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Looking for European Union in the Word-System: a multi-graph approach *

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Abstract

The European Union (EU) is often considered (at least in Europe) as a key-actor in a globalized world. The aim of this presentation is to check the relevance of this perception which sometimes seems too Eurocentric to be honest. We used methodological tools coming from 'Social Network Analysis' (density, centrality measures and multi-graph) in order to produce a relevant partition of the contemporary world, and to check if an entity called 'European Union' appears (or not). This multi-graph analysis uses two databases, one regarding world trade (IMF database), the second one dealing with United Nations General Assembly (UNGA) voting behaviour. The first step is to transform the original valued matrices and the second one is to search for regional groups without any *a priori* and to check if, when and how EU appears. Finally, a cross-synthesis tries to highlight the EU place, and its internal cohesiveness in the world-system. What appears from both political and economical points of view is a large EU including close neighbours (Iceland, Norway) but some members' states are still playing their own tunes at the UNGA. Despite this balanced conclusion, the relevance of these methodological tools clearly appears for both economic and political geography.

Key-words: European Union, Trade, United Nations General Assembly, Voting behaviour, Word-System

Introduction

The European Union (EU) is often described nowadays as a key global actor in the World-System and the academic production related to this subject knows an exponential increase (see for example Bretherton and Vogler, 2008

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[2]). But this literature often consider the relevance of the EU in the World-System as taken for granted. The purpose of this paper is first to search for a global regionalization without any *a priori* regarding the relevant partition. Instead of checking the coherence of predefined actors, it examines partition produced on a large scale. In order to cross political and economic flows, two databases are used to produce a world partition. The first part presents the data and the methods used to realize this partition, the second one details the results obtained, firstly on economic flows, and secondly on the political ones. A last section tries to provide a synthesis despite some methodological problems not completely solved yet. The aim of this paper is clearly an exploratory one and must be read as a collection of research proposals rather than an achieved work-piece.

1 Data and methods

In order to provide a world-scale regionalization from both political and economic points of views, two databases are used in this paper. The first one, built by the author, deals with the voting behaviour of United Nations General Assembly (UNGA) member states from 1985[1] (40th session) until 2008-2009 (63^{rd} session). On each session, all member states (159 in 1985, 192 today) have to define themselves on many topics, from decolonization to global governance and human rights. About a third of resolutions are putted on vote, which represents around 150 votes per year in the 80's and between 75 and 100 for the two last decades. The fact that two countries vote the same way can't be regarded strictly speaking as a link between two states (United States and Iran often vote the same way). But, when several states always take the same position regarding many topics, they can be considered as a united group. Many papers exist on this subject and using these data give a quite relevant image of world political blocs (see, among many others, Voeten 2000 [12]). First, matrices country/resolution are built with archives from the UNGA. Then a similarity matrix country/country is realized, it provides the common percentage of voting behaviour between each pair of states from 1985 until 2009. All countries that were absent for half or more of votes are deleted (detailed list is provided in the annex).

The trade database used comes from the IMF and gives in US$ millions the volume of trade flows between countries on four dates (1986, 1996, 2006 and 2007). The fact to get only isolated years causes a problem of data viability because of possible short term variations (oil price for example). It can therefore give a relevant picture of main world economic centres. A first problem appears here; the two databases are not completely comparable. The IMF one provides information about territories that are not

[1] UNGA sessions take place from September until December with some extra sessions. So 1985 (or 40^{th} session) actually means the session 1985-1986.

(yet?) considered as states (Greenland), or about states non members of the UNGA. The most famous example is Taiwan, but the problem also appears for Switzerland which became a full-member only in 2002 (it had before a status of observer that doesn't give the right to vote at the UNGA). We realize preliminary tests on the two complete databases and tried to find the best solution possible, regarding results produced, for the synthesis (see part 3).

