Business Regulation in International Comparison – Aggregating World Bank "Doing Business" Data

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Sound business regulations are essential for a dynamic development of the private sector. This applies to developed as well as to developing countries where a lack of regulation or enforcement and high administrative or transaction costs often contribute to weak growth performance (Matthes 2004, 78). The World Bank (2003; 2004) has filled a gap with regard to data on various aspects of business regulation in international comparison. The "Doing Business" online database comprises 145 countries and covers 23 indicators belonging to seven indicator groups (Table 1).

The World Bank (2004) provides a summary indicator for only the top 20 countries based on an ordinal scaling method. As a more comprehensive aggregate comparison is not available so far, this article embarks on this venture. Two basic problems have to be solved:

1. The different indicators have to be made comparable by unitary scaling.
2. The distributions of the values of the 23 indicators differ greatly – with some indicators displaying a fairly even and others a highly uneven distribution with extreme values. The aggregation method should not be overly influenced by extreme values, however. More generally, the method should not lead to a unitary scaling that is theoretically implausible.

This article, which is based on Matthes and Schröder (2004), presents a new continuous scaling method (based on a logistic function) which solves these problems to a larger extent than several other commonly used methods. This is important as rankings seem to have gained in popularity recently.

Results

Before the properties of these different methods are discussed, the results of the new method are presented. Table 2 displays an ordinal ranking of the top 30 countries. It is based on the resulting values of the employed method with regard to the 23 individual indicators. The arithmetic mean is used to aggregate these indicators into group averages and the values of the seven indicator groups into the overall value. This aggregation scheme has also been employed by the World Bank (2004). Thus, the very important issue of weighting different indicators when aggre-

Table 1

Business regulation indicators of the World Bank

1	**Starting a business**[1)] – Number of procedures – Average time spent during each procedure[2)] – Official cost of each procedure[3)] – Paid-in minimum capital[3)]
2	**Hiring and firing workers** – Rigidity of employment index (average of sub-indices for difficulty of hiring, rigidity of hours, difficulty of firing) – Cost of firing indicator (weeks of weekly wages)
3	**Registering property** – Number of procedures – Time[2)] – Official costs (as a percentage of the property value)
4	**Getting credit** – Cost to create and register collateral[3)] – Index of legal rights of borrowers and lenders – Index of credit information availability – Coverage of public registries[4)] – Coverage of private bureaus[4)]
5	**Protecting investors** (disclosure of ownership index)
6	**Enforcing contracts** – Number of procedures – Time[2)] – Official costs (as a percentage of the debt value)
7	**Closing a business** – Time (in years) – Cost (as a percentage of the estate) – Recovery rate (cents on the dollar)

[1)] Data relevant for companies with limited liability. – [2)] In calendar days. – [3)] As a percentage of income per capita. – [4)] Number of individuals and/or firmst that have a record in the registry/bureau, scaled to the adult population size.

Source: World Bank, 2004.

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Table 2

Business regulations in international comparison – Top 30 countries on the basis of a continuous scaling method with a logistic function (c = endogenous) –

Rank	Country	Indicator group[1)]						
		1	2	3	4	5	6	7
		Rank						
1	New Zealand	3	2	**1**	5	25	4	16
2	Singapore	8	**1**	6	15	25	8	**1**
3	USA	4	4	9	7	**1**	12	26
4	Canada	**1**	15	21	12	**1**	31	6
5	UK	10	20	12	2	**1**	23	11
6	Norway	14	23	2	19	25	**1**	3
7	Hong Kong	5	5	18	8	6	15	15
8	Australia	2	17	23	11	6	6	14
9	Japan	64	22	31	18	6	5	4
10	Sweden	11	53	3	40	6	18	19
11	Netherlands	31	45	27	6	25	14	8
12	Finland	6	54	13	37	25	29	2
13	Switzerland	18	13	11	28	25	10	49
14	Ireland	13	61	69	13	6	27	10
15	Lithuania	37	60	4	51	6	11	20
16	Belgium	17	14	103	17	45	16	7
17	Denmark	9	32	29	66	25	2	32
18	Puerto Rico	12	9	–	20	–	74	35
19	Austria	44	78	19	24	6	34	27
20	Taiwan	84	113	22	10	6	19	5
21	Lativa	30	77	73	38	25	21	9
22	Spain	70	118	35	27	**1**	22	13
23	South Korea	94	93	50	29	6	13	12
24	Germany	50	111	30	4	25	25	22
25	Botswana	82	18	48	16	25	39	44
26	Chile	26	46	25	14	6	40	120
27	Tunisia	73	71	56	76	6	3	23
28	Malaysia	36	49	63	**1**	25	53	60
29	Thailand	25	72	14	36	6	47	80
30	Armenia	29	33	10	94	63	32	25

[1)] Data relevant for companies with limited liability.

