A Rethink on Measuring Health Inequalities Using the Gini Coefficient

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Abstract

Objective: *We show that a standardized Gini coefficient that takes into account the feasible range of health inequality for a given health attribute is a better instrument than the normal Gini coefficient for quantifying inter-individual health inequality.*

Methods: *The standardized Gini coefficient is equal to the normal Gini coefficient divided by the maximal attainable Gini coefficient, which is computed based on the maximal level of a health attribute an individual could achieve. Both the old and new coefficients are used to estimate the lifespan inequality of 185 countries for year 1990, 2000 and 2006, respectively. The results are then compared both across countries and over time.*

Findings: *Firstly, the standardized Gini coefficient can still be related to the Lorenz curve. Secondly, changes in standardized Gini coefficients can be decomposed into respectively the change in the distribution of health outcomes and the change in the average health outcomes. Thirdly, the standardized Gini coefficient provides richer information and often gives different conclusions regarding health inequality in individual countries as well as country ranking, as compared to the normal Gini coefficient.*

Conclusion: *Accounting for the maximal level of health attribute an individual could achieve is important when measuring health inequality. The proposed standardized Gini coefficient can provide more accurate information regarding the actual level of health inequality in a society than the normal Gini coefficient.*

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A Rethink on Measuring Health Inequalities Using the Gini Coefficient

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A brief explanation of what was already known about the topic concerned:

The Gini coefficient is one of most commonly used tools for quantifying inter-individual health inequalities. However, there are reservations about the use of this index because the possibility of redistribution is not necessarily appropriate in the case of health. Very recently there has been a similar discussion in relation to the concentration index with various methods being proposed to address the problem, but as yet there is no consensus on the best way forward.

A brief explanation of what we know as a result of your paper:

Standardizing the Gini coefficient with the maximal feasible Gini coefficient can yield a better counterpart to average health status than the normal Gini coefficient. Differences in standardized Gini coefficients can be decomposed into the difference in dispersion of health attributes and the difference in the average levels of the attributes. The new measure can make a substantial impact to the policy implications of health inequality comparisons across countries or over time.

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Conclusion: Accounting for the maximal level of health attribute an individual could achieve is important when measuring health inequality. The proposed standardized Gini coefficient can provide more accurate information regarding the actual level of health inequality in a society than the normal Gini coefficient.

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1. Introduction

Health inequality has been and remains a great challenge to the global community. Correspondingly, there has also been an extensive amount of literature devoted to understanding of the determinants and subsequent policy implications and remedies of health inequalities. At the same time, more attention has also been paid to the measurement of health inequality, which is the foundation of any quantitative or even qualitative assessment of the issue.[1-8]

In measuring health inequalities, there have been two major approaches, concerning socioeconomic inequalities in health and individual inequalities in health, respectively. The main difference between the two is that the first one focuses on the health gap between different socioeconomic groups stratified typically by income or wealth; while the second one focuses on differences between individuals or groups that are not necessarily stratified based on socioeconomic characteristics. The concentration index has emerged as one of the most commonly used measurement techniques for socioeconomic inequalities in health[1], and the Gini coefficient has been used mostly for measuring inter-individual health inequalities.[9-18]

Using the Gini coefficient to measure health inequality has three major advantages. Firstly, it satisfies a number of (but not all) principles relevant to inequality indexes. Secondly, being widely used in measuring other dimensions of inequalities especially income, consumption and education, it facilitates direct comparison of inequalities across health and other socioeconomic dimensions. This paper, however, argues that the third advantage of the Gini coefficient – that it is conditional on the mean and bounded between 0 and 1, with 0 indicating perfect equality and 1 perfect inequality – does not hold in the domain of health. Consequently, health inequality measures based on the Gini coefficient could be misinterpreted. To address this issue, this paper proposes the use of a standardized Gini coefficient as a replacement.

Wagstaff[19] suggests a similar solution for the concentration index in dealing with binary health outcomes (immunization in his case) which has recently been extended by Erreyger[8] to a more general case where the health variable has both an upper and lower bound. Erreyger uses an example to argue that Wagstaff's approach produces counterintuitive results, but the example actually fails to take into account that inequality measures should be conditional on the mean (i.e. the level of available resources) such that comparisons can be made across countries and over time.

Erreyger also proposes his own approach to adjust the concentration index which leaves the resulting index invariant to the addition of a constant to everyone's health attributes even if both maximal and minimal level of individual attributes do not change, i.e. it is level independent. On the contrary, our standardized Gini index is not level independent. We argue that in the domain of health, level independency is not a desirable property and can produce counterintuitive results. For example, if level independency holds, then reducing 20 years from the lifespan of two persons who would otherwise live for 100 and 25 years will not increase the inequality between them, even though their lifespan ratio increases from 4 to 16. Thus, this paper focuses on using an approach similar to Wagstaff's but applies it to the Gini coefficient, and explains the relationship of the new, standardized Gini coefficient with the Lorenz curve.

