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The Resource Curse and Economic Freedom: A Bayesian Perspective

Danielle M. Roberts
Claremont McKenna College

CLAREMONT MCKENNA COLLEGE

THE RESOURCE CURSE AND ECONOMIC FREEDOM:
A BAYESIAN PERSPECTIVE

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PROFESSOR CAMERON SHELTON

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DEAN NICHOLAS WARNER

BY

DANIELLE ROBERTS

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Dedicated to my Brother. You have always been there when I needed you most.

Be Happy

Have Fun

Keep Smiling

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Abstract

The literature addressing the resource curse has been extensive. Many studies have put forth theories to explain the curse, but these theories are often refuted by new studies. Recently, there has been a theory that natural resource abundance leads to decreased economic freedom, which causes slower economic growth. Many of these studies have using frequentist testing to arrive at their conclusions. Although frequentist testing is widely used, there are several drawbacks. In particular, there is no way of addressing model uncertainty. Unless a study is able to incorporate every significant explanatory variable, the results will suffer from omitted variable bias. Recently, researchers have been applying Bayesian statistics to address the problem of model uncertainty. In this study, we apply Bayesian Model Averaging (BMA) to build a growth model, and see if natural resources have a negative effect on growth. We take the implementation of BMA a step further to see if there is an indirect negative effect of natural resources on economic freedom. However, contrary to previous studies, we were not able to find a negative relationship between resource abundance and economic freedom.

I. Introduction

Since the 1980's, the study of the "resource curse" has grown tremendously. Sachs and Warner (1995) were two early proponents of the notion that resource rich countries tend to experience slower growth than countries which lack abundant natural resources. Despite arguments against the existence of the curse, literature has evolved into establishing explanations about why this so-called resource curse occurs. Wantchekon (1999) put forward a theory suggesting resource rich countries are more likely to be authoritarian and this could be a cause of slower growth. Looking at 141 countries from 1950 to 1990, Wantchekon found that the 1% increase in the ratio of primary exports to GDP was correlated with an 8% increase in the probability of an authoritarian government. Many studies since, like Ross (2001) have found similar results, however, Haber et. al (2011) was able to refute this idea. Through the use of time series analysis, Haber was able to mitigate the, "country specific and time invariant heterogeneity," which past studies did not take into account[1]. Without being able to take this into account, Haber viewed the past literature as suffering from omitted variable bias and therefore drawing conclusions on false data. If these country specific omitted variables are positively correlated with the dependent and explanatory variable, the bias will conflate the two effects and give more weight to the included variable. In this case, if geographic location, or any other country specific time invariant factor is positively correlated with the primary exports to GDP ratio and the probability of an authoritarian government, then researchers might conclude that resources lead to authoritarian governments. By using a more sophisticated model, Haber was able eliminate those effects and reached the opposite conclusion of Wantchekon. Omitted variable bias violates the assumptions that our error term is not correlated with the dependent variables. With panel data, we can we mitigate this violation by using methods such as first differencing or demeaning the data. Demeaning works by averaging a given variable over all time periods by country. Then, for each data point we take the difference of the original data point and the average. This will eliminate any country specific effects.

New theories have emerged suggesting resource abundance can lead to adverse management of the economy which in turn leads to slower economic growth. Alkhater (2012) suggests that rentier states may become rentier predatory states. A rentier predatory state is one in which, "the interaction between political power and resource

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[1]Everhart, Stephen S. 2010. "The Resource Curse and Private Investment: A Theoretical Model of the Impact of Corruption." *Education, Business and Society: Contemporary Middle Eastern Issues* 3, no. 2: 117-35. Accessed February 15, 2015. http://www.emeraldinsight.com/.

abundance is expected to lead to poor economic outcomes in the long run."[2] Poorly run governments have the power to negatively affect both capital and labor accumulation. Perhaps resource abundance doesn't lead to authoritarian regimes, but it could lead to mismanaged ones. It is widely understood that the Solow model incorporates both capital and labor accumulation. Therefore, if a government's mismanagement leads to a reduction on one of these variables, then this may be a channel to explain the existence of a resource curse.

Research into natural resources effect on education suggest that natural resource levels have an inverse relationship with the rate of return of education. Shao and Yang (2014) argue that if the return to education is low enough, then individuals would rather spend their income on consumption rather than invest it in education. Since the government plays a large role in education, the education policies they enact will have a strong say in the rate of return of education. A government might not be supplying strong enough opportunities for education or providing demand of high skilled workers. Wadho (2014) provides an example of how the abundance of a natural resource can lead to disincentives of investing in education. The existence of substantial natural resources is likely to lead to rent seeking behavior. In this case, rather than allocate investment to education, governments investment more in resource extraction. There is a more immediate benefit from resource extraction investment, whereas, payoffs from education investment could take years to be noticed. Gylfason (2001) was able to find an inverse

[2] Alkhater, Khalid R. 2012. "The Rentier Predatory State Hypothesis: An Empirical Explanation of the Resource Curse." *Journal Of Economic Development* 37, no. 4: 29-60. *EconLit*, EBSCO*host*(accessed February 15, 2015).

relationship with resource abundance and school enrollment. Gylfason explains this relationship by suggesting governments might become too confident in their ability to grow economically, and therefore neglect institutions crucial to long term growth

There is also a possibility the channel by which the resource curse can hinder the economy might not be labor but investment instead. Everhart (2010) gives a theoretical model to explain the impact of the "rentier predatory state" on private investment. He shows that resource abundance leads to the corruption, which effects private investment, and therefore GDP growth. Everhart's discussion gives us a way of explaining both the direct and indirect effects of corruption on the economy. Beginning with a Neo-Classical classical growth model, he showed that if technical progress is a function of governance, and governance is a function of the quality of bureaucracy and corruption, then corruption could directly affect technical progress through its relationship with governance or indirectly through its relationship with bureaucracy. This method is not unique to technical accumulation, but rather, Everhart extends this same idea to stock of human, government, and private capital accumulation. Shao and Yang (2014), Wadho (2014), and Gylfason (2001) provide theories to explain the effects on human capital accumulation. Everhart turns to focus much of his paper on the effects on private investment. He finds that the rate of corruption lowers the steady state levels of all capital stock, and therefore concludes that in highly corrupt countries, "the marginal benefit to reducing corruption outweighs virtually any other policy action.[3]" This is a strong

[3] Everhart, Stephen S. 2010. "The Resource Curse and Private Investment: A Theoretical Model of the Impact of Corruption." p. 130.

conclusion backed up by his theoretical model, and the goal of this paper provide an empirical study to test Everhart's claim. As Everhart mentions, finding strong measures of governance are extremely difficult, especially when people disagree about what good governance is. For this reason we need to find statics that capture many of the ideas Everhart provides in his theoretical model. Some statistics, like Economic Freedom Indexes, might provide valuable insight into the resource curses effect on economy.

There is large section of the development literature that shows a relationship between economic freedom and economic growth. Gwartney et el. (1996), Hanke and Walters (1997), Green et al (2002), and Weede (2006) all provide evidence that economic freedom leads to the economic growth. Many studies have utilized such economic freedom indexes as the Fraser Institute's "Economic Freedom of the World Index," and the Heritage Foundation's, "Index of Economic Freedom," to show the positive relationship between these two variables. These indexes provide measurable statistics relating for many of the ideas Everhart touched on in his theoretical model. For example, The Fraser Institutes Economic Freedom of the World Index is broken down into five main categories: Size of Government, Legal System and Property Rights, Sound Money, Freedom to Trade Internationally, and Regulations. Each of these categories are then broken down into subcategories[4]. It is important to notice that these variables provide measurable statistics for a governments influence on the economy. Therefore, if we can find evidence that resource abundance harms any of these categories, then we may have found a channel to explain the resource curse.

