

# Neighborhoods vs. Schools

Lawrence F. Katz  
Harvard University and NBER

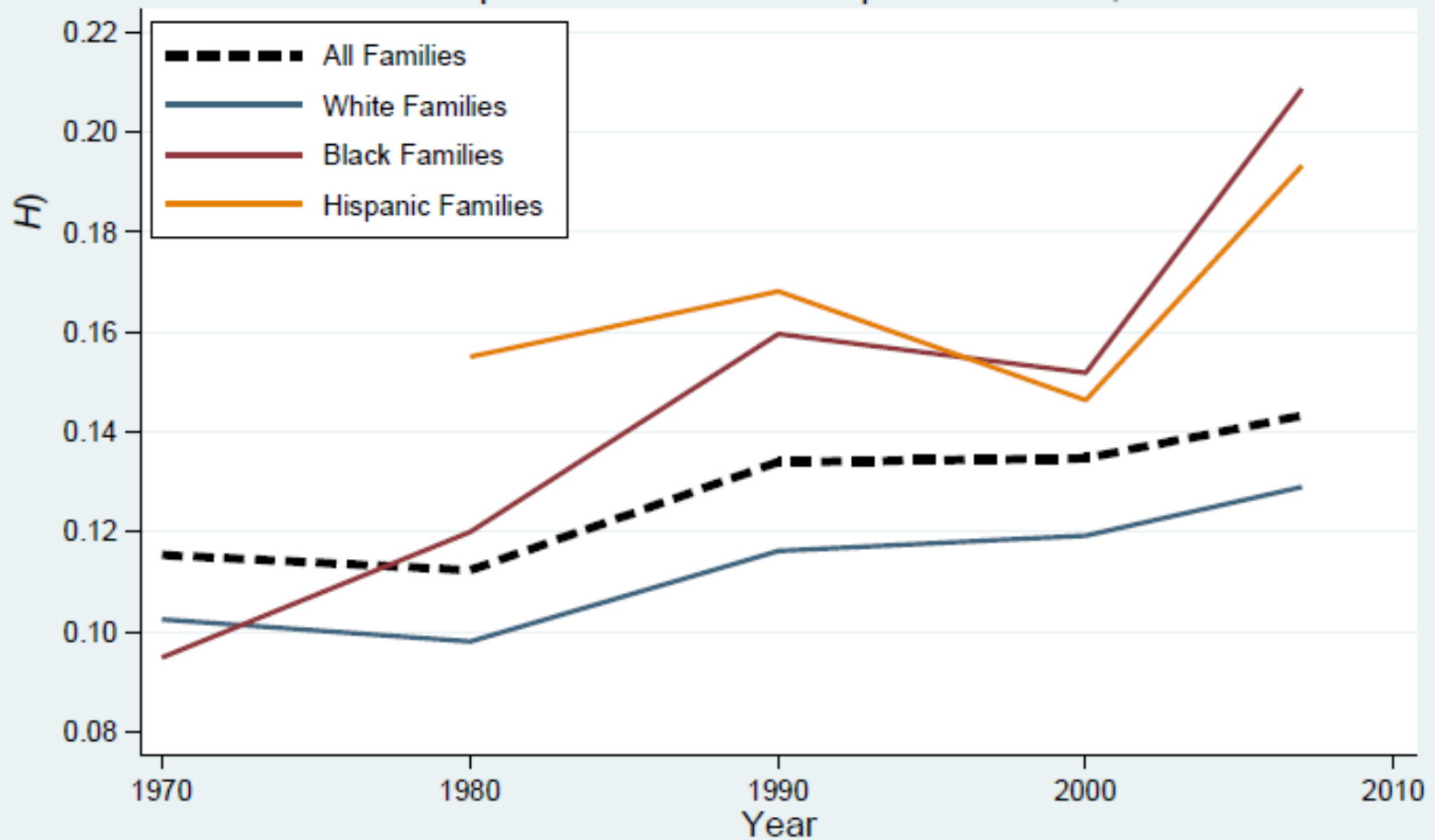
Robert J. Lampman Memorial Lecture, IRP  
University of Wisconsin, Madison  
April 23, 2014

# Motivation I

- Racial Inequality in America persists
  - Large Black-White gaps in academic achievement, earnings & employment, family incomes, health & life expectancy, incarceration, and teen pregnancy
  - Substantial Hispanic-White economic gaps as well
- U.S. residential economic segregation has increased sharply, especially for Blacks & Hispanics
- Rising school segregation by family income
- Rising gaps in parental resources and academic achievement by family income & SES since 1980
- IGE stable with rising inequality → larger economic consequences to accidents of birth

# Reardon and Bischoff (2011)

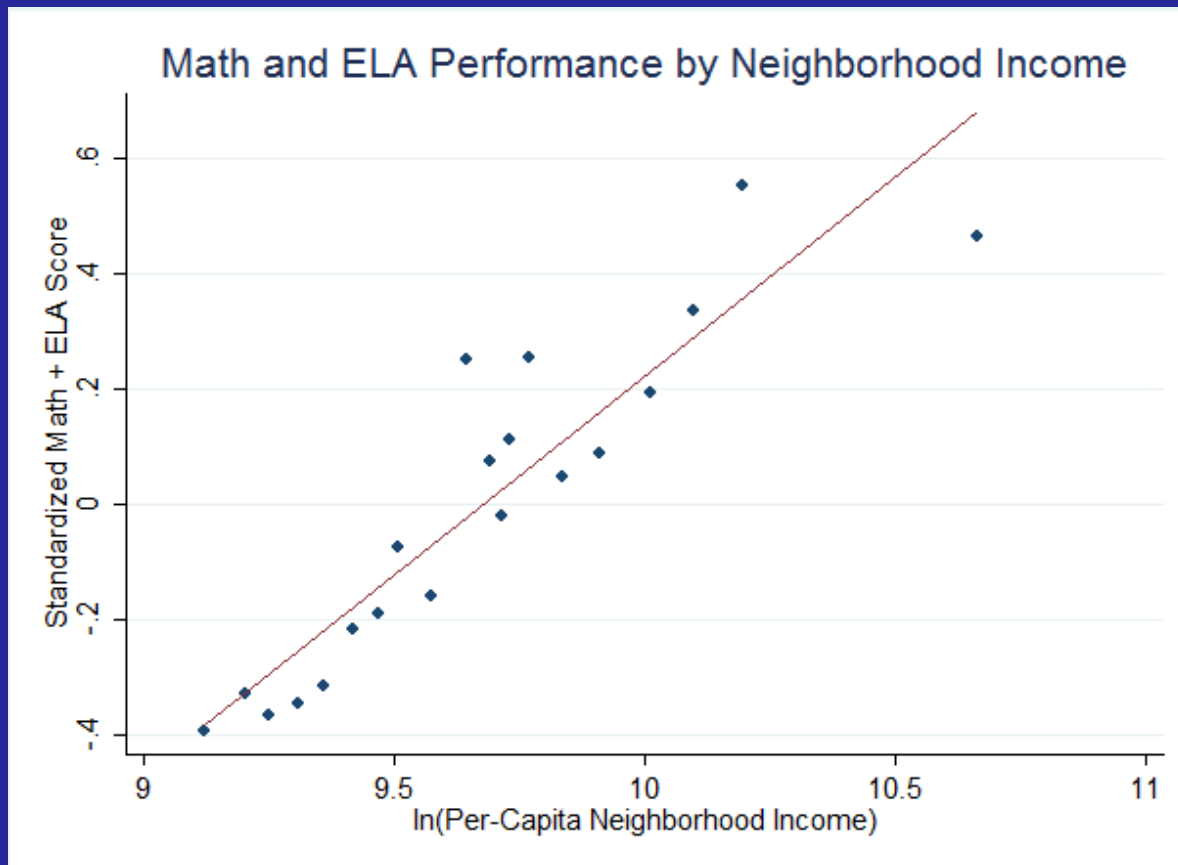
## Trends in Family Income Segregation, by Race Metropolitan Areas With Population > 500,000



# Motivation II

- Children growing up in low-income neighborhoods fare worse on economic, education, and health outcomes
- A strong positive relationship exists between neighborhood family incomes and student academic achievement
- Adults in poor neighborhoods have worse economic and health outcomes
- These patterns remain but are attenuated after controlling for family background and resources and could reflect:
  - Neighborhood characteristics (peers, role models, safety, resources)
  - School Quality
  - Unmeasured family background characteristics from non-random sorting of families to neighborhoods and Schools

# 8th grade Math and ELA Performance by New York City Neighborhood (Zip Code) Income



# Potential Policy Responses

- **Neighborhoods:** What are the causal impacts of improved neighborhood conditions (like neighborhood safety) or moves to lower-poverty neighborhoods on child outcomes?
  - Macro (MSA) vs. Micro (Block) neighborhoods
- **Schools:** Are high-quality schools enough?
- Interactions of neighborhoods and schools
- Family resources, Parenting (Nurse-Family Partnership), Early Childhood Education

- This talk: I examine emerging evidence from credible quasi-experimental and experimental sources of variation in neighborhoods and schools
- Focus on
  - Long-term evaluation of Moving to Opportunity (MTO) Housing Mobility Experiment
  - Dobbie-Fryer work on Harlem Children's Zone
- Draws on

R. Fryer and L. Katz (2013), "Achieving Escape Velocity: Neighborhood and School Interventions to Reduce Persistent Inequality," *AEA P&P* 103(3): 232-7.

