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# **Economic Centrality: How Much is Economics and How Much is Geography?**

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## **Economic Centrality: How Much is Economics and How Much is Geography?**

**Abstract:** Proximity to the markets is a key determinant of the location of firms because distance still matters, as recently reported in the literature. Based on an adapted version of the most standard centrality index we propose a decomposition method that allows isolating the influence of: (i) internal and external factors; (ii) economic and geographical aspects. In order to illustrate our methodology we consider data for 171 countries. This empirical work leads to the conclusion that the centrality level of the countries derives from different sources, therefore requiring different policy interventions in order to improve it.

**Keywords:** centrality, peripherality, economic geography, distance.

**JEL Codes:** F14; R30.

## **I. Introduction**

Globalization is one of the most remarkable trends of the last decades (Head and Mayer, 2013), with trade growing faster than GDP since 1980 (Berthelon and Freund, 2008). Is this equivalent to saying that the friction of distance is not as important now as it was in the past? Recent empirical studies on this topic provide a clear negative answer to this question. As shown by Disdier and Head (2008), the influence of distance on trade has remained consistently high since the middle of the last century. The average result emerging from their meta-analysis points to the fact that a 10% increase in distance has a negative impact of 9% on bilateral trade. In this context the advantage of centrality (or the penalization of peripherality) is obvious and can be grounded on at least four main reasons.

First, firms want to locate where the markets are. In fact, proximity to the markets is one of the location determinants traditionally included in the empirical studies. However, in most cases only the demand that is specific to the region/country under analysis is considered, i.e., the importance of neighboring spaces is ignored (Head and Mayer, 2004). On the contrary, the concept of centrality explicitly incorporates and quantifies the external influence.

Second, also at the theoretical level, the importance of proximity to the markets is for long considered by the location theory. Since the beginning of the 1990s the new economic geography approach brings this kind of consideration into mainstream economics, discussing alternative mechanisms, based on the relative strength of centrifugal and centripetal forces, through which agglomeration of production may occur. In this group of models increasing returns and decreasing trade costs are key elements that generate an uneven spatial distribution of economic activity (Fujita *et al.*, 1999). This perspective thus highlights that behind first nature aspects, second nature

dimensions also matter for final location configurations. As stated by Krugman (1993, 131), “firms that have an incentive to concentrate production at a limited number of locations prefer, other things equal, to choose locations with good access to markets; but access to markets will be good precisely where a large number of firms choose to locate”. Trade costs also play an important role in the heterogeneous firms models. In this context, the reduction of trade costs will force the least productive firms to exit and will generate a reallocation of market shares from less productive to more productive firms (Melitz, 2003).

Third, the centrality theme has extremely important implications for economic policy, namely in the areas of transports and economic and social cohesion (Ottaviano, 2008). In fact, the centrality of the spaces depends critically on accessibility and, as Spiekermann and Neubauer (2002, 7) affirm, “accessibility is the main ‘product’ of a transport system. It determines the locational advantage of an area (...). Indicators of accessibility measure the benefits that the households and the firms in an area enjoy from the existence and use of the transport infrastructure relevant for their area”. Different interventions can be requested in order to minimize the disadvantage associated with peripherality. Therefore, a clear understanding of the factors that constitute an obstacle to an easier access to the markets is valuable knowledge for policy actors.

Fourth, economic centrality has been the subject of an intense debate due not only to the negative impact of remoteness from the markets but also to the positive relationship between centrality and per capita income (Redding and Venables, 2004).<sup>1</sup>

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<sup>1</sup> Crespo and Fontoura (2006) confirm this causal link at the regional level using data from Portugal. Additionally, Redding and Schott (2003) establish a theoretical relationship between centrality and education attainment, reinforcing the advantage of a central position in terms of economic development.

Given the importance of the centrality concept, the emergence of a broad range of measures seeking its empirical materialization is not surprising. This group of indicators has its origin in the pioneering contributions of Keeble *et al.* (1982) and Keeble *et al.* (1988) and include the indexes suggested by Gutiérrez and Urbano (1996), Linneker (1996), Copus (1999), and Schürmann and Talaat (2000), among others (see [Spiekermann and Neubauer, 2002] for a discussion of some of these measures).

These centrality measures differ in their methodological options. However, a common shortcoming is the fact that they do not allow for identifying the relative contribution of geographical and economic components to the overall level of centrality. The present study addresses this specific issue by proposing an adaptation of the most commonly used centrality index and, based on that, a simple decomposition method that allows identifying the contribution of economics and geography at both internal and external levels.

The remainder of the paper is structured as follows. Section 2 presents the index and the decomposition method that we propose. Section 3 provides an empirical example of the methodology proposed. Section 4 presents some final remarks.

## II. Decomposing Centrality

As discussed in the Introduction, from the literature on economic centrality/peripherality several measures have emerged. The most commonly used index was proposed by Keeble *et al.* (1982) and Keeble *et al.* (1988). Using  $i$  for the country under analysis and  $h$  for other countries, the index can be expressed as:

$$P_i = \sum_h \frac{M_h}{\delta_{ih}} \quad (1)$$

where  $M_h$  is a mass variable for country  $h$  and  $\delta_{ih}$  the distance from  $i$  to  $h$ .

Taking this index as our inspiration we propose a new centrality measure:

$$C_i = \frac{l_i}{\delta_{ii}} + \sum_h \frac{l_h}{\delta_{ih}}, i \neq h \quad (2)$$

where  $l_i$  and  $l_h$  are the shares of countries  $i$  and  $h$  in the total value of the mass variable taken as reference, and  $\delta_{ii}$  is the internal distance of country  $i$ .

Equation (2) makes it clear that the level of centrality exhibited by country  $i$  depends on four dimensions, covering geographical and economic aspects at both internal and external levels. However, it does not allow us to identify how much each component contributes to the overall score of the country. Before the discussion of this topic, we consider five methodological options necessary to calculate  $C_i$ .

The first option regards the distance function considered. Despite the existence of other formulations and considerable study on this issue, the use of a linear function is the simplest and most common choice. The second question is how to evaluate inter-country distances. Several options are available including great circle distances, distances by road, time distances, or transport costs. Of course, the choice is strongly influenced by the availability of the data. The third thing to be taken into account also concerns the measurement of the distance between countries and is related to the choice of location to consider as reference. Two options are commonly used: a dimensional criterion (population, economic activity) or an institutional criterion. However, usually the two possibilities do not imply significantly different results. Fourth, what variable should be used to capture the economic dimension of the countries? GDP, population,

employment, or some other variable related to the distribution of economic activity are among the most common choices.

The question that has been submitted to the most intense debate, namely in the context of the so-called “border effect” literature, is the one concerned with the measurement of the internal distance (Anderson and van Wincoop, 2003). Following the proposal of Head and Mayer (2002), we can consider three types of measures (see [Chen, 2004] for a discussion on the influence of considering different measures). The first group of measures was suggested by Wolf (1997, 2000) and associate  $\delta_{ii}$  to a proportion ( $\beta$ ) of the distance to neighbor countries. Wolf (2000) considers only the distance to the closest country and assumes  $\beta = 0.25$ . In turn, Wolf (1997) considers  $\beta = 0.5$  and calculates the average distance from the countries with a common frontier. The second type of measure is supported on infra-national distance measures, i.e., in the distribution of economic activity inside the national space. In general terms, these indicators require a much more demanding set of information for their construction. An exception is Wolf (1997), who considers only the distance between the two largest cities of the country. Alternatively, Wolf (2000) proposes to multiply that distance by twice the weight of the second largest city on the sum of the two cities. Chen (2004) uses the weighted average of the geographical distance between the major cities considering regional GDPs as weights. The indicators suggested by Head and Mayer (2000) and Helliwell and Verdier (2001) can also be classified in this group but are more complex. For example, in the measure proposed by Helliwell and Verdier (2001), the internal distance is expressed as the “weighted average of intra-city distances, intercity distances, the average distance between cities and rural areas, and the average distance from one rural area to another” (Helliwell and Verdier, 2001, 1026). The third group of indicators associates the internal distance with the area of the country, and is therefore easy to calculate.



Representing the area of country  $i$  as  $\psi_i$ , Nitsch (2000) and Melitz (2007) consider the radius of a hypothetical disk, i.e.,  $\sqrt{\frac{\psi_i}{\pi}}$ . Other studies follow alternative ways. For example, Keeble *et al.* (1982), Keeble *et al.* (1988), and Brülhart (2001, 2006) multiply the previous expression by  $\frac{1}{3}$  while Head and Mayer (2000) and Redding and Venables (2004) multiply by  $\frac{2}{3}$ , aiming to obtain “the average distance between two points in a circular country” (Redding and Vanables, 2004, 62).

