# Does Freedom Matter for Growth? Analysing Patterns of Association with Cross Country data using Causality and Classification Techniques

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## Abstract

Why have some countries experienced high growth and why are some lagging behind has always been a matter of debate in economic literature. The traditional theories of growth have looked at many factors including labour, capital and technology which were at the centre of analysis of growth models. There was yet another line of reasoning which debated on how economic freedom could be an influencing factor on economic growth. Given the access to the latest data on economic freedom and its components from Heritage Foundation, we attempt to establish the nature of empirical relationship between economic freedom and growth.We run the Ordinary Least square multiple regression model to test the causal relationship between freedom and growth and use cluster analysis, a classification tool to test for association with the chosen variables. Results of the regression model did not reveal a strong causal relationship between freedom and growth. However, cluster analysis shows strong association of GDP percapita with that of economic freedom and its components highlighting that economic freedom could be an important factor influencing growth and prosperity of nations in the long run but may not be sufficiently influencing in the short run.

*Keywords:Cluster analysis; Economic freedom; Economic growth; K-means cluster; Multiple regression analysis; Ordinary Least square method.*

## 1. Introduction

Why have some countries experienced high growth and why are some lagging behind has always been a matter of debate in economic literature. The traditional theories of growth have looked at many factors including labour, capital and technology which were at the centre of analysis of growth models. There was yet another line of reasoning which debated why economic freedom could be an influencing factor on economic growth. It is believed that free market institutions promote economic efficiency and contribute towards better economic growth as compared to that in controlled economies. This is supported by the idea that market economies that are free from government control help in free flow of information, enforcement of property rights and promotion of competition which would promote growth and development. It is also observed that in such countries governments typically play a limited role[1, 2, 3, 4, 5, 6, 7, 8].

Given the easy access to data on index of economic freedom from Frazer Institute and later from Heritage Foundation, a good number of studies have empirically tested the connections between economic freedom and economic growth. The data developed by the Frazer Institute is widely used among the studies. The overall index of economic freedom consists of five elements [9]. The government size, which includes total spending by government, taxes levied, state run enterprises; property rights and legal structure; inflationary policies; external trade and openness; regulation of business, labour markets and credit markets. Another index of economic freedom is later brought out by the Heritage Foundation. However, the definition of freedom and the method used is the same in both the indices [10]. For each of the subcomponents of the index one can establish logical and theoretical reasons as to why liberalised economies will perform differently from controlled economies [11, 12]. The results of earlier studies have also been controversial when the overall index of economic freedom is decomposed and effects of each sub-component is investigated separately. Given the easy access to the latest data from Heritage Foundation on economic freedom and its decomposed elements, we attempt to re-establish the empirical relationship between economic freedom and economic growth.We examine as to how are the decomposed elements of economic freedom related to economic growth using multiple regression analysis and the classification tool, cluster analysis.

## 2. Related Work

Gwartney et al (1996) define Economic freedom as the degree to which market has a role in economic production and exchange [13]. The strong association between economic freedom and economic growth can be justified due to many reasons [14]. Free economies tend to experience higher growth as against the controlled, as free markets are driven by competition leading to better entrepreneurial opportunities and efficiency in the allocation of resources [15, 16]. The economic freedom index is developed by Milton Friedman, Michael Walker and a few others, who were

keen to arrive at a reasonable way to measure and examine whether economic freedom would promote better economic and social outcomes [10]. Gwartney and Lawson (2007) demonstrate that economic freedom as a concept consists of five elements which are discussed in detail in the next section [9]. For each of these individual components one can find theoretical justifications as to why and how each of these would affect economic growth in different ways [11, 17].

The liberal economists argue that the role of the government in market economies has to be limited to activities where markets do not operate or towards assuring social security and protection of property rights. Interference of the government beyond these roles will reduce efficiency and promote bureaucracy and corruption by reducing freedom [10]. Increase in government involvement will also have an impact on finances of the economy leading to adverse impacts [18]. Similarly, theories of institutional economics argue that guaranteed private property rights are necessary for creating incentives for efficient production and investment. Enforcement of property rights also requires the presence of institutions and a legal framework supported strongly by the government [19].

