Vysoká škola ekonomická v Praze

Fakulta informatiky a statistiky

Katedra Statistiky a Pravděpodobnosti

Studijní program: Kvantitativní metody v ekonomice

Obor: Statisticko-pojistné inženýrství

Statistical Analysis of the Economic Freedom Index

DIPLOMOVÁ PRÁCE

Student : Bc. Evgenia Sakharova

Vedoucí : Mgr. Michal Vrabec, CSc.

2014

Prohlášení

Prohlašuji, že jsem diplomovou práci zpracovala samostatně a že jsem uvedla všechny použité prameny a literaturu, ze kterých jsem čerpala.

V Praze dne 11. Května 2014

. . . . . .

Poděkování

Ráda bych poděkovala svému vedoucímu Mgr. Michalu Vrabcovi, CSc. za inspiraci, odborné rady a věnovaný čas během vypracování diplomové práce. Také bych ráda poděkovala Ing. Dmytrovi Shykhmanterovi za jeho trpělivost a cenné připomínky.

Abstrakt

Index ekonomické svobody je ukazatel, který vymezuje a snaží se měřit ekonomickou svobodu země nebo regionu. Ekonomická svoboda je nezbytnou podmínkou pro demokratický rozvoj, prosperitu a další pozitivní výsledky země. Existuje několik indexů ekonomické svobody, které jsou publikovány každoročně od různých organizací. Mezi nejznámější patří index ekonomické svobody od Heritage Foundation ve spolupráci s Wall Street Journal a index ekonomické svobody od kanadského institutu Fraser. Indexy se skládají z několika komponent, které jsou následně seskupeny do čtyř nebo pěti širších kategorií.

Cílem práce je statisticky prozkoumat index ekonomické svobody a podívat se zda původně nabízené modely odpovídají těm statistickým. Pro tyto účely se použijí vícerozměrné statistické metody. Tato práce prozkoumá soubory dat, ze kterých existující indexy pocházejí. Konkrétně budou použity faktorová, shluková a korelační analýzy pro vytvoření vlastních výsledků a jejich následné porovnání s existujícími indexy.

Klíčová slova

Index ekonomické svobody, faktorová analýza, shluková analýza, korelační analýza, vícerozměrné metody.

Abstract

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 analyze 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, Economic Freedom of the World Index, factor analysis, hierarchical cluster analysis, correlation analysis, multivariate statistical analysis, component, factor

Table of Contents

1 Introduction

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 Heritage Foundation together with the Wall Street Journal suggests that economic freedom is the condition in which individuals can act with autonomy while in the pursuit of their economic livelihood and greater prosperity. 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 and The Economic Freedom of the World index published by the Canadian Fraser Institute. Each of the final indices described below is based on components and sub-components. Their number is large and is difficult to understand. For these reasons variables are grouped to represent some broader area. For example, "starting a business", "administrative requirements" and "licensing restrictions" can form one bigger component named "business regulations". The grouping of the index is derived from logical, idealistic or intuitive reflections. In other words, it is likely that the model based on the statistical analysis will be different. The aim of this thesis is to validate the Economic Freedom of the World index by using statistical approach. For this reason the multivariate statistical methods will be applied to the index and its components. The produced results will be compared to the existing ones. This work will explore data sets; define models by using especially factor analysis and hierarchical cluster analysis.

The outline of the thesis is following. Brief presentation of two considered indices is given in Chapter 2. The deepest overview of the Economic Freedom of the World index is provided in Chapters 7, where among the others, the results of the Czech Republic and its neighboring countries is explored. The Index of Economic Freedom is presented in Chapter 8, where additionally the comparison of both indices is provided.

Chapter 3 characterizes the data set and analyzes it by applying especially descriptive statistics. The purpose of this is to exclude extreme values that can influence the results of multivariate methods. The other reason is to check the distribution of the distinct indicators. The normal distribution is especially desirable for the factor analysis.

The other essential condition of the factor analysis is the existence of relationship between variables. For this reason the correlation analysis of the data set is provided in Chapter 4. It will examine relationships between components and sub-components by using Pearson's and partial correlation coefficients.

The multivariate statistical methods will be used in Chapters 5 and 6. It is main part of the thesis where partial indices of the Economic Freedom of the World index are grouped according to the statistical assumption of each method. One of the purposes of factor analysis is to describe original structure with many variables by using lower number of underlying unobserved variables (called factors). The cluster analysis sorts the variables in data set into groups and tries to identify the structure. Both methods offer different approach in analyzing data structure. In the ideal situation (when the organization of the Economic Freedom of the World index is consistent with statistical assumptions) both methods should correspond to the original index construction.

2 Measuring economic freedom

The Index of Economic Freedom (here and after referred as IEF) published by the Heritage Foundation and the Wall Street Journal is a combined index of 10 economic indicators or "freedoms". According to authors, each of the economic freedoms plays a vital role in developing and sustaining personal and national prosperity (2). Each indicator is measured individually with the scale from 0 to 100:

1. Business Freedom
2. Trade Freedom
3. Fiscal Freedom
4. Government Spending
5. Monetary Freedom
6. Investment Freedom
7. Financial Freedom
8. Property Rights
9. Freedom from Corruption
10. Labor Freedom

These ten indices are then averaged with equal weight to receive summary index. In addition, they should represent four freedom categories:

1. Rule of Law
2. Limited Government
3. Regulatory Efficiency
4. Open Markets.

Unfortunately, the whole data source of the IEF index is not openly represented. What is more, while constructing the index it is often the case that data from the different years are mixed. For example, if there is no data available for the last period data from the previous period are used. Therefore, the IEF index will be only of peripheral importance in this thesis.

Another indicator of economic freedom is the index published in Economic Freedom of the World (here and after referred as EFW). According to the authors, it measures the degree

to which the policies and institutions of countries are supportive of economic freedom. The cornerstones of economic freedom are personal choice, voluntary exchange, freedom to compete, and security of privately owned property. 42 variables are used to construct a summary index and to measure the degree of economic freedom in five broad areas:

1. Size of Government;
2. Legal System and Property Rights;
3. Sound Money;
4. Freedom to Trade Internationally;
5. Regulation. (3)

In addition, 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 10 is the highest possible rating and zero is the lowest. When sub-components are present, the sub-component ratings are averaged to derive the component rating. The construction of the Economic Freedom of the World index from the 42 partial indices is shown in Figure 1 below. The whole structure of the EFW index can be found in the end of this chapter. Due to lack of space, in most of the tables and graphs the code of the component is used instead of the whole name.

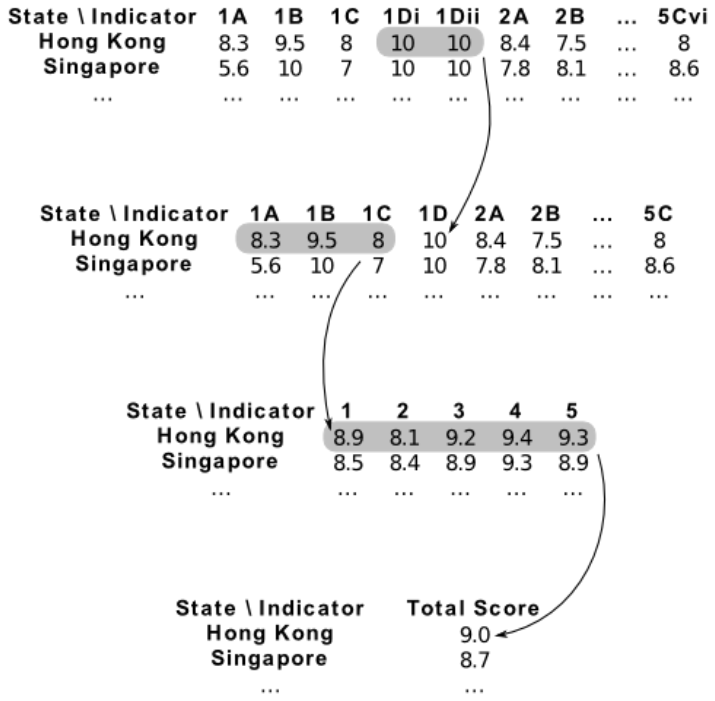


Figure 1 Construction of the EFW index

The organization of the EFW index (areas, components and sub-components) (3):

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. 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

(vi) Cost of tax compliance

3 Description of the data set of the EFW index

3.1 Input data set

The latest index is available for the year 2011 where 152 countries are presented. However, for 57 countries at least one indicator (mostly more than one) is missing. For the purpose of this thesis all the countries with missing values are excluded from the analysis, which means that 95 countries remain in the adjusted data set. The same procedure was applied for the other years.

The data source of the indices varied widely. Within basic sources are the World Bank, International Monetary Fund, United Nations National Accounts, World Economic Forum, but also reports from PricewaterhouseCoopers, PRS Group and others. Therefore, it is clear that the quality of raw data is already very questionable. The quality of statistical data is especially challenging for some developing countries where the economic and political situation is completely different from mature countries with a long tradition in statistical data collection. But for the purpose of comparison it is good to have at least some data even in lower quality.

What is more, some indicators, for example 1C (Government enterprises and investment), are ordinal[1], which means that there is already some loss of information presented and adds more uncertainty to the final model. For this reason ordinal variables (eight variables in total: 1C, 1Di (Top marginal income tax rate), 1Dii (Top marginal income and payroll tax rate), 3D (Freedom to own foreign currency bank accounts), 5Ai (Ownership of banks), 5Aiii (Interest rate controls/negative real interest rates), 5Biv (Hours regulations), 5Bvi (Conscription)) will be taken out from the further analysis.

3.2 Descriptive statistics of the EWF index

The analysis starts with the descriptive statistics to explore the data sample. First goal is to find and exclude (if existed) extreme values, so they will not influence the further analysis. In

[1] The construction of each indicator as well as description data source can be found in the Appendix part of Annual report (5) (last available report is *Economic Freedom of the World: 2013 Annual Report*)

addition, the type of distribution will be checked, as normal distribution is desirable or an essential requirement for the used statistical tools.

To begin, it appears that in the adjusted data set some indicators do not use the whole scale (from 0 to 10)[2]. Moreover, some of them have all results around one value. For instance, in Figure 2 below the proportion of values is shown for the indicator 4C (Black-market exchange rates). It is clear that this indicator would not bring any additional information; almost all countries (with a few exceptions) possess a value of 10. Therefore, this indicator was excluded from the following analysis.

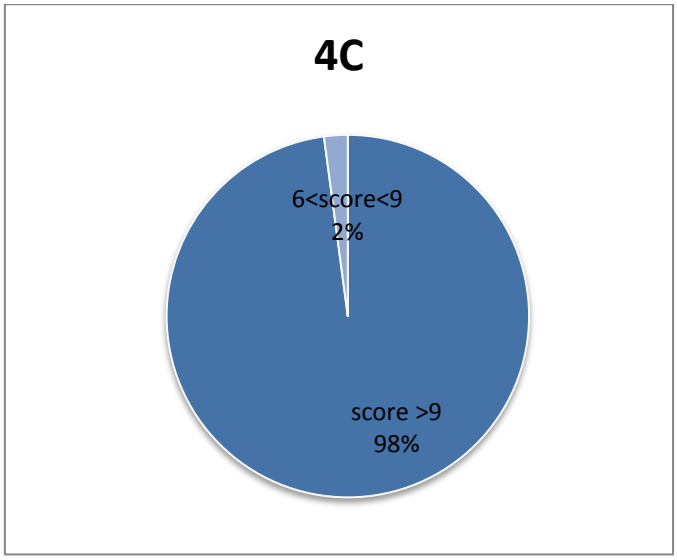


Figure 2: Proportion of values of Black-market exchange rates indicator, EFW 2011

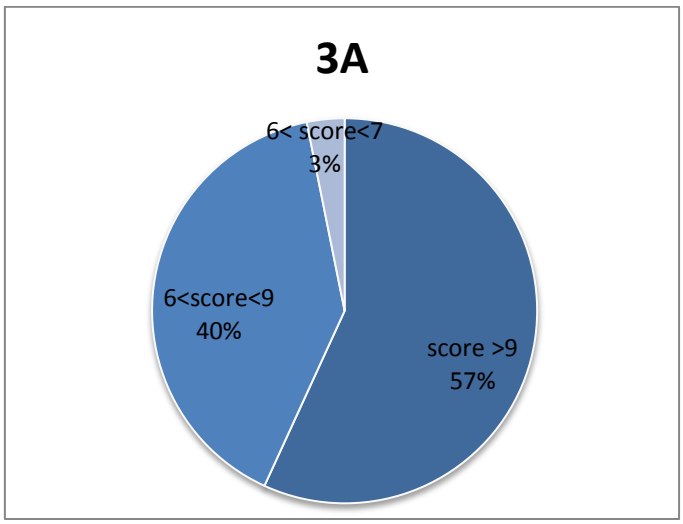


Figure 3: Proportion of values of Sound money indicator, EFW 2011

[2] It is important to say that in the original unadjusted data set the results were almost the same with small corrections in values

The indicator “Money growth” (which is shown in Figure 3 above) does not have values less than 6. Similar results are shown for some other distinct indicators in the attachment (page 66).

Brief presentation of the results of the descriptive statistical analysis for the adjusted data (on 95 remained countries) based on the 42 variables for the year 2011 is shown below (a full version of output can be found in the attached CD). According to the Kolmogorov-Smirnov and Shapiro-Wilk tests of normality, only variables 1A (government consumption), 2B (impartial courts), 2F (legal enforcement of contracts), 4Di (foreign ownership/investment restrictions) and 5Bii (bureaucracy costs) have a normal distribution. For other indicators the hypothesis of normal distribution was rejected on 95 % level of confidence. A histogram of 1A variable is shown in Figure 4 below.

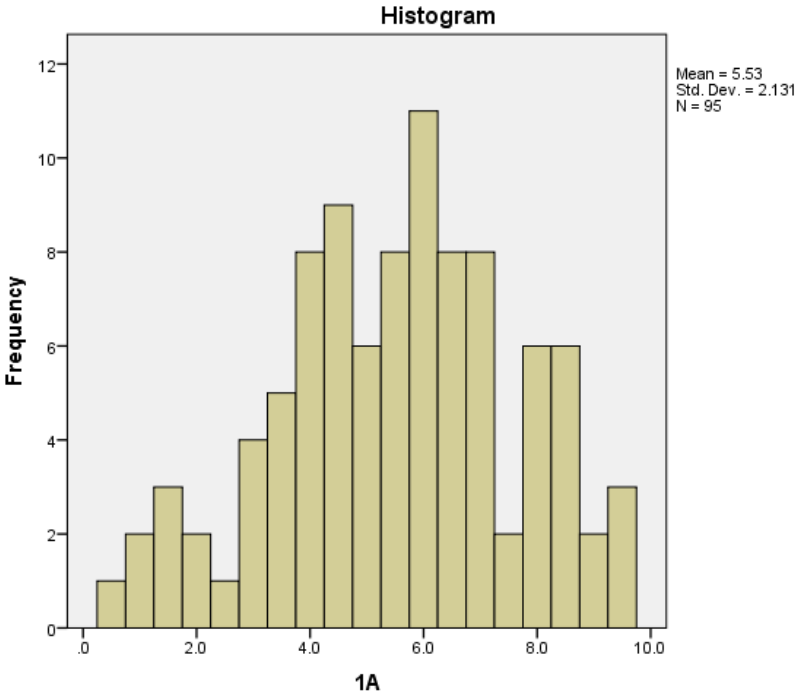


Figure 4: Histogram of 1A (Government consumption), the EFW index, 2011 (calculations in SPSS)

Furthermore, a Q-Q plots and descriptive summary table also confirm that the majority of the 42 variables do not have normal distribution. For instance, some variables have a high skewness and kurtosis in comparison to normal distribution. That means that the whole scale 0-10 is not used and most of the observations are concentrated in tighter boundaries. For example, the indicator 2D (Military interference in rule of law and politics) has negative skewness (-0.641) which means that the mass of the distribution is concentrated on the right

side of Figure: 5 below. Indeed, the mean of the data set is 7.356 and median is 8.3, while for normal distribution it should be around 5. This means that most of the countries show higher values for this indicator and only some countries have lower results. A good example is shown in the boxplot below (Figure 6) where the mean is about 7.5 and most of the countries have values between 6.6 and 8.5. In other words, because the summary index is constructed by the unweighted mean of sub-components and components, these indicators with very low interpretive value shouldn't have the same impact in modeling.

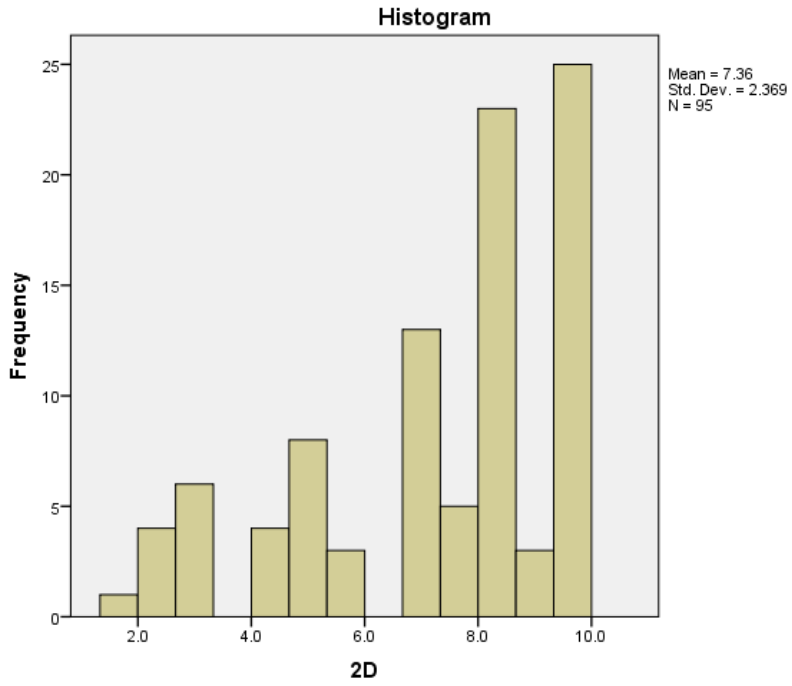


Figure: 5 Histogram of left-skewed 2D (Military interference in rule of law and politics), the EFW index, 2011 (calculations in SPSS)

According to the results of descriptive statistics, countries with extreme values were removed from the following analysis. Brazil has extreme values in variables 5Cii (Bureaucracy costs) and 5Cvi (Cost of tax compliance), and is an outlier in 5Aiii (Interest rate controls/negative real interest rates). Oman, Kuwait and Azerbaijan have extreme values in 3B (Standard deviation of inflation). This component measures the standard deviation of the inflation (based on GDP deflator or Consumer Price Index if the first is unavailable) rate over the last five years (i.e. 2007-2011). Indeed, according to the World Bank ranking, Belarus (where for the given period of time standard deviation of the inflation was 26.76) was in the 1st place, Azerbaijan (18.66) was in the 7th place, followed by Oman (18.56, 8th place). Kuwait (15.78) was in the 13th place (again countries with missing values were excluded). Next, according to the EFW index Argentina and Uganda have extreme values in 3C (Inflation: most recent

year). However, in the World Bank ranking (using CPI or GDP deflator if the first is unavailable) Uganda is in the 8th place with 18.7 %, but Argentina is in the 35th place with 9.47 % and has lower results and better position than Tanzania (12.7 %), Pakistan (11.9 %), Serbia (11.1 %) and Madagascar (9.48 %) which in EFW index do not have extreme values in this component. This issue shows that component 3C may contain old values or some errors and do not represent data from the year 2011. Nevertheless, to preserve the consistency of the final index, the indicator 3C remain as it is published.

Finally, Kazakhstan has extreme value in 4Bii (Compliance costs of importing and exporting). Despite the fact that two indicators 4Ai (Revenue from trade taxes (% of trade sector)) and 4Aiii (Standard deviation of tariff rates) have a lot of extreme values and outliers, none of these countries were reduced. In the case of 4Ai variable, 61 countries (out of 95) have a value greater than 9 and only 8 countries have values less than 5.

Overall, after reducing states with missing values or those that showed extreme values, 88 countries remain in the adjusted data set. Additionally, ordinal indicators were reduced and the following analysis will be applied on the 33 variables model.

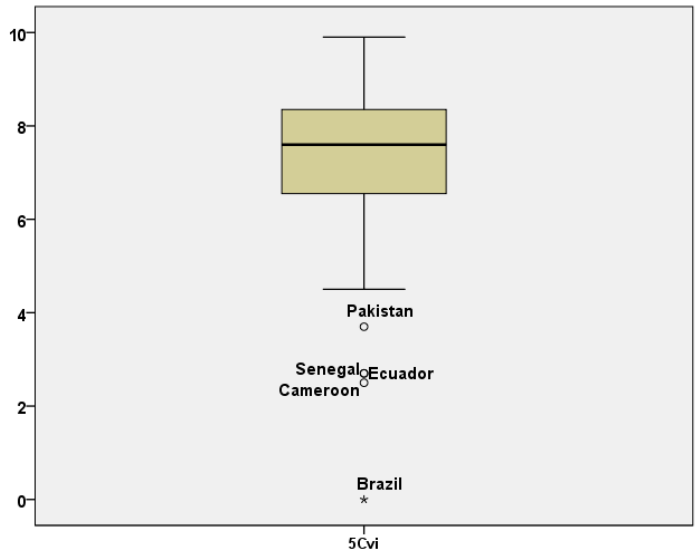


Figure 6: Box-plot of 5Cvi (Cost of tax compliance), the EFW index 2011 (calculations in SPSS)

4 Correlation analysis

Factor analysis is based on the covariance relationship between variables. For this reason correlation analysis is provided. Firstly, relationship (including zero-ordered and partial correlation) in the adjusted 33 indicators model presented for 88 countries will be checked. Secondly, the same will be applied for the original 42, 24 and 5 variables models. Finally, the relation to the summary index will be examined.

