Institutional Quality and Public Spending Efficiency
A Non-Parametric Approach

Hossein Radmard[1]
Department of Economics
West Virginia University
P.O.Box 6025
Morgantown, WV 26506

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Abstract

It is often assumed by many government officials that higher GDP per capita and more income equality are favorable for economies, and to reach these, different policies should be implemented. As a fiscal tool, public spending may have a significant effect on economic growth and income distribution. Yet there is remarkable variation across countries in the effectiveness of public expenditure in influencing these two outcomes. In different economies, public expenditures are functioning differently. This paper examines the impact of institutions on the effectiveness of public spending for different countries by employing a nonparametric method, Data Envelopment Analysis (DEA). Efficiency scores for 83 countries are calculated and then the relationship between these scores and institutional quality are tested. For institutional quality, some components of Economic Freedom of the World (EFW) index are used. The findings suggest that institutions have a positive impact on the effectiveness of public spending across countries.

Keywords: Public Spending, Economic Freedom, Data Envelopment Analysis

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[1] email:Hossein.Radmard@mail.wvu.edu

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1. Introduction

In economic literature, institutional analysis has been a powerful argument in policy and development studies. Hayek (1945, 1960), de Soto (1989) and North (1990) are some examples of leading works in which the importance of institutions in public policies are discussed.

A number of empirical papers have employed measures of institutional quality. This initiated a need to design an expressive and comprehensive quantitative measure of institutions. The Economic Freedom of the World (EFW) Index, introduced by Gwartney, Lawson and Block (1996), was a significant step toward quantifying and understanding the arrangements of institutions across countries. Gwartney et al. (1996) calculate a single index number ranging from zero to ten for each country. As the number gets higher, the economic environment is closer to free market, and as it gets close to zero, the country has less economic freedom and lower institutional quality. EFW concentrates on five different areas which include long term institutional factors like rule of law and short run variables such as fiscal policy. [For details see table A in Appendix]

This measure and its components have been widely used to test different aspects of institutions and their effects on a number of economic variables in empirical papers. Two notable areas are growth and income distribution and development. Due to differences in specifications and other technical and data related reasons, results are varied. But in general, it can be concluded that higher economic freedom would bring better economic performance and also higher equality.

This paper looks at economic freedom and its relationship with public spending efficiency across countries. By efficiency of government spending, I am referring to the effectiveness of public expenditure in reaching two goals: Higher GDP per capita and more equality in income distribution.

One of the government's biggest challenges is to develop policies that raise the standard of living in the society without creating large income gaps between the rich and poor. Pro-growth and pro-equity policies have been simultaneously pursued by governments. Many governments seek to develop policies that raise standards of living without creating large income gaps between the rich and the poor. There is significant debate over the coexistence of these two in the literature. Different studies have shown different relationships between economic growth and income equality. Some believe they are negatively correlated and some claim growth promotes equality (or vice-versa). However, behind these debates, there is an important question that opens a door to another literature which is closer to the main argument of this paper. How effective are governments' policies in changing economic performance and equality simultaneously?

Much of the variation in growth rates and income inequality across countries and over time is still not completely understood. Although cross-country studies, based on dynamic panel data techniques, have been able to correct some of the methodological problems in the earlier literature (such as measurement and specification errors, simultaneity bias, and the potential causality), conclusive empirical results have yet to be obtained. For example, consider the relationship between public spending and growth. Since the seminal contribution by Barro (1990), there have been a number of analytical studies highlighting the various channels through which public expenditure may affect growth. But, at the empirical level, robust relationships have been difficult to capture. Most of the studies on the effects of government expenditure on growth appear to have various conclusions. Almost the same argument can be brought up about income distribution and the impact of government expenditure on it. There are studies in favor of a positive relationship between government expenditure and lower inequality, e.g. Afonso et al.(2008) and there are some confirming the negative correlation [De Mello and Tiongson (2006)].

In this study, by looking at the simple correlation between the spending and the two other factors of interest, economic output and income equality, I establish the analysis framework for this research. These correlations are both positive, and they form the base for the main assumption of the efficiency calculation process. Building on these correlations, general public spending is considered as an input in the “production” process of two outputs, GDP per capita and income equality. In this production process, different economies show different efficiency rates. “Efficiency” refers to how productive the countries are in increasing their GDP and income equality by using the *same* level of public expenditure.

The empirical analysis has two major parts. First, by using a non-parametric method, efficiency scores of public spending are calculated and reported. Second, the relationship between efficiency scores and economic freedom(the measure of institutional quality in this paper) is tested econometrically.

The results illustrate that there is tremendous variation in efficiency scores across countries. For both rich and poor countries, the evidence presented in this paper suggests that higher institutional quality is associated with more public spending effectiveness.

Data for 83 countries on public spending, GDP per capita and income equality is used in a cross-section setup. Based on GDP per capita in year 2000, countries are divided in two groups of rich and poor. Both groups of countries with their respective GDP per capita and GDP per capita annual growth rates are listed in table B in the appendix.

The paper is organized as follows. Section2 will be a literature review consisting of three parts related to the subtopics involved in the paper.Section3 presents the methodology and data.Section4 shows the result and finally the last section will be conclusion.

