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THE PERSISTENCE OF SOCIO-EMOTIONAL SKILLS: LIFE CYCLE AND INTERGENERATIONAL EVIDENCE

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ABSTRACT

This paper investigates the evolution of socio-emotional skills over the life cycle and across generations. We start by characterising the evolution of these skills in the first part of the life cycle. We then examine whether parents' socio-emotional skills in early childhood rather than in adolescence are more predictive of their children's socio-emotional skills. We exploit data from the 1970 British Cohort Study (BCS70) and focus on two dimensions of socio-emotional skills: internalizing and externalizing skills, linked respectively to the ability of focusing attention and engaging in interpersonal activities. When looking at the evolution of socio-emotional skills over the life cycle, we notice a considerable amount of persistence which leads to a rejection of the simple Markov dynamic models often used in the literature. The BCS70 contains data on the skills of three generations. Moreover, the skills for cohort members and their children are not observed at the same calendar time, but at similar ages. We establish that parents' and children's socio-emotional skills during early childhood are comparable and estimate intergenerational mobility in socio-emotional skills, examining the link between the parent's socio-emotional skills at age 5, 10 and 16 and the child's socio-emotional skills between ages 3 and 16. We show that the magnitudes of intergenerational persistence estimates are smaller than the magnitude of intergenerational persistence estimates in occupation and income found for the United Kingdom. Finally, we estimate multi-generational persistence in socio-emotional skills and find that the grandmother's internalizing skill correlates with the grandchild's socio-emotional skills even after controlling for parental skills.

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1 Introduction

It is now widely accepted that human development has many dimensions and that different types of skills are important determinants of many life course outcomes, ranging from economic variables, such as labour market earnings and criminal activities, to subjective well-being and health (Almlund et al., 2011). These different skills include cognitive abilities and socio-emotional skills; the former are brain-based skills that are important to complete simple and complex tasks and are related to learning, paying attention and solving problems rather than with any actual knowledge, while the latter refer to psychological and preference parameters, such as social and emotional skills, locus of control and self-esteem, personality traits (e.g. conscientiousness), risk aversion and time preferences.

It is well established that parental skill endowments and investment play an important role in determining their children's skills, especially in the early years of life, due to the brain's rapid development and malleability (Cunha and Heckman, 2007) and the fact that parents are typically the main source of interaction for very young children. It is therefore likely that different types of skills are transmitted across generations and that this transmission plays an important (although not exclusive) role in the intergenerational transmission of inequality. The economic literature has examined extensively the intergenerational transmission of income and education. The evidence on the intergenerational transmission of socio-emotional skills is nevertheless still scarce despite the fact that these skills are now accepted to be important in determining different dimensions of well-being.[1]

In this paper, we study different aspects of the evolution of socio-emotional skills over the life cycle and across generations. We do so by exploiting some of the unique longitudinal dimensions of the 1970 British Cohort Study (BCS70). In addition to information about the main subjects of the study, who are followed from birth onwards, the BCS70 also contains information about their parents and about offspring they had by age 34.

First, to study the dynamics of socio-emotional skills over the life cycle and across generations, we need to define what they are and how they are measured. We use factor analysis to extract two dimensions of socio-emotional skills, which we label 'internalizing' and 'externalizing'. As the previous literature points out, the first measure captures children's ability to focus their drive and determination, while the second one captures their ability to relate to others. Since we analyse socio-emotional skills measured at different ages and for different generations, we pay attention to the comparability of these measures.

We then present three contributions to the understanding of the evolution of socio-emotional

[1] An excellent review paper on intergenerational mobility is Black and Devereux (2011). Some prominent studies on mobility are, for example, Chetty et al. (2014), who have mapped the geography of intergenerational mobility in the United States. Card et al. (2018) have studied the intergenerational transmission of human capital for children born in the 1920s and educated during an era of expanding but unequally distributed public school resources in the United States. Alesina et al. (2019) have mapped the intergenerational mobility in educational attainment in Africa. Guell et al. (2015) propose an alternative approach to measure mobility by using cross-sectional data on income and the surname of the individual. There is also a growing interest in intergenerational mobility in other outcomes, such as in wealth (Charles and Hurst, 2003) and health (Halliday et al., 2019).

skills. First, we characterise the dynamic properties of skill development and show that the simple Markov structure often used in the literature, where the level of skills at a certain age are a "sufficient statistic" for the level of subsequent skills, might be missing some important elements of the process. In particular, we show that the dynamic process for these skills may be quite complex and might involve the interactions between different dimensions. We also show the returns that socio-emotional skills have on adult outcomes. Second, we study the intergenerational transmission of skills by investigating to what extent parents' socio-emotional skills, measured when they were aged 5, 10 and 16, are associated with their children's socio-emotional skills between the age of 3 and 16. Our findings show that parental internalizing and externalizing skills during childhood predict their child's internalizing and externalizing skills between the age of 3 and 16.[2] Finally, a unique feature of the data we use is that allows us to estimate the association of grandparents' socio-emotional skills with the socio-emotional skills of their grandchildren. We show that the association of socio-emotional skills might be relevant across more than one generation.

Our study is not the first to look at the correlation of socio-emotional skills in the early years on adult outcomes or at the intergenerational transmission of these skills. Heckman et al. (2013), Nandi and Nicoletti (2014), and Gensowski (2018), for instance, present evidence on the returns to socio-emotional skills. As for the intergenerational transmission of skills, two important contributions to this literature in economics are Anger (2012) and Dohmen et al. (2011). These papers use data from the German Socio-Economic Panel Study (SOEP) to study respectively the transmission of socio-emotional skills and attitudes from parents to children during adolescence and young adulthood. In another contribution, Gronqvist et al. (2016) use Swedish data from military enlistment records to study intergenerational transmission of cognitive and socio-emotional skills. The sample used in the analysis includes only men aged 18. Alana et al. (2017) study the transmission of risk attitudes from mothers to children through elicitation of risk in an incentivized experiment in Turkey. The psychological literature has also studied the intergenerational correlation of socio-emotional skills. Loehlin (2005) reviews several studies[3] and concludes that the correlation in socio-emotional skills tends to be around 0.10 to 0.15 for young adult children but argues that those are likely to be underestimated because of self-reported measures, age, sample. Groves (2005) is another review situating these estimates between 0.14 and 0.29. Some of these studies are based on a small number of observations and lack representativeness. In any event, the estimates reviewed above are higher than the associations we find for age compatible associations in early childhood (see, e.g., Appendix B).

Relative to the existing literature mentioned above on the intergenerational transmission of socio-emotional skills, this paper overcomes two drawbacks of existing analyses by exploiting unique features of the BCS70 data. First, the studies mentioned above, like most if not all of the existing literature, focus on measurements obtained during adolescence and early adulthood. At these development stages, skills and attitudes are likely to have developed and changed for

[2]Aside from other conventional measures for intergenerational mobility, we also use a new metric for mobility across generations which may be of interest on its own: the *spectral gap mobility index*.

[3]An example is Duncan et al. (2005) who uses the data from the National Longitudinal Survey of Youth (NLSY) to study personal traits and behaviours measured during adolescence.

other reasons, such as schooling and peer effects, which can be picked in the correlation, while socio-emotional skills are not fully developed during childhood and may still be quite malleable (Almlund et al., 2011). Adolescents' socio-emotional traits may not bear a strong resemblance to their parents' socio-emotional traits if they have changed for other reasons in such a way that the intergenerational correlation for young adults decreases in size. This hints at a life cycle bias which is similar to the one we encounter when we use data about earnings that do not correspond to life earnings to study mobility.

Second, the main direction of intergenerational transmission is presumably from parents to their children, but it is also possible that children influence their parents' values and socio-emotional skills. Previous studies, like some of those mentioned above, use contemporaneously measured parents and children's socio-emotional skills, which makes it difficult to rule out the possibility that children influence their parents' skills. A high (low) correlation between parents and children's socio-emotional skills and attitudes could, therefore, be found because of a convergence (or divergence) in skills and attitudes during adulthood when the children can also affect parents' personality and attitudes.[4]

We tackle these two concerns by using multiple measures of socio-emotional skills collected in different waves of the BCS70. We observe the BCS70 subjects' socio-emotional skills at the age of 5, 10, and 16 and examine their association with their children's skills between the ages of 3 and 16. First, using multiple observations of socio-emotional skills over the life cycle mitigates the 'lifecyle' bias we allude to above and allows us to investigate whether parents' socio-emotional skills in early childhood rather than in adolescence are more predictive of their child's socio-emotional skills. Second, and relatedly, socio-emotional skills are not contemporaneously measured in the BCS70. Parents' skills are measured during their childhood (at age 5, 10 and 16), while their children's skills are measured 18 years later. Therefore, the main direction of intergenerational transmission is presumably from parents to their children, ruling out the possibility of children influencing their parents' personality.

In addition to linear correlations between the parent and child's socio-emotional skills, we present estimates of intergenerational transmission of socio-emotional skills based on rank regressions and intergenerational transition matrices, as in Chetty et al. (2014). While we are aware of the problems that may arise in rank regressions, we notice that the evidence we obtain from different methodologies is very similar.

We also compare the intergenerational mobility estimates on socio-emotional skills to the ones of the intergenerational persistence in other economic domains. We find a higher mobility in socio-emotional skills than in the intergenerational transmission of occupation (Bell et al., 2018) and income (Gregg et al., 2017; Rohenkohl, 2019) in the United Kingdom.[5] Finally, we contribute to the literature by investigating to what extent the interdependence between the internalizing and

[4] Dohmen et al. (2011) try to tackle reverse causality due to contemporaneous measurements by using religion as an instrumental variable for the child's attitude, but the first stage indicates a weak instrumental variable problem even if one accepts its validity.

[5] Rohenkohl (2019) uses income using data from the BHPS and Understanding Society survey, while Gregg et al. (2017) and Belfield et al. (2017) use data from the National Child Development Study (NCDS) and the British Cohort Study (BCS).

externalizing socio-emotional skills can play a role in the intergenerational skill transmission. We study which one of the two skill dimensions correlates to the other dimension more.

We examine multi-generational transmission of socio-emotional skills from grandmothers to grandchildren. Information on grandmother and grandchildren's socio-emotional skill is rarely found in any dataset. The BSC70 is an exception because the cohort members' mother was asked to complete the Malaise Inventory (Rutter et al., 1970) at the 1975, 1980 and 1986 sweeps.[6]

The rest of the paper is organised as follows. In Section 2, we introduce the 1970 British Cohort Study data used in the analysis. Section 3 presents the derivation of the two dimensions of socio-emotional skill and Section 4 the measures of persistence in the process of human development examined in this paper. In Section 5, we present the estimates about the life cycle dynamics of socio-emotional skills. In Section 6, we present the estimates of the life cycle dynamics and intergenerational mobility in socio-emotional skills. Section 7 investigates multi-generational persistence in socio-emotional skills by examining the correlation between grandmother and grandchild's socio-emotional skill. Section 8 summarizes the results and concludes.

2 Data sources

We make use of a unique longitudinal database, the 1970 British Cohort Study (BCS70), which follows the lives of around 17,000 individuals born in England, Scotland and Wales in a single week of 1970 and is publicly available at the UK Data Service. Cohort members have been contacted nine times, resulting in information at age 5, 10, 16, 26, 30, 34, 38, 42 and 46. We use the age 5, 10, and 16 sweeps to derive socio-emotional measures for the cohort members. The age 34 sweep also provides substantial information on the offspring of the cohort members, including a number of tests aimed at measuring their socio-emotional skills. We concentrate on the sample of cohort members linked to their children and present descriptive statistics on the sample of BCS70 with children in Table C3 in Appendix C.[7]

The BCS70 sample's socio-emotional skills were measured at ages 5, 10 and 16 using the Rutter A and Strengths and Difficulties Questionnaire (SDQ). These tests were also administered during the age 34 sweep to the children of the cohort members aged between 3 and 16. In Table 1, we present the questions from these tests (Rutter et al., 1970; Goodman, 1994).

The Rutter and SDQ are behavioural screening scales, where mothers are asked whether their children exhibit a series of behaviours, known as the items of the scale.[8] Items are rated on three levels: 'Does not apply', 'Somewhat applies', 'Certainly applies'. Since they are all behaviours indicating lower skills, we recode all of them in reverse for the ease of interpretation, with higher

[6]Johnson et al. (2013) study multi-generational mobility in mental health across three generations using the BCS70, but find no correlation between the grandmother and grandchild's mental health. In the psychiatry literature, Hancock et al. (2013) do a similar exercise in Australia. We discuss their approach to study multi-generational mobility in mental health when we measure multi-generational in socio-emotional skills.

[7]Please see Tables C4 and C5 in Appendix C respectively for sample sizes in age 34 sweep and response rates for the socio-emotional questions retained in the analysis in the age 5, 10, 16 and 34 sweeps.

[8]The SDQ scale was developed to consider advances in child psychopathology and includes positive as well as undesirable traits.

Table 1: Rutter A and Strengths and Difficulties Questionnaire Scales

Rutter A scale administered to parents when they were 5, 10 and 16 years old	
1. Very restless. Often running about or jumping up and down. Hardly ever still.*	2. Is squirmy or fidgety.*
3. Often destroys own or others' belongings.	4. Frequently fights other children.*
5. Not much liked by other children.	6. Often worried, worries about many things.*
7. Tends to do things on his/her own, is rather solitary.*	8. Irritable. Is quick to fly off the handle.
9. Often appears miserable, unhappy, tearful or distressed.*	10. Sometimes takes things belonging to others.
11. Has twitches, mannerisms or tics of the face or body.	12. Frequently sucks thumb or finger.
13. Frequently bites nails or fingers.	14. Is often disobedient.*
15. Cannot settle to anything for more than a few moments.*	16. Tends to be fearful or afraid of new things or new situations.*
17. Is over fussy or over particular.	18. Often tells lies.
19. Bullies other children.*	A. Complains of headaches.*
B. Complains of stomach-ache or has vomited.*	C. Complains of biliousness
D. Has temper tantrums (that is, complete loss of temper with shouting, angry movements, etc.).*	

Strengths and Difficulties Questionnaire scale administered to children when they were between the age 3-16	
1. Considerate of other people's feelings+	2. Restless, overactive and not able to sit still for long*
3. Often complaining of headaches, stomach-aches or sickness*	4. Sharing readily with other children (treats, toys, pencils etc.)+
5. Has often had temper tantrums or hot tempers*	6. Rather solitary, tending to play alone*
7. Generally obedient, usually doing what adults requested* +	8. Many worries, often seeming worried*
9. Helpful if someone was hurt, upset or feeling ill+	10. Constantly fidgeting and squirming*
11. Has had at least one good friend +	12. Has often had fights with other children or bullies them*
13. Often unhappy, downhearted or tearful*	14. Generally liked by other children +
15. Easily distracted, concentration wandered*	16. Nervous or clingy in new situations, easily loses confidence*
17. Kind to younger children +	18. Often lied or cheated†
19. Picked on or bullied by other children	20. Has often volunteered to help others (parents, teachers, other children)+
21. Able to think things out before acting† +	22. Stole from home, school or elsewhere†
23. Getting on better with adults than with other children	24. Many fears, easily scared
25. Has seen tasks through to the end, good attention span +	

Note. The Rutter and Strengths and Difficulties Questionnaire items are rated on three levels: 'Does not apply', 'Somewhat applies', 'Certainly applies'. Since they are all behaviours indicating lower skills, we recode all of them in reverse, i.e. 'Certainly applies' = 0, 'Somewhat applies' = 1, 'Does not apply' = 2. The question of the Rutter items in the BCS70 administered when parents were 16 years old refers to the teenager. Items denoted by + are positively coded in the original scale. Items denoted by * are retained in the new comparable scale. Items denoted by † are asked only to the children aged 6-16.

values associated with better socio-emotional skills (i.e. 'Certainly applies' = 0, 'Somewhat applies' = 1, 'Does not apply' = 2).[9]

3 Modelling the dimensions of socio-emotional skills

Socio-emotional skills are intrinsically difficult to measure. Factor analysis is commonly used to estimate socio-emotional skill measures from a number of behavioural screening scales, where parents or teachers are asked to evaluate a number of items on the child's behaviour. Table 1 is an example of the type of measures available and provides those measures we use in our factor

[9] We augment the Rutter Scale with three additional parent-reported questions from the parental questionnaire, items A, B, and D in Table 1. These are rated on 4 levels: 'Never in the last 12 months', 'less than once a month', 'at least once a month', 'at least once a week'. We recode these into binary indicators, with 'Never' and 'Less than once a month' to 1 and zero otherwise. At the age 10 sweep, the Rutter A scale is continuous from 0 to 100, where 0 means 'Does not apply' and 100 means 'Certainly applies'. We recode it in reverse. In order to make it comparable to the Rutter A scale in the other waves, we recode the items as follows: if the response is below 40, we code the answer as 0; if the response is between 40 and 70, we code the answer as 1; if the response is between 70 and 100, we code the answer as 2.

analysis. We follow the literature and focus on two factors for the (internalizing and externalizing) socio-emotional skills encoded in these questions. With these variables, we start with an exploratory factor analysis to understand which of the available measures correspond to each of these factors. We then proceed to estimate a factor model.

3.1 Exploratory analysis

In what follows, we analyse the persistence over the life cycle and across generations of the two factors that are typically used to represent socio-emotional skills. This approach has been used in the previous literature (Attanasio et al., 2020; Moroni et al., 2019), where they have been labeled as 'externalizing' and 'internalizing' skills. The first measure captures the ability of children to focus their drive and determination and the second one their ability to relate to others.

