Economic Deadweight Loss from Gender Inequality In Developing Countries

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Abstract

In this paper I develop and support a model regarding gender discrimination and how it has impacted economic growth in developing nations. While gender bias is prevalent in even the most developed nations, it is intensified in developing ones. While there has been meaningful research into this topic, I strived to quantify and visualize the deadweight loss that has been assumed by developing nations as a result of their gender bias in the labor force and educational institutions.

I. Introduction

When first beginning this research project my goal was to uncover which nations had the best policies in place to prevent, or at least reduce, unemployment rate. To do this I looked into countries economic production and expenditures and sought to describe the underlying components of unemployment. As I looked more into the composition of country unemployment rates, I became particularly interested in the gender disparity that is fairly commonplace worldwide. Rather than predicting unemployment, I sought to uncover how this gender bias impacted nation's economic production.

While the world has made positive strides toward gender equality over the past century, the issue of gender discrimination is still one that is prevalent in the world today. This is especially true with regards to developing countries, for multiple reasons that will be further described, including that their respective

economies simply do not have the bandwidth to create jobs for the many unemployed women (and men).

As stated on un.org, "gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous, and sustainable world."[1] My research here has been done with the intention of proving this statement to be true in an economic sense. We already know that on average women are paid less to do the same work as men.[1] Subjecting what is approximately half the world's population to discrimination within the labor market hinders the possibilities of what can be accomplished. By placing the most qualified people, regardless of gender, in what is a limited supply of jobs they will be performed more efficiently. Ultimately this may result in a greater number of jobs available, to coincide with growth within the economy. This belief has been validated within the United States where female labour force participation rose nearly 20% between 1970 and 1990 while male labour force participation fell just by under 10% in that time.[2]

The process of gender discrimination is established during youth and continues through adulthood. There are notable gender differences with regards to literacy rates, education, labor participation, and vulnerable employment rates worldwide. "Disadvantages in education translate into lack of access to skills and limited opportunities in the labour market."[1] There is a direct correlation between education and labor force participation. Assuming a normal distribution of males

[1] Nations, United. "Gender Equality: Why It Matters." *Un.org*. United Nations, n.d. Web.

[2] Yellen, Janet. "Financial Times." *Gender Inequality is Holding US Economy Back, Yellen Warns*. Financial Times, n.d. Web. 07 May 2017.

and females with regards to intellect it intuitively makes sense that equality is the optimal proportion in the job market.

In this paper I will look at the characteristics of gender inequality, starting with education, literacy, and ultimately labor participation in developing nations. While the impact of such discrimination in an economical sense can be quantified to a degree, the societal value of attaining gender equality is more ambiguous.

This issue is extremely important in not just an economic sense, but also with regards to societal justice. Discrimination on the basis of gender has resulted in an inefficient allocation of opportunities and jobs, along with unbalanced access to education. There has not been any valid research concluding that males are significantly smarter than female counterparts. However, the distribution of stable jobs and education has favored males significantly, especially in developing nations that need their most capable people to fill the limited jobs available the most. Ideally throughout the world, the most capable people, gender aside, would fill the limited number of jobs but unfortunately that is not the case. Gender discrimination is deeply rooted within many cultures, so ending it will be a timely, but ultimately worthwhile, endeavor.

Gender gaps favoring males are systematically larger in poor countries than rich ones. Although poor countries are not alone in having gender inequality, disparities in health, education, etc. tend to be larger in countries with low GDP per capita.[2]

Further contextualizing the widespread gender discrimination that is occurring worldwide, "Missing Women" in a country determined by calculating the

number of extra women who would have been in the country if they had the same ratio of women to men as in areas of the world with similar care. The numbers reveal a "terrible story of inequality and neglect leading to the excess mortality of women." [3]

Women outnumber men substantially in Europe, the US, and Japan despite persistent biases against them. However, "the fate of women is quite different in most of Asia and North Africa." [3] Despite the longer average life expectancy of women compared to males, the ratio of women to men in Asia and North Africa can reach as low as .94. Meanwhile in Europe and North America, the ratio of women to men usually is around 1.05 or 1.06 which is perplexing, to say the least.[3] There are a number of extraneous factors that can be pointed to in causing this discrepancy including, but not limited to, genocides in developing nations, disparities in nutrition/health care, and government policy. Perhaps the most disturbing present day factor is Chi's law limiting families to one-child, which lends itself to possibly skewed female infanticide (killing of infants). As men are preferred to women as a result of misogynistic culture, I argue that this disturbing trend is wrong and has inhibited nation's economic growth significantly. While the cost of losing a child so close to birth is difficult to quantify in an economic sense, the equality of labor in developing countries over the past twenty years has been inefficient as a result of gender discrimination. The true tragedy of this matter is the fact that the well over 100 million "missing" women are dead, and at the same time the discrimination

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[3] Sen, Amartya. "More Than 100 Million Women Are Missing." *The New York Review of Books*. N.p., n.d. Web 07 May 2017.

represented by these horrific practices has caused nations to develop more slowly than otherwise possible.

