University of Maine – School of Economics

Economic Freedom and Growth

ECO 530: ECONOMETRICS

Antonio Jurlina
12-3-2018

Contents:

Economic Freedom and Growth

I. Topic and Motivation

Going through an undergraduate career in economics, one starts off by learning the classical assumptions governing the thinking process. They should sound familiar to most – people face tradeoffs, respond to incentives and think at the margin, societies face a tradeoff between inflation and unemployment in the short run and trade can make everyone better off, among others. These assumptions get challenged along the way, thereby structuring a solid reasoning foundation. The most useful way to challenge them has been observing the real world and finding the fault in the simplicity of the assumptions.

Observing real world data, it soon becomes obvious that individuals are not always rational thinkers operating at the margin (Kahneman & Tversky, 1979) and that markets might not always be the best way to organize economic activity. Having an education with an emphasis on micro processes, macroeconomics sometimes takes a back seat and the ability to study real world interactions gives place to perusing (neo)classical theory. This leaves students with having to just accept at face value all about comparative advantage (Ricardo, 1817), the ability of markets to allocate resources and foster growth (Smith, 1776) and much more.

Without any individual econometric experience in dealing with country level data (prior to this semester) it seemed that pushing against the knowledge ceiling in this particular direction, would be an interesting project. I had decided to pursue this, hoping I could cross the adaptive valley along the way. Therefore, this research paper is going to examine if economic freedom is conducive to growth. Specifically, it will attempt to do so by deconstructing an index of economic freedom and testing the effect of all its elements on growth. This should provide an insight into macroeconomic econometrics dealing with panel data, all the parameter identification issues that usually come along with it and possibly prove (or disprove) some theoretical assumptions. The goal is to increase my econometric toolkit, with all the results that come from it as an added knowledge bonus.

II. Literature Review

Adam Smith (1776), with the publication of the *Wealth of the Nations,* instigated a debate around the causes of economic growth. Although mercantilism had dominated the period of late Renaissance in Europe and powerful merchants had built routes based on the belief that trade would benefit them greatly (McCusker & Morgan, 2001), it wasn't until Smith's work had been published that attention turned towards free trade, production advantage, economies of scale and institutions (or lack thereof) intended to orchestrate this in unison. This work was further expanded by Ricardo (1817), who ushered the realization that benefits can be acquired even by those countries that are not the most efficient suppliers around. Eventually, economic growth was taken up by the likes of Solow (1956), who had expanded the Harrod-Domar model (Domar, 1946; Harrod, 1939) so that growth is represented as function of capital, labor and technology (with more optimistic limitations).

Following Solow's work, Kuznets (1973) argued that, while necessary, technology itself wouldn't suffice in producing measurable growth. He claimed that growth would induce change along the way (something along the lines of Schumpeter, 1942), and all the conflict would have to be resolved cost-effectively through institutions designed to do so. Only then, with conflict resolution costs smaller than benefits of growth, would long-term economic progress occur. Finally, there is Milton Friedman (1962), crafting institutional approach along more libertarian lines, arguing for a government that is there to promote safety, monopolize violence and influence the economy through the money supply. He also argued for the removal of major trade barriers as the only way to introduce stable equilibria.

More recent work had found that property rights, monetary stability, and freedom to trade internationally all have visible impact on growth (Ayal & Karras, 1998; Barro, 1991; Easterly, 1992; Knack & Keefer, 1995; Torstensson, 1994). Additionally, previously underdeveloped, closed-off, and/or countries with centralized economies had all undergone drastic economic changes (in the positive direction) upon loosening institutional grips, opening towards the world and openly stifling hierarchical corruption. This can be observed in the economies of Taiwan, Singapore and Hong Kong, with China following closely upon realizing its neighbors had adopted a slightly more laissez-faire approach and experienced significant growth (Naughton, 2007).

Market equilibria inside closed economies adjust themselves according to supply and demand interactions and institutional involvement. With constraints effectively placed to incorporate the costs of most inefficiencies, effective resource allocation is determined on aggregate, through interactions of all the individual participants. With current levels of globalization and economic interconnectedness, eliminating quotas and barriers results in a world-wide market place with freer price points. This, much like on a single-country level, is an amalgamation of countless interactions producing an inherent equilibrium. Depending on the institutional restrictions imposed by all the individual players (and their size), this equilibrium will inch towards comparative efficiency, fostering more growth. With the readjustment of the production possibility frontiers to accommodate the new demand and supply pressures, Mundell and Fleming (Mundell, 1963; Fleming, 1962) identify certain factors affecting GDP levels of open-economies: fiscal policy, monetary policy, and foreign trade shifts. Even if Leonteif's (1953) observations (the failure of H-O theorem) hold across countries, there is still an adjustment shift according to the world market.

Finally, (Gwartney, Lawson, & Block, 1996), have created an index consisting of all these factors influencing growth. The index rates the economic freedom of countries on a scale of 1 to 10, with 10 indicating a country that is completely free economically. The Economic Freedom Index (from here on referred to as EFI), is comprised of separate indices for the size of the government, legal system and property rights, freedom to trade internationally, stability of the monetary policy, and the number of regulatory obstacles. This index, and similar ones (such as the one produced by the Heritage Foundation) have been used in several ways in order to determine a possible causal link between economic freedom and economic growth (Berggren, 2003; Carlsson & Lundström, 2002; de Haan & Sturm, 2000; Gwartney, Lawson, & Holcombe, 1999; Nelson & Singh, 1998).

III. Econometric Model

The EFI is published yearly by the Fraser Institute. Latest edition (Gwartney et al., 2015) is comprised of five areas used to construct a scale of economic freedom, with each area rated on a scale of 1 to 10. *Size of Government* focuses on individual choice-making through market interactions, as opposed to relying on policy making. Countries with low levels of government

spending, a smaller government enterprise sector, and lower tax rates earn the highest ratings in this area. *Legal System and Property Rights* focuses on unbiased judiciary systems, effective protection of private property and impartial enforcement of the law. Countries that satisfy these categories the best, score the highest in this area. *Sound Money* refers to money with a stable purchasing power over time. Countries that score high in this area, must follow policies and adopt institutions that lead to low rates of inflation and avoid regulations that limit the ability to use alternative currencies. *Freedom to Trade Internationally* focuses on the level and ease of interactions across the borders. To score high in this area, a country must have "low tariffs, easy clearance and efficient administration of customs, a freely convertible currency, and few controls on the movement of physical and human capital" (Gwartney, Lawson, & Block, 2015). *Regulation* measures the access into markets and restrictions around economic interactions. To score high in this area, countries need to relax regulatory constraints around labor, product and credit markets. For more detail on the construction of each of these areas, see Appendix 1.

The model under consideration uses these areas as explanatory variables. This should help in determining the causal link, or at least, the sign of the relationship, between economic growth and factors determining classical assumptions around economic freedom. The model is as follows

$$GROWTH_{i,(t-5\ to\ t)} = \beta_0 + \beta_1 GOV_{i,t-5} + \beta_2 LEGAL_{i,t-5} + \beta_3 MONEY_{i,t-5} + \beta_4 TRADE_{i,t-5} + \beta_5 REGULATION_{i,t-5} + \beta_6\, log(GDP)_{i,t-5} + \varepsilon_{i,t} \quad \text{(Equation 1)}$$

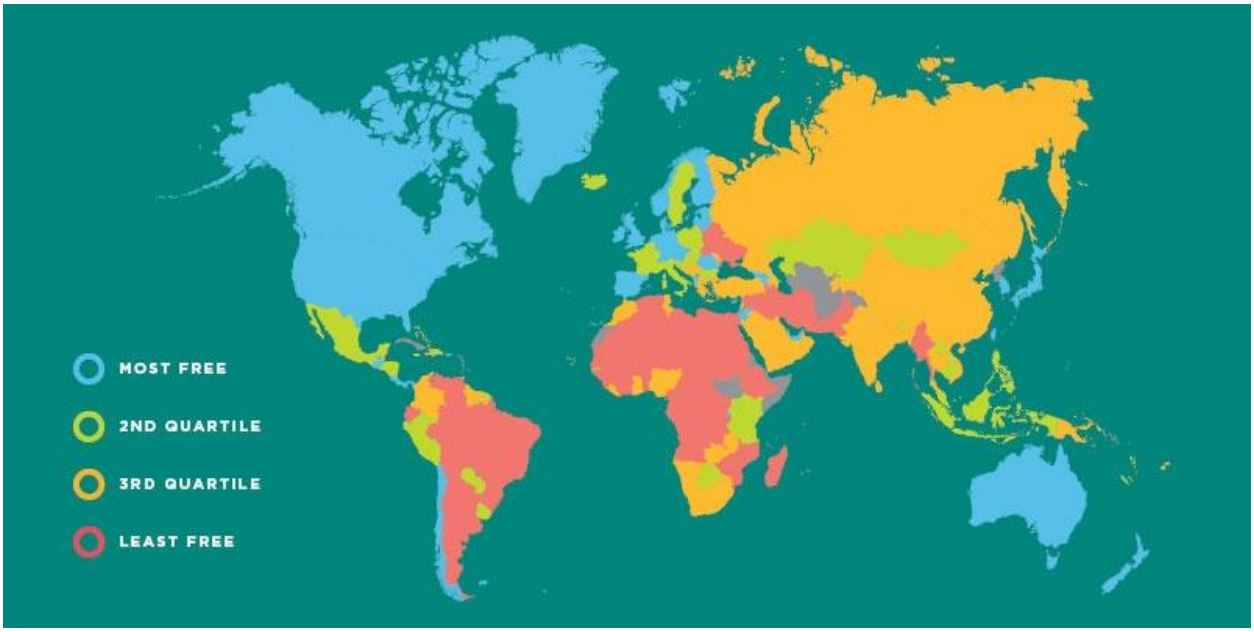
where the dependent variable represents growth of log GDP per capita over a 5-year period, β_1 through β_5 represent the five areas of EFI at the beginning of each 5-year period, β_6 represents the log of GDP per capita at the beginning of each 5-year period and ε represents the error term. Each of these variables is defined across countries (*i*) and time (*t*, *t-5*), making this a fixed effects model. Country-level heterogeneity carries a lot of unobservable variables, so with fixed effects, the remaining variation can be used to causally identify the relationships of interest. The null hypotheses are that there is no significant effect between the five areas of EFI and growth of GDP per capita. The alternative hypotheses are that the higher a country scores in all five areas of EFI, the higher the log growth of GDP per capita, in accordance with classical assumptions.

Data

The data set used for this project was created using three different sources. The EFI was obtained from the Fraser Institute ("Economic Freedom of the World," 2016), data on GDP per capita was obtained from the World Bank Group ("GDP per capita (current US$) | Data," 2018), recorded in 2018 US dollars. GDP was chosen to be per capita specifically to avoid any issues with population size differences among countries. Finally, a dummy variable on whether nations are members of the OECD was created using the list of member nations from the OECD website ("OECD - Members and partners," 2018). These variables are organized as panel data with 52 countries, ranging from 1970 to 2015. Countries were selected based on data availability, to avoid missing values that would result in omitted observations during estimation. Summary statistics (minimum, maximum, mean, and standard deviation) for all variables can be seen in Appendix 2 and graphs representing these variables, faceted by country, can be seen in Appendix 3.

In the 2015 EFI, Hong Kong and Singapore were the top two countries, United States was 16th, Japan (26th), Germany (29th), South Korea (39th), Italy (68th), France (70th), Mexico (93rd), Russia (99th), China (111th), India (114th), and Brazil (118th). The 10 lowest-rated countries were Angola, Central African Republic, Zimbabwe, Algeria, Argentina, Syria, Chad, Libya, the Republic of Congo, and, in last place, Venezuela.

Figure 1. Economic Freedom of the World 2015 Report (The Fraser Institute) (Gwartney, Lawson, & Block, 2015).



IV. Preliminary Estimates

The first step of the analysis revolved around estimating an OLS version of the model in Equation 1. Results were estimated in three different ways – by grouping all countries together, by using only OECD member countries and by using only non-member countries. This dummy variable was introduced due to the special economic relationships fostered by OECD member nations, to stabilize unobservable heterogeneity between members and non-members. The use of the dummy variable was also inspired by previous research, especially that of Mankiw, Romer and Weil (1992). Detailed results are presented in Figure 2.

Figure 2. Panel Least Squares Regressions

Dependent variable: log growth of GDP per capita (1975 - 2015)			
	Pooled	*non-OECD*	*OECD*
Intercept	*0.441* *(0.034)*	*0.372* *(0.054)*	*0.526* *(0.046)*
log GDP per capita	***-0.071**** ***(0.005)***	***-0.072**** ***(0.009)***	***-0.072**** ***(0.007)***
Size of Government	*0.005* *(0.004)*	*0.006* *(0.006)*	*0.002* *(0.005)*
Legal System & Property Rights	*-0.003* *(0.003)*	*-0.005* *(0.005)*	*-0.002* *(0.004)*
Sound Money	*-0.004* *(0.002)*	***-0.006**** ***(0.003)***	*0.000* *(0.004)*
Regulation	***0.024**** ***(0.005)***	***0.024**** ***(0.008)***	***0.025**** ***(0.007)***
Freedom to Trade Internationally	***0.013**** ***(0.003)***	***0.017**** ***(0.004)***	***0.008**** ***(0.004)***
Observations	*430*	*189*	*241*
Cross-sections (periods)	*52* *(9)*	*24* *(9)*	*28* *(9)*
R^2	*0.44*	*0.41*	*0.46*
F-statistic (p value)	*5.03* *(0.000)*	*3.88* *(0.000)*	*5.4* *(0.000)*
Durbin-Watson statistic	*2.67*	*2.41*	*2.92*

Si

** - 90 % significance / ** - 95 % significance / *** - 99 % significance*

As Figure 2 shows, *Freedom to Trade Internationally* and *Regulation* have a significant effect across three model runs, and *Sound Money* has a significant effect for non-OECD countries only. Any one-point increase in the *Freedom to Trade Internationally* index is correlated with a 1.3 % (pooled), 1.7 % (non-OECD) and 0.8% (OECD) increase in the growth rate of GDP per capita, on average. Any one-point increase in the *Regulation* index is correlated with a 2.4 % (pooled), 2.4 % (non-OECD) and 2.5% (OECD) increase in the growth rate of GDP per capita, on average. Finally, any one-point increase in the *Sound Money* index for non-OECD countries is correlated with a 0.6 % decrease in the growth rate of GDP per capita, on average. To reiterate, an increase in index score across all three of the variables mentioned indicates an increase in economic freedom, as per EFI design.

