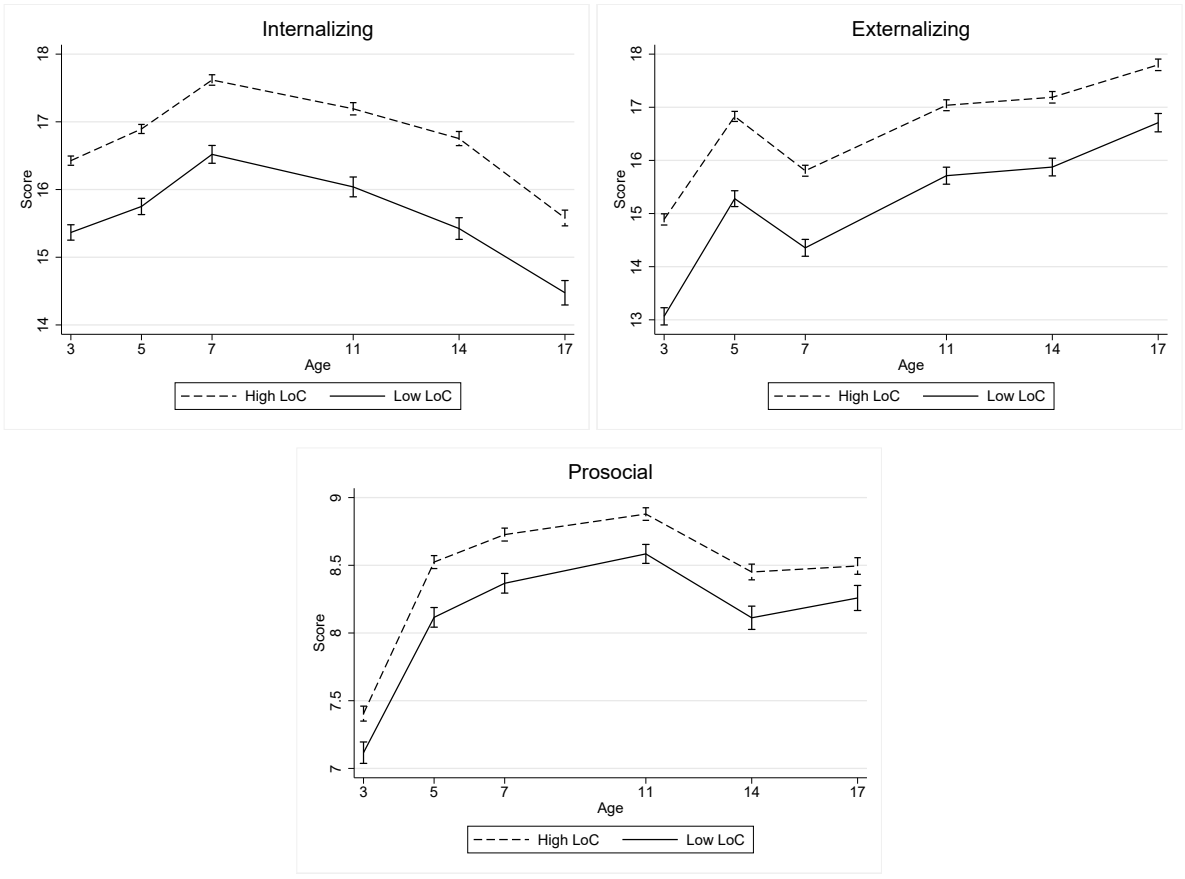
Notes: 90% and 95% confidence intervals. The 'Baseline' specification is the one shown in Equation 7. The other point estimates of LoC are derived from the baseline specification additionally controlling: for all past outcomes ('Baseline+All Outcomes'), for contemporaneous inputs ('Baseline+Cont. Inputs'), and for a more accurate measure of maternal cognitive skills ('Baseline+Mat. Cogn.'), respectively.

