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A comparison of aggregation methods for measures of economic freedom

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Abstract

Empiricists have used various editions of an economic freedom index (EFI) initially developed by Gwartney et al. (1996) [Gwartney, J., Lawson, R., Block, W., 1996. Economic Freedom of the World: 1975–1995. Fraser Institute, Vancouver.] to examine the relationship between economic freedom and other socio-economic variables, such as growth or investment. The EFI quantifies the level of particular institutional characteristics thought to promote economic freedom and aggregates them into a single index value. The aggregation procedures utilized by Gwartney and Lawson in developing their index have changed over time and other scholars have promoted alternative methods. We examine several index aggregation procedures and show that each design may have potential methodological flaws that can greatly affect the empirical findings.

JEL classification: C82; O57; D63
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1. Introduction

Gwartney et al. (1996) pioneered the attempt to quantify the many different institutional characteristics of society thought to enhance economic freedom and combine them into a

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single index reflecting the overall level of economic freedom in a society. These measures of institutional characteristics are grouped together into several major categories within a taxonomy reflecting the many different aspects of the various characteristics of economic freedom. Their economic freedom index (EFI) is a weighted summation of the values given to each of these separate institutional elements, with each individual element assigned a value from 0 (minimum freedom) to 10 (maximum freedom). Over time, Gwartney and Lawson have increased the number of countries for which reliable data can be ascertained and have also increased the number of institutional measures and category classifications within the taxonomy to reflect the concept of economic freedom more completely.

Their seminal work in this area of institutional economics has prompted a large and potentially valuable collection of empirical studies assessing the relationship between the EFI and various socio-economic indicators, such as economic growth. For example, a partial list includes Dawson (1998), Hanson (2000), Ali and Crain (2001), Pitlik (2002) and Adkins et al. (2002), who have all empirically verified a positive statistical correlation between the EFI and the growth rate of various countries. Yet, since this aggregated index value represents many separate measures of economic freedom, it is important to detail the particular way in which the values of these various measures are aggregated to better understand the underlying relationships.

As Berggren (2003) states in his survey of current empirical research using the EFI, "it should be noted that the components of the EFI, as well as weighting schemes, have changed in the various editions that have been published. Hence, when comparing studies, one needs to be careful to clarify which editions one uses (pp. 194–195)." Additionally, Heckelman and Stroup (2000) point out that past empirical research relating the EFI to economic growth may be improperly interpreted because the weights of the various elements that are aggregated into the single index value often do not appropriately reflect the magnitude or even the *direction* of each individual element's marginal impact on growth. We seek to draw attention to the complications that are inherent in interpreting the results of empirical analysis that relate the EFI to other socio-economic variables by more explicitly comparing the various aggregation techniques. Since the EFI is most commonly related to a nation's growth rate, throughout our analysis we use growth as an illustrative example of the more generalizable problems inherent in relating the EFI to any other variable of interest. We conclude that each aggregation procedure is based on questionable methods which prevent subsequent research from taking full advantage of the information contained in the variation of the individual elements.

2. The history of aggregation procedures for the EFI

Gwartney and Lawson, along with different collaborators throughout the years, have published numerous editions of the EFI, culminating in an annual Freedom of the World report. Initially, Gwartney et al. (1996) considered two types of methods to create weights for aggregating the various measures of economic freedom into a single index. One method queried a panel of experts as to which particular elements of freedom they thought would be more important for determining the country's degree of economic freedom and