On a more related note to my examination, according to a study by Ina Ganguli and others, "Closing the gender gap in education: What is the state of gaps in labour force participation for women, wives and mothers?" we have seen that higher educational attainment has allowed women to increase their expected lifetime labour force participation, other cultural factors aside. [4]

II. Model/Hypothesis

My research has been pointed towards developing nations as defined by the United Nations. To qualify as a Least Developed Country (LDC) as of 2015, the nation must have a Gross national Income per capita (GNI) that is greater than $1,035, Human Assets Index (HAI) 60 or below, and an Economic Vulnerability Index (EVI) 36 or above.

List of Developing Countries examined in my research:
Afghanistan, Angola, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Central African Republic, Chad, Comoros, Democratic Republic of Congo, Djibouti, Equatorial Guinea, Eritrea, Ethipoia, The Gambia, Guinnea-Bissau, Haiti, Kiribati, Lao PDR, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Timor-Leste, Togo, Tuvalu, Uganda, Tanzania, Vanuatu Yemen Republic, Zambia
   ** Developing countries research set includes 44 countries and 54 years. **

I hypothesize that if developing nations adopt more gender equal practices then they will experience greater economic growth. The marginal benefit of

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[4] Ganguli, Ina. Ricardo Hausmann, and Marti Viarengo. *Closing the Gender Gap in Education: What is the State of Gaps in Labour Force Participation for Women, Wives and Mothers?* International Labour Review, n.d. Web.

introducing the next most qualified women to the labor market, for countries with gender discrimination, would yield more positive economic impact for countries than the next most qualified male would. By this I mean that countries with large male favored bias would benefit most from moving towards gender equality with positive, but decreasing marginal returns until egalitarianism is reached.

When initially exploring the data set I found it was unbalanced, containing many missing observations. However, the missing data appeared to be randomly occurring and for the sake of research I continued my work under the assumption that the sample is unbiased. Along with my independent variables, I included year and country fixed effects. The reason for this being that over years, nations economies will tend to grow due to factors of globalization, inflation, etc. As for country fixed effects, some developing countries are in a better position to grow whether it is due to permanent cropland, frequency of natural disasters, etc. Since this a panel dataset, I hoped to control for these omitted variables with these fixed effects. Ultimately the OLS regression included data on labor participation ratio, life expectancy, and primary school enrollment regressed on log of three-year lagged GDP average. Once introducing the fixed effects I began by only including year effects, but for subsequent regressions I included country effects, which improved the accuracy of the model significantly. Overall there are 43 dummy variables included for countries (n-1) and 53 for years (t-1).

Regressors I looked into in my research were secondary and primary school enrollment ratios, life expectancy, adult and youth literacy ratios, vulnerable employment ratio, labor force participation ratio, and GDP.

Reason for using squares and logs of these variables is because I expect there

to be decreasing, but positive returns on equality up to the theoretical point where

the gender discrimination is reversed. If a point were to be reached where there

were a far greater number of females educated/employed than men the same issues

of inequality would arise. Also, due to skewness of variables (see density plots and

histograms in appendix), logs help normalize the data and account for % changes.

III. Data

Initially I hoped to include vulnerable employment ratio and secondary

school data points, but the extreme number of missing observations made this

difficult. I believe that my regressors should be related to log of GDP because a

country should perform its best when the most qualified people are given jobs since

they will do the best in them, regardless of gender. Provided the limited number

jobs available in each country (as evidenced by a > 0 unemployment rate) there is

certainly some aspect of choice with regards to who has jobs and who doesn't. To

efficiently allocate the limited resource of jobs is a crucial, and potentially lucrative,

aspect of a country's economy, which many developing countries have struggled at.

Each of the variables included are three-year lag averages, which was done

for multiple reasons. One reason being that there are many intermittently missing

data points which is significantly reduced by using a lag average, and the fact

changes in country practices may not be immediately reflected in GDP since it may

take multiple years to produce economic gains. By using three-year average, the

marginal impact of these changes can be more easily identified and prevents GDP

from being skewed. One instance that could impact a country's GDP for a single year could be a natural disaster, or something unordinary like that.

