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A method for measuring international openness is elaborated. This synthetic indicator measures the capacity of countries for a given phenomenon adjusted for their weight in the same phenomenon. The method implemented and applied to international trade and illustrated here as a case study in merchandise exports, has a wide range of applications in the socio-economic field.

Key words: Index, International Openness, International Trade.

Introduction

An innovative method for measuring openness as applied to international migration (Ferrieri, 2006) was recently proposed. In this article, the method is further implemented and applied to international trade (e.g., merchandise exports). The research focus is on the top world economies (by GDP share). Sample calculations based on empirical data and some simulations are provided in order to better understand the methodology and to evaluate the analytical properties of the index proposed.

Methodology

The method for measuring openness involves two steps. First, the values of the basic indicator (e.g., exports-to-GDP ratio), collected for a number of countries, are divided by their highest value in order to obtain index values on a scale referring to one. In this work, the benchmark is the maximum value at the current year. However, it is preferable to fix as benchmark the highest value observed over time in order to make time comparisons. In the second phase, the index values so normalized are adjusted for the weight of the same countries in the world aggregate considered (e.g., merchandise exports). The share (not in percentage terms) is expressed as distance from one (total observed or assumed) and is raised to a constant factor for all countries. This factor should take into account the importance (in terms of dispersion or variability) of the aggregate that figures as denominator of the basic indicator (e.g., the Gross Domestic Product).

The Index is formulated as follows:

$$Index = \left(\frac{V_i}{V_{MAX}} \right)^{(1-\pi)^{\kappa}}$$

in which: $\mathbf{V_i}$ is the value of the basic indicator (e.g., EXP–to-GDP ratio) for each country in a given year; $\mathbf{V_{MAX}}$ is the maximum value of the basic indicator (i.e. EXP–to-GDP ratio) across the countries; $\boldsymbol{\pi}$ is the share of each country in the world aggregate considered (e.g., merchandise exports) in the given year; $\boldsymbol{\kappa}$ is the constant factor for all countries (e.g., the coefficient of variation of the gross domestic product of the countries analysed, not expressed in percentage terms).

Thus, two different effects determine the Index value and can be defined as:

(1) Capacity effect, given by the expression $\mathbf{Vi / V_{MAX}}$, and
(2) Size effect, given by the expression $\mathbf{(1–\pi)^{\kappa}}$, with the exponent $\boldsymbol{\kappa}$ = constant.

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The value of the Index is basically determined by the capacity effect, while the size effect produces a growth in value for all countries, and particularly for those with a high share in the phenomenon concerned.

It is not difficult to observe how the maximum value of the Index (unity) can be obtained not only in terms of best capacity but also in terms of best size. However, the probability of this latter happening is very remote and even in this hypothesis the Index is mathematically valid and consistent. In this hypothesis, the value of one could be achieved (absurdly) by monopolising the phenomenon analysed (country's weight = 1). Mathematically, the overall result is one. In fact: 1 – 1 = 0; zero raised to any number (different from zero) is equal to zero; any number raised to an exponent of zero is equal to one.

Results

The Index applied to merchandise exports (conventionally defined IOEXP) is calculated for the top 40 economies by share in the world current gross domestic product (GDP). Data for elaboration refer to merchandise exports (F.O.B. valuation) and GDP expressed in US dollars at market exchange rates in 2004. Table 1 illustrates some sample calculations. The samples refer to Malaysia, Germany and the United States. Results for all countries are shown in Table 2.

The value of the EXP-to-GDP ratio of Malaysia is 106.92 percent, the highest value among the 40 countries analysed (see also Table 2). The value of the same indicator is equal to 33.12 percent for Germany and 6.98 percent for the United States that rank respectively 12th and 40th among the countries analysed. However,

Table 1: Index of Openness to (Merchandise) Exports (IOEXP). Sample Calculations: Malaysia, Germany and the United States*