[4] A full list of the Categories and Subcategories are listed in Appendix 6

Currently, there have been a number of articles assessing resource abundance's effect on economic freedom. For example, using cross-sectional data, Campbell and Snyder (2012) were able to show a direct negative relationship between abundant natural resources and economic growth. However, when they controlled for economic freedom, they were able to eliminate the significance resources directly had on growth, which suggests omitted variable bias was present when they did not control for economic freedom. Campbell and Snyder go on to show that economic freedom can be directly negatively affected by resource abundance. This provides some evidence supporting Everhart's theoretical explanation. However, similar to the argument given by Haber, Campbell and Snyder's use of cross sectional data may impair their ability to make strong conclusions about the effect of resource abundance on growth over time. Without being able to account for any time invariant effects, they could be over estimating the significance of resource abundance on economic freedom.

The goal of this study is to build a model that addresses these concerns in the current literature. One way we address the shortcomings of the past literature is by our choice of statistical models. All of the research mentioned thus far has utilized classical methods of least squared regression whether it be panel data of cross sectional. However, the issue of omitted variable bias becomes noticeable in these methods. It is impossible to completely eliminate omitted variable bias, but we can try to mitigate its affects. The first reason this is impossible is due to the lack of information available. For example, the World Bank has a large dataset of variables that might lead to long term economic growth, however the information is not available for every country and every year, and therefore researchers have to eliminate some variables and/or countries. Another reason it is impossible to include all significant variables is because there is an incomplete theoretical understanding of what leads to economic growth. Perhaps there are variables that researchers have never considered that actually help with economic growth. Finally, if we have too many explanatory variable, and not enough data points then we can run into the curse of dimensionality. This curse implies that the space created by the explanatory variables cannot be properly filled by our data points. This can hinder our ability to properly draw conclusions. For these three reasons, any one regression will be flawed. Fernandez, Ley, and Steel (2001) tried to address this problem by implementing Bayesian Modeling (BMA). Moral-Benito (2012) took this implementation a step further by applying it to panel data. In this paper, we attempt to implement BMA to determine whether an abundance of natural resources leads to decreased economic freedom which in turn decreases economic growth.

II. Bayesian Model Averaging (BMA)

In order to be able to interpret our results properly, we need to have a strong understanding of the underlying mathematical theory of Bayesian Statistics. Bayesian Statistics provide a completely different approach to statistical inference than Classical, or Frequentist, testing. With Frequentist testing, researchers are stuck with a fixed set of parameters. This allows for a rather simple computations, but relies heavily on the idea that the choice of explanatory variables chosen are the best set of variables possible. By best, we mean that the set does not omit any significant variables. As we have seen this becomes practically impossible in the setting of economic growth models. Let's first examine how a frequentist test is set up and then explain how BMA can overcome many the problems with frequentist testing. Frequentist models tend to be of the form

$$y = \beta X + \varepsilon \ , y = \begin{pmatrix} y_1 \\ \vdots \\ y_n \end{pmatrix}, X = \begin{pmatrix} x_{11} & \cdots & x_{1p} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{np} \end{pmatrix}, \beta = \begin{pmatrix} \beta_1 \\ \vdots \\ \beta_n \end{pmatrix}, \varepsilon = \begin{pmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_n \end{pmatrix} \tag{1}$$

Where *n* is the total number of observations and *p* is the total number of explanatory variables. However, suppose we did not include an explanatory variable, q, even though β_q would be positive and significant if it were included in the regression. Then we will introduce omitted variable bias, which will have the following effect on our coefficients

$$\tilde{\beta}_i = \hat{\beta}_i + \hat{\beta}_q \tilde{\delta} \qquad \forall\ i = i, \dots, p, \tag{2}$$

where $\hat{\beta}_i$ and $\hat{\beta}_q$ are the estimated coefficients when both variables are included in the regression, and $\tilde{\delta}$ is the coefficient when variable q is regressed on variable i. If this is only regression we were to run then all the variables which are positively related with y and q will be overestimated. Therefore if we are any way uncertain with our model choice, which as we explained is always the case in growth models, then we have to question the validity of our conclusions. Furthermore, if we already had a large number of variables in the model then including q could possibly lead to the dimensionality problem we described earlier. Luckily we can attempt to address this issue using BMA.

A great way to eliminate these problems is to run several regressions with a different combinations of variables and build a distribution of the coefficient's value and significance. This way we are constantly updating our idea of what the true values really are. Suppose we choose a total of P variables. For consistency, think of P as containing all of the variables 1, …, p, q, and any other variables we believe might be significant.

Furthermore, suppose we have a prior assumption that the perfect growth model contains five explanatory variables, but any combination is equally likely to be the best model. Hence, one of $K = \binom{P}{5}$ different regressions could be our best model. Let's consider the model space to be all of these different regressions denoted by M_j where $j = 1, \dots, K$. Thus, some of the regressions will contain the both the variables p and q, some will contain just one of the variables, and some will contain neither of these variables. Therefore we can see the different effects that omitting a variable has on the other variables, and update our estimate accordingly. The best way to update our conclusion is by using Bayes' rule. If we denote our data as X then we can obtain a posterior model probability

$$p(M_i|X) = \frac{p(X|M_i)\pi(M_i)}{\sum_{j=1}^{K} p(X|M_j)\pi(M_j)} \qquad (3)$$

where $p(X|M_j)$ is the probability of seeing the data we provided we assume that M_j is the best model.[5] In other words, if we assume M_j contains the specific $\beta = \begin{pmatrix} \beta_1 \\ \vdots \\ \beta_n \end{pmatrix}$ such that this model provides the best explanation of the dependent variable, then what is the probability X would be the data. In addition, $\pi(M_j)$ is our prior assumption for the likelihood distribution. In our example, our prior assumption is that each combination has a 1/K chance of being the best model. Now, we have a way of measuring the likelihood that M_j is the best model, we can use that create a weighted average.

[5] Zeugner, Stefan. Bayesian Model Averaging with BMS. May 5, 2011. Accessed March 18, 2015. http://cran.r-project.org/web/packages/BMS/vignettes/bms.pdf.

Each model will produce a coefficient for all the variables included. We can use those values and weight them by the probability that model is the best one to obtain a posterior expected value for the coefficient. The posterior mean of each coefficient β_i can be written as

$$E(\beta_i|X) = \sum_{k=1}^{K} P(M_k|X)E(\beta_i|M_k, X) \quad (4)$$

where $E(\beta_i|M_k, X)$ is the value of the coefficient β_i given the specific regression M_k.[6] Following Leamer (1978) and Moral-Benito (2012) they obtain the variance by weighting each variance by the likelihood

$$V(\beta_k|X) = \sum_{k=1}^{K} P(M_k|X)V(\beta_k|M_k) + \sum_{k=1}^{K} P(M_k|X)(E(\beta_k|M_k, X) - E(\beta_k|X))^2 \quad (5)$$

Notice the equation for the variance finds a weighted average of the variance across each models and across the different models. This allows us to take into account the possibility that two models might provide highly significant coefficients, but if the values are also drastically different then there is still uncertainty.[7]

Although we can never be 100% sure, we can obtain a posterior probability that a variable contributes to economic growth by summing up the posterior probabilities for every model that include the given variable as follows

$$Posterior\ Inclusion\ Probability\ (PIP) = P(\beta_i \neq 0|X) = \sum_{\beta_i \neq 0} p(M_k|Y).\text{[8]} \quad (6)$$

[6] Ibid
[7] Moral-Benito, Enrique. 2012. "Determinants of Economic Growth: A Bayesian Panel Data Approach." *Review Of Economics And Statistics* 94, no. 2: 566-579. *EconLit*, EBSCO*host*(accessed March 12, 2015).
[8] Zeugner, Stefan. Bayesian Model Averaging with BMS.