From the correlation matrix[3] for the 33 variables (part of which is presented in Figure 7 below and the whole matrix can be found in the attached CD) it is clear that variables 2A (Judicial independence), 2B (Impartial courts), 2C (Protection of property rights) and 2H (Reliability of police) form one group together with variables 5Cii (Bureaucracy costs) and 5Civ (Extra payments/bribes/favoritism). There is a strong and significant positive correlation between these variables. It is conceivable that these variables should form one factor in factor analysis. The correlation is especially high (0.983) between variables 5Cii and 5Civ. Which, of course, is natural due to the fact that these variables are corresponding: if bribes and favoritism exist it means that additional bureaucracy costs presumably also exist and vice versa. Besides, data for variables 5Cii and 5Civ have the same source based on the subjective research (how people estimate the existence of extra payments/bribes/favoritism in their industry and how substantial their impact is). What is more, there are seemingly significant correlations between 5Cii and 2A (0.906), between 5Cii and 2B (0.859), and between 5Cii and 2C (0.912) and 2H (0.891). In the same way, 5Civ has high correlation coefficients with 2A (0.889), with 2B (0.827), with 2C (0.904) and 2H (0.897).

[3] Here the Pearson's correlation coefficients are used; nevertheless, results of Spearman correlations were almost the same with insignificant difference in values.

	1A	1B	2A	2B	2C	2D	2E	2F	2G	2H	2I	3A	3B	3C	4Ai	4Aii	4Aiii	4Bi
1A	1	.616	-.605	-.466	-.573	-.613	-.710	-.408	-.172	-.602	-.478	-.163	-.082	-.428	-.178	-.294	.203	-.400
1B	.616	1	-.316	-.100	-.347	-.618	-.629	-.351	-.137	-.440	-.527	-.385	-.299	-.433	-.383	-.339	.072	-.323
2A	-.605	-.316	1	.870	.889	.529	.661	.360	.169	.830	.515	.021	.095	.403	.293	.306	-.196	.628
2B	-.466	-.100	.870	1	.882	.379	.555	.394	.122	.783	.494	-.039	.029	.335	.172	.224	-.141	.598
2C	-.573	-.347	.889	.882	1	.560	.697	.415	.151	.879	.589	.083	.154	.565	.374	.375	-.178	.700
2D	-.613	-.618	.529	.379	.560	1	.637	.409	.228	.596	.479	.254	.046	.465	.300	.559	.005	.546
2E	-.710	-.629	.661	.555	.697	.637	1	.604	.205	.775	.772	.188	.172	.487	.277	.386	-.133	.536
2F	-.408	-.351	.360	.394	.415	.409	.604	1	.403	.460	.528	.104	.074	.292	.194	.396	-.068	.322
2G	-.172	-.137	.169	.122	.151	.228	.205	.403	1	.195	.120	.060	-.120	.102	.397	.417	-.023	.113
2H	-.602	-.440	.830	.783	.879	.596	.775	.460	.195	1	.733	.130	.121	.580	.376	.397	-.083	.676
2I	-.478	-.527	.515	.494	.589	.479	.772	.528	.120	.733	1	.199	.096	.430	.252	.303	-.035	.676
3A	-.163	-.385	.021	-.039	.083	.254	.188	.104	.060	.130	.199	1	.123	.306	.298	.261	.025	.187
3B	-.082	-.299	.095	.029	.154	.046	.172	.074	-.120	.121	.096	.123	1	.176	.139	-.024	-.029	.102
3C	-.428	-.433	.403	.335	.565	.465	.487	.292	.102	.580	.430	.306	.176	1	.435	.407	-.134	.462
4Ai	-.178	-.383	.293	.172	.374	.300	.277	.194	.397	.376	.252	.298	.139	.435	1	.507	-.011	.404
4Aii	-.294	-.339	.306	.224	.375	.559	.386	.396	.417	.397	.303	.261	-.024	.407	.507	1	.390	.491

Figure 7: Part of Pearson's correlation coefficient matrix of the 33 variables model of the EFW index, year 2011 (calculations in SPSS)

From the correlation matrix it follows that there are two variables 4Aiii (Standard deviation of tariff rates) and 5Aii (Private sector credit) that do not have any significant relationship with any other variable. Hence, it is possible that these variables are revealed to be as inappropriate for the factor analysis. For the variable 4Aiii the highest correlation is with 4Aii (0.390). However, their association appeared to be much stronger when the effect of other variables is removed. The partial correlation coefficient between 4Aiii and 4Aii is 0.574 (Table 1).

Table 1: Partial correlation coefficient between 4Aii and 4Aiii, the EFW index year 2011 (calculations in SPSS)

Correlations

Control Variables			4Aii	4Aiii
1A & 1B & 2A & 2B & 2C & 2D & 2E & 2F & 2G & 2H & 2I & 3A & 3B & 3C & 4Ai & 4Bi & 4Bii & 4Di & 4Dii & 4Diii & 5Aii & 5Bi & 5Bii & 5Biii & 5Bv & 5Ci & 5Cii & 5Ciii & 5Civ & 5Cv & 5Cvi	4Aii	Correlation	1.000	.574
		Significance (2-tailed)	.	.000
		Df	0	55
	4Aiii	Correlation	.574	1.000
		Significance (2-tailed)	.000	.
		Df	55	0

With the regard to indicator 5Aii, it has the highest Pearson's correlation coefficient with 4Di, which is very low 0.160. It follows that the partial correlation between them (0.040) is also negligible.

It is also interesting to notice variables 1A (government consumption) and 1B (transfers and subsidies). While they show seemingly high mutual positive correlation (0.616), their partial correlation between each other is only 0.258. In addition, both indicators are slightly correlated (mutual correlation coefficients are around 0.3) only with 5Bii (hiring and firing regulations) and 5Biii (centralized collective bargaining). For this there is a good logical explanation, in Western countries with strong social systems it is usual that the government has high consumption which is partially spent on transfers and subsidies. It is often that in these countries workers have better protection, labor unions are strong and the labor market is strictly regulated. Otherwise, 1A, 1B, 5Bii and 5Biii do not have any further significant relationship with other variables.

Due to the large data set (which has 33 variables), only some partial correlation coefficients were made to examine relations more closely. For example, it is obvious that the observed positive relationship (0.892) between 5Cii and 2H is due to the underlying connection with other variables (especially 2A, 2B, 2C and others) and seems to be much higher than it really is. The partial correlation between 5Cii and 2H controlled for the variables 2A, 2B and 2C is 0.420. Moreover, in

Table 2 partial correlation between 5Cii and 2H controlled to the all other indicators is negligible (0.035) and not statistically significant (p = 0.797).

Table 2: Partial correlation coefficient between 5Cii and 2H, the EFW index year 2011 (own calculations in SPSS)

Correlations

Control Variables			2H	5Cii
2A & 2B & 2C & 1A & 1B & 2D & 2E & 2F & 2G & 2I & 3A & 3B & 3C & 4Ai & 4Aii & 4Aiii & 4Bi & 4Bii & 4Di & 4Dii & 4Diii & 5Aii & 5Bi & 5Bii & 5Biii & 5Bv & 5Ci & 5Ciii & 5Civ & 5Cv & 5Cvi	2H	Correlation	1.000	.035
		Significance (2-tailed)	.	.797
		df	0	55
	5Cii	Correlation	.035	1.000
		Significance (2-tailed)	.797	.
		df	55	0

Similar results show partial correlations between indicators 2H and 2I: the Pearson's correlation coefficient is 0.733 whereas the partial correlation is much lower 0.410 (control variables are 2A, 2B, 2C). For example, partial correlation between 5Civ and 2B is negligible (-0.010) and not statistically significant (p=0.929) for the control variables 2A, 2C and 2H.

The seemingly high correlation between 5Civ and 2B appears because both indicators have high positive correlations with 2A, 2C and 2H (and others).

In the end, the partial correlation coefficient was high (0.833) between 5Cii and 5Civ which confirms the logical explanation given above at the beginning of this section. Given the results of the correlation analysis, it is expected that factor analysis should be useful for this data set.

Correlation analysis was also applied to the adjusted model with the 42, 24 and 5 variables model. The results were mostly the same compared to the 33 variables model previously described. The difference was only for the combined components: component 4A (tariffs) is the average of three sub-components 4Ai (revenue from trade taxes (% of trade sector)), 4Aii (mean tariff rate) and 4Aiii (standard deviation of tariff rates). For example, correlation between variable 2B and the cumulative component 5C is higher than between 2A and 5C or 2C and 5C. It is because 2B has higher correlation coefficients with each sub-component of 5C (i.e. from 5Ci to 5Cvi) while 2A and 2C have high correlations with 5Cii and 5Civ, but much lower (in comparison to 2B) with 5Ci, 5Ciii, 5Cv and 5Cvi. This means that association and causality in the dataset changed after each stage or cumulation. As a consequence, correlation analysis shows different results for the 5 areas model. For example, while in the 42, 33 or 24 variables model the partial correlations between components from the third and fourth area were negligible. Pearson's correlation coefficients changed after each cumulation. In the end, in the five components model the third and fourth areas have significant correlations in Pearson's (0.718) and partial (0.536) correlation coefficients. Below is a correlation matrix (Table 3) with Pearson's correlation coefficients.

Table 3: Pearson's correlation coefficient matrix of the 5 areas model of the EFW index, year 2011 (SPSS)

Pearson Correlation					
	Area 1	Area 2	Area 3	Area 4	Area 5
Area 1 - Size of Government	1	-0.222	.019	.048	.001
Area 2 - Legal System and Property Rights	-0.222	1	0.541	0.661	0.68
Area 3 - Sound Money	.019	0.541	1	0.718	0.487
Area 4 - Freedom to Trade Internationally	.048	0.661	0.718	1	0.635
Area 5 - Regulation	.001	0.68	0.487	0.635	1

It can be deduced from these results that Freedom to trade internationally has a high results when Sound money (real GDP is rising, low inflation and there is no restriction to own

foreign currency bank accounts) has a high ranking too. It also seemingly significantly correlates with the second (Legal system and property rights) and fifth (Regulation) areas. But the partial correlations are much lower: 0.310 and 0.254 correspondingly.

Based on the results from Table 3 and partial correlation (-0.359), it follows that the Size of government has a slightly negative correlation with the Legal system and property rights. Which should be due to the reverted score of the Size of government (when it is big, the value of index is low and vice versa). The negative relationship between first and second areas can mean that the rules of law and property rights are well-functioning when the size of government is big. In other words, when government has high spending, a big government enterprise sector and high marginal tax it can guarantee a well-functioning legal system and security of property rights.

Furthermore, from the correlation analysis (both Pearson's and partial correlation coefficients) it seems that no area (except second) is related with the Size of government and they do not affect each other.

Next, the correlation between summary index and the 33 sub-components is checked. From Pearson's correlation coefficients (the correlation matrix can be found in the attachment) it seems that the final index is positively correlated with most of the sub-indicators; and only slight negative correlations exist between the final ranking and the first two indicators, namely government consumption (-0.282) and transfers and subsidies (-0.269). However, from the partial correlations very interesting results appear. In this case, the partial correlation coefficients values are completely different (0.542 and 0.08 correspondingly). The same was checked across the years 2010 and 2008 and it follows that the total score has a positive relation around 0.5 with variable 1A (government consumption) and it shows no significant correlation with the variable 1B (transfers and subsidies).

Moreover, almost opposite results were found for most of the other variables (2A, 2B, 2C, 3A, 3B, 5Cii, 5Civ and others). These variables have a seemingly high positive correlation (0.5 and higher) with the final index (using Pearson's or Spearman's correlation coefficients. However, partial correlations show negligible values (0.17 or less). The highest found partial correlation coefficient (0.385) among these variables was found between summary index and standard deviation of inflation (3B) in the year 2008.

Finally, the correlation analysis was applied to the summary index in relation to the 5 areas. Similarly to the previous description, the results of Pearson's correlation coefficients and partial correlation coefficients are different. Table 4 below, in addition to two described correlations, contains semipartial correlation which is used in the regression analysis. Semipartial correlation shows the correlation between the summary index (dependent variable) and one of the independent variables (area 1 to 5) when the linear effects of the other independent variables in the model have been removed from the independent variable. Pearson's correlation coefficients suggest that all areas except for the Size of government have high positive correlation with the summary index. At the same time, partial correlations are a high for each area. Therefore, the most valuable information is given by semipartial coefficients. They do not differ too much among each other, which is due to the fact that summary index is made by an unweighted mean. Nonetheless, from this table it is clearer now that the first area (Size of government) has the biggest impact on final index. At the same time the fourth and fifth areas have less influence.

Table 4: Correlations between the summary index and 5 areas of the EFW index, 2011 (SPSS)

	Correlations with the summary index		
	Pearson's	Partial	Semipartial
Area 1 - Size of Government	.218	.989	.261
Area 2 - Legal System and Property Rights	.790	.985	.225
Area 3 - Sound Money	.808	.984	.218
Area 4 - Freedom to Trade Internationally	.875	.968	.150
Area 5 - Regulation	.783	.968	.151

5 Factor analysis of the EFW index

One of the main purposes of factor analysis is to describe the structure of observed variables and to find a few underlying "factors" that can better and in a compact way explain the whole model. That is why it was chosen to analyze the structure of the EFW index. The analysis is based on the correlations between variables: if these variables can be grouped by their relationship into different groups so variables inside each group are highly correlated. At the same time variables from different groups have relatively small correlations. Then it is assumed that each group can be represented by the new factor. Under these circumstances, the original variables are replaced by new factors and the number of variables is reduced without significant loss of information[4].

Two of the most popular methods of parameter estimation of the factor model are: the principal component method and maximum likelihood method. In the second method it is assumed that the data are sampled from the multivariate normal distribution. As it was stated in the description part only a few variables have normal distribution, therefore the maximum likelihood method will not be used for the estimation of the factor model in the following analysis.

5.1 Factor analysis of the adjusted 33 variables model

The first model based on the 33 components was obtained by the principal component extraction method. The KMO criterion and the Bartlett test of sphericity state that data reduction should be useful for this data set. These two criteria measure sample adequacy. The Kaiser-Mayer-Olkin tests whether the partial correlations among variables are small. High values of KMO criterion (close to 1.0) generally indicate the sample adequacy and appropriateness of factor analysis. In this case KMO is 0.841 as considered as excellent. Bartlett's test of sphericity tests the hypothesis that correlation matrix is the identity matrix, in other words, whether correlations in the data set are suitable for factor analysis. When null-

[4] For the theory of factor analysis see (17) and (15)

hypothesis is rejected (in this case significance is less than 0.05), factor analysis is relevant. Table 5 below shows the result.

Table 5: KMO and Bartlett's Test for the 33 variables EFW model for the year 2011 (SPSS)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.841
Bartlett's Test of Sphericity	Approx. Chi-Square	2438.935
	df	528
	Sig.	.000

Another criterion is "extraction communalities". It shows the proportion of variance of the original variables explained by the extracted factors. It is clear that higher values are desirable. If the communality for a variable is less than 50%, it is a candidate for exclusion from the analysis because the factor solution contains less than half of the variance in the original variable, and the explanatory power of that variable might be better represented by the individual variable. The part of the communalities table is shown in Table 6 below.

Table 6: Table of communalities of Extraction Method: Principal Component Analysis applied on 33 variables of the EFW index (SPSS)

Communalities

	Initial	Extraction
1A	1.000	.796
1B	1.000	.824
2A	1.000	.883
2B	1.000	.907
2C	1.000	.939
2D	1.000	.755
2E	1.000	.847
2F	1.000	.647
2G	1.000	.710
2H	1.000	.874
2I	1.000	.745
3A	1.000	.533
3B	1.000	.453
3C	1.000	.538
4Ai	1.000	.660

From the presented communalities table (the whole table can be found in the attachment), where the only variable that has lower communality than 0.5 is 3B (0.453), it is clear that all extracted values are acceptable.

The first attempt offers a 7 factors model (based on the criterion that the eigenvalue should be greater than 1). The seventh component has eigenvalue[5] 1.189, while the eighth has 0.928. The scree plot (in Figure 8 below) also offers a 7 or 8 components model. The horizontal line shows the position where eigenvalue equals 1.

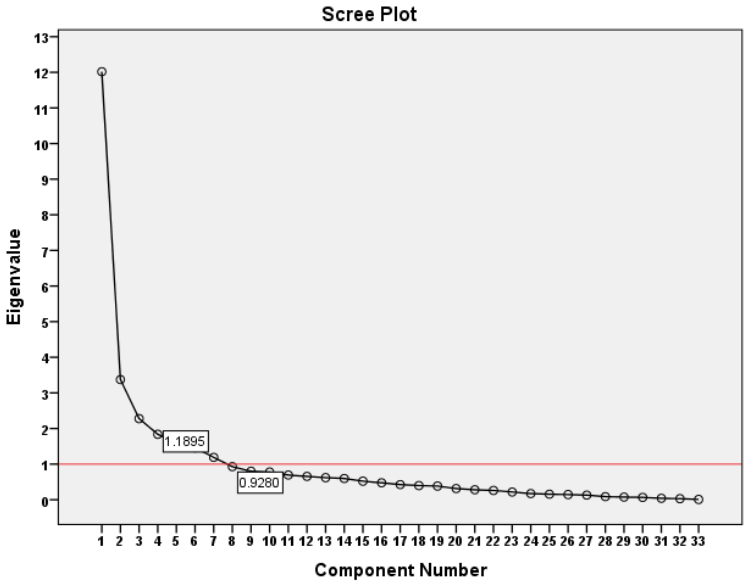


Figure 8: Scree plot of principal component extraction method applied on 33 variables of the EFW index (SPSS)

Table 7 below shows a part of output. Where in the first (Initial Eigenvalues) and second (Extraction Sums of Squared Loadings) columns there is an information regarding the initial and extracted eigenvalues (which are the same in Principal Components Extraction method). It suggests that 38.753 % of total variance is explained by the first component in the unrotated solution. Second component explain additional 10.754 % and cumulative variance explained by two first components in the unrotated solution is 49.507 %. Because the ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables, it is clear that some variables cane be reduced. In another words, if a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. Eigenvalues measure the amount of variation in the total sample accounted for by each factor. It can be seen that the cumulative

[5] The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. (7)

variability explained by 7 factors in the extracted solution is 71.950 %. This means that about 28 % of information will be lost. Obviously, the more original variability is explained by the new model, the better. In a non-laboratory data-set more than 50 % is still acceptable. The third column shows analogous information after rotation is applied.

Table 7: Total Variance explained by the Factor Analysis model for the 33 variables EFW model for the year 2011 (SPSS)

Total Variance Explained

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	12.017	36.415	36.415	12.017	36.415	36.415	7.356	22.290	22.290
2	3.372	10.219	46.634	3.372	10.219	46.634	5.886	17.835	40.125
3	2.278	6.902	53.536	2.278	6.902	53.536	2.501	7.580	47.705
4	1.837	5.567	59.103	1.837	5.567	59.103	2.454	7.437	55.142
5	1.590	4.818	63.921	1.590	4.818	63.921	2.432	7.371	62.513
6	1.460	4.424	68.345	1.460	4.424	68.345	1.697	5.142	67.655
7	1.189	3.605	71.950	1.189	3.605	71.950	1.417	4.295	71.950
8	.928	2.812	74.762						
9	.800	2.424	77.186						

The rotated component matrix for the 7 components solution (shown in Table 8 below) suggests that the number of components can be reduced. Considering the fact that the seventh factor significantly correlated only with the variable 5Aii (Private sector credit) and the sixth factor is also correlated with the single variable 4Aiii (Standard deviation of tariff rates). Otherwise, factors six and seven do not have a significant correlation with any other variable and therefore are trivial.

After reducing trivial variables 4Aiii and 5Aii from the analyzed model the new solution offers a 6 factors model (based on the criterion that the eigenvalue should be greater than 1).The KMO criterion (0.860) is even closer to 1. The extraction communalities for this solution are also acceptable, although the lower value (0.369) of 5Bi (Hiring regulations and minimum wage) shows that it does not fit as well as other variables.

Table 8: Rotated component matrix of the 33 components EFW model for the year 2011, Varimax rotation is used (SPSS)

	Component						
	1	2	3	4	5	6	7
2B	.881	.325	-.018	.072	-.070	-.100	.072
2C	.846	.417	.148	-.084	.115	-.066	-.056
4Di	.799	-.056	.071	-.017	.017	.280	.011
2A	.797	.449	.107	-.063	-.045	-.114	-.127
5Cii	.791	.502	.179	-.002	.131	-.029	.006
5Civ	.749	.533	.220	-.001	.183	-.038	.029
2H	.706	.585	.089	-.005	.147	-.019	-.053
5Ci	.691	.018	-.056	.484	-.094	.066	.261
4Bi	.667	.329	.114	-.037	.215	.442	-.041
5Cv	.605	-.137	.253	.073	.308	-.152	.160
4Bii	.578	.169	.263	.008	.547	-.006	-.085
5Cvi	.474	.462	.258	.096	.001	-.015	-.060
5Bi	.417	.124	.138	.316	-.339	-.104	-.297
2E	.378	.814	.043	-.066	.168	-.086	-.023
2I	.328	.747	-.145	.107	.207	-.001	.051
5Bv	.163	.739	.089	.060	.061	.260	-.095
1B	.063	-.711	-.137	.372	-.347	-.005	.192
2D	.221	.705	.336	-.187	.044	.201	-.141
1A	-.282	-.703	-.212	.385	.070	.151	-.052
2F	.184	.612	.124	.244	.230	-.168	.287
4Diii	.179	.090	.693	-.193	.018	-.115	-.028
2G	-.020	.240	.655	.417	.110	-.144	.130
4Dii	.292	.069	.595	.000	.102	.318	-.024
4Aii	.148	.395	.533	.118	.265	.459	.059
5Bii	.154	-.040	-.158	.800	-.123	.089	-.102
5Biii	-.080	-.091	.137	.758	-.013	.033	.042
3A	-.095	.185	.053	-.211	.651	.109	.080
4Ai	.220	.112	.475	.086	.575	.033	-.187
5Ciii	.178	.336	.050	.236	.548	-.028	-.305
3C	.397	.318	.212	-.193	.442	-.025	.030
3B	.087	.040	-.219	-.303	.396	-.040	-.382
4Aiii	-.080	-.037	-.032	.095	.003	.901	.103
5Aii	.104	-.024	-.030	-.035	-.071	.079	.845

Table 9 below shows that the 6 components model explains 70.385 % of the original total variance.

Table 9: Total Variance explained by the Factor Analysis model for the 31 variables EFW model for the year 2011 (SPSS)

Total Variance Explained

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	12.013	38.753	38.753	12.013	38.753	38.753	7.405	23.886	23.886
2	3.334	10.754	49.507	3.334	10.754	49.507	5.392	17.394	41.281
3	2.182	7.038	56.545	2.182	7.038	56.545	2.766	8.923	50.203
4	1.837	5.926	62.471	1.837	5.926	62.471	2.397	7.733	57.936
5	1.371	4.423	66.894	1.371	4.423	66.894	2.385	7.693	65.629
6	1.082	3.490	70.385	1.082	3.490	70.385	1.474	4.756	70.385
7	.963	3.106	73.491						

After inspecting the rotated component matrix (which can be found in the attachment) the sixth factor revealed to be trivial. It is formed by the single variable 2G (Regulatory restrictions on the sale of real property) and therefore the number of factors was reduced to 5 and variable 2G was left out from the model.