Figure B2: Socio-Emotional Skills
Robustness Checks: Different LoC Indexes



Notes: 90% and 95% confidence intervals. The specification used is the 'Baseline' specification as shown in Equation 7. However, the LoC index is derived in different ways: 'Score (Baseline)' is the average value of the three questions on LoC and it is the main variable used in the analyses, 'Anderson Index' is the LoC index derived using the method proposed in Anderson (2008), and 'Latent Factor' is the index derived from a latent factor model used to extrapolate the underlying LoC from the three relevant questions.

Figure B3: Socio-Emotional Skills Trajectories by Age



Notes: Trajectories of nominal scores of the Strengths and Difficulties Questionnaire across ages 3, 5, 7, 11, 14 and 17.

Table B1: LoC unknown vs LoC known

Variable	Unknown Mean/SD	Known Mean/SD	Total Mean/SD	P-value (1)-(2)
M Age	27.982	28.871	28.834	0.005***
	(5.563)	(5.632)	(5.632)	
M Marital: Seperated	0.059	0.030	0.031	0.002***
	(0.236)	(0.169)	(0.173)	
M Marital: Married	0.772	0.574	0.582	0.000***
	(0.420)	(0.494)	(0.493)	
M Marital: Remarried	0.024	0.044	0.043	0.072*
	(0.152)	(0.205)	(0.203)	
M Marital: Single	0.133	0.305	0.298	0.000***
	(0.340)	(0.461)	(0.457)	
M Marital: Divorced	0.006	0.046	0.044	0.000***
	(0.077)	(0.208)	(0.205)	
M Marital: Widowed	0.006	0.002	0.002	0.054*
	(0.077)	(0.039)	(0.041)	
M Health: Excellent	0.231	0.293	0.290	0.014**
	(0.422)	(0.455)	(0.454)	
M Health: Good	0.574	0.528	0.530	0.101
	(0.495)	(0.499)	(0.499)	
M Health: Fair	0.163	0.150	0.150	0.506
	(0.370)	(0.357)	(0.357)	
M Health: Poor	0.033	0.029	0.029	0.704
	(0.178)	(0.168)	(0.168)	
M Qualification: None	0.598	0.163	0.181	0.000***
	(0.491)	(0.370)	(0.385)	
M Qualification: Other	0.175	0.030	0.036	0.000***
	(0.380)	(0.170)	(0.185)	
M Qualification: GCSE	0.130	0.456	0.443	0.000***
	(0.337)	(0.498)	(0.497)	
M Qualification: A-Level	0.038	0.089	0.087	0.001***
	(0.193)	(0.285)	(0.282)	
M Qualification: Diploma	0.012	0.090	0.087	0.000***
	(0.108)	(0.286)	(0.282)	
M Qualification: Degree	0.047	0.172	0.167	0.000***
	(0.213)	(0.377)	(0.373)	
M Ethnicity: White	0.175	0.783	0.759	0.000***
	(0.380)	(0.412)	(0.428)	
M Ethnicity: Black	0.118	0.051	0.054	0.000***
	(0.323)	(0.220)	(0.225)	
M Ethnicity: Asian	0.639	0.141	0.162	0.000***
	(0.481)	(0.348)	(0.368)	
M Ethnicity: White	0.068	0.024	0.026	0.000***
	(0.252)	(0.154)	(0.160)	
M SES: High Mangerial	0.003	0.050	0.048	0.000***
	(0.054)	(0.217)	(0.213)	
M SES: Low Managerial	0.015	0.156	0.150	0.000***
	(0.121)	(0.362)	(0.357)	
M SES: Intermediate	0.018	0.102	0.099	0.000***
	(0.132)	(0.303)	(0.298)	
M SES: Small Employer	0.015	0.025	0.024	0.241
	(0.121)	(0.156)	(0.154)	
M SES: Low Sup/Technic	0.003	0.024	0.023	0.012**
	(0.054)	(0.153)	(0.150)	
M SES: Semi Routine	0.038	0.086	0.084	0.002***
	(0.193)	(0.281)	(0.278)	
M SES: Routine	0.027	0.039	0.039	0.240
	(0.161)	(0.194)	(0.193)	
N	338	7932	8270	
F-test of joint significance (F-stat)				50.243***
F-test, number of observations				8270

Notes: Maternal characteristics (mean and standard deviations) among the subsample for which LoC is unknown, LoC is known, and for the entire sample of mothers. The last column reports the p-value of the difference in mean of each characteristic between the subsamples of mothers with unknown and known LoC.

