The Effect of Income on the Demand for Democracy and Political Freedoms

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Abstract

The aim of this study was to determine if there was any relationship between income and democracy of countries. We conducted a replication of work done by Acemoglu, et al. (2008) using a random sample of Acemoglu's original panel data. This replication used both a simple linear regression and multiple linear regression to determine whether any relationships were present between the lagged log real GDP of the sample countries and an Augmented version of the Freedom House Index. In addition to a replication of Acemoglu et al.'s paper, an extension was conducted, where simple linear regressions and multiple linear regressions were conducted using a new index as the outcome variable, the fourth iteration of the Polity index. This extension would allow us to confirm our findings of our replication, as well as potentially develop new findings using a similar but different democracy index. However, due to the limitations of our models and data, further research and advancements may be needed.

1. Introduction

With world income of the average person continually increasing, one area of interest is the effect this can have on countries. There have been numerous papers written on the topic, but one specific paper stands out, in particular, a paper written by Acemoglu, et al. (2008) which looks to determine if there is any relationship between income growth and demand for democracy and political freedoms. This paper has been the basis of many existing literature, and we hope to be able to add to the existing research by replicating the work done by Acemoglu, et al. and extend the work of these economists.

2. The Context and Data

The dataset being looked at is a subset of a panel dataset from Acemoglu, et al. (2008) which was used to compare the relationship between income per capita and democracy/political freedoms of countries. The democracy and political freedom in the original paper were measured by an augmented index of political rights by Freedom House, government-funded non-profit non-governmental organization based in the U.S, which had 1 being the highest democracy and political freedom score possible and 0 being the lowest. This original data set is a five-year panel across 208 different countries starting in 1950, of this number 147 were randomly chosen to be used in the subset for this paper. In our dataset, we can look at the descriptive statistics for the variables to get a better understanding of the data, referring to Table 1 for the descriptive statistics of our variables, only the ones that are not a dummy or categorical variable are shown. In the table, one can see that the average Freedom House (FH) index value is 0.5683 ± 0.3577, with a max at 1 and minimum at 0, this suggests that overall, most countries appear to be a hybrid of full autocracies and full democracies, with more leaning towards the latter. Moreover, we can see a similar average for another democracy index, the fourth iteration of the Polity Index, with averages of 0.5563 ± 0.3793. An interesting thing to note is that for both indexes, countries which were former colonies have an overall lower point average, with an index of roughly 0.52, than those who were not colonies, which had an index of roughly 0.65. However, since the standard errors are so large and cause an overlap, this could be due to chance. Another interesting thing to look at is the differences in the democracy indexes of countries that were part of the Eastern Bloc. Looking at Table 1 again, one can see that former Eastern Bloc members had indexes of roughly 0.43 while those who were not see index values of roughly 0.57, so it seems that Eastern Bloc members are less democratic on average. However, because of the large standard errors and small sample size of Eastern Bloc countries this may be due to chance.

3. Regression analysis

3.1. Base Specifications

For the replication portion of this paper, 6 base specifications will be looked at, all of which are shown in Table 2. The first specification is a simple linear regression (SLR) with robust standard errors, as we cannot assume homoskedasticity, this is column (1). The model of which is below, where β_0 and β_1 are the intercept and slope coefficients for the model, respectively.

$$\widehat{Freedom\ House\ Index} = \beta_0 + \beta_1\ Lagged\_Log\_Real\_GDP\_Per$$

$$\widehat{Freedom\ House\ Index} = -1.258 + 0.226\ Lagged\_Log\_Real\_GDP\_Per$$