2. Literature Review:

A significant body of literature analyzes the relationships between economic freedom and economic growth and economic freedom and income inequality. Most of the studies in this area, examine the impact of institutions on the "output" of governments' policies. What is missing in the literature is the effect of institutions (e.g. economic freedom) on the combination of outputs (e.g. GDP per capita and income equality) and "effectiveness" of the public sector in providing the outputs at the same time. Given that many government officials seek to reach these twin goals of output expansion and reduction of income inequality, this is an important question to evaluate theoretically and empirically.

The other side of literature is the issue of public spending efficiency. In previous studies, most of the cases calculate and analyze the "technical efficiency" which refers to the productivity of producers. But here it refers to the effectiveness of public expenditure as an input to provide higher and more equally distributed income. In this section a brief review of both parts of the literature is presented.

2.1*Economic Freedom*

A vast literature explores the relationship between economic freedom and economic growth. [e.g. de Haan (2003); Berggren (2003); Gwarteny, Holcombe and Lawson(2004); Gwartney

(2009)].Using the Economic Freedom of the World (EFW) Index, Ayal and Karras (1998) find that aggregate economic freedom appears to enhance growth both via increasing total factor productivity and via enhancing capital accumulation. De Haan and Siermann (1998) find, however, that the link between freedom and growth depends on the freedom measure used. Easton and Walker (1997) confirm that improvements of economic freedom have a significant impact on steady-state income levels. Carllson and Lundstrom (2002) claim that on average economic freedom is good for growth, but it does not mean that all components of economic freedom have a positive effect on GDP growth. Overall, the empirical literature has shown a positive association between economic freedom and economic growth.

Berggren (1999) looked at the problem differently by investigating the relationship between economic freedom and income distribution. Berggren, by comparing the EFW Index with data of income inequality in 102 countries, concludes that equality is achieved by economies which had increasing economic freedom over time. This result was not only true for developed, higher income countries, but was especially true for low income, less developed countries. Scully (2001) concludes that "economic freedom reduces income inequality." Ashby and Sobel (2008) examine the economic freedom impact on income inequality within states in the U.S. and show that higher economic freedom is associated with lower income inequality. Carter (2006), in contrast with most of the literature, shows the estimated relationship between economic freedom and income inequality is positive, statistically significant, but relatively inelastic.

There are several papers that examine growth and equality together, e.g. Scully (2002) shows economic freedom is significantly affective on both. Doucouliagos(2005) uses a non-parametric method and investigate the relationship between economic freedom and technical efficiency of 80 countries in a panel setup.

2.2*Efficiency of Public Spending*

Previous studies on the efficiency of the public sector in economic performance, that applied non-parametric methods, found a significant divergence of efficiency across countries. The more widely cited studies include Fakin and Crombrugghe (1997) for the public sector output, Gupta and Verhoeven (2001) for education and health in Africa, Clements (2002) for education in Europe, and Aubyn (2003) for education spending in the OECD. Afonso, Schuknecht, and Tanzi (2005, 2006) examine public expenditure efficiency in economic performance in the OECD and in emerging markets. De Borger and Kerstens (1996), and Afonso and Fernandes (2006) find evidence of spending inefficiencies for the local public sectors. Afonso, Schuknecht, and Tanzi(2008) investigate the efficiency of taxation and some other fiscal policies in order to decrease income inequality in OECD countries.

Most of these studies apply the Data Envelopment Analysis (DEA) method. In the context of a cross-country analysis for public spending efficiency in income and income equality, however, to the author’s knowledge, no work has been conducted using such a non-parametric method.

3. Methodology and Data

There are two parts in this section. First after an explanation of the method, I consider the data for 83 countries with respect to three main aspects: public spending, GDP per capita, and income inequality measures. Then by using the DEA method, the efficiency score for each of them is calculated. As explained in the introduction, efficiency refers to the effectiveness of government expenditure in order to have higher GDP per capita and lower income inequality. Note that in the cross-country analysis of this paper, the relationship between public spending and GDP or equality for each country, per se, is not important. As mentioned above, there are studies which investigate these relationships in time series and panel frameworks, but they are not carried out here. In the second part, I examine the relationship between the efficiency score of each country and their corresponding Economic Freedom of the World (EFW) Index. Some different variations of this index are used.

3.1. *Data Envelopment Analysis (DEA)*

Data Envelopment Analysis (DEA), a non-parametric method, was originated by Farrell (1957) and popularized by Charnes, Cooper and Rhodes (1978). The DEA procedure allows for an estimation of the level of technical effectiveness in a production process. There is a long literature with application of DEA in different areas involved in efficiency or productivity measuring topics. Emrouznejad (2001) lists almost 500 studies that use DEA as an evaluation tool. There are several researches in the urban and regional studies using DEA. Usually topics are related to the efficiencies of industries production or local governments in distributive tasks. [Tong (1996), Hajalmarsson(1992), De Borger(1996)]

DEA employs linear programming to compare decision making units (DMUs) which produce multiple outputs using multiple inputs. A production frontier is estimated without any form of production technology being specified. This frontier indicates the maximum possible output given a certain level of input. The term “envelopment” comes from the fact that the frontier envelops the set of observations. This frontier will then serve as a base from which to calculate the relative effectiveness (efficiency) of the DMUs. Units are either on or below the frontier.