Table B2: Identifying Variation in LoC

	Mean	SD	Min	Max
Maternal LoC	1.691	0.487	0.000	2.000
net of maternal characteristics	-0.000	0.424	-1.842	1.187
net of household characteristics	0.000	0.420	-1.872	1.223
net of child characteristics	0.000	0.419	-1.881	1.241
N	7,932			

Notes: The first row summarizes our measure of maternal Locus of Control (LoC). Rows 2-4 summarize the residuals obtained by regressing the LoC on: maternal characteristics; plus household characteristics; plus child characteristics, respectively.

Table B3: Correlation of Maternal Locus of Control with Demographic Characteristics

	Internal Locus of Control							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CM Female	0.011							0.009
	(0.022)							(0.021)
Mother's Ethnicity								
Black			-0.421***					-0.362***
			(0.055)					(0.052)
Asian			-0.447***					-0.292***
			(0.036)					(0.037)
Other-Mixed			-0.276***					-0.193**
			(0.082)					(0.078)
Mother's Socio-Economic Status								
Lo manag/prof					-0.072**			-0.015
					(0.032)			(0.033)
Intermediate					-0.278***			-0.116***
					(0.041)			(0.044)
Small emp and s-emp					-0.147**			-0.013
					(0.060)			(0.061)
Low sup and tech					-0.311***			-0.110
					(0.069)			(0.070)
Semi routine					-0.423***			-0.199***
					(0.046)			(0.049)
Routine					-0.546***			-0.305***
					(0.064)			(0.065)
Mother's Education								
GCSE or Other							0.406***	0.267***
							(0.036)	(0.037)
A Level							0.664***	0.461***
							(0.039)	(0.041)
University							0.793***	0.538***
							(0.037)	(0.041)
Observations	7951	7951	7951	7951	7951	7951	7951	7951
R^2	0.000	0.030	0.031	0.049	0.055	0.024	0.063	0.097

Notes: Base level for ethnicity is White, for SES is SES Category 1, for education is None. SES levels are as follows: 1: High Managerial/Professional, 2: Low Managerial/Professional, 3: Intermediate, 4: Small Employer, 5: Low Supervision/ Technical, 6: Semi-Routine, 7: Routine, 8: NA.

Table B4: Decomposition Analysis: Using Grandparents Education To Define Maternal SES

