1. The Gini coefficient is the most widely used inequality measure, but the *inequality ratio* (the income share of the top 20% and divided by the share of the bottom 20%) is easier to compute. (a) Compute the Island's inequality ratio by dividing the share of the top quintile (20%) by the share of the bottom 20% (see Table 2.1). Or divide 2500/200 to get the same ratio. Use this last calculation to express this measure in words. (b) To compute the Island Gini coefficient we first plot the island Lorenz curve which is the cumulative consumption share of households plotted against the cumulative population share. Plot the Island Lorenz curve on Figure 1 below. Label the five quintiles: the first quintile consumes 4% of total consumption while the bottom 40% consumes 10% of the total and so on. (c) Fill in Table 2.1 and then compute the Gini by summing up the gaps between the actual Lorenz curve the perfect equality Lorenz curve (a 45 degree line).*** Put these gaps in column B. Divide this total by the area of the triangle (A +B) to get the Gini coefficient. Which inequality measure is more sensitive to the share of middle class quintiles 3 & 4, the Gini or the inequality ratio? (d) Use the same approach to compute the Gini for the 4 poor households (Table 2.2). Use the Gini and inequality ratio to determine whether inequality is greater among the poor or among the whole population. *E) G is for Gini below, where G=B/(A+B), but looking at Figure 1, G might also stand for "gap", explain.*

2. Using the poverty rate H (40%) the income gap I (38%) and the *Gini coefficient for the poor* (G_p) from #1c above, compute Sen's Severity index: **$S = H*[I + (1 – I) * G_p]$**. If all incomes are equal, what is the Gini coef? Recalling that post welfare-reform all the poor had incomes of $250, compute the post-welfare reform Sen Index. Did the severity of poverty fall? Why? What is the advantage of severity indices such as the Sen or FGT index (see #3 below) over other poverty measures such as H or I or the poverty gap H*I? **Hypothetical Perfect Equality Lorenz curve**

Plot this column in Figure 1 (label points)*

100%%   **100%**

Table 2.1 Compute the Easter Island Gini Coefficient					
Cumulative Income Distribution					
Cumulative Pop decile	**Consp $PPP**	**Decile Shares:**	**Cumulative shares**	**A+B Equality**	**B Gap**
1 10%	200	2%	2%	10%	8%
2 20%	200	2%	4%	20%	16%
3 30%	300	3%	7%	30%	23%
4 40%	300	3%	10%	40%	30%
5 50%	500	5%	15%	50%	35%
6 60%	800	8%	23%	60%	37%
7 70%	1000	10%	33%	70%	37%
8 80%	1700	17%		80%	
9 90%	2000	20%		90%	
10 100%	3000	30%		100%	
Totals:	**$10,000**	**100%**		****500%**	

Cumulative consumption share
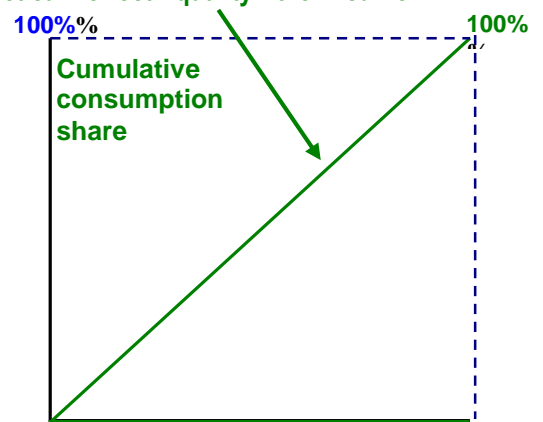
Cumulative Population Share
Figure 1: Easter Island Lorenz Curve

Table 2.2 Compute Gini coefficient for the four Poor households only….					
Cumulative Pop Quartile	**Consp $PPP**	**Quartile shares**	**Cum. Shares**	**A + B Equality**	**B Gap**
1 25%	200	20%		25%	
2 50%	200	20%		50%	
3 75%	300	30%		75%	
4 100%	300	30%		100%	
Totals	**$1000**			**250%**	

***Label every other point on the curve with its y axis value.**

Terms: Sen Severity index, Gini Coefficient, inequality ratio; the Gap Squared or p(2) or FGT severity Index (a measure that is computed by squaring each household=s income gap, $I_i = (y_p - y_i)/y_p$ summing them up for all four poor households and then dividing by the total population (n). Using the column sums to estimate the Gini coefficient which is B divided by A+B or G=B/(A+B)

Notes:
**When you add up this column you get 550, but this is just an approximation of the area under the 45 degree line. We can do better: the area of a triangle is (H*W)/2 or in this case (1x1)/2 = .5, so the area must be 500 not 550.
*** See below (page 3) for the triangles A and B (check your answer on line… see below)

