Network Analysis

Nation's Position in International System: Block Model Approach

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Objective & Agenda

Purpose: To model a study after Ronald Breiger's work on "Structures of Economic Interdependence Among Nations" from the book, Continuities in Structural Inquiry for understanding network analysis for international trade.

Question: What is the positions of nations in the international system in 2008 and 2018 based on simultaneous exchange of different economic goods and CONCOR model?

Agenda

- Background & Theory
- Data
- Analysis
- Results
- Conclusions

Background

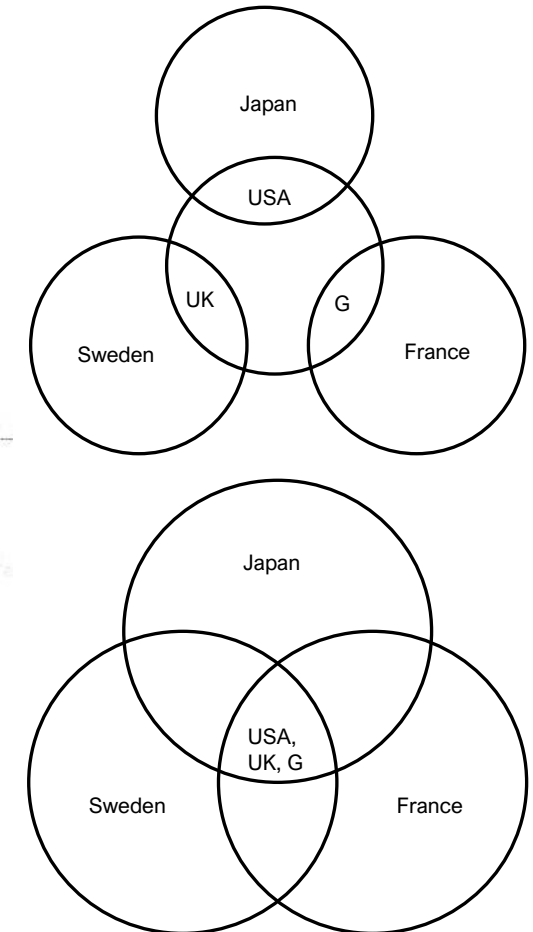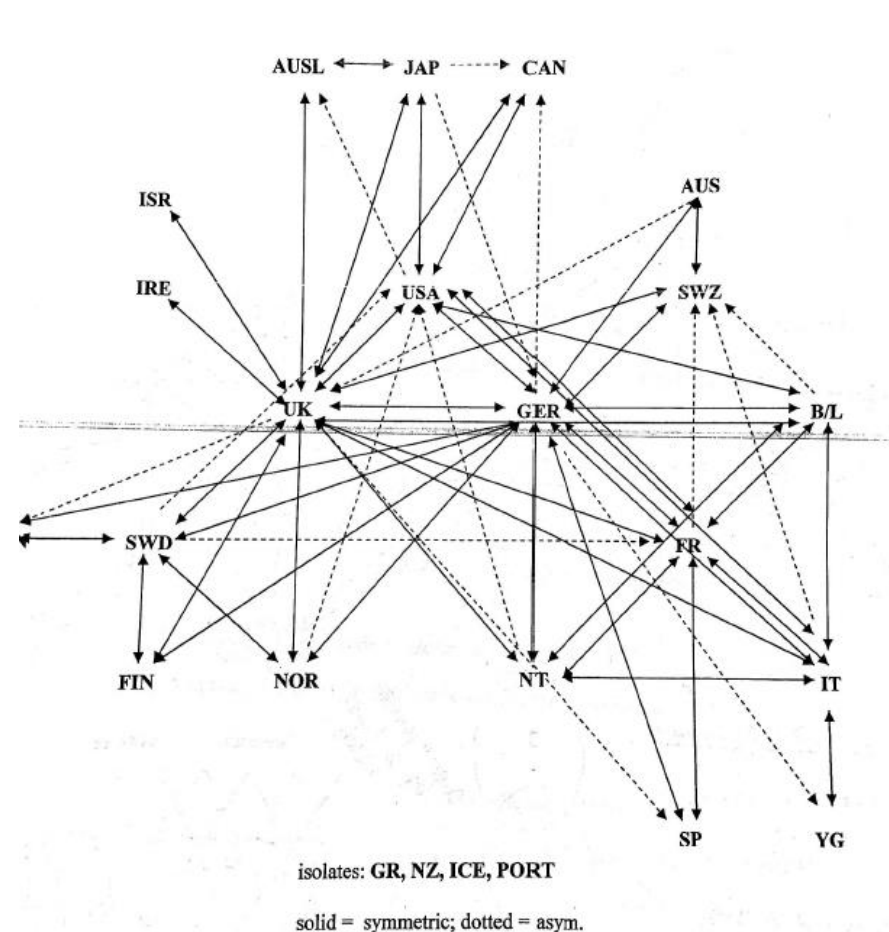Brieger (1981) studies is a structuralist perspective to patterns in world economy