2. The Gini Coefficient

Amongst the many different expressions of the Gini coefficient[20-21], those referring to the Lorenz curve and inter-individual differences are most widely used. Consider the two hypothetical countries in Figure 1. Both countries have a population of 10 people; country A has an average lifespan of 30 years while country B 70 years. If people are ranked by their health attribute, then the Lorenz curve indicates the cumulative share of health attributes for a cumulative share of population, as illustrated in Figure 2 using the data of country A. The Gini coefficient is equal to twice the area between the line of perfect equality and the Lorenz curve, i.e. area (II). It is also equal to area (I) divided by area (I+II+III).

In the inter-individual difference approach, the Gini coefficient is expressed as the total absolute pair-wise difference in health outcomes, normalized by the population's average health outcome:

$$G = \frac{\sum_{i}^{n}\sum_{j}^{n}\left|y_i - y_j\right|}{2n^2\overline{y}} \tag{1}$$

where y_i is the health outcome of individual *i*, n the population size, and $\overline{y}$ the average health outcome.

Using the Gini coefficient to measure health inequality, however, is not without its critics. First of all, some view that the index implicitly assumes the possibility of redistribution, which is not necessarily appropriate in the case of health.[22] This is because health capital, once acquired, cannot be taken away from one person and redistributed to others. This interpretation of the Gini coefficient, however, may be too literal. Although health cannot be possibly redistributed, the index can be considered an indicator of the distribution of related resources, or bias in related policies and institutions, and those factors may well be altered to generate more desirable outcomes in health equality *in the future*.

The second issue is more critical. The Gini coefficient is bounded between 0 and 1, with 0 indicating perfect equality and 1 perfect inequality. In the case of income, perfect inequality corresponds to the situation that one person has all the income in the population and all others have none. However, there is a limit on how much health capital each person can possibly accumulate. For example, even for a small group of 10 people in a less developed country with an average lifespan equal to 40 years (e.g. Niger), the scenario of one person being 400 years old and the other nine dying in infancy – wherein the Gini coefficient is equal to 1 – is simply impossible. If one makes inference on the group's lifespan distribution based on the 0-1 scale of the Gini coefficient, it is easy to grossly understate the true level of health inequality, because the range of *attainable inequality* is in fact much narrower.

The issue has great implications for inequality comparison across countries or over time. Reconsider the two countries in Figure 1. The Gini coefficient of country A is equal to 0.37, while that of country B is 0.3. Therefore, solely based on the index country B appears to be more equal than country A, even though country B has a much more polarized distribution of lifespan. This counterintuitive result is due to the fact that the higher health inequality in country B has been masked by its higher average lifespan.

4. Standardized Gini Coefficient

4.1 A numerical example

Our remedy to the aforementioned problem is to standardize the Gini coefficient with its maximal feasible value associated with the given attribute and population in order to make comparisons over time and across countries more meaningful. The resulting, standardized Gini coefficient will therefore continue to be bounded between 0 and 1, now with both the upper and lower bound values being meaningful benchmarks.

Suppose the upper bound of lifespan is 100 years. Given this, for country A the most "extreme" yet feasible distribution of the total 300 years lifespan is that three people having a lifespan of 100 years and the other seven people zero. The maximal Gini coefficient for the country is therefore equal to 0.7 – much smaller than the hypothetical unity upper bound.

Therefore, the standardized Gini coefficient will be equal to 0.37/0.7 = 0.52. That is, on a 0-0.7 scale, the observed level of inequality is equal to over 50% of the maximal level, which is substantially higher than what the normal Gini coefficient would indicate.

In Figure 2, the maximal Gini coefficient for country A is represented by the area of (I+II)/(I+II+III), so the standardized Gini coefficient I/(I+II). Taking into account the maximal lifespan a person could achieve effectively moves the line of perfect inequality inward and thereby "magnifies" the inequality implication of the Lorenz curve.

For country B, the maximal Gini coefficient is the same as its normal Gini coefficient due to its bipolar distribution, and thus its standardized Gini coefficient is equal to 1. Therefore, based on the standardized measure, we will now reach the (correct) conclusion that conditional on mean lifespan country B is more unequal than country A.

4.2 Modified expressions for the Gini coefficient

For a large population, the number of individuals that could possibly achieve the maximal lifespan is approximately given by

$$n_{\max} = \sum_{i}^{n} y_i / y_{\max} = n\bar{y} / y_{\max} \tag{2}$$

where y_{max} is the maximal lifespan. The maximal Gini coefficient (*M*) therefore, will be equal to

$$M = \frac{n_{\max} n_{\min} (y_{\max} - y_{\min})}{n^2 \bar{y}} = \frac{(y_{\max} - y_{\min})(y_{\max} - \bar{y})}{(y_{\max})^2} \tag{3}$$

where $y_{\min}$ is the minimum lifespan, i.e. zero in our example, and $n_{\min} = n - n_{\max}$. Here where it is assumed that $y_{\max}$ and $y_{\min}$ are constant over time, *M* only reduces as the average lifespan increases.

