Measuring Segregation

AN INTRODUCTION
TO THE TOPIC

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I) Measuring Segregation when there are only two groups:

A) The Concept of Segregation Curve

B) Indices of segregation:

1) The Duncan and Duncan Index I_D
2) The Gini Segregation Index I_G

females in various occupations.

A Simple Illustration of the Segregation Curve

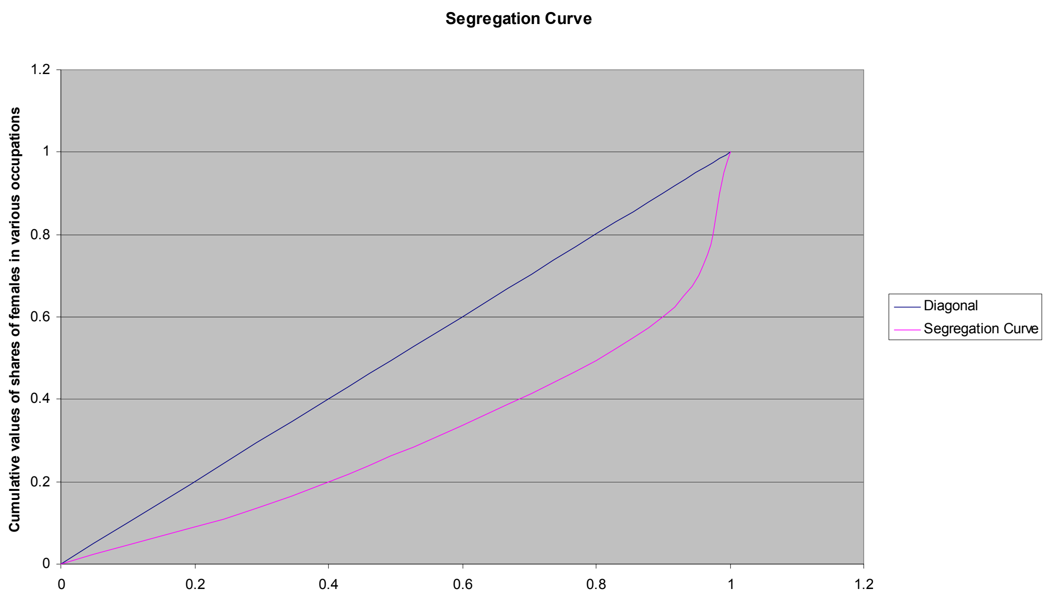
Occupation i	F_i	M_i	F_i / M_i	Rank of (F_i/M_i)
1	100	400	.25	1
2	200	100	2	3
3	200	500	.4	2
Total	500	1000		

Data for Segregation Curve

Occupation i	($F_i / \Sigma_i F_i$)	($M_i / \Sigma_i M_i$)	Cumulative Values of ($F_i / \Sigma_i F_i$)	Cumulative Values of ($M_i / \Sigma_i M_i$)
1	.2	.4	.2	.4
3	.4	.5	.6	.9
2	.4	.1	1	1
Total	1	1		

3

The corresponding Segregation Curve



Indices

a) The case of income inequality measurement:

b) On the Concept of Normative Segregation Indices

A comparative view of the values of the Gini-Segregation index.

Country and year	Self Employed	Employees only	Difference between self-employed and employees	Employees working full time	Employees working part time	Difference between full and part time employees
Switzerland (1997)	0.70 (1)	0.69 (1)	0.01	0.69 (1)	0.64 (2.5)	0.05
Finland (1990)	0.46 (8)	0.66 (5)	-0.20	n.a.	n.a.	n.a.
Norway (1990)	0.58 (3)	0.68 (3)	-0.10	0.66 (3)	0.51 (5)	0.15
Sweden (1990)	0.55 (4)	0.66 (6.5)	-0.11	0.65 (4.5)	0.47 (7)	0.18
France (1997)	0.49 (7)	0.63 (9)	-0.14	0.62 (8)	0.54 (4)	0.08
Hungary (1993)	0.53 (5)	0.64 (8)	-0.11	0.64 (6.5)	0.64 (2.5)	0
Luxembourg (1992)	0.35 (9)	0.68 (3)	-0.33	0.65 (4.5)	0.42 (9)	0.23
Poland (1994)	0.27 (10)	0.67 (5)	-0.40	0.68 (2)	0.46 (8)	0.22
Spain (1993)	0.50 (6)	0.59 (10)	-0.09	0.57 (9)	0.66 (1)	-0.09
The United Kingdom (1989)	0.67 (2)	0.68 (3)	-0.01	0.64 (6.5)	0.48 (6)	0.16

A comparative view of the values of the Duncan index.

