Computational
Social Science

Social Segregation, Misperceptions, and Emergent Cyclical Voting Patterns
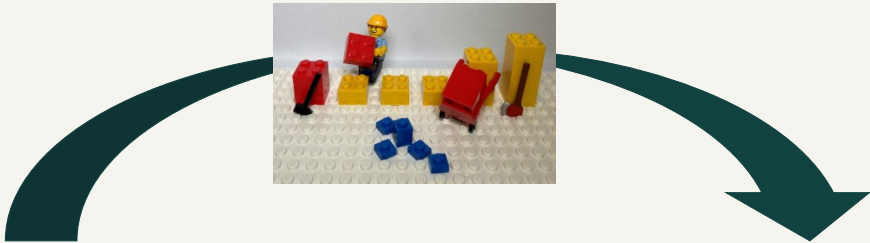
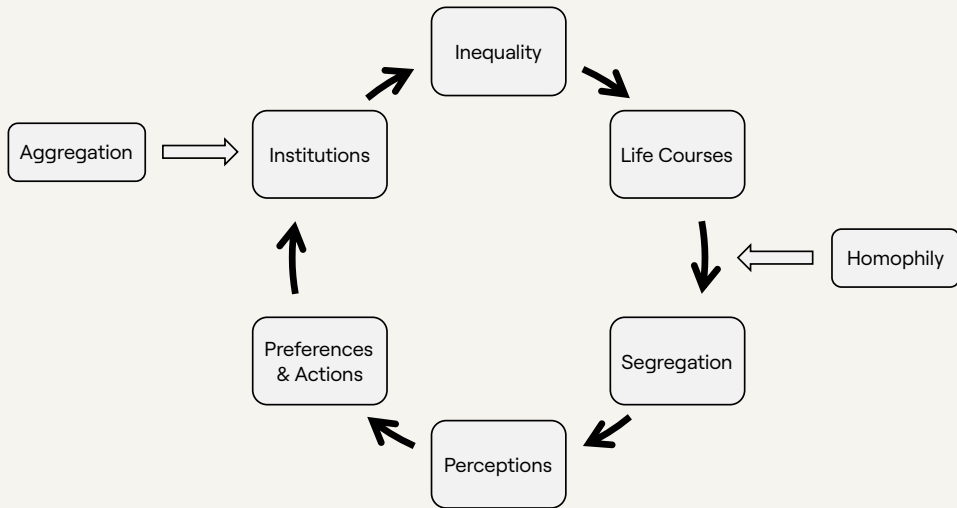**D.M. Mayerhoffer**, J. Schulz