Variables	Malaysia	Germany	United States
Exports-to-GDP ratio (Vi)	106.92 %	33.12 %	6.98 %
Share in world merchandise exports (π)	0.014	0.103	0.093
Constant = coefficient of variation of GDP (κ) [(a)]	2.04	2.04	2.04
Indicator value normalised (IVN = V_i / V_{MAX})[(b)]	1.000	0.310	0.065
IVN (or Vi) rank	1	12	40
Index of Openness (IOEXP)	1.000	0.391	0.107
Index (IOEXP) rank	1	9	39
Difference between IOEXP and IVN value	-	26.38 %	63.60 %
Difference between IOEXP and IVN rank	-	3	1

*EXP: Merchandise Exports (F.O.B. valuation; US dollars at market exchange rates). GDP: (Nominal) Gross Domestic Product (US dollars at market exchange rates). Values refer to 2004. Figures are the result of electronic calculations. Data for elaboration are drawn from WTO (2006) and IMF (2006).

[(a)]The coefficient of variation of GDP (κ) is here calculated over the 40 world economies analysed.

[(b)]V_{MAX} is the maximum value of Vi across the countries analysed and is equal to 106.92% (Malaysia).

Table 2: Index of Openness to (Merchandise) Exports (IOEXP) in the Top 40 World Economies

Country	EXP/GDP% Vi	Share in World EXP	Value		Rank	
			IVN	IOEXP	IVN	IOEXP
Malaysia	106.92	0.014	1.000	1.000	1	1
Singapore[(a)]	91.70	0.011	0.858	0.861	2	2
Belgium	85.75	0.035	0.802	0.814	3	3
Czech Republic	63.75	0.008	0.596	0.601	4	4
Netherlands	58.96	0.041	0.551	0.579	6	5
Thailand	60.25	0.011	0.563	0.571	5	6
Ireland	56.46	0.012	0.528	0.536	7	7
Saudi Arabia	50.31	0.014	0.471	0.481	8	8
Germany	33.12	0.103	0.310	0.391	12	9
Austria	39.84	0.013	0.373	0.383	9	10
Korea	37.35	0.029	0.349	0.371	10	11
China	30.72	0.067	0.287	0.339	21	12
Sweden	34.94	0.014	0.327	0.337	11	13
Canada	31.86	0.036	0.298	0.325	17	14
Switzerland	33.01	0.013	0.309	0.319	13	15
Finland	32.95	0.007	0.308	0.313	15	16
Israel	32.95	0.004	0.308	0.311	14	17
Norway	32.05	0.009	0.300	0.307	16	18
Russia	31.06	0.021	0.290	0.306	20	19
Denmark	31.33	0.009	0.293	0.299	18	20
Venezuela	31.07	0.004	0.291	0.293	19	21
Poland	29.66	0.008	0.277	0.284	22	22
Mexico	27.66	0.021	0.259	0.274	24	23
Indonesia	28.42	0.008	0.266	0.272	23	24
Iran, Islamic Republic of	27.52	0.005	0.257	0.261	25	25
France	21.94	0.051	0.205	0.241	27	26
Italy	20.24	0.040	0.189	0.216	30	27
Argentina	22.67	0.004	0.212	0.215	26	28
South Africa	21.41	0.005	0.200	0.204	28	29
Turkey	20.86	0.007	0.195	0.200	29	30
Portugal	20.14	0.004	0.188	0.191	31	31
United Kingdom	16.26	0.039	0.152	0.176	33	32
Spain	17.16	0.020	0.160	0.173	32	33
Brazil	15.98	0.011	0.149	0.156	34	34
Japan	12.33	0.064	0.115	0.152	36	35
Australia	13.56	0.010	0.127	0.132	35	36
Hong Kong SAR[(a)]	12.05	0.002	0.113	0.114	37	37
India	11.35	0.009	0.106	0.110	38	38
United States	6.98	0.093	0.065	0.107	40	39
Greece	7.31	0.002	0.068	0.069	39	40

EXP: Merchandise Exports (F.O.B. valuation; US dollars at market exchange rates). GDP: (Nominal) Gross Domestic Product (US dollars at market exchange rates). Values refer to 2004; IVN: Indicator value normalised: $Vi/V_{MAX = 106..92}$.
[(a)]Exports data for Hong Kong and Singapore do not include re-exports, but only refer to domestic exports. All figures (values, ranks) result from electronic calculations. Data for elaboration are drawn from WTO (2006) and IMF (2006)

Germany presents the highest share in the world merchandise exports (10.3 percent), followed by the United States (9.3 percent). Owing to their economic size, it is not thinkable that Germany and the United States, as well as other great economies, can have much higher (basic) indicator values. The size effect can increase the index value of Germany and the United States and also their rank, without undermining the performance of Malaysia that ranks steadily first thanks to its capacity effect.

