Testing World Systems Theory in 2000s

An Application of Block Modeling Approach

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Introduction

Human society is a complex web of interactions that spurs multitude effects on the individual participants as well as the network as a whole. In sociology, there are two prevalent views of a analyzing a network: interactionism and structuralism. While interactionism focuses on individual characterization, thought process and individual level relationships, structuralism focuses on the structures on the institutional level that guide individual roles. Interactionist viewpoint in network analysis theory is exemplified in works of Mark Granovetter on strength of ties and Ivan Chase who discussed interaction hierarchy through chicken pecking order. Notable thinkers that emphasized on the role of social structure on human behavior, include Karl Marx, who emphasized on two level class structure and Georg Simmel who extended the alter orientation on family.

In world economic theory, some, such as, modernization theorists, look at nations as individual units of analysis while others, such as, world systems theorists argue that structural position of nations is important in globalization and macroeconomic studies. In this paper, I will review the background of world systems theory and a popular network analysis method, block-model approach, that is used to systematically determine the structural position of a nation. I will then replicate the approach used by Ronald Breiger to determine the positions of 1972 OECD nations in his work, "*Structures of Economic Interdependence Among Nations*", to analyze how has the structural position of major economically contributing nations evolved in the recent times. Considering that new major economies, such as, China, have emerged onto the world scene, I

hypothesize to see a shift in which countries form the core nations, yet the core-periphery structure of world systems still exists.

Literature Review

World system theory, largely credited to Immanuel Wallerstein, is a line of thinking that encourages economic or social analysis from a total world wealth and event standpoint rather than using nations or isolated events for such analysis. Specifically, regarding economic development of nations, much like dependency theory, world system theory disagrees with the "linear notion that the historical growth of Western societies represents the pathway of development for the contemporary Third World" (Nemeth and Smith 518). Instead, the inherent structure of capitalist global economy would maintain the inequality and status quo.

In the 1950s and 60s, Latin American scholars questioned the tenets of modernization theory that promoted the spread of rational thinking, capitalist ideology and democratic institutions to build the foundation for the economic advancement of all nations. They argued that countries remained underdeveloped due to the structure of international relations and not an inherent cultural or economic characteristic. While the dependence theorists emphasized on two-way relations between wealthy, advanced, imperial nations and less developed, colonized nations, the world system theorists extended this two-partition thinking into a grid of interdependence that can be divided into unequal exchange relations of necessary bulk commodities. Wallerstein theorizes that countries can be divided into three positions: "*core* states appropriate the surplus of the world economy as a whole and in particular of those states located in the *periphery*, which produce lower-ranking (labor intensive) goods, while states located in the *semiperiphery* are 'both exploited and exploiters" (Breiger 354).

While core-semiperiphery-periphery division of the world gained acceptance, there was a lack of unified consensus on which countries held this position. The 1979 paper by Snyder and Kick, focused on a multinetwork analyses to find the structural positions of countries. They combine the world system theory with block model analysis to evaluate the structural positions that nations hold in world trade. Snyder and Kick, critique that the world systems theory, prior to their work, lacked operational rigor for classifying nation's position in the system or even structural necessity of three-tiered model in a capitalist world economy (the dominant world system for decades, according to Wallerstein). Additionally, previous regression analyses required a choice between focusing on poor countries to test the "effect of economic or cultural imperialism on economic growth" or include all available data for all nations leading to dubious arguments like Rubinson's claim that, "a nation's exports and imports (as a percentage of the GDP) puts the state and its economic actors in a position of less power and control in the world economy" (Snyder and Kick 1101). These are refuted in the economic standings of countries like USA and Japan. Finally, they urge that previously utilized indicators such as investment dependence or trade concentration do not completely represent the nation's position as they "do not fully specify the institutional locus of transnational flow" (Snyder and Kick 1102). To address this, Snyder and Kick, conduct a multinetwork, block-model analysis on data from 118 countries for four important networks: trade flows, military interventions, diplomatic exchanges, and conjoint treaty memberships. Their analysis strongly supported the world systems theory.

Snyder and Kick utilized the block-model approach of Breiger, White, and Boorman. Consequently, Ronald Breiger built on their work of block model analysis of world system theory, by using different international trade networks to determine a nation's structural position. Breiger proposed that, "a block-model approach to international trade assigns states to positions according

to the structural similarity of nations' imports and exports to all other states, across various types of economic exchange, rather than on the basis of definitional aggregation" (Breiger 357). Breiger's main objective was also to operationalize procedures to identify core, semi-peripheral, peripheral nations based only on trade networks and determine if the core-periphery structures allowed competing centers. Additionally, he intended to explore "the distinctive elements of core-periphery structure in contrast to other ideal type structures that might characterize international exchange" and determine if different exchange networks presented the same results (Breiger 355). Since, Beiger's approach and results from "*Structures on Economic Interdependence Among Nations"* forms the basis of this paper, the following section of this paper details his method.

Following Breiger's approach of using relational interaction of nations through international trade, Nemeth and Smith, also focus on international commodity exchanges in their paper, "*International Trade and World System Structure"*. The authors expand on Breiger's work by using the same UN Comtrade data but include all nations with a population of over a million (86 countries in total) and do not arbitrarily pick the commodities. Instead, they use a principal component analysis on all commodities and reduce to five categories of commodity groups. Using CONCOR block-model technique, Nemeth and Smith also uncover the core countries in accordance to world systems theory. The paper ends with recommend future work on longitudinal data to test the pattern of trade in different periods but attest that the empirically method is valid for understanding world system structure. Nonetheless, they conclude that empirical analysis is a tool to understand modern world, but it should be used with in-depth comparative study.

Scholarly work refining the world systems theory, both qualitative and empirical, is extensive. However, here the focus was on key works that used the network analysis method of block-modelling to uncover the structural position of nations in world systems.

Methodological Foundation

In this paper, the method from Breiger's "*Structures of Economic Interdependence Among Nations"* will be replicated. He conducts a block model analysis of the import and export of 24 nations (OECD nations of 1972 and Israel) for selected commodities. In his study, Breiger formed exchange network matrix for agricultural products, raw materials, manufactured goods and energy resources. The focus of the study is to find groups of nations that are structurally like each other and "examine the possibly distinctive patterns that these blocks induce on the original network data" (Breiger 357).

Breiger creates a 24 by 24 matrix of countries' import and export for each of the trade networks. He binarizes this matrix, by only considering the highest fifth of the interior cell values and then rearranges and partitions the rows and columns using block-model method. Robust block model algorithms for structural equivalence is a contribution by Harrison White, Scott Boorman and Ronald Breiger through their paper, "*Social Structure from Multiple Networks. I. Blockmodels of Roles and Positions".* From this analysis, a distinct core-periphery pattern emerges that bears resemblance to the 118-country analysis of Snyder and Kick. However, he argues that world system theorist would not accept their empirical evaluation based on binarized trade data of one commodity as countries have unequal exchanges in import and export and that the results imply that the "world is bound together by a few core states" (Breiger 364).

To address this concern, Breiger uses Schwartz's technique to net out unequal exchange. For the network data, "row and column means were subtracted from each matrix, leaving residuals from an additive, two-way analysis of variance model" (Breiger 365). Positive values indicated statistical interactions, while negative values represented the opposite. This method was applied to a single correlation matrix created by multiple networks: agricultural products, raw materials,

manufactured goods. The block model algorithm used to cluster countries is, CONCOR (Convergence of Iterated Correlations), "a divisive hierarchical clustering procedure that continuously splits actors into successively smaller groups" (Nemeth and Smith 532). The eigen structure of the resulting matrix was examined and plotted to reveal geographical clustered nations with insight of historical events. Here, Breiger does urge to conduct a time series analysis to see how the positions differ in light of world economic events, such as, formal entry of UK into European Common Market. Breiger examines the correlations between the four matrices to establish that each of the trade matrices are quite different from each other. Therefore, to find any additional asymmetries, it is important to run a four block CONCOR partition to each of the networks. The correlation matrices are adjusted as previously described.

The study concludes that the core-periphery structure identified by Snyder and Kick holds but "adjusting for the total import and export levels of each country, … [reveals] the existence of multiple competing core" (Breiger 375). In the network diagrams (from Dr. Padgett's notes) shown below, the pattern of competing core can be seen. USA, UK and Germany form the core while countries like Japan, Sweden and France form connections with additional countries but interestingly do not overlap in trade between each other.

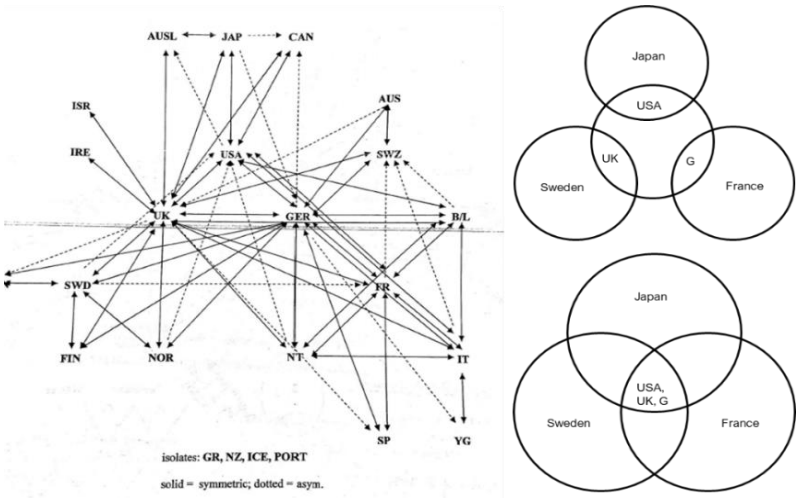
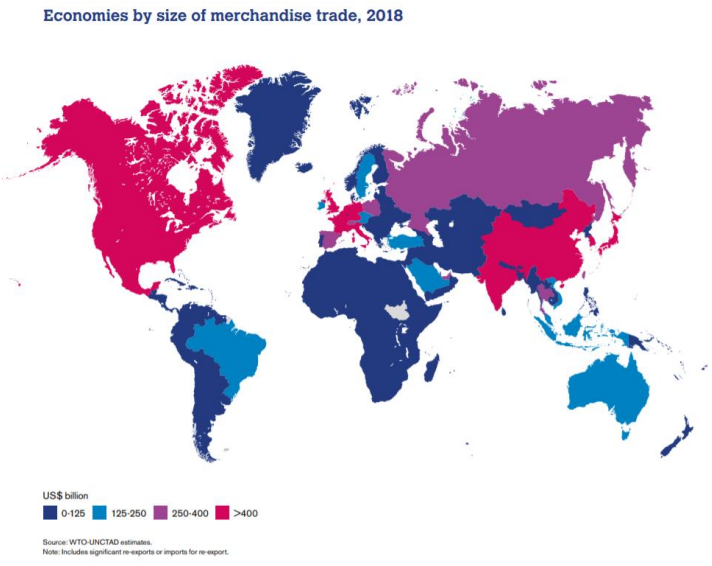


Figure 1 Network Diagram Created by Dr.Padget to Represent Breiger's 1972 Study

Data

In this study, I will use data collected and maintained by Organization for Economic Co-operation and Development (OECD), an organization that "work[s] on establishing international norms and finding evidence-based solutions to a range of social, economic and environmental challenges" (OECD) They have a large database of international trade statistics that has been collected for more than 60 years. Beiger chose to limit his study to 24 OECD nations of 1972 and Israel, since most of the world trade was accounted by them. However, that is no longer the case. The OECD has expanded to include 13 additional countries and non-OECD countries like India, China and Brazil, participate in world trade at a scale that cannot be ignored (see appendix for complete list). According to world trade statistics, the merchandise trade was valued at US$ 19.67 trillion in 2018 and China was the leading merchandise trader (World Trade Statistics). The map shown below highlights the participation of countries in the merchandise trade. In 2018, "developing economies had a 44% share in world merchandise trade" (World Trade Statistics 14). In contrast, when Breiger conducted his study for 1972, the highly industrialized OECD nations, accounted "for over 70 percent of the world totals in 1972" (Breiger 360)



For this study, import-export trade data is collected from UN Comtrade database for the same commodity codes that Breiger used, 0, 2, 3, 6 (whose description can be found in the table below), for the years, 1972, 2007, 2008, 2013 and 2018.

Table 1 SITC Code Description for Data Collected

Commodity SITC Section Code	Description
0	Food and live animals
2	Crude materials, inedible, except fuels
3	Mineral fuels, lubricants and related materials
6	Manufactured goods classified chiefly by material

To determine the world structure in recent times, the latest data available, year 2018, will be used. However, "world systems analysis is directed to studies of social change in which the system itself is open to dynamic alterations", therefore, a temporal analysis is done to evaluate, "the stability or fluidity of structure" (Nemeth and Smith 556). The year 2008 gives a picture of the world ten years prior. However, given that the year 2008 marked a major global financial crisis, to account for any situational differences, years 2007 and 2013 are considered to determine the structure of world in the recent times. For the year 1972, only the original countries from Breiger's study are considered to replicate the results that Breiger found to benchmark the analysis process and account for any discrepancy in methodology.

Method

I apply the same steps, derived from Ronald Breiger's approach to world system analysis, to each of the five years of datasets. Before applying the block model analysis, a rigorous data extraction and preparation is conducted. From the UN Comtrade database, the import-export data for each of the countries in consideration, in each of the years, is individually downloaded. Then,

for each year in consideration, the data is cleaned and combined into one dataframe in Python's Jupyter notebook. The combined dataframe is then cleaned to retain the commodity exchange for only the countries in consideration. That is, only the countries in OECD and India, China, Brazil (OECD and Israel for 1972) are retained for creating the matrix of reporter and partner nations. Additionally, any data for export, re-export and re-import are removed. Nemeth and Smith point out, referring to works of Duran and Linnemann, that, "only import data are used because, as a result of number of factors, reports on imports and exports do not always match perfectly and there is reason to believe that import figures are more accurate" (Nemeth and Smith 526). This discrepancy is observed in the data extracted in this study and since, Breiger's method to address this is not clear, this study utilizes the import-data-only approach of Nemeth and Smith. Finally, all the country names are standardized.

