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Learning from One's Community: Neighborhood Effects on Non-Cognitive Skills

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Abstract

Neighborhoods of residence during youth are known to play an important role in lifetime trajectories, but mechanisms are still poorly understood. In this paper, I quantify the importance of neighborhood in explaining the non-cognitive skills of teenagers and the gender gap in disruptive behavior. Using a selection-on-observables framework, I assess how the rate of father's presence in a census tract affects 5th grade self-regulation in the Early Childhood Longitudinal Survey – Kindergarten cohort 1998 (a random sample of US pupils). I find that a one standard deviation decrease in the neighborhood rate of father presence has about half the effect of the absence of a child's own father, when controlling for a very rich set of student and family-level characteristics (demographic, psychological, ...) Moreover, neighborhood quality correlates with higher development of non-cognitive skills in girls just as much, if not more, as it does in boys. This contrasts with previous research, which finds that boys' socio-emotional development is more affected by growing up in a disadvantaged family than girls'. Since non-cognitive skills have been shown by a large literature to be instrumental to academic and professional success, health and longevity, my findings have profound implications for the design and targeting of public policies across many dimensions, especially inequality, crime and education.

JEL codes: I24, J13, J24

Keywords: Achievement Gap, Education, Education and Gender, Education and Inequality, Human Capital, Non-cognitive skills, Equality of Opportunity, Income Distribution, Inequality, Low Income, Youth, Delinquency, Paternity

I. Introduction

Inequalities of income, wealth and opportunity as well as social mobility have been rising as major topics of concern and inquiry in developed nations. Income and wealth inequalities have been rising steadily since the 1970s (Piketty 2014) and diverse strands of literature warn that this might create social and political unrest (Muller 1985), affect economic growth (Alesina and Rodrick 1994) or even impeded the functioning of democracy (Reuveny and Li, 2003).

Spatial variation is one of the ways to quantify and potentially explain such inequalities: different areas of the U.S. have not only very different levels of average income and wealth, but also very different levels of social mobility. Greater income and wealth inequality is associated (perhaps not surprisingly) with less social mobility. Variation in geographic location is also an important cause, or at least predictor, of inequality: a large literature shows that neighborhood of residence in childhood and adolescence is strongly associated with adult outcomes (among many others, Chetty et al. 2019; Agrawal et al. 2018; Chetty, Hendren and Katz 2016). However, the exact mechanisms and neighborhood characteristics at play remain unclear. Many levels of geography (counties, commuting zones, Census tracts, …) and features (family disruption, prejudice, racial segregation, incarceration and crime, …) have been cited. One potential such mechanism that has gotten little attention so far is the acquisition of non-cognitive skills.

In this paper, I examine how neighborhood quality impacts the development of non-cognitive skills (which to the best of my knowledge has never been done before), and whether that impact differ by gender. I use data from the Early Childhood Longitudinal Survey – Kindergarten cohort, a panel of US children from various locations and socio-economic backgrounds. Using measures of family disruption rates at the neighborhood level (rate of father presence) as measures of neighborhood quality, I assess whether the acquisition of non-cognitive skills is affected by different environments, and whether the impact is the same for boys and for girls. I find that a one standard deviation decrease in the neighborhood rate of father presence has about 1/2 the effect of the absence of a child's own father, and that the size of that effect not statistically significantly different between boys and girls (the point estimate is larger for girls).

While achievement tests, which measure cognitive abilities and are primarily correlated with IQ, have long been the primary measure of human capital, "real-life" success is heavily dependent on a range of other abilities. These include motivation or curiosity, self-regulation (of emotions, attention, etc.) and interaction with others (trust, agreeableness, …). Non-cognitive skills have been shown by a growing literature to be instrumental in academic and professional success, but also to correlate with longer life

expectancy and reduced likelihood of engaging in criminal behavior[1], which makes them a potentially strong mechanism for the influence of neighborhoods on lifetime outcomes. Moreover, past research shows that the formation of non-cognitive skills is done through socialization and depends on strong investments (financially, emotionally and in term of time) during critical windows in infancy and adolescence. These resources are typically provided by parents but programs such as preschool (Heckman et al. 2010) or teenage intervention (Cunha and Heckman (2008), Algan et al. 2014). The social dimension of the acquisition process means that local communities might be of great influence. However, this has not been a topic of enquiry so far, the existing literature focusing on the influence of family and school environment. A growing literature points that the acquisition of those skills is heterogeneous along gender lines: girls exhibit a systematic advantage over boys for at least some of the non-cognitive skills, and the gender gap in non-cognitive skills is bigger in disadvantaged families (Brenøe and Lundberg 2017), single-parent families and children of teenage mothers (Bertrand and Pan 2013) and lower-quality schools (Autor et al. 2016). However, these family and school characteristics are highly correlated with neighborhood-level characteristics such as family disruption and incarceration rates.

The gender gap pattern also fits puzzling observed patterns of income inequality along gender and racial lines. For example, Chetty et al. (2019) find that conditional on parents' income, there is a big gap between white and black males in college attendance, incarceration rates, employment rates and income rank, but not between black and white females. They find that this gap is minimized in low-poverty neighborhoods with low levels of racial bias among whites and high rates of father presence among blacks, which is the type of environment in which the gender gap in non-cognitive skills is also minimized.

My results imply that that neighborhood characteristics are associated with the formation of the non-cognitive dimensions of human capital, and that non-cognitive skills are a likely mechanism of transmission between neighborhood characteristics and lifetime outcomes. While that effect cannot be considered causal since neighborhood of residence is chosen by parents (and its quality might be correlated with unobservables such as taste for schooling or ambition on behalf of the child), identifying at-risk populations and potential mechanisms is key to develop relevant policy instruments. These skills potentially have important welfare impacts and positive externalities, and have shown responsive to investment policies. Hence, the development of non-cognitive skills in children is a prime candidate for policy intervention.