With respect to money market, Inflationary situations bring in economic uncertainties and macroeconomic instability. High inflation rates lead to inefficient allocation of resources by disturbing the price signals [20]. If inflation creates uncertainty about future payoffs, then long term investments are discouraged[21, 36].Likewise, international trade may influence growth due to many factors like creation of gains arising out of competition or from transfer of knowledge [22, 23, 24, 25]. Flexibility in labour market is also seen as a prerequisite to the success of businesses. This would allow the entrepreneurs to adapt to changes that are needed for their enterprises to grow [26, 10].

With the readily available data on economic freedom from Frazer institute, a few studies have tested the empirical relation between economic freedom and growth [27, 28, 29, 30, 31]. Some empirical studies have found a positive association between measures of economic freedom and economic growth [32, 33, 11]. This association is however subject to debates and controversies when the highly aggregated index of economic freedom is decomposed and split into its components and the effects of each of the component on growth is investigated separately. Also with the latest data from heritage foundation being available, there is sufficient reason to reconsider testing the empirical relationship between economic freedom and growth using the latest set of panel data across countries and time periods.

## 3.   Database and Methods

The index of economic freedom developed by Heritage foundation [34] comprises of four elements – Rule of law; Size of Government, Regulatory efficiency and Open markets. Broad components of Rule of Law include property rights, effectiveness of the judiciary and government integrity. Government size consists of tax burden, government spending and fiscal health. The components of Regulatory efficiency include business freedom, labor freedom and monetary freedom. Open markets comprises of trade freedom, investment freedom and financial freedom. The sub-factors under each of the above headings are detailed in Table 1. Data is gathered on the overall index of economic freedom and separately for its 12 components for 183 countries for a period of six years from 2013 to 2018. Data on GDP per capita of the countries for the same year is obtained from IMF world economic outlook [35].

## 4. Methodology

We run the multiple regression analysis using the Ordinary least square method for testing the causal relationship between

economic freedom and economic growth and cluster analysis, a classification tool for testing the association between the variables.

### 4.1 Ordinary Least squares and multiple regression analysis

Ordinary least squares (OLS) method is a tool used for estimating the causal relationship between variables using the linear regression models. We can generalize a simple linear regression equation as:

$$Y = \alpha + \beta X + u \tag{1}$$

Where, Y= dependent variable.X= Independent variable.$\alpha$ = intercept and $\beta$ = Co-efficient or slope of the function. The OLS method will estimate the value of parameters $\alpha$ $and$ $\beta$ such that the sum of squares of difference between observed and predicted values of the dependent variable. i.e. the value of

$$\sum_{i=1}^{n}(Y - \alpha + \beta X)^2 = \sum_{i=1}^{n}(u)^2 \tag{2}$$

will be minimum, and therefore the name least squares method.

A multiple regression model is one which explains the relationship between one dependent variable and two or more independent variables. We can generalize the form of multiple regressions as:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + u_i \tag{3}$$

Where Y is the dependent variable, $X_1$, $X_2$ are independent variables, $\alpha$ is the intercept i.e. the value of Y when $X_1$ and $X_2$ are zero or the average effect of all ceteris paribus variables on Y.

$R^2$ refers to the percentage of change in dependent variable that can be explained by the model. P value or probability value is the probability of committing type I error. It is the lowest significance level at which one can reject a null hypothesis. As it is a probability value its value lies between 0 and 1. Lower the p-value, higher the evidence against null hypothesis.

**Table 1:** The Elements and Components of Economic Freedom Index

| Elements of Economic freedom Index | Components | Sub- factors |
|---|---|---|
| Rule of Law | Property rights (PR) | Physical Property rights |
| | | Intellectual property rights (IPR) |
| | | To what extent is investor protected |
| | | Expropriation risk |
| | | Land administration quality |
| | Judicial effectiveness(JI) | Independence of the judiciary |
| | | judicial process and its quality |
| | | Likelihood that the judicial decisions are favourable |
| | Government integrity (GI) | Trust of the public in politicians |
| | | Bribery and irregular payments |
| | | Transparency in the policy making of the government |
| | | Absence of corruption |
| | | Perception of people on corruption |
| | | Transparency in the functioning of government and civil service |
| Government Size | Tax Burden (TB) | Tax rate on income of the individual |
| | | Rate of tax on corporate income |
| | Government spending (GS) | Ratio of government expenditure to GDP |
| | Fiscal Health (FH) | Average deficits as a percentage of GDP |
| | | Ratio of debt to GDP |
| Regulatory Efficiency | Business Freedom (BF) | Procedures that are meant for Starting a business – (numbers) |
| | | Time taken for starting a business – (no. of days) |
| | | Cost of starting a business – (% of income per capita) |
| | | Procedure for obtaining license |