Based on the World System Theory and trade data for OECD countries in 1972:

- Can a procedure for categorizing states among their myriad import and export arrangements be found?
- The author posits yes and tests his hypothesis against empirical data.
- The core/periphery structure of the system is found to have multiple competing centers rather than just one center as implied above

CONCOR block Modeling:

- Iterates correlations among columns of R
- Splits the matrix into two structural equivalence blocks

Resulting Network Diagram for 1971 OECD data [from Dr. Padgett's Notes]

isolates: **GR, NZ, ICE, PORT**

solid = symmetric; dotted = asym.

Data

- Data is collected from UN Comtrade Database

- The following data is downloaded:
  - Import/Export for same commodities that breiger considered for Year 2018 and 2008 for all countries in OECD + India, China, Brazil (ICB)
  - Goods trade for China for years: 2008 – 2010

- Data is processed using Pandas in python to:
  - Remove countries that are not in OECD or India, China Brazil
  - Create n by n adjacency matrix for countries for block modeling
  - Only consider 5th of the volume (In progress)
  - Create edgelist for China to conduct egocentric analysis of trade patterns (In-Progress)

Method
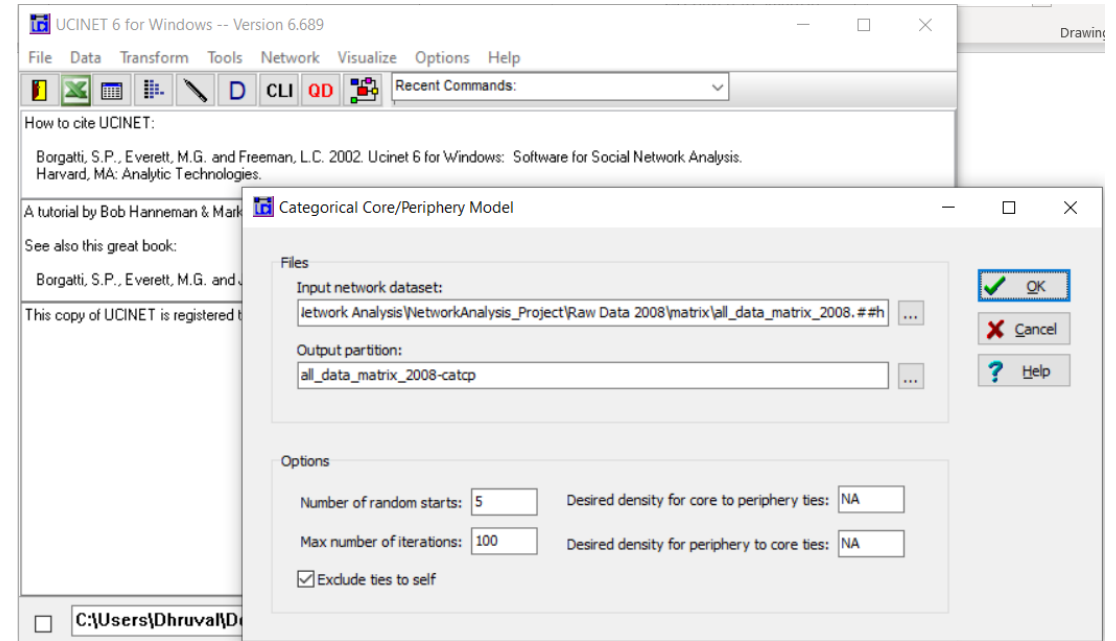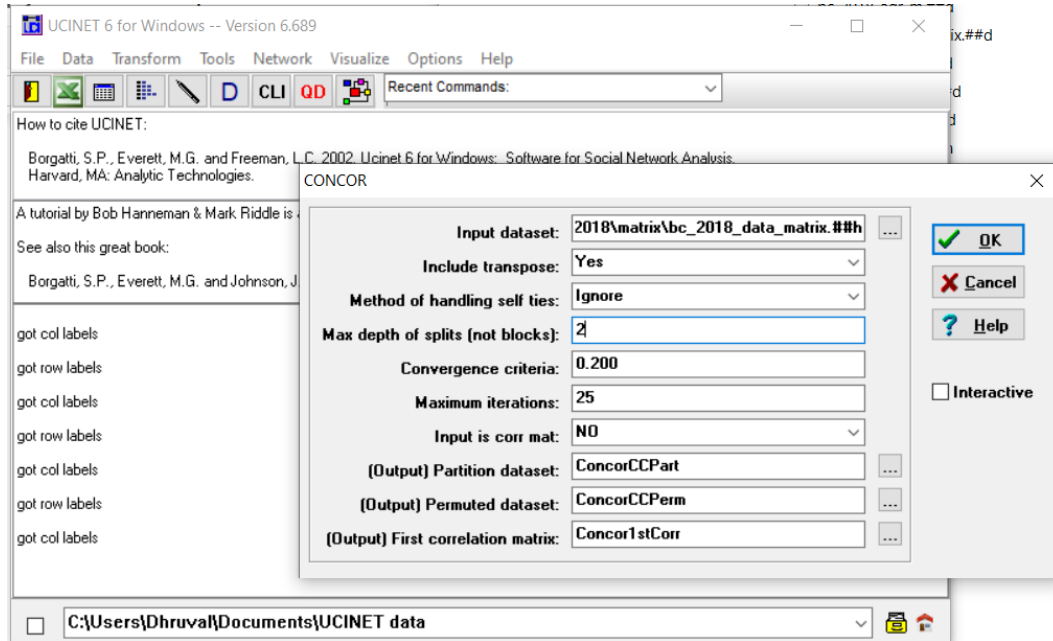
Using program **UCINET**:

