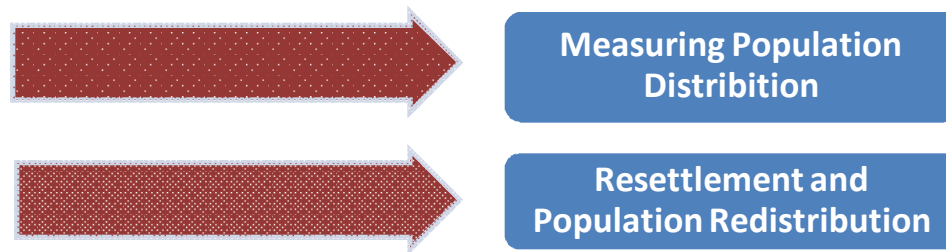


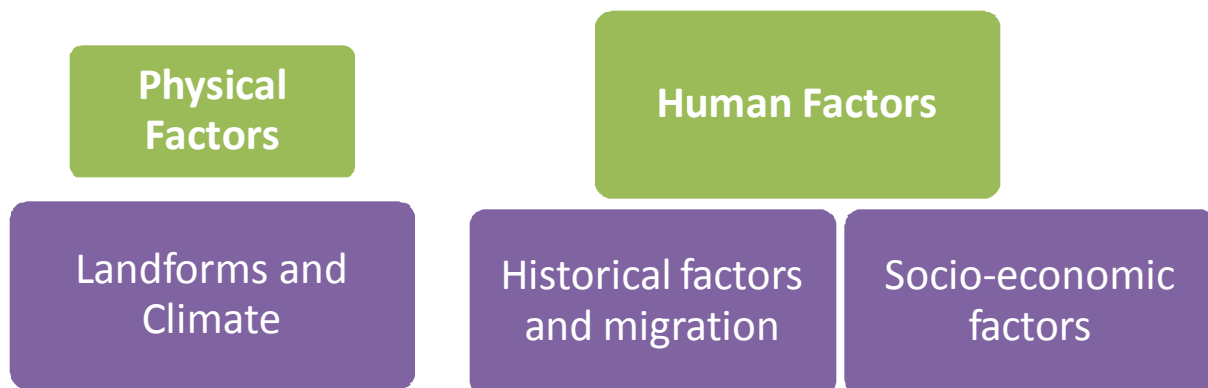
Lesson 3

Population Distribution

Learning Objectives



What Factors Determine Population Distribution in Ethiopia?



Population distribution

Introduction: Population Size

The Central Statistical Authority (CSA) puts Ethiopia's mid-2008 population size at just over 79,221,000 [1]. Much of the discussion below is based on this CSA source.

The total size of a population is the first and most important information kept by governments. In all countries of the world population data are needed:

- ❖ *for fiscal and military purposes,*
- ❖ *in apportionment of representatives in a legislative body,*
- ❖ *to study population movements,*
- ❖ *to determine the existing population-resource balance/imbalance, and*
- ❖ *to make sensible projections for the future.*

Information on the **total** population of a country is not sufficient, however. Data are often needed for geographic subdivisions by province, county, and district, zone, etc. levels.

Populations are rarely evenly distributed across geographic subdivisions. Data on sub-national levels allow analysis of distributional variations across sections of a given country or geographical sub-unit. Moreover, urban centers have a much higher concentration of population than the same area of land in rural villages. This makes the rural urban dichotomy very important for distributional analysis of populations, in addition to geographical or political subdivisions of countries. However, the term "urban" does not mean the same thing everywhere even though it is defined almost always on the basis of the size of the resident population.

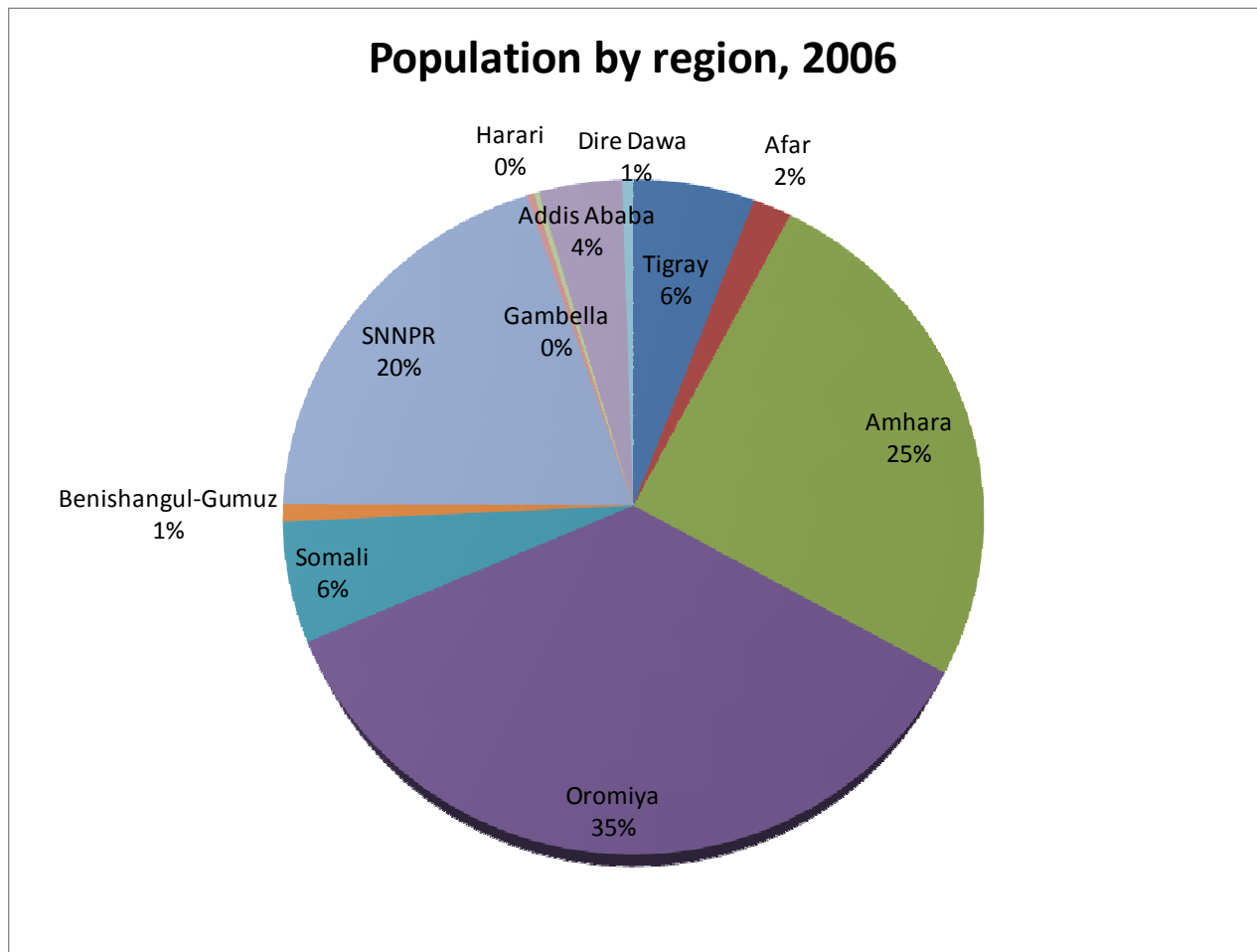
It is difficult to generalize the population distribution patterns for a country the size of Ethiopia with diverse topography, climate, and settlement history. Moreover, since population distribution patterns are partly a reflection of government policies and programs, similar socio-economic environments could produce very dissimilar population patterns. An excellent example is government policy actions towards nomadic populations, which include extreme measures ranging from no intervention of any kind, to forcing nomads to become settled agriculturalists. Another example is the socialist collectivization and resettlement conducted by the defunct Derg government. In just three years (1985 to 1988) 12 million people had been resettled in villages in twelve of the fourteen administrative regions [2].