Using Pandas Groupby command and filtering by commodity code in Python, the cleaned data is converted into a 39 by 39 (24 by 24 for 1972) matrix for each of the four international trade exchange networks. Additionally, since Breiger considers "only the highest fifth of interior cell values" in the first step in analysis, I create matrices that code 1 for the top fifth value and 0 for rest (Breiger 362). The data for each of the trade matrices is thus prepared and saved in csv format for block model analysis.

The block model analysis is conducted in a software specialized for network analysis – UCINET. The csv files are loaded into matrix editor and converted to UCINET native files and analyzed using UCINET's standard CONCOR block model analysis. For all the years in consideration, three types of analysis are conducted: determine the correlation among the four trade networks; conduct block model analysis on each of the binarized trade network; and conduct multinetwork analysis on combined trade networks.

For single matrix analysis, a standard CONCOR block model with 3-part split is applied to each of the binarized trade networks to generate a block model partition and density matrix. For the multinetwork analysis, first, the rows for all four trade exchange matrices are joined and a correlation matrix is created for the combined network. The CONCOR block model analysis is run on this correlation matrix. Additionally, just as Breiger had adjusted for different intensities of trade using the method proposed by Schwartz, a matrix normalization is conducted on the rows and columns of the joined matrix using mean. A block model analysis is then conducted on the correlation matrix of the normalized matrix.

Results

Correlation among Trade Matrices

1972 Correlation Matrix

	raw72	man72	enr72	agr72
raw1972	1	0.868	0.795	0.683
man1972	0.868	1	0.835	0.759
enr1972	0.795	0.835	1	0.851
agr1972	0.683	0.759	0.851	1

2008 Correlation Matrix

	agr2008	enr2008	man2008	raw2008
agr2008	1	0.724	0.591	0.415
enr2008	0.724	1	0.563	0.354
man2008	0.591	0.563	1	0.334
raw2008	0.415	0.354	0.334	1

2018 Correlation Matrix

	agr2018	enr2018	man2018	raw2018
agr2018	1	0.703	0.694	0.348
enr2018	0.703	1	0.519	0.229
man2018	0.694	0.519	1	0.436
raw2018	0.348	0.229	0.436	1

2007 Correlation Matrix

	agr2007	enr2007	man2007	raw2007
agr2007	1	0.757	0.605	0.509
enr2007	0.757	1	0.593	0.461
man2007	0.605	0.593	1	0.415
raw2007	0.509	0.461	0.415	1

2013 Correlation Matrix

	agr2013	enr2013	man2013	raw2013
agr2013	1	0.718	0.674	0.318
enr2013	0.718	1	0.529	0.228
man2013	0.674	0.529	1	0.283
raw2013	0.318	0.228	0.283	1

Figure 2 Comparison of Correlations among Trade Matrices for all Years

1972

Part 1: Density Matrix for Binarized Trade Networks (*See Appendix for Block Models*)

Density Matrix for Manufactured Good in 1972

	1	2	3	4	5
1	0	0.667	0	0	0
2	0.667	0.167	0	0	0
3	0.1	0.133	0.65	0.1	0
4	0	0	0.1	0	0
5	0	0	0	0	0

Density Matrix for Agricultural Products in 1972

	1	2	3	4	5	6
1	0.667	0	0.083	0	0	0
2	0	0	0	0	1	0
3	0	0	0.333	1	0	0
4	0	0	1	1	0	0
5	0	1	0	0	0	
6	0	0	0	0	0	0

Density Matrix for Raw Materials in 1972

	1	2	3	4	5
1	0.333	0.444	0.111	0.111	0
2	0.556	0	0	0.111	0
3	0.222	0	0.333	0.556	0
4	0.111	0.111	0.444	0	0
5	0	0	0	0	0

Density Matrix for Energy Products in 1972

	1	2	3	4	5
1	0	0	0	0	0
2	0	0.2	0.083	0	0.417
3	0	0	0	0.667	0.75
4	0	0	0.5	0	0
5	0	0.5	0.25	0	0

Figure 3 Density Matrix with Positive Values Highlighted (1972)

Part 2: Multinetwork Analysis (Non-Normalized and Normalized)

1	australia	1.000	0.292	0.290	0.350	0.153	0.278
11	ireland	0.292	1.000	0.608	0.343	0.089	0.151
12	israel	0.290	0.608	1.000	0.413	0.591	0.603
10	iceland	0.350	0.343	0.413	1.000	0.243	0.207
14	japan	0.153	0.089	0.591	0.243	1.000	0.878
4	canada	0.278	0.151	0.603	0.207	0.878	1.000
3	belgium-luxembourg	0.039	0.127	0.395	0.162	0.187	0.145
8	germany	-0.037	0.057	0.364	0.076	0.147	0.134
9	greece	0.149	0.169	0.502	0.277	0.202	0.165
7	france	0.025	0.108	0.446	0.215	0.152	0.100
2	austria	0.053	0.172	0.357	0.244	0.075	0.039
18	spain	0.270	0.465	0.655	0.495	0.390	0.429
13	italy	0.058	0.114	0.436	0.224	0.217	0.182
20	switzerland	0.105	0.375	0.619	0.304	0.170	0.158
15	netherlands	0.072	0.151	0.433	0.264	0.132	0.107
22	united kingdom	-0.000	-0.060	0.394	0.220	0.493	0.346
24	yugoslavia	0.085	0.066	0.332	0.298	0.166	0.114
21	turkey	0.171	0.133	0.373	0.248	0.100	0.123
5	denmark	0.233	0.616	0.450	0.526	0.121	0.128
19	sweden	0.073	0.308	0.389	0.259	0.092	0.119
17	portugal	0.277	0.544	0.750	0.549	0.300	0.321
16	norway	0.147	0.435	0.566	0.355	0.234	0.199
23	usa	0.381	0.103	0.188	0.021	0.083	-0.014
6	finland	0.123	0.471	0.554	0.259	0.138	0.169

1	australia	1.000	0.390	0.427	0.344	0.482	0.359	0.467
5	denmark	0.390	1.000	0.706	0.773	0.803	0.758	0.721
9	greece	0.427	0.706	1.000	0.817	0.753	0.828	0.984
16	norway	0.344	0.773	0.817	1.000	0.761	0.927	0.827
11	ireland	0.482	0.803	0.753	0.761	1.000	0.785	0.784
6	finland	0.359	0.758	0.828	0.927	0.785	1.000	0.839
10	iceland	0.467	0.721	0.984	0.827	0.784	0.839	1.000
17	portugal	0.464	0.741	0.975	0.863	0.812	0.888	0.993
21	turkey	0.452	0.711	0.990	0.816	0.769	0.831	0.994
12	israel	0.469	0.708	0.946	0.818	0.847	0.845	0.971
18	spain	0.430	0.745	0.873	0.719	0.804	0.731	0.879
24	yugoslavia	0.382	0.665	0.957	0.777	0.687	0.776	0.932
19	sweden	0.063	0.420	0.306	0.384	0.355	0.575	0.310
2	austria	0.145	0.518	0.668	0.666	0.454	0.653	0.596
20	switzerland	0.048	0.380	0.468	0.572	0.464	0.612	0.411
13	italy	-0.416	-0.331	-0.362	-0.386	-0.454	-0.409	-0.462
7	france	-0.459	-0.368	-0.484	-0.443	-0.514	-0.495	-0.559
8	germany	-0.372	-0.371	-0.397	-0.446	-0.367	-0.376	-0.384
3	belgium-luxembourg	-0.475	-0.450	-0.508	-0.462	-0.529	-0.458	-0.591
15	netherlands	-0.380	-0.276	-0.446	-0.406	-0.440	-0.466	-0.512
4	canada	-0.000	-0.326	-0.382	-0.366	-0.234	-0.339	-0.310
14	japan	-0.093	-0.288	-0.287	-0.283	-0.213	-0.301	-0.210
22	united kingdom	-0.272	-0.054	-0.163	-0.095	-0.296	-0.125	-0.109
23	usa	0.148	-0.301	-0.272	-0.212	-0.203	-0.277	-0.256

Figure 4 Part of CONCOR Blockmodel for Multinetworks (non-normalized on left and normalized on right)

2018

Part 1: Density Matrix for Binarized Trade Networks (*See Appendix for Block Models*)

Density Matrix for Manufactured Good in 2018

	1	2	3	4	5	6	7
1	0.6	0.229	0	0.133	0	0	0
2	0.229	0.095	0	0.016	0	0	0
3	0	0	0	0.148	0	0	0
4	0.089	0.016	0	0.333	0	0.056	0
5	0	0	0	0	0	0	0
6	0	0.071	0	0.056	0	0	0
7	0	0.071	0	0	0	0	0.5

Density Matrix for Agricultural Products in 2018

	1	2	3	4	5	6	7
1	0.667	0.667	0.042	0.111	0.25	0	0
2	0	0	0	0	0	0	0
3	0	0	0.018	0.292	0	0	0
4	0.056	0.083	0.354	0.433	0	0	0
5	0.667	0	0	0	0.167	0	0
6	0	0	0	0	0	0.5	0
7	0	0	0	0	0	0	0

Density Matrix for Raw Materials in 2018

	1	2	3	4	5
1	0	0	0.146	0.025	0
2	0.375	0.233	0.25	0.067	0
3	0.042	0.028	0.033	0.1	0
4	0.025	0	0.4	0.65	0
5	0	0	0	0	0

Density Matrix for Energy Products in 2018

	1	2	3	4	5
1	0	0.233	0.208	0.111	0
2	0.067	0.35	0.017	0	0
3	0.208	0.15	0.038	0.083	0
4	0.111	0.133	0.194	0	0
5	0	0	0	0	0

Figure 5 Density Matrix with Positive Values Highlighted (2018)

Part 2: Multinetwork Analysis (Non-Normalized and Normalized)

1	australia	1.000	0.325	0.858	0.629	0.401	0.306	0.095	0.003
39	usa	0.325	1.000	0.279	0.246	0.164	0.207	-0.007	0.089
4	brazil	0.858	0.279	1.000	0.731	0.436	0.248	0.226	0.080
6	chile	0.629	0.246	0.731	1.000	0.480	0.432	0.222	0.213
27	new zealand	0.401	0.164	0.436	0.480	1.000	0.069	0.113	0.050
31	rep. of korea	0.306	0.207	0.248	0.432	0.069	1.000	0.289	0.462
5	canada	0.095	-0.007	0.226	0.222	0.113	0.289	1.000	0.363
7	china	0.003	0.089	0.080	0.213	0.050	0.462	0.363	1.000
17	india	0.155	0.070	0.254	0.489	0.117	0.613	0.528	0.835
19	israel	0.005	-0.017	0.104	0.243	0.014	0.442	0.401	0.874
21	japan	0.180	0.170	0.220	0.640	0.093	0.724	0.190	0.425
25	mexico	0.111	0.008	0.207	0.360	0.189	0.327	0.781	0.580
9	denmark	-0.002	-0.008	0.057	0.059	0.157	-0.012	0.033	0.108
14	greece	0.093	0.026	0.143	0.166	0.080	0.109	0.169	0.336
15	hungary	-0.059	-0.028	-0.007	0.011	-0.034	0.051	-0.024	0.194
3	belgium	-0.041	0.033	0.018	0.032	-0.023	0.126	0.103	0.247
13	germany	-0.053	-0.058	0.015	0.144	-0.013	0.222	0.075	0.352
37	turkey	0.143	0.068	0.243	0.271	0.089	0.230	0.238	0.547
29	poland	-0.049	-0.011	0.006	0.022	-0.002	0.042	-0.018	0.180
11	finland	0.207	0.081	0.296	0.265	0.071	0.179	0.141	0.362
2	austria	-0.015	0.028	0.045	0.073	-0.009	0.116	0.024	0.289
12	france	-0.014	0.002	0.072	0.087	0.069	0.113	0.092	0.285
32	slovakia	-0.064	-0.062	-0.038	-0.049	-0.069	0.005	-0.034	0.136
24	luxembourg	-0.046	0.029	-0.002	0.037	-0.039	0.116	0.016	0.305
16	iceland	-0.025	0.002	-0.003	0.049	0.126	0.003	0.021	0.125
26	netherlands	-0.020	0.019	0.014	-0.011	0.041	-0.011	0.025	0.040
8	czechia	-0.031	0.009	0.012	0.020	-0.036	0.065	-0.001	0.237
36	switzerland	-0.030	0.040	0.028	0.092	0.030	0.158	0.078	0.373
38	united kingdom	0.120	0.076	0.166	0.085	0.007	0.275	0.289	0.214
30	portugal	-0.011	0.000	0.084	0.090	-0.019	0.117	0.236	0.309
35	sweden	-0.016	0.014	0.057	0.135	-0.051	0.195	0.083	0.293
34	spain	0.042	0.020	0.131	0.138	0.090	0.077	0.140	0.219
33	slovenia	-0.046	-0.016	-0.001	0.008	-0.048	0.076	0.001	0.241
20	italy	-0.035	0.021	0.044	0.138	0.017	0.192	0.137	0.419
28	norway	-0.020	0.047	-0.017	-0.032	-0.018	-0.003	0.093	-0.010
23	lithuania	-0.039	-0.095	0.041	-0.029	-0.042	-0.009	0.303	-0.025
18	ireland	-0.015	-0.009	0.020	0.033	0.213	-0.029	0.027	0.021
10	estonia	-0.013	-0.098	0.036	0.004	-0.026	-0.030	0.012	0.014
22	latvia	0.024	-0.067	0.061	0.014	-0.034	-0.030	-0.019	0.040