By doing an auto regression, I figured it would help account for the missing observations. Since a change in a country's culture or policies is not immediately reflected in GDP, the three-year average is a more accurate representation of economic growth. Akaike information criterion (AIC) reinforced the lag decision. By this I mean that checked to see that the AIC for the regressions ran was lower after introducing the lags of variables. The AIC is a commonly used measure of models that quantifies how well a model describes a high dimensional outcome. Since economic production of a nation is high dimensional outcome, that is reliant upon many different variables and ultimately is a result of past years, AIC is a relevant indicator of lag length effectiveness.

In my research, I first ran linear regression although admittedly I did not anticipate my findings from this to be meaningful. The reason for this belief stems from my hypotheses that as a gender-neutral society is approached economic growth will be higher. This hypothesis favorites neither females nor males in the long run, but requires females to be favored in the short term in order to make up for present biases. Theoretically speaking, if a linear relationship were to be found in my research it would mean that economic production is maximized when one gender is completely favored which of course is not reasonable.

Next I introduced a Log-linear regression where a one-unit change in independent variable is associated with a 100% change in Y (log-GDP). Lastly, I introduced log-log regression where I had logs of independent variables along with

squares and regular lagged averages. In this log-log regression, a 1% change in an independent log variable is associated with a coefficient % change in Y (log-GDP).

All data used is from the World Development Indicators (WDI) dataset, which has been compiled from officially recognized international sources, presenting the most current and accurate global data available.[5] Once I had gathered my variables of interest I looked at the distribution of data points as well as summary statistics (Table 1) for the variables of interest (Tables 2-5)

Aside from the fixed effects, all variables included are numeric, meaning they can take on an infinite number of values. It is shown in Table 6 that when there is more equality in secondary education enrollment, GDP tends to rise. We see this especially in higher GDP nations, which beg the question of whether high GDP countries are capable of educating people more equally at secondary level.

IV. Results

The final, and most reliable, regression I ran was:

$$\log GDP_{tn} = \beta_0 + \beta_1 LPR + \beta_3 LPR^2 + \beta_4 \log(LPR) + \beta_5 LifeExpectancy^2$$

$$+ \beta_6 PSER + \beta_7 PSER^2 + \beta_8 \log(PSER) + \sum_{j=1991}^{2011} {}_{Yj-2011} YEAR_j + \sum_{n=44} {}_{Yi...n} COUNTRY + u_{tn}$$

GDP = Gross Domestic Product
LPR = Labor Participation Ratio (Female/Male)
PSER = Primary School Enrollment Ratio (Female/Male)

In my final regression table on the left I run regression including just year fixed effects. The reason for this being that the number of observations is extremely

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[5] "DataBank." *DataBank | The World Bank*. N.p., n.d. Web. 08 May 2017.

low from including this many variables, due to missingness. The other two regressions on this table (center and right) are adjusted versions of the first regression (left). On the center regression I primary school enrollment ratio due to some collinearity with adult literacy ratio, but now I add in the country fixed effects since there are fewer dropped observations. The most reliable regression (right on table), which is depicted above, includes labor participation ratio data, life expectancy square, primary school enrollment data, along with country and year fixed effects. The most notable coefficients on each of these regressions is regarding labor participation ratio. We see that in developing countries, moving towards gender equality in labor participation is a statistically significant influence on log of GDP. This is apparent from each of the three regressions.

Additionally, as log of labor participation ratio increases so does log of GDP depicted by Table 7, which is extremely meaningful for this study. One nation in particular on the far left side of the plot, Afghanistan, makes noticeable improvements in their log of GDP coinciding with increases in log of labor participation ratio. Afghanistan is one of the worst nations in the world with regards to gender equality, therefore seeing the economic growth they have experienced in accordance with improved impartiality in labor force participation is encouraging. The decreasing marginal benefit of labor equality is depicted in Table 7 as well. At higher levels of log of labor participation ratio, the log of GDP appears to vary. Nonetheless, these preliminary data visualizations are encouraging support for my hypothesis that I seek to justify later on.

There are a few issues I must address with the research including omitted variable bias possibility. Expenditure on health care is a crucial underlying variable with regards to life expectancy. Including difference in pay between individual countries would have added more contexts to the labor market discrepancy. Also, fertility rates for women, what types of contraceptives are available and patrilocality; frequency of wedded people living with or near the husband's parents plays an underlying role in gender equality in education and labor force. Patrilocality, for example, could require at least one of the married people to stay home and care for the elder parents while the other (traditionally male) works. Along the same lines, patrilineality, how much are male descendants favored over females in terms of property passed down through generations. Though this could be partially described by religious beliefs in country and possible effects of those beliefs on gender equality.