- CONCOR
  - limiting the depth of split to 2

- Core/Periphery Analysis

CONCOR: 2018 Data for 1972 OECD + Israel

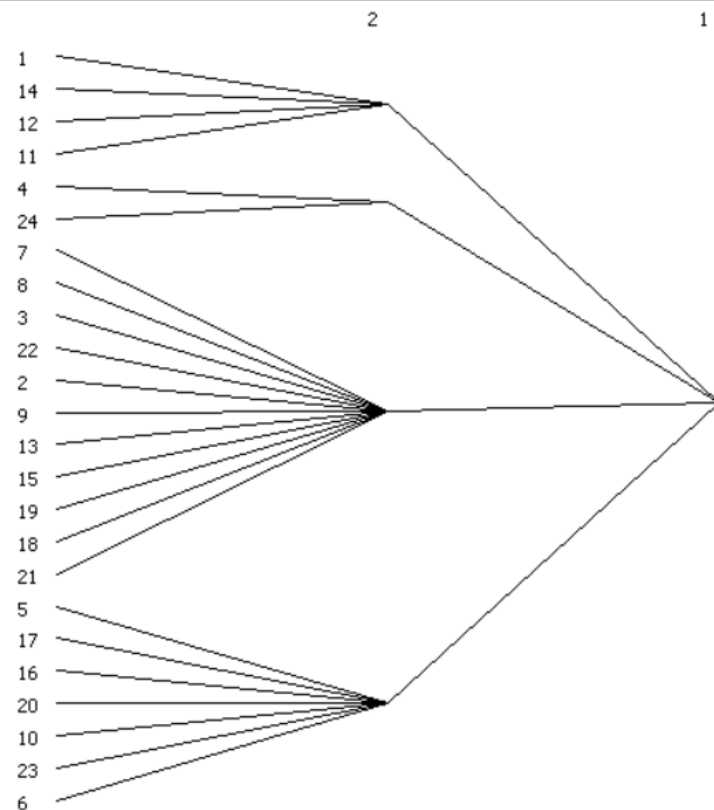|						
1	australia	517143520	41472475136	631045696	1161609472	2060144384
14	japan	59646631936			2938091776	6047730688	19211358208
12	israel	571129984	3335163904		649705984	916214976
11	ireland	879863168	5334209024	377094784	70829864	2023408640
4	canada	2685165824	21197805568	1222320768	2497953792	2919219968
24	usa	28129714176	191604031488	33920145408	52140269568	575672156160
7	france	3651415296	15572513792	2678894336	10093252608	5843280384
8	germany	12752945152	44450021376	6413764096	26476339200	15566739456
3	belgium	2886285056	13619223552	3567942912	25229668352	6265300480
22	turkey	1280508928	4188222464	4684969472	1446104320	2236483328
2	austria	1358326400	3828573440	534956480	854777536	1570255232
9	greece	183078848	544620096	1074166912	733261632	257336048
13	italy	4512708096	8555943424	3162352128	6218114560	4984014336
15	luxembourg	23624644	604707968	28520664	167011808	166746864
19	spain	2350244864	6791175680	2032211584	4684271616	3707242240
18	portugal	211164256	584211520	414812704	917471680	541422144
21	switzerland	2308312576	7515397632	1463145344	9782344704	4871078912
5	denmark	831463424	1563779712	176091984	1400130432	784888000
17	norway	420475712	2886533632	222427184	1784418176	2844134144
16	netherlands	4085283072	11158045696	3862992640	8474516992	5746094592
20	sweden	2062897152	3878992896	423710496	1985759232	1470085632
10	iceland	355025152	255473984	19430390	48738544	233950160
23	united kingdom	6021999616	18010421248	2223396608	36674502656	11296553984
6	finland	744819520	1815064320	258257088	602821056	1314556416

Core/Periphery fit (correlation) = 0.8631

Core/Periphery Class Memberships:

        Core: belgium france germany netherlands united kingdom usa
   Periphery: australia austria canada denmark finland greece iceland ireland israel italy japan luxembourg norway portugal spain sweden switzerland turkey

