ORIGINAL PAPER

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Intergenerational Persistence of Skills and Socioeconomic Status

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Abstract
This paper describes how the socioeconomic status (SES) of parents relates to the formation and development of the skills and preferences of their teenage children, which have proven to be key to understanding differences in life outcomes. The study used data from a novel survey, conducted in Mexico, that recorded cognitive and non-cognitive skills and social preferences of both parents and children. It analyzed the relationship between the SES of parents and their children's skills, and found that children's skills were consistently related to parental skills, and that intergenerational persistence of skills was higher for cognitive than for non-cognitive skills or social preferences. It also found that the cognitive skills gap between the first and fifth quintile of SES was related mainly to characteristics like parents' own skills, years of schooling, and aspirations for their children, but that these parental characteristics were less important in explaining non-cognitive skills and preferences.

Keywords Skills · Preferences · Intergenerational · Persistence · Socioeconomic status · Mexico

Introduction

Social mobility and the reproduction of inequality are important topics of research. An association has been found between a high degree of inequality and a low degree of social mobility (Corak 2013). Although there is a rapidly growing literature on this phenomenon in several countries, little is known about the mechanisms of its persistence (Carvalho 2012; Currie 2009) and the ways in which these may differ according to a country's economic development. This paper analyzes the relationship between the socioeconomic status (SES) of parents (usually measured by an asset index, educational level, or income) and the development of skills and preferences in their adolescent children as a potential explanation for socioeconomic persistence in a developing country.

How is SES transmitted across generations? One possible channel is through the transmission of skills (Blanden et al. 2007). Previous studies have shown that cognitive skills vary by SES from an early age (Carvalho 2012; Cunha and Heckman 2009; Schady et al. 2015), and that more affluent

parents spend more time talking with their children, with a higher quality of conversation than poorer parents, leading to an advantage in vocabulary skills (Hart and Risley 1995; Suskind 2015). Cognitive skills have been found to have important payoffs in wages and life outcomes (Almlund et al. 2011; Hanushek et al. 2015; Heineck and Anger 2010), but other studies have found substantial effects on these outcomes from non-cognitive skills and personality traits (Almlund et al. 2011; Heckman and Kautz 2012; Moffitt et al. 2011). In a study of the United Kingdom, Blanden et al. (2007) found that cognitive abilities explain 27% and non-cognitive abilities 19% of persistence in SES (measured by income) if education was not included in the decomposition.

Although there is an abundant literature on the gradient of cognitive skills by SES, its relationship to non-cognitive skills and economic preferences has not been as thoroughly established (Almlund et al. 2011). Using the German Socioeconomic Panel, Deckers et al. (2015) documented a clear relationship between parental SES and skills and preferences. Children from higher SES households were more patient, more altruistic, and less risk-seeking. This differential in skill acquisition partially explained the persistence in SES over time. Similarly, Anger (2011) found a gradient of SES and skills in Germany. It is possible that these results depend on the economic conditions of particular countries. Mexico provides an excellent case study: it is a country of strong contrasts, with a few very rich individuals and a high

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density of poverty (the official figure is close to 50%), and is thus characterized by high inequality and low social mobility, with a Gini coefficient just below 0.5 (CEEY 2013; Gasparini and Lustig 2011).

This paper contributes to the important recent literature on the origins and development of skills and economic preferences. Equality of opportunity is a basic tenet in modern democracies. If public policy and social environment are the same for different individuals, we might not expect an intergenerational transmission of wealth or a socioeconomic gradient in skills formation. However, children inherit different abilities from their parents, and there is also heterogeneity in parents' investment in children's skills. The reality is that there is some intergenerational transmission of wealth and skills. Previous studies, mainly in developed countries, have found a pattern in which parents at the bottom of the socioeconomic distribution have children who also end up at the bottom (Bowles et al. 2005; Ermisch et al. 2012). This pattern is not explained by genetics but by wealth. Wealthier parents invest more time and money in the skills of their children (Guryan et al. 2008), and they also provide different social environments, such as schools, neighborhoods, peers, and family, that foster skills. This paper seeks to quantify the role of these social environments in the skill transmission process.

The main analysis used a novel survey in Mexico that recorded outcomes and skills for both parents and teenage children. The dataset included cognitive and non-cognitive skills (including locus of control and the Big Five) and preferences (including altruism, reciprocity, risk aversion, and time preferences). Building on previous literature, the analysis investigated whether the children's skills varied with the SES of their parents, and also whether children's skills were related to parental skills. Finally, it used a decomposition analysis, following Blanden et al. (2007) and Goodman et al. (2011), to understand which factors mediated the children's skill gap between the first and fifth quintile. This analysis allowed us to understand whether social environment played a role in the socioeconomic gradient.

There are three important results. First, consistent with previous findings, the SES of parents was related to children's skills. Higher SES was associated with skills that promote and foster increasing future SES. Living in a more affluent household was associated with increased cognitive skills and a personality with greater locus of control. Higher SES was related to lower self-reported risk aversion and higher positive reciprocity, but also to lower altruism. In contrast with the findings of Deckers et al. (2015), SES in the present study did not explain greater patience, but it did explain greater locus of control.

Second, children's skills were consistently related to parental skills. Intergenerational persistence was higher for cognitive skills than for non-cognitive skills and social

preferences. Including the SES of the household as a control variable reduced the persistence of cognitive skills by about 20%, but barely affected the persistence of non-cognitive skills and social preferences. The intergenerational transmission of cognitive skills found for Mexico was thus slightly greater than that found by Anger (2011) for Germany, where the coefficient was 0.24 without SES controls. The transmission of non-cognitive skills was similar to that found in other studies (Anger 2011; Duncan et al. 2005; Loehlin 2005). The estimate for Mexico was lower than that found in previous studies of the transmission of economic preferences relying on samples of young adults and their parents (Dohmen et al. 2012), but the degree of skill transmission increased with age.

Third, the cognitive skills gap between the first and fifth quintile in the SES distribution related mainly to characteristics like parents' own skill, years of schooling, and aspirations for their children. The difference in non-cognitive skills and social preferences explained by parental characteristics was less. These results suggest that personality traits are more malleable outside the home than cognitive skills.

The following section describes the data and descriptive statistics. It is followed by an exploration of the gradient between SES and skills, an analysis of mediating factors for the gradient, and conclusions.

Data and Descriptive Statistics

Data Description

The data for this study were derived from the 2015 Survey of Social Mobility in Mexico (*Encuesta de Movilidad Social en México 2015*, SMS-2015), which the author designed and implemented in 2015. The sample is representative of the Mexican urban population,[1] which is close to the 50% of the total population. The survey provides useful data for research on intergenerational social mobility, as its sample design focuses on parents with children aged 12–18 years. The sample consisted of 2616 complete interviews of a teenager and one of their parents, each of whom was randomly selected among family members.[2] There were separate

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[1] Urban population is defined as that in communities of 100,000 or more inhabitants. The sample includes individuals from 23 states and 86 municipalities. The dataset is available at http://movilidadsocial.colmex.mx/. Torche (2014) describes the other datasets available for Mexico. These surveys only interview one adult in the household (not teenagers) and do not include a measurement of preferences, skills, or environment when growing up (stress in the household of origin). However, these datasets are nationally representative and not only at the urban level.