The standardized Gini coefficient (*S*) for a large population is therefore given by

$$S = \frac{\sum_{i}^{n}\sum_{j}^{n}\left|y_i - y_j\right|}{2n_{\max}n_{\min}(y_{\max} - y_{\min})} \tag{4}$$

When the health outcome is a binary variable, e.g. immunized or not immunized, then $y_{\max} = 1$ and $y_{\min} = 0$, and *M* will become $1 - \bar{y}$.[19]

Differences in standardized Gini coefficients can be decomposed in the following way:

$$S_u - S_t = \frac{G_u}{M_u} - \frac{G_t}{M_t} = m(G_u - G_t) + g(M_t - M_u);$$
$$m = (M_u + M_t)/(2M_u M_t);\ g = (G_u + G_t)/(2M_u M_t) \tag{5}$$

where *S* = standardized Gini coefficient; *G* = normal Gini coefficient; *M* = maximal Gini coefficient. Here the term $m(G_u - G_t)$ represents the portion of the differences due to changes in health distribution, and the term $g(M_t - M_u)$ represents the portion due to changes in average health.

The decomposition explains why using the normal Gini coefficient for cross country or over time inequality comparison could be misleading because it does not take into account the effect of differences in average health on the maximal attainable inequality level.

5. Empirical Illustrations

We apply the concept of the standardized Gini coefficient to measure the inequality of lifespan for 185 countries based on the year 2000 life tables published by the World Health Organisation (WHO). The maximal Gini coefficients are estimated assuming the maximal lifespan of a person being 102 years. The figure is based on the WHO life tables that, in most countries, a person who lives to see his/her 100th birthday is expected to live for about 2 more years.

5.1 Standardized versus normal Gini coefficients

Figure 3 shows the scatter plots of the standardized and maximal Gini coefficients against the normal Gini coefficient. In general, the maximal Gini coefficient has a positive relationship with the normal Gini coefficient. This is because countries with a small normal Gini coefficient tend to have a high average lifespan (see Figure 4) and – as indicated in equation (3) – they will also have a small maximal Gini coefficient.

Although the relatively small normal Gini coefficients are standardized by relatively small maximal Gini coefficient, the resulting standardized Gini coefficient is not constant. Figure 3 shows that the standardized Gini coefficient still retains an overall positive relationship with its normal counterpart. That is, countries with a relatively small normal Gini coefficient in general still have a relatively small standardized Gini coefficient. However, in certain segments there are substantial dispersions in the associated standardized values. This implies that using the standardized Gini coefficient to rank countries will yield very different results compared to using the normal one. For instance, Japan is ranked the seventh lowest inequality country based on the normal Gini coefficient (G = 0.0923), but the 72nd based on the standardized one (S = 0.4517). On the contrary, the ranking of the Czech Republic has moved from the 31st (G = 0.1029) to the sixth (S = 0.3893) across the two series. A lot of other high and middle income countries also see their rankings change substantially. The rankings of all 185 countries are provided in the Appendix.

Figure 4 shows the scatter plots of the standardized and normal Gini coefficients against life expectancy at birth. Firstly, as expected, the standardized Gini coefficients are much larger than their normal counterparts. Secondly, while both inequality measures register a negative relationship with life expectancy, there is greater dispersion in the values for the standardized series. The normal Gini coefficient of lifespan has an almost one-to-one relationship with life expectancy, implying that, as far as mortality is concerned, there is very little information to be gained from measuring health inequality using the normal Gini coefficient once the average health status is known. On the contrary, the large dispersion of the standardized series suggests that both average health status and health inequality measurements are important in portraying the health profile of a country, especially for countries with life expectancy over 65.

5.2 Decomposition of standardized Gini coefficient

We have also estimated the standardized Gini coefficients for a number of selected countries for the years 1990 and 2006 in order to illustrate the contributions of changes in the normal and maximal Gini coefficients to the associated change in the standardized measure. The results are shown in Figure 5. For Australia, S_{2006} is larger than S_{1990} by 0.019, indicating a rise in morality inequality by about 2 percentage points. However, the positive sign of the $m(G_{1990} - G_{2006})$ component (0.067) indicates that the actual dispersion of lifespan, as measured by the normal Gini coefficient, has reduced over the decade. This is due to the mortality rate of older age groups falling at a greater rate than that of the younger age groups over that period, and thus compressing the distribution at the upper end and decreasing the normal Gini coefficient. But the fall in the mortality rate also means a rise in the average lifespan and thus a decline in the maximal Gini coefficient, giving rise to a negative $g(M_{2006} - M_{1990})$ component (-0.087). As the effect of a rising average lifespan dominates that of a falling lifespan dispersion, mortality inequality measured by the standardized Gini coefficient increases.

This demonstrates an important implication of using the standardized Gini coefficient in that, as the average health status of a country improves, the bar against which its level of health equality is assessed is also raised. This is a desirable property as it avoids letting the high average health achievement mask any underlying health inequality problems, as in the case of Japan.

