# Redistribution, Social Segregation and Voting Information

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**Abstract**

This paper examines the puzzle of why economic inequality has not resulted in political countermeasures to mitigate it, and proposes that the reason is due to misperceptions of economic inequality caused by segregation in social networks. We model taxation and voting behavior with an exponential income distribution and a Random Geometric Graph-type model to represent homophily, which leads to people perceiving their own income rank and income to be close to the middle. We find that people base their beliefs about mean income on a weighted sum of the true mean and their local perception in the network, and that higher homophily causes lower implemented tax rates, which explains why redistribution preferences appear decoupled from actual inequality. We suggest two measures to counteract this: educating people about the actual income distribution and promoting diversity to reduce homophily.

**Keywords**

Inequality, redistribution, perception, bias, networks

## 1. Introduction

The literature on political economy has long been puzzled by the fact that, in many countries around the world, massive increases in economic inequality have not prompted widespread calls for redistribution [1].

As a factor contributing to this puzzle, we propose misperceptions of economic inequality, caused by segregation along socioeconomic lines. Namely, an individual's perceptions of inequality is shaped by the people they interact with on a regular basis, which leads to a bias in their perceptions of how unequal the society is as a whole. To test this hypothesis, we develop a model of taxation and voting behaviour that represents the empirically observed homophily, i.e., the tendency of people to form links with those who have similar income levels as themselves, in a Random Geometric Graph-type network. It simulates agents' perceptions of inequality based on their social network and analyses the relationship between social networks, inequality perceptions, individual preferences for redistribution, and their aggregation.

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## 2. Background

Pre-tax wage distributions empirically follow an exponential distribution[2, 3, 4]. We use this robust stylised fact to initialise our agents' pre-tax wages. This is not only empirically sensible, it is also an analytically convenient assumption, since it renders the income distribution with the mean fixed to unity parameter-free.

Regarding the redistribution mechanism, we broadly follow the canonical Meltzer-Richard (MR) model that features endogenous labour-leisure choices with taxation on wages disincentivising work [5]. For the whole range of tax rates, this might give rise to a taxation Laffer curve, i.e., tax revenues being 0 at a linear tax rate of $t = 0$ and $t = 1$, while featuring at least one revenue-maximising rate. [1]

The MR framework assumes perfectly informed voters and predicts taxation to rise with pre-tax inequality, i.e., the median-to-mean ratio. We allow for deviations from the perfect information case and misperceptions, especially regarding the societal mean income. Our model nests the MR result as a special case of reliance on global information alone.

These ego networks are explicitly modelled to capture the salient stylised facts about misperceptions of income inequality [7, 8]. In particular, we assume that agents only interact with a rather small subset of the population (which the empirical literature on so-called Dunbar's numbers [9] suggests to be about five close contacts) and within groups that are homogeneous in income, as predicted by the pronounced income homophily of empirical social networks [10].

## 3. Model

This is a short, non-technical overview. See [11] for the model and a detailed description.

**Population, income distribution, and tax regime** We observe a population of $1,000$ agents[2] that represents individual wage-earners. Agents are identical in all respects (including the weight for network formation and sensing introduced below), except for their income. Pre-tax wage incomes are initialised from an exponential distribution, normalised to $\lambda = 1$.

We model taxation as all taxpayers paying taxes on wages at a linear rate $t$ equal for all agents, irrespective of income. However, the transfer out of taxes $T$ is no fixed proportion of the mean pre-tax income as the tax base decreases in the tax rate, with constant elasticity $\epsilon \in [0, 1]$:

$$T(t, \bar{y}; \epsilon) = t \cdot (1 - t)^{\epsilon} \, \bar{y} \tag{1}$$

The resulting revenue is then equally split amongst all agents, implying the following difference between pre-tax and post-tax income for each agent $i$:

$$\Delta y_i = -t \cdot y_i + t \cdot (1 - t)^{\epsilon} \cdot \bar{y} \tag{2}$$

[1] This mechanism of deteriorating tax bases is necessary to avoid a situation where a 100 % tax rate emerges out of the empirically skewed income distributions or the empirically unlikely case of "slavery of the rich" [6].

