Economic Freedom:
The Relationship between a Government's Political System and Wealth

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A World View of Mathematics and Data Analysis
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Abstract

Each country in the world has their unique form of economy. Many of them are modeled after each other or are slight variations in attempt to emulate the successes of those nations. However, the type of economy that performs the best in terms of wealth has always been, and still is a matter of discussion, each form having its own benefits and downfalls. This paper attempts to answer the question of which type of economy has the most success in terms of wealth and wealth distribution using data collected from nations across the globe. Does government involvement to protect citizens benefit the financial conditions of the country, or do laissez-faire policies really allow the market to self regulate itself to its own benefit. Due to less restrictions, it is expected that countries that allow greater amounts freedom for individuals to act in their own markets have higher productivity. In economies with less freedom, it is expected that the government regulations and interventions help aid those in need and reduce the proportion of the nation in poverty. Using hypothesis testing, it was proven that the productivity of the nation's citizens increased with the degree of economic freedom. It was also found that there was no correlation between poverty rates and economic freedom, instead other factors were more prevalent over this data set.

Background

Capitalism, Socialism, Communism. These words have been the spurs of debate amongst politicians, professors, economists, and businessmen alike. The idea of what kind of role officials should play in the economic institutions of a country has always been a hot button- creating controversy in any conversation. From the birth of the Communist Manifesto, the Truman Doctrine and the entire Containment movement, to the start of civil wars throughout the globe; the idea of how the government should participate in the market has caused innumerable conflicts.

Even after all the dissidence, it would seem that the issue on which political system is best for a country would be resolved by now. However, the issue presses on. This is evidenced by the clash over Obama's health care bill; opposition calls out the bill as a socialistic reform that could ultimately derail the United State's great free market economy, while supporters say the bill is a necessary structure in improving the quality of life. Protestors stand with pickets for hours passionately arguing for their respective sides. The reason behind the passion is obvious. A nation's economy affects almost every aspect of both itself and its citizens. The type of political system a government utilizes (communism, capitalism, etc.) is certainly a vital determining factor for the characteristics of the economy in which the citizens live. The purpose of this paper is to take data from the entire world and determine which form of economy has had the most success in terms of wealth.

To do this, a method of comparing different economic types must be established. On the spectrum of Economic types, it can be observed that the level of government involvement through regulation, laws, taxation, or ownership is the main component that changes. For

example: communism involves state-controlled production, and government ownership of property. Capitalism on the other hand involves citizen-controlled production, and private ownership of property. Although these two systems are opposites of each other, both strive to create a successful nation. The amount of government involvement can translate into the amount of economic freedom an individual has, the ability for a citizen to control his or her own consumption, production, etc. without forceful means. Therefore, it can be indicated that communist type societies with large amounts of government involvement would have smaller amounts of economic freedom while capitalist or free-trade societies would have higher amounts of economic freedom for its citizens.

Research Question

Which form of economy is the most successful in terms of wealth and wealth distribution? The type of economy is measured by the Index of Economic Freedom created by the Heritage Foundation and Wall Street Journal from the year 2009 where less economic freedom suggests more socialistic practices and more economic freedom suggests more capitalistic practices. Wealth of the country is measured by the Gross Domestic Product per Capita to determine on average the dollar amount of goods being produced by each citizen. Wealth distribution is determined through the percentage of the nation's population living in poverty. A polar distribution of wealth (explained by the adage "the rich get richer and the poor get poorer") should show a higher percentage of people in poverty while a condensed distribution of wealth should mean a higher percentage in the middle class and a lower percentage in poverty.

Methods

The research conducted in this paper attempts to find a correlation between economic freedom and the gross domestic product per capita of a country, as well as the correlation between economic freedom and the percentage of a country's population in poverty. The Index of Economic Freedom was used as the numerical measurement of economic freedom of citizens residing in his or her country. The scale goes from 0 to 100; 0 meaning the individual has no economic freedom and 100 meaning the individual has full economic freedom. This index has already been created by the Heritage Foundation in collaboration with the Wall Street Journal. The score is based off of 10 components: business freedom, trade freedom, fiscal freedom, government spending, monetary freedom, investment freedom, financial freedom, property rights, freedom from corruption, and labor freedom. Each component is scored and given equal weight in the final score.

