The Geography of Opportunity: Developmental Trajectories of Children in Baltimore

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Neighborhood disadvantage across America affects children in several domains. Geographic differences that result from racial and economic segregation have the potential to change life paths. Using the Fragile Families and Child Well-Being Study we estimate behavior, cognitive and health trajectories from toddlerhood to adolescence of children born in Baltimore, and we compare their trajectories to those of children with parents of similar age, education, race, and income born in other urban cities across the US. Our outcomes of interest are internalizing behavior, externalizing behavior, Peabody Picture Vocabulary Test (PPVT), delinquent behavior, and health status. We use mothers' reports and, when available, we use youth's reports. In order to account for neighborhood effects, we matched a set of county characteristics that includes measures of income inequality, school quality, social cohesion, crime and racial segregation. Marginal changes in outcomes were estimated for ages 1 to 15 for health outcomes; ages 3 to 15 for externalizing and internalizing behaviors; ages 3 to 9 for PPVT; ages 5 to 15 for delinquent behavior; and ages 9 to 15 for youth-reported delinquency and youth-reported health status. Results were disaggregated by race and gender.

Our findings show that, at age three, children in Baltimore had less behavioral problems, better cognitive outcomes and are healthier, in comparison to children born in other urban cities, after controlling for mothers' age, education, income and relationship status at birth, and race, but before accounting for neighborhood characteristics. As children grew older, there was a convergence of means, which resulted from a worsening situation for children in Baltimore and improvements for children elsewhere.

When we incorporated measures of income inequality, school quality, crime rate and degree of racial segregation at the county level, we observed that, under average levels of neighborhood characteristics, children in Baltimore would have had better trajectories of internalizing behavior, externalizing behavior (aggressiveness), PPVT scores and delinquency. Disaggregated results by race and gender showed larger positive changes in the developmental trajectories of black girls would have taken place if they had lived in neighborhoods with average levels of inequality. These findings suggest that neighborhood inequalities are likely to explain the worsening in social behavior of Baltimore youth, particularly for black girls.

Neighborhood Effects, Mobility and Child Development

Research has shown that residents of disadvantaged neighborhoods tend to fare worse on a wide range of socioeconomic and health outcomes when compared to those who live in more affluent neighborhoods (Kling et al., 2007). A number of social problems tend to come bundled together at the neighborhood level, such as crime, adolescent delinquency, social disorders, low birthweight, infant mortality, school dropout, and child maltreatment (Sampson et al., 2002). Brooks-Gunn et al. (1993) argue that it is the positive influence of concentrated socioeconomic resources, rather than the presence of low-income neighbors, that matters most for adolescent behaviors.

Jencks and Mayer (1990) suggest that there are five theoretical mechanisms through which neighborhoods affect child and adolescent outcomes into five models. First, *neighborhood institutional resource models*, which argue that neighborhoods can affect children through access to resources that provide stimulating learning and social environments that enhance a healthy development. Second, *collective socialization models of neighborhoods*, which posit that neighborhood influences affect children by means of community social organization, such as the presence of adult role models, supervision, and monitoring. Third, *contagion models*, which establish that a negative behavior of peers and neighbors strongly influences the behavior of others. Fourth, *models of competition*, which hypothesizes that neighbors or peers compete for scarce community resources. Fifth, *relative deprivation models*, which argues that neighborhood conditions affect individuals through their evaluation of their own situation relative to neighbors or peers. Leventhal & Brooks-Gunn (2000) posit that these models have guided theoretical discussions of neighborhood influences on children and youth.

In an extensive review of this literature, Leventhal & Brooks-Gunn (2000) discussed the domains of well-being that have been used to examine how neighborhoods affect children and youth. Those domains include school readiness and achievement, behavioral and emotional problems (externalizing and internalizing constructs), among others. During early childhood and adolescence, the most consistent finding in the literature is that high-SES neighborhoods had a positive effect on school readiness and achievement outcomes (accounting for family and other characteristics). The findings for behavior problems are less consistent. The strongest evidence is provided for the adverse effect of low-SES neighborhoods on children's and adolescents' externalizing (acting out and aggressive) behaviors. Among children and adolescents, residing in a low-SES neighborhood had an adverse effect on behavioral and emotional wellbeing, especially externalizing behavior problems among young children and delinquency and problem behavior among adolescents.

Chetty and colleagues, along with several other researchers, have found that neighborhood characteristics are key determinants of long-term economic outcomes. Crowder and South (2011) found that the fraction of childhood spent in high-poverty areas is negatively associated to high-school completion. More recently, Chetty et al. (2014) found that in high-mobility areas, children from low-income families are more likely to attend college and less likely to have a teen pregnancy. Chetty & Hendren (2015) found that moving to an area with high-upward mobility at a young age increases earnings in adulthood.

Using causal evidence from the Moving to Opportunity (MTO) experiment and administrative data, Chetty, Hendren & Katz (2016) measured neighborhood effects on the economic and social outcomes of families that moved from high-poverty housing projects to lower-poverty neighborhoods. Three main findings stem from this study. First, moving to lower-poverty neighborhoods increased college attendance rates and the earnings of children below 13 years of age, when compared to children that did not move. Second, these children were less likely to become single parents, and lived in better neighborhoods in adulthood. Third, economic gains of moving to a better neighborhood prior to adolescence are significant. Children whose families moved to a low-poverty neighborhood using an experimental voucher had an annual income up to 30% higher when compared to the mean income in the control group. Interestingly, this study also found that children who moved after 13 years of age showed negative effects. The authors hypothesized that such a disruption in adolescence offsets the gains of moving to a better neighborhood. Other researchers also found gains from MTO in other domains that include mental health and obesity.

In a qualitative study among Baltimore MTO household members Deluca, Clampet-Lundquist & Edin (2016) focused on understanding neighborhood poverty and economic mobility. This study found that several years after the experiment took place, most youth were at risk of becoming disconnected after spending critical childhood years in distressed public housing where addiction and crime was prevalent. Some interviewees acknowledged that the "worst aspect of living and raising kids in the projects was the direct exposure to violence and death." However, this study found that young people living in distressed neighborhoods held aspirations and an "identity project" (a type of life goal) similar to those of more privileged youth across the country. Thus, even though a large proportion of these youth remained in families living below poverty, they were still characterized as being "on track" regarding job searches, enrollment in community colleges, and having achievable goals. In this paper, we apply these theories to an empirical examination of the trajectories of Baltimore youth from birth to age 15, in comparison to same-aged youth in other large cities. We pay particular attention to trajectories by race and gender.