The best way to understand the population distribution patterns in Ethiopia is to first look at the regional-level distributional patterns. The forum chosen here – the Internet – allows you easy access to the regional-level information we have managed to assemble, with just a click of the computer mouse. Pick any region on the home page, or click the region's flag on the map and

access the regional population information. Every region has a population density map except Harari, Diredawa and Addis Ababa. The density scale is made uniform to allow comparison across regions. A major drawback of the maps, however, is that it is based on administrative Wereda boundary lines. Such maps do not show *natural* density gradations from high to low, or present a true picture of real distributional patterns.

Regional Distribution at a Glance

Over a third of Ethiopia' population lives in Oromia, with Amhara in second place at 25%. The SNNPR ranks third. An identical percentage lives in Tigray and Somali (6% each).



Source: Based on [1]

Population distribution: Determining factors

Altitude

In 1994, 1.88 billion people around the world (35% of the global total then) lived below 100 meters above sea level which comprised only 15 % to total land area [3]. Globally, the number of people "...decreased more than exponentially" with increasing altitude and population density below 100 meters was larger than in any other range of elevation [4]. This effect takes place, primarily, through the coastal distribution of cities including all of the mega cities – those with populations of over 10 million inhabitants - and high-density coastal settlements. "Altitude also affects biological hazards for humans, including infectious diseases such as Malaria, Filariasis, Lyme disease, and toxoplasmosis. Altitude affects human reproductive physiology and birth weight, exposure to cosmic radiation, other physiological functions, and agricultural production" [3]. Three quarters of China's billion-plus population lives below 500 meters and "... some 228 million people - comparable to the combined population of Germany, France, Italy, and Spain..." live below 25 meters" [4]

Ethiopia presents a highly contrasting picture. Here, altitude and the attendant climatic differences determine the distributional pattern of the Ethiopian population more than any other single factor, but not in the manner it affects global population distribution. This is clearly evident in the following quote [5]:

"The Ethiopian population has traditionally been highly concentrated in the highlands. About 10% of the population lives at the extreme cold zone, at an altitude of over 2,600 meters above sea level, 39.2% lives between 2,200 meters and 2,600 meters above sea level, 28% between 1,800 meters and 2,200 meters above sea level...The lowlands are very sparsely populated mainly because of malaria and other vector borne diseases."

As a result 80% of the country's population inhabits only 37% of the total land area, mostly in the highlands [2].

Population Density

A simple but powerful measure of population distribution is known as population density. It is a ratio of two numbers: population size as the numerator, and area size of the land they inhabit as the denominator. This measure (also known as *crude density*) reveals that even in the highlands of Ethiopia the distribution pattern is uneven. Actual density numbers confirm what one might see during a helicopter flight across Ethiopia; that, the highest population densities in Ethiopia

are “.... in the Enset Belt which covers Gurage, Hadiya, Kambata and Wolayta Zones of SNNPR” [2]. All thirteen of the Weredas in Ethiopia with densities of 500 persons/km² or above are located in this region of SNNPR. The table below lists all of the Weredas with a density of 300 or more. A total of 38 Weredas are listed. All but nine of these Weredas are in SNNPR.

Weredas With Densities Over 300 Persons per km² (July 2007)

Wereda	Region	Density	Wereda	Region	Density
Cheha	SNNPR	308	Haromaya	Oromia	442
Selti	SNNPR	322	Hula	SNNPR	446
Bensa	SNNPR	337	Limo	SNNPR	450
Soro	SNNPR	340	Shashemene	Oromia	462
Konteb	SNNPR	342	Kochere	SNNPR	470
Dale	SNNPR	342	Deder	Oromia	476
Mana	Oromia	343	Badawach	SNNPR	500
Kersa	Oromia	349	Awasa	SNNPR	565
Tehuldere	Amhara	350	Boloso	SNNPR	583
Ganta Afeshum	Tigray	351	Shebedino	SNNPR	592
Chencha	SNNPR	359	Kedida Gamela	SNNPR	594
Kersa	Oromia	375	Dara	SNNPR	633
Mata	Oromia	375	Angach	SNNPR	624
Meskanena Mareko	SNNPR	392	Kacha Bira	SNNPR	637
Omo Sheleko	SNNPR	394	Zuria	SNNPR	638
Tulo	Oromia	402	Yirgachefe	SNNPR	677
Arbegona	SNNPR	416	Aleta Wendo	SNNPR	705
Adama	Oromia	436	Damot Gale	SNNPR	746
Bule	SNNPR	441	Wenago	SNNPR	1121
Kem	SNNPR	442			

Source: Based on [1]

With more than a thousand people per square mile Wenago in SNNPR has the highest density of any Wereda in the country. This is an impressive number given that we are talking about a rural

population here. For obvious reasons urban densities can be in the thousands, but the very high rural densities in SNNPR are unique to this part of the country. The happy corollary here is that this is not a region featured in daily news reports, nationally and internationally, of drought, famine, and environmental degradation even though it has a modest share of all of these predicaments. The impressive traditional land-management in SNNPR, especially in the “enset-belt” handed down from generation to generation ensuring a sensible stewardship of the land that feeds the people, is to be emulated and transplanted everywhere else in the country (go to the SNNPR page to see the population density map).