Both percentage of population and gross domestic product per capita were taken from the CIA world fact book from the most recent data available. The data was then paired together with the indexes of economic freedom in a table by country. After plotting the data of economic freedom verses gross domestic product per capita or percent of population in poverty, the strength of correlation can be found using the correlation coefficient (denoted as "r"). Value "r" can be found through the equation:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$$

The "x" value is pieces of data from one list of the two variable set, and the "y" value is the corresponding pieces of data from the second list. The "n" value is the sample size, or the

number of data sets collected. The closer the absolute value of "r" to one, the stronger the correlation between the two sets of data. A positive "r" value would signal a positive correlation while a negative "r" value would signal a negative correlation. By squaring the correlation coefficient, it can be determined the percent of data that can be found by the line of best fit.

These lines help statisticians predict one value based off of the other in the data sets using the already given points. The two types of lines of best fit used in this paper are exponential regression ( ) and linear regression ( ). Use the following equations to find the "m" and "b" value to find the linear regression line of best fit.

$$\mathrm{m} = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} \qquad \mathrm{b} = \frac{\sum y}{n} - m\frac{\sum x}{n}$$

To find the exponential regression line of best fit, the least squares method is used.

After finding the strength of the correlation between the data sets and finding the lines of best fit, use hypothesis testing to determine the type and strength of the correlation. There are two types of hypotheses: null hypothesis (and alternate hypothesis (. The test is always run on the null hypothesis to conclude whether or not to reject it. Because the null and alternate hypotheses are opposite of each other, when is rejected, it is inferred that the is correct. If the has failed to be rejected, then it can be inferred that the is correct. To test the null hypothesis, we must determine what kind of test must be run (one tailed-right, one tailed-left, or two tailed). To do this, we use the alternate hypothesis to determine which test to use. When a number, then it is a right tailed test. If a number, then it is a left tailed test. If a number, then it is a two-tailed test. The type of test denotes which side to shade (right tailed shades right, two tailed shades both sides) of the critical value at the α-level or level of

significance at 0.05 (standard). The degrees of freedom is needed to determine the correct critical value. To find the correct degrees of freedom, simply use the equation:

$$\text{degrees of freedom} = n - 2$$

Value "n" is the sample size. If the degrees of freedom is above 30, then a z-distribution is used. For smaller sample sizes use t-distribution.

After shading one or both sides of the critical value, determine the test statistic value (z* or t*) with the equation:

$$t^* \text{ or } z^* = \frac{\quad}{\quad}$$

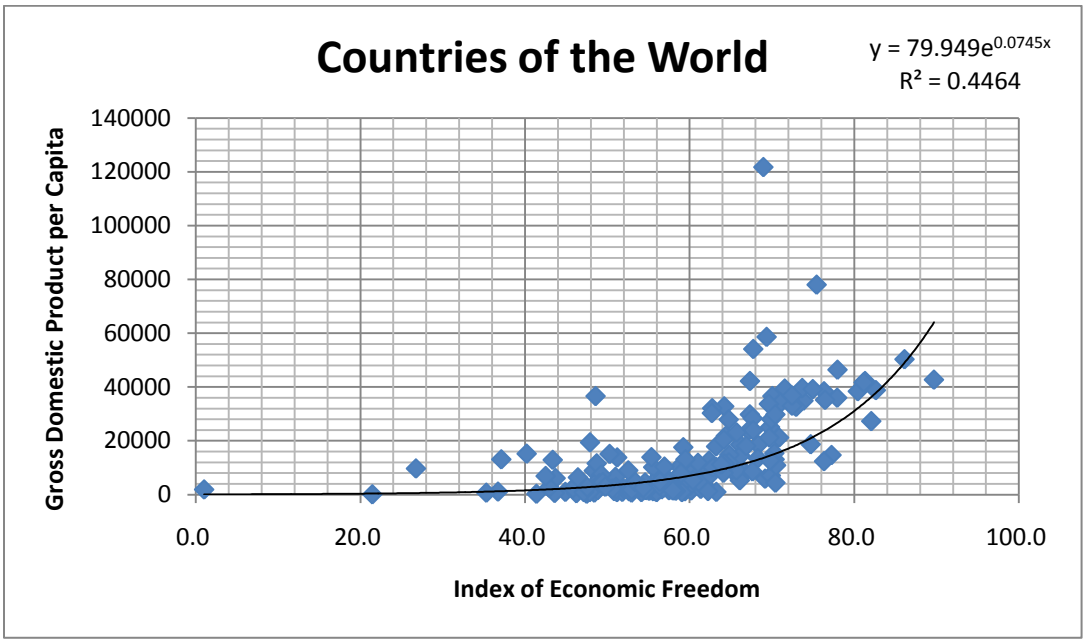
The test statistic will fall to the left or the right of the critical value. If it is in the rejection region (the side shaded), then the null hypothesis will be rejected. If it does not fall in the rejection region, then the null hypothesis has failed to reject. By finding the legitimacy behind the hypotheses, a conclusion can be drawn from the data and correlations.

To reduce the effects of culture, natural resources, and other factors, on the economic differences between each country, the data was analyzed together as a whole and then broken down into similar regions (ex. Countries in the Middle East compared together separately from countries in Eastern Asia).

Results

See appendix for all data gathered and extra graphs.

After plotting all data:



The exponential regression line of best fit was calculated using the least squares method through computational means.

The "r" value is .668 which is not too far off from one, meaning that this correlation between economic freedom and gross domestic product per capita is a moderate correlation. The " " value of .4464 means that 44.6% of the data can be explained by the line of best fit:

$$y = 79.949e^{0.0745x}$$

The next step is to use hypothesis testing to ensure the correlation between the economic freedom and gross domestic product per capita is positive.

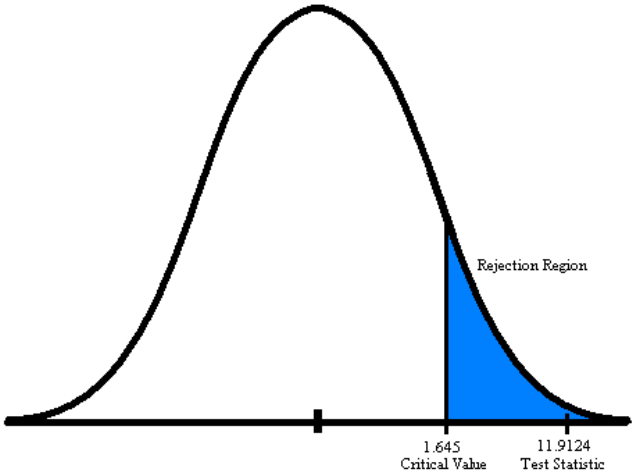
Null Hypothesis: (correlation is zero or negative)

Alternate Hypothesis: > 0 (claim: correlation is positive- right tailed test)

Degrees of Freedom: n – 2 = 178 – 2 = 176. Because 176 ≥ 30, use the z-distribution test statistic. Critical value at α-level of 0.05 and degrees of freedom is 1.645.