Crossing different matrices in order to realize a partition on a global scale is not an innovation and several papers already used this method with valuable results, starting with the pioneer work of Snyder and Kick (1979) [11], continued notably by Gasiorowski (1986) [3] and Pollins (1989) [9]. Many statistical methods are available to produce a partition starting from a matrix. As we want to highlight preferential relations between countries, we choose to use tools coming from 'Social network analysis' (SNA), especially density (number of present links divided by number of possible links), inclusiveness (number of connected nodes divided by number of nodes: Scott, 2000, p.70 [10]) and degree (Wasserman and Faust, 1994 [13]). The two first tools provide indicators to compare the different graphs produced. Using density is a way to provide a common threshold for all matrices used. Even if density is sensitive to size graph, the size variation remains acceptable between 1985 and 2008. The second ones highlights to effect of concentration. For example, a decreasing inclusiveness indicates a larger concentration among a smaller number of actors (the larger is the number of isolates nodes, the smaller is the indicator).

The only critical point regards the matrix used as input (dichotomous or valued, directed or not). The two input matrices are different; the UNGA one is symmetrical and weighted with values starting from 0 (complete divergence in voting behaviour) to 100 (similar positions always took by two member states); the IMF one is directed (the export flow from i to j is different from the export flow from j to i) and the discrepancy between values is impressive (1 to 1000000). Stability of results is not completely assumed with valued graphs, especially when the range is high between min and max - and it's typically the case in a raw trade matrix. Results are much more trustful when these methods are applied on dichotomous matrices, but remains the problem of the threshold's choice. One option is to test several thresholds and to study the results' variance. Another one is to select a threshold based on a graph property itself and that's what is done here.

The first choice is to transform the trade matrix in order to get symmetrical matrices, as methods for directed and undirected graphs are not fully compatible. We took the geometric mean of export flows to symmetrise trade matrices ($F^*_{ij} = F^*_{ji} = \sqrt{F_{ij} \times F_{ji}}$). This method is convenient to take into account and attenuate large asymmetries between pairs of countries. The reverse side is that it gives an advantage to big actors. For each matrix, 2 dichotomous matrices are produced, one that keep the 5% most important

linkages, the second one keeping the upper 1%. Of course, these thresholds are quite selective but the only way I found - for now - to produce readable results. Even if some authors argued recently that dealing with weighted matrices to produce block models was a feasible option (Nordlund, 2007 [7]; Opsahl and Panzarasa, 2009 [8]), many tests made with these specific matrices showed a great instability regarding partitions produced. Our method is much more similar with the one used by Kim and Shin (2002) [5] to comment evolution of world trade.

2 Economic and political groups in the World-System (1986-2006)

The Figure 1 sums up some properties of the 6 matrices produced (2 on trade flows and 2 on political 'links' at three dates). The order means the number of nodes, the inclusiveness indicates the percentage of connected nodes, the threshold shows the value used to dichotomize the original matrix and basic indicators regarding degree are also provided (max - the min is always 0 - and the normalized mean degree).

Figure 1: Graphs' properties

	Order	Isolates	Inclusiveness (%)	Threshold*	Max degree	Mean degree (norm)
IMF86 5%	159	59	63	>124	70	4.98
IMF86 1%	159	112	30	>1200	29	0.98
IMF96 5%	178	61	66	>220	72	5.00
IMF96 1%	178	130	27	>2350	33	1.02
IMF06 5%	177	65	63	>600	76	5.12
IMF06 1%	177	129	27	>5800	31	0.99
UNGA86 5%	155	67	57	>70%	39	4.31
UNGA86 1%	155	98	38	>80%	15	0.99
UNGA96 5%	170	62	64	>89%	31	4.05
UNGA96 1%	170	110	35	>94%	16	0.97
UNGA06 5%	185	93	50	>94%	36	3.94
UNGA06 1%	185	142	23	>98%	15	0.77

*For IMF, the threshold is expressed in million US$
At the UNGA, it's the percentage of similar voting behaviour

Some common patterns appear from this table; thresholds increase for both linkages; which concretely means that the average trade flows between states didn't stop rising and that the consensus is more and more frequent at the UNGA. A slight difference appears regarding that normalized mean degree; it rises a little for the IMF trade flows, which indicates that connected states are becoming more and more linked, with a bonus for the big ones (see the max degree). On the opposite, the UNGA normalized mean degree knows a slight decrease which shows that cohesiveness between connected states is more egalitarian than for trade - and it's not completely surprising.