# Moving to Opportunity Long-Term Study

Lawrence F. Katz, Principal Investigator, Harvard University and NBER  
Jens Ludwig, Project Director, University of Chicago and NBER  
Lisa Sanbonmatsu, Project Manager, NBER

[www.mtoresearch.org](http://www.mtoresearch.org)

## Other Main Collaborators:

Greg Duncan, UC Irvine  
Lisa Gennetian, Brookings Institution  
Ronald Kessler, Harvard Med. Sch.  
Jeffrey Kling, CBO and NBER

## Health Team Collaborators:

Emma Adam, Northwestern U  
Stacy Tessler Lindau, Univ. of Chicago  
Thomas McDade, Northwestern Univ.  
Robert Whitaker, Temple University



# MTO Long-Term Study Publications

J. Ludwig et al. (2013), “Long-Term Neighborhood Effects on Low-Income Families: Evidence from Moving to Opportunity,” *AER P&P* 103(3); longer version NBER WP No. 18772.

J. Ludwig et al. (2012), “Neighborhood Effects on the Long-Term Well-Being of Low-Income Adults,” *Science* 337 (Sept 21), 1505-10.

J. Ludwig et al. (2011), “Neighborhoods, Obesity and Diabetes – A Randomized Social Experiment,” *NEJM* 365 (Oct 20), 1509-19.

R. Kessler et al. (2014), “Associations of Housing Mobility Interventions for Children in High-Poverty Neighborhoods with Subsequent Mental Disorders during Adolescence,” *JAMA* 311(9).

*Cityscape* (2012), Symposium on MTO, 14(2).

# Conceptual Framework

- Simple Reduced Form Model for Each Outcome  $j$  (e.g., Human Capital, Health, Risky Behavior):

$$outcome^j = f^j(\eta, \sigma, \phi)$$

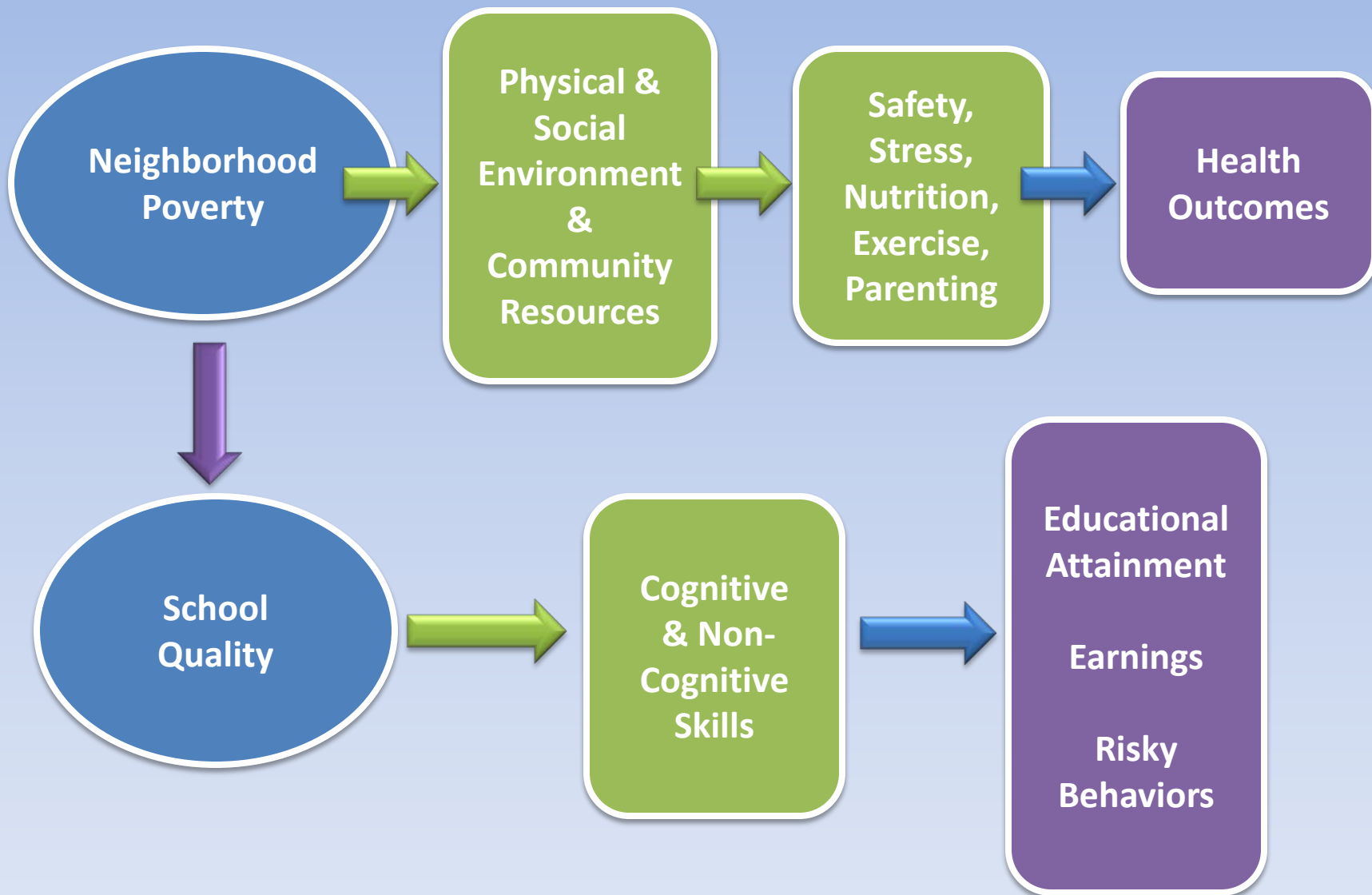
- Where  $\eta$  represents neighborhood quality,  $\sigma$  denotes school quality, and  $\phi$  captures family background
- An ideal randomized experiment
  - Treatment of improving neighborhood quality while keeping school quality constant estimates  $\frac{\partial f^j}{\partial \eta}$
  - Treatment of improving school quality while leaving the neighborhood unchanged estimates  $\frac{\partial f^j}{\partial \sigma}$

# MTO vs. Harlem Children's Zone

- MTO Randomized Housing Mobility Experiment
  - Large improvements in neighborhood conditions
  - Small improvements in school quality
  - MTO Treatment Impact Estimates Provide an Upper-bound on pure micro neighborhood quality effect  $\frac{\partial f^j}{\partial \eta}$

# MTO vs. Harlem Children's Zone

- **Harlem Children's Zone (HCZ):** 97-block area in Harlem, NYC with web of neighborhood services (baby college, pre-school, health and neighborhood safety) and high-quality “No Excuses” Charter School – Promise Academy with lottery for admissions
  - (a) Lottery winners vs. lottery losers in zone gets pure school quality effect with high neighborhood quality  $\frac{\partial f^j}{\partial \sigma} | \text{high } \eta$
  - (b) Lottery winners vs. lottery losers outside zone gets pure school quality effect with low neighborhood quality  $\frac{\partial f^j}{\partial \sigma} | \text{low } \eta$
  - Difference of (a) and (b) gives interaction effect subject to caveat of out of zone lottery winners gaining access to other HCZ services
  - RD at zone border for lottery losers gives pure neighborhood effect



# Past Evidence on Neighborhood Effects I

- **Cross-Section Studies (e.g., Brooks-Gunn et al. 1993 *AJS*)**
  - Strong neighborhood effects that weaken substantially with further controls for family background in PSID, NLSY, etc.
  - Problem of selection bias (unobservable family background variables correlated with neighborhood attributes) lead to upward bias and measurement issues (what is a neighborhood?) lead to downward attenuation bias
- **Area studies and place-based policy evaluations**
  - Kline-Busso (AER 2013); Rob Sampson and Collaborators
  - Do the pre-existing residents benefit?
- **Longitudinal Sibling Studies: Aaronson (1998 *JHR*)**
  - Study families that move and compare siblings spending time in different neighborhoods – include family fixed effects
  - Substantial impacts as in cross-section studies but issues of endogenous moves correlated with unobserved changes in family circumstances or differences by sibling in unobserved characteristics

# Past Evidence on Neighborhood Effects II

- Quasi-Experimental Housing Mobility Studies
  - **Gautreaux Studies – Rosenbaum (1995)** – large impacts of moves to suburbs vs. central city in Chicago on child outcomes but attrition and non-random selection issues; much smaller effects in Duncan, Mendenhall longer-term studies
  - **Oreopoulos (2003 *QJE*)** – Toronto public housing assignments
  - **Jacob (2004 *AER*)** – Chicago public housing demolitions
  - **Gibbons, Silva, & Weinhardt (2013 *EJ*)** – residential migration with controls for individual & school-by-cohort fixed effects for England
  - Quasi-Experimental studies show little impact of neighborhoods on test scores or longer-term child outcomes when controlling for schools (Gibbons et al.) or with little change in school quality (Oreopoulos and Jacob)

# The MTO Experiment

- MTO demonstration authorized by U.S. Congress
  - Housing and Community Development Act of 1992
- A randomized social experiment
- Open to families with children living in:
  - public housing or in project-based assisted housing
  - high-poverty neighborhoods (poverty rate  $\geq$  40%)
- 5 Sites: Baltimore, Boston, Chicago, Los Angeles, and New York
- 4600 families enrolled from 1994 to 1998



# Random Assignment to 3 Groups

## Control

No vouchers – remain eligible for current project-based housing assistance

## Experimental or Low-Poverty Voucher

Restricted Section 8 voucher (<10% Poverty Census Tract)  
+  
Mobility Counseling

## Section 8 or Traditional Voucher

Conventional Section 8 vouchers

# MTO Families Resided in Public Housing and Project-Based Housing at Baseline



# Some Baseline Characteristics of MTO Households

## Employment and Marital Status

- 25 percent of household heads were employed at baseline.
- 87 percent single-parent female-headed households.