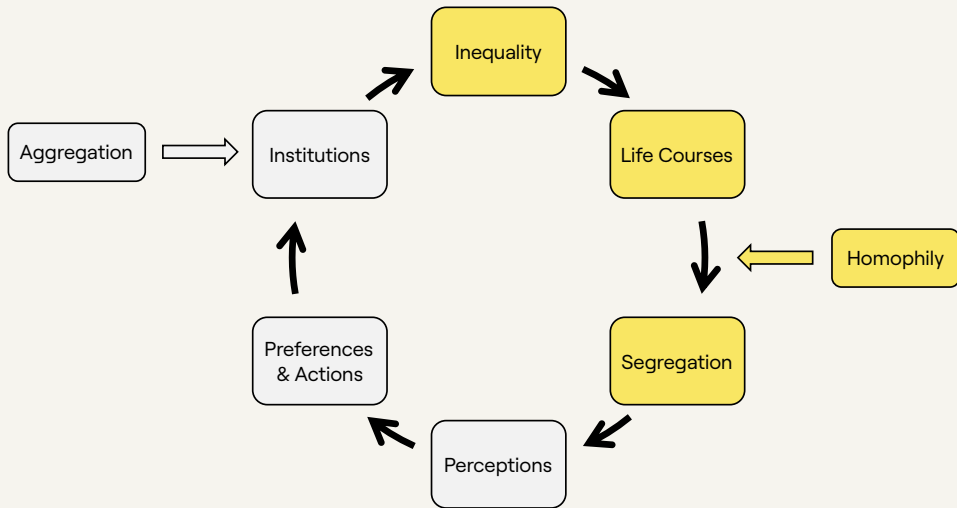JT Keynes Gesellschaft 2024

UNIVERSITY OF AMSTERDAM

Motivation

The Nexus of (Income) Inequality, Its Perception, and Perpetuation

The Nexus of (Income) Inequality, Its Perception, and Perpetuation

Homophilic Network Formation

Focus: Labour Income

Exponential income distribution

Random Geometric Graph (RGG) Type of Network ▸ Example

Preferential attachment procedure applied to a node property other than degree
$\Rightarrow \rho$ setting the strength of the attachment

- ▶ Nodes choose their link-neighbours.
    - $\Rightarrow$ Homophily in income (McPherson, 2001; Talaga and Nowak, 2020)

- ▶ 5 links, i.e., closest layer of interaction (Mac Carron et al. 2016)

- ▶ Weight in choice inversely related to the distance in their defining characteristic (i.e., income):
  $(\text{Exp}[\rho \cdot |Y_i - Y_j|])^{-1}$ with $\rho \in \mathbb{R}_0^+$ as homophily strength

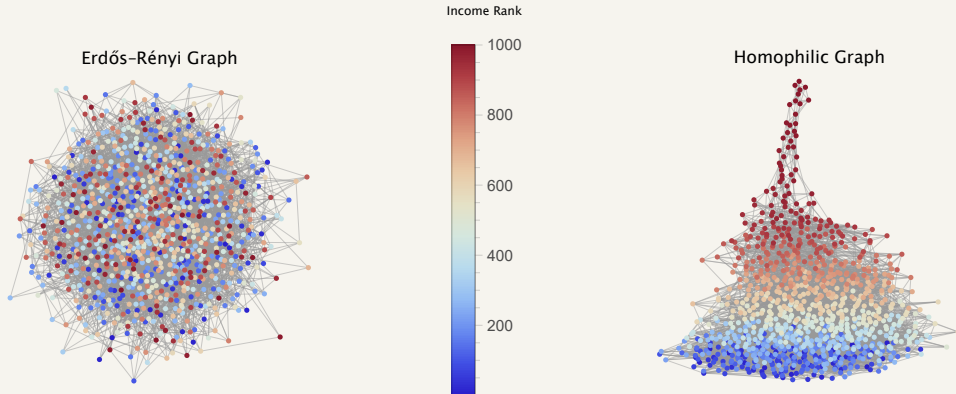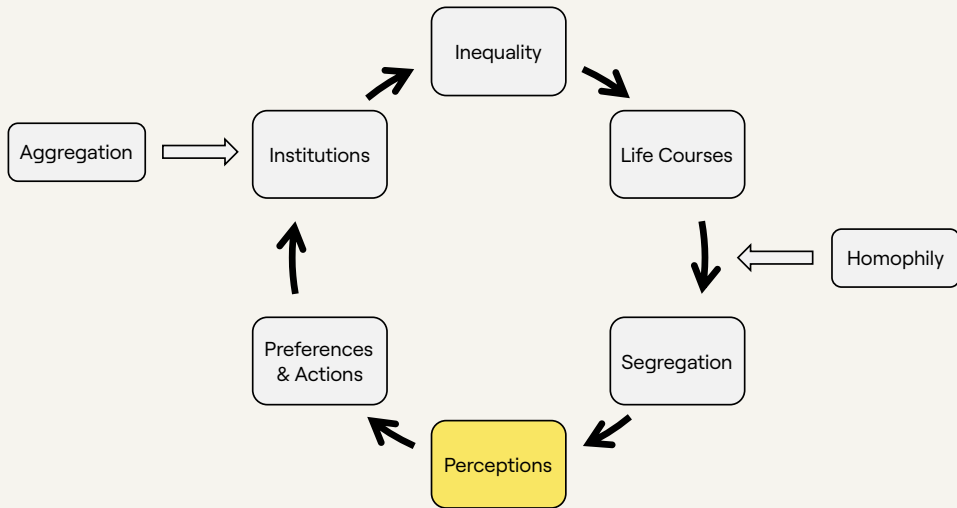# Outcome of Homophily: Connected but Segregated Graph