assigned weights to these elements based directly on the results of that survey.[1] A separate method assumed that each element was equally important, with each element weighted by the inverse of the standard deviation of the element across countries. They favored the survey weights and when more recent data was included in the next index, only the survey weighted index was presented. However, when Gwartney and Lawson (1998) expanded the list of elements to include in their newer index, this rendered the old survey weights unusable. Rather than conduct a new survey each time additional elements were added, this new index relied strictly on the element equality weights. In a later edition, they adopted instead weights derived from the absolute value of the first principal components of the elements (Gwartney and Lawson, 2000). Beginning with the 2002 edition, Gwartney and Lawson turned to simple averaging of the assigned category subgroupings of the various elements. While most empirical scholars have simply relied on using the aggregated index provided by Gwartney and Lawson, others have applied their own aggregation procedure to the Gwartney–Lawson economic freedom taxonomy and measures to create their own unique index. In this study, we compare the two most recent aggregation methods utilized by Gwartney and Lawson (both the averaging and modified principal component methods) to two alternative principal components methods advocated by among others Caudill et al. (2000) and Sturm et al. (2002).

Using element values for 1980 from the first version of the EFI, in Heckelman and Stroup (2000) we were unable to reject the claim that some elements of economic freedom were not significantly related to economic growth in simple bivariate and multivariate regression analyses. We also found that while some elements of the economic freedom index had a statistically significant positive impact on growth, other elements had a statistically significant negative impact on growth. We therefore argued that while the EFI might be a reasonable measure of economic freedom per se, the ad hoc weighted aggregation procedures originally utilized by Gwartney and Lawson may not be appropriate for using an index specifically designed to evaluate the empirical link between economic freedom and economic growth. We pointed out that when an increased presence of economic freedom in any specific element monotonically increases the value of the EFI but some elements of the EFI can be shown to retard growth while others promote growth, then it is unclear how the empirical analysis of the statistical relationship between the EFI and growth could be properly interpreted. This concern also relates to the other aggregation methods subsequently adopted by Gwartney and Lawson in later editions of their index which we focus on here.[2]

One explanation for the divergent effects on growth from the various elements of economic freedom is that they may not necessarily be measuring the same concept. For example, Leschke (2000) identifies two factors representing "degree of political interventions into the market process" and "appropriate framework of the market".

[1] There were actually two separate surveys conducted culminating in two separate sets of weights.

[2] One method not considered here is that of factor analysis which seeks to determine which elements properly belong in the aggregated index, implicitly assigning zero weights to the dropped elements. See Leschke (2000) for an application to the elements of economic freedom. Since Gwartney and Lawson believe in the importance of each of their elements, it is not surprising they have never used this methodology, although there may be other serious concerns to adopting such a procedure.

Heckelman (2000) notes some elements represent "institutional settings" whereas others are "macroeconomic outcomes". De Haan and Sturm (2004) distinguish between "institutional measures ('rules of the game')" and those which have a "policy character ('outcomes of the game')". In the spirit of Gwartney and Lawson, we will generically refer to all elements as "institutional characteristics" while recognizing such a designation may blur important conceptual differences highlighted by various scholars.

Assessing the quality of those institutions that promote economic freedom depends upon the intended purpose of those institutions. If the focus of empirical analysis is on the intrinsic quality of economic freedom directly, then there is no need to compare the EFI to any other socio-economic variable. However, if institutions are to be promoted and developed as a means to some particular end (such as economic growth) other than these intrinsic benefits, then an interpretation of the relative quality of those institutional elements—each reflecting the different characteristics of economic freedom—depends upon the degree to which the objective has been realized. In this sense, institutional "quality" as measured by promoting economic growth (or any other particular goal) can be increased either by increasing *or decreasing* the respective institutional characteristics (element values) that represent economic freedom. Thus, any aggregation procedure that forces all element values to be added positively to the overall value of the EFI will obscure those relationships for the freedom measures that have an inverse relationship to the socio-economic variable under consideration. The conundrum, however, as detailed below, is that allowing some element values to subtract from the overall EFI value would fail to create an accurate measure of the intrinsic value of economic freedom per se, and therefore completely alters the interpretation of the ensuing index itself. A higher index value would no longer necessarily represent an increase in the overall level of economic freedom present in that nation.