Amongst the eight countries, China shows the largest improvement in health equality as measured by the standardized Gini coefficient. The positive sign of its $m(G_{1990} - G_{2006})$ component and the negative sign of $g(M_{2006} - M_{1990})$ suggest that it achieves this by not only reducing the dispersion of lifespan across the population, but also raising the average lifespan. The country's normal Gini coefficient falls from 0.154 to 0.118 over the past 15 years, while its life expectancy increases from 68.5 to 73.5 years. On the contrary, South Africa sees its dispersion of lifespan as measured by the normal Gini coefficient increased steadily from 0.187 to 0.257, whereas its life expectancy fell from 63 to 51.3 years. Although the bar for health equality assessment has been lowered for the country due to the fall in its average lifespan, it is not sufficient to compensate for the rise in lifespan dispersion, resulting in a rise in its standardized health inequality measure.

6. Remarks

Lifespan is used in this paper for illustrative purpose. This particular measure of health status clearly has its limitations, such as omitting morbidity, and not distinguishing between avoidable and unavoidable deaths. The first issue is simply a matter of using morbidity data[5, 23], and some recent studies [18, 24-25] have already attempted to address the second issue. The standardized Gini coefficient proposed in this paper can readily be applied to those modified health status measures.

The argument and solution presented in this paper can be applied to other inequality measures with an upper bound value like the concentration index and coefficient of variation. Likewise, they can also be applied to inequality measures of other personal attributes, such as education[26-27] and human capital.[28]

The standardization method proposed in this paper also goes some way to address the question of how to choose between relative and absolute measures for monitoring health inequalities. Relative health inequality measures tend to increase as the average health level falls, while absolute health inequality measures tend to exhibit an inverse U-shape relationship with the average level. These empirical relationships are results of the mathematic relationships underlying the inequality measures.[29] There is no consensus on which of the two types of measures should be preferred.

This paper's standardization method could provide a solution to the problem. For given maximal and minimal feasible individual health outcomes, the maximal Gini coefficient is a function of the average health outcome. Therefore, the standardized Gini coefficient has *to some extent* neutralized the effect of the mean value in the normal Gini coefficient as well as providing an intuitive interpretation as the percentage of maximal attainable inequality conditional on the mean. As shown in Figure 4, the resulting health inequality measure does not necessarily rise as the average health outcome falls. In other words, the standardized measures can be considered an alternative – arguably a better alternative – to the conventional absolute and relative health inequality measures.

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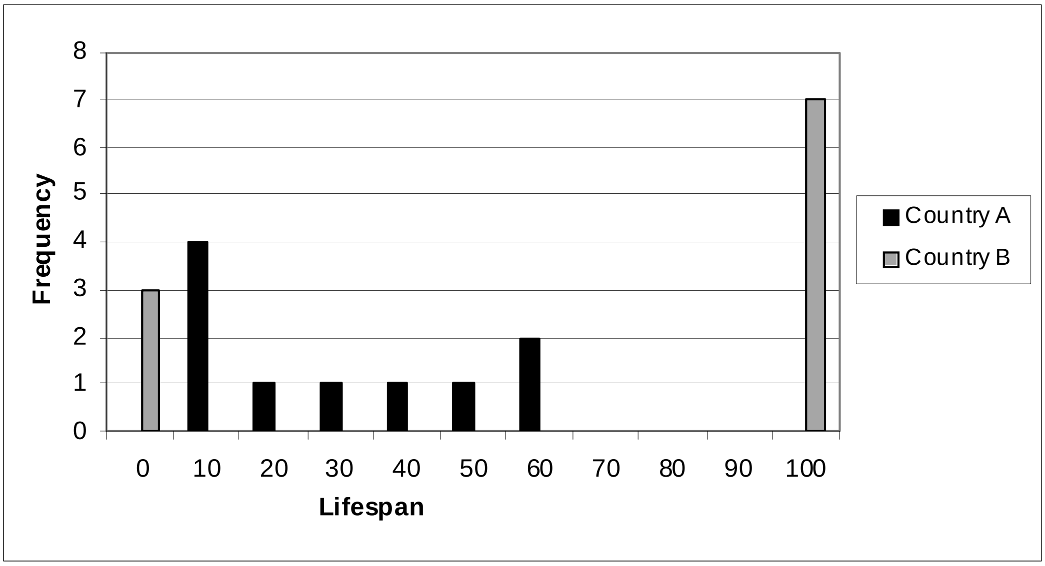

