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Economic Freedom and Fiscal Performance: A Regression Analysis of Indices of Economic Freedom on Per Capita GDP

Jason R. Ockey

Brigham Young University - Utah, jason.ockey@gmail.com

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Abstract
This paper explores whether different forms of economic freedom drive fiscal performance. We also seek to determine which specific measurements of economic freedom have the most statistically significant impacts. Though the results of our analysis show that economic freedom does impact levels of per capita GDP, the interpretation of these results is more complicated. Because some indices of economic freedom have negative effects on per capita GDP or are statistically insignificant, it is important to note that simply generally increasing a country's overall level of economic freedom will not necessarily spur economic growth or increase fiscal performance. This paper does not seek to argue for or against the neo-liberal tradition, but rather provide an additional body of analysis that proves useful in analyzing economic relationships.

Keywords
economic freedom, per capita GDP, fiscal performance

Cover Page Footnote
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I. Literature Review and Introduction

It is often argued that economic freedom and fiscal performance are positively correlated one with another. Indeed, the argument that economic freedom drives economic prosperity lies at the center of much of the ongoing political debate in the United States as it forms neoliberal political philosophy. Numerous studies have been performed using empirical data to examine the relationship between economic freedom and fiscal performance (see Barro, 1994; Scully and Slottje, 1991; De Vanssay and Spindler, 1994; Torstensson, 1994; de Haan and Sierman, 1998; Carlsson and Lundström 2002; Altman 2008). The body of economic literature confirming a positive relationship between economic freedom and growth is extensive. Yet as Caudill, Zanella, and Mixon noted in their analysis of economic freedom that "economic freedom is not one dimensional and that efforts to squeeze so much information into a single index will result in much lost information. Our suggestion is that several principal components be used as measures of aspects of economic freedom."[1]

Carlsson and Lundström reached a similar conclusion in their paper "Economic freedom and growth: Decomposing the effects". They concluded that it is not only important to analyze an overall index of economic freedom, but it is also important to "investigate which components of the economic freedom indices that are important for growth and the direction of these effects."[2] Their decomposition of economic freedom found that government size and trade freedom negatively impacted GDP whereas legal structure, private ownership, and freedom to use alternative forms of currency had positive and robust relations to fiscal performance. They also discovered that monetary policy and price stability were insignificant variables.

De Haan and Sierman stated in their paper "Further evidence on the relationship between economic freedom and economic growth" that their main conclusion is that "the link between economic freedom and economic growth depends upon the measure used: for some measures of economic freedom there appears a robust direct relationship, while for others there is no such relationship."[3] They noted the importance of further research which could "provide more insights by applying other indicators of economic freedom."

Though the body of literature may generally disagree on which components of economic freedom tend to impact fiscal performance the most, the general consensus is that on balance higher levels of economic freedom are indicative of a country's financial success. Even Morris Altman, one of the more critical researchers on the subject and a proponent of "big government", conceded that "at a most general level the evidence supports the hypothesis that Economic Freedom…is economically important to the determination of per capita income."[4]

Since Adam Smith, economists have fervently argued that freedom to act in a competitive market is a central component for economic progress. This paper explores whether the ability to engage in voluntary transactions (i.e. economic freedom) can foster higher levels of per capita gross domestic product. In so doing, I seek to follow the recommendations of De Haan and Siermann who suggested further research in which other indicators of economic freedom are applied. As such, I have chosen to adopt the ten indices of economic freedom provided by The

[1] Caudill, Steven B., Fernando C. Zanella, and Franklin G. Mixon, Jr. "Is Economic Freedom One Dimensional?" *Journal of Economic Development* 25.1 (2000): 17-40.
[2] Carlsson, Fredrik, and Susanna Lundström. "Economic Freedom and Growth: Decomposing the Effects." *Public Choice* 112.3-4 (2002): 335.
[3] De Haan, Jakob, and Clemens L J Siermann. "Further Evidence on the Relationship between Economic Freedom and Economic Growth." *Public Choice* 95.3-4 (1998): 374.
[4] Altman, Morris. "How Much Economic Freedom Is Necessary for Economic." *Economics Bulletin* 15.2 (2008): 7.

Heritage Foundation as my independent variables in this paper: business freedom, trade freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, and labor freedom. This paper uses regression analysis to examine whether different indicators of economic freedom drive fiscal performance. I do so in an effort to provide additional insights that prove useful in analyzing economic relationships central to the neoliberal tradition.

II. Description of Model

I begin by analyzing the effect of economic freedom on the log of per capita GDP using an overall index of economic freedom. The log of per capita GDP will simplify the interpretation of the model in that it will allow us to see the percentage effects of each independent variable on per capita GDP, rather than forcing the analyst to attempt to conceptualize significance of varying dollar amount impacts on per capita GDP. The model is as follows:

$$\mathbf{log(pcgdp)_i} = \alpha + \beta_1 \mathbf{Literacy_i} + \beta_2 \mathbf{Unemp_i} + \delta_0 \mathbf{Overall_i} + \varepsilon_i$$

(Model 1)

where pcgdp is per capita gross domestic product measured as the nominal gross domestic product (GDP) divided by the number of people in the country. log(pcgdp) is defined as the natural log of per capita GDP. $Overall_i$ is the overall economic freedom rating provided by The Heritage Foundation. $Literacy_i$ is the literacy rate of the adult population (meaning the percent of the population that is age 15 and over that can read and write. $Unemp_i$ is the unemployment rate.

Literacy rate and unemployment rate are variables that were expected to have a significant impact on per capita GDP that were not included as part of the calculation underlying the overall freedom score. The literacy rate is expected to positively impact per capita GDP. The unemployment rate has been shown to negatively impact GDP.[5] The inclusion of these variables is intended to reduce the incidence of endogeneity problems within the model that could result from omitted variables bias.[6] While I recognize that the addition of these explanatory variables to the model decrease the likelihood of biased and inconsistent estimators, I also recognize that per capita GDP is irreducibly complex. Consequently, I do not include every possible variable that could impact per capita GDP within the model. However, it is important to note that many additional variables typically thought to impact GDP are components of the "overall economic freedom score" (and therefore they are implicitly included in the model).[7] Moreover it is essential to consider that the inclusion of too many independent

[5] Ottosen, Garry K., and Douglas N. Thompson. *Reducing Unemployment: a Case for Government Deregulation*. Westport, CT: Praeger, 1996. 4-5.

[6] Wooldridge, Jeffrey M. *Introductory Econometrics: A Modern Approach*. 4th Edition ed. Mason, OH: South Western, Cengage Learning, *2009*. 93, 506.

[7] Inflation is included in "monetary freedom score". Government expenditures is part of the "government spending score". Tariff rates were included in the "trade freedom score". Tax rates were included in the "fiscal freedom score". Insofar as the "overall economic freedom score" is simply the average of the various other subscores, the inclusion of any of the aforementioned variables (inflation, expenditures, tariffs, taxes) in addition to the overall score would result in multicollinearity problems.

variables can cause overfitting within the model, causing undesirable results. As Wooldridge noted, overspecifying a model can exacerbate multicollinearity problems, decrease the efficiency of estimators, and result in increased variance of estimators.[8]

I expect this simple model to illustrate that overall economic freedom has an impact on per capita GDP. As noted within the introduction, the body of literature confirming the positive nature of this relationship is extensive. However, this paper seeks to demonstrate that economic freedom consists of various components, each of which has a differing impact on per capita GDP in terms of magnitude, significance, and possibly direction.