Source: World Bank, 2004; Institut der deutschen Wirtschaft Köln.

gating a ranking is not touched upon by this study. Columns one and two present the overall ranking, columns three to nine the ranking regarding the seven indicator groups.

As the differences in resulting values between countries in the overall ranking are, for the most part, not very large, a more qualitative interpretation of the ranking order is appropriate: Anglo-Saxon countries, and the Asian city states rank highest. Among the continental EU-15 countries, Sweden, the Netherlands, and Finland hold the highest positions, followed by Belgium, Denmark and Austria, and then by Spain and Germany. The other larger continental European countries – France (34) and Italy (35) – are ranked much lower. The other southern European countries display even greater weaknesses in business regulation, so Portugal (43) and Greece (77). It is striking that quite a few developing countries are ranking among the top 30.

Generally, no country holds the top position in more than one of the seven categories. However, the top scorers in each group also rank in the top positions in the overall ranking – with the exception of Malaysia. Most EU-15 countries rank at worst in category two (Hiring and firing workers). This is particularly true of the larger and the southern European countries. A rather low position is also held with regard to category one (Starting a business) by Germany (50), Spain (70), Portugal (83) and Greece 107.

Methodological analysis

The results of the chosen method can be compared to a ranking obtained by using two other commonly employed scaling methods: ordinal scaling (OS) and proportional continuous scaling on a scale from 0 to 100 (PCS). Both methods are described in more detail below. The resulting values for each of the 23 indicators are aggregated as described above so that the respective overall value is again the basis for the overall ranking. Generally, the top positions of the Anglo-Saxon countries, some Asian as well as Scandinavian countries are revealed by all three methods, which thus obviously presents a rather robust finding. However, when looking at individual countries among the top 30, larger differences in positions are possible. This does not apply to Germany whose rank does not change significantly (OS: 25; PCS: 26). However, Spain's position changes by six ranks up and down and Armenia's by nine positions up (OS) and ten positions down (PCS). On average, compared to OS, the differences are 1.7 positions and 3.3 positions compared to PCS. When regarding the whole range of 145 countries, these differences become even greater: 5.2 positions compared to OS and 8.1 positions compared to PCS.

The maximum difference is 21 positions in case of OS and 48 positions in case of PCS.

These divergences necessitate taking a closer look at the properties of different scaling methods with regard to the above-mentioned problems of grossly divergent distributions of indicator values in general and the existence of extreme values in particular as present in the World Bank data. A simplified but relatively realistic example is chosen to make the basic problems and insights more evident. Table 3 presents six countries (A–F) and two indicators – growth with a fairly even distribution of indicator values and inflation with a rather uneven distribution featuring an extremely high value for country D and relatively low and similar values for the other countries. Both indicators are to be aggregated with the same weight by an arithmetic average.

Intuitive ranking

With regard to growth, two country groups can be discerned: (A, B, C) and (D, E, F). Both groups differ from each other but hardly within each group. Referring to inflation, the within-differences in both groups are relatively larger than with regard to growth, not only in the second group (D, E, F) but also in the first group, if an inflation rate of 2 percent (C) is regarded as a very good value, but one of 6 percent is already considered relatively high. On this basis, a clear ranking can be obtained. C is better than B, B is better than A; F is better than E and E is better than D. If the country with the worst performance of the first group (A) is compared to the country with the best performance in the second group (F), the inflation differences are much smaller than the growth differences. Thus, a rather clear intuitive ranking is obtained (Table 2: 1. Basic data and intuitive ranking). The following section analyses whether different commonly used scaling methods are able to reproduce the intuitive ranking.

Ordinal scaling method

For each indicator an ordinal rank (1 to 6) is assigned to each country (Table 3: 2. Ordinal scaling method). The ordinal numbers can be added or averaged to obtain the aggregate values as a basis for the overall ranking. This method does not rely on all available information, as the extent of the differences between indicator values is not considered. As the large differences regarding inflation are neglected, it is not surprising that this method fails to reproduce the intuitive ranking.