Figure 1 Hypothetical frequency distributions of lifespan for two countries

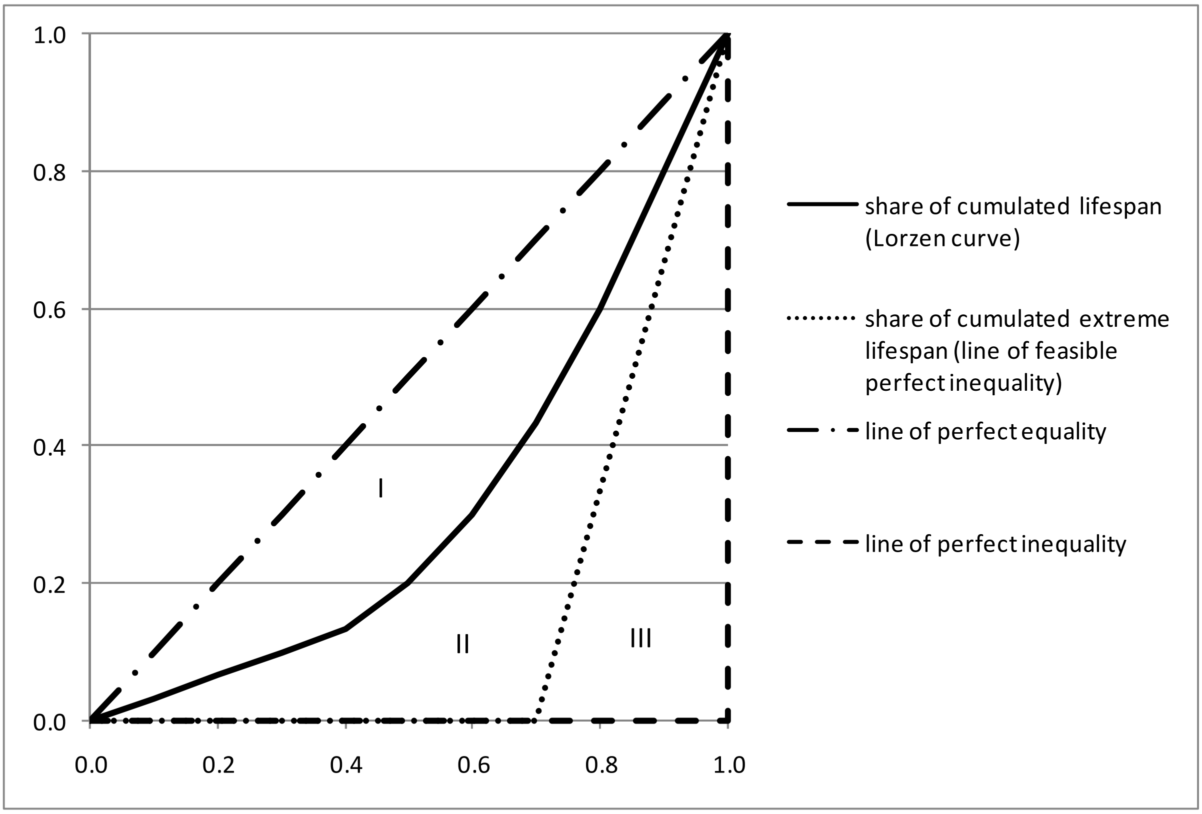

Figure 2 Lorenz curve of lifespan for country A

Figure 3 Standardized and maximal Gini coefficients against normal Gini coefficient

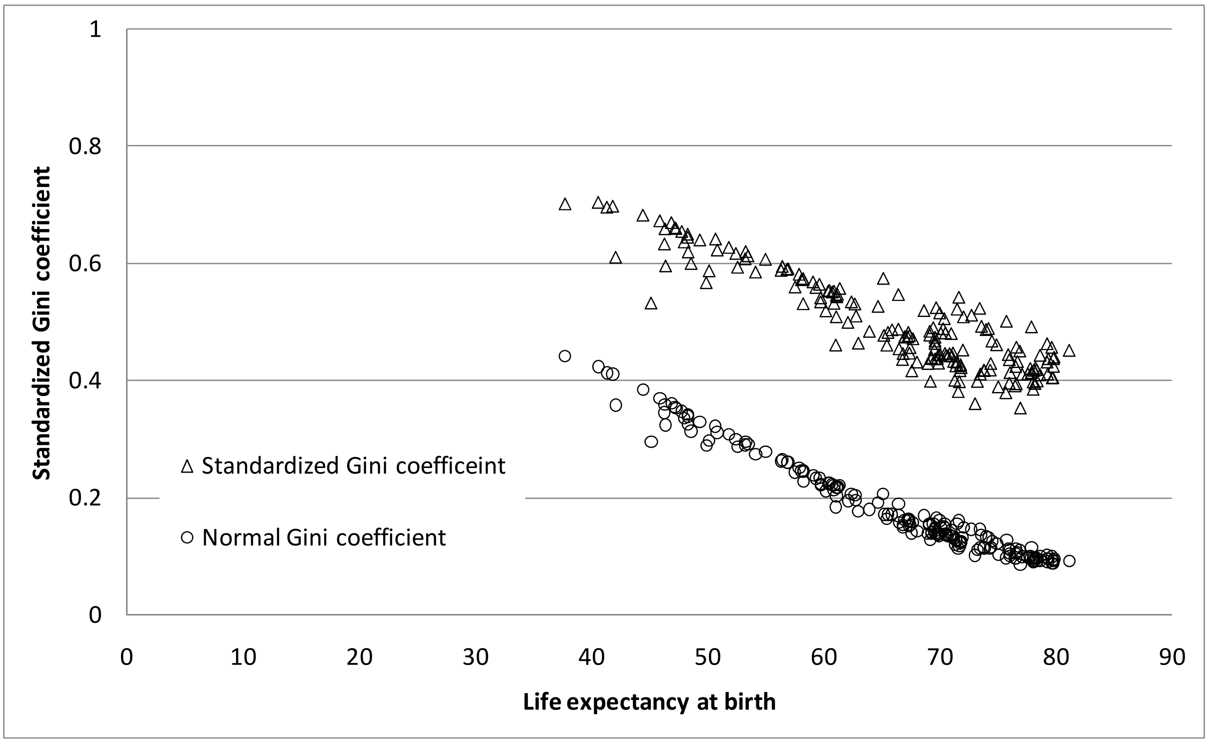

Figure 4 Normal and standardized Gini coefficients against life expectancy at birth

