The End of the American Dream? Inequality and Segregation in US cities

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Motivation

- Large increase in inequality in US over the last 40 years.
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- This paper explores the dynamic implications of high inequality:
 - How does high inequality affect residential and education choices?
 - How do these choices in turn affect mobility and future inequality?

Contribution

- We develop a GE model in which inequality and segregation are both endogenous and feed on each other.
 - High inequality, through housing prices, leads to higher residential segregation across different income groups.
 - This change, in turn, creates wedge in the return from education of rich and poor families, amplifying differences in the investment in children's education
 - The differential investment in children may in turn lead to even larger future inequality and low intergenerational mobility

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The End of the American Dream?

Roadmap

- Evidence on inequality and segregation
 - inequality and segregation over time
 - income segregation across US cities
 - the empirical link between inequality and segregation
- A dynamic theory of inequality and segregation through residential and educational choices
- Evidence on the predictions of the model: a closer look to educational outcomes

Data and Sample Selection

- Data
 - Census data 1970 - 2000
 - County-level and census tract-level tabulations of family income.
- Sample Selection
 - 100 MSAs with largest population in 2000
 - covers about 2/3 of all census tracts and about 2/3 of the number of families
- Measure of Inequality
 - Gini coefficients: family income tabulated at county level aggregated to the MSA level

Measures of Segregation

Figure: Trends in Residential Patterns, 1970-2000, 100 Largest MSA

- Measure affected by income inequality

Rank Order Information Theory Index

- H_k measures the ratio of within unit (tract) income rank variation to overall (MSA) income rank variation.
 - Let p_k be a binary measure of income variation in a MSA (i.e. fraction of families earning less than k)
 - Let $v_k = f(p_k)$ be a mapping from $[0, 1]$ into $[0, 1]$, s.t. $f(1/2) = 1$, $f(1) = f(0) = 0$.
 - Let $v_{k,i}$ be the same index for Census tract i .
 - The H_k segregation index $= \sum_{i=1}^N \left(v_k \frac{T_i}{T(v_k - v_{k,i})} \right)$

Examples

- H_{10} Segregation of poverty:
if all CTs have the same fraction $\rightarrow$ no segregation
if all poor are concentrated in few CTs $\rightarrow$ max segregation)
- H_{90} Segregation of affluence.
- $H_R = f(H_{10}, H_{20}, \dots)$ weighted average of segregation at each point income distribution. Overall measure
- H_R independent from inequality

Trend in Inequality and Segregation

Figure: Trends in Family Income Inequality and Income Segregation, 1970-2000, 100 Largest Metropolitan Areas

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Figure: Trends in Average MSA Income Segregation, by Income Percentile, All Families, 100 Largest, 1970-2000

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The Geography of Segregation

H(90) All CBSAs

1. Seattle, WA

2. Detroit, MI

Sample Summary Statistics for H(90)

Mean : 0.110

SD : 0.048

Min : 0.00

Max : 0.259

The Geography of Segregation (Top 100)

H(90) Top 100 CBSAs

1. Seattle, WA

2. Detroit, MI

Sample Summary Statistics for H(90)

Mean : 0.121

SD : 0.046

Min : 0.04

Max : 0.259

Inequality and Segregation: Correlations

	By Decade				
	All Families	1970	1980	1990	2000
Gini Index	0.561*** (0.085)	0.624* (0.268)	0.649* (0.276)	0.688*** (0.194)	0.732*** (0.153)
Year = 1980	0.027*** (0.007)				
Year = 1990	0.025* (0.012)				
Year = 2000	0.012 (0.016)				
Metro-Year Covariates	Yes				
Group-Metro-Year Covariates		Yes	Yes	Yes	Yes
Metro Fixed Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.959	0.689	0.789	0.821	0.866
N	400	161	161	161	161

Note: Bootstrapped standard error in parentheses. * $p < .05$; ** $p < .01$; *** $p < .001$. Sample includes observations from 100 largest metropolitan areas in 2000, excluding black observations from with fewer than 10,000 black families in 1970. Coefficients on covariates and fixed effects not shown. Metro-year covariates include metro population, unemployment rate, proportion under age 18, proportion over age 65, proportion with high school diploma, proportion foreign born, proportion female headed families, per capita income, proportions employed in manufacturing, construction, financial and real estate, professional and managerial jobs, and proportions of housing build within ten, five, and one years. Group-metro-year covariates include race-group-specific population, per capita income, proportion with high school diploma, proportion female headed families, and unemployment rate.