The next step in our discussion (and the main contribution of the study) is to propose a simple method to decompose the global index into four parcels with specific interpretation. This is obtained as follows:

$$C_i = \underbrace{\frac{1}{N}}_{(C1)_i} + \underbrace{\frac{(l_i - \frac{1}{N})}{\overline{\delta_{ii}}}}_{(C2.1)_i} \underbrace{\frac{\overline{\delta_{ii}}}{\delta_{ij}}}_{(C2.2)_i} + \underbrace{\sum_h \frac{1}{N}}_{(C3)_i} + \underbrace{\sum_h \frac{(l_h - \frac{1}{N})}{\delta_{ih}}}_{(C4)_i} \quad (3)$$

where  $\overline{\delta_{ii}}$  is the average internal distance  $\left(\frac{\sum_i \delta_{ii}}{N}\right)$  and  $N$  the total number of countries.

The *internal geographical component*, (C1), assumes an equal distribution of the economic activity (i.e., each country capturing a fraction  $\frac{1}{N}$  of total economic activity). Thus, the values obtained by each country depend (negatively) only on its geographical dimension, evaluated through its area, as is common in this type of measure. If the same portion of economic activity is located in a smaller country, we will then say that this country is more central than another one with a larger dimension, where the economic activity is more dispersed in space.

In turn, the *internal economic component* is measured through (C2), in which (C2.1) is a *pure internal economic component* and (C2.2) a *geographical adjustment factor*.

(C2.1) assumes a positive value when an above-average share of economic activity is located in that country, indicating that its centrality level benefits from a favorable position in economic terms. A negative value occurs when the country captures a below-average fraction of economic activity. Given that we fixed the internal distance at its average, the differences between countries are fully attributable to this economic effect. (C2.2) has a value above 1 when the country is (geographically) smaller than the average and below 1 in the opposite case. The overall effect (C2) captures the internal economic component adjusted by the dimension of the country.

The centrality level of a given country depends not only on what happens at the internal level (the aspects analyzed so far) but also on external dimensions.

The *external geographical component*, (C3), is at the heart of the centrality concept. It assumes, once again, as in (C1), the equal distribution of economic activity in space and reveals how far country  $i$  is from the remaining countries. More remote countries suffer from a “tyranny of distance” (Battersby and Ewing, 2005), an expression, inspired by the title of the book by Geoffrey Blainey (1966) that became popular to summarize the idea that a negative position in this aspect is difficult to minimize and impossible to overcome in its full extension.

Finally, we should also consider the distribution of economic activity by the other countries. In this case, however, it is important to note that unlike the preceding components, we cannot isolate a pure external economic component. The reason for that is straightforward. Obviously the share of economic activity located outside  $i$  is  $(1 - l_i)$  but this does not give us any new insight. What really matters is the spatial distribution of that part of the total economic activity and, more specifically, its proximity to  $i$ . Therefore, (C4) is influenced by both economic and geographical aspects, assuming a positive value when economic advantages are obtained by countries closer to  $i$ . Its

minimum value is reached, for  $i$ , when all the economic activity is concentrated in the farthest country.

One of the most important insights gained in this decomposition methodology is that it offers guidance for policy interventions aimed at improving the centrality level of a country. In fact, distinct policy measures can be recommended depending on the main weaknesses detected. Let us consider then each specific component. Improvement in the internal geographical component, (C1), can be obtained through better infrastructures, allowing a reduction in transport costs and times. In turn, if a country shows a low score on the internal economic component, (C2), interventions should be devoted to the attraction of more economic activity to the country, for instance through favorable conditions to FDI. For its part, rapid access to external countries is vital to improve centrality through component (C3). The creation and/or improvement of infrastructures that connect the country to foreign countries are adequate interventions to improve centrality. Component (C4) is the only one that is out of control of national authorities. It depends on the distribution of economic activity across the remaining countries, a factor that national policymakers do not influence in a direct way. Nevertheless, an indirect feature may help to improve this component, namely the formation of regional integration blocs, with the elimination (or, at least, reduction) of trade barriers between the members of the bloc. This may attract more economic activity for the whole bloc, which is commonly composed of adjacent countries.

Until this point we have presented a simple procedure to identify the components that contribute to the level of economic centrality of each country. An obvious shortcoming of the method presented is the fact that considering an equal distribution of economic activity across all countries is not a realistic assumption since the countries differ considerably in spatial terms. In fact, an equal distribution presupposes that a country as

small as Luxembourg should locate the same share of economic activity as a much larger country as China. This can only be accepted as a first approximation. In order to overcome this problem, we suggest an adjustment to the baseline decomposition method in which, instead of using  $\frac{1}{N}$  as reference, we consider the share of each country in spatial terms. This can be seen as a topographic adaptation, somewhat in line with the approach followed by Brühlhart and Traeger (2005) to measure the level of specialization. This new version can therefore be expressed as:

$$C_i = \underbrace{\frac{\rho_i}{\delta_{ii}}}_{(C5)_i} + \underbrace{\frac{(l_i - \rho_i)}{\delta_{ii}}}_{(C6.1)_i} \underbrace{\frac{\bar{\delta}_{ii}}{\delta_{ii}}}_{(C6.2)_i} + \underbrace{\sum_h \frac{\rho_h}{\delta_{ih}}}_{(C7)_i} + \underbrace{\sum_h \frac{(l_h - \rho_h)}{\delta_{ih}}}_{(C8)_i} \quad (4)$$

in which  $\rho_i$  and  $\rho_h$  are the shares of the internal distances of  $i$  and  $h$  in the sum of all the internal distances, respectively.

Component (C5) is similar to (C1) in equation (3) but instead of  $\frac{1}{N}$  we assume as reference the share of  $i$  in terms of its internal distance ( $\rho_i$ ), which means that we are using internal distance as a proxy for area. Considering (C6), we can verify that, in (C6.1), the countries are ranked according with the excess they exhibit vis-à-vis their share in spatial terms. A positive value is thus obtained when the country captures a higher proportion of economic activity than what it has in terms of area. The interpretation of (C7) is also different from (C3) in equation (3). Now, the distances to the remaining countries are not equally weighted. Instead, each destination country is weighted by  $\rho_h$ . Finally, (C8) evaluates the geographical adjusted external economic effect. This component assumes a positive value if the countries closer to  $i$  have a greater share of economic activity than they have in spatial terms.

### III. An Empirical Example

In order to illustrate the method discussed in the previous section, we calculate the centrality level for a group of 171 countries. Using data from World Bank we consider information on GDP for 2011. Internal and external distances are obtained from CEPII. Thus, the following methodological options are considered: (i) geodesic distances; (ii) external distances between the largest cities; (iii) internal distances calculated as  $\frac{2}{3} \sqrt{\frac{\psi_i}{\pi}}$  (Mayer and Zignago, 2011). Table 1 shows the aggregate centrality index ( $C_i$ ) for each of these countries.

[Insert Table 1 here]

Let us retain four main results from this evidence. First, there is an accentuated difference between the centrality levels of the most central countries and the remaining ones. In fact, only the first six countries show a centrality index above 70% of the maximum value (Belgium). Second, in aggregate terms, a very central position of the countries of the northern hemisphere is evident. Third, Europe clearly shows the most favorable situation regarding proximity to the markets, with seven countries in the best 10 (and 24 in the best 30) of the  $C_i$  index. Fourth, Africa and Oceania show the worst positions in terms of centrality, being penalized in their capacity to reach the markets.

The next step of our empirical example is to decompose the aggregate index with the aim of verifying the sources of centrality/peripherality in each specific case. The evidence is also shown in Table 1. Several interesting conclusions can be highlighted.

The central idea to keep in mind is the fact that a high/low centrality level can be derived from very different sources. Regarding component (C1) we find, obviously, that the smallest countries have the highest values, meaning that the same amount of economic activity located in a more confined space corresponds to better access to that economic activity and therefore a higher level of centrality. A second and very important source of centrality is the internal economic component. Considering, more specifically, the component (C2.1) we see that the countries with the highest scores are, in this order: USA, China, Japan, Germany, France, UK, and Brazil. This group contains some of the most powerful economic countries, all of them members of the G20. As we emphasized above, component (C3) is critical to understand the concept of centrality, indicating the proximity to all the other countries. This proximity has an exclusive geographic dimension. The six countries that benefit the most from their location are from Africa (Republic of Congo and Democratic Republic of Congo) and Europe (Slovakia, Austria, Croatia, and Hungary). Finally, component (C4) corresponds to the external economic component representing the degree to which a large amount of economic activity locates close to the country under study. In this regard, Belgium, Canada, Netherlands, Luxembourg, and Korea comprise the group at the top of the classification.