1. See the seminal paper by Jencks et al. (1979) for influence of non-cognitive skills on occupational achievements. Later literature includes Heckman & Rubinstein (2001), Heckman & Masterov (2007) and Heckman & Kautz (2012) on academic success; Barrick and Mount (1991), Hogan and Holland (2003), Nyhus and Pons (2005), and Salgado (1997) on job market success; Gottfredson and Hirschi (1990) and John & al. (1994) on crime; and Robert & all. (2007) on life expectancy.

II. Data

For information on non-cognitive skills, neighborhood of residence and socio-economic background, I use the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K). It followed one cohort of children who entered Kindergarten in fall 1998, in both public and private schools, for full-day or part-day programs. The sample of more than 20,000 children was randomly selected by a multistage probability design (stratified sampling of counties, then schools, then children within school) to be representative of the United States. The children were followed (with some attrition[2]) through the spring of 2007, at which point most of them were in 8th grade. Children were assessed in the same way no matter what grade they attended in each wave.[3.]

In every wave, the study includes a rich phone survey answered by a parent or guardian, as well as a questionnaire filled by one or several teacher(s) – which includes information about the school environment and the behavior of the focal child in class.

I use 5th grade teacher-measured non-cognitive skills as the outcome. The data on children non-cognitive skills is only available in the ECLS-K as 5 aggregated (composite) indicators that average the score of each child over several behaviors[4]. The composites are Externalizing Problems, Internalizing Problems, Self-Control, Approaches to Learning and Interpersonal Skills. Of the 5 measures, only Self-control and Externalizing Problems are correlated to neighborhood characteristics. They also intuitively seem to be the most likely to affect education outcomes, job market success and crime participation orthogonally to IQ. Approaches to Learning are extremely correlated with cognitive abilities. Teachers report on a scale from one ("Never") to four ("Very often") the frequency of exhibiting behaviors constitutive of each category. Below, I list the behaviors that are included in Externalizing Problems and Self-Control are:

- ***Externalizing Problems***: arguing, fighting, anger, impulsiveness, and disturbing ongoing activities.
- ***Self-Control:*** respecting the property rights of others, controlling temper, accepting peer ideas for group activities, and responding appropriately to pressure from peers.

[2] In each wave, only 15 to 75% of students who moved to schools or counties outside of the sample frame were followed (depending on the specific wave and situation). As a result, the number of respondents falls from 19,684 in fall of Kindergarten to 9,725 in Spring of "8th grade" (see Tourangeau et al., 2009).

[3] Going forward, I use "Xth grade" or "age Y" to indicate the wave in which most children are Y years old and attend Xth grade, but it is of note that for any year (i) a minority is attending a different grade and (ii) the cohort ages span 4 years depending on age of entry in Kindergarten. By the Spring of 2004, 75% of the respondents are 11 but the youngest is 9 and the oldest, 14 years old. 91.7 % of them are in 5th grade and 7.2 % are in 4th grade after having repeated one grade in their academic career. The remaining ones range from 2nd to 6th grade and includes disabled and special-education students who attended ungraded classrooms.

[4] Item-level responses exist but are copyrighted and thus require an additional level of restricted access.

These indicators are derived from the Social Skills Rating Scales, which have been widely used to assess social and behavioral problem in school-aged children (Gresham and Elliott, 1990). They appear to be internally consistent, and to have high validity based on test-retest reliability (Neidell and Walfogel, 2011). Note that since they are composites (average over several 4-point scale responses) they can take non-integer values. Since externalization problems are negative occurrences, a lower score reflects better skills, whereas self-control is a positive behaviors, so a *higher* score reflects better skills. To get consistent measures, I reverse the scale on Externalization so that a higher score always reflects better skills. The full range of the scale is used, which means that for each category, at least some of the students exhibit all of the behaviors very often, and some other students don't ever exhibit any. The percentage of these students is reported in parentheses.

Table 1: Summary statistics of non-cognitive measures in ECLS-K sample in 5th grade

Variable	Mean	Standard deviation	Median	Minimum ("never")	Maximum ("very often")
Externalization	3.38	0.57	3.5	1 (< 1 %)	4 (17 %)
Self-Control	3.26	0.59	3.33	1 (< 1 %)	4 (16 %)

Notes: based on author's calculations. Sample restricted to ECLSK students present in 5th grade for whom we have parent data and relevant non-cognitive measures (N=8,272).
Each variable is an average of several behavior items (listed above) reported by teachers on a 4-point scale (1 = "Never"; 4 = "Very often"). The proportion of the sample that present the minimum and maximum value of each variable is indicated in parentheses.

Following Sampson (1987) who highlights the importance of father presence in black communities, and Bertrand and Pan (2013) who find big effects of single motherhood and teenage motherhood on non-cognitive skills, I use measures of family disruption rates within a neighborhood as my measures of "neighborhood quality" : proportion of fathers present in neighborhood (race-specific) and rate of teenage motherhood in neighborhood. The proportion of fathers present is constructed from tabulations of the 2000 census at the census tract level. Chetty et al. (2019) show that father presence effects are race-specific and can vary a lot between different ethnic and racial communities within the same neighborhood, so I construct it constructed separately for the 6 major racial and ethnic groups (Non-Hispanic white, Hispanic, Asian, Native American and Pacific Islander, Other races/ethnicities and Multiple races/ethnicities) in each tract using the following formula:

$$prop\ fathers\ present = \frac{\begin{array}{l} number\ of\ hh\ of\ race\ r\ with\ married\ household\ heads\ living\ with\ their\ own\ children \\ + number\ of\ hh\ of\ race\ r\ with\ male\ hh\ head\ living\ with\ his\ own\ children \end{array}}{\begin{array}{l} number\ of\ hh\ of\ race\ r\ with\ married\ hh\ heads\ living\ with\ their\ own\ children \\ + \quad number\ of\ hh\ of\ race\ r\ with\ female\ hh\ head\ living\ with\ her\ own\ children \\ + \quad number\ of\ hh\ of\ race\ r\ with\ male\ hh\ head\ living\ with\ his\ own\ children \end{array}}$$