Score classes method

Alternatively, points can be assigned to indicator values dependent on pre-defined score classes of indicator values. For example inflation rates between 3 and 6 percent are assigned 4 points, inflation rates between 6 and 12 percent 3 points. These points (or scores) can be added. This method is used in the *Index of Economic Freedom* (Heritage Foundation 2003), in the publication *Freedom in the World* (Freedom House 2004) and – partly – in the publication *Economic Freedom of the World* (Fraser Institute 2004) and the *Global Competitiveness Report* (WEF 2003). In Table 3: 3a (Score classes method – version 1), the score classes of the Heritage Foundation (1 to 5 points) are used in reverse order for the inflation category. Lacking an example, the score classes of the growth indicator have been chosen by the authors. As a result, version 1 nearly reproduces the intuitive ranking – with the exception of countries A and B, both being ranked in the first position.

In principle, this method offers the advantage that the score classes can be adapted to a theoretically founded interpretation of the respective indicator. However, if such a theoretical basis is lacking, the definition of the score classes becomes arbitrary. This can be of considerable relevance as the differences between score values can be large in comparison to the differences in indicator values. Version 2 (Table 3: 3b) presents an example. Here, the score classes of the growth indicator are only slightly shifted upwards by one percentage point. As a consequence, countries A (and D) are assigned a higher value than countries B and C (E and F), although their growth performance is only marginally better. This results in country A being ranked together with country C in the first position which is in contrast to the intuitive ranking. This problem could in principle be mitigated by choosing more and smaller score classes. However, regarding the World Bank data, the problem of a lacking theoretical foundation for defining the score classes is still relevant.

Proportional continuous scaling methods

The distortion caused by discrete borders and unwarranted large score changes is avoided when using proportional continuous scaling methods which are based on a linear interpolation. These transform the underlying indicator values into a continuous scale which is uniform for each indicator and which retains the relative distances between the original values. Values for each indicator (I) are

Table 3

Illustrative example

1. Basic data and intuitive ranking

Country	Growth[1)]	Inflation[1)]		**Ranking**
A	5.1	6.0		**3**
B	5.0	4.0		**2**
C	4.9	2.0		**1**
D	3.2	100.0		**6**
E	3.0	10.0		**5**
F	2.8	5.0		**4**

2. Ordinal Scaling Method

Country	Growth	Inflation	Sum	**Ranking**
A	1	4	5	**3**
B	2	2	4	**1**
C	3	1	4	**1**
D	4	6	10	**5**
E	5	5	10	**5**
F	6	3	9	**4**

3. Score classes method
a) Version 1

Country	Growth[2)]	Inflation[3)]	Sum	**Ranking**
A	4	4	8	**2**
B	4	4	8	**2**
C	4	5	9	**1**
D	3	1	4	**6**
E	3	3	6	**5**
F	3	4	7	**4**

b) Version 2

Country	Growth[4)]	Inflation[5)]	Sum	**Ranking**
A	4	4	8	**1**
B	3	4	7	**3**
C	3	5	8	**1**
D	3	1	4	**6**
E	2	3	5	**5**
F	2	4	6	**4**

4. Proportional continuous scaling methods
a) Version 1: scale 0–100

Country	Growth	Inflation	Sum	**Ranking**
A	100.0	95.9	195.9	**1**
B	95.7	98.0	193.6	**2**
C	91.3	100.0	191.3	**3**
D	17.4	0.0	17.4	**6**
E	8.7	91.8	100.5	**4**
F	0.0	96.9	96.9	**5**

b) Version 2: standardised distribution[6)]

Country	Growth	Inflation	Sum	**Ranking**
A	1.0	0.39	1.39	**1**
B	0.9	0.44	1.35	**2**
C	0.8	0.50	1.31	**3**
D	– 0.7	– 2.04	– 2.76	**6**
E	– 0.9	0.29	– 0.62	**4**
F	– 1.1	0.42	– 0.67	**5**

5. Continous scale based on a logistic function
a) c = endogenous, with median of 50[7)]

Country	Growth	Inflation	Sum	**Ranking**
A	63	49	111	**3**
B	62	54	115	**2**
C	60	59	119	**1**
D	40	0	40	**6**
E	37	39	76	**5**
F	35	51	86	**4**

b) c = 10 for inflation[8)]

