The Truth behind Free Markets

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1 Introduction

1.1 Definitions

- Purchasing Power Parity (PPP) per capita: An economic technique used to determine the relative values of two currencies; this solves the problem of the drastically varying amount of goods a currency can purchase within nations.

- Index of Economic Freedom: A series of economic measurements created by the Heritage Foundation and the *Wall Street Journal* to measure the degree of economic freedom in the world's nations. (Scale from 0 to 100, where 100 represents the maximum freedom.)

- Gini Coefficient: A measure of statistical dispersion developed and commonly used as a measure of inequality of income or wealth. (Scale of 0 to 100, where 0 represents perfect equality.)

1.2 Overview

The classical liberalist believes that "basic institutions that protect the liberty of individuals to pursue their own economic interests result in greater prosperity for the larger society." (Adam Smith) While greater economic freedom may summarily benefit a nation's economy, these benefits may not be directed to all members of the society; specifically, it may be that the rich get richer whereas the poor remain poor.

Therefore, while the relationship between PPP per capita and the index of economic freedom may be positive, we hypothesize that there may be little or next to no correlation between the Gini coefficient and the index of economic freedom. This may imply that while economic freedom may increase overall wealth, it does not mean greater wealth for everyone; otherwise, there should be a negative correlation between the two variables.

1.3 Method

We use a set of published data of PPP per capita, the index of economic freedom and the Gini coefficient from various nations to study the relationships. Through this study, we hope to affirm our suspicions about how a free market may not really be as ideal as those who have hoped it to be.

2 PPP per capita vs Index of Economic Freedom

2.1 Linear Regression Model

We test the hypothesis that economic freedom (indicated by the index of economic freedom) has no effect on the PPP per capita versus the one-sided alternative that greater economic freedom increases PPP per capita. However, when we check the conditions for regression inference, we find (see Figure 1):

- The observations are assumed to be independent.

- The overall pattern of the scatterplot of data points appears to be roughly linear (with a hint of an exponentially increasing relationship).

- The residual plot appears to be curved.

- The Normal probability plot appears slightly curved.

We realize that we cannot proceed with the regression inference using this hypothesized model as it clearly does not follow a simple linear regression model.

2.2 Linearized exponential regression model

2.2.1 Hypothesis

We test the hypothesis that economic freedom (explanatory variable X), indicated by the index of economic freedom, has no effect on the PPP per capita (response variable Y) versus the one-sided alternative that greater economic freedom correlates to an exponentially increasing PPP per capita.

The linearized exponential form of the relationship is

$$Y = \alpha e^{\beta X} \tag{1}$$

$$\ln(Y) = \beta X + \ln \alpha \tag{2}$$

The hypotheses, in symbols and in words are

- $H_0 : \beta = 0$: Economic freedom has *no* effect on PPP per capita.

- $H_\alpha : \beta > 0$: Economic freedom has a positive effect on PPP per capita.

where β is the slope of the true regression line.

2.2.2 Conditions

We check the conditions required for regression inference (see Figure 2):

- The observations are assumed to independent.

- The scatterplot of data points is roughly linear.

- The residual plot appears to have a random scatter with no pattern.

- The Normal probability plot appears to be roughly linear, suggesting Normality of data.