The ECLS-K only provides a census tract of residence for waves up to spring of 3rd grade (2002). I use the census tract recorded in 2002 to link each child to the proportion of families of their own race with children who have a father present in their census tract. Hence, census tract is measured 2 years before non-cognitive skills are. This is likely not a problem (or even a good thing) because 90% of the sample does not move between 3rd and 5th grade, those who do are likely to move into similar neighborhoods to the ones they were previously in, and neighborhood effects take time to have an impact (for example, Chetty, Hendren and Katz (2016) find that in the Moving to Opportunity experiment, children exhibit benefit in lifetime outcomes from moving to low-poverty neighborhoods only if they do so before 13 years old). As a robustness check, I exclude movers from the sample and find results extremely similar to the main ones.

It is worth noting that different dimensions of neighborhood quality (family disruption, poverty, unemployment, rates of college graduation, …) are highly correlated with each other. Hence, my main explanatory variable, own-race neighborhood rate of father presence, should be seen first and foremost as a measure of neighborhood quality. Further analysis will be necessary to determine the effect of other dimensions of neighborhood quality, and whether the effects differ for different subpopulations.

As a robustness check and alternative measure of neighborhood-level family disruption, the rate of teenage motherhood is constructed at the county level from public use data from the National Vital Statistics System, a compilation of all births and deaths in the U.S. by the National Center for Health Statistics (NCHS), as the average proportion of births in the county for which the mother was a teenager over the years 1995-2002. Obviously, county-level is much less granular than census tract, which is less than ideal. Moreover, to protect privacy, county code is redacted (combined under "unidentified counties" for each state) when the population within a county is less than 100,000 and number of births is redacted when there were less than 10 birth in a given cell (county by age range of mother). Because of this, the proportion of teenage births in county is only available for about 72% of the sample, and only 24% for children in rural areas. I am currently in the process of requesting census-tract level data from the NCHS, which will address these two issues (granularity and redacted data).

Table 2: Summary statistics of explanatory variables

Variable	Mean	Standard deviation	Median	Minimum	Maximum	Number of obs.
Neighborhood rate of own-race father presence (source: 2000 census tabulations)	0.81	0.17	0.85	0 (< 1 %)	1 (5.61 %)	8,272
Neighborhood rate of teen birth (source: NHCS)	0.11	0.04	0.11	0.02 (< 1 %)	0.23 (<1%)	5,959 (72 %)

Sample restricted to ECLSK students present in 5th grade for whom we have parent data and relevant non-cognitive measures (N=8,272). The percentage in parentheses in the last column indicate the proportion of sample children for whom these neighborhood-level variables are available.

Table 2 above presents descriptive statistics on the two measures of neighborhood quality in our sample. In the "minimum" and "maximum" columns, the numbers in parentheses indicate what proportion of children live in a neighborhood for which the values are minimum or maximum.

For ease of interpretation in the subsequent analysis, all the key dependent and explanatory variables are standardized, using their mean and standard deviation within the sample for which we have all ECLS-K information *and* rate of father presence at the census tract level (n = 8,272). Going forward, this is considered the sample of reference. To reduce measuring error, I compute z-scores for Self-control and Externalization and take the average of these 2, which I call "Self-Regulation" and is the main outcome variable for my study.

Table 3 below presents the descriptive statistics for the standardized variables. Figure 1 and 2 show the distributions of self-regulation and tract rate of own-race father presence in the sample.

Table 3: Summary statistics of standardized variables (outcome and explanatory)

Variable	Median	Minimum	Maximum	Number of obs.
Externalization (z-score)	0.21	-4.18	1.08	8,272
Self-Control (z-score)	0.12	-3.84	1.26	8,272
Self-Regulation (average of the above 2)	0.23	-3.72	1.17	8,272
Neighborhood rate of father presence (z)	0.26	-4.67	1.12	8,272
Neighborhood rate of teen birth (z-score)	0.07	-2.16	2.86	5,959

Sample restricted to ECLSK students present in 5th grade for whom we have all parent data, relevant non-cognitive measures, and census tract level race-specific father presence. (n=8,272). Variables are standardized from their mean and standard deviation within this sample (see tables 1 and 2).

Finally, it is of note that the sample covers 1,785 schools. Only 851 children are alone in their school (10 % of the sample), most schools represented in the sample have a handful of students participating in the study (average and median are both around 9.5 students/school) and some schools have up to 32 students in the sample. Similarly, the sample covers 3,200 different census tracts, with 21% of children being the only respondent in their census tract, the median being 3.5 children per tract, the average 5.6 children per tract and one tract having 27 respondents.

