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Practical Modified Gini Index

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Abstract

The Gini index is the most common method for estimating the level of income inequality in countries. In this paper we suggest a simple modification that takes into account the moderating effect of in-kind government benefits. Unlike other studies that use micro level data that is rarely available for many countries or over a period of time, the proposed modified Gini index could be calculated using just the regularly available data for each country. Such data includes the original Gini coefficient, government consumption expenditures, GDP and total tax revenue as a percentage of GDP. This modified version of the Gini index allows us to calculate the level of inequality more precisely, and make better comparisons between countries and over time.

1. Introduction

The Gini coefficient is a popular and widely-used index for measuring inequality (Lerman and Yitzhaki, 1984). Evidence for the OECD countries indicates that there has been a significant and widespread increase in income inequality during the past 20 years (Chapell et al., 2009; OECD, 2008). When inequality is measured in terms of disposable income, the rise was more modest than it is when comparing market incomes, which indicates that the tax and social transfer systems do serve to redistribute income towards the poor (Chapell et al., 2009).

We argue that the redistribution role played by the government through the provision of public services is significant, and should be taken into considerations when calculating the Gini index (see also Stack, 1978). Neglecting public, in-kind benefits when measuring income might give an incomplete picture of the distribution of economic inequality (Aaberge et al., 2010) because in-kind benefits such as education, health insurance, and other public services actually constitute approximately one-half of the welfare state transfers in developed countries (Atkinson et al., 2002; Garfinkel et al., 2006).

We suggest a simple, practical modification to the traditional Gini index that can be calculated using the aggregate data published for each country.

Let us assume two countries with the same Gini index, one where the government provides more in-kind benefits (education, healthcare, social services, security, etc.) than the government of the other provides. We argue that the actual level of inequality will be lower in the country which provides more in-kind benefits. Since the distribution of in-kind benefits is biased toward the low income families, the traditional Gini index that does not consider the redistribution generated by in-kind benefits will be biased upward.

Sefton (2002) shows that poorer households receive a greater proportion of non-cash welfare benefits than richer households. Nolan (1981) found that the value of non-cash benefits (such as

medical services, housing and education) appeared relatively stable across income groups, falling only marginally as income rose. Nolan and Russell (2001) look at a range of non-cash benefits in Ireland, including the "free schemes", such as free travel, free electricity etc. They found that the medical card scheme was strongly concentrated towards the bottom end of the distribution with 61 percent of medical card spending going towards the bottom 30 percent of the income distribution. Callan and Keane (2009) showed that the overall pattern of redistribution through public health and education is "pro-poor".

Aaberge et al., (2010) showed that inclusion of noncash income (education and healthcare) reduces inequality by 15-25 percent. He used detailed data regarding the allocation of the public in-kind benefits among the different individuals in the economy. This approach makes it almost impossible to generalize for all countries and different years. This paper offers a generalization of this approach that uses aggregate data that is available for each country.

In the next section, we present the calculation approach of the modified Gini (MGINI). Then, we illustrate our approach using recent data for the Gini index for the OECD countries and conclude the paper in the last section.

2. The modified Gini index

Let us consider $y(\alpha)$ as the accumulated income of the α percentile. In that case the Gini index would be:

$$Gini = 1 - 2\int_0^1 y(\alpha)d\alpha \qquad (1)$$

$$y_k = y(\alpha_k) = \frac{\sum_{i=1}^{k} I_i}{\sum_{i=1}^{N} I_i} = \frac{\sum_{i=1}^{k} I_i}{\bar{I}}$$

where $\alpha_k = \frac{k}{N}$ represents the percentile of the households with income less than the income of the kth household, and N represents the total number of households.