Such a table shows that, even if amounts rise (amounts of trade or percentage of similar behaviour), the general structure doesn't seem to move that much. But this global picture doesn't tell anything regarding which actors are involved. A way to illustrate it is to represent graphs on the two extreme periods studied. All graphs presented here were made with the same algorithm of visualization, some actors were slightly moved to increase readability of the figures. For the same reason, isolates nodes were deleted (that's why looking for USA at the UNGA is a loss of time). What matters on these graphs is the relative position (and topological distance) between connected actors, and also the size of components.

The first pair of graphs (figure 3) shows the political links (density 5%) in 1986 (up) and 2006 (down). EU members are in blue to help the reading of these figures. Two slightly connected blocks appear in 1985; a group composed of what was called then the Third World, mixing members from the Non Aligned Movement and members of the Group of 77 (to get an overview on this period, see Holloway and Tomlinson, 1995 [4]; Kim and Russett, 1996 [6]). On the right appears the socialist block, highly interconnected. Apart from these, a couple of links joined the EU members. Twenty years later, the situation is quite different. Of course, the socialist block vanished. The EU - including its neighbours but excluding both France and United Kingdom - appears as a strongly interconnected block. And what remains from the Third World is not more a cohesive subgroup.

Regarding economic links (figure 4), the evolution is less impressive. A strong interconnected core remains the centre of the economic world and peripheral states get only one or two connections with one of these key-players. The graph is too full to examine specific situation but, for example, it shows that China was already an important actor in 1985, but moved closer to the core of the world trade system for the last two decades. The Figure 2 provides for each period the first 15 countries with their rank, and degree (raw and normalized).

Figure 2: The 15 more connected states in 2006 (and their situation before that)

	Rank 06	Degree 06	NrmDegree 06	Rank 96	Degree 96	NrmDegree 96	Rank 86	Degree 86	NrmDegree 86
United States	1	76	68	1	72	41	1	70	44
Germany	2	66	59	2	70	40	3	60	38
China	3	65	59	12	39	22	11	27	17
Italy	4	59	53	4	61	34	6	54	34
France	5	56	50	3	64	36	2	62	39
Netherlands	6	52	47	7	48	27	7	49	31
United Kingdom	7	49	44	5	58	33	5	57	36
Japan	8	46	41	6	53	30	4	58	37
Spain	9	45	41	8	45	25	9	31	20
Korea, Rep. of	10	41	37	9	43	24	14	24	15
Belgium	11	41	37	11*	40*	23*	8*	32*	20*
Russian federation	12	38	34	10	43	24	12**	27**	17**
Brazil	13	35	32	17	32	18	15	23	15
India	14	32	29	22	27	15	22	19	12
Switzerland	15	31	28	14	34	19	10	31	19

* Belgium and Luxembourg are aggregated in the IMF database in 1986 and 1996
**USSR

A first conclusion, before trying to provide a synthesis, is to note that the two systems examined (trade and UNGA) are not fully comparable as actors involved don't have the same strategy in both arenas. The UNGA during the 70's and the 80's was an anti-imperialist forum where weak countries could get the opportunity to tell the good and the bad. It's less and less the case, and, on the other side, the main economic actors, especially if they are also permanent members of the Security Council, do not need to be comprehensive and diplomat at the UNGA (notice the absence on UNGA graph of USA, UK or France). Reversely, economic powers that would like to get one (Germany or Japan) do have an interest in being consensual on the larger scale possible.

3 Elements for a synthetic partition

If producing several partitions on several topics is not so complicated, the real challenge is to produce a synthetic picture of the situation. It's of course easier when the situation remains stable through time and when the different thematic partitions reveal similar structures. Unfortunately, this is not the case here. The number of member states at the UNGA didn't stop increasing since 1989. On the other side, some states vanished; USSR, German Democratic Republic, Yugoslavia, Czechoslovakia and, more often ignored, Democratic Yemen.