V. Testing

Although the results seem significant at first glance, there are many causes for concern regarding the validity of parameter identification in a simple OLS approach to this data set. This section is dedicated to discovering possible violations of Gauss-Markovian assumptions and checking the validity of model design.

Multicollinearity

One of the primary issues with deconstructing an index is the causal relationships between some of the subcomponents. It seems reasonable to assume that size of the government, amount of regulation and property rights are correlated with one another. This can result in multicollinearity among explanatory variables, affecting the robustness of the estimates. The correlation matrix in Figure 3 indicates strong correlation (over 0.5) between the five areas of the EFI. This serves as a rough estimate of multicollinearity present in the model, indicating that estimates need to be interpreted conservatively. For future reference, multicollinearity should be further confirmed by estimating the model and changing the data slightly, many times over, seeing how the estimates react. Also, dependent variables should be dropped, and model estimated without some, to see the effect on estimates. Significant estimate changes in both these approaches would indicate a presence of multicollinearity. Finally, a variance inflation factor should be calculated, as it gives an exact numeric value for evaluation. Since multicollinearity doesn't change the BLUE properties of the model, and due to time limitations, the model will be left as is.

Figure 3. Correlation Matrix

	log growth of GDP per capita	*GDP per capita*	*Size of Government*	*Legal System & Property Rights*	*Sound Money*	*Regulation*	*Freedom to Trade Internationally*
log growth of GDP per capita	1.000						
GDP per capita	-0.089	1.000					
Size of Government	0.042	-0.162	1.000				
Legal System & Property Rights	-0.007	0.686	-0.185	1.000			
Sound Money	-0.029	0.533	0.043	0.583	1.000		
Regulation	-0.035	0.590	0.239	0.626	0.649	1.000	
Freedom to Trade Internationally	0.030	0.495	0.079	0.722	0.644	0.668	1.000

Autocorrelation

Since the primary statistical software used in estimation doesn't allow for direct autocorrelation testing, several indirect ways shall be explored, to detect any potential autocorrelation. First, simply observing graphs of residuals from the three OLS approaches, can be very indicative of any potential autocorrelation. Indeed, by looking at the attached graphs (see Appendix 4), it seems highly possible that autocorrelation is present. The order is harder to discern. Furthermore, Durbin-Watson statistic can be used for identification of first-order autocorrelation. The autocorrelation coefficient, ρ, (with stable errors) is located on the interval $-1 < \rho < 1$, and the Durbin-Watson test statistic is approximately equal to 4, 2 and 0, for the ρ values of -1, 0, and 1, respectively. Therefore, the d-statistic serves as a rough guide of first order autocorrelation. In the first (pooled) OLS estimate, d is 2.7. Being further from 2 (in the positive direction), indicates that autocorrelation is more likely. The same can be said for the d values of the second (non-OECD) and third (OECD) OLS estimates, for which d values are 2.4 and 2.9, respectively (see Figure 2). Finally, a feasible GLS model is estimated, with the addition of autocorrelation parameters. These are added individually, starting with a parameter for first order autocorrelation, up to the point where their p-values start to become insignificant at conventional confidence levels (see Figure 4). The results indicate a presence of first and second order autocorrelation, with any

subsequent level added failing to pass as significant or reducing the number of observations past the optimal point.

Figure 4. FGLS Regression - Sensitivity Testing for Autocorrelation

Dependent variable: log growth of GDP per capita (1975 - 2015)										
	Pooled	non-OECD	OECD	Pooled	non-OECD	OECD	Pooled	non-OECD	OECD
Intercept	0.365	0.320	0.430	0.239	0.225	0.286	0.164	0.112	0.240
	(0.032)	(0.059)	(0.038)	(0.024)	(0.049)	(0.022)	(0.062)	(0.092)	(0.106)
log GDP per capita	-0.063***	-0.065***	-0.064***	-0.037***	-0.048***	-0.031***	-0.023***	0.016	-0.032***
	(0.006)	(0.011)	(0.007)	(0.004)	(0.010)	(0.004)	(0.009)	(0.017)	(0.009)
Size of Government	0.008	0.006	0.009	0.005*	0.006	0.005**	0.000	-0.002	0.003
	(0.003)	(0.006)	(0.004)	(0.003)	(0.005)	(0.002)	(0.005)	(0.008)	(0.005)
Legal System & Property Rights	0.001	-0.004	0.006	-0.001	-0.004	0.000	0.000	0.000*	0.000
	(0.003)	(0.006)	(0.004)	(0.003)	(0.005)	(0.003)	(0.005)	(0.007)	(0.008)
Sound Money	-0.004**	-0.007**	-0.001	-0.009***	-0.010***	-0.006***	-0.008***	-0.006	-0.008*
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)
Regulation	0.019***	0.024***	0.014**	0.009**	0.019**	0.003	0.003	0.012	0.005
	(0.005)	(0.009)	(0.006)	(0.004)	(0.009)	(0.003)	(0.007)	(0.016)	(0.006)
Freedom to Trade Internationally	0.013***	0.016***	0.008**	0.017***	0.018***	0.009***	0.022***	0.017*	0.009
	(0.003)	(0.005)	(0.003)	(0.002)	(0.004)	(0.002)	(0.005)	(0.009)	(0.006)
AR(1)	**-0.351*** **	**-0.226** **	**-0.478*** **	**-0.590*** **	**-0.406*** **	**-0.821*** **	**-0.517*** **	**-0.498*** **	**-0.586*** **
	(0.053)	**(0.089)**	**(0.065)**	**(0.050)**	**(0.089)**	**(0.054)**	**(0.073)**	**(0.121)**	**(0.009)**
AR(2)				**-0.469*** **	**-0.447*** **	**-0.607*** **	**-0.513*** **	**-0.585*** **	**-0.552*** **
				(0.049)	**(0.089)**	**(0.051)**	**(0.064)**	**(0.095)**	**(0.079)**
AR(5)							**-0.089***	**-0.262** **	0.008
							(0.049)	**(0.100)**	(0.055)
Observations	377	165	212	325	141	184	169	69	100
Cross-sections (periods)	52	24	28	52	24	28	50	22	28
	(8)	(8)	(8)	(7)	(7)	(7)	(4)	(4)	(4)
R^2	0.44	0.37	0.54	0.53	0.38	0.74	0.71	0.73	0.78
F-statistic (p value)	4.3	2.66	6.03	5.03	2.17	11.79	4.72	3.49	6.18
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
Durbin-Watson statistic	2.32	2.22	2.56	1.80	2.06	1.60	2.41	2.61	2.24

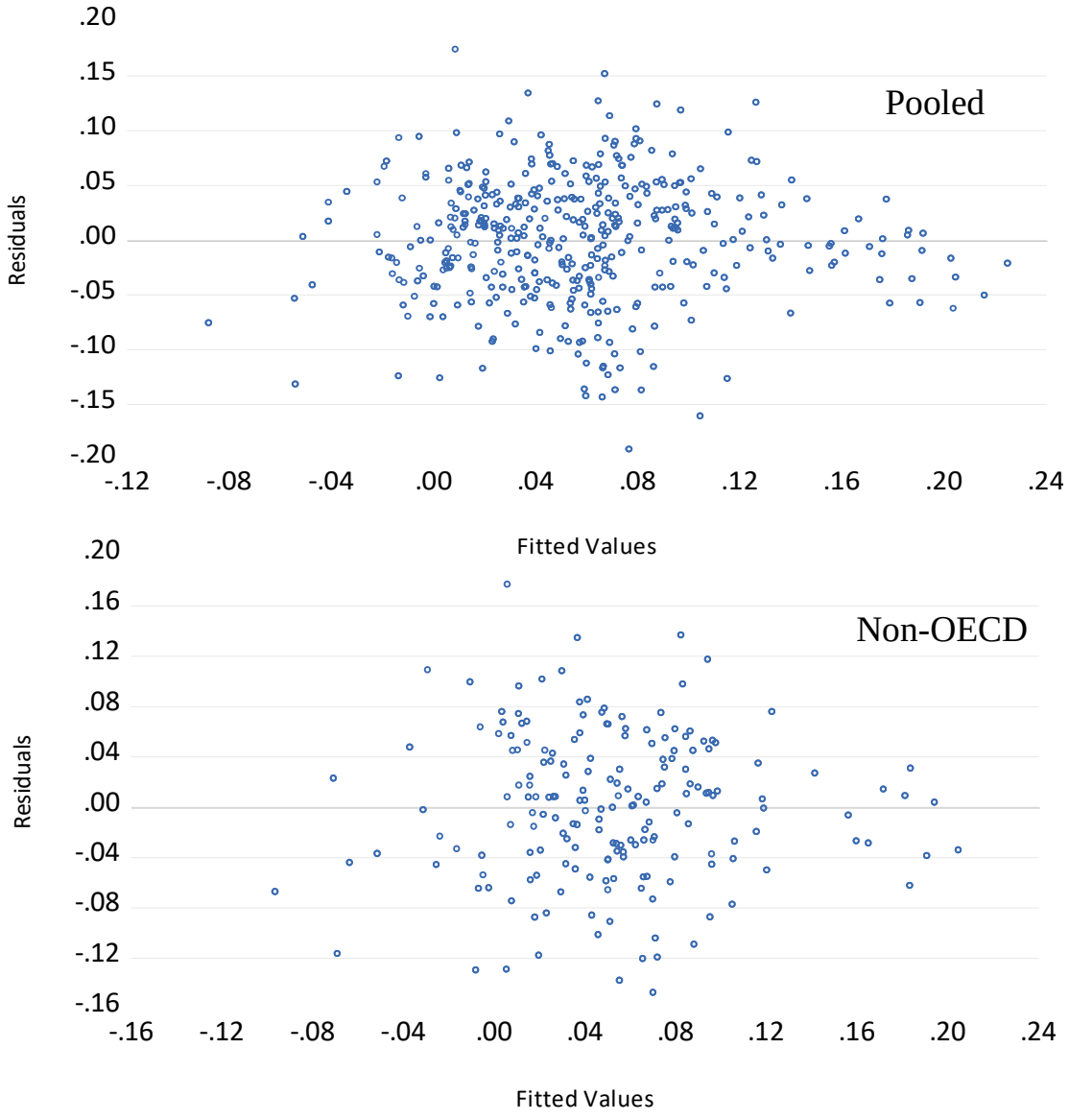
*Note: This approach assumes there might be first, second and fifth order autocorrelation. The fifth order autocorrelation is assumed because growth is studied through 5-year periods. Sensitivity analysis is looking for AR terms that are significant at standard confidence levels and that produce d-statistics closest to 2. Significance levels are as follows: * - 90 % significance / ** - 95 % significance / *** - 99 % significance.*

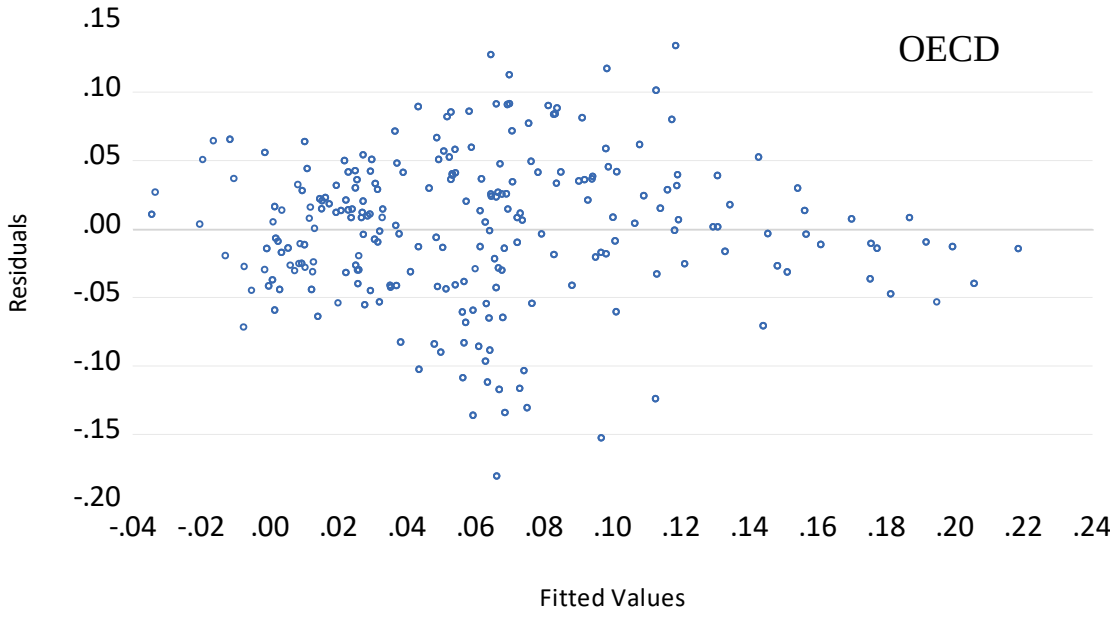
Heteroskedasticity

After scouring EViews help pages and related forums and blogposts, I have concluded that the current version of the statistical software just doesn't provide support when it comes to testing for heteroskedasticity in panel data through direct tests. With that in mind, there were two options left for attempting to detect possible heteroskedasticity in the data. First approach is a common-sense (backed by econometrics textbooks - Guajarati, 1987; Wooldridge, 2016) approach, that

assumes there is high probability of heteroskedastic errors occurring in cross-sectional data. This seems intuitively reasonable as well – countries vary greatly in GDP per capita and economic freedom measures, indicating a strong possibility of errors having varying degrees of statistical dispersion. Furthermore, Figure 5 plots residuals against fitted values, for the three OLS estimates (pooled, non-OECD, and OECD). These graphs indicate that errors are indeed not uniformly dispersed and that heteroskedasticity is likely present between cross-sections (i.e. countries). Finally, plots showing within-country fitted values and residuals aren't feasible since there are only 10 periods under consideration meaning that there aren't enough points to visually estimate the shape of error dispersion.