As shown in Table 2 (last two columns), for 12 countries the rank by index value is the same as that by indicator value; for 17 countries there is a fall and for 11 countries an increase. In other terms, 70 percent of the countries analysed show a change in rank. For example, the top four countries by EXP-to-GDP ratio (Malaysia, Singapore, Belgium and Czech Republic) maintain their positions in the IOEXP ranking. The Netherlands and Thailand invert their rank: there is not a considerable difference between their indicator values, and the size effect can improve the position of the European country.

As observed, the size effect can help in particular those countries with a high share in the phenomenon analysed. However, the size effect cannot work wonders without an adequate capacity effect that remains the fundamental base of the Index (see also Ferrieri 2006, p. 249).

The United States, for example, presents the lowest EXP-to-GDP ratio and though the size effect increases its index by around 64 percent, the latter remains very low (0.107) as compared to the other countries analysed and the US advances just one position (from 40th to 39th). The EXP-to-GDP ratio of China is equal to 30.72 percent. Thanks to the size effect the country grows by about 18 percent in terms of value and advances nine positions (from 21st to 12th). In the case of China, the EXP-to-GDP ratio is not low (it is above the average of the 40 countries) and is close to other countries that have a lower weight in the phenomenon analysed. So the size effect can significantly help China.

In this cross-country perspective, it is interesting to analyze those economies with a very similar indicator value. This is the case for Finland and Israel: both countries lose in terms of rank, but due to the size effect Finland surpasses Israel. Venezuela and Russia rank respectively 19th and 20th by indicator value, but due to the size effect Russia gains one place (ranking 19th) and Venezuela loses two positions (ranking 21st).

Further Considerations and Simulations on the Index

Due to its mathematical formulation, the Index is able to reconcile capacity with size as it preserves the role of capacity. In this regard, it is important to remark that the Index is basically expressed by the indicator value. The size effect, as said, can help those countries with a high size and particularly, among them, those having good performance in terms of capacity. For instance, the difference between Germany and the United States (see Table 1) is that the indicator value of the first country is notably higher than that of the US, while the difference in terms of weight between the two countries is not remarkable. So the index model allows more gains for Germany than for the United States.

The aggregates that determine the index value are assumed as those observed across countries at a given time. With respect to the benchmark (indicator value), it is necessary to fix an optimum over time in order to make time comparisons. As for size, shares are simply those referring to the time or period of analysis (a given year; three-year average, etc), being one the total of the phenomenon concerned. Obviously, as observed, it is really unlikely that a country can monopolise a given phenomenon.

On the other hand, the need to individuate a maximum weight, theoretically acceptable, depends on the importance and the meaning that one wants to give to the Index: to emphasize capacity by introducing a simple adjustment for size (as shown in the model proposed and calculations) or to better balance capacity and size (it is possible in the model proposed, as well). In the latter hypothesis, it is possible to fix as maximum share (one), for example, 25 percent of the (observed) world exports value instead of 100 percent. This seems to be a maximum weight theoretically acceptable. Some simulations are given in Table 3.

Table 3: Index of Openness to (Merchandise) Exports
Values and Ranks Given the Assumptions of a Maximum Size in the World Exports Equivalent to 100% and 25%

