Lot Sizes, Welfare and Urban Structure: A View from the US

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Motivation

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- Lot size regulation disproportionately burdens low income families, causing considerable residential sorting on income and race (Kulka, 2019) (Song, 2021).

- How does the minimum lot size shape *aggregate welfare* and *urban structure*?
  - The sizes of productive cities? ...
  - The location of affluent neighborhoods in those cities?

In this paper

1. Income sorting has important implications for the *aggregate* welfare consequences of regulation, building on Hsieh and Moretti (2019) and Duranton and Puga (2019):
    - Deregulation causes high income, productive households to sort out of productive cities
    - Exacerbated when local amenities are endogenous
    - Ensuing externalities, e.g. Hamilton (1976).

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    - Exacerbated when local amenities are endogenous
    - Ensuing externalities, e.g. Hamilton (1976).

2. Evidence that *heterogeneous* regulation has altered the urban structure of expensive cities. Within city migration is crucial for assessing welfare consequences in the model:
    - Evidence that low income households choose high density neighborhoods to avoid stringent lot sizes
    - This choice imposes externalities through the endogenous supply of amenities

How?

- Build and calibrate a structural GE model with heterogenous households, cities and neighborhoods across the contiguous United States
  - (Heterogenous) regulations cause income sorting both within and across cities ...
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  - (Heterogenous) regulations cause income sorting both within and across cities ...
  - and income sorting endogenously shapes the pattern of neighborhood amenities
- Focus on a simple counterfactual:
  - Removing all measured lot size restrictions across MSA's within the contiguous United States
  - Ignores the political economy of housing regulation, unlike Parkhomenko (2020) or Bunten (2017)

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  2. *Average* landlord sees their land values rise by 5%.
     However, strongly regulated neighborhoods lose substantially, and this is driven entirely by endogenous amenities.

- The endogenous supply of amenities account for approximately *half* of these gains to households of *all* income groups.
  - Inuition: Many high income households live *outside* of neighborhoods with large lots in the data.
  - They *benefit* from the movement of low income households after deregulation!

Preliminary Results: Urban Structure

- Counterfactual equilibrium hints at the importance of within *and* across city sorting for welfare
- Across cities: Hsieh and Moretti (2019) style productivity gains are completely nullified by the weakening of income sorting into expensive cities.
- Within cities: a weakening of negative income sorting into the high density neighborhoods of expensive cities.
    - *Gentrification accelerates*, and the affluent households who locate in these neighborhoods benefit from it.

Estimation

- Housing regulation is hard to measure, but recent advances...
  - Song (2021) shows that a structural break detection algorithm works well for minimum lot sizes
  - I adapt a variation of this procedure using assessment data
- Endogenous amenities $\implies$ key identification challenge
  - Employ a lot-level "donut design" following Kulka (2019), Anagol et al. (2021), and originally Bayer et al. (2007)
  - Use terrain slopes as an IV
  - This still needs to be completed
  - For this draft I use an identification strategy from my previous presentation

Literature

- Macroeconomics of housing regulation (Hsieh and Moretti, 2019) (Duranton and Puga, 2019) (Parkhomenko, 2020) (Bunten, 2017) (Herkenhoff et al., 2018) (Ganong and Shoag, 2017) (Gyourko et al., 2013)
- Lot Size/Unit density regulation (Kulka, 2019) (Song, 2021) (Kulka et al., 2022) (Zabel and Dalton, 2011) (Gyourko et al., 2021) (Grieson and White, 1981) (Gyourko and Voith, 1997) (Davidoff et al., 2022)
- Housing Regulation + Supply + Affordability (Baum-Snow and Han, 2021) (Saiz, 2010) (Asquith et al., 2021) (Mast, 2020) (Albouy et al., 2016) (Bertaud and Brueckner, 2005) (Mills, 2005) (Brueckner and Singh, 2020) (Brueckner et al., 2017) (Acosta, 2021) (Martynov, 2022) (Turner et al., 2014) (Gyourko and Molloy, 2015) Anagol et al. (2021)
- Urban spatial sorting (Diamond, 2016) (Couture and Handbury, 2020) (Su, 2022) (Baum-Snow and Hartley, 2020) (Couture et al., 2019) (Amalgro and Dominguez-Iino, 2021) (Brueckner et al., 1999) (Glaeser et al., 2008) (Brueckner and Rosenthal, 2009) Lee and Lin (2017)
- Inequality in cities (Baum-Snow and Pavan, 2013) (Eeckhout et al., 2014) (Fogli and Guerrieri, 2019)
- Exclusionary Zoning (Hamilton, 1975) (Calabrese et al., 2007) (Fernandez and Rogerson, 1997) (Calabrese et al., 2011) (Barseghyan and Coate, 2016) (Brueckner, 2021)