To justify our focus on two factors, we perform an exploratory factor analysis. We concentrate on the 11 items from the Rutter A and Strengths and Difficulties Questionnaire (SDQ) scale which are common across the cohort members and their children (Table 2). Finally, we estimate the factor loadings from the exploratory factor analysis, based on decomposing the polychoric correlation matrix of the items and using weighted least squares (Olsson, 1979).[10] The solution is rescaled using oblique factor rotation (Hendrickson and White, 1964). Table 3 presents the factor loadings which show a clear separation between items. In particular, we highlight that the factor loadings have a similar magnitudes across groups, pointing out that there is a similar association between the item and the factor across groups.

[10]The polychoric correlation is an estimate for the correlation between two normally distributed continuous random variables observed as ordinal variables.

Table 2: Subscale of comparable items

Itm.	Factor	Cat.	Title	Rutter Wording (Parents during childhood)	SDQ Wording (Children aged 3-16)
1	EXT	3	*Restless*	Very restless. Often running about or jumping up and down. Hardly ever still	Restless, overactive and not able to sit still for long
2	EXT	3	*Squirmy/fidgety*	Is squirmy or fidgety.	Constantly fidgeting and squirming
3	EXT	3	*Fights/bullies*	Frequently fights other children	Has often had fights with other children or bullied them
4	EXT	3	*Distracted*	Cannot settle to anything for more than a few moments.	Easily distracted, concentration wandered
5	EXT	2/3	*Tantrums*	Has temper tantrums (that is, complete loss of temper with shouting, angry movements, etc.)	Has often had temper tantrums or hot tempers
6	EXT	3	*Disobedient*	Is often disobedient	(+) Generally obedient, usually doing what adults requested
7	INT	3	*Worried*	Often worried, worries about many things	Many worries, often seeming worried
8	INT	3	*Fearful*	Tends to be fearful or afraid of new things or new situations	Nervous or clingy in new situations, easily loses confidence
9	INT	3	*Solitary*	Tends to do things on his/her own, is rather solitary	Rather solitary, tending to play alone
10	INT	3	*Unhappy*	Often appears miserable, unhappy, tearful or distressed	Often unhappy, downhearted or tearful
11	INT	2/3	*Aches*	Complains of headaches + stomach-ache or has vomited	Often complaining of headaches, stomach-aches or sickness

Note. Itm. is item number. Factor is the latent construct to which the item loads - EXT is externalizing skills, INT is internalizing skills. Cat. is the number of categories in which the item is coded - 2 denotes a binary item (applies/does not apply) and 3 denotes a 3-category item. Title is a short label for the item. Wording columns show the actual wording in the scales used in each of the cohort studies. Items denoted by (+) are positively coded in the original scale.

Table 3: Loadings from exploratory factor analysis on entire sample

		BCS - parents at age 5		BCS - parents at age 10		BCS - parents at age 16		Children aged 3-16	
Item	Title	Factor 1 (EXT)	Factor 2 (INT)	Factor 1 (EXT)	Factor 2 (INT)	Factor 1 (EXT)	Factor 2 (INT)	Factor 1 (EXT)	Factor 2 (INT)
1	*Restless*	**0.801**	-0.153	**0.801**	-0.122	**0.603**	0.077	**0.863**	-0.124
2	*Squirmy/fidgety*	**0.691**	0.032	**0.741**	-0.012	**0.616**	0.112	**0.779**	0.013
3	*Fights/bullies*	**0.506**	-0.019	**0.592**	0.038	**0.700**	-0.009	**0.487**	0.200
4	*Distracted*	**0.583**	0.074	**0.651**	0.069	**0.709**	0.058	**0.643**	0.055
5	*Tantrums*	**0.493**	0.174	**0.510**	0.096	**0.723**	-0.019	**0.549**	0.155
6	*Disobedient*	**0.667**	0.013	**0.684**	0.013	**0.817**	-0.179	**0.578**	-0.061
7	*Worried*	-0.098	**0.702**	-0.026	**0.813**	-0.069	**0.774**	-0.106	**0.797**
8	*Fearful*	-0.095	**0.568**	-0.121	**0.813**	-0.075	**0.693**	0.064	**0.470**
9	*Solitary*	0.086	**0.300**	0.040	**0.326**	0.107	**0.439**	-0.038	**0.481**
10	*Unhappy*	0.247	**0.509**	0.250	**0.529**	0.400	**0.400**	0.052	**0.792**
11	*Aches*	-0.022	**0.431**	-0.009	**0.443**	0.192	**0.086**	-0.009	**0.540**

Note. The table displays the factors loadings obtained from exploratory factor analysis (EFA) by sample. The EFA is based on the decomposition of the polychoric correlation matrix, and uses oblimin rotation.

3.2 Factor model

To model formally the relationship between internalizing and externalizing skills and the available measures, the Rutter and SDQ items, based on the results of the exploratory analysis described in section 3.1, we specify a factor model. We consider four groups of individuals $c \in \{C_1, C_2, C_3, C_4\}$, corresponding respectively to the children of the cohort members, and the cohort members at the age of 5, 10 and 16. Each individual is denoted by $i = 1, ..., N_c$. For each individual and group, we observe categorical item responses X_{ijc}, corresponding to the common Rutter/SDQ scale questions (Table 2) where j indexes the 11 available items. We follow the literature and assume a latent bi-dimensional vector of externalizing and internalizing socio-emotional skills $\theta_{ic} = (\theta_{ic}^{EXT}, \theta_{ic}^{INT})$

The relationship between the latent factors θ_{ic} and the available measures X_{ijc} is characterised by item- and group-specific intercepts v_{jc} and loadings λ_{jc} and is affected by an independent measurement error term u_{ijc}. The measures are defined in terms of the following variable:

$$X^*_{ijc} = v_{jc} + \lambda_{jc}^{\top}\theta_{ic} + u_{ijc} \tag{1}$$

We consider a dedicated factor structure, where each item loads only on one latent dimension, and follow the structure found in the exploratory factor analysis (Heckman et al., 2013; Conti et al., 2010). We estimate the baseline model which is characterized by the bare minimum number of assumptions with the parameterisation defined below (Wu and Estabrook, 2016).

Given the specification of the behavioural scale, the measures X_{ijc} have a discrete nature and take one of an ordered number of values. To allow for such measures we introduce item- and group-specific threshold parameters τ_{jc} as follows:

$$X_{ijc} = s \quad \text{if} \quad \tau_{s,jc} \geq X^*_{ijc} \geq \tau_{s+1,jc} \quad \text{for} \quad s = 0, 1, 2 \tag{2}$$

with $\tau_{0,jc} = -\infty$ and $\tau_{3,jc} = \infty$. We assume that the latent factors and the measurement error terms are normally distributed:

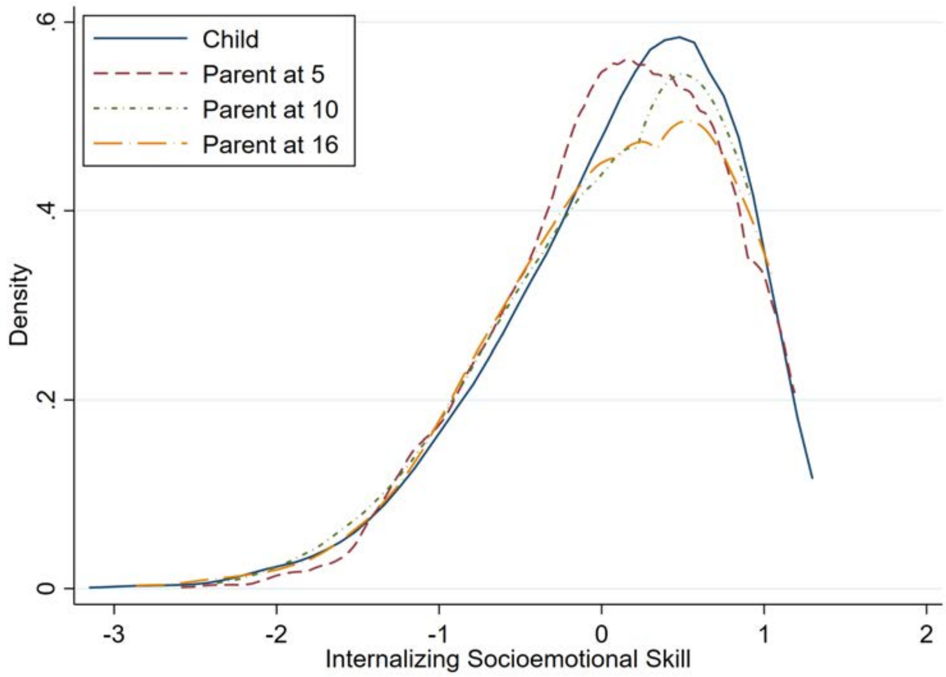
$$\theta_{ic} \sim \mathcal{N}(\kappa_c,\, \sigma^2_{\theta_c}) \quad \text{and} \quad u_{ijc} \sim \mathcal{N}(0,\, \sigma^2_c) \tag{3}$$

Finally, we make the normalisation assumption needed to deal with factor indeterminacy by setting the mean κ_c and the variance $\sigma^2_{\theta_c}$ of the factor equal to 0 and 1 respectively. In addition, the intercepts v_{jc} are equal to zero and the error variance σ^2_c to 1 , while the loadings λ_{jc} and threshold τ_{jc} are free to vary.

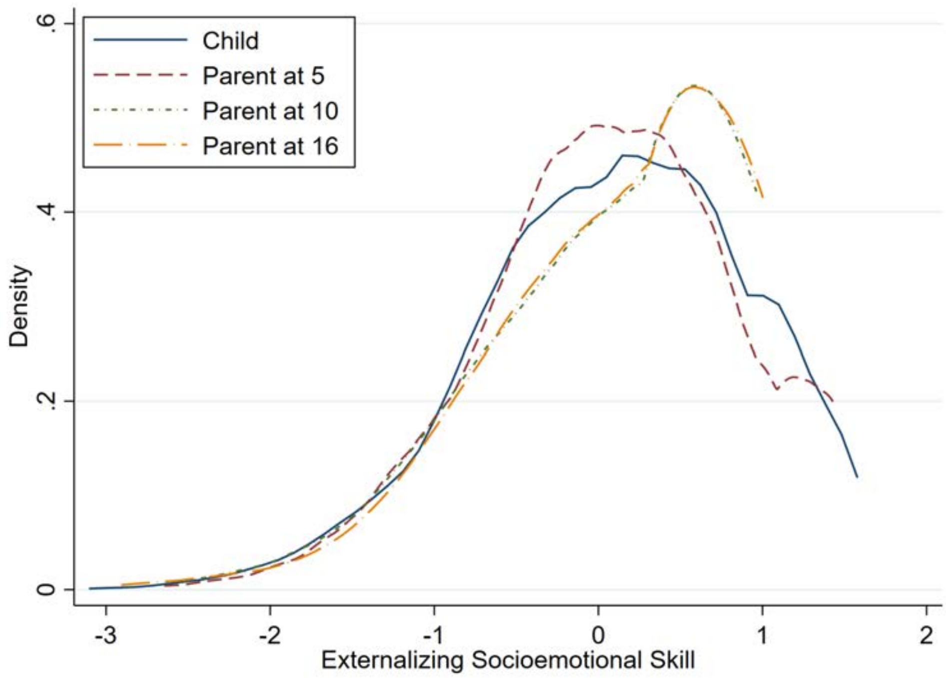
Having estimated the factor model, we can use it to predict the latent factors θ_{ic} for any individual, based on their observed values of the Rutter/SDQ items. These latent factors are weighted sums of the observed items, with the weights determined by the parameters of the fitted model. Indicators which are more reliable measures of a factor – namely those with larger loadings λ_{jc} – will receive higher weights in the calculation of a factor score for that factor. Figure 1 shows the distributions of the two latent factors: internalizing and externalizing skills.

Figure 1: Distribution of Factor Scores

Internalizing



Externalizing



Note. These figures present the distributions of the internalizing and externalizing socio-emotional skills for the children and parents respectively at age 5, 10, and 16. Higher scores correspond to better skills. The distribution is estimated nonparametrically, using an Epanechnikov kernel. The scale of the Rutter/SDQ items at the age-5, age-16 and child-questionnaire sweep is categorical. The scale of the Rutter items at the age-10 sweep is converted to a categorical variable.

In Appendix A, we follow Attanasio et al. (2020) and test for measurement invariance since any comparison between socio-emotional skills across different generations requires that the socio-emotional measures we derived have the same relationship with the latent constructs (Vandenberg and Lance, 2000; Putnick and Bornstein, 2016).

4 Measuring persistence in the process of human development

We perform the analysis of life cycle and intergenerational persistence of socio-emotional skills in two steps. First, we estimate the two factor scores (internalizing and externalizing) for the cohort members and their children, as outlined in section 3.2. We then estimate the relevant persistence measures with different types of regressions, which we discuss below. In principle, we could estimate all the parameters of interest in one step, estimating the relevant factor models and the regressions that describe their relationships jointly. However, since our measured indicators are categorical this approach could be computationally costly.

4.1 Life cycle persistence

To estimate the life cycle persistence of socio-emotional skills we estimate various versions of the following regressions.

$$Y^j_{i,16} = \phi^j_{16} + \alpha^j_{1,16} Y^j_{i,10} + \alpha^j_{2,16} Y^j_{i,5} + \beta^j_{1,16} Y^k_{i,10} + \beta^j_{2,16} Y^k_{i,5} + \rho^\top \mathbf{X}_i + \epsilon^j_{i,16}, \quad j,k = int, ext. \tag{4}$$

$$Y^j_{i,10} = \phi^j_{10} + \alpha^j_{1,10} Y^j_{i,5} + \beta^j_{1,10} Y^k_{i,5} + \rho^\top \mathbf{X}_i + \epsilon^j_{i,10}, \qquad j,k = int, ext. \tag{5}$$

where the subscript i identifies a member of the cohort and the superscripts j and k refer to the particular dimension of socio-emotional skills we consider, where internalising or externalising skills. Equation (4) models the skills at age 16, while equation (5) is for the skills at age 10. In both cases we let the skills at a given age to depend on the lagged value of that skill as well as other skills.

In modeling the evolution of socio-emotional skill and characterising their persistence over the life cycle, we let not only the skills observed at the most recent age to play a role but also skills observed at previous ages. In this sense our model deviates from the standard Markov assumption normally used in the literature.

We further generalise the models in equations (4) and (5) to consider also the association of socio-emotional skills with past cognitive skills. For the age 16 socio-emotional skills we consider the following model:

$$\begin{aligned} Y^j_{i,16} = \quad & \phi^j_{16} + \alpha^j_{1,16} Y^j_{i,10} + \alpha^j_{2,16} Y^j_{i,5} + \beta^j_{1,16} Y^k_{i,10} + \beta^j_{2,16} Y^k_{i,5} \\ & + \gamma^j_{1,16} Y^{cog}_{i,10} + \gamma^j_{2,16} Y^{cog}_{i,5} + \rho^\top \mathbf{X}_i + \epsilon^j_{i,16}, \quad j,k = int, ext. \end{aligned} \tag{6}$$

while for the age 10 skills we have:

$$Y_{i,10}^{j} = \phi_{10}^{j} + \alpha_{1,10}^{j} Y_{i,5}^{j} + \beta_{1,10}^{j} Y_{i,5}^{k} + \gamma_{1,10}^{j} Y_{i,5}^{cog} + \rho^{\top}\mathbf{X}_i + \epsilon_{i,10}^{j}, \qquad j,k = int, ext. \tag{7}$$

As cognitive skills can be important in several dimensions, we also estimate a regression similar to equation (6), but with the level of cognitive skills on the left-hand side.

Finally, using the age 42 sweep, we relate a number of adult outcomes, including employment, earnings and the probability of smoking, to both cognitive and socio-emotional skills at age 5, 10 and 16.

4.2 Intergenerational mobility

To study how socio-emotional skills can be transmitted across generation, we relate a number of outcomes observed on the children of our cohort members to a number of outcomes observed in their parents *before they reached adulthood*.

In particular, for each parent and child in household i we estimate:

$$Y_i^C = \phi + \gamma^{\top}\mathbf{Y}_i^P + \rho^{\top}\mathbf{X}_i + \epsilon_i \tag{8}$$

where Y_i^C is the child i's socio-emotional skill score and $\mathbf{Y}_i^P$ is a vector of child i's parent's socio-emotional skill observed at the age of 5, 10, and 16. γ is a vector of parameters measuring intergenerational mobility in socio-emotional skills (i.e. internalizing and externalizing skills). Higher values of the coefficient γ correspond to lower mobility. In our specifications, we control for a vector $\mathbf{X_i}$ of individual's characteristics, which include the region of birth fixed effects, the parent's gender, the child's gender and age, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old. We include these controls to consider some other possible channels that might relate to skills. For example, the employment variables are here to proxy for other channels like income that might explain skills. Region of birth fixed effects can account for the fact that parents were born in different geographical areas. We also include controls on family characteristics to consider the fact that the family composition can influence skills.

Rank regression For each parent and child in household i we estimate:

$$R_i^C = \alpha + \beta^{\top}\mathbf{R}_i^P + \rho^{\top}\mathbf{X}_i + \epsilon_i \tag{9}$$

where R_i^C is the child i's socio-emotional skill score (rank) and $\mathbf{R}_i^P$ is a vector of child i's parent's socio-emotional skill score (rank) at the age of 5, 10, and 16. β is a vector of parameters measuring intergenerational mobility (relative) in socio-emotional skills (i.e. internalizing and externalizing skills). Higher values of the coefficient β correspond to lower mobility. We control for a vector $\mathbf{X_i}$ of individual's characteristics which are the same as above.