CONCOR: 2018 OECD + India, China, Brazil
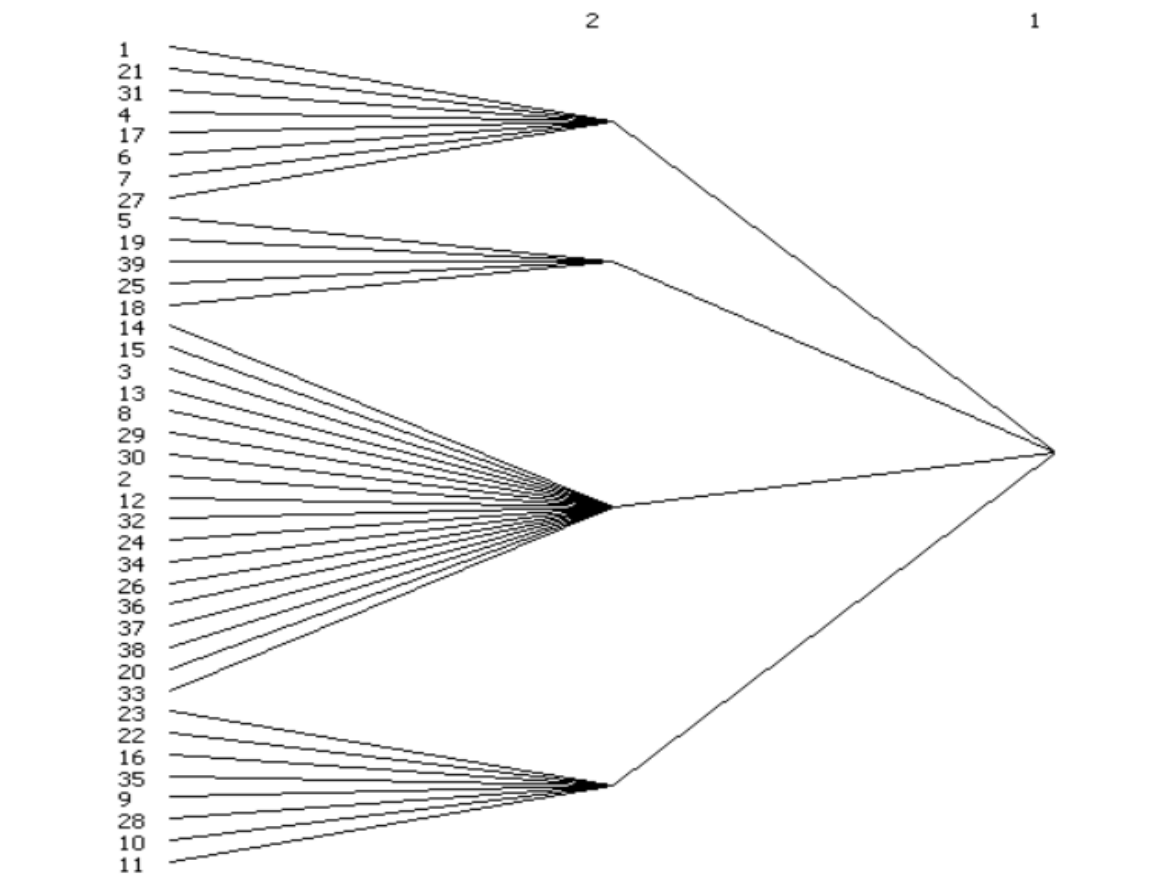
|						
1	australia	517143520	41472475136	23292854272	1640821888	13992464384
21	japan	59646631936		72515534848	10341156864	14755411968
31	rep. of korea	29888950272	75933458432		8380747776	20463589376
4	brazil	1521966464	8239423488	8519138304	7373501952	6340885504
17	india	16611989504	15816676352	20311908352	6956424704	
6	chile	449486176	9218666496	6113245696	9657931776	2126505472
7	china	127746924544	268858605568	279014866944	104194990080	85245026304
27	new zealand	9072730112	5218292224	3034972160	172828352	763382336
5	canada	2685165824	21197805568	11171569664	5507627520	6517892608
19	israel	571129984	3335163904	2056052992	1453035008	3729207040
39	usa	28129714176	191604031488	119812538368	60695597056	78736015360
25	mexico	1404957184	19105179648	16333260800	9732770816	6025734144
18	ireland	879863168	5334209024	1535017472	603322304	781918336
14	greece	183078848	544620096	1228811008	251757008	575720768
15	hungary	495279232	2082825600	2429864704	377982304	685526016
3	belgium	2886285056	13619223552	4493067264	6129507840	14367540224
13	germany	12752945152	44450021376	31075868672	18154971136	20039010304
8	czechia	546297792	3324178176	4361704960	662894080	1286472064
29	poland	1016737088	3584219392	4818653184	2105437952	2217042688