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. The total variance explained by 5 factors is 67.624 % (Table 10). While variable 5Bi again has lower extraction communality (0.339), most of the other extraction communalities are high.

Table 10 Total Variance explained by the Factor Analysis model for the 30 variables EFW model for the year 2011 (SPSS)

Total Variance Explained

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						

Table 11 below displays a rotated component matrix for the final solution with 5 factors. In addition, factor scores were saved and used for the regression analysis (with regards to summary index) to check the efficiency of the found model. An adjusted R-square (goodness-of-fit statistics) suggests that 82.2 % of the response variable (summary index) is explained by the 5 factors linear model. The part of output of the stepwise algorithm is shown in Table 12.

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 case of 5Ci with forth) 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 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 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 system (including unbiased police and courts), which do not implement essential barriers on trade and business area, will have greater economic freedom.

The second component loads most strongly 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 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.

Table 11 Rotated Component Matrix for the 30 variables EFW model for the year 2011 without trivial solution, Varimax rotation is used (SPSS)

Rotated Component Matrix

	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

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, international trade and can impose different restrictions on commercial freedom, and at the same time 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.

Table 12: Regression coefficients found by stepwise algorithm, EFW 2011 (SPSS)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.199	.055		131.060	.000
	REGR factor score 1 for analysis 2	.344	.055	.558	6.234	.000
…	…	…	…	…	…	…
5	(Constant)	7.199	.028		259.479	.000
	REGR factor score 1 for analysis 2	.344	.028	.558	12.341	.000
	REGR factor score 5 for analysis 2	.281	.028	.455	10.068	.000
	REGR factor score 2 for analysis 2	.236	.028	.383	8.467	.000
	REGR factor score 3 for analysis 2	.193	.028	.312	6.909	.000
	REGR factor score 4 for analysis 2	.163	.028	.265	5.857	.000

a. Dependent Variable: Summary Index

The forth 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.

Very similar results (found by varimax rotation method) were found by using the equamax rotation: all the variables gathered in the same factors. The only difference is that indicator

5Cvi is more correlated with the second factor instead of the first. Otherwise, only loadings change their value.

The quartimax rotation, however, gives different results. The rotated component matrix is shown below; the whole output can be found in the attached CD.

Table 13: Rotated Component Matrix for the 30 variables EFW model for the year 2011 without trivial solution, Quartimax rotation is used (SPSS)

Rotated Component Matrix					
	Component				
	1	2	3	4	5
5Cii - Bureaucracy costs	.961	-.020	.061	.011	.036
5Civ - Extra payments/bribes/favoritism	.955	-.022	.017	.063	.079
2C - Protection of property rights	.947	-.089	.155	-.011	.024
2H - Reliability of police	.930	-.026	-.060	.047	-.034
2A - Judicial independence	.907	-.098	.092	-.148	-.053
2B - Impartial courts	.882	.059	.228	-.235	-.138
2E - Integrity of the legal system	.794	-.119	-.421	.110	-.084
4Bi - Non-tariff trade barriers	.758	.016	.126	.155	.140
2I - Business costs of crime	.694	.079	-.411	.142	-.212
5Cvi - Cost of tax compliance	.686	.051	-.090	-.033	.094
4Bii - Compliance costs of importing and exporting	.655	.021	.245	.466	.159
1A - Government consumption	-.644	.435	.387	.116	-.102
2D - Military interference in rule of law and politics	.625	-.175	-.452	.083	.332
4Di - Foreign ownership/investment restrictions	.611	.064	.482	-.080	.106
3C - Inflation: most recent year	.569	-.170	.008	.362	.182
5Bv - Mandated cost of worker dismissal	.568	.076	-.532	.098	.118
5Ci - Administrative requirements	.548	.516	.337	-.262	-.070
2F - Legal enforcement of contracts	.547	.172	-.347	.151	-.055
5Bi - Hiring regulations and minimum wage	.398	.280	.086	-.307	-.024
5Bii - Hiring and firing regulations	.076	.822	.041	-.106	-.160
5Biii - Centralized collective bargaining	-.093	.782	-.031	.017	.139
1B - Transfers and subsidies	-.413	.427	.546	-.414	-.037
5Cv - Licensing restrictions	.478	.063	.506	.149	.123
4Ai - Revenue from trade taxes (% of trade sector)	.375	.066	.107	.603	.320
3A - Money growth	.102	-.201	-.127	.603	.117
5Ciii - Starting a business	.415	.182	-.112	.583	-.124
3B - Standard deviation of inflation	.116	-.370	.110	.446	-.373
4Diii - Freedom of foreigners to visit	.288	-.184	.035	.024	.617
4Dii - Capital controls	.359	.066	.108	.132	.617
4Aii - Mean tariff rate	.445	.161	-.219	.304	.560

The first component is defined by 19 variables and explains 38.431 % of the total variance in rotated solution. From the rotated component matrix in Table 13 it is clear, that two factors are the same as in varimax rotation: 5Bii + 5Biii and 4Dii + 4Dii+4Aii. The first factor can be interpreted as general freedom in a country and means a strong independent judicial system with responsible government which guarantees basic property, labor and civil rights, does not apply trade barriers or other economic restrictions, and supports business development. The society is "healthy", i.e. bribes and bureaucracy costs do not exist. Other factors can be interpreted as additional or secondary. Since a five factors model cannot be shown in the graph, the number of extracted factors will be reduced to three. The total variance explained by 3 factor model (53.536 %) is still acceptable. In Figure 9 below the model is shown in 3 dimensions.

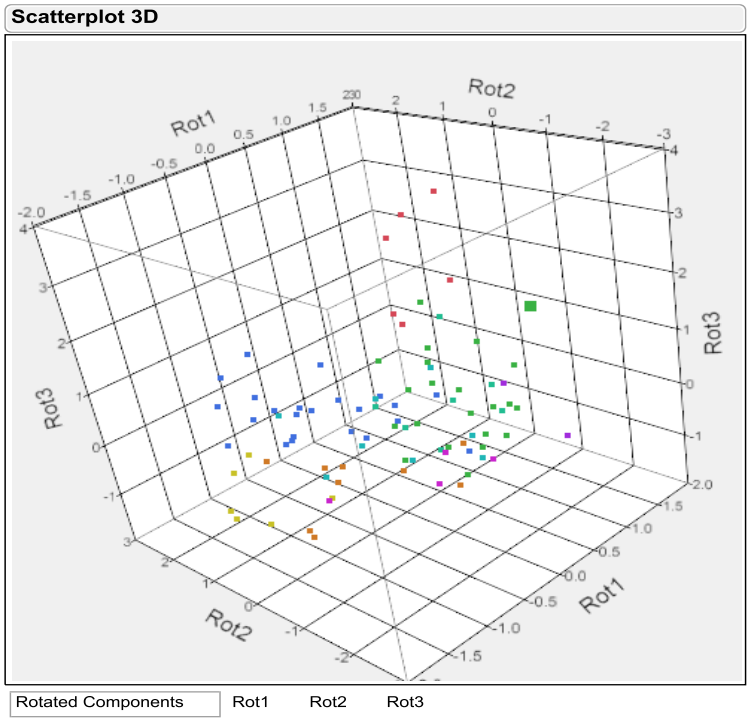


Figure 9: Rotated component solution for the 33 variables EFW model for the year 2011, Varimax rotation (JMP)

In Figure 10 below the extracted two factors solution is shown. It is clearer now that most of the variables are relatively close to each other and can be relatively well explained by two factors. However, variables 1A (Government consumption) and 1B (Transfers and subsidies) significantly deviate from others. The two factors solution explains 46.6 % of variance. Where the first factor describes 36.077 % of variance and can explain the main drivers of economic freedom, which are the protection of property rights, judicial independence,

impartial courts, absence of bureaucracy costs and absence of extra payments, bribes and favoritism.

The second factor can explain less important indicators of economic freedom: inflation and labor market regulation.

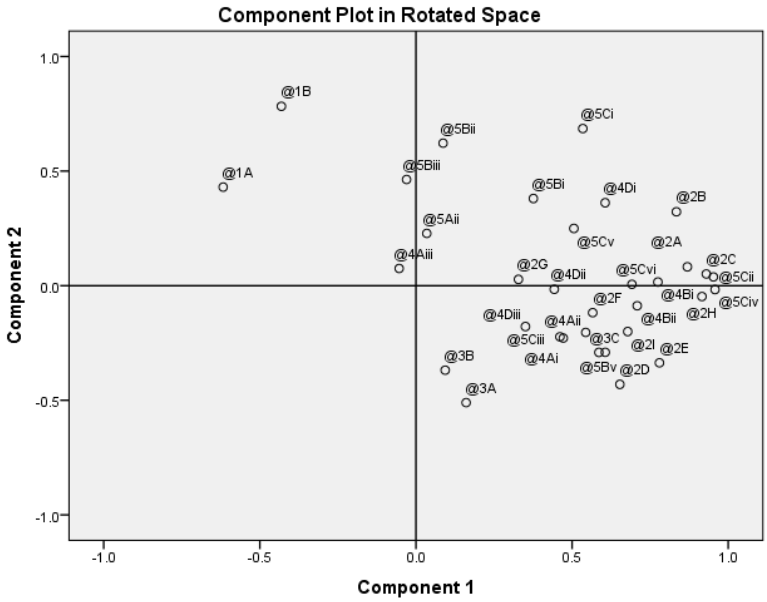


Figure 10: Varimax rotation with 2 factors model applied on the 33 variables EFW model for the year 2011 (SPSS)

5.2 Factor analysis of the 24 variables model

To compare the results between the 42 and 24 variables modes, the factor analysis was provided on the 24 variables model. However, remembering the results of Chapter 3, some variables should be excluded before the analysis. Namely variables 1C (Government enterprises and investment) and 3D are ordinal by the origin. Component 1D (Top marginal tax rate) is an average of two ordinal sub-component 1Di and 1Dii. The indicator 4C (black-market exchange rates) was excluded for the same reason as for the 42 variables model (almost all countries have the same values). Because variables 5A (Credit market regulations) and 5B (Labor market regulations) are also made partly from the ordinal variables (5Ai, 5Aiii and 5Biv, 5Bvi accordingly) and contain a summary error they were excluded from the analysis. As a result, 18 components remain for the following analysis.

The extracted solution with four factors is shown in Table 14 below. This model explains 72.594 % of the total variance. All other criteria (KMO, eigenvalues, extracted communalities and scree-plot) also confirm that this solution is appropriate.[6]

Table 14: Rotated Component Matrix for the 18 variables EFW model for the year 2011, Varimax rotation (SPSS)

	Component			
	1	2	3	4
2B - Impartial courts	.931	.159	-.075	.063
2C - Protection of property rights	.904	.318	.149	-.065
2A - Judicial independence	.875	.316	.006	.002
5C - Business regulations	.868	.275	.237	.158
2H - Reliability of police	.798	.469	.160	-.033
4B - Regulatory trade barriers	.714	.224	.543	-.106
1B - Transfers and subsidies	-.009	-.824	-.285	.234
2E - Integrity of the legal system	.504	.773	.059	-.013
1A - Government consumption	-.386	-.722	.018	.008
2I - Business costs of crime	.431	.675	.039	-.037
2D - Military interference in rule of law and politics	.329	.643	.319	.040
2F - Legal enforcement of contracts	.268	.622	.062	.369
4A - Tariffs	.090	.038	.820	.107
4D - Controls of the movement of capital and people	.474	.029	.554	.213
3A - Money growth	-.149	.337	.525	-.301
3C - Inflation: most recent year	.407	.372	.423	-.257
2G - Regulatory restrictions on the sale of real property	.051	.240	.365	.732
3B - Standard deviation of inflation	.045	.160	.140	-.621

By examining the results for the 33 and 18 variables model it is clear that two main components are the same. The third factor in the 18 variables model is a combination of the third and fifth factors in the 33 variables model. It means that the results correspond, as well as for the two factors model shown in Figure 11 below.

The two factors model explains 57.165 % of the original variability. Almost all variables (except for 1A and 1B which are lying in the third quadrant) are situated in the first quadrant. Component 2B (impartial courts) is located very close to the first quadrant, but already in the fourth; as well as 3A (money growth) which lies in the third very close to the axis and north-east quadrant. The first factor explains the legal system and property rights together

[6] For the whole output see attachment

with the trade and business barriers; while the second factor explains monetary policy in the country and military interference in the rule of law and politics.

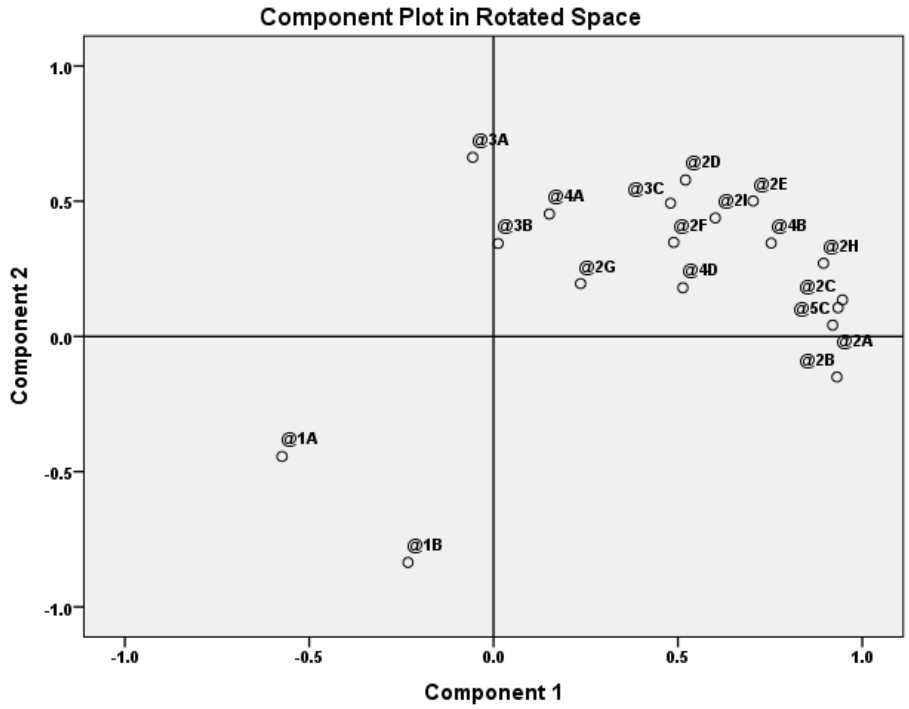


Figure 11 Varimax rotation with the 2 factors model applied on the 18 variables EFW model for the year 2011 (SPSS)

To sum up the results of factor analysis, it can be said that original sample set indeed can be gathered together and explained by a fewer number of components. This means that using factor analysis was entirely appropriate. As it was assumed, none of the obtained models correspond to the five areas order defined by the Canadian Fraser Institute. All distinct indicators were mixed together. On the other hand, received models confirm the main and logical idea of the index. Those countries with higher indicators (components and sub-components) should have higher Economic Freedom.

6 Hierarchical Cluster analysis of the EFW index

In contrast to factor analysis, before using hierarchical cluster analysis no strong assumptions are needed. Cluster analysis is an exploratory data analysis tool which aims to sort different objects into groups in a way that the degree of association between two objects is maximal if they belong to the same group and minimal otherwise. This method is great in the exploratory or research part of analysis and can be used without a prior hypothesis. It can discover the structure of data set and classify it on a natural basis. Therefore, it can be useful to compare results from cluster analysis with the ones from factor analysis.

Hierarchical clustering methods proceed by either a series of successive merges or a series of successive divisions. In the agglomerative hierarchical techniques initially each variable is in a separate cluster. Firstly, the most similar objects are grouped and these initial clusters are merged together according to their similarities (distances between objects). Eventually, as the similarity decreases, all subgroups are fused into a single cluster.

Divisive hierarchical methods work in the opposite direction. At the beginning there is only a single cluster of all objects which is consequently divided into two groups, so objects in one group are "far from" the objects in the other. This procedure continues further until each object forms a group. A special tree-diagram graph called a dendogram is used to represent the structure and distances between clusters (for both methods).

Hierarchical cluster analysis uses numerous methods that differ by the way distances (similarities) are computed[7] and by linkage method. Among the applied methods will be **average linkage**, where the distance between clusters is calculated as an average distance from the objects from the first cluster to the objects from the second cluster. This method tends to join clusters with small variances and is slightly biased toward producing clusters with the same variance. In **Ward's** minimum variance **method**, the distance between two clusters is the ANOVA sum of squares between the two clusters added up over all the variables. Ward's function tries to minimize the increase in error sum of squares in each step. Ward's method tends to join clusters with a small number of observations and is strongly biased toward producing clusters with roughly the same number of observations. It is also

[7] See (15) and (17)

very sensitive to outliers. The next method is **centroid linkage**: the distance between two clusters is defined as the squared Euclidean distance between their means. The centroid method is more robust to outliers than most other hierarchical methods but in other respects might not perform as well as Ward's method or average linkage. In **complete linkage**, the distance between two clusters is the maximum distance between an observation in one cluster and an observation in the other cluster. Complete linkage is strongly biased toward producing clusters with roughly equal diameters and can be severely distorted by moderate outliers. **Single linkage** has a similar manner to the complete linkage. In single linkage the distance between two clusters is the minimum distance between two observations from the two clusters (4). A drawback of this method is the so-called chaining phenomenon, when it merges very distant objects in the same group if their previous neighbors made a bridge. It often adds several single object clusters at the final stages. As a consequence, the produced clusters may be hardly interpretable. To summarize, all described methods (except for Ward's) compute the distance between the variables as the different type of means. While the Ward method is based on variance. Therefore it will be primary technique to use. Nevertheless the dendogram for each method is presented in the attachment (to show the typical appearance of described methods).

Despite the assumption that all variables have values between 0 and 10, but as it is already known some indictors have tighter borders and never reach values lower than 3 or higher than 8 especially in adjusted data. It follows that some results were more interpretable when the standardization was used.

6.1 Hierarchical cluster analysis applied on partial indicators

Firstly, hierarchical cluster analysis is provided on the same data set as factor analysis, i.e. the 33 variables model with 88 countries for the EFW index for the year 2011. For each method a 4 clusters model was offered (based on the criterion of the biggest jump in distances). However, none of these four clusters correspond to any of the 5 factors in the factor analysis solution. Only fragmentary clusters (that join two, three or up to seven variables) match with the same variables inside the factor model. Centroid and single linkage methods gave one big cluster which contains all variables except three (5Bi "Hiring regulations and minimum wage", 4Diii "Freedom of foreigners to visit" and 4Dii "Capital

controls") which stand by themselves until the final amalgamation stages. The average linkage method gives a very similar result.

Better results that more or less match the 5 factors model were given by the Ward's method (shown below), the average method and the complete linkage method. The clustering sequence for the Ward method is visualized with the help of a dendogram, shown in Figure 12.

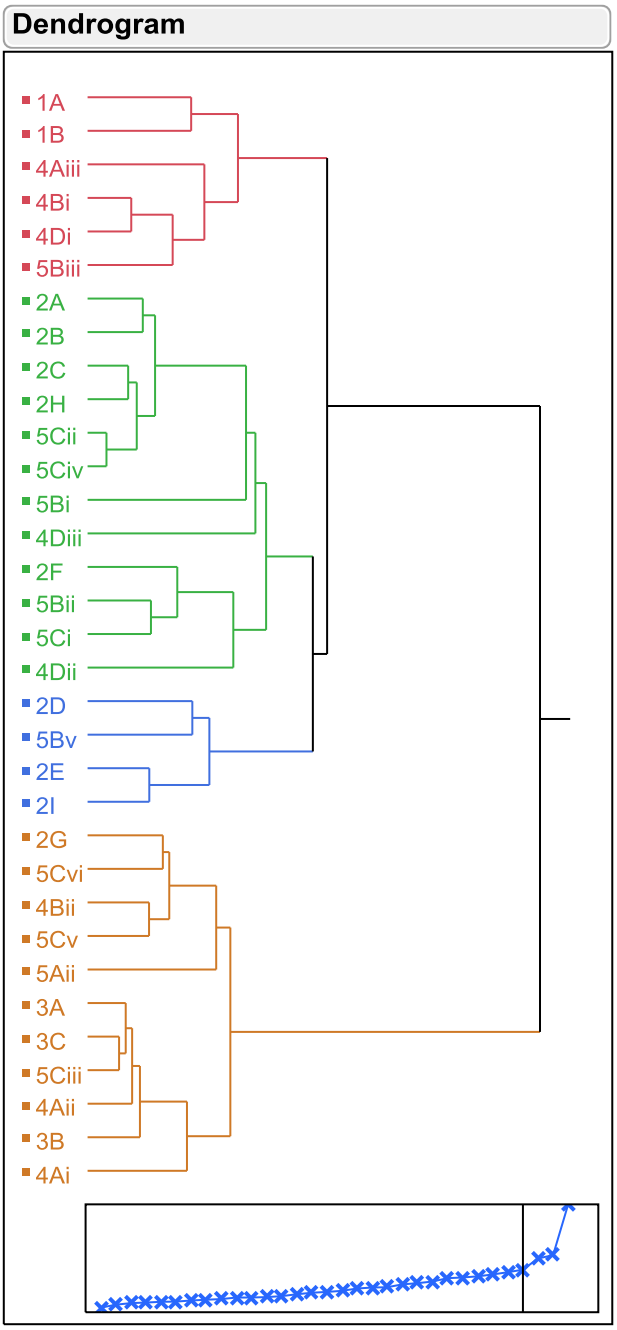


Figure 12: Ward's Linkage dendogram for distances between 33 variables of the EFW index 2011 (JMP Pro)

It is clear that most of the variables from the first component in factor model (applied to 33 variables) are in the same (green) cluster (i.e. 2A, 2B, 2C, 2H, 5Cii, 5Civ and 5Bi). The whole blue cluster corresponds to the part of the second factor from the factor model. The yellow cluster (without 5Cvi, 5Cv, 5Aii, 4Aii and 2G) matches with the third factor. The natural break, where the distance jumps up suddenly and offers 4 clusters, can be seen in the small scree-plot, which is shown at the bottom part of Figure 12.