| | | Closing business (time days) |
|---|---|---|
| | | Cost of electricity (% of income per capita) |
| | Labour Freedom (LF) | Restrictions to hire more workers |
| | | Rigidity of number of working hours |
| | | Difficulty in firing redundant employees |
| | | Legal mandate on notice period |
| | | Pay structure that is mandated |
| | | Rate of Labor force participation |
| | Monetary freedom (MF) | Inflation rate for the most recent three years |
| | | Control on price |
| Open markets | Trade Freedom (TF) | Tariffs and Non-Tariff Barriers |
| | Investment Freedom (IF) | Treatment of foreign investment in the country |
| | | Foreign investment code |
| | | Restriction on ownership of land |
| | | Restrictions on Sectoral investment |
| | | Control on Foreign exchange |
| | | Capital controls |
| | Financial Freedom (FF) | To what extent is financial and capital market developed |
| | | The extent of government regulation and financial services |
| | | State intervention and ownership in banks and other financial institutions. |
| | | Government influence on the allocation of credit |

## 4.2 Cluster Analysis

**Cluster analysis** is a technique to group multidimensional heterogeneous objects to homogenous groups called clusters. Within this clusters objects will be similar. There are two types of methods used to arrive at clusters [37] **Hierarchicaland non-hierarchical methods. Hierarchical** clusters have an inherent hierarchical structure in the formation and interpretation. There are two types of approaches for hierarchical cluster formation: 1. Agglomerative, 2. Divisive. **Non-hierarchical analysis**: in this method, clusters formed will not have any hierarchy. This method is suited for large data set. It starts either with initial random partition of items or initial set of seed point which forms the nuclei of initial clusters. If we have 'N cases' these are grouped in to k number of means i.e. k number of clusters. E.g.- k means clustering. **Agglomerative Hierarchical cluster analysis** operates by successive merger of cases i.e. if we have N cases we consider it as N clusters then we will merge 2 clusters through iteration process until all the cases are merged into 1 cluster. **Divisive cluster analysis**: starts with one single cluster composing of "N cases" and then this cluster is divided into 2 groups in such a way that one cluster is different from the other cluster this process is continued until there are 'N clusters' containing single cases. Results of both clusters are represented through a tree structured graph called **Dendrogram.**

A **K-means cluster** is an algorithm which assigns each object to a cluster having nearest cluster centroid (mean value). Through iteration process objects are assigned to clusters until there cannot be a reassignment. As clustering segments items which are similar, some measure is needed to assess similarity. A popular measure of similarity is **Euclidean distance,** which can be defined as the square root of sum of squared differences in values for each variable.

## 4.3 Estimation Models

We first examine if there is a causal relationship between economic freedom and growth using the OLS regression model with the cross sectional country level data (averaged for a period of six years from 2013-2018). The first set of model is run with GDP per capita (GDP) representing the economic growth and

prosperity of the country as a function of overall economic freedom (EF). The model is specified as below

$$GDP_{it} = \beta_0 + \beta_1 (EF)_{it} + u_{it} \qquad (4)$$

The second model is run for GDP as the function of all subcomponents of the index of economic freedom. We include all the variables in the initial model, i.e property rights (PR), government integrity (GI), Judicial Effectiveness (JE), Tax burden (TB), Government spending (GS), Fiscal Health (FH), Business freedom (BF), Labour freedom (LF), Monetary freedom (MF), Trade freedom (TF), Investment freedom (IF) and Financial freedom (FF). However high multi-co linearity of property rights (PR) with other variables make us drop this variable in the final model. Lot of missing values in the time series make us drop two more variables, i.e, Judicial Effectiveness (JE) and Fiscal Health (FH). We include the remaining nine variables in the final model as specified below-

$$GDP_{it} = \beta_0 + \beta_1 (GI)_{it} + \beta_2 (TB)_{it} + \beta_3 (GS)_{it} + \beta_4 (BF)_{it} \\ + \beta_5 (LF)_{it} + \beta_6 (MF)_{it} + \beta_7 (TF)_{it} \\ + \beta_8 (IF)_{it} + \beta_9 (FF)_{it} + u_{it} \qquad (5)$$