Country	Growth	Inflation	Sum	**Ranking**
A	74	43	106	**3**
B	72	70	132	**2**
C	70	88	148	**1**
D	30	0	40	**6**
E	26	7	44	**5**
F	22	57	92	**4**

[1)] Average change of real GDP and consumer prices per year in percent (timer period can be for example a decade). – [2)] Score classes: up to 0 pc: 1 point, up to 2 pc: 2 points, up to 4 pc: 3 points, up to 6 pc: 4 points, more than 6 pc: 5 points. – [3)] Score classes: up to 3 pc: 5 points, up to 6 pc: 4 points, up to 12 pc: 3 points, up to 20 pc: 2 points, more than 20 pc: 1 point. – [4)] Score classes: up to 1 pc: 1 point, up to 3 pc: 2 points, up to 5 pc: 3 points, up to 7 pc: 4 points, more than 7 pc: 5 points. – [5)] Score classes: as in version 1 (see footnote 3). – [6)] Distribution with mean = 0 and standard deviation = 1. – [7)] Growth: c = 0.5; Inflation: c = 1.8. – [8)] Growth: c = 0.5 (endogenous); Inflation: c = 10 (by discretion).

Source: Institut der deutschen Wirtschaft Köln.

transformed into standardised values (X) by the following equation with the constants a and b

$$X = (I - a) / b$$

Table 4 depicts two basic versions of this method. Version 1 results in a uniform scale ranging from I_{min} to I_{max} (e. g. 0 to 100) which is used, for example, in part by WEF (2003) and the Fraser Institute (2004). Version 2

Table 4

Proportional continuous scaling methods – two examples[1)]

	a		b
Theoretical direction	Higher value is better	Lower value is better	
Version 1: Max-min-scale (I_{min} and I_{max} optional)	$I - I_{min}$	$I_{max} - I$	$I_{max} - I_{min}$
Version 2: Standardised distribution (mean(X) = 0, SD(X) = 1)	I – mean(I)	- (I – mean(I))	SD(I)[2)]

[1)] I = indicator value; Basic equation X = (I – a)/b. – [2)] SD = standard deviation.

Source: Institut der deutschen Wirtschaft Köln.

transforms the original indicator values into a standardised distribution with a mean of 0 and a standard deviation of 1 (e.g. Schweikert 2002). IMD (2004) uses a combination of version 2 and version 1.

A major disadvantage of this method is relevant in the case of the World Bank data. When relatively even and uneven distributions with extreme indicator values are prevalent at the same time, the linear interpolation treats both kinds of distributions quite differently which can be counter-intuitive. This is caused by the denominator b. In case of extreme I-values, b obtains a high value which results in small X-values for the non-extreme I-values and which compresses potentially relevant differences between the latter. In the case of a more even distribution, this distortion is not prevalent so that the comparison between X-values of indicators with uneven distributions and even distributions can be seriously distorted. This effect is more extreme in version 1, as b (= $I_{min} – I_{max}$) is more influenced by extreme values than in version 2 (b = SD (I)).

However, both versions – when applied to the illustrative example (Table 2: 4a, 4b) – lead to counter-intuitive results as they unduly compress the rather important differences between the low-inflation values.

These problems could be mitigated by completely neglecting extreme values or by assigning to them a (positive or negative) standard deviation of 2 or 3. However, both attempts would – to a different degree – involve rather arbitrary and discretionary intervention.

Continuous scaling method based on a logistic function

The question thus arises whether a scaling method can be found that mitigates the effects of uneven distributions (with extreme values) but which also avoids the disadvantages of the ordinal scaling and score class methods. Taking up a proposal by Hafemann and Suntum (2004), a logistic function is employed for this purpose. However, another form of a logistic function and a less complicated scaling method are proposed. Several steps are involved:

1. The indicator values are transformed by means of a proportional continuous scaling method into a standardised distribution with median = 0 and an average absolute deviation from the median (AAD) of 1.