[2] More precisely, 97.2% of the sample consists of parent–child relationships. The rest of the sample consists of relationships of steppar-

questionnaires for adults and teenagers, and they were interviewed in separate rooms to avoid interference in answers. The details and availability of the dataset are discussed in Campos-Vazquez (2016).

This dataset is an important source of information to measure intergenerational skills. Representative intergenerational data are rare and are difficult to collect. The only Latin American countries with such data are Argentina, Brazil, Chile, Mexico, and Uruguay (Torche 2014). The SMS-2015 is the only such survey that in addition to intergenerational questions includes batteries of questions to measure cognitive and non-cognitive skills for one parent and one teenager in the household. Most outcomes of interest to social scientists have to be measured at an age at which many children have already left home, causing problems with co-residence bias or the tracking of family members who left the original household. By focusing on skills and preferences that can be measured in teenagers, the SMS-2015 avoids this problem.[3]

The adult sample includes educational and basic sociodemographic data for all household members. Labor information, including employment status, income, and occupational profile, is available for the adult interviewed. The sample also includes data on household assets and services, which allows for the construction of wealth indexes. Additionally, the questionnaire includes retrospective data about respondents' households when they were 14 years of age. These data about the origin household include assets, parents' educational attainment, parents' employment status, and descriptions of parenting attitudes. The children's sample includes labor and educational data for the teenager interviewed, as well as information about school environment and quality, peer influence, relationship with parents, and parents' parenting skills.

Both adults' and children's interviews include a wide array of skill and social preference measures. There are measures of cognitive skill (fluid intelligence, crystallized intelligence, and working memory), non-cognitive skill (Big Five, Grit, and Locus of Control), and social preferences (risk-taking, time, altruism, reciprocity, and trust). These data are especially useful, as they can be used not only to calculate persistence of SES from past to current generations, but also to compare cognitive and personality profiles for parents and children of different SES.

Table 1 shows basic descriptive statistics for the adult sample. The average adult is 43 years old, with 10 years of schooling, and there are more women than men. Nearly 20% of the adult sample are single mothers. Most adults (75%)

Table 1 Descriptive statistics, adult sample. Source: Author's calculations from SMS-2015

	Mean
Age	42.7 (7.6)
Years of schooling	9.9 (4.2)
Female	55.5%
No. of children in household	2.3 (1.0)
Educational attainment	
Less than elementary	6.0%
Elementary	18.5%
Junior high school	36.3%
High school	24.1%
College	15.1%
Marital status	
Married or cohabiting	74.6%
Single mother	19.4%
Single father	3.9%
Employment	
Not employed	27.3%
Self-employed/employer	26.9%
Weekly working hours	37.3 (21.1)
N	2616

Standard deviations are reported in parentheses

Table 2 Descriptive statistics, teenager sample. Source: Author's calculations from SMS-2015

	Mean
Age	14.9 (2.1)
Years of schooling	7.9 (2.9)
Female	48.8%
% Working	9.5%
% Attending school	87.2%
Educational attainment	
Less than elementary	7.7%
Elementary	42.5%
Junior high school	39.5%
High school	10.3%
Household situation	
Lives with both parents	74.6%
Lives with father only	3.9%
Lives with mother only	19.4%
Lives with other person	1.8%
N	2616

Standard deviations are reported in parentheses

are married and there is an average of two children in each household.

Table 2 shows descriptive statistics for the teenager sample, which is restricted to teenagers aged 12–18 living in the

Footnote 2 (continued)

ent–stepchild (1.5%), grandparent–grandchild (0.8%), aunt/uncle–nephew/niece (0.2%), and other relationships (0.3%).

[3] I thank an anonymous reviewer for this observation.

Table 3 Asset ownership by wealth index quintile. Source: Author's calculations using SMS-2015

	Q1	Q3	Q5
Asset ownership			
Has a shower	34.2%	93.9%	99.8%
Has a washing machine	57.8%	94.9%	99.3%
Has a gas or electric stove	93.0%	99.7%	99.9%
Has a refrigerator	73.9%	96.1%	99.3%
Has a landline telephone	6.7%	52.2%	88.5%
Has a water heater	12.0%	57.5%	94.0%
Has internet access	6.8%	61.1%	97.2%
Has cable television	13.5%	56.1%	92.7%
Number of assets/services in household			
No. of televisions	1.26	1.89	2.91
No. of cell phones	1.49	2.49	3.38
No. of automobiles	0.08	0.49	1.42
No. of personal computers	0.05	0.66	1.62
No. of complete bathrooms	0.35	0.97	1.50
No. of domestic workers employed	0.00	0.02	0.18
Other household characteristics			
No. of rooms per household member	0.38	0.54	0.76
No. of light bulbs per household member	1.06	1.75	3.18
Has dirt floor	4.2%	2.2%	0.1%

The wealth index corresponds to the first principal component of the assets in the table. Q1 corresponds to the least wealthy quintile and Q5 to the wealthiest. The difference between Q1 and Q5 is statistically significant for all variables at the 1% level, except Dirt Floor, which is statistically significant at the 5% level

household. The average age of the sample is almost 15 years. Most of the teenagers are students (87%), while 10% are working. Most (75%) live with both of their parents. A significant proportion (19%) live only with their mother; the proportion living in other situations is small (6%).

Index of Socioeconomic Status

In order to compare the SES of households, an index of economic well-being was constructed using a principal component analysis, a common method in mobility research (CEEY 2013; Filmer and Pritchett 1999; McKenzie 2005; Torche 2015), with a mainly asset-based approach. Dummy variables for asset ownership were used for the following: shower, washing machine, gas or electric stove, refrigerator, landline telephone, water heater, internet access, and cable television. The number of assets or services in the household was used for televisions, cell phones, automobiles, personal computers, complete bathrooms, and domestic workers employed. Three additional household characteristics were included: number of rooms and light bulbs per household member, and a dummy variable for dirt floor. Descriptive variables are shown in Table 3. The table includes the mean

value of each variable for different quintiles (the poorest, the middle, and the wealthiest) and shows how more affluent households have more assets. For example, almost all wealthier households have a shower, but only about a third of the poorest households do. A similar pattern holds for the rest of the variables.

Skill Measurement

The social mobility survey included a variety of measures of cognitive and non-cognitive skills and social preferences. Three types of cognitive skill were measured. Fluid intelligence is the skill to solve previously unknown problems, detect patterns in sets of observations, and perform general logical reasoning. It was measured in the survey with Raven's progressive matrix test, which consists of ten items to be completed in 5 min. Crystallized intelligence is reflected in the ability to solve problems using previous experience, cultural knowledge, and use of language. It was measured using the animal naming task, where the respondent must name as many different animals as possible in 30 s. This test has been used in other surveys, such as the German Socioeconomic Panel (GSOEP), and has a high degree of correlation with other measures of crystallized intelligence (Schipolowski et al. 2014). It has been used in studies by Anger and Heineck (2010) and Anger and Schnitzlein (2013) as a quick test of crystallized intelligence. The third skill is working memory, a cognitive system that handles the processing of new and previously acquired knowledge, and which is essential not only for learning, but also for quick problem-solving. It is an integral part of the development of fluid and crystallized intelligence, as both of these intelligence measures are memory-intensive. It was measured with a five-item digit span test, one of the most widely-used tests of short-term memory (Richardson 2007) in clinical diagnosis and in psychological and economic research (Ostrosky-Solís and Lozano 2006; Schurer et al. 2015). The first component of the standardized scores from these three cognitive skill measures was used to construct a general intelligence measure.