Figure 1 provides an example of the DEA approach; A, B, C, ..., J are 10 DMUs. Z is the single input. X and Y are outputs, and we do not know their production functions. As it is illustrated H, J and F are the efficient units and the rest are inefficient. It means that these three units are able to produce the highest level of combined output given a certain level of input.

[Figure1 Here]

Each DMU’s efficiency is defined relative to that of all others. So at a specific level of input, the DMU with the highest output would be the most efficient, and respectively other DMUs will be ranked. The efficient unit cannot increase the amount of one of its output without decreasing other outputs or increasing the inputs. So clearly there is an optimization problem. The foundation of the optimization process is as follows:

For each DMU, the model finds the optimal linear combination of units in the sample which produce a higher output level with fewer inputs. This linear combination represents a hypothetical composite unit that should satisfy two constraints:

1. All output levels are greater or equal to the output level of the DMU under analysis.
2. All input levels of the composite unit are less than or equal to the input levels of the analyzed DMU.

The model searches for the comparison that identifies output slack or excess input usage of the unit under analysis, as defined by the above inequality conditions. Suppose we have *n* DMU and each unit has *k* inputs and produces *m* outputs. The DEA model can be sketched with the following mathematical programming for a given DMU_i:

$$\mathrm{Min}_{\lambda_i}\, \delta = u_i s_i + v_i e_i \qquad (1)$$

Subject to:

$$Y\lambda_i - y_i = s_i \qquad \textit{Output Slack} \qquad (2)$$

$$x_i - X\lambda_i = e_i \qquad \textit{Excess Input} \qquad (3)$$

$$\sum_{j=1}^{n} \lambda_{ij} = 1,\ \lambda_i \geq 0, e_i \geq 0, s_i \geq 0$$

Where;

y_i :$(m \times 1)$ vector of the outputs for DMU_i
x_i :$(k \times 1)$ vector of the inputs for DMU_i
Y :$(m \times n)$ output matrix
X :$(k \times n)$ input matrix
λ_i :$(n \times 1)$ vector of weights assigned to linear combination of comparison set
s_i :$(m \times 1)$ vector of output slack
e_i :$(k \times 1)$ vector of input excess
u_i, v_i : $(1 \times m)$ and$(1 \times k)$ vectors of weights used in the evaluation process of the objective function.

The objective in an output-oriented model is to maximize the proportional increase in outputs produced with a given level of inputs, equation (2). For the input-oriented model, the objective is to maximize the proportional decrease in the input necessary to produce a given level of output, equation (3).

DEA models can be either variable return to scale (VRS) or constant return to scale (CRS). In the case where the weights determining hypothetical composite comparison, λ_{ij},sum to one, the model is VRS, otherwise it is CRS.

What is important and useful for the purpose of this research at this stage is to determine the efficiency score with this model. The efficiency score is basically a measure of distance of any DMU from the frontier. An efficient DMU, which would be located on the frontier (or very close to it), get the score of 1 or 100 percent. With the input orientation, DMUs get the score between zero and one. If, for example, a DMU gets a score of 0.7, it implies that the DMU could produce the same output using 70 percent of its current input level. So it has 30 percent inefficiency.

For this paper, VRS and the input-oriented model are used.[i]

The outputs are GDP per capita for year 2000 and (100-GINI) as an equality measure for year 2000. The input is average general public spending (as a percentage of GDP) between year 1990 and 2000. [Data on two alternative outputs and one extra input are presented but they are not implemented in the model yet: output: GDP per capita annual growth in 2000 and the average of (100-GINI) between 1990 to 1999; input: public spending on education (as a percentage of GDP between 1990 and 1999]

Thus, a 2 outputs- 1input process will determine the efficiency score of each country. Eighty three countries including developed and developing are examined. Based on their GDP per capita level in year 2000, they are divided into two groups; rich and poor. The efficiency calculation and the testing of the correlation with economic freedom have been completed separately for the two groups. Table 1. presents descriptive statistics and sources of the data set.

[Table1 Here]

There are a few points that should be noted before proceeding with the analysis. In similar studies, the growth rate of GDP per capita is typically considered as the output rather than level of GDP per capita. The reason for the difference is because in those studies inputs are physical and human capital within the growth theories framework. Consequently, these studies try to compare the productivity of DMUs (countries) in affecting GDP growth. But since growth is not the key variable of interest and income distribution is an output as well, I consider public spending as the input and dropped capital from the model. Also the spending is used in the average form of a decade before the outputs year, 2000. This has been done to capture any lag in effectiveness of spending.

For income inequality, there are several measures. Data availability was the main concern and reason for picking the GINI index. Data on GINI is a mixed data from three sources, World Bank, OECD and UTIP (University of Texas Inequality Project). In all of these, the GINI index is calculated for households and not families.

DEA calculates the efficiency scores which are shown in Table2.a and 2.b. Note that these results come from the model using two outputs (GDP per capita in year 2000 and (100-GINI) for the same year) and one input (general public spending as percentage of GDP). I decided to use the above combination because of the generality of public spending rather than just education. Also education spending has shown unstable correlation with the outputs for different years and among different countries. {However other inputs and outputs (GDP growth, education spending) are tested separately in another model and reported in Appendix. [*To be completed*]}

[Table 2.a, 2.b Here]

Peer DMUs are the efficient DMUs which are taken in the corresponding composite output units. For first group; Hong Kong, Japan, Norway, Sweden and the U.S are the efficient countries. For poor countries; Argentina, Bulgaria, Guatemala, Hungary, Indonesia, Mexico, Oman, Romania, Slovakia and Uruguay are the efficient DMUs.