3. The gap squared FGT poverty index starts with every household's personal poverty gap (technically there income shortfall or I): The FGT or Foster-Greer-Thorbecke poverty is the most multi-talent poverty measure we will consider. The index also encompasses all the H-I poverty measures as special cases (nice). Like the Sen index gap squared is sensitive to the severity of poverty, meaning inequality among the poor. Moreover it is the first index we have studied that falls most when the poorest of the poor are helped first (recall the New York Times holiday slogan, "remember the neediest"). The "gap squared" FGT squares all the HH poverty gaps then adds them up a task best done in a spreadsheet. calculations sometimes involve

squaring the personal poverty gaps, takes the income gap or shortfall for each poor household, $I_i = \dfrac{(y_p - y_i)}{y_p}$

where y_p is the poverty line and y_i is the consumption or income of household i. Next raise each gap to some exponent α and add them up for all q poor households. Finally multiply this sum by $(1/n)$ where n is the total population.* For the Paradise island base case for example, there are four poor people ($q = 4$) and n is 10. **(a)** Compute the FGT for $\alpha = 0$, $\alpha = 1$ and $\alpha = 2$. These three cases of the FGT are sometimes referred to as p(0), p(1) and p(2) in the ILO Poverty Compendium. (b) Note that when $\alpha = 0$, the FGT = H and when $\alpha = 1$, the FGT is equal to the poverty gap H*I. Finally when $\alpha = 2$, we get the "gap squared" poverty measure that, finally, gives the poorest of the poor most weight in our poverty measures (whoever has the largest income gap). **(b)** Compute "the gap squared" or FGT with $\alpha = 2$ before and after the welfare reform, starting with base case of problem set 1 (that is, income of 200 for the two rural poor and 300 for the urban poor). Why does the welfare reform affect the "gap squared" but not H or H*I, the poverty gap? **(c)** *Extra Credit— use a spreadsheet) Show how the "gap squared" implements the NY Times slogan "remember the neediest." Take $100 and distribute it evenly among the poor, compute the new "gap squared." Now take the same $100 and just give it to the two poorest rural households, and compute the gap squared again. Given this result, how can focusing on the gap squared poverty index, as opposed to H, shift the priorities of policy*

makers? To summarize the $\text{FGT} = (1/n)\displaystyle\sum_{i=1}^{q}\left(I_i\right)^{\alpha}$ where $I_i = \dfrac{(y_p - y_i)}{y_p}$ where q is the number of poor and n

is whole population. When $\alpha = 0$, the FGT = H; when $\alpha = 1$ the FGT equals the poverty gap (H*I) and when $\alpha = 2$ (or greater) the FGT becomes the "gap squared" a severity measure, sometimes referred to as p(2),

4. Median income can mislead, especially if there is immigration. The middle class is an important barometer of economic wellbeing, and median household income is therefore an important barometer of economic wellbeing (if one uses a relative poverty measure it is also a benchmark for defining poverty. However, it is also an "anonymous measure" of economic wellbeing, it is possible for median incomes to decline even when no one is relatively worse off. Consider case when two below the median income families get married, their combined income raises them above the median income, so the median household has to change.

Worldwide Income Inequality, 1820–1995

in percent

1820	'50	'70	'90	1910	'30	'50	'70	'90	'95
42.2	48.5	54.4	61.0	66.8	69.0	77.5	88.1	81.4	77.7
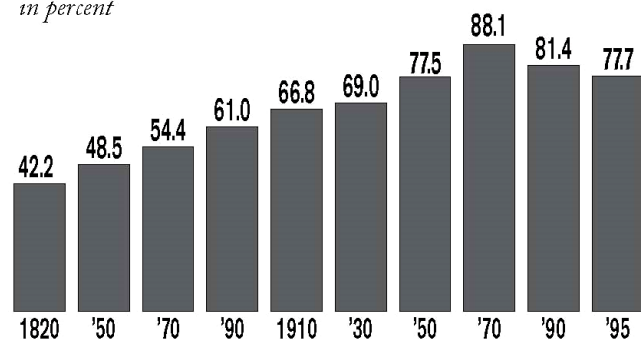
Note: Figures represent the mean log deviation between a typical individual income and the average per capita income.

Sources: F. Bourguignon and C. Morrisson, "Inequality Among World Citizens, 1820–1992," working paper 2001-25 (Paris: Department and Laboratory of Applied and Theoretical Economics, 2001); and David Dollar, "Globalization, Inequality, and Poverty Since 1980," World Bank background paper, available at http://www.worldbank.org/research/global.