We follow Chetty et al. (2014) and estimate rank regressions to capture monotone relationships possibly not encoded in the simple correlation between socio-emotional skill scores. The relationship between parents' and children's socio-emotional scores is often non-linear, making a simple linear correlation possibly not a good summary of mobility at all points of the distribution. Another advantage of the rank-based measure is to possibly reduce the attenuation and lifecycle bias (Nybom and Stuhler, 2017).

We need to consider that data come from the prediction of the factor model estimated in section 3. Therefore, we compute standard errors for equations 8 and 9 by bootstrapping both the factor model and the regression. More specifically, first, we generate 1000 samples by block sampling with replacement from the original sample (i.e. we randomly draw the entire history of the parent-child link with replacement from the original sample). Second, for each bootstrap sample, we estimate the factor model, predict the factors and then estimate the intergenerational mobility regression.

Absolute mobility indexes Another common measure of intergenerational mobility is to study the children's outcomes from parents at a given quintile in the distribution (Chetty et al., 2014). For example, a measure which is often reported is the probability of going from the lowest to the highest quintile of the socio-emotional skill distribution (Corak and Heisz, 1999).

$$LH = Pr(R_i^C \geq 80 | R_i^P < 20) \tag{10}$$

We thus produce non-parametric matrices of transition probabilities across quintiles of the socio-emotional skill distribution. We do this for the parents' internalizing and externalizing skill at the age of 5, 10 and 16 to document how mobility may differ at different points of the socio-emotional skill distribution.

To facilitate comparison across the several matrices, we propose a summary measure to compare the different transition matrices and order them in terms of mobility. Our measure is based on the difference between the largest and the second largest eigenvalues in the transition matrix. This difference is usually referred to as the 'spectral gap.' We thus call this measure the *'spectral gap mobility index'*. This measure is useful to understand how far the intergenerational transition matrices are from an identity matrix which corresponds to a table with no mobility across quintiles: all its eigenvalues are equal to one and the measure above, (1 - second largest eigenvalue), is zero. The discrepancy between one and the second largest could be seen as a departure from zero mobility, where higher numbers of the *'spectral gap mobility index'* corresponds to higher mobility.

5 Persistence in childhood socio-emotional skills over the life cycle

Table 4 presents the estimates of various versions of equations (4) and (5). The parameters' estimates we present measure the degree and modality of persistence of socio-emotional skills over the life cycle for the cohort we are considering. We estimate the parameters for the process of both *internalizing* (columns 1-4) and *externalizing skills* (columns 5-8) at different ages.[11] For all specifications we include a set of controls, which are the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old. In columns 1 and 5, we study to what extent parental skills at the age of 5 can predict their own skills at the age of 10, whereas in other columns, we study to what extent parental skills at the age of 5 and 10 can predict their own skills at the age of 16.

An interesting pattern emerges from the results in Table 4. Socio-emotional skills both at age 5 and at age 10 predict skills during adolescence. Table 4 shows that one unit increase in the internalizing skill at the age of 5 corresponds to 0.319 unit increase in the internalizing skill at the age of 16, while one unit increase in the internalizing skill at the age of 10 corresponds to 0.127 unit increase in the internalizing skill at the age of 16 (column 4). Even more surprisingly, one unit increase in the internalizing skill at the age of 5 corresponds to 0.229 unit increase in the externalizing skill at the age of 16, while one unit increase in the externalizing skill at the age of 5 corresponds to 0.181 unit increase in the externalizing skill at the age of 16 (column 8).[12]

Remarkably, skills at age 5 (both internalising and externalising), are important in predicting skills at age 16, *even after controlling for skills at age 10*. This evidence is suggestive of the importance of early childhood in the skill formation process. Usually, when studying skill formation, researchers estimate first-order Markov chain processes, where the skills today depend only on the skills in the previous period. When data for adjacent periods are not available, by recursive substitution, one can get an expression where skill today depend on skills *on the previous available period.* However, if the model's assumptions are valid, conditioning on a certain period skills, future skills should not depend on the level of development in previous periods. Our results point towards extending these models to consider the skills not only in the previous period but also in earlier periods, especially in the early childhood.

The richer persistence we document can be due to a variety of reasons. First, our finding could be due to the fact that early childhood skills are better measured than the ones at the age of 10. Therefore, this would imply that they better predict subsequent development. However, it is also important to notice that the magnitudes of the coefficients of the skills at the age of 5 do not substantially change as we include controls. Table 4 shows that one unit increase in the internalizing skill at the age of 5 corresponds to 0.384 unit increase in the internalizing skill at the age of 16 when we do not control for externalizing skills (column 2), while the effect does not change substantially when we include controls for externalizing skills (column 4). Second, it is

[11] Table C6 in Appendix C presents the contemporaneous correlation of internalizing and externalizing skill measures.

[12] A similar pattern emerges if we use a rank regression, of the type we estimate for intergenerational correlations.

possible that the significance of early years development captures the presence of individual (in this case family) fixed effects. Finally, it is possible that specific ages are particularly salient and important for the process of development. We cannot distinguish among these different sources of persistence without richer data. We leave this investigation to future research.

Another important pattern that the data highlight is the interdependence of skills. Namely, externalizing skills can predict internalizing skills and vice-versa. Columns 4 and 8 of Table 4 constitute strong evidence in this respect. Internalising skills at age 5 seem to be particularly important to predict age-16 skills of both types considered. Analogously, both externalising skills at age 5 and 10 are important for age-16 socio-emotional skills.

Table 4: **Persistence** over the life cycle socio-emotional skills

Dependent variable:	**Internalizing**				**Externalizing**			
	At age 10	At age 16	At age 16	At age 16	At age 10	At age 16	At age 16	At age 16
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
INT at age 5	0.292***	0.384***		0.319***	-0.029	0.366***		0.229***
	(0.035)	(0.030)		(0.044)	(0.041)	(0.034)		(0.049)
INT at age 10		0.229***		0.127***		0.210***		-0.043
		(0.031)		(0.045)		(0.035)		(0.051)
EXT at age 5	0.127***		0.269***	0.088**	0.498***		0.312***	0.181***
	(0.033)		(0.027)	(0.039)	(0.037)		(0.030)	(0.043)
EXT at age 10			0.217***	0.137***			0.314***	0.343***
			(0.027)	(0.040)			(0.031)	(0.045)
Observations	1702	1116	1116	1116	1702	1116	1116	1116
R^2	0.174	0.262	0.210	0.283	0.284	0.237	0.324	0.346
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for the regression of parents' persistence in skills (parent-children link). Other controls include the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old.

As mentioned above, to investigate further the process of socio-emotional skills formation, we consider a specification where, in addition to the socio-emotional skills at age 5 and 10, in the regressions for socio-emotional skills at age 16, we also consider cognitive skills at ages 5 and 10. We report the results in Table 5. We note that in the richer specifications in columns 4 and 8, these cognitive skills are not associated significantly with socio-emotional skills of either type considered.

In Table 6, we also relate cognitive skills at age 16 with different types of skills at ages 5 and 10.[13] Interestingly, the dynamic patterns that emerge for cognitive skills are different from those for socio-emotional skills. In the richest specification considered in Column 5, it seems that in addition to cognition at age 10, cognition at age 16 seems to be associated with internalising socio-emotional skills at age 5. This evidence is confirmed by the more parsimonious specification in column 3. Whereas test statistics for the hypothesis that coefficient on socio-emotional skills are jointly zero are associated with rather small p-values, this appears to be mostly driven by

[13]The response rate is lower at the age-16 sweep because of a teacher-led industrial strike disrupting the dissemination of the questionnaire. Only 2 cognitive tests (spelling test and vocabulary test) were fully completed out of 4 tests.

Table 5: **Persistence** in socio-emotional skills with cognitive skill

Dependent variable:	**Internalizing**				**Externalizing**			
	At age 10	At age 16	At age 16	At age 16	At age 10	At age 16	At age 16	At age 16
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cognitive skill (age 5)	0.058**	-0.013	-0.020	-0.015	0.060*	-0.001	-0.013	-0.008
	(0.028)	(0.039)	(0.039)	(0.039)	(0.031)	(0.045)	(0.045)	(0.045)
Cognitive skill (age 10)		0.026	0.019	0.012		0.049	0.019	0.015
		(0.032)	(0.032)	(0.032)		(0.034)	(0.035)	(0.035)
INT at age 5	0.321***	0.385***		0.342***	0.001	0.362***		0.226***
	(0.036)	(0.033)		(0.049)	(0.042)	(0.038)		(0.054)
INT at age 10		0.214***		0.099**		0.228***		-0.035
		(0.034)		(0.049)		(0.038)		(0.056)
EXT at age 5	0.111***		0.243***	0.051	0.473***		0.300***	0.171***
	(0.034)		(0.029)	(0.044)	(0.038)		(0.033)	(0.048)
EXT at age 10			0.231***	0.163***			0.346***	0.366***
			(0.030)	(0.044)			(0.034)	(0.050)
Observations	1610	914	914	914	1610	914	914	914
R^2	0.188	0.260	0.207	0.279	0.287	0.252	0.339	0.359
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for the regression of parents' persistence in skills (parent-children link). Other controls include the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old. The cognitive skill measure at the age of 5 comes from a simple factor model where three tests are combined: Copy Designs (child is asked to copy simple designs adjacently), Human Figure Drawing (child draws an entire human figure), English Picture Vocabulary Test (child identifies the picture referring to a word among four pictures). The cognitive skill at the age of 10 comes from a simple factor model where four tests where combined: Shortened Edinburgh Reading Test, Friendly Math Test, Spelling Dictation Task and Pictorial Language Comprehension Test.

internalizing socio-emotional skills.[14]

Our next step is to check whether skills during early childhood can predict their outcomes later in life. This allows us to contextualise our estimates on the evolution of socio-emotional skills, given previous findings on how those relate to economic outcomes later in life. Table 7 presents regressions of behavioural and economic outcomes at the age of 42 on skills during childhood. We highlight that socio-emotional skills during childhood can predict whether the cohort member smokes, is employed and how much she or he earns per week, conditional on being a paid employee or self-employed at the age of 42. These results are robust even after controlling for own cognitive skill at the ages of 5 and 10 and the inclusion of their controls, such as the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old.

A final pattern we document is the socio-economic gradient in socio-emotional skills. Figure 2 presents the socio-economic gradient in socio-emotional skills for the sample of BCS70 cohort members for which we observe socio-emotional skills at ages 5, 10 and 16 for internalizing and externalizing skills.[15] We also report the p-value from Kolmogorov-Smirnov tests of equality

[14] The bootstrapped p-value for the test of the hypothesis that the coefficients on the internalising skills in column 5 are jointly zero is 0.081, while the p-value for a similar hypothesis for the externalising skill coefficients is 0.930.

[15] The socioeconomic status is the mother's education at the age-5 sweep; namely, a dummy equal to 1 if the mother

between the distributions by socioeconomic gradient.

These tests document that there is a statistically meaningful difference in externalizing socio-emotional skills between the children of mothers with different educational attainment, but not for internalizing skills. This gap is already visible at age 5 and is persistent over the life cycle. Given the association of age 5 socio-emotional skills with a variety of adult outcomes, including earnings, this result is informative about the origin of background gaps in a variety of outcomes. We present a similar analysis for gradient in socio-emotional skills by the mother's pregnancy smoking (maternal smoking is a dummy equal to 1 if the mother reported smoking during pregnancy) in Figure 3, where the Kolmogorov-Smirnov test statistics are statistically significant at conventional significance levels for both internalizing and externalizing skills.

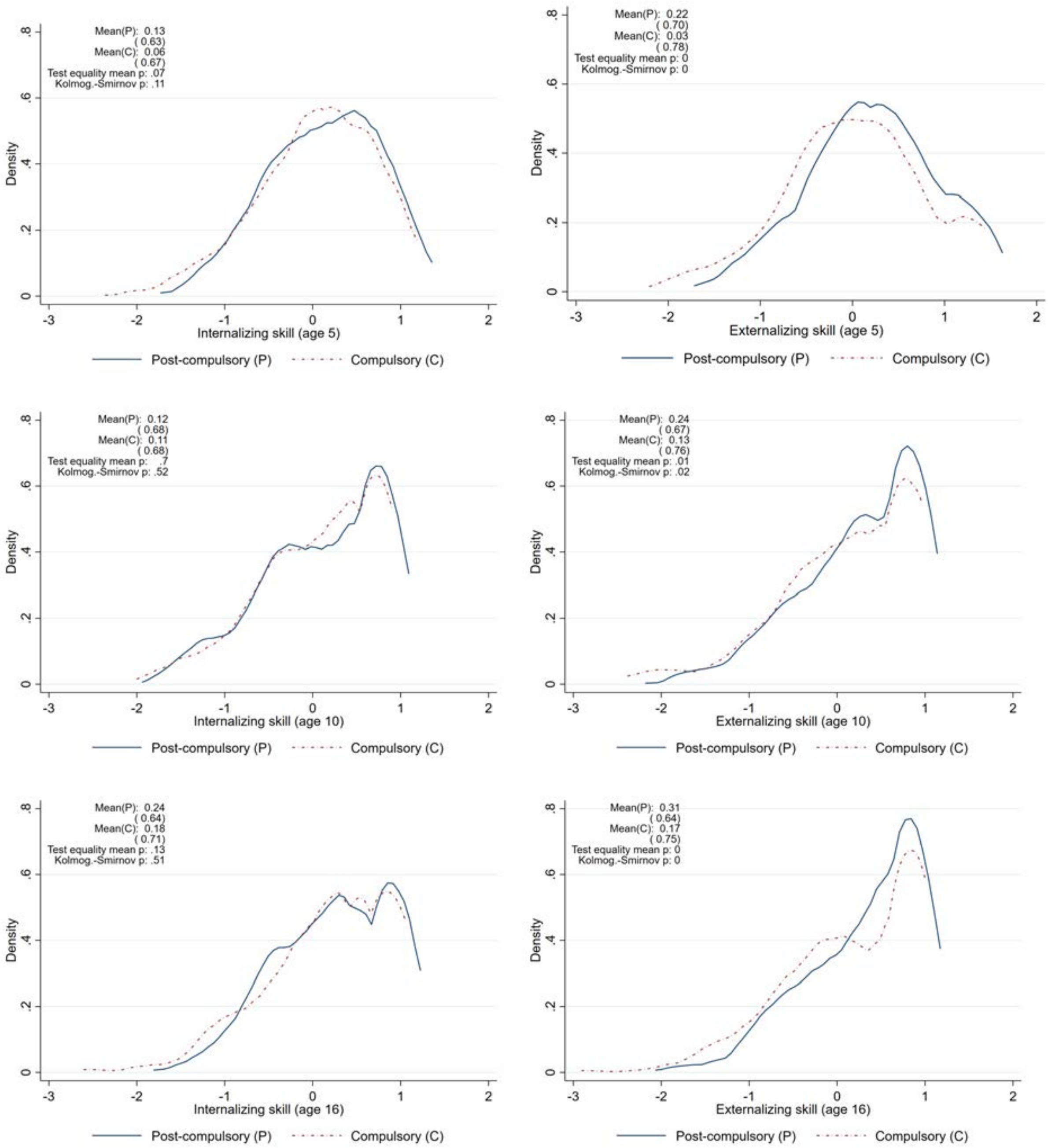
Table 6: Cognitive skills over the life cycle

Dependent variable:	**Cognitive skill (age 16)**				
	(1)	(2)	(3)	(4)	(5)
Cognitive skill (age 5)	0.042*	0.039	0.037	0.035	0.037
	(0.025)	(0.026)	(0.028)	(0.028)	(0.028)
Cognitive skill (age 10)	0.498***	0.508***	0.481***	0.478***	0.480***
	(0.031)	(0.032)	(0.034)	(0.034)	(0.034)
INT at age 5		-0.072**	-0.053**		-0.062*
		(0.032)	(0.023)		(0.034)
INT at age 10			0.039*		0.043
			(0.023)		(0.034)
EXT at age 5		0.009		-0.024	0.014
		(0.030)		(0.021)	(0.031)
EXT at age 10				0.023	-0.009
				(0.021)	(0.031)
p-value (socio-emotional skills coeffs are jointly zero)		0.009	0.038	0.650	0.083
Observations	819	747	632	632	632
R^2	0.548	0.547	0.542	0.539	0.542
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for the regression of parents' skills on economic outcomes at age 42 (parent-children link). The cognitive skill measure at the age of 5 comes from a simple factor model where three tests are combined: Copy Designs (child is asked to copy simple designs adjacently), Human Figure Drawing (child draws an entire human figure), English Picture Vocabulary Test (child identifies the picture referring to a word among four pictures). The cognitive skill at the age of 10 comes from a simple factor model where four tests where combined: Shortened Edinburgh Reading Test, Friendly Math Test, Spelling Dictation Task and Pictorial Language Comprehension Test. The cognitive skill at the age of 16 comes from a simple factor model where two tests where combined: the Vocabulary and Spelling Tests. Employed is a dummy for being in paid employment or self-employment, either full or part time. Gross weekly pay is weekly pre-tax pay from the respondent's main activity, conditional on being a paid employee or self-employed. Other controls include the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old. The p-value for the test that the socio-emotional skill coefficients are jointly zero is computed as follows by bootstrapping the entire procedure. For each bootstrapped sample, we estimate the factors, run the regression and estimate the Wald statistics (the weighting matrix for the Wald statistic is obtained by using the bootstrap sample (Hall and Wilson, 1991)). This gives us the distribution for the Wald statistic once recentered (by subtracting the mean of the empirical distribution). So we compute the percentile of the Wald statistic for the hypothesis we want to test in the empirical distribution for the test statistic obtained from the bootstrap samples. One minus that is the p-value.