   $$Z = (I – MED(I)) / AAD(I)$$

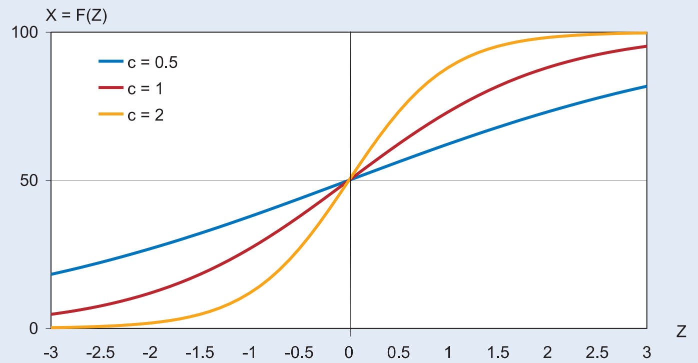
   By using the median (instead of the mean), more transformed Z-values lie relatively close to zero (the transformed median). This is important as the differences between values with a greater distance to zero will be compressed by the logistic function which is usually not warranted.
2. The standardised Z-values are multiplied by –1 if lower I-values are assessed to be better than higher I-values on theoretical grounds.
3. The following logistic function – with a constant c that can be freely chosen – is employed for a second transformation step:

   $$X = F(Z) = 100 / (1 + e^{-c*z})$$
   with $F(0) = 50; F(-\infty) = 0; F(\infty) = 100$

The figure below depicts the logistic function for three different values of c (0.5; 1; 2). In each case the standardised Z-values, which are centred around zero, are transformed into X-values, which are centred around the X-median of 50 and which approximate 0 for low Z-values and 100 for high Z-values. Thus, extreme indicator values are forced into the given range of 0 to 100 without the need to do this by discretion. Moreover, differences between values (of I and Z) at the margins are generally compressed relative to differences between values around the median.

LOGISTIC FUNCTION

$X = F(Z) = 100/(1+e^{-c*z})$



Source: Institut der deutschen Wirtschaft Köln.

For higher values of c, the degree of this different treatment increases. Moreover, high values for c extend the differences between Z-values around the median (which are compressed relative to differences of I-values due to the first transformation step), thus compensating for this portrayed potential disadvantage of a proportional continuous scaling method.

Choice of constant c

The choice of c should lead to a scaling method that satisfies the following plausible considerations:

– The results of the scaling method should not depend on whether the original indicator values are multiplied by a constant.
– An absolute difference of the same size between two indicator values should – a priori – be evaluated as less (more) important when the average value level of the indicator is high (low). The intuitive consideration underlying this suggestion can be demonstrated by means of an example: let a first indicator be characterised by the values 2, 4, 6, 8, a median of 5 and an average absolute deviation from the median (AAD) of 2 and let a second indicator have the values 47, 49, 51, 53, a median of 50 and the same AAD. The value 8 of the first indicator and the value 53 of the second indicator have the same absolute deviation from the median. However, in the first case the relative distance is much greater so that the value 8 should be evaluated as relatively better than the value 53. This is, for example, not the case with the two versions of the proportional continuous scale as transformed values would be identical for both indicators.
– Identical absolute differences in indicator values should be valued more (less) when the dispersion of the indicator values is small (large). If, for example, the values of a first indicator are 49.2, 49.9, 50.1, 51, the median is 50 and the AAD is 0.5. A second indicator with the values 31, 49, 51 and 69 has the same median of 50 but an AAD of 10. The indicator value of 51, which in both cases has the same deviation from the median, should be valued higher in the first than in the second case. This is also achieved by the proportional continuous scaling method.

Both conditions are satisfied, if c obeys the following equation (Matthes and Schröder 2004):

4. $c = (AAD(I) / |MED(I)|)^{1/2}$

Thus, c obtains a specific value for each indicator. In case extreme indicator values exist, the differences between the non-extreme Z-values (which by and large should lie around the median) are compressed by the first transformation. By using the logistic function with a relatively high value of c in the second transformation, these compressed differences are extended again. In the case of a relatively even distribution, c will be relatively small so that a relatively large spectrum around the median is transformed roughly proportionally.

If this method is used in the illustrative example (Table 2: 5a) the results of the intuitive ranking are reproduced. This is achieved mainly by assigning greater differences between the relatively lower inflation values than in the proportional continuous scaling methods.

Advantages of the proposed method and qualifications

Summing up, this method has several advantages:

– It uses a continuous scale.
– It satisfies several intuitively plausible conditions for scaling methods.
– It is able to mitigate the effects of extreme values on other indicator values and thus enhances the comparability of indicators with an even and with an uneven distribution,
– The choice of the median (instead of the mean) as a benchmark for other indicator values renders this method relatively independent of extreme values, as the median is much more stable than the mean with regard to extreme values.
– By using specific values of c for each indicator – which results in relatively low values for c in case of a fairly even distribution – this method can, in principle, also be used if only indicators with an even distribution are prevalent.