3. Weighing in on different weighting schemes

To illustrate the last point above, consider the attempt to create a *growth-enhancing* institutions index rather than using the more generic EFI. Although the specific economic aggregation procedure that we proposed in Heckelman and Stroup (2000) has been criticized by Sturm et al. (2002), one could follow the spirit of this index by selecting an aggregation procedure that gives a positive weight to those elements of the EFI that are directly correlated with growth and a negative weight to those elements inversely correlated with growth. In this way, a higher aggregated index value would accrue to those countries with both higher levels of growth-promoting economic freedoms and lower values of growth-retarding economic freedoms. This type of institutional index, while based on the same economic freedom characteristics as the standard EFI, does not strictly represent the degree of economic freedom present in a nation. It would however create a useful ranking of nations based on the quality of their institutional policies—where "quality" is specifically defined as the tendency to promote growth.

Such an index could then also be used as a regressor to explain other social goals, such as investment, income distribution, or environmental standards, to determine if the mix of policies and institutions which best promote growth also contribute positively or

negatively to these other goals. Alternative institutional "quality" rankings could also be constructed by weighting the elements instead based on their individual impact on these other social goals. The weightings may well differ in each case and thus a nation's institutional "quality" ranking might vary depending on the goal being considered.

Alternatively, Sturm et al. (2002) propose a first principal components methodology to construct the EFI. They do not find a robust correlation to exist between growth and their index and consequently reject the importance of economic freedom in determining growth rates.[3] Caudill et al. (2000) suggest instead that six principal components should be utilized to develop a new economic freedom index, arguing that although the first principal components is an improvement over the original Gwartney–Lawson weighting schemes, it is a poor performer itself. Unlike the other studies however, Caudill et al. are only interested in creating a new aggregate index and do not present correlations with growth or any other economic variables.

Unfortunately, the principal component methodology is not without its own inherent problems. While a true principal components methodology allows the data to determine both the proper magnitude and sign for aggregating the elements into a single, overall index value, this methodology fails to reflect any conceptual link between the economic theory behind the selection of the elements being aggregated and the aggregate index value itself.

Econometricians tend not to favor using principal component analysis as an estimation technique for aggregating the weights of multiple variables into a single value. For example, Greene (1993, p. 273) explains

> There are three problems with using this estimator. First, the results are quite sensitive to the scale of measurement in the variables. The obvious remedy is to standardize the variables, but unfortunately, this has substantial effects on the computed results. Second, the principal components are not chosen on the basis of any (theoretical) relationship of the regressors to **Y**, the variable we are attempting to explain. Lastly, the calculation makes ambiguous the interpretation of the results. The principal components estimator is a mixture of all of the original coefficients. It is unlikely that we shall be able to interpret these combinations in any meaningful way.

Moreover, Darnell (1994, p. 317–318) succinctly states

> Not only is it difficult, if not impossible, to give a meaning to a principal component, but the fact that the first component is that linear combination of regressors with greatest variance says nothing of its relationship to the dependent variable **Y**.

Relying on principal components is especially problematic for creating an EFI. Since some of the economic freedom measures in a principal components analysis may generate negative weights, this implies that the resulting aggregated index cannot be strictly interpreted as representing a measure of overall economic freedom, since greater levels of economic freedom on those elements which create negative weights would *reduce* the aggregated index value. In fact, as Greene and Darnell explain, it is not clear exactly what

[3] In past work, some of these same authors use robustness tests to reject the importance of economic freedom in terms of the level of the EFI, but also show the change in EFI is robustly related to growth (De Haan and Sturm, 2000, 2001). The study by Sturm et al. (2002) was limited to the level of the index.

such an index would represent. For example, a country that has perfect freedom scores (a 10 for every characteristic) may not receive the highest aggregate index score possible, receiving an aggregated EFI that is lower than another country that is more repressive on those specific characteristics which have negative weights from the principal component method. It should be noted that while the institutional "quality" index described above may also contain negative weights for some characteristics, those weights would be specifically derived from the characteristics' relationship to **Y** and thus retains an intuitive interpretation.