Figure 1: Distribution of Self-Regulation

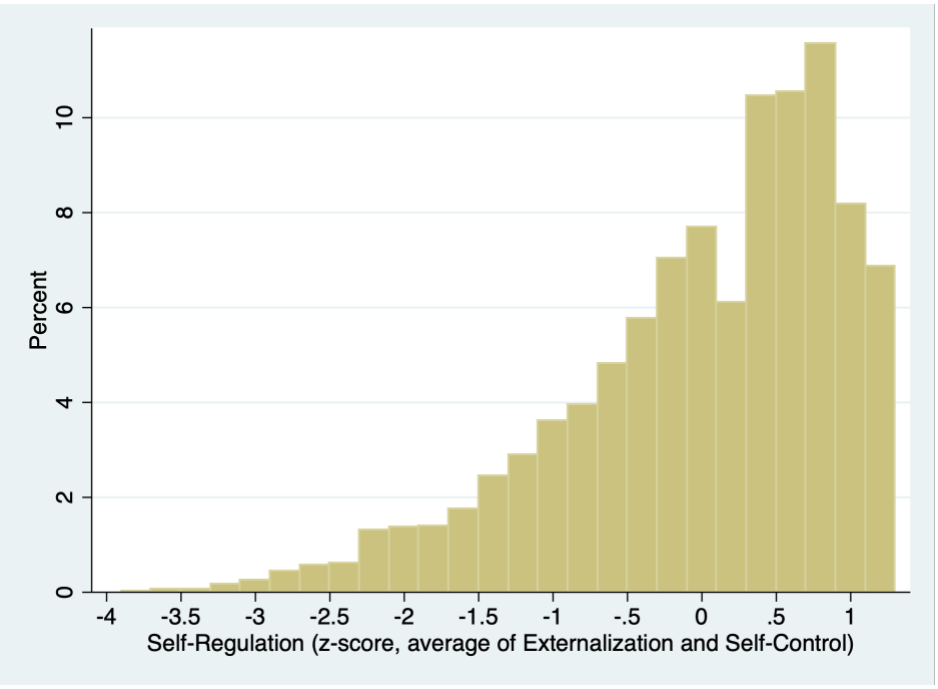
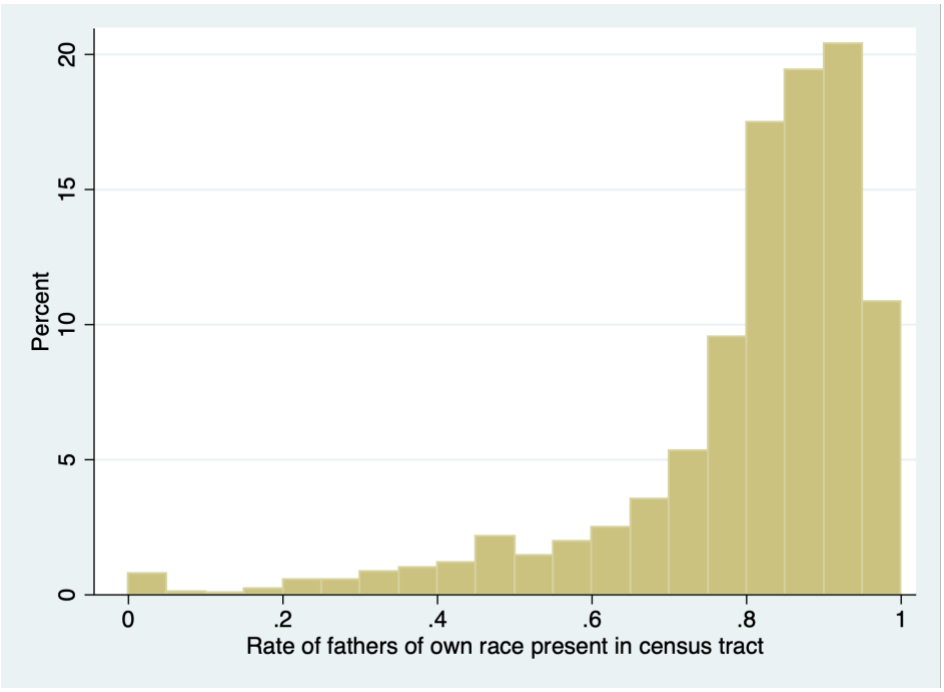


Figure 2:
Distribution of rate of families of own race in census tract of residence who have a father present



III. Identification strategy

Equation (1) below presents the main regression to be estimated, where *i* is an individual child living in neighborhood *n* in 2005. Of particular interest is coefficients β_1, since it identifies whether neighborhood quality has a measurable effect on non-cognitive skills when controlling for all of the vectors of controls.

$$Skill_{ins} = \beta_0 + \beta_1 Neighborhood_n + \mathbf{B_2\,BasicDemographics_i} + \mathbf{B_3 Family\&SESControls_i} + \mathbf{B_4 ChildHealthControls_i} + \mathbf{B_5 ParentMentalHealth_i} + \mathbf{B_6 SchoolControls_s} + \boldsymbol{\varepsilon_{ins}} \quad (1)$$

The dependent variable, denoted $Skill_{ins}$, is the average of the z-scores of the externalizing and self-control measures reported in 2003 by the teachers of school *s* for child *i* leaving in neighborhood *n*. $Neighborhood_n$ measure census tract rate of father presence of own race (and in robustness checks, county rate of teenage births or tract rate of poverty). The vectors of controls (all measured in 2005) are quite extensive. The exact contents of each category are described below:

- **Basic Demographics:** Gender (boy or girl); Dummies controlling for the age of the focal child compared to the rest of the cohort non-parametrically[5]; Race and ethnicity: Non-Hispanic white, non-Hispanic black, Hispanic of any race, Asian, American Indian or Native Hawaiian or Pacific Islander, more than one race).
- **Family-level socio-demographic controls:** dummies for family structure (presence of siblings, teenage mother, single mother (= father absence), single father and absence of both parents); a dummy indicating whether the child's mother is foreign-born; a SES gradient (5 categories, built into the ECLS-K) which includes education and occupation prestige for any present parents, and yearly family income, and mother's education (8th grade or less, high school dropout, high-school graduate or GED, some college but no bachelor's degree, bachelor's degree, graduate degree)
- **Child-level health controls:** dummies controlling for birth weight of the focal child non-parametrically (one category for each pound) and dummies controlling for disability status of the focal child (not disabled (92.3% of sample), learning disability (4.3%), speech or language impairment (1.2%), health impairment (0.6%), not otherwise classified disability (0.5%), serious emotional disturbance (0.4%),

[5] The cohort who enters Kindergarten in 1998 spans 5 years (dates of birth range from August 1990 to February 1995 age). I use 6 dummies to account flexibly for the effect of being red-shirted at the entry in kindergarten to different degrees versus entering kindergarten early. The baseline is the subgroup born between January 1st 1993 and June 30th 1993. The other categories are: born between August 1st 1990 and December 31th 1990; born between January 1st 1991 and June 30th 1991; born between August 1st 1991 and December 31th 1991; born between January 1st 1992 and June 30th 1992; born between August 1st 1993 and December 31th 1993; and born between January 1st 1994 and June 30th 1995.

mental retardation (0.3%), autism (0.1%), blindness, deafness, orthopedic or physical impairment, traumatic brain injury, multiple impairments, developmental delay).