Figure: Graph resulting from homophilic linkage (compared to ER network). The network is
▸ highly segregated and exhibits ▸ (Weak) Small Worldiness . Most ego networks are symmetric in income
ranks (▸ Linkage PDF).

The Nexus of (Income) Inequality, Its Perception, and Perpetuation

Localised But Otherwise Correct Perception
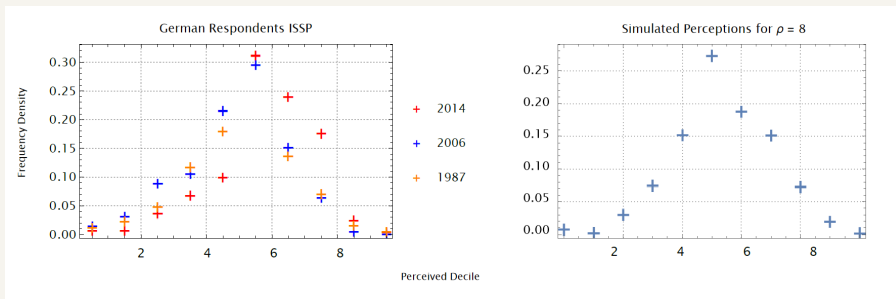
Everybody in the Middle Class?

Figure: The figure shows self-perceptions of income deciles from a survey for German respondents in the International Social Survey Program (left panel) and as simulation outcomes in the right panel for $\rho = 8$. The middle-class bias that emerges in the simulation baseline model of Schulz et al. (2022) closely mimics the empirical middle-class bias that empirical surveys consistently demonstrate.

The Nexus of (Income) Inequality, Its Perception, and Perpetuation
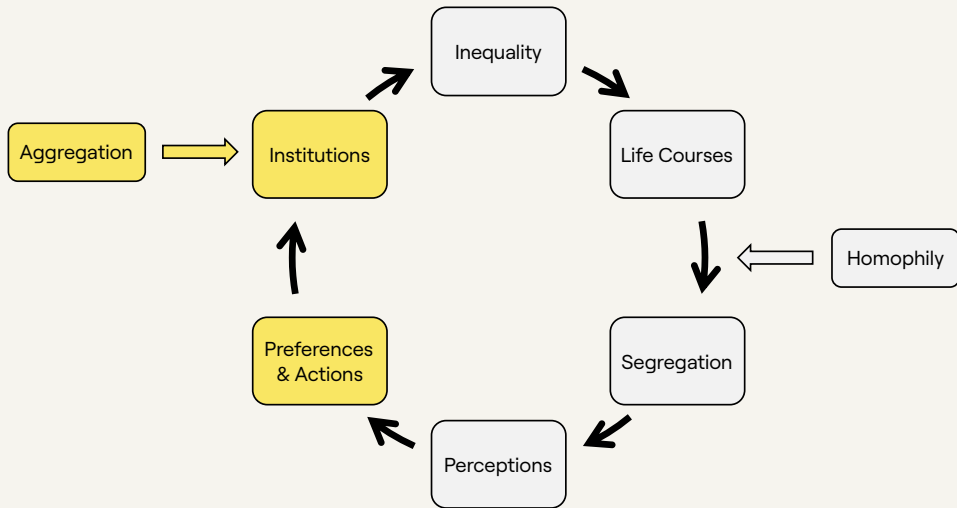
Taxable Income and Tax Efficiency

