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Maximum Second Order Entropy Lorenz Curve

M. Yaghoobi Avval Riabi* **G. R. Mohtashami Borzadaran †**
M. Nezhadabdolah †

* *Islamic Azad University, Gonabad Branch, Gonabad, Iran*
E-mail: Corresponding author:m_yaghoobiawal@yahoo.com.

† *Ferdowsi University of Mashhad, Mashhad, Iran,*
Islamic Azad University, Mashhad Branch, Mashhad, Iran
E-mails: grmohtashami@um.ac.ir, m.nezhadabdolah@yahoo.com

Abstract
In this work, we derive a family of maximum second order entropy distributions provided that the mean and the Gini index are known as the optional side conditions. Then via these distributions, families of Lorenz curves are obtained which are compatible with the optional side conditions. Also some results are derived via maximization of the Second order entropy in view of income distributions.

Keywords and phrases: Gini Index, Lorenz Curve, Maximum Entropy, Income Inequality

1. Introduction

Suppose a probability density function of a random variable is at hand, thus the distribution is completely known. But in many cases, the explicit density is hidden and must be estimated. The classical procedure consists of fitting an analytical function on observations. Another more logical approach is to apply the maximum entropy that was proposed by Jaynes (1957). This technique allows to choose among all the possible probability distributions the most suitable one with respect to the available knowledge. The maximum entropy principle state that, when given some information about a random variable, the least biased probability distribution is obtained by maximizing entropy subject to the given constraints. Lorenz curve is one of the most important tools for analyzing the income distributions, proposed by Max Lorenz (1905). The Lorenz curve relates the cumulative proportion of income to the cumulative proportion of population, when population is arranged according to increasing level of income. The Gini index, that is widely used in the study of the inequality of income distributions, was proposed by Corrado Gini (1912). The Gini index measures the ratio of the area, between the Lorenz curve and the equality line.

Holm (1993), derived a family of maximum Shannon entropy density functions under side conditions on the mean and Gini index. Ryu (2008) determined the functional form of the share function (as a density function) via maximum Shannon entropy method under side conditions on the Bonferroni index. Over the past sixty years, after Shannon (1948) introduced his measure of entropy, various forms of the entropy suggested. One of them is