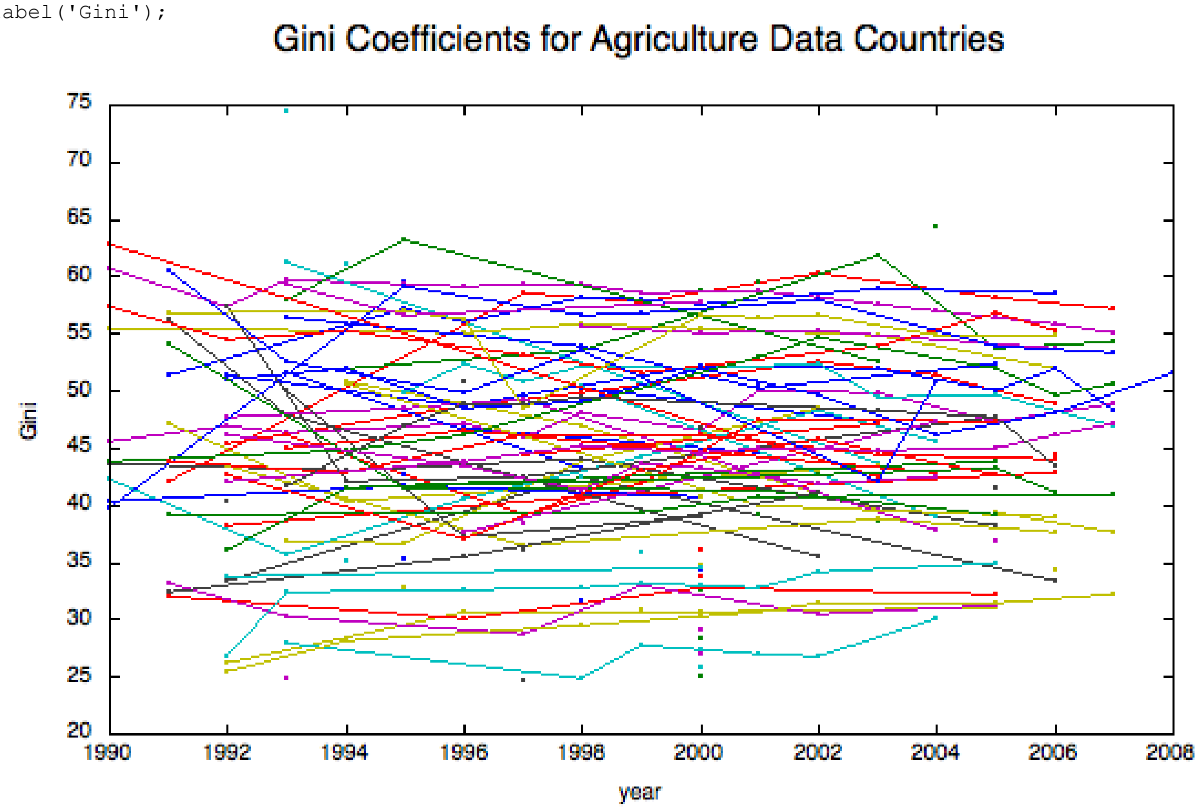
Below, I calculate Gini coefficients based on the two-sector model, using agricultural and urban data, and then compared these calculations to measured Ginis. From their difference, I can calculate the theoretical size of a poverty sector, expressed as a portion of the population with 0 income and a wealth sector, expressed as the portion of income earned by only the infinitesimally few.

The Matlab code is intertwined in this text.

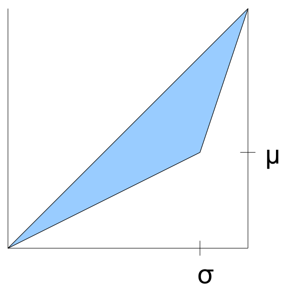
```
load ps1data.tsv
load gini.tsv

% ps1data.tsv: 0 is no-data
% 1-51: Real GDP Per Worker, PWT6.1
% 52: ignore
% 53-57: Agriculture shares of GDP, selected years, from World
% Development Indicators 2001 and International Historical
% Statistics (ed. B.R. Mitchell)
% 58-62: Agricultural Workforce as Fraction of Total (from FAOSTAT)
% 63-68: ignore

% gini.tsv: 0 is no-data
% 1-19: 1990 - 2008

close all;
for ii = 2:119
  valid = gini(ii, :) > 0;
  if sum(valid) > 0
    plot(gini(1, valid), gini(ii, valid), '.-');
    hold on;
  end
end
title('Gini Coefficients for Agriculture Data Countries','fontsize',16);
xlabel('year');
ylabel('Gini');
```



I claim that the two-sector model has an implicit assumption that manufacturing workers get more income than agricultural workers, and I can use this to predict the Gini coefficient for a

given country.

Below are the calculations for translating the data provided in the spreadsheet into a Gini estimation. Each sector is assumed to consist of people with uniform income.