- ▶ Y is total income before taxes
- ▶ Tax base decreases with taxation according to constant elasticity of taxable income ϵ with respect to the net of tax rate $(1 - t)$
  - $\Rightarrow$ Microfoundations from a labour-leisure trade-off with isoelastic utility
- ▶ Lump sum transfer to all individuals with rate t is therefore

$$T = (1/N) \cdot t \cdot (1 - t)^{\epsilon} Y \text{ or}$$
$$= t \cdot (1 - t)^{\epsilon} \bar{y},$$

with $\bar{y}$ as the mean pre-tax income.
  - $\Rightarrow$ Gives rise to a Laffer curve as model closure.
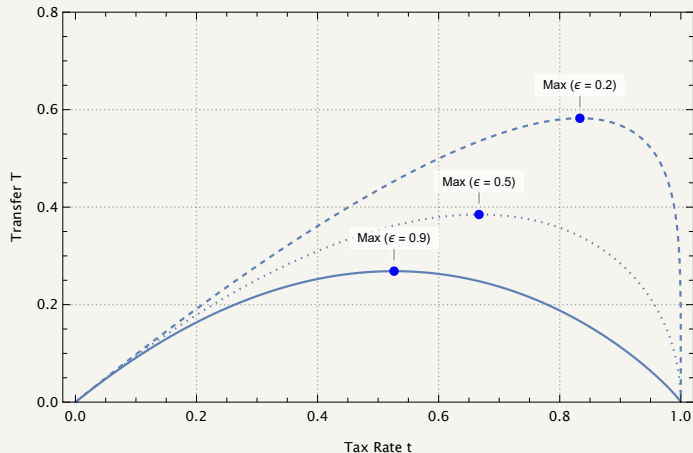
Laffer Curves for Different ϵ

Figure: Laffer curves for different degrees of tax inefficiency with respective maximum revenue points.

Voting Decisions

Individual Voting Decision of Agent i:

$$V_i = \begin{cases} 1 & \text{if } t \cdot (1-t)^\epsilon \cdot \bar{y}_i > t \cdot y_i \\ 0 & \text{if } t \cdot (1-t)^\epsilon \cdot \bar{y}_i = t \cdot y_i \\ -1 & \text{if } t \cdot (1-t)^\epsilon \cdot \bar{y}_i < t \cdot y_i \end{cases}$$

Agents form beliefs about the mean income $\bar{y}_i$ according to

$$\hat{y}_i = a \cdot \bar{y} + (1-a)l_i,$$

with $\bar{y}$ as the true mean income, l_i as the locally perceived mean income and $0 \leq a \leq 1$ as the weight on the true, global mean income.
The tax rate $0 < t < 1$ has a majority, if $V > 0$:

$$V(t, \epsilon, a, \bar{y}, \vec{l}, \vec{y}) = \sum_{i=1}^{N} V_i = \sum_{i=1}^{N} \textbf{sign}[t \cdot (1-t)^\epsilon \cdot \hat{y}_i - t \cdot y_i]$$
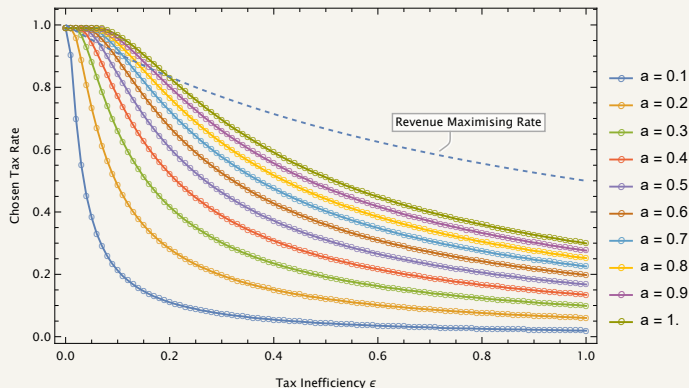
Initial Bias and Redistribution