As it was assumed, none of the hierarchical cluster models applied for the 33 (or 30) variables corresponds to the original 5-areas model offered by the Fraser Institute. The most significant correspondence was found only for variables 2A, 2B, 2C and 2H that were mostly merged into the same cluster. Otherwise, all the variables from different areas were mixed together.

Cluster analysis was also applied to the 24 and 18 variables model. However, found results were the same, i.e. none, of the clustering models correspond entirely with the structure of the EFW index.

6.2 Hierarchical Cluster analysis applied to the countries

In this part of the thesis Hierarchical Cluster analysis will be applied to the sample of countries to explore whether they can be organized in good interpretable groups. Firstly, the data set with 95 countries will be analyzed with the original 42 indices model. Secondly, the analysis will be applied on the adjusted model with 88 countries and 33 indices, 24 and 5 areas. Ideally, clusters applied to the 42 (33) variables model correspond to clusters from the 24 and 5 variables model. Therefore, at the end all the results will be compared.

Because cluster analysis is not very robust towards outliers it is appropriate to use standardization for the data set of 95 countries. It was also confirmed by the results of standardized and non-standardized data. In the second case the results showed very unusual combinations of countries, for instance, Kenya, Uganda and the Czech Republic were merged into the same cluster together with the United Kingdom, the United States and Jordan and some other countries.

For the interpretation, the solution offered by the Ward linkage method was chosen. In Figure 13 the dendogram is shown with 20 clusters. In the first “red” cluster (from top to bottom) there are countries from the “TOP 20” of the EFW index. Hong Kong and Singapore linked in the first stage connection. First cluster contains only one country from Europe (Estonia), one

country from Latin America (Chile) and two countries from Australia and Oceania (Australia and New Zealand). Other four countries are from Asia (Hong Kong, Singapore, the United Arab Emirates and Bahrain). The green cluster is made only of two countries Oman and Kuwait. It is unusual to see these countries in a combination of other countries from neighboring clusters. However, there is probably some correspondence with the United Arab Emirates and Bahrain that are situated in the first (red) cluster. At the same time, countries from the green cluster have fewer similarities with the countries from the bottom clusters. The following blue cluster except for Jordan contains countries with advanced economies according to the International Monetary Fund (Switzerland, the United Kingdom, the United States and etc.). The orange cluster has a logical interpretation, where countries from Western and Northern Europe are situated. This cluster contains the first merged countries (Sweden and the Netherlands). The described 4 clusters are merged into one big cluster, which contains in total 28 countries (out of 95), and joins in the last stage the other big cluster with the rest of the countries. The part of the clustering history is shown in the attachment. Due to the lack of space, proximity matrix (with calculated distances between variables can be found in the attached CD).

Turning to the bottom half clusters, in the first sea-green cluster there are countries (except for Malta) from the former Eastern Bloc: Poland, the Slovak Republic, the Czech Republic, Lithuania, Latvia, Hungary, Romania and Bulgaria. This cluster joins in the next stage with the following violet cluster. Together they form countries from Eastern and Southern Europe. Next, the yellow and the light-blue clusters are formed by countries (except for South Africa) from The Community of Latin American and Caribbean States (CELAC[8]). Among them are Peru, Costa-Rica, Jamaica, Nicaragua, El Salvador and some others. Additionally, two more clusters at the bottom can be logically explained. The Dark-moss green cluster displays African countries from the same region: Uganda, Kenya, Tanzania and Malawi, only Ghana is located farther on the west part of Africa. At the very bottom there is a cluster with former Soviet (socialist) countries.

[8] http://en.wikipedia.org/wiki/Community_of_Latin_American_and_Caribbean_States

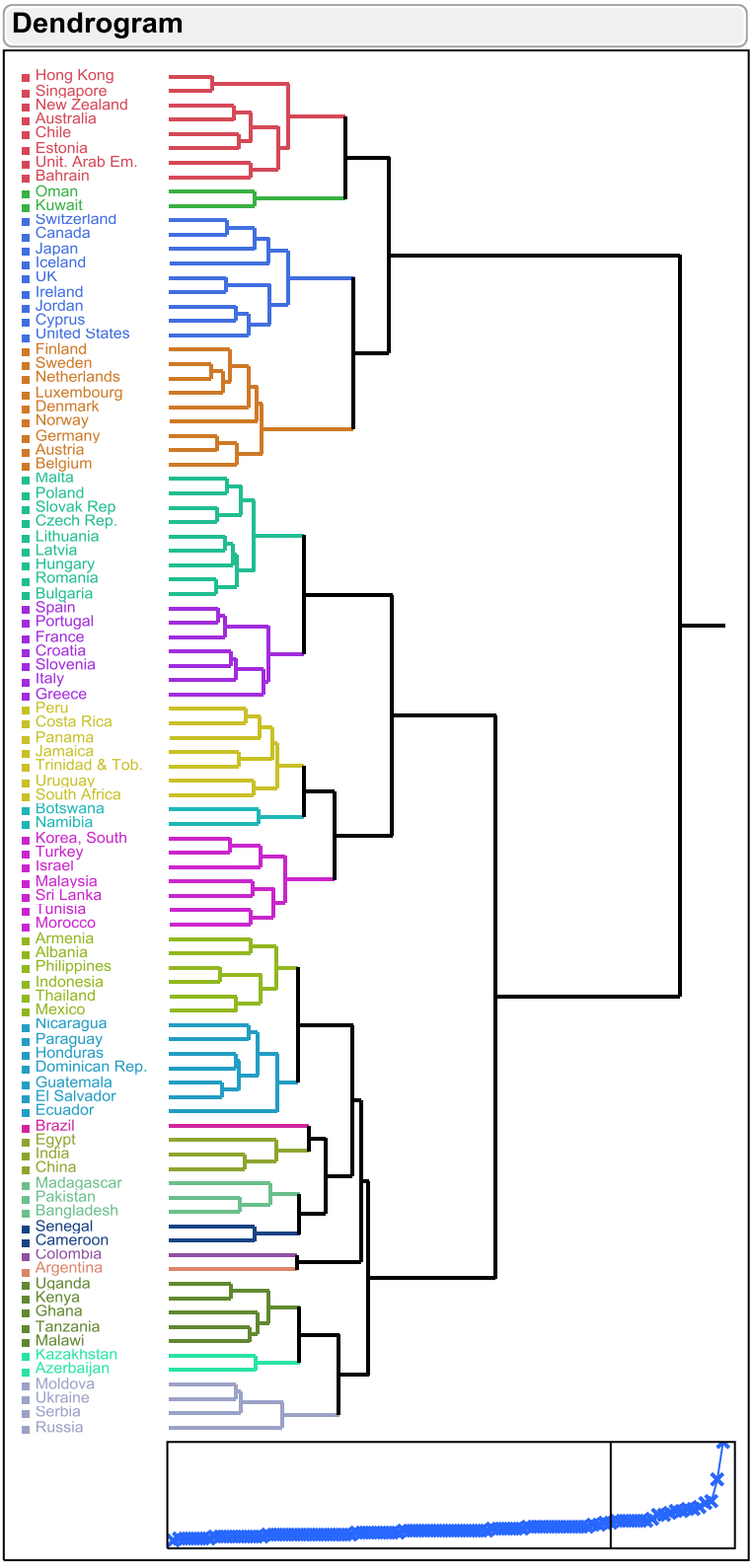


Figure 13 Ward's Linkage dendogram for 95 countries of the EFW index 2011, standardized (JMP Pro)

It is also interesting that all methods except the Ward linkage and complete linkage left Argentina in a separated cluster until the last stage where two big clusters merged into a single cluster. It confirms the accuracy (appropriateness) of Argentina's exclusion for its

extreme values in the preparation part (Descriptive statistics of the EWF index). Very similar results are shown for Brazil which also has extreme values in some indices and does not match with other countries.

For the reason of comparison, the single linkage method applied to the same sample is shown in the attachment on page 74. Where chaining phenomenon is shown: almost all the countries belong to one big cluster. This is unsuitable for the purpose of this thesis.

After providing hierarchical cluster analysis on the 33, 24 and 5 variables models it follows that a logical explanation of obtained order can be found only for the first two models. For the 5 areas model (Size of Government, Legal System and Property Rights, Sound Money, Freedom to Trade Internationally, and Regulation) only some of the initial stage clusters (at a minimum distance level) have a conventional view of the world. For example, the United Kingdom and Ireland or Germany and Austria are merged in the first stage. Unfortunately, there are also examples when China and Slovenia are fused together. When the allowable level is increased some unusual clusters appeared, i.e. the United States, Lithuania and Hungary are merged together or Moldova, Ghana and Thailand also appeared in the one cluster. In the end, for bigger clusters no reasonable explanation can be found as to why countries were merged together. One of the possible reasons for this is that this 5 areas model is made from the original 42 by averaging sub-components to the 24 variables model, and then again averaging procedure was applied. Clearly, as it was already shown in the beginning of the thesis (Description of the data set of the EFW index and Descriptive statistics of the EWF index), some indices should be omitted or different weights in averaging should be applied otherwise, the cumulative error arises from partial indices to the summary index.

To get back to the point, hierarchical cluster analysis applied to the 24, 33 and 42 variables model mostly offers a few clusters with good explanation and at least one or two clusters that could not be logically explained. For example, below (Figure 14) is a dendogram of the 6 clusters model obtained by using Ward's linkage method applied to the 33 variables model with 88 countries. The second (green) cluster from the top contains developed countries, 12 European countries (Finland, the United Kingdom, Denmark, Germany, Ireland, Austria, Sweden, Netherlands, Luxembourg, Switzerland, Norway, Iceland) and 5 non-European (New Zealand, the United States, Australia, Canada and Japan). The orange cluster (forth from the top) includes former communist countries including Czech Republic and Slovakia. The fifth cluster (sea-green) is entirely organized by CELAC countries. In the bottom (violet)

cluster developing countries (according to IMF and World Bank data)[9] are fused together. Again, the top cluster contains only 23 countries (out of 88) which can be considered as the most economically free.

There are two clusters: first (red) and third (blue) that do not have a commonly accepted explanation. However, after analyzing each cluster more closely some more association is found. Countries are approximately fused into clusters by the values of a particular indicator. For instance, the first (red) cluster contains countries that have approximately the same high results (in comparison to other clusters) in indicators 1B (Transfers and subsidies), 2D (Military interference in rule of law and politics) and 4Aiii (Standard deviation of tariff rates). At the same time, countries (i.e. Switzerland, Canada, Norway, Japan and Iceland) from the partial (sub-cluster) from the second (green) cluster have extremely low results in indicator 4Aiii. Furthermore, countries from the top and from the bottom clusters have almost polarized values in some indices. Especially it can be seen on indices 2H (Reliability of police), 4Dii (Capital controls), 4Diii (Freedom of foreigners to visit), 5Bv (Mandated cost of worker dismissal), 5Cii (Bureaucracy costs) and 5Civ (Extra payments/bribes/favoritism). Countries from the top clusters are in general higher (better values) in mentioned indicators than countries from the bottom clusters. The biggest difference is in indicators 5Cii and 5Civ. While for the top two clusters the average for the Bureaucracy costs is 7.6 and for the Extra payments/bribes/favoritism is 8.1, for the "former communist countries" cluster it is 4.2 and 4.4 accordingly. Obviously, the highest results for these indices are shown by the most economically free countries. The best result for the Bureaucracy costs are shown by Singapore (8.6) and New Zealand (9.2) for the Extra payments/bribes/favoritism.

Countries from the bottom clusters have noticeably better results in the first two indicators: the average result in government consumption is 6.12 in comparison to 4.09 for countries from the top cluster; in transfers and subsidies it was 7.34 and 5.97 correspondingly. Otherwise, in roughly one third of indicators there is no significant difference between two clusters and the average is approximately the same.

[9] http://en.wikipedia.org/wiki/Developing_country

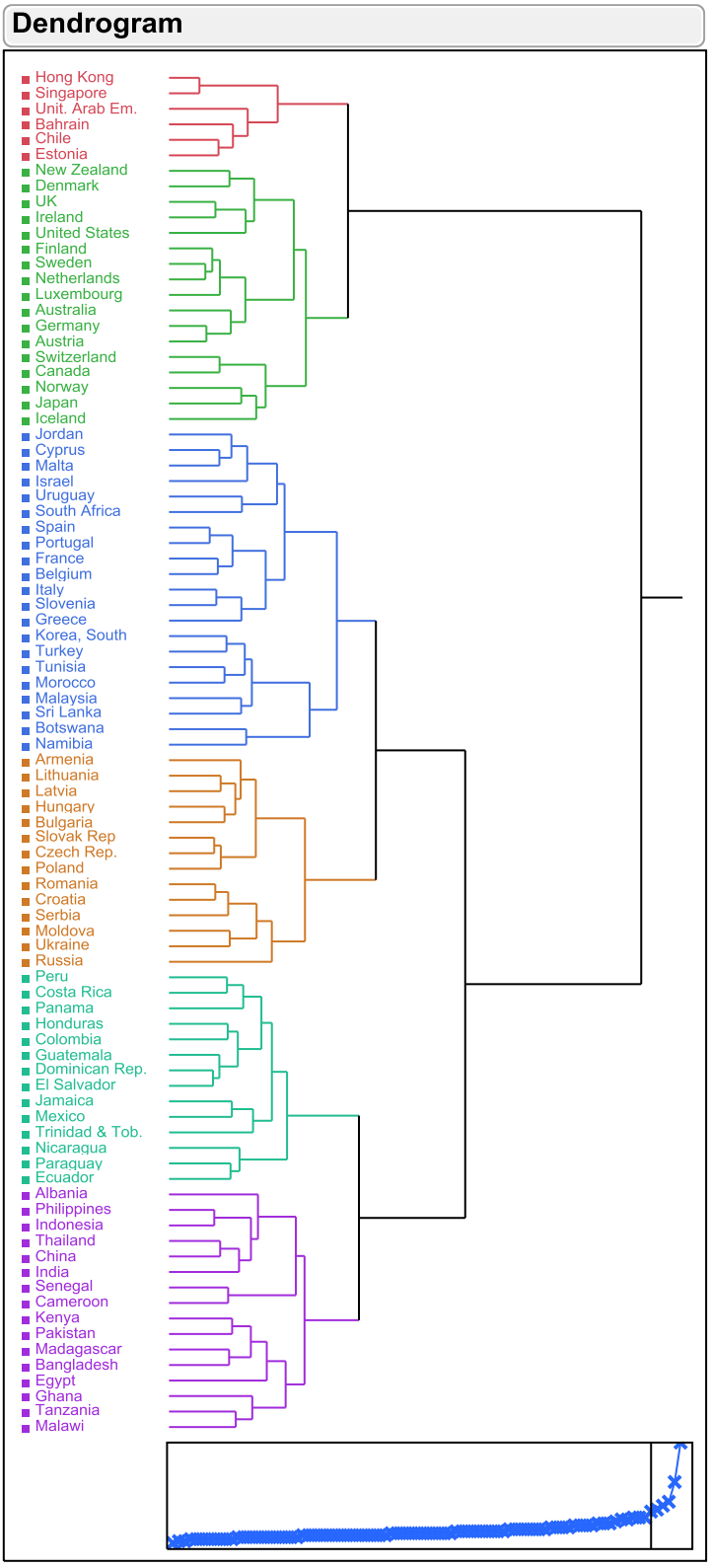


Figure 14: Ward's Linkage dendogram for 88 countries and 33 variables of EFW index 2011, standardization applied (JMP Pro)

Countries from the upper cluster score much better in judicial independence (with average 8.2 for the top in comparison to 4.3 for the bottom clusters), impartial courts (6.7 and 4.1

accordingly), protection of property rights (8.0 and 5.3), military interference in the rule of law and politics (9.1 and 6.8), integrity of the legal system (8.9 and 5.8), reliability of police (8.4 and 5.0), business costs of crime (7.8 and 5.7), hiring regulations and minimum wage (7.9 and 6.0), mandated cost of worker dismissal (9.4 and 5.6), bureaucracy costs (7.6 and 4.6) and of course extra payments/bribes/favoritism (8.1 and 4.6).

These results show that the biggest problem for the economically less free countries lies in the unstable legal system together with the presence of corruption (which was already revealed in the correlation and factor analysis previously described). The role of corruption in relation to economic freedom is obvious and was already examined in several studies[10].

In conclusion, the summary of the common features based on the results of cluster analysis (applied to the 42, 33 and 24 variables models (for 88 or 95 countries)) is provided. Considering, the Visegrad Group countries (the Czech Republic, Hungary, Poland and Slovakia), it can be said that the Czech and Slovak Republics were mostly linked in the first stage cluster. Sometimes the Czech Republic was paired with Poland and the Slovak Republic with Hungary. These four countries mainly fused in one cluster with other post-communist countries.

Similar results (to merge into one cluster) are valid for the most developed countries with high income (i.e. Western Europe, the United States, New Zealand, Australia, Chile and Canada). The United Arab Emirates was in most cases grouped in the same cluster (mostly in the middle stages) with first degree cluster of Hong Kong and Singapore. In some methods the United Arab Emirates was connected with Bahrain as a first neighbor but with farther distance. As it was stated, the first two countries in ranking were always clustered at the minimum distance (maximum similarity) level. The result is obvious; because Hong Kong and Singapore together with Taiwan and South Korea form the Four Asian Tigers[11] and they have very similar results in most of the indicators.

Some countries, especially South Korea, Russia, Israel, Egypt and Uruguay did not have a clear group to which they mostly belonged. In addition, Russia and Egypt often stayed in separate clusters until the penultimate stage in single linkage or average methods. Uruguay

[10] Corruption and the effects of economic freedom by Pieroni, L.,d'Agostino, G. (2013);
VZTAH INDEXU EKONOMICKÉ SVOBODY K INDEXU VNÍMÁNÍ KORUPCE by Ševcík R. (2007)
[11] http://en.wikipedia.org/wiki/Four_Asian_Tigers

was generally connected with other CELAC countries, but sometimes it was linked with Turkey, South Korea and Israel.

As for the Southern European countries (Greece, Spain, Portugal, Italy, Croatia, Slovenia), which were also usually joined together, they subsequently merged with the Eastern Europe countries (Czech Republic, Slovakia, Hungary, Poland, Lithuania, Latvia, Romania and Bulgaria) cluster in the intermediate level.

It is important to say that standardized data within different variables models (from 5 to 42) and by applying different linkage methods always showed better results than non-standardized. Explanations of the standardized models were more logical and corresponded to the generally accepted world order.

Finally, the idealistic assumption in the beginning of this section (that should support the correctness of the original structure offered by the EFW index) was not confirmed. It was shown that countries order did not correspond between models with different number of variables.

7 The Czech Republic and its neighbors

To analyze the Czech Republic's position it is reasonable to take into account its neighbors and Visegrad Four as the closest group. It is also insightful to compare it with other countries from the European Union (EU). According to Economic Freedom summary rating in 2011 all these countries belong to the "Top 60": Germany (19), Austria and Hungary share 27th place (before Sweden), the Slovak Republic (36), the Czech Republic (52) and Poland (59). However, remembering the fact that there were significant changes during the last 25 years, it would be very interesting to look back to previous years. For these countries the EFW index is available for each year from 2000 till 2011. Additionally, there are data for each five years, i.e. 1995, 1990 and so on till 1970. Due to the fact that the Czech and Slovak Republics formed a unitary state Czechoslovakia till the end of the year 1992, only data from 1995 is available for both countries. Considering the fact that all countries from the Visegrad group till late 1989 were communist countries, the cut in time serious was made in the year 1985 to include the latter communist years. All available summary indices and rankings are shown in Table 15 below.

Table 15: Summary Economic Freedom Ratings for 1985-2011 (Economic Freedom of the World, version 2013.0.0)

Country / Year		2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1995	1990	1985
Germany	Total Score	7.68	7.57	7.56	7.52	7.6	7.79	7.75	7.77	7.84	7.54	7.45	7.67	7.6	7.64	7.27
	Ranking	19	31	19	29	28	18	17	18	19	21	22	18	16	11	11
Austria	Total Score	7.59	7.61	7.63	7.69	7.8	7.94	7.85	7.92	8.02	7.46	7.38	7.55	7.14	6.96	6.46
	Ranking	27	27	17	17	19	15	15	13	12	28	26	22	32	24	21
Hungary	Total Score	7.59	7.3	7.17	7.16	7.12	7.19	7.21	7.35	7.22	6.69	6.9	6.56	6.16	4.89	4.48
	Ranking	27	64	52	57	62	60	52	36	42	60	46	61	59	82	87
Slovakia	Total Score	7.46	7.42	7.48	7.58	7.54	7.59	7.63	7.45	6.93	6.58	6.53	6.2	5.42		
	Ranking	36	33	26	24	35	31	21	29	55	66	61	75	82		
Czech Rep.	Total Score	7.25	7.21	7.17	7.25	7.22	7.1	7	7.07	7.09	6.68	6.56	6.53	5.79		
	Ranking	52	58	52	50	58	66	64	52	47	61	59	63	73		
Poland	Total Score	7.2	7.13	7.15	7.01	6.96	7.16	6.91	6.93	6.52	6.48	6.13	6.34	5.3	3.54	3.7
	Ranking	59	48	56	64	70	62	69	57	72	71	80	72	89	104	97

From the table above it is clear that communist countries had less Economic Freedom. It can be estimated that the Czech Republic and Slovakia had similar results to Poland and Hungary. It is especially confirmed by taking into account the fact that they had comparable development over the years 1990-2005. All these countries became a part of European Union

on the 1st of May 2004, while Austria entered on the 1st of January 1995 and Germany is one of the founders. The process for each country was different over the years. Countries from the Visegrad Four made giant improvements with regards to Economic Freedom. It is especially seen from the growth rate of summary index through the years 1985-2011 shown in Table 16[12]. The most significant rise was, probably, in the first decade after the fall of communism. Poland, for example, had shown increase by 149.7 % from 1990 with the total score of 3.54 in comparison to 5.3 in 1995. All Visegrad countries have an increase higher than 107 % between the years 1995 and 2005. With regard to the Czech Republic, in 1995 it had a worse summary ranking (5.79) than Hungary (6.16), but overtook it in the year 2007 with the score 7.22 compared to 7.12 for Hungary. It follows that Czech Republic had a higher ranking till the year 2010, but in 2011 ended in the 52nd position, while Hungary "jumped" to 27th (from the 64th in 2010).

