FACTOR ANALYSIS OF THE INDEX OF ECONOMIC FREEDOM

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Abstract

Economic freedom is a very complex term. It is defined as "a necessary condition for democratic development. It liberates people from dependence on government in a planned economy, and allows them to make their own economic and political choices" (1).The Index of Economic Freedom is an indicator which defines and tries to measure the economic freedom of a country or a region. Economic freedom is a necessary condition for democratic development, prosperity and other positive outcomes. There are several indices of economic freedom which are published yearly from different organizations. The most famous are the Index of Economic Freedom created by the Heritage Foundation and the Wall Street Journal and Economic Freedom of the World published by the Canadian Fraser Institute. The indices consist of a number of components which are grouped in four or five broad categories.

The aim of this thesis is to analyse the Economic Freedom of the World index. For this purpose two multivariate statistical methods will be used, namely factor analysis and hierarchical cluster analysis with the help of correlation analysis. The produced results will be compared with the existing indices.

Key words: Index of Economic Freedom, Canadian Fraser Institute, Factor analysis

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Introduction

Economic freedom is a very complex term, and its measurement is even more complex. There are several different indices that measure economic freedom. The most famous are the Index of Economic Freedom created by the Heritage Foundation and the Wall Street Journal (IEF), and the Economic Freedom of the World Index published by the Canadian Fraser Institute (EFW). We will devote our efforts to the latter. The cornerstones of economic freedom are personal choice, voluntary exchange, freedom to compete, and security of privately owned property.

1 Structure of EFW

42 variables are used to construct a summary index and to measure the degree of economic freedom in five broad areas (Size of Government; Legal System and Property Rights; Sound Money; Freedom to Trade Internationally; Regulation) (Ševčík, 2008). In addition, these 42 variables are grouped into 24 components. Each component and sub-component is placed on a scale from 0 to 10 that reflects the distribution of the underlying data, where ten is the highest possible rating and zero is the lowest. The construction of the Economic Freedom of the World index from the 42 partial indices is shown in Figure 1 below[1].

Fig. 1: Construction of the EFW index
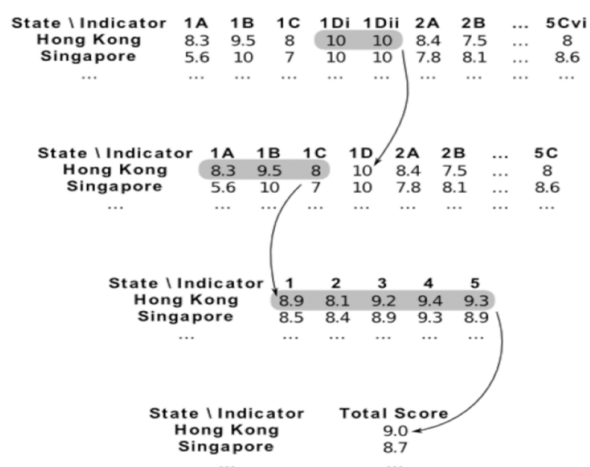
Source: The Heritage Foundation

The following list describes the hierarchical structure of the indicators involved in the design of the final index[2].

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

[1]Economic Freedom of the World Data.
[2]Economic Freedom of the World, Annual Report (Gwartney2013).

    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

5) Regulation

    a) Credit market regulations

        i) Ownership of banks

        ii) Private sector credit

        iii) Interest rate controls/negative real interest rates

    b) Labor market regulations

        i) Hiring regulations and minimum wage

        ii) Hiring and firing regulations

        iii) Centralized collective bargaining

        iv) Hours regulations

        v) Mandated cost of worker dismissal

        vi) Conscription

    c) Business regulations

        i) Administrative requirements

        ii) Bureaucracy costs

        iii) Starting a business

        iv) Extra payments/bribes/favoritism

        v) Licensing restrictions

Because strong inter-correlation among the directly observed indices can be expected, we have applied factor analysis to find latent variables hidden behind the construction of the Index of Economic Freedom.

1   Factor analysis of EFW

As a result, in the last attempt a model with 5 components based on the 30 variables is offered with a KMO criterion of 0.864(Hair, 1998). The total variance explained by 5 factors is 67.624 % (Table 1). While variable 5Bi again has lower extraction communality (0.339), most of the other extraction communalities are high.

Tab. 1: Factor analysis for 5 factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.917	39.725	39.725	11.917	39.725	39.725	6.998	23.327	23.327
2	3.331	11.104	50.829	3.331	11.104	50.829	5.941	19.803	43.130
3	1.957	6.524	57.353	1.957	6.524	57.353	2.604	8.679	51.809
4	1.757	5.855	63.208	1.757	5.855	63.208	2.384	7.947	59.756
5	1.325	4.415	67.624	1.325	4.415	67.624	2.360	7.868	67.624
6	.974	3.246	70.870						

Source: SAS (Hatcher1994)

In addition, factor scores were saved and used for the regression analysis (with regards to the summary index) to check the efficiency of the found model (Harman, 1967). An adjusted R-square (goodness-of-fit statistics) suggests that 82.2 % of the response variable (summary index) is explained by the 5-factor linear model. Table 2 below displays a rotated component matrix for the final solution with these five factors.