1	australia	1.000	0.255	0.102	0.839	0.488	-0.023	-0.155	-0.166
39	usa	0.255	1.000	0.045	0.186	0.069	-0.121	-0.036	-0.204
31	rep. of korea	0.102	0.045	1.000	-0.033	0.160	0.017	0.197	0.363
4	brazil	0.839	0.186	-0.033	1.000	0.570	0.096	-0.109	-0.108
6	chile	0.488	0.069	0.160	0.570	1.000	-0.127	-0.195	0.083
5	canada	-0.023	-0.121	0.017	0.096	-0.127	1.000	0.266	0.330
7	china	-0.155	-0.036	0.197	-0.109	-0.195	0.266	1.000	0.752
17	india	-0.166	-0.204	0.363	-0.108	0.083	0.330	0.752	1.000
13	germany	-0.235	-0.199	-0.000	-0.201	-0.135	-0.118	0.180	0.185
25	mexico	-0.088	-0.170	0.015	-0.020	0.008	0.722	0.445	0.563
21	japan	-0.026	0.020	0.621	-0.031	0.491	-0.066	0.188	0.471
29	poland	-0.372	-0.231	-0.275	-0.387	-0.310	-0.442	-0.271	-0.407
26	netherlands	-0.161	-0.083	-0.224	-0.158	-0.250	-0.141	-0.150	-0.243
12	france	-0.323	-0.218	-0.244	-0.290	-0.313	-0.272	-0.080	-0.162
34	spain	-0.270	-0.203	-0.274	-0.238	-0.210	-0.249	-0.204	-0.250
3	belgium	-0.291	-0.138	-0.173	-0.281	-0.335	-0.177	-0.042	-0.182
2	austria	-0.384	-0.222	-0.225	-0.403	-0.286	-0.464	-0.222	-0.348
20	italy	-0.360	-0.206	-0.189	-0.336	-0.316	-0.205	0.118	-0.063
38	united kingdom	-0.184	-0.143	-0.020	-0.203	-0.301	-0.077	-0.220	-0.224
11	finland	-0.316	-0.261	-0.237	-0.346	-0.133	-0.560	-0.441	-0.452
9	denmark	-0.378	-0.246	-0.233	-0.425	-0.147	-0.519	-0.529	-0.471
14	greece	-0.356	-0.231	-0.149	-0.427	-0.081	-0.513	-0.526	-0.352
23	lithuania	-0.352	-0.228	-0.133	-0.414	-0.081	-0.464	-0.567	-0.420
24	luxembourg	-0.396	-0.234	-0.153	-0.470	-0.126	-0.556	-0.536	-0.435
16	iceland	-0.353	-0.215	-0.134	-0.426	-0.071	-0.516	-0.551	-0.421
18	ireland	-0.342	-0.214	-0.170	-0.397	-0.087	-0.476	-0.528	-0.410
27	new zealand	-0.040	-0.100	-0.161	-0.081	0.234	-0.406	-0.506	-0.400
28	norway	-0.182	-0.060	-0.148	-0.216	-0.183	-0.121	-0.257	-0.226
10	estonia	-0.338	-0.213	-0.117	-0.407	-0.057	-0.502	-0.549	-0.404
8	czechia	-0.409	-0.245	-0.238	-0.458	-0.271	-0.528	-0.367	-0.439
22	latvia	-0.339	-0.216	-0.125	-0.409	-0.063	-0.510	-0.552	-0.410
32	slovakia	-0.386	-0.252	-0.171	-0.454	-0.153	-0.536	-0.509	-0.440
33	slovenia	-0.378	-0.233	-0.144	-0.449	-0.109	-0.540	-0.538	-0.425
15	hungary	-0.409	-0.255	-0.179	-0.475	-0.151	-0.569	-0.539	-0.463
35	sweden	-0.440	-0.271	-0.150	-0.473	-0.189	-0.518	-0.397	-0.362
36	switzerland	-0.481	-0.269	-0.217	-0.536	-0.264	-0.561	-0.371	-0.400
37	turkey	-0.408	-0.310	-0.255	-0.425	-0.200	-0.503	-0.250	-0.207
19	israel	-0.478	-0.346	0.074	-0.482	-0.160	-0.223	0.228	0.407
30	portugal	-0.414	-0.262	-0.178	-0.456	-0.153	-0.465	-0.485	-0.386

Figure 6 Part of CONCOR Blockmodel for Multinetworks (non-normalized on left and normalized on right)

2008

Part 1: Density Matrix for Binarized Trade Networks (*See Appendix for Block Models*)

Density Matrix for Manufactured Good in 2008

	1	2	3	4	5	6	7
1	0.5	0	0	0	0	0	0
2	0	0	0	0	0	0.083	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0.121	0	0
5	0	0.045	0	0	0.345	0.076	0.061
6	0	0	0	0.056	0.152	0.067	0
7	0.667	0	0	0	0.03	0.111	0.83

Density Matrix for Agricultural Products in 2008

	1	2	3	4	5	6	7
1	0.05	0.133	0	0	0	0	0
2	0.6	0.333	0	0	0.417	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0.119	0
5	0	0.083	0	0	0	0.036	0
6	0	0	0	0.143	0.286	0.762	0.071
7	0	0	0	0.167	0	0.143	0

Density Matrix for Raw Materials in 2008

	1	2	3	4	5
1	0.2	0.05	0	0	0
2	0.55	0.143	0	0.063	0
3	0	0	0	0.025	0
4	0.3	0.016	0.15	0.304	0
5	0	0	0	0	0

Density Matrix for Energy Products in 2008

	1	2	3	4	5	6
1	0.036	0	0	0.143	0	0
2	0	0	0.389	0.571	0	0
3	0	0.444	0	0.016	0	0
4	0.161	0.5	0.032	0.571	0.143	0
5	0	0	0	0	0	
6	0	0	0	0	0	0

Figure 7 Density Matrix with Positive Values Highlighted (2008)

Part 2: Multinetwork Analysis (Non-Normalized and Normalized)

1	australia	1.000	0.134	0.225	0.637	0.642	0.421	0.273	0.240
21	japan	0.134	1.000	0.698	0.238	0.342	0.596	0.153	0.073
31	rep. of korea	0.225	0.698	1.000	0.225	0.299	0.459	0.130	0.143
4	brazil	0.637	0.238	0.225	1.000	0.811	0.576	0.310	0.291
17	india	0.642	0.342	0.299	0.811	1.000	0.555	0.287	0.226
6	chile	0.421	0.596	0.459	0.576	0.555	1.000	0.321	0.346
39	usa	0.273	0.153	0.130	0.310	0.287	0.321	1.000	0.177
27	new zealand	0.240	0.073	0.143	0.291	0.226	0.346	0.177	1.000
5	canada	0.070	0.134	0.235	0.424	0.231	0.161	-0.020	0.096
19	israel	0.015	0.328	0.374	0.235	0.534	0.294	-0.012	0.060
7	china	0.093	0.454	0.396	0.220	0.489	0.385	0.110	0.177
25	mexico	0.038	0.117	0.213	0.392	0.193	0.141	-0.020	0.108
9	denmark	-0.035	-0.004	-0.018	0.069	0.030	0.052	-0.006	0.147
14	greece	-0.000	0.086	0.098	0.203	0.259	0.285	0.045	0.174
15	hungary	-0.069	0.020	-0.008	0.055	0.080	0.116	-0.016	-0.009
3	belgium	-0.026	0.086	0.085	0.113	0.162	0.158	0.024	-0.002
13	germany	-0.071	0.156	0.137	0.058	0.194	0.186	-0.039	-0.046
18	ireland	-0.019	-0.019	-0.025	0.103	0.051	0.036	-0.001	0.271
29	poland	-0.058	0.069	0.026	0.062	0.089	0.157	0.004	0.011
11	finland	-0.008	0.154	0.164	0.150	0.223	0.204	0.033	-0.040
2	austria	-0.040	0.097	0.072	0.082	0.149	0.217	0.034	-0.003
12	france	-0.043	0.088	0.084	0.166	0.207	0.168	0.024	0.069
32	slovakia	-0.065	-0.003	-0.022	-0.033	0.028	0.034	-0.051	-0.095
24	luxembourg	-0.043	0.110	0.081	0.052	0.183	0.232	0.044	-0.024
16	iceland	-0.034	0.005	-0.015	0.065	0.059	0.105	0.029	0.214
26	netherlands	-0.008	-0.010	-0.004	0.091	0.064	0.015	0.016	0.038
8	czechia	-0.051	0.057	0.031	0.043	0.107	0.137	0.011	-0.043
37	turkey	0.166	0.192	0.195	0.375	0.527	0.372	0.113	0.119
33	slovenia	-0.044	0.050	0.037	0.038	0.123	0.198	0.015	-0.041
30	portugal	-0.034	0.052	0.064	0.104	0.150	0.163	0.020	-0.023
35	sweden	-0.047	0.140	0.130	0.090	0.168	0.176	0.013	-0.080
36	switzerland	-0.034	0.157	0.135	0.076	0.177	0.230	0.052	0.016
20	italy	-0.041	0.167	0.136	0.115	0.202	0.241	0.054	0.038
34	spain	0.049	0.056	0.036	0.247	0.234	0.240	0.059	0.109
10	estonia	-0.056	-0.033	-0.011	0.084	0.001	-0.058	-0.037	-0.119
23	lithuania	-0.055	-0.064	-0.053	0.042	-0.037	-0.095	-0.035	-0.088
28	norway	-0.002	-0.019	0.033	-0.000	0.025	-0.052	0.023	-0.065
38	united kingdom	-0.010	0.097	0.126	0.185	0.176	0.091	0.062	-0.053
22	latvia	-0.060	-0.051	-0.051	-0.009	-0.017	-0.057	-0.079	-0.126

1	australia	1.000	0.028	-0.063	0.599	-0.090	-0.142	0.219	0.614
21	japan	0.028	1.000	0.283	0.025	-0.108	-0.141	0.060	0.152
7	china	-0.063	0.283	1.000	-0.052	0.209	0.123	-0.018	0.225
4	brazil	0.599	0.025	-0.052	1.000	0.210	0.150	0.213	0.711
5	canada	-0.090	-0.108	0.209	0.210	1.000	0.977	-0.161	-0.140
25	mexico	-0.142	-0.141	0.123	0.150	0.977	1.000	-0.183	-0.210
39	usa	0.219	0.060	-0.018	0.213	-0.161	-0.183	1.000	0.177
17	india	0.614	0.152	0.225	0.711	-0.140	-0.210	0.177	1.000
13	germany	-0.207	-0.005	0.135	-0.199	-0.118	-0.167	-0.155	-0.060
38	united kingdom	-0.216	-0.170	-0.100	-0.184	0.095	0.097	-0.102	-0.241
3	belgium	-0.206	-0.150	-0.022	-0.226	-0.150	-0.189	-0.125	-0.204
26	netherlands	-0.123	-0.182	-0.137	-0.126	-0.070	-0.102	-0.081	-0.201
12	france	-0.250	-0.174	-0.007	-0.196	-0.188	-0.223	-0.143	-0.181
20	italy	-0.256	-0.080	0.080	-0.283	-0.191	-0.214	-0.112	-0.206
34	spain	-0.121	-0.182	-0.216	-0.099	-0.343	-0.338	-0.096	-0.098
28	norway	-0.079	-0.132	-0.182	-0.177	-0.103	-0.100	-0.045	-0.155
2	austria	-0.223	-0.130	-0.183	-0.342	-0.544	-0.518	-0.130	-0.215
16	iceland	-0.081	-0.077	-0.500	-0.282	-0.633	-0.511	-0.088	-0.125
14	greece	-0.094	-0.085	-0.482	-0.286	-0.643	-0.524	-0.098	-0.118
11	finland	-0.217	-0.124	-0.343	-0.399	-0.591	-0.514	-0.173	-0.220
10	estonia	-0.076	-0.071	-0.500	-0.270	-0.602	-0.479	-0.089	-0.119
18	ireland	-0.098	-0.107	-0.474	-0.235	-0.584	-0.487	-0.098	-0.133
23	lithuania	-0.087	-0.088	-0.520	-0.278	-0.587	-0.460	-0.097	-0.139
24	luxembourg	-0.147	-0.103	-0.478	-0.376	-0.720	-0.612	-0.118	-0.168
6	chile	0.279	0.433	-0.110	0.248	-0.436	-0.419	0.174	0.294
22	latvia	-0.077	-0.074	-0.502	-0.277	-0.616	-0.492	-0.094	-0.121
27	new zealand	0.002	-0.060	-0.443	-0.180	-0.588	-0.468	-0.034	-0.056
9	denmark	-0.125	-0.121	-0.446	-0.259	-0.577	-0.491	-0.111	-0.176
29	poland	-0.227	-0.153	-0.381	-0.379	-0.646	-0.592	-0.161	-0.276
8	czechia	-0.195	-0.142	-0.356	-0.377	-0.643	-0.573	-0.140	-0.219
31	rep. of korea	0.110	0.624	0.101	-0.063	-0.129	-0.137	0.011	0.053
32	slovakia	-0.123	-0.104	-0.473	-0.333	-0.644	-0.536	-0.127	-0.161
33	slovenia	-0.099	-0.086	-0.492	-0.311	-0.660	-0.541	-0.100	-0.137
15	hungary	-0.133	-0.115	-0.499	-0.331	-0.689	-0.578	-0.124	-0.174
35	sweden	-0.243	-0.106	-0.288	-0.395	-0.568	-0.526	-0.173	-0.231
36	switzerland	-0.214	-0.083	-0.302	-0.406	-0.667	-0.604	-0.128	-0.206
37	turkey	-0.079	-0.111	-0.353	-0.249	-0.712	-0.616	-0.118	0.012
19	israel	-0.186	0.107	0.340	-0.218	-0.227	-0.203	-0.206	0.238
30	portugal	-0.135	-0.111	-0.431	-0.310	-0.622	-0.514	-0.116	-0.145

Figure 8 Part of CONCOR Blockmodel for Multinetworks (non-normalized on left and normalized on right)

2007

Part 1: Density Matrix for Binarized Trade Networks (*See Appendix for Block Models*)

Density Matrix for Manufactured Good in 2007

	1	2	3	4	5	6	7
1	0.583	0	0	0	0	0.063	0
2	0	0	0.2	0	0	0	
3	0	0	0	0	0	0	0
4	0.05	0	0	0.05	0.218	0.15	0.4
5	0	0	0	0	0.3	0	0
6	0.25	0	0	0.15	0.045	0.083	0
7	0	0	0	0.2	0.045	0	0.5