The SMS-2015 also included a selection of personality measures. The first was a short version of the Big Five personality test, the so-called Big Five-10 (Rammstedt and John 2007). The Big Five traits are openness to experience (intellectual and artistic interests), conscientiousness (responsibility and hard work), extraversion (sociability and outgoingness), agreeableness (cooperation and trust), and neuroticism (the opposite of emotional stability). The survey included two items for every trait, which respondents were asked to rate on a scale of 1–5, where 1 meant "It describes me perfectly" and 5 "It doesn't describe me at all." The measure of each trait was the average of the scores.

Locus of control refers to individuals' perception of control over situations that affect their lives. The SMS-2015 survey included a ten-item Locus of Control scale, an updated version of the original Rotter scale (1966). In every item, respondents were asked to rate their agreement with a statement on a scale of 1–10, where 1 meant "Totally disagree" and 10 meant "Totally Agree." Five of the items represented internal control (e.g., "You have to work hard to succeed") and five external control (e.g., "I frequently feel that others have control over my life"). The measure of locus of control was the average of the 10 ratings, with the external control statements reverse-scored. A high score meant a high perception of internal control and a low score a high perception of external control. This measure has been used in multiple studies (Anger and Heineck 2010; Caliendo et al. 2015; Cobb-Clark 2015; Piatek and Pinger 2010; Rammstedt 2007) as a short test of locus of control.

Among the measures of soft skills included "grit," defined as the quality of perseverance and passion for long-term goals (Duckworth et al. 2007). Grit is closely related to other personality traits, such as conscientiousness, self-control, and internal locus of control, but it also takes into account motivation, that is, the capacity to persevere, to fulfill long-term goals. The SMS-2015 survey included the eight-item Short Grit Scale developed by Duckworth and Quinn (2009). Each item consisted of a statement reflecting grit-related attitudes (e.g., "I have difficulty maintaining my focus on projects that take more than a few months to complete"). Respondents rated each item on a scale of 1–5, where 1 meant "Very much like me" and 5 meant "Not like me at all." An aggregated measure of non-cognitive skill was constructed using the first principal component of the standardized Big Five scores, the Locus of Control score, and the Grit score.

Economic preferences are important potential explanations of socioeconomic persistence (Becker et al. 2012). Risk preferences refer to individuals' willingness to engage in situations with uncertain outcomes: Those who prefer outcomes that are certain over the possibility of greater gain are considered risk-averse. Most risk preference measurements are based on incentivized experimental designs, where respondents are subjected to real-life decision-making with varying levels of uncertainty. Using experiments to measure preferences of representative samples in household surveys is a difficult task (Charness et al. 2013). However, recent studies have successfully done so using survey questions validated with experiments (Falk et al. 2016). The present study used a self-reported assessment of risk preferences (as in Dohmen et al. 2012), with the question: "How willing are you to take risks?" Respondents were asked to answer on a scale of 1–10, where 1 meant "I am not willing to take risks at all" and 10 meant "I am totally willing to take risks."

Time preference refers to individuals' valuing of present consumption versus future consumption, or the capacity to delay immediately gratification for a greater future gratification. Patience in early life has been found to have important effects on future life outcomes, as in the classic marshmallow experiment described by Mischel (2014) or the studies of Dohmen et al. (2015), Golsteyn et al. (2014), and Moffitt et al. (2011). The measure of time preference used was the average score, on a scale of 1–10, for two survey items: (1) "How patient do you consider yourself?" where 1 meant "very patient" and 10 "very impatient"; this question, which was reverse scored, was recommended by Vischer et al. (2013); and (2) "I can do without today in order to have more tomorrow," where 1 meant "It doesn't describe me at all" and 10 "It totally describes me."

Altruism can be defined as the willingness to give or share without ulterior motives. It is a difficult preference to measure, especially when experiments are not incentivized. However, Becker et al. (2012) and Falk et al. (2016) have shown that survey questions are good predictors of altruistic behavior even if they are not incentivized. The measure of altruism in the present study was based on the basic Dictator Game, which has commonly been used for this purpose (Falk et al. 2016). In this experiment, the respondent unexpectedly received a hypothetical amount of money ($1000 MXN, approximately $59 USD). Respondents were asked to say how much of this money they would donate to a charity of their choosing. Individuals who specified larger amounts were considered more altruistic.

Trust can be described as our capacity to act cooperatively with other individuals. Trustfulness is an important determinant of the way people approach others. It is impossible to act cooperatively with others without believing they will behave in the same way. Higher levels of trust can benefit economic development by allowing people to reach optimal social results. A self-reported trust scale was constructed by asking respondents to assess their agreement with two statements: (1) "I am willing to trust other people," and (2) "If I am not convinced otherwise, I always assume that people have the best of intentions." They were asked to rate each statement on a scale of 1–10, where 1 meant "Totally disagree" and 10 "Totally Agree." Their score was the average of the two.[4]

Reciprocity can be defined as an individual response triggered by the actions or attitudes of another individual or group. Reciprocity can be positive, rewarding kind actions with kindness, or negative, punishing unkind actions even where doing so could be unbeneficial (Fehr and Gächter 2002). The measure of positive reciprocity was constructed

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[4] Results were similar using a simple average or a principal component analysis.

Table 4 Skill and preferences scores, teenagers and adults. Source: Author's calculations using SMS-2015

Skill/preference	Teenagers	Adults
Cognitive skills		
Fluid intelligence	5.07 (1.88)	4.39 (2.10)
Crystallized intelligence	14.23 (5.09)	14.45 (5.28)
Memory	15.34 (4.53)	14.33 (4.60)
Non-cognitive skills		
Openness	3.31 (0.91)	2.86 (0.93)
Conscientiousness	3.50 (0.78)	4.12 (0.72)
Extraversion	3.12 (0.80)	3.00 (0.82)
Agreeableness	3.63 (0.70)	3.61 (0.75)
Neuroticism	2.90 (0.81)	2.70 (0.86)
Locus of control	6.33 (1.40)	6.54 (1.50)
Grit	3.35 (0.49)	3.56 (0.52)
Preferences		
Self-reported risk willingness	6.88 (2.67)	7.00 (2.59)
Self-reported patience	6.03 (1.92)	6.04 (1.97)
Altruism	422.5 (301.9)	352.2 (278.4)
Trust	6.45 (2.07)	6.02 (2.25)
Positive reciprocity	7.53 (1.93)	7.67 (1.92)
Negative reciprocity	5.56 (2.38)	4.94 (2.22)

Standard deviations are reported in parentheses

by asking respondents to assess their agreement with two items: (1) "I make a great effort to help someone who has helped me before," and (2) "I am willing to return a favor to a stranger." They were asked to rate each statement on a scale of 1–10, where 1 meant "Totally disagree" and 10 "Totally Agree." The positive reciprocity score was the average of the two. The measure of negative reciprocity used two items rated on the same scale: (1) "If someone hurts me intentionally, I try to hurt them back," and (2) "I am willing to punish someone for unfair behavior even if it costs me something." The negative reciprocity score was the average of the two. Higher scores mean higher levels of reciprocity, positive or negative.