	Internal					External					Prosocial				
	(1) Age 5	(2) Age 7	(3) Age 11	(4) Age 14	(5) Age 17	(6) Age 5	(7) Age 7	(8) Age 11	(9) Age 14	(10) Age 17	(11) Age 5	(12) Age 7	(13) Age 11	(14) Age 14	(15) Age 17
overall															
Low_SES	7.663***	7.187***	6.892***	5.455***	6.478***	5.677***	4.705***	5.149***	5.610***	5.415***	0.008	0.044*	0.039*	0.049**	0.021
	(0.021)	(0.020)	(0.023)	(0.024)	(0.025)	(0.023)	(0.023)	(0.022)	(0.023)	(0.024)	(0.024)	(0.023)	(0.023)	(0.024)	(0.025)
High_SES	7.781***	7.251***	6.965***	5.560***	6.570***	5.814***	4.835***	5.271***	5.732***	5.527***	0.033	0.035	0.083***	0.074**	0.020
	(0.026)	(0.028)	(0.032)	(0.032)	(0.035)	(0.029)	(0.029)	(0.030)	(0.031)	(0.032)	(0.032)	(0.032)	(0.030)	(0.033)	(0.035)
Difference	-0.118***	-0.064*	-0.073*	-0.105***	-0.092**	-0.137***	-0.130***	-0.122***	-0.122***	-0.112***	-0.024	0.009	-0.044	-0.025	0.000
	(0.034)	(0.035)	(0.039)	(0.040)	(0.043)	(0.037)	(0.037)	(0.037)	(0.038)	(0.041)	(0.040)	(0.039)	(0.038)	(0.040)	(0.043)
Explained	-0.099***	-0.097***	-0.063***	-0.039	-0.089***	-0.112***	-0.111***	-0.100***	-0.082***	-0.114***	-0.000	-0.016	-0.013	-0.028	-0.006
	(0.016)	(0.019)	(0.021)	(0.025)	(0.029)	(0.022)	(0.027)	(0.027)	(0.028)	(0.029)	(0.016)	(0.021)	(0.020)	(0.022)	(0.026)
Unexplained	-0.019	0.033	-0.010	-0.066**	-0.003	-0.024	-0.018	-0.022	-0.040	0.002	-0.024	0.025	-0.031	0.003	0.006
	(0.030)	(0.029)	(0.034)	(0.032)	(0.033)	(0.031)	(0.026)	(0.026)	(0.028)	(0.030)	(0.037)	(0.034)	(0.033)	(0.035)	(0.036)
explained															
Lagged	-0.071***	-0.077***	-0.043**	-0.023	-0.065**	-0.093***	-0.104***	-0.090***	-0.076***	-0.104***	0.007	-0.017	-0.003	-0.018	-0.005
	(0.013)	(0.018)	(0.020)	(0.024)	(0.027)	(0.020)	(0.025)	(0.025)	(0.027)	(0.028)	(0.013)	(0.019)	(0.018)	(0.021)	(0.025)
LOC (Std)	-0.013***	-0.006**	-0.010**	-0.009**	-0.005*	-0.009***	-0.006**	-0.004*	-0.004	-0.004	-0.011**	-0.004*	0.002	-0.009**	-0.000
	(0.005)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)
CM: female	-0.000	0.001	-0.001	-0.004	-0.002	0.002	0.003	0.002	0.002	0.001	0.004	0.003	0.003	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)	(0.005)	(0.003)	(0.004)	(0.002)	(0.003)
M: age	-0.007**	-0.004*	-0.003	0.001	-0.003	-0.003	-0.005**	-0.001	-0.004*	-0.002	0.002	-0.002	-0.007**	-0.001	-0.001
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
M: white	0.001	0.001	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	0.000	-0.001	-0.000	0.000	0.000	-0.000
	(0.001)	(0.001)	(0.002)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
M: reading	0.001	0.000	0.000	-0.000	-0.000	0.001	0.000	0.000	-0.000	-0.000	0.001	-0.000	-0.001	0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)	(0.002)	(0.001)	(0.000)
M: understanding	-0.002	-0.000	0.000	0.001	-0.000	-0.001	-0.000	-0.000	0.000	-0.001	-0.000	0.001	-0.000	0.000	-0.001
	(0.003)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
M: maths	-0.002	-0.000	0.003	0.001	-0.001	-0.001	0.001	0.001	0.000	-0.000	0.001	0.004	-0.000	0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
F: at home	-0.004	-0.006**	-0.006*	-0.006*	-0.005*	-0.006**	0.001	-0.006**	-0.003	-0.003	-0.003	-0.001	-0.007**	-0.004	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)
London	-0.001	-0.005	-0.002	-0.001	-0.007**	-0.002	0.000	-0.002	0.003	-0.001	0.001	-0.001	-0.001	0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	3137	3056	3007	2920	2663	3137	3056	3007	2920	2663	3137	3056	3007	2920	2663

Notes: This table replicates the decomposition analysis shown in Table ??. In this table, however, maternal SES is defined by the education of the parents of the mother, instead of maternal education. More specifically, a mother is defined to be of a high socio-economic status if one of her parents, who are the grandparents of the cohort member, had a university degree. Note that given the high level of missing information on grandparents education, we imputed the likelihood of having a degree qualification for those with missing information. 'CM' stands for cohort member, 'M' for mother, and 'F' for father. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level.