Figure 5. Residuals versus Fitted Values plots





Redundant Fixed Effects

Figure 6 shows the results of redundant fixed effects tests, performed on the three OLS models. With future revised estimation in mind, the tests were completed for fixed cross-sectional effects, fixed period effects, and both. In each case, across all the model version, tests confirm that all model specifications are supported, with significant p-values across multiple tests.

Figure 6. Redundant Fixed Effects Test

Effects Test			
	Pooled	*non-OECD*	*OECD*
Cross-Section F	***3.039*** (0.000)***	***3.057*** (0.000)***	***2.782*** (0.000)***
Cross-Section Chi-Square	***152.544*** (0.000)***	***72.255*** (0.000)***	***77.188*** (0.000)***
Period F	***38.593*** (0.000)***	***13.747*** (0.000)***	***54.386*** (0.000)***
Period Chi-Square	***264.110*** (0.000)***	***103.413*** (0.000)***	***279.292*** (0.000)***
Cross-Section/Period F	***10.400*** (0.000)***	***6.794*** (0.000)***	***16.360*** (0.000)***
Cross-Section/Period Chi-Square	***424.806*** (0.000)***	***165.049*** (0.000)***	***326.592*** (0.000)***

*Note: * - 90 % significance / ** - 95 % significance / *** - 99 % significance*
Null: Cross-Section/Period/Both Effects specifications are redundant,
Alternative: Cross-Section/Period/Both Effects specifications are valid

Hausman Test

Hausman Test null hypothesis states that there is no correlation between unique errors and regressors (meaning that the random effects model is preferred) against an alternative that there is correlation between unique errors and regressors (meaning that the fixed effects model is preferred). This test could only be performed on cross-sectional fixed effects and not two-way fixed effects since EViews doesn't estimate two-way random effects tests on unbalanced data for the purposes of further testing. Hausman test results (see Figure 7) reject the null hypothesis and the alternative is accepted – fixed effects model is appropriate.

Figure 7. Random versus Fixed Effects Test

Test Summary

	Pooled	*non-OECD*	*OECD*
Chi-Square Statistic	***146.276****	***52.771****	***37.882****
	(0.000)	***(0.000)***	***(0.000)***
df	*6*	*6*	*6*

*Note: * - 90 % significance / ** - 95 % significance / *** - 99 % significance.*

VI. Revised Estimates

Following all the tests performed, I have decided to reformulate the previous cross-section fixed effects OLS model. For more precise parameter identification and robust standard errors, cross-sectional heteroskedasticity and first (and possibly second) order autocorrelation need to be addressed. Therefore, the revised model is structured as a cross-section fixed effects GLS model, with two terms for autocorrelation and cross-section weights which assume the presence of heteroskedasticity in the relevant dimension. Estimates for this model are presented in Figure 8, split up between estimates for all countries, only non-OECD countries, and only OECD countries.

As Figure 8 shows, *Freedom to Trade Internationally* and *Sound Money* have a significant effect across three model runs, and *Regulation* has a significant effect for non-OECD countries only. Any one-point increase in the *Freedom to Trade Internationally* index is correlated with a 1.3 % (pooled), 1.7 % (non-OECD) and 1% (OECD) increase in the growth rate of GDP per capita, on average. Any one-point increase in the *Sound Money* index is correlated with a 0.7 % (pooled), 0.9 % (non-OECD) and 0.6% (OECD) increase in the growth rate of GDP per capita, on average. Any one-point increase in the *Regulation* index for non-OECD countries is correlated with a 1.3

% increase in the growth rate of GDP per capita, on average. Finally, any one-point increase in the *Size of Government* index for pooled countries is correlated with a 0.5 % increase in the growth rate of GDP per capita, on average. To reiterate, an increase in index scores across all three of the variables mentioned indicates an increase in economic freedom, as per EFI design.

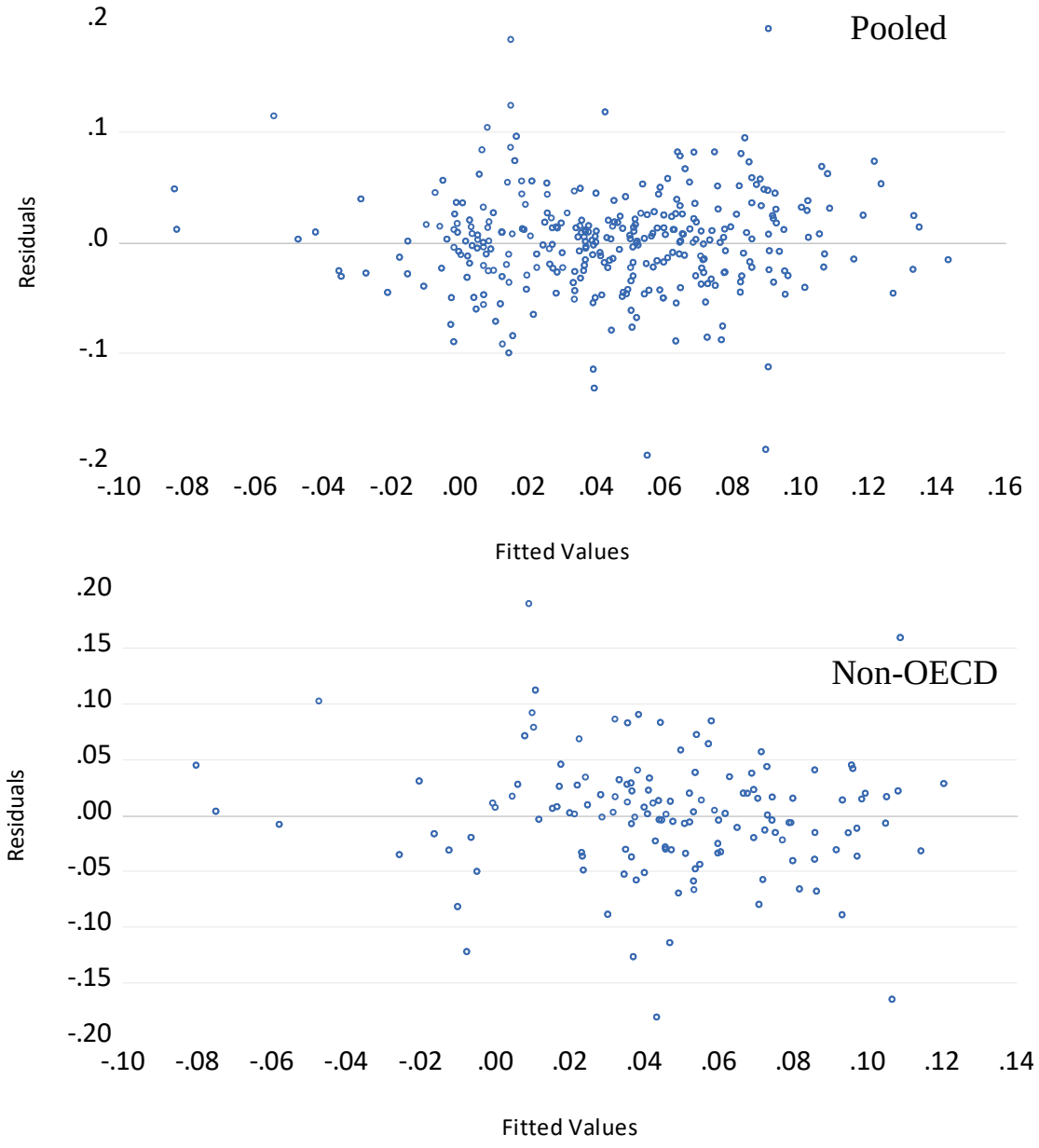
Figure 8. Panel EGLS Regression (Cross-Section Weights)

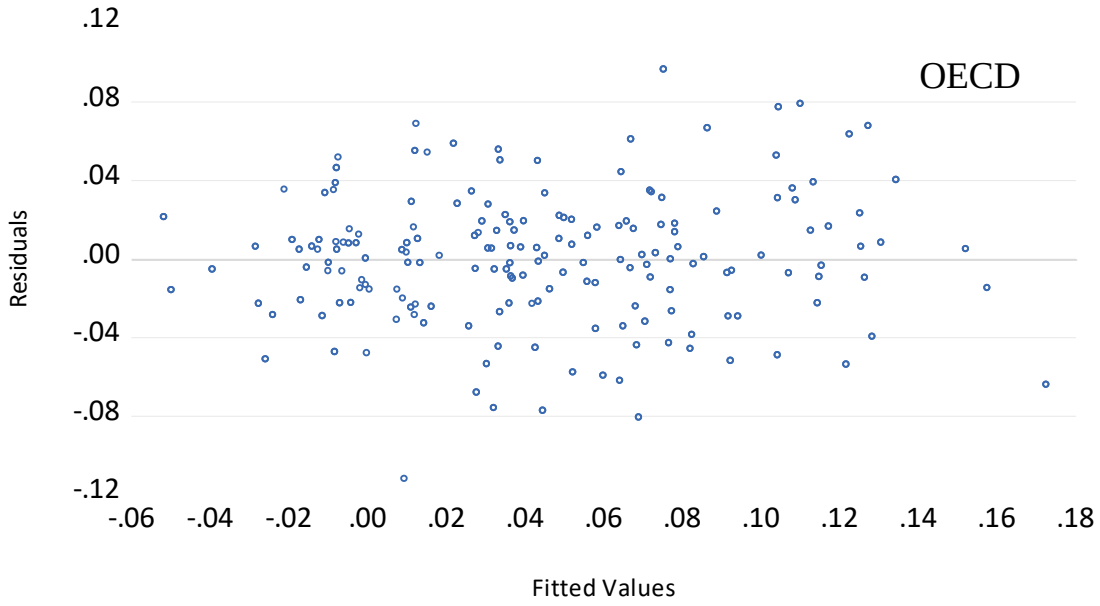
Dependent variable: log growth of GDP per capita (1975 - 2015)						
	EGLS	OLS	EGLS	OLS	EGLS	OLS
	Pooled		non-OECD		OECD	
Intercept	0.228***	0.441***	0.217***	0.372***	0.280***	0.526***
	(0.014)	(0.034)	(0.028)	(0.054)	(0.016)	(0.046)
log GDP per capita	**-0.032*** **	**-0.071*** **	**-0.044*** **	**-0.072*** **	**-0.027*** **	**-0.072*** **
	(0.003)	**(0.005)**	**(0.007)**	**(0.009)**	**(0.003)**	**(0.007)**
Size of Government	**0.005*** **	0.005	0.005	0.006	0.002	0.002
	(0.003)	(0.004)	(0.003)	(0.006)	(0.001)	(0.005)
Legal System & Property Rights	0.001	-0.003	0.001	-0.005	-0.002	-0.002
	(0.002)	(0.003)	(0.003)	(0.005)	(0.002)	(0.004)
Sound Money	**-0.007*** **	-0.004	**-0.009*** **	**-0.006** **	**-0.006*** **	0.000
	(0.001)	(0.002)	**(0.002)**	**(0.003)**	**(0.001)**	(0.004)
Regulation	0.003	**0.024*** **	**0.013** **	**0.024*** **	0.001	**0.025*** **
	(0.003)	**(0.005)**	**(0.006)**	**(0.008)**	(0.002)	**(0.007)**
Freedom to Trade Internationally	**0.014*** **	**0.013*** **	**0.017*** **	**0.017*** **	**0.010*** **	**0.008***
	(0.002)	**(0.003)**	**(0.006)**	**(0.004)**	**(0.002)**	**(0.004)**
AR(1)	-0.669***		-0.498***		-0.862***	
	(0.038)		(0.072)		(0.039)	
AR(2)	-0.538***		-0.530***		-0.663***	
	(0.033)		(0.071)		(0.034)	
Observations	325	430	141	189	184	241
Cross-sections (periods)	52	52	24	24	28	28
	(7)	(9)	(7)	(9)	(7)	(9)
R^2	0.71	0.44	0.56	0.41	0.85	0.46
F-statistic (p value)	10.83	5.03	4.42	3.88	24.64	5.4
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Durbin-Watson statistic	1.84	2.67	2.08	2.41	1.74	2.92

*Note: * - 90 % significance / ** - 95 % significance / *** - 99 % significance.*

Moreover, to confirm that the revised model significantly diminishes heteroskedasticity and autocorrelation detected previously, Figure 8 reports the Durbin-Watson statistic and Figure 9 shows the residual plots. The Durbin-Watson (d) statistic went from 2.7 to 1.8 (pooled), 2.4 to 2.1 (non-OECD), and 2.9 to 1.7 (OECD). Since a d value of 2 indicates that ρ is 0, this indicates a reduction in residual trend correlation. Additionally, Appendix 5 reports the trend of residuals across periods (compared with the OLS estimated ones), indicating a smoothening. Finally, Figure 9 reports the error dispersion (compared with the OLS estimated ones), indicating more uniform dispersion (homoskedasticity).

Figure 9. Residuals versus Fitted Values plots





VII. Conclusion

This paper finds a significant relationship between freedom to trade internationally and economic growth. This freedom is reflected in lower tariffs, few regulations on movement of human and physical capital, easily convertible currency and simple customs clearance operations. This finding mirrors that of Gwartney and Torstensson (1999; 1994), and contradicts the findings of Ayal and Karras (1998), who find a negative relationship between freedom to trade and economic growth. This finding holds for all countries pooled together, only non-OECD countries, as well as OECD member nations. Furthermore, this research finds that pursuing low inflation and allowing free access to alternative currency use has a small negative impact on economic growth (between 0.6% and 0.9% for each EFI area unit increase). This result directly contradicts that of Ayal and Karras (1998) and Barro (1996). There is also significant evidence that less stringent regulation positively affects economic growth for non-OECD countries only. This reflects the findings of Barro, Torstensson and Knack & Keefer (Barro, 1996; Knack & Keefer, 1995; Torstensson, 1994). Finally, there is significant evidence that smaller governments, that intervene economically less often, are positively correlated with economic growth. This has only been observed for the pooled data set and the effect was only 0.05%. This finding is mirrored in a more robust way in other research (Barro, 1991; Gwartney et al., 1999; Knack & Keefer, 1995).