Before moving on to the results it is worth raising the question of accuracy in the measurement of skills. The survey includes short batteries of questions that attempt to correctly measure skills. Although there has been much progress in identifying the right type of questions in order to gauge skill level (Becker et al. 2012; Falk et al. 2016), there is still the issue of measurement error and its effect on intergenerational correlations (Grönqvist et al. 2017). With classical measurement error in skills, the intergenerational correlation is biased toward zero. Given the subjectivity of the questions about non-cognitive skills, it is more likely that they suffer from measurement error than cognitive skills. The analysis employed here was not able to correct for this problem. Our intergenerational estimates should thus be

interpreted as a lower bound on the effect of parental skills on the skills of teenagers.

Table 4 shows the average score of the skill and preference measures for the teenager and adult samples. Teenagers performed better on the fluid intelligence and memory test, while adults performed better on the crystallized intelligence test. On the tests of personality traits, teenagers showed higher levels than adults in openness to experience, agreeableness, extraversion, and neuroticism, while parents had higher levels of conscientiousness. Adults also scored higher on the locus of control and grit tests and showed higher self-reported willingness to take risks than teenagers. There were no notable differences in the self-reported patience scores, but adults had lower altruism scores. Teenagers reported lower levels of positive reciprocity and higher levels of negative reciprocity than adults. With the exception of cognitive skills, the differences between adults and teenagers were relatively small.

Relationship Between Socioeconomic Status and Skills

Differences in skills and preferences by socioeconomic outcomes were analyzed with every measure of skill or preference standardized with mean 0 and standard deviation 1. Skills were compared between the first quintile (Q1, the least wealthy) and the fifth quintile (Q5, the wealthiest) of the wealth index (obtained with a principal component analysis from household assets, as described in the previous section). Table 5 shows the mean scores for cognitive and non-cognitive skills and preferences for the first and fifth wealth quintiles of the adult and teenager samples. The last column shows the difference in score between the first and fifth quintiles.

The results showed a socioeconomic gradient in skills for the teenager sample. The greatest differences were in cognitive skills, where the wealthiest respondents (Quintile 5) scored between 0.4 and 0.6 standard deviations higher than the least wealthy (Quintile 1). The difference was greatest, approximately 0.68 standard deviations, and was statistically significant, for the general intelligence measure. The differences were lower for non-cognitive skills than for cognitive skills, consistent with previous studies by Anger (2011), Cunha and Heckman (2009), and Ermisch et al. (2012). The wealthiest respondents scored approximately 0.43 standard deviations higher on the locus of control scale. However, there were no significant differences in the grit scores. Wealthier teenagers scored 0.3 standard deviations higher on extraversion and 0.15 standard deviations lower on neuroticism than their least wealthy counterparts. In the aggregated non-cognitive skill measure, the difference was approximately 0.2 standard deviations, which was lower than

Table 5 Differences in skills and preferences by SES. Source: Author's calculations using SMS-2015

Skills	Teenagers				Adults			
	Q1	Q5	Difference		Q1	Q5	Difference	
Cognitive skills								
Fluid intelligence	−0.32	0.30	0.62	**	−0.38	0.44	0.82	**
Crystallized intelligence	−0.15	0.24	0.39	**	−0.22	0.34	0.56	**
Memory	−0.17	0.22	0.39	**	−0.32	0.43	0.75	**
General intelligence	−0.31	0.37	0.68	**	−0.44	0.57	1.01	**
Non-cognitive skills								
Openness	−0.03	0.05	0.08		−0.23	0.21	0.44	**
Conscientiousness	0.00	−0.04	−0.04		−0.01	0.10	0.12	
Extraversion	−0.17	0.13	0.30	**	−0.14	0.10	0.25	**
Agreeableness	−0.02	0.02	0.04		−0.08	0.1	0.25	**
Neuroticism	0.04	−0.11	−0.15	†	0.14	−0.20	−0.34	**
Locus of control	−0.23	0.20	0.43	**	−0.22	0.40	0.62	**
Grit	−0.06	0.02	0.09		−0.12	0.31	0.43	**
Non-cognitive skill	−0.12	0.10	0.22	*	−0.20	0.39	0.59	**
Preferences								
Self-reported risk	−0.06	0.14	0.20	*	−0.13	0.03	0.16	†
Self-reported patience	0.11	−0.03	−0.14		0.14	−0.18	−0.32	**
Altruism	0.12	−0.15	−0.27	**	−0.07	0.01	0.08	
Trust	−0.09	0.06	0.15		−0.18	0.09	0.27	**
Positive reciprocity	−0.13	0.12	0.25	**	−0.13	0.05	0.18	*
Negative reciprocity	0.05	−0.02	−0.07		−0.01	−0.15	−0.14	

Table shows the mean skill and preference scores for the first and fifth wealth quintiles of the teenager and adult samples. The last column for each sample shows the difference in score between the quintiles. All measures were standardized with mean 0 and standard deviation 1

†p < .1; *p < .05; **p < .01

the gap in general intelligence. In sum, in contrast to Anger (2011), who did not find a gradient in non-cognitive skills, the present study found a gradient in extraversion, neuroticism (significant at the 10% level), and locus of control in Mexico.

Differences in preferences by SES were lower than for cognitive skills. There were no significant differences in time preferences, trust, or negative reciprocity scores by SES. However, there were significant differences in altruism, positive reciprocity, and self-reported risk willingness. The wealthiest teenagers were less altruistic (0.3 standard deviations lower), more positively reciprocal (0.3 standard deviations higher), and more willing to take risks (0.2 standard deviations higher) than their least wealthy counterparts. These results contrasted with those of Deckers et al. (2015), who found that children (averaging 8 years old) from wealthier families were more altruistic and more risk-averse. However, Piff et al. (2010) found that higher SES was related to less altruistic behavior in an incentivized experiment of the Dictator Game for a sample of mostly young adults (average age 22). The difference in the results were likely affected by social norms and culture within a country. Indeed, Dohmen et al. (2015) have argued that variation in preferences is a

key component in explaining differences in economic outcomes across countries.

The SES gradient in skills was more pronounced in the adult than in the teenager sample. For cognitive skills, the differences were between 0.6 and 0.8 standard deviations, and for general intelligence, the difference between the wealthiest and the least wealthy was one standard deviation. The wealthiest adult respondents showed greater locus of control than the poorest (0.6 standard deviations higher), and they scored higher on the grit scale than their least wealthy counterparts (0.4 standard deviations). The wealthiest adults were also more risk-seeking (nearly 0.2 standard deviations higher), more altruistic (0.2 standard deviations higher), more trustful (0.3 standard deviations higher), and more positively reciprocal (0.2 standard deviations higher), but they showed lower levels of patience (0.3 standard deviations lower).