Table B5: Socio-Emotional Skills - Cumulative VA Model

	Internal				External				Prosocial			
	(1) Age 7	(2) Age 11	(3) Age 14	(4) Age 17	(5) Age 7	(6) Age 11	(7) Age 14	(8) Age 17	(9) Age 7	(10) Age 11	(11) Age 14	(12) Age 17
LOC (Std)	0.039**	0.038*	0.023	-0.015	0.037**	0.021	0.009	0.012	0.045**	0.031	0.049**	-0.003
	(0.018)	(0.021)	(0.021)	(0.022)	(0.016)	(0.015)	(0.017)	(0.019)	(0.019)	(0.019)	(0.020)	(0.022)
Age 3	0.174***	0.077***	0.009	-0.030	0.186***	0.027	-0.001	-0.014	0.130***	0.035**	0.023	0.008
	(0.021)	(0.022)	(0.021)	(0.020)	(0.016)	(0.016)	(0.016)	(0.018)	(0.016)	(0.017)	(0.016)	(0.018)
Age 5	0.436***	0.173***	0.058***	0.063***	0.554***	0.208***	0.081***	0.040*	0.443***	0.156***	0.049**	0.043**
	(0.021)	(0.026)	(0.022)	(0.023)	(0.018)	(0.020)	(0.021)	(0.024)	(0.019)	(0.019)	(0.020)	(0.021)
Age 7		0.426***	0.150***	0.074***		0.515***	0.120***	0.032		0.363***	0.225***	0.064***
		(0.026)	(0.023)	(0.023)		(0.019)	(0.022)	(0.024)		(0.020)	(0.021)	(0.022)
Age 11			0.486***	0.137***			0.581***	0.183***			0.403***	0.198***
			(0.022)	(0.024)			(0.021)	(0.026)			(0.021)	(0.025)
Age 14				0.479***				0.528***				0.414***
				(0.023)				(0.022)				(0.025)
Observations	4554	4247	3805	3233	4554	4247	3805	3233	4554	4247	3805	3233

Notes: All the regressions control for maternal characteristics: marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Robust standard errors are shown in parenthesis.

Table B6: Socio-Emotional Skills - Nominal Scores

	SDQ - Internal (Std)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Age 3	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.260***	0.207***	0.081	0.119*	0.119*	-0.083
	(0.053)	(0.050)	(0.050)	(0.065)	(0.063)	(0.061)
Lagged		0.425***	0.569***	0.616***	0.620***	0.645***
		(0.020)	(0.022)	(0.021)	(0.018)	(0.016)
Observations	5268	4899	4751	4627	4437	4251

	SDQ - External (Std)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Age 3	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.502***	0.211***	0.133**	0.101*	0.036	0.023
	(0.082)	(0.063)	(0.056)	(0.053)	(0.058)	(0.054)
Lagged		0.494***	0.712***	0.662***	0.686***	0.655***
		(0.014)	(0.014)	(0.013)	(0.015)	(0.014)
Observations	5263	4895	4752	4634	4427	4248

	SDQ - Prosocial (Std)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Age 3	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.096**	0.142***	0.090***	0.050*	0.074**	-0.001
	(0.039)	(0.031)	(0.030)	(0.029)	(0.035)	(0.035)
Lagged		0.355***	0.507***	0.447***	0.616***	0.570***
		(0.013)	(0.016)	(0.016)	(0.021)	(0.017)
Observations	5289	4945	4794	4652	4441	4258

Notes: All the regressions control for maternal characteristics: marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Robust standard errors are shown in parenthesis.