Density Matrix for Agricultural Products in 2007

	1	2	3	4	5	6	7
1	0	0	0	0	0	0	0
2	0.25	0	0	0.083	0	0.25	0.375
3	0	0	0	0	0	0	0
4	0	0	0	0	0.104	0	0
5	0	0	0	0.167	0.607	0.188	0.125
6	0	0	0	0	0	0	0.375
7	0.5	0	0	0	0	0.5	0

Density Matrix for Raw Materials in 2007

	1	2	3	4	5
1	0.2	0.024	0.033	0	0
2	0.405	0.167	0.114	0.102	0
3	0.033	0	0	0.029	0
4	0.143	0	0.343	0.381	0
5	0	0	0	0	0

Density Matrix for Energy Products in 2007

	1	2	3	4	5	6
1	0.036	0	0	0.161	0	0
2	0	0	0.35	0.571	0	0
3	0	0.45	0	0.014	0	0
4	0.161	0.5	0.014	0.548	0.143	0
5	0	0	0	0	0	
6	0	0	0	0	0	0

Figure 9 Density Matrix with Positive Values Highlighted (2007)

Part 2: Multinetwork Analysis (Non-Normalized and Normalized)

1	australia	1.000	0.198	0.254	0.626	0.609	0.477	0.285	0.259
21	japan	0.198	1.000	0.159	0.296	0.428	0.610	0.087	0.726
39	usa	0.254	0.159	1.000	0.269	0.231	0.289	0.182	0.132
4	brazil	0.626	0.296	0.269	1.000	0.825	0.581	0.349	0.310
17	india	0.609	0.428	0.231	0.825	1.000	0.562	0.249	0.390
6	chile	0.477	0.610	0.289	0.581	0.562	1.000	0.355	0.496
27	new zealand	0.285	0.087	0.182	0.349	0.249	0.355	1.000	0.151
31	rep. of korea	0.259	0.726	0.132	0.310	0.390	0.496	0.151	1.000
5	canada	0.068	0.225	-0.020	0.461	0.391	0.242	0.125	0.391
19	israel	0.043	0.362	-0.007	0.377	0.652	0.318	0.098	0.373
7	china	0.127	0.451	0.128	0.356	0.606	0.418	0.249	0.405
25	mexico	0.031	0.181	-0.022	0.404	0.315	0.190	0.123	0.351
18	ireland	-0.018	-0.013	0.010	0.155	0.067	0.028	0.308	-0.026
14	greece	0.006	0.133	0.014	0.328	0.386	0.336	0.195	0.151
15	hungary	-0.072	0.020	-0.008	0.101	0.105	0.138	-0.012	-0.002
3	belgium	-0.027	0.124	0.029	0.179	0.228	0.231	0.013	0.129
13	germany	-0.050	0.175	-0.013	0.136	0.275	0.234	-0.028	0.165
8	czechia	-0.053	0.058	0.017	0.080	0.136	0.161	-0.050	0.038
29	poland	-0.056	0.072	0.016	0.111	0.130	0.186	0.013	0.034
11	finland	0.002	0.183	0.056	0.192	0.295	0.269	-0.029	0.190
2	austria	-0.031	0.109	0.051	0.152	0.203	0.265	0.005	0.090
12	france	-0.033	0.104	0.036	0.234	0.282	0.198	0.082	0.107
32	slovakia	-0.073	0.008	-0.036	-0.008	0.059	0.073	-0.092	-0.014
24	luxembourg	-0.033	0.121	0.066	0.123	0.248	0.303	-0.022	0.101
16	iceland	-0.029	-0.003	0.028	0.110	0.055	0.130	0.249	-0.022
26	netherlands	-0.004	0.008	0.008	0.145	0.117	0.049	0.062	0.002
36	switzerland	-0.022	0.167	0.068	0.145	0.236	0.270	0.027	0.139
37	turkey	0.115	0.190	0.098	0.401	0.527	0.372	0.113	0.207
38	united kingdom	-0.015	0.134	0.028	0.216	0.260	0.138	-0.052	0.199
30	portugal	-0.027	0.067	0.018	0.179	0.194	0.158	-0.015	0.101
35	sweden	-0.033	0.173	0.039	0.170	0.252	0.252	-0.057	0.151
34	spain	0.033	0.073	0.056	0.280	0.255	0.264	0.120	0.071
33	slovenia	-0.040	0.051	0.022	0.092	0.169	0.252	-0.040	0.049
20	italy	-0.034	0.197	0.079	0.183	0.281	0.280	0.045	0.173
23	lithuania	-0.094	-0.054	-0.086	0.049	-0.028	-0.060	-0.064	-0.025
9	denmark	-0.030	-0.003	0.002	0.113	0.054	0.050	0.169	-0.020
28	norway	-0.012	-0.007	-0.007	0.001	0.050	-0.040	-0.064	0.006
10	estonia	-0.028	-0.041	-0.073	0.055	0.038	-0.060	-0.120	-0.003
22	latvia	-0.042	-0.028	-0.063	0.038	0.032	-0.033	-0.115	-0.011

1	australia	1.000	0.090	0.163	0.599	-0.152	-0.181	-0.092	0.605	0.201
21	japan	0.090	1.000	0.637	0.045	-0.016	-0.075	0.246	0.196	0.063
31	rep. of korea	0.163	0.637	1.000	-0.001	0.044	0.028	0.057	0.075	0.008
4	brazil	0.599	0.045	-0.001	1.000	0.165	0.099	0.004	0.710	0.162
5	canada	-0.152	-0.016	0.044	0.165	1.000	0.962	0.323	-0.020	-0.164
25	mexico	-0.181	-0.075	0.028	0.099	0.962	1.000	0.168	-0.121	-0.179
7	china	-0.092	0.246	0.057	0.004	0.323	0.168	1.000	0.279	-0.010
17	india	0.605	0.196	0.075	0.710	-0.020	-0.121	0.279	1.000	0.098
39	usa	0.201	0.063	0.008	0.162	-0.164	-0.179	-0.010	0.098	1.000
38	united kingdom	-0.223	-0.164	-0.156	-0.201	0.123	0.131	-0.077	-0.223	-0.138
13	germany	-0.221	-0.028	-0.123	-0.191	-0.070	-0.138	0.160	-0.066	-0.137
3	belgium	-0.230	-0.155	-0.238	-0.227	-0.149	-0.194	-0.001	-0.244	-0.126
26	netherlands	-0.122	-0.185	-0.246	-0.104	-0.123	-0.141	-0.153	-0.199	-0.088
20	italy	-0.273	-0.095	-0.232	-0.283	-0.157	-0.197	0.114	-0.231	-0.083
36	switzerland	-0.116	-0.158	-0.131	-0.322	-0.672	-0.600	-0.396	-0.240	-0.103
35	sweden	-0.155	-0.156	-0.145	-0.307	-0.570	-0.526	-0.319	-0.238	-0.139
34	spain	-0.108	-0.227	-0.254	-0.076	-0.330	-0.315	-0.242	-0.168	-0.093
12	france	-0.241	-0.193	-0.276	-0.158	-0.213	-0.255	0.006	-0.170	-0.122
29	poland	-0.132	-0.222	-0.208	-0.304	-0.675	-0.599	-0.469	-0.312	-0.135
2	austria	-0.162	-0.197	-0.210	-0.283	-0.565	-0.535	-0.257	-0.262	-0.108
28	norway	-0.069	-0.137	-0.130	-0.193	-0.104	-0.072	-0.216	-0.158	-0.073
11	finland	-0.107	-0.182	-0.112	-0.327	-0.611	-0.533	-0.391	-0.231	-0.136
23	lithuania	0.057	-0.142	0.022	-0.168	-0.608	-0.455	-0.599	-0.135	-0.078
24	luxembourg	-0.005	-0.184	-0.056	-0.272	-0.737	-0.601	-0.590	-0.188	-0.092
6	chile	0.426	0.437	0.303	0.316	-0.303	-0.321	-0.085	0.269	0.169
14	greece	0.043	-0.157	-0.001	-0.173	-0.646	-0.497	-0.571	-0.122	-0.091
18	ireland	0.023	-0.171	-0.051	-0.116	-0.591	-0.471	-0.553	-0.149	-0.076
9	denmark	-0.010	-0.185	-0.090	-0.160	-0.586	-0.475	-0.525	-0.196	-0.091
10	estonia	0.067	-0.138	0.025	-0.170	-0.614	-0.462	-0.597	-0.127	-0.073
8	czechia	-0.088	-0.207	-0.146	-0.294	-0.650	-0.559	-0.454	-0.246	-0.117
22	latvia	0.061	-0.143	0.018	-0.177	-0.612	-0.459	-0.602	-0.135	-0.078
32	slovakia	0.004	-0.172	-0.044	-0.244	-0.662	-0.526	-0.572	-0.181	-0.104
33	slovenia	0.041	-0.158	-0.006	-0.205	-0.671	-0.525	-0.590	-0.150	-0.081
15	hungary	0.006	-0.186	-0.052	-0.223	-0.698	-0.558	-0.602	-0.194	-0.101
16	iceland	0.060	-0.145	0.011	-0.172	-0.640	-0.490	-0.596	-0.139	-0.069
27	new zealand	0.150	-0.124	0.049	-0.061	-0.590	-0.447	-0.514	-0.062	-0.015
37	turkey	0.013	-0.222	-0.105	-0.173	-0.721	-0.612	-0.460	-0.054	-0.116
19	israel	-0.117	0.086	0.104	-0.034	-0.046	-0.097	0.423	0.367	-0.214
30	portugal	-0.022	-0.197	-0.054	-0.208	-0.586	-0.451	-0.518	-0.185	-0.110

Figure 10 Part of CONCOR Blockmodel for Multinetworks (non-normalized on left and normalized on right)

2013

Part 1: Density Matrix for Binarized Trade Networks (*See Appendix for Block Models*)

Density Matrix for Manufactured Good in 2013

	1	2	3	4	5	6
1	0.5	0.04	0	0.057	0.1	0
2	0.12	0.1	0.025	0.171	0	0
3	0.025	0	0.286	0.25	0	0
4	0.057	0.114	0.071	0.214	0	0
5	0	0	0	0.071	0	0
6	0	0	0	0	0	0

Density Matrix for Agricultural Products in 2013

	1	2	3	4	5	6	7
1	0.024	0.071	0	0	0	0	0
2	0.571	0.5	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0.018	0.125	0.458	0
5	0.048	0	0	0.083	0	0.444	0
6	0.048	0	0	0.667	0.444	0.833	0
7	0	0	0	0.125	0.333	0	0

Density Matrix for Raw Materials in 2013

	1	2	3	4	5
1	0.036	0	0.083	0	0
2	0.286	0.167	0.31	0.25	0
3	0.063	0.024	0.033	0.042	0
4	0.063	0	0.375	0.917	0
5	0	0	0	0	0

Density Matrix for Energy Products in 2013

	1	2	3	4	5	6
1	0	0	0	0.233	0	0
2	0	0.067	0.148	0.306	0	0
3	0	0.148	0	0.056	0	0
4	0.1	0.417	0.037	0.567	0	0
5	0	0	0.111	0	0	
6	0	0	0	0	0	0

Figure 11 Density Matrix with Positive Values Highlighted (2013)

Part 2: Multinetwork Analysis (Non-Normalized and Normalized)

1	australia	1.000	0.424	0.874	0.571	0.407	0.280	0.089
39	usa	0.424	1.000	0.457	0.339	0.283	0.131	0.009
4	brazil	0.874	0.457	1.000	0.650	0.461	0.164	0.255
6	chile	0.571	0.339	0.650	1.000	0.388	0.509	0.180
27	new zealand	0.407	0.283	0.461	0.388	1.000	0.086	0.080
31	rep. of korea	0.280	0.131	0.164	0.509	0.086	1.000	0.239
5	canada	0.089	0.009	0.255	0.180	0.080	0.239	1.000
7	china	0.000	0.090	0.100	0.284	0.079	0.409	0.268
17	india	0.319	0.184	0.403	0.594	0.159	0.612	0.483
19	israel	0.000	-0.015	0.121	0.298	0.017	0.417	0.307
21	japan	0.205	0.185	0.250	0.703	0.112	0.700	0.149
25	mexico	0.065	0.010	0.236	0.234	0.112	0.258	0.947
9	denmark	0.001	0.004	0.083	0.035	0.144	-0.032	-0.017
14	greece	0.058	0.020	0.088	0.067	0.036	0.016	0.024
15	hungary	-0.050	-0.034	0.016	0.023	-0.034	0.004	-0.028
3	belgium	-0.026	0.055	0.058	0.084	-0.021	0.156	0.108
13	germany	-0.033	-0.020	0.045	0.152	-0.028	0.170	0.035
18	ireland	-0.002	-0.007	0.054	0.025	0.142	-0.030	0.005
29	poland	-0.046	-0.010	0.028	0.047	-0.005	0.028	-0.010
11	finland	0.124	0.105	0.204	0.211	0.013	0.175	0.167
2	austria	-0.024	0.015	0.038	0.080	-0.021	0.066	0.002
12	france	-0.018	0.004	0.098	0.099	0.048	0.077	0.099
32	slovakia	-0.058	-0.068	-0.041	-0.027	-0.075	-0.017	-0.035
24	luxembourg	-0.048	0.026	0.006	0.083	-0.044	0.097	0.011
16	iceland	-0.036	0.001	0.032	0.070	0.144	-0.008	-0.001
35	sweden	0.000	0.030	0.075	0.135	-0.049	0.135	0.047
8	czechia	-0.033	-0.004	0.016	0.047	-0.044	0.042	-0.005
37	turkey	0.386	0.232	0.516	0.434	0.204	0.215	0.184
33	slovenia	-0.042	-0.026	-0.002	0.035	-0.051	0.023	-0.017
30	portugal	0.012	0.028	0.109	0.104	-0.021	0.082	0.204
20	italy	-0.026	0.034	0.058	0.161	0.012	0.159	0.100
36	switzerland	-0.038	0.027	0.029	0.124	0.001	0.138	0.030
34	spain	0.018	0.031	0.112	0.092	0.053	0.039	0.109
10	estonia	-0.019	-0.075	-0.005	-0.042	-0.082	-0.037	-0.028
22	latvia	-0.020	-0.044	0.020	-0.038	-0.073	-0.052	-0.034
23	lithuania	-0.041	-0.050	0.060	-0.065	-0.058	0.003	0.518
28	norway	-0.024	0.063	-0.014	-0.042	-0.045	0.012	0.056
38	united kingdom	0.032	0.074	0.120	0.069	-0.025	0.122	0.321
26	netherlands	-0.010	0.044	0.024	-0.021	-0.003	-0.006	0.037