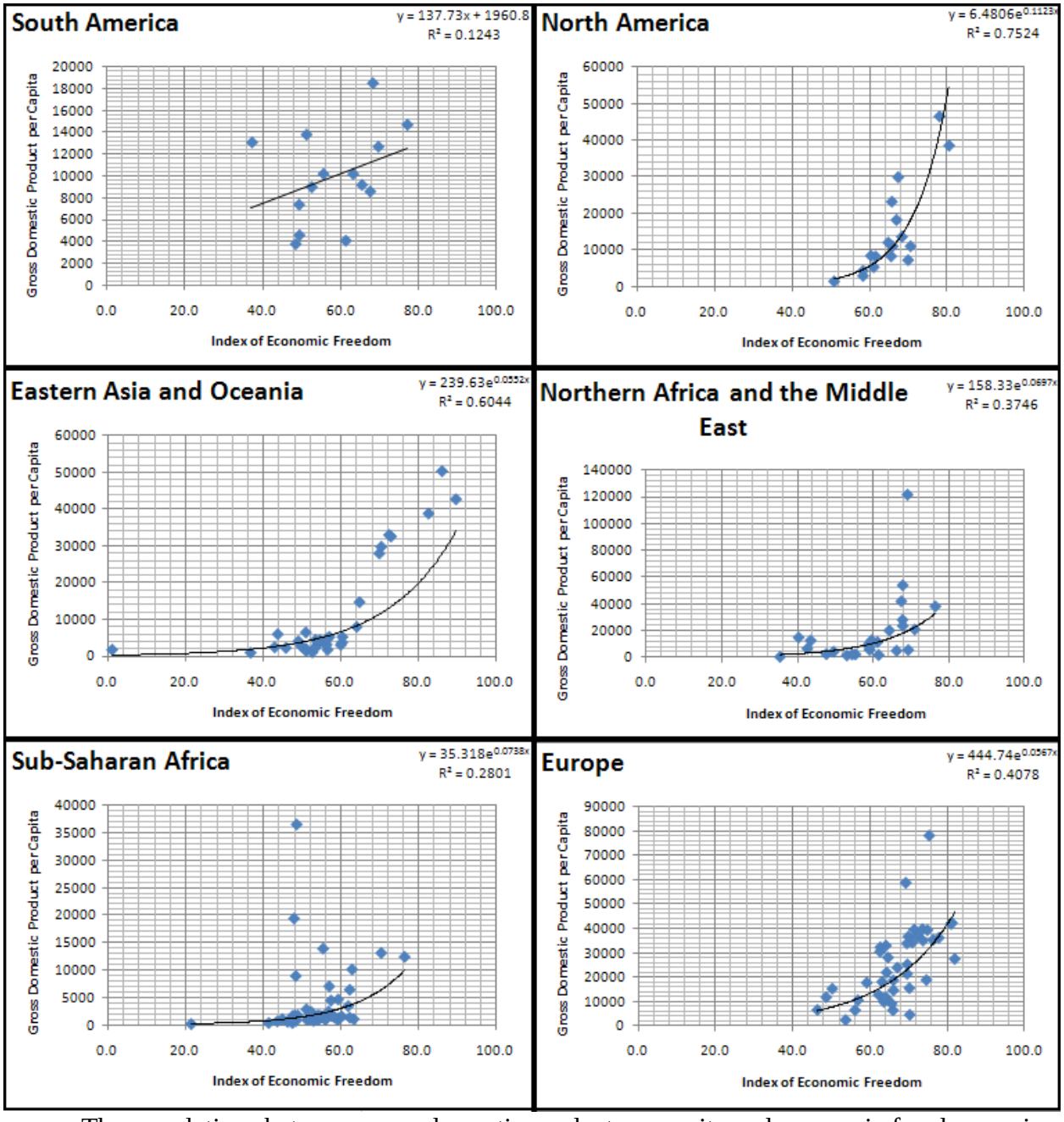
$z^* =$ $\qquad$ $z^* =$

$z^* = 11.9124$



The test statistic falls to the right of the critical value and in the shaded region. This means the null hypothesis is rejected. There is not sufficient evidence to prove that the correlation is zero or negative. This means that there is enough evidence to prove that there is a positive correlation between economic freedom and economic success through gross domestic product per capita.