Other issues that stuck out regarding external validity include the difficulty of identifying the "most qualified" people for jobs. While standardized tests are helpful, there is more to efficient working than test-taking ability may indicate. As mentioned in the omitted variables section previously, mortality rate and general health may correlate where there is subpar medical care, mothers may be unable to work.

Lastly, issues of internal validity must be addressed. There is a lot of missing data points, so the research could have very well yielded different results if none were missing. Since my study predicts GDP growth, there are many other factors outside of gender equality that play a role in this. Areas government expenditure

has significant impact on GDP, as do government policies regarding immigration, business regulation, etc. Additionally, because the sample is all developing nations, so there are fewer service jobs in these nations, which have tended to favor females in developed nations. Putting more females in employed positions would likely bring about different type of economic expenditure than males currently enact. As depicted by Esther Duflo, in her study regarding women as policy makers in India she found that "Women invest more in infrastructure that is directly relevant to the expressed development priorities of women," writes Duflo. "In West Bengal, where women complained more often than men about water and roads, reserved councils [those with seats reserved for women] invested more in water and roads. In Rajasthan, where women complained more often about drinking water but less about roads, reserved councils invested more in water and less in roads." [6] There is justified reason to be skeptical here, as the opportunity cost of investment must be noted, but there is evidence to believe that expenditures would change somewhat under female leadership.

I found that adult literacy ratio is statistically significant as a regressor to labor participation ratio, which makes sense intuitively. Also I discovered that secondary education ratio is a statistically significant regressor of adult literacy ratios. Evidenced by Table 8, as adult literacy ratio moves closer to 1, labor participation ratio does too. This makes sense because as males and females are more equally literate, they ideally should enter the job market at a similar rate.

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[6] Duflo, Esther, and Raghabendra Chattopadhyay. "Women As Policy Makers: Evidence From A Randomized Policy Experiment In India." *Mit.edu*. Econometrica, Sept. 2004. Web.

Issues have arisen in developing nations where there is gender bias in education which leads to fewer females being qualified to work in the job market even though, if properly educated, could outperform males.

Clearly this educational aspect of gender bias is a major component. I decided to include primary school enrollment rather than secondary for a number of reasons. The motivation for this being that there are significantly more missing observations regarding secondary education in the data set. Secondary enrollment could also have underlying bias with regards to nations contraceptive availability as higher teen pregnancy rate could influence women to not attend secondary school.

I chose to include life expectancy data because the opportunity cost of not entering the labor force is higher if you expect to live longer. This is because the wages you would earn provide value for more years. Also, countries plagued by short life expectancy may have family members staying home to care for the ill rather than getting jobs. This omitted factor could be explained by patrilocality, which has been previously described.

The most notable coefficients are on labor participation ratio, which were very good in that they support my hypothesis. These can be seen in my final regression table (Table 10). A negative coefficient on log of labor participation ratio is an argument in favor of equality. Since the data studied is a ratio of female to male, the observations are, for the most part, between zero and 1 (with a few exceptions). Taking a log of a number between zero and 1 produces a negative number, so having a negative coefficient on that variable means that developing nations can improve economic production by increasing female participation in

labor force. However, this also reinforces my point that economies would benefit up to a certain point where males would be employed less often than female counterparts. Thus, the gains from increased female participation in labor force cease once the gender bias is reversed.

V. Conclusion

We see that investing in equality in education will lead to equality in adult literacy. Making the jump from equality in adult literacy to labor force participation is where further work must be done. Wage discrimination has been a well-studied topic that has shown that even reaching labor force participation equality may not be enough. By compensating females less than equally qualified males, there are undoubtedly some mothers who choose to raise families at home in lieu of entering the job market.

I have learned that labor force participation equality would in fact generate significant economic growth in developing nations. While there are certainly more factors that I would like to tease out, I believe that the research I've done substantiates much of the previous research that has been done on this topic. These results of course seem reasonable given my earlier hypothesis regarding marginal returns on gender equality. Table 9 depicts the potential economic gains being sacrificed in terms of GDP by developing nations that maintain gender discriminatory practices. With actual log of GDP on the x-axis, the y-axis represents what the regression (depicted above) predicted log of GDP would be with gender equal education and labor participation.