In order for any aggregated index of multiple freedom measures to represent some notion of the overall level of economic freedom present in a nation, more freedom for any element value must contribute positively to the aggregated index score, which means all weights must be positive. Presumably this is why Gwartney and Lawson (2000) use the absolute value of the principal component weights to construct their aggregate index.[4] Yet, this methodology has its problems as well. On the one hand, arbitrarily altering the weights in this manner means that the aggregation index retains its intended interpretation—more economic freedom in any dimension increases the EFI. On the other hand, the index value is no longer based on any underlying logical statistical framework, since the weights being aggregated are no longer the true principal components weights.

Gwartney and Lawson (2002) have since conceded the inherent problems of using principal components as an aggregating methodology and adopted instead a straight averaging approach.[5] Their method of averaging, however, replaces some problems with other problems. Averaging across the various freedom categories within the taxonomy provides for equal weights to each of the classification groupings of economic freedom elements. Subsequently, this process assigns unequal weighting for individual elements in different classification groups since there are an unequal number of elements across each of the classification groups. For example, the original taxonomy of EFI freedom categories was composed of four distinct top level categories consisting of 4, 6, 3, and 4 measures, respectively. The latest EFI taxonomy is composed of five freedom categories consisting of 4, 5, 4, 5, and 3 measures respectively.

Thus, element weights in the averaging system are based strictly on the arbitrary structure of the economic freedom taxonomy, such that relative weights are inversely related to how many elements are assigned to each category. Including an additional measure in a particular grouping automatically lowers the relative weights on the other measures within the same group. This is particularly important since, as Caudill et al. (2000) have shown, many elements of a given category are actually more highly correlated with elements in a different category than in their own category.

4. Comparing the empirical results from different aggregation methodologies

Herein, we apply four different aggregation methodologies used in Gwartney and Lawson (2000, 2002), Sturm et al. (2002), and Caudill et al. (2000) to the various

[4] Pitlik (2002) uses this principal components index in his growth regressions.

[5] See also the detailed discussion in Gwartney and Lawson (2003).

Table 1
Imputed weights for economic freedom elements

Element	Averaging	|PC1|	PC1	PC6
IA	0.0625	0.2605	0.2605	−0.0236
IB	0.0625	0.2817	0.2817	0.2995
IC	0.0625	0.2795	0.2795	−0.1779
ID	0.0625	0.2811	0.2811	−0.1735
IIA	0.0625	0.2284	−0.2284	0.1597
IIB	0.0625	0.1144	0.1144	−0.1262
IIC	0.0625	0.2815	0.2815	0.2452
IIF	0.0625	0.3142	0.3142	0.5273
IIIA	0.0833	0.2952	−0.2952	0.1568
IIIB	0.0833	0.0565	−0.0565	0.4180
IIIC	0.0833	0.0614	−0.0614	−0.3860
IVA	0.0625	0.3301	0.3301	−0.0131
IVB	0.0625	0.3458	0.3458	0.0252
IVC	0.0625	0.1058	0.1058	−0.1677
IVD	0.0625	0.3445	0.3445	−0.3017

Element descriptions are provided in Gwartney et al. (1996, p. 16). PC1 weights are the first principal component, PC6 weights are from the sixth principal components, and |PC1| are the absolute value of the first principal components. Averaging assigns equal weights to the category group average.

economic freedom measures for 1990, as presented in Gwartney et al. (1996).[6] Principal component methods will assign lower weights to those measures which are highly correlated with each other, while under the averaging method weights depend on the number of measures in each category. Such weighting procedures will lead to inconsistencies if any countries contain missing data. Aggregation under these methodologies is therefore only valid for those countries with a complete set of values for all measures. In the analysis below we eliminate those countries with any missing values for 1990, which leaves a sample of only 56 nations.[7]