The correlation coefficient and lines of best fit were found individually for the regions of world and the countries within the regions:

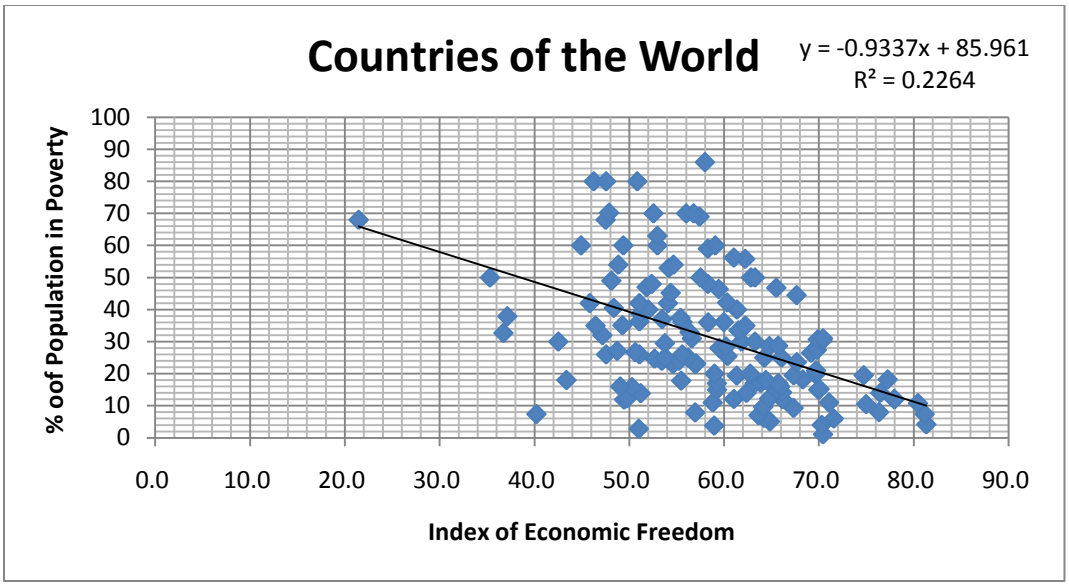


The correlations between gross domestic product per capita and economic freedom varies from region to region. In North America, Eastern Asia and Oceania, the correlation is relatively strong, while in other regions such as South America and Sub-Saharan Africa, the correlation is quite weak. After hypothesis testing, the test statistics are as followed:

Country	Test Statistic	Critical Value
South America	1.3584	1.771
North America	6.522	1.761
Eastern Asia and Oceania	10.192	1.645
North Africa and the Middle East	3.6301	1.717
Sub-Saharan Africa	4.0902	1.645
Europe	5.1823	1.645

Using this data, it can be concluded that there is not enough evidence at the α-level of 0.05 to say that South America has a positive correlation. The rest of the regions can be said to have a positive correlation between economic freedom and wealth in terms of gross domestic product per capita.

Because government systems with more communistic practices tend to distribute wealth amongst citizens and prevent either extremes in personal wealth, the hypothesis that will be tested will be whether or not a more socialistic economy (less economic freedom) would have less of their population in poverty verses a free trade economy (more economic freedom).



Here, the correlation coefficient is quite weak, with only 22.64% of the data being explained by the line of best fit. Using hypothesis testing, it can be determined whether or not the correlation between economic freedom and people in poulation is really a positive correlation (the more capitalistic an economy, the higher the proportion of people in poverty).

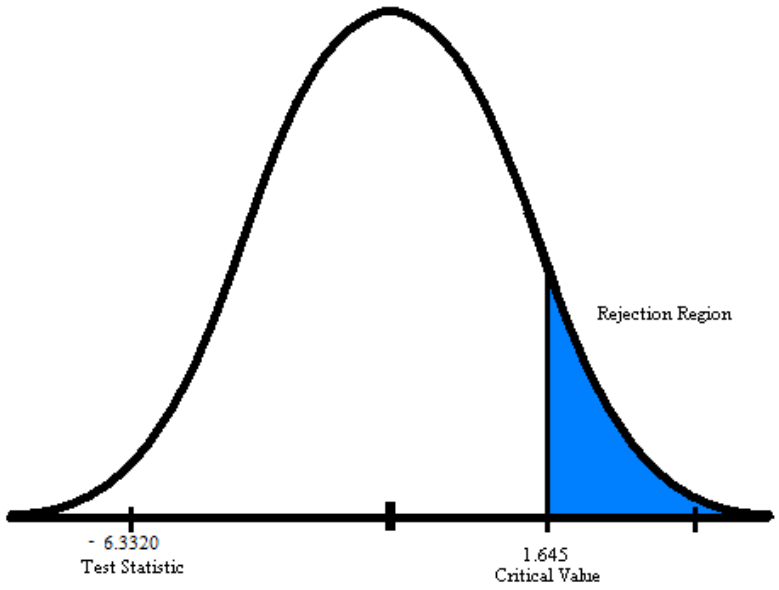
Null Hypothesis: (correlation is zero or negative)