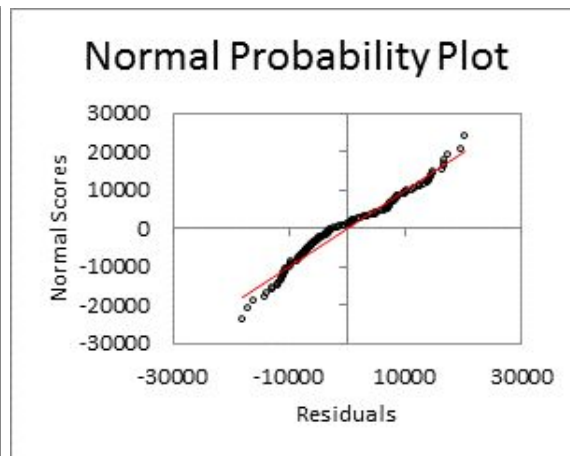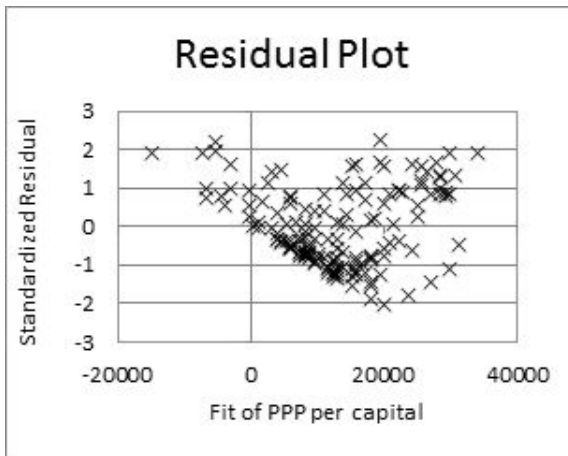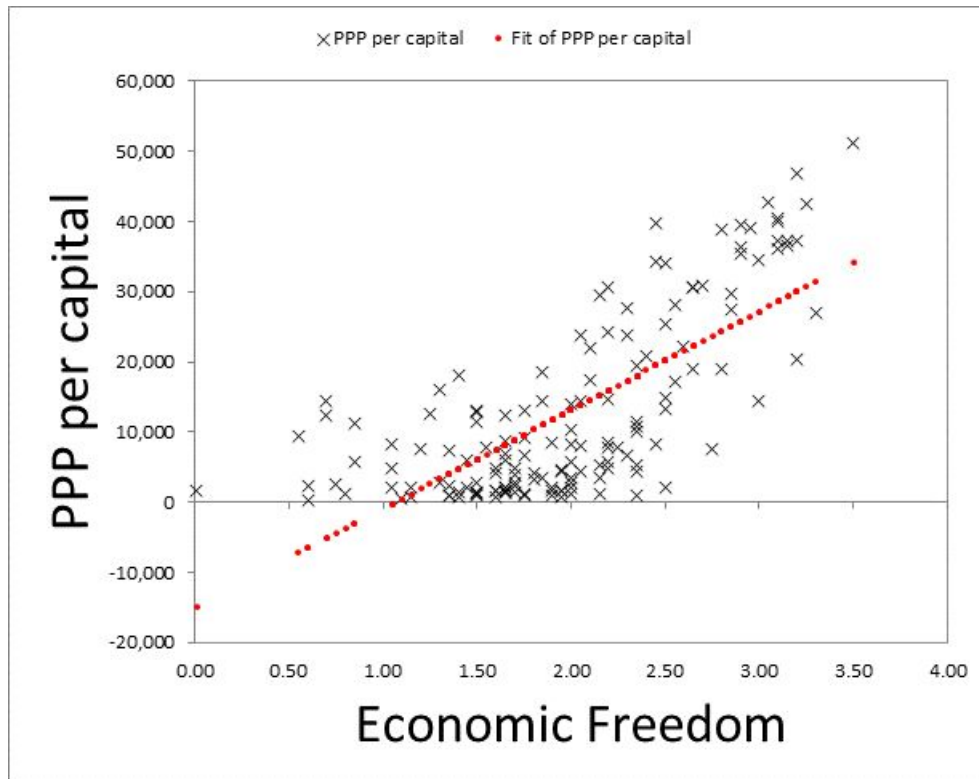Thus, we can proceed with the linear regression test.