Several caveats have to be raised, however:

– In cases of very extreme values, the proposed method does not guarantee a correct outcome. Referring to the illustrative example (Table 2: 5a), the suggested method would still reproduce the intuitive result if the inflation value for country D were 1,000. However, if this value were 2,000, the intuitive result would not be reproduced, as the second transformation by the logistic function can no longer "correct" for the distortions of the first transformation.

– Mitigating the effects of extreme values on potentially important differences of non-extreme values comes at a cost. By forcing the extreme values into the given scale of 0 to 100, the extreme value is evaluated as relatively better (or worse in case a high value is better) than warranted. Thus, potentially important differences between the extreme values and the other values are reduced. However, this trade-off cannot be solved satisfactorily. Generally, it seems better to misjudge relatively few indicators at the margin of the distribution.
– The above-mentioned intuitively plausible considerations have been deduced for absolute indicators and might not be applicable to the same degree to each and every indicator. This could, for example, be relevant for rates of change and mainly for index values – the inflation rates in the illustrative example could also be expressed as index values (e.g. 102 instead of 2 percent). In this case, as in other individual cases, it might be theoretically deduced that small relative differences between indicator values are important. This could be applicable to the second example in the intuitive consideration 2. While in this case the proposed method results in a rather narrow value-spectrum, an adequate choice of c is possible so that a theoretically founded evaluation is possible.
The advantage of the proposed method lies in its adaptability. In contrast, the proportional continuous scaling method is not adaptable. It might produce a better result in the special case mentioned here, but does not fulfil the intuitive consideration which should be a general starting point. However, these qualifications show that it is necessary – as far as it is possible – to examine the resulting evaluation of a given scaling method by means of theoretical deliberations. This unveils a trade-off between the objective of obtaining a highly plausible evaluation and the objective of not interfering arbitrarily with the evaluation. This trade-off has to be tackled case-by-case.
The illustrative example highlights the underlying problem. Here, the resulting evaluation is rather plausible for growth but could be more theoretically plausible for inflation. It can be argued that the inflation rate of 2 percent of country C should obtain a better X-value than 59. If c=10 is chosen for the inflation indicator, country C obtains the more plausible X-value of 88 (see Table 2: 5b).
The World Bank data feature absolute indicators for which – lacking a thorough theoretical foundation that suggests otherwise – the intuitive considerations should be relevant. Thus, the proposed method seems justified.
– The method is not warranted in case an indicator is characterised by a distribution with many values at both margins and a median in the centre of the distribution. In this case the potentially important differences between the values at the margins are compressed unwarrantedly. A possible solution could be to split the distribution in two groups. However, this problem does not seem relevant in the case of the World Bank data.
– A basic question arises as to whether the implicit utility function underlying the logistic function is suitable for the respective indicator. It is implicitly assumed that positive or negative deviations from the median have the same relevance and that for larger deviations a further increase in the deviation becomes less and less important.
The basic problem becomes particularly relevant if it can be theoretically shown that indicators should be evaluated by a non-monotonic utility function. This can be illustrated, for example, in the case of inflation where very high inflation rates as well as negative inflation rates (deflation) have to be considered problematic. However, the proportional continuous scaling method cannot solve the problem either. In contrast, the ordinal scaling method and the score class method could in principle solve this problem. In the case of the illustrative example, the inflation values were chosen so that a monotonic evaluation was possible. In case of the World Bank data this problem is not relevant.
– The proposed method cannot be applied if the median obtains a value of zero (as a division by zero is not possible) or a value very close to zero, as in this case c becomes unwarrantedly large. Hence, indicators with positive and negative values which thus extend across zero can pose problems. A pragmatic solution could be to set c=1. This has been done in two cases of the 23 indicators of the World Bank where the median of the indicator values is zero.

Summing up, the proposed method represents an improvement in several dimensions in comparison to other commonly used methods. Nevertheless, potential problems remain. Thus, the results should – if possible – always be examined to see whether they represent a theoretically plausible evaluation.

Moreover, sensitivity test should be performed with different methods as done in the first part of this article, which showed, for example, that the Anglo-Saxon countries are at the top of the ranking regardless of the method chosen. Due to the remaining problems, the position of a country should be judged rather broadly by looking at whether it is ranked at the top, in the twenties or thirties rather than by looking at its exact position.

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