The weights from each methodology used for aggregating the economic freedom element values into a single index are shown in Table 1. The different columns represent weights from the group averaging approach from Gwartney and Lawson (denoted by Averaging), followed by the principal components methods of Gwartney and Lawson (denoted by |PC1|), Sturm et al. (denoted by PC1), and Caudill et al. (denoted by PC6). Each of the latter two methods generates negative values for some of the economic freedom element weights. As a result, only the first two aggregated indexes based on the Gwartney–Lawson procedures can be rightfully interpreted as representing a monotonic relationship between the aggregated index value and the level of economic freedom for any element value. Additionally, the correlation coefficients in Table 2 reveal that the three sets of principal components-based weights are not consistent with each other. The most inverted weights appear to be between the Sturm et al. PC1 weights and the Gwartney–

[6] The elements labeled as D and E in Category II by Gwartney et al. (1996) are only included in the 1995 EFI (there are no values for 1990 or earlier) and thus are not included here. See p16 of their volume for a detailed description of each individual measure.

[7] See Table 3 below for the listing of sample countries.

Table 2
Correlations between weights

	|PC1|	PC1	PC6
Averaging	−0.5130	−0.6996	0.0627
|PC1|		0.5181	0.1455
PC1			−0.0886

The weights for each are presented in Table 1.

Lawson group averaging, whereas the greatest similarity is between the two first principal component weighting schemes. Even the two Gwartney–Lawson procedures generate highly inverted weights.

Inspection of Table 1 reveals the importance of our concerns and explains why the correlations between the four methodologies are so low. Although the largest positive weights from PC1 naturally match those in |PC1|, the largest negative weights from PC1 become large positive weights under |PC1|. The largest positive weights from the averaging method belong to the elements in group III, but only because this group has fewer elements than the other groups and each of the group III elements receive *negative* weights under PC1.

Table 3 presents the aggregated index values for each nation, along with its relative ranking in parenthesis. As there was little correlation between the various weighting schemes, it is not surprising to find there is subsequently little consistency across the country rankings. No single country appears in the top or bottom 10 across all procedures. Even the two Gwartney–Lawson procedures generate vastly different rankings. Only Panama is in the top 10 for both of their ranking systems (although New Zealand comes close). At the other extreme, only Dominican Republic is in the bottom 10 for both (at #50). Indonesia is rated last under |PC1|, and close to the bottom under PC1, but it fares much better under PC6 and averaging. The United States is rated as most free under averaging, but is in the middle of the rankings under each of the other aggregation procedures.

As stated above, many researchers have used the aggregated freedom indexes to determine if the institutional environment affects a nation's growth rate. However, biased estimates may result from standard regression analysis, since the aggregated index obscures individual element relationships (Heckelman and Stroup, 2000). Furthermore, the method of aggregation itself may affect the estimated relationships between institutional characteristics and economic growth. In Table 4, we present results from standard cross-country growth regressions, controlling for the starting level of GDP, an index of political rights, an index of civil liberties, the average years of schooling for the population, labor force growth rate, life expectancy and the percent of the population in urban areas. To conserve space and focus on the differing aggregation results, the control variables are not reported in the table.[8]

[8] Per capita growth is measured from 1990 to 1997, and all other values are for 1990. GDP data are taken from Penn World Tables database (version 6.1). The index values for political rights and civil liberties are from Freedom House. The average number of years of schooling is from the Barro–Lee dataset. Remaining data are taken from World Bank. Detailed results are available from the authors upon request.