Country and year	Self Employed	Employees only	Difference between self-employed and employees	Employees working full time	Employees working part time	Difference between full and part time employees
Switzerland (1997)	0.54 (1)	0.55 (1)	-0.01	0.56 (1)	0.56 (1)	0.00
Finland (1990)	0.31 (8)	0.54 2)	-0.23	n.a.	n.a.	n.a.
Norway (1990)	0.51 (2)	0.51 (7)	0.00	0.51 (5)	0.34 (8)	0.17
Sweden (1990)	0.40 ((5)	0.52 (4)	-0.12	0.52 (3)	0.36 (6)	0.16
France (1997)	0.32 (7)	0.52 (4)	-0.20	0.50 (7)	0.44 (5)	0.14
Hungary (1993)	0.41 (4)	0.51 (7)	-0.10	0.51 (5)	0.51 (3)	0.00
Luxembourg (1992)	0.25 (9)	0.52 (4)	-0.27	0.52 (3)	0.55 (2)	-0.03
Poland (1994)	0.22 ((10)	0.54 (2)	-0.32	0.54 (2)	0.35 (7)	0.19
Spain (1993)	0.34 (6)	0.44 (10)	-0.10	0.44 (9)	0.51 (3)	-0.07
The United Kingdom (1989)	0.51 (2)	0.48 (9)	0.03	0.48 (8)	0.34 (8)	0.14

Notes: n.a. means data "not available"
The ranking of the countries is given in parenthesis. When two countries have the same rank i, the rank given to them is (i + 0.5). If three countries have the same rank j, the rank given to them is j+1.

A comparison of the values taken by the normative segregation index when $\delta = 3$

A) Self-Employed and Employees

Country and year (1)	Self Employed. The "prior distribution is that of males. (2)	Self Employed. The prior distribution is that of females. (3)	Employees only. The prior distribution is that of males (5)	Employees only. The prior distribution is that of females (6)
Switzerland (1997)	0.85 (1)	0.81 (1)	0.86 (1)	0.76 (4.5)
Finland (1990)	0.62 (8)	0.58 (8)	0.83 (6)	0.74 (7)
Norway (1990)	0.68 (5.5)	0.75 (3)	0.85 (2)	0.77 (2.5)
Sweden (1990)	0.70 (4)	0.68 (4)	0.82 (7.5)	0.76 (4.5)
France (1997)	0.64 (7)	0.63 (5)	0.81 (9)	0.70 (9)
Hungary (1993)	0.73 (3)	0.61 (6)	0.82 (7.5)	0.73 (8)
Luxembourg (1992)	0.44 (9.5)	0.50 (9)	0.84 (4)	0.78 (1)
Poland (1994)	0.44 (9.5)	0.32 (10)	0.84 (4)	0.75 (6)
Spain (1993)	0.68 (5.5)	0.60 (7)	0.78 10)	0.67 (10)
The United Kingdom (1989)	0.84 (2)	0.76 (2)	0.84 (4)	0.77 (2.5)

Notes: n.a. means data "not available"
The ranking of the countries is given in parenthesis. When two countries have the same rank i, the rank given to them is (i + 0.5). If three countries have the same rank j, the rank given to them is j+1.

Country and year	Employees working full time. The “prior distribution is that of males.	Employees working full time. The prior distribution is that of females.	Employees working part time. The prior distribution is that of males	Employees working part time. The prior distribution is that of females
(1)	(2)	(3)	(5)	(6)
Switzerland (1997)	0.86 (1)	0.76 (2)	0.83 (1)	0.72 (3)
Finland (1990)	n.a.	n.a.	n.a.	n.a.
Norway (1990)	0.83 (3.5)	0.76 (2)	0.67 (5)	0.63 (4)
Sweden (1990)	0.80 (7.5)	0.75 (4.5)	0.65 (8)	0.55 (7)
France (1997)	0.81 (6)	0.70 (8)	0.74 (4)	0.62 (5)
Hungary (1993)	0.82 (5)	0.73 (7)	0.82 (2)	0.73 (2)
Luxembourg (1992)	0.83 (3.5)	0.75 (4.5)	0.59 (9)	0.52 (9)
Poland (1994)	0.85 (2)	0.76 (2)	0.66 (6.5)	0.54 (8)
Spain (1993)	0.77 (9)	0.64 (9)	0.80 (3)	0.78 (1)
The United Kingdom (1989)	0.80 (7.5)	0.74 (6)	0.66 (6.5)	0.58 (6)

Notes: n.a. means data “not available”

The ranking of the countries is given in parenthesis. When two countries have the same rank i, the rank given to them is (i + 0.5). If three countries have the same rank j, the rank given to them is j+1.