## 5. Results and Discussions

### 5.1: Results of Multiple regressions Analysis

**Table 2:** Results of regression analysis of the first Model

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -11034.00 | 6574.62 | | -1.68 | 0.10 |
| | Economic Freedom Index | 484.19 | 107.94 | 0.32 | 4.49 | 0.00 |

R square for the model 0.099

a. Dependent Variable: GDP per Capita PPP

**Table 3:** Results of the Regression Analysis of the Second Mode

| | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | T | Sig |
| (Constant) | 19220.47 | 9415.584 | | 2.041 | 0.043 |
| Government Integrity Index | 507.209 | 92.347 | 0.471 | 5.492 | |
| Tax Burden Index | 26.12 | 102.6 | 0.018 | 0.255 | 0.799 |
| Government Spending Index | -57.833 | 52.679 | -0.068 | -1.098 | 0.274 |
| Business Freedom Index | 121.562 | 110.777 | 0.092 | 1.097 | 0.274 |
| Labour Freedom Index | 68.902 | 81.29 | 0.051 | 0.848 | 0.398 |
| Monetary Freedom Index | -853.263 | 136.788 | -0.455 | -6.238 | 0 |
| Trade Freedom Index | 229.437 | 115.831 | 0.143 | 1.981 | 0.049 |
| Investment Freedom Index | 17.318 | 88.584 | 0.02 | 0.195 | 0.845 |
| Financial Freedom Index | 265.247 | 105.409 | 0.252 | 2.516 | 0.013 |

a. Dependent Variable: GDP per Capital PPP

**R square for the model  0.552**

From Table 2 above it is evident that overall Economic freedom index does not show a causal relationship with that of Economic growth. The R square of the model which displays the goodness of the fit of the model is only close to 0.09. In the second model which shows the regression results with the subcomponents of economic freedom as independent variables, the R square is at .552 shows only a fair amount of fit of the model. But the signs of the coefficients and the p values are not as per the theoretical expectations. Government integrity index, Trade freedom index, monetary freedom index and financial freedom index are the four variables that have emerged significant in influencing economic growth. The sign of the monetary freedom index is negative which is again not as per the expectation. Thus we can infer that economic freedom and many of its subcomponents do not influence the economic growth directly for the given limited years of data set.

**Table 4:** Final Cluster Centres

|  | Cluster | |
| --- | --- | --- |
|  | 1 | 2 |
| Economic Freedom Index | 57 | 71 |
| Property Rights Freedom Index | 38 | 74 |
| Government Integrity Index | 35 | 67 |
| Tax Burden Index | 79 | 69 |
| Government Spending Index | 65 | 47 |
| Business Freedom Index | 61 | 81 |
| Labour Freedom Index | 59 | 68 |
| Monetary Freedom Index | 74 | 78 |
| Trade Freedom Index | 72 | 85 |
| Investment Freedom Index | 49 | 76 |
| Financial Freedom Index | 43 | 69 |
| GDP per Capita PPP | 9874 | 50421 |

**Table 5:** Number of Cases in each Cluster

| Cluster | 1 | 149.000 |
| --- | --- | --- |
|  | 2 | 36.000 |
| Valid | | 185.000 |
| Missing | | .000 |

**Table 6:** ANOVA

|  | F | Sig. |
| --- | --- | --- |
| Economic Freedom | 37.948 | .000 |
| Property Rights Freedom | 140.343 | .000 |
| Government Integrity | 162.176 | .000 |
| Tax Burden | 14.182 | .000 |
| Government Spending | 18.081 | .000 |
| Business Freedom | 66.416 | .000 |
| Labour Freedom | 11.610 | .001 |
| Monetary Freedom | 5.565 | .019 |
| Trade Freedom | 36.646 | .000 |
| Investment Freedom | 50.460 | .000 |
| Financial Freedom | 81.114 | .000 |
| GDP per Capita PPP | 311.994 | .000 |