The Amhara and Tigray regions have only one Wereda each in the 300+ density category. Oromiya has seven. Weredas with low densities (very many of them) are mostly in the Afar and Somali zones as well as the low lands of Tigray, SNNPR, and Oromiya.

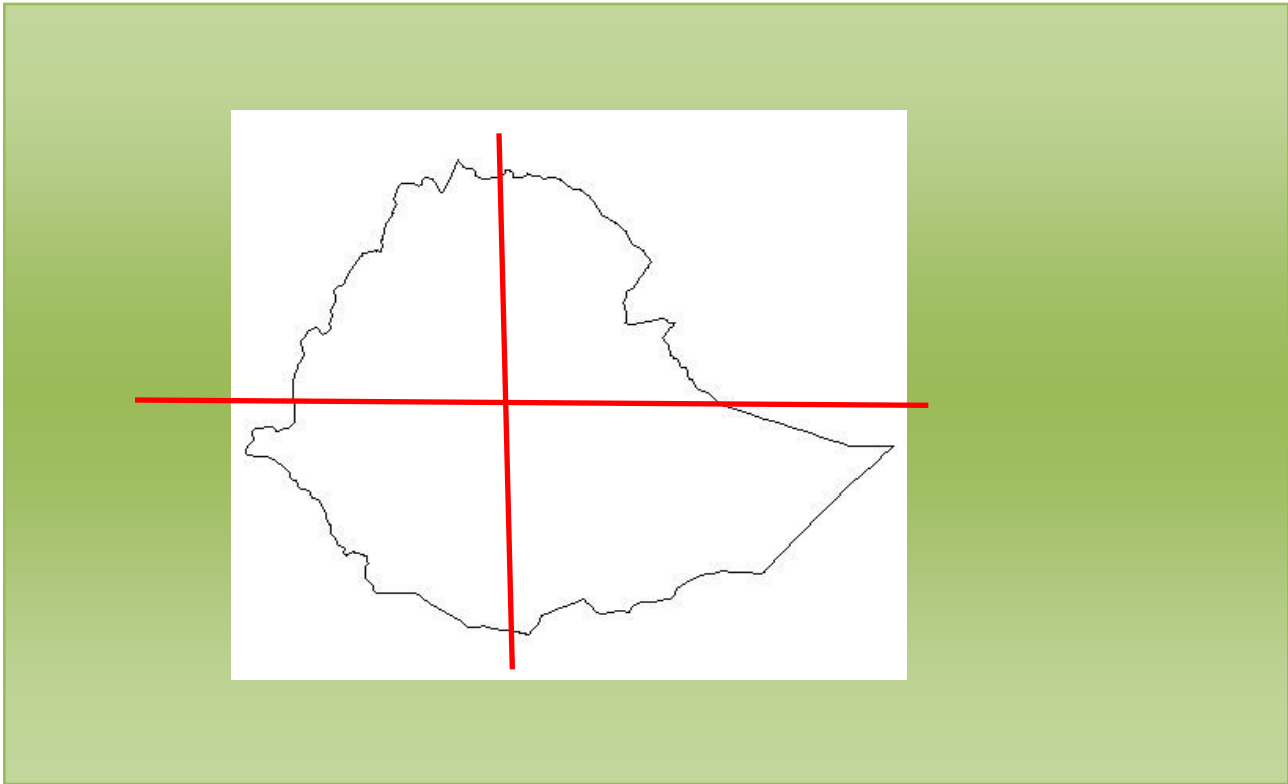
In sum, the population density measure offers a glimpse, though very crude and potentially misleading, in to how the population of a country is distributed, and whether or not there are too many”, or too few, persons per unit area. It is useful to stress here, however, that the terms “too many” and “too few” can be deceptive since no threshold population sizes could be accurately defined for a given geographical location. For example, the crude density of 4.2 for Guradamole and Arero (Oromiya) could most realistically be described as a case of too many people per unit area compared to the figure of 1121 in Wenago (SNNPR). It all depends on the population-resource balance/imbalance, i.e whether or not equilibrium has been reached. Crude densities do not accurately depict how the population of a country is distributed. It is always the case, for example, that urban areas of Ethiopia, or any other country for that matter, have much larger densities than rural settlements, with the capital Addis Ababa representing an area of most intense population concentration in the country.

The Ethiopian population being mostly agrarian (over four-fifths of the population is engaged in traditional farming), a different measure known as *agricultural density* would be more appropriate. This measure, also referred to as *physiological density* [6], relates the numbers of rural inhabitants to the size of arable land. It is difficult to compute agricultural densities here, however, due to the unavailability of data on rural population sizes, and the exact sizes of arable land for all Weredas or sub-divisions of Weredas. This might be a topic to be picked up by one of the students in this course as part of a term paper, or a senior essay, or post-graduate research. One of the likely outcomes of such research would be a change in the ordering of Weredas given in the table above. Moreover, for the country at large, the range between the highest and lowest density values would be much smaller than that represented by the crude density values.

Measuring Population Distribution

Spatial Central Tendency Measures

In statistics the mean, mode, and median represent the measures of central tendency of a given observation. The concept has been adopted in the geographical study of populations to find out the mean, median, and modal centers of the population of a country.



Median lines – two orthogonal lines (at right angle to each other) each of which divides the geographical area of a country or its sub-divisions into two parts with equal numbers of inhabitants - are superimposed on a population distribution map, preferably a dot map [7]. In population geography, the median point of the population of a country, whether it is evenly distributed or not, would be the point of intersection of the two lines. The modal point is much easier to locate because it is the point of maximum population concentration often represented by the capital city. Hence, for almost all countries of Africa, the capital cities also represent the modal centers of their population space.