A similar principle is applied when more than 3 countries have the same rank.

4) The Desirable Properties of Segregation index:

Axiom 1: *Size Invariance*

Axiom 2: *Complete Integration*

Axiom 3: *Complete Segregation*

Axiom 4: *Symmetry in Groups*

Axiom 5: *Symmetry in Types*

Axiom 6: *Weak Principle of Transfers*

Axiom 7: *Movement between Groups*

Axiom 9: This axiom has also been introduced by Kakwani (1994).

Axiom 10: *Increasing Returns to a Movement Between Groups (see,* Zoloth 1976)

Axiom 11: *Zero Member Independence*

Axiom 12: It has been called *Organizational Equivalence* by James and Taeuber (1985) and *Insensitivity to Proportional Divisions by* Hutchens (2001).

Axiom 13: *Additivity*

Axiom 14: *Additive Decomposability*

<u>5) Entropy based Indices of Segregation</u>:

a) Measuring local segregation:

In information theory, the expression

$$I_j = w_j \log(w_j/W) + (1 - w_j) \log((1 - w_j)/(1 - W))$$

is known as the expected information of the message that transforms the proportions $(W, (1 - W))$ into proportions $(w_j, (1 - w_j))$.

$I_E = \sum_j s_{tj} I_j$.

In other words I_E is the weighted average of the information expectations, with weights proportional to the number of people in the occupations.

One can prove that I_E satisfies the axioms of

- *Size Invariance*
- *Complete Integration*
- *Symmetry in Groups*
- *Symmetry in Types*
- *Additivity*
- *Complete Segregation*
- *Weak Principle of Transfers*
- *Movement between Groups*
- *Increasing Returns to Movement Between Groups*
- *Zero Member Independence*

Analysis of Segregation:

A) Deriving a multidimensional formulation of segregation measurement:

Moir and Selby Smith (1979) suggested measuring segregation via the index

$$I_{MSS} = (1/2)\sum_{i=1}^{m} \left| (T_i / T) - (F_i / F) \right|$$

Lewis (1982) suggested using the following segregation measure:

$$I_L = (1/2)\sum_{i=1}^{m}\left|(M_i / M) - (T_i / T)\right|$$

Karmel and Maclachlan (1988) proposed a third extension of the Duncan index by defining the following segregation index:

$$I_{KM} = (1/T)\sum_{i=1}^{m}\left|(F / T)M_i - (M / T)F_i\right|$$

The Karmel and Maclachlan index may be expressed as

$$I_{KM} = \sum_{i=1}^{m} \sum_{j=1}^{K} \left| (T_{ij}/T) - (T_{i.}/T)(T_{.j}/T) \right|$$

We may interpret segregation as the comparison of "a priori" shares $(T_{i.}/T)(T_{.j}/T)$

with "a posteriori" shares (T_{ij}/T).

But we are not limited to using an extension of the Duncan index.

Using the G-matrix we may define a "generalized Gini segregation index" as

$$I_{GG} = [...((T_{i.}/T)(T_{.j}/T))...]' G [...(T_{ij}/T)..]$$

2002)

1) <u>Segregation as Disproportionality in Group Proportions</u>:

<u>Example 1</u>: An index derived from the mean relative deviation.

Assume that

$$f(r_{ij}) = (1/2)\left|r_{ij} - 1\right|.$$

$$\mathit{Then}$$

$$W = (1/2)\sum^{I} m_{i\cdot} \sum^{J} m_{\cdot j}\left|r_{ij} - 1\right|$$

Assume that

$$f(r_{ij}) = \left| r_i - r_j \right|.$$

Then

$$W = (1/2)\sum_{i=1}^{I} m_{i.} \sum_{h=1}^{J}\sum_{k=1}^{J} (m_{.h}\, m_{.k}) \left| r_{ih} - r_{ik} \right|$$

Example 3: An index derived from the concept of entropy (from the Theil index).