In an ideal study on this topic, I would like to look into the types of jobs available/fulfilled by women in developing nations. Of course, in this perfect study there would not be any missing data points, but that is unfortunately not the case. There are significant factors that surround gender inequality from government's perspective such as policies and sanctions that have been enforced over recent years. Along those same lines, the number of female lawmakers in a nation should have some underlying impact on the equality-favored laws in place. Further, the number of female executives in large market cap companies certainly plays a role in gender discrimination with a presumed trickle down effect, more or less, that I would like to look further into. To reach equality there most likely will need to be policies introduced that favor females significantly, perhaps to the hindrance of males. For example, limiting Development Assistance Committee (DAC) aid flows based on gender equality would certainly push developing nations towards equivalence. Currently, although there is certainly some underlying bias in this regression, countries with more male-favored labor participation have received greater DAC contributions. This has essentially rewarded gender-biased nations and provides no incentive for them to change. By reducing DAC flows based upon level of gender discrimination, developing countries could be inclined to become more competent in filling their domestic labor force. Ultimately, this would save aid-giving countries money in the short term and would help these developing nations economies grow.

It is clear that the policies and employment processes currently in place are not resulting in socially optimal outcomes. In my opinion, the only way to truly fix

the deeply rooted issues of gender inequality will be to create policies that favor females. Although this may be an unlikely scenario due to the disproportionate number of males currently holding political chair positions in developing nations, it is crucial that these people put their bias aside and do what is best for humanity. Although reaching gender equality may force currently favored males to make some sacrifice, it is reasonable to say that society would benefit.

VI. References

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Duflo, Esther, and Raghabendra Chattopadhyay. "Women As Policy Makers: Evidence From A Randomized Policy Experiment In India." *Mit.edu*. Econometrica, Sept. 2004. Web.

TABLE 1

	GDP average	youth literacy ratio	adult literacy ratio
nbr.values	1818	354	363
min	8824746	0.243	0.165
max	72440400000000	1.241	1.297
range	72440391175254	0.998	1.132
median	1356190850	0.819	0.657
mean	45894516487	0.782	0.650
SE.mean	39850794865	0.011	0.011
std.dev	1699158638211	0.201	0.201

	primary school enrollment ratio	secondary school enrollment ratio
nbrvalues	1011	386
min	0.5701	0.169
max	1.5404	2.304
range	0.9703	2.134
median	0.9936	0.789
mean	0.9770	0.831
SE.mean	0.0035	0.020
std.dev	0.1125	0.393

	secondary school repeat ratio	labor force participation ratio
nbr.values	732	1018
min	0.122	16.65
max	4.305	108.04
range	4.182	91.40
median	1.038	82.32
mean	1.069	73.73
SE.mean	0.012	0.75
std.dev	0.338	24.05

	vulnerable employment ratio	life expectancy
nbr.values	111	2236
min	0.810	19.50
max	1.862	71.13
range	1.053	51.62
median	1.145	48.49
mean	1.196	49.08
SE.mean	0.019	0.18
std.dev	0.197	8.48

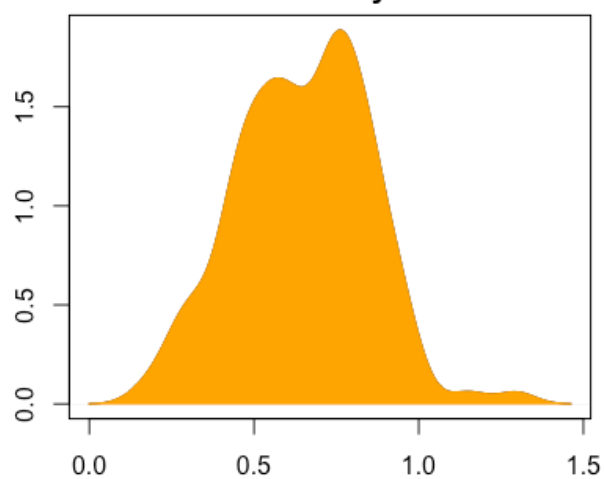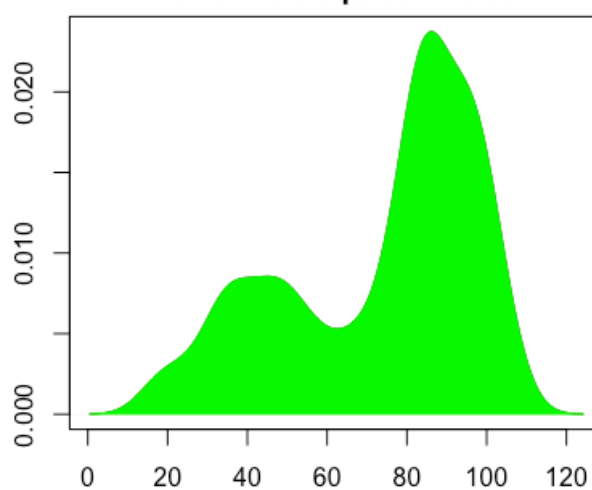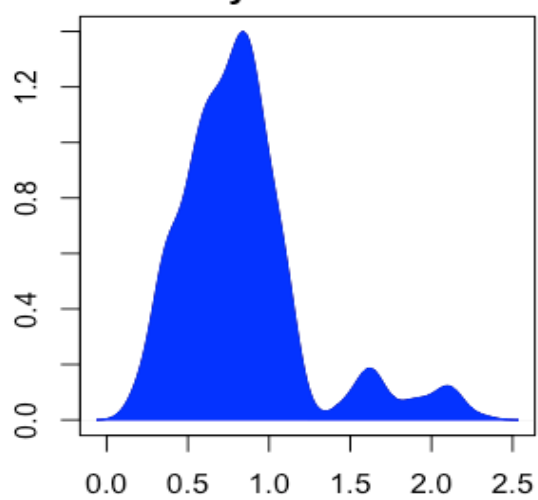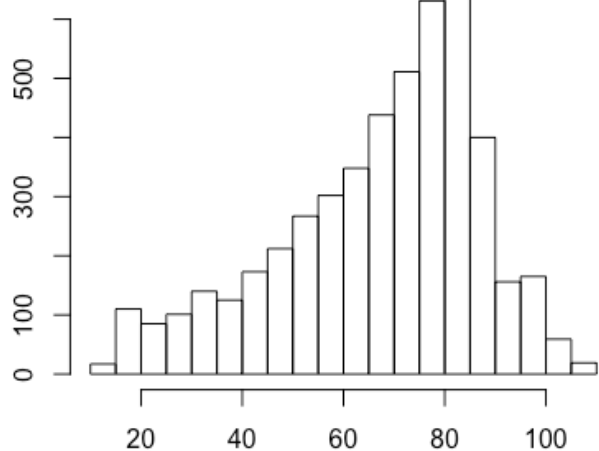**All independent variables are 3-year lag average and ratios (female over male) besides life expectancy