Data and Methods

Data

Data for this study came from the Fragile Families and Child Well-being Study (FFCWS). The sample size at baseline was 4,898, from which 3,711 were non-marital and 1,737 were marital births. The first wave of data was collected at the time of birth (1998 to 2000) and consecutive waves (2-6) were collected when the child was 1, 3, 5, 9, and 15 years of age. The sixth wave took place from 2014 to 2016, 15 years after child's birth. Our sample includes 4,897 mothers with complete baseline information, from which 338 were living in Baltimore at the time of the interview, and 4,559 who were living in other cities. Due to size, the Baltimore sample incudes Baltimore county and Baltimore city.

Outcomes

We examined child outcomes in five domains: (1) Internalizing problems: a measure of negative behaviors directed at the self (e.g., social withdrawal, fearfulness); (2) Externalizing problems: a measure of negative behaviors directed at others (e.g., aggression, fighting); (3) PPVT scores: a measure of language skills; (4) Delinquent behavior: reported by mothers and reported by the child; and (5) Health scores, which includes mothers' report on general health status, and on asthma, and a child's report on overall health.

Children's internalizing and externalizing behavior reported by mothers at ages 3, 5, 9 and 15 were measured through the Child Behavior Checklist (CBCL). [1] At ages 3, and 5 the parental caregiver is asked to rate their child's behavior from *Not true* (=1) to *Very true / often true* (=3). From age 5 through 15 both parent and child are asked questions from the CBCL and reported separately. The FFCWS includes selected items in the CBCL to assess different subtypes of problems. The eight constructs assessed are: aggressive behavior, withdrawn/ depressed, anxious/ depressed, attention problems, social problems, rule-breaking behavior, somatic complaints, and thought problems. The CBCL is widely used in research and has acceptable validity and several researchers have tested the reliability of this scale in different contexts around the world, showing good fit through confirmatory factor analysis (Ivanova et al., 2007). Research has shown that behavior problems in preschool children can predict adjustment problems later in life. Based on a sample of 88 children who were originally assessed when they were between the ages of 3 and 5 years, Lerner et al. (1985) explored the relationship between problem behaviors in preschool and psychiatric disorders later in life. This study found that children with higher ratings of behavioral problems had an increased risk of developing subsequent psychiatric disorders within 11 years from the first assessment. There is also evidence that behavioral and emotional scores differ by gender. In an international study that included 24 countries, Rescorla et al. (2007) showed that girls had significantly higher internalizing problems than for boys, while and boys had significantly higher externalizing problems than girls.

One of the constructs measured through the CBCL questionnaire, and that we assess separately, is delinquent behavior. This subscale was reported by the mother at ages 5, 9 and 15. At ages 9 and 15 children were interviewed to report their own delinquent behavior. PPVT scores were assessed when the child was 3, 5 and 9. The PPVT test measures receptive vocabulary and screens for verbal ability. An interviewer administers the test to the child using a book. The interviewer reads a word and asks the child to identify a picture that corresponds to that word, each correct identification adds 1 point (Dunn, 1997). Duncan et al. (2007) and Duncan and Magnuson (2011) have shown that performance on PPVT early on is associated with later school performance. Currie and Thomas (2001) and Case and Paxson (2008) have also

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[1] The CBCL are the most widely used scales for assessing problematic behavior, the standard questionnaire includes 111 items and scales, but varies according to age in order to adapt to children's developmental stage. There are versions available for preschoolers as well as older children, as well as for teacher- and parent-reports.

found that early vocabulary is predictive of adult labor market outcomes. Schady (2012) found that one-standard deviation increase in PPVT score at age 5, among Ecuadorian children, is associated with a 0.32 standard deviation increase in math and language scores three years later, and a decrease of 6.6 percentage points in the probability that a child is a year or more delayed in grade progression.

We measured health based on three outcomes: good health (1= good health, 0= otherwise) and asthma (1= child has asthma, 0= otherwise) were reported by mothers since age 1 through 15. Child's self-report of health was assessed at ages 9 and 15.

Standardization

We produce z-scores for our outcomes that can be interpreted relevant to the larger population (children born to the 20 Fragile Families' sample cities between 98-00), which are standardized using city weights. Our outcome variables are standardized in the following form. First, we calculated the weighted mean and standard deviation at each wave using city weights. Second, we subtracted the weighted mean from children's observed score and divided by the weighted standard deviation. Z-scores should be interpreted in the following way: a score of "0" would be the average score of children born to the 20 cities in the sample between 1998 and 2000. A score of "1" indicates a one standard deviation above the average score of children in this cohort, and a score of "-1" indicates a one standard deviation below the average score of children in this cohort. Even though using national weights would have produced coefficients that could be interpreted in relation to the larger population in the U.S. and not only in relation the 20 cities from the sample, these weights would exclude the 4 most disadvantage cities in the sample.

Neighborhood characteristics

To account for neighborhood environment in our multivariate models that examine children's trajectories, we introduced a set of variables from Chetty and Hendren (2015).[2] We matched these characteristics to our Fragile Families sample using county codes. As we aimed to characterize inequality in different domains, we included measures of income and race inequality, school quality, social capital and crime at the county level. Chetty and Hendren have found that these dimensions strongly correlate with upward mobility. Each construct was defined as follows: *income inequality* is measured using the Gini index, where 1 indicates perfect income inequality and 0 indicates perfect income equality. *School quality* is measured through school expenditure per capita (average expenditures per student in public schools) and income-adjusted test score percentile (residual from a regression of mean math and English standardized test scores on household income per capita in 2000). *Social capital* is measured through a standardized social capital index that includes measures of voter turnout rates, the fraction of people who return their census forms, and measures of participation in community organizations. We also included *crime rate*, measured as the number of crimes per capita; and a measure of

[2] Chetty, Raj, and Nathaniel Hendren. "The impacts of neighborhoods on intergenerational mobility: Childhood exposure effects and county-level estimates." *Harvard University and NBER* (2015). Data is available at the Equality of Opportunity website: http://equality-of-opportunity.org/

racial segregation using a multi-group Theil index calculated at the census-track level over four groups: White alone, Black alone, Hispanic and other (where a 1 indicates a higher level of racial segregation). Finally, we added the *fraction of single mothers* (number of single female households with children divided by total number of households with children; and a control for *population density* (population divided by land area in square miles and expressed in logarithmic terms).