Table 5 shows important differences in cognitive skills and personality traits related to SES. The Q5 adult respondents showed more developed cognitive skills, more locus of control, more perseverance, more altruism, and were less risk-averse and more positively reciprocal and trustful than their Q1 counterparts. Although the wealthiest teenagers'

Fig. 1 Effect of parents' skill scores on teenagers' skill scores. The figure shows the OLS coefficients of parents' skill scores over teenagers' skill scores. SES controls included the wealth index and parents' years of schooling. All regressions included age and gender controls for both parents and teenagers. The skill measures and the wealth index scores were standardized with mean 0 and standard deviation 1. The figure shows 95% confidence intervals using robust standard errors. Source: Author's calculations using SMS-2015
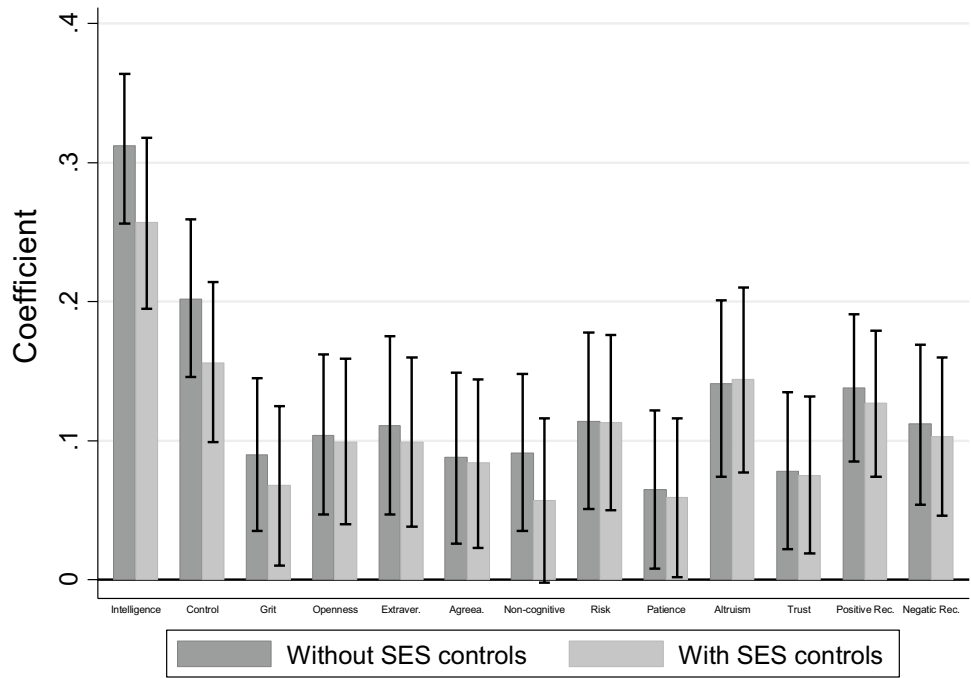
Fig. 2 Effect of the wealth index on teenagers' skill scores. The figure shows the OLS coefficients of the wealth index over teenagers' skill scores. All regressions included age and gender controls for both parents and teenagers. The skill measures and the wealth index scores were standardized with mean 0 and standard deviation 1. The figure shows 95% confidence intervals using robust standard errors. Source: Author's calculations using SMS-2015
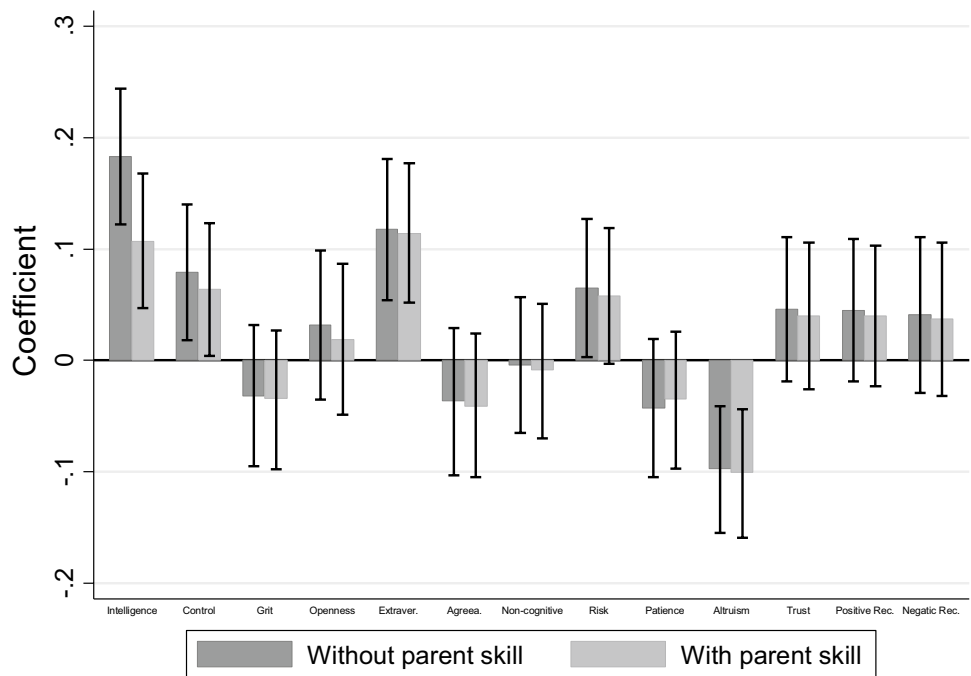

scores showed similar patterns in cognitive skills, locus of control, risk aversion, and positive reciprocity as their wealthy adult counterparts, the wealthiest teenagers were less altruistic than the least wealthy.

To show the variables most correlated with skill differences between the Q1 and Q5 teenagers, simple least square regressions were run for every teenager skill and preference. All skill measures and the wealth index were standardized with mean 0 and standard deviation 1. Three

main specifications were proposed. The first included not only basic characteristics (both parents' and teenagers' age and gender), but also the wealth index score and the parents' years of schooling, two variables closely related to families' SES. The second specification excluded the socioeconomic related variables but included the parents' scores for the same skill. Finally, the last specification included both socioeconomic variables and the parents' skill scores.