TABLE 2

TABLE 3

Adult Literacy Ratio

Labor Participation Ratio

TABLE 4

TABLE 5

Secondary Enrollment Ratio

Histogram of labor.force.participation.ratio
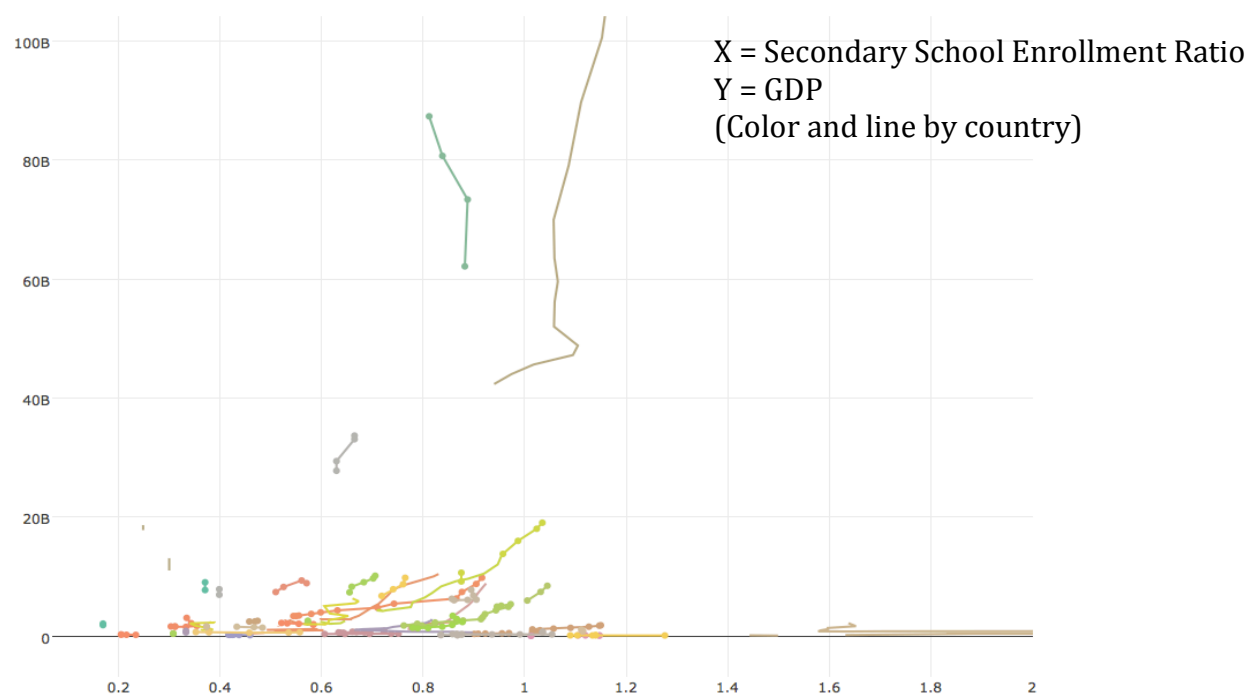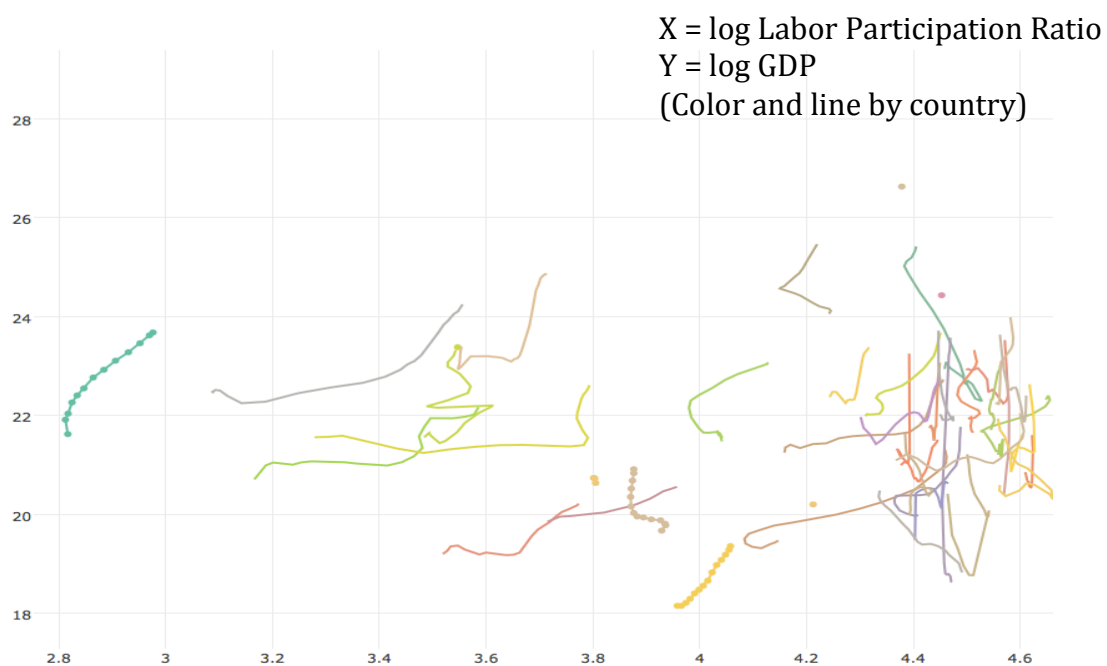