## Race/Ethnicity

- Almost 2/3 of sample are black.
- Baltimore and Chicago samples are almost 100 percent black.
- LA, and NY are roughly 50 percent black, 50 percent Hispanic.
- About 40 percent of the sample in Boston is black.

## Main Reason to Move

- Fear of violent crime.

# MTO Interim Findings (Kling-Liebman-Katz *EMA* 2007)

## 4-7 Years After Random Assignment

- Substantial adult gains in mental & physical health
- Little impact on adult economic self-sufficiency
- Gender gap for youth: positive impacts for girls, not for boys
- Reactions to mixed results
  - Many Sociologists: “Weak Treatment” so not informative
  - Many Economists: “Neighborhoods Don’t Matter”
  - MTO Research Team – neighborhoods matter in more subtle ways than simple models; particularly important for health
  - What about longer term impacts? What about children that moved at young ages before forming school peer groups?

# Final Impacts Evaluation

Survey Data Collection Joint Survey Research Center at the  
University of Michigan

Surveys Collected from June 2008 to April 2010

(10-15 Years After Random Assignment)

- Adult Household Heads (N=3273)
- Youth ages 10 to 20 in Dec 2007 (N=5101)
- Grown Children 21-30 & under 18 at baseline (N=3217)
- Two-Stage Sampling – once reach 75% response rate by site then intensive efforts at random 35% of remaining cases
- Effective Response Rates: 90% for Adults; 89% for youth
- Response rates almost identical by MTO treatment groups

Administrative Data

- State UI Earnings, AFDC/TANF, and Food Stamps
- Adult & Juvenile arrest histories
- School district data and NSC college enrollment data
- Housing assistance from HUD administrative data

# Estimating MTO Impacts

Impact Measure	Represents	Calculation
Intent to Treat (ITT)	<b>Impact on ALL members of treatment group</b>	<b>Dummy for treatment group in regression</b>
Treatment on Treated (TOT)	<b>Impact on TREATED members of treatment group (lease-ups): assumes zero impact on non-lease-ups</b>	<b>ITT estimate divided by proportion who leased up</b>

# Compliance Rates

**Experimental Group:** 47% leased-up

**Section 8 Group:** 63% leased-up

We will present ITT results. For TOT, multiply experimental group estimates by 2.1 and Section 8 estimates by 1.6.



# Types of Neighborhoods to which MTO Experimental Families Moved



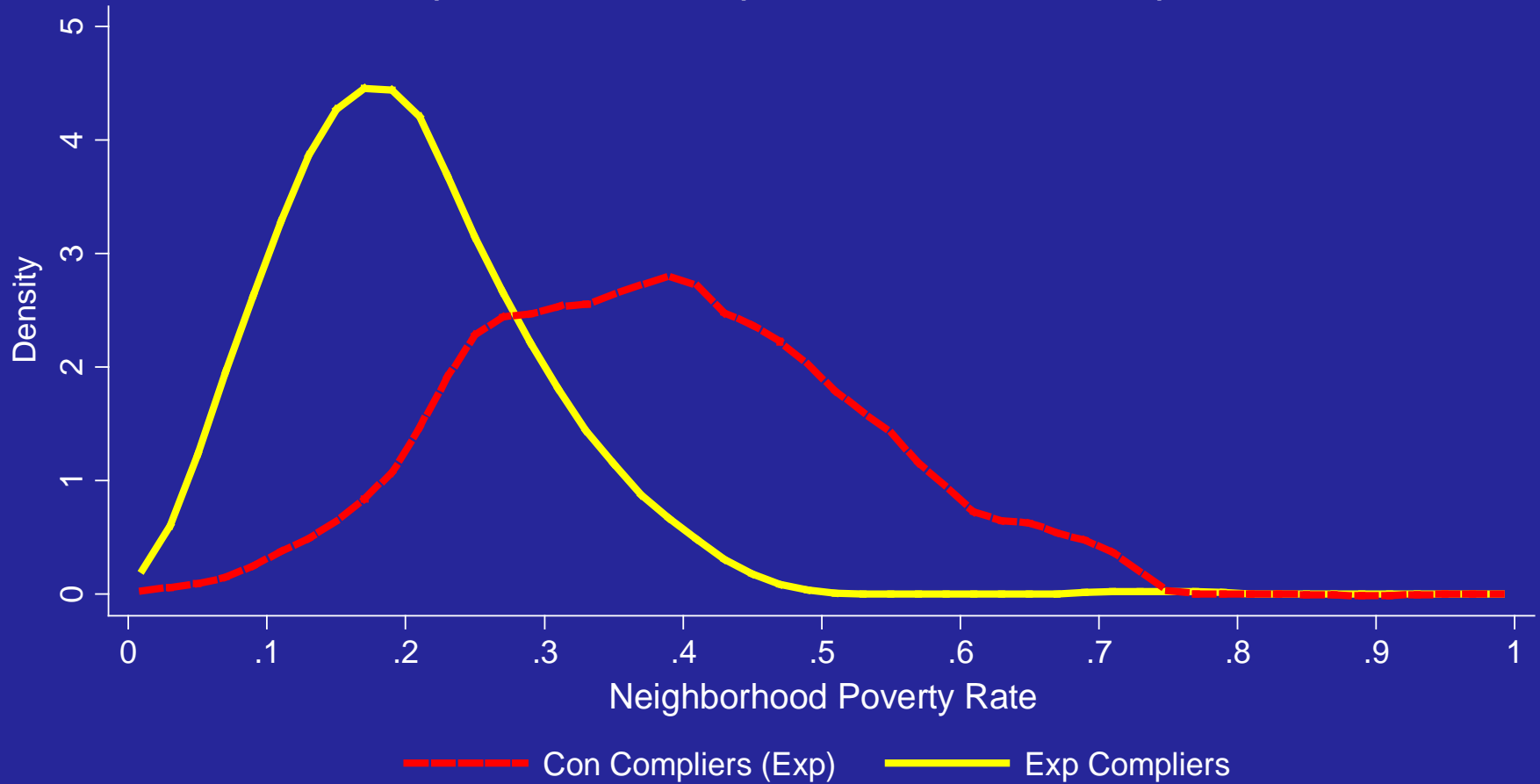


# MTO effects on neighborhood poverty

Outcome	Control Mean	Exp vs. Control		S8 vs. Control	
		ITT	TOT	ITT	TOT
Percent Poor - Baseline	53.103	-0.392 (0.457)	-0.808 (0.942)	-0.474 (0.567)	-0.754 (0.903)
Percent Poor - 1 Year After RA	49.970	-17.024 * (0.767)	-35.151 * (1.584)	-14.135 * (0.892)	-22.434 * (1.416)
Percent Poor - 5 Years After RA	40.012	-9.953 * (0.745)	-20.389 * (1.527)	-6.971 * (0.939)	-11.124 * (1.499)
Percent Poor - 10 Years After RA	33.050	-4.655 * (0.690)	-9.588 * (1.420)	-3.994 * (0.880)	-6.403 * (1.411)
Percent Poor - Duration-Weighted	39.685	-8.955 * (0.566)	-18.432 * (1.165)	-6.861 * (0.673)	-10.940 * (1.074)