The best way to make clear the crucial idea that the sources of centrality are very different is by providing a classification of the different countries according to the specific combination they show in the main components that contribute to their centrality score. Four criteria are used, leading to a total of 16 possible combinations:

- (i)  $(C1)_i$  above or below average, which we designate as  $(\overline{C1})_i$ . The case of  $(C1)_i > (\overline{C1})_i$  occurs for the smallest countries, while  $(C1)_i \leq (\overline{C1})_i$  for the largest countries.

(ii)  $(C2.1)_i$  with a positive or negative value.  $(C2.1)_i > 0$  occurs when the country captures a proportion of total GDP above that associated with an equal distribution across all countries. In the opposite case,  $(C2.1)_i$  takes a negative value.

(iii)  $(C3)_i$  above or below average, which we designate as  $(\overline{C3})_i$ .  $(C3)_i > (\overline{C3})_i$  occurs in the case of the countries that benefit the most from their geographical position, i.e., that in a purely geographical sense are closer to the markets. Countries that locate far away from the markets have  $(C3)_i \leq (\overline{C3})_i$ .

(iv)  $(C4)_i$  with a positive or negative value.  $(C4)_i > 0$  occurs if there is a concentration of economic activity in countries close to the country under consideration.  $(C4)_i \leq 0$  corresponds to the case in which the largest part of economic activity is located far from the country considered.

Additionally, in order to establish the association between  $C_i$  and the four components mentioned, the names of the countries are presented:

- (i) In bold and with an \* if  $\frac{C_i}{\text{Max } C_i} > 0.75$  (see Table 1);
- (ii) In bold if  $0.50 < \frac{C_i}{\text{Max } C_i} \leq 0.75$ ;
- (iii) With an \* if  $0.25 < \frac{C_i}{\text{Max } C_i} \leq 0.50$ ;
- (iv) Without any specific mention in the remaining cases.

The results from this exercise are presented in Table 2.

[Insert Table 2 here]

While Table 2 explores in a qualitative way the results emerging from the decomposition method discussed, a quantitative analysis is also important, aiming to provide a more comprehensive perspective on the centrality sources. That analysis was

already initiated in Table 1 but we can now move forward, exploring those results further (Table 3).

[Insert Table 3 here]

Column (1) of Table 3 compares the centrality level of each country with the mean value in relative terms. The first four countries exhibit a centrality level above 200% of the mean of the 171 countries. Belgium and Netherlands – the two countries at the top of the ranking – have values of 283.8% and 275.5% above the mean of  $C_i$ . The results also show that the first 16 countries in the centrality ranking present a value that exceeds the mean in more than 100%. The case of The Bahamas, 54<sup>th</sup> in the ranking, corresponds exactly to the mean while 117 countries have a negative gap vis-à-vis  $\bar{C}_i$  (i.e., the average of  $C_i$ ).

How much of the differential in the centrality index should be attributed to the differentials founded in each specific component? The answer to this question is provided in columns (2) to (5) of Table 3. Let us consider the case of Luxembourg (ranked 3<sup>rd</sup> regarding  $C_i$ ) as an example. The positive gap from the average revealed by this country is due to its favorable situation in (C1), (C3), and (C4). The first is explained by its small dimension in geographical terms, the case of (C3) by its central position regarding the remaining countries, namely its proximity to several markets of central Europe, and the case of (C4) by the fact that some economically important countries are located close to Luxembourg. The advantage in (C4) is the most important in the explanation of the overall performance of the country in terms of centrality, accounting for 69.0% of the gap. On the negative side, Luxembourg shows an insufficient result regarding the component (C2). Looking at the results in a broader



perspective, we can easily infer the strong heterogeneity among the different countries concerning the components that contribute the most for their centrality score.

The empirical analysis conducted so far considers only the decomposition that assumes as reference an equal distribution across all countries. However, as we discussed in section 2, it is interesting to contrast the results from this case with those emerging from an analysis in which the spatial dimension of each country is taken as reference. This analysis was also undertaken in this study, following equation (4). The full range of results cannot be presented here due to space restraints but the classification of the countries according to criteria similar to those discussed above (with the necessary adaptation in terms of interpretation) is presented in Table 4.<sup>2</sup>

[Insert Table 4 here]

In this case, we consider only three components, namely (C6.1), (C7), and (C8). Component (C5) is not included because, by construction, it gives a constant value for all countries. Regarding the classification according to  $C_i$ , we follow the procedure already used in Table 2. Of course, the results show considerable differences when compared with the first decomposition method above reported. This derives directly from the concept inherent to each one of the decomposition methods proposed in this study (equations (3) and (4)), reinforcing the advantage of their joint consideration.

Considering the evidence in Table 4, we verify that only 27 countries have more economic activity than expected given their area (i.e.,  $(C6.1)_i > 0$ ). This group of countries can be divided into 2 subgroups. A first one only includes European countries and corresponds to the case in which  $(C7)_i > \overline{(C7)}_i$  while the second case refers to

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<sup>2</sup> All the results are available upon request.

more peripheral countries in geographical terms, namely from Asia and (North, Central, and South) America.

#### **IV. Final Remarks**

Based on an adjusted version of a standard index of economic centrality, the main contribution of this paper is the proposal of a decomposition method that allows to retain the influence of: (i) factors that are internal or external to the country under study; (ii) economic and geographic aspects. This is an important issue because very different policy interventions can be executed in order to overcome each specific weakness.

Behind the methodological contribution, we provide an empirical illustration considering data for 171 countries. This empirical analysis makes it clear that the roots of the centrality level of each country are very different, with positive and negative impacts of both economic and geographical factors. The final centrality score is therefore the net effect of a complex range of causes.

Based on the methodology discussed in this paper, several research avenues can be traced. First, it is important, of course, to extend the empirical exercise in order to improve our knowledge about the level and the sources of economic centrality of the countries. In that context, the analysis over a long-term period is certainly a fruitful way to capture the main historical trends. Second, the existence of studies conducted at regional level for some countries is also useful to deepen our understanding of the phenomenon. Third, some methodological improvements can also be emphasized for future research. Especially important, in our perspective, is the possibility to adjust the decomposition method proposed in this study in order to capture the concept of sectoral centrality. In fact, we may argue that the level of centrality may be very different across

sectors, pointing to the interest of obtaining the centrality level of country  $i$  in each sector and studying the corresponding determinants. Still at the sectoral level, we can also conceive an extension of the decomposition method that associates centrality not only with the spatial distribution of the sector but also with the distribution of vertically-linked sectors. Finally, the empirical analysis conducted here should be understood as a preliminary exercise. Its development had an essentially illustrative purpose, but several refinements (for example regarding the methodological options on the measurement of distance) are welcomed.

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**Table 1:** The centrality index and its four components – 1st method