To analyze the individual effects of the subcategories of economic freedom, I expand the model (recognizing that the overall index of economic freedom used in the previous model is composed of several variables with differing effects on per capita GDP). Thus, I produce the following model:

$$\mathbf{log(pcgdp)_i} = \alpha + \beta_1\mathbf{Literacy_i} + \beta_2\mathbf{Unemp_i} + \delta_1\mathbf{Bus_i} + \delta_2\mathbf{Trade_i} + \delta_3\mathbf{Fiscal_i} + \delta_4\mathbf{Spend_i} + \delta_5\mathbf{Monetary_i} + \delta_6\mathbf{Invest_i} + \delta_7\mathbf{Financial_i} + \delta_8\mathbf{Property_i} + \delta_9\mathbf{Corrupt_i} + \delta_{10}\mathbf{Labor_i} + \varepsilon_i$$

(Model 2)

where the additional variables are provided by The Heritage Foundation and defined as follows (for a detailed description, see the section titled "Description of Data"): Bus_i is the business freedom score. $Trade_i$ is the trade freedom score. $Fiscal_i$ is the fiscal freedom score. $Spend_i$ is the government spending score. $Monetary_i$ is the monetary freedom score. $Invest_i$ is the investment freedom score. $Financial_i$ is the financial freedom score. $Property_i$ is the property rights score. $Corrupt_i$ is the freedom from corruption score. $Labor_i$ is the labor freedom score.

The expectation is that the inclusion of individual components of economic freedom as opposed to an overall measure will increase the model's explanatory power. If I accept the intuition underlying the basic macroeconomic model for GDP, I expect that any components of economic freedom that would likely increase consumption, investments, government spending, or net exports will probably have a positive relation to per capita GDP.[9] Given this insight $Trade_i$ is expected to increase per capita GDP (because greater trade freedom would likely increase the potential for higher net exports) and $Invest_i$ is also expected to increase per capita GDP (because higher levels of investment freedom would likely increase the overall level of investment). I may expect $Spend_i$ to have a negative relationship with per capita GDP because the government spending score rewards countries with lower levels of government expenditures as a portion of their overall GDP. Expected comparative statics for the other variables may be based more off of intuition than an underlying formula. For example, $Corrupt_i$ (the freedom from corruption score) is likely to have a positive relationship with per capita GDP because countries with lower levels of corruption tend to have increased stability and create an environment where high levels of fiscal performance are sustained. Though this line of reasoning is very intuitive, it is supported in the literature. Paolo Mauro found that corruption lowers private investment, thereby lowering economic growth (which fits in nicely with the basic macroeconomic GDP model).[10]

[8] Wooldridge, 89, 100, 203-204.
[9] GDP = C + I + G + X, where C is consumption, I is investment, G is government spending, and X is net exports
[10] Mauro, Paolo. "Corruption and Growth." *Quarterly Journal of Economics* 110.3 (1995): 683.

III. Description of Data

The data was accumulated from two main sources. The data on literacy rates was collected from "The World Factbook"[11] published by the Central Intelligence Agency. Literacy rates were gathered for 164 different countries with the most recent data being used. The literacy rate percentages are not expressed as decimals, but rather as the percent in decimal form multiplied by 100. The unemployment rate data came from The Heritage Foundation. Where data was not available from The Heritage Foundation, the most recent data available from the Central Intelligence Agency was used.[12] If data was not available from either of those two sources, it was collected from the International Labour Organization for the most recent year available.[13] In total, unemployment rates were gathered across 164 countries. Finally, the scores relating to economic freedom were all gathered from The Heritage Foundation's 2011 Index of Economic Freedom.[14] The indices of economic freedom were calculated for 164 countries on a scale of 0 to 100.[15] For descriptions of the method of calculation for each economic freedom variable, see Appendix (I). Short descriptions of the variables used in this paper are provided in the table below:

Table A: Variable Descriptions

Variables	Description of variables
Logpcg	Log(per capita GDP)
Literacy	Literacy rate; generally defined as % of population over 15 that can read/write
Unemp	Unemployment rate; or the percent of the labor force that is not employed
Overall	Overall freedom; the average of the 10 indices of economic freedom below
Bus	Business freedom; ability to start, operate, and close a business
Trade	Trade freedom; absence of barriers affecting imports and exports (e.g. tariffs)
Fiscal	Fiscal freedom; the extent of the tax burden imposed by the government
Spend	Government spending; the level of government expenditures
Monetary	Monetary spending; the level of inflation or price controls
Invest	Investment freedom; measures constraints on the flow of investment capital
Financial	Financial freedom; measure of banking efficiency and financial sector freedom
Property	Property rights; the ability to own private property that is secured by the state
Corrupt	Freedom from corruption; measures perceived corruption of public officials
Labor	Labor freedom; the absence of government intervention in the labor market

[11] *The World Factbook 2009*. Washington, DC: Central Intelligence Agency, 2009. <https://www.cia.gov/library/publications/the-world-factbook/fields/2103.html>.
[12] This occurred 21 times.
The World Factbook 2009. <https://www.cia.gov/library/publications/the-world-factbook/fields/2129.html>
[13] This only occurred 3 times, in the cases of Benin, Ethiopia, and Uganda.
LABORSTA. International Labour Organization Department of Statistics. <http://laborsta.ilo.org>.
[14] Terry Miller and Kim R. Holmes, *2011 Index of Economic Freedom* (Washington, D.C.: The Heritage Foundation and Dow Jones & Company, Inc., 2011). < http://www.heritage.org/index>.
[15] Though data from The Heritage Foundation was available for 179 countries, missing unemployment rate data and/or missing literacy rate data resulted in the omission of 15 additional countries (Burundi, Chad, Democratic Republic of Congo, Republic of Congo, Côte d'Ivoire, Eritrea, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Montenegro, North Korea, Samoa, and the Soloman Islands)

The means, standard errors, minimum observations, and maximum observations for the variables are summarized in the following table[16]:

Table B: Summary Statistics

Variable	Observations	Mean	St. Deviation	Min	Max
pcgdp	164	14368.84	15209.6	355	83841
logpcg	164	8.952741	1.229285	5.872118	11.33668
literacy	164	84.29085	17.91402	21.8	100
umemp	164	13.32073	14.88873	.5	95
overall	164	60.9378	10.84064	22.1	89.7
bus	164	66.32805	17.12371	10	99.9
trade	164	75.99634	11.46066	33.4	90
fiscal	164	77.05732	12.20269	37.6	99.9
spend	164	64.43415	23.57778	0	98.1
monetary	164	74.32927	9.060945	0	87.9
invest	164	52.10366	23.61491	0	95
financial	164	50.06098	19.07354	10	90
property	164	45.4878	23.61644	5	95
corrupt	164	42.07317	20.83372	14	94
labor	164	61.47378	17.48864	20	98

IV. Model Estimation

I begin estimation by performing OLS regression according to model 1. This yields the following results:

Output A: OLS for Model 1

```
. reg  logpcg literacy unemp overall

      Source |       SS       df       MS              Number of obs =     164
-------------+------------------------------           F(  3,   160) =   99.41
       Model |  160.307647     3  53.4358823            Prob > F      =  0.0000
    Residual |  86.0082957   160  .537551848            R-squared     =  0.6508
-------------+------------------------------           Adj R-squared =  0.6443
       Total |  246.315943   163  1.51114075            Root MSE      =  .73318

------------------------------------------------------------------------------
      logpcg |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    literacy |   .0342991    .003501     9.80   0.000     .0273849    .0412133
       unemp |  -.0063702   .0041551    -1.53   0.127    -.0145762    .0018358
     overall |    .049377   .0059211     8.34   0.000     .0376834    .0610705
       _cons |   3.137573   .4166619     7.53   0.000     2.314707    3.960439
------------------------------------------------------------------------------
```

Note that OLS regression shows that the overall index of economic freedom is statistically significant at the .01 level. With 95% confidence, I can say that the impact of overall economic freedom on per capita GDP is positive (insofar as the 95% confidence interval contains

[16] Data for per capita GDP (pcgdp) is also included in the table, though it is not a variable included in the aforementioned models. The summary statistics for per capita GDP may provide more useful than the summary statistics of the log of per capita GDP (though both are included).

only positive values).[17] This is consistent with the body of literature cited in the introduction that has established a positive relationship between overall economic freedom and fiscal performance. Although the literacy rate is statistically significant at the .01 level, the unemployment rate is not. As expected, the slope coefficient of the unemployment rate is negative (though not with 95% confidence) and the slope coefficient of the literacy rate was positive (with 95% confidence). The model also has good explanatory power: R^2 is reported as .6508, meaning that approximately 65.08% of the total sample variation of the log of per capita GDP is explained by the three independent variables included in Model 1.[18] Although this data is interesting, its usefulness is limited until the assumptions associated with the Classical Normal Linear Regression model have been proven to be true.