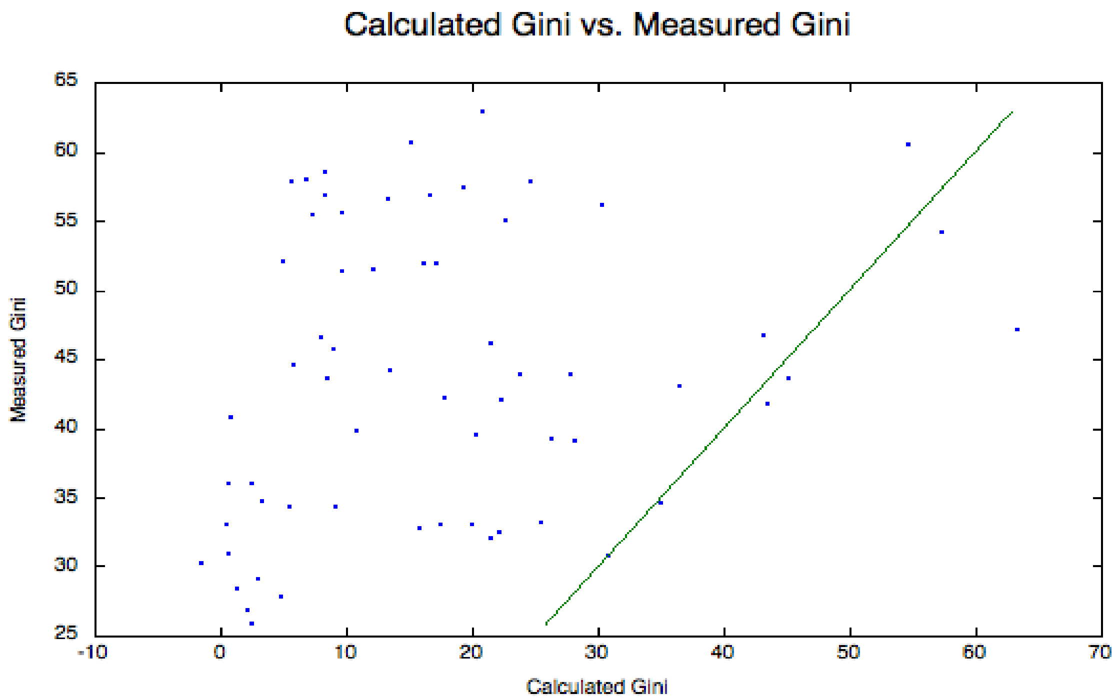


$$\begin{aligned}\hat{G} &= 2[\frac{1}{2} - (\frac{1}{2}\mu\sigma + (1-\sigma)\mu + \frac{1}{2}(1-\sigma)(1-\mu))] \\ &= 1 - (\mu\sigma + 2\mu - 2\mu\sigma + 1 - \sigma - \mu + \mu\sigma) \\ &= \sigma - \mu\end{aligned}$$

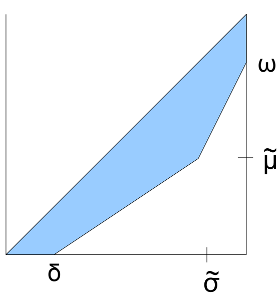
$$\mu = \frac{Y_F}{Y_F + Y_M} = \frac{\sigma y_F}{\sigma y_f + (1-\sigma) y_M}$$

$$\begin{aligned}y_F &= \frac{Y_F}{L_F} = \frac{Y_F}{Y}\frac{Y}{L}\frac{L}{L_F} = \frac{Y_F}{Y}\frac{Y}{L}/\sigma \\ y_M &= \frac{Y_M}{L_M} = \frac{Y - Y_F}{L}\frac{L}{L - L_F} = (\frac{Y}{L} - \frac{Y_F}{Y}\frac{Y}{L})/(1-\sigma)\end{aligned}$$

```
% We can calculate the expected gini:
sigma = [agri_frac(valid_1990, 1); agri_frac(valid_1999, 2)];
YFoY = [agri_gdp(valid_1990, 1); agri_gdp(valid_1999, 2)];
YoL = [worker_gdp(valid_1990, 1); worker_gdp(valid_1999, 2)];
yf = YFoY .* YoL ./ sigma;
ym = (YoL - YFoY .* YoL) ./ (1 - sigma);
Gexp = sigma - (sigma .* yf) ./ (sigma .* yf + (1 - sigma) .* ym);

figure;
ginis_used = [ginis(valid_1990, 1); ginis(valid_1999, 2)];
plot(100 * Gexp, ginis_used, '.');
hold on
plot([min(ginis_used) max(ginis_used)], [min(ginis_used) max(ginis_used)]);
title('Calculated Gini vs. Measured Gini','fontsize',16);
xlabel('Calculated Gini');
ylabel('Measured Gini');
```



The green line shows perfect matching between calculated and measured Gini. Calculated Gini appears to trend in the same direction, but be biased considerably lower (and at one point, where agricultural per capita income exceeds manufacturing per capita income, is calculated as negative). This suggests "poor" and "rich" sectors, adding inequality but no benefit.
Below are general calculations, then simplified to only account for a poor sector (I can't solve for the sizes of both, and solving with only a poor sector is computationally easier). The poor sector is assumed to consist of people with 0 wealth, while the wealth sector consists of infinitesimally few people who only add income disparity.