3.2. *Institutions and Efficiency score*

The main hypothesis of the paper to be tested is: “Countries with higher institutional quality (economic freedom) are more efficient in using their public spending in order to grow GDP and decrease income inequality”. Put differently, “there is a positive correlation between efficiency score and level of institutional quality”.

In this section, I test the hypothesis that countries with higher institutional quality (operationalized here as economic freedom) are more efficient in using their public spending to influence the level of economic output and the level of income equality.

The next step is determine a quantitative measure of institutional quality and the check if it can explain the variation in the efficiency scores calculated in previous section. For this purpose, I use Economic Freedom of the World (EFW) Index. The most recent version of it, the 2010 report by Gwartney, Hall and Lawson, is applied here. As mentioned before, this index is based on different criteria which are grouped in 5 areas (see table A in Appendix).

To examine the relationship between institutional quality and public sector efficiency, five different measures constructed from EFW index are shown in table 3. Regarding the selection of these variables, it should be noted that since government expenditure is already implemented in the first step and we are assessing its efficiency, area one of EFW (Size of government) cannot be involved in the analysis. Also this research attempts to examine the effect of institutional quality rather than government share or other measures related to the size of public sector. A possible limitation arise from the fifth variable which is the percentage change in legal system and property rights security during 10 years. These types of institutional measures do not show a significant variation through the short time period of a decade.

[Table 3 Here]

-*Correlation between Efficiency and EFW:*

Assuming these variables are relatively good representatives of institutional quality, I can complete testing the hypothesis by a regression or correlation check. A simple OLS regression is conducted for the model using efficiency score as the dependent variable and five different independent variables for economic freedom.

$$EFF_{r,p} = \beta_0 + \beta_1 EFW_{r,p} + \beta_2 X_{r,p} + \varepsilon$$

The five different composed indices from EFW are plugged in the simple model above for rich and poor countries separately. Also as a control, I include GDP per capita and (100-GINI) .The results are reported and discussed in next section.

Before analyzing the result, in table 4.a and 4.b, correlation matrix for all inputs, outputs and EFWs is presented.

[Table.4.a, 4.b Here]

There are two important points about correlations to mention. First, the relationship between inputs and outputs; for the input which I used (general expenditure), all correlations in both rich and poor countries are positive. This, as mentioned before, was the basis for the production process. However as it is shown, correlation between public expenditure on education and income equality for poor countries is negative.

Second, the correlation between economic freedom measures and outputs; for rich countries all correlations are positive, but for the poor ones EFW (2-5) for both 1995 and 2000 appears to be negatively correlated with income equality.

4. Results

Table5.a and 5.b show the regression results for rich and poor countries. Five different combinations of EFW measures and two outputs are tested plugged in the simple model.

[Table 5.a, 5.b Here]

One important issue is the size of coefficients which is relatively small. But regarding the significance, we can see that 95EFW (2-5) and 00EFW (2-5) as well as EFW2 are almost in all equation significant. But on the other hand the percentage change measure appears to be negatively related to efficiency. This is the case for both rich and poor countries.

5. Robustness Check, Bootstrapping Regression: (To be Edited and completed)

The efficiency scores cannot be used in a least square regression. For obvious reason the scores are related. Basically, they are calculated with respect to each other's; that is why if you change the sample of the scores would change and an efficient DMU might become inefficient. Simply due to the dependence of the scores, which are the dependent variables in the regression, residuals would not be distributed.

Simar(1992) introduces the bootstrap method in non-parametric analysis for the first time. Since then, this method has been used for hypothesis testing of DEA efficiency scores (Atkinsons and Wilson 1995), to derive the confidence interval and a measure of bias for the DEA efficiency scores (Ferrier and Hirschberg 1997), and for analyzing the sensitivity of the DEA efficiency scores related to the variations of the estimates frontier (Simar and Wilson 1998). Bootstrap method is a powerful tool to address the statistical aspects of DEA(Grosskopf 1996).

***So basically in this section I will follow three steps of the bootstrapping method and report the final results for 100,200,500 and 1000 replications. The result reported here are the original results of OLS without bootstrapping. But I have the other ones as well, which confirm the current conclusion.

6. Conclusion

Governments are assumed to pursue policies by which they would promote higher economic output and more equally distributed income. Also public expenditures are one of the main tools in their hand to implement and approach these goals. Assuming these assertions are correct, this paper accomplished two tasks. First, it calculated the efficiency of public expenditure for different countries. Second, with a simple OLS regression, it tested the relationship between this efficiency and institutional quality of each country. For calculating the efficiency, Data Envelopment Analysis (DEA), a nonparametric method, is employed. The study creates a cross-sectional analysis for year 2000 using Economic Freedom for the World (EFW) Index as the measure for institutional quality. The main finding of the paper can be summarized as follows. Institutional quality, legal structure and security of property rights, are important factors for economies in order to use their spending more effectively. However, this claim cannot be supported for the change in institutions.