Prior to testing those assumptions, I will proceed to perform OLS regression according to Model 2. This will allow us to test the hypothesis that Model 2 (which includes the 10 specific indices of economic freedom) will provide more useful in predicting fiscal performance than Model 1 (which only includes the overall index). OLS regression resulted in the following:

Output B: OLS for Model 2

```
. reg logpcg literacy unemp  bus trade fiscal spend monetary invest financial
> property corrupt labor
```

Source	SS	df	MS		
Model	179.029919	12	14.9191599	Number of obs	= 164
Residual	67.2860235	151	.445602805	F(12, 151)	= 33.48
				Prob > F	= 0.0000
				R-squared	= 0.7268
				Adj R-squared	= 0.7051
Total	246.315943	163	1.51114075	Root MSE	= .66753

logpcg	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
literacy	.02763	.0038381	7.20	0.000	.0200467	.0352132
unemp	-.0080879	.0039433	-2.05	0.042	-.015879	-.0002967
bus	.0058216	.0048057	1.21	0.228	-.0036735	.0153167
trade	.0044574	.0065841	0.68	0.499	-.0085515	.0174663
fiscal	.0101974	.0053888	1.89	0.060	-.0004497	.0208445
spend	-.0009205	.0027665	-0.33	0.740	-.0063865	.0045455
monetary	.0090423	.0074873	1.21	0.229	-.0057511	.0238357
invest	-.0034922	.0044567	-0.78	0.435	-.0122977	.0053134
financial	.0032053	.0054603	0.59	0.558	-.0075831	.0139936
property	.0039339	.0080205	0.49	0.625	-.011913	.0197807
corrupt	.0251437	.0082797	3.04	0.003	.0087847	.0415028
labor	-.005804	.0035462	-1.64	0.104	-.0128105	.0012026
_cons	3.74953	.7513144	4.99	0.000	2.265083	5.233976

Notice that the regression on the expanded model (Model 2) resulted in increased explanatory power as expected. R^2 increased to .7268, meaning that approximately 72.68% of the sample variation in per capita GDP is explained by the independent variables.

In determining whether or not Model 2 explains per capita GDP better than Model 1, it is not sufficient to simply compare the coefficients of determination. This is because a property of R^2 is that it increases with the addition of more explanatory variables. It is more useful to compare the adjusted R^2 of both models because it does not tend to increase simply because additional explanatory variables are added (in fact, the adjusted R^2 will only increase if the square of the t-statistic of an additional added variable is greater than one). The adjusted R^2 of

[17] The 95% confidence interval for overall economic freedom is (.0376834,.0610705)
[18] Wooldridge, 40.

Model 1 is 0.6443 whereas the adjusted R^2 of Model 2 is 0.7051. This would seem to indicate that Model 2 is preferable to Model 1.

I now seek to validate this intuition by performing a chow test on Model 2. Specifically, I test the null hypothesis the all ten of the economic indices of freedom are equal to each other. Failure to reject the null hypothesis would indicate that perhaps the impacts of all ten economic indices are the same, and thus Model 1 should be adopted to prevent unwanted noise in the model. A rejection of the null hypothesis would imply that the different indices do indeed have differing effects, and consequently Model 2 should be adopted. The chow test resulted in the following output:

Output C: Chow Test for Equivalent δ's in Model 2

```
. test bus=trade=fiscal=spend=monetary=invest=financial=property=corrupt=labor

 ( 1)  bus - trade = 0
 ( 2)  bus - fiscal = 0
 ( 3)  bus - spend = 0
 ( 4)  bus - monetary = 0
 ( 5)  bus - invest = 0
 ( 6)  bus - financial = 0
 ( 7)  bus - property = 0
 ( 8)  bus - corrupt = 0
 ( 9)  bus - labor = 0

       F(  9,   151) =    4.67
            Prob > F =    0.0000
```

The chow test yielded a chow statistic of 4.67 distributed as an F-statistic with 9, 151 degrees of freedom, causing us to reject the null hypothesis that $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10}$ not only at the .01 significance level but even at the .0001 significance level! This has tremendous implications for research regarding economic freedom because it indicates that different aspects of economic freedom have differing effects on per capita GDP. Such results are in line with the research performed by Carlsson and Lundström where they concluded that different aspects of economic freedom affected fiscal performance in different ways. These results are also consistent with my hypothesis that economic freedom is multidimensional in nature, and cannot be codified with a single variable.

As a result of higher adjusted R^2 values, differing signs on the slope coefficients of the various economic freedom indices in Model 2 (which indicate that economic freedom can both positively and negatively impact per capita GDP), and finally as a result of an extraordinarily significant chow test I proceed by adopting Model 2 for the remainder of the paper.

The accuracy of the OLS regression performed on the second model is dependent upon the properties of the data. Specifically, it is important to test whether the data meets the five basic assumptions associated with the Classical Normal Linear Regression Model. These assumptions are: (A.1) the error terms are normally distributed; (A.2) the expected value of the errors is zero; (A.3) the data is homoskedastic; (A.4) there is no autocorrelation[19]; and (A.5) the independent variables are nonstochastic. When the five assumptions (A.1 – A.5) are met, the slope coefficients within the basic multiple linear regression model are unbiased, consistent, normally distributed, equivalent to maximum likelihood estimators, and the minimum variance of all unbiased estimators (consequently they will also be BLUE [best linear unbiased estimators]). I proceed to test these assumptions.

[19] The data used in this project was cross-sectional data as opposed to time-series data, so autocorrelation will not impact the validity of the estimators.

A.1 – Normality Assumption

The following table displays summary information for the residuals:

Table C: Summary Statistics for Residuals

Obs	Mean	Std. Deviation	Skewness	Kurtosis
164	0	.6424933	.1768794	3.460917

A normal distribution is symmetric (meaning that skewness is 0) and has a kurtosis level of 3. To test for normality, a skewness/kurtosis test is performed in STATA using the sktest command. The results are as follows:

Output D: Skewness Kurtosis Test

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
error	164	0.3388	0.1861	2.70	0.2590

The skewness/kurtosis test leads us to fail to reject the null hypothesis that the error terms are normally distributed. The Jarque–Bera test (JB test), Shapiro-Wilk test, and Shapiro-Francia test all support this conclusion.[20] Consequently, I proceed and assume normality in the error terms. Note however that even if the error terms are not distributed normally, if the Gauss-Markov Assumptions (A.2-A.5) are satisfied then the estimators produced by the model will be still be unbiased, consistent, and BLUE (they will have the minimum variance of all linear unbiased estimators).

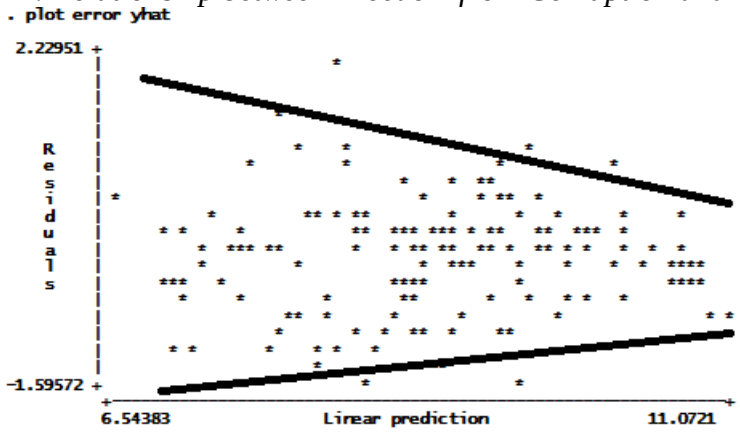
A.3 – Homoskedasticity

Homoskedasticity means that the errors in a regression model have a non-zero constant variance. Though White's test for homoskedasticity fails to reject the null hypothesis of homoskedasticity at the .05 significance level, a Breusch-Pagan test indicates a rejection of homoskedasticity at the .05 significance level.[21] A simple graphical plot of showing the relationship between freedom from corruption and the residuals is indicative of a model that is at least somewhat heteroskedastic:

[20] See Appendix (IV). The JB test resulted in a $\chi^2(2)$ of 2.307 and a p-value of .3156. The Shapiro-Wilk test resulted in a z-score of 0.832 and a p-value of 0.20282. The Shapiro-Francia test resulted in a z-score of 1.156 and a p-value of 0.12388. In all of these tests we fail to reject the null hypothesis at the .05 level. The null hypothesis is normality.