- **Parent mental health controls:** a dummy for whether "During the past 12 months, [any of the parents] have felt or anyone has suggested that [any of the parents] needed professional help for any emotional problem or for drug or alcohol use?" and for whether they declined to answer that question; and a caretaker's answers to a depression scale broken into 3 categories: not depressed, depressed and severely depressed.
- **School-level controls:** type of school (neighborhood public school, public school of choice, magnet school, catholic private school, other religious school, other private school, tribal school (on a reservation), special education school, other public school); percentage of pupils testing at or above grade level nationally in reading/verbal and/or mathematics/quantitative skills, dummies controlling non-parametrically for percentage of white pupils; and dummies controlling non-parametrically for percentage of pupils with limited English proficiency.
- **School-level poverty** (only in some specifications): whether the school is eligible for Title I funding (indicating that at least 40% of pupils come from low-income families) and dummies controlling non-parametrically for percentage of pupils eligible for free or reduced-price lunches.

The comparison group is white non-Hispanic boys with no reported disability born weighing 7 lbs between January and June 1993, living with 2 parents and no siblings with average family SES, attending a regular public school with 50 to 90% white students, 50 to 75% of students testing at or above grade level nationally in reading and mathematics and no limited English proficiency students, no Title I funding and less than 12.5% of students eligible for free or reduced-price lunch, whose mother has some college education but no degree, is a U.S.-born citizen and gave birth for the first time at more than 19 years of age, rates as "non-depressed" on the depression scale and doesn't report a need for professional help because of emotional or substance abuse problems.

To assess whether the impact of neighborhood quality differs depending on the gender of the child (which is of interest since the existing literature shows that boys' non-cognitive skills are much more responsive to inputs than girls') I then estimate equation (2) below, which is similar to equation (1) but interacting rate of father presence and each vector of controls with the child's gender. The parameters of interest are then γ_2, which determines the effect of neighborhood rates of own-race father presence on boys only, and γ_3, which measures the difference of that effect between boys and girls.

$$Skill_{ins} = \gamma_0 + \gamma_1 Female_i + \gamma_2 Neighborhood_n + \gamma_3 Neighborhood_n * Female_i + \boldsymbol{\Gamma_4}\, \mathbf{Controls_{is}} + \boldsymbol{\Gamma_5}\, \mathbf{Controls_{is}} * Female_i + u_{ins} \quad \textbf{(2)}$$

The identification of the parameters of interest relies on variation in non-cognitive skills between children of the same race, age, SES background, family structure and health status attending schools with similar characteristics and whose parents report similar mental health. Endogeneity is a problem if even conditional on this rich set of observable characteristics, there are some unobservable characteristics that are correlated with neighborhood levels of family disruption and also affect children's non-cognitive skills. One such unobservable characteristic might be children's motivation, ability or valuation of education.

If families whose children are more academically promising or well-behaved than other children of their own race, age, SES, family structure, etc. systematically chose to live in areas with less family disruption (which are also on average areas with less poverty, unemployment, racial segregation and gang activity) it would bias my results towards finding a positive β_1[6]. On the other hand, if parents whose children exhibit tendencies to "problem" behaviors decide to live in "better" neighborhoods than their counterparts, it would bias me away from finding any effects of the neighborhood characteristics. (Parents choosing nicer or safer neighborhoods if they have a girl creates no omitted variable bias, since that would be picked up by coefficients β_1 and γ_3). It is plausible that both tendencies exist in parents, which somewhat mitigates concern over bias. However, this bias cannot be ruled out, since applying the Oster methodology shows that even modest levels of selection on unobservable relative to the existing selection on observables would confound the results.

IV. Results

Table 4 presents my main specifications. The first column only includes the neighborhood rate of father presence and basic demographic controls. It indicates that a 1 standard deviation increase in rates of fathers present in neighborhood (i.e. 17 percentage points increase) is associated with an increase in self-regulation of about 0.067 standard deviations, which is a fairly big effect. However, the neighborhood rate of own-race father presence is obviously correlated with students' families' characteristics, as discussed above. Actually, the set of controls described in section III explains about 44% of the variation in rates of father presences between the respondents' census tracts of residence. Column (2) to (5) progressively add all controls, category by category.

[6] In fact, among students who moved between 3rd and 5th grade, disruptive behavior in 3rd grade is uncorrelated with the probability of parents indicating that the reason(s) for the move included going to a "safer area" or a "better school" (1 std increase in externalizing behavior in 3rd grade associated with a 1.9 percentage point increase in likelihood of moving to be in "safer area", p-value = 0.30) *but* disruptive behavior in 1st grade *is* correlated with the probability of parents indicating that the reason(s) for the move included going to a "safer area" (1 std increase in externalizing behavior in *1st grade* associated with 1.3 pp *decrease* in likelihood of moving to be in "safer area", p-value = 0.007). 3rd grade externalization scores seem to have little predictive power in general.