Rank	Country	$C_i$	$\frac{C_i}{\max(C_i)}$	$(C1)_i$	$(C2)_i$	$(C2.1)_i$	$(C2.2)_i$	$(C3)_i$	$(C4)_i$
1	Belgium	0.00091	1.000	0.000085	0.000018	0.000006	3.096168	0.000413	0.000394
2	Netherlands	0.00089	0.978	0.000076	0.000070	0.000026	2.753691	0.000392	0.000353
3	Luxembourg	0.00080	0.878	0.000306	-0.000262	-0.000024	11.079399	0.000407	0.000348
4	Germany	0.00072	0.793	0.000026	0.000195	0.000206	0.942538	0.000409	0.000093
5	UK	0.00067	0.737	0.000031	0.000160	0.000140	1.140349	0.000330	0.000150
6	France	0.00064	0.702	0.000021	0.000116	0.000152	0.761774	0.000358	0.000145
7	Switzerland	0.00062	0.681	0.000077	0.000044	0.000016	2.772799	0.000367	0.000132
8	Macau	0.00059	0.650	0.003110	-0.002772	-0.000025	112.683509	0.000245	0.000008
9	Singapore	0.00057	0.627	0.000612	-0.000193	-0.000009	22.167367	0.000159	-0.000007
10	Canada	0.00054	0.588	0.000005	0.000017	0.000098	0.178381	0.000145	0.000368
11	Japan	0.00053	0.583	0.000025	0.000351	0.000383	0.916640	0.000121	0.000034
12	Slovakia	0.00052	0.567	0.000070	-0.000054	-0.000021	2.544327	0.000527	-0.000026
13	Hong Kong	0.00051	0.560	0.000470	-0.000162	-0.000009	17.049785	0.000244	-0.000043
14	Czech Rep	0.00049	0.538	0.000055	-0.000028	-0.000014	2.006277	0.000408	0.000055
15	Austria	0.00049	0.535	0.000054	0.000000	0.000000	1.945621	0.000521	-0.000088
16	Denmark	0.00048	0.525	0.000075	-0.000016	-0.000006	2.714076	0.000336	0.000084
17	Slovenia	0.00045	0.500	0.000109	-0.000097	-0.000024	3.958709	0.000452	-0.000009
18	Italy	0.00045	0.499	0.000028	0.000114	0.000111	1.026394	0.000354	-0.000042
19	Croatia	0.00043	0.476	0.000065	-0.000056	-0.000024	2.369519	0.000467	-0.000043
20	Korea	0.00043	0.471	0.000049	0.000090	0.000050	1.786298	0.000135	0.000155
21	Ireland	0.00042	0.466	0.000059	-0.000028	-0.000013	2.125196	0.000263	0.000131
22	Hungary	0.00042	0.458	0.000051	-0.000035	-0.000019	1.847201	0.000454	-0.000053
23	Poland	0.00039	0.432	0.000028	0.000006	0.000006	1.007574	0.000373	-0.000014
24	Bosnia & Herzeg	0.00038	0.414	0.000069	-0.000066	-0.000026	2.489175	0.000437	-0.000063
25	Norway	0.00038	0.413	0.000027	0.000007	0.000007	0.990203	0.000288	0.000054
26	Estonia	0.00037	0.404	0.000073	-0.000069	-0.000026	2.649302	0.000372	-0.000008
27	Sweden	0.00037	0.401	0.000023	0.000007	0.000009	0.839927	0.000319	0.000016
28	Serbia & Monten	0.00036	0.400	0.000049	-0.000044	-0.000025	1.762634	0.000439	-0.000079
29	Spain	0.00036	0.396	0.000022	0.000052	0.000065	0.792091	0.000266	0.000021
30	Lithuania	0.00036	0.393	0.000061	-0.000054	-0.000025	2.204823	0.000373	-0.000022
31	Latvia	0.00035	0.388	0.000061	-0.000057	-0.000026	2.216926	0.000354	-0.000005
32	Belarus	0.00034	0.378	0.000034	-0.000029	-0.000023	1.236579	0.000361	-0.000022
33	USA	0.00034	0.376	0.000005	0.000192	0.001052	0.182517	0.000152	-0.000007
34	Albania	0.00034	0.371	0.000092	-0.000089	-0.000027	3.322971	0.000410	-0.000076
35	Macedonia	0.00033	0.368	0.000097	-0.000095	-0.000027	3.513613	0.000433	-0.000101
36	Bulgaria	0.00033	0.365	0.000047	-0.000041	-0.000024	1.691144	0.000416	-0.000090
37	Finland	0.00033	0.365	0.000027	-0.000010	-0.000010	0.971131	0.000358	-0.000043
38	Romania	0.00033	0.360	0.000032	-0.000018	-0.000016	1.153946	0.000380	-0.000066
39	Ukraine	0.00032	0.347	0.000020	-0.000011	-0.000015	0.725150	0.000331	-0.000024
40	Rep Moldova	0.00031	0.343	0.000085	-0.000083	-0.000027	3.069131	0.000350	-0.000039
41	Tunisia	0.00031	0.340	0.000038	-0.000034	-0.000024	1.390625	0.000303	0.000002
42	Portugal	0.00031	0.338	0.000051	-0.000024	-0.000013	1.853618	0.000243	0.000037
43	Malta	0.00030	0.334	0.000875	-0.000856	-0.000027	31.694714	0.000305	-0.000020
44	Greece	0.00030	0.330	0.000043	-0.000016	-0.000010	1.552987	0.000332	-0.000058
45	Algeria	0.00030	0.328	0.000010	-0.000005	-0.000013	0.365076	0.000275	0.000018
46	Turkey	0.00029	0.322	0.000018	0.000017	0.000027	0.637709	0.000335	-0.000076
47	China	0.00026	0.283	0.000005	0.000098	0.000539	0.182104	0.000145	0.000010
48	Russian Fed	0.00025	0.279	0.000004	0.000015	0.000111	0.136347	0.000267	-0.000032
49	Morocco	0.00025	0.277	0.000018	-0.000014	-0.000021	0.668254	0.000239	0.000008
50	Lebanon	0.00025	0.271	0.000152	-0.000136	-0.000025	5.511003	0.000372	-0.000142
51	Mongolia	0.00024	0.269	0.000012	-0.000012	-0.000027	0.450302	0.000148	0.000097
52	Cyprus	0.00024	0.267	0.000162	-0.000152	-0.000026	5.857821	0.000319	-0.000085
53	Iceland	0.00024	0.262	0.000048	-0.000047	-0.000027	1.757089	0.000185	0.000052
54	The Bahamas	0.00024	0.260	0.000132	-0.000129	-0.000027	4.772156	0.000172	0.000062
55	Puerto Rico	0.00023	0.258	0.000163	-0.000122	-0.000021	5.904924	0.000234	-0.000040
56	Syrian Arab Rep	0.00023	0.251	0.000036	-0.000030	-0.000023	1.313460	0.000369	-0.000148
57	Georgia	0.00022	0.243	0.000059	-0.000057	-0.000027	2.134096	0.000288	-0.000069
58	Jordan	0.00022	0.241	0.000051	-0.000047	-0.000025	1.858927	0.000321	-0.000105
59	Armenia	0.00022	0.240	0.000090	-0.000088	-0.000027	3.263790	0.000290	-0.000074
60	Egypt	0.00021	0.233	0.000016	-0.000006	-0.000010	0.563010	0.000276	-0.000074