In other words, if we ran all K regressions and β_i was significant in 15 of those, then we can sum up the 15 posterior model probabilities to obtain a measurement of significance. We now have a way measuring robustness and value for each explanatory variable, but we have not yet applied this to our research question. In the next section use these ideas in the context of GDP growth and provide an explanation for any assumptions we have had to make.

III. BMA in the Context of Growth Models

In the previous section, we described an example where we assumed the best model contained five explanatory variables. This is an extremely strict prior assumption and one that is likely to be false. In fact, we are totally uncertain what the correct number of the explanatory variables should be. Due to this uncertainty, our model space increases drastically. In this study, we have chosen 29 potential explanatory variables. A full list of explanatory variables can be found in Appendix 1, and we will provide a more detailed explanation of our variable choice in section IV. Since we are uncertain how many of these explanatory variable are significant the model space for our experiment is 2^{29} or approximately 5.3 x 10^8. To see how this number is derived, we will first begin with a simple example and then expand. Suppose, we were sure that five covariates is the best number. The equation for calculating the total number of these combination, or 29 choose 5 is

$$\binom{n}{k} = \binom{29}{5} = \frac{29!}{5!(29-5)!} = 142{,}506. \qquad (7)$$

However, sense we are unsure how many of our covariates, if any, are linked with GDP growth we have no way of knowing the value of k. Therefore we have to sum over all the values of $0 \leq k \leq 30$. Therefore, we get

$$\sum_{k=0}^{29} \binom{29}{k} = 2^{29} \approx 5.3 \times 10^{8}. \quad (8)$$

As you can see our model space is extremely large, and visiting every model in the model space would not only be extremely computationally extensive, but also unnecessary. There are many models contained in the model space which are obviously silly to include. The empty model { }, as well as models which contain only one regressor are included in the model space, but do not have any real application. Luckily, we have a way of deal with this issue to cut down on computation time.

We will utilizes a Markov Chain Monte-Carlo method to deal with this issue known as a birth/death algorithm. Initially, it chooses a covariate at random. It runs the regression containing only that covariate. Maybe the regression looks like

$$GDP_{growth} = \beta_1(population\ density) \quad (9)$$

Then, with replacement, the algorithm chooses another variable from the list of 30. If the variable is different from population density say, life expectancy, then the regressor is added to the initial model and we get

$$GDP_{growth} = \hat{\beta}_1(population\ density) + \hat{\beta}_2(life\ expectancy). \quad (10)$$

This process continues to add new regressors as long as they are not already in the model. As the model gets larger, it becomes more likely that the variable chosen will already be in the model. If the variable is already in the model, then it will be removed and the model will be run without that variable.[9] This is where the idea of birth and death becomes obvious. A birth implies we are adding a new variable to the model that was not previously there, but the death implies a variable is removed from the model if it was already there.

The process of birth and death will ultimately mean we will converge to some "Mean Number of Regressors," and although it is possible to sharply deviate from this mean, it is unlikely. Since this process is random, it is unreasonable to think that the first few iterations will be significant in any way.[10] Until the algorithm starts to converge to a mean, the first few models will likely look like the equations (9) and (10), which have little relevance to our final conclusions. Therefore, it is common to simply ignore the first X amount of combinations, and start calculating the models once we get closer to the mean number of regressors. We refer to X as "Burn-in" value. We will use a burn-in of 1000. Since we are going to run 1,000,000 iterations through the model space, the burn-in value of 1000 (.1%) will be sufficient.

This leads us to our choice of iterations. As just mentioned we chose to complete 1,000,000 iterations. Appendix 4 shows the different results based on our iteration choice. By the law of large numbers and the Central Limit Theorem it is clear to see convergence of the posterior inclusion probability, posterior mean, and posterior standard deviation. This shows us that even though we only visited a fraction of a percent of the total model

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[9] Zeugner, Stefan. Bayesian Model Averaging with BMS.
[10] Ibid

space, we can still be confident that we are providing a strong approximation of what variables lead to GDP growth.

Finally, the mean number of regressors is largely dependent on our prior assumptions. Consider the idea that initially we believe every variable is equally likely to be in our final model. If we let θ be fixed number that represents the likelihood any given variable is in the "true model" then our mean number of regressors would be 30θ. Since θ is fixed then the number of regressors will be clustered around this mean. However, if we allow θ to be a random variable then we can decrease our dependence on our prior assumption. Following the lead of Ley and Steel (2008), we have set our prior assumptions to be a random variable with a binomial-beta distribution. This means that the probability of that any variable is included has a beta distribution with parameters a and b such that a = 1 and b = (k-m)/m.[11] In this case, we have to specify a prior assumption for the model size, m. Graphs 1 and 2 shows the distributions of the posterior model size for both a fixed θ with a prior model size assumption of 14.5 and a random $\theta \sim \mathrm{Be}(1{,}14.5)$ with a prior model size assumption of 14.5. In this example, the fixed prior puts more emphasis on the models around size 14.5, whereas the random prior puts equal weight to all possible sizes. As you can see, the results are similar, however, the fixed prior does not follow a uniform distribution. By putting more weight on models of size 12-15, we decrease the level of uncertainty. By setting our prior assumption to be

[11] Ley, Eduardo, and Mark F. J. Steel. 2009. "On the Effect of Prior Assumptions in Bayesian Model Averaging with Applications to Growth Regression." *Journal Of Applied Econometrics* 24, no. 4: 651-674. *EconLit*, EBSCO*host* (accessed April 10, 2015).

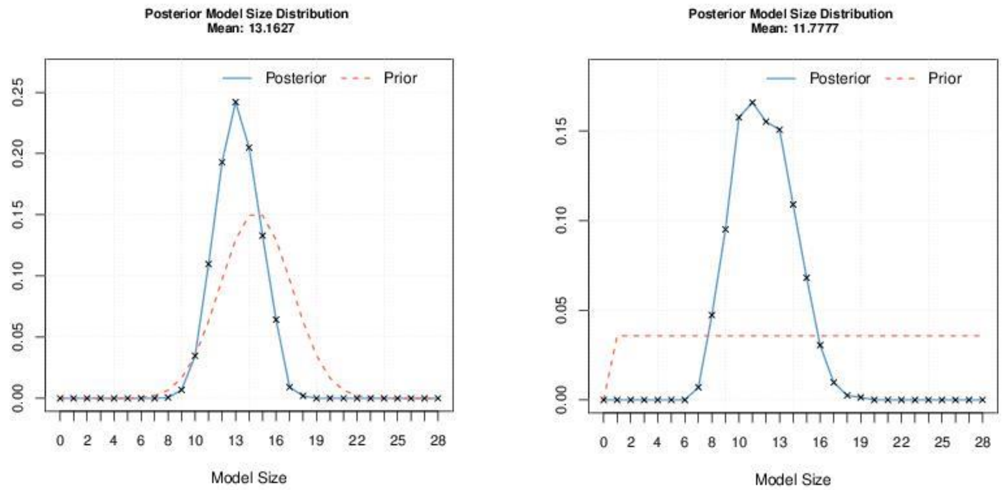

Figure 1- Fixed Prior (Left) and Random Prior (Right). By letting our prior assumption be random we are allowing for more uncertainty in the model.

random, we are allowing for more uncertainty in our model. There is one caveat that must be mentioned. Following the overwhelming empirical evidence, a lag variable for GDP growth is included in all of the models. This can be seen in the sharp jump between 0 and 1 in graph 2. Now that we have explained the procedure, it is time to look at the results and begin to draw conclusions.