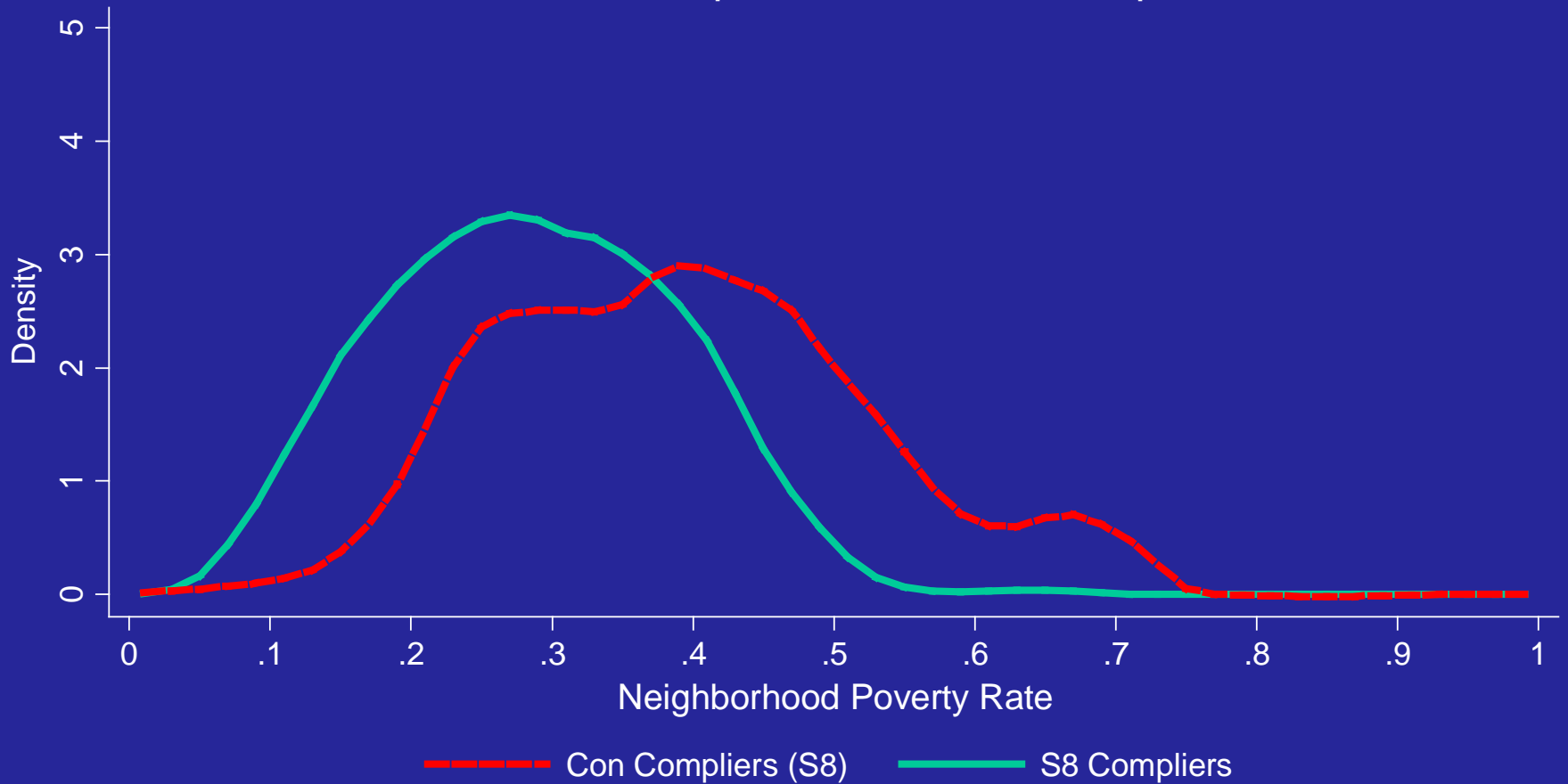
# Neighborhood Poverty Distribution (Duration-Weighted)

Experimental Compliers vs Control Compliers



# Neighborhood Poverty Distribution (Duration-Weighted)

Section 8 Compliers vs Control Compliers



# Impacts on Neighborhoods & Housing

Outcome	Control Mean	Intent-To-Treat	
		Exp vs. Control	S* vs. Control
Avg. (duration-weighted) tract minority	.880	-.060*	-.010
Adult felt unsafe during day	.196	-.036*	-.047*
Collective efficacy†	.589	.076*	.042
Has 1+ friends w/ college degree	.532	.071*	-.018
Very satisfied or satisfied with current neighborhood	.515	.094*	.082*
Number of housing problems	2.051	-.359*	-.395*
Number of moves since baseline	2.165	.555*	.588*
Total Monthly Housing Costs	\$679	19.50	-6.26
Avg School % Rank on State Exam	18.7	3.1*	1.2*

Notes: \* =  $p < .05$ . ~ =  $p < .10$ .

† = Likely/very likely neighbors would do something about kids doing graffiti on local building.

# MTO Impacts on Adults

**Mental Health** – beneficial impacts on psychological distress and some mental health disorders

**Physical Health** – beneficial impacts on severe obesity, diabetes, stress indicators, and health limitations

**Economic Self-Sufficiency** – no detectable effects  
– contrast with positive & sustained impacts of **Jobs Plus**, EITC impacts, and macro labor impacts

**Subjective Well-Being** – substantial improvements

# Impacts on Adult Mental Health

Outcome	Control Mean	Intent-To-Treat	
		Exp vs. Control	S* vs. Control
Major Depression	.203	-.032~ (.017)	-.045* (.023)
Generalized Anxiety Disorder	.065	-.003 (.010)	-.020~ (.011)
Psychological Distress Index (K6 Z-Score)	.000	-.104* (.039)	-.106~ (.042)
Absence of Mental Health Problems Index ( Mean Z-Score - depression, anxiety, distress, calm, sleep)	.000	.070~ (.041)	.069 (.042)

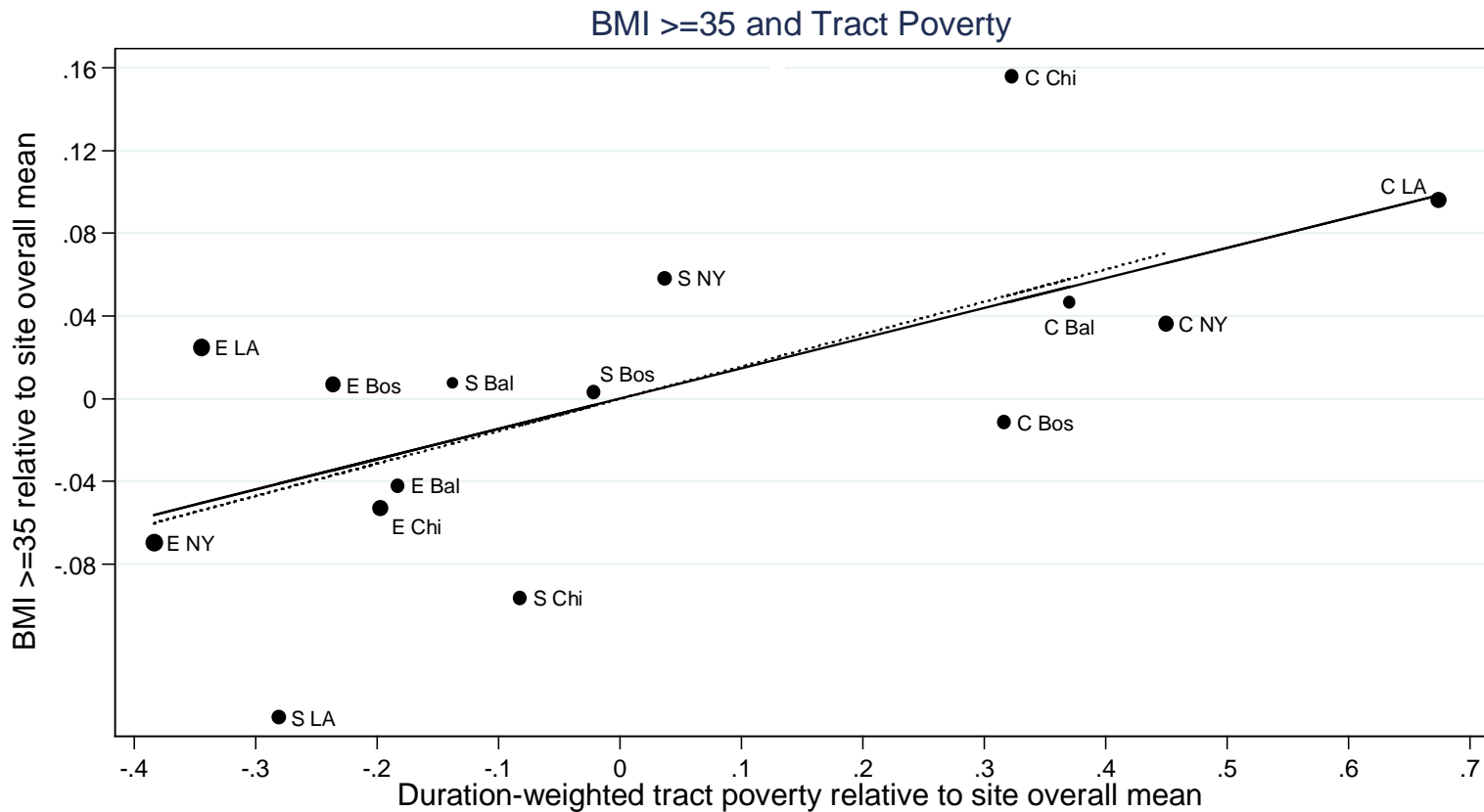
Notes: \* =  $p < .05$ , ~ =  $p < .10$

# Impacts on Adult Physical Health

Outcome	Control Mean	Intent-To-Treat	
		Exp vs. Control	S8 vs. Control
Physical limitations	.510	-.048* (.021)	-.023 (.028)
High Risk C-reactive protein (>3mg/L)	.586	-.042~ (.024)	.010 (.030)
Obese Class II (BMI $\geq$ 35)	.351	-.046* (.020)	-.053* (.027)
Diabetes (HbA1c $\geq$ 6.5)	.204	-.052* (.018)	-.011 (.024)