Table B7: Total impact of LoC on Socio-Emotional Skills

	SDQ - int (Std)				
	(1)	(2)	(3)	(4)	(5)
	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.122***	0.115***	0.102***	0.099***	0.047*
	(0.023)	(0.022)	(0.024)	(0.023)	(0.027)
Observations	4972	4874	4848	4575	4245

	SDQ - ext (Std)				
	(1)	(2)	(3)	(4)	(5)
	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.125***	0.123***	0.124***	0.107***	0.058**
	(0.023)	(0.021)	(0.021)	(0.023)	(0.025)
Observations	4972	4874	4848	4575	4245

	SDQ - pro (Std)				
	(1)	(2)	(3)	(4)	(5)
	Age 5	Age 7	Age 11	Age 14	Age 17
LOC (Std)	0.085***	0.091***	0.073***	0.088***	0.037
	(0.021)	(0.022)	(0.021)	(0.022)	(0.024)
Observations	4972	4874	4849	4575	4245

Notes: All the regressions control for maternal characteristics: marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery; household characteristics: natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence; and child characteristics: sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours. * denotes significance at 10% level, ** denotes significance at 5% level and *** denotes significance at 1% level. Robust standard errors are shown in parenthesis.

Table B8: Total impact of LoC on Socio-Emotional Skills: Oster Bounds

	(1) LoC when δ=1	(2) LoC when δ=-1	(3) δ when LoC=0
Internal 5yo	0.045	0.195	1.431
Internal 7yo	0.043	0.187	1.447
Internal 11yo	0.033	0.174	1.368
Internal 14yo	0.018	0.184	1.186
Internal 17yo	-0.015	0.105	0.782
External 5yo	0.043	0.205	1.396
External 7yo	0.052	0.188	1.541
External 11yo	0.052	0.189	1.530
External 14yo	0.031	0.178	1.325
External 17yo	-0.007	0.118	0.900
Prosocial 5yo	0.069	0.098	3.013
Prosocial 7yo	0.076	0.104	3.143
Prosocial 11yo	0.055	0.087	2.734
Prosocial 14yo	0.063	0.108	2.338
Prosocial 17yo	0.012	0.058	1.388

Notes: Covariates included are: maternal characteristics (marital status, mental health, physical health, level of education, age, age-squared, ethnicity, socio-economic status, whether the interview is conducted in English, reading skills, mathematical skills, whether received fertility treatment, whether had any illness during pregnancy, whether labor induced, and the type of delivery), household characteristics (natural father resident/in contact, number of siblings, number of people in the HH, parental combined labor market status, standardized OECD income score, language spoken at home, and region of residence), and child characteristics (sex, year and month of birth, birth weight, whether preterm, main childcare, childcare start time, and childcare hours).

Appendix C: Variables

Table C1: Control Variables

Control Variables
Maternal Characteristics
Marital Status
Physical Health
Mental Health (Rutter Malaise Scale)
Level of Education Acquired
Age
Age-squared
Ethnicity
Socio-Economic Classification
Whether the interview is conducted in English
Reading Skills
Mathematical Skills
Whether Received Fertility Treatment
Whether Had any Illness During Pregnancy
Whether Labor was Induced
Type of Birth Delivery
Household Characteristics
Natural Father Resident/In Contact
Number of Siblings
Number of People in the Household
Parental Labor Market Status Combined
Equalized OECD Income Score
Language Spoken at Home
Region of Residence
Cohort Member Characteristics
Sex
Year and Month of Birth
Birth Weight
Whether Preterm
Main Childcare
Childcare Start Date
Childcare Hours

Table C2: Cognitive Skills Scales by Age

		Crystallized Ability	Visual Processing	Quantitative Knowledge
Age 3	BAS II Naming Vocabulary	x		
	Bracken School Readiness Assessment-Revised	x	x	x
Age 5	BAS II Naming Vocabulary	x		
	BAS II Pattern Construction		x	
	BAS II Picture Similarities			
Age 7	BAS II Word Reading	x		
	BAS II Pattern Construction		x	
	NFER Progress in Maths (adapted)			x
Age 11	BAS II Verbal Similarities	x		
Age 14	APU Vocabulary Test	x		
Age 17	Number Analogies			

Notes: Further information on each of these tests is contained in Moulton et al. (2020). The grouping of tests under the three categories (crystallised, visual and quantitative abilities) is based on the work reported here: https://closer.ac.uk/cross-study-data-guides/cognitive-measures-guide/mcs-cognition/.