Controls

We included socio economic characteristics from children's mothers to control for fixed differences among them. These control variables were reported at baseline. Education was included as a four-category dummy (less than high school, high school diploma, some college or Associate's degree, and college or more) with less than high school as the omitted category. Race was included as a four-category dummy: white, black, Hispanic and other. Marital status was categorized in five: married, cohabiting, involved in a romantic relationship but living apart, being friends, and no relationship to the child's father. Household poverty status was categorized into five: 0-49%, 50-99%, 100-199%, 200-299%, and 300% +. Four dummies were included for mothers' age (14-20, 21-24, 25-29, and 30+).

Methods

To estimate the trajectory of children's behavior, our empirical strategy consists of two steps. First, we used a pooled ordinary least squares model (OLS) for continuous outcomes (behavior and cognitive outcomes) and a linear probability model (LPM) for dichotomous outcomes (health constructs) of the following form:

$$Child\ Outcome_{it} = \propto + \beta_1 wave_t + \beta_2 wave_t * Baltimore_i + \theta X_i + \varepsilon_{it} \qquad (1)$$

In model (1), or the "reference model", *Child Outcome* represents one of six developmental outcomes for children at the *t* survey wave (consecutively 1-6), which corresponds to the age of the child (birth, 1, 3, 5, 9 and 15). Externalizing and internalizing behaviors are measured from ages 3 to 15; PPVT is observed from ages 3 to 9; delinquent behavior is observed from ages 5 to 15; youth-reported delinquency and youth-reported health status were measured from ages 9 to 15; and health and asthma reported by the child's mother were observed from ages 1 to 15. The dummy Baltimore takes on the value of 1 if the mother of child *i* reported living in Baltimore at the time of the baseline interview. We included an interaction of Baltimore and time (wave) to measure the differentiated effect of Baltimore residence children through time and to allow for a change in the slope. The vector X_i includes a set of controls at baseline and e_{it} is the identically distributed error across individuals and across time.

In model (2), which we call the "full model," we used county codes from mothers' baseline residence that match a set of variables at the *j* county level of residence. We added measures of income inequality, school quality, social capital, the rate of violent crime and a measure of racial segregation specific to county j. This model serves as a counterfactual to our reference model to help us understand how developmental trajectories would be different if children in Baltimore lived in neighborhoods with average levels of income, racial and other sources of inequality.

$$\begin{aligned}Child\ Outcome_{it} = \propto + \beta_1 wave_t + \beta_2 wave_t * Baltimore_i + \beta_3 Income\ Inequality_j + \\ \beta_4 School\ Quality_j + \beta_5 Social\ Capital_j + \beta_6 Crime\ Rate_j + \\ \beta_7\ Racial\ Segregation_j + \theta X_i + \varepsilon_i \qquad (2)\end{aligned}$$

The second step consisted of calculating the longitudinal marginal changes to compare the outcomes of children in Baltimore to the outcomes of children in other cities of the Fragile Families sample. This means that we obtained the discrete difference in probability between Baltimore and non-Baltimore children while holding all other variables at their mean values at each wave. Thus, each of these marginal changes reflect a change in the slope for a given child outcome.

$$Marginal\ Change\ \Delta = \frac{d(Child\ outcome|X, Baltimore = 0{,}1)}{dwave_t}$$

We then disaggregated results by race and gender to compare the developmental trajectories of Baltimore children against children in other cities across the U.S. All of our models use clustered errors at the area of residence level.

Results

Descriptive Results

We begin our comparative analysis by exploring unadjusted differences in means of child outcomes, socioeconomic covariates, and neighborhood controls between Baltimore and non-Baltimore children. Table 1 shows the mean scores of our outcomes of interest and the differences among children in Baltimore and children in other large cities. The first column shows the mean scores of children in urban cities that exclude Baltimore, and the second column shows the average scores of children in Baltimore. Scores in the first two columns correspond to the first period when these dimensions are measured. The third column shows the difference in means between non-Baltimore children and children living in Baltimore. These estimates come from a two-sample *t* test with equal variances in which Difference (X_i) = mean Y_i (non-Baltimore) – mean Y_i (Baltimore) where X_i represents each child outcome and Y_i represents the corresponding sample mean. Columns (4) and (5) show scores at the most current point in time, when the child is 15 years old, except for the PPVT score which most current measure is at 9 years. All outcomes in the table below, and in our analyses, were standardized scores using city weights. As a robustness check, we recalculated all measures using national weights and unweighted coefficients. Even though some coefficients change, trends, differences and significance levels remain unchanged.