Alternate Hypothesis: > 0 (claim: correlation is positive- right tailed test)

Degrees of Freedom: n – 2 = 139 – 2 = 137. Critical Value is 1.645 with an α-level of 0.05 (standard).

$z^* =$ ——— $z^* =$ ———

$z^* = -6.3320$



The test statistic falls in the left of the critical value outside of the rejection region meaning the null hypothesis has failed to be rejected. This means it is impossible to say that there is a negative correlation between economic freedom and percentage of population in poverty.

After separating the countries into regions to prevent interference of differences in culture and natural resources, the process is repeated to determine the correlation between economic freedom and percentage of population in poverty. After hypothesis testing, all null hypotheses on correlation between economic freedom and poverty failed to reject. This means that there is little to no negative correlation between economic freedom and poverty.

Conclusions

After the hypothesis testing proved that there is a positive correlation between economic freedom and gross domestic product per capita, it is shown that there is indeed a relationship between the type of economy and wealth. The more capitalistic the practices, the more the amount of goods and wealth traded within the nation. In capitalist economies, regulations, taxation, and government intervention is minimal. Although it would seem possible that businesses would run each other over competing for the top profit without these rules holding them back, the lesser amount of government presence seems to spur on the economy and encourages trade between businesses. Without as many regulations or taxes, an individual's will to work and produce is not hindered. Potentials have a higher chance to be reached. Instead of being taxed after reaching success, the individual in a capitalistic society has more opportunity to produce at his or her own will. In an economy with more regulations, taxation, or government intervention, an individual with the capacity to work in his or her own field may be hindered to do so. For example, if a business gets large, taxations or competition regulations could hold it back from contributing as much to the economy as possible.

However, under further inspection of the data, one region failed the hypothesis testing while a couple other regions had very poor correlation coefficients. However, in these regions, many of the areas are extremely rural and trade may be non-existent due to physical barriers or trade could be through bartering instead of monetary exchange. This means although trade is still free, it would not contribute anything to the gross domestic product per capita. This could skew the actual amount of wealth within the nation in terms of monetary value instead of goods.

After the hypothesis testing was done on the correlation between economic freedom and percentage of people in population, it can be concluded that there is little to no relationship between the two data sets. Although a large part of communism is to eliminate classes between wealth and give every citizen an adequate standard of leaving, it seems it remains largely ineffective as because there is no relation between that and poverty levels. There are many countries with little amounts of economic freedom with large amounts poverty, as there are many countries with large amounts of economic freedom with the same problem. Perhaps the communistic approach remains ineffective as a whole and although the citizens may be condensed so that the majority have the same amount of wealth, the wealth could be a small amount close to poverty level due to the approaches of socialistic practices. In free market economies, the success of the individual is said to be dependent on the work of the individual. The idea is lazy people will be poor and hard workers will be successful. In this case, the poverty level will be largely dependent of the culture and work ethic of the citizens instead of the type of economy. This can help explain different countries with high amounts of economic freedom have such varied amounts of poverty.

If the culture of citizens actually does have such an impact on these economic indicators, how much does it affect it and in which ways? Even when regions were grouped together to reduce the impact of differences between culture and geographical, the variation was still large. Is it the major economic shifter, the drive behind the financial institutions, and monetary exchange?