[21] See Appendix (V)

Graph A: Relationship between Freedom from Corruption and Residuals



As Wooldridge notes, "the variance formula derived under homoskedasticity is no longer valid when heteroskedasticity is present."[22] Consequently, the t-statistics that were produced with OLS regression used the wrong standard error, and therefore were invalid. I correct for this problem by using robust standard errors to generate heteroskedasticity-robust t-statistics. Using the robust regression results in the following regression output:

Output E: OLS with Robust Standard Errors

```
. reg logpcg literacy unemp bus trade fiscal spend monetary invest financial
> property corrupt labor, robust

Linear regression                               Number of obs =     164
                                                F( 12,   151) =   52.51
                                                Prob > F      =  0.0000
                                                R-squared     =  0.7268
                                                Root MSE      =  .66753
```

logpcg	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
literacy	.02763	.0037895	7.29	0.000	.0201426	.0351173
unemp	-.0080879	.0043751	-1.85	0.066	-.0167323	.0005565
bus	.0058216	.0048571	1.20	0.233	-.003775	.0154182
trade	.0044574	.0070596	0.63	0.529	-.0094908	.0184057
fiscal	.0101974	.0054983	1.85	0.066	-.0006661	.0210609
spend	-.0009205	.0026486	-0.35	0.729	-.0061537	.0043127
monetary	.0090423	.0095046	0.95	0.343	-.0097369	.0278215
invest	-.0034922	.0041462	-0.84	0.401	-.0116842	.0046999
financial	.0032053	.0044182	0.73	0.469	-.0055243	.0119348
property	.0039339	.0066809	0.59	0.557	-.0092662	.017134
corrupt	.0251437	.0074444	3.38	0.001	.010435	.0398525
labor	-.005804	.0033757	-1.72	0.088	-.0124737	.0008658
_cons	3.74953	.8152033	4.60	0.000	2.138852	5.360207

I now consider variance weighted least squares (VWLS) estimation as a solution for the problems resulting from heteroskedasticity. I use the feasible GLS procedure suggested by Wooldridge wherein the estimated residuals are obtained; the natural logarithm of the squared residuals are regressed on the independent variables; fitted values are obtained, exponentiated, and then square-rooted; and finally the calculated weights are used to perform the variance weighted least squares estimation.[23] This technique resulted in the following:

[22] Wooldridge, 266
[23] Wooldridge, page 283

Output F: VWLS Regression

```
. vwls logpcg literacy unemp bus trade fiscal spend monetary invest financial
> property corrupt labor, sd(sig)

Variance-weighted least-squares regression          Number of obs   =     164
Goodness-of-fit chi2(151)  =  515.36                Model chi2(12)  = 2104.21
Prob > chi2                =  0.0000                Prob > chi2     =  0.0000
```

logpcg	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
literacy	.0286444	.0020285	14.12	0.000	.0246686	.0326202
unemp	-.0058786	.0020586	-2.86	0.004	-.0099133	-.0018439
bus	.0007066	.0023584	0.30	0.764	-.0039158	.005329
trade	.014967	.0037148	4.03	0.000	.0076861	.0222478
fiscal	.0055583	.0023445	2.37	0.018	.0009633	.0101534
spend	-.0007969	.001326	-0.60	0.548	-.0033957	.0018019
monetary	.0001049	.0048622	0.02	0.983	-.0094249	.0096346
invest	-.0017794	.0022423	-0.79	0.427	-.0061742	.0026153
financial	.0017079	.0022275	0.77	0.443	-.002658	.0060738
property	.0131236	.0034755	3.78	0.000	.0063118	.0199355
corrupt	.0135047	.0035489	3.81	0.000	.006549	.0204605
labor	-.0063439	.0015502	-4.09	0.000	-.0093821	-.0033056
_cons	4.284764	.4272016	10.03	0.000	3.447465	5.122064

Initially the discrepancy between White's test for homoskedasticity and the Breusch-Pagan test raised questions as to whether the data was homoskedastic or heteroskedastic. However, the much lower standard errors provided by VWLS regression is evidence that the standard errors of the OLS estimates were inflated due to heteroskedasticity. Even though the VWLS estimators are biased, they are consistent and "asymptotically more efficient than OLS."[24]

A.5 – Nonstochastic Independent Variables

The last possible violation of the assumptions associated with the classical normal linear regression model is that the independent variables are nonstochastic. Violations of this assumption result when endogenous explanatory variables exist in the model. This causes correlation between the error and the explanatory variables that are endogenous.

Endogenous explanatory variables arise when an explanatory variable is a function of other variables that are included in the model. Consequently, I must consider the problem of reverse causality. Reverse causality would suggest that not only does an "explanatory variable" impact the "dependent variable", but also that the "dependent variable" impacts the "explanatory variable". For example, a reverse causality problem often occurs in GDP models because not only does consumption drive GDP, but GDP also drives consumption. Note that my model does not include consumption as a variable; rather it includes variables thought to drive consumption: property rights, freedom from corruption, fiscal freedom, etc. In fact, these variables might actually function as instrumental variables for econometricians seeking to model GDP based off of the typical macroeconomic GDP model.

However, the absence of corruption as one of my explanatory variables is not alone sufficient to conclude that reverse-causality is not a problem within my models. Indeed, it is likely that literacy rates would drive GDP in that a more educated populace is capable of capitalizing on ideas that would make more money. However, increases in GDP may have a secondary impact on literacy rates if the government can harness the additional growth and use

[24] Wooldridge, page 284

that growth to expand the education system. Such logic may also extend to the indices of economic freedom.

Though I recognize that endogeneity may be a problem as a result of possible reverse causality, confirming this hypothesis would require a Hausman test which requires the creation of instrumental variables for the indices of economic freedom. Unfortunately, due to lack of data and time constraints, it was not possible to identify an instrumental variable that would allow us to test the presence of endogeneity error. For purposes of this paper, I assume that the reverse causality problem is limited if it exists. It is important to note that this is considered when interpreting the model.