Fig. 3 Effect of parents' years of schooling on teenagers' skill scores. The figure shows the OLS coefficients of parents' skill scores over the teenagers' skill scores. All regressions included age and gender controls for both parents and teenagers. The skill measures and the wealth index score were standardized with mean 0 and standard deviation 1. The figure shows 95% confidence intervals using robust standard errors. Source: Author's calculations using SMS-2015
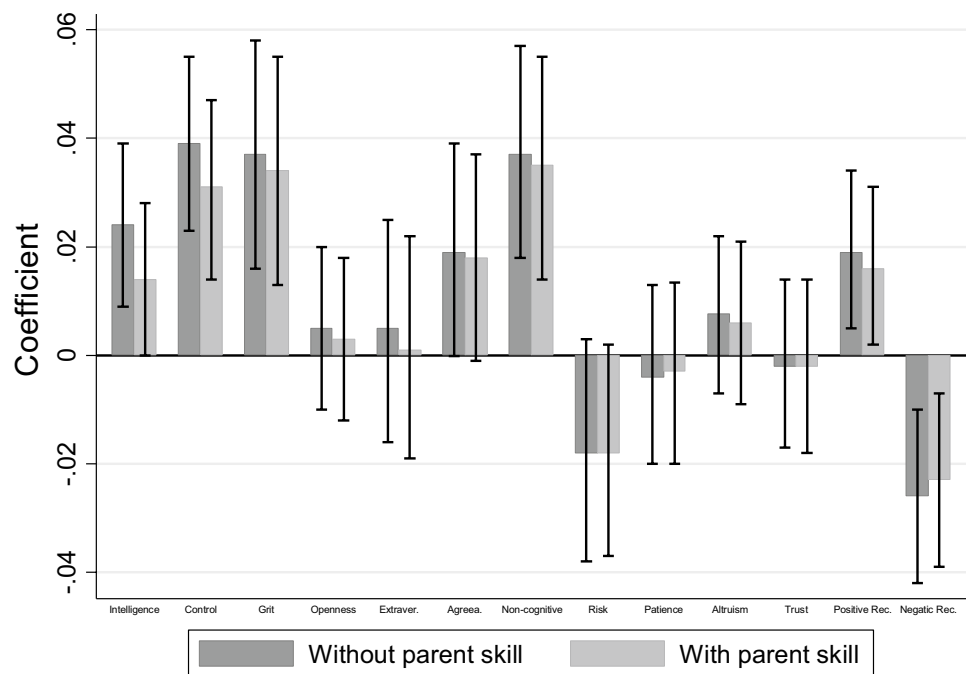
Figure 1 shows the regression coefficients for the parents' over teenagers' skill scores with and without SES controls. The coefficients for the wealth index and parents' years of schooling, the SES controls, are shown in Figs. 2 and 3.[5] Figure 1 shows that increasing a parent's general intelligence score by one standard deviation increases a child's score by 0.31 standard deviations. But including all SES variables simultaneously reduced parents' skill coefficient by 20% and the wealth index coefficient by 40% (Fig. 2), although the confidence intervals were overlapping in both specifications and it was therefore not statistically possible to distinguish the point estimates. The transmission of cognitive skills was greater than any other skill or preference. This predominance of cognitive skills over personality traits has also been found in studies that calculate the heritability of skills (Cesarini et al. 2009; Mosing et al. 2012; Turkheimer et al. 2014). The second highest coefficient was the transmission of locus of control (0.2), which was also reduced by 20% when SES variables were included. The rest of the skill variables showed transmission coefficients between 0.06 (patience) and 0.14 (altruism), with little change with the inclusion of SES variables. These results may suffer from measurement error in the skill variables. Using administrative and longitudinal data in Sweden, Grönqvist et al. (2017) instrumented the parental skill variable with the parent's sibling's skill, and

found that the intergenerational skill estimate was understated, especially the non-cognitive skill measure. Most of the intergenerational skill correlations in the literature suffer from this potential bias. Hence, the estimates presented here should be taken as a lower bound of the true intergenerational correlation in skills.

Estimates in Mexico are difficult to compare with other studies because few samples include teenagers. Most previous studies have used panel data to identify parents, measuring the cognitive and non-cognitive skills of children when they are young adults (Anger and Heineck 2010; Dohmen et al. 2012). Those studies using samples similar to the present one have shown similar results. The intergenerational transmission of cognitive skills (without socioeconomic controls) found in the present study for Mexico was 0.31; in Germany and the United Kingdom it has been reported as 0.24 (Anger 2011; Duncan et al. 2005). The transmission of non-cognitive skills in the present study was below 0.1, similar to that in Loehlin (2005) and lower than the estimate for cognitive skills; the locus of control showed an intergenerational transmission coefficient similar to that in Anger (2011), but estimates of traits in the Big Five were slightly lower than in that study. Using population-wide enlistment data in Sweden that recorded cognitive and non-cognitive skills (measured by a psychologist), Grönqvist et al. (2017) found a transmission coefficient of 0.32 for cognitive and 0.21 for non-cognitive skills, which were similar to the estimates found here for locus of control in Mexico. However, once they corrected for measurement error in the skill variables, they obtained a transmission coefficient of 0.48 for cognitive and 0.42 for non-cognitive skills. Finally, in their

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[5] Complete regression results are reported in the supplementary materials. There was an age bonus in the intelligence results, as older teenagers scored better than younger ones. Also, girls scored 0.11 standard deviations lower than boys. Skill of the parent means the skill of either the mother or father.

sample of young adults, Dohmen et al. (2012) found intergenerational transmission estimates close to 0.15 for risk and trust (when the parental measure is of the father), which were higher than those found in the present study (although the difference may be due to the difference in the age of children in the sample). Despite the high degree of inequality, the intergenerational transmission of skill found in Mexico was similar to that reported in other countries.

Mediating Factors

This study also examined whether the gap in skills and preferences between the poorest and richest quintile was mediated by specific characteristics. It followed the methodology of Goodman et al. (2011) and Blanden et al. (2007), which was similarly applied in the work of Crawford et al. (2011).[6]

This analysis began with an estimate of the gap in skills and preferences using a regression framework ($skill = \beta_0 + \sum_{j=2}^{5} \beta_j SES_j + e$, where β_5 is the gap between the first and fifth quintiles). Following the omitted variable bias formula, the gap was decomposed by including controls on this relationship ($skill = \sum_i \alpha_i X_i + \sum_{j=2}^{5} \gamma_j SES_j + \varepsilon$, where X was a vector of control variables and γ_5 is now the gap between the poorest and richest, conditional on X). If there are mediating factors observed in the data, then we would expect that with inclusion of the control variables the coefficient of SES would approach zero, that is, that mediating factors would explain the gap in skills due to SES. If not, then there are unobserved components related to SES that explain the gap. For each control variable we then estimated the corresponding gap in SES ($X_i = \sum_{j=2}^{5} \theta_{ij} SES_j + \mu_{ij}$, where θ_{i5} is the gap for each control variable i). Using these two relationships, we obtained the gap in skills and preferences due to each control variable as the product of the correlation of the control variable and SES (θ_{k5}) and the direct effect of the control variable on skills (α_k) over the observed gap ($share_k = \alpha_k \theta_{k5} / \sum_i \alpha_i \theta_{i5} + \gamma_5$). This decomposition was implemented for each of the skills and preferences that showed a statistically significant socioeconomic gap for the

Table 6 Overview of possible mediating factors

Mediating factor	Variables
Respondent characteristics	• Parents' and children's age • Parents' and children's gender • Living with a single parent
Socioeconomic status	• Household wealth (five dummy variables, one for each quintile) • Parents' years of schooling
Parent' skill factor	• Parents' skill score
Family relationship factor	• Household stress • Parenting quality score
School environment factor	• School's level of demand on students • Teachers' quality of interaction • Quality of school facilities
Parents' aspirations	• Parents' aspirational educational level for their children • Parents' aspirational earnings for their children
Peer attitudes	• Peer attitudes about school • Peer risk behavior

teenager sample in Table 5 (general intelligence, locus of control, aggregated non-cognitive skill, extraversion, neuroticism, self-reported risk willingness, altruism, and positive reciprocity).