**Table 7:** Countries included in the two clusters

| Cluster-1 | | |
| --- | --- | --- |
| Afghanistan | Gambia | Pakistan |
| Albania | Georgia | Panama |
| Algeria | Ghana | Papua New Guinea |
| Angola | Greece | Paraguay |
| Argentina | Guatemala | Peru |
| Armenia | Guinea | Philippines |
| Azerbaijan | Guinea Bissau | Poland |
| Bahamas | Guyana | Portugal |
| Bangladesh | Haiti | Romania |
| Barbados | Honduras | Russia |
| Belarus | Hungary | Rwanda |
| Belize | India | Saint Lucia |
| Benin | Indonesia | Saint Vincent and The Grenadines |
| Bhutan | Iran | Samoa |
| Bolivia | Iraq | Saudi Arabia |
| Bosnia and Herzegovina | Jamaica | Senegal |
| Botswana | Jordan | Serbia |
| Brazil | Kazakhstan | Seychelles |
| Burkina Faso | Kenya | Slovakia |
| Burma | Kiribati | Slovenia |
| Burundi | North Korea | Solomon Islands |
| Cambodia | Kosovo | Somalia |
| Cameroon | Republic of Kyrgyz | South Africa |
| Canada | Laos | Spain |
| Cape Verde | Latvia | Sri Lanka |
| Chad | Lebanon | Sudan |
| Chile | Lesotho | Suriname |
| China | Liberia | Switzerland |
| Colombia | Libya | Syria |
| Comoros | Lithuania | Tajikistan |
| Congo | Macedonia | Tanzania |
|  | Madagascar | Thailand |
| Costa Rica | Malawi | Timor Leste |
| Cote d'Ivoire | Malaysia | Togo |
| Croatia | Maldives | Tonga |
| Cuba | Mali | Trinidad and Tobago |
| Cyprus | Mauritania | Tunisia |
| Czech Republic | Mauritius | Turkey |
| Djibouti | Mexico | Turkmenistan |
| Dominica | Micronesia | Uganda |
| Dominican Republic | Moldova | Ukraine |
| Ecuador | Mongolia | Uruguay |
| Egypt | Montenegro | Uzbekistan |
| El Salvador | Morocco | Vanuatu |
| Equatorial Guinea | Mozambique | Venezuela |
| Eritrea | Namibia | Vietnam |
| Estonia | Nepal | Yemen |
| Ethiopia | Nicaragua | Zambia |
| Fiji | Niger | Zimbabwe |
| Gabon | Nigeria |  |
| Cluster-2 | | |
| Australia | Ireland | Norway |
| Austria | Israel | Oman |
| Bahrain | Italy | Qatar |
| Belgium | Japan | Sao Tome |
| Bulgaria | South Korea | Sierra Leone |
| Central African Republic | Kuwait | Singapore |
| Denmark | Liechtenstein | Swaziland |
| Finland | Luxembourg | Sweden |
| France | Macau | Taiwan |
| Germany | Malta | United Arab Emirates |
| Hong Kong | Netherlands | United Kingdom |
| Iceland | New Zealand | United States |

## 5.2 Results of Cluster analysis

To test for association between economic prosperity and economic freedom, we use the classification technique, the cluster analysis. We consider all the variables including GDP per capita, Overall Economic freedom index, and the subcomponents of freedom index shown in Table 1. The agglomeration schedule in cluster analysis suggest for two clusters. We then use the K-means clustering method. The results of K-means clusters are displayed in Tables 4 to 7.

The values of indices of economic freedom showed in final cluster centres in Table 4 interestingly reveals that there is difference in values for all indices of economic freedom across two clusters. The first cluster consists of countries with low per capita GDP as against the second which consists of countries with high per capita GDP. The list of countries under each of the two clusters is shown in Table 7. The Economic freedom index and the components of the freedom index, other than the government spending index, are much higher for the countries in cluster two. Lower government

spending index in rich capitalistic countries is justified with the presence of larger private sector which again is seen as a contributing factor towards higher economic growth. ANOVA results shown in Table 6 supports the difference in the values of the variables across the two groups.

# 6. Conclusions

With the latest data available with Heritage foundation on the index of economic freedom and its subcomponents, the study tries to establish the empirical relationship between economic freedom and its subcomponents and the economic growth and prosperity of the nations. The OLS model using the multiple regression analysis using the latest six years average data for GDP per capita of countries, economic freedom index and its 12 subcomponents does not establish a strong causal relationship between freedom and growth. Some of the subcomponents like government integrity seemed to have emerged significant in the model in explaining economic growth seen through per capita GDP. However, the results of cluster analysis reveals interesting pattern of association between freedom and all the subcomponents of economic freedom. This can also lead to the conclusion that economic freedom may not be a strong influencing factor for economic growth in the short run but could be an essential prerequisite in the long run.

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