Country	Maximum Size = 100% *			Maximum Size = 25% **			Change	
	Share in Total EXP	IOEXP	IOEXP Rank	Share in Total EXP	IOEXP	IOEXP Rank	IOEXP Value (%)	IOEXP Rank
Argentina	0.004	0.215	28	0.016	0.223	31	3.74	-3
Australia	0.010	0.132	36	0.039	0.149	37	12.84	-1
Austria	0.013	0.383	10	0.053	0.414	13	8.08	-3
Belgium	0.035	0.814	3	0.139	0.850	3	4.36	-
Brazil	0.011	0.156	34	0.044	0.176	36	13.17	-2
Canada	0.036	0.325	14	0.143	0.414	12	27.28	2
China	0.067	0.339	12	0.269	0.518	9	52.83	3
Czech Republic	0.008	0.601	4	0.031	0.616	6	2.44	-2
Denmark	0.009	0.299	20	0.035	0.319	23	6.61	-3
Finland	0.007	0.313	16	0.028	0.329	19	5.05	-3
France	0.051	0.241	26	0.203	0.370	15	53.46	11
Germany	0.103	0.391	9	0.413	0.674	4	72.24	5
Greece	0.002	0.069	40	0.007	0.071	40	2.86	-
Hong Kong SAR	0.002	0.114	37	0.009	0.117	39	3.06	-2
India	0.009	0.110	38	0.034	0.124	38	12.20	-
Indonesia	0.008	0.272	24	0.033	0.290	28	6.73	-4
Iran, Islamic Republic of	0.005	0.261	25	0.020	0.272	29	4.22	-4
Ireland	0.012	0.536	7	0.047	0.561	8	4.58	-1
Israel	0.004	0.311	17	0.017	0.321	22	3.16	-5
Italy	0.040	0.216	27	0.158	0.310	24	43.62	3
Japan	0.064	0.152	35	0.256	0.308	25	102.84	10
Korea	0.029	0.371	11	0.115	0.441	11	18.71	-
Malaysia	0.014	1.000	1	0.057	1.000	1	0.00	-
Mexico	0.021	0.274	23	0.086	0.324	21	18.25	2
Netherlands	0.041	0.579	5	0.162	0.661	5	14.16	-
Norway	0.009	0.307	18	0.037	0.328	20	6.90	-2
Poland	0.008	0.284	22	0.034	0.303	26	6.73	-4
Portugal	0.004	0.191	31	0.016	0.199	35	4.19	-4
Russia	0.021	0.306	19	0.083	0.355	16	16.06	3
Saudi Arabia	0.014	0.481	8	0.057	0.513	10	6.57	-2
Singapore	0.011	0.861	2	0.045	0.869	2	1.03	-
South Africa	0.005	0.204	29	0.021	0.214	34	5.20	-5
Spain	0.020	0.173	33	0.081	0.214	32	23.98	1
Sweden	0.014	0.337	13	0.056	0.370	14	9.60	-1
Switzerland	0.013	0.319	15	0.054	0.350	17	9.78	-2
Thailand	0.011	0.571	6	0.044	0.593	7	3.84	-1
Turkey	0.007	0.200	30	0.029	0.214	33	7.28	-3
United Kingdom	0.039	0.176	32	0.157	0.265	30	50.26	2
United States	0.093	0.107	39	0.371	0.347	18	225.02	21
Venezuela	0.004	0.293	21	0.016	0.302	27	2.95	-6

(*) Total amounting to 8,826,396 million US$. (**) Total amounting to 2,220,699 million US$. The gross domestic product (GDP) values are unchanged as well as the CV ($\kappa = 2.04$).

As observed in Table 3, in the new assumption (25%) compared to the previous one (100%), the main gainers are those countries with the highest export shares: the United States, France, Japan, Germany, etc. The index value of the United States, for example, grows by more than 200 percent and the country gains 21 positions as compared to the previous assumption. The top ranked countries – those in the first three places – remain unchanged: Malaysia, Singapore and Belgium.

Impact Analysis of Change in Export Value: Case One

What happens if the export value of a country rises without any change in the world export value? Suppose that Singapore records an increase in its export value (for example, the value of merchandise exports of Singapore grows from the observed value of 98,576 million US$ to 120,000 million US$ corresponding exactly to the decrease in the same aggregate of Malaysia (-21,424 million US$). Results from this scenario are illustrated in Table 4a, assuming all other factors remain the same.