Motivating Evidence

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- log Average income is demeaned by MSA to control for fixed effects.

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Counterfactual

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- Model yields a simple statistic $\mathbb{I}^{\star}(i)$: *the cost to rent structure on a lot at the minimum size* in block group i.

$$\mathbb{I}^{\star}(i) = V(i)l(i) \tag{1}$$

  - Assuming we observe the minimum lot size $l(i)$ (in acres) and value of housing per acre $V(i)$

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- Constructed from most recent assessment data as of 2015

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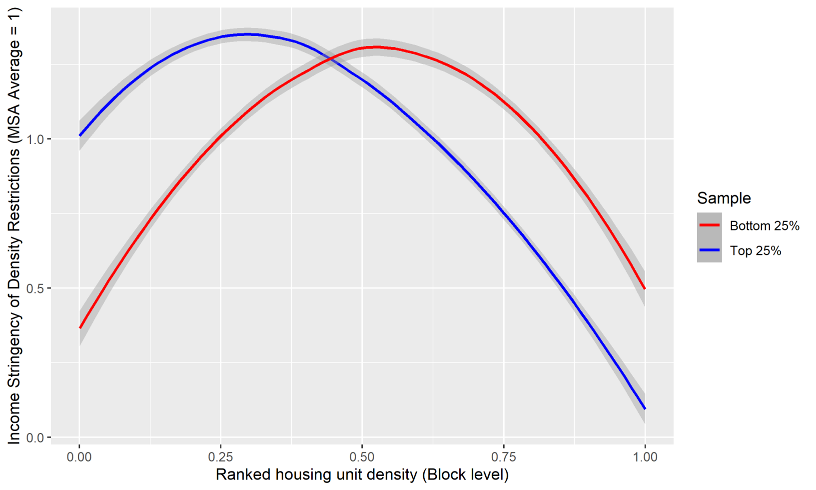

Model

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- Each block group i has land $T_R(i)$ available for residential development.

Developer's Problem

- Start with a standard Cobb-Douglas production function for housing, yielding housing supply per unit of land

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- Define: $\mathbb{I}^{\star}(i) := P(i) A^{\star}(i)$, which is increasing in $P(i)$ and $l(i)$

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$$\max_{A,g} A^{\beta} g^{1-\beta} \tag{4}$$

subject to $P(i)A \geq \mathbb{I}^{\star}(i)$ and $P(i)A + g \leq w_s(i)f$.

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- Let z index both education and units of labour, and let $V(i,z)$ be the indirect utility associated with this problem.
- Features *income sorting*: $\frac{\partial}{\partial f}\left[-\frac{\partial V(i,z)}{\partial \mathbb{I}^{\star}(i)}\right] \leq 0$

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and

$$\boldsymbol{W}(z) = \log\left[\sum_{c \in C} e^{\theta(z)W(c,z)}\right]$$

Endogenous Amenities

- Let $\tau(i)$ be the commuting time in i. I allow amenity values $b(i, z)$ to respond to neighborhood income per capita via the equation:

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  2. Local, congested public good financed through property taxes (Calabrese et al., 2007) (Calabrese et al., 2011)

Calibration + Identification

Measuring Minimum Lot Sizes

- Follows a structural break algorithm in Song (2021).
  - Idea: Zoning variances are present, but rare
  - Implies "bunching" of lot sizes around the minimum, which can be fit with a discontinuous CDF

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  - Problem: Need sufficient amount of data within "zoning districts" to rule out *spurious discontinuities*
- How would one construct these "Zoning Districts"?
  - Clustering algorithm of Chavent et al. (2018)
  - Cluster on shares of single family/multifamily homes + modes and quartiles of their lot size distributions; commercial and vacant land shares
  - allows one to weigh the importance of geographic proximity in assigning clusters
- Clusters approx. 174,000 block groups into 20,000 Zoning Districts Zoning Districts

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- Additional cleaning:
  - Remove regulation if 35% of lots below measured minimum
  - Remove regulation if the implied number of housing units at the measured lot size exceeds measure of residential land use $T_R(i)$
  - Top-coding at 5 acres (only 400 block groups are changed)

Measurements

Prices, Wages, and Other Parameters

- Prices $P(i)$
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  - Rescale $\theta(z)$ and $\rho(z)$ to match migration elasticity estimates from Hornbeck and Moretti (2018) across cities and Herzog (2022) within cities.

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  - $b(i, z)$ chosen to rationalize $L(i, z)$ after appropriate choice of support of Z.

Estimating Ω

- Recall the estimating equation:

$$\log\left[b(i,z)\right] = -\kappa\tau(i) + \color{red}{\Omega}\log\left[AverageIncome(i)\right] + \epsilon(i,z)$$

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- Identification challenged by a *simultaneity bias* analogous to Diamond (2016) or Lee and Lin (2017).
  - Reverse Causality – unobserved neighborhood demand shocks $\epsilon(i,z)$ exacerbate income sorting
- Sloped terrain does well at *predicting* income per capita (Saiz, 2010)
  - One problem: they enter directly into the demand for neighborhoods.

Estimating Ω

- Propose a "donut" style instrument (Bayer et al., 2007)
  - For some house h, use the slopes of houses within some distance d from the lot as an instrument for income per capita of neighbors
  - *This is after controlling for slopes very close to the lot of house h.*
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- For this draft: $\hat{\Omega} = 2.65$ estimated using a tract-level strategy

Counterfactual Results

The sources of welfare gains

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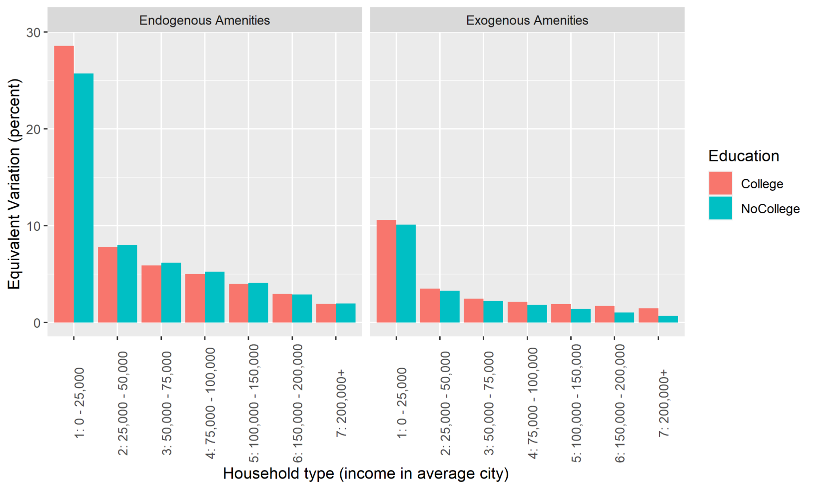
The sources of welfare gains

- Focus on a simple counterfactual – setting $l(i) = 0$ in all neighborhoods.
- 4 channels in which deregulation affects welfare:
    1. Households can purchase smaller lots below (binding) minimum lot size
    2. Gains from the expansion of productive cities (Hsieh and Moretti, 2019)
    3. Correcting inefficiencies caused by altering urban structure, such as inefficient sprawl or density (Bertaud and Brueckner, 2005)
    4. Endogenous amenities

Welfare By Household Type



Framework?