**Table 1 (cont.):** The centrality index and its four components – 1st method

Rank	Country	$C_i$	$\frac{C_i}{\max(C_i)}$	$(C1)_i$	$(C2)_i$	$(C2.1)_i$	$(C2.2)_i$	$(C3)_i$	$(C4)_i$
61	Azerbaijan	0.00021	0.232	0.000053	-0.000044	-0.000023	1.914571	0.000253	-0.000051
62	Dominican Rep	0.00021	0.229	0.000070	-0.000060	-0.000024	2.552198	0.000226	-0.000029
63	Pakistan	0.00021	0.228	0.000017	-0.000007	-0.000012	0.599627	0.000202	-0.000003
64	Kyrgyzstan	0.00021	0.225	0.000035	-0.000034	-0.000027	1.264591	0.000226	-0.000021
65	Iraq	0.00020	0.223	0.000024	-0.000011	-0.000013	0.852224	0.000252	-0.000061
66	Haiti	0.00020	0.221	0.000093	-0.000092	-0.000027	3.382197	0.000217	-0.000018
67	Jamaica	0.00020	0.217	0.000148	-0.000143	-0.000027	5.374174	0.000195	-0.000002
68	India	0.00020	0.215	0.000009	0.000031	0.000099	0.310736	0.000189	-0.000032
69	Uzbekistan	0.00020	0.215	0.000023	-0.000020	-0.000024	0.842330	0.000226	-0.000033
70	Tajikistan	0.00019	0.214	0.000041	-0.000040	-0.000027	1.489423	0.000224	-0.000030
71	Nepal	0.00019	0.214	0.000041	-0.000039	-0.000026	1.468603	0.000188	0.000004
72	Kazakhstan	0.00019	0.213	0.000009	-0.000005	-0.000014	0.341792	0.000217	-0.000027
73	Vietnam	0.00019	0.211	0.000027	-0.000017	-0.000018	0.979133	0.000173	0.000010
74	St. Kitts & Nevis	0.00019	0.209	0.000948	-0.000946	-0.000028	34.352177	0.000300	-0.000111
75	Turkmenistan	0.00019	0.209	0.000022	-0.000020	-0.000025	0.806447	0.000221	-0.000032
76	Antigua & Barbuda	0.00019	0.207	0.000740	-0.000737	-0.000028	26.799039	0.000305	-0.000119
77	Bhutan	0.00019	0.206	0.000072	-0.000072	-0.000027	2.609422	0.000187	0.000000
78	Bangladesh	0.00019	0.205	0.000041	-0.000029	-0.000020	1.484746	0.000181	-0.000007
79	Mexico	0.00018	0.200	0.000011	0.000021	0.000053	0.401703	0.000132	0.000017
80	Trinidad & Tobago	0.00018	0.199	0.000217	-0.000204	-0.000026	7.866323	0.000267	-0.000098
81	Dominica	0.00018	0.199	0.000567	-0.000567	-0.000028	20.559399	0.000307	-0.000127
82	Philippines	0.00018	0.198	0.000028	-0.000011	-0.000010	1.028655	0.000141	0.000022
83	Benin	0.00018	0.198	0.000046	-0.000045	-0.000027	1.678877	0.000348	-0.000168
84	Lao People Dem Rep	0.00018	0.197	0.000032	-0.000031	-0.000027	1.157816	0.000178	0.000001
85	Venezuela	0.00018	0.196	0.000016	-0.000001	-0.000001	0.589997	0.000215	-0.000052
86	St. Lucia	0.00018	0.196	0.000626	-0.000624	-0.000028	22.682336	0.000337	-0.000160
87	El Salvador	0.00018	0.195	0.000107	-0.000101	-0.000026	3.884161	0.000218	-0.000047
88	Thailand	0.00018	0.194	0.000022	-0.000002	-0.000002	0.786544	0.000173	-0.000016
89	Guatemala	0.00018	0.194	0.000047	-0.000041	-0.000024	1.707413	0.000197	-0.000026
90	St. Vincent & Grenad	0.00018	0.194	0.000788	-0.000787	-0.000028	28.566404	0.000340	-0.000165
91	Grenada	0.00018	0.194	0.000837	-0.000835	-0.000028	30.333380	0.000308	-0.000133
92	Honduras	0.00017	0.192	0.000046	-0.000044	-0.000026	1.682871	0.000217	-0.000044
93	Malaysia	0.00017	0.188	0.000027	-0.000007	-0.000007	0.981144	0.000162	-0.000011
94	Panama	0.00017	0.186	0.000057	-0.000051	-0.000025	2.048479	0.000187	-0.000022
95	Costa Rica	0.00017	0.186	0.000069	-0.000061	-0.000024	2.492998	0.000192	-0.000031
96	Nicaragua	0.00017	0.185	0.000043	-0.000042	-0.000027	1.558628	0.000210	-0.000042
97	Cambodia	0.00017	0.183	0.000037	-0.000035	-0.000027	1.324187	0.000168	-0.000002
98	Mauritania	0.00016	0.180	0.000015	-0.000015	-0.000027	0.554963	0.000233	-0.000069
99	Colombia	0.00016	0.178	0.000015	-0.000001	-0.000002	0.527285	0.000178	-0.000029
100	Niger	0.00016	0.177	0.000014	-0.000014	-0.000027	0.500544	0.000252	-0.000092
101	Togo	0.00016	0.177	0.000065	-0.000065	-0.000027	2.364360	0.000328	-0.000168
102	Burkina Faso	0.00016	0.173	0.000030	-0.000029	-0.000027	1.075962	0.000256	-0.000099
103	Senegal	0.00016	0.172	0.000035	-0.000034	-0.000027	1.270293	0.000271	-0.000115
104	Cape Verde	0.00016	0.171	0.000245	-0.000244	-0.000027	8.871891	0.000204	-0.000050
105	Sudan	0.00016	0.171	0.000010	-0.000008	-0.000024	0.355923	0.000226	-0.000072
106	Mali	0.00016	0.170	0.000014	-0.000014	-0.000027	0.505935	0.000245	-0.000090
107	The Gambia	0.00015	0.170	0.000146	-0.000146	-0.000028	5.301359	0.000286	-0.000131
108	Guyana	0.00015	0.170	0.000034	-0.000033	-0.000027	1.215182	0.000205	-0.000050
109	Brunei Darussalam	0.00015	0.169	0.000205	-0.000196	-0.000026	7.420459	0.000140	0.000005
110	Chad	0.00015	0.169	0.000014	-0.000013	-0.000027	0.497218	0.000234	-0.000080
111	Nigeria	0.00015	0.169	0.000016	-0.000006	-0.000010	0.586204	0.000325	-0.000182
112	Rep Congo	0.00015	0.168	0.000027	-0.000026	-0.000027	0.963424	0.000778	-0.000626
113	Eritrea	0.00015	0.168	0.000045	-0.000044	-0.000027	1.617574	0.000225	-0.000073
114	Ghana	0.00015	0.167	0.000032	-0.000029	-0.000025	1.153591	0.000291	-0.000142
115	Guinea-Bissau	0.00015	0.166	0.000082	-0.000082	-0.000028	2.964330	0.000277	-0.000126
116	Suriname	0.00015	0.165	0.000038	-0.000038	-0.000027	1.392024	0.000190	-0.000040
117	Yemen	0.00015	0.165	0.000021	-0.000019	-0.000025	0.761623	0.000212	-0.000063
118	Ecuador	0.00015	0.164	0.000030	-0.000023	-0.000022	1.072999	0.000159	-0.000016
119	Equat Guinea	0.00015	0.162	0.000093	-0.000089	-0.000026	3.364002	0.000274	-0.000131
120	Guinea	0.00015	0.161	0.000031	-0.000031	-0.000027	1.136290	0.000259	-0.000113



