Annals of Natural Sciences
(Peer Reviewed/Referred International Journal)
Vol. 4(4), December 2018: 30-33
Journal's URL: http://www.crsdindia.com/ans.html
Email: crsdindia@gmail.com

e-ISSN: 2455-667X
Annals of Natural Sciences

ORIGINAL ARTICLE

A Measurement of Income Inequality Based on a Model

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ABSTRACT

A number of scholars tried to develop measure of income inequality by taking mean income, ratio from mean income etc. In the present paper an attempt has been made to develop a measure of income inequality based on a model.

Keywords: *Income Inequality, Normality Parameter*

Received: 4th Sept. 2018, Revised: 12th Oct. 2018, Accepted: 21st Oct. 2018
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How to cite this article:
Singh D.P. (2018): A Measurement of Income Inequality Based on a Model. Annals of Natural Sciences, Vol. 4[4]: December, 2018: 30-33.

INTRODUCTION

The unequal distribution of income and wealth among members of a region is a universally observed phenomenon. The extent of such inequality can be judged only if we examine the relevant statistical evidence. Such statistical information is usually in short supply and even the available data is often of lower quality than those in many other fields. However, without such information it is impossible to assess the problem and magnitude of inequality. The early estimates are based on social tables. Holmes, 1977 showed King's limitation as a social analyst and criticized his social table. The problem of measuring income inequality can be traced back to the end of the last century. Pareto, 1895 discussed the topic in a study on personal income distribution, Pareto based his work mainly on fiscal data and interpreted the parameter α of the model he proposed as in income inequality measure. Lorenz, 1905 introduced a graphical tool which has since then been called the Lorenz curve and has played an important role in subsequent studies on inequality. Gini, 1909 analysed the relationship between social classes and wealth distribution, introduced a parameter 'δ' and argued the 'δ' unlike Pareto's 'α', was a direct measure of concentration.

Gini, 1914 arrives at a summary inequality index, called as concentration ratio (R). Atkinson, 1970 proposed that R and other conventional summary indices should no longer be used because they do not rank income distribution according to strictly concave social utility functions. Atkinson's point of view stimulated the interest of researchers and was at the origin of many studies on the measurement of income inequality. Dagum, 1990 showed how every income inequality measure has a social welfare base and vice-versa.

MEASURES BASED ON A MODEL

Consider a general model of income inequality like Sen, 1976 poverty model is as follow-

$$I_{19} = \beta \sum_{i=1}^{n} \left(R_n - y_i \right) u_i$$

Where u_i is weight and β is normality parameter.

Let $u_i \propto \left(R_n - y_i\right)^b$, where $b > 0$

$$u_i = k\left(R_n - y_i\right)^b$$

$$\sum_{i=1}^{n} u_i = k\sum_{i=1}^{n}\left(R_n - y_i\right)^b$$

$$k = \frac{1}{\sum_{i=1}^{n}\left(R_n - y_i\right)^b}$$

If $\sum_i u_i$ taken as unity.

$$u_i = \frac{\left(R_n - y_i\right)^b}{\sum_{i=1}^{n}\left(R_n - y_i\right)^b}$$

$$I_{19} = \beta\frac{\sum_{i=1}^{n}\left(R_n - y_i\right)^{b+1}}{\sum_{i=1}^{n}\left(R_n - y_i\right)^b}$$

If $y_1 = y_2 = ... = y_{n-1} = 0$ and $y_n = R_n$ and measure is taken as unity, then

$$1 = \beta\left[\frac{R_n^{b+1} + R_n^{b+1} + ... + (n-1)\,times}{R_n^{b} + R_n^{b} + ... + (n-1)\,times}\right]$$

$$\beta = \frac{1}{R_n}$$

Hence, the required measure is

$$I_{19} = \frac{1}{R_n}\frac{\sum_{i=1}^{n}\left(R_n - y_i\right)^{b+1}}{\sum_{i=1}^{n}\left(R_n - y_i\right)}$$