(0.062) (0.007)

n = 1023 , R^2 = 0.4034

In this model, we only use a one period lagged value for the income per capita as the explanatory variable and the outcome is the FH index. We can see that if there is a country with no income per capita, then they would have a Freedom House index of -1.258, however, if we look at Table 1 this could not be the case as the smallest value of lagged log real GDP per capita is 5.7739. So, using the point estimates the smallest value one could get would be 0.0469 where every unit increase in the lagged log real GDP per capita would result in a 0.226 increase in the FH index, which is a relatively large increase since this index goes from 0 to 1. In addition to the point estimates, one can get a 95% confidence interval using the standard errors, giving an interval of (0.211, 0.24) for this model which suggest that for every unit increase in the lagged log real GDP per capita, the FH index increases by a minimum of 0.211 and a maximum of 0.24. Since this interval is overall greater than 0, this also suggests the point estimate is statistically significant to the 0.05 significance, which is reflected in the p-value, 0.000.

Another specification conducted is seen in column (2), where we have used clustered standard errors for our SLR. We can see in Table 2 that the point estimate does not change at all going from our first model to our second, with the only difference being the standard error, being 0.012 opposed to 0.007, and hence the confidence interval is also different. Looking at the confidence interval we get a confidence interval of (0.201, 0.25), which still is overall greater than 0 and suggests a minimum increase of 0.201 and maximum of 0.25 to the FH index for every unit increase in lagged log real GDP per capita. Thus, we can make the same conclusion as model 1 and say that the point estimate is still statistically significant in our second model, where we still see a 0.226 increase in the FH index for every unit increase in the lagged log real GDP per capita. Using this specification, we can see that it is important to use clustered standard errors as we are looking at panel data of many different countries at different points in time, and thus there are many country specific things that are accounted for in clustering. However, because the outcome variable is rather complicated and we are using only an SLR model, it is likely that we are missing some variables, and hence there is likely some sort of omitted variable bias. One example of such an omitted variable could be the location or region the country is

in, such as countries in Europe, this would not really change over time, but has an effect on the country's democracy and income as these countries could be in the European Union or precursors to it and thus may be more democratic and have higher income compared to countries in Africa or Asia because of the close ties with neighbouring countries. Therefore, this would result in some sort of bias that may not be completely captured in our model due to omitted variable bias.

After establishing a need to account for other variables, one variable we can control for is country, seen in column (3). This is given by the following model where the only change in the model is the addition of a fixed effect for each country, $D_{country}$, and its coefficient, β_2.

$$\widehat{Freedom\ House\ Index} = \beta_0 + \beta_1 Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country}$$

$$\widehat{Freedom\ House\ Index} = -0.331 + 0.055\ Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country}$$

(0.141) (0.018)

n= 1023 , R^2 = 0.7272

Here, we can see an estimate of 0.055 ± 0.018, which is much smaller than the GDP estimate in our SLR models, however this increase is still relatively large as this is an increase for every unit change in the lagged log real GDP. Moreover, the confidence interval for this model estimate is (0.02, 0.09), which along with a p-value of 0.002, still suggests that our results are statistically significant. Furthermore, this also implies that at minimum we could expect a 0.02 increase in the FH index for every unit increase in the lagged log real GDP per capita and at maximum a 0.09 increase. Comparing this to the estimates for model 2, we can see that it is completely different as the confidence intervals do not overlap at any point, so they are not the same estimates, namely being much smaller than previous models. As well, only including the country fixed effect may not be the only omitted variable in our model, as there could be a confounder in the time. For example, a time varying variable that could be omitted is the year, this variable doesn't vary between countries, but does have an effect on democracy and income, since people's incomes change over the years, usually increasing as the years go on and political sentiment can change depending on the year, like pre- or post- certain events like the fall of the USSR.