TABLE 6

X = Secondary School Enrollment Ratio
Y = GDP
(Color and line by country)

TABLE 7

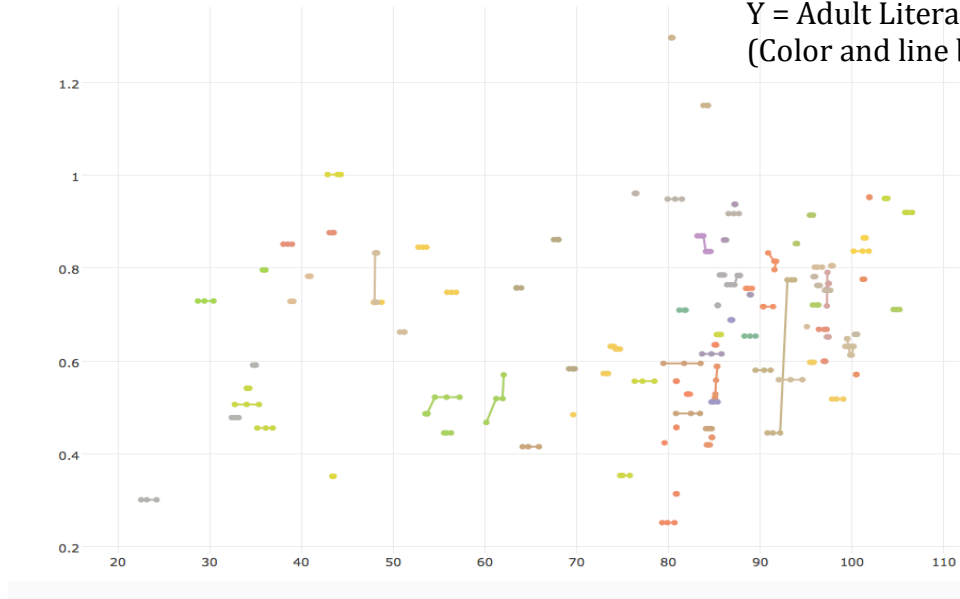X = log Labor Participation Ratio
Y = log GDP
(Color and line by country)