Assume that

$$f(r) = r \ln r$$

Then

$$W = \sum_{i=1}^{I} m_{i.} \sum_{j=1}^{J} m_{.j}\, r_{ij} \ln r_{ij}$$

Assume that

$$f(r) = (r-1)^2$$

then

$$W = \sum_{i=1}^{I} m_{i.} \sum_{j=1}^{J} m_{.j} (r_{ij} - 1)^2$$

2) <u>Segregation as a measure of the degree of dependence between the lines and the columns (the areas and the groups)</u>

<u>Example 1</u>: if we use the logarithmic function, that is the concept of entropy, the index obtained will be

$$I_S = \sum_{i=1}^{I} \sum_{j=1}^{J} (m_{i.} m_{.j}) \ln \frac{(m_{i.} m_{.j})}{m_{ij}}$$

$$G_S = (1/2)\sum_{h=1}^{I\times J}\sum_{k=1}^{I\times J} f_h f_k \left| \frac{s_h}{f_h} - \frac{s_k}{f_k} \right|$$

where

$f_h = (m_{i.} m_{.j})$ *for* $h = 1$ *to* $(I \times J)$ *and similarly for* f_k

and

$s_h = m_{ij}$ *for* $h = 1$ *to* $(I \times J)$ *and similarly for* s_k.

Note that this formulation is the same as the one given previously in terms of the G – matrix.

3) Segregation as a measure related to the concept of diversity:

- Using the notations defined previously we could define the degree of diversity D in the whole population as

  $D = \Sigma_{j=1 \text{ to } J}\, m_{.j}\,(1 - m_{.j})$

  D is in fact equal to the probability that two individuals, taken randomly in the population, belong to two different groups.

We can similarly define the degree of diversity in area i as

$D_i = \Sigma_{j=1 \text{ to } J}\,(m_{ij}/m_{i.})(1 - (m_{ij}/m_{i.}))$

segregation:

1) A result by Deming and Stephan (1940) on the convergence of matrices

2) The Concept of Shapley Decomposition

3) An Empirical Illustration: Changes in Occupational Segregation in Switzerland between 1970 and 2000

Table 1: Decomposition of the Change in Switzerland between 1970 and 2000 in the Generalized Duncan Index (Occupational Segregation by Gender, Nationality or Age)

Criterion of Comparison of Subpopulations	Value of the Index in 1970	Value of the Index in 2000	Change observed between 1970 and 2000	Component of the change due to variations in the "internal structure"	Component of the change due to variations in the "margins"	Component due to variation in the occupational structure	Component due to variations in the shares of the subpopulations
Gender	0.4787	0.4875	0.0088	-0.0216	0.0304	-0.0237	0.0542
Nationality (Swiss versus Foreigners)	0.2449	0.1446	-0.1003	-0.0524	-0.0479	-0.0224	-0.0255
Age (up to 50 and above 50)	0.1325	0.0651	-0.0673	-0.0691	0.0017	0.0036	-0.0019

Table 2 : Decomposition of the variation in Switzerland between 1970 and 2000 of the degree occupational segregation by gender, separately for Swiss and foreign workers (based on the use of the Generalized Duncan Index)

Criterion of Comparison of Subpopulations	Value of the Index in 1970	Value of the Index in 2000	Change observed between 1970 and 2000	Component of the change due to variations in the "internal structure"	Component of the change due to variations in the "margins"	Component due to variation in the occupational structure	Component due to variations in the shares of the subpopulations
Swiss	0.4683	0.4905	0.0223	-0.0224	0.0447	-0.0114	0.0561
Foreigners	0.5210	0.4705	-0.0505	-0.0269	-0.0235	-0.0617	0.0382

III) An Axiomatic Approach to the Ordinal Measurement of Segregation:

1) Homogeneity
2) Symmetry
3) Transfers

Definition: Hutchens (1991) calls then a "Relative Inequality Measure for Occupations" (RIMFO) any segregation measure that satisfies these three properties of homogeneity, symmetry and transfers

Assume two populations A and B. Then $S_A > S_B$ for every RIMFO S if and only if the segregation curve SC_B of population B lies at no point below and at some point above the segregation curve SC_A of population A (SC_B is said to dominate SC_A).

IV) Axiomatic Approaches to the Derivation of Segregation Indices:

A) The recently published paper by Chakravarty and Silber (2007) entitled A generalized index of employment segregation

1) **Symmetry in Occupations (SYO)**

2) **Continuity (CON)**

3) **Strict Separability (SSP)**

4) **Scaling Consistency (SCC)**

5) **Movement Between Occupations (MBO)**

6) **Monotonicity (MON)**

7) **Symmetry in Types (SYT)**

8) **Scale Invariance**

Theorem 1: An integration index satisfies axioms **SYO, CON, SSP, SCC, MBO, MON** and **SYT** if and only if it is ordinally equivalent to

$$aT + b\sum_{j=1 \text{ to } T} \prod_{i=1 \text{ to } 2} (x_{ij})^{\alpha}$$

or

$$aT + b\sum_{j=1 \text{ to } T} \sum_{i=1 \text{ to } 2} \alpha \log (x_{ij})$$

More specific forms:

$$K_{\alpha}(x) = 1 - \{(1/T)\sum_{j=1 \text{ to } T} \prod_{i=1 \text{ to } 2} (x_{ij}/n_i)^{\alpha}\}^{(1/2\alpha)}$$

and

$$K(x) = 1 - \prod_{j=1 \text{ to } T} \{\prod_{i=1 \text{ to } 2} (x_{ij}/n_i)^{(1/2)}\}^{(1/T)}$$

These indices are applications of multidimensional Atkinson inequality indices to the measurement of segregation. For a given *X*, as α increases, the segregation index decreases. α can therefore be interpreted as a segregation aversion parameter.