[2] See [7] and the model implementation for a sensitivity analysis. This shows that the results of the network formation are robust also for larger population sizes and ego-networks, and identifies the relevant range of homophily levels.

This trivially implies a threshold income $y^* = (1-t)^\epsilon \, \bar{y}$ distinguishing agents with a net benefit from the tax ($y_i < y^*$) from those with a net loss ($y_i > y^*$). $y^*$ equals the mean pre-tax income for $\epsilon = 0$, and shrinks in $\epsilon$ and in $t$ for $\epsilon > 0$. As a corollary on the macro-level, taxation always decreases wage inequality.

**Income homophily in a Random Geometric Graph-type network** Links in the model represent mutual knowledge of pre-tax income and are thus unweighted and undirected. As argued in Section 2, this mutual knowledge of incomes empirically exists for an agent's closest layer of interaction that is relatively homogenous in income. To account for the underlying income homophily, we employ the Random Geometric Graph-type linking procedure introduced by [7]: Each agent $i$ draws five link-neighbours, based on weights for a potential drawee $j$ as inversely exponentially related to the distance in pre-tax income ($y$) between $i$ and $j$. The homophily strength parameter $\rho$ determines the intensity of this relation: A value of 0 for $\rho$ means a random network, while rising $\rho$ means that agents with large income distances become very unlikely to be linked due to the exponential nature of the weight given by $w_{ij} = 1/\exp[\rho \, |y_j - y_i|]$. [7] prove analytically that people tend to find themselves having the median income in their ego network in line with empirical studies finding a 'middle-class bias'.

**Localised individual perceptions and voting behaviour on tax regime** For decisions on whether to accept any given tax rate $t$, we assume purely selfish motivations of agents, i.e., they accept any tax rate from which they expect a net gain for themselves. Furthermore, agents exhibit perfect, unbiased information processing and possess identical expectations about the elasticity $\epsilon$. However, agents' sensing is imperfect. Namely, their perception of the mean income is a compound of the actual global mean $\bar{y}$ and the mean income in their ego-network $l_i$. Consequently, the threshold income determining whether an agent expects net gains or losses from a tax rate is now individualised:

$$y_i^*(t) = (1-t)^\epsilon \cdot [a \cdot \bar{y} + (1-a) \cdot l_i] \tag{3}$$

The weight parameter $a \in [0, 1]$ is identical for all agents; $a = 1$ equals perfect information, and $a = 0$ means that agents only rely on what they observe in their ego network. If $l_i < \bar{y}$, the agent does not accept some tax rates giving them a net gain; vice versa, they accept some tax rates meaning a net loss if $l_i < \bar{y}$. To then aggregate individual preferences, we simply simulate the highest tax rate that a majority of agents would accept.

## 4. Results

**Simulation mode and validation** To ensure internal validity, we simulate 100 Monte Carlo runs for each parameter combination and report aggregates of or distributions across them. The homophilic linkage mechanism as the central force in our model is also externally valid since it can reproduce the stylised empirical perception patterns of income inequality in general [7] and of wage-gaps [8]. Furthermore, it also features a middle-class bias [7] because agents tend to occupy the median income rank in their ego network. We will utilise this latter fact below.