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Appendix

South America

Country	2009 Overall	GDP per Capita	% in Poverty
Argentina	51.2	13800	13.9
Barbados	68.3	18500	N/A
Bolivia	49.4	4600	60
Brazil	55.6	10200	26
Chile	77.2	14700	18.2
Colombia	65.5	9200	46.8
Dominica	63.2	10200	30
Ecuador	49.3	7400	35.1
Guyana	48.4	3800	N/A
Paraguay	61.3	4100	19.4
Peru	67.6	8600	44.5
Suriname	52.5	9000	70
Uruguay	69.8	12700	27.4
Venezuela	37.1	13100	37.9

North America

Country	2009 Overall	GDP per Capita	% in Poverty
Bahamas, The	67.3	29800	9.3
Belize	61.5	8100	33.5
Canada	80.4	38400	10.8
Costa Rica	65.9	10900	16
Cuba	26.7	9700	N/A
Dominican Republic	60.3	8300	42.2
El Salvador	69.9	7100	30.7
Guatemala	61.0	5200	56.2
Haiti	50.8	1300	80
Honduras	58.3	4200	59
Jamaica	65.5	8200	14.8
Mexico	68.3	13500	18.2
Nicaragua	58.3	2800	48
Panama	64.8	11900	28.6
Saint Lucia	70.5	10900	N/A
Saint Vincent and The Grenadines	66.9	18100	N/A
Trinidad and Tobago	65.7	23100	17
United States	78.0	46400	12

Eastern Asia and Oceania

Country	2009 Overall	GDP per Capita	% in Poverty
Australia	82.6	38800	N/A
Bangladesh	51.1	1600	36.3
Bhutan	57.0	5400	23.2
Burma	36.7	1100	32.7
Cambodia	56.6	1900	31
China, People's Republic of	51.0	6600	2.8
Fiji	60.3	3900	25.5
Hong Kong	89.7	42700	N/A
India	53.8	3100	25
Indonesia	55.5	4000	17.8
Japan	72.9	32600	N/A
Kiribati	43.7	6100	N/A
Korea, Democratic People's Republic of	1.0	1900	N/A

Korea, Republic of	69.9	28000		15
Laos	51.1	2100		26
Macau	72.5	33000	N/A	
Malaysia	64.8	14800		5.1
Maldives	49.0	4200		16
Micronesia	50.6	2200		26.7
Mongolia	60.0	3200		36.1
Nepal	52.7	1200		24.7
Papua New Guinea	53.5	2400		37
Philippines, The	56.3	3300		32.9
Samoa	60.4	5400	N/A	
Singapore	86.1	50300	N/A	
Solomon Islands	42.9	2600	N/A	
Sri Lanka	54.6	4500		23
Taiwan	70.4	29800		1.08
Thailand	64.1	8100		9.6
Timor-Leste	45.8	2400		42
Tonga	53.4	4600		24
Vanuatu	56.4	4800	N/A	
Vietnam	49.8	2900		12.3

Northern Africa and the Middle East

Country	2009 Overall	GDP per Capita		% in Poverty
Afghanistan	n/a	800		36
Armenia	69.2	5900		26.5
Azerbaijan	58.8	10400		11
Bahrain	76.3	38400	N/A	
Cyprus	70.9	21200	N/A	
Egypt	59.0	6000		20
Eritrea	35.3	700		50
Iran	43.4	12900		18
Iraq	n/a	3600		25
Israel	67.7	28400		23.6
Jordan	66.1	5300		14.2
Kazakhstan	61.0	11800		12.1
Kuwait	67.7	54100	N/A	
Kyrgyz Republic	61.3	2100		40
Lebanon	59.5	13100		28
Libya	40.2	15200		7.4
Oman	67.7	23900	N/A	
Pakistan	55.2	2600		24
Qatar	69.0	121700	N/A	
Saudi Arabia	64.1	20400	N/A	
Syria	49.4	4600		11.9
Tajikistan	53.0	1800		60
Tunisia	58.9	8000		3.8
Turkmenistan	42.5	6900		30
United Arab Emirates	67.3	42200		19.5
Uzbekistan	47.5	2800		26
Yemen	54.4	2500		45.2

