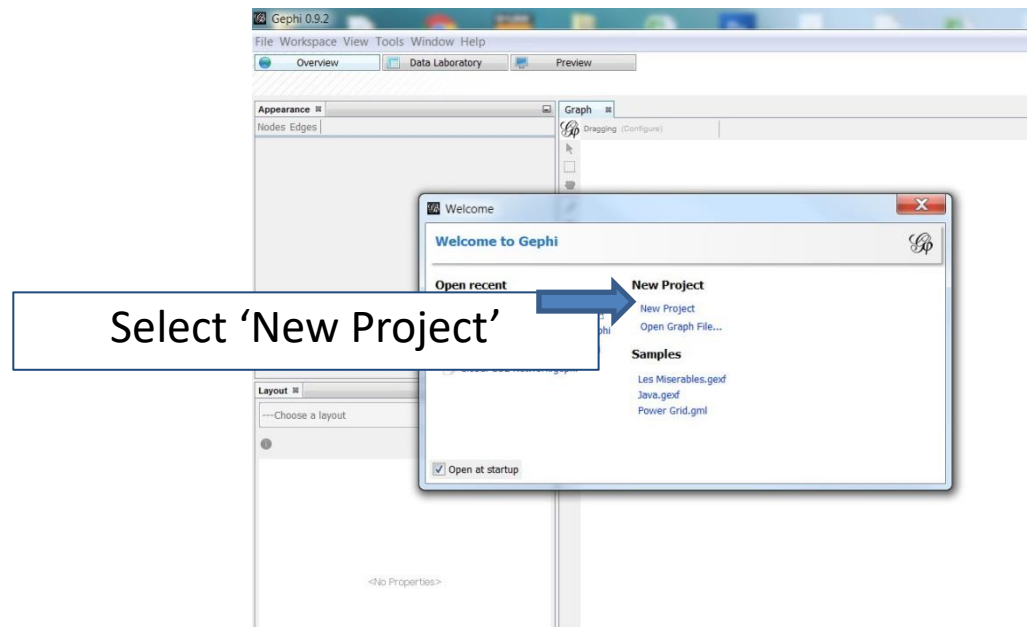


Tutorial: Using Gephi for Analyzing Global Input-Output Table

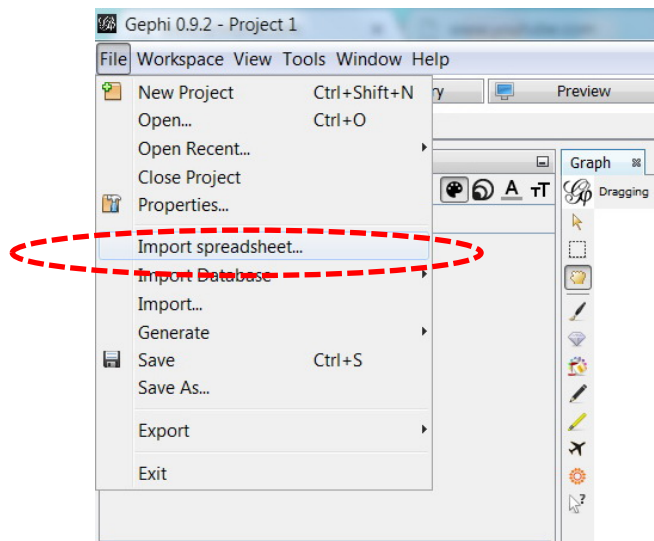
Nattapong Puttanapong, Ph.D.