The option took in their time by Snyder and Kick was a clever way to avoid the problem; they selected the 80 bigger countries. It creates strictly comparable results but the image produced can't take into account the dynamic of the system.

Anyway, some kind of simplification is needed. The first step for each period was to keep only states present in the two databases; it involves the deletion of some marginal actors (Palau, Micronesia) but, specially regarding trade, it causes the suppression of not minor actors of the economic scene, notably Taiwan and Switzerland (except for 2006).

As the two main objectives of this paper (apart from a methodological point of view) are to highlight changes in world structure and the possible emergence of European Union, I firstly consider links presents for both political and economic matrices in 1986 and in 2006. Then I mapped common links involving EU members and the result is illustrated by figure 5.

The increasing of links is particularly impressive and it's interesting to note that the EU is a pole of convergence for many neighbours for both political and economic links. This tendency gets even stronger during the last 2 sessions of the UNGA (2007-2009) as Ukraine, Georgia and nearly all Balkan states are now associating themselves with the declarations of the EU and, most of the time, vote the same way. Of course, the anomaly already mentioned - absence of France and United-Kingdom - remains. Its main

Figure 3: Political links at the UNGA in 1986 and 2006

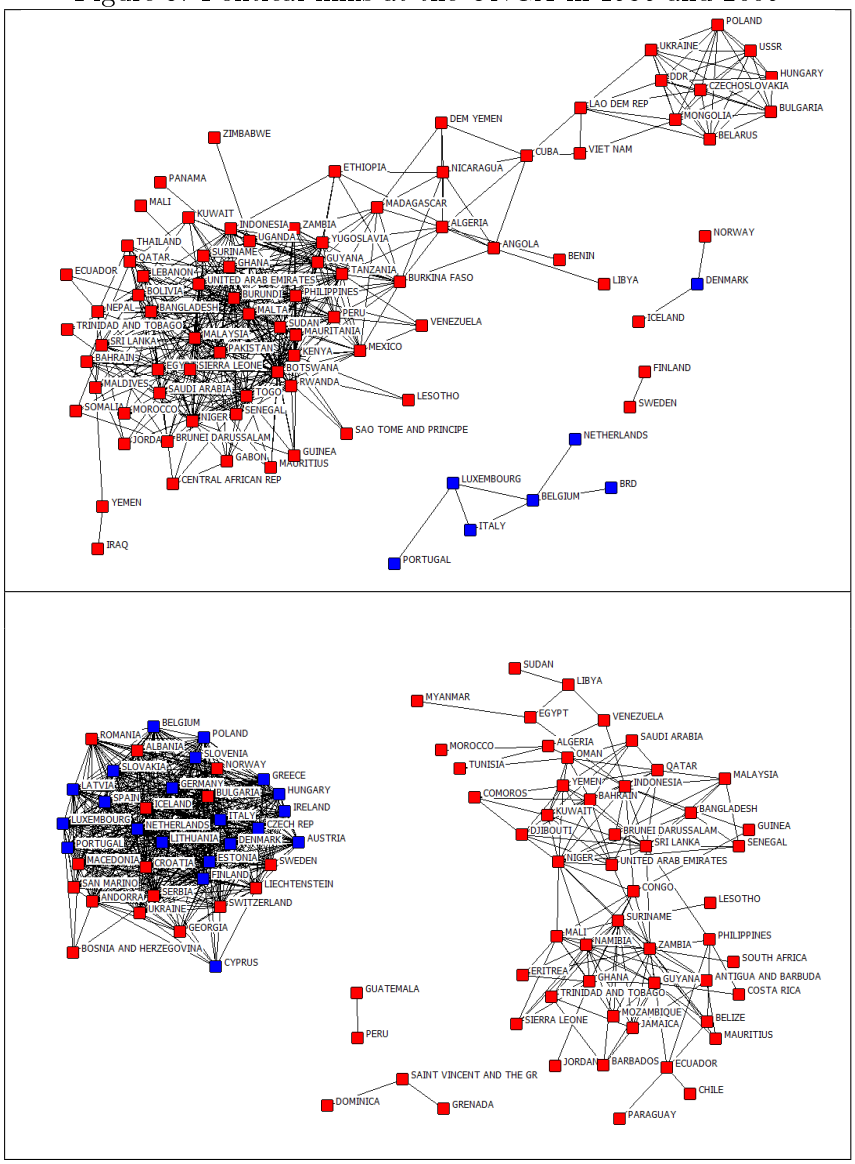


Figure 4: Trade flows in 1986 and 2006

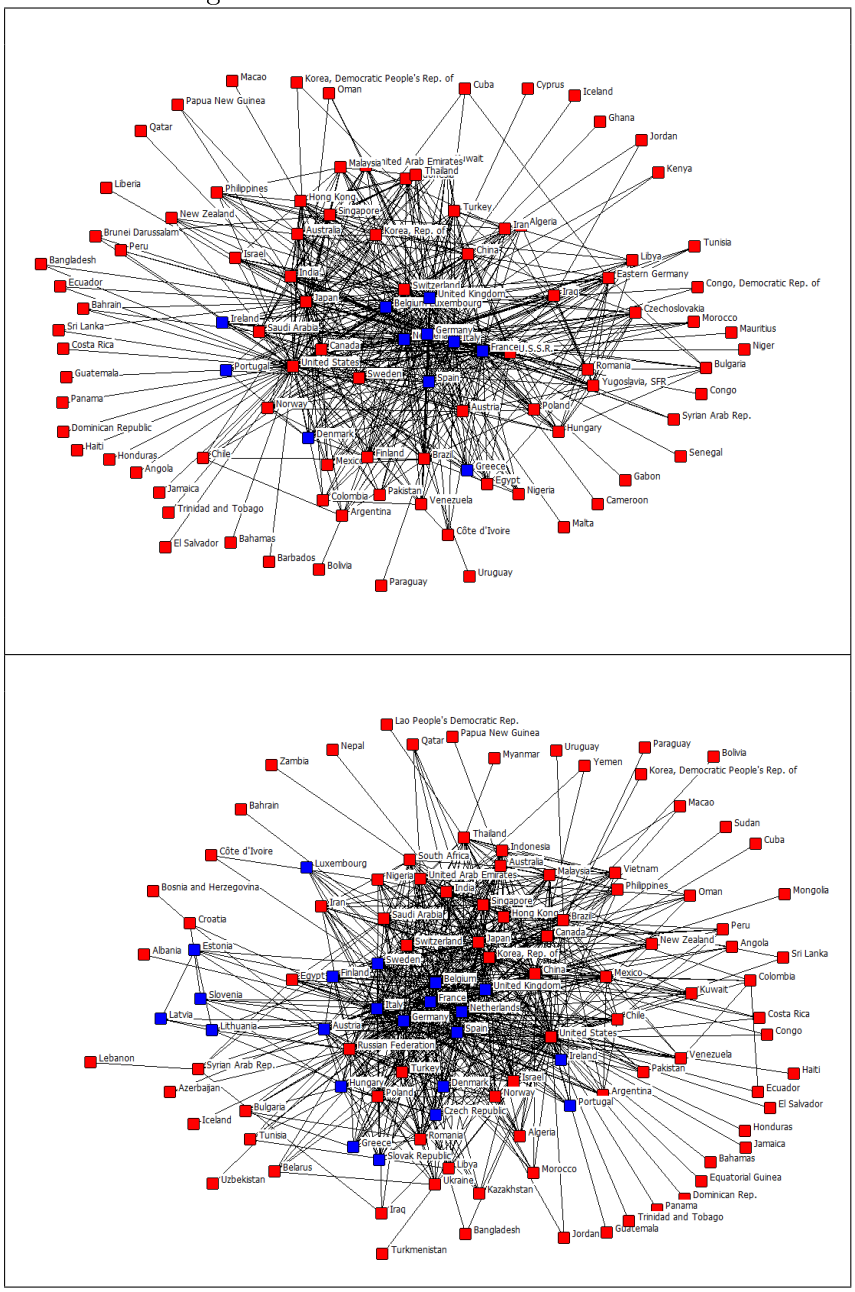
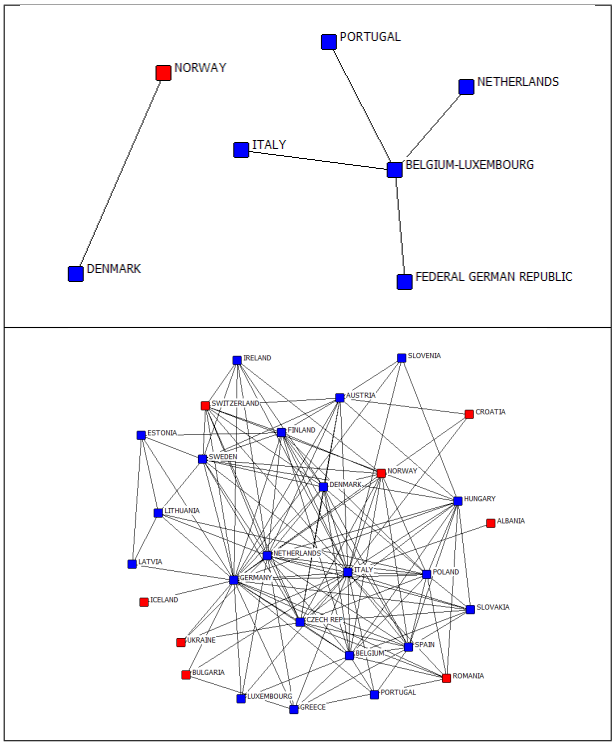