IV. Panel Data

In order to determine what factors lead to long term growth, our sample must stretch over a long enough period of time. If the time horizon is too short we will pick up business cycle effects. On the other hand, data for many countries does not go back very far. Therefore we need to find a balance that includes the most countries and spans a long enough time period. The time period of 1986-2010 was chosen because this created the most access to data. Moral-Benito (2012) discussed a similar issue with his choice of time periods. We follow his lead by averaging over five year periods. This allows us to decrease the effects of serial autocorrelation. For example if we included population density for every year, then the data for 2000 would be strongly correlated with the data from 1999. By averaging over all 5 year time periods we can mitigate some of that effect. We need to find a balance between the number of variables with the number of countries. For example it would not make much sense to add a variable we think my influence GDP growth when it restricts the number of countries in our panel to, say, twenty. Regardless of the variables we choose employ we are restricted by the data available. This is a problem inherent in all growth models, and is one that BMA can help address. To help alleviate this problem we have eliminated any variables that Moral-Benito found to have a low PIP, which also drastically decreased the number of countries in our sample. The result is a balanced panel of 29 variables, including the dependent variable, with 78 countries.

The data in the panel came from three sources. The first source is the Penn World Table 6.2. This source provided important macro-economic variables. This is where data for GDP, consumption and investment were found. The second source is the World Bank's World Development Indicators Database. This source provided the demographic variables used in the model. These variables include life expectancy, age distributions and employment ratios. In addition, we were able to find Barro- Lee information about education through the World Bank's Database.

The final source, and arguably the most important for this study, is the Fraser Institute's Economic Freedom of the World Index. This source provides us with a comprehensive assessment of a countries legal and economic rights. The Index is broken down into five categories: Size of Government, Legal System and Property Rights, Sound Money, Freedom to Trade Internationally, and Regulation. The Size of Government

index takes into account how much the government interferes in the economy. If the government is making most of the decisions or, "countries rely on the political process to allocate resources and goods and services," then they will receive a lower score in the index.[12] Based on Everhart's theoretical model, resource decrease private investment and therefore it would seem reasonable to think that resource abundance should be negatively correlated with this Index.

Everhart's theory also extends to Legal System and Property Rights. Corruption would lead to poor institution and in turn cause a misallocation of resources. Countries with strong institutions will receive a higher score with this index, so we should see a negative relationship between natural resources and the Legal System and Property Rights index.[13]

The next category, Sound Money, provides a rating for a countries ability to control inflation. If inflation is not controlled, economic freedom will be hindered by to inability to plan for the future.[14] People will have no idea what their purchasing power is going to be due to the inflation volatility. Therefore, we should see a positive relationship between this index and economic growth.

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[12] Gwartney, James, Robert Lawson, and Joshua Hall. "Economic Freedom of the World: 2014 Annual Report." 2014. Accessed March 20, 2015. www.freetheworld.com.

[13] Ibid

[14] Ibid

The next Index is the Freedom to Trade Internationally. In an increasingly globalized world, the ability to trade internationally should be critical to economic growth. For this reason, a high score in this index represents low tariffs and a few other constraints to International trade.[15] Therefore, we would expect this to have a positive relationship with growth. In addition, Everhart's argument that natural resources lead to corruption could be evident in this index. If a country has many impediments, such as tariffs, then corruption could set in. Officials may be bribed in order to overcome the many regulations.

Finally, the last category of the Index is Regulation. In particular, this index focuses on credit, labor, and product markets. Regulations are thought to introduce distortions and inefficiencies into the market. Credit regulations refer to the ease that private banks have to provide loans to private individuals.[16] Labor Regulations looks at the institutions like minimum wage and union contracts and business regulations look at the ease of setting a new business, such as licensing and taxes. This category is of great importance to Everhart's theory as he argues corruption could lead to heavy distortions on private investment, private investment is likely to be a function of the ease of doing business.

V. Results

Having now explained the methodology and our choice of variables, we can now turn to the results of our BMA. Table 1 gives a full list of the variables along with their

[15] Ibid

[16] Ibid

posterior inclusion probabilities, means, and variances. In addition, Appendix 6 provides a graphical representation of the the importance of each variable. We have established that our prior assumption was a random variable with an average of 14.5. Following Doppelhofer et al (2000) we will consider a variable to be robust if the PIP is greater than .50 = 14.5/29. Initially, we assumed any variable had a .50 chance of being significant. Therefore, if we find that the PIP has increased, then our data provides evidence to increase our initial assumption that the variable contributes to economic growth. In addition, using equations (4) and (5) we can obtain a distribution for each variable where the post mean is the expected value and the post standard deviation provides us with measurement for the spread of the distribution.

A. Demographic Variables

There were a few variables that we found to have very different Posterior Inclusion Probabilities than Moral-Benito (2012). Life expectancy had a staggeringly high PIP in Moral-Benito's work, but as he argues, "We think it cannot be viewed as robust because its posterior standard deviation is bigger than it posterior mean."[17] This is

[17]Moral-Benito, Enrique. 2012. "Determinants of Economic Growth: A Bayesian Panel Data Approach." *Review Of Economics And Statistics* 94, no. 2: 566-579. *EconLit*, EBSCO*host*(accessed March 12, 2015). p 575

Table 1 – BMA Panel Data Results

Variable	PIP	Post Mean	Post SD
gdpgrowth	1.000	0.071	0.037
cc	0.999	-0.009	0.002
Pop15	0.998	-0.021	0.005
Popgrowth	0.970	-0.109	0.030
Urpopgrowth	0.960	0.052	0.016
percenttertiary25	0.948	-0.012	0.004
ci	0.867	0.006	0.003
SouMoney	0.845	0.016	0.009
Pop65	0.801	-0.027	0.016
Reg	0.669	0.028	0.023
TradeInt	0.548	-0.012	0.013
cg	0.396	-0.004	0.005
Lifeexp	0.368	0.003	0.005
Urpop	0.324	-0.002	0.004
LegPropRight	0.222	-0.004	0.009
Avgprischool15	0.205	-0.012	0.033
SizGov	0.122	0.002	0.007
Rurpopgrow	0.090	-0.001	0.008
Avgschool15	0.088	-0.004	0.024
Popden	0.081	0.000	0.000
POP	0.071	0.000	0.000
openk	0.068	0.000	0.000
Avgschool25	0.062	0.001	0.011
Percentsecschool	0.059	0.000	0.001
pi	0.058	0.000	0.000
Avgsecschool15	0.055	0.002	0.022
Avgsecschool15_19	0.043	0.000	0.003
Energyimp	0.039	0.000	0.000

Number of observations 390, random prior, 1,000,000 Iterations, 1,000 burn-in

consistent with our conclusions as well. However, on top of the standard deviation being larger than the posterior mean, our model only gives Life Expectancy a PIP of .3526. Furthermore, Population Growth and Urban Population Growth both saw a decrease from Moral-Benito's results, but they are still fairly high in our model, and the conclusions don't change much with respect to the sign of the coefficient, the posterior mean, and the posterior standard deviation.