More work is involved in the calculation of the spatial equivalent of the mean of a statistical distribution. The geographical mean center of the population represents “the center of population gravity for the area”, or “the point upon which the [area under consideration] would balance, if it were a rigid plane without weight and the population distributed there on, each individual being assumed to have equal weight and to exert an influence on the central point proportional to his

distance from the point. The pivotal point, therefore, would be its center of gravity” [7]. The calculation of the mean center or the center of gravity of the population uses the following formula:

$$\bar{X} = \frac{P_i X_i}{P_i} \quad \text{and} \quad \bar{Y} = \frac{P_i Y_i}{P_i}$$

where:

P_i is the population at a point i and

X_i and Y_i are the vertical and horizontal coordinates of point i .

For ease of calculation, all of the people living in a given area, a Wereda for instance would be assumed to be concentrated at the geographic center of that district. Given these assumptions the calculation of the numerators - the products of populations and the X coordinates ($P_i X_i$) and Y coordinates ($P_i Y_i$) - is done fairly easily. The denominator is the total population of an area whose center of population is being calculated.

A study in the mid 1980's put both the geographical mean and median of the Ethiopian population very near the modal point (Addis Ababa) [8]. However, a major change has taken place since then which removed over 3 million people from the northern half, or the then northern limit of the country. Here we are referring to the Eritrean independence. This would lead to a shift in the horizontal line above, southwards, and a similar southward shift in the locations of the geographical mean and median. The Eritrean independence did not affect or change the location of Addis Ababa. Hence, there are no changes in the location of the modal point. Another catalyst in the possible shift in median and mean population centers is the north-to-south population movement – both individual and government-sponsored. Given the numbers involved, it would be reasonable to assume that this has had at least as much impact as the separation of Eritrea from Ethiopia, thereby forcing the mean and median centers further south.

Spatial measure of standard deviation

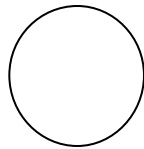
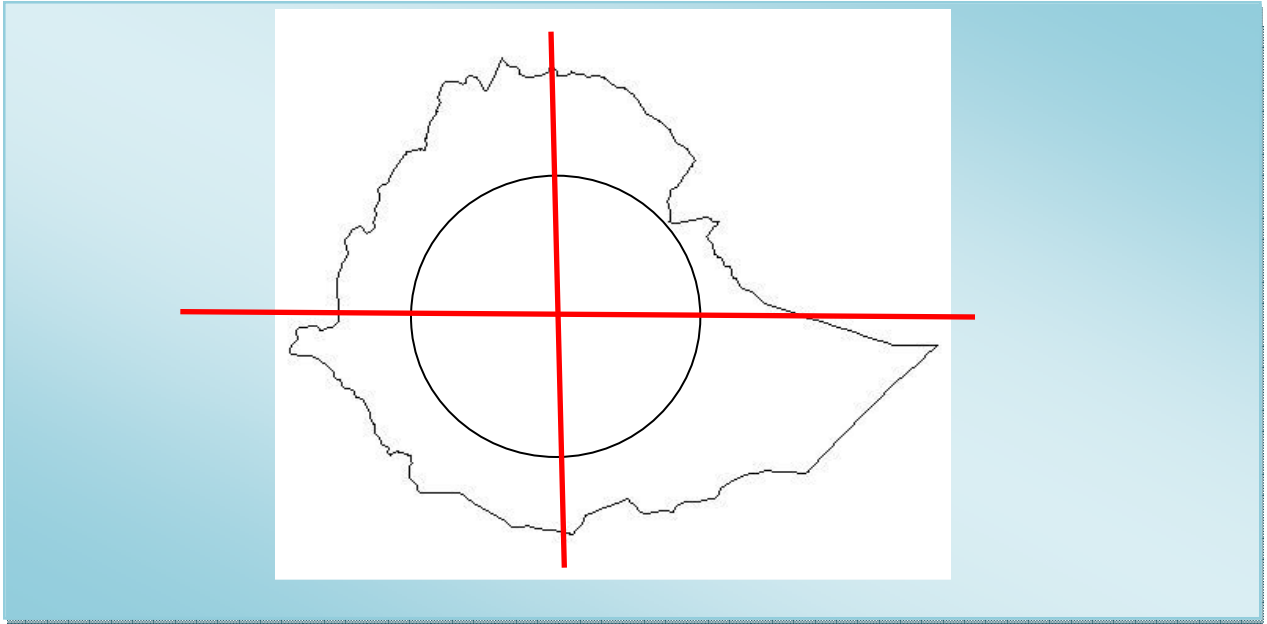
Like the measures of central tendency in numeric data, the measures of dispersion – standard deviation, variance, etc. - also have their spatial equivalent. The spatial equivalent of standard deviation is known *as spatial distance deviation*, and is represented by upper case letter ***D*** in the formula below. “The standard distance deviation bears the same kind of relationship to the center of the population that the standard deviation of any frequency distribution bears to the arithmetic mean. In other words, it is a measure of the dispersion of the distance of all inhabitants from the center of the population” [7]

$$D = \sqrt{\frac{f_i (x_i - x)^2}{n} + \frac{f_i (y_i - y)^2}{n}}$$

where:

f_i = the population in a given unit area and

n equals the total number of areas (usually subdivisions of a country) considered in the calculation of ***D***.



Area within one Standard Distance Deviation contains 68 percent of the population of the geographic area under consideration.

As with numerical data represented by an area under normal curve, the spatial distance within one standard deviation from the mean is presumed to contain roughly 68 percent of the total population.

The Lorenz Curve and Gini Concentration Ratio

The Lorenz curve has long been used to measure income inequalities, but “it has also been used to depict the state (as opposed to the process) of concentration of population and of other demographic aggregates” [6]. To draw the Lorenz Curve, the spatial subunits of a country or a portion of it (for example the Amhara region), are arranged individually or grouped into class intervals according to the population density ranking of the spatial subunits (Weredas), from places with the lowest densities, to those with the highest densities or vice versa.

The tables below show the application to the SNNPR of Ethiopia. Columns 3 and 6 (zoom to 150% for best viewing, or visit the “calculate demographic rates” page of this website) show the population and area share of each Wereda in SNNPR. For example, Aleta Wendo’s share of the

population (X_3) is 0.0264 and the y_3 (its share of Wereda area size) is 0.005. The two columns add up to 1.0 each.