Table 3
Aggregated index and relative rating

Country	Averaging	|PC1|	PC1	PC6
United States	8.04 (1)	18.17 (32)	8.41 (38)	4.45 (21)
Canada	7.75 (2)	16.30 (37)	6.43 (45)	4.28 (23)
Malaysia	7.62 (3)	13.65 (46)	6.04 (47)	5.38 (16)
Japan	7.58 (4)	21.63 (25)	12.01 (31)	4.00 (26)
United Kingdom	7.19 (5)	22.92 (23)	16.05 (21)	0.42 (50)
Panama	7.06 (6)	28.17 (5)	25.89 (3)	2.76 (33)
Australia	7.04 (7)	18.04 (33)	9.80 (36)	2.28 (36)
Costa Rica	6.96 (8)	15.76 (41)	11.19 (34)	9.48 (2)
Germany	6.79 (9)	12.60 (51)	10.97 (35)	2.86 (31)
New Zealand	6.79 (9)	26.89 (11)	21.14 (17)	0.80 (47)
Belgium	6.60 (11)	9.84 (54)	−0.45 (55)	1.92 (37)
Netherlands	6.50 (12)	23.91 (19)	22.27 (14)	5.21 (17)
Uruguay	6.48 (13)	16.44 (36)	7.18 (42)	4.29 (22)
Indonesia	6.46 (14)	6.42 (56)	0.76 (53)	5.12 (19)
Guatemala	6.21 (15)	18.97 (30)	15.17 (24)	8.61 (3)
Denmark	6.15 (16)	27.53 (7)	21.19 (16)	0.76 (48)
Austria	6.04 (17)	23.00 (22)	23.00 (10)	3.65 (28)
Thailand	5.98 (18)	17.86 (34)	8.46 (37)	0.10 (53)
France	5.94 (19)	11.38 (52)	7.85 (41)	7.13 (7)
Chile	5.79 (20)	7.37 (55)	0.64 (54)	−4.19 (56)
Bolivia	5.69 (21)	20.98 (26)	11.93 (32)	7.01 (8)
Philippines	5.62 (22)	24.46 (17)	13.79 (26)	6.02 (12)
Italy	5.58 (23)	20.25 (27)	12.40 (29)	0.29 (51)
Fiji	5.54 (24)	29.12 (3)	24.64 (6)	1.38 (42)
Mexico	5.50 (25)	14.46 (43)	6.15 (46)	1.05 (44)
Iceland	5.40 (26)	15.62 (42)	6.67 (44)	6.37 (9)
Finland	5.35 (27)	14.21 (44)	5.52 (49)	12.92 (1)
Ireland	5.31 (28)	19.08 (29)	14.01 (25)	0.86 (46)
Norway	5.25 (29)	13.62 (47)	5.87 (48)	0.17 (52)
Venezuela	5.25 (29)	10.25 (53)	−0.86 (56)	−1.39 (54)
Belize	5.12 (31)	30.34 (1)	24.72 (5)	2.50 (34)
Sweden	5.00 (32)	14.18 (45)	7.17 (43)	5.59 (14)
Egypt, Arab Rep.	4.81 (33)	25.55 (12)	23.84 (7)	4.20 (24)
Kenya	4.81 (33)	25.52 (13)	23.56 (8)	5.18 (18)
Cameroon	4.71 (35)	28.87 (4)	26.44 (2)	3.95 (27)
Jordan	4.71 (35)	16.79 (35)	4.75 (50)	5.67 (13)
Turkey	4.67 (37)	23.14 (21)	22.35 (12)	2.86 (31)
Ecuador	4.65 (38)	18.90 (31)	12.20 (30)	4.03 (25)
Barbados	4.62 (39)	12.85 (49)	3.82 (51)	2.99 (30)
Spain	4.42 (40)	25.24 (14)	21.40 (15)	0.76 (48)
Botswana	4.25 (41)	13.07 (48)	3.33 (52)	1.89 (38)
South Africa	4.10 (42)	22.92 (23)	13.37 (27)	7.65 (4)
Argentina	4.06 (43)	15.86 (39)	8.20 (40)	6.16 (11)
Colombia	4.06 (43)	29.80 (2)	22.33 (13)	1.65 (39)
Malawi	4.06 (43)	19.41 (28)	15.65 (23)	3.17 (29)
India	4.04 (46)	27.09 (9)	26.50 (1)	1.40 (41)
Portugal	3.98 (47)	15.82 (40)	11.66 (33)	7.63 (6)
Greece	3.92 (48)	23.35 (20)	16.40 (20)	5.55 (15)

(continued on next page)