1	australia	1.000	0.358	0.862	0.363	0.084	-0.022	-0.149
39	usa	0.358	1.000	0.371	0.128	-0.056	-0.115	-0.039
4	brazil	0.862	0.371	1.000	0.387	-0.142	0.099	-0.111
6	chile	0.363	0.128	0.387	1.000	0.323	-0.260	-0.075
31	rep. of korea	0.084	-0.056	-0.142	0.323	1.000	-0.040	0.199
5	canada	-0.022	-0.115	0.099	-0.260	-0.040	1.000	0.151
7	china	-0.149	-0.039	-0.111	-0.075	0.199	0.151	1.000
17	india	0.045	-0.110	0.023	0.247	0.426	0.190	0.588
21	japan	0.022	0.029	0.004	0.580	0.611	-0.102	0.272
25	mexico	-0.118	-0.170	0.005	-0.203	-0.031	0.927	0.224
9	denmark	-0.367	-0.268	-0.399	-0.015	-0.143	-0.565	-0.417
10	estonia	-0.349	-0.252	-0.417	0.086	-0.042	-0.547	-0.410
32	slovakia	-0.381	-0.287	-0.453	0.016	-0.085	-0.564	-0.373
14	greece	-0.337	-0.250	-0.400	0.072	-0.062	-0.544	-0.390
15	hungary	-0.403	-0.292	-0.465	0.016	-0.097	-0.598	-0.392
22	latvia	-0.354	-0.255	-0.421	0.077	-0.050	-0.554	-0.417
8	czechia	-0.405	-0.288	-0.464	-0.088	-0.142	-0.560	-0.265
18	ireland	-0.334	-0.245	-0.373	0.039	-0.093	-0.508	-0.384
19	israel	-0.428	-0.350	-0.425	0.058	0.174	-0.289	0.375
11	finland	-0.392	-0.290	-0.455	-0.024	-0.110	-0.583	-0.319
2	austria	-0.371	-0.254	-0.410	-0.136	-0.156	-0.492	-0.151
35	sweden	-0.411	-0.288	-0.456	-0.065	-0.101	-0.553	-0.254
23	lithuania	-0.380	-0.278	-0.436	0.029	-0.071	-0.461	-0.452
24	luxembourg	-0.400	-0.276	-0.472	0.043	-0.066	-0.594	-0.385
16	iceland	-0.363	-0.256	-0.429	0.079	-0.053	-0.560	-0.411
30	portugal	-0.409	-0.293	-0.461	0.004	-0.100	-0.532	-0.366
27	new zealand	-0.111	-0.093	-0.142	0.241	-0.062	-0.502	-0.383
37	turkey	-0.249	-0.248	-0.274	0.094	-0.153	-0.671	-0.263
29	poland	-0.393	-0.280	-0.421	-0.168	-0.194	-0.504	-0.246
34	spain	-0.299	-0.220	-0.290	-0.167	-0.208	-0.322	-0.192
33	slovenia	-0.376	-0.269	-0.446	0.060	-0.062	-0.574	-0.400
36	switzerland	-0.452	-0.297	-0.510	-0.065	-0.097	-0.586	-0.218
12	france	-0.308	-0.232	-0.268	-0.247	-0.207	-0.256	-0.045
3	belgium	-0.254	-0.126	-0.244	-0.271	-0.090	-0.151	-0.010
26	netherlands	-0.125	-0.053	-0.140	-0.280	-0.189	-0.093	-0.136
13	germany	-0.206	-0.167	-0.186	-0.106	-0.018	-0.168	0.134
28	norway	-0.188	-0.063	-0.236	-0.231	-0.135	-0.159	-0.226
38	united kingdom	-0.248	-0.150	-0.244	-0.349	-0.180	0.032	-0.150
20	italy	-0.332	-0.209	-0.340	-0.204	-0.126	-0.265	0.130

Figure 12 Part of CONCOR Blockmodel for Multinetworks (non-normalized on left and normalized on right)

Discussion

The results of this study are represented in two main ways: a block model partition and density matrix (found in the results section and appendix). The block model partition helps determine which countries are subset together based on the equivalence in their trading pattern. While the density matrix is a quick way to visualize how the partitions relate to each other. A density matrix "is a matrix that has positions rather than individual actors as its rows and columns, and the values in the matrix are the proportion of "choices" that are present from the actors in the row position to the actors in the column position" (Faust and Wasserman 13). With these results, it is possible to evaluate if the countries still form the core-periphery pattern and which countries form the core.

When the results of the benchmark study of 1972 data are compared with Breiger's results (included in the appendix), it is evident the results are not identical. For instance, the normalized block model from the combined networks in this study groups UK with USA, Canada and Japan while Breiger's study groups UK with Australia. The differences in subsets of partition can be observed in Figure 4 and Figure 34. This pattern is evident in other results obtained for binarized trade networks as well as density matrix: the nations are partitioned in a similar manner but not the same.

The reasons for these differences could be the choice of data or an unintentional difference in methodology from Breiger's original work. For instance, in this study, the network of trade exchanges is created using import data to address discrepancies in values but Breiger might have used another approach that is not explicitly stated in his paper, leading to differences in outcome. Additionally, this study utilizes UCINET's generation of correlation matrix and normalization, that could be different from the steps employed by Breiger, leading to discrepancies in calculation.

Although the resulting nations are not identical from Breiger's work and this study, the methodology applied in this benchmark analysis is deemed credible because there are limited number of countries that are partitioned differently and the density matrix for manufactured goods (Figure 3), follows a similar pattern to the mean value trade within and between blocks in Breiger's analysis (Figure 34). As seen in Figure 13, the block model image of binarized manufacturing network in 1972, the nations in core have extensive trade among themselves compared to the ones on the outside. The missing piece of information from this image is the distinction that emerges from including the values that are exports only. Nonetheless, given that the benchmark analysis indicates an existence of core-periphery pattern in density matrices and produces similar nations in core, the methodology and data is used to explore the recent data.

Overall, in the recent years (2007, 2008, 2013 and 2018), with a few exceptions, the density matrix and block model partitions for binarized trade networks follow a similar trend as 1972. Most of the trade is concentrated in the top and left of the matrix. That is, countries in those blocks trade extensively in import and export. This includes countries like USA, Japan, UK, Germany and some other western European countries. In addition, consistently and as expected, China is a part of the countries that extensively trade. The binarized networks for each of the trade exchanges (manufacturing goods, agricultural products, raw materials and energy products) mostly exhibit a similar core-periphery pattern in all recent years, except some such as manufactured goods in 2007/2008 and agricultural products in 2007/2008 have heavy trading in the 3rd and 4th blocks in the bottom right corner. Even in this case, the heavy trading countries are the same.

Before extending the study from individual trade networks to multinetwork analysis, the correlation among trade networks is tested. The results in figure 2, show that correlation varies from 22% to 75%. Therefore, overall, they are networks with different information contained but

a single partition can be derived by correlating the matrices and applying CONCOR block model. Based on 1972 results, it can be noticed that normalized data is more revealing and consistent with Breiger's results and hence it is the prime choice for block partition results. The four-block partition for normalized, multinetwork data reveals groupings that are consistently geographically aligned. That is, most of dominant western European economies in one group, a large partition of other European countries and New Zealand and the rest splitting Asian and South American economies trading with major players like United States and Germany.

In these results, the temporal effect of changing global economy is evident. Even though no block model partitions are identical, countries partitioned in 2007 and 2008 are similar and later years 2013 and 2018 are similar. From 2007/2008 to 2013/2018, the blocks still cluster European nations but cluster with USA is reduced and concentrated with South American economies while Asian economies are partitioned into separate groups. Nonetheless, the effect of structural patterns in nation and the geographical and cultural homophily determining that, is evident.

While the partition of countries seems plausible and reinforce the initial hypothesis, the resulting density matrix does not. The density matrix of the normalized, multinetwork (Figure 33) look like the ideal type pattern for separate trading areas (Breiger 358). This is not expected and seems unlikely. The strength of trade among some partitions will no doubt be stronger but on the whole, the world even today does not operate in such a fashion. This discrepancy is likely due to an error in applying the method or incompleteness of data that should be reevaluated.

Even with the anomalies in the density matrix of multinetwork analysis, the repeated patterns in block model partition and density matrix for individual networks, confirm the existence of a core-periphery pattern and transformation in the nations that form the core.

Conclusion

Through meticulous review of block model approach for studying world systems theory and application of Ronald Breiger's methodology to identify positions of OECD nations in world systems, this study evaluates the world system in the recent times. From the results, it is evident that the world system theory's pattern of core and periphery nations is still prevalent, even if the participating countries have changed. Emerging economies like China are consistently clustered with other dominant economies. The results of temporal analysis over a decade, indicate hints of the global economic transitions due to events like stock market crash of 2008 or Brexit in 2016. While the strength of block models to quantify a widely accepted theory is undeniable, it is also true that a complete picture of world system theory or any sociological phenomenon is incomplete without strong theoretical reasoning and historical background. A multilevel analysis that exhibits understanding of individual nations, an application of block models for global patterns over time and a dynamic historical background would create robust analysis and results.

Though this study serves as a starting point for analyzing world system theory in the current times, it can be improved and enhanced. While the selected trade exchanges are still a major commodities in international markets, economic dominance in today's knowledge economy cannot truly be evaluated without the role of information control, intellectual transfers and financial markets. A study that includes measures such as capital investments, patents held and source of technical innovation and transfer of technical talent, would paint a richer picture of nations' position in world system. Additionally, this replication study should be repeated with variation in data source as well as processing to include export, re-import and re-export, to address the discrepancies noted earlier. To allow reproducibility and expansion of study, the data, documents as well as log files from UCINET are available here.

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Appendix

Table 2 Complete List of Countries in Consideration

INCLUDED BY BREIGER	COUNTRY	YEAR OF ACCESSION
*	**AUSTRIA**	1961
*	**BELGIUM**	1961
*	**CANADA**	1961
*	**DENMARK**	1961
*	**FRANCE**	1961
*	**GERMANY**	1961
*	**GREECE**	1961
*	**ICELAND**	1961
*	**IRELAND**	1961
*	**LUXEMBOURG**	1961
*	**NETHERLANDS**	1961
*	**NORWAY**	1961
*	**PORTUGAL**	1961
*	**SPAIN**	1961
*	**SWEDEN**	1961
*	**SWITZERLAND**	1961
*	**TURKEY**	1961
*	**UNITED KINGDOM**	1961
*	**UNITED STATES**	1961
*	**ITALY**	1962
*	**JAPAN**	1964
*	**FINLAND**	1969
*	**AUSTRALIA**	1971
	NEW ZEALAND	1973
	MEXICO	1994
	CZECHIA	1995
	HUNGARY	1996
	KOREA	1996
	POLAND	1996
	SLOVAKIA	2000
	CHILE	2010
	ESTONIA	2010
*	ISRAEL	2010
	SLOVENIA	2010
	LATVIA	2016
	LITHUANIA	2018
	BRAZIL	Not OECD
	CHINA	Not OECD
	INDIA	Not OECD

1972: Binarized for each trade networks

1	australia		1			
23	usa		1 1 1			
4	canada	1				
14	japan	1 1	1			
13	italy	1				
3	belgium-luxembourg			1 1		
15	netherlands			1 1 1 1		
8	germany	1	1	1 1 1 1		
22	united kingdom			1	1	
7	france		1	1 1	1	
11	ireland					
20	switzerland					
16	norway			1		
19	sweden			1		
6	finland					
12	israel					
9	greece					
5	denmark					
18	spain					
2	austria					
21	turkey					
10	iceland					
17	portugal					
24	yugoslavia					

Figure 13 CONCOR Block Model for Manufactured Goods - 1972

1	australia		1			
23	usa	1	1	1	1	
4	canada	1	1 1			
14	japan	1 1 1				
22	united kingdom	1			1	
16	norway	1				
3	belgium-luxembourg				1	
8	germany	1		1	1 1 1	
13	italy	1		1	1	
15	netherlands	1		1		
7	france			1 1 1		
19	sweden		1			
6	finland					
5	denmark					
12	israel					
2	austria					
9	greece					
17	portugal					
18	spain					
20	switzerland					
21	turkey					
10	iceland					
11	ireland					
24	yugoslavia					

Figure 14 CONCOR Block Model for Raw Materials - 1972

1	australia		1	1				
14	japan	1		1				
4	canada			1				
23	usa	1	1	1		1		
5	denmark						1	
11	ireland						1	
3	belgium-luxembourg				1	1	1	
15	netherlands			1		1	1	
13	italy					1	1	
7	france			1	1	1		1
8	germany			1	1	1	1	
22	united kingdom		1	1				
6	finland							
12	israel							
9	greece							
16	norway							
2	austria							
18	spain							
19	sweden							
20	switzerland							
21	turkey							
10	iceland							
17	portugal							
24	yugoslavia							

Figure 15 CONCOR Block Model for Agriculture Products – 1972

1	australia							
5	denmark							
9	greece							
10	iceland							
11	ireland							
6	finland							
17	portugal							
21	turkey							
12	israel							
18	spain							
24	yugoslavia							
7	france			1		1		1
13	italy		1					1
2	austria							1
20	switzerland							
3	belgium-luxembourg		1		1	1		1
15	netherlands				1			1
16	norway						1	1 1
23	usa						1 1 1	1
4	canada					1		
22	united kingdom					1		
14	japan					1		
19	sweden							
8	germany		1 1 1 1 1 1			1		