The mediating factors for the intergenerational transmission of skills were classified as shown in Table 6. In the regressions, the basic respondent characteristics were the teenagers' and adults' ages, their gender, and an identifying variable for teenagers living with a single parent. SES was formed by variables related to the household. The variables used were five dummy variables for the five quintiles derived from the wealth index, as defined above, and the parents' years of schooling. The household environment factor (family relationship) consisted of measures of parenting skills and household stress included in the teenager sample. A measure of household stress was calculated as the first principal component of three items: (1) "How often do you hear insults, shouts, screams, or threats in your household?" (2) "How often do you feel emotionally connected to your family?" and (3) "How often do you feel afraid or worried?" The first component accounted for nearly 50% of the correlation between the items.

The parenting quality score was constructed using five characteristics of the parent–child relationship as reported by the teenagers: (1) "Do you feel emotionally connected to your parent?" (2) "Do you feel that your parent understands your problems?" (3) "Does your parent help you with school activities?" (4) "Does your parent spend free time with you?" and (5) "How consistent are your parent's rules in your household?" The score was constructed as the first principal component of the five items. The SMS-2015 includes the reported answers for both mother and father. If

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[6] This methodology has a long tradition in sociology (Alwin and Hauser 1975; Duncan 1966), and recently in economics, in decompositions of intergenerational transmission coefficients (Mood et al. 2012). This decomposition is different from the traditional Oaxaca–Blinder decomposition. The latter separates the contribution of observable characteristics and returns, while the former distinguishes how much of the socioeconomic gradient is accounted for by observable characteristics.

Table 7 Decomposition results. Source: Author's calculations using SMS-2015

Skill	Absolute difference 1st–5th quintile	Own skill	Parents' schooling	Respondent characteristics	Family relationship	School characteristics	Parents' aspirations	Peer attitudes	Unexplained
General Intelligence	0.691	33.1	7.4	11.3	2.3	3.7	18.4	3.1	20.6
	[0.52,0.85]	[22.3,49.1]	[0.7,15.6]	[6.4,17.4]	[0.4,5.5]	[1.0,6.9]	[10.7,28.3]	[0.9,6.7]	[3.7,37.4]
Locus of control	0.428	23.8	27.6	12.0	5.9	1.1	4.0	8.7	16.9
	[0.34,0.61]	[13.6,32.4]	[9.5,42.7]	[2.3,21.1]	[1.4,11.2]	[0.2,5.8]	[0.7,16.8]	[2.3,13.2]	[3.3,40.0]
Non cognitive skill	0.610	5.6	20.9	15.5	14.2	2.8	7.1	6.4	27.5
	[0.37,0.81]	[1.1,10.4]	[9.5,28.5]	[8.9,22.7]	[8.1,24.3]	[0.2,6.9]	[0.9,16.3]	[2.7,12.8]	[3.5,43.0]
Extraversion	0.368	5.8	7.0	3.2	1.4	0.6	23.6	3.3	55.0
	[0.26,0.61]	[1.6,11.5]	[0.5,27.4]	[0.5,14.0]	[0.1,6.6]	[0.2,6.13]	[2.9,41.0]	[0.6,9.8]	[19.0,73.5]
Neuroticism	0.270	2.1	5.5	28.0	20.1	2.1	7.4	7.5	27.4
	[0.19,0.51]	[0.4,6.7]	[1.4,23.2]	[9.8,37.6]	[7.2,28.4]	[0.2,8.2]	[0.9,20.7]	[0.9,12.6]	[3.3,49.8]
Risk	0.444	3.3	21.6	19.8	4.1	0.2	12.4	3.1	35.5
	[0.26,0.63]	[0.3,8.6]	[3.9,28.9]	[9.7,37.7]	[0.5,9.7]	[0.2,6.3]	[1.3,26.6]	[0.3,8.2]	[6.6,56.3]
Altruism	0.375	2.8	5.6	1.8	4.2	0.6	6.4	0.8	77.7
	[0.26,0.61]	[0.2,8.0]	[0.9,17.8]	[0.3,11.9]	[0.5,10.4]	[0.4,6.1]	[0.5,19.5]	[0.2,5.5]	[51.8,82.1]
Positive reciprocity	0.297	8.3	25.3	8.4	4.9	1.9	4.1	7.4	39.7
	[0.21,0.51]	[2.1,15.9]	[3.3,41.2]	[1.2,22.9]	[0.5,10.3]	[0.4,6.8]	[1.1,16.4]	[1.5,15.9]	[7.9,68.4]

Table shows the percentage of the SES gap (Q1–Q5 shown in column 1) in teenagers' skill measure attributable to the mediating factors defined in Table 6. The decomposition followed the methodology of Goodman et al. (2011). The first column includes the absolute SES gap between the first and fifth quintile. The other columns are in percentage terms and total 100%. A 90% confidence interval from a nonparametric bootstrap with 500 replications is shown below each estimate. General intelligence was constructed using the first principal component of the three cognitive tasks in the survey. Non-cognitive skill was constructed as the first principal component of Locus of Control, Grit, and Big Five

the teenager lived with both parents, the parenting skill score was calculated as the average of the father's and mother's scores.

The school environment factor consisted of measures based on teenagers' reporting of the quality of facilities and teachers, and the educational demands of their schools. The teacher quality score was constructed as the first principal component of three items: (1) "My teachers are well prepared for class," (2) "My teachers are disrespectful to students," and (3) "My teachers are often absent." The school facility quality score took into account the existence and state of bathrooms, classrooms, library, and drinking fountains. The perceived quality of the facilities was reported by the teenagers on a scale of 1–4, where 1 meant "very bad" and 4 meant "excellent."

Parents' educational aspirations for their children were determined as perceived by the children. The measure included was the educational level parents expected their children to achieve. Parents' economic aspirations were assessed by asking them what they expected their children's monthly earnings would be when they reached the age of 30. The logarithm of these reported earnings was included in the regression analysis.

Finally, peer attitudes were reported as perceived by the teenagers. A measure of peer attitudes about school was constructed using three questions from the SMS-2015 survey about the teenage respondents' five closest friends: (1) "How many of your friends do you think will graduate college?" (2) "How many of them skip classes often?" and (3) "How many of them think it is good to work hard at school?" A measure of risky behavior by peers was constructed using three questions about the same five friends: (1) "How many of your friends are considered troublemakers?" (2) "How many of them drink alcohol at least once a week?" and (3) "How many of them smoke cigarettes?"

The results of the decomposition analysis for the SES gap for general intelligence are shown in Table 7. The first column includes the absolute SES gap between the first and fifth quintile. The other columns are in percentage terms and total 100%. Below the estimates a 90% confidence interval is shown, using a nonparametric bootstrap with 500 replications. The main share of the gap for cognitive skills came from the parents' own cognitive skills (33%), followed by parents' aspirations (18%). Respondent characteristics (11%), household environment (1%), peer attitudes (3%), and school characteristics (4%) totaled less than 20% of the socioeconomic gap. Approximately 21% of the gap was unexplained. In other words, parents' own skill and schooling explained close to 40% of the gap, which were both highly related to wealth.