Across all model formulations, freedom to trade internationally remained very robust. These results support classical economic theory (Ricardo, 1817; Smith, 1776), as well as more modern assumptions (Friedman, 1962). Monetary stability through low inflation and the freedom to use alternate currencies seemed likely to be correlated with economic growth. However, research did not support this hypothesis. There are a few reasons that might explain this finding. Subcomponents of this area of the index might be constructed out of elements with opposite effects. Also, most countries in the data set do not wield the economic power of the United States and are economically tied to the fluctuations of more influential currencies. Therefore, they are unable to produce sound monetary policy and often attempt to restrict the power of foreign currencies in the domestic marketplace. If these countries experience increased growth rates, this area of the index does not predict development as assumed. Free movement into markets, as pictured through the regulation variable, is only significant for non-OECD countries, most of which are underdeveloped. This could indicate that lax regulation fosters growth on the way to the status of a first-world country. However, countries that had already reached these levels of development are not experiencing such growth rates and often begin introducing new regulation when they become appropriately placed on the Kuznets curve to do so. This is often regulation that deals with various market inefficiencies (externalities, informational asymmetry, etc.).

Limitations and future research

This data set was somewhat unbalanced (missing periods for a few cross-sections), resulting in the omission of those observations. Along with balanced panel data, the set needs to extend over a longer time frame, given that in the process of correcting for autocorrelation, the number of observations got further reduced. It would also be useful to detect breakpoints in the time series, centered around significant economic events (like the Great Recession), and perform the estimation around them. Much like a longer time frame, more countries included in the set would be useful. The issue lies in procuring the necessary data, especially further into the past, given that some countries do not provide any data or provide data that is highly questionable.

VIII. Bibliography

1. Ayal, E. B., & Karras, G. (1998). Components of Economic Freedom and Growth: An Empirical Study. *The Journal of Developing Areas*, *32*(3), 327–338.
2. Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. *The Quarterly Journal of Economics*, *106*(2), 407–443. https://doi.org/10.2307/2937943
3. Barro, R. J. (1996). Democracy and Growth. *Journal of Economic Growth*, *1*(1), 1–27.
4. Berggren, N. (2003). The Benefits of Economic Freedom: A Survey. *The Independent Review*, *8*(2), 193–211.
5. Carlsson, F., & Lundström, S. (2002). Economic freedom and growth: Decomposing the effects. *Public Choice*, *112*, 335–344. https://doi.org/10.1023/a:1019968525415
6. de Haan, J., & Sturm, J.-E. (2000). On the relationship between economic freedom and economic growth. *European Journal of Political Economy*, *16*(2), 215–241. https://doi.org/10.1016/S0176-2680(99)00065-8
7. Domar, E. D. (1946). Capital Expansion, Rate of Growth, and Employment. *Econometrica*, *14*(2), 137–147. https://doi.org/10.2307/1905364
8. Easterly, W. (1992). *Marginal income tax rates and economic growth in developing countries* (No. WPS1050) (p. 1). The World Bank. Retrieved from http://documents.worldbank.org/curated/en/432391468766196026/Marginal-income-tax-rates-and-economic-growth-in-developing-countries
9. Economic Freedom of the World. (2016, December 22). Retrieved October 9, 2018, from http://bit.ly/2h5xBVI
10. Friedman, M. (1962). *Capitalism and Freedom* (1st ed.). University of Chicago Press. Retrieved from https://www.goodreads.com/work/best_book/1534488-capitalism-and-freedom
11. GDP per capita (current US$) | Data. (2018). Retrieved October 9, 2018, from https://data.worldbank.org/indicator/NY.GDP.PCAP.CD
12. Guajarati, D. N. (1987). *Basic Econometrics* (4th ed.).
13. Gwartney, J. D., Lawson, R. A., & Block, W. (1996). *Economic Freedom of the World: 1975-1995* (p. 342). The Fraser Institute. Retrieved from http://bit.ly/2jUkBGR
14. Gwartney, J. D., Lawson, R. A., & Holcombe, R. G. (1999). Economic Freedom and the Environment for Economic Growth. *Journal of Institutional and Theoretical Economics*, *155*(4), 643–663.
15. Harrod, R. F. (1939). An Essay in Dynamic Theory. *The Economic Journal*, *49*(193), 14–33. https://doi.org/10.2307/2225181
16. J. M. Fleming, "Domestic Financial Policies under Fixed and Floating Exchange Rates," IMF Staff Papers, Vol. 9, 1962, pp. 369-379. doi:10.2307/3866091
17. Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, *47*(2), 263–291. https://doi.org/10.2307/1914185
18. Knack, S., & Keefer, P. (1995). Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures. *Economics & Politics*, *7*(3), 207–227. https://doi.org/10.1111/j.1468-0343.1995.tb00111.x
19. Kuznets, S. (1973). Modern Economic Growth: Findings and Reflections. *The American Economic Review*, *63*(3), 247–258.

20. Leontief, W. (1953). Domestic Production and Foreign Trade; The American Capital Position Re-Examined. *Proceedings of the American Philosophical Society*, *97*(4), 332–349.
21. Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, 407–437. https://doi.org/10.3386/w3541
22. McCusker, J., & Morgan, K. (Eds.). (2001). The Early Modern Atlantic Economy. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511523878
23. Mundell, R. A. (1963). Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *The Canadian Journal of Economics and Political Science / Revue Canadienne d'Economique et de Science Politique*, *29*(4), 475–485. https://doi.org/10.2307/139336
24. Naughton, B. (2007). *The Chinese economy: transitions and growth*. Cambridge, Mass: MIT Press.
25. Nelson, M. A., & Singh, R. D. (1998). Democracy, Economic Freedom, Fiscal Policy, and Growth in LDCs: A Fresh Look. *Economic Development and Cultural Change*, *46*(4), 677–696. https://doi.org/10.1086/452369
26. OECD - Members and partners. (2018, July). Retrieved December 12, 2018, from http://www.oecd.org/about/membersandpartners/
27. Ricardo, D. (2004). *On the Principles of Political Economy and Taxation*. London: Dover Publications.
28. Schumpeter, J. (1942). *Capitalism, Socialism and Democracy* (Vol. 1). Routledge. Retrieved from https://www.goodreads.com/work/best_book/129884-capitalism-socialism-and-democracy
29. Smith, A. (2003). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Bantam Classics.
30. Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, *70*(1), 65. https://doi.org/10.2307/1884513
31. Torstensson, J. (1994). Property Rights and Economic Growth: An Empirical Study. *Kyklos*, *47*(2), 231–247.
32. Wooldridge, J. M. (2016). *Introductory Econometrics: A Modern Approach* (6th ed.). Thomson South-Western.

Appendix 1 – Index Area Components

1. Size of Government
    A. Government consumption
    B. Transfers and subsidies
    C. Government enterprises and investment
    D. Top marginal tax rate
        (i) Top marginal income tax rate
        (ii) Top marginal income and payroll tax rate

2. Legal System and Property Rights
    A. Judicial independence
    B. Impartial courts
    C. Protection of property rights
    D. Military interference in rule of law and politics
    E. Integrity of the legal system
    F. Legal enforcement of contracts
    G. Regulatory costs of the sale of real property
    H. Reliability of police
    I. Business costs of crime

3. Sound Money
    A. Money growth
    B. Standard deviation of inflation
    C. Inflation: most recent year
    D. Freedom to own foreign currency bank accounts

4. Freedom to Trade Internationally
    A. Tariffs
        (i) Revenue from trade taxes (% of trade sector)
        (ii) Mean tariff rate
        (iii) Standard deviation of tariff rates
    B. Regulatory trade barriers
        (i) Non-tariff trade barriers
        (ii) Compliance costs of importing and exporting
    C. Black-market exchange rates
    D. Controls of the movement of capital and people
        (i) Foreign ownership/investment restrictions
        (ii) Capital controls
        (iii) Freedom of foreigners to visit

5. Regulation
    A. Credit market regulations
        (i) Ownership of banks
        (ii) Private sector credit
        (iii) Interest rate controls/negative real interest rates
    B. Labor market regulations
        (i) Hiring regulations and minimum wage
        (ii) Hiring and firing regulations
        (iii) Centralized collective bargaining
        (iv) Hours regulations
        (v) Mandated cost of worker dismissal
        (vi) Conscription
    C. Business regulations
        (i) Administrative requirements
        (ii) Bureaucracy costs
        (iii) Starting a business
        (iv) Extra payments /bribes /favoritism
        (v) Licensing restrictions
        (vi) Cost of tax compliance

Appendix 2 – Summary Statistics

Descriptive Statistics for GDP
Categorized by values of COUNTRIES
Date: 12/13/18 Time: 13:34
Sample: 1970 2015
Included observations: 511

COUNTRIES	Mean	Max	Min.	Std. Dev.	Obs.
Argentina	5738.989	13698.29	1317.488	3989.468	10
Australia	23458.21	56561.41	3299.037	18426.40	10
Austria	23342.53	46858.04	2058.769	16342.06	10
Belgium	22544.10	44380.18	2780.696	14772.88	10
Brazil	4149.343	11224.15	444.0263	3450.127	10
Canada	23004.32	47447.48	4121.933	14982.75	10
Chile	5266.681	13736.64	730.4099	4755.834	10
Colombia	2498.397	6250.655	326.2903	2143.511	10
Congo, D...	333.9315	546.1424	135.6735	134.6768	10
Denmark	29044.12	58041.41	3464.457	19612.70	10
Ecuador	2462.319	6150.156	471.3860	1731.232	10
Finland	23786.89	46202.42	2467.476	15564.98	10
France	21487.20	40638.33	2853.004	13269.90	10
Germany	22592.39	41785.56	2750.720	14518.54	10
Greece	11749.77	26917.76	1494.388	8526.764	10
Guatemala	1588.325	3923.573	338.6820	1099.041	10
Hong Kong	17982.68	42431.89	960.0320	14201.35	10
Iceland	26798.70	56250.68	2538.188	18520.21	10
India	565.6714	1606.038	111.2576	510.4577	10
Indonesia	1142.135	3334.549	79.68566	1151.401	10
Iran	2829.169	6531.927	384.9422	1822.843	10
Ireland	23769.35	61807.67	1488.295	22285.67	10
Israel	15822.50	35690.96	2369.088	11395.73	10
Italy	18198.04	35849.37	2099.914	12103.73	10
Japan	25137.15	44507.68	2037.560	16689.28	10
Kenya	508.6221	1355.046	142.4971	370.8185	10
Korea, South	10368.45	27105.08	279.1252	9670.180	10
Luxembourg	46640.75	104965.3	4449.540	37902.55	10
Malaysia	4002.459	9648.553	357.6619	3255.634	10
Mexico	4757.737	9290.761	682.6849	3254.921	10
Morocco	1416.078	2864.093	246.0880	907.2497	10
Netherlands	24603.36	50338.25	2889.715	16672.77	10
New Zealand	16649.59	38649.38	2356.540	12650.55	10
Nigeria	863.8361	2655.158	224.1075	888.1993	10
Norway	37334.51	87770.27	3306.219	29473.50	10
Pakistan	556.2923	1428.638	169.7912	403.5977	10
Peru	2281.149	6053.112	557.0935	1859.932	10
Philippines	1081.596	2878.338	186.7688	831.3087	10
Portugal	10088.27	22538.65	934.1740	7966.437	10
Singapore	20731.12	54940.86	925.2874	18828.47	10
South Africa	3515.285	7275.382	806.4131	2027.307	10
Spain	14219.96	30736.63	1208.997	10570.54	10
Sweden	28030.85	52076.26	4669.439	16806.11	10
Switzerland	46502.64	82016.02	16655.34	23674.31	8
Syria	1098.067	1577.457	337.0396	428.4369	8
Tanzania	445.8978	872.2955	172.0448	287.0657	6
Thailand	2215.055	5846.395	192.1257	1967.361	10
Tunisia	2041.993	4140.152	284.4121	1300.397	10
Turkey	4360.920	10984.81	489.9308	3938.508	10
United Kin...	22035.41	44305.55	2347.544	15770.72	10
United States	28224.77	56443.82	5246.884	17747.86	10
Venezuela	4514.852	13545.26	1108.821	3642.872	9
All	13390.07	104965.3	79.68566	17303.58	511

Descriptive Statistics for GROWTH
Categorized by values of COUNTRIES
Date: 12/13/18 Time: 13:34
Sample (adjusted): 1975 2015
Included observations: 459 after adjustments

COUNTRIES	Mean	Max	Min.	Std. Dev.	Obs.
Argentina	0.052034	0.141028	-0.082505	0.065666	9
Australia	0.063149	0.150243	0.012863	0.047155	9
Austria	0.068150	0.188576	-0.042140	0.087532	9
Belgium	0.059448	0.176990	-0.077057	0.092207	9
Brazil	0.066243	0.190255	-0.049798	0.092491	9
Canada	0.052378	0.119448	-0.017256	0.044630	9
Chile	0.059264	0.252180	-0.114581	0.110717	9
Colombia	0.064869	0.164475	-0.013563	0.070629	9
Congo, D...	0.015859	0.218959	-0.163807	0.130941	9
Denmark	0.060622	0.167355	-0.027931	0.076056	9
Ecuador	0.057079	0.170659	-0.077262	0.091097	9
Finland	0.063212	0.186203	-0.017063	0.084089	9
France	0.056712	0.169278	-0.052652	0.084519	9
Germany	0.060213	0.172183	-0.058197	0.086240	9
Greece	0.055391	0.149342	-0.079698	0.085294	9
Guatemala	0.054438	0.129302	-0.071348	0.059823	9
Hong Kong	0.084193	0.185734	0.006817	0.069456	9
Iceland	0.066768	0.183670	-0.059137	0.088778	9
India	0.059326	0.128736	0.003344	0.042281	9
Indonesia	0.082978	0.214623	-0.054855	0.090012	9
Iran	0.056359	0.282657	-0.107826	0.124496	9
Ireland	0.082809	0.169515	-0.011654	0.068309	9
Israel	0.060275	0.133452	-0.004672	0.048624	9
Italy	0.059229	0.191583	-0.034427	0.082452	9
Japan	0.062915	0.165415	-0.050548	0.082209	9
Kenya	0.050050	0.124223	-0.071595	0.065551	9
Korea, South	0.101685	0.203812	-0.006350	0.074095	9
Luxembourg	0.069483	0.197246	-0.056192	0.083109	9
Malaysia	0.073222	0.168423	-0.013516	0.063610	9
Mexico	0.058016	0.150056	-0.032261	0.062238	9
Morocco	0.054540	0.152495	-0.098035	0.081983	9
Netherlands	0.060886	0.183745	-0.065782	0.086184	9
New Zealand	0.062163	0.142037	-0.048681	0.063334	9
Nigeria	0.054936	0.211608	-0.185708	0.122338	9
Norway	0.069222	0.181774	-0.032790	0.070126	9
Pakistan	0.046965	0.116129	-0.003294	0.037147	9
Peru	0.053013	0.137544	-0.042015	0.066818	9
Philippines	0.060780	0.131619	-0.038148	0.059357	9
Portugal	0.067239	0.213948	-0.043851	0.087304	9
Singapore	0.090754	0.197969	-0.009394	0.064216	9
South Africa	0.043640	0.130219	-0.061347	0.076322	9
Spain	0.068004	0.215507	-0.055689	0.099980	9
Sweden	0.053047	0.161164	-0.044796	0.074295	9
Switzerland	0.042038	0.167213	-0.050159	0.071394	7
Syria	0.044096	0.197757	-0.088636	0.095019	7
Tanzania	0.064935	0.106082	0.009556	0.038839	5
Thailand	0.075898	0.140401	-0.069757	0.070869	9
Tunisia	0.057771	0.198097	-0.035699	0.069693	9
Turkey	0.069111	0.168267	-0.026752	0.065106	9
United Kin...	0.065283	0.169446	-0.029594	0.071710	9
United States	0.052791	0.095364	0.017566	0.025518	9
Venezuela	0.062568	0.182721	-0.066947	0.091085	8
All	0.061590	0.282657	-0.185708	0.075486	459

