Physica A 437 (2015) 1–11

Contents lists available at ScienceDirect

Physica A

journal homepage: www.elsevier.com/locate/physa

Inequality measures perform differently in global and local assessments: An exploratory computational experiment

Yen-Sheng Chiang *

Department of Sociology, The Chinese University of Hong Kong, Hong Kong

HIGHLIGHTS

- We simulate incomes distributed in networks using the Exponential Random Graph Model.
- We compare population and network inequality using a selection of inequality measures.
- Network inequality tends to be lower than population inequality for the Gini index.
- Network inequality tends to be lower when inequality of nodal degree increases.

ARTICLE INFO

Article history:
Received 11 December 2014
Received in revised form 17 February 2015
Available online 22 May 2015

Keywords:
Inequality measures
Referent networks
Exponential Random Graph Model
Social comparison

ABSTRACT

Inequality measures are widely used in both the academia and public media to help us understand how incomes and wealth are distributed. They can be used to assess the distribution of a whole society – global inequality – as well as inequality of actors' referent networks—local inequality. How different is local inequality from global inequality? Formalizing the structure of reference groups as a network, the paper conducted a computational experiment to see how the structure of complex networks influences the difference between global and local inequality assessed by a selection of inequality measures. It was found that local inequality tends to be higher than global inequality when population size is large; network is dense and heterophilously assorted, and income distribution is less dispersed. The implications of the simulation findings are discussed.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

Economic inequality is ubiquitous in human societies. To assess the degree of inequality, econometricians developed an array of measures [1,2] and reports of inequality using the measures have been widely cited in scholarly publications as well as in public media. Statistics derived from the inequality measures help us to understand how incomes and wealth are distributed in a society.

Inequality measures can be used to assess the distribution of a whole society as well as inequality within subgroups. A subgroup can consist of actors defined by particular social identities. The income distribution among women of a country is an example. Inequality measures also can be applied to the distribution within social networks. As human activities such as the provision of social supports [3] and the transmission of information [4] are conducted in social networks, the economic inequality of a person's social networks is arguably a more informative indication of how inequality is distributed. The question is: For an income measure, is there a difference in the inequality assessed over a population versus that assessed over people's social networks?

* Tel.: +852 3943 6621.
E-mail address: chiang.ys@cuhk.edu.hk.

http://dx.doi.org/10.1016/j.physa.2015.05.026
0378-4371/© 2015 Elsevier B.V. All rights reserved.

Assessing the difference between population and subgroup/network inequality assessed by an inequality measure is by no means a trivial task. First of all, not all inequality measures are an unbiased estimate of population inequality [5,6]. Even when subgroups or networks are random samples of the population, the mean of the subgroup/network inequality would not be the same as the population inequality. What is more challenging is that, the formation of subgroup or networks is far from being random. Different kinds of mechanisms, such as homophily – comparing with similar kinds [7], and pursuits of higher social status – the so-called "frog–pond effect" [8], are determining the formation of referent groups. These factors are expected to influence the distribution of inequality within subgroups or networks.

Although empirical assessments of how incomes are distributed in social networks are difficult, limited sources of data provide evidence to the fact that incomes are far from randomly distributed in a person's social network. For example, the 2009 Canadian general social survey (on social networks) indicates that 49% of the respondents ($N = 8306$) have (household) incomes similar to *most* of their friends and only 28% of them report that their incomes are close to *a few* of their friends [9]. The survey result suggests a non-negligible degree of income homophily in social networks. Similarly, a sample of Facebook data among students of an elite university in the US show that homophily in socioeconomic status – represented by household incomes estimated from the locations (zip code) of users' original residence – is a strong determinant of friendship ties [10]. Just because incomes are not evenly distributed in social networks and thus are not equally accessed, people's estimate of the income equality of a society could be considerably deviant from reality, as was shown by the recent studies [11,12]. Experimental studies that manipulated exposure to an income distribution provide more evidence to that the perception of income inequality is influenced by the network structure that governs the vision of the distribution [13,14].

The research findings above suggest that population inequality could be different from the inequality assessed within subgroup/networks. The difference is determined not only by how the subgroup/network is constructed, but also by the property of the inequality measure selected to measure inequality. The paper conducts a simulation as a thought experiment to investigate whether an inequality measure produces a different result when it assesses the distribution of a population – global inequality versus the distribution in each actor's network – local inequality. The computational experiment allows us to systematically investigate how network topology and the choice of inequality measures influence the difference between global and local inequality—a task that is difficult to be empirically tested in the absence of reliable data where records of social networks and personal incomes are both available.

2. Background

2.1. Inequality assessed in networks

The social psychological research has long indicated that people tend to compare with particular reference groups than the whole collectivity when evaluating their economic well-being [15–17,8,7]. The fact that people are more attentive to local distribution can be attributed to cognitive and social psychological reasons. On the one hand, it is cognitively infeasible to trace each person's income status at all times in a large population. On the other hand, people prefer to compare with certain types of others, especially the similar ones, as similarity in social attributes serves as a valid criterion to judge the fairness of rewards and merits they receive [18,19].

Exactly whom we choose to compare with – the formation of reference groups – is a debate in the social sciences. Reference groups can consist of people in a person's social surrounding—those who have contacts within social networks, or can include people of a particular social category defined by attributes such as age, gender, and social class [20]. Empirical evidence for both types of reference groups are mixed [21–27,7]. Whether the formation of reference groups is contact- or category based, the relationship between an individual and his referents can be generalized as a network [20]. It is thus interesting to see how network topology influences the difference between global and local inequality assessed by an inequality measure.

2.2. Decomposability of inequality measures

The distinction between global and local inequality raised related discussions in the econometrics literature. Economists are interested in whether an inequality measure allows us to disentangle population inequality into the inequalities of its components—the issue of decomposability [28–31]. An inequality measure is decomposable if population inequality assessed by it can be expressed as a weighted-sum of inequalities within each subgroup, plus the weighted between-subgroup inequality.

Not all inequality measures are decomposable [32,1]. Accumulated efforts in the past decades have been dedicated to studying the mathematical foundations of decomposability [28,33,29,34–38]. Earlier attempts, such as Bourguignon [28] and Shorrocks [29], had successfully summarized a family of decomposable inequality measures and the mathematical properties of decomposability were nicely discussed. For inequality measures, such as the Gini index, that cannot be decomposed mathematically as a weighted sum of within-group and between-group inequality especially when there is overlapping among subgroups' income distributions, some innovative solutions were proposed [39–41,34,42,36,31], but interpretation of the decomposition becomes more difficult [43].

Download English Version:

https://daneshyari.com/en/article/974880

Download Persian Version:

https://daneshyari.com/article/974880

Daneshyari.com