Several of the variables that appear to be significant might not have the causal relationship we are intending to look for. For example, the percentage of the population over the age of 25 with a tertiary degree is highly significant but has a negative value. This does not appear to be consistent with our intuition. It does not seem reasonable to think that increasing the education of you labor force should decrease economic growth. Researchers have found mixed results when determining the relationship between education and growth[18]. They provide several explanations for these mixed results. One explanation could be that the quality of tertiary educations are not the same across different countries, but we find the most compelling argument to be that growth is determined by ensuring a countries highly educated workers are in job that maximize their potential.[19] Therefore, growth is more determined by what jobs these highly skilled workers are doing than their education alone. Furthermore the Percentage of the Population over 65 likely has a reverse causal relationship. Birth rates are likely to drop as a country becomes more developed, and therefore the average age of the population will begin to increase. For this reason, these variables provide us with only a very limited insight into the factors that cause economic growth. Now that we have considered the robust demographic variables, we will now turn to the economic variables.

B. Economic Variables

As usual, the lag variable for GDP growth is highly significant. However, our posterior mean is not only twice the size of Moral-Benito's data, but it is also the opposite sign. This is somewhat puzzling, but it could be due to our choice in time periods. Lag GDP is not only variables from the Penn Tables to highly significant. Both Consumption share of GDP and Investment share of GDP were highly significant. Investment share of GDP has a positive coefficient. This would imply that economic growth is driven from investment and not consumption, which has a negative coefficient.

[18] "The Road Not Traveled : Education Reform in the Middle East and North Africa." *MENA Development Report*, 2008. Accessed March 15, 2015. http://siteresources.worldbank.org/INTMENA/Resources/EDU_Flagship_Full_ENG.pdf.

[19] Ibid

There is an interesting interaction between these two variables in politics, as many politicians will argue that stimulating consumption will lead to investment and growth. At least from this model, it would seem like focusing on investment is a key to economic Growth.

C. Economic Freedom Variables

Finally, this brings us to the Economic Freedom variables. Of these, Access to Sound Money was the most significant and had a positive sign. This variable controls for a countries ability to control inflation. Therefore, this positive sign is consistent with our intuition. A higher score in this index corresponds to a low and stable inflation rate, which in turn, help lead to economic growth. The second most significant economic freedom variable is the Regulation Index. With a positive sign we can interpret this variable as follows: countries whose banking system are privately owned, allow market forces to determine labor market equilibrium, and do not impede business activities through bureaucratic corruption are likely to see higher economic growth The last of the economic freedom variables to be considered robust is the Freedom to Trade Internationally Index, and the sign was negative. At first, this sign seemed contradictory to our intuition. However, after more thought, tariffs and constraints on capital moving in and out of a country are put in place to help bolster domestic production. If imports were too cheap they could crowd out domestic production which could have long term repercussions.

These variables provide us with the ability to test if natural resource abundance hinders economic freedom. We have clearly shown there are facets of economic freedom that do lead to economic growth. This is consistent with the prior research which uses frequentist tests (Campbell et al 2012, Panahi et al 2014). Since our data is consistent with prior studies, we can feel confident that there is some relationship between economic freedom and economic growth. The goal of employing Bayesian Modeling was to address the issue of uncertainty. We made no prior assumptions about the relationship between economic freedom and growth, but our results back up this claim. Interestingly, our variable for resource abundance, Percent of Energy Imported, has the lowest PIP of any of our explanatory variables. In addition, we are not very confident about what the sign of the variable should be. By looking at figure 2, the distribution of the Energy Imports variable straddles the origin. Therefore, we can conclude that the resource curse, at least with respect to energy, cannot be explained with a direct relationship with economic growth. For this reason, we will now build a new model where the explanatory variable is an economic freedom Index, and test whether natural resources negatively impacts this dependent variable. The next section provides an overview of the variable used in this new regression.

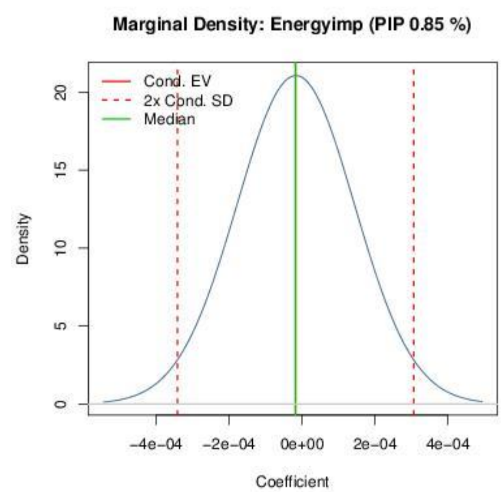

Figure 2 - Distribution of Energy Imports Coefficient when regressed on GDP

VI. Natural Resources and Economic Freedom

In order to properly decide which economic freedom variable to include as the dependent, we need to consider two criteria: does the theoretical literature back up this choice and does this variable lead to growth? The first idea is important because we want to be able to test the theoretical claims of the past research. With the second idea, we want to make sure we are finding an indirect negative effect economic growth. If we were to choose one the economic freedom variables that was not robust and find a negative relationship with resource abundance, then we still haven't explained why resource abundant countries have slower economic growth. Following Everhart's theoretical argument, we believe the best variable to use is the Regulations Index. Everhart argues that resource abundance could lead to corruption in bureaucratic roles which would lead to slower economic growth.

The Regulation Index fulfills both of these criteria. Regulations was the second most significant of the five Freedom variables in our growth model. Although, the Sound Money Index has a higher PIP, we do not have as much theoretical evidence to support testing this variable. Regulations seem like a strong gauge of the economic freedom of a country. This variable takes into account, "the extent to which the banking industry is privately owned," which could have large repercussions on a countries growth if the government had strong control of the banking sector and this exactly what Everhart concludes in his model.[20] For example, the amount of investment, both leaving and

[20] Everhart, Stephen S. 2010. "The Resource Curse and Private Investment: A Theoretical Model of the Impact of Corruption." *Education, Business and Society: Contemporary Middle Eastern Issues* 3, no. 2: 117-35. Accessed February 15, 2015. http://www.emeraldinsight.com/.

coming into the country, could be greatly swayed by the interests of government officials. In addition, Everhart considers the detrimental effect this corruption could have on the labor and business market as well. The existence of natural resources could greatly sway the return to education. The labor force might realize that there are well paying jobs for lower skilled workers in the extraction industry, or corruption might make it incredibly difficult for entrepreneurs to start a business. The regulations variable takes all of these into account, and because of this, we feel it is the best variable to test for the existence of the resource curse.

For this model we have included our variable of interest: resource abundance. This is the same as the variable included our original growth model. In addition, we have included a few other control variables we thought might be important to regulations. The first of these variables is Foreign Direct Investment. As mentioned, we think there might be drastic implications on investments coming into the country if there are terrible Regulations. We are hoping this variable can give us some insight into this claim. Secondly, we have included variables for both Exports and Imports as a percent of GDP. Finally, we included a few education statistics because we believe that education would likely lead to more freedoms and better regulations. A full list of variable can be seen in Appendix 2.