Table 4:
Effect of Rates of Father Presence in Census Tract and Absence of Own Father on Self-Regulation

	Outcome: Self-regulation (z-score)				
	(1)	(2)	(3)	(4)	(5)
Rate of own-race fathers present in tract (z-score)	0.067***	0.031**	0.030**	0.028**	0.023*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Girl	0.435***	0.424***	0.424***	0.424***	0.423***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Single mother (own father absent)		-0.067**	-0.050*	-0.047	-0.051*
		(0.029)	(0.029)	(0.029)	(0.029)
Biological mother teenager at first birth		-0.143***	-0.138***	-0.141***	-0.138***
		(0.031)	(0.031)	(0.031)	(0.031)
Siblings (dummy)		0.116***	0.116***	0.117***	0.112***
		(0.030)	(0.030)	(0.030)	(0.030)
Basic demographic controls	Yes	Yes	Yes	Yes	Yes
Family structure and SES	No	Yes	Yes	Yes	Yes
Focal child's health	No	Yes	Yes	Yes	Yes
Parent mental health	No	No	Yes	Yes	Yes
School characteristics	No	No	No	Yes	Yes
School poverty controls	No	No	No	No	Yes
Observations	8,272	8,272	8,272	8,272	8,272
R-squared	0.099	0.142	0.144	0.148	0.150

*** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by census tract of residence in parentheses (3,200 clusters).

Sample restricted to students present in wave 6 (spring of "5th grade") for whom we have parent questionnaires and non-cognitive measures.

The basic demographic controls include child gender, race and semester of birth.

Other child and family-level controls include immigrant status of mother, single father (dummy), absence of both parents (dummy), quintile of SES index (index including income, parents' education and parents' occupation), mother's education, birthweight in pounds of child and disability status of child.

Parents non-cognitive skills include parent's score on a depressions scale and a dummy for parent reporting that (or refusing to answer whether) they need professional help for emotional or substance abuse problems.

School characteristics include school type (charter school, magnet school, catholic school, other private school, other public school), percent of pupils currently enrolled who test at or above grade level nationally in reading and mathematics, percent of pupils currently enrolled who are white, and percent of pupils currently enrolled in 5th grade who have limited English proficiency.

School poverty controls include percent of pupils currently enrolled who are eligible for a free or reduced lunch, and Title 1 status of school.

Colum (2) adds family structure and SES as well as controls of the focal child's health and shows that the effect of a 2 standard deviation increases in rates of fathers present in neighborhood (i.e. going from a disadvantaged neighborhood to an average one) is similar in magnitude to going from a single-mother family to a 2-parent family, which is noted in the literature as being an important factor in the development of non-cognitive skills (Bertrand and Pan 2013). The size of these two coefficients remains quite stable as more controls are added. Particularly, column (3), which adds measures of parents' mental health, is almost identical to column (2), except for the fact that the size of the coefficient on living with a single mother decreases quite a bit. This indicates that parents' mental health is correlated with their children's self-regulation skills, and that parent's mental health is on average poorer for single mothers.

Column (4), which includes controls for family structure and SES, child health, caretaker's mental health and school characteristics other than poverty levels, is my preferred specification. It indicates that the effect of a 1 standard deviation increase in rate of father presence in neighborhood is a 0.028 standard deviation increase in self-regulation, and is statistically significant at the 5% level.

Columns (5) adds school poverty levels to the controls. The magnitude of the coefficient of interest doesn't change much but its statistical significance decreases. This might be because school poverty is highly correlated with neighborhood level family disruption, creating imperfect multicollinearity, and/or because poverty is one of the channels through which family disruption affects children, with single-parent households mechanically earning less than 2-parent households. While the effect of a student's own father being absent (being raised by a single mom) become bigger, the effect of the neighborhood rate of father presence becomes smaller.

Table 5 presents the results from my preferred specification (table 4, column 4) when interacting neighborhood father presence and all controls with the focal child's gender. We notice that the difference in the effect of neighborhood-level father absence between boys and girls is not statistically significant, and most importantly, the size of the point estimate for boys is much smaller than it is for girls (0.012 vs 0.044). This indicates that if anything, girls' socio-emotional development benefit more from living in a high-quality neighborhood than boys' do. This pattern is interesting because it runs counter to most of the existing research, which shows that the gender gap in non-cognitive skills is more pronounced in disadvantaged circumstances. And indeed, we find that the gender gap in our sample is bigger in children of teenage mothers, and in children raised by a single mother, even though these differences are not statistically significant.

Table 5:
Differential Effects of Circumstances on Self-Regulation by Child Gender

	Outcome: Self-regulation (z-score)	
	(4)	Interaction
Girl	0.424***	0.429***
	(0.019)	(0.133)
Rate of own-race father presence in tract (z-score)	0.028**	0.012
	(0.014)	(0.021)
Rate of own-race father presence in tract (z-score)* Girl		0.032
		(0.027)
Total effect of rate of father presence in tract for girls		**0.044****
		(0.018)
Single mother (own father absent)	-0.047	-0.071
	(0.029)	(0.043)
Single mother * Girl		0.051
		(0.057)
Total effect of single mother for girls		**-0.023**
		(0.038)
Biological mother teenager at first birth	-0.141***	-0.156***
	(0.031)	(0.047)
Biological mother teenager at first birth * Girl		0.033
		(0.062)
Total effect of teenage mother for girls		**-0.122*****
		(0.040)
Siblings (dummy)	0.117***	0.072
	(0.030)	(0.047)
Siblings * Girl		0.082
		(0.061)
Total effect of siblings for girls		**0.151*****
		(0.040)
Observations	8,272	8,272
R-squared	0.148	0.158

*** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by census tract of residence in parentheses (3,200 clusters).

The left-hand column corresponds to specification 4 in table 5, which is my preferred specification. It includes basic demographic controls, other child- and family- level controls, parent non-cognitive skills and school characteristics but no school poverty controls as these are a likely mechanism through which neighborhood-level father absence affect children.

V. Robustness Checks

a. Result in subsamples with additional controls available

Some potential controls of interest are only available for a subset of the sample. Table 6 compares results of the preferred specification in the entire sample with results of that same specification in the subsamples for which we have, respectively, (i) scores for the standardized tests administered during the ECLS-K, (ii) type of location (large or mid-size city, suburb or large town, small town or rural) and (iii) county rate of teenage birth, and specifications in which I add the controls in question.