Table 1. Unadjusted trajectories of behavior, cognitive and health outcomes for children

	First score reported			Last score reported		
	Non-Baltimore	Baltimore	Difference	Non-Baltimore	Baltimore	Difference
	(1)	(2)	(3)	(4)	(5)	(6)
Behavior and cognitive outcomes						
Internalizing behavior	0.052	-0.158	0.210**	0.131	0.165	-0.034
	(0.020)	(0.051)		(0.020)	(0.076)	
Externalizing behavior	0.141	-0.016	0.157*	0.116	0.250	-0.134+
	(0.020)	(0.061)		(0.020)	(0.082)	
Cognitive Score	-0.099	-0.021	-0.078	-0.144	-0.225	0.082
	(0.022)	(0.071)		(0.016)	(0.057)	
Delinquent Behavior	0.052	0.079	-0.027	0.113	0.262	-0.149+
	(0.052)	(0.079)		(0.021)	(0.083)	
Self-rep. Delinquency	0.046	0.237	-0.191***	0.141	0.409	-0.268***
	(0.015)	(0.062)		(0.022)	(0.092)	
Health outcomes						
Good Health	-0.025	0.135	-0.160**	-0.116	-0.112	-0.004
	(0.016)	(0.055)		(0.019)	(0.068)	
Asthma	0.101	0.175	-0.075	0.120	0.095	0.025
	(0.019)	(0.070)		(0.017)	(0.060)	
Self-reported Good health	-0.043	0.081	-0.124+	-0.104	-0.056	-0.049
	(0.019)	(0.061)		(0.020)	(0.069)	
Observations	2,766	247		2,870	228	

Notes: Earliest scores for internalizing and externalizing behavior and PPVT were reported when child was 3 years of age. The earliest scores for delinquent behavior was reported when the child was 5 years old. Earliest scores for self-reported delinquency and self-reported health were reported when the child was 9 years old. Earliest measures of asthma and health status were reported at age one. Latest measures were collected at age 15 for all scores except for PPVT which latest score was reported at age 9. Standard errors in parentheses. Statistical significance: ***p<0.001, **p<0.01, *p<0.05, +p<0.10

From table 1 we can observe that internalizing and externalizing scores of children in Baltimore are lower than scores of children in other cities at age 3, and these differences are statistically significant. By age 15, behavior scores worsened for children in Baltimore, while scores for non-Baltimore children improved, although differences between the two groups are not statistically significant. There are no statistically significant differences in cognitive scores at age 3 or at age 9.

At age 5, mothers' reports show that children in Baltimore have a worse delinquent behavior, compared to children from other cities (but the difference is not statistically significant). By age 9 the gap widens considerably, and differences are marginally significant. Trends in delinquent behavior are similar when we look at child reports. Delinquent behavior for children in Baltimore continues to worsen and by age 15 the gap widens. In the case of youth-reported delinquency, differences are statistically significant. Health measures show a deteriorating trend for children in the sample, regardless of the city of residence. Mothers report lower levels of "good health" for their children, as well as higher levels of asthma as time goes by, both in Baltimore and in other cities in the sample. Youth reports show that children in Baltimore have better health than children in other cities, however, differences are not statistically significant.

Table 2. Descriptive Characteristics of mothers in Baltimore and in other urban cities

	Proportion – All Cities	Non-Baltimore	Baltimore	Difference
Race				
White	0.211	0.214	0.172	0.042***
Black	0.476	0.454	0.775	-0.321***
Hispanic	0.273	0.291	0.030	0.261***
Other	0.039	0.041	0.024	0.017***
Education				
Less than high school	0.348	0.351	0.299	0.052***
High School	0.302	0.298	0.361	-0.062***
Some College / Assoc.	0.243	0.245	0.216	0.029*
College or more	0.107	0.106	0.124	-0.018**
Household poverty level				
0 – 49%	0.189	0.190	0.183	0.006
50 – 99%	0.171	0.174	0.136	0.038***
100 – 199%	0.258	0.258	0.251	0.006
200 – 299%	0.155	0.152	0.195	0.008***
300% +	0.226	0.226	0.234	-0.008
Relationship status				
Married	0.243	0.243	0.246	-0.003
Cohabiting	0.364	0.367	0.320	0.047***
Visiting	0.260	0.260	0.272	-0.012
Friends	0.060	0.058	0.095	-0.036***
No relationship	0.073	0.073	0.068	0.005
Age categories				
14-20	0.265	0.264	0.275	-0.011
21-24	0.267	0.267	0.260	0.006
25-29	0.234	0.234	0.228	0.006
30+	0.235	0.235	0.237	-0.001
Observations	4,877	4,539	338	

Notes: A two-sample t-test was used to determine differences in means from non-Baltimore cities – Baltimore cities. Statistical significance: ***$p<0.001$, **$p<0.01$, *$p<0.05$, +$p<0.10$.

Table 2 shows the socioeconomic characteristics of our sample. Mothers in Baltimore are slightly more educated in comparison to other cities from our sample. In Baltimore, 29.9% are high school dropouts and 12.4% are college educated, in comparison to 35% high school drop outs and 10.6% college graduates in other cities. The most noticeable difference across cities is found in the race category. In Baltimore 77% of the population is black, 3% is Hispanic and 17%

is white, in comparison to 45% black, 29% Hispanic and 21% white in other cities. Race and education differences are statistically significant at the 99% level of confidence. Across all cities, there are similar levels of married couples, age distribution and poverty levels.

Table 3. Neighborhood Differences in Baltimore and in other urban cities

	Non-Baltimore	S.D.	Baltimore	S.D.	Difference
Income Inequality (Gini Index)	0.536	(0.119)	0.576	(0.091)	-0.040***
School Expenditure	6.835	(1.200)	6.712	(0.196)	0.123***
Student-Teacher Ratio	19.494	(2.789)	18.275	(0.758)	1.219***
Test Score Percentile	-10.685	(9.246)	-17.898	(6.968)	7.213***
Fraction of Single Mothers	0.293	(0.099)	0.439	(0.135)	-0.146***
Social Capital Index	-0.218	(0.959)	-0.204	(0.300)	-0.014
Crime Rate	0.009	(0.004)	0.015	(0.002)	-0.006***
Racial Segregation (Theil Index)	0.291	(0.128)	0.347	(0.081)	-0.056***
Population Density	7.780	(1.371)	8.423	(0.965)	-0.643***
Median Rent	$783.96	(242.21)	$613.44	(117.74)	170.516***