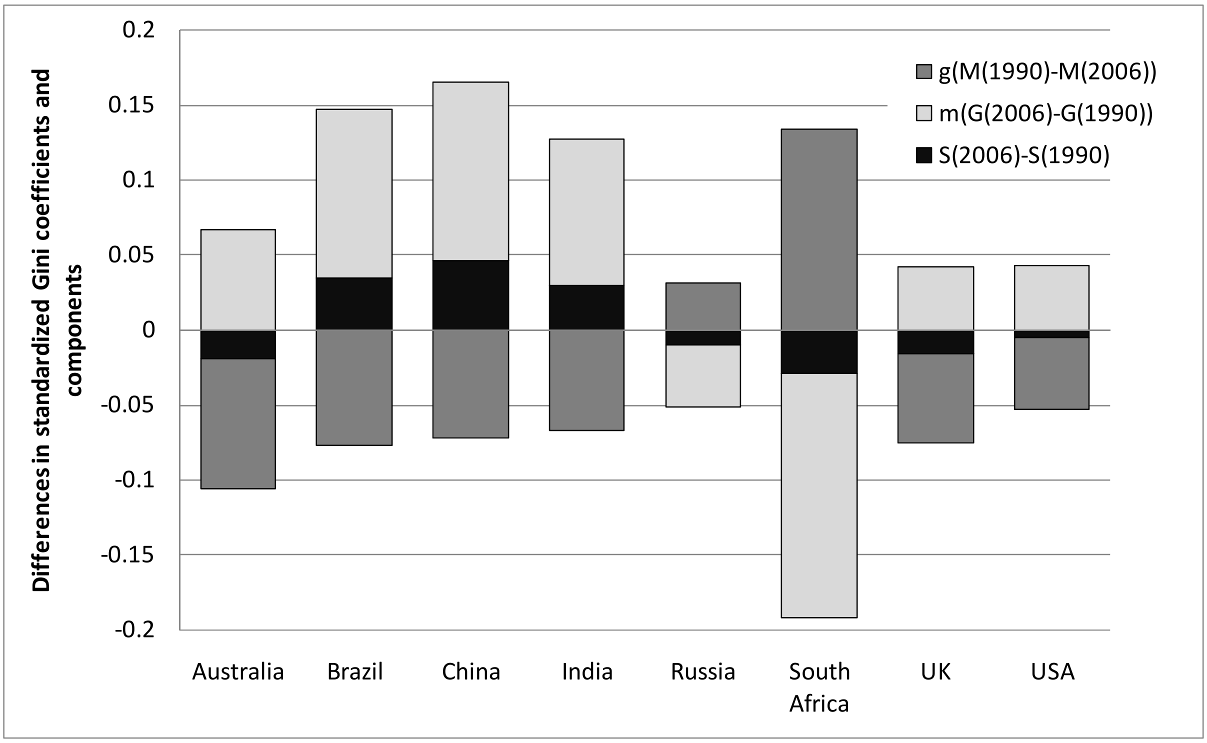

Figure 5 Decomposition of standardized Gini coefficients, 1990-2006

Appendix: Normal and standardized Gini coefficients for 185 countries, 2000

Ranking		Normal Gini coefficient (G)		Standardized Gini coefficient (S)
1	Cyprus	0.0867	Cyprus	0.3531
2	Iceland	0.0884	Bahrain	0.3606
3	Sweden	0.0885	Kuwait	0.3792
4	Malta	0.0904	Serbia	0.3812
5	Italy	0.0915	Malta	0.3851
6	Greece	0.0922	Czech Republic	0.3893
7	Japan	0.0923	Ireland	0.3910
8	Switzerland	0.0924	United Arab Emirates	0.3945
9	Singapore	0.0924	Greece	0.3950
10	Netherlands	0.0934	Rep. of Korea (South)	0.3956
11	Norway	0.0938	Netherlands	0.3977
12	Andorra	0.0952	Bulgaria	0.3981
13	Australia	0.0956	Slovakia	0.3986
14	Spain	0.0963	Albania	0.3988
15	Israel	0.0971	Singapore	0.3995
16	Canada	0.0971	Malaysia	0.4006
17	Germany	0.0976	Sweden	0.4046
18	United Kingdom	0.0977	Iceland	0.4052
19	Ireland	0.0977	Norway	0.4099
20	Kuwait	0.0978	Denmark	0.4108
21	Luxembourg	0.0979	Italy	0.4111
22	Austria	0.0982	Oman	0.4111
23	United Arab Emirates	0.0982	Finland	0.4115
24	Finland	0.0984	Slovenia	0.4136
25	Belgium	0.0998	United Kingdom	0.4137
26	Monaco	0.1001	Republic of Moldova	0.4167
27	Denmark	0.1003	Antigua and Barbuda	0.4169
28	Rep. of Korea (South)	0.1008	Poland	0.4172
29	New Zealand	0.1015	Germany	0.4176
30	Bahrain	0.1024	Luxembourg	0.4178
31	Czech Republic	0.1029	Croatia	0.4179
32	France	0.1033	Bosnia and Herzegovina	0.4180