Figure: Implemented tax rates for different weights for the global signal a $\in [0; 1]$ and for varying the elasticity of taxable income $\epsilon \in [0, 1]$. Homophily level kept constant at $\rho = 8$. Increasing the weight of the global signal and improving the accuracy of perceptions unanimously increases (implemented) redistribution since agents then expect higher transfers on average.
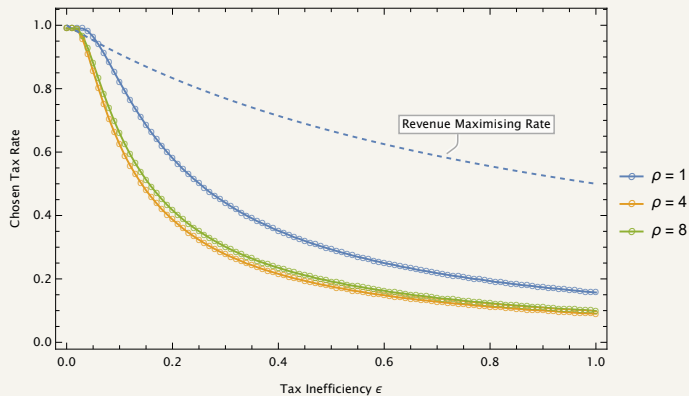
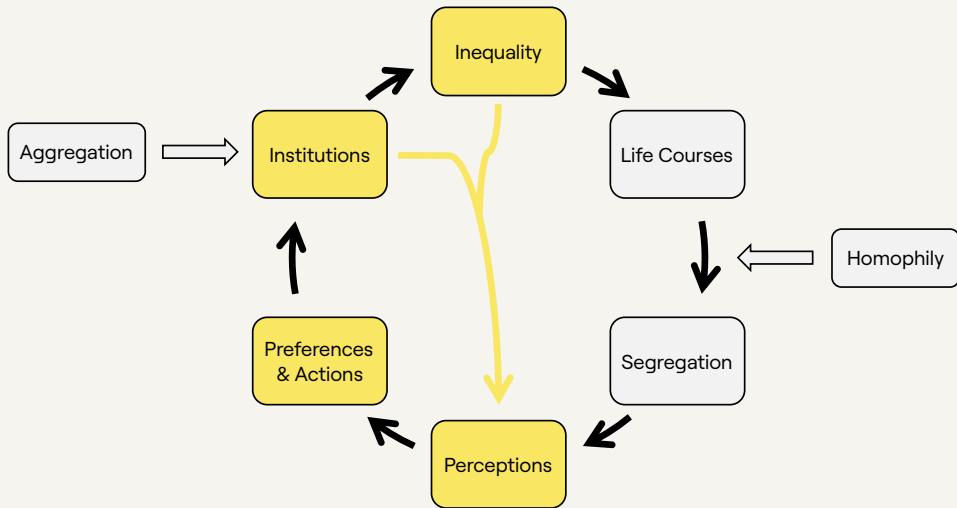# Segregation and Redistribution

Figure: Implemented tax rates for varying the elasticity of taxable income $\epsilon \in [0, 1]$. Weight of the global signals is kept constant at $a = 0.3$, homophily strength varies in the range $\rho \in \{1; 4; 8\}$. Increasing network segregation decreases (implemented) redistribution.

The Nexus of (Income) Inequality, Its Perception, and Perpetuation

Adaptive Expectation and Dynamic Voting

Agents form adaptive expectations about taxation efficiency at time τ

$$\epsilon_{i,\tau}^{e} = \epsilon_{i,\tau-1}^{e} + \lambda(\epsilon_{i,\tau-1} - \epsilon_{i,\tau-1}^{e}),$$

with λ as the error correction parameter and with $\lambda = 1$ implying naive expectations, i.e., $\epsilon_{i,\tau}^{e} = \epsilon_{i,\tau-1}$.