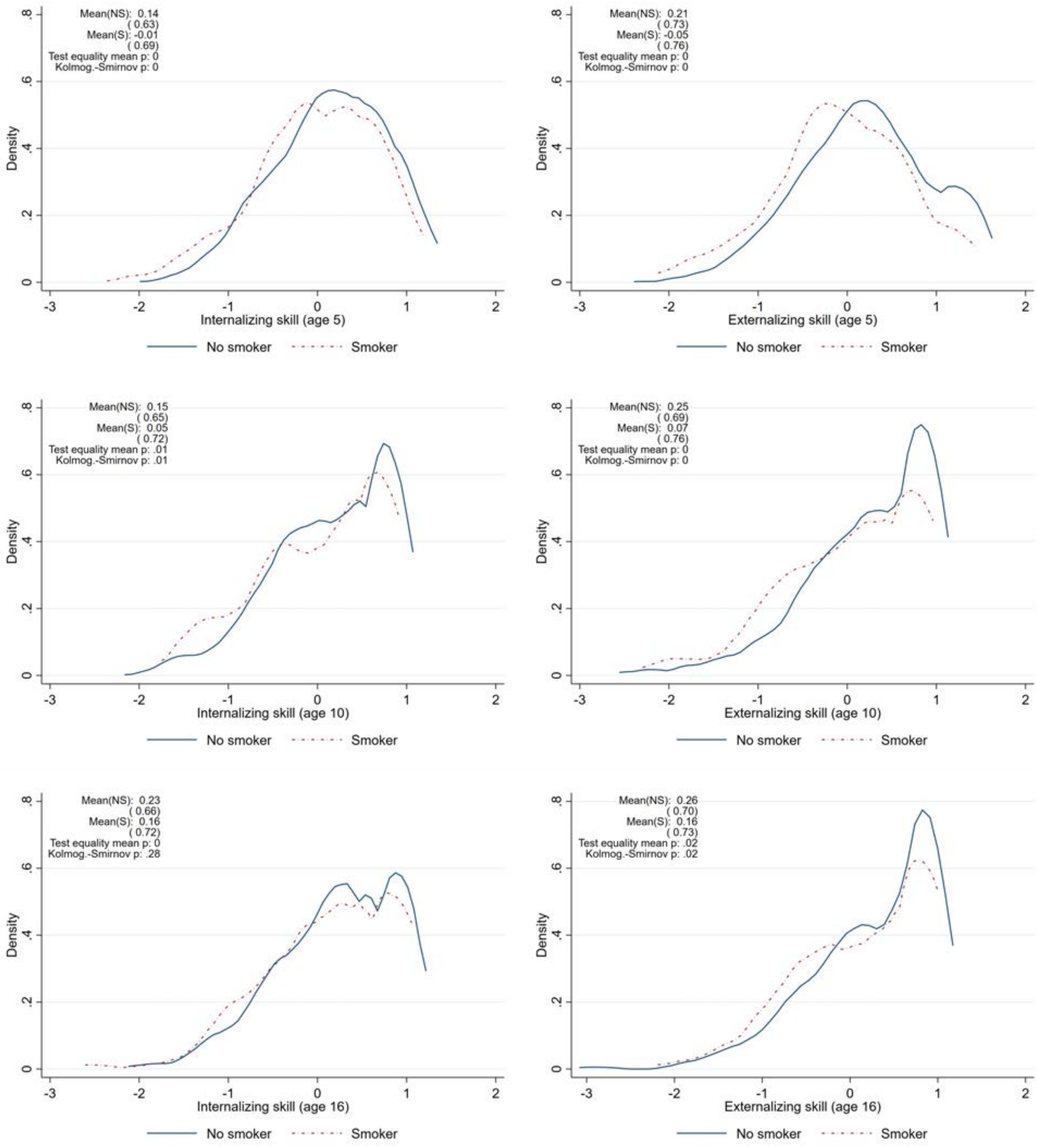
continued schooling past the minimum leaving age, based on her date of birth.

Figure 2: Socioeconomic gradient in socio-emotional skills at the age of 5, 10, and 16 (maternal schooling).



Note. The Figure presents the socioeconomic gradient in socio-emotional skills for the sample of parents that we use in the main analysis at the age of 5, 10 and 16 for internalizing and externalizing skills (parent-children link). The socioeconomic status is the mother's education at the age-5 sweep (dummy for whether the mother continued schooling past the minimum leaving age, based on her date of birth). Higher scores correspond to better skills. We report the means of the socio-emotional skill by socioeconomic gradient and their standard errors between parentheses. The distribution is estimated nonparametrically, using an Epanechnikov kernel. We report the p-value of a t tests on the equality of means between the two groups assuming unequal variances. We report the p-value from Kolmogorov-Smirnov tests of equality between the distributions by socioeconomic gradient.

Figure 3: Socioeconomic gradient in socio-emotional skills at the age of 5, 10, and 16 (mother's pregnancy smoking).



Note. The Figure presents the socioeconomic gradient in socio-emotional skills for the sample of parents that we use in the main analysis at the age of 5, 10 and 16 for internalizing and externalizing skills (parent-children link). The socioeconomic status is the mother's pregnancy smoking (maternal smoking is a dummy equal to 1 if the mother reported smoking during pregnancy). Higher scores correspond to better skills. We report the means of the socio-emotional skill by socioeconomic gradient and their standard errors between parentheses. The distribution is estimated nonparametrically, using an Epanechnikov kernel. We report the p-value of a t tests on the equality of means between the two groups assuming unequal variances. We report the p-value from Kolmogorov-Smirnov tests of equality between the distributions by socioeconomic gradient.

Table 7: **Outcomes at age 42**

Dependent variable:	**Smoke**		**Employed**		**Log Pay**	
	(1)	(2)	(3)	(4)	(5)	(6)
Cognitive skill (age 5)		-0.035		0.075***		-0.013
		(0.024)		(0.020)		(0.051)
Cognitive skill (age 10)		-0.015		-0.011		0.191***
		(0.017)		(0.017)		(0.041)
INT at age 5	-0.023	-0.045*	0.006	0.009	0.105**	0.066
	(0.023)	(0.026)	(0.024)	(0.026)	(0.053)	(0.059)
INT at age 10	-0.038*	-0.040	0.028	0.048*	-0.046	-0.032
	(0.024)	(0.026)	(0.024)	(0.026)	(0.055)	(0.062)
INT at age 16	0.130***	0.138***	-0.064***	-0.059**	-0.104*	-0.052
	(0.023)	(0.026)	(0.024)	(0.027)	(0.055)	(0.061)
EXT at age 5	0.010	0.043*	0.009	-0.014	-0.170***	-0.123**
	(0.021)	(0.023)	(0.021)	(0.024)	(0.048)	(0.054)
EXT at age 10	0.032	0.028	-0.054**	-0.066***	0.081	0.040
	(0.022)	(0.024)	(0.022)	(0.023)	(0.050)	(0.056)
EXT at age 16	-0.122***	-0.139***	0.096***	0.081***	0.138***	0.116**
	(0.021)	(0.024)	(0.021)	(0.023)	(0.051)	(0.056)
p-value (socio-emotional skills coeffs are jointly zero)	0.001	0.000	.007	0.033	0.008	0.064
Observations	964	794	963	793	772	633
R^2	0.067	0.091	0.060	0.091	0.282	0.337
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for the regression of parents' skills on economic outcomes at age 42 (parent-children link). Employed is a dummy for being in paid employment or self-employment, either full or part time. Gross weekly pay is weekly pre-tax pay from the respondent's main activity, conditional on being a paid employee or self-employed. The mean of parents who smoke is 15 percent, who are employed is 85 percent and the mean of log pay is 5.84. The cognitive skill measure comes from a simple factor model where three tests administered at the age of 5 are combined: Copy Designs (child is asked to copy simple designs adjacently), Human Figure Drawing (child draws an entire human figure), English Picture Vocabulary Test (child identifies the picture referring to a word among four pictures). The cognitive skill at the age of 10 comes from a simple factor model where four tests where combined: Shortened Edinburgh Reading Test, Friendly Math Test, Spelling Dictation Task and Pictorial Language Comprehension Test. Other controls include the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old. The p-value for the test that the socio-emotional skill coefficients are jointly zero is computed as follows by bootstrapping the entire procedure. For each bootstrapped sample, we estimate the factors, run the regression and estimate the Wald statistics (the weighting matrix for the Wald statistic is obtained by using the bootstrap sample (Hall and Wilson, 1991)). This gives us the distribution for the Wald statistic once recentered (by subtracting the mean of the empirical distribution). So we compute the percentile of the Wald statistic for the hypothesis we want to test in the empirical distribution for the test statistic obtained from the bootstrap samples. One minus that is the p-value.

6 Intergenerational mobility in socio-emotional skills

As discussed above, we study the transmission across generations of socio-emotional skills estimating equation (8). We do so using the sweep that contains information on the children of the 1970 cohort, which was collected when the cohort members were about 34. We report the results of this exercise in Table 8, with the outcome variable being the child's internalizing or externalizing skills. In what follows, we refer to the cohort members as parents.

In the regression, we include a set of controls, which are the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975, the number of children in the parent's household when the parent is 5 years old, region of the parent's birth fixed effects and age of child fixed effects. In columns 1-3, the outcome variable is the child's internalizing skill, while in columns 4-6 the outcome variable is the child's externalizing skill.

In Table 8, we observe that parental skills during their childhood are important predictors of their children's skills even after including a large set of controls. In particular, one unit increase in the parent's internalizing skill at the age of 16 translates into a 0.109 unit increase in the child's internalizing skill (column 1), while one unit increase in the parent's externalizing skill at the age of 10 translates into a 0.078 unit increase in the child's internalizing skill (column 2). In column 3, we study the relationship between the child's internalizing skills and the parent's skills and find that the magnitude of the coefficients of the parent's internalizing skill at the age of 16 and externalizing skill at the age of 10 increases when we control for other dimension of the socio-emotional skill. This points towards the importance of considering an interdependence across skills in the transmission process.

On the other hand, in columns 4-6, we study the relationship between the child's externalizing skill and the parental skills (Table 8). The parent's internalizing skill at the age of 16 is still an important predictor for the child's skill. One unit increase in the parent's internalizing skill at the age of 16 translates in 0.191 unit increase in the child's externalizing skill (column 4). This effect still remains significant and the magnitude of the coefficient decreases slightly once we control for parental externalizing skills. Namely, in column 6, we observe that one unit increase in the parent's internalizing skill at the age of 16 translates in 0.148 unit increase in child's externalizing skill. While one unit increase in the parent's externalizing skill at the age of 10 translates in 0.149 unit increase in the child's externalizing skill (column 5) and in 0.229 unit increase in child's externalizing skill when we control for the parent's internalizing skills (column 6).[16]

Figures 4 and 5 present the binscatter plots for rank regressions (equation 9) when we residualize the socio-emotional skill rank and correlate the residualized rank of the child's socio-emotional skills (internalizing and externalizing) with the residualized rank of the parent's skills at the age of 5, 10 and 16. This is done in two steps. First, we regress each socio-emotional skill rank on the parent's gender, the child's gender, the number of children in the household, the mother's age at

[16]The R^2s have the same magnitude as in Anger (2012), Dohmen et al. (2011) and Charles and Hurst (2003).

the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975, the number of children in the parent's household when the parent is 5 years old, region of the parent's birth fixed effects and age of child fixed effects and obtain the residualized rank. Second, we correlate the residualized rank of parent's and child's skills. This method should reduce the bias from other possible channels that can affect skills and make the results comparable to estimates in Table 9.

An interesting pattern emerges from the figures: the rank of parent's socio-emotional skills during childhood is positively associated with the rank of child's skills. This pattern holds for both dimensions of socio-emotional skills. The magnitude of the rank slope ranges between 0.05 and 0.16. In Appendix B, we present similar scatter plots for the intergenerational mobility equation (8) in levels (residualized socio-emotional skills) and for the rank regressions equation (9) when we do not include any controls.[17]

The magnitudes of our estimates in the rank regressions are smaller than the ones in the intergenerational mobility in occupation found in Bell et al. (2018), who use the Longitudinal Study of England and Wales (LS), and income found by Rohenkohl (2019) who uses data on income from the BHPS and Understanding Society survey and Gregg et al. (2017), who use data from the National Child Development Study (NCDS) and the British Cohort Study (BCS).[18] The nightingale rose chart in Figure 6 compares the rank regression coefficients from the studies mentioned above (without controls) when equation 9 is estimated without controls (see Figures B2 and B1).[19]

Table 9 presents the estimates for equation (9) respectively with the outcome variable being the rank of the child's internalizing and externalizing skills. We include a set of controls, which are the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975, the number of children in the parent's household when the parent is 5 years old, region of the parent's birth fixed effects and age of child fixed effects. In columns 1-3, the outcome variable is the rank of the child's internalizing skill, while in columns 4-6 the outcome variable is the rank of the child's externalizing skill.[20]

The rank regressions in table 9 show that an increase in one rank in the parent's internalizing skill at the age of 16 translates in 0.107 increase in the rank of child's internalizing skill (column 1), while an increase in one rank in the parent's externalizing skill at the age of 10 translates in 0.125 increase in the rank of the child's internalizing skill (column 2). These coefficients remain significant when we study to what extent skills are interdependent in the transmission process in

[17] In this instance, the relationship is nonlinear as previously noticed by the literature (Chetty et al., 2014).

[18] Similar results have been found by Belfield et al. (2017), who use data from the National Child Development Study (NCDS) and the British Cohort Study (BCS).

[19] We urge caution in comparing our results to the findings in intergenerational mobility in income and/or occupation because of different datasets, variables and model specifications.

[20] At the age 10 sweep, teachers were also asked to answer socio-emotional questions similar to the ones asked to the parents in the Rutter A questionnaire. We can also do the same exercise and estimate the intergenerational mobility in socio-emotional skills by using the questions answered by the teachers - instead of the parents - at the age 10 sweep. We present the results from the rank regression in Table B2 in Appendix B and highlight that we find similarities in our estimates.

column 3. In columns 4-6, we study the relationship between the rank of the child's externalizing skill and the parental skills. Importantly, the parent's internalizing skill at the age of 16 and externalizing skill at the age of 10 are still important predictors for the other dimension of the child's socio-emotional skill. An increase in one rank in the parent's internalizing skill at the age of 16 corresponds to 0.139 increase in the rank of the child's externalizing skill and an increase in one rank in the parent's externalizing skill at the age of 10 corresponds to 0.253 increase in the rank of child's externalizing skill (column 6).

As mentioned previously, some results in the extant literature focus on measurements taken contemporaneously for parent and child. Here we provide evidence on what we would encounter if we were to use contemporaneous measures of socio-emotional skills as in Dohmen et al. (2011) and Anger (2012), for example. Tables 10 and 11 present the estimates for intergenerational mobility for level and rank regressions when we use socio-emotional skill measures which are contemporaneously measured for parents and children. Parents at the age-34 sweep were asked some socio-emotional related questions, which we exploit to measure socio-emotional skill. We focus on the internalizing skill which is derived by a multi-factor model that considers 3 items (unhappy, worried and fearful) common across the 4 different waves. Column 1 in the tables reproduces the estimates from Column 1 in Tables 8 and 9 using this alternative measure for internalizing skills. Column 2 in the tables shows estimates using contemporaneous measures. Table 10, for example, shows that an increase in one unit in the parent's internalizing skill translates in a 0.253-unit increase in the child's internalizing socio-emotional skill. This coefficient is more than three times as large as the coefficient we observe when we use measures of socio-emotional skills collected in different waves and at different ages (column 1, Table 10).[21] In column 3, we present estimates from an instrumental variable regression where the socio-emotional skill at the age 34 is instrumented by their own socio-emotional skill during childhood. The coefficient is noisily estimated and not significant, but its magnitude is even higher. Finally, column 4 presents the first stage of the instrumental variable regression and F-statistics for the first stage are presented in the notes to the tables.

Finally, Tables 12 and 13 report the transition matrices by quintile of the socio-emotional skill distribution. We report them for the parents' internalizing and externalizing skills at the age of 5, 10 and 16. The transition probabilities report measures of directional mobility, highlighting how mobility may change at different quintile of the socio-emotional skill distribution. One advantage of reporting transition matrices is to gain a deeper understanding on whether intergenerational persistence in socio-emotional skills arises from what happens in the tails. Interestingly, children of very low socio-emotional or very high socio-emotional skill parents mostly stay in the same quintile as their parents, while children of parents in the middle of the socio-emotional skills distribution often end up in a different quintile from their parents.

We also notice that there are large variations in the percentage of children staying in the same

[21] Fewer items are used to compute the socio-emotional skill measure since the age-34 sweep asked fewer socio-emotional related questions. Interestingly, our estimates of intergenerational mobility do not change even if we change the items considered to measure socio-emotional skills. We notice that the estimates of mobility from column in Table 9 are robust and similar to the ones in column 1 in Table 11.