**Table 1(cont.):** The centrality index and its four components – 1st method

Rank	Country	$C_i$	$\frac{C_i}{\max(C_i)}$	$(C1)_i$	$(C2)_i$	$(C2.1)_i$	$(C2.2)_i$	$(C3)_i$	$(C4)_i$
121	Dem Rep Congo	0.00015	0.161	0.000010	-0.000010	-0.000026	0.367893	0.000778	-0.000632
122	Uruguay	0.00015	0.161	0.000037	-0.000033	-0.000024	1.342175	0.000145	-0.000004
123	Sierra Leone	0.00015	0.160	0.000057	-0.000057	-0.000027	2.080662	0.000255	-0.000110
124	Côte d'Ivoire	0.00015	0.160	0.000027	-0.000026	-0.000026	0.992180	0.000249	-0.000106
125	Sri Lanka	0.00014	0.158	0.000061	-0.000052	-0.000024	2.199608	0.000156	-0.000021
126	Indonesia	0.00014	0.158	0.000011	0.000013	0.000033	0.405173	0.000132	-0.000013
127	Liberia	0.00014	0.157	0.000047	-0.000046	-0.000027	1.688294	0.000238	-0.000096
128	Cameroon	0.00014	0.156	0.000023	-0.000021	-0.000026	0.817112	0.000264	-0.000123
129	Ethiopia	0.00014	0.154	0.000015	-0.000013	-0.000025	0.530694	0.000215	-0.000076
130	Central Afric Rep	0.00014	0.152	0.000020	-0.000020	-0.000027	0.713825	0.000233	-0.000095
131	S. Tomé & Príncipe	0.00014	0.151	0.000501	-0.000500	-0.000028	18.146463	0.000258	-0.000121
132	Palau	0.00014	0.151	0.000705	-0.000704	-0.000028	25.530890	0.000118	0.000019
133	Gabon	0.00014	0.151	0.000030	-0.000029	-0.000026	1.089013	0.000265	-0.000129
134	Maldives	0.00013	0.148	0.000901	-0.000896	-0.000027	32.637904	0.000156	-0.000027
135	Paraguay	0.00013	0.147	0.000024	-0.000023	-0.000026	0.883416	0.000134	-0.000002
136	Brazil	0.00013	0.144	0.000005	0.000025	0.000127	0.193115	0.000133	-0.000032
137	Uganda	0.00013	0.143	0.000032	-0.000030	-0.000026	1.147592	0.000233	-0.000105
138	Rwanda	0.00013	0.141	0.000096	-0.000094	-0.000027	3.471674	0.000252	-0.000126
139	Peru	0.00013	0.139	0.000014	-0.000007	-0.000014	0.496984	0.000132	-0.000012
140	Kenya	0.00013	0.139	0.000020	-0.000018	-0.000025	0.738122	0.000219	-0.000095
141	Burundi	0.00013	0.138	0.000093	-0.000093	-0.000027	3.377089	0.000246	-0.000122
142	Bolivia	0.00012	0.136	0.000015	-0.000014	-0.000026	0.537544	0.000135	-0.000012
143	Angola	0.00012	0.136	0.000014	-0.000010	-0.000020	0.504603	0.000215	-0.000095
144	Argentina	0.00012	0.135	0.000009	0.000002	0.000005	0.338715	0.000146	-0.000034
145	Seychelles	0.00012	0.130	0.000729	-0.000727	-0.000028	26.413423	0.000166	-0.000049
146	Tanzania	0.00012	0.130	0.000016	-0.000015	-0.000026	0.579554	0.000206	-0.000088
147	F.S Micronesia	0.00012	0.129	0.000585	-0.000584	-0.000028	21.189502	0.000107	0.000010
148	Chile	0.00012	0.129	0.000018	-0.000006	-0.000009	0.647587	0.000117	-0.000012
149	East Timor	0.00012	0.128	0.000127	-0.000127	-0.000028	4.619729	0.000114	0.000002
150	Comoros	0.00011	0.124	0.000360	-0.000360	-0.000028	13.056915	0.000189	-0.000077
151	Malawi	0.00011	0.123	0.000045	-0.000045	-0.000027	1.636818	0.000208	-0.000096
152	Zambia	0.00011	0.123	0.000018	-0.000017	-0.000026	0.649448	0.000211	-0.000099
153	Mauritius	0.00011	0.122	0.000344	-0.000335	-0.000027	12.459012	0.000147	-0.000045
154	Zimbabwe	0.00011	0.121	0.000025	-0.000024	-0.000027	0.901314	0.000210	-0.000100
155	Marshall Islands	0.00011	0.119	0.001156	-0.001155	-0.000028	41.878498	0.000107	0.000001
156	Namibia	0.00011	0.119	0.000017	-0.000017	-0.000027	0.620108	0.000177	-0.000069
157	South Africa	0.00011	0.119	0.000014	-0.000001	-0.000001	0.510113	0.000152	-0.000057
158	Papua New Guinea	0.00011	0.118	0.000023	-0.000022	-0.000027	0.828161	0.000106	0.000000
159	Botswana	0.00011	0.117	0.000020	-0.000019	-0.000027	0.727143	0.000195	-0.000089
160	Swaziland	0.00011	0.116	0.000118	-0.000117	-0.000027	4.275683	0.000219	-0.000114
161	Madagascar	0.00010	0.115	0.000020	-0.000020	-0.000027	0.735353	0.000167	-0.000063
162	Lesotho	0.00010	0.114	0.000089	-0.000089	-0.000027	3.233816	0.000183	-0.000080
163	Mozambique	0.00010	0.114	0.000017	-0.000017	-0.000027	0.629295	0.000214	-0.000112
164	Kiribati	0.00010	0.113	0.000581	-0.000580	-0.000028	21.041219	0.000109	-0.000006
165	Solomon Islands	0.00010	0.112	0.000090	-0.000090	-0.000028	3.264612	0.000108	-0.000007
166	Australia	0.00010	0.111	0.000006	0.000016	0.000077	0.203215	0.000092	-0.000012
167	Samoa	0.00009	0.104	0.000292	-0.000291	-0.000028	10.568623	0.000114	-0.000020
168	Vanuatu	0.00009	0.104	0.000128	-0.000128	-0.000028	4.637063	0.000111	-0.000016
169	Tuvalu	0.00009	0.104	0.003049	-0.003049	-0.000028	110.495263	0.000105	-0.000011
170	Fiji	0.00009	0.100	0.000115	-0.000114	-0.000027	4.161152	0.000107	-0.000018
171	Tonga	0.00009	0.096	0.000568	-0.000568	-0.000028	20.600590	0.000097	-0.000010
	Average	0.00024		0.000157	-0.000133	0.000000	5.705117	0.000251	-0.000039

**Table 2:** Countries' typology according to the four components – 1st method

		$(C1)_i \leq (\overline{C1})_i$		$(C1)_i > (\overline{C1})_i$	
		$(C3)_i \leq (\overline{C3})_i$	$(C3)_i > (\overline{C3})_i$	$(C3)_i \leq (\overline{C3})_i$	$(C3)_i > (\overline{C3})_i$
$(C2.1)_i > 0$	$(C4)_i > 0$	<b>Canada</b> , China*, <b>Japan</b> , Korea*, Mexico	<b>Belgium*</b> , <b>France</b> , <b>Germany*</b> , <b>Netherlands*</b> , Norway*, Spain*, Sweden*, <b>Switzerland</b> , <b>UK</b>		
	$(C4)_i \leq 0$	Argentina, Australia, Brazil, India, Indonesia, USA*	Italy*, Poland*, Russian Fed*, Turkey*		
$(C2.1)_i \leq 0$	$(C4)_i > 0$	East Timor, Iceland*, Lao People Dem Rep, Mongolia*, Morocco*, Nepal, Papua New Guinea, Philippines, Portugal*, The Bahamas*, Vietnam	Algeria*, <b>Czech Rep.</b> , <b>Denmark</b> , Ireland*, Tunisia*	Brunei Darussalam, F.S. Micronesia, <b>Macao</b> , Marshall Islands, Palau	<b>Luxembourg*</b>
	$(C4)_i \leq 0$	Angola, Bangladesh, Bhutan, Bolivia, Botswana, Burundi, Cambodia, Central Afric Rep, Chad, Chile, Colombia, Costa Rica, Côte d'Ivoire, Dominican Rep, Ecuador, El Salvador, Eritrea, Ethiopia, Fiji, Guatemala, Guyana, Haiti, Honduras, Jamaica, Kazakhstan, Kenya, Kyrgyzstan, Lesotho, Liberia, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mozambique, Namibia, Nicaragua, Pakistan, Panama, Paraguay, Peru, Solomon Islands, South Africa, Sri Lanka, Sudan, Suriname, Swaziland, Tajikistan, Tanzania, Thailand, Turkmenistan, Uganda, Uruguay, Uzbekistan, Vanuatu, Venezuela, Yemen, Zambia, Zimbabwe	Albania*, Armenia, <b>Austria</b> , Azerbaijan, Belarus*, Benin, Bosnia & Herzeg*, Bulgaria*, Burkina Faso, Cameroon, Croatia*, Dem Rep Congo, Egypt, Equat Guinea, Estonia*, Finland*, Gabon, Georgia, Ghana, Greece*, Guinea, Guinea- Bissau, Hungary*, Iraq, Jordan, Latvia*, Lebanon*, Lithuania*, Macedonia*, Niger, Nigeria, Rep Congo, Rep Moldova*, Romania*, Rwanda, Senegal, Serbia & Monten*, Sierra Leone, <b>Slovakia</b> , Slovenia*, Syrian Arab Republic*, The Gambia, Togo, Ukraine*	Cape Verde, Comoros, <b>Hong Kong</b> , Kiribati, Maldives, Mauritius, Puerto Rico*, Samoa, Seychelles, <b>Singapore</b> , Tonga, Tuvalu	Antigua & Barbuda, Cyprus*, Dominica, Grenada, St. Kitts & Nevis, St. Lucia, Malta*, S. Tomé & Príncipe, St. Vincent & Grenad, Trinidad & Tobago

Note: The names of the countries are presented: (i) in bold and with an \* if  $\frac{C_i}{\text{Max } C_i} > 0.75$ ; (ii) in bold if  $0.50 < \frac{C_i}{\text{Max } C_i} \leq 0.75$ ; (iii) with an \* if  $0.25 < \frac{C_i}{\text{Max } C_i} \leq 0.50$ ; and (iv) without any specific mention in the remaining cases.