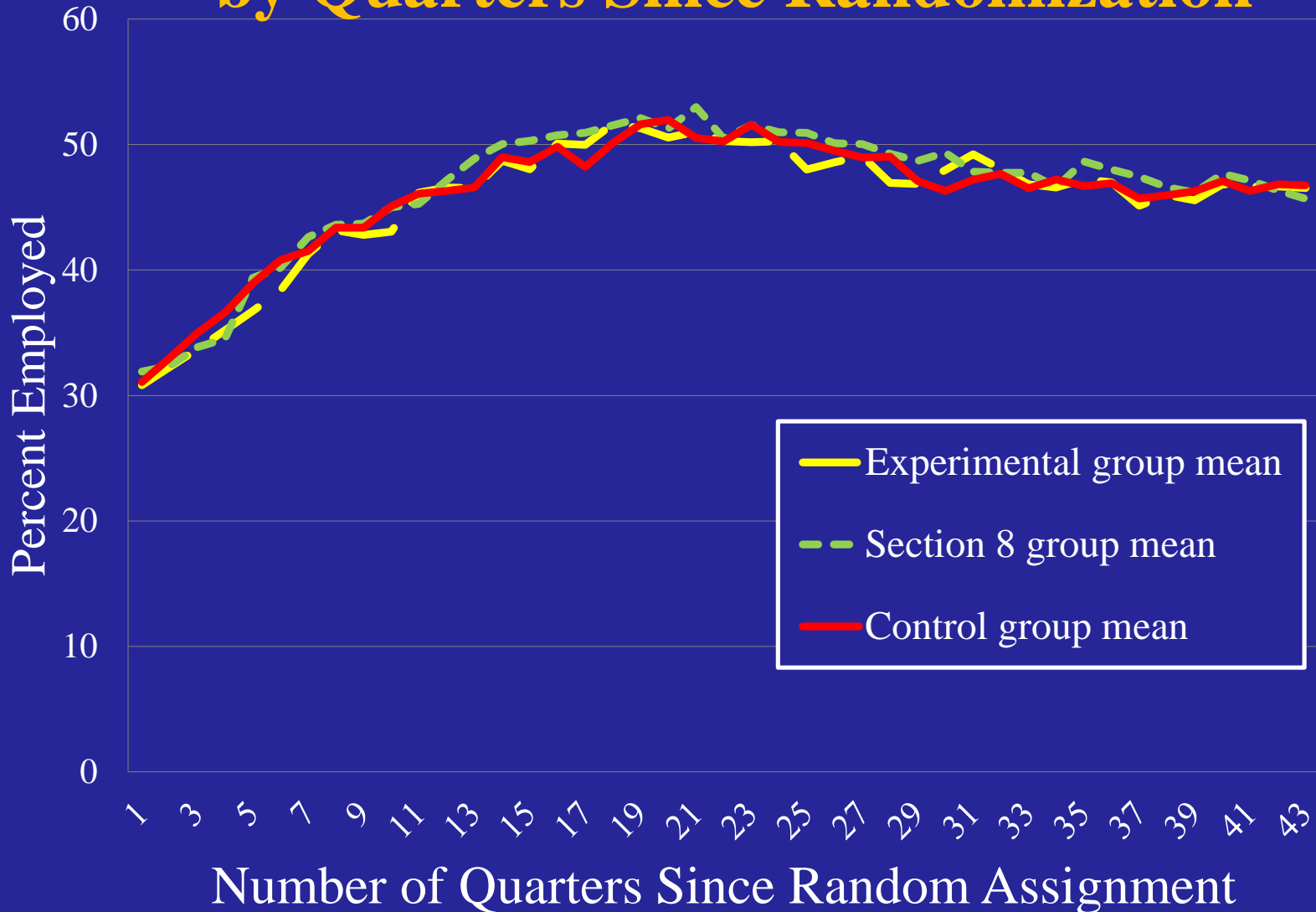
Notes: \* =  $p < .05$ , ~ =  $p < .10$

# BMI $\geq 35$ and Neighborhood Poverty (Duration-Weighted)





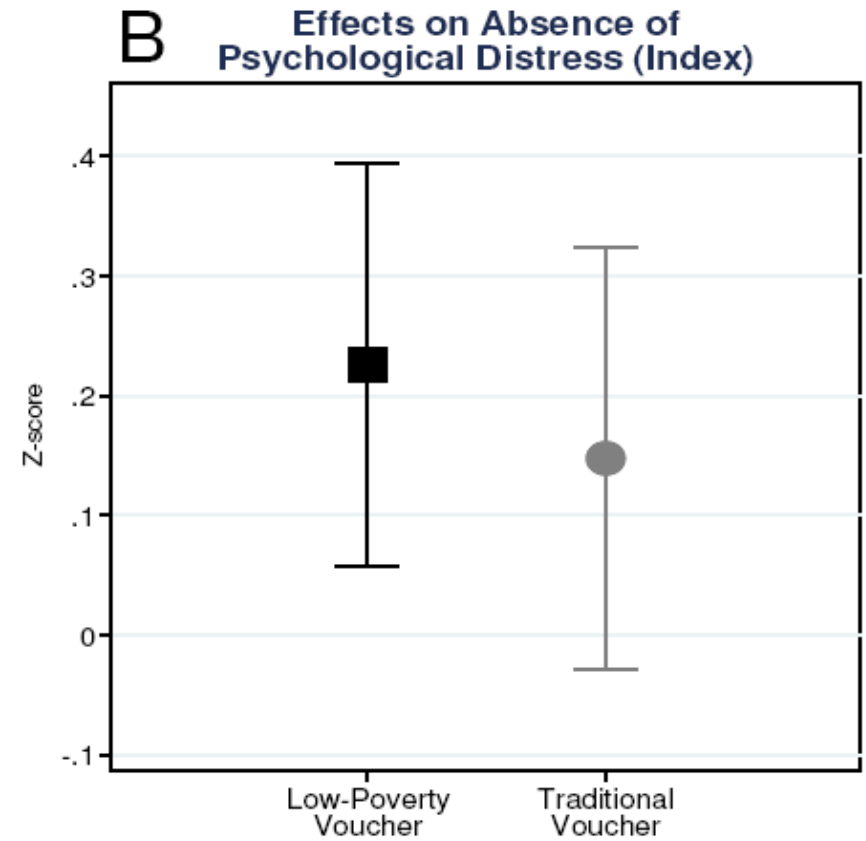
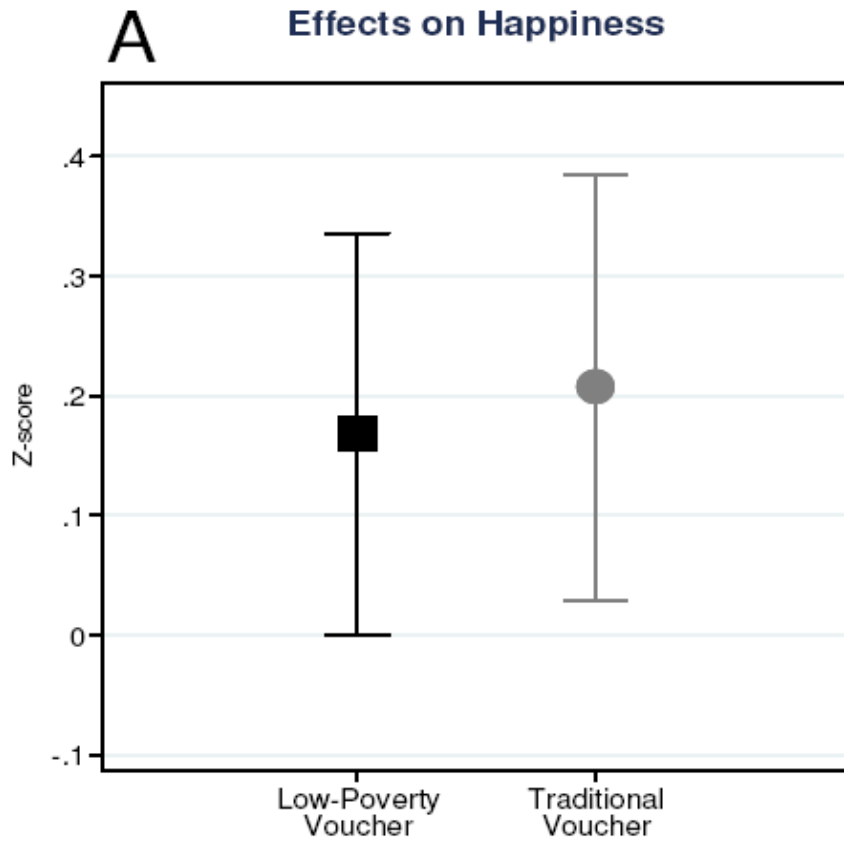
# Adult Employment by Quarters Since Randomization