Table 3 (*continued*)

Country	Averaging	|PC1|	PC1	PC6
Peru	3.56 (49)	25.16 (15)	23.22 (9)	4.80 (20)
Dominican Republic	3.52 (50)	12.81 (50)	8.29 (39)	−1.45 (55)
Morocco	3.48 (51)	27.09 (9)	18.63 (18)	0.91 (45)
Ghana	3.29 (52)	27.93 (6)	25.42 (4)	1.58 (40)
Israel	3.06 (53)	25.07 (16)	15.77 (22)	7.64 (5)
Hungary	2.87 (54)	27.45 (8)	22.98 (11)	1.18 (43)
Zambia	2.79 (55)	16.30 (37)	12.52 (28)	12.52 (10)
Brazil	2.15 (56)	24.11 (18)	16.96 (19)	2.46 (35)

Ratings based on weights reported in Table 1. Relative rankings are in parentheses.

None of the various aggregated index measures are statistically significant at the standard 5% level when controlling for these factors, which might give the false impression that institutional characteristics thought to promote economic freedom do not affect a nation's economic growth rate. Greater freedom across the board in one case (|PC1|) just barely manages to generate a statistically significant positive coefficient at the weaker 10% error allowance, whereas greater freedom across the board using another weighting scheme (Averaging) just barely manages to avoid generating a statistically significant *negative* coefficient at the same confidence level. The two unadjusted principal component methods (PC1 and PC6), while both based on the same objective of accounting for variation in the element values to develop the aggregation weights, generate conflicting coefficient signs for the index although neither comes close to any reasonable level of statistical significance. Again, it is difficult to interpret the effect of the index under the unadjusted principal component weighting schemes since higher index values do not necessarily reflect greater levels of economic freedom. While Sturm et al. (2002) have previously shown that the relationship between the level of the EFI and growth is not robust to alternative regression specifications, we have shown that the relationship between the level of EFI and growth is not robust to alternative aggregation methods, even when using the same regression specification.

The reason for such disparate results under the various weighting schemes may be that more freedom in some areas improves growth, whereas more freedom in other areas reduces growth. We showed this before (Heckelman and Stroup, 2000) at the element level, and Carlsson and Lundstrom (2002) have shown this at the category level. While many institutional characteristics do matter for economic growth, growth can be

Table 4
Partial correlations for growth regressions, 1990–1997

Freedom measure	Coefficient	Std. error	*T*-statistic	*R*-square	*F*-value
Averaging	−2.620	1.641	−1.60	0.270	1.94
|PC1|	0.838	0.508	1.65	0.273	1.97
PC1	0.630	0.495	1.27	0.254	1.79
PC6	−0.346	0.832	−0.42	0.229	1.56

Each regression controls for starting GDP, political rights, civil liberties, education level, labor force growth rate, life expectancy, urbanization ratio, and includes a constant.

manifested by either more or less economic freedom in a given institutional characteristic, depending on which particular institutional characteristic is being considered.

Some researchers have utilized the change in EFI, in addition to or instead of the level of EFI, in their growth regressions (Berggren, 2003 summarizes the results). While there are concerns over the potential for endogeneity (Dawson, 2003), De Haan and Sturm (2000, 2001) have shown that the change in the EFI is robustly related to growth using Extreme Bound Analysis. In a new working paper (De Haan and Sturm, 2004), they have also shown changes to the aggregated index are robustly related to growth across a variety of aggregation methods, including some but not all of the ones considered here.

5. Conclusions

A great deal of research has been conducted relating the Gwartney–Lawson Economic Freedom Index (EFI) to various socio-economic variables, such as economic growth. However, Gwartney and Lawson have historically used many different aggregation procedures for quantifying the appropriate weight for each freedom characteristic's contribution to the overall index value. Additionally, other authors have proposed or used different aggregation methodologies to create their own indexes for relating economic freedom to growth and other socio-economic variables. This calls into question whether the statistical results of this whole body of empirical research have been properly interpreted, such that we can safely conclude whether or not those institutions that promote economic freedoms overall also have a significant impact on other socio-economic variables.