No Labour Productivity Gains

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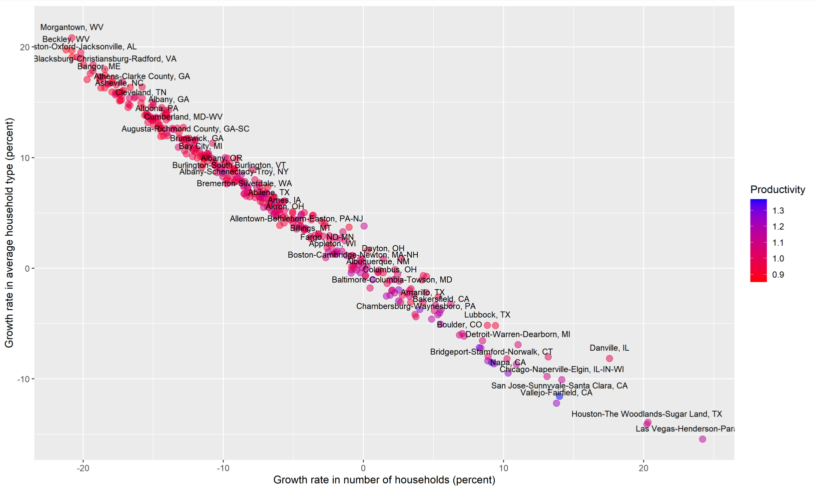

The y axis is defined as the change in the average income that a household could earn in an average city. Productivity is defined as the average of the college and non-college wages per unit of labor. Correlation between growth rate in the number of households and productivity is approximately 0.55.

Welfare of Landlords in previously regulated neighborhoods

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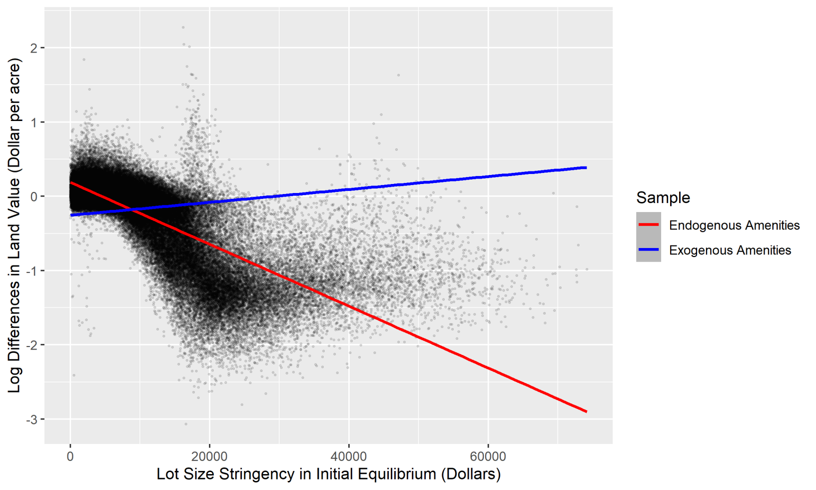
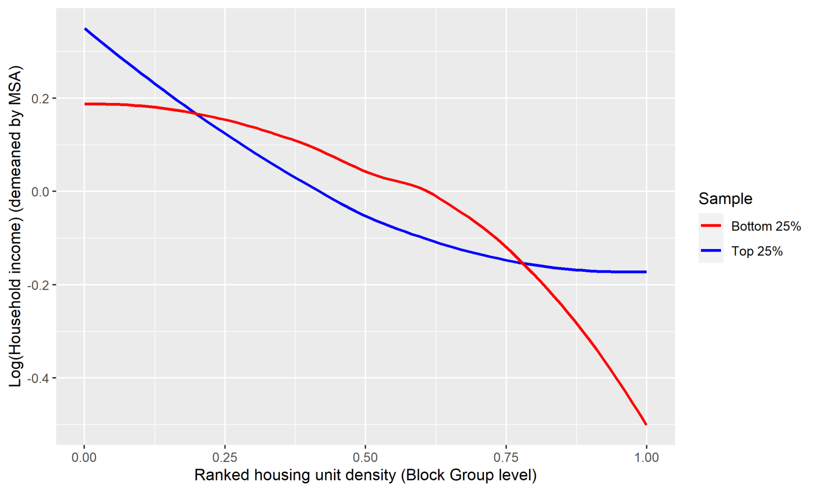