The indicator value of Malaysia decreases from 106.92 to 88.81 percent. The size in the world export of the same country decreases from 0.014 to 0.012. The decrease is -16.94 percent as compared to the previous situation (given in Table 2). The index value of Malaysia in terms of capacity becomes 0.796, and with the size effect increases to 0.800. The loss in terms of sole capacity is somewhat higher than that in global terms (capacity and size): -20.44 percent compared to -20.00 percent. In both terms, Malaysia ranks 2nd behind Singapore. Due to its growth in size, Singapore gains correspondingly in terms of indicator value (+21.73%). The index value (capacity effect) of Singapore rises by 16.60 percent while its global index (capacity + size) grows by 16.19 percent. As for all other countries, obviously, even if their indicator values and size remain unchanged, there is an equal variation (-4.22%) in the index value (capacity effect: IVN) due to the new higher benchmark (Singapore: 111.63%); and a different decrease in global terms (IOEXP).

Impact Analysis of Change in Export Value: Case Two

What happens if the export value of a country rises with a corresponding change in the total world export value? Suppose that the same increase in the export value of Singapore (+21.424 million US$) translates into a corresponding growth in the world total exports (+0.24%). All other values (for all countries) remain the same; results are shown in Table 4b.

As in the previous case, the indicator value of Singapore is the highest and rises in the same measure (111.63%; +21.73%). The size of Singapore in the world total exports rises by 21.44 percent (as compared to 21.73% of the previous case). As the increase in the export value of Singapore is assumed to produce coherently a growth in the world total export value (+0.24%), it results that all other countries register a corresponding decrease in their share. Malaysia maintains the same indicator value (106.92%) but, as in the previous case, loses one position in the ranking. The capacity decrease for Malaysia is the same as that of all other countries (-4.22%), while that in global terms (IOEXP) is -4.10 percent (compared to -20.00% of the previous case). Excluding Singapore and Malaysia, the decrease in global terms (IOEXP) for all countries is higher than in the previous case. However, in both assumptions, the decrease in global terms is lower than that in terms of sole capacity. This is due to the size effect.

Another parameter is considered in the expression of the size effect: the constant κ. The parameter κ is assumed as a simple measure of variability of the phenomenon at the denominator of the indicator value. In the case study, the gross domestic product (GDP) represents the denominator of the basic indicator and its importance in determining the same indicator value is not irrelevant: it has been considered useful to introduce a measure of variability of this indicator in the index model. Given its formulation and meaning, the coefficient of variation (CV) is a suitable indicator in this regard. A higher CV means a higher variability of a given phenomenon (GDP) relative to its mean, and (in the case study) this would be in favour of countries having a high economic size.

Table 4a: Index of Openness to (Merchandise) Exports

Values and Changes in Percentage Terms (compared to values in Table 2) Due to a Simulated Increase in the Export Value of Singapore (*) without a Corresponding Increase in the World Exports