$$\tilde{\sigma} = (1-\delta)\sigma$$

$$\tilde{\mu} = \frac{Y_F}{Y_F + Y_M + W}$$

$$\omega = \frac{W}{Y_F + Y_M + W} \implies W = \frac{\omega Y_F + Y_M}{1-\omega}$$

$$\begin{aligned}\tilde{G} &= 2[\frac{1}{2} - (\frac{1}{2}\tilde{\mu}\tilde{\sigma} + (1-\tilde{\sigma}-\delta)\tilde{\mu} + \frac{1}{2}(1-\tilde{\sigma}-\delta)(1-\tilde{\mu}-\omega))] \\ &= \delta + \tilde{\sigma} - \tilde{\mu} + \delta\tilde{\mu} - \omega\tilde{\sigma} - \omega\delta \\ &= \delta + \sigma - \mu + \delta\mu - \delta\sigma \text{ for } \omega = 0 \\ \implies \tilde{\delta} &= \frac{G + \mu - \sigma}{1 + \mu - \sigma}\end{aligned}$$

```
% Determine poverty sectors
sigma2 = agri_frac(:, 2);
YFoY2 = agri_gdp(:, 2);
YoL2 = worker_gdp(:, 2);
yf2 = YFoY2 .* YoL2 ./ sigma2;
ym2 = (YoL2 - YFoY2 .* YoL2) ./ (1 - sigma2);
```

```
mu2 = (sigma2 .* yf2) ./ (sigma2 .* yf2 + (1 - sigma2) .* ym2);
Gexp2 = sigma2 - mu2;
delta = (ginis(:, 2)/100 + mu2 - sigma2) ./ (1 - mu2 - sigma2);
% invalidate invalids
Gexp2(~valid_1999) = nan;
Gexp2(Gexp < 0) = -inf;
Gexp2(Gexp > 1) = inf;
delta(~valid_1999) = nan;
delta(delta < 0) = -inf;
delta(delta > 1) = inf;

% nan: 78, inf: 6, valid: 38
```

The results are below. Note the inclusion of a wealth sector would change these estimates drastically, however they appear to be picking up something interesting, with European countries clustered at the top, followed by developing countries.

	Gini Coefficients			Wealth/Poverty Sector Sizes	
Country Name	1999	2000	Estimated	Upper Bound	Lower Bound
Tanzania		34.62	35	1.47%	0.74%
Poland	33.08	32.93	17.55	20.94%	11.08%
Norway		25.79	2.56	24.87%	13.32%
Finland		26.88	2.11	27.19%	14.67%
Hungary	27.77	27.32	4.8	27.53%	14.87%
Germany		28.31	1.36	27.97%	15.13%
Austria		29.15	2.94	28.27%	15.31%
Netherlands	30.9		0.59	32.29%	17.71%
Greece		34.27	9.19	33.14%	18.23%
Belgium		32.97	0.47	33.56%	18.49%
Ireland		34.28	5.44	33.87%	18.68%
Egypt, Arab Rep.		32.76	15.77	34.56%	19.11%
Madagascar	41.81		43.52	34.57%	19.11%
Spain		34.66	3.36	35.31%	19.57%
United Kingdom	35.97		0.63	36.42%	20.26%
Italy		36.03	2.48	36.53%	20.33%
Morocco	39.46		20.37	39.60%	22.28%
United States		40.81	0.89	41.28%	23.37%
Jamaica	44.22		13.54	42.36%	24.08%
Romania		30.25	-1.58	46.70%	26.99%
Uruguay		44.56	5.86	48.04%	27.92%
Mauritania		39.04	28.17	48.52%	28.25%
Mexico		51.87	16.22	48.64%	28.33%
Pakistan	33.02		20.02	50.28%	29.49%
Costa Rica		46.6	7.97	57.05%	34.46%
Philippines		46.09	21.53	57.84%	35.07%
El Salvador		51.92	17.15	58.87%	35.87%
Panama		56.56	13.39	59.35%	36.24%
South Africa		57.77	5.68	60.21%	36.92%
Chile		55.36	7.36	63.29%	39.41%
Dominican Republic		52.11	5.03	65.77%	41.49%
Brazil	58.59		8.4	66.89%	42.46%
Colombia	57.92	57.5	6.9	77.20%	52.25%
Honduras	51.5		12.11	80.80%	56.18%
Bolivia	57.79		24.68	91.16%	70.27%
Bangladesh		30.72	30.82	< 0	
Rwanda		46.68	43.19	< 0	
Thailand	43.53	43.15	45.17	< 0	
Uganda	43.07		36.46	< 0	
Guatemala		54.97	22.67	> 1	
Paraguay	56.85		8.4	> 1	

The 1999 and 2000 columns show the reference measured Gini data, as recorded in those years. Estimated lists the estimated Gini coefficient based on the provided data. The difference between these can be used to determine either the size of the poverty or wealth sectors (since they are symmetric). When the other sector is assumed to be 0, this produces an upper bound on the size of such a theoretical sector; the lower bound (assuming the presence of both a wealth and a poverty sector) is 1 – sqrt(1 – X)), where X is the upper bound.