Column (1) presents baseline results for comparison. Columns (2) and (4) show that restricting the sample to children for whom standardized test scores or type of location (urban, suburb or rural) is available slightly reduces the size and statistical significance of the coefficient of interest, and that adding test scores and type of location to the list of controls (columns 3 and 5) again makes the coefficients slightly smaller and less statistically significant without changing their magnitude much.

Cognitive and academic abilities (measured here by standardized scores to the tests administered as part of the ECLS-K) might be resulting from the same human capital acquisition process as non-cognitive abilities such as self-regulation, and be an outcome that shouldn't be included as a control. On the other hand, academic performance might facilitate the development of socio-emotional skills, and vice-versa. As such, it is interesting to note that the inclusion of standardized test z-scores as a control in column (3) affects the magnitude of the coefficient of interest only marginally: the effect of neighborhood quality on self-regulation does not seem to come from the fact that children who, other things equal, live in better neighborhood also perform better academically on average. Moreover, when substituting standardized test scores as the outcome in our preferred specification, I find that neighborhood rates of father presence do not significantly affects cognitive performance the way they impact non-cognitive skills.

Interestingly, restricting the sample to children for whom the county rate of teenage births is available (columns 6 and 7) makes the effect of father presence more than 1/3 bigger. Adding county rate of teenage births doesn't affect the results at all, and a one standard deviation increase in teenage births rates in the county is associated with a 0.027 standard deviation decrease in self-regulation, significant at the 5% level. Neighborhood rates of teenage motherhood and father absence appear to both affect self-regulation development independently.

However, the fact that the results of the baseline specification are so much bigger in that subsample indicates some underlying heterogeneity in the effect of neighborhood quality on self-regulation. Since data is redacted for counties with population below 100,000 and counties for which there were less 10 birth to either teenage or non-teenage mother between 1995 and 2002, a lot of rural counties are omitted from that

Table 6: Sensitivity to additional controls

	Full sample	Test Scores available		Location type available		Teen birth rate available		All data available	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rate of own-race father presence in tract	0.028**	0.028**	0.026*	0.028*	0.024*	0.040**	0.039**	0.040**	0.033**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.016)	(0.016)	(0.016)	(0.016)
Reading test z-score			0.079***						0.075***
			(0.015)						(0.018)
Math test z-score			0.084***						0.075***
			(0.015)						(0.017)
Suburb or Large Town					0.077***				0.081***
					(0.026)				(0.030)
Small Town or Rural					-0.001				0.130**
					(0.035)				(0.055)
Teen birth rate in county (z-score)							-0.027**		-0.019
							(0.013)		(0.015)
Single mother	-0.047	-0.045	-0.044	-0.053*	-0.056*	-0.038	-0.040	-0.040	-0.040
	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)	(0.034)	(0.034)	(0.035)	(0.035)
Teenage mother	-0.141***	-0.142***	-0.120***	-0.143**t*	-0.137***	-0.152***	-0.149***	-0.153***	-0.122***
	(0.031)	(0.031)	(0.031)	(0.032)	(0.031)	(0.038)	(0.038)	(0.039)	(0.038)
All child controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
All parent controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
School controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
School poverty controls	no	no	no	no	no	no	no	no	yes
Observations	8,272	8,260	8,260	7,942	7,942	5,959	5,959	5,685	5,685
R-squared	0.148	0.146	0.162	0.148	0.149	0.159	0.160	0.158	0.175

*** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by census tract of residence in parentheses.

All child controls include child gender, race and semester of birth, single father (dummy), absence of both parents (dummy), birthweight in lbs and disability status.

All parent controls include immigrant status of mother, quintile of SES index (index including income, parents' education and parents' occupation), mother's education, caretaker's score on a depressions scale and a dummy for parent reporting that (or refusing to answer whether) they need professional help for emotional or substance abuse problems.

School characteristics include school type (charter school, magnet school, catholic school, other private school, other public school), percent of pupils currently enrolled who test at or above grade level nationally in reading and mathematics, percent of pupils currently enrolled who are white, and percent of pupils currently enrolled in 5th grade who have limited English proficiency.

School poverty controls include percent of pupils currently enrolled who are eligible for a free or reduced lunch, and Title 1 status of school.

subsample: rate of teenage births is only available for 23.65% of the sample children residing in small towns and rural areas, versus 91.90% of sample children residing in large and mid-size cities. The subsample for which teen birth rates are available is much less rural than the full sample (6.8% versus 20.7%). This suggests that my results are bigger and more statistically significant for children residing in cities. This is explored in the next section.

b. Heterogeneous effects of neighborhood quality on self-regulation

In table 7, I run my preferred specification then add test scores and school poverty measures separately for each type of location: Large or mid-size city; Suburb or large town; and small town or rural. It appears that my results are virtually entirely driven by cities, in which the effects of neighborhood quality are almost half again as big as they are in the whole sample. In contrast, the effects of neighborhood quality in suburban or rural environment are essentially zero. This make intuitive sense: cities are denser and a census tract in a city is a much smaller geographic area than a rural census tract. Increased population density means interaction with many more people in the neighborhood, and hence more sensitivity to neighborhood average characteristics (as opposed to interaction with the few closest neighbors in a rural environment).

I find that the effects of neighborhood quality are heterogeneous along other dimensions (not presented here): they are bigger among black children (as implied by the evidence outlines in Chetty et al. 2019) and among children who have lower test-scores (possibly because having role models in the community is more important for the non-cognitive skills of children who have more difficulty fitting with academic norms). On the other hand, children of single mothers, teenage mothers or low SES do not seem to be more sensitive to neighborhood quality, which indicates that neighborhoods cannot be a substitute for a disadvantaged family environment, and affect children separately.