5. **One more inequality measure** you can use this spreadsheet to compute (if you really want to). In their *Foreign Affairs* article, "Spreading the Wealth" (see case study 2.4) David Dollar and Art Kraay use a different, but also very intuitive poverty measure, the "mean log deviation between a typical individual's income and average per capita income." This title of this measure says it all: in 1970 for example the average deviation of all individuals income from the world mean was 88% up from 42% in 1820, but higher that the 78% mean deviation in 1995. Those of you who have taken statistics will realize this as the standard deviation of income in logs (taking the natural log change in the difference in any two points a percentage – try it and you will see). **(a)** Use the poverty measures spreadsheet to compute the "mean log deviation" poverty measure for Tropical Island. Why do we have to square each deviation before we average it and then take square root? How does the Lorenz curve deal with this problem? **(b)** *(extra credit— use the poverty measures spreadsheet) Just print out and include your final results, not the base case. Take $200 from the richest house and distribute among the poor? Does it make any difference if you give $50 to all the poor families, or $100 to each of the two $200 poorest households? Is this similar to what happens with gap squared poverty measure? Why?*

** You can check your Gini calculation and plot a really nice Lorenz curve at http://www.we*ssa.net/co.wasp.
Put the list of decile shares shown on the next page (copy and paste them) into the box shown,
Decile shares for Easter Island (copy and paste these into the box with five numbers in right now). Here is the Lorenz curve Wessa's program displays for Easter Island (evidently statisticians call it concentration, as in concentration of income in the hands of the rich, we call it inequality).

Decile shares for Easter Island (copy and paste these into the box with five numbers in it):

2.5
2.5
3.5
3.5
5
8
9
16
20
30
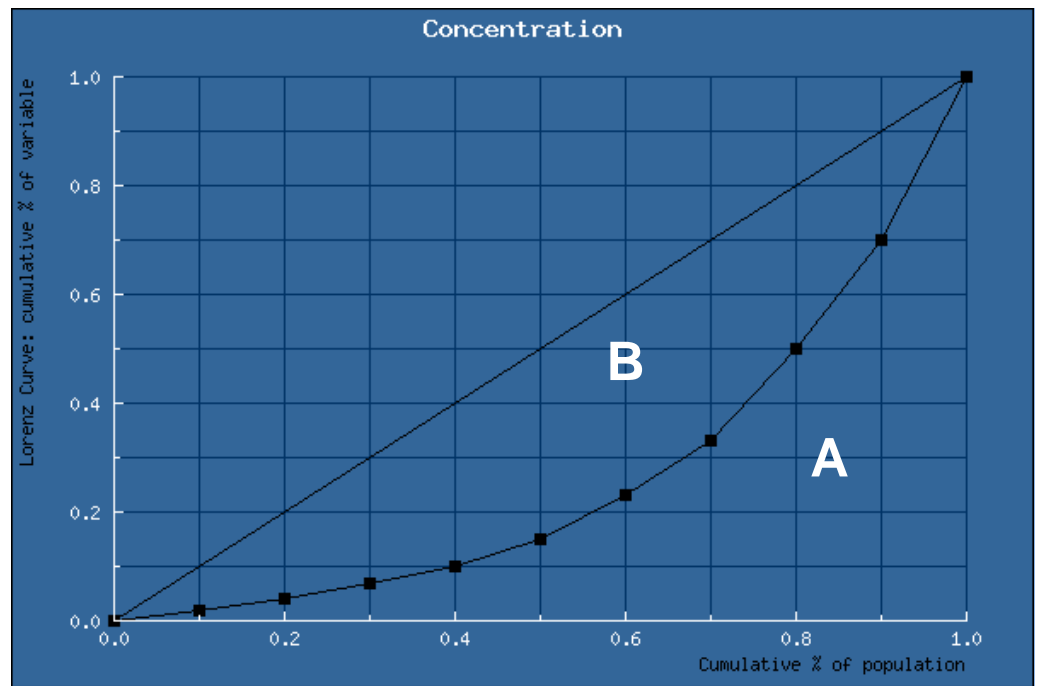
EC Exercise: Here are the actual quintile shares 2000 consumption in Guatemala for the year 2000. What is the Guatemala Gini for 2000? It seems close to Easter Island (4 6 13 27 50) but what makes it more equal? Take the extra 4% from the 4th quintile give it to the rich (as in Guatemala) and then distribute 2% each to it to the bottom two quintile quintiles—what is the Gini now? Now take the 4% and distribute it to the 2nd & 3rd quintiles (so they would have 8 and 15 instead of 6 and 13% shares). Which of these redistributions lowers the Gini the most?

5
8
13
19
54