This realization is not a criticism of the important and valuable effort that Gwartney and Lawson have gone through to create the EFI itself. They have carefully designed a systematic effort to catalogue those institutional characteristics thought to comprise economic freedom and quantified these measures through the meticulous collection of relevant data. Rather, our concern here is the questionable application of relating the aggregated economic freedom index to other socio-economic variables.

Each of the different methodologies that have been used for aggregating each individual freedom element into a singular index of economic freedom has its own complications for properly interpreting the results of these empirical studies. As such, any conclusions regarding the role of economic freedom in promoting growth based on studies relying on the aggregated EFI may be premature. Any aggregation methodology used to generate the EFI presupposes the directional impact of each individual freedom characteristic on whatever is the dependent socio-economic variable of interest in the subsequent regression equation. Specifically, all statistical tests of significance in the body of empirical research using the Gwartney–Lawson versions of the EFI inherently assume that each and every measure of economic freedom affects the dependent variable in the same way, either positively or negatively. Such misinterpretations have caused some authors to erroneously conclude that any type of economic freedom is beneficial to growth (Hanson, 2000; Pitlik, 2002) while others erroneously conclude that the level of economic freedom has no influence on economic growth (Sturm et al., 2002). Flawed statistical measures have led to flawed statistical inferences.

Alternative methodologies which assign both positive and negative weights implicitly require elements with oppositely signed weights to generate impacts of opposite directions to avoid misspecification bias. Since the principal component weights are data dependent, signs can easily change across elements of freedom depending on the particular set of nations included, or even the number of principal components included. Furthermore, we agree with the general criticism by Greene (1993) and Darnell (1994) in that the principal component procedure fails to retain any intuitive link between the sign and magnitude of the individual freedom measures and the resulting aggregated index value. A ranking based on unadjusted principal components is devoid of any substantive meaning relating the actual level of economic freedoms in various categories and the value of the freedom index generated. Thus, growth regressions using these types of aggregated freedom indexes do not directly address the relationship between growth and freedom.

Ultimately, the conundrum of using the EFI in empirical analysis to uncover a possible relationship between economic freedom and any other socio-economic variables stems from the assumption that all institutional characteristics comprising the index of economic freedom will influence the other socio-economic variable in a pre-specified direction. When the EFI takes on a greater value if *any* freedom measure increases in value, then the relationship to the other variables of interest must be uniform in their direction. If the aggregation procedure does not require this by allowing for some of the underlying characteristics to exert a negative influence over the value of the aggregated freedom index, then the index can no longer be interpreted as a reflection of the overall level of economic freedom in that society. Therefore, even if a statistically significant relationship is found between this type of EFI and growth, it is not proper to conclude that those institutional characteristics that promote economic freedom overall also promote growth. Likewise, lack of a statistically significant relationship between this type of EFI and growth does not preclude the ability for economic freedom to influence growth. In short, using this type of EFI does not properly address the relationship between economic freedom and growth.

Thus, symmetry of the conundrum is complete. We suggest empirical research relating economic freedom to growth or any other variable should be based on keeping the various elements distinct without aggregating them into a single index in order to allow each characteristic of economic freedom to speak freely.[9] Such an approach would also allow for a direct comparison between different empirical studies. Empirical studies that use different versions of the EFI cannot be directly compared because changes in the taxonomy of characteristics used to construct the EFI alter the relative weights assigned to each element value, which then alters the overall value of the EFI without any changes in the actual values of the elements themselves. Gwartney and Lawson have done the profession a great service in publishing all the data for each element value in addition to the aggregated index itself. The empirical economic freedom literature would benefit from more fully and carefully exploiting this wealth of information.

[9] Relating different types of economic freedoms to growth by analysis of the individual elements has previously been conducted by Ayal and Karras (1999) and Heckelman and Stroup (2000).

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