Descriptive Statistics for MONEY
Categorized by values of COUNTRIES
Date: 12/13/18 Time: 13:34
Sample: 1970 2015
Included observations: 520

COUNTRIES	Mean	Max	Min.	Std. Dev.	Obs.
Argentina	5.264000	9.710000	2.500000	2.625563	10
Australia	9.266000	9.620000	8.470000	0.327760	10
Austria	9.075000	9.640000	8.040000	0.689497	10
Belgium	9.578000	9.740000	9.010000	0.210597	10
Brazil	4.137000	7.970000	0.000000	3.441560	10
Canada	9.402000	9.690000	8.750000	0.347397	10
Chile	6.854000	9.340000	0.000000	3.246147	10
Colombia	6.349000	8.200000	4.860000	1.308098	10
Congo, D...	3.714000	7.990000	0.000000	3.256949	10
Denmark	8.391000	9.770000	6.240000	1.578948	10
Ecuador	6.357000	8.150000	3.980000	1.420298	10
Finland	8.768000	9.620000	6.800000	1.037763	10
France	8.452000	9.830000	6.260000	1.610161	10
Germany	9.544000	9.760000	9.320000	0.129203	10
Greece	8.047000	9.670000	6.890000	1.149860	10
Guatemala	8.152000	9.630000	6.830000	1.077299	10
Hong Kong	9.172000	9.510000	8.510000	0.315165	10
Iceland	6.200000	9.450000	2.620000	2.598273	10
India	6.741000	8.100000	6.290000	0.515675	10
Indonesia	7.649000	9.360000	4.320000	1.709688	10
Iran	7.490000	8.990000	3.870000	1.481433	10
Ireland	7.941000	9.650000	5.700000	1.716291	10
Israel	6.228000	9.490000	1.250000	3.000929	10
Italy	8.119000	9.740000	5.550000	1.857510	10
Japan	8.962000	9.890000	6.930000	1.074780	10
Kenya	7.333000	9.100000	5.730000	1.322448	10
Korea, South	7.322000	9.660000	4.560000	1.948326	10
Luxembourg	9.326000	9.750000	8.340000	0.427270	10
Malaysia	7.826000	9.110000	6.520000	1.030967	10
Mexico	6.891000	9.180000	3.590000	1.972052	10
Morocco	6.772000	7.290000	6.090000	0.386028	10
Netherlands	9.517000	9.750000	9.140000	0.172501	10
New Zealand	8.130000	9.750000	5.900000	1.742514	10
Nigeria	5.003000	7.940000	1.270000	2.070228	10
Norway	8.079000	9.510000	6.250000	1.477411	10
Pakistan	6.544000	7.870000	5.210000	0.789700	10
Peru	5.611000	9.680000	0.000000	3.696306	10
Philippines	7.349000	9.440000	4.590000	1.803777	10
Portugal	7.766000	9.750000	5.580000	1.920273	10
Singapore	8.571000	9.840000	6.510000	1.302855	10
South Africa	6.863000	8.180000	5.290000	1.115408	10
Spain	7.975000	9.760000	5.730000	1.754621	10
Sweden	8.568000	9.840000	6.130000	1.295572	10
Switzerland	9.622000	9.810000	9.390000	0.114969	10
Syria	6.673000	8.180000	4.870000	0.997587	10
Tanzania	6.067000	8.060000	4.110000	1.531579	10
Thailand	7.265000	9.460000	6.290000	1.035860	10
Tunisia	6.787000	7.300000	6.050000	0.408929	10
Turkey	4.579000	9.080000	0.780000	2.589554	10
United Kin...	8.364000	9.840000	5.080000	1.876067	10
United States	9.585000	9.780000	9.220000	0.220467	10
Venezuela	5.656000	9.710000	1.930000	2.550574	10
All	7.498000	9.890000	0.000000	2.194067	520

Descriptive Statistics for TRADE
Categorized by values of COUNTRIES
Date: 12/13/18 Time: 13:34
Sample: 1970 2015
Included observations: 518

COUNTRIES	Mean	Max	Min.	Std. Dev.	Obs.
Argentina	4.894444	8.540000	0.900000	2.561065	9
Australia	7.381000	8.330000	6.210000	0.763041	10
Austria	7.696000	9.110000	6.630000	0.883455	10
Belgium	9.157000	9.910000	8.190000	0.674669	10
Brazil	4.920000	7.150000	0.940000	2.275322	10
Canada	8.374000	8.970000	7.770000	0.476310	10
Chile	6.571000	8.450000	2.270000	2.049257	10
Colombia	5.319000	6.980000	3.090000	1.636395	10
Congo, D...	4.101000	6.320000	0.670000	1.753203	10
Denmark	8.337000	9.400000	7.830000	0.556937	10
Ecuador	5.481000	7.420000	2.190000	1.871051	10
Finland	7.736000	9.250000	6.650000	1.016467	10
France	7.729000	8.990000	6.770000	0.771873	10
Germany	8.891000	9.690000	7.890000	0.648579	10
Greece	7.062000	9.050000	5.340000	1.093169	10
Guatemala	6.606000	8.450000	2.500000	1.819439	10
Hong Kong	9.553000	9.970000	8.330000	0.501687	10
Iceland	6.099000	8.240000	2.200000	1.825002	10
India	4.304444	6.250000	2.400000	1.592727	9
Indonesia	5.819000	7.150000	4.000000	1.120600	10
Iran	4.033000	7.400000	0.980000	2.228188	10
Ireland	8.163000	9.180000	6.800000	0.833734	10
Israel	6.518000	8.700000	2.220000	2.184246	10
Italy	8.092000	9.010000	7.330000	0.436547	10
Japan	7.551000	8.740000	6.640000	0.705856	10
Kenya	5.513000	7.440000	3.360000	1.551945	10
Korea, South	6.500000	7.600000	4.780000	1.156162	10
Luxembourg	9.243000	9.960000	8.300000	0.625407	10
Malaysia	7.199000	7.510000	6.490000	0.315927	10
Mexico	6.145000	7.720000	1.300000	2.040960	10
Morocco	5.443000	6.840000	4.400000	0.946491	10
Netherlands	8.624000	9.570000	6.960000	0.744986	10
New Zealand	8.213000	9.320000	7.000000	0.860879	10
Nigeria	3.474000	6.390000	1.300000	2.083561	10
Norway	7.684000	8.970000	6.310000	0.891805	10
Pakistan	3.749000	6.110000	0.780000	1.749650	10
Peru	5.548000	8.630000	1.300000	2.949417	10
Philippines	5.592000	7.310000	1.580000	1.856890	10
Portugal	7.357000	8.950000	3.510000	1.585210	10
Singapore	9.293000	9.960000	7.980000	0.538352	10
South Africa	6.578000	7.350000	5.310000	0.558745	10
Spain	7.707000	8.980000	5.440000	1.099889	10
Sweden	8.031000	9.650000	6.060000	1.160292	10
Switzerland	8.242000	9.760000	6.470000	1.288503	10
Syria	3.792000	5.980000	1.550000	1.691008	10
Tanzania	3.893000	6.660000	1.510000	2.182898	10
Thailand	5.942000	7.030000	5.070000	0.776170	10
Tunisia	4.888000	6.810000	2.510000	1.489040	10
Turkey	5.342000	7.750000	0.000000	2.618926	10
United Kin...	8.483000	9.680000	4.690000	1.556949	10
United States	8.500000	8.970000	7.540000	0.524065	10
Venezuela	6.230000	8.690000	3.320000	2.113785	10
All	6.692529	9.970000	0.000000	2.178159	518

Descriptive Statistics for GOV
Categorized by values of COUNTRIES
Date: 12/13/18 Time: 13:34
Sample: 1970 2015
Included observations: 517

COUNTRIES	Mean	Max	Min.	Std. Dev.	Obs.
Argentina	6.333000	8.220000	4.870000	1.131558	10
Australia	5.618000	6.670000	4.420000	0.810265	10
Austria	4.178000	5.760000	2.820000	1.091348	10
Belgium	4.170000	5.430000	3.600000	0.531622	10
Brazil	5.898000	6.990000	5.080000	0.650842	10
Canada	5.648000	6.380000	4.890000	0.447854	10
Chile	6.290000	7.910000	3.960000	1.358627	10
Colombia	5.992000	7.230000	4.450000	0.936575	10
Congo, D...	5.496000	7.450000	3.600000	1.129810	10
Denmark	3.545556	4.230000	3.060000	0.450281	9
Ecuador	6.507000	8.930000	5.000000	1.618717	10
Finland	4.528000	6.390000	2.690000	0.924852	10
France	4.071000	5.450000	3.130000	0.727621	10
Germany	4.803000	5.740000	3.790000	0.655626	10
Greece	5.523000	8.040000	3.420000	1.418717	10
Guatemala	8.366000	9.490000	7.070000	0.754383	10
Hong Kong	9.207000	9.750000	8.550000	0.368512	10
Iceland	5.895000	6.920000	4.830000	0.788152	10
India	5.900000	7.820000	4.230000	1.344511	10
Indonesia	7.076000	7.960000	5.270000	0.854767	10
Iran	5.272000	6.680000	4.330000	0.744413	10
Ireland	5.408000	6.640000	3.660000	0.991181	10
Israel	4.100000	6.300000	1.820000	1.589235	10
Italy	4.761000	6.140000	2.960000	1.131650	10
Japan	5.966000	9.270000	4.710000	1.252475	10
Kenya	5.849000	8.570000	3.790000	1.794779	10
Korea, South	6.650000	8.110000	5.970000	0.586686	10
Luxembourg	5.237778	7.390000	4.030000	1.283557	9
Malaysia	5.991000	6.930000	4.840000	0.656767	10
Mexico	7.026000	7.960000	5.690000	0.779704	10
Morocco	5.773000	6.710000	4.630000	0.708630	10
Netherlands	4.325000	4.950000	3.360000	0.498670	10
New Zealand	5.419000	7.460000	3.540000	1.286455	10
Nigeria	5.800000	9.650000	2.190000	2.191184	10
Norway	3.801000	5.690000	2.870000	0.982519	10
Pakistan	6.426000	8.680000	4.700000	1.529300	10
Peru	7.170000	8.210000	5.420000	0.873957	10
Philippines	7.795000	8.790000	6.490000	0.903010	10
Portugal	4.736000	5.610000	3.630000	0.759125	10
Singapore	7.602000	8.390000	6.590000	0.645390	10
South Africa	5.846000	6.450000	4.560000	0.597889	10
Spain	5.712000	8.200000	4.160000	1.272939	10
Sweden	2.834000	3.670000	1.630000	0.765204	10
Switzerland	7.130000	7.880000	6.370000	0.615630	9
Syria	4.662000	6.520000	1.950000	1.345047	10
Tanzania	5.491000	7.310000	3.580000	1.405667	10
Thailand	6.932000	7.890000	5.580000	0.718498	10
Tunisia	5.139000	6.280000	3.860000	0.791629	10
Turkey	6.113000	7.840000	4.400000	1.144660	10
United Kin...	5.003000	6.630000	3.000000	1.195548	10
United States	6.240000	7.130000	5.090000	0.806033	10
Venezuela	6.123000	7.810000	4.910000	1.022449	10
All	5.721199	9.750000	1.630000	1.562079	517

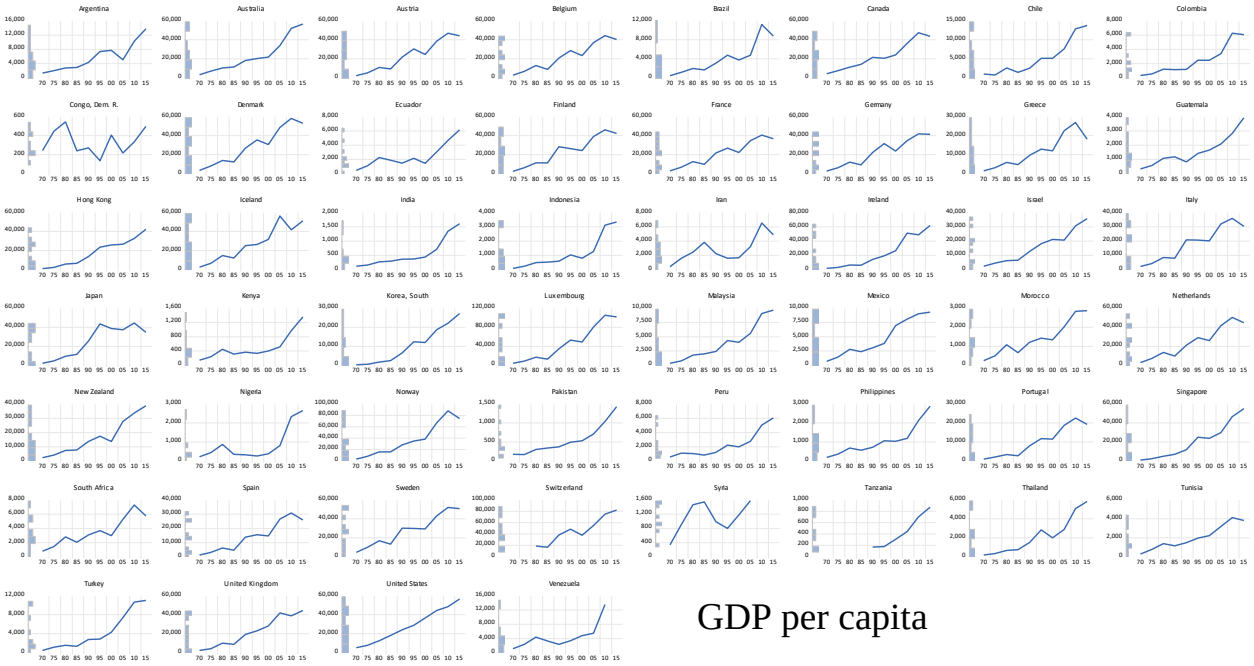
Descriptive Statistics for LEGAL
Categorized by values of COUNTRIES
Date: 12/13/18 Time: 13:34
Sample: 1970 2015
Included observations: 510