TABLE 8

X = Labor Participation Ratio
Y = Adult Literacy Ratio
(Color and line by country)

TABLE 9

X = Actual log GDP
Y = Predicted log GDP
(Color by country)

Once Y > X, there is economic "deadweight loss," or growth that the nation is believed to be capable of but is not attaining
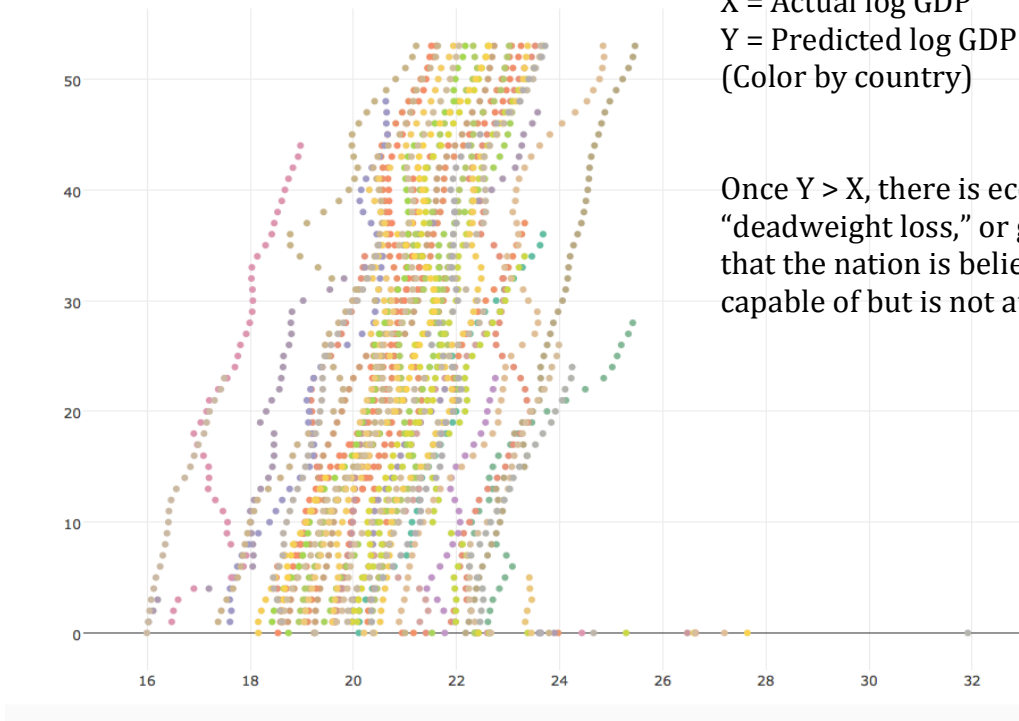
TABLE 10

	Dependent variable:		
	log.dev.GDP		
	(1)	(2)	(3)
dev.lag.adult.literacy.ratio	11.000 (17.000)	−7.500** (3.700)	
log.dev.adult.literacy.ratio	−2.100 (5.000)	2.900*** (1.100)	
dev.adult.literacy.ratio.sq	−6.300 (6.500)	1.900 (1.500)	
dev.lag.labor.participation.ratio	0.750*** (0.260)	0.140* (0.081)	0.290*** (0.069)
dev.labor.participation.ratio.sq	−0.003*** (0.001)	−0.001** (0.0004)	−0.001*** (0.0003)
log.dev.labor.participation.ratio	−23.000*** (7.800)	−2.600 (1.900)	−7.300*** (1.700)
log.dev.life.expectancy	−0.0003** (0.0001)	0.0003*** (0.0001)	0.00001 (0.00004)
dev.life.expectancy.sq	−18.000 (30.000)		4.200 (3.400)
dev.primary.enrollment.ratio.sq	77.000 (134.000)		−20.000 (14.000)
dev.lag.primary.school.enrollment.ratio	−40.000 (72.000)		11.000 (7.200)

Fixed Effects?	Year	Country and Year	Country and Year
Dropped Variable	None	Primary School Enrollment	Adult Literacy Ratio
Observations	203	260	565
R2	1.000	1.000	1.000
Adjusted R2	1.000	1.000	1.000
Residual Std. Error	1.000 (df = 171)	0.180 (df = 195)	0.250 (df = 499)
F Statistic	2,751.000*** (df = 32; 171)	56,911.000*** (df = 65; 195)	62,163.000*** (df = 66; 499)

Note: *p<0.1; **p<0.05; ***p<0.01