VII. Results of Freedom Regression

Table 2 – BMA Results Using Regulations Index as Dependent

Variable	PIP	Post Mean	Post SD
Imports	0.983	0.056	0.016
Avgprischool15	0.900	0.585	0.238
Avgschool15	0.206	0.071	0.183
Avgsecschool15	0.175	-0.039	0.180
Avgschool25	0.140	0.019	0.059
percenttertiary25	0.096	0.002	0.008
Percentsecschool	0.066	0.001	0.003
FDI	0.060	0.000	0.002
Energyimp	0.029	0.000	0.000
Avgsecschool15_19	0.029	0.000	0.011
Exports	0.028	0.000	0.001

The only variables appear to be significant are the Imported Goods as a percentage of GDP and Average years of primary School at age 15. The prior assumptions are the same as the first model. That is, we allow the probability that a regressor is in the "true model" to be a random variable with a binomial-beta distribution.

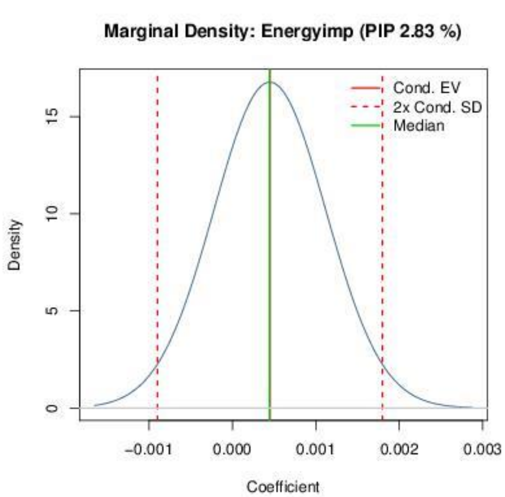

Figure 3 - Distribution of Energy Imports Coefficient when regressed on Regulations Index

The one difference, however, is that the number of variables is only 11. Therefore, there are only 2^11 = 2048 different models, so it is not computationally intensive to run through all of them. As you can see from table 2, our energy variables have a very low PIP. Furthermore, based on the distributions shown in figure 3, the sign of these variables is actually positive. This would suggest that increasing natural resource abundance is actually beneficial for regulations.

VIII. Discussion

This is not the first study to find a similar result that the resource curse is not as pronounced as one might have guessed. Campbell et al (2012) was also able obtain similar results. First, they built a cross sectional model and found evidence of a resource curse. Using the same variable for natural resource abundance, Energy Imports, they found a statistically significant positive correlation. At first glance, this seems like a strong conclusion. The coefficient for Energy Imports was significant at a 1% significance level.[21] However, once they control for economic freedom, the Energy Imports coefficient becomes insignificant. They go on to show that resource abundance has detrimental effects on economic freedom, and are able to support their findings with prior theoretical literature. There is no doubt their findings are significant, but we have to rigorously asses their methods, before conclude their results are worthy of attention. After all, policy decisions could be influenced by the findings of these types of studies. If it became widely accepted that natural resources have a detrimental effect on economic freedom, then heads of state from countries with high levels of resource abundance should focus on improving economic freedom. However, this conclusion could be greatly influenced by the type of model employed in the study.

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[21] Campbell, Noel D., and Thomas J. Snyder. 2012. "Economic Growth, Economic Freedom, and the Resource Curse." *Journal Of Private Enterprise* 28, no. 1: 23-46. *EconLit*, EBSCO*host*(accessed February 12, 2015).

As we discussed earlier, there are many drawbacks from using cross sectional regressions. There are many effects from country specific time invariant factors that need to be accounted for. Since, cross sectional data has no time component, there is now way of removing these effects. Our use of panel data is one way of dealing with this problem. Furthermore, the choice of variables in a frequentist model, will have drastic implications on the conclusions found. Campbell et al (2013) address this issue in an interesting way. Their tables show results from multiple different models. In the models, they include different variables to see the effects of introducing different variables. For example, in one model they found evidence of a resource curse, but when they included a variable for economic freedom the energy variable became insignificant. This is a great way of showing that one's choice of variables will greatly influence the conclusion. This is another issue our study tries to eliminate. Campbell et al built 5 models with different combinations of their explanatory variable, however in our study we 171,248 different models as an approximation for the 5.5×10^8 total combinations of our 29 different explanatory variables.

When we build a model regressing Energy Imports on GDP growth we see the same positive relationship Campbell et al find. We need to cautious when interpreting this result. There might be a slight positive relation in the graph below, but we have not accounted for any other variables nor does this model consider any country specific effects. If this the only information people had access to, this would suggest there is indeed a resource curse. However, our Bayesian Model clearly indicated that it is very unlikely the percent of Energy Imports has any effect on GDP growth. In fact out of all thirty variables we chose, Energy Imports had the smallest likelihood of being contained the “true model” for GDP growth. This clearly shows evidence that frequentist models introduce bias by the variables they chose to include.

Past literature has been able to show that increases in natural resources will decrease economic freedom. This is the conclusion of Campbell et all (2013). Although they seemed to find a way to mitigate the direct effect of natural resources on GDP growth, they found evidence to argue that natural resources may harm economic freedom. However, we have to wonder if their conclusions again are reliant on their choice of variables. Our second regression, with the Regulations index as the dependent variable, tries to address that concern. Again, we find the Energy Imports variable is very unlikely to effect on our dependent variable. Therefore, we can provide no evidence that natural resources indirectly harm economic growth by directly harming Regulations.

Our choice of Regulations could be a constraint in our study. There are three economic freedom variables that are included in the “Best Model” according to figure 2. We chose to see if natural resource abundance harmed Regulations because it seems most closely linked to Everhart’s theory of corruption.

Finally, we need to consider any issues we might with our data that might influence our conclusions. The first concern has to do with the time period. We only incorporate 25 years of data. Although we believe our time period is long enough to avoid any short term business cycles, we have to wonder if there are any trends that span our time period which might skew our results. One explanation could be the structure of the oil industry since 1980. As Cramer and Salehi-Isfahani (1989) argue, there are four phases of oil industry. Since 1980, we have been in the fourth phase, which is characterized by high level of volatility in prices. With such volatility it may be hard to find any relationship between natural resources and GDP growth. Any rigorous assessment of this price volatility claim is beyond the scope of this study, however it is a good example of a possible shortcoming.

Another concern about the study is the choice countries used. Due to the lack of data, we had to eliminate several countries. There are many countries we wanted to include such as Saudi Arabia, Kuwait, and Russia, but including these countries would have meant eliminated many of the variables we found to be significant. It is unfortunate that the lack of information has forced us to eliminate many countries whose natural resource abundance is so crucial the global energy market, but since we also had to eliminate several countries who are not exporters of energy, we believe the data is not excessively skewed by this choice of sample. Appendix 3 provides a full list of the countries used.

Our last concern has to do with the data its self. As Ciccone and Jarocinski (2010) conclude that source used to obtain GDP data has significant effects on results.[22] This could be due to reporting error across different reports, or due to the assumptions made in each report (i.e. inflation deflators).[23] For this reason, Moral-Benito (2012) concludes in that using, “the last available revision of the Penn World Table seems to produce more

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[22] Moral-Benito, Enrique. 2012. "Determinants of Economic Growth: A Bayesian Panel Data Approach." *Review Of Economics And Statistics* 94, no. 2: 566-579. *EconLit*, EBSCO*host*(accessed March 12, 2015)
[23] Ibid

stable results than previous revisions."[24] We follow this lead in our own study, but we are aware of the sensitivity of this issue.