List of occupations

Management occupations
Business and financial operations occupations
Computer and mathematical occupations
Architecture and engineering occupations
Life, physical and social science occupations
Community and social services occupations
Legal occupations
Education, training and library occupations
Arts, design, entertainment, sports and media occupations
Healthcare practitioner and technical occupations
Healthcare support occupations
Protective service occupations
Food preparation and swerving related occupations
Building and ground cleaning and maintenance occupations
Personal care and service occupations
Sales and related occupations
Office and administrative support occupations
Farming, fishing and forestry occupations
Construction and extraction occupations
Installation, maintenance and repair occupations
Production occupations
Transportation and material moving occupations

Type of Segregation and Year	Duncan Index	Gini Segregation Index	Theil-Finniza Index	Hutchens' Square Root Index	$\overline{K}$	$\overline{K}_{0.1}$	$\overline{K}_{0.3}$	$\overline{K}_{0.5}$	$\overline{K}_{0.7}$	$\overline{K}_{0.9}$
Occupational Segregation between White and Blacks	0.170	0.230	0.303	0.021	0.9679	0.965473	0.9604	0.955	0.9506	0.946
Occupational Segregation between Whites and Asians	0.183	0.270	0.299	0.033	0.9678	0.965470	0.9607	0.956	0.9514	0.947
Occupational Segregation between Asians and Blacks	0.248	0.360	0.343	0.057	0.969	0.967	0.9619	0.957	0.9525	0.948
Occupational Segregation by Gender	0.414	0.560	0.425	0.149	0.972	0.970	0.9660	0.961	0.9564	0.952

B) Generalized Gini Segregation Indices (unpublished paper by Chakravarty, D'Ambrosio and Silber):

A set of four axioms constraining the form of the index I(S) are proposed.

1) Equality of Limits (EQL)
2) Equality of Weight Gaps (EWG)
3) Occupation-wise Symmetry in Types (OST)
4) Movement Between Occupations (MBO)

Theorem 1: The only integration index of the form satisfying axioms **EQL**, **EWG, SYT** and **MBO** is given by

$I(S) = \Sigma_j \Sigma_i [\alpha_j + (i-1)f_j] s'_{ij}$

where for each occupation j the shares s'_{ij} are the shares s_{ij} ranked by non increasing values, α_j is the minimal value of $a_{ij}(S)$ and $f_j = a_{i+1,j}(S') - a_{i,j}(S')$

In addition the generalized Gini integration index is assumed to satisfy the following axioms:

5) Symmetry in Occupations (SYO)

6) Continuity (CON)