# MTO Impacts on Subjective Well-Being

- Was MTO a Success? What do the Respondents say?
  - They asked for neighborhood safety and got it
- Summary Evaluation using GSS Happiness question implies:
  - MTO moves improve SWB by 0.20 standard deviations
  - 1-standard deviation decrease in duration-weighted tract poverty rates induced by MTO is associated with 0.14 standard deviations higher subjective well-being.
  - About equal in magnitude to two-thirds of the overall gap in SWB between blacks & whites in U.S.
  - Also equivalent in size to change in happiness associated with \$13,000 per year increase in permanent income as compared to average control group income in long-term follow-up of ~\$20,000

# TOT Estimates of MTO Impacts on Happiness and Absence Of Psychological Distress



# MTO Adult Impact Conclusions

- Impacts still substantial after 10-15 years
  - New neighborhoods were safer and less poor, housing was better
  - Beneficial adult mental & physical health impacts
  - Large obesity and diabetes impacts
  - No detectable impacts on adult economic outcomes
  - Contrast with **MDRC Jobs Plus demonstration** – increase returns to work, training, placement within public housing → sustained income and earnings gains
- Substantial adult happiness gains
  - Moving to Tranquility rather than Opportunity?
  - Neighborhood economic segregation rather than racial segregation seems to matter most
  - Worrisome given racial segregation declining since 1970 while income segregation has been increasing – problem getting worse?

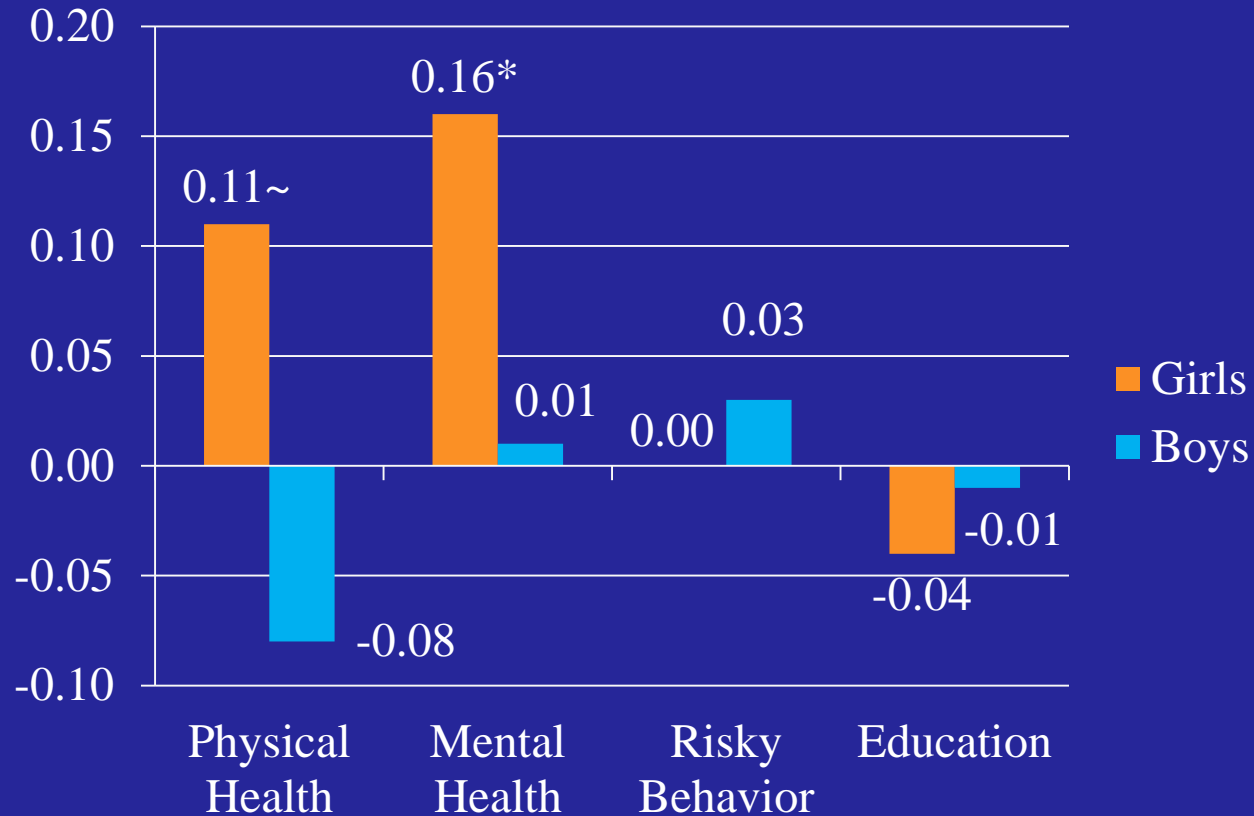
# MTO Impacts on Neighborhood Quality for Youths

	Control mean	Experimental versus Control		Section 8 versus Control	
		ITT	TOT	ITT	TOT
<b>A. Neighborhood Quality</b>					
Average Census Tract Poverty Rate, MTO Youth					
Share Poor	0.399	-0.090 (0.007)	-0.188 (0.013)	-0.076 (0.007)	-0.113 (0.010)
Share Poor, percentile units among U.S. tracts	91.85	-8.87 (0.64)	-18.38 (1.09)	-4.63 (0.53)	-6.90 (0.76)
Share Poor, z-score on U.S. tracts	2.102	-0.733 (0.057)	-1.520 (0.102)	-0.613 (0.056)	-0.914 (0.079)

# MTO Impacts on School Quality

		Experimental versus Control		Section 8 versus Control	
	Control mean	ITT	TOT	ITT	TOT
<b>B. School Quality for Average School Attended</b>					
Share Eligible for Free- or Reduced-Price Lunch	0.752	-0.040 (0.007)	-0.083 (0.014)	-0.019 (0.008)	-0.029 (0.012)
School Percentile Ranking on State Exam	18.68	3.07 (0.65)	6.43 (1.36)	1.22 (0.66)	1.81 (0.98)
School Climate Index, All	0.797	0.020 (0.011)	0.043 (0.023)	-0.002 (0.012)	-0.003 (0.017)
School Climate Index, Female	0.786	0.025 (0.015)	0.052 (0.032)	0.006 (0.016)	0.010 (0.025)
School Climate Index, Male	0.807	0.016 (0.014)	0.034 (0.031)	-0.011 (0.016)	-0.015 (0.022)

# MTO Experimental Long-Term Impacts on Youth Summary Indices



Notes: \* =  $p < .05$ , ~ =  $p < .10$

# MTO Impacts on Children/Youth

- **MTO treatments led to much larger changes in neighborhood quality than school quality**
  - Change in share poor in Census tract more than twice as large as share poor in schools
  - Change in nghd poverty rank 3 times larger than school test score rank
- MTO Treatments Improved Girls Mental Health (Depression and Conduct Disorder ↓, but not for Boys (PTSD, Depression, and Conduct Disorder ↑) – see Kessler et al. (*JAMA* 2014)
- MTO had no detectable long-run impacts on academic achievement, educational outcomes, risky behaviors
- **MTO → short-run declines in arrests for boys (0-4 years) that fade**
- Implications:  $\frac{\partial f^{human\ capital}}{\partial \eta} \approx 0$  for boys and girls
- $\frac{\partial f^{health}}{\partial \eta} > 0$  for girls but 0 for boys
- Site\*Treatment group variation → No impact of nghd poverty on education/risky behavior but some positive effect of school quality