30	portugal	211164256	584211520	749720448	1998001280	858183616
2	austria	1358326400	3828573440	2317096192	1160891136	1540121216
12	france	3651415296	15572513792	8269628928	8203970048	10836191232
32	slovakia	141301440	650959168	5206888960	185830368	229543952
24	luxembourg	23624644	604707968	181286160	67796376	72946192
34	spain	2350244864	6791175680	5633197056	8179954688	4785269760
26	netherlands	4085283072	11158045696	10270869504	6828962304	4919516160
36	switzerland	2308312576	7515397632	2367100928	3071943424	2865270272
37	turkey	1280508928	4188222464	6885658112	3543714304	8074903040
38	united kingdom	6021999616	18010421248	11707407360	4166872320	12117907456
20	italy	4512708096	8555943424	7899261952	7790480896	9807015936
33	slovenia	146187296	410868672	574568896	340013152	469785024
23	lithuania	57596756	93380328	135292288	35178536	99010208
22	latvia	26990748	78073464	91016264	19187592	114279096
16	iceland	355025152	255473984	91015176	231906544	23854464
35	sweden	2062897152	3878992896	2527538144	1459783936	1798432000
9	denmark	831463424	1563779712	1699212928	543380736	876243200
28	norway	420475712	2886533632	3621298688	1707180288	603296576
10	estonia	84243872	352112032	180670480	58743680	155171392
11	finland	744819520	1815064320	1665271424	880286016	863596032