Figure 5: Multi-links involving EU member states in 1986 (top) and 2006 (down)



cause is the position took by these two nuclear powers regarding precisely disarmament and nuclear reducing.

It must also be mentioned that this configuration - a political unity among economically integrated states - on such a scale remains an exception in the world. Of course, the fact we took the amount of flows (even if it's the geometric mean) but without considering its direction gives a quite idealistic image of the economic integration within EU member states.

Conclusion

Using quite basic methods coming from Social Network Analysis, we tried to map the evolution of economic and political world scene and to see how and when the EU does appear. Of course, nearly all choices made here could be discussed, and further explorations, as I already mentioned in the introduction, are clearly needed. It could be interesting for example to consider raw amount of exports but also relative amount of export on a national base; it would helpful to study the evolution of small states that are completely

skipped here.

What we tried was also to cross different links that clearly obey to different rules and to see if congruence between them appears or not. Anyway, it could seem strange to provide a synthetic image of flows on a world scale ignoring the USA (among others). It reminds being central somewhere in a system doesn't involve being central everywhere on all systems.

Last but not least, some methodological points are still to be explored and many work paths remain open. If we consider that studying relational properties of an actor (state or group) is a relevant way to define its place on a world scale, then working with more sophisticated methods (subgroups, equivalence, clustering) could help catching the evolution of this World-System.

Annex: Deleted states

Deleted States (percentage of absenteeism)
Session 61 (2008-2009), 86 resolutions voted: Kiribati (97%), Seychelles (92%), Equatorial Guinea (80%), Saint Kitts and Nevis (59%), Tuvalu (58%), Chad (57%), Somalia (56%), Madagascar (55%).
Session 51 (1998-1999), 74 resolutions voted: Central African Republic (100%), Iraq (100%), Sao Tome and Principe (100%), Somalia (100%), Yugoslavia (100%), Turkmenistan (95%), Rwanda (86%), Comoros (82%), Greece (81%), Democratic Republic of the Congo (81%), Dominican Republic (72%), Palau (62%), Saint Vincent and the Grenadines (55%), Equatorial Guinea (50%), Seychelles (50%).
Session 41 (1988-1989), 154 resolutions voted: South Africa (100%), Dominica (89%), Gambia (57%), Albania (53%).

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