D

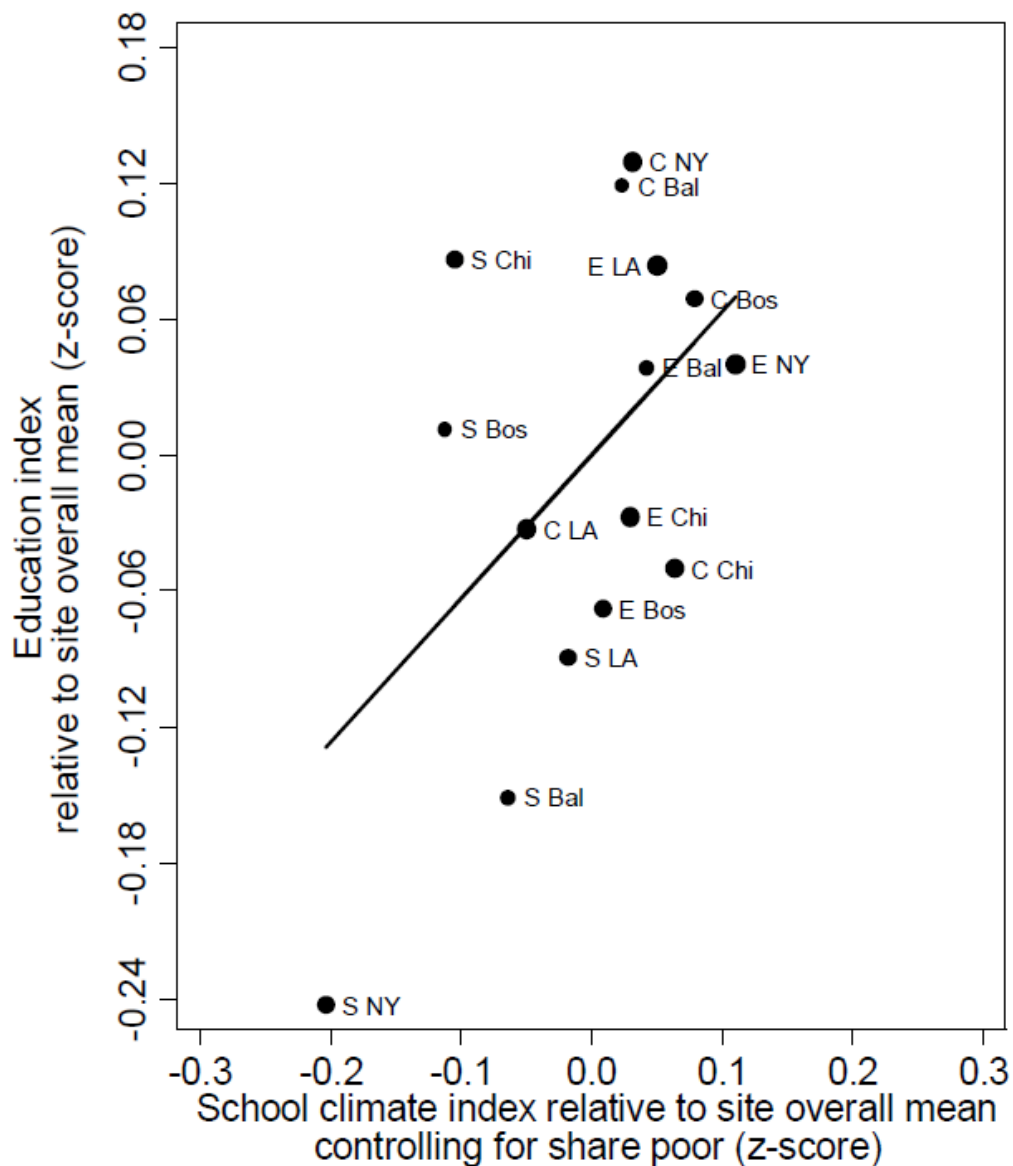
### MALE YOUTH: Educational Attainment vs. School Climate Controlling for Poverty

IV Partial Leverage Plot  
For MTO Male Youth:

Education Outcomes  
Vs. School Climate  
Controlling for  
Neighborhood Poverty  
And Site Fixed Effects

Site\*Treatment Group  
As instruments for  
School climate index  
and tract share poor

p value = .04 for school climate  
Slope coefficient



IV Partial Leverage Plot  
For MTO Male Youth:

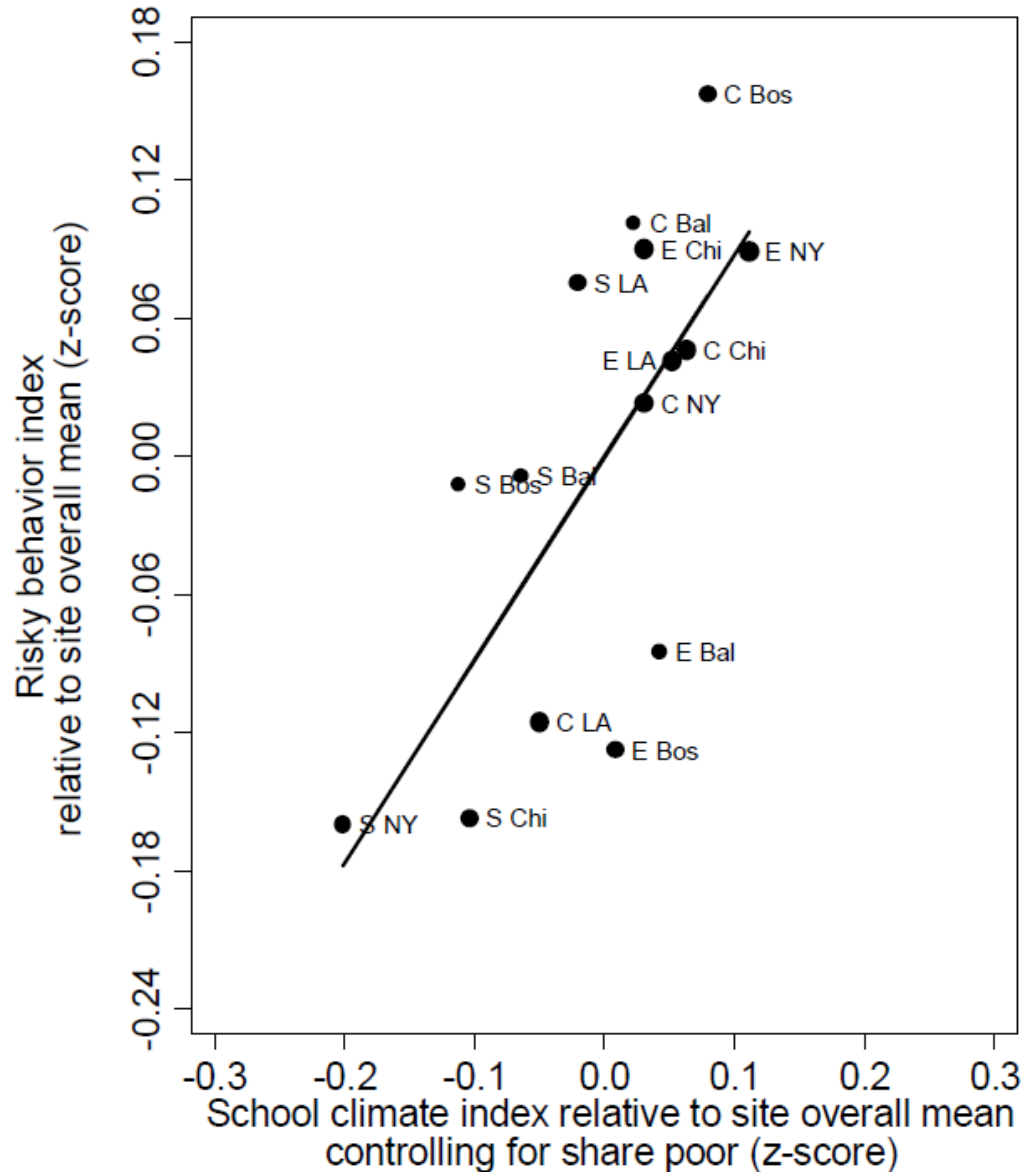
Risky Behaviors  
Vs. School Climate  
Controlling for  
Neighborhood Poverty  
And Site Fixed Effects

Site\*Treatment Group  
As instruments for  
School climate index  
and tract share poor

$p=.01$  for slope coefficient  
of School Climate

D

MALE YOUTH: Risky Behavior vs.  
School Climate Controlling for Poverty



# School Quality Evidence I

- **Public School Choice – Longer Run Impacts:**
  - Deming (2011 QJE) and Deming et al. (2014 AER) use CMS school choice lottery – medium-term follow-up shows higher school quality lowers crime and increases college attainment for low-income & minority students
- **Charter School Entrance Lottery Evidence – Longer run evidence from Harlem Children’s Zone (Fryer and Dobbie)**
  - Boston Charter Schools from Angrist et al. (2013) find impacts on AP exams, SAT scores, and college going
- **Fryer (2014 QJE, forthcoming): Injecting Charter School Best Practices into Public Schools in Houston, Denver, and Chicago with Short-Run Impacts**

# School Quality Evidence II

- **Class Size:** Tennessee Project STAR Randomized Class Size Experiment in K-3 positive impacts on test scores (Krueger 1999 QJE) and longer-run impacts on college going and adult outcome index at age 27 linking to IRS tax data (Chetty et al. QJE 2011)
  - Class size impacts largest for minority and free lunch students
  - Fredriksson et al. (2013 QJE) using RD strategy and Swedish maximum class size rule finds positive impacts of smaller class size on adult earnings at ages 27 to 42
  - These estimates hold teacher quality constant but general equilibrium issues of whether smaller class sizes dilute teacher quality as in California class size reduction experience (Jepsen and Rivkin JHR 2009)
  - But Card-Krueger (1992a,b) historical evidence show substantial impacts on adult earnings of state level persistent reductions in class size in K12 – gets a GE effects from state aggregate variation

# School Quality Evidence III

- **Teacher Quality:** Chetty et al. (2011 QJE) use Project STAR RA & find more experienced teachers in K-3 have a positive impact on adult wages – Hanushek review pieces as well
  - Chetty, Friedman and Rockoff (2013 NBER WP) – cross-section and teacher turnover-based estimates of teacher quality (measured by teacher value-added) on adult outcomes linking public school administrative data for large urban school district to IRS tax data
  - Find substantial impacts on adult earnings, college going, & college quality of a high Value-Added Teacher in grades 4-8
  - Positive impacts for girls and boys, high and low income, minority and nonminority children
- Implication:  $\frac{\partial f^j}{\partial \sigma} > 0$