Figure 1: The scatterplot, residual plot and normal probability plot for PPP per capita vs. index of economic freedom
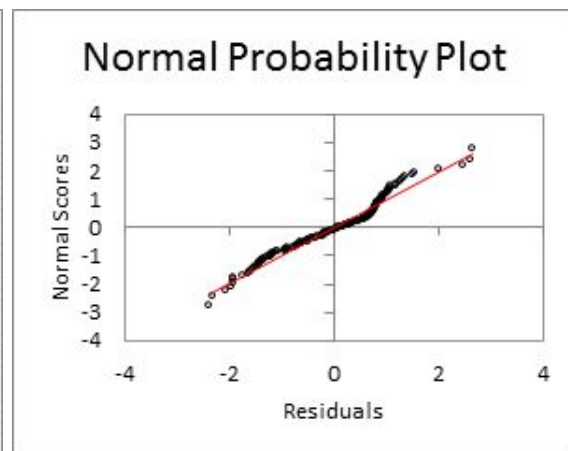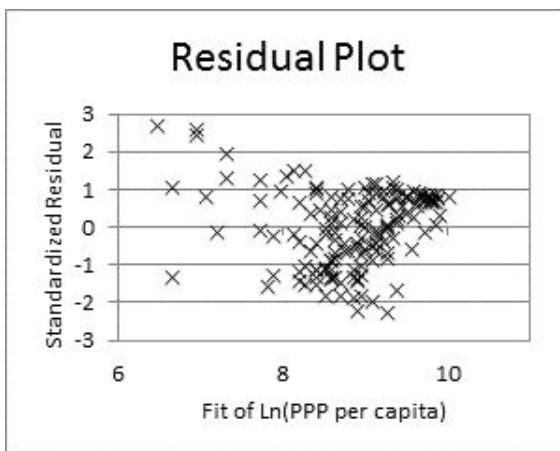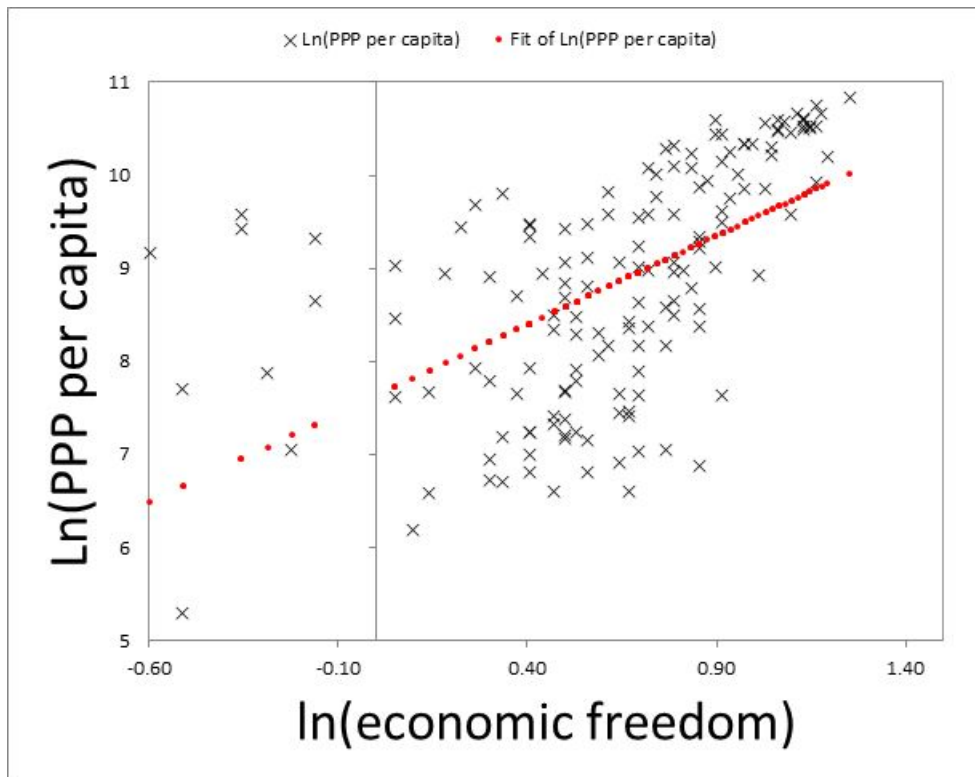
Figure 2: The scatterplot, residual plot and normal probability plot for the logarithm of PPP per capita vs. the logarithm of the index of economic freedom

2.2.3 Calculations

	Regression Statistics
Multiple R	0.565 515 5
R Square	0.319 808 9
Adjusted R Square	0.315 243 9
Standard Error	1.043 907 4
Observations	151

Ln(PPP per capita)	Coefficients	Standard Error
Intercept	7.631 236 7	0.167 555
Ln(economic freedom)	1.911 215 9	0.228 343

From the summary statistics, we find that about 32.0% of the PPP per capita can be explained by the index of economic freedom ($r^2 = 0.320$).

To find evaluate the significance of this result, we find the t-statistic:

$$t = \frac{b}{\mathrm{SE}_b} = \frac{1.911\,215\,9}{0.228\,343} \approx 8.370 \quad (\mathrm{df} = 149) \tag{3}$$

with a one-side P-value of $P = 1.932 \times 10^{-14}$ to 3 decimal places.

2.2.4 Interpretation

We reject H_0 as the P-value is much smaller than any reasonable significance level, say $\alpha = 0.01$. Thus, there is statistically significant evidence to conclude that an increased freedom in the economy exponentially increases PPP per capita.

2.2.5 Miscellaneous

While analyzing our data, we discovered that there was an extreme outlier and we decided not to include it in our final analysis as it heavily distorts our model (see Figure 3). Upon further investigation, we found that this data point corresponds to North Korea, which is a country economically isolated from the rest of the world and therefore constitutes an extreme anomaly that is not representative of the rest of the modern world.