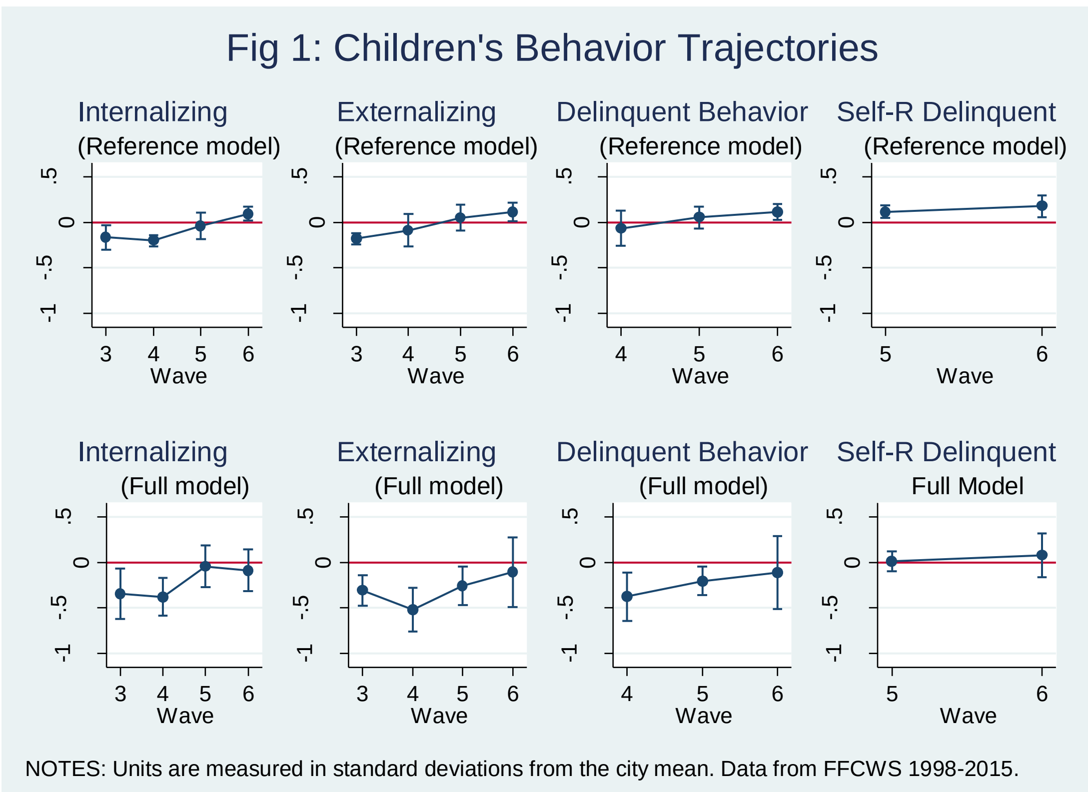
Notes: 1. All measures are taken from Chetty and Hendren (2015). 2. In our models, scores are standardized using national means and standard deviations from the 2000 census. 3. In this table we present unstandardized measures for simplicity of interpretation. 4. Both indices show that worse levels of inequality as the measure approaches one. 5. A two-sample t-test was used to determine differences in means from Baltimore – non-Baltimore cities. 6. Statistical significance: ***p<0.001, **p<0.01, *p<0.05, +p<0.10.

Table 3 shows the differences in neighborhood characteristics. For simplicity of interpretation we show unstandardized scores. In this table, we observe statistically significant differences between Baltimore and other urban cities in almost all dimensions. A worse situation in Baltimore is reflected in worse school quality-related indicators such as lower average school expenditure, lower student-teacher ratio and worse test scores. Baltimore also has a lower social capital index and a larger fraction of single mothers. A higher Gini coefficient reflects greater income inequality in Baltimore. In addition, the crime rate is almost twice as high in Baltimore in comparison to other cities. The only comparative advantage in Baltimore is found on lower rents. Thus, Baltimore neighborhoods have demonstrably worse neighborhood conditions on average than in other large cities in the sample.

Children's Developmental Trajectories

To examine whether Baltimore children were doing better than non-Baltimore children across our six measures of cognitive, behavior, and health outcomes, we started with an overall analysis of the whole sample. In the figures shown below we plotted the average marginal change in adjusted scores of children in Baltimore (blue lines) along with 95% confidence intervals. As previously explained, scores are standardized using the city weights, thus red lines show the city mean scores (zero). The scores of children in all other cities lie at the city mean, as 97% of the observations are in those cities.

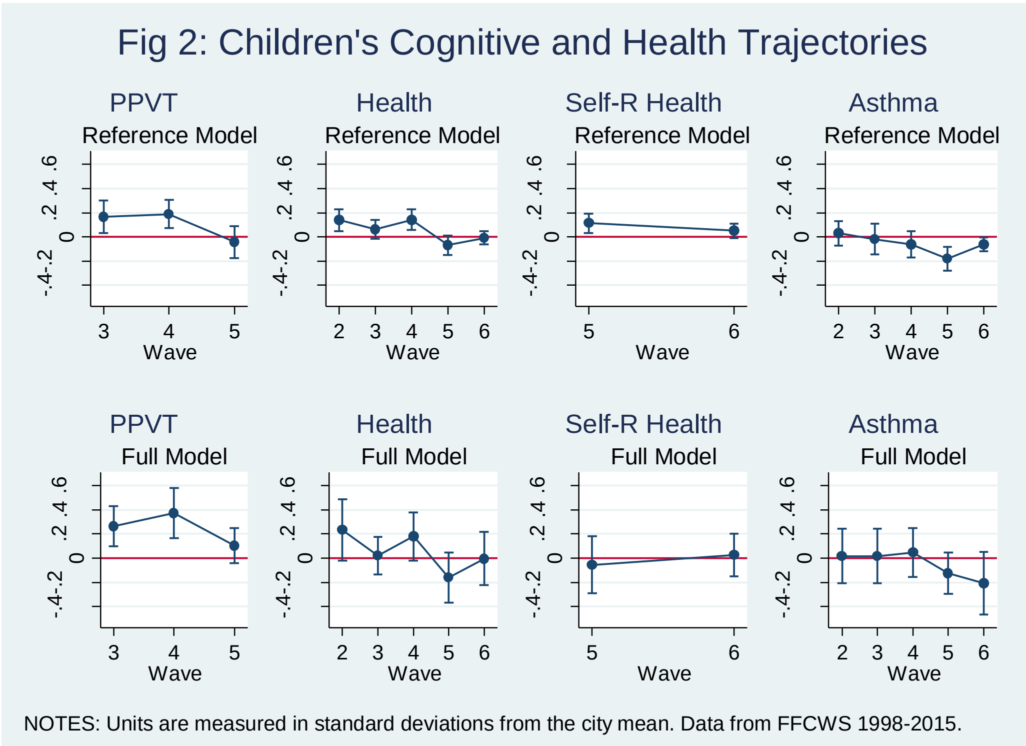
At age 3, Baltimore children outperformed children in other cities across all outcomes. By age 9 (wave 5), the trajectories of children in Baltimore and non-Baltimore cities had converged in the case of internalizing and delinquent behaviors, and in the case of all other dimensions Baltimore children showed worse outcomes in comparison to children in other cities. At age 15, children in Baltimore had uniformly deteriorated across behavioral, health and cognitive[3] trajectories. Using our full model specification, that includes neighborhood characteristics, we observe that had Baltimore children faced average levels of racial and economic inequality, better schools and more social capital, they would've had better behavior and cognitive outcomes. In figure 1, full models show that internalizing, externalizing and delinquent scores (reported by mothers) would be below the city mean if neighborhood characteristics in Baltimore were similar to those of mean neighborhoods in the U.S.