These beliefs can be expressed as a function of the realized previous-period transfer $T_{\tau-1}$ by

$$\epsilon_{i,\tau}^{e} = \lambda \cdot \frac{\log\left(\frac{t_{\tau-1}y_i + T_{t-1}}{t_{\tau-1}(a \cdot \bar{y} + (1-a)l_i)}\right)}{\log(1 - t_{\tau-1})} + (1-\lambda) \cdot \epsilon_{i,\tau-1}^{e}$$

Endogenous Opinion Polarisation
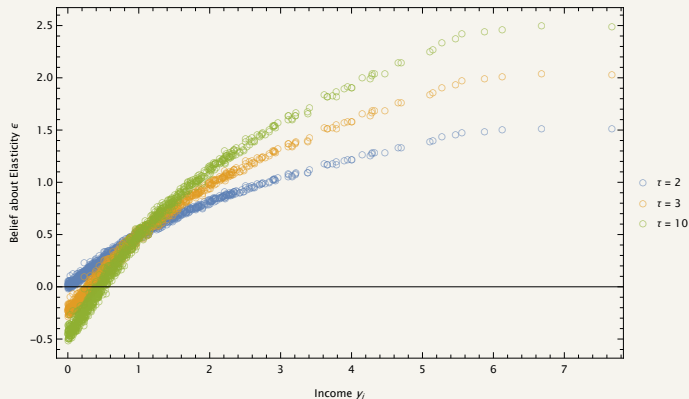

Figure: Agents' beliefs about the elasticity of taxable income ϵ against their pre-tax incomes y_i for $\rho = 8$, $a = 0.5$, $\lambda = 0.25$ and the true $\epsilon = 0.5$. Beliefs are polarized, with poorer agents exhibiting higher trust in tax efficiency. Opinion polarization grows, as is immediately visible by the belief schedules growing steeper through time.

Figure: Chosen tax rates for the dynamical updating process with different error-adjustment parameters $\lambda \in \{0.25; 0.5; 0.75; 1\}$. Simulations for $a = 0.5$, $\rho = 8$ and a true $\epsilon = 0.5$.

Figure: Chosen tax rates for the dynamical updating process with different error-adjustment parameters $\lambda \in \{0.25; 0.5; 0.75; 1\}$. All simulations are conducted for a $= 0.25$, $\rho = 8$ and a true $\epsilon = 0.5$.