Thus, taking into account a year fixed effect for any time variant factors gives the estimates in column (4). This is given by the following model

$$\widehat{Freedom\ House\ Index} = \beta_0 + \beta_1 Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country} + \beta_3 D_{year}$$

$$\widehat{Freedom\ House\ Index} = -0.335 + 0.059\ Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country} + \beta_3 D_{year}$$

(0.186) (0.027)

n= 1023 , R^2 = 0.757

Here, one can see that the estimated coefficient for the lagged log real GDP per capita is 0.059 ± 0.027, with an 95% confidence interval of (0.007, 0.111). This suggests that the FH index

increases by 0.059 for every increase in the lagged log real GDP per capita, and this estimate is statistically significant to 0.05 significance, as the interval is greater than 0 and p-value is 0.028. This estimate is also practically large, since the index is still between 0 and 1, however when comparing to model (3) the confidence intervals do overlap, thus there is the possibility that they have the same estimate. Conducting an exclusion test, i.e., an F-test, on the year fixed effect will also tell us if there is any statistically significant fixed effects for any given year, which will tell us whether the fixed effect is important, this can be seen in Table 2. The F-statistic of the test is 10.80 with a p-value of 0.000, so this means we would reject the null hypothesis of the test, which is that all estimates for the year fixed effect is equal to 0. Thus, the results of the F-test suggests that at least one of the years needs to be controlled for and hence including the year fixed effects would account for some of the omitted variable bias.

In addition to the country and year fixed effects, another source of bias could be the exclusion of certain demographic controls, as democracy and income can depend on things such as age, education, or country population. However, because certain demographic information may be missing from the data, we need to create a subsample to use in a new set of models. Once we have done so, the specifications of the 4^{th} model will be run again on this subsample to determine if there are any major differences between the full sample and subsample, the results this is the output of column (5).

Now we can include these controls in our model, the estimates of which are shown in column (6). Looking at these estimates, one can see an estimate of 0.016 ± 0.041 with a 95% confidence interval of (-0.065, 0.097) and p-value of 0.7. This suggests the FH index increases by 0.016 for every unit increase of the lagged log real GDP per capita, with a maximum of 0.097 and a minimum of -0.065. Clearly, one can see that the estimate may not be statistically significant, as our p-value is greater than 0.05 and our confidence interval contains 0, so we cannot rule out the possibility that the estimate is 0. Looking at the actual point estimate, it is also rather small, being 0.016, so even if it were statistically significant, it would not really have much of an effect on the FH index, so practically it could be considered small. Comparing this value to the one in model 4, we can see that it does overlap in the confidence interval, so there is the possibility of the estimates being the same as well. Although this overlap could be due to the reduction in the sample, as much of the original sample was removed because of missing data, and thus there is lower power. Conducting an F-test on the year fixed effects, age variables and all demographic controls in general yields statistically significant F-statistics, seen in Table 2. All three tests return a p-value that is less than 0.05 and thus are statistically significant for each of the controls, suggesting there is at least one non-zero estimate for each of the variables tested.

Thus, the results of the F-tests and the point estimate itself suggests that there may not be a relationship between the lagged log real GDP per capita and democracy score.

So overall, based on the estimates conducted in all six models, we find statistically significant results in 4 of the 6 models, where a unit increase in the lagged log real GDP per capita resulted in statistically significant increases to the FH index. Hence this could suggest an inconclusive relationship between the income per capita and the democracy and political freedom of a country.

3.2. Extension

The extension that will be conducted is a complete replication of the previous regressions using a new democracy index as an outcome, the 4th iteration of the Polity Index, a political science project similar to the Freedom House index which also goes from 0 to 1, where 1 represents full democracy. Doing so would allow us to compare results and determine if the results we saw in the base specifications can still hold with another democracy index. Moreover, this would allow us to provide further support for any conclusions we may draw, and potentially draw new conclusions based on both sets of models. The estimates of this new set of models are presented in Table 3, where each column are the same specifications, just with the Polity4 (P4) index as the outcome variable. The first model specification was our SLR model with only robust standard errors and the model is shown below.