Table 7: Effect of Rates of Father Presence in Census Tract by Location Type

	Large or Mid-Size City			Suburb or Large Town			Small Town or Rural		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rate of own-race father presence in tract	0.041**	0.042**	0.039*	0.010	0.005	0.002	-0.004	-0.001	-0.001
	(0.021)	(0.021)	(0.021)	(0.024)	(0.023)	(0.023)	(0.036)	(0.036)	(0.036)
Reading test z-score		0.078***	0.077***		0.065***	0.066**		0.110***	0.106***
		(0.026)	(0.026)		(0.025)	(0.025)		(0.032)	(0.033)
Math test z-score		0.085***	0.086***		0.077***	0.076***		0.073**	0.075**
		(0.024)	(0.024)		(0.024)	(0.024)		(0.035)	(0.035)
Single mother	-0.024	-0.017	-0.020	-0.052	-0.059	-0.062	-0.120*	-0.109	-0.115
	(0.047)	(0.046)	(0.046)	(0.048)	(0.048)	(0.048)	(0.069)	(0.071)	(0.070)
Teenage mother	-0.182***	-0.174***	-0.169***	-0.105*	-0.076	-0.084	-0.098	-0.065	-0.078
	(0.048)	(0.047)	(0.047)	(0.055)	(0.055)	(0.056)	(0.064)	(0.063)	(0.063)
All child controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
All parent controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
School controls	yes	yes	yes	yes	yes	yes	yes	yes	yes
School poverty controls	no	no	yes	no	no	yes	no	no	yes
Observations	3,009	3,009	3,009	3,218	3,218	3,218	1,703	1,703	1,703
R-squared	0.184	0.200	0.201	0.155	0.167	0.169	0.178	0.198	0.204

*** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by census tract of residence in parentheses.

All child controls include child gender, race and semester of birth, single father (dummy), absence of both parents (dummy), birthweight in lbs and disability status.

All parent controls include immigrant status of mother, quintile of SES index (index including income, parents' education and parents' occupation), mother's education, caretaker's score on a depressions scale and a dummy for parent reporting that (or refusing to answer whether) they need professional help for emotional or substance abuse problems.

School characteristics include school type (charter school, magnet school, catholic school, other private school, other public school), percent of pupils currently enrolled who test at or above grade level nationally in reading and mathematics, percent of pupils currently enrolled who are white, and percent of pupils currently enrolled in 5th grade who have limited English proficiency.

School poverty controls include percent of pupils currently enrolled who are eligible for a free or reduced lunch, and Title 1 status of school.

c. Excluding students who move between 3rd and 5th grade

Finally, since my measure of neighborhood quality happens in 3rd grade while the non-cognitive skills are measured in 5th grade, it is important to check that the measurement error created by respondents who move between 3rd and 5th grade does not bias my results (I do not observe census tract of residence in 5th grade but students who move between the two waves of the survey are flagged). In table 8, I present the results for the entire sample and for non-movers only side-by-side. They are extremely similar.

Table 8: Excluding respondents who move between 3rd and 5th grade

	Whole sample	**Non-movers only**
	(1)	(2)
Rate of own-race fathers present in tract (z-score)	0.028**	0.034**
	(0.014)	(0.015)
Single mother (own father absent)	-0.047	-0.035
	(0.029)	(0.031)
Biological mother teenager at first birth	-0.141***	-0.134***
	(0.031)	(0.033)
Siblings (dummy)	0.117***	0.124***
	(0.030)	(0.032)
All child controls	yes	yes
All parent controls	yes	yes
School controls	yes	yes
School poverty controls	no	no
Observations	8,272	7,468
R-squared	0.148	0.147

*** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered by census tract of residence in parentheses.

All child controls include child gender, race and semester of birth, single father (dummy), absence of both parents (dummy), birthweight in lbs and disability status.

All parent controls include immigrant status of mother, quintile of SES index (index including income, parents' education and parents' occupation), mother's education, caretaker's score on a depressions scale and a dummy for parent reporting that (or refusing to answer whether) they need professional help for emotional or substance abuse problems.

School characteristics include school type (charter school, magnet school, catholic school, other private school, other public school), percent of pupils currently enrolled who test at or above grade level nationally in reading and mathematics, percent of pupils currently enrolled who are white, and percent of pupils currently enrolled in 5th grade who have limited English proficiency.

Conclusion

In conclusion, I expose a likely mechanism for recent results in the literature on geography of opportunity in the U.S. For example, Chetty, Hendren and Katz (2016) study the Moving to Opportunity experiment and find that moving to a lower poverty neighborhood (which is very likely to be a lower family disruption neighborhood) before age 13 increases college attendance and earnings and reduces single parenthood rates, while Chetty and Hendren (2015) show that neighborhoods have causal exposure effects on children's outcomes using quasi-experimental methods. I find that a one standard deviation increase in the neighborhood rate of father presence increases self-regulation in 11 years old students by about 0.03 standard deviations, which is about 1/2 the effect of the presence of a child's own father. This implies that children of single mothers who are at risk of youth delinquent behavior or dropping out of high school (both of which have been linked to low non-cognitive skills) might effectively mitigate that risk by moving from neighborhood with high family disruption (father presence rates 1 std below average corresponds to 68% of fathers present, which is around the 20th percentile) to neighborhood with high rates of father presence (1 std above average corresponds to 100% of fathers present, or around the 95^{th} percentile) before they enter adolescence.

Moreover, I fill a gap in the current literature in non-cognitive skills which has focused on explaining variation in self-regulation and interpersonal skills through family characteristics which are highly correlated with neighborhood characteristics. Interestingly, the size of the effect of own family characteristics does not change significantly when controlling for neighborhood characteristics, which implies that these effects are additive. This makes it all the more important from a policy perspective to target high-poverty neighborhoods with remediation efforts. These strong neighborhood effects also entail that the high incarceration rates that are linked with poor neighborhood quality and family disruption (especially in inner-city segregated neighborhoods) do not simply affect future economic prospects of the children of convicts through direct effects but also those of the entire community through fairly large spillovers.

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