3 Gini coefficient vs economic freedom

We test the hypothesis that economic freedom (explanatory variable X), indicated by the index of economic freedom, has no effect on the Gini coefficient (response variable Y) versus the one-sided alternative that greater economic freedom correlates to a decreasing Gini coefficient.

The hypothesized relationship is

$$Y = X + C \tag{4}$$

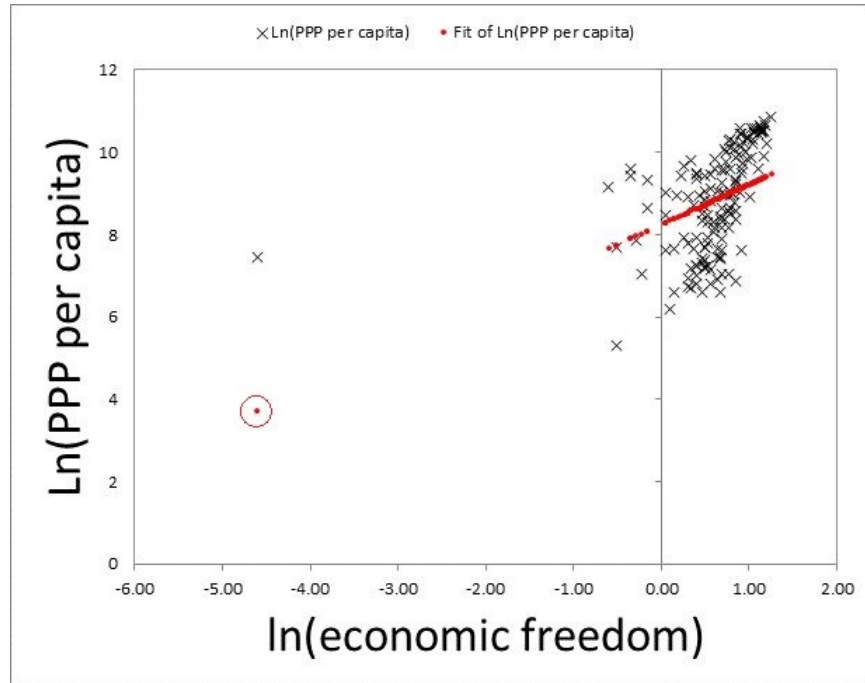The hypotheses, in symbols and in words are:

Figure 3: Outlier in the analysis of PPP per capita vs. economic freedom

- $H_0 : \beta = 0$: Economic freedom has *no* effect on Gini coefficient.

- $H_\alpha : \beta < 0$: Economic freedom has a negative relationship with the Gini coefficient.

where β is the slope of the true regression line. (Note here that we do not include North Korea in this analysis due to the reasons stated before.)

3.1   Conditions

We check the conditions required for regression inference (see Figure 4):

- The observations are assumed to independent.

- The scatterplot of data points is roughly linear.

- The residual plot appears to have a random scatter with no pattern.

- The Normal probability plot appears to be roughly linear, suggesting Normality of data.