$$\widehat{Polity\ 4\ Index} = \beta_0 + \beta_1\ Lagged\_Log\_Real\_GDP\_Per$$

$$\widehat{Polity\ 4\ Index} = -1.293 + 0.231\ Lagged\_Log\_Real\_GDP\_Per$$

$$(0.066) \quad (0.008)$$

$$n = 932\ ,\ R^2 = 0.3831$$

We can see in Table 3 column (1) that we have an estimate of 0.231 ± 0.008 a very similar estimate to the corresponding FH model, being a point estimate of 0.226. Moreover, the 95% confidence interval for this model is (0.215, 0.246) which is very similar to the original model interval, (0.211, 0.24), so one cannot exclude the possibility the estimates are the same. Thus, we can conclude that every unit increase of the lagged log real GDP per capita results in a 0.231 ± 0.008 increase to the P4 index, with a max increase of 0.246 and minimum of 0.211, a similar conclusion to what happens to the FH index. Moreover, looking at the p-value of the model, 0.000, and the interval, we determine the estimate is statistically significant, and the point estimate is practically significant, because like the FH index the P4 index goes from 0 to 1 and 0.231 is a rather large portion.

The second model that clusters by country is seen in column (2) of Table 3 and we see the same estimate as model (1), which is something that also occurred in the Freedom House models. The only change between the two models is a change to the standard errors, being 0.014 in the clustered model, thus this changes the confidence interval to (0.204, 0.257). In any case, the interval for model 2 still

overlaps with the first P4 model, as well as both the FH models, thus we can conclude the two P4 models may have the same conclusions as the first 2 FH models.

The next specification that is done on the P4 index is the model which adds the country fixed effects, seen in column (3), and is displayed below.

$$\widehat{Polity\ 4\ Index} = \beta_0 + \beta_1 Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country}$$

$$\widehat{Polity\ 4\ Index} = -0.818 + 0.133\ Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country}$$

(0.165) (0.02)

n= 932 , R^2 = 0.7169

In this model, the estimate we get is 0.133 ± 0.02, which is the significantly different from the one seen in the corresponding FH model, as well as the previous SLR models. With the standard errors, the 95% confidence interval is (0.093, 0.172), which does not overlap with either of the intervals for the SLR P4 models or the corresponding FH model estimate, which had an interval of (0.02, 0.09). Thus, we can conclude that the estimate in this P4 model is likely different from the models we have mentioned before. Furthermore, this model's point estimate is more than double that of the third FH model estimate, being a 0.133 increase in the P4 index for every unit increase in the lagged log real GDP per capita compared to a 0.055 increase in the FH model. Additionally, looking at the confidence interval and the p-value, 0.000, one can see that this point estimate, 0.133, is statistically significant, and also practically significant since the P4 index ranges from 0 to 1.

However, because of the same problems as before, we also want to look at the specification where time is added into the model. This model is part of the (4) column of Table 3 and the model specifications are as follows

$$\widehat{Polity\ 4\ Index} = \beta_0 + \beta_1 Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country} + \beta_3 D_{year}$$

$$\widehat{Polity\ 4\ Index} = 0.143 - 0.005\ Lagged\_Log\_Real\_GDP\_Per + \beta_2 D_{country} + \beta_3 D_{year}$$

(0.205) (0.029)

n= 932 , R^2 = 0.7692

This model has an estimate of -0.005 ± 0.029, with a confidence interval of (-0.063, 0.053), which suggests that the P4 index goes down by 0.005 for every unit increase in the lagged log real GDP per capita. Based on the confidence interval, it is pretty clear that the estimate may not be statistically significant, given the p-value is 0.866 this further supports this notion. In contrast, when comparing this result to model 4 of the FH index, we see that the point estimate is drastically different, being 0.059, and is also statistically significant, though the confidence intervals do overlap. So, this suggests that perhaps this specification's conclusion is inconclusive, as we have evidence that suggests that there may be a relationship in the FH model, and contradicting results from the P4 model with the same specifications.