IX. Conclusion

There have been many studies trying to explain the resource curse. Often someone puts forth an explanation and then someone comes along and refutes it. The literature is filled with back and forth claims, but no one has able to provide a conclusive explanation for the curse. Recently there have been many studies providing evidence of natural resources effect on economic freedom. The goal of this study was to use state of the art econometric methods to reinforce this claim. Unfortunately we did not find the same results, and we have now added to the cycle of refuting a recent claim.

We discussed possible draw backs in our study. The most problematic of these could be our choice of the Economic Freedom variables. We chose Regulations because it was closest to the theoretical literature, but perhaps future research should look at the effects resource abundance has on the other economic freedom variables. Furthermore, a closer examination of the resources effect on the labor market could provide some insight into the existence of a curse. Until then, an explanation of the resource curse has still yet to be found.

[24] Ibid

X. Appendix

Appendix 1 – List of Variables Used in Initial Growth Model, Their Code, and Source

Name	Code	Source
GDP growth	gdpgrowth	Penn World Table PWT 7.1
lag GDP growth	lgdpgrowth	Penn World Table PWT 7.1
Population (in thousands)	pop	Penn World Table PWT 7.1
Consumption Share of PPP Converted GDP Per Capita at current prices [cgdp], (%)	cc	Penn World Table PWT 7.1
Investment Share of PPP Converted GDP Per Capita at current prices [cgdp], (%)	ci	Penn World Table PWT 7.1
Price Level of Investment	pi	Penn World Table PWT 7.1
Openness at Current Prices (%)	openc	Penn World Table PWT 7.1
Life expectancy at birth, total (years)	lifexp	World Bank (World Development Indicators)
Population ages 0-14 (% of total)	pop15	World Bank (World Development Indicators)
Population ages 65 and above (% of total)	pop65	World Bank (World Development Indicators)
Population density (people per sq. km of land area)	popden	World Bank (World Development Indicators)
Urban population (% of total)	urpop	World Bank (World Development Indicators)
Urban Population growth (annual %)	popgrowth	World Bank (World Development Indicators)
Energy imports, net (% of energy use)	enrgyimp	World Bank (World Development Indicators)
Population growth (annual %)	popgrowth	World Bank (World Development Indicators)
Rural Population growth (annual %)	Rurpopgrow	Barro-Lee
Average years of total schooling, age 15+, total	Avgschool15	Barro-Lee
Average years of total schooling, age 25+, total	Avgschool25	Barro-Lee
Average years of total schooling, age 15-19, total	Avgsecschool15_19	Barro-Lee
Average years of secondary schooling, age 15+, total	Avgsecschool15	Barro-Lee
Average years of primary schooling, age 15+, total	Avgprischool15	Barro-Lee
Percentage of population age 25+ with tertiary schooling. Completed Tertiary	percenttertiary25	Barro-Lee
Percentage of population age 15+ with secondary schooling. Completed Secondary	Percentsecschool	Barro-Lee
Size of Government	SizGov	Fraser Institute 2014 Economic Freedom Dataset
Legal System and Property Rights	LegPropRight	Fraser Institute 2014 Economic Freedom Dataset
Sound Money	SouMoney	Fraser Institute 2014 Economic Freedom Dataset
Freedom to Trade Internationally	TradeInt	Fraser Institute 2014 Economic Freedom Dataset
Regulation	Reg	Fraser Institute 2014 Economic Freedom Dataset

Appendix 2 - List of Variable used in Freedom Regression, codes, and sources

Imports as Percent of GDP	Imports	World Bank (World Development Indicators)
Average years of primary schooling, age 15+, total	Avgprischool15	Barro-Lee
Average years of total schooling, age 15+, total	Avgschool15	Barro-Lee
Average years of secondary schooling, age 15+, total	Avgsecschool15	Barro-Lee
Average years of total schooling, age 25+, total	Avgschool25	Barro-Lee
Percentage of population age 25+ with tertiary schooling. Completed Tertiary	percenttertiary25	Barro-Lee
Percentage of population age 15+ with secondary schooling. Completed Secondary	Percentsecschool	Barro-Lee
Foreign Direct Investment	FDI	World Bank (World Development Indicators)
Energy imports, net (% of energy use)	enrgyimp	World Bank (World Development Indicators)
Average years of total schooling, age 15-19, total	Avgsecschool15_19	Barro-Lee
Exports as Percent of GDP	Exports	World Bank (World Development Indicators)

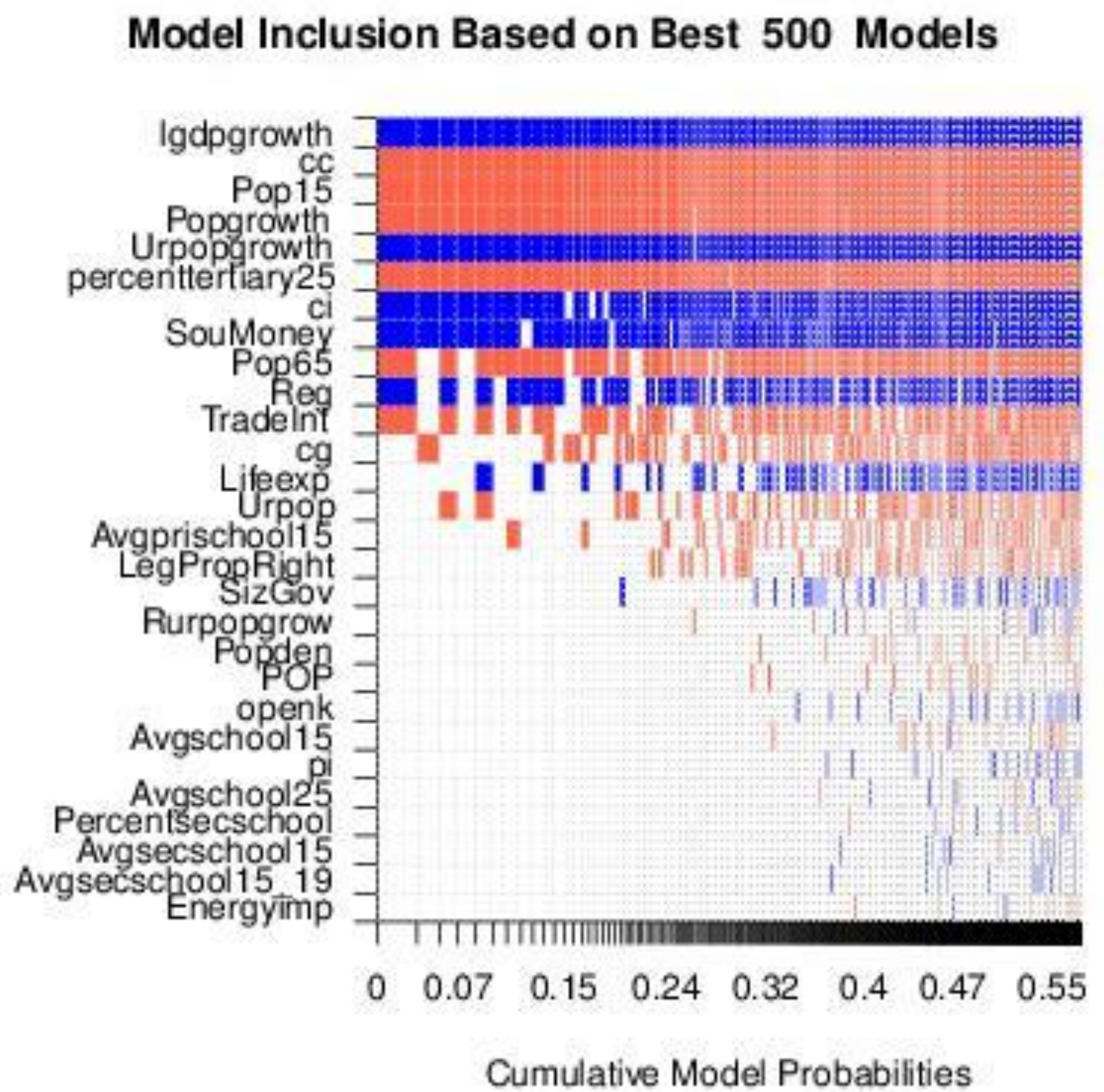
Appendix 3 – List of Countries Used in Sample