Multicollinearity

One final possible problem to consider is multicollinearity. Multicollinearity occurs when there is a high level of correlation between at least two of the independent variables. I produce the following correlation matrix in STATA in order to observe the incidence of high levels of correlation:

Output G: Correlation Matrix

```
. corr literacy unemp bus trade fiscal spend monetary invest financial property corrupt labor
(obs=164)
```

	literacy	unemp	bus	trade	fiscal	spend	monetary	invest	financ~l	property	corrupt	labor
literacy	1.0000											
unemp	-0.2692	1.0000										
bus	0.4132	-0.2792	1.0000									
trade	0.4164	-0.2529	0.4322	1.0000								
fiscal	-0.0663	-0.0056	-0.1505	-0.1149	1.0000							
spend	-0.3534	-0.1101	-0.1962	-0.1537	0.4301	1.0000						
monetary	0.0996	-0.3010	0.4016	0.4632	-0.1690	0.0461	1.0000					
invest	0.2878	-0.2334	0.6133	0.6289	-0.1967	-0.1260	0.5235	1.0000				
financial	0.3791	-0.2420	0.6082	0.5952	-0.1440	-0.1184	0.5085	0.8251	1.0000			
property	0.3978	-0.2622	0.7100	0.4718	-0.3500	-0.2647	0.4838	0.7132	0.7231	1.0000		
corrupt	0.4382	-0.2271	0.6758	0.4803	-0.3928	-0.3253	0.4335	0.6422	0.6422	0.9431	1.0000	
labor	0.2390	-0.1465	0.4660	0.1638	0.1349	-0.0374	0.2062	0.2701	0.3205	0.3546	0.3413	1.0000

In general, the correlations between the independent variables appear to be relatively low, with a few exceptions.[25] I also obtain the variance inflation factors:

Output H: Variance Inflation Factors

```
. estat vif
```

Variable	VIF	1/VIF
property	13.12	0.076196
corrupt	10.88	0.091875
invest	4.05	0.246808
financial	3.97	0.252041
bus	2.48	0.403694
trade	2.08	0.480115
literacy	1.73	0.578299
monetary	1.68	0.593968
fiscal	1.58	0.632223
spend	1.56	0.642538
labor	1.41	0.710756
unemp	1.26	0.793097
Mean VIF	3.82	

[25] The correlation between freedom from corruption and property rights is .9431. The correlation between investment and financial freedom is .8251.

Property rights and freedom from corruption are cause for concern because their variance inflation factors are larger than 10. Even though Wooldridge notes that "setting a cutoff value above which we conclude that multicollinearity is a 'problem' is arbitrary and not especially helpful," he also notes that a VIF of 10 is a typical threshold used to identify multicollinearity problems. Using the VIF score as an indicator for multicollinearity as well as the high correlation level between property and corrupt (0.9431), I conclude that the data is multicollinear. The presence of multicollinearity between property and freedom from corruption actually makes intuitive sense. It is likely that corrupt governments do not have the resources to protect property. Thus, it is incredibly unlikely that countries with high levels of corruption also extensively protected property rights. Instead, it is more likely that countries capable of enforcing property rights are free from corruption. Consequently there is a high correlation between these variables.

Multicollinearity increases the probability of an incorrect sign in the model even though it is not a violation of A.1-A.5. However, after running VWLS regression with property rights eliminated from the model, all of the same variables remained significant and none of the signs changed.[26] As a result, I opt to retain property rights within the model despite the multicollinearity that exists. As seen in *Output F* (page 15), both property rights and freedom from corruption are significant according to VWLS regression. As such, removing either of those variables may jeopardize some of the model's explanatory power. Moreover, even though the correlation between property rights and freedom from corruption is high, each of these variables measures two different aspects of economic freedom; consequently the elimination of either of these variables could potentially result in omitted variable bias.

V. Results

I adopted Model 2, which accounts for the fact that individual indices of economic freedom impact per capita GDP differently. A chow test confirmed that Model 2 was statistically significant from Model 1. Due to the data being heteroskedastic, I used both OLS robust and VWLS regression to correct for problems in the regular OLS regression. The results of all 3 regressions are displayed in the table below:

[26] See Appendix (VII)

Table D: Results for Various Regression Methodologies for Model 2

Variable	OLS	Robust	VWLS
literacy	.02763***	.02763***	.0286444***
	(.0038381)	(.0037895)	(.0020285)
unemp	-.0080879**	-.0080879*	-.0058786***
	(.0039433)	(.0043751)	(.0020586)
bus	.0058216	.0058216	.0007066
	(.0048057)	(.0048571)	(.0023584)
trade	.0044574	.0044574	.014967***
	(.0065841)	(.0070596)	(.0037148)
fiscal	.0101974*	.0101974*	.0055583**
	(.0053888)	(.0054983)	(.0023445)
spend	-.0009205	-.0009205	-.0007969
	(.0027665)	(.0026486)	(.001326)
monetary	.0090423	.0090423	.0001049
	(.0074873)	(.0095046)	(.0048622)
invest	-.0034922	-.0034922	-.0017794
	(.0044567)	(.0041462)	(.0022423)
financial	.0032053	.0032053	.0017079
	(.0054603)	(.0044182)	(.0022275)
property	.0039339	.0039339	.0131236***
	(.0080205)	(.0066809)	(.0034755)
corrupt	.0251437***	.0251437***	.0135047***
	(.0082797)	(.0074444)	(.0035489)
labor	-.005804	-.005804*	-.0063439***
	(.0035462)	(.0033757)	(.0015502)
cons	3.74953***	3.74953***	4.284764***
	(.7513144)	(.8152033)	(.4272016)

Notes: Standard deviations are in parenthesis.
*Significant at the .1 level; **Significant at the .05 level; ***Significant at the .01 level
STATA output can be found in *Output B* (page 10), *Output E* (page 14), and *Output F* (page 15)

I choose to adopt VWLS regression as my final model, as it decreased the standard errors and resulted in more significant estimators.

As expected, literacy and unemp are statistically significant at the .01 level, with positive and negative slope coefficients respectively. For each percent increase in the literacy rate, per capita GDP is expected to increase by approximately 2.82 percent, whereas a single percentage increase in the unemployment rate is expected to decrease per capita GDP by .91 percent.

The following economic freedom variables were also significant at the .01 level: trade, property, corrupt, and labor. Fiscal freedom was significant at the .05 level. As predicted on page 6, the slope coefficient on trade freedom was positive. The value of .0115 means that for each additional calculated unit of trade freedom, per capita GDP increases by 1.15 percent. This is logical in that it is likely that higher levels of trade freedom enable net exports to increase, therefore driving up per capita GDP. Property rights had a positive relationship with fiscal performance. A 1.31 percent increase in fiscal performance is expected to result when the property rights index increases by one unit. This supports Carlsson and Lundström's conclusion

that private ownership has a positive, robust relationship to fiscal performance (see page 2). The slope coefficient on freedom from corruption was also positive as I hypothesized, with every unit increase in corruption freedom corresponding with a 2.38 percent increase in per capita GDP. This confirms the results of Paolo Mauro's analysis where he found that corruption decreases investment and consequently decreases fiscal performance.[27] Fiscal freedom, which rewards countries with lower tax burdens, also had a positive slope coefficient. An additional unit of fiscal freedom is expected to be correlated with a 0.56% increase in GDP per capita.

The fifth significant economic freedom variable was labor freedom. Unlike the other four significant freedom variables, labor freedom actually has a negative slope coefficient. According to the VWLS regression, a single unit increase in labor freedom will decrease per capita GDP by 0.65 percent. Though I did not expect this result initially, the intuition behind the negative relationship may be that as the labor market becomes more protected in the form of minimum wages, restrictions on working hours, restrictions on firing employees, etc. then individuals are able to be more productive employees. This may cause an increase in per capita GDP. However the more likely reason for the relationship is probably due to endogeneity problems within the model due to reverse causality. In other words, countries with resources to protect the labor market tend to have higher levels of per capita GDP. Unfortunately, the reliability of this estimator (and consequently the model as a whole) falls into question as the high level of significance is more likely either (1) a result of correlation rather than causation or (2) a result of reverse causality. I did not have data for an instrumental variable that would allow us to test for the possibility of endogeneity with a Hausman test. However, I recommend further research in which an instrumental variable for labor freedom is used to generate a more predictive two-stage least squares regression model.

Note that bus, spend, monetary, invest, and financial were all insignificant at the .05 level. Although I cannot say with 95 percent confidence that spending freedom has a negative slope coefficient, I can say with 80 percent confidence that it is negatively related to per capita GDP. This is not very useful in a strictly academic sense, but it does provide numerical backing to my hypothesis found on page 6 that as spending freedom increases, per capita GDP will decrease due to the fact that the spending freedom score rewards lower levels of government expenditures.