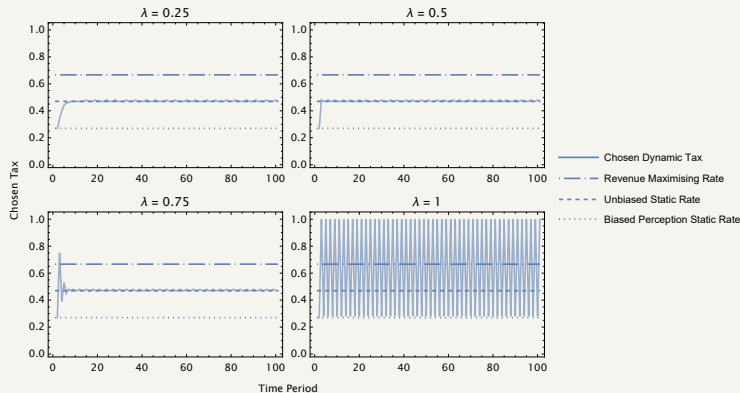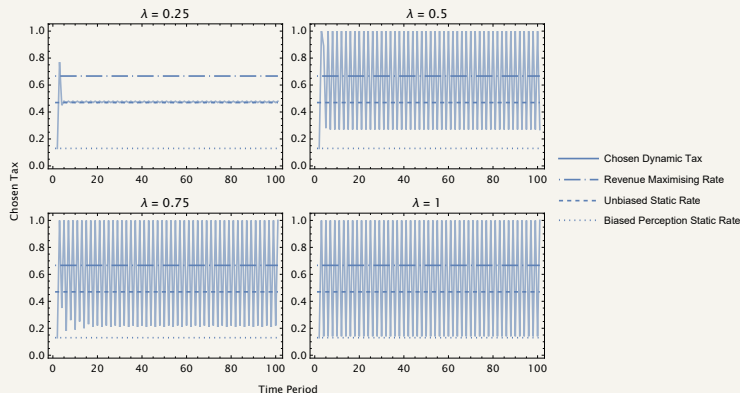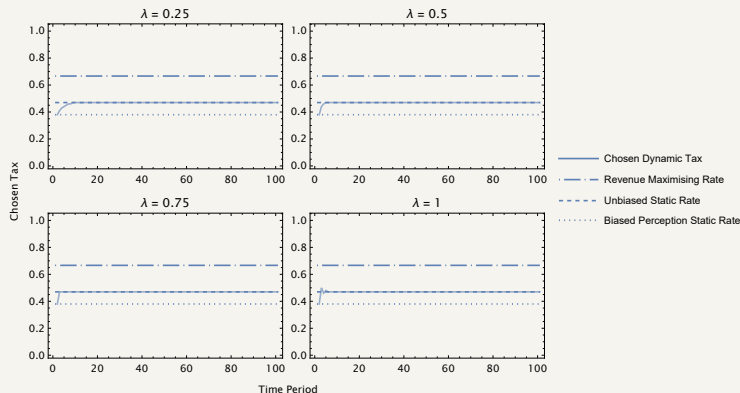# Almost Instantaneous Convergence for Low Initial Bias

Figure: Chosen tax rates for the dynamical updating process with different error-adjustment parameters $\lambda \in \{0.25; 0.5; 0.75; 1\}$. All simulations are conducted for $a = 0.75$, $\rho = 8$ and a true $\epsilon = 0.5$.

Discussion

Main Findings

- ▶ Simulation results and empirical preferences consistent with individual perceptions consisting of a localised component and a global signal.
- ▶ Distortion of localised perception because of individuals typically occupying a middle income rank in their ego network
  - $\Rightarrow$ No appreciation of own benefit from tax.

Implications

- ▶ Account for lack of connection between actual inequality and redistribution preferences
- ▶ Potential countermeasures:
  - a) Promote knowledge about actual mean income
  - b) Counteract segregation of social contacts

Other Current and Possible Subprojects

Baseline Model of Inequality Perception (SN 70)

Perceptions of intergroup wage-gaps (ANS 7 (32))

Importance of global signal and lived experience

- ▶ Perception of intersectionality (wip)

Homophily, inequality and expenditure cascades (RBE 10(3))

- ▶ Focus on functional distribution and distribution-growth nexus (accepted for ROPE)
- ▶ Consumption emulation in a SFC model with explicit financial sector (wip)

Empirical data (in preparation)

- ▶ Homophily and perception in the POPNET data
- ▶ Studies into inequality perception patterns (planned)

Save the Date!

Spring School on Perceptions of Wealth Inequality, **March 17 - 28, 2025**, Bamberg (with Daria Tisch, MPIfG Cologne and Jan Schulz, Uni Bamberg)

- ▶ Research incubator with associated special issue in Historical Social Research
- ▶ 7 experts from economics, sociology, history, political science and communication studies
- ▶ Travel and accomodation costs fully covered thanks to generous funding by the Volkswagen Foundation

Thanks for Your Attention! Looking Forward to Your Questions!

https://www.uni-bamberg.de/fileadmin/uni/fakultaeten/sowi_faecher/vwl/BERG/BERG_188.pdf