33	Slovenia	0.1052	Israel	0.4187
34	Portugal	0.1058	Belgium	0.4207
35	Chile	0.1073	Austria	0.4219
36	United States of America	0.1109	Hungary	0.4221
37	Qatar	0.1111	Portugal	0.4240
38	Slovakia	0.1123	Switzerland	0.4244
39	Bosnia and Herzegovina	0.1133	Syrian Arab Republic	0.4252
40	Serbia	0.1136	Seychelles	0.4260
41	Brunei Darussalam	0.1137	Libyan Arab Jamahiriya	0.4272
42	Costa Rica	0.1138	Belarus	0.4292
43	Oman	0.1149	Barbados	0.4292
44	Poland	0.1152	Georgia	0.4298
45	Croatia	0.1155	Spain	0.4317
46	Barbados	0.1161	Fiji	0.4317
47	Cuba	0.1162	Mauritius	0.4317
48	Bulgaria	0.1183	Chile	0.4325
49	Malaysia	0.1206	Romania	0.4328
50	Uruguay	0.1226	Qatar	0.4359
51	Antigua and Barbuda	0.1236	Maldives	0.4361
52	Hungary	0.1248	Armenia	0.4370
53	Argentina	0.1261	Canada	0.4373
54	Seychelles	0.1261	Andorra	0.4374
55	Libyan Arab Jamahiriya	0.1265	Palau	0.4376
56	Syrian Arab Republic	0.1276	Saint Kitts and Nevis	0.4378
57	Albania	0.1282	Tonga	0.4395
58	Panama	0.1290	Australia	0.4402
59	Mauritius	0.1293	Tunisia	0.4421
60	Romania	0.1307	Estonia	0.4422
61	Lithuania	0.1330	Jordan	0.4429
62	Paraguay	0.1333	New Zealand	0.4432
63	Saint Lucia	0.1338	Viet Nam	0.4440
64	Tunisia	0.1341	Saudi Arabia	0.4441
65	China	0.1352	Brunei Darussalam	0.4444
66	Georgia	0.1353	Cook Islands	0.4460
67	Estonia	0.1357	Grenada	0.4461
68	Cook Islands	0.1362	Latvia	0.4465
69	Jordan	0.1366	Ukraine	0.4468
70	Venezuela	0.1372	China	0.4471
71	Latvia	0.1381	United States of	0.4505