At age 9, the cognitive scores of children in Baltimore are below the level achieved at age 3, however, under the full model specification, that controls for neighborhood characteristics, the cognitive score of Baltimore children would have been above that of children elsewhere. We also observe that health trajectories remain almost unchanged across all outcomes using both the reference and full models. As observed in the literature of neighborhood effects, we

[3] PPVT is measured from age 3 to age 9, and in this case we refer to age 9.

hypothesized that there are gender differences in behavior and cognitive outcomes as observed by Leventhal & Brooks-Gunn (2000) as boys and girls have different developmental experiences. We also expect to find race differences following evidence from Sharkey (2014) who found that 1% of whites were raised in neighborhoods where at least 30% of their neighbors were poor, in contrast one third of black people lived in neighborhoods with at least 30% of poor neighbors. We explore those differences in a disaggregated analysis of gender and race differences in behavior and cognitive trajectories.



Race and Gender Differences

When we incorporated measures of income inequality, school quality, social capital and crime rate, and degree of racial segregation at the county level, we find that if Baltimore boys and girls had lived in neighborhoods with average levels of inequality, their behavioral trajectories would not have deteriorated as rapidly, and in some cases children in Baltimore would have done better than children in other cities by the time they reached adolescence. We focused on behavior and cognitive trajectories, and excluded health from the subgroup analyses because we did not observe changes between the reference and full models for any of the health outcomes.

The subgroup analyses showed that girls, and black girls consistently presented a different path once neighborhood inequalities were accounted for. Changes in the trajectories of behavior and cognitive outcomes are more pronounced for black girls, these results suggest that black girls would have been better off across all domains had inequality in Baltimore been similar to that observed in other cities. As observed in figures 3-7 in the appendix, the means of all outcomes for black girls in Baltimore would have been better once neighborhood characteristics were accounted for. This finding suggests that black girls were more susceptible to their environment, and would benefit the most from higher quality schools, less racial segregation, lower income inequality and neighborhoods with lower crime.

The full-model specification showed delinquent behavior of Baltimore youth reported by mothers and self-reported by youth would have been lower for girls and black girls all the way through age 15 under average levels of inequality (see figures 5 and 6). The trajectory of delinquent and self-reported delinquent behavior remained unchanged for all boys and black boys in Baltimore for whom delinquent behavior at age 9 and 15 would have been similar to that of boys in other cities after controlling for neighborhood inequality (see figures 5 and 6). The trajectory of girls' externalizing behavior, and black girls in Baltimore improved once average neighborhood inequality was accounted for (see figure 4). As with other outcomes, the strongest results were observed for black girls.

In the case of internalizing behavior, the full model specification showed potential gains for Baltimore girls and black girls once several forms of inequality were accounted for (see figure 3). The trajectory of black girls in Baltimore would have changed from being worse than that of black girls in other cities by age 9 to being better off all the way through age 15 if those girls had lived in neighborhoods with less inequalities than the ones they faced in reality. Trajectories of internalizing behavior for Baltimore boys would not have changed even if neighborhood inequalities were closer to the mean and not as exacerbated as they were in Baltimore.

Cognitive trajectories would likely have changed for girls, and black girls in Baltimore once neighborhood racial segregation, income inequality and other characteristics at the county level were accounted for. As in other outcomes, changes would have been stronger for black girls, followed by all girls. The trajectories of boys and black boys in Baltimore would not have changed under average levels of neighborhood inequalities.

Limitations

We found two important limitations in this study: missing data and endogeneity in moving decisions. We partially solved these problems by running the analyses on the full sample (not on the race and gender) on the households that throughout the 6 waves do not move, and the estimated trajectories are similar. Due to sample restrictions, we are not able to run the analyses on the disaggregated categories of race and gender. We are currently exploring other options to correct those issues and run the race and gender models.

Conclusions

In sum, our findings showed that a youth's neighborhood environments may affect their developmental trajectories. Over time, we observe worse developmental trajectories of children in Baltimore, but once we included neighborhood characteristics, we found that those children would have likely been better off than children in other cities in several domains, if those Baltimore children had lived in neighborhoods with lower inequalities. For that reason, we believe social capital, the crime rate and racial segregation are likely to be key factors that help explain the deterioration of social behavior of Baltimore children over time, particularly for black girls. It is also interesting to note that the developmental trajectories of black boys in Baltimore did not seem to be affected by income, race or other forms of inequality found in their neighborhoods. Research has shown that neighborhoods tend to depress upward mobility in adulthood, and in this study, we also found that neighborhoods can also have negative consequences for children at a young age. Neighborhood inequalities can even change the trajectories of children in a way that might be difficult to reverse. Community-level factors such as income and racial inequality are also important predictors of economic mobility for individuals living in predominantly low-income neighborhoods. Researchers in this literature posit that children and youth in low-income and segregated communities may lack informal control and, consequently, the ability to regulate the behavior of children and youth. In these neighborhoods, institutions may not be present to supervise and protect children and adolescents.