Now, let us add the provision of public services and assume that $\hat{I}_i = I_i + \frac{G}{N}$, where G is the total in-kind benefits provided by the government. In this case $\hat{y}_k$ will be:

$$\hat{y}_k = \frac{\sum_{i=1}^{k}(\hat{I}_i)}{\sum_{i=1}^{N}\hat{I}_i} = \frac{\sum_{i=1}^{k}\left(I_i + \frac{G}{N}\right)}{\bar{I} + G} = \frac{\frac{\sum_{i=1}^{k} I_i}{\bar{I}} + \frac{kG}{N\bar{I}}}{1 + \frac{G}{\bar{I}}} = \frac{y_k + \alpha_k SG}{1 + SG}$$

where the $SG = \frac{G}{\bar{I}}$ represents the services that the government provides as a share of the total net income in the economy.

$$G\hat{I}NI = 1 - 2\int_0^1 \hat{y}(\alpha)d\alpha = \frac{GINI}{1 + SG} \qquad (2)$$

As can be seen in equation 2 and the illustration in figure 1, the modified Gini index is a simple interpolation, which uses the traditional Gini and the share of public in-kind benefits in the total net income of the economy.

The modified Gini index is always lower then the traditional Gini. The larger the share of the public in-kind benefits, the lower the modified Gini. It converges to the traditional Gini index when no government in-kind benefits are provided.

Figure 1: Lorenz curve: Regular vs. modified Gini
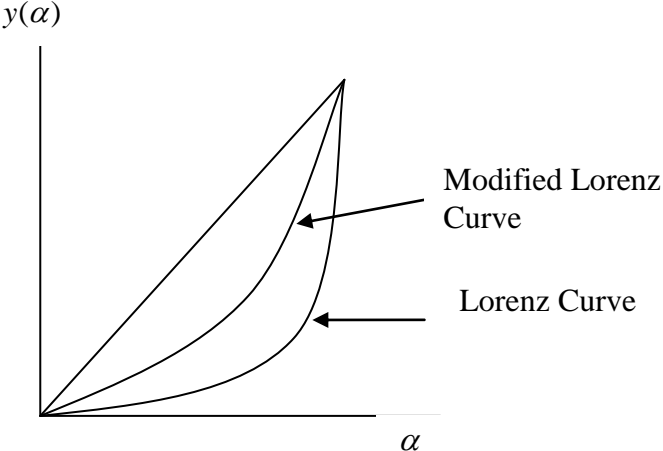
In the next section, we show the results comparing the modified GINI to the traditional Gini for the OECD countries.

3. Comparing the modified Gini to the traditional Gini for the OECD countries

In order to modify the Gini index, we need to evaluate the share of government in-kind benefits in the total net income in the economy (SG). To this end, we use three basic measures: GDP, government consumption expenditures (G) and total tax revenue as a percentage of GDP (T) to give:

$$SG \approx \frac{G}{GDP(1-T)}$$

where GDP(1-T) is a proxy for the total net income of the economy. It should be noted that this is not exactly the total net income, because the GDP includes the depreciation. The SG as presented here underestimates the effect of the in-kind benefits on the level of inequality. If we had the accurate figure, the change in the Gini would be even greater (Recall: $MGINI = \frac{GINI}{1+SG}$).

In addition, we assume that the in-kind benefits provided by the government are distributed equally among all households in the economy. This assumption further underestimates the effect of the in-kind benefits on the Gini index because it is more likely that the lower income percentiles actually receive a higher share of the in-kind benefits (Callan and Keane 2009; Nolan, 1981).

In table 1 we present the modified Gini index vis-à-vis the traditional Gini for the OECD countries. We also present the Gini ranking change that results from the proposed modification.