# Neighborhood & Schools: Harlem Children's Zone (HCZ) Evidence

## Key HCZ references:

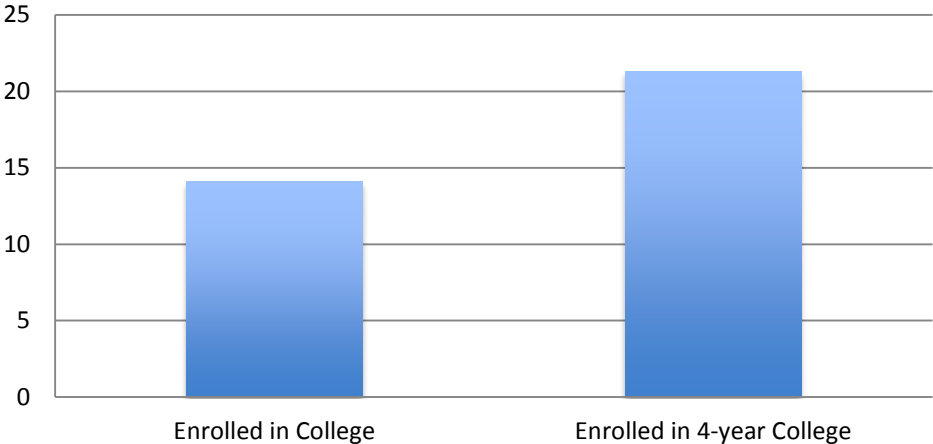
- Dobbie, Will and Roland G. Fryer, Jr. 2011. “Are High-Quality Schools Enough to Increase Achievement among the Poor? Evidence from the Harlem Children’s Zone.” *American Economic Journal: Applied Economics* 3 (3): 158-87.
- Dobbie, Will and Roland G. Fryer, Jr. 2013. “The Medium Term Impacts of High-Achieving Charter Schools on Non-Test Score Outcomes” Harvard University, September.

# HCZ Evidence

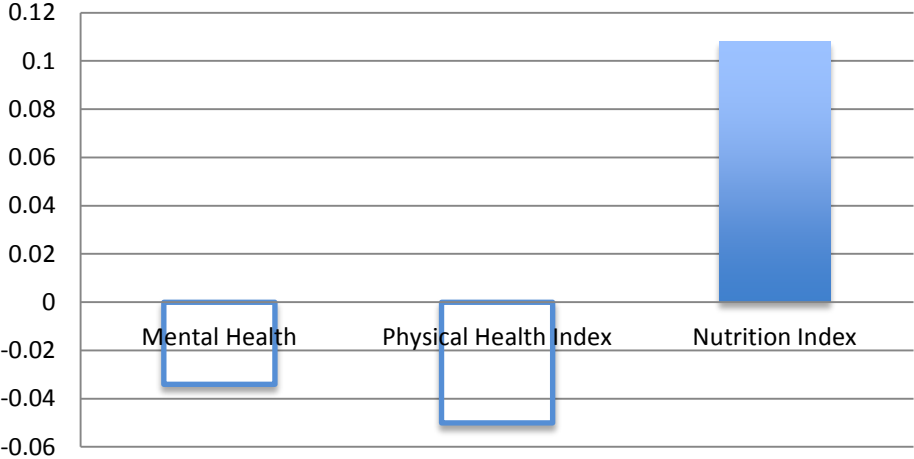
- Dobbie and Fryer (2012) look at medium-term outcomes 6 years after random admissions lottery to Promise Academy charter school in a follow-up survey plus NYC School and NSC data
- Lottery winners have large increase in math achievement (0.283 SD), college enrollment (14.1 percentage points), females are 12.1 percentage points less likely to be teen mothers, and males 4.3 percentage points less likely to be incarcerated -- ITT estimates
- Promise Academy access improves human capital index, reduces risky behavior index, and no impact on health index
  - Evidence that  $\frac{\partial f^j}{\partial \sigma} > 0$  for human capital and risky behavior and = 0 for health
- Lottery impacts similar for in-zone and out-of-zone youth suggesting little interaction effect of schools & nghds
- No impact of being in zone for lottery losers at zone border consistent with little or no direct neighborhood effects

# HCZ Promise Academy ITT Impacts

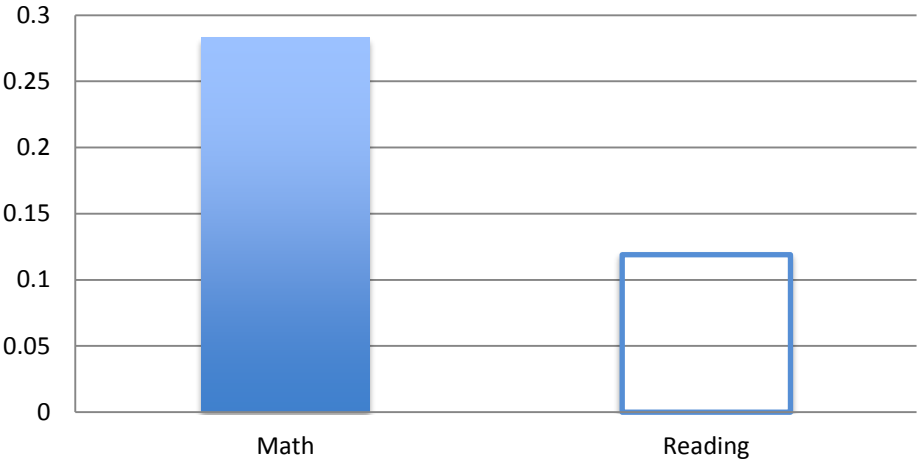
### College-Going



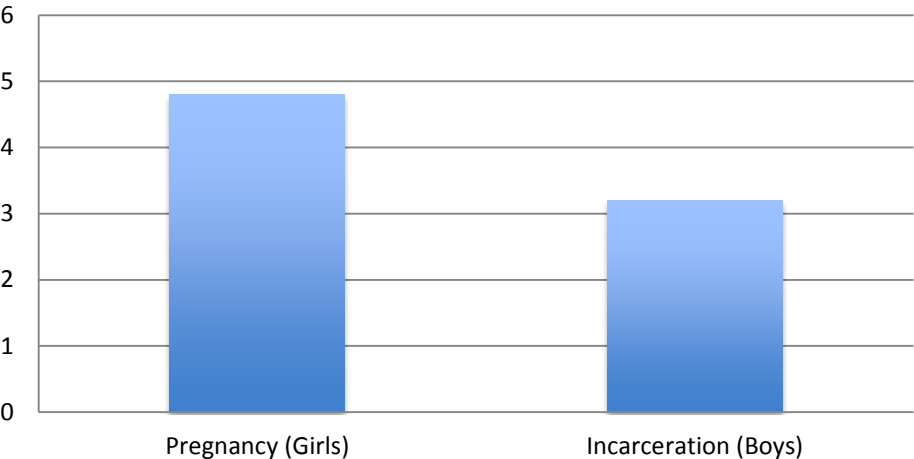
### Health Outcomes



### Woodcock Johnson



### Social Outcomes (Odds Ratios)





# HCZ Promise Academy ITT Impacts for those Inside vs. Outside the Zone – Medium Term

Table 6  
The Impact of Attending the Promise Academy  
Inside and Outside the Zone

	Inside Zone	Outside Zone	p-value
	(1)	(2)	(3)
Human Capital Index	0.281** (0.124) 147	0.268*** (0.077) 361	0.918
Risky Behavior Index	-0.127 (0.103) 122	-0.135* (0.077) 315	0.932
Health Index	0.045 (0.094) 112	0.034 (0.062) 287	0.907

# Conclusions I

- Micro Neighborhood conditions have substantial impacts on adult well-being and health and female youth mental and physical health
- Micro Neighborhood environments in the range affected by housing vouchers have little impact on children's education, economic, or risky behavior outcomes unless they lead to large increases in school quality
- $\frac{\partial f^{human\ capital}}{\partial \eta} \approx 0$  for males and females
- $\frac{\partial f^{health}}{\partial \eta} > 0$  for females

# Conclusions II

- School quality improvements have large positive effects on youth human capital, labor market, and risky behavior outcomes
- But little direct medium-term impact on youth health from school quality
- Neighborhoods matter more for health inequalities and matter a lot for well-being
- Schools matter more for achievement gaps, poverty, and economic inequality

# Conclusions III

- How can one bring school quality changes (charter schools, teacher quality ...) to scale??
  - General equilibrium effect issues
  - Can one increase supply of talented teachers, principals, and school practices?
- G.E. and political economy effects on school quality for low-income students of changes in neighborhood economic segregation
- Micro vs. Macro impacts of neighborhoods
- Chetty et al.(2014) on neighborhood segregation and upward mobility at MSA level; Cutler-Glaeser (1997), WJ Wilson(1987)