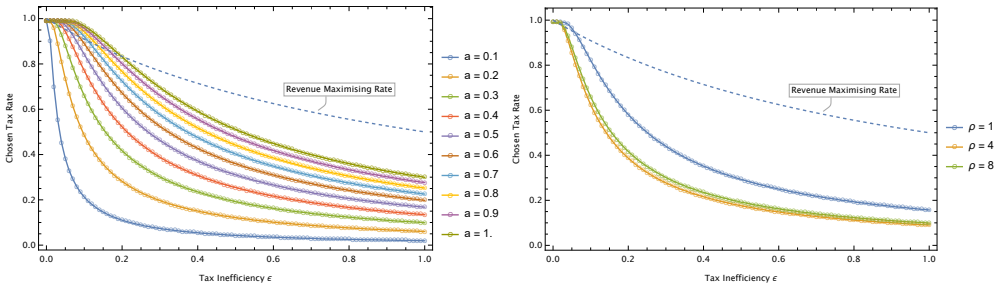


**Figure 1:** The two panels show the implemented tax rates for various parameter constellations and for varying the elasticity of taxable income $\epsilon \in [0, 1]$. The left panel holds the homophily level constant at $\rho = 8$ and varies $a \in [0; 1]$. The right panel holds the weight of the global signal constant at $a = 0.3$ and varies the homophily strength in $\rho \in \{1; 4; 8\}$.

**Acceptance of tax rates depending on weight of global signal** The left panel of Figure 1 shows the highest accepted tax rate given level of tax inefficiency and weight attributed to the globally correct mean income, as opposed to their localised perception. The plot line for $a = 1$ is a benchmark for perfect sensing and an indicator of the highest tax rate that yields a net benefit for a majority of agents. Yet, many agents do not perceive their benefit from redistribution since the mean income in their ego networks is lower than the global mean. Thus, the accepted tax rate decreases the higher the weight put on the localised perception (i.e., the lower $a$). [3]

**Homophily and segregation as bias-increasing factors** The underestimation of one's own benefit from redistribution becomes more pronounced the higher the homophily level $\rho$, as the right panel of Figure 1 highlights. As a corollary of the linkage procedure and the underlying income distribution, agents tend to occupy the median income in their ego network, and the median tends to be lower than the mean. Yet, the higher $\rho$, and consequently the segregation of ego networks, the smaller this difference between local mean and median grows - and the more severely agents underestimate their personal gain from redistribution. There is almost no change in redistribution preference for extreme levels of segregation ($\rho > 8$) because there the variation in incomes within an ego network shrinks but the mean remains nearly unaffected.

## 5. Discussion

The study presented a model that suggests that misperceptions of income and, consequently paradoxical voting behaviour can result from correct belief formation, given segregation in social networks. The model is based on a simplistic implementation of taxation and voting behaviour, and it uses a Random Geometric Graph-type model to represent the observed homophily. The results of the model support the hypothesis that individual perceptions of inequality are shaped by the people they interact with on a regular basis and that this leads to a bias in their perceptions

[3] That for low inefficiency levels, the highest tax rate capable of winning a majority exceeds the revenue maximising one is a feature of the exponential income distribution: The median income is considerably lower than the mean income; hence, a majority of agents still benefit from (almost) full redistribution even if there is some inefficiency.

of how unequal the society is as a whole. We also show the implications of these misperceptions on the relationship between taxation and revenue.

The results of the model support our hypothesis that misperceptions of economic inequality are caused by segregation in social networks. The high level of segregation in the network structure, coupled with the agents' bias towards assuming their own income rank and income to be close to the middle, leads to a significant underestimation of the actual level of inequality in society. This has important implications for the relationship between taxation and revenue, as optimal tax rates and revenue depend on the agents' perceptions of the overall mean income. Both educational interventions and desegregationist measures might improve perceptions and thus foster redistributive measures.

Even though our results rely on rather specific assumptions regarding the Laffer curve, income distribution, perception formation and aggregation mechanism, they provide a robust joint explanation of why perceptions are so skewed and how they might mediate the nexus between inequality and redistribution. With our model, we hope to provide a benchmark that can be extended in several ways. In particular, it could include the role of media, education, or political polarisation. Additionally, the model can be adapted to other voting and tax regimes - to examine the robustness of the results.

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