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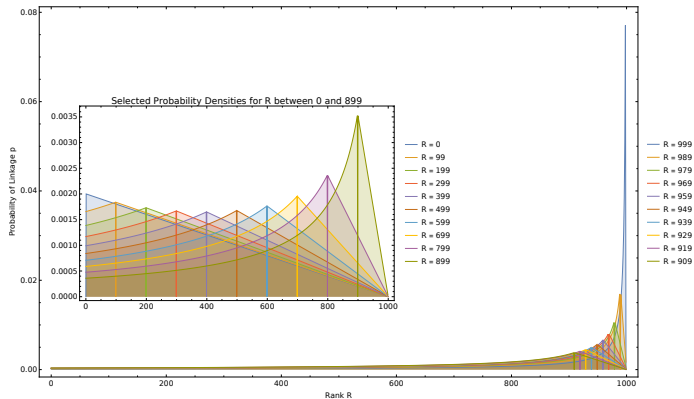
Appendix: Linkage PDF I

Figure: Theoretical PDF of Linkage Probabilities for Ranks
R and $\rho = 1$.

Note: The figure plots the Probability Density Functions (PDFs) of a node with a given income rank
for linkage with another node for the whole support of income ranks.
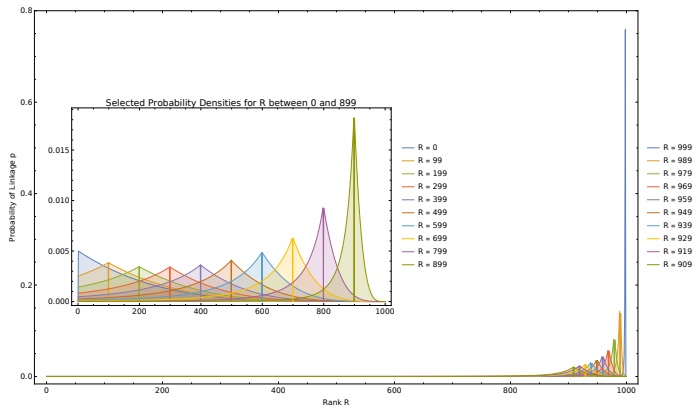
Appendix: Linkage PDF II

Figure: Theoretical PDF of Linkage Probabilities for Ranks
R and $\rho = 4$.

Note: The figure plots the Probability Density Functions (PDFs) of a node with a given income rank
for linkage with another node for the whole support of income ranks.

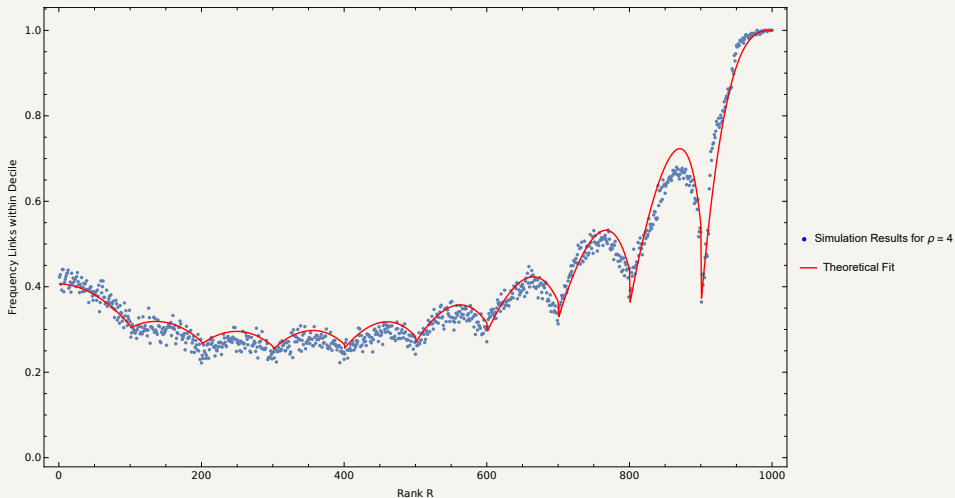# Appendix: Network Segregation by Income

Figure: Links to nodes within the own decile as a function of income rank. Relationship is strongly