Takeways

- Strong correlation between inequality and segregation
- It holds for levels and first differences
- Stronger in MSA with higher percentage of families with children

A Dynamic GE Theory of Inequality and Segregation

- overlapping generations of agents who live for 2 periods: young and old
- when old, agents have a child with ability $a \sim G(a)$ iid
- two neighborhoods: $k \in \{A, B\}$
- old agent with wage w and child ability a at time t chooses
 - how much to consume $c_t(w, a)$
 - in which neighborhood to live $k_t(w, a)$
 - investment in child's education $e_t(w, a) \in \{e^L, e^H\}$

Housing Market

- houses are all of the same size and quality
- R_t^k = rent in neighborhood k at time t
- extreme assumptions on supply (to be relaxed!):
 - fixed supply H in neighborhood A ;
 - fully elastic supply of houses in neighborhood B ;
- marginal cost of construction equal to 0 $\Rightarrow R_t^B = 0$ for all t
- S_t^k = share of college educated agents in neighborhood k at time t

Wage distribution

- initial wage distribution $F_0(w)$
- crucial: dynamics of wage distribution are endogenous!
- children wages affected by
 - their ability a (random)
 - their education e (chosen by parents)
 - their neighborhood's spillover S^k (chosen by parents)
- spillover effect: quality of public school, peer effect, learning from neighbors' experience,...
- wage function:

$$w_{t+1} = Q(a_t, e_t, S_t^k)$$

Optimization Problem

- bequest motive: old agents care about their child's wage
- old agent (w_t, a_t) at time t solves

$$\begin{aligned} U(w_t, a_t) &= \max_{c_t, e_t, k_t} u(c_t) + g(w_{t+1}) \\ \text{s.t. } &c_t + R_t^{k_t} + \tau e_t \leq w_t \\ &w_{t+1} = Q(a_t, e_t, S_t^k) \end{aligned}$$

taking as given R_t^k and S_t^k for $k = A, B$

Assumption

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The function $Q(a, e, S^k)$ has increasing differences in (a, S_k) and in (e, S^k) , that is, for $a' > a$, $e^H > e^L$, and $S^A > S^B$,

$$Q(a', e, S^A) - Q(a', e, S^B) \geq Q(a, e, S^A) - Q(a, e, S^B) \text{ for any } e,$$

and

$$Q(a, e^H, S^A) - Q(a, e^H, S^B) \geq Q(a, e^L, S^A) - Q(a, e^L, S^B) \text{ for any } a.$$

Cut-off Characterization

Proposition

If $S^A > S^B$, there are two cut-off functions $\hat{w}_t(a)$ and $\hat{\hat{w}}_t(a)$ such that

$$e_t(w_t, a_t) = \begin{cases} 0 & \text{if } w_t < \hat{w}_t(a_t) \\ 1 & \text{if } w_t \geq \hat{w}_t(a_t) \end{cases} ,$$

and

$$k_t(w_t, a_t) = \begin{cases} B & \text{if } w_t < \hat{\hat{w}}_t(a_t) \\ A & \text{if } w_t \geq \hat{\hat{w}}_t(a_t) \end{cases} .$$

Cut-off Characterization (continued)

- neighborhood A is the “good” one = $S_t^A > S_t^B \Rightarrow R_t^A > R_t^B$
- assume for simplicity $Q(a, e^L, S^k)$ is independent of S^k
- $\Rightarrow$ never optimal to choose neighborhood A and low education
- $\Rightarrow$ old agents have three options:
 1. neighborhood A and high education ($w \geq \hat{w}_t(a)$)
 2. neighborhood B and high education ($\hat{w}_t(a) \leq w < \hat{\hat{w}}_t(a)$)
 3. neighborhood B and low education ($w < \hat{w}_t(a)$)

Static Equilibrium

For given $F_t(w)$, a static equilibrium is two cutoff functions $\hat{w}_t(a_t)$ and $\hat{\hat{w}}_t(a_t)$ and four scalars R_t^A , R_t^B , S_t^A and S_t^B such that

- agents optimize taking as given rents and spillovers
- housing markets clear: $R_t^B = 0$ and R_t^A such that

$$\int [1 - F_t(\hat{w}_t)] dG(a_t) = H;$$

- spillover effect consistent with equilibrium: $S_t^A = 1$ and

$$S_t^B = \frac{\int [F_t(\hat{\hat{w}}_t(a_t)) - F_t(\hat{w}_t(a_t))] dG(a_t)}{\int F_t(\hat{w}_t(a_t)) dG(a_t)}.$$