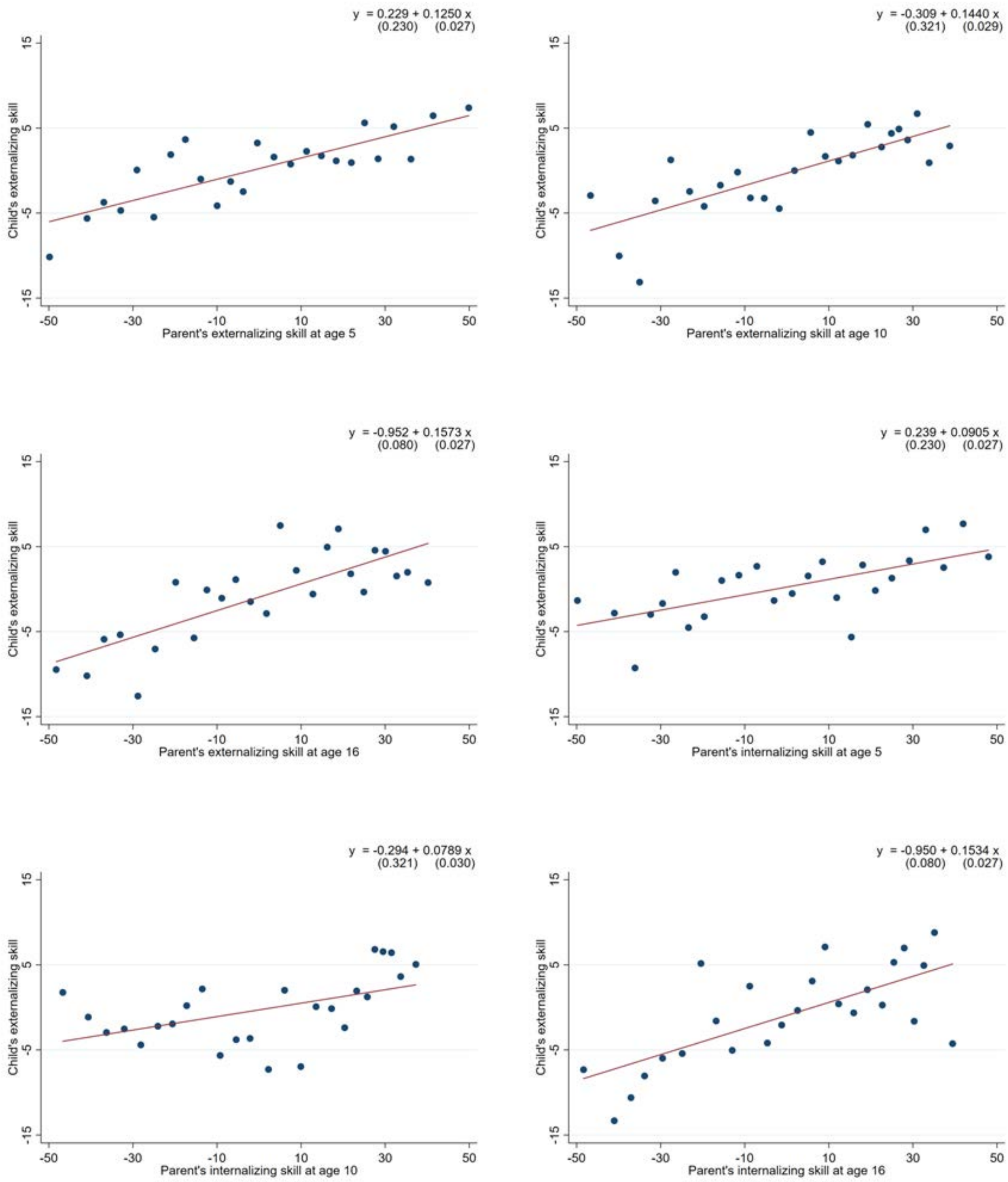
quintile of their parents as well as those moving up or down across different skills and ages. The probability of moving from the lowest to the highest quintile ranges from 13.1 to 21.1, highlighting the importance of distinguishing among skills. For each matrix, we also present the 'spectral gap mobility index' introduced earlier to facilitate comparison across matrices. The intergenerational transition matrix with higher mobility is the one relating the child's internalizing skill to the parent's externalizing skill at the age of 5, while the one with lower mobility is the one relating the child's externalizing skill to the parent's externalizing skill at the age of 10. The correlation between this measure and the rank regression coefficient estimates is -0.75 (the correlation is negative because a higher rank coefficient implies lower mobility, while a high spectral gap mobility index implies higher mobility). This high correlation comes mostly from the mobility measures of child's externalizing skill on parent's skill (the correlation is -0.90: almost the same ranking) rather than the child's internalizing skill on parent's skill (the correlation is -0.26).

Table 8: **Intergenerational mobility** (regression of child's socio-emotional score on parent's socio-emotional score (internalizing) at the age of 5, 10 and 16)

Dependent variable:	**Internalizing (INT) Skills**			**Externalizing (EXT) Skills**		
	(1)	(2)	(3)	(4)	(5)	(6)
Parent's INT at age 5	0.014		0.053	-0.036		-0.032
	(0.031)		(0.044)	(0.035)		(0.051)
Parent's INT at age 10	0.021		-0.058	0.036		-0.116**
	(0.032)		(0.045)	(0.036)		(0.051)
Parent's INT at age 16	0.109***		0.136***	0.191***		0.148***
	(0.029)		(0.043)	(0.034)		(0.050)
Parent's EXT at age 5		-0.025	-0.055		-0.019	-0.004
		(0.028)	(0.039)		(0.031)	(0.045)
Parent's EXT at age 10		0.078***	0.124***		0.149***	0.229***
		(0.028)	(0.040)		(0.031)	(0.045)
Parent's EXT at age 16		0.077***	-0.046		0.133***	0.015
		(0.027)	(0.040)		(0.031)	(0.045)
Observations	1101	1101	1101	1101	1101	1101
R^2	0.085	0.084	0.091	0.128	0.143	0.151
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes
Child's age FE	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

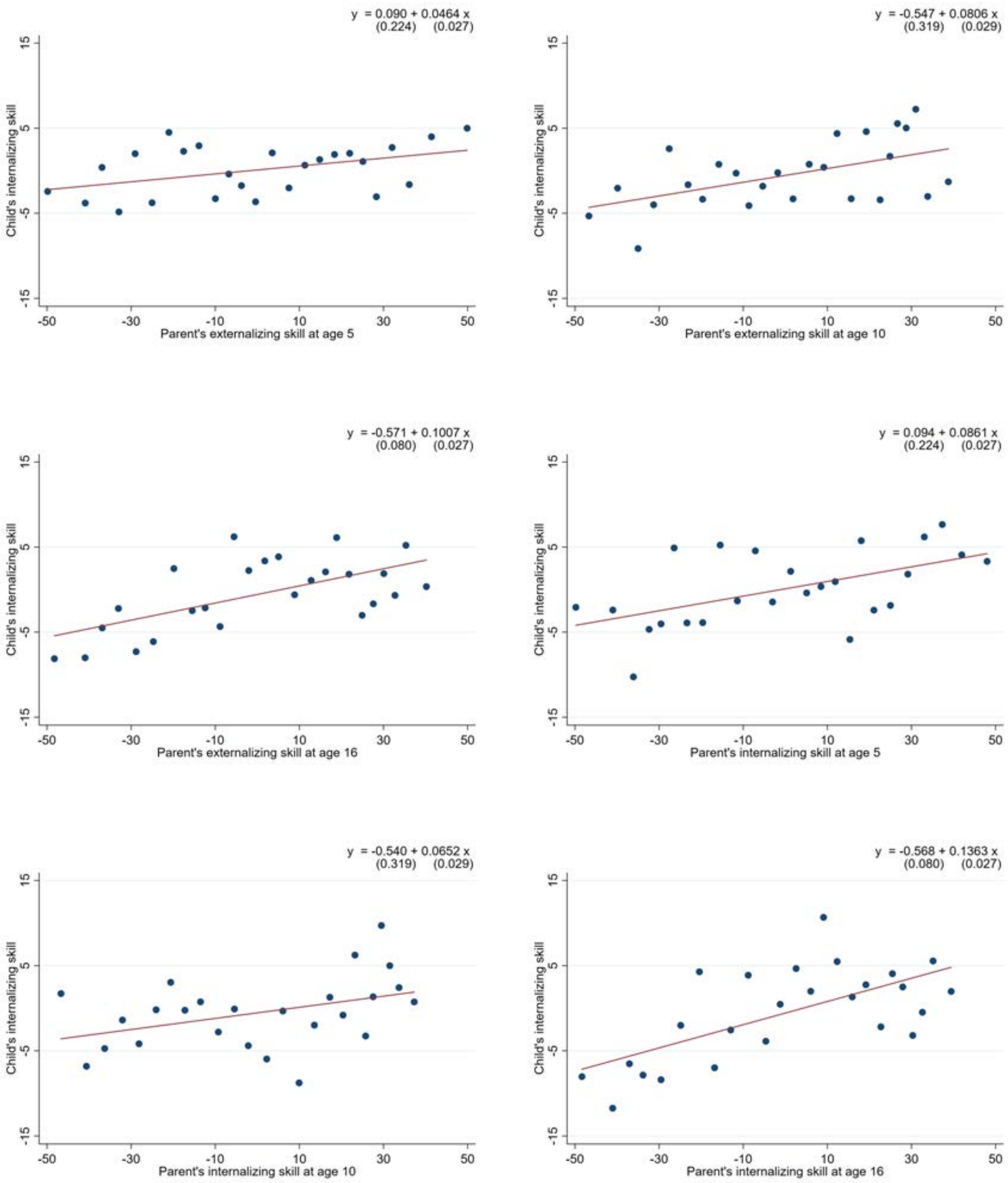
Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for equation 8 on the intergenerational mobility in socio-emotional skills (regression of child's socio-emotional score on parent's socio-emotional score at the age of 5, 10 and 16). Other controls include the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old.

Figure 4: Association between the children's residualized rank of externalizing skill and the parents' residualized rank of socio-emotional skills at different ages.



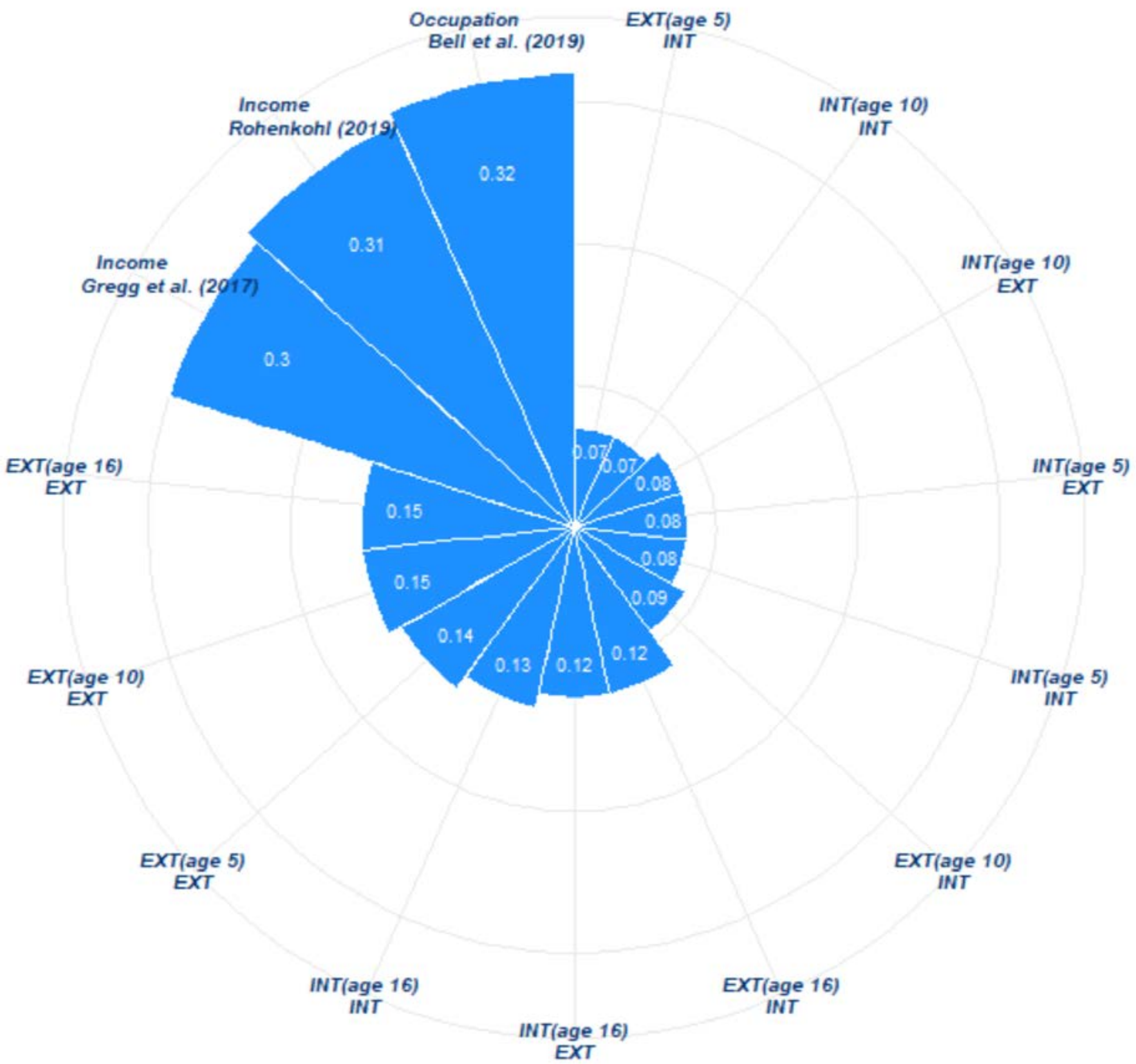
Note. These figures present non-parametric binned scatter plots of the relationship between the children's and the parent's residualized rank of socio-emotional skills. These figures are based on the socio-emotional skill scores built from factor analysis. Each panel plots the mean child socio-emotional skill within each parent socio-emotional skill bin. To construct each series, we group parents into 25 equally sized (4 percentile points) bins and plot the mean child's skill versus the mean parent's skill within each bin. The slopes are estimated using an OLS linear regression on the microdata on the two dimensions of residualized rank of socio-emotional skills. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression.

Figure 5: Association between the children's residualized rank of internalizing skill and the parents' residualized rank of socio-emotional skills at different ages.



Note. These figures present non-parametric binned scatter plots of the relationship between the children's and the parent's residualized rank of socio-emotional skills. These figures are based on the socio-emotional skill scores built from factor analysis. Each panel plots the mean child socio-emotional skill within each parent socio-emotional skill bin. To construct each series, we group parents into 25 equally sized (4 percentile points) bins and plot the mean child's skill versus the mean parent's skill within each bin. The slopes are estimated using an OLS linear regression on the microdata on the two dimensions of the residualized rank of socio-emotional skills. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression.

Figure 6: Comparison of the mobility measures



Note. The nightingale rose chart presents a comparison of the mobility measures in socio-emotional skills from the rank regressions without controls to the mobility measures (i.e., coefficients from the rank regressions) in other economic domains. Bell et al. (2018) and Rohenkohl (2019) study an older cohort born respectively in 1974-83 and 1973-1991. Gregg et al. (2017) study mobility in income in the BCS70. Higher values of the rank coefficient correspond to lower mobility.

Table 9: **Intergenerational mobility (rank-rank)** regression of child's socio-emotional score on parent's socio-emotional score (internalizing) at the age of 5, 10 and 16)

Dependent variable:	**Internalizing (INT) Skills**			**Externalizing (EXT) Skills**		
	(1)	(2)	(3)	(4)	(5)	(6)
Rank of parent's INT at 5	0.024		0.073	-0.019		-0.013
	(0.030)		(0.045)	(0.030)		(0.044)
Rank of parent's INT at 10	0.044		-0.054	0.042		-0.109**
	(0.031)		(0.045)	(0.032)		(0.045)
Rank of parent's INT at 16	0.107***		0.161***	0.170***		0.139**
	(0.030)		(0.044)	(0.031)		(0.045)
Rank of parent's EXT at 5		-0.047	-0.092**		-0.028	-0.025
		(0.030)	(0.045)		(0.030)	(0.044)
Rank of parent's EXT at 10		0.125***	0.172***		0.171***	0.253***
		(0.031)	(0.044)		(0.031)	(0.044)
Rank of parent's EXT at 16		0.075**	-0.076*		0.124***	0.009
		(0.031)	(0.045)		(0.031)	(0.046)
Observations	1101	1101	1101	1101	1101	1101
R^2	0.084	0.084	0.094	0.130	0.147	0.154
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes
Child's age FE	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills (rank-rank regression of child's socio-emotional score on parent's socio-emotional score at the age of 5, 10 and 16). Other controls include the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old.

Table 10: **Intergenerational mobility** regression of child's socio-emotional score on parent's socio-emotional score (internalizing) at the age of 5, 10, 16 and 34)

Dependent variable:	Internalizing (INT) Skills			
	Child	Child	Child	Parent (age 34)
	(1)	(2)	(3)	(4)
	(OLS)	(OLS)	(IV)	(First Stage)
Parent's INT (age 34)		0.253***	0.444	
		(0.031)	(0.873)	
Parent's INT (age 5)	0.025			0.031
	(0.031)			(0.031)
Parent's INT (age 10)	-0.001			0.038
	(0.032)			(0.032)
Parent's INT (age 16)	0.074**			0.160***
	(0.030)			(0.031)
Observations	1101	1099	1099	1099
R^2	0.057	0.111	0.076	0.121
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes
Child's age FE	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills. The internalizing skill is derived by a factor model that considers 3 items (unhappy, worried and fearful) common across the 4 different waves. Column 1 presents the regression of the child's internalizing skill on the parent's internalizing skill at the age of 5, 10 and 16. Column 2 presents the regression of the child's internalizing skill on the parent's internalizing skill at the age of 34. Column 3 presents the regression of the child's internalizing skill on the parent's internalizing skill at the age of 34 instrumented by the parent's internalizing skill at the age of 5, 10 and 16. Column 4 presents the first stage of the instrumental variable regression. The F-statistics for exclusion of the instruments is 13.46. Other controls include the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old.