Index of Concentration (Δ)

In column 7 the corresponding rows of columns 6 are subtracted from those in column 3 and the absolute values entered. The total for this column is shown at the bottom as 0.9330. We divide this number by two to get the index of concentration (Δ). Algebraically, the index of concentration (see formula below) is simply “the maximum of the set of k values of $(X_i - Y_i)$. Geometrically, it is the maximum vertical distance from the diagonal to the [Lorenz] curve. Δ is also algebraically equivalent to the Index of Dissimilarity, which is the sum of the positive differences between the two percentage distributions” [7]

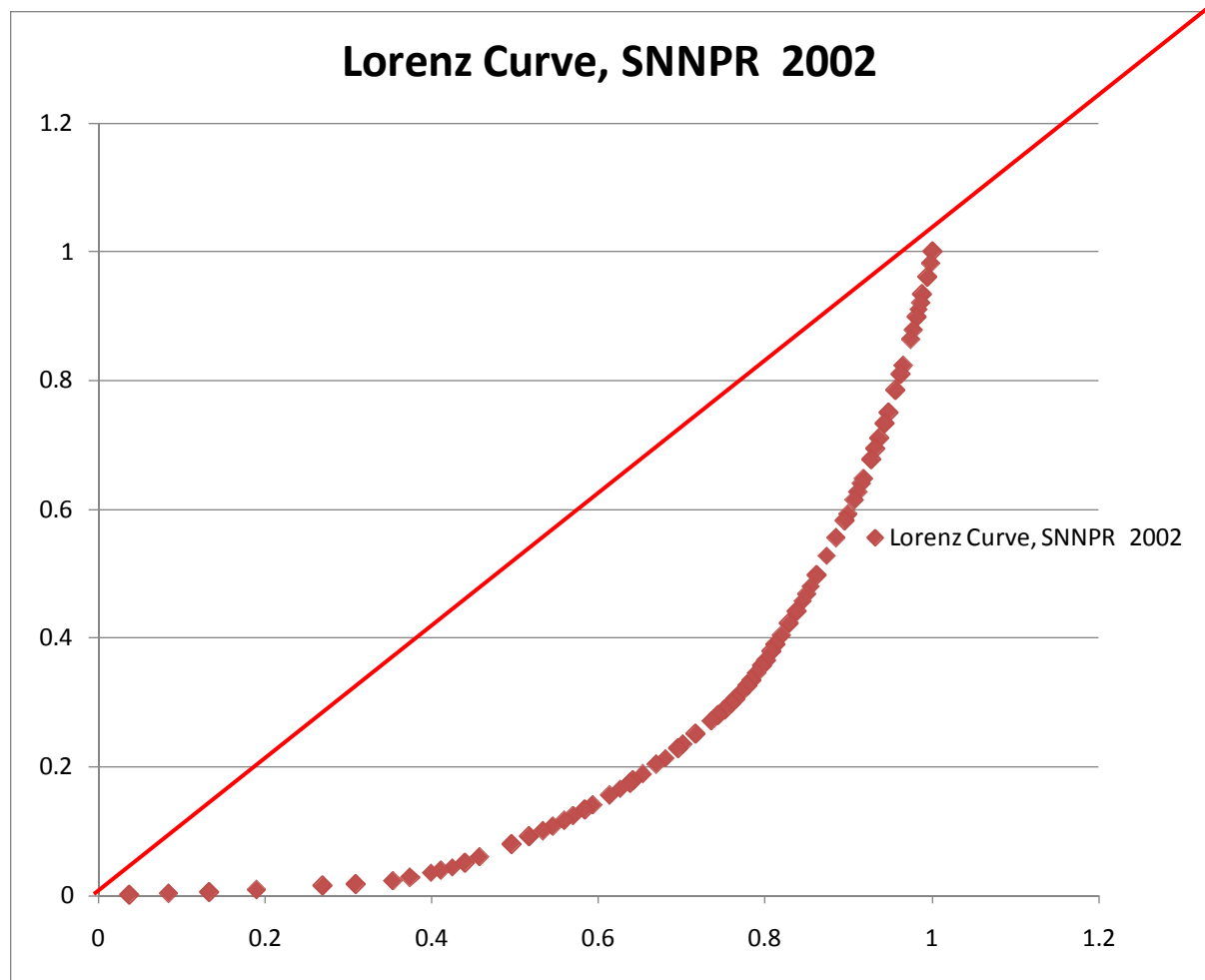
The formula gives a value of 0.4665 for SNNPR showing a 46.65 percent departure from evenness (see the Lorenz Curve also). If the population of SNNPR was perfectly evenly distributed, a graph made on the basis of x_i and y_i values would be a perfect diagonal, with no distance in between the Lorenze Curve and the diagonal, i.e. the Lorenze curve and the diagonal would overlap. However, since the population of SNNPR is not evenly distributed the Lorenz Curve and the diagonal do not overlap. Thus, the Index of Concentration (Δ) tells us algebraically what we can see pictorially.

$$\Delta = \frac{1}{2} \sum_{i=1}^k |x_i - y_i|$$

Computation of Gini Concentration Ratio and Index of Concentration, SNNPR 2002.