Sub-Saharan Africa

Country	2009 Overall	GDP per Capita	% in Poverty
Algeria	56.9	7000	23
Angola	48.4	8900	40.5
Benin	55.4	1500	37.4
Botswana	70.3	13100	30.3
Burkina Faso	59.4	1200	46.4
Burundi	47.5	300	68
Cameroon	52.3	2300	48

Cape Verde	61.8		3400		30
Central African Republic	48.4		700	N/A	
Chad	47.5		1600		80
Comoros	44.9		1000		60
Congo, Democratic Republic of	41.4		300	N/A	
Congo, Republic of	43.2	N/A		N/A	
Cote d'Ivoire	54.1		1700		42
Djibouti	51.0		2800		42
Equatorial Guinea	48.6		36600	N/A	
Ethiopia	51.2		900		38.7
Gabon	55.4		13900	N/A	
Gambia, The	55.1		1400	N/A	
Ghana	60.2		1500		28.5
Guinea	51.8		1000		47
Guinea - Bissau	43.6		600	N/A	
Kenya	57.5		1600		50
Lesotho	48.1		1700		49
Liberia	46.2		500		80
Madagascar	63.2		1000		50
Malawi	54.1		900		53
Mali	55.6		1200		36.1
Mauritania	52.0		2100		40
Mauritius	76.3		12400		8
Morocco	59.2		4600		15
Mozambique	56.0		900		70
Namibia	62.2		6400		55.8
Niger	52.9		700		63
Nigeria	56.8		2400		70
Rwanda	59.1		900		60
Sao Tome and Principe	48.8		1700		54
Senegal	54.6		1600		54
Seychelles	47.9		19400	N/A	
Sierra Leone	47.9		900		702
South Africa	62.8		10100		50
Sudan	n/a		2300		40
Swaziland	57.4		4400		69
Tanzania	58.3		1400		36
Togo	47.1		900		32
Uganda	62.2		1300		35
Zambia	58.0		1500		86
Zimbabwe	21.4		100		68

Europe

Country	2009 Overall	GDP per Capita		% in Poverty
Albania	66.0	6300		25
Austria	71.6	39400		6
Belarus	48.7	11600		27.1
Belgium	70.1	36600		15.2
Bosnia and Herzegovina	56.2	6300		25
Bulgaria	62.3	12600		14
Croatia	59.2	17600		17
Czech Republic	69.8	25100	N/A	
Denmark	77.9	36000		12.1
Estonia	74.7	18700		19.5
Finland	73.8	34900	N/A	
France	64.2	32800		6.2
Georgia	70.4	4400		31
Germany	71.1	34100		11
Greece	62.7	32100		20
Hungary	66.1	18600		12
Iceland	73.7	39600	N/A	
Ireland	81.3	42200		4.2

Italy	62.7	30300	N/A	
Latvia	66.2	14500	N/A	
Liechtenstein	n/a	122100	N/A	
Lithuania	70.3	15400		4
Luxembourg	75.4	78000	N/A	
Macedonia	65.7	9000		28.7
Malta	67.2	23800	N/A	
Moldova	53.7	2300		29.5
Montenegro	63.6	9800		7
Netherlands, The	75.0	39200		10.5
New Zealand	82.1	27300	N/A	
Norway	69.4	58600	N/A	
Poland	63.2	17900		17
Portugal	64.4	21800		18
Romania	64.2	11500		25
Russia	50.3	15100		15.8
Serbia	56.9	10400		7.9
Slovakia	69.7	21200		21
Slovenia	64.7	27900		12.3
Spain	69.6	33700		19.8
Sweden	72.4	36800	N/A	
Switzerland	81.1	41700		7.4
Turkey	63.8	11200		17.11
Ukraine	46.4	6400		35
United Kingdom	76.5	35200		14