			America	
72	Saint Kitts and Nevis	0.1382	Japan	0.4517
73	Armenia	0.1388	Lithuania	0.4522
74	Belarus	0.1388	Lebanon	0.4528
75	Viet Nam	0.1391	Egypt	0.4542
76	Saudi Arabia	0.1398	Samoa	0.4563
77	Palau	0.1403	Monaco	0.4568
78	Republic of Moldova	0.1405	Costa Rica	0.4571
79	Tonga	0.1409	Russian Federation	0.4605
80	Fiji	0.1437	Nauru	0.4607
81	Lebanon	0.1441	Uruguay	0.4613
82	Niue	0.1460	France	0.4629
83	Mexico	0.1465	Turkey	0.4634
84	Bahamas	0.1467	Kazakhstan	0.4640
85	Turkey	0.1472	Algeria	0.4675
86	Algeria	0.1485	Argentina	0.4676
87	Belize	0.1487	Iran	0.4715
88	Jamaica	0.1494	Morocco	0.4740
89	Maldives	0.1505	Vanuatu	0.4743
90	Brazil	0.1505	Philippines	0.4747
91	Morocco	0.1506	Micronesia	0.4751
92	Ukraine	0.1516	Iraq	0.4768
93	Thailand	0.1518	Kyrgyzstan	0.4773
94	Grenada	0.1537	Trinidad and Tobago	0.4777
95	Trinidad and Tobago	0.1538	Niue	0.4803
96	Samoa	0.1546	Brazil	0.4813
97	Peru	0.1560	Belize	0.4815
98	Colombia	0.1561	Indonesia	0.4823
99	Sri Lanka	0.1565	Honduras	0.4824
100	Ecuador	0.1567	Mongolia	0.4841
101	Egypt	0.1581	Peru	0.4843
102	Iran	0.1585	Uzbekistan	0.4867
103	Nicaragua	0.1614	Saint Lucia	0.4872
104	Philippines	0.1617	DPR of Korea (North)	0.4878
105	Iraq	0.1618	Thailand	0.4886
106	Dominican Republic	0.1618	Paraguay	0.4889
107	Vanuatu	0.1627	Sri Lanka	0.4905
108	Micronesia	0.1630	Cuba	0.4919
109	Honduras	0.1641	Venezuela	0.4927
110	Russian Federation	0.1650	Turkmenistan	0.4994
111	El Salvador	0.1661	Panama	0.5014
112	Cape Verde	0.1699	Ecuador	0.5058
113	DPR of Korea (North)	0.1700	Jamaica	0.5089
114	Kyrgyzstan	0.1722	Tajikistan	0.5091
115	Uzbekistan	0.1723	Azerbaijan	0.5103
116	Indonesia	0.1724	Bahamas	0.5117
117	Kazakhstan	0.1774	Dominican Republic	0.5156
118	Mongolia	0.1806	Marshall Islands	0.5192
119	Nauru	0.1850	Cape Verde	0.5196
120	Guatemala	0.1906	Colombia	0.5220
121	Solomon Islands	0.1926	Mexico	0.5236
122	Turkmenistan	0.1954	El Salvador	0.5246
123	Azerbaijan	0.1961	Solomon Islands	0.5268
124	Tajikistan	0.2041	Bolivia	0.5309
125	Bolivia	0.2045	South Africa	0.5313
126	Comoros	0.2075	Papua New Guinea	0.5320
127	Kiribati	0.2076	Zimbabwe	0.5325
128	Marshall Islands	0.2128	Guyana	0.5344
129	Papua New Guinea	0.2144	Comoros	0.5345
130	Bangladesh	0.2175	Nepal	0.5412
131	India	0.2187	Nicaragua	0.5424
132	Sao Tome and Principe	0.2189	Bangladesh	0.5432
133	Guyana	0.2214	India	0.5453
134	Pakistan	0.2219	Guatemala	0.5469
135	Bhutan	0.2227	Sao Tome and Principe	0.5474
136	Namibia	0.2230	Namibia	0.5514
137	Nepal	0.2242	Gabon	0.5526
138	Gabon	0.2254	Bhutan	0.5527
139	Eritrea	0.2255	Eritrea	0.5541
140	South Africa	0.2279	Pakistan	0.5574
141	Sudan	0.2338	Sudan	0.5591
142	Yemen	0.2344	Lao PDR	0.5599
143	Myanmar	0.2392	Yemen	0.5645
144	Lao PDR	0.2440	Botswana	0.5672
145	Ghana	0.2458	Myanmar	0.5686

146	Haiti	0.2463	Haiti	0.5723
147	Cambodia	0.2464	Ghana	0.5731
148	Mauritania	0.2515	Cambodia	0.5744
149	Gambia	0.2610	Kiribati	0.5746
150	Senegal	0.2612	Mauritania	0.5816
151	Togo	0.2633	Congo	0.5854
152	Madagascar	0.2657	Lesotho	0.5876
153	Congo	0.2746	Togo	0.5883
154	Djibouti	0.2798	Senegal	0.5900
155	Kenya	0.2875	Gambia	0.5910
156	Botswana	0.2897	Kenya	0.5936
157	Côte d'Ivoire	0.2906	Madagascar	0.5950
158	Ethiopia	0.2915	Uganda	0.5959
159	Benin	0.2962	Tanzania	0.6001
160	Zimbabwe	0.2968	Djibouti	0.6072
161	Lesotho	0.2987	Côte d'Ivoire	0.6081
162	Cameroon	0.2998	Zambia	0.6107
163	Somalia	0.3085	Ethiopia	0.6131
164	Swaziland	0.3124	Cameroon	0.6172
165	Tanzania	0.3142	Malawi	0.6196
166	Guinea	0.3228	Benin	0.6204
167	Uganda	0.3248	Swaziland	0.6230
168	Malawi	0.3259	Somalia	0.6275
169	Mozambique	0.3305	Rwanda	0.6335
170	Burundi	0.3371	Burundi	0.6368
171	Central African Republic	0.3396	Mozambique	0.6403
172	Burkina Faso	0.3423	Guinea	0.6419
173	Rwanda	0.3459	Central African Republic	0.6450
174	Equatorial Guinea	0.3479	Burkina Faso	0.6501
175	Nigeria	0.3538	Equatorial Guinea	0.6547
176	Chad	0.3552	DR of Congo	0.6594
177	Zambia	0.3587	Nigeria	0.6598
178	DR of Congo	0.3597	Chad	0.6612
179	Guinea-Bissau	0.3619	Guinea-Bissau	0.6699
180	Mali	0.3701	Mali	0.6729
181	Liberia	0.3851	Liberia	0.6826
182	Angola	0.4116	Afghanistan	0.6962
183	Afghanistan	0.4140	Angola	0.6980
184	Niger	0.4241	Sierra Leone	0.7019
185	Sierra Leone	0.4421	Niger	0.7045