If in the model, u_i is taken as $\left(n+1-i\right)$ like Sen (1976) poverty index, the model is

$$I_{20} = \beta\sum_{i=1}^{n}\left(R_n - y_i\right)\left(n+1-i\right)$$

If $y_1 = y_2 = ... = y_{n-1} = 0$ and $y_n = R_n$ and income inequality as 1, then

$$1 = \beta\left[R_n.n + z.(n-1) + ... + z.2\right]$$

$$1 = \beta R_n\left[2 + 3 + ... + n\right]$$

$$1 = \beta R_n\left[\frac{n^2 + n - 2}{2}\right]$$

$$\beta = \frac{2}{\left(n^2 + n - 2\right)R_n}$$

Hence, the required income inequality measure is as

$$I_{20} = \frac{2}{\left(n^2 + n - 2\right)R_n}\sum_{i=1}^{n}\left(R_n - y_i\right)\left(n+1-i\right)$$

COMPUTATION FOR A HYPOTHETICAL DATA

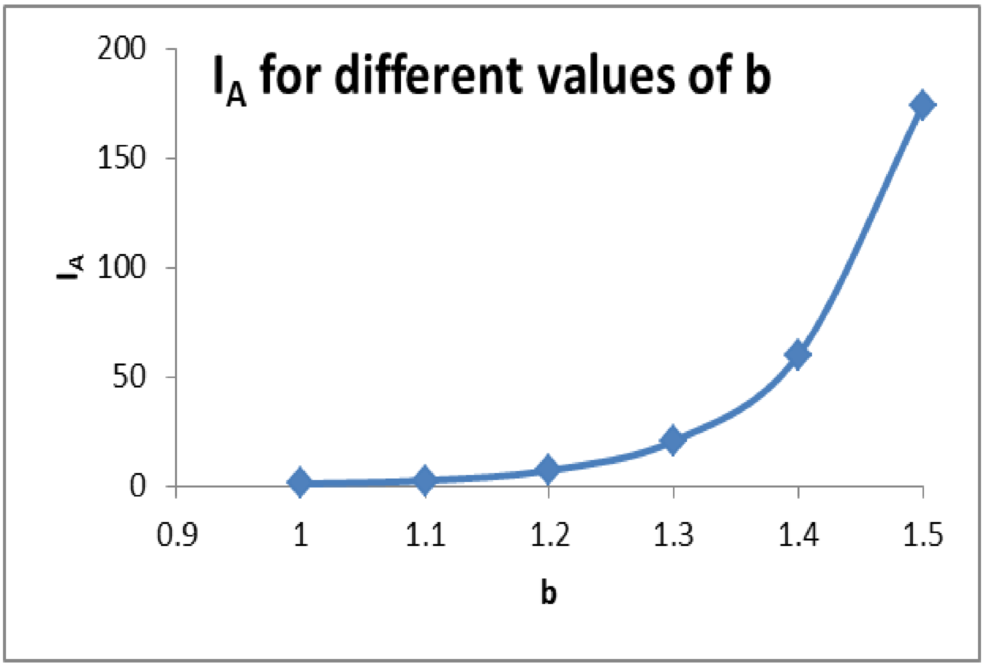
Now, we consider a hypothetical data to compute some proposed measures. Suppose there is a firm of 50 persons and the monthly salary of these employees are as follows:

2300	2350	2200	2400	3000	3200
3500	2600	2800	2250	2500	3000
3500	5000	5200	2800	2700	3000
3200	2700	4500	5000	6000	5500
5800	10000	12000	13000	14000	13000
12000	18000	16000	15000	19000	17000
14000	13000	16000	16000	18000	5250
11000	13000	16000	30000	32000	35000
50000	3350				

Here the maximum value is $R_n = 50000$

Then the value of our proposed index I_A for different values of 'b' are-

b>0	1.0	1.1	1.2	1.3	1.4	1.5
I_A	0.84	2.44	7.09	20.61	59.89	174.10



Similarly for the same data the value of our proposed index I_B is :

$$I_B = 56502850 \times \frac{2}{(50^2+50-2)}$$

$$= 56502850 \times 0.00078499$$

$$= 44350.74568$$

CONCLUSION

In the present paper measure of income inequality I_A and I_B are developed in section 2 are based on a model. Further to make it more reliable and valid under different conditions the proposed measures have been calculated for a hypothetical data.

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