COUNTRIES	Mean	Max	Min.	Std. Dev.	Obs.
Argentina	4.169000	5.700000	1.500000	1.161785	10
Australia	7.849000	8.960000	5.070000	1.098306	10
Austria	8.332500	8.850000	7.880000	0.382352	8
Belgium	7.216000	8.350000	5.730000	0.750529	10
Brazil	4.980000	6.190000	4.200000	0.666217	10
Canada	7.924000	8.950000	5.840000	0.872840	10
Chile	5.131000	6.800000	1.020000	1.743237	10
Colombia	3.615000	4.420000	2.660000	0.586236	10
Congo, D...	1.743750	2.650000	0.990000	0.580048	8
Denmark	8.178000	9.090000	6.160000	0.916282	10
Ecuador	4.092000	5.530000	2.660000	0.838793	10
Finland	8.030000	9.280000	4.960000	1.377550	10
France	6.949000	7.730000	4.590000	0.896133	10
Germany	8.041000	9.130000	6.600000	0.753163	10
Greece	5.917000	6.760000	5.380000	0.584543	10
Guatemala	3.445000	4.680000	1.770000	1.181537	8
Hong Kong	7.464000	8.200000	5.940000	0.873425	10
Iceland	7.795000	9.050000	4.960000	1.209373	10
India	4.736000	6.510000	2.090000	1.274931	10
Indonesia	3.413000	4.520000	2.760000	0.629180	10
Iran	3.551000	4.850000	1.370000	1.405240	10
Ireland	7.674000	9.090000	6.380000	0.798877	10
Israel	5.943000	6.850000	3.980000	0.995814	10
Italy	6.145000	7.730000	3.870000	1.054538	10
Japan	7.602000	8.130000	6.160000	0.578596	10
Kenya	4.365000	5.010000	3.430000	0.538336	10
Korea, South	5.635000	6.900000	3.700000	1.020438	10
Luxembourg	8.368000	9.090000	7.830000	0.326422	10
Malaysia	5.509000	6.210000	4.120000	0.606565	10
Mexico	5.104000	6.760000	4.090000	0.859938	10
Morocco	4.033000	5.720000	1.610000	1.660027	10
Netherlands	8.094000	9.110000	6.380000	0.745359	10
New Zealand	8.166000	9.170000	5.070000	1.169589	10
Nigeria	3.290000	4.520000	2.370000	0.621271	10
Norway	8.097000	9.190000	5.400000	1.142114	10
Pakistan	3.084000	4.670000	1.410000	1.070495	10
Peru	3.420000	5.100000	0.960000	1.571312	10
Philippines	3.704000	4.660000	2.190000	0.974226	10
Portugal	6.445000	8.040000	1.060000	2.056406	10
Singapore	7.885000	8.580000	6.600000	0.654697	10
South Africa	3.974000	6.060000	1.460000	1.716704	10
Spain	6.055000	7.460000	3.100000	1.490557	10
Sweden	7.538000	8.850000	4.420000	1.357316	10
Switzerland	7.980000	9.140000	6.320000	1.092225	10
Syria	3.290000	4.360000	1.370000	1.097686	8
Tanzania	5.545000	6.250000	4.890000	0.386966	8
Thailand	5.715000	6.520000	4.640000	0.688819	10
Tunisia	4.342000	5.820000	2.770000	1.294336	10
Turkey	4.633000	6.390000	2.470000	1.052194	10
United Kin...	7.950000	8.840000	6.650000	0.679722	10
United States	8.099000	9.010000	7.140000	0.627330	10
Venezuela	3.995000	6.220000	2.050000	1.448956	10
All	5.878020	9.280000	0.960000	2.119051	510

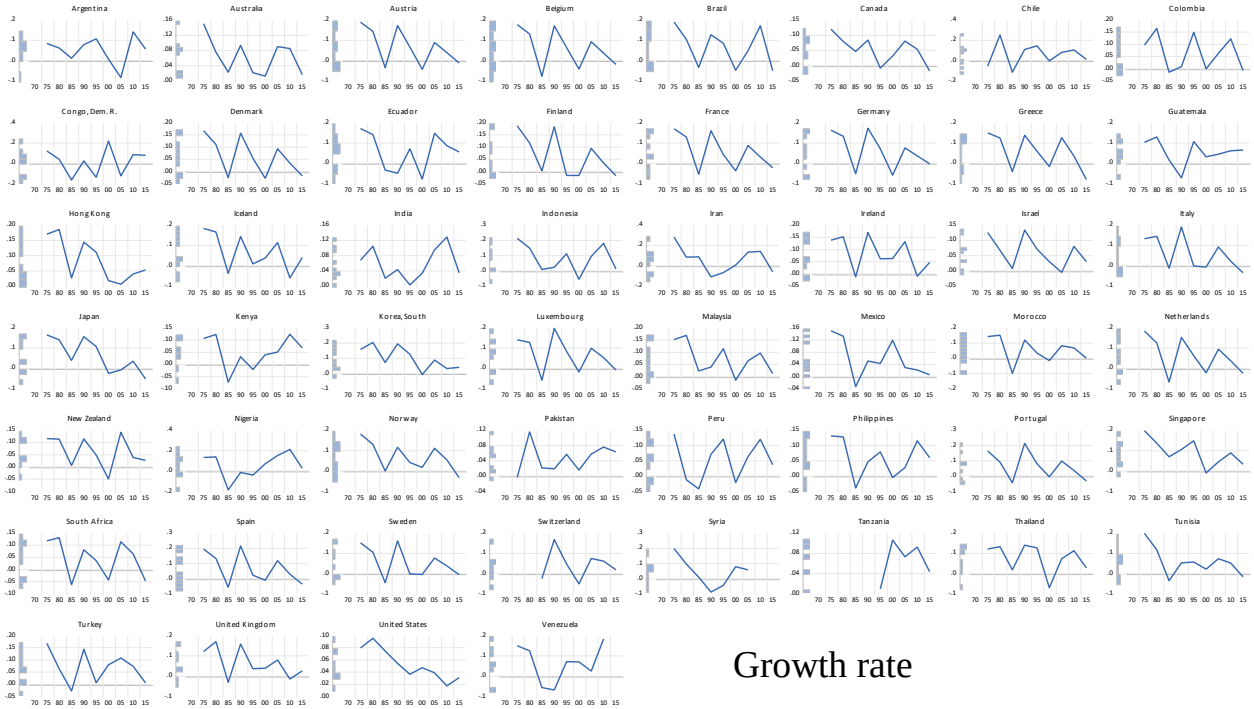
Descriptive Statistics for REGULATION
Categorized by values of COUNTRIES
Date: 12/13/18 Time: 13:34
Sample: 1970 2015
Included observations: 503

COUNTRIES	Mean	Max	Min.	Std. Dev.	Obs.
Argentina	5.176000	6.340000	3.580000	1.013774	10
Australia	7.364000	8.550000	5.390000	1.167697	10
Austria	6.453000	7.620000	5.160000	0.965793	10
Belgium	6.739000	8.120000	5.330000	1.168241	10
Brazil	4.887000	5.510000	4.300000	0.409147	10
Canada	8.365000	8.700000	7.670000	0.302554	10
Chile	6.580000	7.550000	4.570000	1.024451	9
Colombia	6.071250	7.170000	5.160000	0.840109	8
Congo, D...	4.702000	5.800000	3.940000	0.696990	10
Denmark	7.381000	8.600000	6.280000	0.925712	10
Ecuador	5.192500	6.240000	3.880000	0.892488	8
Finland	7.089000	7.880000	6.380000	0.592123	10
France	6.793000	7.820000	5.950000	0.682773	10
Germany	6.068000	7.850000	5.150000	0.861701	10
Greece	4.942000	6.400000	3.580000	1.053700	10
Guatemala	6.214000	6.950000	5.410000	0.588486	10
Hong Kong	8.408000	9.430000	7.160000	1.031975	10
Iceland	6.852222	8.840000	5.290000	1.254769	9
India	6.008000	6.740000	5.240000	0.500484	10
Indonesia	5.018000	6.340000	3.310000	1.210030	10
Iran	4.311250	5.730000	3.380000	0.812288	8
Ireland	7.396000	8.620000	5.490000	0.890421	10
Israel	5.062000	7.380000	3.340000	1.621473	10
Italy	5.849000	7.470000	4.570000	1.150840	10
Japan	7.711000	8.220000	6.830000	0.406050	10
Kenya	6.696000	7.800000	5.470000	0.794749	10
Korea, South	6.058889	7.210000	4.580000	0.935661	9
Luxembourg	7.432000	8.310000	6.900000	0.572748	10
Malaysia	7.344000	8.650000	6.180000	0.883543	10
Mexico	5.844444	7.120000	3.740000	1.178814	9
Morocco	5.358750	6.210000	4.550000	0.656037	8
Netherlands	6.782000	8.190000	5.280000	1.129019	10
New Zealand	7.809000	9.110000	6.350000	1.201697	10
Nigeria	5.905556	7.310000	4.820000	1.051072	9
Norway	6.669000	7.790000	5.350000	0.805336	10
Pakistan	5.636000	6.600000	3.350000	0.906252	10
Peru	5.836250	7.670000	3.390000	1.901473	8
Philippines	6.663333	7.900000	5.340000	0.902330	9
Portugal	5.287000	7.060000	4.100000	1.055547	10
Singapore	7.449000	8.970000	5.140000	1.457833	10
South Africa	6.675000	7.490000	5.300000	0.801044	10
Spain	6.364000	7.340000	5.460000	0.712011	10
Sweden	6.747000	8.240000	5.300000	1.054494	10
Switzerland	7.265000	8.580000	5.850000	1.015253	10
Syria	4.034000	6.010000	2.720000	1.563566	10
Tanzania	4.846000	7.270000	2.690000	1.519621	10
Thailand	6.303000	7.090000	5.090000	0.718100	10
Tunisia	5.773000	7.300000	4.700000	0.970327	10
Turkey	5.534444	6.490000	4.410000	0.764953	9
United Kin...	7.943000	8.590000	6.920000	0.634316	10
United States	8.337000	8.710000	6.840000	0.557735	10
Venezuela	4.815000	5.580000	2.560000	0.889360	10
All	6.328867	9.430000	2.560000	1.428200	503