Tab. 2: Rotated Component Matrix for the 30-variable EFW model

	Component				
	1	2	3	4	5
2B - Impartial courts	.887	.341	-.050	.030	-.023
2C - Protection of property rights	.824	.434	.152	-.113	.162
2A - Judicial independence	.794	.464	.010	-.119	.072
5Cii - Bureaucracy costs	.778	.515	.162	-.041	.176
4Di - Foreign ownership/investment restrictions	.764	-.039	.075	.032	.191
5Civ - Extra payments/bribes/favoritism	.733	.544	.201	-.039	.220
5Ci - Administrative requirements	.707	.040	-.109	.489	-.012
2H - Reliability of police	.683	.600	.181	-.042	.103
5Cv - Licensing restrictions	.622	-.134	.280	.031	.204
4Bi - Non-tariff trade barriers	.617	.336	.272	-.002	.259
5Cvi - Cost of tax compliance	.483	.467	.052	.044	.188
5Bi - Hiring regulations and minimum wage	.441	.155	-.219	.270	.011
2E - Integrity of the legal system	.358	.818	.173	-.116	.036
2I - Business costs of crime	.300	.756	.206	.080	-.106
5Bv - Mandated cost of worker dismissal	.107	.753	.098	.093	.198
2D - Military interference in rule of law and politics	.166	.711	.080	-.158	.422
1B - Transfers and subsidies	.104	-.698	-.378	.410	-.125
1A - Government consumption	-.275	-.692	.087	.425	-.190
2F - Legal enforcement of contracts	.208	.604	.189	.175	.027
4Ai - Revenue from trade taxes (% of trade sector)	.194	.119	.634	.056	.408
5Ciii - Starting a business	.155	.351	.629	.173	-.030
4Bii - Compliance costs of importing and exporting	.536	.184	.575	-.003	.283
3A - Money growth	-.144	.169	.571	-.198	.171
3B - Standard deviation of inflation	.082	.027	.493	-.388	-.316
3C - Inflation: most recent year	.344	.325	.422	-.179	.288
5Bii - Hiring and firing regulations	.158	.001	-.057	.814	-.167
5Biii - Centralized collective bargaining	-.075	-.061	.001	.787	.111
4Dii - Capital controls	.252	.076	.147	.066	.669
4Diii - Freedom of foreigners to visit	.167	.098	.016	-.178	.656
4Aii - Mean tariff rate	.104	.395	.288	.173	.631

Source: SAS and MS Excel

Factor loadings (shown in rotated component matrix) indicate how hidden factors are associated with the original (observable) variables. It is clear that variables 2C, 2A, 5Cii, 5Civ, 2H and 5Cvi are better identified by the first factor, although they have aspects of similar characteristics with the second (in the case of 5Ci with the fourth) factor. That means that these variables are complex. At the same time, variables 2B, 4Di, 5Cv, 4Bi and 5Bi have high loadings on the first factor and negligible or small loadings on other factors. The first component is formed by 12 variables in total and explains 23.327 % of the variance in the

rotated solution. The variables with the most significant factor loadings (2A, 2B, 2C, 2H, 5Cii, 5Civ) were expected to merge in one group from the correlation analysis described earlier. In addition, all sub-components of 5C (except 5Ciii) belong to the first factor. Considering most of the variables which form the first component, it can be named "Legal System and Business Regulations". This factor means the guarantee of the judicial system (impartial courts + judicial independence), reliability of the police and business, and trade regulations. Since the regression coefficient for the first factor is positive, it is expected that uncorrupted countries with reliable legal systems (including unbiased police and courts), which do not implement essential barriers on the trade and business areas will have greater economic freedom.

The second component loads most heavily on integrity of the legal system (0.818), business costs of crime (0.756), mandated cost of worker dismissal (0.753), military interference in rule of law and politics (0.711), transfers and subsidies (-0.698), government consumption (-0.692) and legal enforcement of contracts (0.604). This factor can be named "Government Presence" or "Limited Government" and means the size of government (variables 1A and 1B) and how it protects property rights and guarantees the effective rule of law (2D, 2E, 2F and 2I). The negative component loadings for the transfers and subsidies and government consumption suggest that countries with high government spending and transfers are expected to have lower economic freedom.

The third factor, which loads most strongly on revenue from trade taxes (% of trade sector), starting a business, compliance costs of importing and exporting, money growth, standard deviation of inflation, and inflation in most recent year can be named "Regulations and Monetary Policy". This factor explains how government can limit business and international trade and can impose different restrictions on commercial freedom, and at the same time it shows the inflation and money growth stability. The positive correlation coefficient for the third factor suggests that countries with higher values for the described indicators are expected to be more successful in Economic Freedom.

The fourth factor is formed by only two variables 5Bii (Hiring and firing regulations) and 5Biii (Centralized collective bargaining) and can be named "Labor Market Regulations". Since this component has a positive regression coefficient, it is assumed that countries with a more flexible labor market are more likely to have a higher ranking in economic freedom.

The fifth component is difficult to interpret because variable 4Aii (Mean tariff rate) is very different from the two others. By including variables 4Dii (Capital controls) and 4Diii (Freedom of foreigners to visit), it can be named "Capital and Movement Control". Because

this factor has a positive regression coefficient, it is assumed that countries that do not impose tariffs, have less restrictions in foreign currency payments and less administration in human movements are expected to have greater economic freedom.

Conclusion

Our expectation was confirmed that the Index of Economic Freedom is "over-parameterized" – in other words, instead of the original, strongly inter-correlated indices a substantially lower number (five) of latent properties could be used for its construction because they are hidden behind sorting countries according to the Index of Economic Freedom. The order in which the countries are sorted with respect to the factor variables is different for less than 5% of countries in comparison with the original sorting. Moreover, the order has not been changed by more than three levels for any of the countries.

Acknowledgment

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