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Figure1

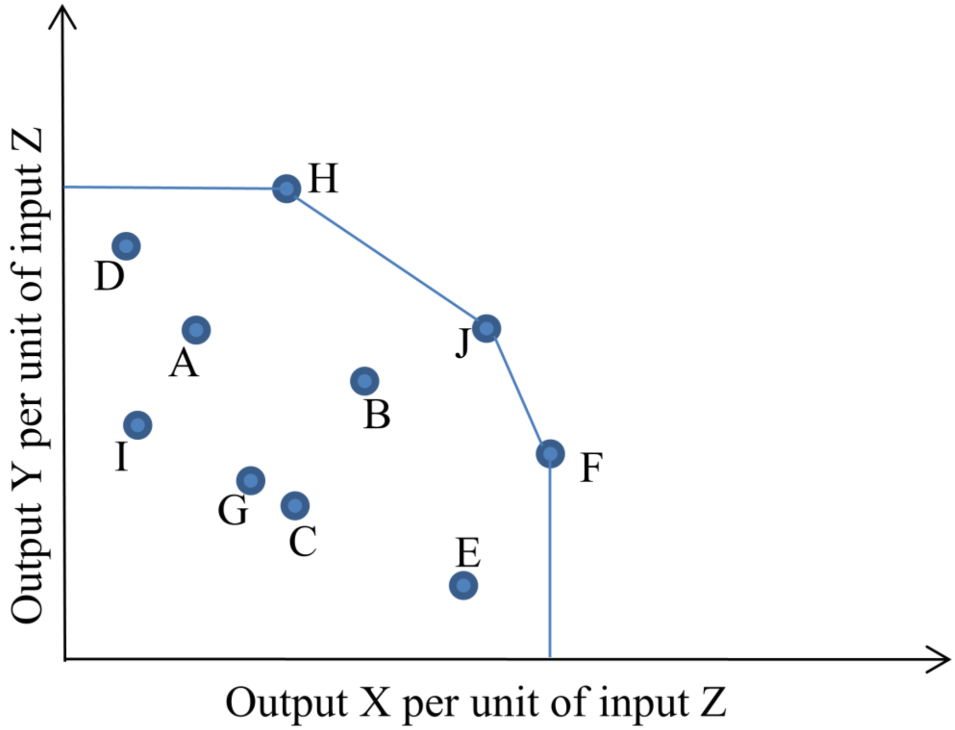

Table1.: Descriptive statistics and sources				
Variables	Mean	Maximum	Minimum	Std. Dev.
Out-puts				
00(100-GINI) ,year 2000[a]	59.603	77.781	41.500	8.348
90-99(100-GINI)Average b/w1990-1999[b]	57.021	77.781	42.573	6.905
Per capita GDP, 2000, current US $[c]	8226.217	37472.371	109.548	10237.785
Per capita GDP Growth, 2000 (annual%)[d]	2.760	10.005	-8.528	3.246
In-put				
General Government Expenditure, 2000 (% of GDP)[e]	15.066	25.946	4.572	4.986
Public Spending on Education, 2000 (% of GDP)[f]	3.381	8.290	1.985	2.314

Source:[a] WDI (World Bank), OECD ; [b] UTIP ; [c] WDI, OECD ; [d,e,f] WDI, OECD

Table2.a: DEA result/Rich Countries

Country	Efficiency Score	Rank	Peers
Australia	0.515875995	20	HKG
Austria	0.830482244	9	HKG ,NOR
Belgium	0.55552268	17	HKG ,NOR
Canada	0.658779263	12	HKG ,NOR
Cyprus	0.56931299	16	---
Germany	0.879673839	8	HKG ,NOR
Denmark	0.577435255	15	HKG ,NOR
Spain	0.585108399	14	HKG ,NOR
Finland	0.885176897	7	HKG ,NOR
France	0.429757595	22	HKG ,NOR
United Kingdom	0.539841056	18	HKG ,NOR
Greece	0.588195562	13	HKG ,NOR
Hong Kong	1	1	---
Ireland	0.76838851	10	HKG ,NOR
Israel	0.351510376	24	HKG
Italy	0.494367748	21	HKG
Japan	1	1	---
Korea, Rep.	0.763043761	11	HKG
Netherlands	0.42164579	23	HKG ,NOR
Norway	1	1	---
New Zealand	0.527391911	19	HKG
Singapore	0.894509673	6	HKG ,NOR
Sweden	1	1	---
United States	1	1	---

Table2.b: DEA result/Poor Countries

Country	Efficiency Score	Rank	Peers
Albania	0.799443781	17	IDN, ROM
Argentina	1	1	---
Burundi	0.40210858	54	IDN, ROM
Bulgaria	1	1	---
Bolivia	0.456555724	46	GTM,IDN
Brazil	0.466936022	44	GTM,MEX
Botswana	0.337859094	57	GTM,MEX,ROM
Chile	0.811311007	16	GTM,MEX
China	0.418669015	53	GTM,IDN,ROM
Cote d'Ivoire	0.904011905	13	IDN
Cameroon	0.690716088	25	IDN