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	
WEREDA	POPULATION	POPULATION	DENSITY	AREA	AREA	CUMULATIVE						
	PROPORTION	RANK	SQ. MILES)	PROPORTION	POPULATION	AREA	PROPORTION	POPULATION	AREA	$I(X_i) - (X_i)$	$X_{i+1}Y_i$	X_iY_{i+1}
	(x_i)			(y_i)								
WENAGO	243,987	0.0186	1	255.16	2.29E-03	0.0163	1.0000	1.00E+00	0.0000	9.81E-01	9.98E-01	
DAMOT GALE	278,092	0.0212	2	429.07	3.85E-03	0.0173	0.9814	9.98E-01	-0.0163	9.58E-01	9.75E-01	
ALETA WENDO	347,123	0.0264	3	567.03	5.09E-03	0.0213	0.9603	9.94E-01	-0.0336	9.28E-01	9.49E-01	
YIRGACHEFE	176,500	0.0134	4	301.1	2.70E-03	0.0107	0.9339	9.89E-01	-0.0549	9.10E-01	9.21E-01	
DARA	134,284	0.0102	5	243.75	2.19E-03	0.0080	0.9204	9.86E-01	-0.0656	8.98E-01	9.06E-01	
KACHA BIRA	152,727	0.0116	6	277.5	2.48E-03	0.0091	0.9102	9.84E-01	-0.0737	8.84E-01	8.93E-01	
SODO ZURIA	262,614	0.0200	7	481.25	4.32E-03	0.0157	0.8986	9.81E-01	-0.0828	8.62E-01	8.78E-01	
ANGA CHA	197,569	0.0150	8	364.07	3.27E-03	0.0118	0.8786	9.77E-01	-0.0985	8.44E-01	8.56E-01	
SHEBEDINO	535,057	0.0407	9	1,035.47	9.29E-03	0.0314	0.8636	9.74E-01	-0.1102	8.01E-01	8.33E-01	
KEDIDA GAMELA	180,825	0.0138	10	351.25	3.15E-03	0.0106	0.8229	9.65E-01	-0.1416	7.80E-01	7.91E-01	
BOLOSO SORE	319,898	0.0243	11	632.66	5.68E-03	0.0187	0.8091	9.61E-01	-0.1522	7.54E-01	7.73E-01	
AWASA	454,078	0.0345	12	942.35	8.46E-03	0.0261	0.7848	9.56E-01	-0.1709	7.17E-01	7.43E-01	
BADAWACHO	224,540	0.0171	13	516.57	4.64E-03	0.0124	0.7502	9.47E-01	-0.1970	6.94E-01	7.07E-01	
GUMER	304,867	0.0232	14	740.78	6.65E-03	0.0165	0.7331	9.43E-01	-0.2094	6.69E-01	6.86E-01	
KOCHERE	205,364	0.0156	15	504.22	4.53E-03	0.0111	0.7100	9.36E-01	-0.2260	6.50E-01	6.61E-01	
HULA	227,094	0.0173	16	583.76	5.24E-03	0.0120	0.6943	9.31E-01	-0.2371	6.31E-01	6.43E-01	
LIMO	388,127	0.0295	17	1,002.03	8.99E-03	0.0205	0.6770	9.26E-01	-0.2491	6.00E-01	6.21E-01	
BULE	103,067	0.0078	18	268.91	2.41E-03	0.0054	0.6475	9.17E-01	-0.2697	5.87E-01	5.92E-01	
ARBEGONA	172,069	0.0131	19	474.07	4.25E-03	0.0088	0.6397	9.15E-01	-0.2751	5.73E-01	5.82E-01	
OMO SHELEKO	160,440	0.0122	20	467.35	4.19E-03	0.0080	0.6266	9.11E-01	-0.2839	5.59E-01	5.68E-01	
MESKANENA	294,252			872.5								
MAREKO		0.0224	21		7.83E-03	0.0146	0.6144	9.06E-01	-0.2919	5.37E-01	5.52E-01	
CHENCHA	113,232	0.0086	22	365	3.28E-03	0.0053	0.5920	8.98E-01	-0.3065	5.24E-01	5.30E-01	
KONTEB	365,672	0.0278	23	1,225.00	1.10E-02	0.0168	0.5834	8.95E-01	-0.3118	4.97E-01	5.16E-01	
SORO	366,065	0.0279	24	1,234.54	1.11E-02	0.0168	0.5556	8.84E-01	-0.3287	4.67E-01	4.85E-01	
DALE	393,194	0.0299	25	1,326.41	1.19E-02	0.0180	0.5277	8.73E-01	-0.3454	4.35E-01	4.54E-01	
BENSA	237,117	0.0180	26	806.88	7.24E-03	0.0108	0.4978	8.61E-01	-0.3634	4.13E-01	4.25E-01	
SEITI	150,119	0.0114	27	535	4.80E-03	0.0066	0.4797	8.54E-01	-0.3742	4.00E-01	4.07E-01	
CHEHA	147,444	0.0112	28	549.85	4.94E-03	0.0063	0.4683	8.49E-01	-0.3809	3.88E-01	3.95E-01	
EZHA NA WOLENE	208,229	0.0158	29	815.63	7.32E-03	0.0085	0.4571	8.44E-01	-0.3871	3.73E-01	3.83E-01	
ALABA	240,532	0.0183	30	973.76	8.74E-03	0.0096	0.4413	8.37E-01	-0.3957	3.54E-01	3.65E-01	
ENEMORINA EANER	248,938			1,018.75								
		0.0189	31		9.14E-03	0.0098	0.4230	8.28E-01	-0.4052	3.35E-01	3.46E-01	
DAMOT WEYDE	190,209	0.0145	32	783.44	7.03E-03	0.0074	0.4040	8.19E-01	-0.4150	3.19E-01	3.28E-01	
OFFA	141,595	0.0108	33	588.13	5.28E-03	0.0055	0.3895	8.12E-01	-0.4225	3.08E-01	3.14E-01	
KINDO KOYSHA	178,824	0.0136	34	776.41	6.97E-03	0.0066	0.3788	8.07E-01	-0.4280	2.95E-01	3.03E-01	
LANFRO	102,491	0.0078	35	451.88	4.06E-03	0.0037	0.3652	8.00E-01	-0.4346	2.86E-01	2.91E-01	
DALOCHA	157,280	0.0120	36	718.75	6.45E-03	0.0055	0.3574	7.96E-01	-0.4383	2.75E-01	2.82E-01	
DITA DERMALO	138,668	0.0106	37	654.85	5.88E-03	0.0047	0.3454	7.89E-01	-0.4439	2.64E-01	2.71E-01	
YEKI	110,900	0.0084	38	603.91	5.42E-03	0.0030	0.3349	7.83E-01	-0.4485	2.56E-01	2.61E-01	
NONKE	139,024	0.0106	39	797.82	7.16E-03	0.0034	0.3264	7.78E-01	-0.4515	2.46E-01	2.52E-01	
SODO	138,450	0.0105	40	830.63	7.46E-03	0.0031	0.3158	7.71E-01	-0.4550	2.35E-01	2.41E-01	
KOKIR GEDEBANO	85,881			533.44								
GUTAZER		0.0065	41		4.79E-03	0.0017	0.3053	7.63E-01	-0.4580	2.28E-01	2.32E-01	