Dynamic Equilibrium

A dynamic equilibrium is a sequence of static equilibria and a law of motion for F_t given by

- an initial condition $F_0(w)$
- the evolution of the intergenerational wages

$$w_{t+1}(w_t, a_t) = Q\left(a_t, e_t(w_t, a_t), S_t^{k_t(w_t, a_t)}\right)$$

Numerical Example

- 2 periods (full dynamics coming soon!)
- choose $u(c) = \log(c)$ and $g(c) = c$
- set $e^L = 0$ and $e^H = 1$
- ability distribution $G(a)$ lognormal
- initial wage distribution $F_0(w)$ lognormal
- wage function

$$Q(a, e, S^k) = a + ae(\beta_0 + \beta_1 S^k)$$

Partial vs Full Segregation

- remember that all agents in neighborhood A have high education: $S^A = 1$
- 2 possible scenarios:
 1. **partial segregation**: $\hat{w}_t(a_t) < \hat{\hat{w}}_t(a_t)$
 - neighborhood B has some agents with high and some with low education $\Rightarrow 0 < S^B < 1$
 2. **full segregation**: $\hat{w}_t(a_t) = \hat{\hat{w}}_t(a_t)$
 - all agents in neighborhood B have low education $\Rightarrow S^B = 0$

Time 0: Partial Segregation

Segregation and Inequality

- $F_0(w)$ such that there is partial segregation at time 0
- partial segregation = higher return on education in neighborhood A than B
- moreover richer agents live in neighborhood A
- $\Rightarrow$ increase in inequality and reduction in intergenerational mobility
- $\Rightarrow$ even more segregation
- in our example: switch to full segregation in 1 period!

Increase in Inequality

Time 1: Full Segregation

Dynamic Implications

- Rich and poor have different educational attainments
- This implies that, as inequality increases, attainment gap increases
- Key point is that increase in segregation amplifies the impact of inequality on educational attainment gap
- Segregation is powerful force in making inequality higher and more persistent

Stanford Education Data Archive (SEDA)

- Average district-level standardized test scores (on state accountability tests)
 - 11,280 geographic school districts (including charter schools)
 - Grades 3-8
 - Math & ELA
 - 2009 - 2013 (10 cohorts of students entering K in 2000 - 2009)
 - Based on 215,000,000 test scores
 - Scores are placed on common scale across states, years, and grades
- Demographic data
 - Family characteristics (of families with children in public schools)
 - From American Community Survey (ACS)

Some direct evidence: across districts

Large achievement gap between rich and poor

Educational attainment in each school district in the U.S.

Each circle represents one school district. Larger circles represent districts with more students.

Some direct evidence: across time

This gap has increased over time

Segregation Amplifies Achievement Gap H90

Segregation Amplifies Achievement Gap H90

Segregation Amplifies Achievement Gap H10

Segregation Amplifies Achievement Gap H10

The End of the American Dream?

More millennials say American dream is "not really alive"

Q: Do you personally feel that The American Dream is very much alive today, somewhat alive, or not really alive? % saying "not really alive" among those ages 18-35

Source: [Fusion 2016 Issues poll among Americans ages 18-35, Nov. 4-18, 2015. 1996 poll Roper/WSJ](#) The Washington Post

Summary Statistics

In 2000, our subsample of 100 MSAs contains:

- 66 % of the total number of families for whom income is tabulated.
- 18 % of all counties in the U.S.
- 67 % of all census tracts in the U.S.
- 36 % of all MSAs in the U.S.

Measuring Income Segregation

- Let p_k be a binary measure of income variation in a MSA (i.e. fraction of families earning less than k)
- Let $v_k = f(p_k)$ be a mapping from $[0, 1]$ into $[0, 1]$, s.t. $f(1/2) = 1$, $f(1) = f(0) = 0$. (variation is maximal when $p = 1/2$ and minimal when $p = 1$ or $p = 0$.)
- Let $v_{k,i}$ be the same index for Census tract i .
- The H_k segregation index $= \sum_{i=1}^N \left(v_k \frac{T_i}{T(v_k - v_{k,i})} \right)$
- Independent from income inequality

Examples

- H_{10} segregation of poverty: measures differences (across CT) in fraction of families living below the MSA 10th income percentile. (I.e. If all CTs have the same fraction $\rightarrow$ no segregation, if all poor are concentrated in few CTs $\rightarrow$ max segregation)
- H_{90} Segregation of affluence
- $H_R = f(H_{10}, H_{20}, \dots)$, captures overall segregation
- Time trends are unweighted averages