Table2.b Cont'd

Colombia	0.466515154	45	GTM,MEX
Costa Rica	0.703344345	21	GTM,MEX,ROM
Ecuador	0.691247642	24	GTM,IDN
Egypt	0.638906956	31	IDN,ROM
Fiji	0.434335798	50	GTM,MEX,ROM
Gabon	0.989554524	11	GTM,MEX,ROM
Ghana	0.642180622	30	IDN
Guatemala	1	1	---
Honduras	0.500086427	40	GTM,IDN
Hungary	1	1	---
Indonesia	1	1	---
India	0.535694718	35	IDN,ROM
Iran	0.510558605	38	GTM,IDN,ROM
Jamaica	0.616124868	33	GTM,MEX,ROM
Jordan	0.305727094	59	GTM,MEX,ROM
Kenya	0.433897197	51	IDN
Sri Lanka	0.624820948	32	GTM,IDN
Lithuania	0.383214265	55	HUN,MEX,ROM
Latvia	0.421254009	52	HUN,MEX,ROM
Morocco	0.371825755	56	GTM,IDN,ROM
Mexico	1	1	---
Mauritius	0.656997561	27	HUN,MEX,ROM
Malawi	0.450429142	49	IDN,ROM
Malaysia	0.928539157	12	HUN,MEX,ROM
Namibia	0.320826471	58	GTM,MEX,ROM
Nepal	0.729837835	20	IDN
Oman	1	1	---
Pakistan	0.903574169	14	HUN,ROM
Panama	0.69610858	22	GTM,MEX
Peru	0.696041584	23	GTM,MEX,ROM
Philippines	0.50614202	39	GTM,IDN
Poland	0.53645575	34	HUN,MEX,ROM
Paraguay	0.534801841	36	GTM,IDN
Romania	1	1	---
Russia	0.480783463	41	GTM,ROM
Senegal	0.512031555	37	IDN
Sierra Leone	0.455731362	48	IDN
El Salvador	0.73989892	19	GTM,ROM
Slovak Republic	1	1	SVK
Thailand	0.651408613	29	HUN,MEX,,ROM
Tunisia	0.4797391	42	GTM,MEX,ROM
Turkey	0.796923518	18	GTM,MEX,ROM

Table2.b Cont'd

Tanzania	0.655681789	28	IDN,ROM
Uruguay	1	1	---
Venezuela, RB	0.81318742	15	HUN,MEX,ROM
South Africa	0.456323385	47	GTM,MEX
Zambia	0.685024202	26	IDN
Zimbabwe	0.468273312	43	IDN

Table3: Economic Freedom Variables

Economic Freedom	Description	Mean	Max	Min	Standard Deviation
95EFW2	Area 2 of EFW, year 1995	6.148	9.28	2.64	1.6668
00EFW2	Area 2 of EFW, year 2000	6.111	9.62	3.26	1.8852
95EFW2-5	Average of Area 2 to 5, year 1995	6.394	8.98	3.81	1.3944
00EFW2-5	Average of Area 2 to 5, year 2000	6.775	8.94	4.277	1.2064
%ΔEFW2-5	Percentage change in EFW2-5 from 1990 to 2000	0.075	0.477	-0.226	0.1281

Table 4.a: Rich Countries Correlation Matrix

	GDPPC2000	GDPPCg90-99	1-GINI2000	1-GINI9099	GEX90-99	EDex90-99	95EFWI (2-5)	95EFW2	00EFWI (2-5)	00EFWI2	%ΔEFW (2-5)
GDPPC2000	1										
GDPPCg90-99	-0.1397808	1									
1-GINI2000	0.40828783	0.2291138	1								
1-GINI9099	0.4346638	0.1651145	0.8460624	1							
GEX90-99	0.16777285	-0.4689379	0.0246246	-0.003040	1						
EDex00-99	0.41000587	-0.0421799	0.5080269	0.4403568	0.5224016	1					
95EFWI(2-5)	0.53176885	-0.0837341	0.4324449	0.5056454	-0.071262	0.082231	1				
95EFW2	0.60518741	-0.1744069	0.5343582	0.5161177	0.1272277	0.370487	0.899224	1			
00EFWI(2-5)	0.49334112	-0.0445028	0.4932014	0.5491974	0.1175009	0.181035	0.931529	0.863729	1		
00EFWI2	0.56720945	-0.2518041	0.4456277	0.518718	0.3749384	0.486533	0.784152	0.897704	0.822045	1	
%ΔEFW2-5	-0.2586701	0.0873087	-0.174922	-0.242025	-0.017615	-0.10497	-0.26517	-0.16508	-0.0468	-0.142	1

Table 4.b: Poor Countries Correlation Matrix

	GDPPC2000	GDPPCg90-99	1-GINI2000	1-GINI9099	GEX90-99	EDUex90-99	95EFWI (2-5)	95EFW2	00EFWI (2-5)	00EFWI2	%ΔEFW (2-5)
GDPPC2000	1										
GDPPCg90-99	0.123111416	1									
1-GINI2000	-0.081302841	0.358231	1								
1-GINI9099	0.333622272	0.3870548	0.4575858	1							
GEX90-99	0.303614343	0.0979646	0.0447651	0.2757259	1						
EDUex90-99	0.209017418	-0.2614355	-0.138959	0.0806409	0.2027719	1					
95EFWI(2-5)	0.39826243	0.0041712	-0.259927	0.0971322	0.1330474	0.274944	1				
95EFW2	0.440556307	0.1321042	0.1841151	0.3841237	0.3712538	0.280759	0.493049	1			
00EFWI(2-5)	0.544160437	0.2364759	-0.109445	0.2714787	0.385336	0.156127	0.729042	0.585631	1		
00EFWI2	0.420536829	0.2148729	0.2841543	0.4141234	0.5420674	0.29421	0.369875	0.808122	0.628744	1	
%ΔEFW2-5	0.00233425	0.1734128	-0.011829	-0.056934	0.0906399	-0.1364	-0.10397	0.162195	0.338547	0.181794	1