Name	Code		Name	Code		Name	Code
Algeria	DZA		Germany	DEU		Pakistan	PAK
Argentina	ARG		Ghana	GHA		Panama	PAN
Australia	AUS		Greece	GRC		Paraguay	PRY
Austria	AUT		Guatemala	GTM		Peru	PER
Bahrain	BHR		Honduras	HND		Philippines	PHL
Bangladesh	BGD		Hungary	HUN		Poland	POL
Bolivia	BOL		Iceland	ISL		Portugal	PRT
Botswana	BWA		India	IND		Romania	ROU
Brazil	BRA		Indonesia	IDN		Senegal	SEN
Bulgaria	BGR		Iran	IRN		South Africa	ZAF
Cameroon	CMR		Ireland	IRL		Spain	ESP
Canada	CAN		Israel	ISR		Sri Lanka	LKA
Chile	CHL		Italy	ITA		Sweden	SWE
Colombia	COL		Jamaica	JAM		Switzerland	CHE
Congo, Dem. R.	COD		Japan	JPN		Syria	SYR
Congo, Rep. Of	COG		Jordan	JOR		Tanzania	TZA
Costa Rica	CRI		Kenya	KEN		Thailand	THA
Cote d'Ivoire	CIV		Korea, South	KOR		Trinidad & Tob.	TTO
Cyprus	CYP		Malaysia	MYS		Tunisia	TUN
Denmark	DNK		Malta	MLT		Turkey	TUR
Dominican Rep.	DOM		Mexico	MEX		United Kingdom	GBR
Ecuador	ECU		Morocco	MAR		United States	USA
Egypt	EGY		Netherlands	NLD		Uruguay	URY
El Salvador	SLV		New Zealand	NZL		Venezuela	VEN
Finland	FIN		Nicaragua	NIC		Zambia	ZMB
France	FRA		Norway	NOR		Zimbabwe	ZWE

Appendix 4 - Three Iteration Choices for BMA Model. 10,000 (Left) 100,000 (Middle) 1,000,000 (Right)

Variable	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
lgdpgrowth	1.000	0.072	0.037	1.000	0.070	0.037	1.000	0.071	0.037
cc	1.000	-0.009	0.002	1.000	-0.009	0.002	0.999	-0.009	0.002
Pop15	1.000	-0.021	0.005	0.999	-0.021	0.005	0.998	-0.021	0.005
Popgrowth	0.997	-0.112	0.024	0.967	-0.109	0.031	0.970	-0.109	0.030
Urpopgrowth	0.993	0.054	0.013	0.958	0.052	0.016	0.960	0.052	0.016
percenttertiary25	0.961	-0.012	0.004	0.945	-0.012	0.004	0.948	-0.012	0.004
ci	0.873	0.006	0.003	0.861	0.006	0.003	0.867	0.006	0.003
SouMoney	0.807	0.016	0.010	0.850	0.016	0.009	0.845	0.016	0.009
Pop65	0.786	-0.025	0.016	0.802	-0.027	0.017	0.801	-0.027	0.016
Reg	0.640	0.027	0.023	0.668	0.028	0.023	0.669	0.028	0.023
TradeInt	0.525	-0.012	0.013	0.565	-0.013	0.013	0.548	-0.012	0.013
cg	0.420	-0.004	0.005	0.392	-0.004	0.005	0.396	-0.004	0.005
Lifeexp	0.350	0.003	0.005	0.364	0.003	0.005	0.368	0.003	0.005
Urpop	0.306	-0.002	0.004	0.342	-0.003	0.004	0.324	-0.002	0.004
Avgprischool15	0.248	-0.013	0.036	0.206	-0.004	0.008	0.222	-0.004	0.009
LegPropRight	0.211	-0.004	0.008	0.194	-0.011	0.033	0.205	-0.012	0.033
SizGov	0.131	0.002	0.007	0.128	0.002	0.007	0.122	0.002	0.007
Popden	0.085	0.000	0.000	0.089	-0.004	0.025	0.090	-0.001	0.008
pi	0.075	0.000	0.000	0.086	-0.002	0.008	0.088	-0.004	0.024
openk	0.062	0.000	0.000	0.077	0.000	0.000	0.081	0.000	0.000
Avgsecschool15	0.060	0.002	0.026	0.076	0.000	0.000	0.071	0.000	0.000
Avgschool15	0.056	-0.003	0.025	0.073	0.000	0.000	0.068	0.000	0.000
POP	0.052	0.000	0.000	0.062	0.000	0.000	0.062	0.001	0.011
Rurpopgrow	0.049	0.000	0.004	0.061	0.001	0.011	0.059	0.000	0.001
Avgschool25	0.047	0.000	0.006	0.060	0.000	0.001	0.058	0.000	0.000
Percentsecschool	0.040	0.000	0.001	0.056	0.002	0.024	0.055	0.002	0.022
Energyimp	0.035	0.000	0.000	0.055	0.000	0.004	0.043	0.000	0.003
Avgsecschool15_19	0.035	0.000	0.003	0.042	0.000	0.000	0.039	0.000	0.000
iterations		10000			10000			10000	
burn in		1000			1000			1000	
prior model size		14.5			14.5			14.5	
posterior model size		11.844			11.844			11.844	

Appendix 5 - Graphical Representation of BMA. Blue represents negative Values and red represents positive values



Appendix 6 - Areas, Components, and Sub-components of the Economic Freedom of the World Index

1. Size of Government

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

2. Legal System and Property Rights

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

3. Sound Money

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

4. Freedom to Trade Internationally

A. Tariffs
- (i) Revenue from trade taxes (% of trade sector)
- (ii) Mean tariff rate
- (iii) Standard deviation of tariff rates

B. Regulatory trade barriers
- (i) Non-tariff trade barriers
- (ii) Compliance costs of importing and exporting

C. Black-market exchange rates

D. Controls of the movement of capital and people
- (i) Foreign ownership/investment restrictions
- (ii) Capital controls
- (iii) Freedom of foreigners to visit

5. Regulations

A. Credit market regulations
- (i) Ownership of banks
- (ii) Private sector credit
- (iii) Interest rate controls/negative real interest rates

B. Labor market regulations
- (i) Hiring regulations and minimum wage
- (ii) Hiring and firing regulations
- (iii) Centralized collective bargaining
- (iv) Hours regulations
- (v) Mandated cost of worker dismissal
- (vi) Conscription

C. Business regulations
- (i) Administrative requirements
- (ii) Bureaucracy costs
- (iii) Starting a business
- (iv) Extra payments/bribes/favoritism
- (v) Licensing restrictions
- (vi) Cost of tax compliance

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