Core/Periphery fit (correlation) = 0.7868

Core/Periphery Class Memberships:

    Core: china germany japan usa
 Periphery: australia austria belgium brazil canada chile czechia denmark estonia finland france greece hungary iceland india ireland israel italy latvia lithuania luxembourg mexico

CONCOR: 2008 OECD + India, China, Brazil
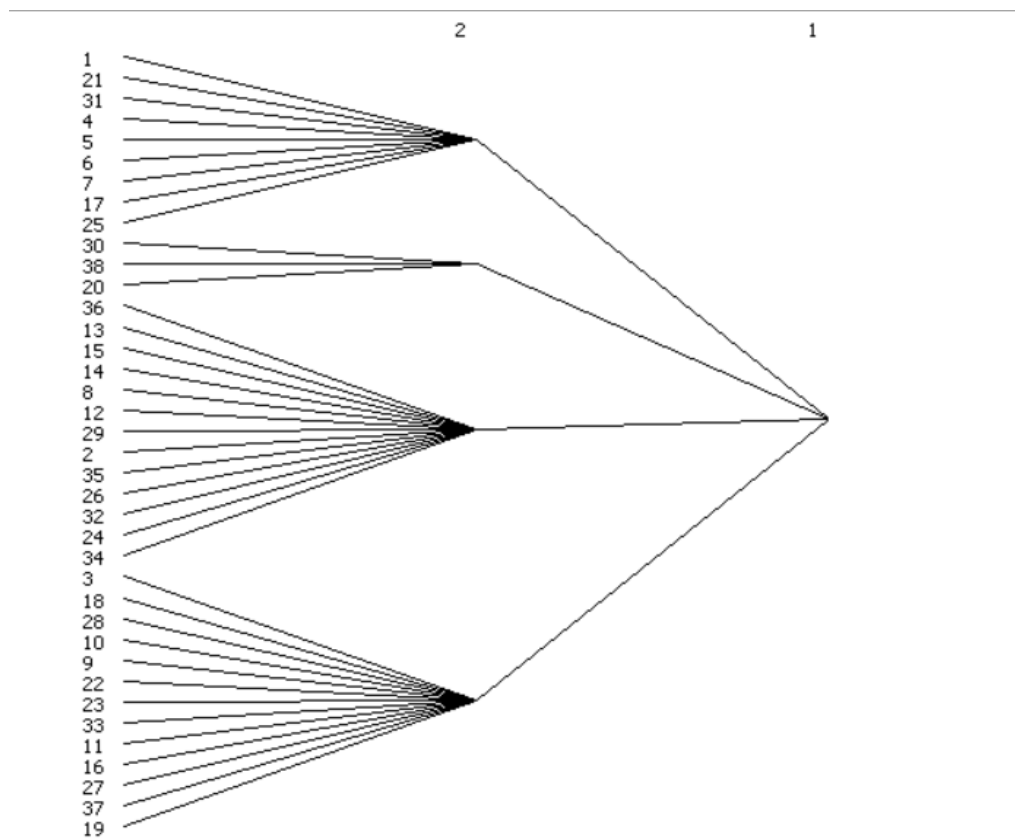
1	australia	6848713728	36783710208	14780611584	1605250432	1101524992	754495168
21	latvia	72701040	35160924	27599288	9774352	11069737	3472971
31	slovakia	291610528	46865192	221822416	134071568	55516160	9725931
4	brazil	21796937728	6537322496	3498393600	81610584	2530106624	5948118528
5	canada	264185888768	10646040576	3789522688	2903548416	471780256	1746266880
6	chile	12333068288	7140540416	4776287744	621268336	1580638720	
7	china	73324150784	61399977984	55794204672	32483866624	12668132352	12597951488
17	ireland	1239933568	98653328	63995888	266839008	118637328	29019278
25	netherlands	13847733248	1942306048	1133676032	6424855040	2015605504	1364838016
30	rep. of korea	22994999296	30949187584		5520287744	3951529984	5651551744
38	usa		33611626496	21338011648	26061877248	268003164160	12431532032
20	japan	38559031296		29852905472	9228220416	11796681728	8627745792
36	turkey	9191885824	690125504	1273416832	1004627968	1417570048	433156256
13	germany	23782375424	4300751872	2349920768	11387757568	4267253504	3364006400
15	hungary	629406976	246454000	130808000	46614000	50921000	4026000
14	greece	2020423680	208431008	188735200	297579616	180931616	132874848
8	czechia	1251044736	473785856	290019296	317159104	192409120	62774920
12	france	12990481408	2340049920	1473098624	5323394048	2371016448	2556028928
29	portugal	1788990080	262024384	155796720	1909178752	347586528	105124160
2	austria	1837023744	661592192	327557632	602819584	445935936	82362408
35	switzerland	3706509824	2094145280	284034272	705986368	401585504	69302328
26	new zealand	2540552192	2785264384	1207634816	65134108	464138560	52592308
32	slovenia	480393504	27986504	69042344	128103744	99604776	42863636
24	mexico	131731816448	3370328832	1816626560	1801547776	5059064832	2574621952