Figure 16 CONCOR Block Model for Energy Products – 1972

2018: Binarized for each trade networks

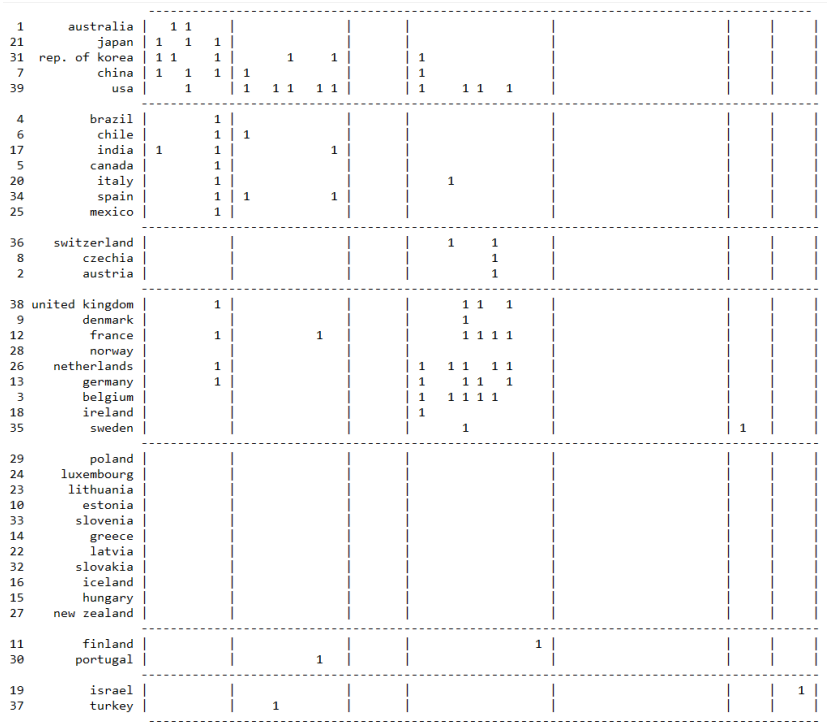


Figure 17 CONCOR Block Model for Manufacturing – 2018

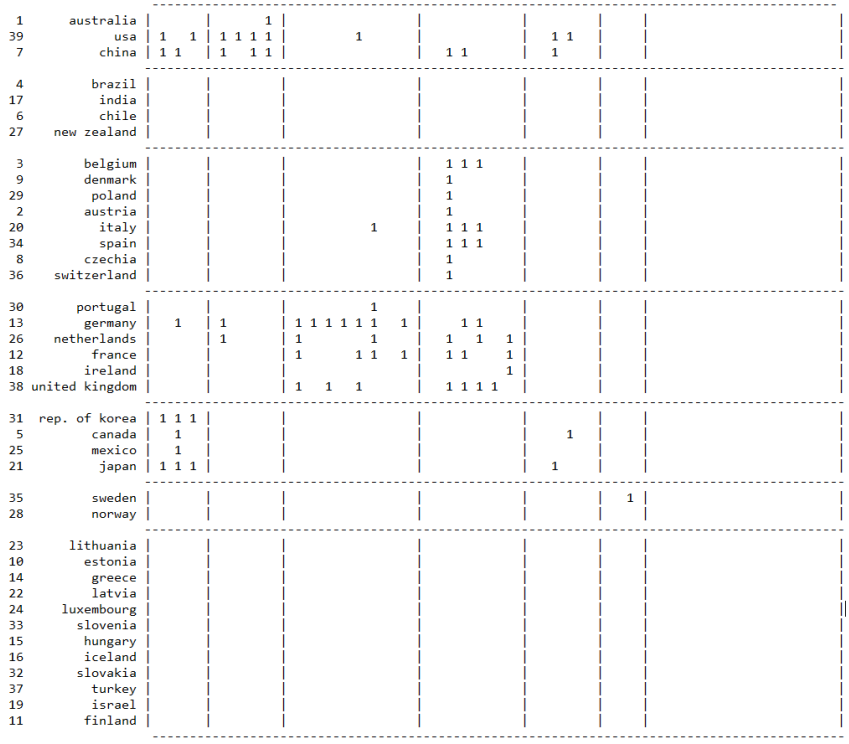


Figure 18 CONCOR Block Model for Agriculture Products – 2018

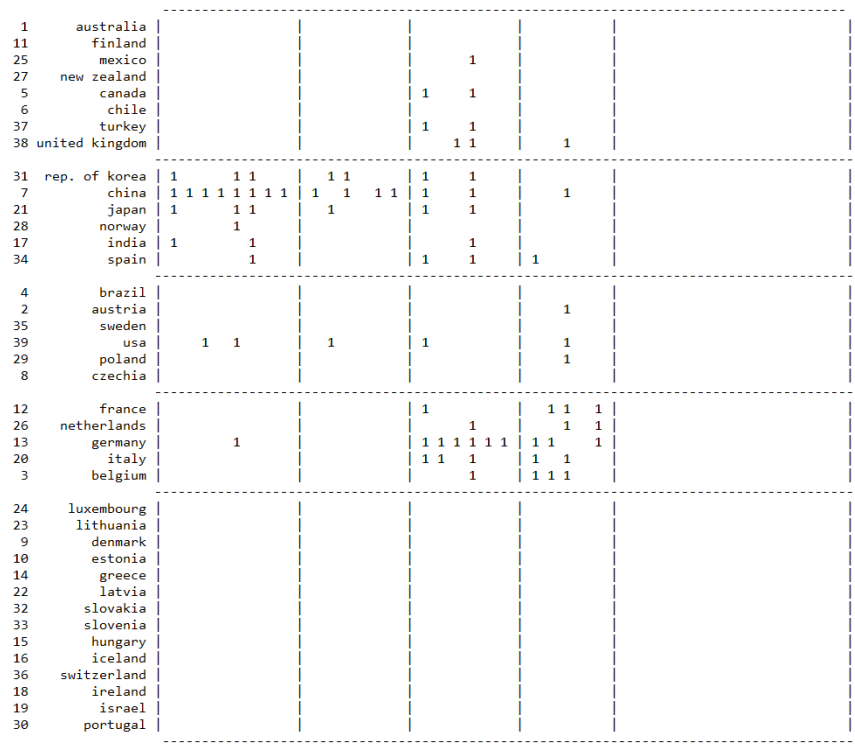


Figure 19 CONCOR Block Model for Raw Materials – 2018

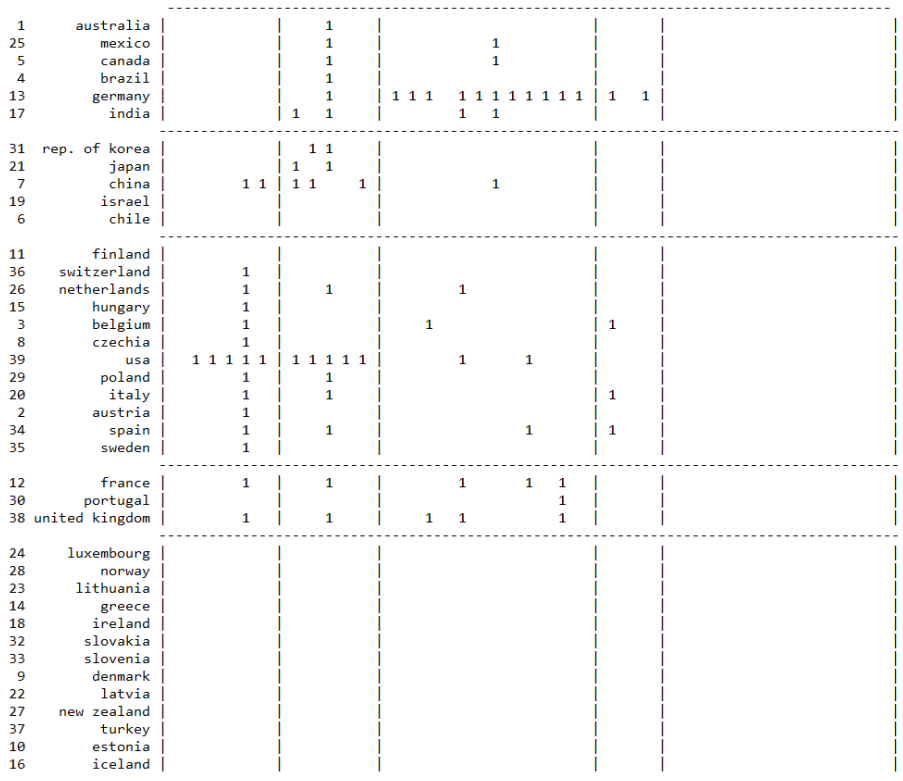


Figure 20 CONCOR Block Model for Energy Products – 2018

2008: Binarized for each trade networks

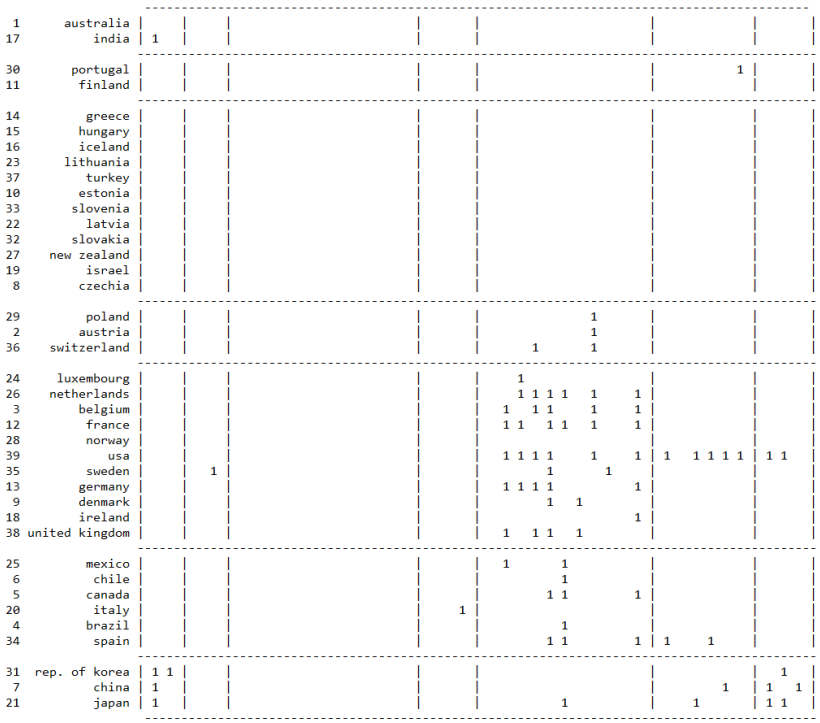


Figure 21 CONCOR Block Model for Manufacturing – 2008

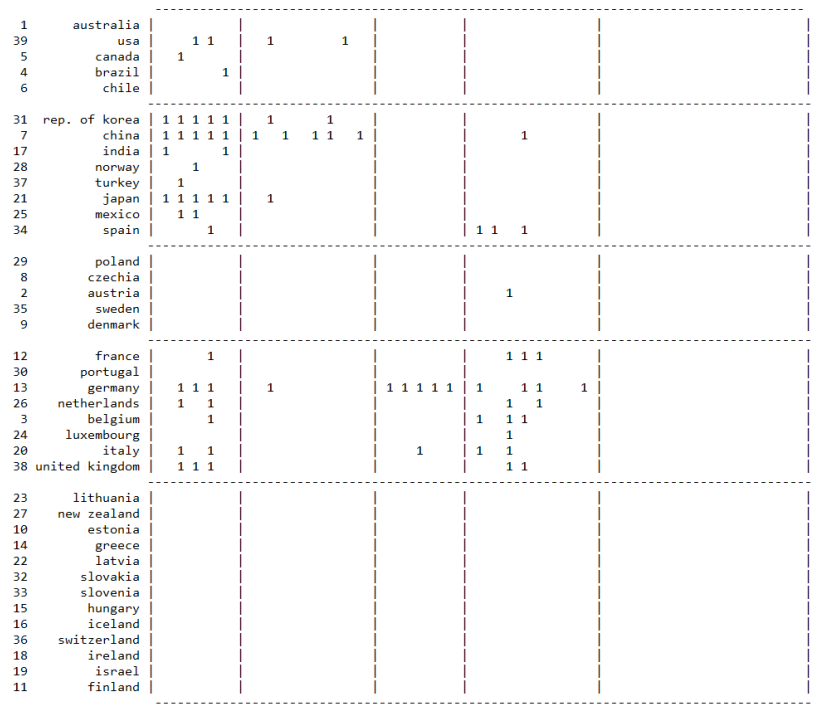


Figure 22 CONCOR Block Model for Raw Materials - 2008

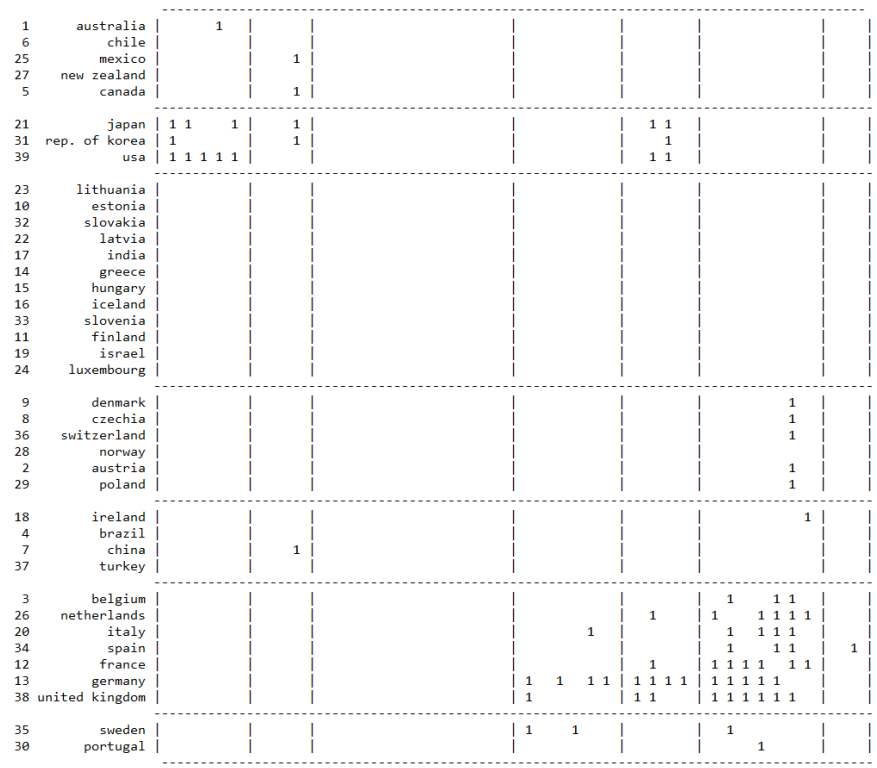


Figure 23 CONCOR Block Model for Agricultural Products – 2008

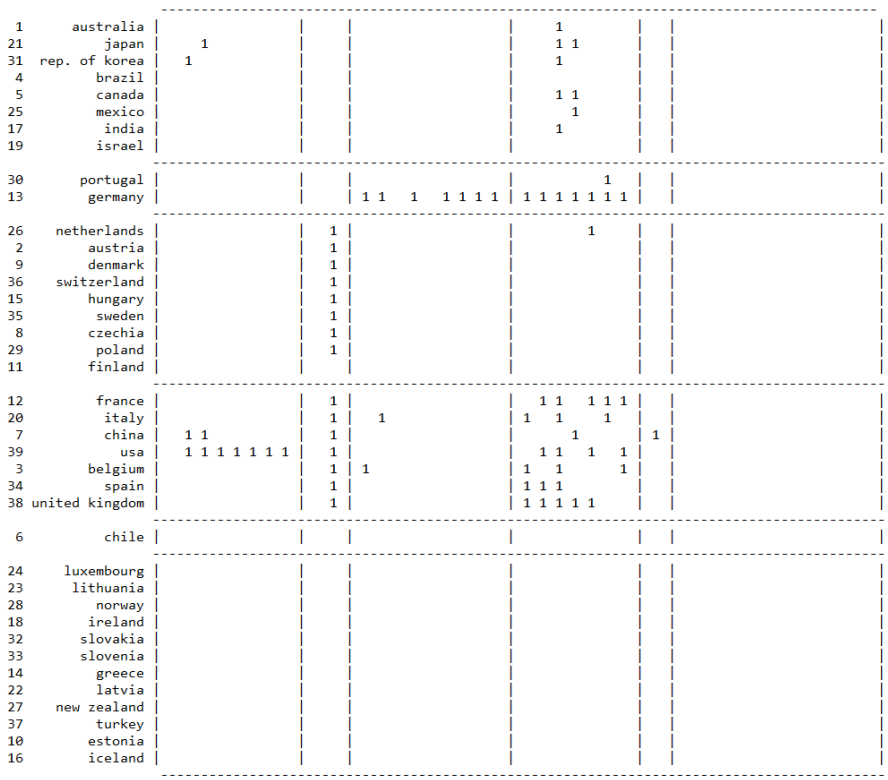


Figure 24 CONCOR Block Model for Energy Products – 2008

2007: Binarized for each trade networks

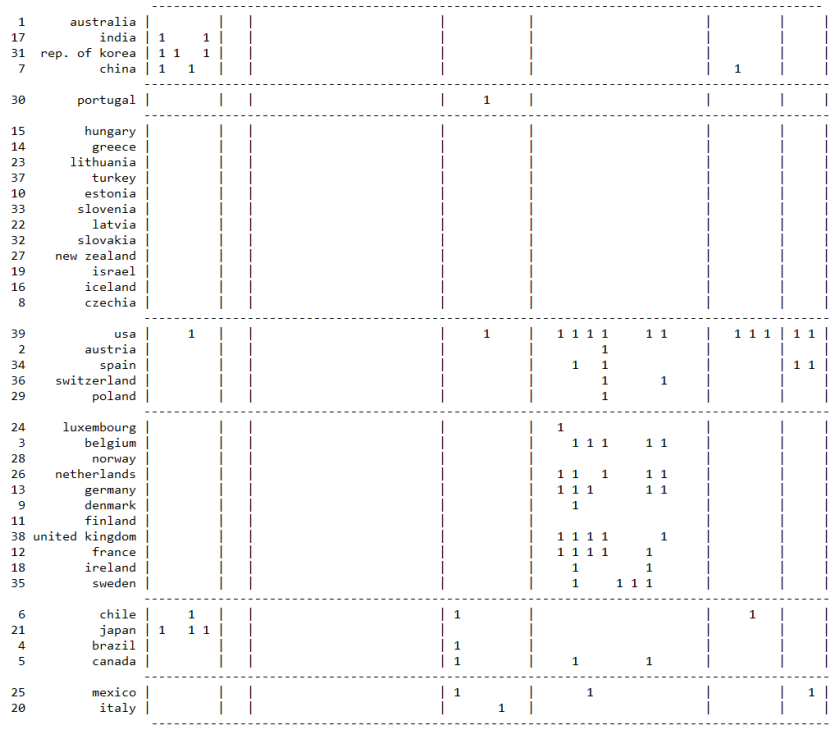


Figure 25 CONCOR Block Model for Manufacturing – 2007

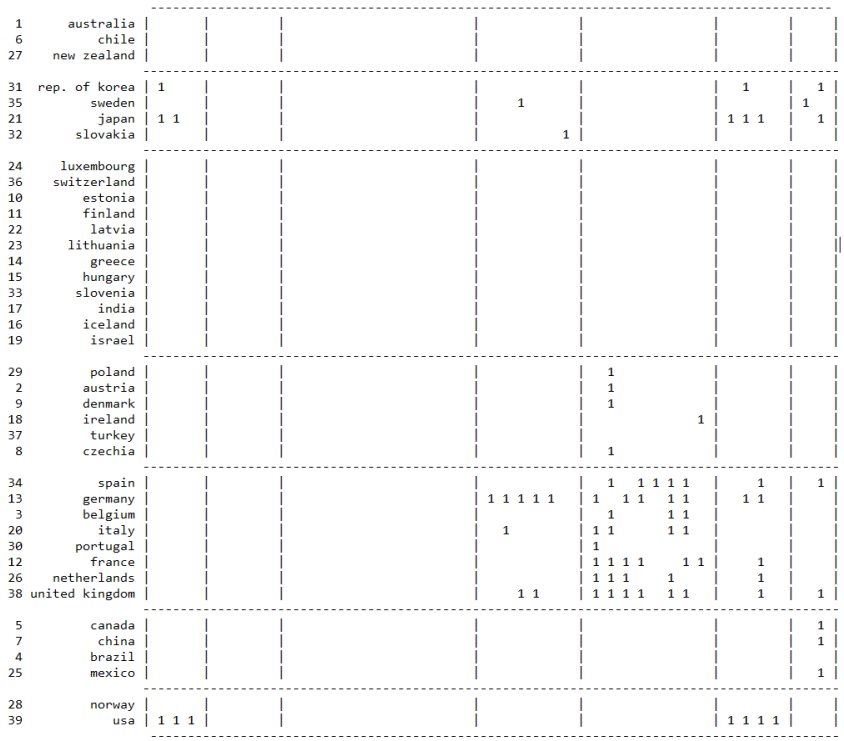


Figure 26 CONCOR Block Model for Agriculture Products – 2007

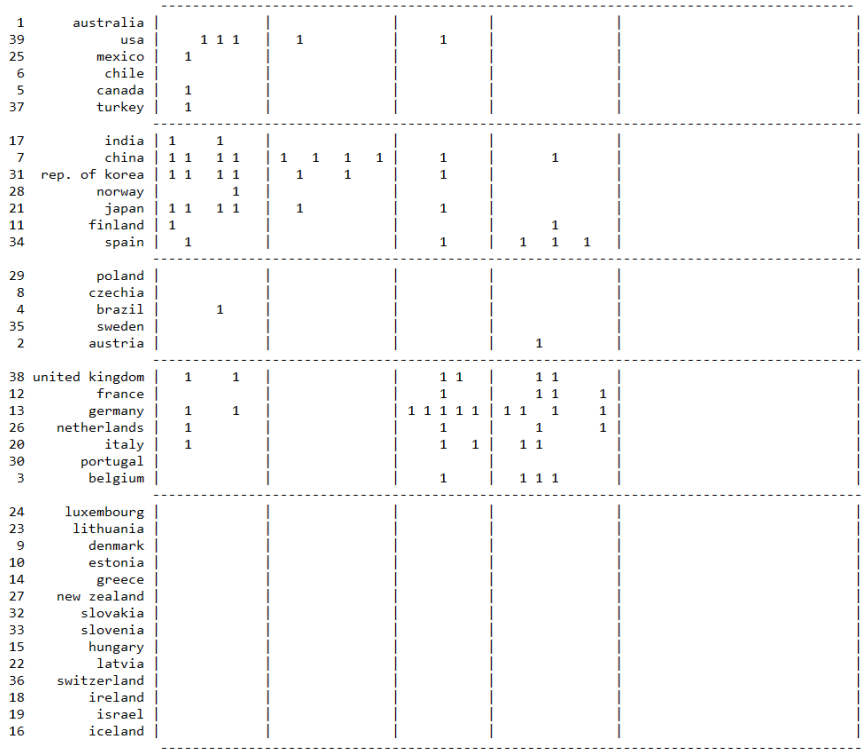


Figure 27 CONCOR Block Model for Raw Materials – 2007

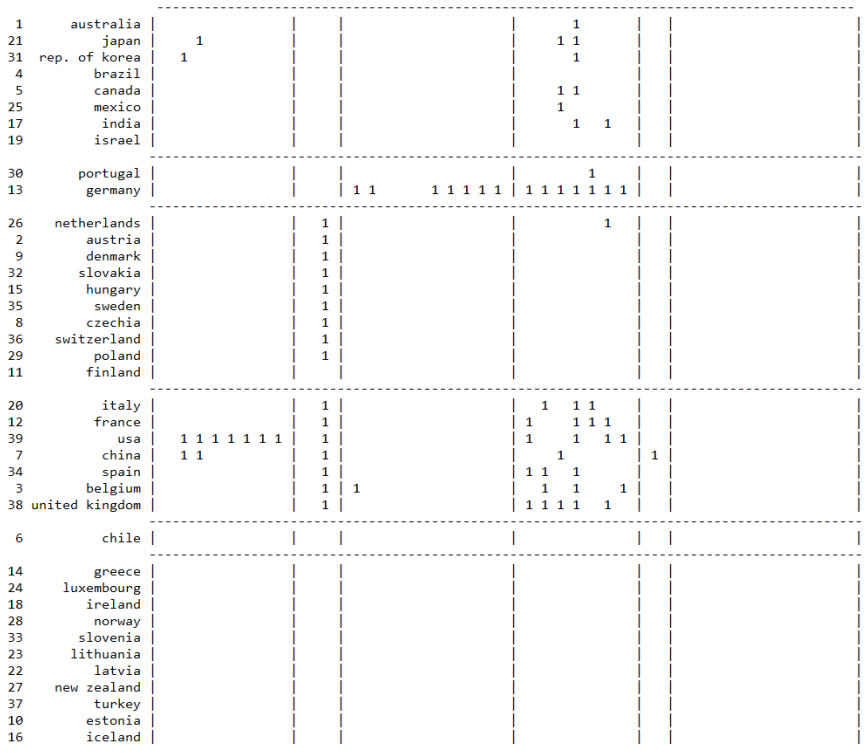


Figure 28 CONCOR Block Model for Energy Products – 2007

2013: Binarized for each trade networks

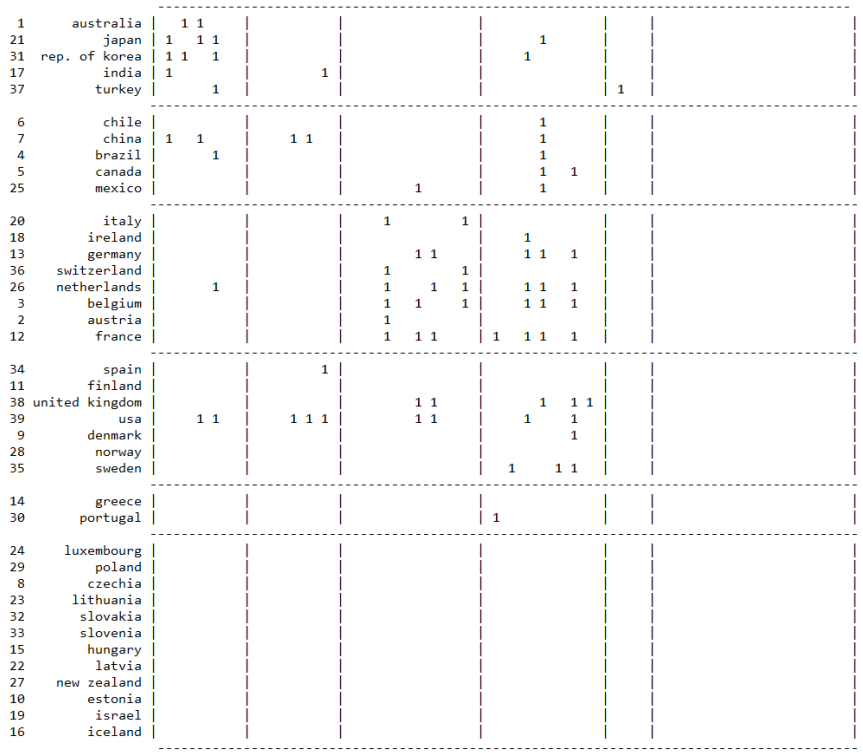


Figure 29 CONCOR Block Model for Manufacturing – 2013

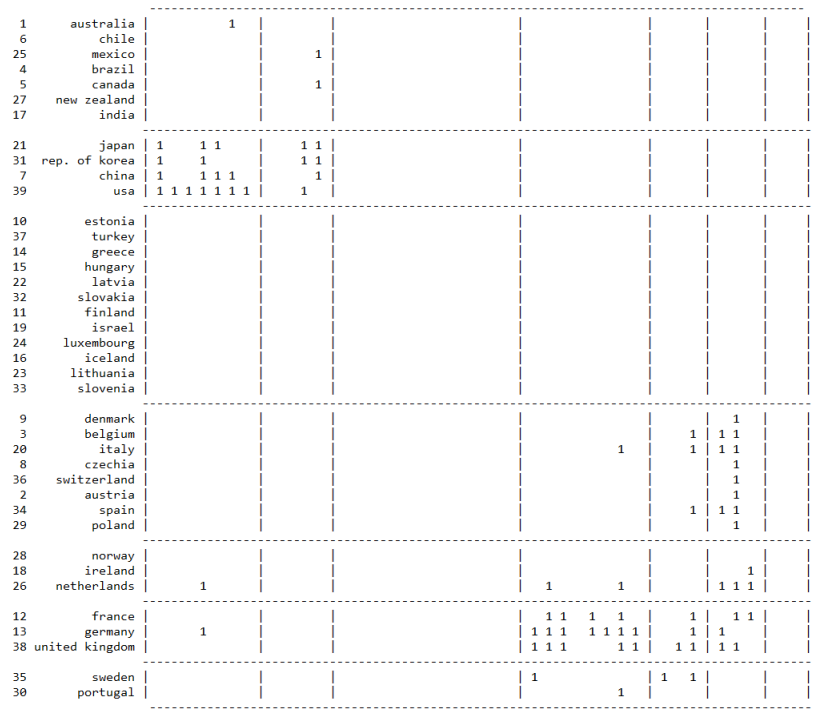


Figure 30 CONCOR Block Model for Agriculture Products – 2013

```
                  -----------------------------------------------------------------------------------------
 1      australia |                 |               |             |         |                             |
11        finland |                 |               |             |         |                             |
25         mexico |                 |               |   1         |         |                             |
27    new zealand |                 |               |             |         |                             |
 5         canada |                 |               |   1         |         |                             |
 6          chile |                 |               |             |         |                             |
37         turkey |                 |               |   1         |         |                             |
17          india | 1         1     |               |   1         |         |                             |
                  -----------------------------------------------------------------------------------------
 7          china | 1 1 1 1 1 1 1 1 |   1 1   1   1 | 1 1         |   1   1 |                             |
38 united kingdom |         1       |               | 1 1     1   |   1   1 |                             |
31  rep. of korea | 1         1     | 1       1     | 1 1         |         |                             |
20          italy |                 |               | 1 1 1       | 1     1 |                             |
21          japan | 1       1 1     | 1             | 1 1         |         |                             |
28         norway |         1       |               |             |         |                             |
34          spain |           1     |               | 1           | 1       |                             |
                  -----------------------------------------------------------------------------------------
 4         brazil |                 |               |             |         |                             |
39            usa       1   1     1 | 1             | 1           |         |                             |
 2        austria |                 |               |             |       1 |                             |
29         poland |                 |               |             |         |                             |
35         sweden |                 |               |             |         |                             |
 8        czechia |                 |               |             |         |                             |
                  -----------------------------------------------------------------------------------------
12         france |                 |               | 1           |   1 1 1 |                             |
26    netherlands |                 |               |   1         |     1 1 |                             |
 3        belgium | 1               |               |   1         | 1 1   1 |                             |
13        germany |         1       |               | 1 1 1 1 1 1 | 1 1 1   |                             |
                  -----------------------------------------------------------------------------------------
24     luxembourg |                 |               |             |         |                             |
23      lithuania |                 |               |             |         |                             |
 9        denmark |                 |               |             |         |                             |