- Note: x axis is just the $\mathbb{I}^{\star}(i)$ in the model.

Counterfactual income gradients



Return

Conclusion

- I show that minimum lot sizes have important implications for the macroeconomics of housing regulation
  - Build and calibrate a structural GE model emphasizing both within and across city mobility
  - and this mobility shapes the pattern of neighborhood amenities
- I find substantial welfare gains of deregulation for renters across all income groups
- . . . and large losses accruing only to landowners in regulated neighborhoods
  - corroborating reduced form evidence
- The welfare gains appear to operate because of movement *within* cities
  - But residential segregation may (ironically) increase

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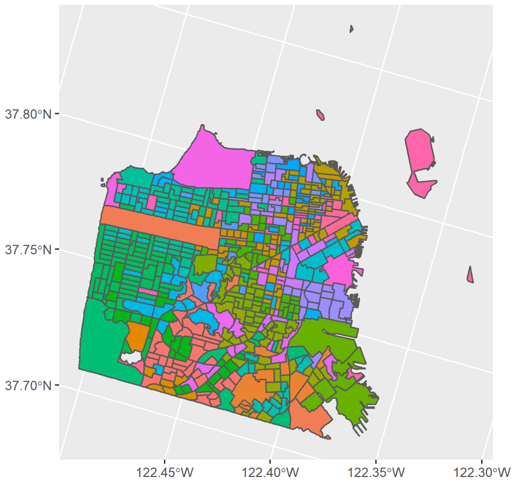
Appendix

Appendix: Zoning Districts



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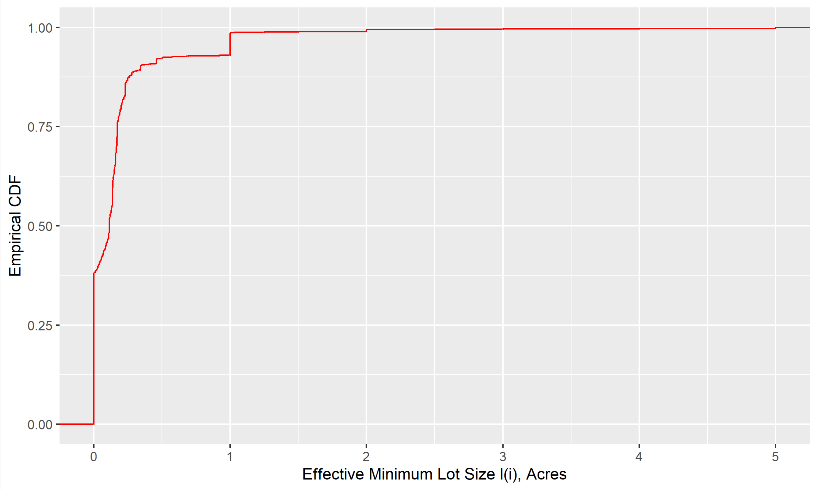
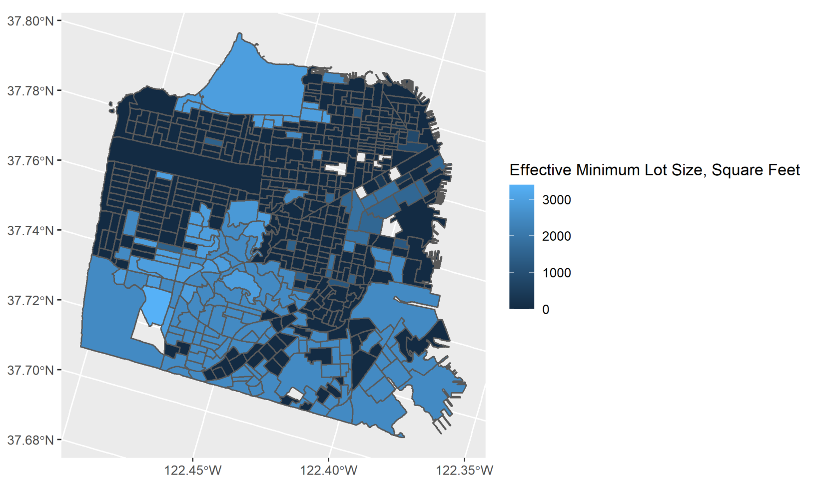
Appendix: Minimum Lot Sizes