Table 11: **Intergenerational mobility (rank-rank)** regression of child's socio-emotional score on parent's socio-emotional score (internalizing) at the age of 5, 10, 16 and 34)

Dependent variable:	**Internalizing (INT) Skills**			
	Child	Child	Child	Parent (age 34)
	(1)	(2)	(3)	(4)
	(OLS)	(OLS)	(IV)	(First Stage)
Parent's INT at age 34		0.250***	0.444	
		(0.032)	(0.383)	
Parent's INT at age 5	0.020			0.035
	(0.032)			(0.032)
Parent's INT at age 10	0.001			0.053
	(0.033)			(0.034)
Parent's INT at age 16	0.080**			0.164***
	(0.032)			(0.033)
Observations	1101	1099	1099	1099
R^2	0.049	0.097	0.064	0.113
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes
Child's age FE	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills. The internalizing skill is derived by a factor model that considers 3 items (unhappy, worried and fearful) common across the 4 different waves. Column 1 presents the rank-rank regression of the child's internalizing skill on the parent's internalizing skill at the age of 5, 10 and 16. Column 2 presents the rank-rank regression of the child's internalizing skill on the parent's internalizing skill at the age of 34. Column 3 presents the rank-rank regression of the child's internalizing skill on the parent's internalizing skill at the age of 34 instrumented by the parent's internalizing skill at the age of 5, 10 and 16. Column 4 presents the first stage of the instrumental variable regression. The F-statistics for exclusion of the instruments is 13.62. Other controls include the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old.

Table 12: **Intergenerational transition matrix (child's internalizing skill)**

Parent's EXT (age 5) - child's INT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	22.5	16.7	15.7	17.3	18.9
	2	19.9	21.1	22.6	19.1	17.1
	3	22.5	21.1	19.6	20.4	21.5
	4	20.4	18.5	22.2	21.8	19.3
	5	14.7	22.5	20	21.3	23.2

Spectral gap mobility index: 0.97

Parent's EXT (age 10) - child's INT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	23.8	19.4	15.6	20.5	12.4
	2	22	26	19.7	16.8	16.1
	3	20.8	22.5	18	23	20.6
	4	16.1	17.6	26.2	16	25.2
	5	17.3	14.5	20.5	23.8	25.7

Spectral gap mobility index: 0.86

Parent's EXT (age 16) - child's INT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	25.7	19.2	13	16.4	17.8
	2	20.2	23	19.9	19.5	17.3
	3	23	22.5	18.1	20.1	22
	4	18	16.4	28.7	20.1	18.3
	5	13.1	18.8	20.4	23.8	24.6

Spectral gap mobility index: 0.91

Parent's INT (age 5) - child's INT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	20.6	19.2	18.7	16	16
	2	25.5	20.1	19.1	16	19.6
	3	22.5	24.6	19.1	22.1	16.9
	4	14.7	17.4	21.7	25.4	22.7
	5	16.7	18.8	21.3	20.7	24.9

Spectral gap mobility index: 0.90

Parent's INT (age 10) - child's INT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	19.6	19.7	18.9	18.6	13.9
	2	21.6	23.6	20.8	18.6	15.7
	3	23	17	27.8	18.1	19.6
	4	16.7	22.7	16	21.2	24.8
	5	19.1	17	16.5	23.5	26.1

Spectral gap mobility index: 0.89

Parent's INT (age 16) - child's INT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	24.3	22.1	14.9	14.4	17.8
	2	26	18.1	21.5	18.4	17.3
	3	22	21.1	21.1	19.7	22
	4	14.5	23	22.4	22	18.3
	5	13.3	15.7	20.2	25.6	24.6

Spectral gap mobility index: 0.90

Note. The Tables present the percent frequency with which a child is in certain internalizing quintile (row) when parent is in a certain socio-emotional quintile (column). The spectral gap mobility index is computed by taking the difference between one and the second largest eigenvalues of the transition matrices. The transition matrices are stochastic matrices; therefore, their largest eigenvalue is always one. The discrepancy between one and the second largest could be seen as a departure from zero mobility, which corresponds to an identity matrix. Higher numbers of the spectral gap mobility index corresponds to higher mobility.

Table 13: **Intergenerational transition matrix (child's externalizing skill)**

Parent's EXT (age 5) - child's EXT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	25.7	19.4	18.7	14.7	15.4
	2	23.6	22	23.9	22.2	17.5
	3	18.8	20.7	15.7	18.2	19.7
	4	16.2	18.1	18.3	24.9	26.8
	5	15.7	19.8	23.5	20	20.6

Spectral gap mobility index: 0.88

Parent's EXT (age 10) - child's EXT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	32.7	20.3	16.4	16.8	10.1
	2	20.2	28.6	27.5	17.2	14.7
	3	18.5	18.5	13.9	22.5	19.7
	4	14.3	19.8	20.1	20.1	29.4
	5	14.3	12.8	22.1	23.4	26.1

Spectral gap mobility index: 0.78

Parent's EXT (age 16) - child's EXT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	29	22.1	14.8	15.1	14.1
	2	24.6	24.4	25	18.1	18.3
	3	15.8	19.7	19.4	18.8	18.8
	4	16.4	16.9	21.3	23.2	26.2
	5	14.2	16.9	19.4	24.8	22.5

Spectral gap mobility index: 0.82

Parent's INT (age 5) - child's EXT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	21.6	19.2	18.3	18.8	15.1
	2	19.6	25.9	22.1	22.5	18.7
	3	19.1	21	17.4	16.4	19.1
	4	20.1	16.5	24.3	20.2	23.6
	5	19.6	17.4	17.9	22.1	23.6

Spectral gap mobility index: 0.94

Parent's INT (age 10) - child's EXT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	19.1	21.8	25.5	15	11.7
	2	21.1	24.9	22.6	26.1	14.3
	3	18.1	21.8	17	16.8	19.1
	4	20.1	15.7	17.9	22.1	28.7
	5	21.6	15.7	17	19.9	26.1

Spectral gap mobility index: 0.93

Parent's INT (age 16) - child's EXT

		Parent quintile				
		1	2	3	4	5
Child quintile	1	25.4	24	17.5	14.4	14.1
	2	26	23.5	23.2	19.3	18.3
	3	19.7	16.7	19.7	18.4	18.8
	4	15	20.1	18.4	23.6	26.2
	5	13.9	15.7	21.1	24.3	22.5

Spectral gap mobility index: 0.83

Note. The Tables present the percent frequency with which a child is in certain externalizing quintile (row) when parent is in a certain socio-emotional quintile (column). The spectral gap mobility index is computed by taking the difference between one and the second largest eigenvalues of the transition matrices. The transition matrices are stochastic matrices; therefore, their largest eigenvalue is always one. The discrepancy between one and the second largest could be seen as a departure from zero mobility, which corresponds to an identity matrix. Higher numbers of the spectral gap mobility index corresponds to higher mobility.

7 Multi-generational persistence in socio-emotional skills

During the 1975, 1980 and 1986 sweeps, the mothers of the subjects (i.e., grandmothers to the children of the 1970 cohort) were also asked some socio-emotional related questions. We exploit these data to study multi-generational persistence in socio-emotional skills that is, the relationship between the grandmother and grandchild's socio-emotional skills.

The data on the grandmother's socio-emotional skill in adulthood come from the cohort members' mothers who have completed the Malaise Inventory (Rutter et al., 1970) in the 1975, 1980 and 1986 sweeps.[22] Table 14 presents the set of 24 'yes-no' self-completion questions asked to the grandmothers to measure their levels of psychological distress, or depression.[23] Individuals responding 'yes' to eight or more of the 24 items are considered to be at risk of depression.[24]

We focus only on one dimension of socio-emotional skill, 'internalizing skills', for which we have data comparable between grandmothers and grandchildren. Table 15 shows the questions retained from both waves. Subsequently, we fit a multi-group factor model to derive the factor score, as outlined in section 3, in order to study multi-generational mobility in socio-emotional skills.

We begin by studying intergenerational mobility in socio-emotional skill by correlating the cohort member's and the mother's internalizing skill. Table 16 presents the estimates from the level regressions, while Table 17 presents the same estimates from the rank regression. We include a set of controls which are the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old. We still find that the mother's internalizing skill is positively correlated with the cohort member's socio-emotional skills. However, we urge caution in comparing these results to the main estimates for the following reasons. First, the controls we include are different. Second, the measures of skills for the mothers (aged around 25 years old in 1975) and the cohort members are contemporaneous. These results hint at the bias that we highlight in Section 6 when we estimate intergenerational mobility in socio-emotional skills using contemporaneous measures. The intergenerational mobility coefficients obtained from using contemporaneous measures of socio-emotional skills for the sample of parents and children (see column 2 of Tables 10 and 11), estimated at around 0.25 in both cases, has the same magnitude as the estimates obtained for the sample of grandmothers and parents, which uses contemporaneous measures of socio-emotional skills (see column 1 in Table 16 and 17). Interestingly, these results

[22]The Malaise Inventory was developed from the Cornell Medical Index Health Questionnaire which is comprised of 195 self-completion questions.

[23]In the 1975 sweep the scale is binary, in the 1980 sweep the scale is continuous from 0 to 100 and in the 1986 sweep the scale is categorical with 3 categories. We converted them to binary. We converted the continuous scale form 0 to 100 (where 100 means "most of the times") to 'no behavioural problem' (dummy equal to 1) if the answer is below 80 and 'yes behavioural problem' (dummy equal to 0) if the answer is above 80. We have tried different cutoffs and the results are robust.

[24]Rodgers et al. (1999) show that that the internal consistency of the scale is acceptable and holds in different socioeconomic groups. Rutter et al. (1970) notice that 'the inventory differentiates moderately well between individuals with and without psychiatric disorder'.

do not depend on which items we include or not to derive the internalizing skill (in Tables 10 and 11, we use only 3 items to derive the internalizing score).[25]

Tables 18 and 19 present the estimates for multi-generational persistence in the internalizing skill respectively when the outcome variable is the child's raw internalizing score and the rank of the internalizing score. We include a set of controls which are the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the grandparent's employment status, education and profession in 1975, the number of children in the parent's household when the parent is 5 years old, region of the parent's birth fixed effects and age of child fixed effects.

The estimates show that the grandmother's internalizing skill in adulthood is predictive of the grandchild's internalizing skill. This finding hints at a strong persistence in socio-emotional skills which goes back even to the grandmother's generation. For example, Table 19 shows that an increase in one rank in the grandmother's internalizing skill in 1975 translates in an increase in 0.086 rank in the grandchild's internalizing skill (column 1) and in 0.053 rank in the grandchild's internalizing skill after we control for parental skills (column 5). The multi-generational mobility coefficient - namely, the grandmother's internalizing skill at the 1975 sweep - is significant when we do not include any controls for the parent's internalizing skill (column 1). This effect is also robust to controlling for the parents internalizing skills in the rank regressions on Table 19, though not in the linear regression in Table 18 hinting at potential 'masking' by outliers (see (Rousselet and Pernet, 2012)).[26]

A strand of the literature has investigated multi-generational mobility in mental health, which is related to a certain extent to socio-emotional skills. Johnson et al. (2013) study multi-generational mobility in mental health across three generations by using the BCS70, but find no correlation between the grandmother and grandchild's mental health. Their approach to study multi-generational mobility suffers from some of the problems which we have mentioned in the introduction and discussed in Section 6. They measure parents' mental health during adulthood, while they measure children's mental health during childhood. In addition, contemporaneous measure of parents' and children's mental health are used from the age-34 sweep, which could lead to reverse causality if the disruptive child affects the parents' mental health.[27]

[25] One alternative to discipline our estimates would be a statistical model where

$$Y_i^C = \gamma Y_i^P + \epsilon_i, \qquad Y_i^C = \tilde{\gamma}\tilde{Y}_i^P + \tilde{\epsilon}_i \quad \text{and} \quad Y_i^C = \tilde{\gamma} \times \gamma \tilde{Y}_i^G + \eta_i,$$

where Y_i^C and Y_i^P are child and parent skills in childhood as previously defined and $\tilde{Y}_i^P$ and $\tilde{Y}_i^G$ are parent and grandparent skills in adulthood.

[26] The p-value for a bootstrapped Wald test that the grandmothers' internalizing skill coefficients are jointly different from zero is 0.06 in column 5 from Table 19. For the linear regression (column 5 from Table 18), the p-value for such a joint test is 0.573.

[27] Some other reasons for why Johnson et al. (2013) find no multi-generational correlation after controlling for parents could be the following. Their measure of grandchildren's mental health is not directly comparable to the ones of grandmothers and parents. For grandmothers and parents, they use the same questions, while for grandchildren they sum all the responses from SDQ which contains some items that are not mental health related. Finally, their measure of mental health is obtained by averaging the responses to the mother mental health questionnaire, instead of estimating a factor model.

Table 14: Malaise Inventory Questions

Cohort members' mothers (i.e. grandmothers to the children of the 1970 cohort) answered the following questions	
1. Tired Most of Time	13. Easily Upset or Irritated
2. Often Feel Depressed	14. Frightened of Going Out
3. Often Have Bad Headaches	15. Constantly Keyed Up, Jittery
4. Often Get Worried	16. Suffer From Indigestion
5. Sleeping Difficulty	17. Suffer From Upset Stomach
6. Waking Unnecessarily Early	18. Is Appetite Poor
7. Worn Out Worrying About Health	19. Everything Gets on Nerves
8. Often Get Into Violent Rage	20. Does Heart Race
9. Do People Annoy and Irritate	21. Often Have Bad Pains in Eyes
10. Had Twitching of Face,Head	22. Rheumatism, Fibrositis
11. Scared for No Good Reason	23. Had Nervous Breakdown
12. Scared to be Alone	24. Other Health Problems

Note. The table reports the Malaise inventory questions. Cohort members' mothers (i.e. grandmothers to the children of the 1970 cohort) answered them at the age-5 sweep. The Malaise inventory questions are a set of self-completion questions which combine to measure levels of psychological distress, or depression. The 24 items of the inventory are 'yes-no' questions.

Table 15: Subscale of comparable items between grandmother and grandchild

Itm.	Factor	Cat.	Title	Mother's malaise (grandmother)	Rutter Wording (Children aged 3-16)
1	INT	2	*Worried*	Often Get Worried	Many worries, often seeming worried
2	INT	2	*Fearful*	Scared for No Good Reason	Nervous or clingy in new situations,
3	INT	2	*Unhappy*	Often Feel Depressed	Often unhappy, downhearted or tearful
4	INT	2	*Aches*	Suffer From Upset Stomach stomach-ache or has vomited	Often complaining of headaches, stomach-aches or sickness
5	INT	2	*Solitary*	Scared to be alone	Rather solitary, tending to play alone

Note. Itm. is item number. Factor is the latent construct to which the item loads - EXT is externalizing skills, INT is internalizing skills. Cat. is the number of categories in which the item is coded - 2 denotes a binary item (applies/does not apply). For the Rutter Wording (Children aged 3-16), 3-category item is converted to be binary (Does not apply is 1). Title is a short label for the item. Wording columns show the actual wording in the scales used in each of the cohort studies.

Table 16: **Intergenerational mobility** regression of parent's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent's socio-emotional skill at the age of 5, 10 and 16)

Dependent variable:	Internalizing Skills					
	At age 5	At age 10	At age 10	At age 16	At age 16	At age 16
	(1)	(2)	(3)	(4)	(5)	(6)
Grandmother's INT (1975)	0.295***	0.109***	0.028	0.135***	0.044	0.046
	(0.022)	(0.024)	(0.025)	(0.028)	(0.029)	(0.029)
Grandmother's INT (1980)		-0.160***	-0.169***	0.029	0.031	0.058*
		(0.024)	(0.025)	(0.029)	(0.031)	(0.031)
Grandmother's INT (1986)				0.363***	0.365***	0.372***
				(0.028)	(0.029)	(0.030)
Parent's INT at age 5			0.283***		0.267***	0.214***
			(0.030)		(0.024)	(0.030)
Parent's INT at age 10						0.129***
						(0.030)
p-value (grandmother's INT skills coeffs are jointly zero)		0.000	0.000	0.000	0.000	0.000
p-value (parent's INT skills coeffs are jointly zero)						0.000
Observations	1249	1265	1179	1296	1210	1145
R^2	0.170	0.121	0.199	0.202	0.257	0.272
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills (regression of parent's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent'socio-emotional skill at age 5, 10 and 16). Other controls include the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old. The p-value for the test that the socio-emotional skill coefficients are jointly zero is computed as follows by bootstrapping the entire procedure. For each bootstrapped sample, we estimate the factors, run the regression and estimate the Wald statistics (the weighting matrix for the Wald statistic is obtained by using the bootstrap sample (Hall and Wilson, 1991)). This gives us the distribution for the Wald statistic once recentered (by subtracting the mean of the empirical distribution). So we compute the percentile of the Wald statistic for the hypothesis we want to test in the empirical distribution for the test statistic obtained from the bootstrap samples. One minus that is the p-value.

Table 17: **Intergenerational mobility (rank-rank** regression of parent's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent's socio-emotional skill at the age of 5, 10 and 16)

Dependent variable:	**Internalizing Skills**					
	At age 5	At age 10	At age 10	At age 16	At age 16	At age 16
	(1)	(2)	(3)	(4)	(5)	(6)
Grandmother's INT (1975)	0.290***	0.085***	0.022	0.113***	0.032	0.036
	(0.023)	(0.024)	(0.025)	(0.028)	(0.029)	(0.029)
Grandmother's INT (1980)		-0.135***	-0.140***	0.010	0.016	0.041
		(0.024)	(0.025)	(0.029)	(0.031)	(0.031)
Grandmother's INT (1986)				0.297***	0.297***	0.298***
				(0.029)	(0.030)	(0.031)
Parent's INT at age 5			0.220***		0.262***	0.206***
			(0.024)		(0.030)	(0.030)
Parent's INT at age 10						0.172***
						(0.031)
p-value (grandmother's INT skills coeffs are jointly zero)		0.000	0.000	0.000	0.000	0.000
p-value (parent's INT skills coeffs are jointly zero)						0.000
Observations	1249	1265	1179	1296	1210	1145
R^2	0.147	0.116	0.187	0.177	0.233	0.249
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills (rank-rank regression of parent's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent's socio-emotional skill at age 5, 10 and 16). Other controls include the cohort member's gender, the age of the cohort member's mother at birth, a dummy equal to 1 if the cohort member is the first born, the employment status, education and profession of the cohort member's parent in 1975, and the number of children in the cohort member's household when the cohort member is 5 years old. The p-value for the test that the socio-emotional skill coefficients are jointly zero is computed as follows by bootstrapping the entire procedure. For each bootstrapped sample, we estimate the factors, run the regression and estimate the Wald statistics (the weighting matrix for the Wald statistic is obtained by using the bootstrap sample (Hall and Wilson, 1991)). This gives us the distribution for the Wald statistic once recentered (by subtracting the mean of the empirical distribution). So we compute the percentile of the Wald statistic for the hypothesis we want to test in the empirical distribution for the test statistic obtained from the bootstrap samples. One minus that is the p-value.