An interesting illustration of the formulation of I(S) is given by

$I(S)=1-\{[\Sigma_j s'_{ej}]/J\}$

where $s'_{ej}= \Sigma_i((2i-1)/\Sigma_i(2i-1))s'_{ij}$

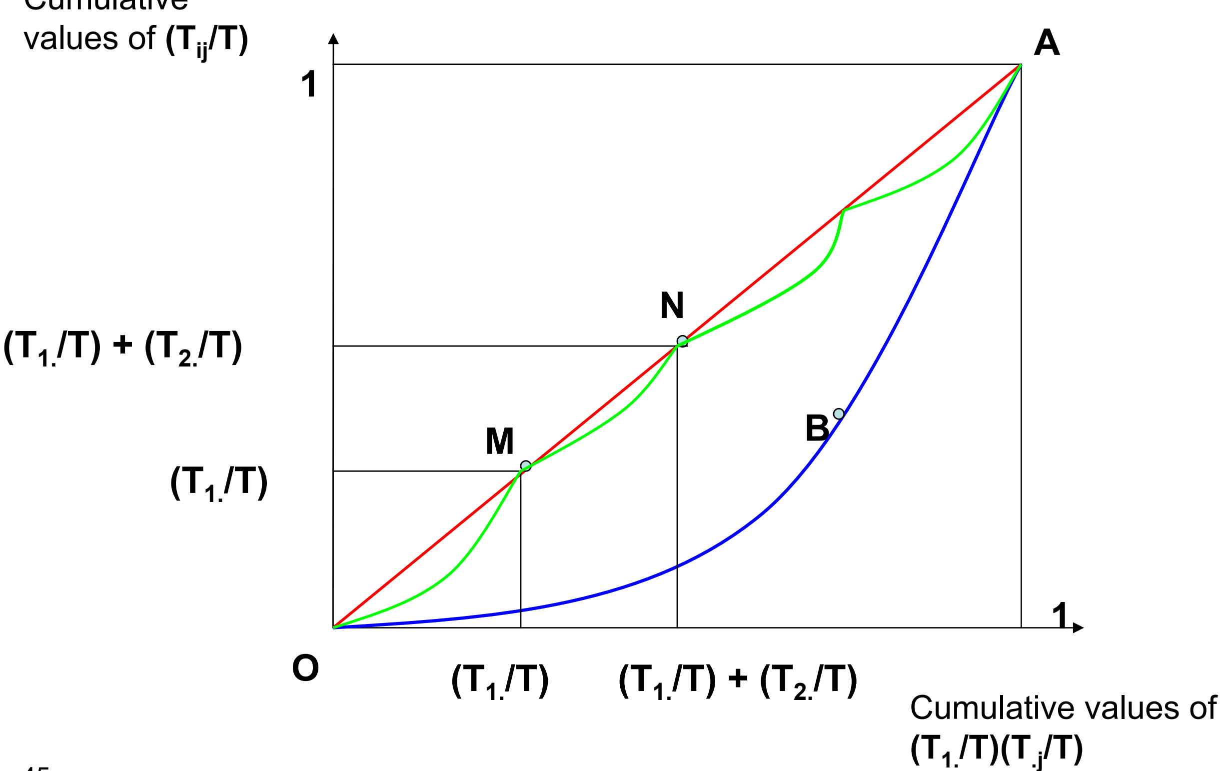
A Comparison with other Gini-related Segregation Indices:

a) The "Generalized Gini Index" (that was defined previously)

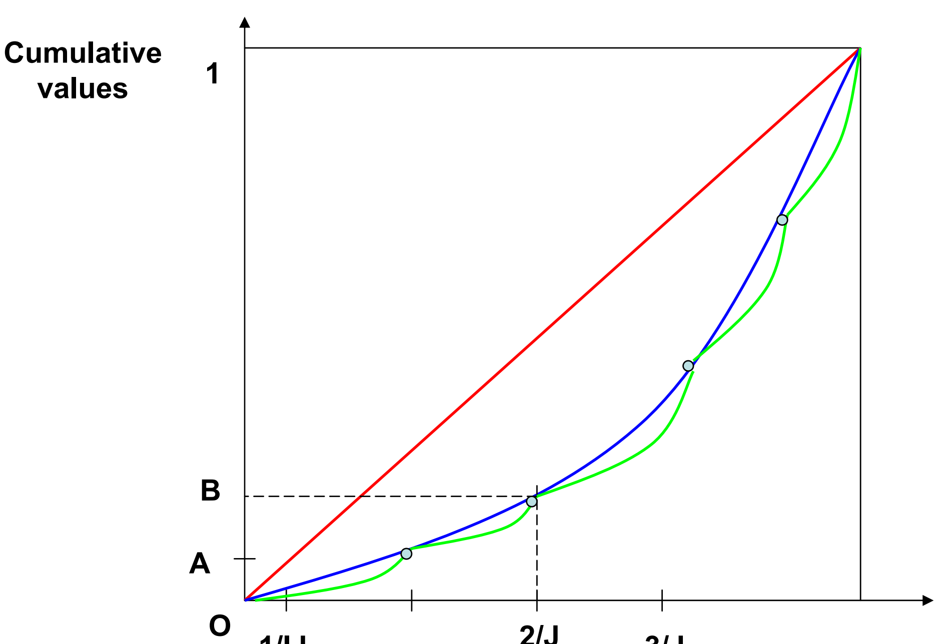
b) Reardon and Firebaugh's formulation for the multi-group Gini Index

c) The Chakravarty-D'Ambrosio-Silber formulation

d) The weighted version of the Chakravarty-D'Ambrosio-Silber Index



Graph 3:
The Chakravarty - D'Ambrosio - Silber Approach



List of Occupations

Code of the Occupation	Label of the Occupation
1	Farming, Forestry, and Fishing Occupations
2	Managerial and Professional Specialty Occupations
3	Military Occupations
4	Operators, Fabricators, and Laborers
5	Precision Production, Craft, and Repair Occupations
6	Service Occupations
7	Technical, Sales, and Adminstrative Support Occupations
8	Unemployed since 1984