10        estonia |                 |               |             |         |                             |
14         greece |                 |               |             |         |                             |
22         latvia |                 |               |             |         |                             |
32       slovakia |                 |               |             |         |                             |
33       slovenia |                 |               |             |         |                             |
15        hungary |                 |               |             |         |                             |
16        iceland |                 |               |             |         |                             |
36    switzerland |                 |               |             |         |                             |
18        ireland |                 |               |             |         |                             |
19         israel |                 |               |             |         |                             |
30       portugal |                 |               |             |         |                             |
                  -----------------------------------------------------------------------------------------
```

Figure 31 CONCOR Block Model for Raw Materials – 2013

```
                  ------------------------------------------------------------------------------------------
 1      australia |           |             |                   |       1     |   |                         |
25         mexico |           |             |                   |       1   1 |   |                         |
 5         canada |           |             |                   |       1   1 |   |                         |
 4         brazil |           |             |                   |       1     |   |                         |
37         turkey |           |             |                   |       1     |   |                         |
                  ------------------------------------------------------------------------------------------
21          japan |           |   1         |                   |       1   1 |   |                         |
31  rep. of korea |           | 1           |                   |       1     |   |                         |
17          india |           |             |                   |     1 1     |   |                         |
 6          chile |           |             |                   |             |   |                         |
19         israel |           |             |                   |             |   |                         |
13        germany |           |             | 1 1 1   1 1 1 1 1 | 1 1 1 1 1 1 |   |                         |
                  ------------------------------------------------------------------------------------------
 2        austria |           |           1 |                   |             |   |                         |
11        finland |           |             |                   |             |   |                         |
36    switzerland |           |           1 |                   |             |   |                         |
15        hungary |           |           1 |                   |             |   |                         |
26    netherlands |           |           1 |                   |     1       |   |                         |
 8        czechia |           |           1 |                   |             |   |                         |
34          spain |           |           1 |                   | 1 1         |   |                         |
29         poland |           |           1 |                   |             |   |                         |
35         sweden |           |           1 |                   |             |   |                         |
                  ------------------------------------------------------------------------------------------
20          italy |           |           1 |                   |   1   1     |   |                         |
12         france |           |           1 |             1     | 1   1 1     |   |                         |
 3        belgium |           |           1 |         1         |   1   1 1   |   |                         |
 7          china |           | 1 1 1 1   1 |                   |           1 |   |                         |
38 united kingdom |           |           1 |                   | 1 1 1 1   1 |   |                         |
39            usa |   1 1 1   | 1 1 1 1 1 1 |                   | 1   1 1     |   |                         |
                  ------------------------------------------------------------------------------------------
30       portugal |           |             |             1     |             |   |                         |
                  ------------------------------------------------------------------------------------------
24     luxembourg |           |             |                   |             |   |                         |