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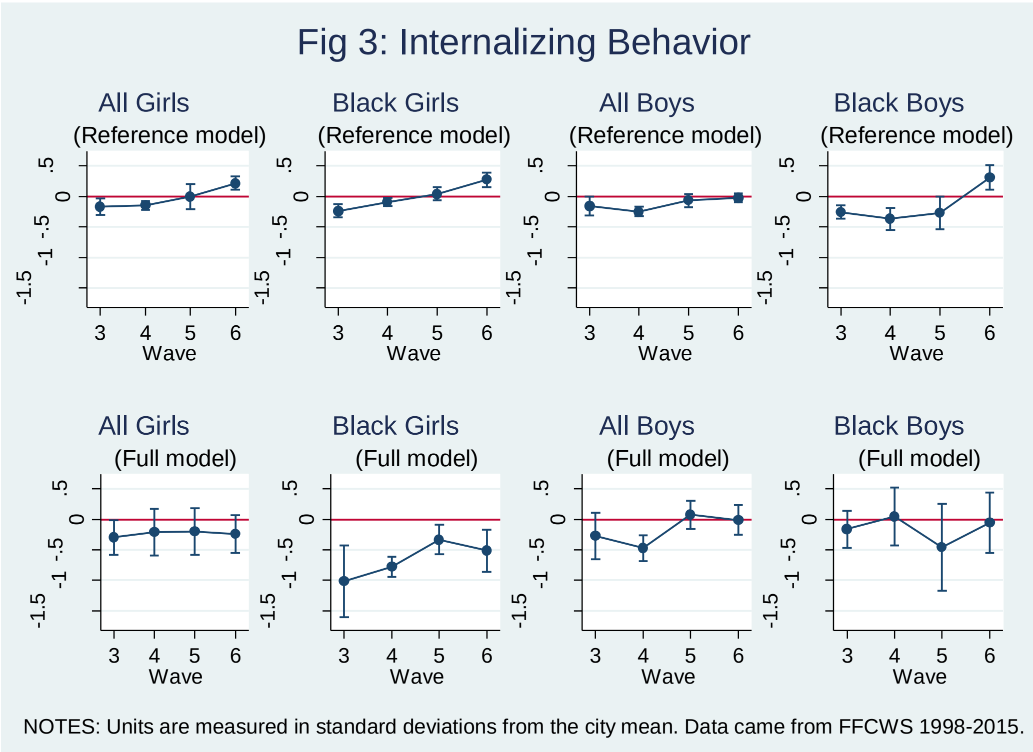
Appendix: Race and Gender Differences in Children's Developmental Trajectories



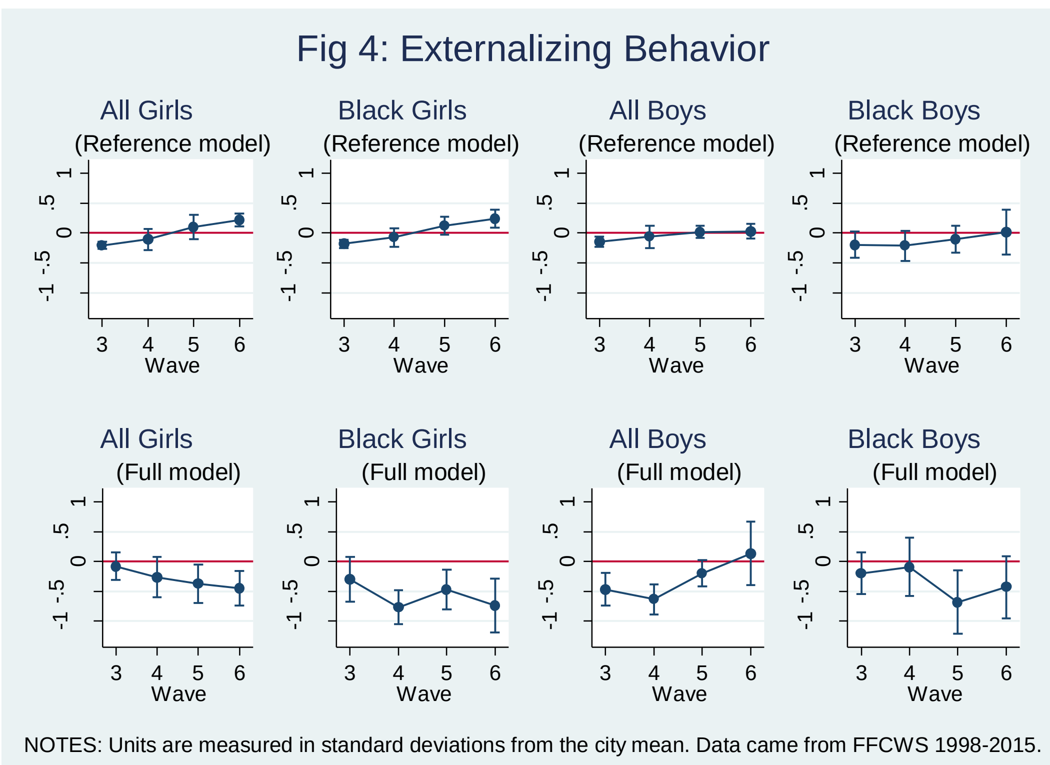
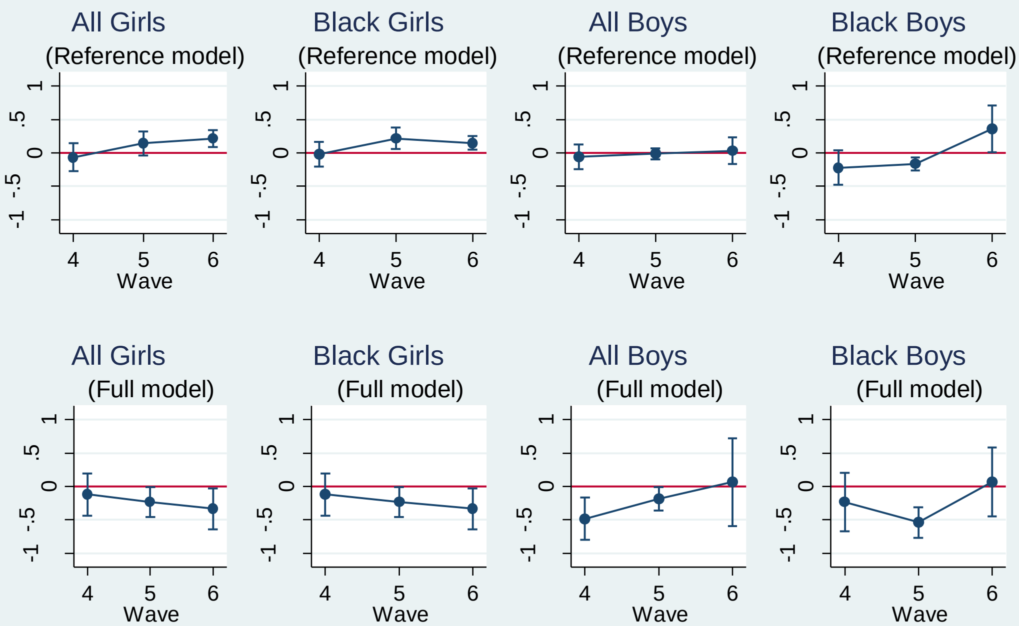
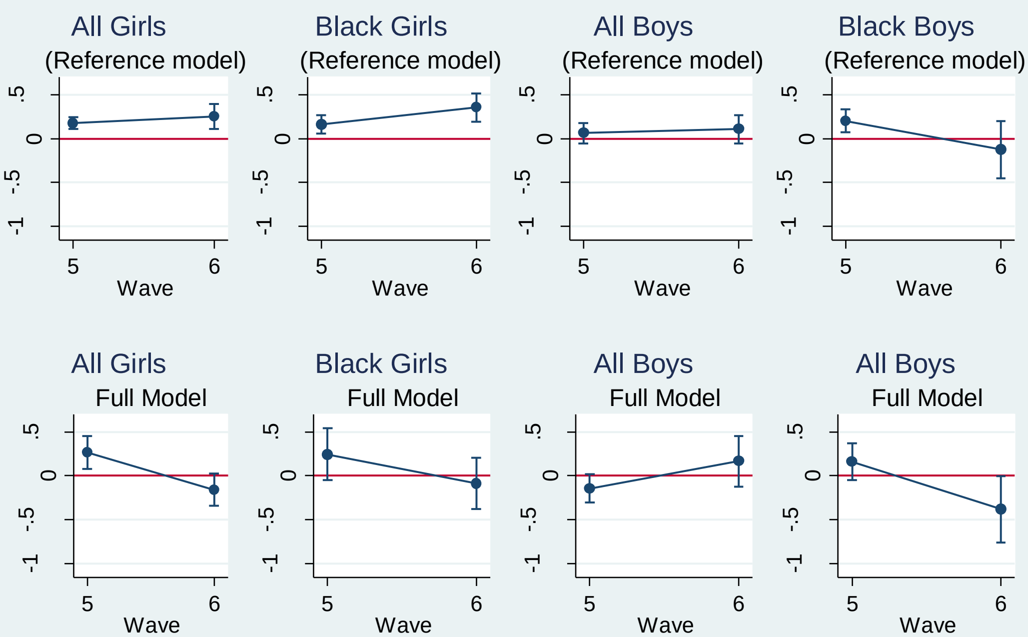