Table 16: Growth rate of the EFW index for the years 1985-2011

Country / Year		2011	2010	2005	2000	1995	1990	1985
Germany	Total Score	7.68	7.57	7.75	7.67	7.6	7.64	7.27
	growth rate	*101.5%*	***97.7%***	***101.0%***	***100.9%***	***99.5%***	***105.1%***	
Austria	Total Score	7.59	7.61	7.85	7.55	7.14	6.96	6.46
	growth rate	*99.7%*	***96.9%***	***104.0%***	***105.7%***	***102.6%***	***107.7%***	
Hungary	Total Score	7.59	7.3	7.21	6.56	6.16	4.89	4.48
	growth rate	*104.0%*	***101.2%***	***109.9%***	***106.5%***	***126.0%***	***109.2%***	
Slovakia	Total Score	7.46	7.42	7.63	6.2	5.42		
	growth rate	*100.5%*	***97.2%***	***123.1%***	***114.4%***			
Czech Rep.	Total Score	7.25	7.21	7	6.53	5.79		
	growth rate	*100.6%*	***103.0%***	***107.2%***	***112.8%***			
Poland	Total Score	7.2	7.13	6.91	6.34	5.3	3.54	3.7
	growth rate	*101.0%*	***103.2%***	***109.0%***	***119.6%***	***149.7%***	***95.7%***	

Next, the more interesting development of the index was for Slovakia. In 1995 it had even lower value of the summary index (5.42) than Czech Republic. Nevertheless, it overtook Czech Republic in 2004 with the score 7.45 (compared to 7.07) and remained with better results up until the last reported year 2011. In general, the evolution of economic freedom was more unstable for the former communist countries. This result is natural not only because the economical system should change from planned to market, but also the organization of the country (including legal system) and equally important the way of thinking. Through the given period of time, the lowest score for Germany as well as for Austria was in 1985

[12] For the years 1985-2010 five years growth rate is calculated, for the year 2011 annual growth rate is shown

(7.27 and 6.46 correspondingly) and the highest in 2003 (7.84 and 8.02). The development of the summary index and movements in rankings are shown in Figure 15 and Figure 16 below. From both graphs it is clear that during the whole time period 1985-2011 countries from the Visegrad Group pursued Germany and Austria and in the last years they drew closer especially in score of the index. The total scores have risen rapidly during the years 1985-2000 for the all Visegrad countries. Then from the years 2001-2002 there was still an incremental trend however with slowdowns for some years.

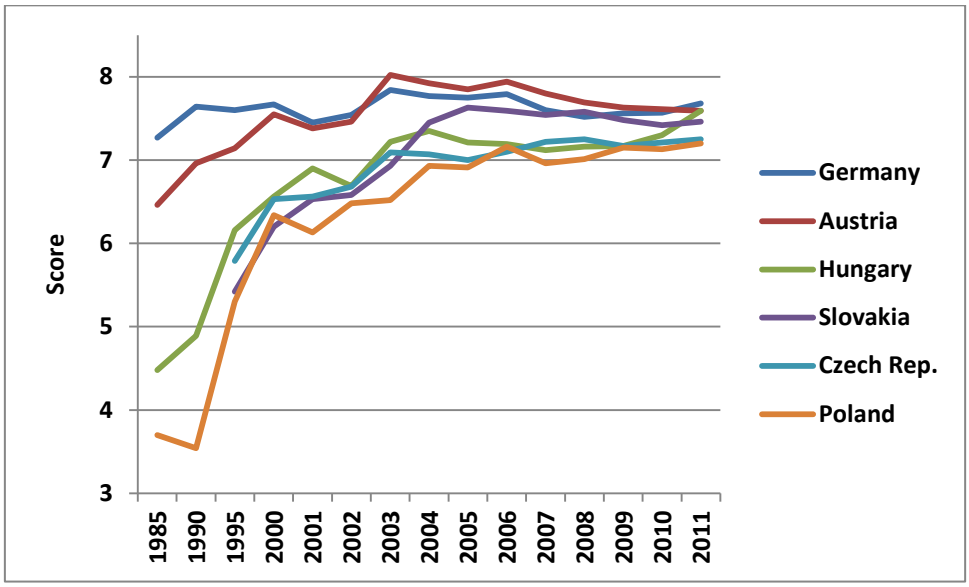


Figure 15: Summary EFW index for the years 1985-2011

Despite the growing score, the graph of final ranking shows a very volatile process during all the years. Partially it is because the rating included more countries which could shift "competitors". For instance, in 1990 the final rating was calculated for 113 countries, in 1995 for 123, for 2011 it contains 152 countries. However, the performance of the countries adds more fluctuation in ranking. For example, as it can be seen from the graph below, in 1990 Poland was in 104th place in comparison to 48th place in 2010. At the same time, Germany was in 11th place in 1985 and 1990, but rolled back to 31st place in 2010.

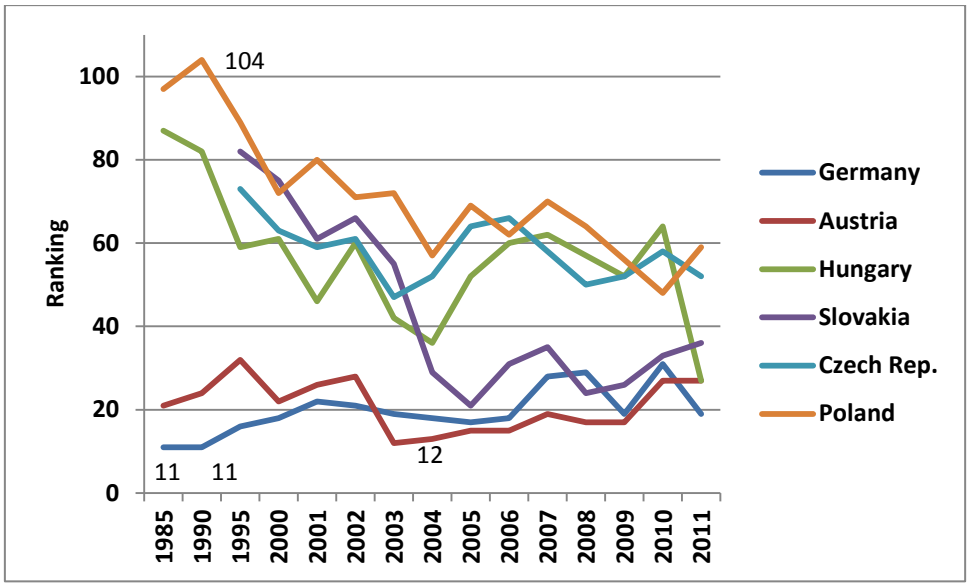


Figure 16: EFW rating for the years 1985-2011

Within 42 partial indices the results are almost the same for each country with only a few exceptions. The highest value of the component 1A (Government consumption), where countries with a larger proportion of government consumption received a lower rating, is shown by Hungary (8 out of 10), while the lowest is shown by the Czech Republic (3 out of 10). Germany and Austria have 4, while Slovakia and Poland have 5. All these countries have very low results (5 or less) in components 1B (Transfers and subsidies), 1Dii (Top marginal income and payroll tax rate), in 4Dii (Capital controls) only Slovakia has 5.4, while Poland has the lowest value of 1.5; in 5Bii (Hiring and firing regulations) only Hungary has 5.3; in 5Ci (Administrative requirements) Germany and Austria have the highest values of 4. Lower values in described indicators mean that these countries have higher taxes and high regulation barriers. The same results can be found within the majority of high-income countries. On the other hand, these countries have high values in 2D (Military interference in rule of law and politics), which means that military involvement in politics is rare; in comparison to 57 countries (out of 152) which have values 5 or less. With regard to Ukraine which has 8.3 (in this parameter) and Russia (7.5), it would certainly be interesting to see how these values will change taking into consideration the current situation in the region. For example, Egypt was known for its military intervention of government institution and politics. From the existed data it can be seen that Egypt had the highest score of 6.1 in indicator 2D in 1995. Then between 2000 and 2009 it had 5, with a following decrease in 2010 (4.2) and ended up with 2.5 in 2011. As a result, in comparison to the 70th place in 1995 in overall ranking or even 50th in 2000, Egypt ended up in 108th place in 2011. Without a doubt, this result among other

things is connected to the so called Arab Spring (a revolutionary wave in Arab world). Obviously, indicator 2D (Military interference in rule of law and politics) is very important not only for the foreign and domestic business and investments, but it is a basic prerequisite for the freedom of a country in general.

The other indicators as it was already stated earlier, where developed countries have significantly higher values are 2C (Protection of property rights), 2E (Integrity of the legal system), 2H (Reliability of police) and 2I (Business costs of crime). All these variables only prove that these are basic requirements for the prosperity of the country. To get back to the subject, Austria and Germany significantly differ (their values lie farther from the group's mean than one standard deviation) from the Visegrad Four in protection of property rights (both have 8.1 while the mean for the Visegrad Group is 5.1 and for the current EU countries it is 6.6). It is the same for the indicator "business costs of crime", where both countries have a value of 8 in comparison to 7.4 for the EU (the mean of 28 European Union's countries), Slovakia turned out the worse (from the group of six countries) with 6.4, while the Czech Republic has 7.3. On the other hand, the Czech Republic has the lowest value in the "legal enforcement of contracts" in comparison to 5.4 for the EU or 6.6 for Germany and Hungary. Unfortunately, the Czech Republic (as well as other countries from the Visegrad Group) does not have good value in "reliability of police" indicator (4.7), while the mean for the EU is 6.8. The other two indicators where countries from the Visegrad Four have lower values are 5Cii (Bureaucracy costs) and 5Civ (Extra payments/bribes/ favoritism). In addition, the Czech Republic has the lowest value (5.4) among the group of six in 5Cvi (Cost of tax compliance) indicator (compared to the European Union's mean of 7.8). This means that it takes longer for businesses to prepare, file, and pay taxes on corporate income, value added or sales taxes, and taxes on labor. In addition to what already has been mentioned, the Czech Republic is far below the mean of the European Union (including the nearest neighbors) in the following indicators: Transfers and subsidies, Judicial independence, Impartial courts, Reliability of police, Capital controls, Business regulations. Below (Table 17) is a part of the table where values for the indicators are shown for the Czech Republic and its neighbors. In addition, the table contains the mean and standard deviation for given countries, as well as the mean for the 28 countries of the European Union and the difference in values between the Czech Republic and the EU ("Difference CZ-EU"). The cells with light red color show countries that have a significantly higher score (lie far than one standard deviation from the mean of six countries) for the indicator. It is similar for the light green cells but with opposite meaning

(countries have significantly lower values). From Table 17 it is also clear that the Czech Republic is much better (orange cells) in six indicators than the EU's average, i.e. Top marginal tax rate, Top marginal income tax rate, Centralized collective bargaining, Hours regulations, Conscription and Licensing restrictions.

Table 17: Partial indicators of the EFW index 2011

	Germany	Austria	Hungary	Slovakia	Czech Rep.	Poland	Mean	Std. dev	EU 28	Difference (CZ - EU)
1B. Transfers and subsidies	2.9	2.2	4.6	4.5	**2.8**	5.3	3.7	1.24	**4.40**	-1.60
1D. Top marginal tax rate	5	3.5	6.5	6.5	**7**	5.5	5.7	1.29	**4.66**	2.34
1Di Top marginal income tax rate	5	4	10	10	**10**	7	7.7	2.73	**6.14**	3.86
2A. Judicial independence	8.7	7	4.5	2.8	**4.5**	5.4	5.5	2.09	**6.03**	-1.53
2B. Impartial courts	6.6	6.2	3	2.3	**3.3**	3.5	4.2	1.79	**4.81**	-1.51
2C. Protection of property rights	8.1	8.1	4.7	5.1	**5.1**	5.6	6.1	1.56	**6.64**	-1.54
2F. Legal enforcement of contracts	6.6	6.4	6.6	4.5	**3.9**	4.1	5.4	1.31	**5.36**	-1.46
2H. Reliability of police	8.2	8.3	5.4	4.8	**4.7**	5.5	6.2	1.66	**6.83**	-2.13
4Dii Capital controls	3.8	3.1	3.8	5.4	**3.1**	1.5	3.5	1.27	**5.33**	-2.23
5Biii Centralized collective bargaining	3.6	2.5	6.7	6.8	**7**	7.3	5.7	2.05	**5.76**	1.24
5Biv Hours regulations	8	8	4	8	**10**	8	7.7	1.97	**7.00**	3.00
5Bvi Conscription	10	3	10	10	**10**	10	8.8	2.86	**8.39**	1.61
5C. Business regulations	7.6	7.2	6.3	5.7	**5.8**	6	6.4	0.79	**6.83**	-1.03
5Cii Bureaucracy costs	7.3	7.4	4.7	4.3	**4.3**	5.6	5.6	1.44	**5.99**	-1.69
5Civ Extra payments/bribes/favoritism	7.8	7	5.2	3.9	**4.4**	6.2	5.8	1.52	**6.29**	-1.89
5Cv Licensing restrictions	9.3	7.7	9.2	6.2	**8.9**	5.9	7.9	1.52	**7.84**	1.06
5Cvi Cost of tax compliance	7.7	8.1	6.9	7.7	**5.4**	6.8	7.1	0.97	**7.83**	-2.43

To conclude, according to the Economic Freedom of the World index, countries from the Visegrad Group made significant steps and improved their results in the degree of Economic Freedom. They have achieved the results close to the most economically free countries. During the last decade they solidly took place within 60 of the most economically free countries and had a higher ranking than most of the other post-communist countries. They have good prerequisites and already have high values in some indicators, but still should work on the field of regulations (including business requirements, time cost and obviously in bureaucracy costs, bribes and etc.).

8 Comparison of the IEF and EFW indices

In this section the two indices of economic freedom will be compared. Firstly, the analogues of the construction of the IEF index (in relation to the EFW structure) will be described. Secondly, the comparison of the ratings and summary scores will be provided; i.e. whether the order and degree of freedom of the countries are the same (where they agree or disagree) in both indices. Thirdly, the results for the Visegrad Group will be examined. Finally, a summary of the results will be provided.

8.1 General comparison of the IEF and EFW indices

With regard to the construction of the Index of Economic Freedom (IEF) produced by the Heritage Foundation and Wall Street Journal, it is interesting to notice two things. First, even though the IEF index consists of four categories instead of the five areas in the EFW index, the distinct indices from both models correspond. For example, the broad area "Limited Government" (which consists of Fiscal Freedom and Government Spending) from the IEF index, entirely corresponds by meaning to the first area (Size of Government) from the EFW index. As well as, "Labor Freedom" from the "Regulatory Efficiency" area from the IEF index corresponds to "Labor market regulations" (component 5B) which is part of the fifth (Regulation) area in the EFW index. The correspondence can be seen in Table 18 below.

Second, the data sources of the indices are almost the same for some distinct indicators, but can be completely different for others. For instance, the IEF index widely uses data from Economist Intelligence Unit, OECD, reports from the U.S. Departments, but also "various news and magazine articles" (5), whereas none of these sources are used for the construction of the EFW index. In addition, it follows that the IEF index gives greater weight to the Freedom from corruption and made it one of the ten important components, while the EFW index measures it only indirectly through indicators 2A (Judicial independence), 2B (Impartial courts), 2H (Reliability of police), 2I (Business costs of crime) and 5Civ (Extra payments/bribes/favoritism) out of 42 indicators in total. Except for the Impartial courts indicator (which additionally is used by the World Bank), the main source for the mentioned indicators is the Global Competitiveness Report from the World Economic Forum. The main

source for the Freedom from corruption indicator (from the IEF index) is the Corruption Perceptions Index published by Transparency International, which (among others) also refers to the Global Competitiveness Report from the World Economic Forum. In other words, the results should be very close to each other.

Table 18: Structure of the IEF index and its correspondence to the EFW structure

IEF	EFW
Rule of Law	
Property Rights	**Legal System and Property Rights** (Area 2)
Freedom from Corruption	Extra payments / bribes / favoritism (5Civ)
Limited Government	**Size of Government** (Area 1)
Fiscal Freedom	Top marginal tax rate (1D)
Government Spending	Government consumption (1A)
	Transfers and subsidies (1B)
	Government enterprises and investment (1C)
Regulatory efficiency	
Business Freedom	Business regulations (5C, except for 5Civ)
Labor Freedom	Labor market regulations (5B)
Monetary Freedom	**Sound Money** (Area 3)
Open Markets	
Trade Freedom	Tariffs (4A)
	Regulatory trade barriers (4B)
Investment Freedom	Controls of the movement of capital and people (4D)
Financial Freedom	Credit market regulations (5A)

In comparison to the EFW index (which for 2011 displays results for 152 countries); the IEF index contains results for 179 countries. The index published by the Heritage Foundation contains 29 countries which are not shown in the EFW index. Except for Macau (in 20th place) and Saint Lucia (in 25th position), most of the other countries (which are included in the IEF and not included in the EFW index) possess a ranking higher than 100. Among them are Belarus, Bhutan, Cuba, Maldives, Syria and others. North Korea had "valid" indicators only in Property Rights and Freedom from Corruption, both with a score of 5 (out of 100). Hence had an overall score of 1 (out of 100), placed in 179th position. On the other hand, the EFW index shows results for the Brunei Darussalam (in 71st place) and Myanmar (in 151st

place) which are not listed in the IEF index. Syria was listed in the EFW index till the year 2010 and was in 124th place (with the score 6.07), in 2007 however it had 116th place (with the score 6.14). The IEF report 2012 placed Syria in 139th position and excluded the country from the list in 2013 and 2014.[13] To sum up, indices for 150 countries will be compared.

Considering the fact that the IEF index (as well as its distinct indicators) score has a scale of 0 to 100, for the reasons of comparison, the score of the EFW index is multiplied by 10. The average value in this sample of 150 countries was 61.5 in the IEF and 68.4 in the EFW. It follows that the average difference in score between two indices is approximately 6.9. Obviously, countries in the EFW index (with only a few exceptions) have higher score. The first two countries in both indices are in the same place with almost the same score. Four states in total are in identical positions: Hong Kong (1st), Singapore (2nd), Estonia (16th) and the Central African Republic (145th). Eight more countries differ in position by one place: New Zealand (3rd position in the EFW and 4th in the IEF), Switzerland (4-5), Cyprus (18-19), Qatar (23-24), Austria (27-28), Oman (46-47) Israel (49-48) and Tajikistan (128-129). Otherwise, from the third position some dissimilarity appeared; in total in almost two quarters of the countries, they differ by more than 10 places in ranking.

According to the Heritage Foundation and the Wall Street Journal the freest countries are those with the score between 80 and 100. By using this criterion, only five countries can be considered as free (in descending order from the first position): Hong Kong (89.9), Singapore (87.5), Australia (83.1), New Zealand (82.1) and Switzerland (81.1). The rule follows with 21 "mostly free" countries with the score between 70 and 79.9. It continues with "moderately free" of values between 60 and 69.9 (with 59 countries in total) and "mostly unfree" countries with the score between 50 and 59.9 (in this sample represented by 50 countries). The last group contains "repressed" countries which have score low than 50 (in this data sample 15 countries). Unfortunately, the Canadian Fraser Institute does not offer such a criterion. It simply offers to divide it into four equal groups (of 38-39 countries in each).

The other possibility to differ the freest countries could be by finding "the biggest jump" (the biggest difference in the score value in a chain of countries). However, by applying this criterion it follows that the biggest differences in score are between countries at the beginning

[13] The last available IEF index (2014 Index of Economic Freedom) is related to the year 2013: "*the period of study for the current year's Index considers all information as of the last day of June of the previous year (in this case, June 30, 2013). Any new legislative changes or policy actions effective after that date have no positive or negative impact on scores or rankings.*" (5) Considering this, the EFW index will be compared with the IEF index 2012 (which is related to the second half of 2010 till first half of 2011).

of ranking or at the very end. Namely, the differences between first five countries in the EFW ranking is between 1.9 and 2.4 and within last five values between 1.9 and 6.4 (except for the difference between Zimbabwe and Congo Republic). Otherwise, approximate difference is 0.21. It is the same in the IEF index, where the biggest jump is within the "Top 3" and the "Bottom 3" countries and the average distance in values for the rest is 0.29. For this reason (the impossibility of using "jump" criterion), the comparison will be provided for the 10 freest (Table 19) and least free countries in ranking. In addition, because the size of the sample set is 150 countries, it will be divided into 3 equal groups, "Top 50", "Middle 50" and "Bottom 50".

Table 19: "Top 10" economically free countries in 2011 according to the EFW and IEF indices

Country	Ranking		Score	
	EFW	IEF	EFW	IEF
Hong Kong	1	1	89.7	89.9
Singapore	2	2	87.3	87.5
New Zealand	3	4	84.9	82.1
Switzerland	4	5	83	81.1
United Arab Emirates	5	35	80.7	69.3
Mauritius	6	8	80.1	77.0
Finland	7	17	79.8	72.3
Bahrain	8	12	79.3	75.2
Canada	8	6	79.3	79.9
Australia	10	3	78.8	83.1
Chile	11	7	78.7	78.3
Ireland	20	9	76.6	76.9
United States	17	10	77.3	76.3

To begin, in Table 19 above is the list of the "Top 10" countries from both indices, including ranking and total score. The biggest difference (of 30 positions) in ranking between the EFW and IEF indices is shown for the United Arab Emirates where it possessed the 5th and 35th place correspondingly. During last five years (2007-2011) the country was placed in "Top 20" in the EFW index (with the best position in 2011 and worst in 2007 (19th)). During the same time period, however, in the IEF index it was listed between the 35th and 60th place (with the highest ranking in 2011 and the lowest also in 2007). In other words, there was

an increasing trend in both indices during these years, but perception of the economic freedom in the country (from the point of view in in both indices) is different.

Next, according to the EFW index, 9 countries out of 10 the least economically free countries are African. The last listed (and therefore least economically free) country in the EFW ranking is Venezuela (152nd place); while in the IEF index there are 6 countries from Africa, two from Asia (Iran and Timor-Leste), one from Latin America (Venezuela) and one from Europe (Ukraine). Zimbabwe has the lowest score (26.3 out of 100) and ranking (178).

Considering the "Top 50" most free countries, 43 countries in total are listed within the freest countries in both indices. It is approximately the same for the "Bottom 50" where 41 countries belong to the 50 economically least free states in both indices. There is less accordance in ranking between two indices in the "Middle 50", where 33 countries are situated in the same boundaries in both indices. It is also evident from the scatterplot of rankings below (Figure 17). Green dots represent "Top 50", blue dots "Middle 50" and red dots "Bottom 50" (sort order is given by the IEF index). Red line represents linear trend

EFW_rank = 10.383 + 0.804*IEF_rank.