List of the States and the Symbols used to represent them

Symbol used for the State	
AK	Alaska
AL	Alabama
AR	Arkansas
AZ	Arizona
CA	California
CO	Colorado
CT	Connecticut
DC	District of Columbia
DE	Delaware
FL	Florida
GA	Georgia
HI	Hawaii
IA	Iowa
ID	Idaho
IL	Illinois
IN	Indiana
KS	Kansas
KY	Kentucky
LA	Louisiana
MA	Massachussets
MD	Maryland
ME	Maine

MS	Mississipi
MT	Montana
NC	North Carolina
ND	North Dakota
NE	Nebraska
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NV	Nevada
NY	New York
OH	Ohio
OK	Oklahoma
OR	Oregon
PA	Pennsylvania
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VA	Virginia
VT	Vermont
WA	Washington
WI	Wisconsin
WV	West Virginia
WY	Wyoming

Table 1: Segregation by Race in the United States in 1990

State	Unweighted Gini Index (I^{U}_{CDS})	Weighted Gini Index (I^{W}_{CDS})	Generalized Duncan Index (I_{DG})	Generalized Gini Index (I_{GG})	Reardon and Firebaugh Index (I_{RF})
AK	0.83113	0.4547	0.15042	0.10944	0.093059
AL	0.83119	0.46426	0.18021	0.12289	0.10473
AR	0.82185	0.33033	0.10549	0.077123	0.061832
AZ	0.82974	0.40735	0.1188	0.088877	0.074714
CA	0.8298	0.54315	0.15412	0.11683	0.10037
CO	0.81278	0.2488	0.070421	0.055286	0.045115
CT	0.81548	0.26615	0.080464	0.061521	0.05129
DC	0.84128	0.58819	0.34208	0.22794	0.2065
DE	0.82142	0.37764	0.1428	0.10278	0.085731
FL	0.81986	0.35891	0.12499	0.088938	0.071671
GA	0.82935	0.49544	0.1827	0.12196	0.10577
HI	0.83702	0.61272	0.13903	0.10072	0.093721
IA	0.80572	0.074965	0.016381	0.014289	0.011256
ID	0.8075	0.11548	0.048824	0.038286	0.030328
IL	0.83202	0.43192	0.10643	0.081806	0.07026
IN	0.81959	0.23942	0.044551	0.03665	0.030887
KS	0.8193	0.24637	0.057146	0.045898	0.037545
KY	0.81497	0.20384	0.049875	0.039343	0.031682
LA	0.83651	0.53329	0.21253	0.13967	0.1218
MA	0.81351	0.2195	0.050202	0.038661	0.031327
MD	0.82612	0.49226	0.1276	0.096802	0.086696

MS	0.83894	0.55059	0.26231	0.16587	0.14601
MT	0.8114	0.15597	0.044409	0.033883	0.025776
NC	0.82701	0.4487	0.16893	0.11532	0.096853
ND	0.81015	0.11682	0.029439	0.0238	0.018772
NE	0.8162	0.17981	0.03276	0.027852	0.022418
NH	0.80308	0.043708	0.0074084	0.0063287	0.0050127
NJ	0.82107	0.40442	0.11944	0.088707	0.073856
NM	0.82065	0.41956	0.11774	0.085609	0.074024
NV	0.82166	0.34425	0.12172	0.089296	0.072511
NY	0.82742	0.46715	0.11139	0.086289	0.077777
OH	0.81966	0.27095	0.05861	0.04724	0.040033
OK	0.82253	0.36643	0.091299	0.068242	0.056198
OR	0.80838	0.15205	0.041401	0.032331	0.026183
PA	0.81871	0.25984	0.051242	0.041909	0.036135
RI	0.81395	0.2006	0.064697	0.051151	0.040735
SC	0.83458	0.51958	0.23203	0.15169	0.13171
SD	0.81806	0.18224	0.044464	0.035135	0.027672
TN	0.82216	0.34201	0.099163	0.072935	0.06047
TX	0.82473	0.46289	0.15523	0.11343	0.096593
UT	0.80925	0.14501	0.043608	0.033461	0.026237
VA	0.82451	0.43405	0.14477	0.10479	0.089941
VT	0.80219	0.035608	0.0071787	0.006436	0.0048622
WA	0.81575	0.25768	0.06012	0.046384	0.038516
WI	0.81781	0.19069	0.046471	0.036455	0.028897
WV	0.80644	0.095537	0.018602	0.01592	0.012325
WY	0.80717	0.11345	0.035513	0.029146	0.023452