HUMBO	122,908	0.0094	42	846.57	7.60E-03	0.0018	0.2988	7.59E-01	-0.4598	2.20E-01	2.24E-01
ARORESA	120,471	0.0092	43	853.13	7.66E-03	0.0015	0.2894	7.51E-01	-0.4615	2.10E-01	2.15E-01
MAREKA GENA	112,145	0.0085	44	875.78	7.86E-03	0.0007	0.2802	7.43E-01	-0.4631	2.02E-01	2.06E-01
BENCH	266,860	0.0203	45	2,128.91	1.91E-02	0.0012	0.2717	7.35E-01	-0.4637	1.85E-01	1.95E-01
GOFA ZURIA	214,490	0.0163	46	1,720.63	1.54E-02	0.0009	0.2514	7.16E-01	-0.4649	1.68E-01	1.76E-01
YEM SPECIAL WEREDA	82,292	0.0063	47	666.25	5.98E-03	0.0003	0.2351	7.01E-01	-0.4658	1.60E-01	1.63E-01
ARBA MINCH ZURIA	203,636	0.0155	48	1,681.72	1.51E-02	0.0004	0.2288	6.95E-01	-0.4661	1.48E-01	1.56E-01
KEMBA	126,596	0.0096	49	1,160.94	1.04E-02	-0.0008	0.2133	6.80E-01	-0.4665	1.38E-01	1.43E-01
CHENA	197,402	0.0150	50	1,871.72	1.68E-02	-0.0018	0.2037	6.69E-01	-0.4657	1.26E-01	1.33E-01
GINBO	130,538	0.0099	51	1,269.38	1.14E-02	-0.0015	0.1887	6.53E-01	-0.4639	1.17E-01	1.21E-01
BASKETO	43,112	0.0033	52	420.94	3.78E-03	-0.0005	0.1788	6.41E-01	-0.4625	1.13E-01	1.14E-01
BOREDA ABAYA	127,130	0.0097	53	1,322.04	1.19E-02	-0.0022	0.1755	6.37E-01	-0.4620	1.06E-01	1.10E-01
KUCHA	130,246	0.0099	54	1,384.22	1.24E-02	-0.0025	0.1658	6.26E-01	-0.4598	9.75E-02	1.02E-01
KONSO SPECIAL WEREDA	200,644	0.0153	55	2,276.25	2.04E-02	-0.0052	0.1559	6.13E-01	-0.4572	8.62E-02	9.24E-02
MENJIWO	90,816	0.0069	56	1,054.22	9.46E-03	-0.0026	0.1406	5.93E-01	-0.4521	7.93E-02	8.20E-02
AMARO SPECIAL WEREDA	125,092	0.0095	57	1,534.07	1.38E-02	-0.0043	0.1337	5.83E-01	-0.4495	7.24E-02	7.61E-02
TELO	96,906	0.0074	58	1,191.72	1.07E-02	-0.0033	0.1242	5.69E-01	-0.4453	6.65E-02	6.94E-02
DIRASHE SPECIAL WEREDA	115,648	0.0088	58	1,526.41	1.37E-02	-0.0049	0.1168	5.59E-01	-0.4420	6.04E-02	6.37E-02
ZALA UBAMALE	97,558	0.0074	60	1,301.72	1.17E-02	-0.0043	0.1080	5.45E-01	-0.4371	5.48E-02	5.76E-02
ISARA TOCHA	117,822	0.0090	61	1,838.60	1.65E-02	-0.0075	0.1006	5.33E-01	-0.4328	4.89E-02	5.20E-02
GESHA	148,774	0.0113	62	2,382.35	2.14E-02	-0.0101	0.0916	5.17E-01	-0.4253	4.15E-02	4.54E-02
BAKO GAZER	265,866	0.0202	63	4,284.07	3.85E-02	-0.0182	0.0803	4.96E-01	-0.4152	2.98E-02	3.67E-02
LOMA BOSA	117,694	0.0090	64	1,980.63	1.78E-02	-0.0088	0.0601	4.57E-01	-0.3970	2.34E-02	2.64E-02
MELOKOZA	95,099	0.0072	65	1,614.85	1.45E-02	-0.0073	0.0511	4.39E-01	-0.3882	1.93E-02	2.17E-02
MASHA ANDERACHA	60,115	0.0046	66	1,524.69	1.37E-02	-0.0091	0.0439	4.25E-01	-0.3809	1.67E-02	1.80E-02
BURJI SPECIAL WEREDA	50,058	0.0038	67	1,319.85	1.18E-02	-0.0080	0.0393	4.11E-01	-0.3718	1.46E-02	1.57E-02
DECHA	95,007	0.0072	68	2,841.26	2.55E-02	-0.0183	0.0355	3.99E-01	-0.3637	1.13E-02	1.33E-02
ELA	66,846	0.0051	69	2,253.76	2.02E-02	-0.0151	0.0283	3.74E-01	-0.3455	8.67E-03	1.00E-02
KURAZ	61,366	0.0047	70	5,034.53	4.52E-02	-0.0405	0.0232	3.54E-01	-0.3303	6.55E-03	7.16E-03
MEINIT	45,629	0.0035	71	4,333.69	3.89E-02	-0.0354	0.0185	3.08E-01	-0.2898	4.65E-03	4.99E-03
HAMER BENA	75,406	0.0057	72	8,850.94	7.94E-02	-0.0737	0.0151	2.69E-01	-0.2544	2.51E-03	2.86E-03
SHEKO	45,920	0.0035	73	6,321.72	5.67E-02	-0.0532	0.0093	1.90E-01	-0.1807	1.11E-03	1.24E-03
SURMA	30,073	0.0023	74	4,883.13	4.38E-02	-0.0415	0.0058	1.33E-01	-0.1274	4.72E-04	5.22E-04
DIZI	29,284	0.0022	75	5,775.31	5.18E-02	-0.0496	0.0035	8.95E-02	-0.0859	1.18E-04	1.33E-04
SELAMAGO	17,308	0.0013	76	4,191.25	3.76E-02	-0.0363	0.0013	3.76E-02	-0.0363	0.00E+00	0.00E+00



Source: Based on [1]

The cumulative percentage of the [size] of areas (Y_i) is then plotted against the cumulative percentage of population (X_i). A diagonal line is usually drawn at 45° to show the amount of deviation from an ideal condition of a perfectly even distribution. [7]. The graph above shows the Lorenz Curve for SNNPR based on the year 2002 population numbers. A diagonal line has been added to show the amount of deviation of SNNPRs population form an ideal condition of perfect evenness.