This implies that if the IEF ranking rises by 1 point, it is expected that the EFW index will also grow by 0.804. Adjusted R-square (0.797) suggests that given linear regression model explains 79.7 % of total variance.

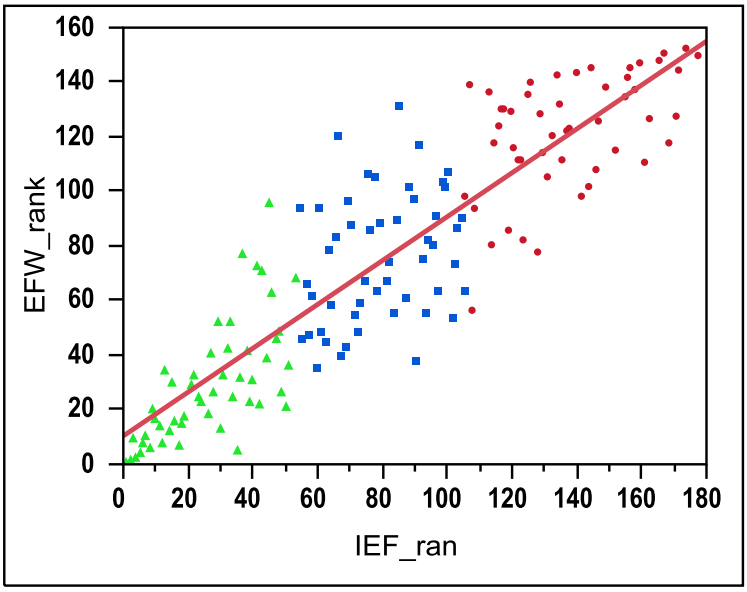


Figure 17: Correspondence of the EFW and IEF rankings (2011)

From the graph above it is also clear that the least variance is in the endings of the list and the biggest variance is approximately in between the 20th and 140th place.

Similar results were given by the linear regression applied to the score of both indices (where the EFW index score is a dependent variable and the IEF score is an independent variable). Formula EFW_score = 23.01 + 0.738*IEF_score suggests that growth of the IEF score by 1 point would result in 0.738 increase of the EFW index. According to the adjusted R-square, model fits to 78.6 % of data. The graph (Figure 18) looks differently because of the reverted score (values close to 100 represents the higher economic freedom), but colors (and corresponding countries) are the same as in Figure 17. Both scatterplot and histograms show that distribution of the values of the EFW index score is more skewed and more compact in comparison to the score of the IEF index.

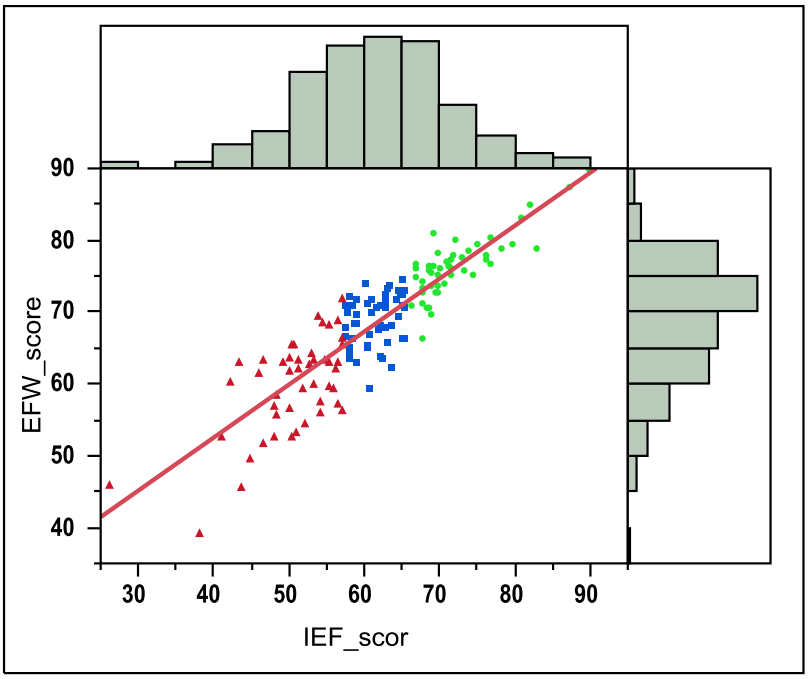


Figure 18: Correspondence of the EFW and IEF indices' score (2011)

8.2 The Czech Republic and its neighbors in the IEF index

To begin, it is important to say that the Index of Economic Freedom offered data available for the years 1995-2013. In addition, its methodology changed several times[14] which means that

[14] See more info: http://en.wikipedia.org/wiki/Index_of_Economic_Freedom#Reception and http://www.bi-me.com/main.php?id=16985&t=1&c=33&cg=4

some indices are hardly comparable through given time period. This is also confirmed by the graphs of scores (Figure 19) and rankings (Figure 20) of the IEF index for the years 1995-2012. As it was stated earlier for the EFW index, ranking of the IEF index shows bigger fluctuation than its score. Partially it is because the number of listed countries grew from 101 in 1995 to 178 in 2012 and some previously unlisted countries overtook those that were covered in the beginning. For example, Mauritius which in 2011 IEF index was in 8th place was not included in rating till 1999. It is the same for the Luxembourg which in 2011 was in 13th place (firstly listed in 1996) and some other countries.

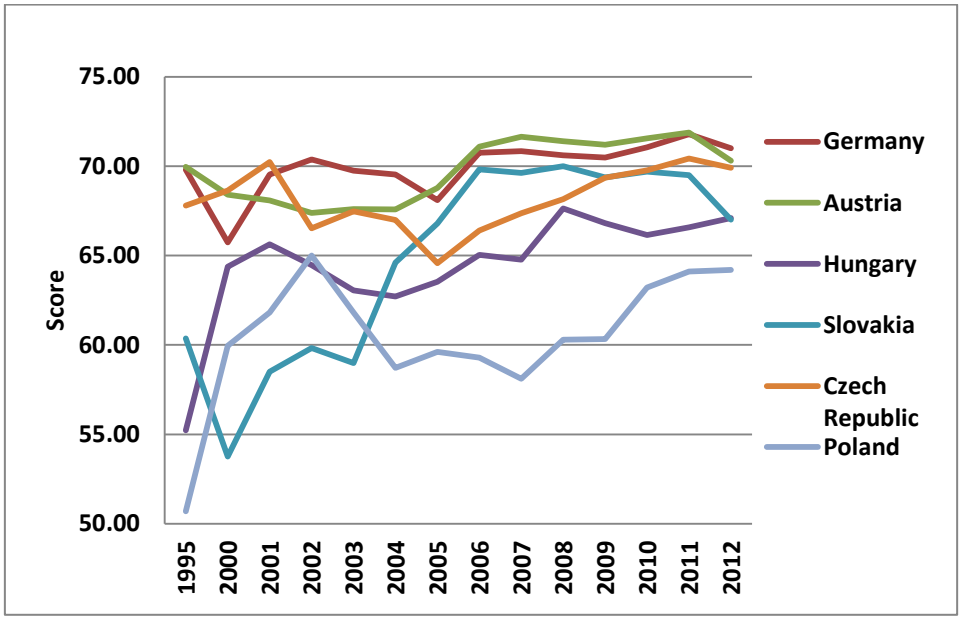


Figure 19: Summary score of the IEF index for the years 1995-2012

Nevertheless, the volatility in both results (especially in ranking) could be the result of the methodology changes. Indeed, if the trend in summary scores for the Czech Republic and its neighbors (Figure 19) of the IEF index is somewhat clear, the explanation for the movements in ranking (given below) could be hardly found. Therefore, as it was already stated for the EFW index, for the IEF index it is more important to see whether the score of a country had changed and how (in which partial indices). Meanwhile the changes in ranking of a country should be always considered as a part of dynamic group where other countries also had significant changes.

Nevertheless, from both graphs (Figure 19 and Figure 20) the interesting fact revealed. Slovakia had the worst results among the considered countries in the IEF index during the second half of 1990s. This, for sure, reflects the period when the prime minister of the Slovak Republic was Vladimír Mečiar. At that time his autocratic style of administration,

corruption, lack of respect for democracy and other issues were constantly criticized by many Western countries.[15] Because in the EFW index the data for the period 1996-1999 are not presented this fact remained almost unnoticed.

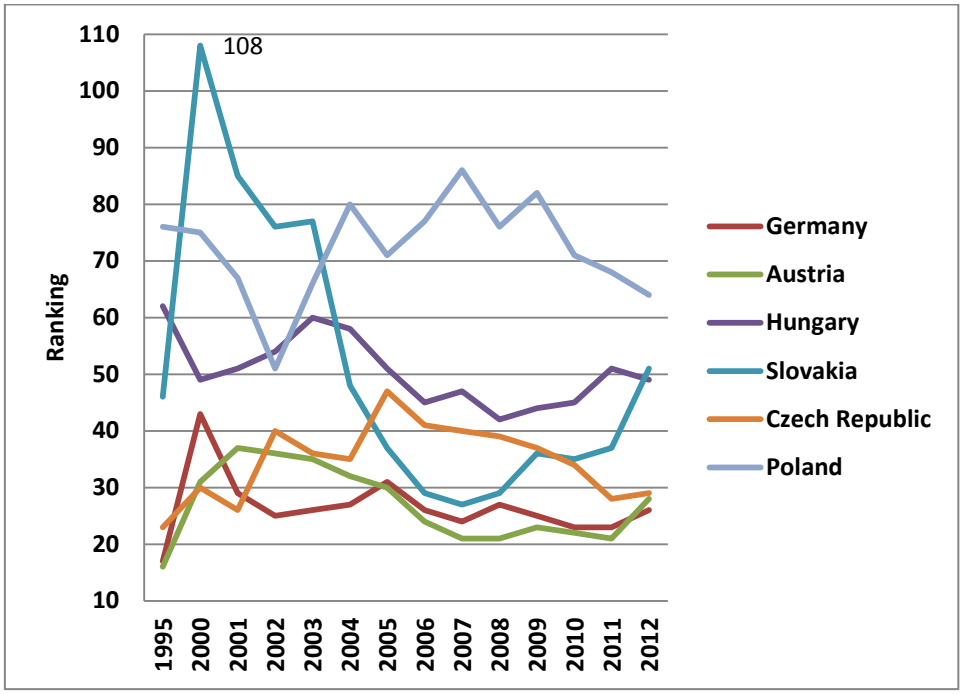


Figure 20: IEF rating for the years 1995-2012

To get back to the point, given the fact that methodology of the IEF index changed several times and therefore the comparison over the years is difficult, the comparison of the Czech Republic's and its neighbors' results will be provided only for the year 2011. From Table 20 below, where the overall IEF index (as well as its 10 distinct components) for each country is presented, some interesting results appeared. First of all, in comparison to the EFW ranking, it seems that the Czech Republic "overtook" Hungary and Slovakia in the IEF summary ranking. Indeed, in the EFW index the sequence in ranking among countries was different (in descending order): Germany was in 19th place (in the IEF 26th), Austria shared 27th place with Hungary, but in the IEF index was in 28th place and was followed by the Czech Republic with 29th place. Hungary ended up in 49th place, whereas Slovakia was in 36th place in the EFW index, but in 51st place in the IEF ranking. In both indices Poland was the last (among six countries): 59th in the EFW ranking and 64th in the IEF ranking.

[15] http://en.wikipedia.org/wiki/Vladim%C3%ADr_Me%C4%8Diar

Table 20: The IEF index for chosen countries for the year 2011

Country / Index	Score	Business Freedom	Trade Freedom	Fiscal Freedom	Government Spending	Monetary Freedom	Investment Freedom	Financial Freedom	Property Rights	Freedom from Corruption	Labor Freedom	Ranking
Germany	71.0	90.5	87.1	61.3	32.2	83.5	85.0	60.0	90.0	79.0	41.4	26
Austria	70.3	70.3	87.1	50.5	15.4	82.2	80.0	70.0	90.0	79.0	78.1	28
Hungary	67.1	79.8	87.1	78.6	24.4	76.1	70.0	70.0	70.0	47.0	67.6	49
Slovakia	67.0	71.0	87.1	84.2	48.2	83.5	75.0	70.0	50.0	43.0	58.1	51
Czech Republic	69.9	67.7	87.1	82.0	36.8	81.5	70.0	80.0	70.0	46.0	77.9	29
Poland	64.2	61.4	87.1	74.4	40.3	79.1	65.0	60.0	60.0	53.0	61.3	64

As it is shown in the table, all the countries have the same results in Trade Freedom index. This reflects the existence of "internal market" inside the European Union. This means that member states have removed customs barriers between themselves and introduced a common customs policy towards other countries.[16] However, according to the EFW index (where Trade Freedom indicator corresponds to 4A and 4B indices) there were still differences in 4B (Regulatory trade barriers).

Among all neighbors the Czech Republic (with score 80 out of 100) was the best in Financial Freedom, while the worst were Germany and Poland (both with the value of 60). This result differs from the EFW index, where Financial Freedom corresponds to 5A (Credit market regulations). Poland also had the worst result among compared countries; however, the best result was shown by Hungary (10 out of 10).

In Business Freedom Germany showed the best result (90.5 out of 100) which significantly differ from others. The worst score was shown by Poland (64.2). Meanwhile, in the EFW index's similar indicator 5C (Business regulations), Slovakia was in the worst position among compared countries (5.7 out of 10). Germany was also the best, however with the score of 7.6 out of 10.

The interesting result appears in the Monetary Freedom component, where Hungary (country with the worst performance 76.1 out of 100) showed the best result in area 3 (Sound Money) in the EFW index. However in the EFW index all six countries had results close to maximum (9.48 or higher).

Very similar results for both indices appeared in Property Rights and Freedom from Corruption: Germany and Austria showed the best results, while Slovakia had the worse.

[16] http://en.wikipedia.org/wiki/Internal_market

In Fiscal Freedom, Government Spending, Investment Freedom and Labor Freedom the results between the IEF and EFW indices were different.

In this table it is also good seen that three distinct indicators are entirely ordinal, i.e. Investment Freedom, Financial Freedom and Property Rights. As noted earlier, this means that not only mentioned indicators contain cumulated loss of information, but it brings hidden uncertainty into summary index.

According to the results given by the IEF and EFW indices, the Czech Republic is highly evaluated in Labor Freedom (Labor market regulations) and Financial Freedom (Credit market regulations). On the other hand, it has low results in Freedom from Corruption (Extra payments/bribes/favoritism) where among these states only Slovakia has worse results. Otherwise, Czech Republic mostly had "middle" values in considered indicators.

To conclude, despite the fact that the construction of the indices is different, as well as information resources, the results of the indices largely coincide. Given the results of the comparison of the summary score and ranking of the IEF and EFW indices it can be said that there is approximately 80 % of correspondence between them. In other words, if a country is listed in some position in the Index of Economic Freedom it is expected that it will have a similar position in the Economic Freedom of the World index (and vice versa).

9 Conclusions

The objective of this paper was to analyze the index of economic freedom and to examine whether the logical organization of its structure corresponds to the model based on the statistical analysis. For this reason, the factor analysis and hierarchical cluster analysis were used. Because sufficient data was available only for the Economic Freedom of the World index (EFW) published by the Canadian Fraser Institute, it was the main target of the analysis. The Index of Economic Freedom (IEF) released by the Heritage Foundation and the Wall Street Journal was only complimentary compared to the EFW index.

The first issue encountered was the quality of the data. From the provided descriptive statistics it followed that some of the given indicators were unsuitable for the analysis (due to extreme values or poor representativeness) and therefore they were excluded. In addition, 57 countries (which is more than one third of the sample) were removed due to missing indicators.

Subsequently provided correlation analysis showed that distinct indicators that form summary index are correlated. Hence, it confirmed the convenience of implementing factor analysis to the existing data. The factor analysis revealed that indeed the number of indicators can be reduced from the original 42 to 5. More importantly, it suggested that the grouping of indicators can be different. For example, the factor analysis would put *Impartial courts* together with *Extra payments / bribes / favoritism.*

The results of the cluster analysis also supported the assumption that the original structure of the index components does not fit with the statistical model. Similarly as the factor analysis, it confirmed that the original number of the distinct indicators can be reduced. The cluster analysis was applied first to 42 sub-indicators, then to 24 indicators and finally to 5 areas to verify the stability of the original model. Each time the cluster analysis produced different grouping of states which suggested high instability.

With regard to the results of the Czech Republic and its neighbors in the EFW index it can be said that countries from the Visegrad group (the Czech Republic, Hungary, Poland and Slovakia) are somewhere in the middle between high-income and developing countries. They

reach a level close to the most economically free countries as they have high values in some indicators. Nevertheless, there is still space for improvements especially in bureaucracy costs and extra payments, bribes and favoritism. These results reflect the reality.

The IEF index structure contains fewer indicators than the EFW. However, the correspondence with the EFW indicators is visible. The basic sources of the IEF are different from the EFW. Nevertheless, in reality, the results (considering ranking and score of 2011) showed significant resemblance. It is also important to say that the summary scores of both indices (the EFW and IEF) are uncertain because of the inclusion of interval (or ordinal) components in their structure.

To conclude, the proposed indices of economic freedom should be taken carefully and more as a guideline or recommendation because of the cumulated inaccuracy which is hidden in data collection and the construction of the indicators.

10 Future works

It should be interesting to examine closer relationship among components of the EFW index and find more appropriate and simpler structure. Specifically, it might be useful to examine the countries score based on the results of the factor analysis.

Additionally, the correspondence between the components of the two explored indices based on statistical approach can be investigated.

Finally, a deeper historical and geopolitical explanation of the states' scores can be sought. Similarly as it was done for the Czech Republic and its neighboring countries. Especially interesting is the 36th place of Rwanda which scored better than the 52nd Czech Republic.

Bibliography

1. Economic Freedom of the World project. [Online] Fraser Institute, 2014. http://www.freetheworld.com/.

2. Defining Economic Freedom | 2014 Index of Economic Freedom | 2014 Index of Economic Freedom Book:. *2014 Index of Economic Freedom.* [Online] http://www.heritage.org/index/book/chapter-5.

3. **James Gwartney, Robert Lawson, and Joshua Hall.** 2013 Economic Freedom Dataset, published in Economic Freedom of the World: 2013 Annual Report. *Free the World.* [Online] 2013. http://www.freetheworld.com/datasets_efw.html.

4. *SPSS Tutorial.*

5. Index of Economic Freedom. [Online] The Wall Street Journal and The Heritage Foundation, 2014. http://www.heritage.org/index/.

6. StatSoft Electronic Statistics Textbook. [Online] [Cited: 4 16, 2014.] https://www.statsoft.com/Textbook/Cluster-Analysis/button/1.

7. Factor Analysis. [Online] http://sites.stat.psu.edu/~ajw13/stat505/fa06/17_factor/.

8. *Analysis of the Communalities.* [Online] http://www.utexas.edu/courses/schwab/sw388r7/Tutorials/PrincipalComponentsAnalysisintheLiterature_doc_html/033_Analysis_of_the_Communalities.html.

9. *Principal Component Analysis.* [Online] http://www.utexas.edu/courses/schwab/sw388r7/Tutorials/PrincipalComponentsAnalysisintheLiterature_doc_html/.

10. **Harman, Harry H.** *Modern Factor Analysis.*

11. *statistics.com.* [Online] http://www.statistics.com/glossary&term_id=876.

12. *Single Linkage Clustering.* [Online] http://en.wikipedia.org/wiki/Single-linkage_clustering.

13. **Ševčík, Radim.** *Vztah Indexu Ekonomické Svobody k Indexu Vnímání Korupce.* Prague : s.n., 2007.

14. *Corruption and the effects of economic freedom.* [Online] http://ideas.repec.org/a/eee/poleco/v29y2013icp54-72.html.

15. **Hebák Petr, Hustopecký Jiří, Pecáková Iva, Průša Milan, Řezanková Hana, Vlach Petr, Svobodová Alžbeta.** *Vícerozměrné statistické metody [3].* Praha : INFORMATORIUM, 2005. ISBN 80-7333-039-3.

16. **Hebák Petr, Hustopecký Jiří, Jarošová Eva, Pecáková Iva.** *Vícerozměrné statistické metody [1].* Praha : INFORMATORIUM, 2004. ISBN 80-7333-025-3.

17. **Richard A. Johnson, Dean W. Wichern.** *Applied Multivariate Statistical Analysis.* s.l. : Prentice-Hall, 1992. ISBN 0-13-041807-2.

18. Statistical Methods. [Online] 5 12, 2012. http://evolutionarymedia.com/cgi-bin/wiki.cgi?StatisticalMethods,template.html.

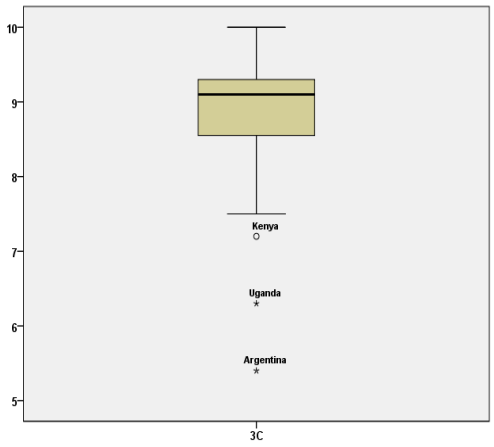
19. *JMP Pro Tutorial.* s.l. : SAS Institute Inc.

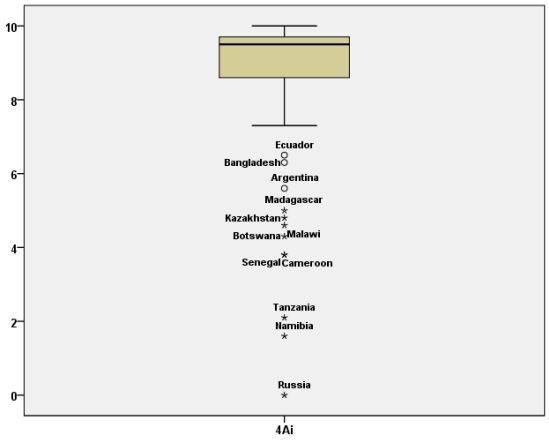
20. Factor analysis. *Wikipedia, the free encyclopedia.* [Online] http://en.wikipedia.org/wiki/Factor_analysis.