Appendix 3 – Summary Graphs

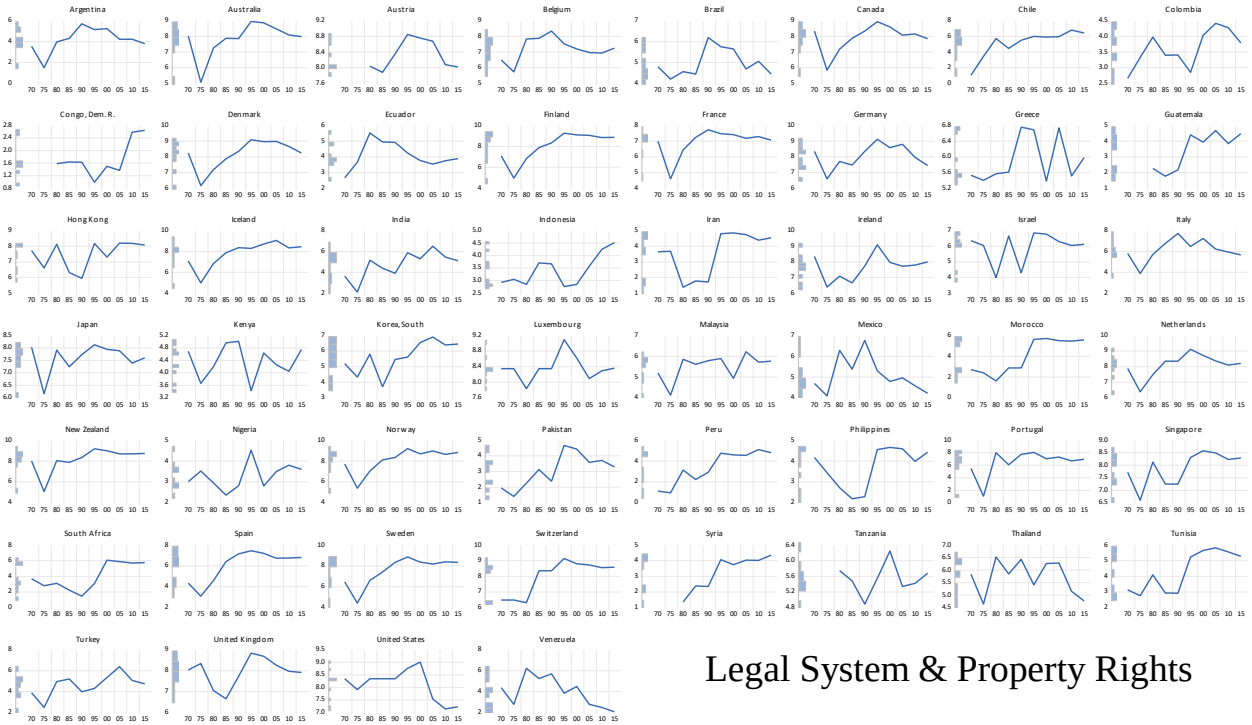


GDP per capita

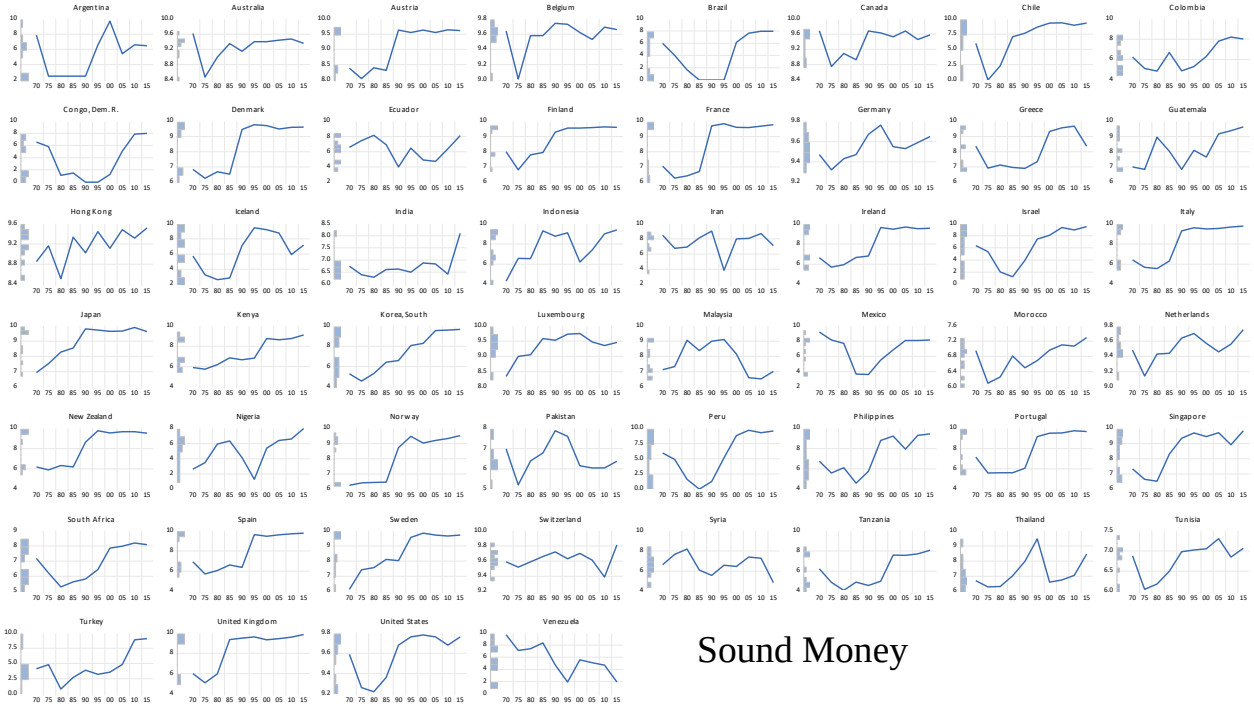


Growth rate

Size of Government

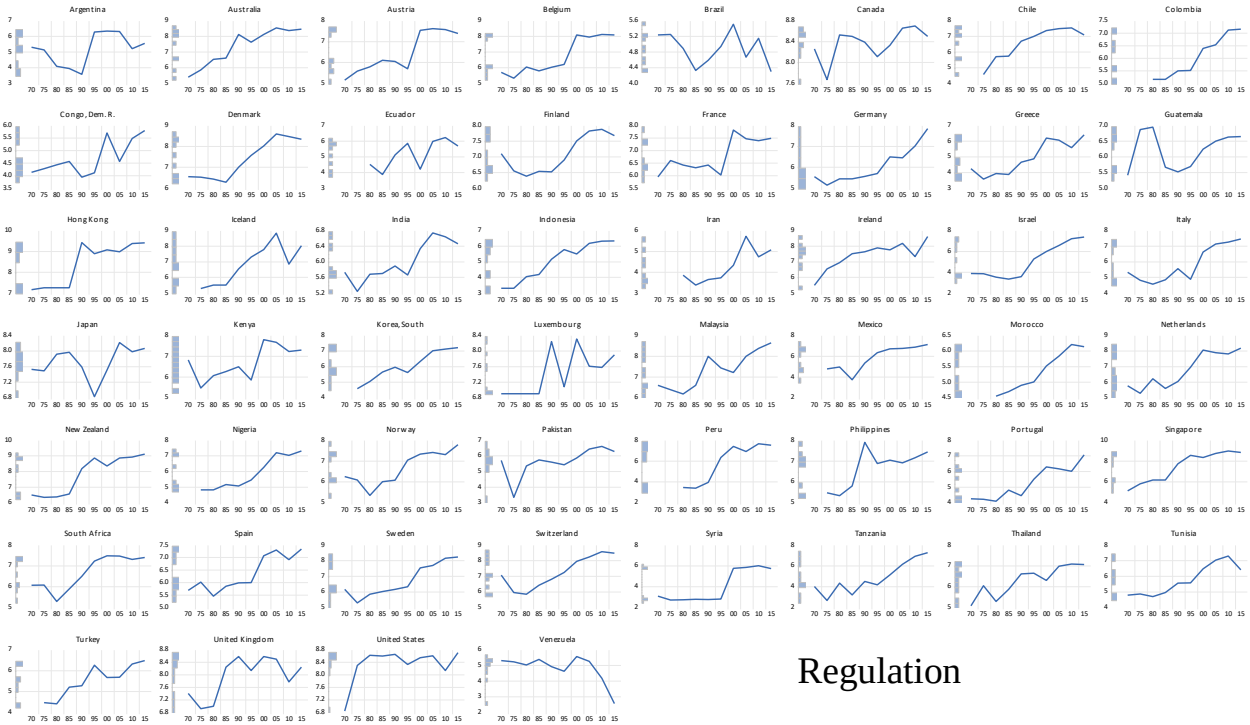


Legal System & Property Rights



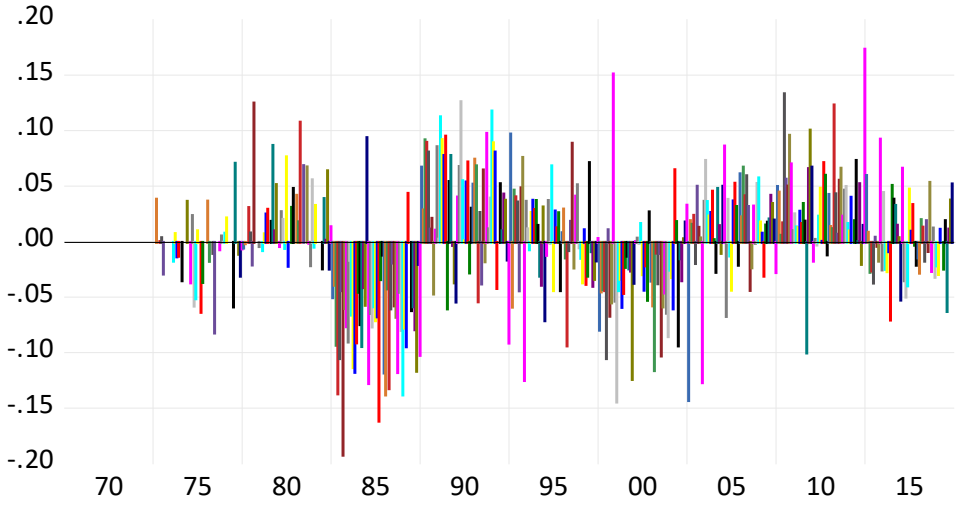
Sound Money

Freedom to Trade Internationally

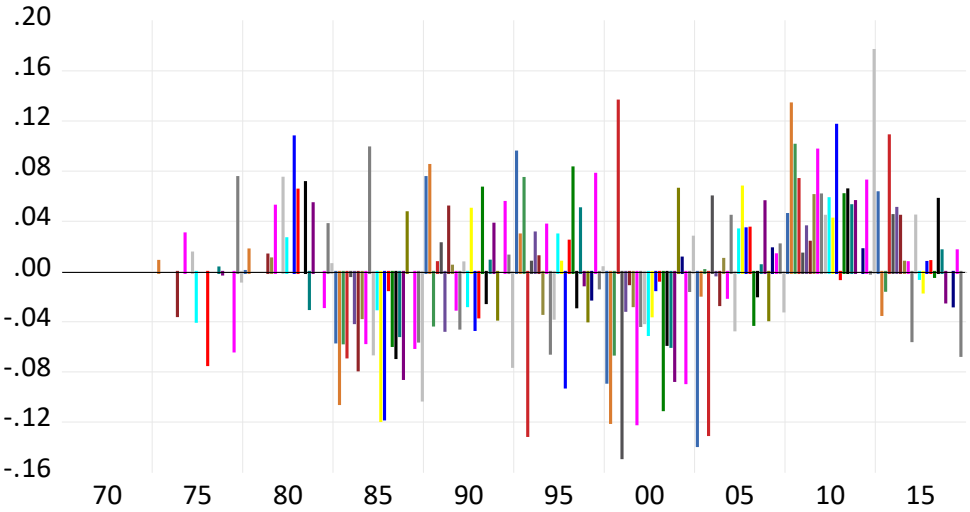

Argentina
Australia
Austria
Belgium
Brazil
Canada
Chile
Colombia
Congo, Dem. R.
Denmark
Ecuador
Finland
France
Germany
Greece
Guatemala
Hong Kong
Iceland
India
Indonesia
Iran
Ireland
Israel
Italy
Japan
Kenya
Korea, South
Luxembourg
Malaysia
Mexico
Morocco
Netherlands
New Zealand
Nigeria
Norway
Pakistan
Peru
Philippines
Portugal
Singapore
South Africa
Spain
Sweden
Switzerland
Syria
Tanzania
Thailand
Tunisia
Turkey
United Kingdom
United States
Venezuela

Regulation

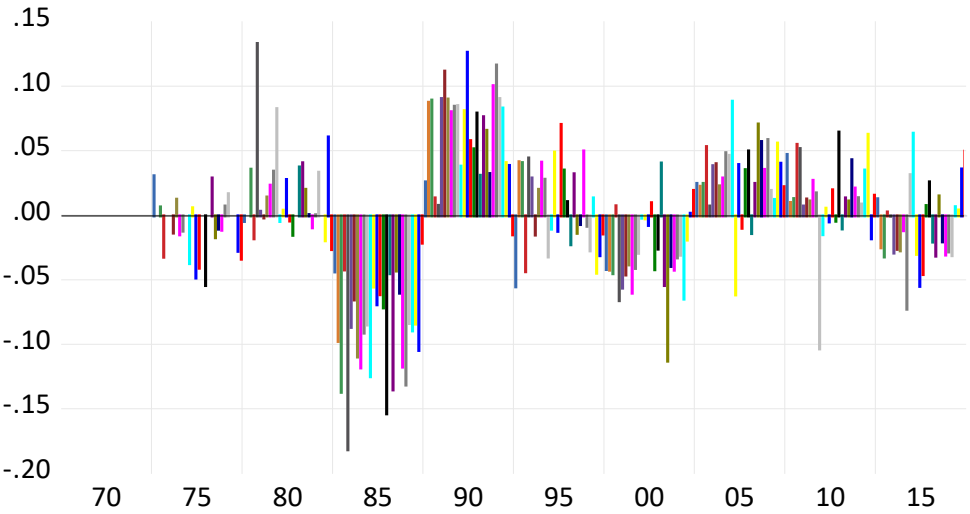
Appendix 4 – Residuals Plots (before)