Fig 5: Delinquent Behavior

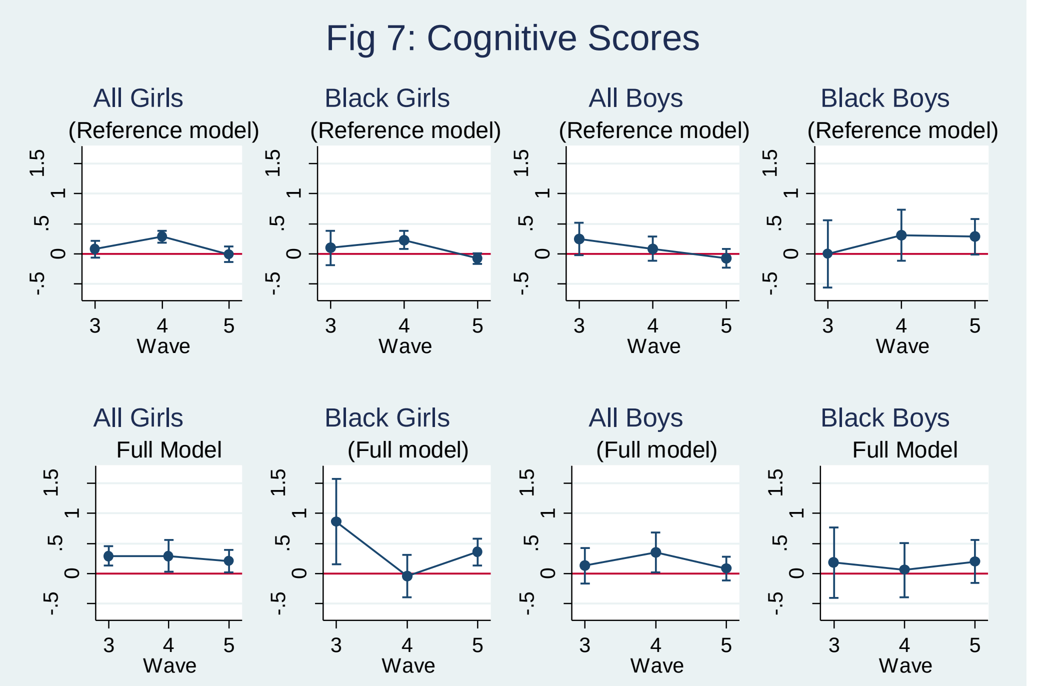


NOTES: Units are measured in standard deviations from the city mean. Data came from FFCWS 1998-2015.

Fig 6: Self-Reported Delinquent Behavior



NOTES: Units are measured in standard deviations from the city mean. Data came from FFCWS 1998-2015.



NOTES: Units are measured in standard deviations from the city mean. Data came from FFCWS 1998-2015.