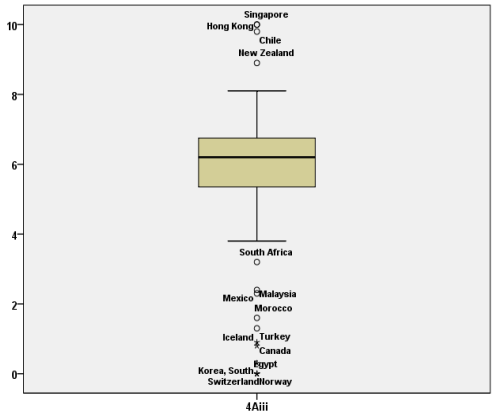
List of Figures

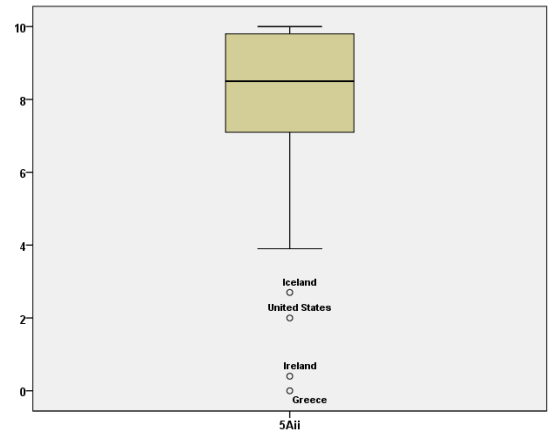
List of Tables

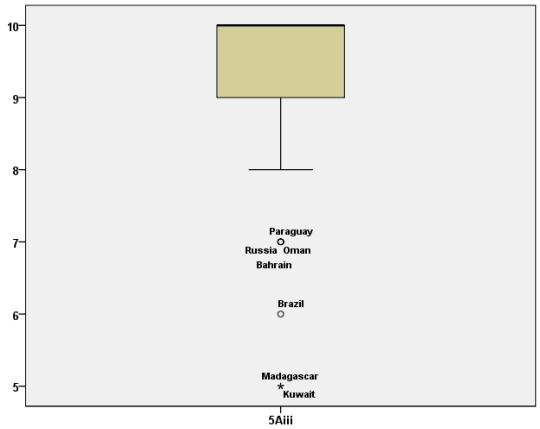
Attachment to the Chapter 3

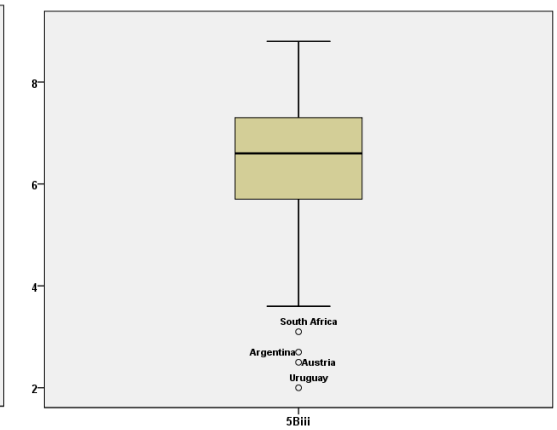


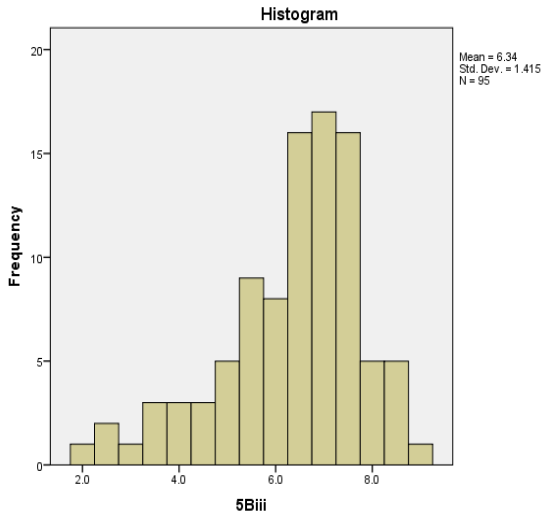


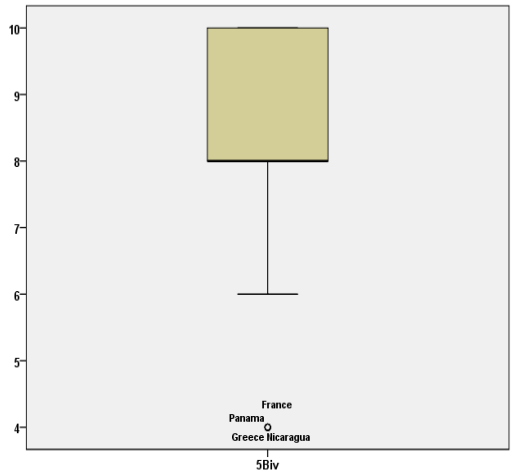


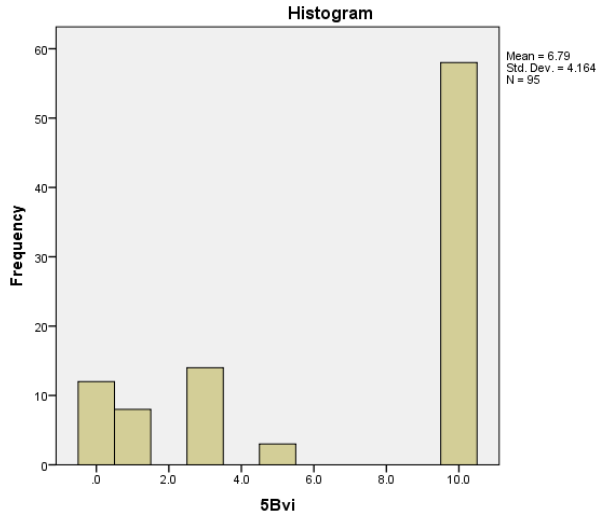


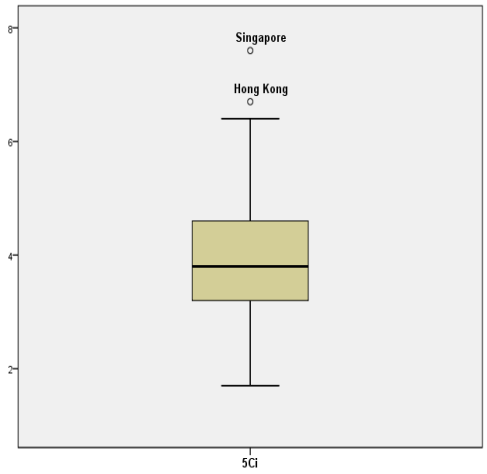


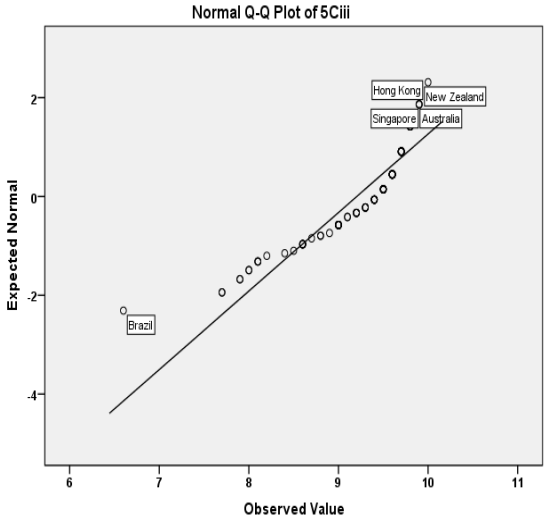


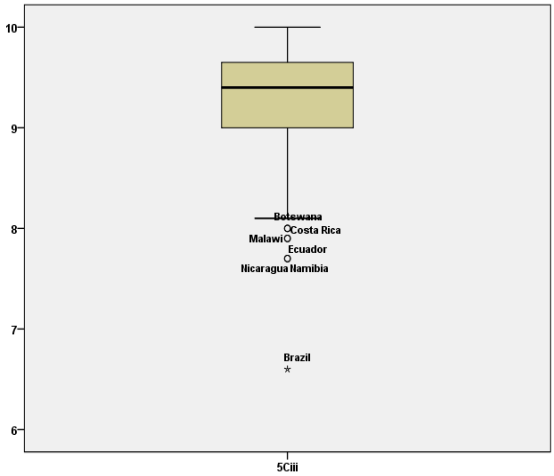

Histogram
Mean = 6.34
Std. Dev. = 1.415
N = 95
Frequency
5Biii

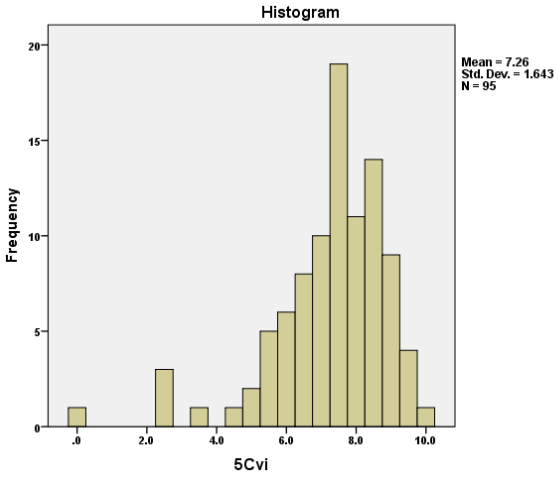

France
Panama
Greece Nicaragua
5Biv

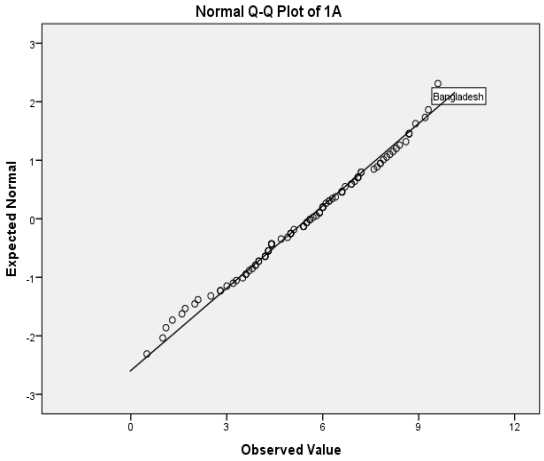

Histogram
Mean = 6.79
Std. Dev. = 4.164
N = 95
Frequency
5Bvi

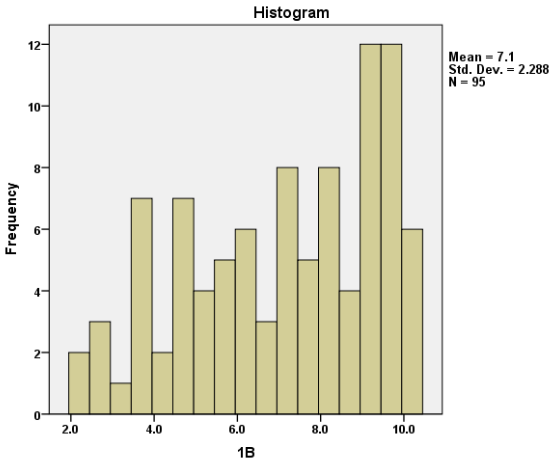

Singapore
Hong Kong
5Ci

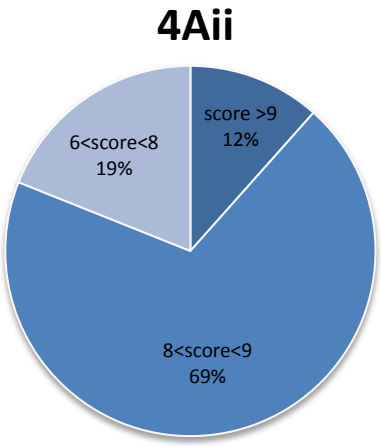

Normal Q-Q Plot of 5Ciii
Hong Kong
New Zealand
Singapore
Australia
Brazil
Expected Normal
Observed Value

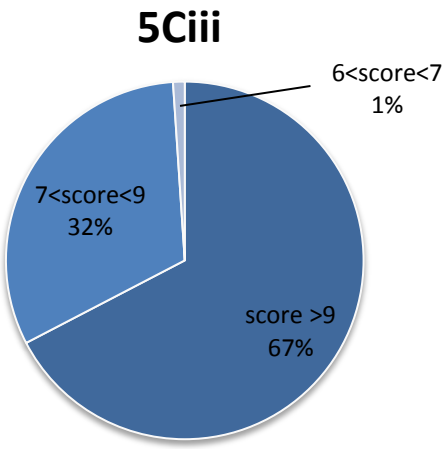

Botswana
Costa Rica
Malawi
Ecuador
Nicaragua Namibia
Brazil
5Ciii


Histogram
Mean = 7.26
Std. Dev. = 1.643
N = 95
Frequency
5Cvi


Normal Q-Q Plot of 1A
Bangladesh
Expected Normal
Observed Value


Histogram
Mean = 7.1
Std. Dev. = 2.288
N = 95
Frequency
1B


4Aii
score >9
12%
6<score<8
19%
8<score<9
69%


5Ciii
6<score<7
1%
7<score<9
32%
score >9
67%

Attachment to Chapter 4

Pearson Correlation

	1A	1B	2A	2B	2C	2D	2E	2F	2G	2H	2I	3A	3B	3C	4Ai	4Aii	4Aiii	4Bi	4Bii	4Di	4Dii	4Diii	5Ai	5Bi	5Bii	5Biii	5Bv	5Ci	5Cii	5Ciii	5Civ	5Cv	5Cvi	TS
1A	1	.616	-.605	-.466	-.573	-.613	-.710	-.408	-.172	-.602	-.478	-.163	-.082	-.428	-.178	-.294	.203	-.400	-.300	-.170	-.199	-.281	-.039	-.132	.311	.297	-.493	-.029	-.602	-.163	-.611	-.134	-.470	-.282
1B	.616	1	-.316	-.100	-.347	-.618	-.629	-.351	-.137	-.440	-.527	-.385	-.299	-.433	-.383	-.339	.072	-.323	-.313	.033	-.193	-.190	.124	.024	.368	.329	-.485	.303	-.372	-.418	-.416	.063	-.262	-.269
2A	-.605	-.316	1	.870	.889	.529	.661	.360	.169	.830	.515	.021	.095	.403	.293	.306	-.196	.628	.551	.548	.272	.224	-.037	.413	.053	-.157	.418	.461	.906	.300	.889	.400	.602	.633
2B	-.466	-.100	.870	1	.882	.379	.555	.394	.122	.783	.494	-.039	.029	.335	.172	.224	-.141	.598	.503	.632	.192	.192	.114	.382	.172	-.072	.358	.700	.859	.247	.827	.470	.582	.606
2C	-.573	-.347	.889	.882	1	.560	.697	.415	.151	.879	.589	.083	.154	.565	.374	.375	-.178	.700	.676	.641	.362	.317	.013	.363	-.001	-.119	.461	.513	.914	.334	.904	.504	.589	.700
2D	-.613	-.618	.529	.379	.560	1	.637	.409	.228	.596	.479	.254	.046	.465	.300	.559	.005	.546	.362	.260	.332	.334	-.101	.141	-.101	-.158	.677	.006	.558	.295	.583	.139	.447	.558
2E	-.710	-.629	.661	.555	.697	.637	1	.604	.205	.775	.772	.188	.172	.487	.277	.386	-.133	.536	.494	.254	.213	.236	-.052	.145	-.046	-.130	.622	.213	.723	.377	.742	.199	.563	.547
2F	-.408	-.351	.360	.394	.415	.409	.604	1	.403	.460	.528	.104	.074	.292	.194	.396	-.068	.322	.356	.129	.144	.173	.152	.167	.068	.055	.389	.257	.504	.353	.527	.271	.390	.490
2G	-.172	-.137	.169	.122	.151	.228	.205	.403	1	.195	.120	.060	-.120	.102	.397	.417	-.023	.113	.196	-.001	.332	.270	.053	.197	.110	.298	.170	.176	.255	.230	.291	.235	.347	.451
2H	-.602	-.440	.830	.783	.879	.596	.775	.460	.195	1	.733	.130	.121	.580	.376	.397	-.083	.676	.614	.478	.334	.261	.001	.340	.071	-.109	.536	.454	.892	.392	.897	.400	.590	.688
2I	-.478	-.527	.515	.494	.589	.479	.772	.528	.120	.733	1	.199	.096	.430	.252	.303	-.035	.497	.344	.237	.128	.126	.038	.169	.085	-.012	.519	.303	.607	.382	.641	.100	.459	.496
3A	-.163	-.385	.021	-.039	.083	.254	.188	.104	.060	.130	.199	1	.123	.306	.298	.261	.025	.187	.315	-.047	.110	.056	-.095	-.238	-.271	-.114	.217	-.138	.123	.197	.184	.096	.025	.151
3B	-.082	-.299	.095	.029	.154	.046	.172	.074	-.120	.121	.096	.123	1	.176	.139	-.024	-.029	.102	.193	.070	-.030	.018	-.199	-.091	-.163	-.262	.059	-.243	.113	.167	.084	.036	.052	.051
3C	-.428	-.433	.403	.335	.565	.465	.487	.292	.102	.580	.430	.306	.176	1	.435	.407	-.134	.462	.556	.320	.263	.268	.027	.131	-.169	-.073	.390	.129	.557	.263	.574	.372	.291	.433
4Ai	-.178	-.383	.293	.172	.374	.300	.277	.194	.397	.376	.252	.298	.139	.435	1	.507	-.011	.404	.549	.201	.323	.335	-.112	.081	.012	.009	.158	.100	.388	.435	.422	.273	.302	.527
4Aii	-.294	-.339	.306	.224	.375	.559	.386	.396	.417	.397	.303	.261	-.024	.407	.507	1	.390	.491	.430	.197	.431	.323	.017	.086	.016	.096	.451	.154	.455	.270	.481	.229	.399	.696
4Aiii	.203	.072	-.196	-.141	-.178	.005	-.133	-.068	-.023	-.083	-.035	.025	-.029	-.134	-.011	.390	1	.318	-.090	.126	.159	-.126	.122	-.100	.100	.042	.120	.073	-.093	-.044	-.103	-.110	-.055	.142
4Bi	-.400	-.323	.628	.598	.700	.546	.536	.322	.113	.676	.497	.187	.102	.462	.404	.491	.318	1	.503	.669	.384	.175	.025	.242	-.010	-.044	.405	.427	.698	.384	.699	.428	.526	.689
4Bii	-.300	-.313	.551	.503	.676	.362	.494	.356	.196	.614	.344	.315	.193	.556	.549	.430	-.090	.503	1	.490	.445	.295	-.036	.139	.015	-.019	.331	.285	.649	.478	.661	.454	.420	.650
4Di	-.170	.033	.548	.632	.641	.260	.254	.129	-.001	.478	.237	-.047	.070	.320	.201	.197	.126	.669	.490	1	.335	.185	.160	.304	.093	.058	.176	.481	.565	.149	.535	.401	.362	.539
4Dii	-.199	-.193	.272	.192	.362	.332	.213	.144	.332	.334	.128	.110	-.030	.263	.323	.431	.159	.384	.445	.335	1	.347	.037	.106	.017	.044	.263	.205	.384	.191	.399	.242	.271	.597
4Diii	-.281	-.190	.224	.192	.317	.334	.236	.173	.270	.261	.126	.056	.018	.268	.335	.323	-.126	.175	.295	.185	.347	1	-.039	.022	-.164	-.035	.163	.017	.310	.098	.346	.230	.243	.365
5Ai	-.039	.124	-.037	.114	.013	-.101	-.052	.152	.053	.001	.038	-.095	-.199	.027	-.112	.017	.122	.025	-.036	.160	.037	-.039	1	-.089	-.029	.016	-.043	.192	.055	-.214	.046	.077	-.025	.046
5Bi	-.132	.024	.413	.382	.363	.141	.145	.167	.197	.340	.169	-.238	-.091	.131	.081	.086	-.100	.242	.139	.304	.106	.022	-.089	1	.267	.182	.147	.309	.362	.067	.316	.197	.235	.318
5Bii	.311	.368	.053	.172	-.001	-.101	-.046	.068	.110	.071	.085	-.271	-.163	-.169	.012	.016	.100	-.010	.015	.093	.017	-.164	-.029	.267	1	.492	.093	.489	.047	.065	.016	.066	.037	.198
5Biii	.297	.329	-.157	-.072	-.119	-.158	-.130	.055	.298	-.109	-.012	-.114	-.262	-.073	.009	.096	.042	-.044	-.019	.058	.044	-.035	.016	.182	.492	1	-.002	.239	-.103	.040	-.080	-.003	-.011	.147
5Bv	-.493	-.485	.418	.358	.461	.677	.622	.389	.170	.536	.519	.217	.059	.390	.158	.451	.120	.405	.331	.176	.263	.163	-.043	.147	.093	-.002	1	.146	.503	.357	.535	.064	.394	.515
5Ci	-.029	.303	.461	.700	.513	.006	.213	.257	.176	.454	.303	-.138	-.243	.129	.100	.154	.073	.427	.285	.481	.205	.017	.192	.309	.489	.239	.146	1	.551	.083	.513	.382	.346	.477
5Cii	-.602	-.372	.906	.859	.914	.558	.723	.504	.255	.892	.607	.123	.113	.557	.388	.455	-.093	.698	.649	.565	.384	.310	.055	.362	.047	-.103	.503	.551	1	.399	.983	.453	.618	.751
5Ciii	-.163	-.418	.300	.247	.334	.295	.377	.353	.230	.392	.382	.197	.167	.263	.435	.270	-.044	.384	.478	.149	.191	.098	-.214	.067	.065	.040	.357	.083	.399	1	.420	.224	.330	.451
5Civ	-.611	-.416	.889	.827	.904	.583	.742	.527	.291	.897	.641	.184	.084	.574	.422	.481	-.103	.699	.661	.535	.399	.346	.046	.316	.016	-.080	.535	.513	.983	.420	1	.475	.617	.769
5Cv	-.134	.063	.400	.470	.504	.139	.199	.271	.235	.400	.100	.096	.036	.372	.273	.229	-.110	.428	.454	.401	.242	.230	.077	.197	.066	-.003	.064	.382	.453	.224	.475	1	.282	.496
5Cvi	-.470	-.262	.602	.582	.589	.447	.563	.390	.347	.590	.459	.025	.052	.291	.302	.399	-.055	.526	.420	.362	.271	.243	-.025	.235	.037	-.011	.394	.346	.618	.330	.617	.282	1	.655
TS	-.282	-.269	.633	.606	.700	.558	.547	.490	.451	.688	.496	.151	.051	.433	.527	.696	.142	.689	.650	.539	.597	.365	.046	.318	.198	.147	.515	.477	.751	.451	.769	.496	.655	1