Country	Values (Simulated)				% Change Compared to Values in Table 2			
	EXP/GDP% (Vi)	Share in World EXP	IVN	IOEXP	EXP/GDP% (Vi)	Share in World EXP	IVN	IOEXP
Argentina	22.67	0.004	0.203	0.206	-	-	-4.22	-4.18
Australia	13.56	0.010	0.121	0.127	-	-	-4.22	-4.14
Austria	39.84	0.013	0.357	0.367	-	-	-4.22	-4.11
Belgium	85.75	0.035	0.768	0.782	-	-	-4.22	-3.93
Brazil	15.98	0.011	0.143	0.149	-	-	-4.22	-4.13
Canada	31.86	0.036	0.285	0.312	-	-	-4.22	-3.92
China	30.72	0.067	0.275	0.326	-	-	-4.22	-3.67
Czech Republic	63.75	0.008	0.571	0.576	-	-	-4.22	-4.15
Denmark	31.33	0.009	0.281	0.287	-	-	-4.22	-4.14
Finland	32.95	0.007	0.295	0.300	-	-	-4.22	-4.16
France	21.94	0.051	0.197	0.232	-	-	-4.22	-3.80
Germany	33.12	0.103	0.297	0.378	-	-	-4.22	-3.39
Greece	7.31	0.002	0.066	0.066	-	-	-4.22	-4.20
Hong Kong SAR	12.05	0.002	0.108	0.109	-	-	-4.22	-4.20
India	11.35	0.009	0.102	0.106	-	-	-4.22	-4.15
Indonesia	28.42	0.008	0.255	0.261	-	-	-4.22	-4.15
Iran, Islamic Republic of	27.52	0.005	0.247	0.250	-	-	-4.22	-4.18
Ireland	56.46	0.012	0.506	0.514	-	-	-4.22	-4.12
Israel	32.95	0.004	0.295	0.298	-	-	-4.22	-4.18
Italy	20.24	0.040	0.181	0.208	-	-	-4.22	-3.89
Japan	12.33	0.064	0.111	0.146	-	-	-4.22	-3.69
Korea	37.35	0.029	0.335	0.356	-	-	-4.22	-3.98
Malaysia	***88.81***	***0.012***	***0.796***	***0.800***	***-16.94***	***-16.94***	***-20.44***	***-20.00***
Mexico	27.66	0.021	0.248	0.263	-	-	-4.22	-4.04
Netherlands	58.96	0.041	0.528	0.556	-	-	-4.22	-3.88
Norway	32.05	0.009	0.287	0.294	-	-	-4.22	-4.14
Poland	29.66	0.008	0.266	0.272	-	-	-4.22	-4.15
Portugal	20.14	0.004	0.180	0.183	-	-	-4.22	-4.18
Russia	31.06	0.021	0.278	0.294	-	-	-4.22	-4.04
Saudi Arabia	50.31	0.014	0.451	0.461	-	-	-4.22	-4.10
Singapore	***111.63***	***0.014***	***1.000***	***1.000***	***21.73***	***21.73***	***16.60***	***16.19***
South Africa	21.41	0.005	0.192	0.195	-	-	-4.22	-4.17
Spain	17.16	0.020	0.154	0.166	-	-	-4.22	-4.05
Sweden	34.94	0.014	0.313	0.323	-	-	-4.22	-4.10
Switzerland	33.01	0.013	0.296	0.306	-	-	-4.22	-4.11
Thailand	60.25	0.011	0.540	0.547	-	-	-4.22	-4.13
Turkey	20.86	0.007	0.187	0.192	-	-	-4.22	-4.16
United Kingdom	16.26	0.039	0.146	0.169	-	-	-4.22	-3.89
United States	6.98	0.093	0.063	0.103	-	-	-4.22	-3.47
Venezuela	31.07	0.004	0.278	0.281	-	-	-4.22	-4.19

EXP: Merchandise Exports. IVN: Indicator value normalised: $Vi/V_{MAX = 111.63.}$ IOEXP: Index of Openness to (Merchandise) Exports. The gross domestic product (GDP) values are unchanged. (*) The growth in the export value of Singapore (+21,424 million US$) corresponds to an equivalent decrease in that of Malaysia.

Table 4b: Index of Openness to (Merchandise) Exports

Values and Changes in Percentage Terms (compared to values in Table 2) Due to a Simulated Increase in the Export Value of Singapore (*) with a Corresponding Increase in the World Exports.