34	sweden	3580538112	858155456	454968192	735410432	500924160	465736160
3	belgium	9977589760	2018022144	145376128	3914456064	2887683328	331517664
18	israel	12787622912	312744000	247716000	338451008	336985984	42515000
28	poland	1901408000	429187488	582118208	441402848	324964832	246204640
10	estonia	672121984	218539184	45063072	44484856	84693336	9194193
9	denmark	1659322112	1035049280	338313120	359525024	522092640	137544768
22	lithuania	610431616	15773446	25227214	30057234	293934592	11548373
23	luxembourg	393831008	36242920	38156384	96634232	72695376	8468556
33	spain	9852695552	1207228416	1025092608	4441492480	1958863488	2025570048
11	finland	2804663296	626267136	272513216	842594368	1129824000	389161376
16	iceland	324060320	92839328	19599376	23679928	53660772	5983102
27	norway	5902337536	1060805184	428503808	1438928256	5989211136	110324080
37	united kingdom	29723998208	3037369344	3396954368	4367403520	7100516864	733850624
19	italy	14763878400	1943983616	2009320448	5518816768	2884956928	3298522880

Core/Periphery fit (correlation) = 0.7689

Core/Periphery Class Memberships:

        Core: canada usa
 Periphery: australia austria belgium brazil chile china czechia denmark estonia finland france germany greece hungary iceland ireland israel italy japan latvia lithuania

Conclusions & Future Work

If we looked at the exact same 24 countries that Brieger did: the following forms the core: USA, UK, Germany, Belgium, Netherlands and France
* What is the effect of volume control?

With all OECD countries and India, China, Brazil in 2018 – China, Germany, USA, Japan form the core.
* Smaller group of countries in the core

With all OECD countries and China, Brazil – USA, Canada form the core
* Why? What is the role of financial crisis and how has China's participation changed from 2008 to 2018?

Additional measures to consider to assess world theory system?
* Services and intellectual transfer - to support/refute Wallerstein's world system idea of unequal development this would be an important consideration in knowledge economy.
  * This is currently limited by data availability

CONCOR: 2018 Data for 1972 OECD + Israel