**Table 3: Contribution of the four components to the centrality index – 1st method**

Rank	Country	$\frac{C_i - \bar{C}_i}{\bar{C}_i}$	$\frac{(C1)_i - (\bar{C1})_i}{C_i - \bar{C}_i}$	$\frac{(C2)_i - (\bar{C2})_i}{C_i - \bar{C}_i}$	$\frac{(C3)_i - (\bar{C3})_i}{C_i - \bar{C}_i}$	$\frac{(C4)_i - (\bar{C4})_i}{C_i - \bar{C}_i}$
		(1)	(2)	(3)	(4)	(5)
1	Belgium	283.8	-10.7	22.3	24.0	64.4
2	Netherlands	275.5	-12.5	31.1	21.4	60.0
3	Luxembourg	236.8	26.4	-23.1	27.7	69.0
4	Germany	204.4	-27.1	67.5	32.4	27.2
5	UK	182.9	-29.0	67.4	18.0	43.7
6	France	169.5	-33.9	61.8	26.4	45.7
7	Switzerland	161.3	-21.1	46.2	30.2	44.7
8	Macau	149.4	833.0	-744.6	-1.7	13.3
9	Singapore	140.8	136.1	-17.9	-27.7	9.6
10	Canada	125.8	-51.1	50.3	-35.6	136.4
11	Japan	123.8	-45.0	164.6	-44.5	24.9
12	Slovakia	117.7	-31.2	28.1	98.5	4.6
13	Hong Kong	115.1	114.7	-10.6	-2.6	-1.5
14	Czech Rep	106.4	-40.5	41.3	61.9	37.2
15	Austria	105.2	-41.6	53.1	108.0	-19.5
16	Denmark	101.7	-34.2	48.3	35.1	50.9
17	Slovenia	91.8	-22.1	16.4	91.9	13.8
18	Italy	91.4	-59.6	113.8	47.3	-1.5
19	Croatia	82.6	-47.0	39.0	110.1	-2.1
20	Korea	80.9	-56.4	115.8	-60.5	101.0
21	Ireland	79.0	-52.7	55.9	6.0	90.9
22	Hungary	75.9	-59.1	54.2	112.4	-7.5
23	Poland	66.0	-82.9	88.7	77.8	16.4
24	Bosnia & Herzeg	58.9	-63.5	47.9	132.9	-17.2
25	Norway	58.6	-93.6	100.3	26.6	66.8
26	Estonia	55.2	-64.4	48.5	92.2	23.7
27	Sweden	53.9	-105.0	109.3	52.4	43.2
28	Serbia & Monten	53.7	-85.4	69.9	146.9	-31.4
29	Spain	51.9	-110.1	149.6	12.0	48.5
30	Lithuania	50.7	-80.4	65.1	101.3	14.0
31	Latvia	48.8	-83.1	65.4	88.1	29.6
32	Belarus	45.2	-115.0	96.9	102.1	16.0
33	USA	44.3	-145.1	309.1	-94.7	30.8
34	Albania	42.2	-65.6	43.9	158.2	-36.5
35	Macedonia	41.1	-62.0	39.0	186.0	-63.0
36	Bulgaria	40.0	-116.9	96.9	173.5	-53.6
37	Finland	39.9	-138.0	129.4	112.8	-4.2
38	Romania	38.0	-139.2	126.7	142.1	-29.5
39	Ukraine	33.2	-174.7	154.3	101.3	19.0
40	Rep Moldova	31.8	-96.4	65.6	130.1	0.8
41	Tunisia	30.5	-164.6	136.4	70.8	57.5
42	Portugal	29.6	-151.2	154.4	-12.2	108.9
43	Malta	28.2	1071.7	-1080.3	79.6	29.0
44	Greece	26.5	-182.4	185.3	127.3	-30.2
45	Algeria	25.8	-240.5	208.5	38.0	94.0
46	Turkey	23.5	-250.9	268.6	149.1	-66.8
47	China	8.7	-738.5	1118.0	-516.7	237.2
48	Russian Fed	7.1	-909.6	874.7	90.2	44.7
49	Morocco	6.2	-949.3	810.2	-84.8	323.9
50	Lebanon	4.0	-56.4	-33.3	1273.7	-1084.0
51	Mongolia	3.2	-1883.3	1565.2	-1345.9	1764.0
52	Cyprus	2.4	72.6	-340.5	1162.8	-794.9
53	Iceland	0.6	-7106.1	5595.5	-4359.0	5969.6
54	The Bahamas	0.0	44437.8	-6232.2	136790.1	-174895.7
55	Puerto Rico	-1.1	-210.9	-418.1	686.4	42.6
56	Syrian Arab Rep	-3.7	1367.9	-1163.0	-1331.7	1226.8
57	Georgia	-6.7	620.6	-479.0	-232.0	190.4
58	Jordan	-7.3	612.9	-492.7	-401.7	381.5
59	Armenia	-7.8	363.8	-241.8	-210.2	188.3
60	Egypt	-10.6	562.3	-503.5	-97.5	138.7

Note: Columns (1) to (5) are in percentage.

**Table 3 (cont.):** Contribution of the four components to the centrality index – 1st method

Rank	Country	$\frac{C_i - \bar{C}_i}{\bar{C}_i}$	$\frac{(C1)_i - (\bar{C1})_i}{C_i - \bar{C}_i}$	$\frac{(C2)_i - (\bar{C2})_i}{C_i - \bar{C}_i}$	$\frac{(C3)_i - (\bar{C3})_i}{C_i - \bar{C}_i}$	$\frac{(C4)_i - (\bar{C4})_i}{C_i - \bar{C}_i}$
		(1)	(2)	(3)	(4)	(5)
61	Azerbaijan	-10.9	404.0	-342.4	-5.6	44.0
62	Dominican Rep	-12.3	298.9	-249.2	86.6	-36.2
63	Pakistan	-12.5	476.9	-425.2	169.2	-120.9
64	Kyrgyzstan	-13.5	381.8	-306.2	80.3	-55.8
65	Iraq	-14.3	396.0	-359.1	-2.7	65.8
66	Haiti	-15.1	179.1	-114.9	95.9	-60.1
67	Jamaica	-16.5	23.3	26.0	144.9	-94.2
68	India	-17.4	361.6	-397.0	152.5	-17.0
69	Uzbekistan	-17.7	320.4	-268.2	61.8	-13.9
70	Tajikistan	-17.9	273.8	-217.1	65.5	-22.2
71	Nepal	-18.0	273.7	-220.2	147.5	-101.0
72	Kazakhstan	-18.1	345.7	-298.8	80.7	-27.6
73	Vietnam	-19.0	289.0	-255.2	174.5	-108.3
74	St. Kitts & Nevis	-19.7	-1690.7	1740.0	-103.4	154.2
75	Turkmenistan	-19.8	287.7	-238.9	65.7	-14.6
76	Antigua & Barbuda	-20.6	-1189.6	1235.9	-108.6	162.4
77	Bhutan	-21.0	171.3	-122.2	128.7	-77.8
78	Bangladesh	-21.5	228.6	-203.1	138.6	-64.1
79	Mexico	-23.3	264.8	-278.8	216.5	-102.5
80	Trinidad & Tobago	-23.5	-107.0	128.3	-27.2	106.0
81	Dominica	-23.8	-727.2	770.0	-99.0	156.2
82	Philippines	-24.1	225.7	-213.3	193.7	-106.1
83	Benin	-24.1	194.2	-152.4	-167.9	226.0
84	Lao People Dem Rep	-24.2	218.7	-176.7	128.7	-70.6
85	Venezuela	-24.7	241.2	-225.3	62.2	21.9
86	St. Lucia	-24.9	-793.5	832.4	-144.4	205.5
87	El Salvador	-25.2	84.2	-53.3	56.2	12.9
88	Thailand	-25.4	224.9	-216.6	130.3	-38.6
89	Guatemala	-25.5	182.6	-151.4	89.8	-21.0
90	St. Vincent & Grenad	-25.5	-1041.5	1080.2	-146.9	208.2
91	Grenada	-25.7	-1114.8	1152.8	-92.1	154.1
92	Honduras	-26.4	177.3	-141.0	55.7	8.0
93	Malaysia	-27.9	197.3	-190.8	135.5	-42.0
94	Panama	-28.6	149.0	-119.9	95.9	-24.9
95	Costa Rica	-28.8	129.9	-104.9	86.6	-11.6
96	Nicaragua	-29.0	166.5	-132.1	61.0	4.6
97	Cambodia	-29.6	172.2	-138.7	119.5	-53.0
98	Mauritania	-30.9	193.8	-160.2	25.0	41.4
99	Colombia	-31.5	191.4	-176.1	98.8	-14.0
100	Niger	-32.2	188.1	-155.9	-1.3	69.1
101	Togo	-32.2	120.7	-89.0	-100.3	168.6
102	Burkina Faso	-33.4	161.2	-130.9	-6.1	75.7
103	Senegal	-34.0	151.8	-122.5	-23.6	94.4
104	Cape Verde	-34.4	-107.1	136.1	58.1	12.9
105	Sudan	-34.4	180.9	-152.2	31.2	40.2
106	Mali	-34.6	174.7	-144.9	8.0	62.2
107	The Gambia	-34.7	13.5	16.2	-41.5	111.7
108	Guyana	-34.7	150.5	-120.7	56.9	13.3
109	Brunei Darussalam	-34.9	-57.1	76.6	134.0	-53.5
110	Chad	-35.0	173.4	-143.9	21.2	49.3
111	Nigeria	-35.1	169.5	-152.4	-88.0	171.0
112	Rep Congo	-35.4	155.9	-127.4	-627.6	699.1
113	Eritrea	-35.7	133.4	-104.4	31.1	39.9
114	Ghana	-35.9	147.3	-122.0	-46.4	121.1
115	Guinea-Bissau	-36.2	88.2	-59.5	-29.6	100.9
116	Suriname	-36.5	137.5	-109.4	71.1	0.7
117	Yemen	-36.7	156.7	-130.3	45.9	27.7
118	Ecuador	-37.0	145.8	-124.6	105.7	-26.9
119	Equat Guinea	-37.9	71.8	-48.8	-24.6	101.6
120	Guinea	-38.0	139.8	-112.8	-8.5	81.6

Note: Columns (1) to (5) are in percentage.