Table5.a:	**OLS Regression Result; Dependent Variable: Efficiency Score (Rich Countries)**				
Independent Variables	(1)	(2)	(3)	(4)	(5)
constant	0.2677989 (0.4468121)	0.7177793 (1.47074)	0.361853 (1.181795)	0.75569 (1.571452)	0.729692*** (15.85273)
95EFW2	0.0599493 (2.6427001)**	3.1453231* (1.911435)	1.234417*** (3.938041)	-----	-----
95EFW(2-5)	0.2056036** (2.6956777)	2.2071963** (2.361914)	2.18717** (2.38943)	3.349187** (2.807005)	-----
00EFW2	1.139372* (1.997661)	0.1231961 (1.40817)	-----	-----	-----
00EFW(2-5)	0.194316 (1.420459)	0.219886 (1.26143)	-----	2.34635* (2.27078)	-----
%ΔEFW2-5	-0.392337 (-1.016934)	-0.4764602 (-0.98859)	-----	-----	-0.82165* (-1.89492)
GDPPC2000	1.784E-05*** (3.3331632)	-----	-----	-----	-----
100-GINI2000	0.0102171 (1.2635424)	------	-----	-----	-----
R^2	0.673758	0.408398	0.297757	0.296631	0.25783

Notes statistics in parentheses. *** = 1% , ** = 5%, * = 10% significance level

Table5.b: OLS Regression Result; Dependent Variable: Efficiency Score (Poor Countries)

Independent Variables	(1)	(2)	(3)	(4)	(5)
constant	0.278318 (0.299612)	0.492115 (0.229692)	0.498103 (0.185585)	0.637602 (0.220805)	0.684078 (16.64307)
95EFW2	1.056457 (1.041204)	1.103899* (2.050601)	3.006694*** (3.031552)	-----	-----
95EFW(2-5)	0.059282 (0.045421)	2.0146** (2.854419)	2.021194** (2.033125)	3.050691** (2.041651)	-----
00EFW2	2.11878 (0.039206)	0.10281 (0.046818)	-----	-----	-----
00EFW(2-5)	1.07508 (0.066163)	1.042616 (1.076305)	-----	0.04412* (1.750952)	-----
%ΔEFW2-5	-0.218599 (-0.384085)	0.03391 (0.460251)	-----	-----	-0.33646 (-0.95302)
GDPPC2000	7.57E-05 (1.44E-05)	-----	-----	-----	-----
100-GINI2000	0.01098 (0.003545)	-----	-----	-----	-----
R^2	0.460998	0.415349	0.353522	0.325776	0.215684

Notes statistics in parentheses. *** = 1% , ** = 5%, * = 10% significance level

The Areas and Components of the EFW Index

Table A: The Areas and Components of the EFW Index
Area 1: Size of Government: Expenditures, Taxes, and Enterprises A General government consumption spending B Transfers and subsidies as a percentage of GDP C Government enterprises and investment D Top marginal tax rate: i: Top marginal income tax rate, ii: Top marginal income and payroll tax rate
Area 2: Legal Structure and Security of Property Rights A Judicial independence (GCR) B Impartial courts (GCR) C Protection of property rights (GCR) D Military interference in rule of law and the political process (CRG) E Integrity of the legal system (CRG) F Legal enforcement of contracts (DB) G Regulatory restrictions on the sale of real property (DB)
Area 3: Access to Sound Money A Money Growth B Standard deviation of inflation C Inflation: Most recent year D Freedom to own foreign currency bank accounts
Area 4: Freedom to Trade Internationally A Taxes on international trade i.International trade tax revenues (% of trade sector) ii.Mean tariff rate iii.Standard deviation of tariff rates B Regulatory Trade Barriers i Non-tariff trade barriers (GCR) ii Compliance cost of importing and exporting (DB) C Size of the trade sector relative to expected D Black-market exchange rates E International capital market controls i.Foreign ownership/investment restrictions (GCR) ii. Capital controls
Area 5: Regulation of Credit, Labor, and Business A Credit market regulations i.Ownership of banks ii.Foreign bank competition Iii.Private sector credit iv.Interest rate controls/Negative real interest rates B Labor market regulations i.Minimum wage (DB) ii.Hiring and firing regulations (GCR) iii.Centralized collective bargaining (GCR) iv.Mandated cost of hiring (DB) v .Mandated cost of worker dismissal (DB) vi.Conscription C Business Regulations i.Price controls ii.Administrative requirements (GCR) COn

iii.Bureaucracy costs (GCR)
iv .Starting a business (DB)
v.Extra payments/Bribes (GCR)
vi.Licensing restrictions (DB)
vii.Cost of tax compliance (DB)