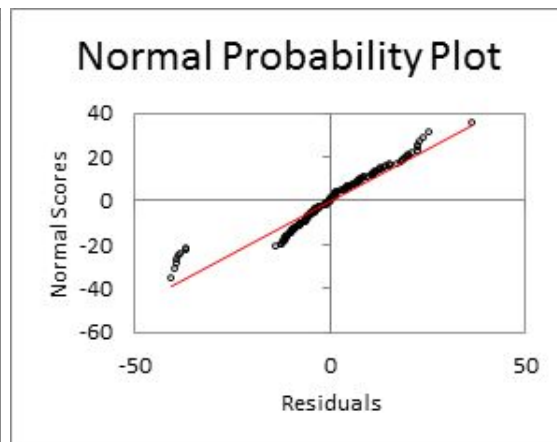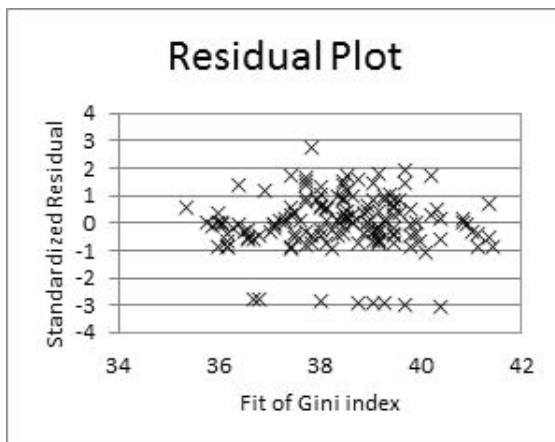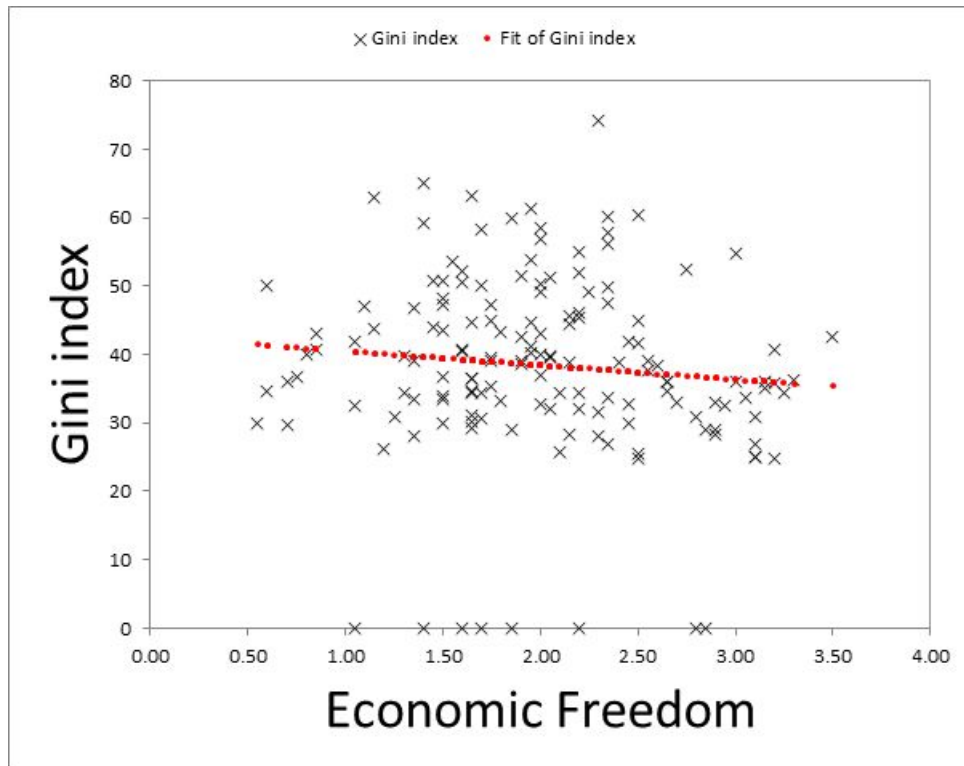Thus, we can proceed with the linear regression test.

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Figure 4: The scatterplot, residual plot and normal probability plot of Gini index vs. the index of economic freedom

3.2 Calculations

	Regression Statistics
Multiple R	0.100 519 5
R Square	0.010 104 2
Adjusted R Square	0.003 460 6
Standard Error	13.408 599
Observations	151

Gini index	Coefficients	Standard Error
Intercept	42.581 96	3.529 053
Economic Freedom	−2.067 061	1.676 118

From the summary statistics, we find that there is little correlation between the two variables. Just to make sure, we evaluate the significance of this result.

The t-statistic is

$$t = \frac{b}{\text{SE}_b} = \frac{-2.067\,061}{1.676\,118} \approx -1.233 \quad (\text{df} = 149) \tag{5}$$

with a one-sided P-value of $P = 0.110$ to 3 decimal places.

3.3 Interpretation

We do not reject H_0 as the P-value of $P = 0.110$ is greater than any reasonable level of significance, say at $\alpha = 0.05$. There is insufficient evidence to conclude that there is any correlation between greater economic freedom and lower Gini coefficient, or in other words, higher levels of economic equality.

4 Conclusion

From this study, we conclude that, overall, greater economic freedom does play a significant role in contributing to greater prosperity for a nation. However, the insignificant relationship between economic freedom and Gini coefficient demonstrates that, as many critics of the free market have pointed out, the inherent problem of the world is not that there is not enough economic freedom; rather, it is that there is no guarantee that even if nations were to embrace it they will become better as a whole as there is no equality within the society. It is easy for the elite class to become wealthier while many of their poorer counterparts continue to suffer under exploitation and corruption. We believe that only through a political system with institutions that protect the liberty of the people can a free market system work and provide for an equal (in terms of opportunity) and just society.