Table 3: Correlation Matrix between the various Segregation Indices

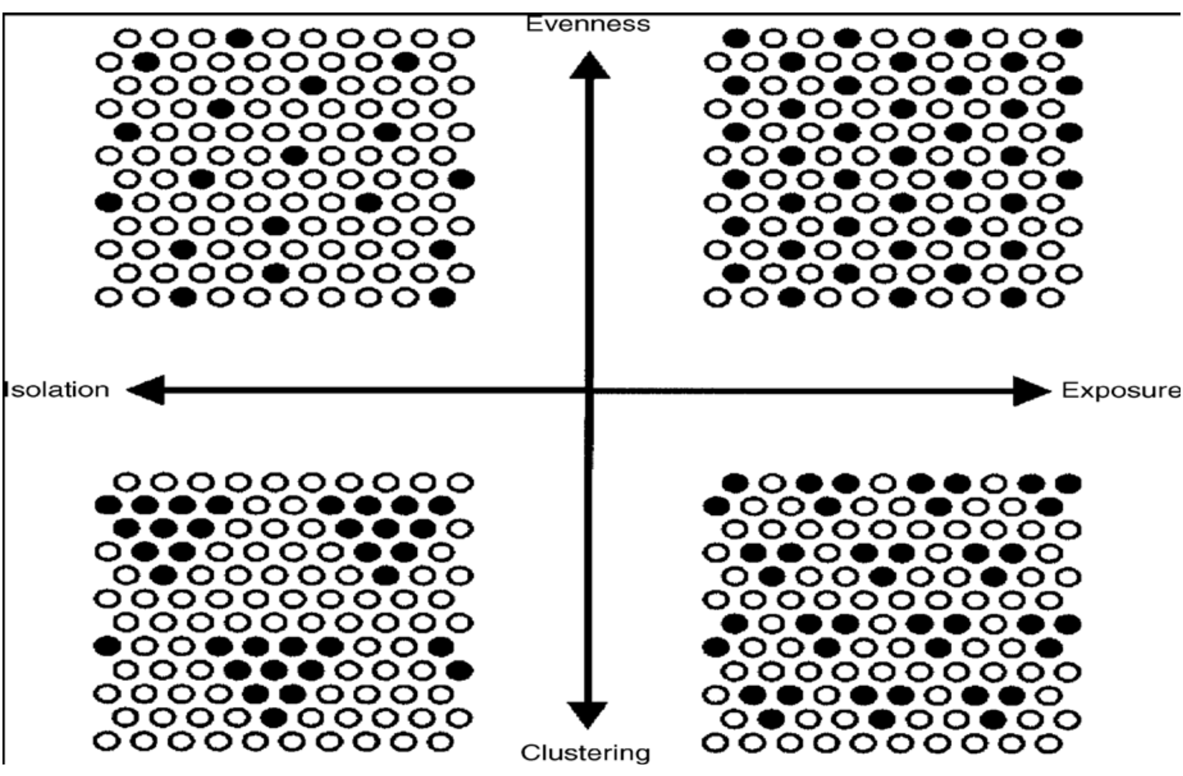
	Weighted Gini Index (I^W_{CDS})	**Generalized Duncan Index** (I_{DG})	**Generalized Gini Index** (I_{GG})	**Reardon and Firebaugh Index** (I_{RF})
Unweighted Gini Index (I^U_{CDS})	0.956	0.885	0.900	0.902
Weighted Gini Index (I^W_{CDS})		0.895	0.918	0.918
Generalized Duncan Index (I_{DG})			0.996	0.996
Generalized Gini Index (I_{GG})				0.999

Segregation:

A) Basic concepts in the field of residential segregation measurement (see, Massey and Denton, 1988):

- First concept: evenness
- Second concept: exposure
- Third concept: Concentration
- Fourth concept: Centralization
- Fifth concept: Clustering

An Illustration: The Checkboard problem



Criteria for Evaluating Spatial segregation Measures:

1) Scale interpretability
2) Arbitrary boundary independence
3) Location equivalence
4) Population density invariance
5) Composition invariance
6) Transfers and exchanges
7) Additive spatial decomposability
8) Additive grouping decomposability

The spatial information theory segregation index:

The spatial information theory index is a measure of how much less diverse individual's local environment are, on average, than is the total population of a region.

It will be equal to 1 (maximum segregation) only when each individual's local environment is mono-racial.

If each individual's local environment has the same racial composition as the total population, then segregation will be nil. There will be complete integration.

therefore a measure of how much less diverse individual's local environment are, on average, than is the total population of region R.

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