Table 1: Ranking change when using modified Gini

Country	Gini ranking	Gini	Year	G % of total income	Modified Gini	Modified rank	ΔRank
Sweden	6	0.26	2008	0.49	0.17	1	5.0
Denmark	3	0.25	2007	0.41	0.18	2	1.0
Slovenia	1	0.24	2007	0.28	0.19	3	-2.0
Norway	4	0.25	2008	0.34	0.19	4	0.0
Slovak Republic	2	0.25	2007	0.24	0.20	5	-3.0
Belgium	9	0.27	2007	0.34	0.20	6	3.0
Czech Republic	5	0.26	2007	0.26	0.20	7	-2.0
Finland	7	0.26	2007	0.29	0.20	8	-1.0
Hungary	10	0.27	2007	0.32	0.21	9	1.0
Netherlands	15	0.29	2008	0.42	0.21	10	5.0
France	14	0.29	2008	0.41	0.21	11	3.0
Iceland	13	0.28	2007	0.34	0.21	12	1.0
Austria	8	0.26	2007	0.26	0.21	13	-5.0
Germany	16	0.30	2008	0.29	0.23	14	2.0
Luxembourg	11	0.27	2007	0.17	0.23	15	-4.0
Switzerland	12	0.28	2004	0.17	0.24	16	-4.0
Italy	27	0.34	2008	0.36	0.25	17	10.0
New Zealand	25	0.33	2008	0.30	0.25	18	7.0
Greece	23	0.32	2004	0.27	0.25	19	4.0
Spain	18	0.31	2007	0.20	0.26	20	-2.0
Ireland	17	0.30	2007	0.16	0.26	21	-4.0
Canada	22	0.32	2007	0.23	0.26	22	0.0
Korea	21	0.32	2008	0.21	0.26	23	-2.0
Poland	20	0.31	2007	0.20	0.26	24	-4.0
Japan	24	0.33	2006	0.25	0.26	25	-1.0
Estonia	19	0.31	2007	0.17	0.27	26	-7.0
Australia	26	0.34	2008	0.24	0.27	27	-1.0
United Kingdom	28	0.34	2007	0.26	0.27	28	0.0
Israel	30	0.37	2008	0.37	0.27	29	1.0
Portugal	29	0.36	2007	0.23	0.29	30	-1.0
United States	31	0.38	2008	0.23	0.31	31	0.0
Turkey	32	0.41	2007	0.10	0.37	32	0.0
Mexico	33	0.48	2008	0.14	0.42	33	0.0
Chile	34	0.50	2006	0.14	0.44	34	0.0

In table 1, we see that there are significant transformations in the ranking when using the modified Gini index instead of the traditional Gini index. For example, we can see that Italy moved up from the 27th position to the 17th position. Even though the level of inequality according to the income distribution is relatively high, the in-kind benefits provided by the government significantly reduces the inequality. Similar results appear in the cases of Sweden, Netherlands and New Zealand. According to the modified Gini, Sweden is the country with the lowest inequality in income distribution, while according to the standard Gini Sweden is ranked 6th. Conversely, we can see that the rankings of Austria, Luxemburg, Switzerland, Poland and Estonia deteriorate significantly because these countries provide a significantly smaller quantity of in-kind benefits to the public.

The median decrease in the Gini index as a result of inclusion of the in-kind benefits is 15%. For comparison's sake, Aaberge (2010) found that for European countries the change in Gini would be approximately 15-25% when using his more elaborate calculation of in-kind benefits, which is not very different than our results. However, unlike the method proposed by Aaberge (2010), our method makes it possible to calculate a modified Gini without having detailed data about the distribution in-kind benefits, because it uses only the available aggregate data that both developed and developing countries report annually.

4. Conclusion

In this paper, we present a simple modification to the GINI index that can be calculated simply using the common aggregate data available for each country. This measure which takes into consideration the value of the in-kind benefits that the government provides allow us to better understand the inequality in income distribution in the different economies. To the best of our knowledge, our general approach toward integrating the in-kind benefits into the income distribution has not yet been presented in the literature. We believe that the modified Gini index can be used by policy makers and researchers around the world to assess the differences in inequalities between countries as well as trends in the level of inequality over time more accurately because it takes in-kind benefits into account without needing access to complicated and rarely available data sets.

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