VI. Conclusion

Though the results of my analysis show that economic freedom does impact levels of per capita GDP, the interpretation of these results is more complicated. My analysis confirms that economic models focusing on individual indices of economic freedom are preferable to models that ignore the complexity of what constitutes overall economic freedom. Because some indices of economic freedom have negative effects on per capita GDP or are statistically insignificant, it is important to note that simply generally increasing a country's overall level of economic freedom will not necessarily spur economic growth or increase fiscal performance. Rather, each independent economic freedom variable's impact on per capita GDP differs in magnitude, importance, and direction. Additionally, there is the issue of whether the indices are simply correlated with fiscal performance or actually drive fiscal performance; the causal relationship is not conclusively determined (though intuition does underlie the argument that the relationship is causal in nature). I conclude that "trade freedom," "fiscal freedom," "property rights," and

[27] For more on Mauro, see page 3 of this report.

"freedom from corruption" are economic freedom indices associated with higher levels of fiscal performance; "labor freedom" has the opposite relationship. Note however that reverse causality problems may distort the validity of the model (but probably to a limited extent). Though I do not draw conclusions that challenge or confirm the neo-liberal tradition, this body of analysis proves useful in analyzing these economic relationships.

References

Altman, Morris. "How Much Economic Freedom Is Necessary for Economic Growth." *Economics Bulletin* 15.2 (2008): 1-20.

Caudill, Steven B., Fernando C. Zanella, and Franklin G. Mixon, Jr. "Is Economic Freedom One Dimensional?" *Journal of Economic Development* 25.1 (2000): 17-40.

Carlsson, Fredrik, and Susanna Lundström. "Economic Freedom and Growth: Decomposing the Effects." *Public Choice* 112.3-4 (2002): 335-44.

De Haan, Jakob, and Clemens L J Siermann. "Further Evidence on the Relationship between Economic Freedom and Economic Growth." *Public Choice* 95.3-4 (1998): 363-80.

Mauro, Paolo. "Corruption and Growth." *Quarterly Journal of Economics* 110.3 (1995): 681-712.

Ottosen, Garry K., and Douglas N. Thompson. *Reducing Unemployment: a Case for Government Deregulation*. Westport, CT: Praeger, 1996.

Wooldridge, Jeffrey M. *Introductory Econometrics: A Modern Approach*. 4th Edition ed. Mason, OH: South Western, Cengage Learning, 2009.

Data Availability

LABORSTA. International Labour Organization Department of Statistics. <http://laborsta.ilo.org>.

Terry Miller and Kim R. Holmes, *2011 Index of Economic Freedom* (Washington, D.C.: The Heritage Foundation and Dow Jones & Company, Inc., 2011). <http://www.heritage.org/index>.

The World Factbook 2009. Washington, DC: Central Intelligence Agency, 2009. <https://www.cia.gov/library/publications/the-world-factbook/index.html>.

VII. Appendix

(I) Detailed Description of Economic Freedom Variables (from The Heritage Foundation)

Variable	Description/Method of Calculation
Overall	***Overall Economic Freedom Score*** • **Calculation:** The ten component scores defined below were averaged.
Bus	***Business Freedom Score*** • **Definition:** "a quantitative measure of the ability to start, operate, and close a business that represents the overall burden of regulation as well as the efficiency of government in the regulatory process" • **Calculation:** Ten raw factors were collected from the World Bank's *Doing Business* study. Each raw factor was converted to a scale of 0 to 100. Then the ten converted factors were averaged to calculate the country's business freedom score. The ten factors were: (1) the number of procedures in starting a business; (2) the time in days of starting a business; (3) the cost of starting a business in terms % of income per capita; (4) the minimum capital required to start a business in terms of % of income per capita; (5) the number of procedures in obtaining a license; (6) the time in days of obtaining a license; (7) the cost of obtaining a license in % of income per capita; (8) the time in closing a business in years; (9) the cost of closing a business in % of estate; and (10) the recovery rate of closing a business in cents on the dollar. The final business freedom score is a number between 0 and 100, where 100 denotes the freest business environment.
Trade	***Trade Freedom Score*** • **Definition:** "a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services" • **Calculation:** Two components determine the trade freedom score. The first component is the trade-weighted average tariff rate. This data was collected from the World Bank. The second component was non-tariff barriers (NTBs). The extent of NTBs was determined according to both qualitative and quantitative information. These included quantity restrictions, price restrictions, regulatory restrictions, investment restrictions, customs restrictions, and direct government intervention. NTBs resulted in a deduction from the base score according to their severity. The following equation was then used to calculate trade freedom: $\text{Trade Freedom}_i = (((\text{Tariff}_{max} - \text{Tariff}_i)/(\text{Tariff}_{max} - \text{Tariff}_{min})) * 100) - \text{NTB}_i$ where Trade Freedom$_i$ is the trade freedom in country i, Tariff$_{max}$ and Tariff$_{min}$ are the upper and lower bounds for tariff rates (%), and Tariff$_i$ is the weighted average tariff rate (%) in country i. The minimum tariff was zero percent. The upper bound was set as 50 percent. Any NTB penalties were then subtracted from the base score.
Fiscal	***Fiscal Freedom Score*** • **Definition:** "a measure of the tax burden imposed by government. It includes both the direct tax burden in terms of the top tax rates on individual and corporate incomes and the overall amount of tax revenue as a percentage of GDP." • **Calculation:** The calculation was based on three quantitative factors: (1) the top tax rate on individual income, (2) the top tax rate on corporate income, and (3) the total tax revenue as a percentage of GDP. Each factor received equal weighting. "Fiscal freedom scores are calculated with a quadratic cost function to reflect the diminishing revenue returns from very high rates of taxation. The data for each factor are converted to a 100-point scale using the following equation: $\text{Fiscal Freedom}_{ij} = 100 - \alpha\,(\text{Factor}_{ij})^2$ where Fiscal Freedom$_{ij}$ represents the fiscal freedom in country i for factor j; Factor$_{ij}$ represents the value (based on a scale of 0 to 100) in country i for factor j; and α is a coefficient set equal to 0.03."
Spend	***Government Spending Score*** • **Definition:** "This component considers the level of government expenditures as a percentage of GDP. Government expenditures, including consumption and transfers, account for the entire score." • **Calculation:** "The scale for scoring government spending is non-linear, which means that government spending that is close to zero is lightly penalized, while levels of government spending that exceed 30 percent of GDP receive much worse scores in a quadratic fashion (for