Pooled

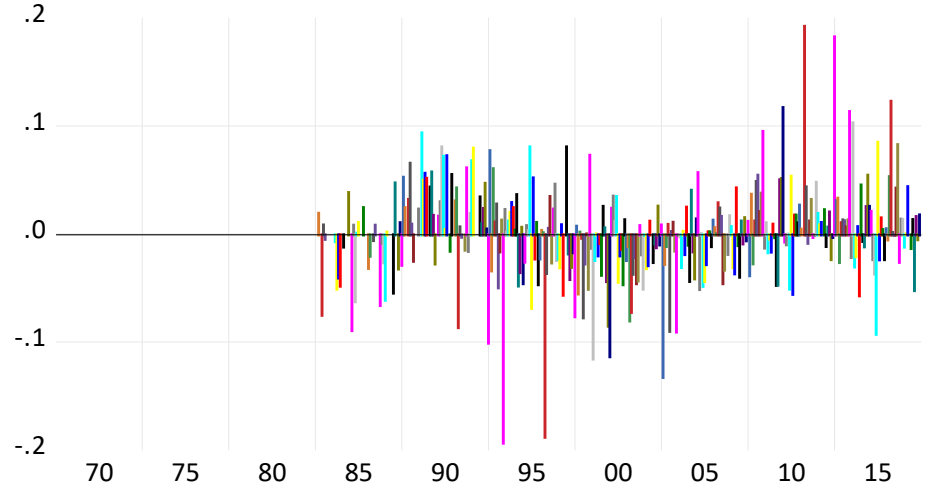


Non-OECD

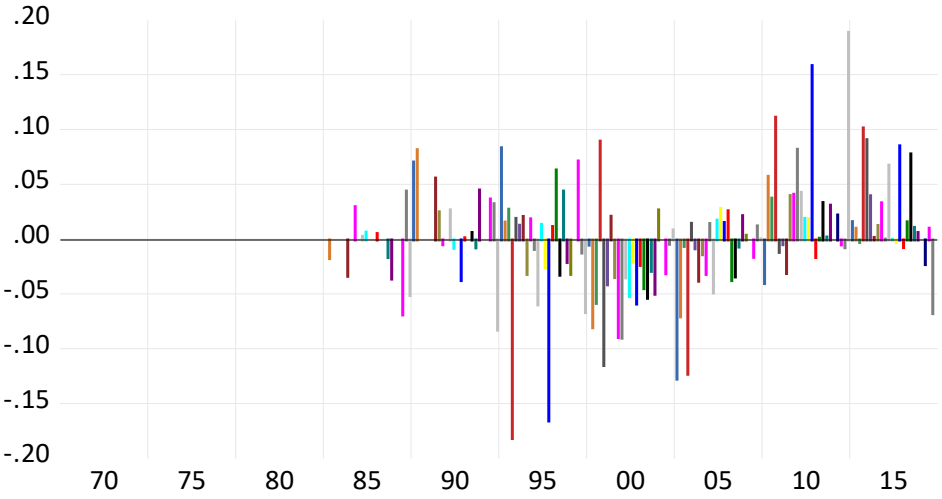


OECD

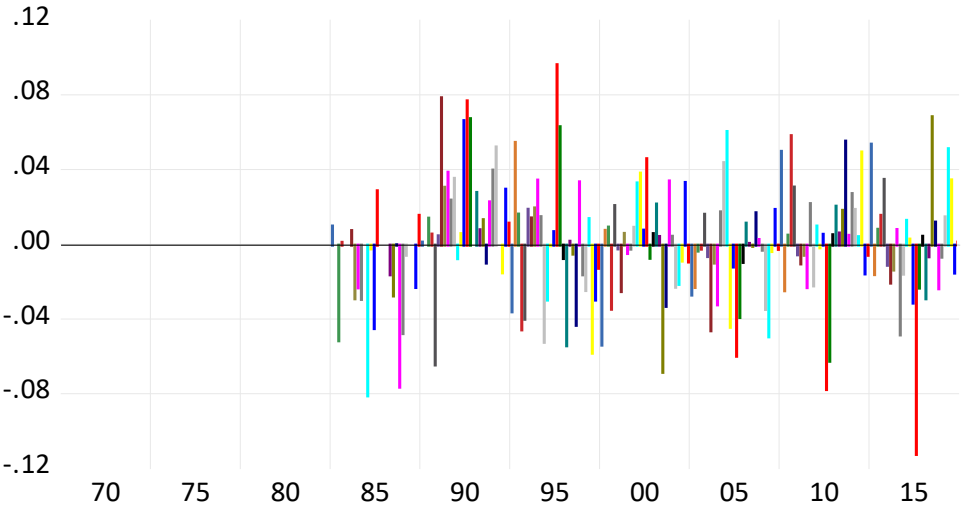
Appendix 5 – Residuals Plots (after)



Pooled



Non-OECD



OECD

Appendix 6 – EViews Code

```
'Antonio Jurlina
'ECO 530
'Final Project Program
'11/6/2018

cd  "E:\UMaine\Fall (2018)\ECO 530\economicfreedom"

wfopen "gdp_data"

spool results
output(s) results

'creating variables necessary to introduce growth to the model
series pp = log(gdp)
series growth = (pp - pp(-1)) / 5

'''''' Creating summary statistics, graphs and a covariance matrix''''''''''''''
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''

alpha country = countries
group dataset country year gdp gov growth*100 legal money oecd pp regulation trade
results.insert dataset
delete country

gdp.statby(max, min, nov, noa, p) countries
close gdp
graph ggdp.line(m, ab = histogram, panel = individual) gdp
ggdp.options connect
results.insert ggdp

growth.statby(max, min, nov, noa, p) countries
close growth
graph ggrowth.line(m, ab = histogram, panel = individual) growth
ggrowth.options connect
results.insert ggrowth

gov.statby(max, min, nov, noa, p) countries
close gov
graph ggov.line(m, ab = histogram, panel = individual) gov
ggov.options connect
results.insert ggov

legal.statby(max, min, nov, noa, p) countries
close legal
graph glegal.line(m, ab = histogram, panel = individual) legal
glegal.options connect
results.insert glegal

money.statby(max, min, nov, noa, p) countries
close money
graph gmoney.line(m, ab = histogram, panel = individual) money
gmoney.options connect
results.insert gmoney

trade.statby(max, min, nov, noa, p) countries
close trade
graph gtrade.line(m, ab = histogram, panel = individual) trade
gtrade.options connect
results.insert gtrade

regulation.statby(max, min, nov, noa, p) countries
close regulation
graph gregulation.line(m, ab = histogram, panel = individual) regulation
gregulation.options connect
results.insert gregulation

group variables growth gdp gov legal money regulation trade
matrix x = @cor(variables)
x.setcollabels growth gdp gov legal money regulation trade
x.setrowlabels growth gdp gov legal money regulation trade
x.displayname Correlation Matrix
x.label
results.insert x

delete ggdp ggov glegal gtrade gmoney gregulation ggrowth world_gdp usd
delete variables rank economic_freedom_summary_index x

results.displayname untitled01 "Data Set"
results.displayname untitled02 "GDP per capita"
results.displayname untitled03 "GDP per capita"
results.displayname untitled04 "Growth rate"
results.displayname untitled05 "Growth rate"
results.displayname untitled06 "Size of Government"
results.displayname untitled07 "Size of Government"
results.displayname untitled08 "Legal System & Property Rights"
results.displayname untitled09 "Legal System & Property Rights"
results.displayname untitled10 "Sound Money"
results.displayname untitled11 "Sound Money"
results.displayname untitled12 "Freedom to trade internationally"
results.displayname untitled13 "Freedom to trade internationally"
results.displayname untitled14 "Regulation"
results.displayname untitled15 "Regulation"
results.displayname untitled16 "Correlation Matrix"
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''

'''''' end of summary statistics
'''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''


'''''' Fixed effects OLS models
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''

smpl @all
equation eq_a.ls(cx=f) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1)
results.insert eq_a
results.displayname untitled17 "OLS (pooled)"

smpl if oecd = 0
equation eq_b.ls(cx=f) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1)
results.insert eq_b
results.displayname untitled18 "OLS (non-OECD)"

smpl if oecd = 1
equation eq_c.ls(cx=f) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1)
results.insert eq_c
results.displayname untitled19 "OLS (OECD)"
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
```

```
''''''' End of OLS estimation
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
'


''''' Tests
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
''''''''
smpl @all
equation eq_d.ls(cx=f, per=f) growth c gov(-1) legal(-1)
money(-1) trade(-1) regulation(-1) pp(-1)
eq_d.fixedtest(p)
results.displayname untitled20 "Redundancy Test a"
smpl if oecd = 0
equation eq_e.ls(cx=f, per=f) growth c gov(-1) legal(-1)
money(-1) trade(-1) regulation(-1) pp(-1)
eq_e.fixedtest(p)
results.displayname untitled21 "Redundancy Test b"
smpl if oecd = 1
equation eq_f.ls(cx=f, per=f) growth c gov(-1) legal(-1)
money(-1) trade(-1) regulation(-1) pp(-1)
eq_f.fixedtest(p)
results.displayname untitled22 "Redundancy Test c"
close eq_d
close eq_e
close eq_f

smpl @all
equation eq_d.ls(cx=r) growth c gov(-1) legal(-1) money(-1)
trade(-1) regulation(-1) pp(-1)
eq_d.ranhaus(p)
close eq_d
results.displayname untitled23 "RE vs FE Test a"

smpl if oecd = 0
equation eq_e.ls(cx=r) growth c gov(-1) legal(-1) money(-1)
trade(-1) regulation(-1) pp(-1)
eq_e.ranhaus(p)
close eq_e
results.displayname untitled24 "RE vs FE Test b"

smpl if oecd = 1
equation eq_f.ls(cx=r) growth c gov(-1) legal(-1) money(-1)
trade(-1) regulation(-1) pp(-1)
eq_f.ranhaus(p)
close eq_f
results.displayname untitled25 "RE vs FE Test c"

smpl @all
EQ_A.makeresids resid_a
graph res_a.spike(m, panel = combine) resid_a
res_a.options connect
results.insert res_a
results.displayname untitled26 "OLS (pooled) Residuals"

smpl if oecd = 0
EQ_B.makeresids resid_b
graph res_b.spike(m, panel = combine)  resid_b
res_b.options connect
results.insert res_b
results.displayname untitled27 "OLS (non-OECD) Residuals"

smpl if oecd = 1
EQ_C.makeresids resid_c
graph res_c.spike(m, panel = combine)  resid_c
res_c.options connect
results.insert res_c
results.displayname untitled28 "OLS (OECD) Residuals"

smpl @all
eq_a.forecast(e, g) growthf
graph hetero1.scat(panel = stack) growthf resid_a
hetero1.axis(b) angle(auto)
hetero1.legend position(LEFT)
hetero1.setelem(1) symbol(CIRCLE) linepattern(none)
linecolor(@rgb(57,106,177))
hetero1.setelem(1) legend(Fitted Values)
hetero1.setelem(2) legend(Residuals)
hetero1.setelem(1) axis(b)
results.insert hetero1
results.displayname untitled29 "OLS (pooled) Residuals
Plot"

smpl if oecd = 0
eq_b.forecast(e, g) growthf
graph hetero2.scat(panel = stack) growthf resid_b
hetero2.axis(b) angle(auto)
hetero2.legend position(LEFT)
hetero2.setelem(1) symbol(CIRCLE) linepattern(none)
linecolor(@rgb(57,106,177))
hetero2.setelem(1) legend(Fitted Values)
hetero2.setelem(2) legend(Residuals)
hetero2.setelem(1) axis(b)
results.insert hetero2
results.displayname untitled30 "OLS (non-OECD) Residuals
Plot"

smpl if oecd = 1
eq_c.forecast(e, g) growthf
graph hetero3.scat(panel = stack) growthf resid_c
hetero3.axis(b) angle(auto)
hetero3.legend position(LEFT)
hetero3.setelem(1) symbol(CIRCLE) linepattern(none)
linecolor(@rgb(57,106,177))
hetero3.setelem(1) legend(Fitted Values)
hetero3.setelem(2) legend(Residuals)
hetero3.setelem(1) axis(b)
results.insert hetero3
results.displayname untitled31 "OLS (OECD) Residuals Plot"

delete res_a res_b res_c hetero1 hetero2 hetero3 resid_a
resid_b resid_c  growthf

smpl @all
equation eq_g.ls(cx=f) growth c gov(-1) legal(-1) money(-1)
trade(-1) regulation(-1) pp(-1) ar(1) ar(2)
results.insert eq_g
results.displayname untitled32 "OLS (pooled)"

smpl if oecd = 0
equation eq_h.ls(cx=f) growth c gov(-1) legal(-1) money(-1)
trade(-1) regulation(-1) pp(-1) ar(1) ar(2)
results.insert eq_h
results.displayname untitled33 "OLS (non-OECD)"

smpl if oecd = 1
equation eq_i.ls(cx=f) growth c gov(-1) legal(-1) money(-1)
trade(-1) regulation(-1) pp(-1) ar(1) ar(2)
results.insert eq_i
results.displayname untitled34 "OLS (OECD)"

''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
''''''''
'''' end of tests
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''


smpl @all
```

```
equation eq_j.ls(cx=f, wgt=cxdiag, deriv=aa) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1) ar(1) ar(2)
results.insert eq_j
results.displayname untitled35 "OLS (pooled)"

smpl if oecd = 0
equation eq_k.ls(cx=f, wgt=cxdiag, deriv=aa) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1) ar(1) ar(2)
results.insert eq_k
results.displayname untitled36 "OLS (non-OECD)"

smpl if oecd = 1
equation eq_l.ls(cx=f, wgt=cxdiag, deriv=aa) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1) ar(1) ar(2)
results.insert eq_l
results.displayname untitled37 "OLS (OECD)"

smpl @all
equation eq_m.ls(cx=f, per=f) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1)
results.insert eq_m
results.displayname untitled38 "OLS (pooled)"

smpl if oecd = 0
equation eq_n.ls(cx=f, per=f) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1)
results.insert eq_n
results.displayname untitled39 "OLS (non-OECD)"

smpl if oecd = 1
equation eq_o.ls(cx=f, per=f) growth c gov(-1) legal(-1) money(-1) trade(-1) regulation(-1) pp(-1)
results.insert eq_o
results.displayname untitled40 "OLS (OECD)"

smpl @all
eq_j.makeresids resid_j
graph res_j.spike(m, panel = combine) resid_j
res_j.options connect
results.insert res_j
results.displayname untitled41 "OLS (pooled) Residuals"

smpl if oecd = 0
eq_k.makeresids resid_k
graph res_k.spike(m, panel = combine) resid_k
res_k.options connect
results.insert res_k
results.displayname untitled42 "OLS (non-OECD) Residuals"

smpl if oecd = 1
eq_l.makeresids resid_l
graph res_l.spike(m, panel = combine) resid_l
res_l.options connect
results.insert res_l
results.displayname untitled43 "OLS (OECD) Residuals"

smpl @all
eq_j.forecast(e, g) growthf
graph hetero1.scat(panel = stack) growthf resid_j
hetero1.axis(b) angle(auto)
hetero1.legend position(LEFT)
hetero1.setelem(1) symbol(CIRCLE) linepattern(none) linecolor(@rgb(57,106,177))
hetero1.setelem(1) legend(Fitted Values)
hetero1.setelem(2) legend(Residuals)
hetero1.setelem(1) axis(b)
results.insert hetero1
results.displayname untitled44 "OLS (pooled) Residuals Plot"

smpl if oecd = 0
eq_k.forecast(e, g) growthf
graph hetero2.scat(panel = stack) growthf resid_k
hetero2.axis(b) angle(auto)
hetero2.legend position(LEFT)
hetero2.setelem(1) symbol(CIRCLE) linepattern(none) linecolor(@rgb(57,106,177))
hetero2.setelem(1) legend(Fitted Values)
hetero2.setelem(2) legend(Residuals)
hetero2.setelem(1) axis(b)
results.insert hetero2
results.displayname untitled45 "OLS (non-OECD) Residuals Plot"

smpl if oecd = 1
eq_l.forecast(e, g) growthf
graph hetero3.scat(panel = stack) growthf resid_l
hetero3.axis(b) angle(auto)
hetero3.legend position(LEFT)
hetero3.setelem(1) symbol(CIRCLE) linepattern(none) linecolor(@rgb(57,106,177))
hetero3.setelem(1) legend(Fitted Values)
hetero3.setelem(2) legend(Residuals)
hetero3.setelem(1) axis(b)
results.insert hetero3
results.displayname untitled46 "OLS (OECD) Residuals Plot"

delete res_j res_k res_l hetero1 hetero2 hetero3 resid_j resid_k resid_l  growthf

results.options displaynames
```