The next specification is the subsample model, seen in column (5). Comparing the results from Table 2 and Table 3 of this specification we can see that in the P4 model, the point estimate is now statistically significant and negative, being -0.082 compared to the non statistically significant estimate in the FH subsample model, -0.023. This is interesting as it suggests that there may be a negative relationship between the lagged log real GDP per capita and democracy, however because of certain limitations with our model this may require future analysis.

Finally, the last specification is the sub sample with demographic controls, shown in column (6). Here, we can see that there still continues to be no statistically significant effect that the lagged log real GDP per capita has on the Polity 4 index, which is the same conclusion as the FH model. We know this because looking at the confidence interval, (-0.099, 0.076), we see that it contains 0, and the p-value of the estimate is 0.807, thus this suggests we would not be able to reject the null hypothesis that the estimate is zero. Furthermore, looking at the F-statistics of the same 3 F-tests, we also reach the same conclusions as the base specifications, where we reject the null hypothesis for all 3 tests. Hence, this suggests that at least one of the fixed effects and controls in the 3 sets of tests on year, age and demographic are nonzero. These results lead us to make the same conclusions as the FH model, where there may not be a concrete relationship between income per capita and democracy.

4. Limitations of results

Looking at both our sets of models, there are some limitations with what was done. First off, there is the possibility that certain SLR and MLR assumptions may be violated. For the SLR models, as discussed, there were likely many variables that were omitted from the model that are important to include, as such this would fail the zero conditional mean assumption, as there may be bias in the coefficient. Regarding the MLR assumptions, a few of our models were also omitting certain variables, namely models (3) to (5), as we continued to add more variables into the model that were omitted, like year and the demographics. Thus, these failures of the assumptions may put the validity of the results in jeopardy. Furthermore, there could be a problem with reverse causality, as instead of income affecting democracy, it could be that democracy has an effect on income, which could be resolved with an instrumental variable approach. Another limitation is that the data is rather old, being the latest year in the data set is 2000, thus the results of our paper may differ with the addition of more recent data.

5. Conclusion

Based on our replication of Acemoglu et al.'s (2008), we can conclude that there may be inconclusive evidence of any statistically significant effect that income has on democracy. This is due to some of our models showing statistically significant effects while others provide contradicting evidence. When only accounting for country and year, we found statistically significant increases correlated with

income the Freedom House index in the complete sample, and no evidence of an effect on the Polity 4 index. However, once controlling for demographics, we found no statistically significant effect of income on either index. Furthermore, because of limitations with the models and the data, the resulting estimates may be out of date or invalid, therefore further research may be required to truly determine if there is any effect because of these limitations, such as using an instrumental variable approach.

References:

Acemoglu, Daron, Simon Johnson, James A. Robinson, and Pierre Yared. 2008. "Income and Democracy." *American Economic Review*, 98 (3): 808-42. DOI: 10.1257/aer.98.3.808

Table 1: Descriptive Statistics of Continuous Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Freedom House (FH) index	1,194	0.5683	0.3577	0	1
Polity 4 Index	1,092	0.5563	0.3793	0	1
Log real GDP per capita	1,199	8.165	1.0372	5.7739	10.6917
Age Percentage: very young	1,551	0.3634	0.0947	0.1429	0.5161
Age Percentage: young	1,551	0.2546	0.0256	0.1685	0.3466
Age Percentage: middle age	1,551	0.1753	0.0298	0.0897	0.2979
Age Percentage: old	1,551	0.1184	0.0374	0.056	0.2215
Age Percentage: very old	1,551	0.0883	0.0493	0.0316	0.2406
Years of Education	722	4.4584	2.8737	0.042	12.179
Log of total population (in thousands)	1,308	8.6819	1.9073	3.7136	14.0486
FH index if former colony	866	0.5354	0.3474	0	1
Polity 4 Index if former colony	758	0.5135	0.3642	0	1
FH index if not former colony	328	0.6553	0.3705	0	1
Polity 4 Index if not former colony	334	0.6534	0.3953	0	1
FH index if former Eastern Bloc	89	0.4184	0.3478	0	1
Polity 4 Index if former Eastern Bloc	89	0.4556	0.3658	0.05	1
FH index if not former Eastern Bloc	1105	0.5804	0.3559	0	1
Polity 4 Index if not former Eastern Bloc	1003	0.5652	0.3794	0	1