Table C3: Content of Age 9 Months Indexes

Parental Beliefs Index
Picked up the baby whenever they cried
baby has regular sleeping and eating times
Importance of stimulation for development
importance of talking
Importance of cuddling
Parental Attachment Index
Feelings of annoyance of irritation with the baby
Thinking about the baby when apart from the baby
Feelings when you leave the baby
Feelings when caring for the baby
Feelings of patience when with the baby
Feelings about giving up things because of the baby
Development Index
Smiles
Sits up
Stands up holding on
Holds hands together
Grabs objects
Holds small objects
Passes a toy
Gives toy
Waves bye-bye
Extends their arms for being picked up
Nodes for yes
Moves from place to place

Table C4: Parental Inputs

		Activity Types			
		All	Educational	Recreational	Parental
Age 3	Freq anyone else read to the child	x	x		
	Freq you read to the child	x	x		
	Freq child taken to library	x	x		
	Freq teach child songs/poems/rhymes	x		x	
	Anyone at home help child to learn sport etc	x		x	
	Freq CM paint/draw at home	x		x	
	Freq help child learn alphabet	x		x	
	Freq at home try to teach child counting	x		x	
	Strictness of parenting style				
	Family has lots/not many rules				x
	Rules strictly/not strictly enforced				x
	CM eats at regular times				x
	How important for family to eat meals together				x
	CM has regular bedtimes				x
	Hours a day child watches tv/videos				x
	Parenting Style				x
Age 5	Freq you read to CM	x	x		
	Freq CM receives help with reading	x	x		
	Freq CM helped with writing	x	x		
	Freq CM helped with maths	x	x		
	Anyone has attended parents evening	x	x		
	Freq tells stories to CM	x		x	
	Freq musical activities with CM	x		x	
	Freq CM paint/draw at home	x		x	
	Freq you play physically active games with CM	x		x	
	Freq play INDOOR games with child	x		x	
	Freq take child to park or playground	x		x	
	Strictness of parenting style				
	Regular bedtime on term-time weekdays				x
	CM eats at regular times				x
	Hours per term-time weekday watching tv/dvd				x
	Hours per term-time weekday playing on computer				x
Age 7	Freq CM receives help with reading?	x	x		
	Freq CM helped with writing	x	x		
	Freq CM helped with maths	x	x		
	Freq tells stories to CM	x		x	
	Freq musical activities with CM	x		x	
	Freq CM paint/draw at home	x		x	
	Freq you play physically active games with CM	x		x	
	Freq play indoor games with child	x		x	
	Freq take child to park or playground	x		x	
	Freq you read to CM	x		x	
	Strictness of parenting style				
	Regular bedtime on term-time weekdays				x
	Rules about hours watching TV				x
	Rules about timed watching TV				x
	Hours per term-time weekday playing on computer				x
Age 11	Freq talks to CM about things inportant to them	x	x		
	Freq anyone at home help with CM's homework	x	x		
	Freq anyone at home make sure CM s HW is complete	x	x		
	Anyone has attended parent evening at CM school	x	x		
	Freq you play physically active games with CM	x		x	
	Freq play INDOOR games with child	x		x	
	Strictness of parenting style				
	Have rules about when CM can watch?				x
	Have rules about what CM can watch?				x
	Regular bedtime on term-time weekdays				x
	Hours per weekday spent watching TV/ videos on computer				x
	Hours per weekday spent on computer or games				x
Age 14	Amount of time spent with CM	x			
	Freq talks with CM	x			

Table C5: Negative Home Environment

Age 3
Noise from tv/radio
Background conversation
Anyone entering/leaving home
Interruptions by another child
Interruptions by another adult
Age 5 to 17
Background noise from conversation
Background noise from other children
Background noise from people entering/leaving room
Background noise from people entering/leaving house
Interruption of cognitive assessment from another child
Interruption of cognitive assessment by an adult