**Table 3 (cont.):** Contribution of the four components to the centrality index – 1st method

Rank	Country	$\frac{C_i - \bar{C}_i}{\bar{C}_i}$	$\frac{(C1)_i - (\bar{C1})_i}{C_i - \bar{C}_i}$	$\frac{(C2)_i - (\bar{C2})_i}{C_i - \bar{C}_i}$	$\frac{(C3)_i - (\bar{C3})_i}{C_i - \bar{C}_i}$	$\frac{(C4)_i - (\bar{C4})_i}{C_i - \bar{C}_i}$
		(1)	(2)	(3)	(4)	(5)
121	Dem Rep Congo	-38.1	163.1	-136.1	-582.9	656.0
122	Uruguay	-38.4	132.3	-110.0	116.7	-39.0
123	Sierra Leone	-38.5	109.6	-83.0	-4.1	77.5
124	Côte d'Ivoire	-38.7	141.7	-116.5	2.3	72.5
125	Sri Lanka	-39.2	104.1	-87.1	102.7	-19.7
126	Indonesia	-39.3	156.9	-156.6	127.8	-28.1
127	Liberia	-39.9	117.2	-91.2	14.0	60.0
128	Cameroon	-40.0	142.1	-117.4	-13.1	88.5
129	Ethiopia	-40.7	147.8	-123.7	37.5	38.4
130	Central Afric Rep	-41.7	139.3	-114.3	18.7	56.3
131	S. Tomé & Príncipe	-42.0	-344.4	368.9	-6.5	81.9
132	Palau	-42.1	-548.4	572.8	133.6	-58.0
133	Gabon	-42.1	127.6	-104.2	-13.7	90.3
134	Maldives	-43.2	-725.9	745.3	92.9	-12.3
135	Paraguay	-43.7	128.3	-105.8	113.1	-35.5
136	Brazil	-44.8	143.1	-147.9	111.9	-7.0
137	Uganda	-45.2	117.3	-95.6	17.0	61.3
138	Rwanda	-46.0	56.5	-35.3	-0.7	79.5
139	Peru	-46.5	130.2	-113.9	108.1	-24.5
140	Kenya	-46.6	124.0	-103.2	29.1	50.1
141	Burundi	-47.1	57.5	-35.8	4.5	73.8
142	Bolivia	-47.7	126.0	-105.0	102.9	-24.0
143	Angola	-47.9	126.4	-108.0	32.4	49.3
144	Argentina	-48.2	129.7	-117.6	92.7	-4.7
145	Seychelles	-50.0	-482.3	501.6	72.2	8.4
146	Tanzania	-50.0	119.2	-99.3	38.5	41.5
147	F.S. Micronesia	-50.5	-356.9	377.2	120.4	-40.8
148	Chile	-50.6	116.4	-105.6	111.9	-22.7
149	East Timor	-50.8	24.9	-4.6	114.0	-34.3
150	Comoros	-52.6	-162.7	182.2	49.8	30.7
151	Malawi	-52.6	90.0	-70.5	35.1	45.4
152	Zambia	-52.6	111.8	-92.6	32.6	48.3
153	Mauritius	-53.1	-147.9	160.4	82.7	4.7
154	Zimbabwe	-53.7	104.2	-85.2	32.8	48.2
155	Marshall Islands	-54.2	-776.8	795.7	112.4	-31.3
156	Namibia	-54.2	109.1	-90.2	57.8	23.4
157	South Africa	-54.4	111.2	-102.4	77.3	14.0
158	Papua New Guinea	-54.6	103.9	-85.4	112.1	-30.5
159	Botswana	-55.2	104.9	-86.5	43.3	38.3
160	Swaziland	-55.6	29.9	-11.9	24.9	57.1
161	Madagascar	-55.8	103.7	-85.3	63.6	18.1
162	Lesotho	-56.3	51.1	-32.9	51.2	30.6
163	Mozambique	-56.4	104.8	-86.7	27.8	54.1
164	Kiribati	-56.7	-314.7	332.9	106.3	-24.6
165	Solomon Islands	-57.1	49.7	-31.6	105.8	-23.9
166	Australia	-57.4	111.5	-108.9	117.3	-19.9
167	Samoa	-60.1	-94.2	111.3	96.2	-13.2
168	Vanuatu	-60.2	20.7	-3.4	98.8	-16.0
169	Tuvalu	-60.2	-2024.5	2041.7	102.4	-19.6
170	Fiji	-61.6	29.2	-12.9	98.6	-14.8
171	Tonga	-63.0	-275.0	291.2	103.3	-19.4

Note: Columns (1) to (5) are in percentage.

**Table 4:** Countries' typology according to the four components – 2nd method

	$(C7)_i \leq (\overline{C7})_i$	$(C7)_i > (\overline{C7})_i$
$(C8)_i > 0$ $(C6.1)_i > 0$	China*, <b>Hong Kong, Japan</b> , Korea*, <b>Macau</b> , Mexico, Puerto Rico*	<b>Austria, Belgium*, Denmark, France, Germany*, Italy*, Ireland*, Luxembourg*, Netherlands*, Norway*, Poland*, Spain*, Sweden*, Switzerland, UK</b>
$(C8)_i \leq 0$	Brazil, India, <b>Singapore</b> , USA*	Turkey*
$(C8)_i > 0$	Antigua & Barbuda, Brunei Darussalam, Cambodia, <b>Canada</b> , Dominica, Dominican Rep, East Timor, F.S. Micronesia, Fiji, Guatemala, Haiti, Iceland*, Indonesia, Jamaica, Kiribati, Lao People Dem Rep, Malaysia, Marshall Islands, Mongolia*, Morocco*, Palau, Papua New Guinea, Philippines, Russian Fed*, Samoa, Solomon Islands, St. Kitts & Nevis, Tonga, Tuvalu, Vanuatu, Venezuela, Vietnam, The Bahamas*	Albania*, Algeria*, Bosnia & Herzeg*, Croatia*, <b>Czech Rep</b> , Finland*, Hungary*, Latvia*, Malta*, Portugal*, Serbia & Montenegro*, <b>Slovakia</b> , Slovenia*, Tunisia*
$(C6.1)_i \leq 0$	Angola, Argentina, Australia, Bangladesh, Bhutan, Bolivia, Botswana, Cape Verde, Chile, Colombia, Comoros, Costa Rica, Ecuador, El Salvador, Ethiopia, Grenada, Guinea, Guyana, Honduras, Kazakhstan, Kenya, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mauritius, Mozambique, Namibia, Nepal, Nicaragua, Pakistan, Panama, Paraguay, Peru, St. Lucia, St. Vincent & Grenad, Seychelles, South Africa, Sri Lanka, Sudan, Suriname, Tanzania, Thailand, Trinidad & Tobago, Turkmenistan, Uruguay, Yemen, Zambia, Zimbabwe	Armenia, Azerbaijan, Belarus*, Benin, Bulgaria*, Burkina Faso, Burundi, Cameroon, Central Afric Rep, Chad, Côte d'Ivoire, Cyprus*, Dem Rep Congo, Egypt, Equat Guinea, Eritrea, Estonia*, Gabon, Georgia, Ghana, Greece*, Guinea-Bissau, Iraq, Jordan, Kyrgyzstan, Lebanon*, Lithuania*, Macedonia*, Niger, Nigeria, Romania*, Rwanda, S. Tomé & Príncipe, Senegal, Sierra Leone, Swaziland, Syrian Arab Rep*, Rep Congo, Rep Moldova*, Tajikistan, The Gambia, Togo, Uganda, Ukraine*, Uzbekistan

Note: The names of the countries are presented: (i) in bold and with an \* if  $\frac{C_i}{\text{Max } C_i} > 0.75$ ; (ii) in bold if  $0.50 < \frac{C_i}{\text{Max } C_i} \leq 0.75$ ; (iii) with an \* if  $0.25 < \frac{C_i}{\text{Max } C_i} \leq 0.50$ ; and (iv) without any specific mention in the remaining cases.