Table 2: Base Freedom House Regression Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
Lag of log real GDP pc	0.226***	0.226***	0.055***	0.059**	-0.023	0.016
	(0.007)	(0.012)	(0.018)	(0.027)	(0.036)	(0.041)
	(0.211, 0.24)	(0.201, 0.25)	(0.02, 0.09)	(0.007, 0.111)	(-0.093, 0.047)	(-0.065, 0.097)
Age						
Age group: Young						-0.509
						(0.518)
Age group: Middle Age						-2.618***
						(0.636)
Age group: Old						0.452
						(0.935)
Age group: Very Old						0.848
						(0.988)
Education						-0.004
						(0.016)
Log Population						-0.104
						(0.087)
F-statistics and P-values						
Year Fixed Effects				10.80	7.88	7.43
				(0.000)	(0.000)	(0.000)
Age Controls						4.49
						(0.0014)
Demographic Controls						3.30
						(0.0034)
Year Fixed Effects	No	No	No	Yes	Yes	Yes
Country Fixed Effects	No	No	Yes	Yes	Yes	Yes
Clustered Standard Err.	No	Yes	Yes	Yes	Yes	Yes
Demographic Sample	No	No	No	No	Yes	Yes
Number of Obs.	1,023	1,023	1,023	1,023	685	685
Number of Countries	147	147	147	147	94	94
R-Squared	0.4034	0.4034	0.7272	0.7570	0.7259	0.7354

Notes: The standard errors reported in this table are robust standard errors, as there may be problems with homoskedasticity of the errors. As a result of the robust regression analysis, this means that the R-Squared are also reported, rather than adjusted R-Squared values. The confidence interval was conducted at a 95% significance level. The time span of the data is from 1950 to 2000 with observations taken at 5-year intervals, and any lags were conducted for 1 period.

***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.

Table 3: Polity 4 Regression Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
Lag of log real GDP pc	0.231***	0.231***	0.133***	-0.005	-0.082**	-0.011
	(0.008)	(0.014)	(0.02)	(0.029)	(0.038)	(0.044)
	(0.215, 0.246)	(0.204, 0.257)	(0.093, 0.172)	(-0.063, 0.053)	(-0.156, -0.008)	(-0.099, 0.076)
Age						
Age group: Young						0.426
						(0.504)
Age group: Middle Age						-2.452***
						(0.718)
Age group: Old						1.496
						(0.95)
Age group: Very Old						-0.88
						(1.131)
Education						-0.022
						(0.018)
Log Population						-0.016
						(0.094)
F-statistics and P-values						
Year Fixed Effects				16.43	17.52	8.93
				(0.000)	(0.000)	(0.000)
Age Controls						4.86
						(0.0014)
Demographic Controls						4.26
						(0.0003)
Year Fixed Effects	No	No	No	Yes	Yes	Yes
Country Fixed Effects	No	No	Yes	Yes	Yes	Yes
Clustered Standard Err.	No	Yes	Yes	Yes	Yes	Yes
Demographic Sample	No	No	No	No	Yes	Yes
Number of Obs.	932	932	932	932	657	657
Number of Countries	147	147	147	147	94	94
R-Squared	0.3831	0.3831	0.7169	0.7692	0.7478	0.756

Notes: The standard errors reported in this table are robust standard errors, as there may be problems with homoskedasticity of the errors. As a result of the robust regression analysis, this means that the R-Squared are also reported, rather than adjusted R-Squared values. The confidence interval was conducted at a 95% significance level. The time span of the data is from 1950 to 2000 with observations taken at 5-year intervals, and any lags were conducted for 1 period.

***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.