Attachment to Chapter 5

Communalities

	Initial	Extraction
1A	1.000	.796
1B	1.000	.824
2A	1.000	.883
2B	1.000	.907
2C	1.000	.939
2D	1.000	.755
2E	1.000	.847
2F	1.000	.647
2G	1.000	.710
2H	1.000	.874
2I	1.000	.745
3A	1.000	.533
3B	1.000	.453
3C	1.000	.538
4Ai	1.000	.660
4Aii	1.000	.760
4Aiii	1.000	.840
4Bi	1.000	.810
4Bii	1.000	.738
4Di	1.000	.726
4Dii	1.000	.556
4Diii	1.000	.573
5Aii	1.000	.739
5Bi	1.000	.522
5Bii	1.000	.724
5Biii	1.000	.612
5Bv	1.000	.664
5Ci	1.000	.798
5Cii	1.000	.928
5Ciii	1.000	.598
5Civ	1.000	.929
5Cv	1.000	.598
5Cvi	1.000	.518

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
2B	.907	.261	-.032	.034	-.005	.107
2C	.850	.376	.165	-.114	.160	.053
2A	.820	.391	.058	-.122	.041	.138
5Cii	.802	.448	.186	-.047	.171	.136
4Di	.768	-.039	.220	.069	.040	-.241
5Civ	.757	.482	.235	-.047	.201	.142
2H	.719	.549	.110	-.036	.192	.078
5Ci	.707	-.016	.010	.503	-.092	.039
4Bi	.639	.348	.305	.036	.216	-.196
5Cv	.586	-.203	.258	-.004	.289	.166
5Cvi	.499	.387	.178	.007	.071	.317
5Bi	.449	.068	-.030	.232	-.169	.283
5Bv	.170	.780	.191	.124	.043	-.083
2E	.408	.771	.023	-.120	.194	.170
2D	.224	.731	.398	-.151	.005	-.018
2I	.352	.730	-.099	.100	.228	.048
1B	.067	-.712	-.139	.406	-.356	-.051
1A	-.322	-.655	-.133	.439	.086	-.193
2F	.224	.505	.028	.116	.242	.477
4Dii	.253	.092	.690	.048	.038	-.016
4Aii	.123	.404	.659	.146	.183	.075
4Diii	.176	.040	.584	-.283	-.026	.312
5Bii	.163	-.037	-.154	.809	-.026	.068
5Biii	-.085	-.078	.143	.768	-.021	.126
5Ciii	.152	.309	.050	.151	.653	.153
4Ai	.168	.091	.497	.014	.589	.162
3B	.062	.007	-.256	-.382	.562	.002
4Bii	.530	.161	.359	-.013	.543	-.022
3A	-.151	.268	.293	-.126	.472	-.340
3C	.361	.342	.332	-.166	.367	-.133
2G	.002	.124	.461	.239	.120	.692

Rotated Component Matrix[a]

	Component	
	1	2
5Civ	.958	-.016
5Cii	.954	.041
2C	.934	.062
2H	.919	-.041
2A	.873	.098
2B	.838	.330
2E	.781	-.332
4Bi	.780	.009
4Bii	.709	-.083
5Cvi	.688	.008
2I	.681	-.201
2D	.652	-.432
1A	-.617	.433
4Di	.612	.358
3C	.608	-.293
5Bv	.586	-.296
2F	.557	-.135
4Aii	.535	-.230
5Cv	.503	.249
4Ai	.464	-.230
5Ciii	.460	-.209
4Dii	.436	-.032
4Diii	.345	-.182
1B	-.431	.782
5Ci	.533	.679
5Bii	.085	.629
3A	.160	-.515
5Biii	-.040	.457
5Bi	.375	.398
3B	.101	-.348

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Factor Analysis on the 18 variables model

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.883
Bartlett's Test of Sphericity	Approx. Chi-Square	1328.905
	df	153
	Sig.	.000

Total Variance Explained

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	8.423	46.795	46.795	8.423	46.795	46.795	5.543	30.797	30.797
2	1.867	10.370	57.165	1.867	10.370	57.165	3.964	22.023	52.820
3	1.524	8.465	65.630	1.524	8.465	65.630	2.185	12.139	64.959
4	1.253	6.964	72.594	1.253	6.964	72.594	1.374	7.635	72.594
5	.893	4.963	77.557						
6	.817	4.541	82.098						
7	.657	3.649	85.747						
8	.568	3.156	88.903						
9	.451	2.506	91.409						
10	.405	2.252	93.661						
11	.325	1.803	95.464						
12	.214	1.188	96.652						
13	.181	1.007	97.658						
14	.113	.629	98.287						
15	.100	.553	98.841						
16	.088	.487	99.328						
17	.077	.425	99.754						
18	.044	.246	100.000						

Extraction Method: Principal Component Analysis.

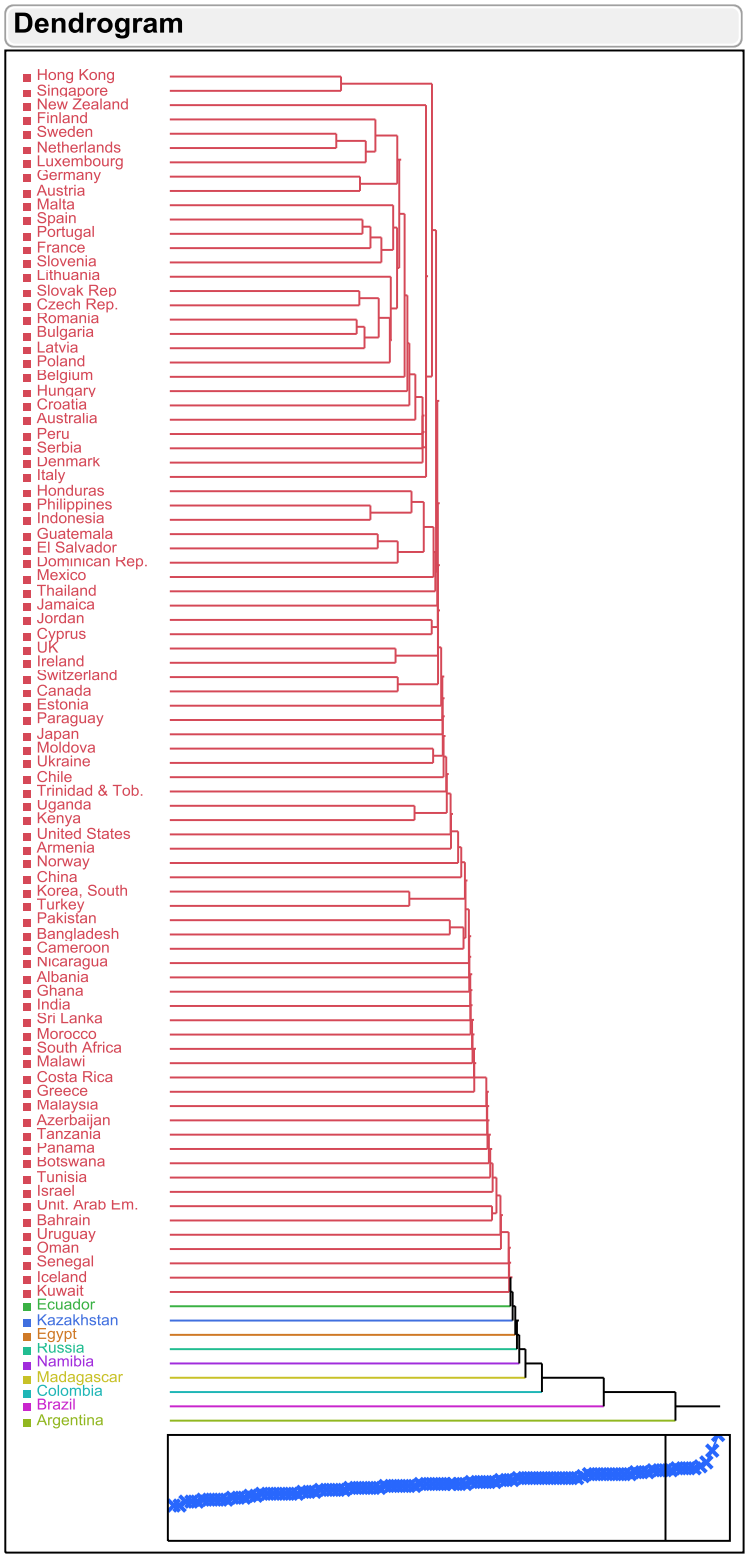
2 factors solution

Total Variance Explained

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	8.423	46.795	46.795	8.423	46.795	46.795	7.175	39.860	39.860
2	1.867	10.370	57.165	1.867	10.370	57.165	3.115	17.305	57.165
3	1.524	8.465	65.630						
4	1.253	6.964	72.594						
5	.893	4.963	77.557						

Attachment to the Chapter 6

Single Linkage method applied to the 42 variables model with 95 countries, EFW 2011, standardized

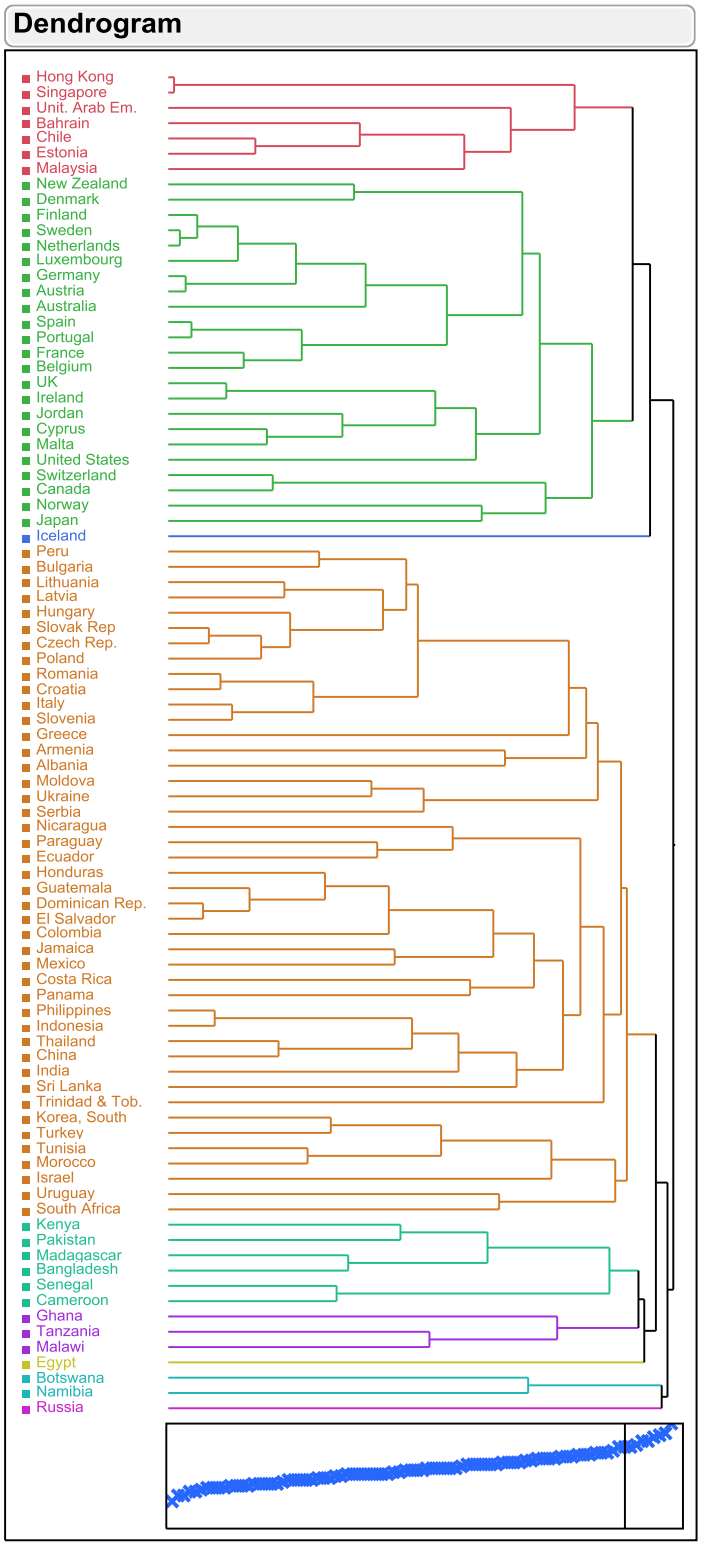


Part of clustering history of Ward's linkage method (42 variables, EFW 2011, std)

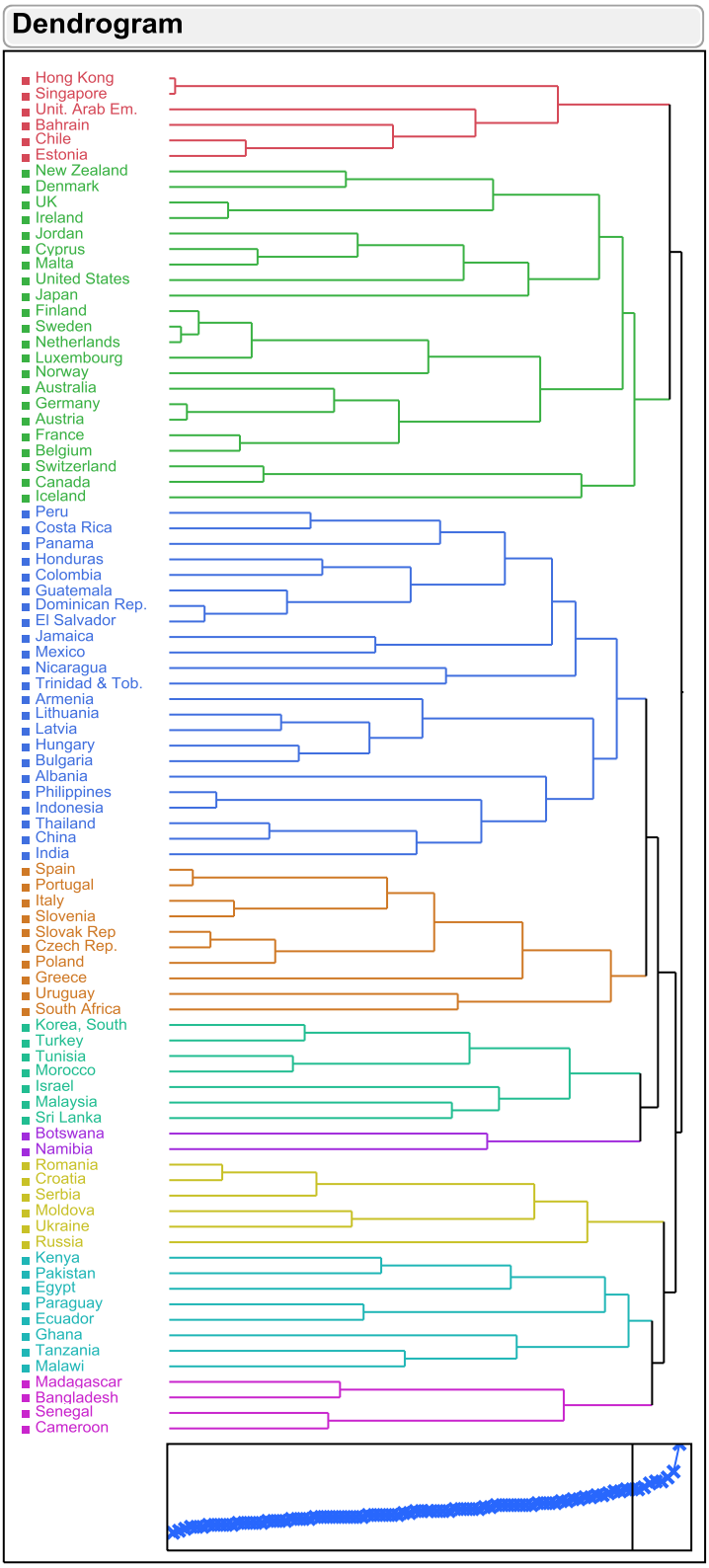
Clustering History

Number of Clusters	Distance	Leader	Joiner
94	2.28489770	Sweden	Netherlands
93	2.35006233	Hong Kong	Singapore
92	2.56473518	Romania	Bulgaria
91	2.60128491	Slovak Rep	Czech Rep.
90	2.61057191	Germany	Austria
89	2.64484420	Spain	Portugal
88	2.75355991	Philippines	Indonesia
87	2.85425696	Guatemala	El Salvador
86	2.92277662	Sweden	Luxembourg
85	3.02465488	Spain	France
84	3.03282288	Lithuania	Latvia
83	3.09845435	UK	Ireland
82	3.11944131	Malta	Poland
81	3.12868709	Switzerland	Canada
80	3.28755473	Korea, South	Turkey
79	3.29964883	Finland	Sweden
78	3.35613815	Croatia	Slovenia
77	3.35917152	Uganda	Kenya
76	3.45096995	Lithuania	Hungary
75	3.51651029	New Zealand	Australia
74	3.59495475	Jordan	Cyprus
73	3.60067823	Croatia	Italy
72	3.61433142	Moldova	Ukraine
71	3.62018032	Honduras	Dominican Rep.
70	3.64425534	Thailand	Mexico
69	3.66512205	Germany	Belgium
68	3.67266809	Lithuania	Romania
67	3.78220971	Honduras	Guatemala
66	3.79154491	Chile	Estonia
65	3.79428511	Jamaica	Trinidad & Tob.
64	3.84327488	Pakistan	Bangladesh
63	3.87995311	Moldova	Serbia
62	3.91145390	Malta	Slovak Rep
61	4.12399942	India	China
60	4.17569526	Peru	Costa Rica
59	4.29868158	Jordan	United States
58	4.30302796	Nicaragua	Paraguay
57	4.30698063	Finland	Denmark
56	4.35659407	Tanzania	Malawi
55	4.39779474	Tunisia	Morocco
54	4.40192323	Armenia	Albania
53	4.42264483	Unit. Arab Em.	Bahrain
52	4.44460689	New Zealand	Chile
51	4.52517560	Malaysia	Sri Lanka
50	4.60736662	Uruguay	South Africa
49	4.60993264	Malta	Lithuania
48	4.64237116	Switzerland	Japan

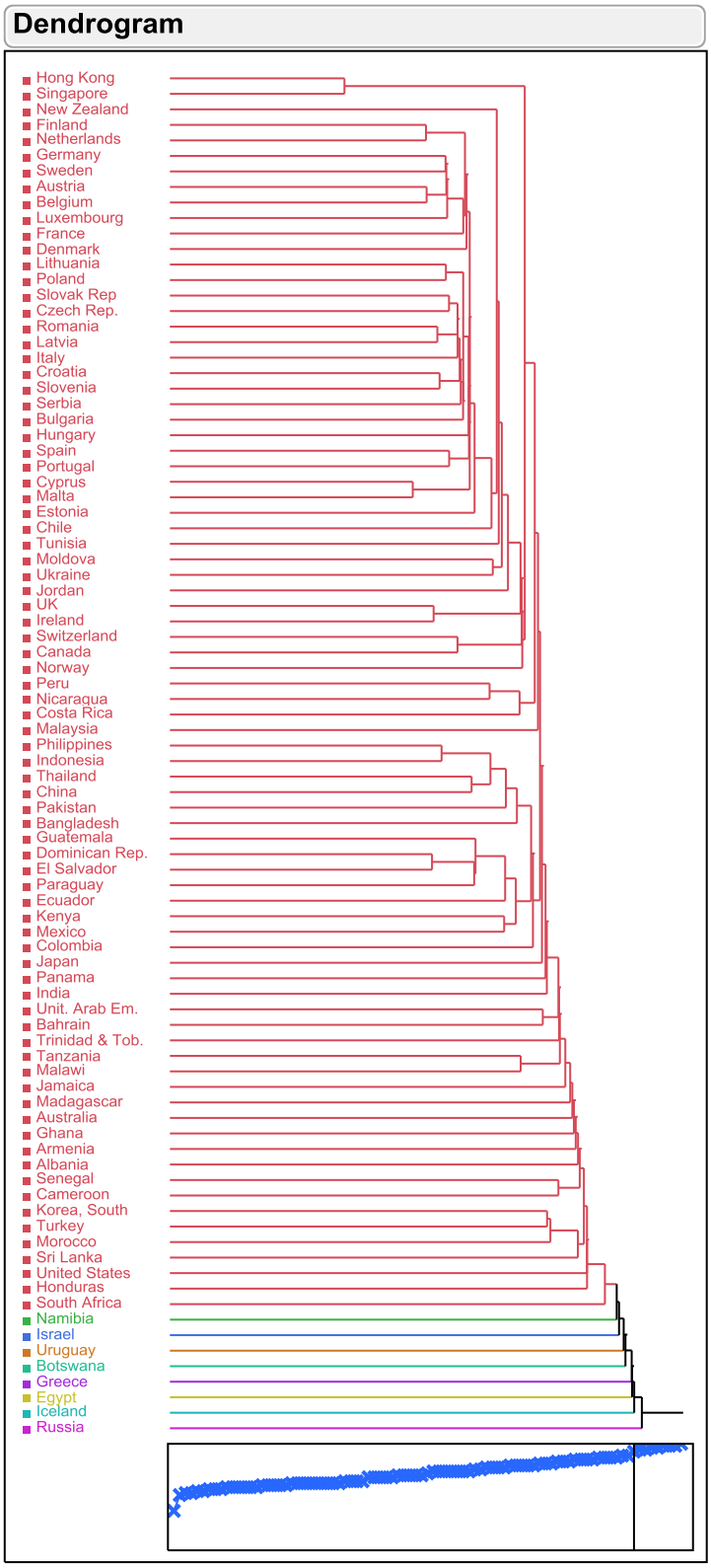
Average Linkage method applied on the 33 variables model of the EFW index 2011



The Complete Linkage method applied on the 33 variables model of the EFW index 2011



Single linkage method applied on the 33 variables model of the EFW index 2011



Centroid Linkage method applied on the 5 areas model of the EFW index 2011