A related concept, and a very useful measure of population distribution in space, is the Gini Concentration Ratio (Gi). The ratio measures the proportion of the area under the diagonal line (above) relative to the area that lies between the Lorenz Curve and the diagonal line. Columns 5 and 6 are, simply, the X_i and y_i columns cumulated from top down. In column 7 the X_i values in column 5 are multiplied with y_{i+1} (or a y_i value in the next row) of column 6. In column 8

the y_i values of column 6 are multiplied with the X_{i+1} (or an X_i value in the next row). The totals for these two columns are calculated easily, and represent the values needed to calculate the Gini Concentration Ratio (Gi). The detailed nature of the table above points to the immense computational need and time required to arrive at these two numbers, and the need for spreadsheet programs like Microsoft Excel.

$$Gi = \left(\sum_{i=1}^n X_i Y_{i+1} \right) - \left(\sum_{i=1}^n X_{i+1} Y_i \right)$$

To learn more about the calculation of the Gini Concentration Ratio (Gi), Click on the “calculate demographic rates” button on the main page at www.EthioDemographyAndHealth.Org and follow the instructions.

As has been defined above, the Gini Concentration Ratio measures the proportion of the total area under the diagonal that lies between the diagonal and the Lorenz Curve. We have also noted that if the population of SNNPR was perfectly evenly distributed the diagonal line and the curve would overlap; there would be no area under the curve. In other words, the area under the curve would be 0. The calculated Gi of 0.611 represents an uneven population distribution in this southern region of Ethiopia, as elsewhere in the country. One might be confused by the lack of similarity in the values of Δ and Gi for SNNPR. The difference results from the fact that they measure two different things. The index of concentration (Δ) measures the distance between the curve and the diagonal whereas the Gini Concentration Ratio (Gi) measures the area between the curve and the diagonal

Population Redistribution in Ethiopia

Government sponsored large-scale resettlement involving millions of people is a relatively recent affair in Ethiopia. It started under the former Derg regime headed by Colonel Mengistu Hailemariam. “By 1988, despite the resettlement program's obvious failure, President Mengistu repeatedly asserted that the program would continue. He estimated that eventually 7 million of Ethiopia's approximately 48 million people would be resettled” [9].

As the country celebrates its entry into the 21st century, resettlement is in full swing again. “Under pressure from international donors tired of giving millions of dollars in food aid to help Ethiopians at risk of starvation, the Ethiopian government came up with a quick fix -- move them; two million of them.” [10].

This is a 2004 news account of an ongoing resettlement program, followed by detailed account of individual sufferings, and the colossal life impacts on communities consisting of the hundreds of thousands who have already been moved. At its core, the plan envisaged resettling over 2 million people in just 3 years (2004 – 07). “And it is not hard to see why. The country faces enormous challenges: its central highlands have been over-worked for generations; its population has doubled since the great famine of 1974. Something has to be done” [11]. The process was advertised to be entirely voluntary and “the destination areas were characterized as safe havens with abundant land, fertile soil, regular rainfall, and irrigation potentials. Each settler household was promised access to two hectares of land, a house, a pair of oxen, three years of relief aid, infrastructural facilities, social services, agricultural inputs, and complete household utensils” [12]. Many have researchers on the subject considered these to be empty promises very few of which have actually materialized. This is déjà vu all over again; a tragic re-run of the news accounts of resettlement under the previous regime. A number of questions need to be asked here:

Is the current resettlement based on scientific studies of its short- and long-term merits?

Is it based on sound planning?

Is it truly voluntary both on the part of settlers, and the host communities?

Have exhaustive cost-benefit analysis of its impacts on human lives and the environment been carried out?

Brushing aside the seemingly endless justifications in daily offerings of political speeches, is there a measurable difference in the outcomes of the ongoing resettlement when compared to those conducted by the defunct Derg regime?

The answer, according to the Ethiopian Forum for Social Studies, seems to be an emphatic **NO**. The head of the Organization Desalegn Rhmato recommends relocation to urban centers instead. [11].

A study of settler response to the new environment reveals adoptive strategies that varied significantly not just on the basis of macro groupings, but also at the individual level based on gender, age, education, “wealth”, health status, etc. Alula Pankurst’s yardstick for measuring success and failure at the individual (micro) and community levels was very apt [13]:

“Some resettlers, particularly from the Harerge area of Oromia, have been able to become very successful in a short period of time. They were able to do so by bringing cash with them or obtaining income from production in their home areas, which they were able to invest to increase production in the resettlement areas, by obtaining more land through share-cropping, hiring labour, producing cash crops and involvement in trade. Some have been able to construct houses with iron roofs and purchase more and better household and consumer goods, build shops and tea rooms in local towns, and even have hired tractor services and bought grinding mills. Many of the more successful are characterised by better social capital, taking on leadership positions, with involvement in informal community institutions such as funeral associations and churches, and good relations with the administration, local people and investors. Avenues to success include not just agriculture with a focus on cash crops and irrigation, but also livestock rearing and trade.

Cases of failure often exhibited the opposite attributes of the more successful. They produced much less, were food insecure, had few or no livestock, and poor social capital. They included or involved female-headed households, the elderly, weak, disabled, those suffering from malaria and other lowland diseases, those who had problems of drink, those who were characterised as “lazy” by other resettlers or “not cooperative” by the leadership, and also included those who were not motivated to stay in resettlement areas, and were unable to get access to education or jobs.”

Resettlement has negatively impacted the host communities. It has been reported that “with the exception of a few sites (e.g., Quara and Shanaka), in almost all sites covered in the studies, dispossession of land and other natural resources was reported by the host communities” [12].

Stories of positive outcomes among individual settlers and communities abound, and notable benefits have accrued to some. This has been overshadowed, however, by the preponderance of reports of failures of some, or all, of the goals of resettlement depending primarily on the match or mismatch between planned actions, and resources available for implementation.

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