23      lithuania |           |             |                   |             |   |                         |
28         norway |           |             |                   |             |   |                         |
 9        denmark |           |             |                   |             |   |                         |
32       slovakia |           |             |                   |             |   |                         |
33       slovenia |           |             |                   |             |   |                         |
14         greece |           |             |                   |             |   |                         |
22         latvia |           |             |                   |             |   |                         |
27    new zealand |           |             |                   |             |   |                         |
18        ireland |           |             |                   |             |   |                         |
10        estonia |           |             |                   |             |   |                         |
16        iceland |           |             |                   |             |   |                         |
                  ------------------------------------------------------------------------------------------
```

Figure 32 CONCOR Block Model for Energy Products – 2013

Density Matrix for All Networks for All Years

Density Matrix for all networks in 1972				
	1	2	3	4
1	0.383	0.289	0.233	0.357
2	0.289	0.878	0.186	0.158
3	0.233	0.186	0.579	0.398
4	0.357	0.158	0.398	0.499

Density Matrix for all networks in 1972 (Normalized)				
	1	2	3	4
1	0.771	0.438	-0.445	-0.231
2	0.438	0.488	-0.114	-0.302
3	-0.445	-0.114	0.392	-0.125
4	-0.231	-0.302	-0.125	0.159

Density Matrix for all networks in 2018				
	1	2	3	4
1	0.455	0.17	0.036	-0.003
2	0.17	0.543	0.163	0.02
3	0.036	0.163	0.477	0.139
4	-0.003	0.02	0.139	0.155

Density Matrix for all networks in 2018 (Normalized)				
	1	2	3	4
1	0.268	-0.015	-0.251	-0.257
2	-0.015	0.26	-0.15	-0.312
3	-0.251	-0.15	0.345	0.192
4	-0.257	-0.312	0.192	0.702

Density Matrix for all networks in 2008				
	1	2	3	4
1	0.351	0.208	0.076	-0.011
2	0.208	0.527	0.13	0.12
3	0.076	0.13	0.478	0.149
4	-0.011	0.12	0.149	0.257

Density Matrix for all networks in 2008 (Normalized)				
	1	2	3	4
1	0.131	-0.122	-0.184	-0.256
2	-0.122	0.206	0.167	-0.129
3	-0.184	0.167	0.198	0.106
4	-0.256	-0.129	0.106	0.629

Density Matrix for all networks in 2007				
	1	2	3	4
1	0.377	0.267	0.105	-0.014
2	0.267	0.5	0.148	0.052
3	0.105	0.148	0.482	0.154
4	-0.014	0.052	0.154	0.336

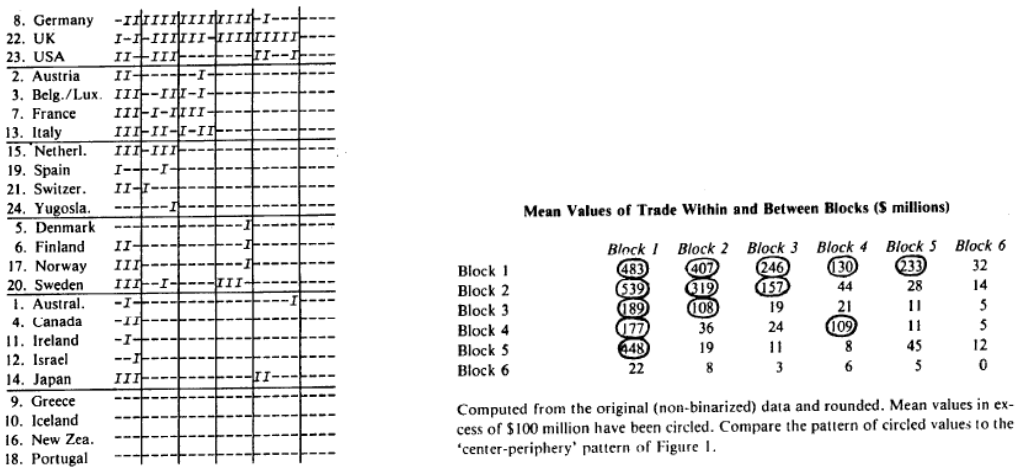
Density Matrix for all networks in 2007 (Normalized)				
	1	2	3	4
1	0.139	-0.136	-0.246	-0.219
2	-0.136	0.236	0.131	-0.172
3	-0.246	0.131	0.338	0.284
4	-0.219	-0.172	0.284	0.681

Density Matrix for all networks in 2013				
	1	2	3	4
1	0.485	0.187	0.044	-0.01
2	0.187	0.485	0.125	0.057
3	0.044	0.125	0.46	0.152
4	-0.01	0.057	0.152	0.29

Density Matrix for all networks in 2013 (Normalized)				
	1	2	3	4
1	0.411	-0.005	-0.257	-0.215
2	-0.005	0.272	-0.299	-0.128
3	-0.257	-0.299	0.7	0.043
4	-0.215	-0.128	0.043	0.211

Figure 33 Density Networks for Multinetwork Analysis with top 10% highlighted

Breiger's Results



8. Germany	-II	III	III	III	III	I-	----
22. UK	I-I	-III	III	III-	III	IIII	----
23. USA	II-	-III	---	---	---	II--	I---
2. Austria	II-	---	---	-I-	---	---	----
3. Belg./Lux.	III	--II	I-I	---	---	---	----
7. France	III	-I-I	III	---	---	---	----
13. Italy	III	-II-	I-II	---	---	---	----
15. Netherl.	III	-III	---	---	---	---	----
19. Spain	I--	--I	---	---	---	---	----
21. Switzer.	II-	I---	---	---	---	---	----
24. Yugosla.	---	-I--	---	---	---	---	----
5. Denmark	---	---	---	---	-I-	---	----
6. Finland	II-	---	---	---	--I	---	----
17. Norway	III	---	---	---	-I-	---	----
20. Sweden	III	--I	---	-III	---	---	----
1. Austral.	-I-	---	---	---	---	---	I---
4. Canada	-II	---	---	---	---	---	----
11. Ireland	-I-	---	---	---	---	---	----
12. Israel	--I	---	---	---	---	---	----
14. Japan	III	---	---	---	II-	---	----
9. Greece	---	---	---	---	---	---	----
10. Iceland	---	---	---	---	---	---	----
16. New Zea.	---	---	---	---	---	---	----
18. Portugal	---	---	---	---	---	---	----

Mean Values of Trade Within and Between Blocks ($ millions)

	Block 1	*Block 2*	*Block 3*	*Block 4*	*Block 5*	*Block 6*
Block 1	(483)	(407)	(246)	(130)	(233)	32
Block 2	(539)	(319)	(157)	44	28	14
Block 3	(189)	(108)	19	21	11	5
Block 4	(177)	36	24	(109)	11	5
Block 5	(448)	19	11	8	45	12
Block 6	22	8	3	6	5	0

Computed from the original (non-binarized) data and rounded. Mean values in excess of $100 million have been circled. Compare the pattern of circled values to the 'center-periphery' pattern of Figure 1.

Figure 34 Results of Binarized Manufacture Network Data by Breiger

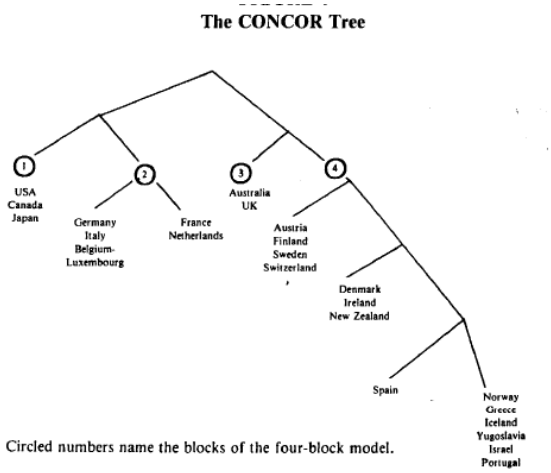


Figure 35 Concor Tree From Breiger's Result

TABLE 2
Correlations among the Trade Matrices Employed in this Study*

	Agricultural products	Raw materials	Manufactured goods	Energy resources
Agricultural products	1.000	0.579	0.591	0.470
Raw materials		1.000	0.524	0.661
Manufactured goods			1.000	0.584
Energy resources				1.000

Figure 36 Correlations Matrix from Breiger's Study