	example, doubling spending yields four times less freedom), so that only really large governments receive very low scores. The expenditure equation used is: $GE_i = 100 - \alpha\,(\text{Expenditures}_i)^2$ where GE_i represents the government expenditure score in country i; Expenditures_i represents the total amount of government spending at all levels as a portion of GDP (between 0 and 100); and α is a coefficient to control for variation among scores (set at 0.03)."
Monetary	***Monetary Freedom Score*** • **Definition:** "combines a measure of price stability with an assessment of price controls. Both inflation and price controls distort market activity. Price stability without microeconomic intervention is the ideal state for the free market." • **Calculation:** Two factors were used to calculate the monetary freedom score. They were the weighted average inflation rate for the three most recent years and the existence of price controls. The following equation was used to calculate the weighted average inflation rate: $\text{Weighted Avg. Inflation}_i = \theta_1\,\text{Inflation}_{it} + \theta_2\text{Inflation}_{it-1} + \theta_3\,\text{Inflation}_{it-2}$ where "θ_1 through θ_3 (thetas 1–3) represent three numbers that sum to 1 and are exponentially smaller in sequence (in this case, values of 0.665, 0.245, and 0.090, respectively); Inflation_{it} is the absolute value of the annual inflation rate in country i during year t as measured by the consumer price index". The weighted average inflation rate was used in calculating the monetary freedom score. Price controls were penalized according to their extent by deducting the penalty from the base score. The following equation was used to calculate the monetary freedom score: $\text{Monetary Freedom}_i = 100 - \alpha\sqrt{\text{Weighted Avg. Inflation}_i} - \text{PC penalty}_i$ where the weighted average of inflation was under the square root in order to create more separation for countries that have lower inflation rates (in other words, it distinguished levels of hyperinflation such that they were not all seen as equally bad). α was a coefficient that "stabilizes the variance of scores" which was set equal to 6.333. The PCpenalty_i was the penalty assessed due to the existence of price controls which ranged in value from 0 to 20.
Invest	***Investment Freedom Score*** • **Definition:** "In an economically free country, there would be no constraints on the flow of investment capital. Individuals and firms would be allowed to move their resources into and out of specific activities both internally and across the country's borders without restriction." • **Calculation:** Various restrictions on investment were penalized based on their severity and subtracted from the base score of 100. If the investment restrictions resulted in a penalty of over 100, the country would simply receive a score of 0. Penalties were applied as follows: o National treatment of foreign investment: no national treatment, prescreening (25 pts.); some national treatment, some prescreening (15 pts.); some national treatment or prescreening (5 pts.) o Foreign investment code: no transparency, burdensome bureaucracy (25 pts.); inefficient policy implementation, bureaucracy (15 pts.); some non-transparent or inefficient investment laws/practices (5 pts.) o Restrictions on land ownership: all real estate purchases restricted (15 pts.); no foreign purchases of real estate (10 pts.); some restrictions on real estate purchases (5 pts.) o Sectoral investment restrictions: multiple sectors restricted (20 pts.); few sectors restricted (10 pts.); one or two sectors restricted (5 pts.) o Expropriation of investments without fair compensation: common, no legal recourse (25 pts.); common, some legal recourse (15 pts.); uncommon, but occurs (5 pts.) o Foreign exchange controls: no access by foreigners/residents (25 pts.); heavily restricted access (15 pts.); few restrictions (5 pts.) o Capital controls: no repatriation of profits, government approval required for all transactions (25 pts.); inward/outward capital movements require approval and face some restrictions deducted (15 pts.); most transfers approved with some restrictions (5 pts.) o Other: other deductions given for security issues, lack of investment infrastructure, or other inhibiting government policies
Financial	***Financial Freedom Score*** • **Defined:** "a measure of banking efficiency as well as a measure of independence from government control and interference in the financial sector." • **Calculation:** Five areas were analyzed. They are: (1) the extent of government regulation of financial services; (2) the degree of state intervention in banks and other financial firms through

	direct and indirect ownership; (3) the extent of financial and capital market development; (4) government influence on the allocation of credit; and (5) openness to foreign competition. Scores were then allocated on a scale of 0 to 100 based on the level of government interference in these areas (negligible, minimal, nominal, limited, significant, considerable, strong, extensive, heavy, near repressive, and repressive). More information regarding the rating scale can be found on The Heritage Foundation's website.
Property	***Property Rights*** • **Defined:** "an assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state. It measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. The more certain the legal protection of property, the higher a country's score; similarly, the greater the chances of government expropriation of property, the lower a country's score." • **Calculation:** A set of criteria was established. Although a more detailed description is available through The Heritage Foundation, the grading system generally followed the following guidelines: o 100: Private property. Efficient court system. Justice system effective in punishing unlawful property confiscation. No corruption/expropriation. o 90: Corruption is "nearly nonexistent, and expropriation is highly unlikely" o 80: Delays in court system, but still efficient. o 70: Court system is lax in enforcement. Corruption is possible. o 60: Property rights enforced in lax manner and subject to delays. Judiciary may be influenced by other branches of government. Expropriation is possible. o 50: Court system is inefficient and subject to delays. o 40: Court system is highly inefficient and delays deter its utilization. Corruption is present. Judiciary is influenced by other branches of government. o 30: Property ownership is weakly protected. Corruption is extensive. Judiciary strongly influenced by other branches. o 20: Court system is so corrupt/inefficient that outside arbitration is the norm. Property rights are difficult to enforce. Expropriation is common. o 10: Almost all property belongs to the state. Private property rarely protected. Protection of property almost impossible to enforce. o 0: Private property outlawed, all belongs to the state. People do not have access to courts. Corruption is endemic.
Corrupt	***Freedom from Corruption Score*** • **Defined:** "erodes economic freedom by introducing insecurity and uncertainty into economic relationships." • **Calculation:** This score comes from Transparency International's Corruption Perceptions Index (CPI) for 2009, which measures corruption levels. The CPI is a 10 point scale. The freedom from corruption score was simply created by multiplying the CPI by 10. If a country wasn't included in the CPI, then other "qualitative information from internationally recognized and reliable sources" was used.
Labor	***Labor Freedom Score*** • **Defined:** "a quantitative measure that looks into various aspects of the legal and regulatory framework of a country's labor market. It provides cross-country data on regulations concerning minimum wages; laws inhibiting layoffs; severance requirements; and measurable regulatory burdens on hiring, hours, and so on." • **Calculation:** Six different factors were equally weighted and converted on a scale of 0 to 100. The six factors were: (1) ratio of minimum wage to the average value added per worker; (2) hindrance to hiring additional workers; (3) rigidity of hours; (4) difficulty firing redundant employees; (5) legally mandated notice period; and (6) mandatory severance pay. Data was gathered from the World Bank's *Doing Business* study. The following equation was then used to generate each factor score: $\text{Factor Score}_i = 50\ \text{factor}_{average}/\text{factor}_i$ where the world average was divided by the data for country i and then multiplied by 50. The labor freedom score was then generated by averaging the converted values for the six different factors.

(II) Summary Statistics

The following output was used to form *Table B*:

```
. sum pcgdp logpcg literacy unemp overall bus trade fiscal spend monetary invest financial property corrupt labor
```

Variable	Obs	Mean	Std. Dev.	Min	Max
pcgdp	164	14368.84	15209.6	355	83841
logpcg	164	8.952741	1.229285	5.872118	11.33668
literacy	164	84.29085	17.91402	21.8	100
unemp	164	13.32073	14.88873	.5	95
overall	164	60.9378	10.84064	22.1	89.7
bus	164	66.32805	17.12371	10	99.9
trade	164	75.99634	11.46066	33.4	90
fiscal	164	77.05732	12.20269	37.6	99.9
spend	164	64.43415	23.57778	0	98.1
monetary	164	74.32927	9.060945	0	87.9
invest	164	52.10366	23.61491	0	95
financial	164	50.06098	19.07354	10	90
property	164	45.4878	23.61644	5	95
corrupt	164	42.07317	20.83372	14	94
labor	164	61.47378	17.48864	20	98

(III) Summary of Residuals

The following output was used to form *Table C*:

```
. sum error, detail
```

Residuals

Percentiles	Smallest		
1% -1.553507	-1.595716		
5% -1.065035	-1.553507		
10% -.8590232	-1.298239	Obs	164
25% -.4371503	-1.249865	Sum of Wgt.	164
50% .0696644		Mean	1.87e-09
	Largest	Std. Dev.	.6424933
75% .3790785	1.400218		
90% .8053448	1.40412	Variance	.4127977
95% 1.109759	1.775465	Skewness	.1768794
99% 1.775465	2.229508	Kurtosis	3.460917

(IV) Tests for A.1 (Normality)

Skewness/Kurtosis Test:

```
. predict error, resid

. predict yhat, xb

. predict sfe, stdf

. predict syhat, stdp

. sktest error
```

Skewness/Kurtosis tests for Normality

				joint	
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
error	164	0.3388	0.1861	2.70	0.2590

JB Test:

```
. jb error
Jarque-Bera normality test:  2.307 Chi(2)  .3156
Jarque-Bera test for Ho: normality:
```

Shapiro-Wilk Test:

```
. swilk error
```

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
error	164	0.98853	1.441	0.832	0.20282

Shapiro-Francia Test:

Shapiro-Francia W' test for normal data

Variable	Obs	W'	V'	z	Prob>z
error	164	0.98722	1.740	1.156	0.12388

(V) Tests for A.3 (Homoskedasticity)

White's Test:

```
. imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(90)     =     94.63
         Prob > chi2  =    0.3486

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	94.63	90	0.3486
Skewness	12.20	12	0.4296
Kurtosis	0.74	1	0.3884
Total	107.58	103	0.3592

Breusch-Pagan test:

```
. estat hettest literacy unemp bus trade fiscal spend monetary invest financial
>   property corrupt labor

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: literacy unemp bus trade fiscal spend monetary invest
                    financial property corrupt labor

         chi2(12)     =    25.65
         Prob > chi2  =   0.0120
```

(VI) Correcting for Heteroskedasticity

Robust Correction:

```
. reg logpcg literacy unemp bus trade fiscal spend monetary invest financial
> property corrupt labor, robust

Linear regression                               Number of obs =     164
                                                F( 12,   151) =   52.51
                                                Prob > F      =  0.0000
                                                R-squared     =  0.7268
                                                Root MSE      =  .66753
```

logpcg	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
literacy	.02763	.0037895	7.29	0.000	.0201426	.0351173
unemp	-.0080879	.0043751	-1.85	0.066	-.0167323	.0005565
bus	.0058216	.0048571	1.20	0.233	-.003775	.0154182
trade	.0044574	.0070596	0.63	0.529	-.0094908	.0184057
fiscal	.0101974	.0054983	1.85	0.066	-.0006661	.0210609
spend	-.0009205	.0026486	-0.35	0.729	-.0061537	.0043127
monetary	.0090423	.0095046	0.95	0.343	-.0097369	.0278215
invest	-.0034922	.0041462	-0.84	0.401	-.0116842	.0046999
financial	.0032053	.0044182	0.73	0.469	-.0055243	.0119348
property	.0039339	.0066809	0.59	0.557	-.0092662	.017134
corrupt	.0251437	.0074444	3.38	0.001	.010435	.0398525
labor	-.005804	.0033757	-1.72	0.088	-.0124737	.0008658
_cons	3.74953	.8152033	4.60	0.000	2.138852	5.360207

VWLS Correction:

```
. gen Le2=ln(error*error)

. reg Le2 literacy unemp bus trade fiscal spend monetary invest financial proper
> ty corrupt labor
```

Source	SS	df	MS		
Model	100.147385	12	8.34561543	Number of obs	= 164
Residual	638.649119	151	4.22946437	F(12, 151)	= 1.97
				Prob > F	= 0.0303
Total	738.796504	163	4.53249389	R-squared	= 0.1356
				Adj R-squared	= 0.0669
				Root MSE	= 2.0566

Le2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
literacy	-.0083057	.0118244	-0.70	0.483	-.0316683	.015057
unemp	-.0025413	.0121486	-0.21	0.835	-.0265446	.021462
bus	-.0072307	.0148056	-0.49	0.626	-.0364836	.0220221
trade	-.0113164	.0202846	-0.56	0.578	-.0513947	.0287619
fiscal	.0276965	.0166019	1.67	0.097	-.0051056	.0604985
spend	-.0037795	.0085231	-0.44	0.658	-.0206194	.0130604
monetary	-.043632	.0230671	-1.89	0.060	-.089208	.0019441
invest	-.0158313	.0137304	-1.15	0.251	-.0429598	.0112972
financial	.011496	.0168222	0.68	0.495	-.0217413	.0447332
property	.0291876	.0247098	1.18	0.239	-.019634	.0780093
corrupt	-.0228177	.0255084	-0.89	0.372	-.0732173	.0275818
labor	-.0141166	.0109253	-1.29	0.198	-.0357027	.0074696
_cons	1.956055	2.314677	0.85	0.399	-2.617281	6.529392

```
. predict xdelta, xb

. gen sig = (exp(xdelta))^.5

. vwls logpcg literacy unemp bus trade fiscal spend monetary invest financial
> property corrupt labor, sd(sig)
```

```
Variance-weighted least-squares regression          Number of obs   =     164
Goodness-of-fit chi2(151)  =  515.36                Model chi2(12)  = 2104.21
Prob > chi2                =  0.0000                Prob > chi2     =  0.0000
```

logpcg	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
literacy	.0286444	.0020285	14.12	0.000	.0246686	.0326202
unemp	-.0058786	.0020586	-2.86	0.004	-.0099133	-.0018439
bus	.0007066	.0023584	0.30	0.764	-.0039158	.005329
trade	.014967	.0037148	4.03	0.000	.0076861	.0222478
fiscal	.0055583	.0023445	2.37	0.018	.0009633	.0101534
spend	-.0007969	.001326	-0.60	0.548	-.0033957	.0018019
monetary	.0001049	.0048622	0.02	0.983	-.0094249	.0096346
invest	-.0017794	.0022423	-0.79	0.427	-.0061742	.0026153
financial	.0017079	.0022275	0.77	0.443	-.002658	.0060738
property	.0131236	.0034755	3.78	0.000	.0063118	.0199355
corrupt	.0135047	.0035489	3.81	0.000	.006549	.0204605
labor	-.0063439	.0015502	-4.09	0.000	-.0093821	-.0033056
_cons	4.284764	.4272016	10.03	0.000	3.447465	5.122064

(VII) Possible Correction for Multicollinearity

VWLS Corrected for Multicollinearity ("Property" Removed):

```
. predict e, resid

. gen le2 = ln(e*e)

. reg le2 literacy unemp bus trade fiscal spend monetary invest financial corrupt labor
```

Source	SS	df	MS		
Model	81.6512294	11	7.42283904	Number of obs	= 164
Residual	756.525987	152	4.97714465	F(11, 152)	= 1.49
				Prob > F	= 0.1399
Total	838.177216	163	5.14219151	R-squared	= 0.0974
				Adj R-squared	= 0.0321
				Root MSE	= 2.231

le2	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
literacy	-.0118266	.0127926	-0.92	0.357	-.037101	.0134477
unemp	-.0010615	.0131204	-0.08	0.936	-.0269835	.0248604
bus	-.0035347	.0158534	-0.22	0.824	-.0348561	.0277867
trade	-.0219149	.0214987	-1.02	0.310	-.0643898	.0205599
fiscal	.0254962	.0180091	1.42	0.159	-.0100842	.0610766
spend	.0005182	.0092448	0.06	0.955	-.0177467	.018783
monetary	-.0371589	.0249327	-1.49	0.138	-.0864183	.0121006
invest	-.0115038	.0147074	-0.78	0.435	-.0405611	.0175536
financial	.0182279	.017582	1.04	0.302	-.0165088	.0529646
corrupt	.0088058	.0142874	0.62	0.539	-.0194218	.0370334
labor	-.016045	.0118505	-1.35	0.178	-.0394579	.0073679
_cons	1.742264	2.510934	0.69	0.489	-3.218573	6.703101

```
. predict xdelt, xb

. gen Sig = (exp(xdelt))^.5

. vwls logpcg literacy unemp bus trade fiscal spend monetary invest financial
> corrupt labor, sd(Sig)
```

```
Variance-weighted least-squares regression          Number of obs   =     164
Goodness-of-fit chi2(152)  =  546.57                Model chi2(11)  = 1890.20
Prob > chi2                =  0.0000                Prob > chi2     =  0.0000
```

logpcg	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
literacy	.0281507	.0020832	13.51	0.000	.0240677	.0322338
unemp	-.0091054	.0021732	-4.19	0.000	-.0133647	-.004846
bus	.0026895	.0023346	1.15	0.249	-.0018863	.0072652
trade	.0115248	.003624	3.18	0.001	.0044219	.0186278
fiscal	.0045637	.0023991	1.90	0.057	-.0001384	.0092659
spend	-.0016487	.0012634	-1.31	0.192	-.0041249	.0008274
monetary	.0047733	.0047415	1.01	0.314	-.0045199	.0140664
invest	.0001082	.002158	0.05	0.960	-.0041214	.0043378
financial	.0033088	.0022327	1.48	0.138	-.0010672	.0076848
corrupt	.0237517	.0018956	12.53	0.000	.0200364	.027467
labor	-.0064706	.0015714	-4.12	0.000	-.0095504	-.0033908
_cons	4.262332	.4415006	9.65	0.000	3.397007	5.127657