Country	Values (Simulated)				% Change Compared to Values in Table 2			
	EXP/GDP % (Vi)	Share in World EXP	IVN	IOEXP	EXP/GD% (Vi)	Share in World EXP	IVN	IOEXP
Argentina	22.67	0.004	0.203	0.206	-	-0.24	-4.22	-4.19
Australia	13.56	0.010	0.121	0.127	-	-0.24	-4.22	-4.15
Austria	39.84	0.013	0.357	0.367	-	-0.24	-4.22	-4.11
Belgium	85.75	0.035	0.768	0.782	-	-0.24	-4.22	-3.93
Brazil	15.98	0.011	0.143	0.149	-	-0.24	-4.22	-4.14
Canada	31.86	0.036	0.285	0.312	-	-0.24	-4.22	-3.94
China	30.72	0.067	0.275	0.326	-	-0.24	-4.22	-3.71
Czech Republic	63.75	0.008	0.571	0.576	-	-0.24	-4.22	-4.15
Denmark	31.33	0.009	0.281	0.287	-	-0.24	-4.22	-4.15
Finland	32.95	0.007	0.295	0.300	-	-0.24	-4.22	-4.16
France	21.94	0.051	0.197	0.232	-	-0.24	-4.22	-3.84
Germany	33.12	0.103	0.297	0.378	-	-0.24	-4.22	-3.44
Greece	7.31	0.002	0.066	0.066	-	-0.24	-4.22	-4.21
Hong Kong SAR	12.05	0.002	0.108	0.109	-	-0.24	-4.22	-4.20
India	11.35	0.009	0.102	0.106	-	-0.24	-4.22	-4.15
Indonesia	28.42	0.008	0.255	0.260	-	-0.24	-4.22	-4.15
Iran, Islamic Republic of	27.52	0.005	0.247	0.250	-	-0.24	-4.22	-4.18
Ireland	56.46	0.012	0.506	0.514	-	-0.24	-4.22	-4.12
Israel	32.95	0.004	0.295	0.298	-	-0.24	-4.22	-4.18
Italy	20.24	0.039	0.181	0.208	-	-0.24	-4.22	-3.92
Japan	12.33	0.064	0.111	0.146	-	-0.24	-4.22	-3.76
Korea	37.35	0.029	0.335	0.356	-	-0.24	-4.22	-3.99
Malaysia	106.92	0.014	0.958	0.959	-	-0.24	-4.22	-4.10
Mexico	27.66	0.021	0.248	0.263	-	-0.24	-4.22	-4.05
Netherlands	58.96	0.040	0.528	0.556	-	-0.24	-4.22	-3.89
Norway	32.05	0.009	0.287	0.294	-	-0.24	-4.22	-4.15
Poland	29.66	0.008	0.266	0.272	-	-0.24	-4.22	-4.15
Portugal	20.14	0.004	0.180	0.183	-	-0.24	-4.22	-4.19
Russia	31.06	0.021	0.278	0.294	-	-0.24	-4.22	-4.06
Saudi Arabia	50.31	0.014	0.451	0.461	-	-0.24	-4.22	-4.10
Singapore	***111.63***	***0.014***	***1.000***	***1.000***	***21.73***	***21.44***	***16.60***	***16.19***
South Africa	21.41	0.005	0.192	0.195	-	-0.24	-4.22	-4.18
Spain	17.16	0.020	0.154	0.166	-	-0.24	-4.22	-4.07
Sweden	34.94	0.014	0.313	0.323	-	-0.24	-4.22	-4.11
Switzerland	33.01	0.013	0.296	0.306	-	-0.24	-4.22	-4.11
Thailand	60.25	0.011	0.540	0.547	-	-0.24	-4.22	-4.13
Turkey	20.86	0.007	0.187	0.192	-	-0.24	-4.22	-4.16
United Kingdom	16.26	0.039	0.146	0.169	-	-0.24	-4.22	-3.93
United States	6.98	0.093	0.063	0.103	-	-0.24	-4.22	-3.58
Venezuela	31.07	0.004	0.278	0.281	-	-0.24	-4.22	-4.19

EXP: Merchandise Exports. IVN: Indicator value normalised: $Vi/V_{MAX = 111.63.}$ IOEXP: Index of Openness to (Merchandise) Exports. The gross domestic product (GDP) values are unchanged. (*) The growth in the export value of Singapore is the same as in the previous table: +21,424 million US$.

It is also important to remark that κ is constant. So, theoretically, all countries could take advantage of a growth in κ, but notably (and coherently) those with a high size in the phenomenon concerned. Any change in the κ value does imply no change in the index value for the first ranked country, whose performance is determined exclusively by the indicator value. Finally, there is no need to comment that if $\kappa = 1$ the index value for all countries is determined by their "capacity effect" and a size effect based only on their share in the phenomenon concerned. If $\kappa = 0$ is equal to zero the index value is given by the sole capacity effect.

Conclusion

The proposed method for measuring international openness takes into account not only the capacity of countries for a given phenomenon but also their weight in the same. The values of the proposed index can be compared in both static and dynamic perspectives. In the latter approach (time comparisons) it is necessary to set a suitable benchmark for measuring the capacity effect, such as the maximum value observed across countries over time. It is also suitable to calculate the exponent factor (κ) over time in order to appreciate changes affecting the indicator value and the share in the phenomenon (a) concerned for each country. This method could be applied to many transferable phenomena, expressed in terms of flow and/or stock, such as international migration, foreign direct investment and many others.

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