Table B.1
Rich Countries

Country	Code	2000GDP per capita (current US$)	2000GDP per capita growth (annual %)
Australia	AUS	21768.04252	2.718014466
Austria	AUT	23865.55054	3.529730307
Belgium	BEL	22665.96527	3.418724979
Canada	CAN	23559.50369	4.308170626
Cyprus	CYP	13424.18589	3.931414043
Germany	DEU	23114.23326	3.055406301
Denmark	DNK	29992.9406	3.175048849
Spain	ESP	14421.94074	4.17068661
Finland	FIN	23514.46063	5.123679726
France	FRA	21914.07186	3.396199548
United Kingdom	GBR	25089.44638	3.544936809
Greece	GRC	11500.6477	4.147250419
Hong Kong	HKG	25374.51485	7.003839554
Ireland	IRL	25380.26273	7.997266021
Israel	ISR	19836.09816	6.348921535
Italy	ITA	19269.02735	3.643934431
Japan	JPN	36789.21969	2.681773936
Korea, Rep.	KOR	11346.66499	7.583834901
Netherlands	NLD	24179.85582	3.154911452
Norway	NOR	37472.37103	2.540761522
New Zealand	NZL	13336.43123	1.753447613
Singapore	SGP	23018.65935	8.169476941
Sweden	SWE	27879.14713	4.315576786
United States	USA	35080.7309	3.017106345

Table B.2
Poor Countries

Country	Code	2000 GDP per Capita (Current US $)	2000GDP per capita growth (Annual %)
Albania	ALB	1201.819751	7.380451669
Argentina	ARG	7693.923442	-1.872155001
Burundi	BDI	109.547939	-2.324231399
Bulgaria	BGR	1600.9363	7.667340202
Bolivia	BOL	1009.677001	0.422522668
Brazil	BRA	3701.471956	2.811550713
Botswana	BWA	3269.790747	4.057458425
Chile	CHL	4877.875065	3.218403252
China	CHN	949.1823289	7.549211378
Cote d'Ivoire	CIV	602.7844084	-6.097908958
Cameroon	CMR	635.0299878	1.771920502
Colombia	COL	2523.421205	2.655567013
Costa Rica	CRI	4056.728322	-0.503247311
Ecuador	ECU	1294.982558	1.423898223
Egypt	EGY	1422.732572	3.394987481
Fiji	FJI	2100.723035	-2.422584045
Gabon	GAB	4108.803224	-4.161022753
Ghana	GHA	254.8728073	1.243056202
Guatemala	GTM	1717.663164	1.18190698
Honduras	HND	1140.539787	3.577045478
Hungary	HUN	4689.608437	6.498222714
Indonesia	IDN	803.8816779	3.505623528
India	IND	452.9693998	2.299135328
Iran	IRN	1584.120419	3.427503158
Jamaica	JAM	3479.056754	0.290461802
Jordan	JOR	1764.229892	1.702277428
Kenya	KEN	403.6584537	-1.984614905
Sri Lanka	LKA	872.665518	5.42022531
Lithuania	LTU	3267.355382	4.179292936
Latvia	LVA	3302.305407	7.725231046

Morocco	MAR	1270.333706	0.304767839
Mexico	MEX	5934.981748	5.098688099
Mauritius	MUS	3861.038542	7.960482401
Malawi	MWI	147.3622692	-1.633861698
Malaysia	MYS	4029.874088	6.428675514
Namibia	NAM	2142.822297	1.250794021
Nepal	NPL	224.881593	3.728938829
Oman	OMN	8270.757174	3.573619487
Pakistan	PAK	535.5762961	1.775907177
Panama	PAN	3938.083253	0.757349369
Peru	PER	2049.302351	1.38308056
Philippines	PHL	977.1290384	3.852549111
Poland	POL	4454.08022	4.806739538
Paraguay	PRY	1321.673896	-5.331562466
Romania	ROM	1650.966288	2.168213977
Russia	RUS	1775.141291	10.00451119
Senegal	SEN	473.8365264	0.506866484
Sierra Leone	SLE	150.3902792	1.262000544
El Salvador	SLV	2209.158531	1.617520652
Slovakia	SVK	5326.059737	1.490099863
Thailand	THA	1968.428282	3.871658822
Tunisia	TUN	2033.071277	3.517329494
Turkey	TUR	4010.972384	5.139070134
Tanzania	TZA	273.813436	2.463467426
Uruguay	URY	6914.362582	-1.800391266
Venezuela	VEN	4818.70818	1.793274503
South Africa	ZAF	3019.946548	1.606315217
Zambia	ZMB	309.3178881	0.937783301
Zimbabwe	ZWE	594.0593435	-8.527829412

[i] The efficiency score measures overall technical efficiency in CRS, DEA model. By the overall efficiency I am referring to two non-additive scale and pure technical efficiencies. However in VRS , DEA only calculates the pure waste inefficiency and not the scale one. It is due to the fact that in VRS we assume to some extent similar size for the DMUs. This fact can be a source of

bias in the efficiency scores produced by my program. Because of different sizes of countries and their corresponding GDP per capita. For this reason, I separate rich and poor countries. Therefore a poor country's efficiency wouldn't be compared to a rich one.