Table 18: **Multi-generational mobility** regression of grandchild's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent's socio-emotional skill at the age of 5, 10 and 16)

Dependent variable:			**Internalizing Skills**		
	(1)	(2)	(3)	(4)	(5)
Grandmother's INT (1975)	0.068**	0.046	0.062**	0.048*	0.022
	(0.029)	(0.029)	(0.030)	(0.029)	(0.031)
Grandmother's INT (1980)	0.008	0.013	0.012	0.001	0.017
	(0.029)	(0.030)	(0.030)	(0.029)	(0.031)
Grandmother's INT (1986)	0.041	0.045	0.045	0.017	0.041
	(0.028)	(0.029)	(0.029)	(0.029)	(0.031)
Parent's INT at age 5		0.064**			0.040
		(0.031)			(0.032)
Parent's INT at age 10			0.035		0.008
			(0.028)		(0.030)
Parent's INT at age 16				0.078***	0.050*
				(0.029)	(0.031)
p-value (grandmother's INT skills coeffs are jointly zero)	0.010	0.080	0.026	0.156	0.573
p-value (parent's INT skills coeffs are jointly zero)					0.095
Observations	1333	1237	1252	1285	1135
R^2	0.068	0.073	0.063	0.073	0.066
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes
Child's age FE	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills (regression of grandchild's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent'socio-emotional skill at age 5, 10 and 16). Other controls include the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old. The p-value for the test that the socio-emotional skill coefficients are jointly zero is computed as follows by bootstrapping the entire procedure. For each bootstrapped sample, we estimate the factors, run the regression and estimate the Wald statistics (the weighting matrix for the Wald statistic is obtained by using the bootstrap sample (Hall and Wilson, 1991)). This gives us the distribution for the Wald statistic once recentered (by subtracting the mean of the empirical distribution). So we compute the percentile of the Wald statistic for the hypothesis we want to test in the empirical distribution for the test statistic obtained from the bootstrap samples. One minus that is the p-value.

Table 19: **Multi-generational mobility (rank-rank** regression of grandchild's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent's socio-emotional skill at the age of 5, 10 and 16)

Dependent variable:	**Internalizing (INT) Skills**				
	(1)	(2)	(3)	(4)	(5)
Grandmother's INT (1975)	0.086***	0.070**	0.080***	0.072**	0.053*
	(0.029)	(0.030)	(0.030)	(0.029)	(0.031)
Grandmother's INT (1980)	0.009	0.016	0.013	0.007	0.022
	(0.029)	(0.030)	(0.030)	(0.030)	(0.031)
Grandmother's INT (1986)	0.030	0.033	0.037	0.011	0.034
	(0.029)	(0.030)	(0.030)	(0.030)	(0.032)
Parent's INT at age 5		0.050			0.030
		(0.031)			(0.031)
Parent's INT at age 10			0.028		0.005
			(0.028)		(0.029)
Parent's INT at age 16				0.070**	0.041
				(0.029)	(0.031)
p-value (grandmother's INT skills coeffs are jointly zero)	0.001	0.010	0.001	0.028	0.060
p-value (parent's INT skills coeffs are jointly zero)					0.091
Observations	1333	1237	1252	1285	1135
R^2	0.063	0.066	0.060	0.068	0.061
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes
Child's age FE	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills (rank-rank regression of grandchild's socio-emotional score on grandmother's socio-emotional score (internalizing) and parent'socio-emotional skill at age 5, 10 and 16). Other controls include the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old. The p-value for the test that the socio-emotional skill coefficients are jointly zero is computed as follows by bootstrapping the entire procedure. For each bootstrapped sample, we estimate the factors, run the regression and estimate the Wald statistics (the weighting matrix for the Wald statistic is obtained by using the bootstrap sample (Hall and Wilson, 1991)). This gives us the distribution for the Wald statistic once recentered (by subtracting the mean of the empirical distribution). So we compute the percentile of the Wald statistic for the hypothesis we want to test in the empirical distribution for the test statistic obtained from the bootstrap samples. One minus that is the p-value.

8 Conclusion

This study investigates the life cycle dynamics and the intergenerational mobility in socio-emotional skills in the United Kingdom by using unique data from the 1970 British Cohort Study. We notice a considerable amount of persistence in the life cycle dynamics of socio-emotional skills, providing suggestive evidence of the importance of early childhood in the skill formation and pointing towards extending these models to consider the skills not only in the previous period but also in earlier periods, especially in the early childhood.

In addition, our results contribute to the literature by providing an estimate of intergenerational mobility, which tackles some of the concerns on previous ones. First, the possibility to use multiple observations of socio-emotional skills over the life cycle mitigates the 'lifecyle' bias and questions whether parents' socio-emotional skills in early childhood rather than in adolescence are more predictive of their child's socio-emotional skills. Second, socio-emotional skills are not contemporaneously measured in the BCS70. This means that the main direction of the intergenerational transmission is presumably from parents to their children, ruling out the possibility of children influencing their parents' personality. We also move away from estimating the correlation between parents and children's socio-emotional skills and estimate a rank regression of child's socio-emotional skills on parents' socio-emotional skills measured at the age of 5, 10 and 16. A comparison of our estimates to the ones on the intergenerational mobility in other economic domains shows that our estimates have a smaller magnitude to the ones found in the intragenerational mobility in income and occupation in the United Kingdom (Bell et al., 2018; Gregg et al., 2017; Rohenkohl, 2019).

Multi-generational mobility in socio-emotional skills is finally investigated. We select items from the behavioural questionnaires which are comparable across children, parents and grandmothers. We adopt methodological advances in multi-group factor analysis to establish that the grandmother and grandchild's socio-emotional skill measures are comparable. Our estimates show that the transmission of socio-emotional skills is quite persistent. The grandmother's socio-emotional skill predicts her own grandchild's socio-emotional skills.

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Appendices to "Intergenerational Mobility in socio-emotional Skills"

A Measurement invariance

As in Attanasio et al. (2020), we test for measurement invariance since any comparison between socio-emotional skills across different generations requires that the socio-emotional measures we derived have the same relationship with the latent constructs (Vandenberg and Lance, 2000; Putnick and Bornstein, 2016). Specifically, the items in the age 5, 10 and 16 sweeps for the cohort members and the child-sweep must measure internalizing and externalizing in the same way.

This is a formally testable property following the assumptions introduced by Wu and Estabrook (2016). Intuitively, this is done by comparing the baseline model, namely the maximal identifiable model, with a series of models with stronger restrictions on the item- and cohort-specific intercepts v_{ic} and loadings λ_{ic}, requiring them to be the same across groups. Their fit is compared to see if the models with stronger restrictions have a worse fit. If this is not the case, the invariance is achieved.

We estimate three models with additional restrictions that we can compare with the baseline model and assess their relative fit. First, we estimate the threshold invariant model which is observationally equivalent to the baseline model when each item is a categorical variable with three categories (Wu and Estabrook, 2016). We highlight that the number of parameters and fit are indeed the same for the baseline and threshold invariant model.

Second, we estimate the loading- and threshold-invariant model, which imposes stronger restrictions. Namely, we impose that the factor loadings λ_{ic} and the threshold on the parameters must be the same between parents and children. This means that the items in the Rutter/SDQ scale from the children and parents have the same relationship with the latent skill because the factor loadings are the same across groups. If the fit of the model is similar to the baseline one, then socio-emotional skills can be placed on the same scale and we can compare the variance.

Third, we estimate a loading-, threshold-, and intercept-invariant model. Namely, we impose that the factor loadings λ_{jc}, the intercepts v_{jc} and the threshold be the same between parents and children. If the fit of the model does not worsen compared to the baseline model, we can also compare the means of the socio-emotional skills between the two groups.

Table A1 compares the fit of each model. We first present the χ^2 statistic, but also other alternative goodness-of-fit indices commonly used, such as the root mean squared error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker-Lewis index (TLI).[2]

The baseline model fits the data well. When we restrict the threshold and loadings to be the same across groups, this yields a fit comparable to the baseline one. The fit worsens when we also

[2]The RMSEA is defined as $\sqrt{(\chi^2 - df)/df(N-1)}$, where df are the degrees of freedom and N is the sample size. Lower values imply a better fit and MacCallum et al. (1996) suggest measures between 0.05 and 0.08 to be fair. On the other hand, CFI and TLI determine how far our model is from the model with the model where the variables have no correlation across them). The CFI is defined as $(\epsilon_{\text{Null Model}} - \epsilon_{\text{Alternative Model}})/\epsilon_{\text{Null Model}}$, where $\epsilon = \chi^2 - df$, whereas the TLI is defined as $(\epsilon_{\text{Null Model}} - \epsilon_{\text{Alternative Model}})/(\epsilon_{\text{Null Model}} - 1)$, where now $\epsilon = \chi^2/df$. Both indices are between 0 and 1 and a higher value corresponds to a better fit for the alternative model.

Table A1: Measurement invariance fit comparison

Model	Number of parameters	χ^2	RMSEA	CFI	TLI
Baseline model/ Threshold Invariance	136	1875.935	0.061	0.959	0.947
Threshold and loading invariance	108	2425.905	0.064	0.946	0.941
Threshold, loading, and intercept invariance	81	5056.477	0.089	0.883	0.886

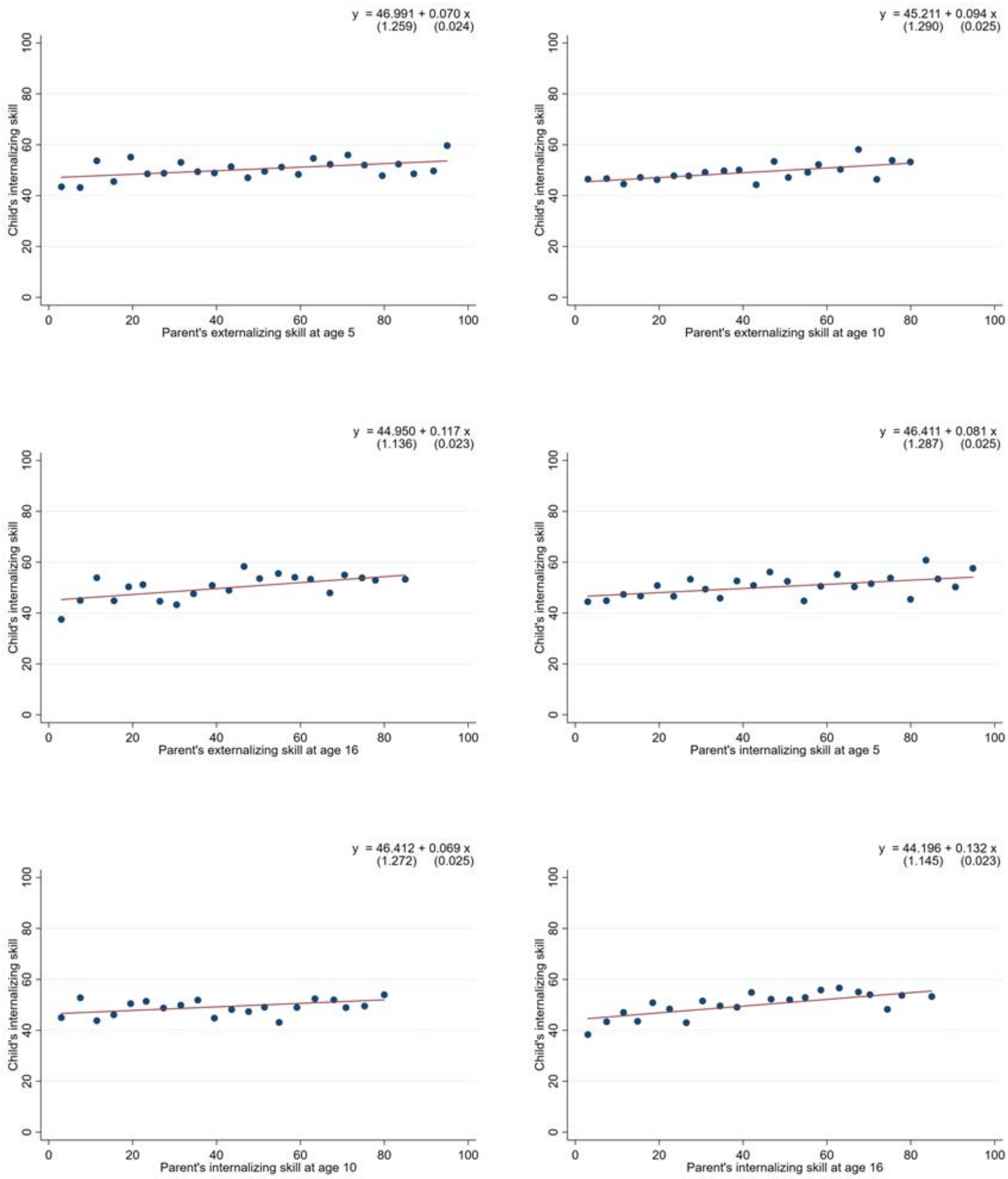
Note. The table compares the optimal number of factors suggested by different approaches. RMSEA stands for the root mean squared error of approximation, CFI for the comparative fit index, and TLI for the Tucker-Lewis index.

restrict the intercepts to be the same, but still provides comparable fit according to the measures above.

B Mobility in socio-emotional skills

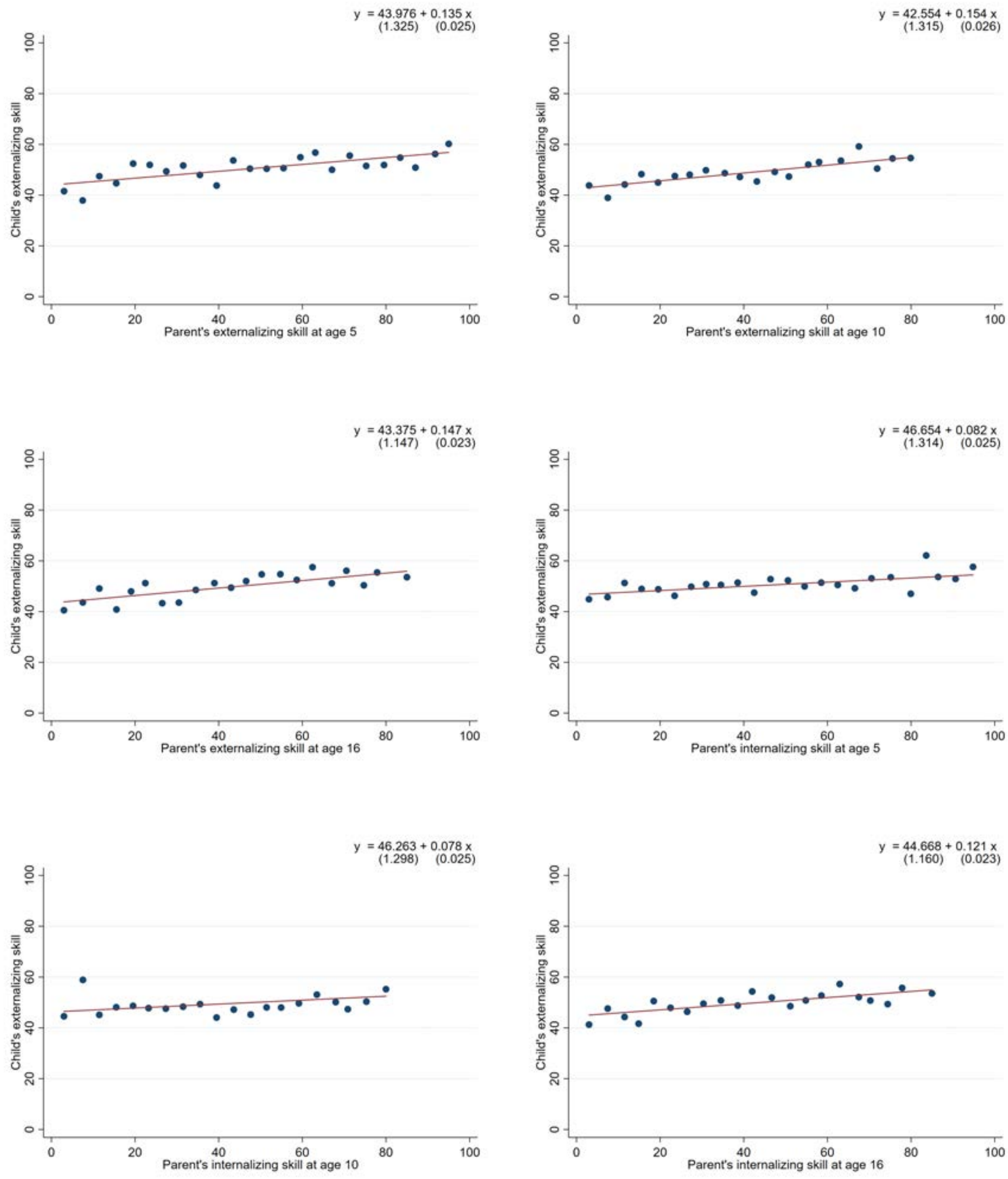
In this section, we report additional estimates of mobility in socio-emotional skills. Figures B1 and B2 report binned scatter plots of the rank regression for internalizing and externalizing skills when we do not include any controls. Figures B3 and B4 present non-parametric binned scatter plots of the relationship between the children's and the parent's residualized socio-emotional skill. Table B2 presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills (rank-rank regression of child's socio-emotional score on parent's socio-emotional score at the age of 5, 10 and 16), where socio-emotional skill at the age-10 sweep are derived from questionnaire administered to teachers.