Appendix: Minimum Lot Sizes



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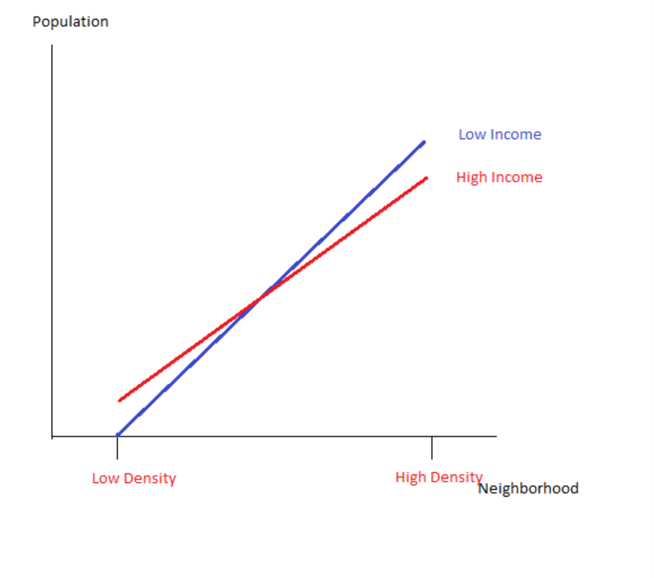
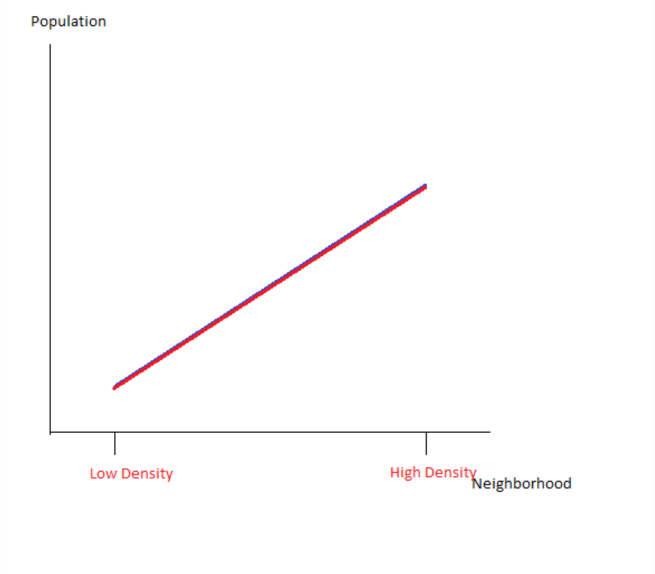
A framework for why income segregation intensifies



A framework for why income segregation intensifies



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