The results of the decomposition for the teenagers' locus of control are shown in the second row of Table 7. Here the main share of the SES gap came from parents' schooling (27%), followed by parents' locus of control (24%), respondent characteristics (12%), and peer attitudes (9%). Family relationships (6%), parents' aspirations (4%), and school characteristics (1%) had significant smaller shares of the gap. Approximately 17% of the SES gap in locus of control remained unexplained. For cognitive skills and locus of control, personal characteristics and parental skills and schooling mattered more than factors related to home and school environment (including peer attitudes).

The next rows in Table 7 show the decomposition results for the aggregated non-cognitive skill measure, extraversion, and neuroticism. For non-cognitive skills, the main share of the SES gap was explained by parents' schooling (21%), followed by family relationship (14%) and respondent characteristics (15%). Parents' own skill was less important (6%) in explaining this gap. Approximately 28% of the gap remained unexplained. The main share of the gap for extraversion was related to parents' aspirations for their children (24%), followed by parents' schooling (7%); approximately 55% of this gap remained unexplained. Finally, for neuroticism, the main share of the gap was related to respondent characteristics (28%) and the family relationship (20% was related to parenting skills and household stress); 27% of this gap remained unexplained. For non-cognitive skills, family relationship and the household environment were more important than cognitive skills or locus of control.

Finally, the last three measures in Table 7 refer to preferences. The main share of the SES gap for self-reported risk aversion was related to parents' schooling (22%) and respondent characteristics (20%). The main share of the gap for positive reciprocity was related to parents' schooling (25%); approximately 40% of this gap was unexplained. Finally, parents' schooling and aspirations both explained approximately 6% of the gap, but nearly 80% of this gap remained unexplained.

Figure 4 shows an overview of the decomposition results for the measures that showed significant SES-related gaps in teenagers' scores. The figure shows the share of the SES gap for every skill attributable to parent-related effects: parent skill, parent schooling, and parent aspiration. For cognitive skill, the main share of the SES gap (approximately 60%) was related to these parent characteristics. For non-cognitive skills and preferences the influence was less, which implies that these traits were more malleable outside the home than cognitive skills.

The results of this study suggest the need for public policy interventions that seek equality of opportunity. First, public investment should be prioritized in poorer schools and neighborhoods to diminish the socioeconomic gradient in skills. The results imply that schools do not counteract
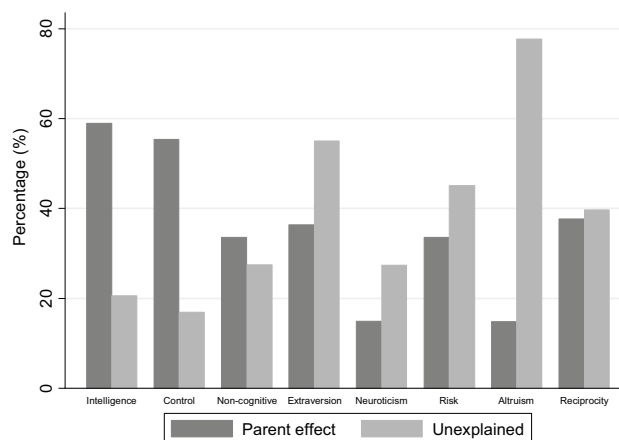
Fig. 4 Decomposition of the SES skill gap, overview. The figure shows the percentage of the SES gap in every skill attributable to a parent-related effect (parent skill, parent schooling, and parent aspiration), as well as the unexplained share. Source: Author's calculations using SMS-2015

the gap in cognitive skills; with greater investment and targeted programs they could diminish this inequality. Second, programs should be promoted that foster skill formation at an early age (Almlund et al. 2011). The results of this study are for teenagers, but studies in other developing countries have found a socioeconomic gradient in skills from an early age (Schady et al. 2015). Early skill formation could be encouraged not only through high-quality daycare, but also by educating parents about the importance of their involvement. Third, non-cognitive skills and preferences are more dependent on the social environment than cognitive skills. Neighborhoods may play an important role in promoting such skills.

Conclusions

This study used novel survey data for Mexico to measure the impact of parents' SES on the formation and development of skills and preferences of their teenage children. The survey recorded cognitive skills, non-cognitive skills, and economic preferences using questions validated in previous studies. Parents and their teenage children were interviewed separately to avoid contamination bias.

There were three key results. First, SES of parents was found to be related to children's skills. Higher SES was associated with skills that promoted and fostered the continuation of that status: a socioeconomic gradient was found for adolescents' skills, similar to that found in previous studies (Ermisch et al. 2012). Second, children's skills were consistently related to parental skills. Even after controlling for SES, intergenerational persistence was greater for cognitive skills than for non-cognitive

skills or economic preferences. Including the SES of the household as a control variable reduced the persistence of cognitive skills by about 20% (although the effect was not statistically significant), but barely affected the persistence of most non-cognitive skills (the exception was locus of control) or economic preferences. The intergenerational transmission of skill is similar to that in other countries, in spite of different conditions of inequality and poverty.

Third, the skills gap between the first and fifth quintiles in the SES distribution related mainly to socioeconomic characteristics in cognitive skills and locus of control. For non-cognitive skills and neuroticism the home environment mattered more than cognitive skills. Parents' aspirations for their children, which were related to SES, also explained an important part of the gap across skills. The gap in preferences was largely unexplained by socioeconomic differences, suggesting that while cognitive skills were largely influenced by parental skills and aspirations, personality traits were more malleable outside the home. This result reinforces previous findings (Almlund et al. 2011) that suggested the need to strengthen social skills from an early age in order to foster social mobility.

Modern democracies aim to obtain equality of opportunity. Studies of children and teenagers in different countries have shown a socioeconomic gradient in skills. In other words, inequality today results in lesser social mobility because of differences in skill formation. These skills have important returns to life outcomes (Heckman and Kautz 2012). Hence, public policies should be directed toward weakening the links between SES and skill formation. This could be accomplished through the school system and through investment at an early age in high-quality daycare with parental involvement.

This study presents limitations and opportunities for future research. First, there is a challenge in measuring skills with household surveys. It is likely that non-cognitive skills suffer more from measurement error than cognitive skills (Grönqvist et al. 2017). Correcting the measurement error in skills thus increases the intergenerational correlation, in particular for non-cognitive skills, and the results presented here show only a lower bound in the intergenerational estimate of skills. Second, the sample used in this study should be extended to younger children in order to understand whether the socioeconomic gradient is strengthened or weakened over time. Third, this study lacks a high-quality measure of neighborhood characteristics, so the potential role of this factor in skill transmission remains uncertain. Future studies and household surveys that include intergenerational comparisons need to plan ahead to decrease or eliminate measurement error in skills as well as to include a representative sample of non-adults.

Compliance with Ethical Standards

Conflict of interest The author declares no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki Declaration and its later amendments.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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