Figure B1: Association between the children's percentile ranks of internalizing skill and the parents' percentile ranks of socio-emotional skills at different ages.



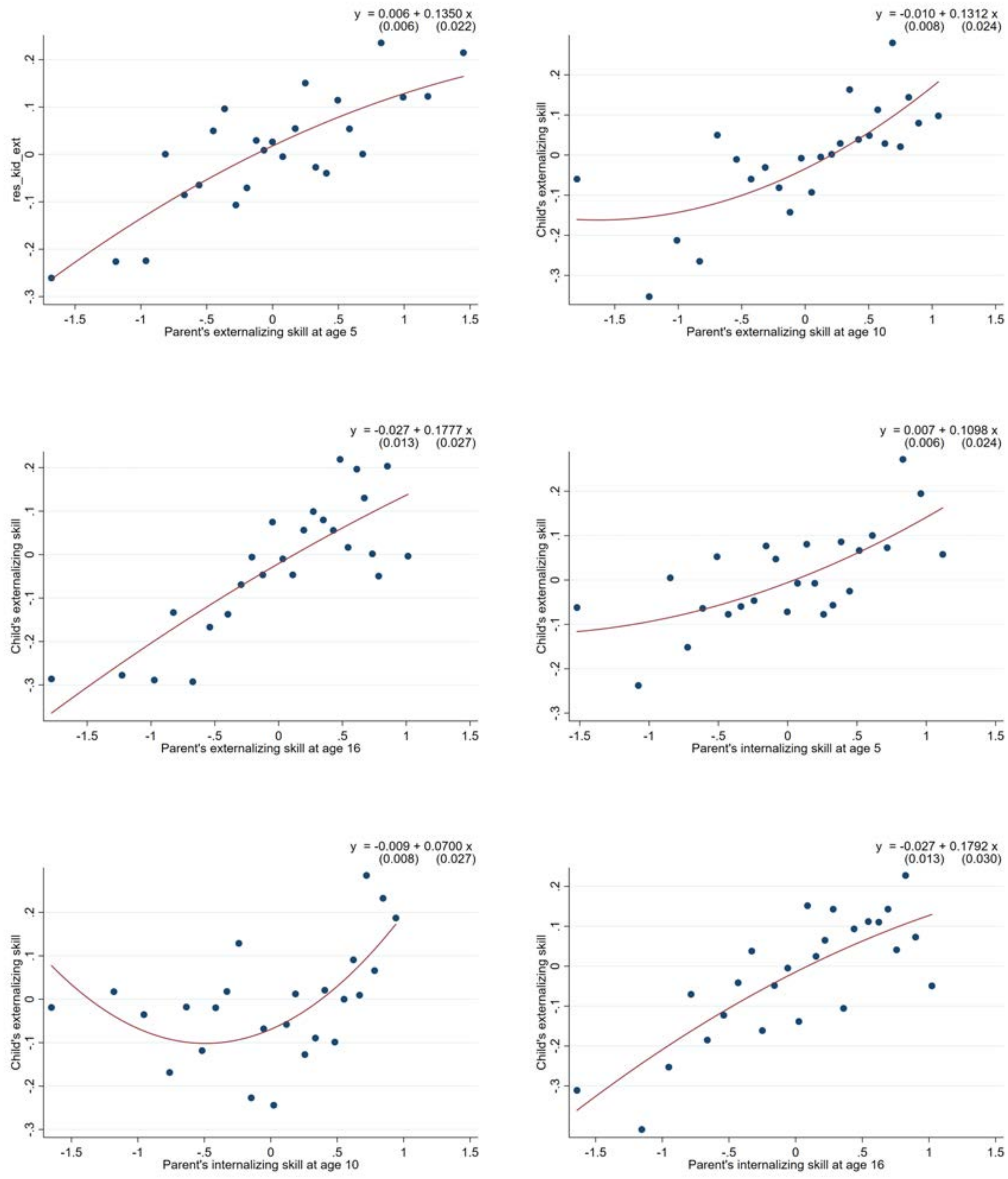
Note. These figures present non-parametric binned scatter plots of the relationship between children's and parent's percentile socio-emotional skill ranks. These figures are based on the socio-emotional skill scores built from factor analysis. Each panel plots the mean child percentile rank within each parent percentile rank bin. To construct each series, we group parents into 25 equally sized (4 percentile point) bins and plot the mean child percentile rank versus the mean parent percentile rank within each bin. The slopes are estimated using an OLS rank-rank regression on the microdata on the two dimensions of socio-emotional skill. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression.

Figure B2: Association between the children's percentile ranks of externalizing skill and the parents' percentile ranks of socio-emotional skills at different ages.



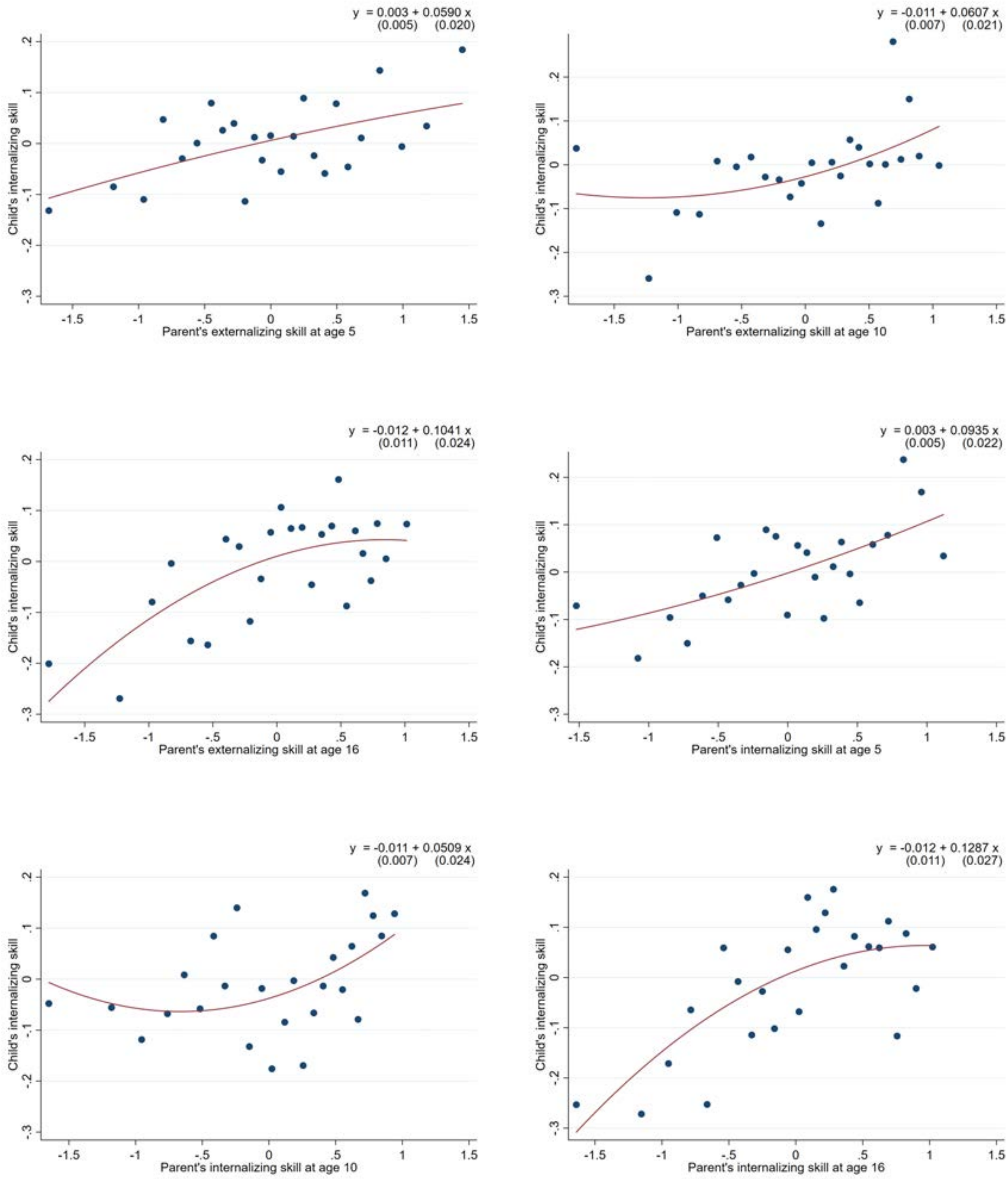
Note. These figures present non-parametric binned scatter plots of the relationship between children's and parent's percentile socio-emotional skill ranks. These figures are based on the socio-emotional skill scores built from factor analysis. Each panel plots the mean child percentile rank within each parent percentile rank bin. To construct each series, we group parents into 25 equally sized (4 percentile points) bins and plot the mean child percentile rank versus the mean parent percentile rank within each bin. The slopes are estimated using an OLS rank-rank regression on the microdata on the two dimensions of socio-emotional skill. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression.

Figure B3: Association between the children's residualized externalizing skill and the parents' residualized socio-emotional skills at different ages.



Note. These figures present non-parametric binned scatter plots of the relationship between the children's and the parent's residualized socio-emotional skill. These figures are based on the socio-emotional skill scores built from factor analysis. Each panel plots the mean child socio-emotional skill within each parent socio-emotional skill bin. To construct each series, we group parents into 25 equally sized (4 percentile points) bins and plot the mean child's skill versus the mean parent's skill within each bin. The slopes are estimated using an OLS linear regression on the microdata on the two dimensions of socio-emotional skill. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression.

Figure B4: Association between the children's residualized internalizing skill and the parents' residualized socio-emotional skills at different ages.



Note. These figures present non-parametric binned scatter plots of the relationship between the children's and the parent's residualized socio-emotional skill. These figures are based on the socio-emotional skill scores built from factor analysis. Each panel plots the mean child socio-emotional skill within each parent socio-emotional skill bin. To construct each series, we group parents into 25 equally sized (4 percentile points) bins and plot the mean child's skill versus the mean parent's skill within each bin. The slopes are estimated using an OLS linear regression on the microdata on the two dimensions of socio-emotional skill. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression.

Table B2: **Intergenerational mobility (rank-rank)** regression of child's socio-emotional score on parent's socio-emotional score (internalizing) at the age of 5, 10 and 16) - socio-emotional skill at the age-10 sweep derived from questionnaire administered to teachers.

Dependent variable:	**Internalizing (INT) Skills**			**Externalizing (EXT) Skills**		
	(1)	(2)	(3)	(4)	(5)	(6)
Rank of parent's INT at 5	0.051		0.057*	0.016		-0.026
	(0.031)		(0.034)	(0.031)		(0.035)
Rank of parent's INT at 10	0.039		0.061*	0.004		0.057
	(0.030)		(0.032)	(0.030)		(0.035)
Rank of parent's INT at 16	0.123***		0.187***	0.178***		0.166***
	(0.030)		(0.033)	(0.030)		(0.035)
Rank of parent's EXT at 5		0.023	-0.007		0.056*	0.074**
		(0.032)	(0.034)		(0.032)	(0.036)
Rank of parent's EXT at 10		0.011	0.061*		0.068**	0.109***
		(0.031)	(0.033)		(0.031)	(0.036)
Rank of parent's EXT at 16		0.097***	-0.073**		0.145***	0.005
		(0.030)	(0.033)		(0.030)	(0.035)
Observations	1133	1133	1133	1133	1133	1133
R^2	0.095	0.085	0.099	0.123	0.128	0.137
Region of birth FE (BCS70 5y)	Yes	Yes	Yes	Yes	Yes	Yes
Child's age FE	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes

Note. All standard errors in parentheses are obtained using 1,000 bootstrap repetitions, taking into account the factor estimation stage that precedes the regression (*** p<0.01, ** p<0.05, * p<0.1). The table presents estimates for equation 9 on the intergenerational mobility in socio-emotional skills (rank-rank regression of child's socio-emotional score on parent's socio-emotional score at the age of 5, 10 and 16). Socio-emotional skill at the age-10 sweep derived from questionnaire administered to teachers. We do not include items for disobedient and aches because teachers were not administered such questions. Other controls include the parent's gender, the child's gender, the number of children in the household, the mother's age at the parent's birth, a dummy equal to 1 if the parent is the first born, the parent's employment status at the age of 34, the grandparent's employment status, education and profession in 1975 and the number of children in the parent's household when the parent is 5 years old.

C Descriptive statistics

Table C3 reports the descriptive statistics for the sample of parent and children linked. Table C4 presents the number of responses in the BCS70 at the age-34 sweep. Table C5 reports the response rates for the questionnaire items used in the main analysis. Table C6 reports the correlation matrix of internalizing and externalizing skills at different ages.

Table C3: Descriptive statistics

	Household characteristics		
	Mean	St.Dev.	N
	(1)	(2)	(3)
Grandparents at age-5 sweep			
Grandmother's age	25	5.02	1101
Grandmother has higher education degree	0.06	0.23	1101
Grandmother's occupation: professional (%)	8.99	28.62	1101
Grandmother's occupation: managerial-technical (%)	34.79	47.65	1101
Grandmother's occupation: skilled non-manual (%)	5.72	23.24	1101
Grandmother's occupation: skilled manual (%)	18.17	38.57	1101
Grandmother's occupation: unskilled (%)	1.36	11.60	1101
Grandfather's occupation: professional (%)	4.61	20.83	1101
Grandfather's occupation: managerial-technical (%)	11.33	31.61	1101
Grandfather's occupation: skilled non-manual (%)	15.42	36.04	1101
Grandfather's occupation: skilled manual (%)	46.02	49.80	1101
Grandfather's occupation: unskilled (%)	18.50	38.77	1101
Parents (BCS70 cohort members)			
Number other children in HH (5y)	2	1.02	1101
Number other children in HH (5y)	1.52	1.02	1101
First born (%)	45.78	49.84	1101
Male cohort member (%)	28.16	45.00	1101
Employed at age 34 (%)	76.66	42.32	1101
Region of birth			
North (%)	18.35	38.72	1101
Yorksh. + Humbers. (%)	9.81	29.76	1101
East Midlands (%)	7.36	26.12	1101
West Midlands (%)	10.99	31.29	1101
South West (%)	7.99	27.13	1101
East + SE (%)	30.34	45.99	1101
Wales (%)	6.45	24.57	1101
Scotland (%)	8.72	28.22	1101
Northern Ireland (%)	0.00	0.00	1101
Children at age-34 sweep			
Total number of children	2	0.85	1101
Child's age	7	3.27	1101
Child's sex (%)	51.67	49.02	1101

Note. The mean is reported in column 1, the standard deviation in column 2, and the number of observations of parent-children link in column 3. The occupation is based on the Registrar General's social class.

Table C4: Number of responses in British Cohort Study (BCS70) at the age-34 sweep

	Number of observations
BCS70 cohort members:	
Core interviews	9,665
Parent and Child Survey:	
Parent Interview	5,207
Parent self-completions:	
Children aged 0-11 months	414
Children aged 1-2 years	825
Children aged 3-5 years	1,259
Children aged 6-16 years	2,285

Note. This Table presents the sample sizes of the age 34 sweep. It contains the number of completed interviews by the cohort members and parents (namely, cohort members with children). The sample sizes are also divided by children's age for the parents. The socio-emotional skill questions were administered only to the parents who have children between the age of 3 and 16.

Table C5: Response rates for children and parents at age 5, 10, 16 and 34 sweeps

Itm.	Factor	Children	Parents (age 5)	Parents (age 10)	Parents (age 16)
1	*Restless*	0.997	0.804	0.852	0.619
2	*Squirmy/fidgety*	0.997	0.801	0.850	0.620
3	*Fights/bullies*	0.998	0.810	0.850	0.617
4	*Distracted*	0.998	0.809	0.851	0.618
5	*Tantrums*	0.998	0.775	0.813	0.625
6	*Disobedient*	0.998	0.808	0.848	0.620
7	*Worried*	0.997	0.808	0.850	0.615
8	*Fearful*	0.998	0.809	0.851	0.622
9	*Solitary*	0.997	0.807	0.852	0.619
10	*Unhappy*	0.999	0.809	0.850	0.620
11	*Aches*	0.997	0.757	0.814	0.620

Note. Itm. is item number. Title is a short label for the item. The response rate is lower at the age 16 sweep because of a teacher-led industrial strike distrupting the dissemination of the questionnaire.

Table C6: Correlation matrix of internalizing and externalizing skills at different ages

	INT (age 5)	INT (age 10)	INT (age 16)	EXT (age 5)	EXT (age 10)	EXT (age 16)
INT (age 5)	1.00					
INT (age 10)	0.39	1.00				
INT (age 16)	0.43	0.38	1.00			
EXT (age 5)	0.65	0.32	0.37	1.00		
EXT (age 10)	0.29	0.67	0.36	0.47	1.00	
EXT (age 16)	0.40	0.33	0.84	0.46	0.47	1.00

Note. The table reports the Pearson correlation of the internalizing and externalizing factor scores at different ages.