*Faculty of Economics, Thammasat University
Bangkok, Thailand*

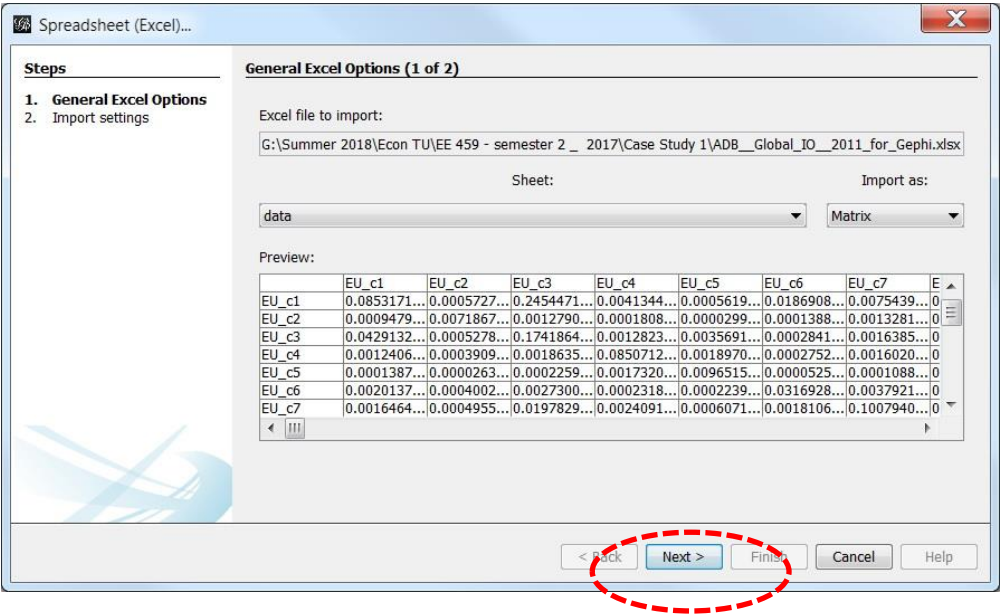
Step 1: Import the Excel data (which is ADB’s global IO table of 2011) by selecting ‘New Project’.



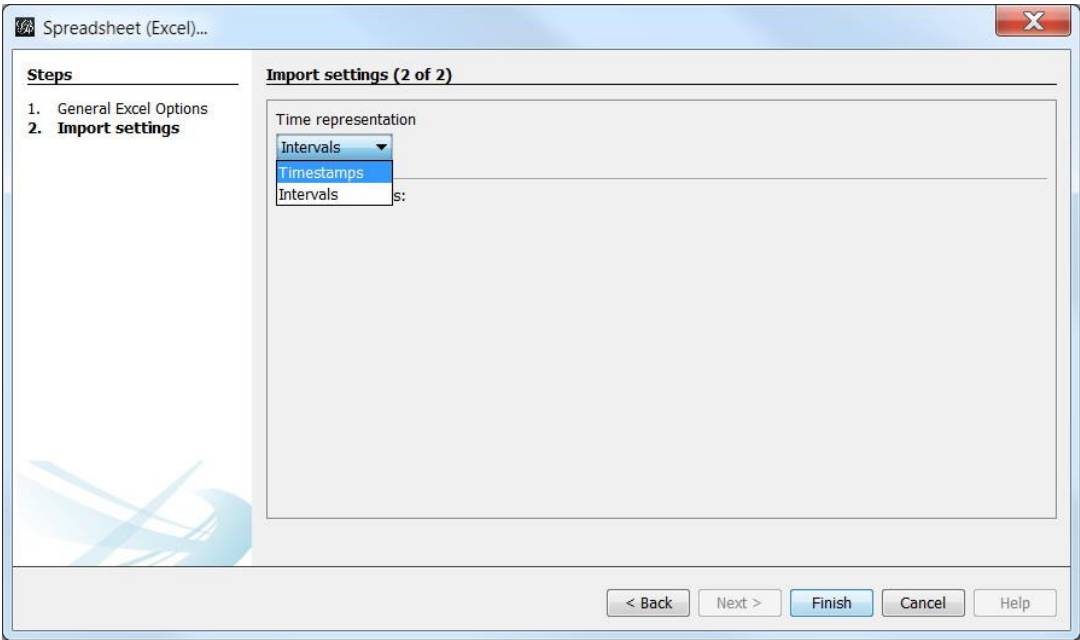
Step 2: On the top menu, select ‘File → Import spreadsheet’. Then identify the location of the spreadsheet of ADB’s global IO table.



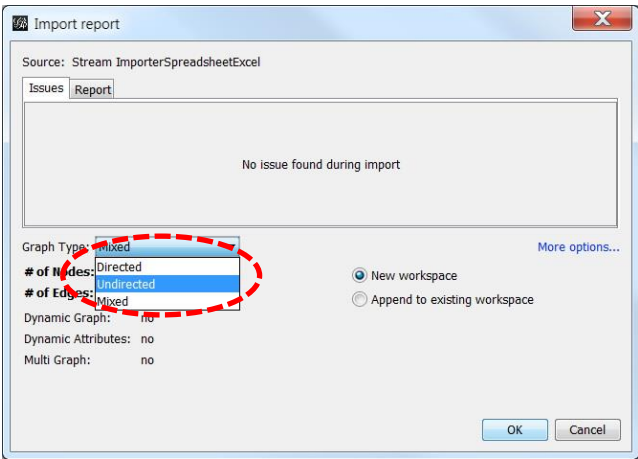
Step 3: The spreadsheet import window will be displayed. Select 'Next'.



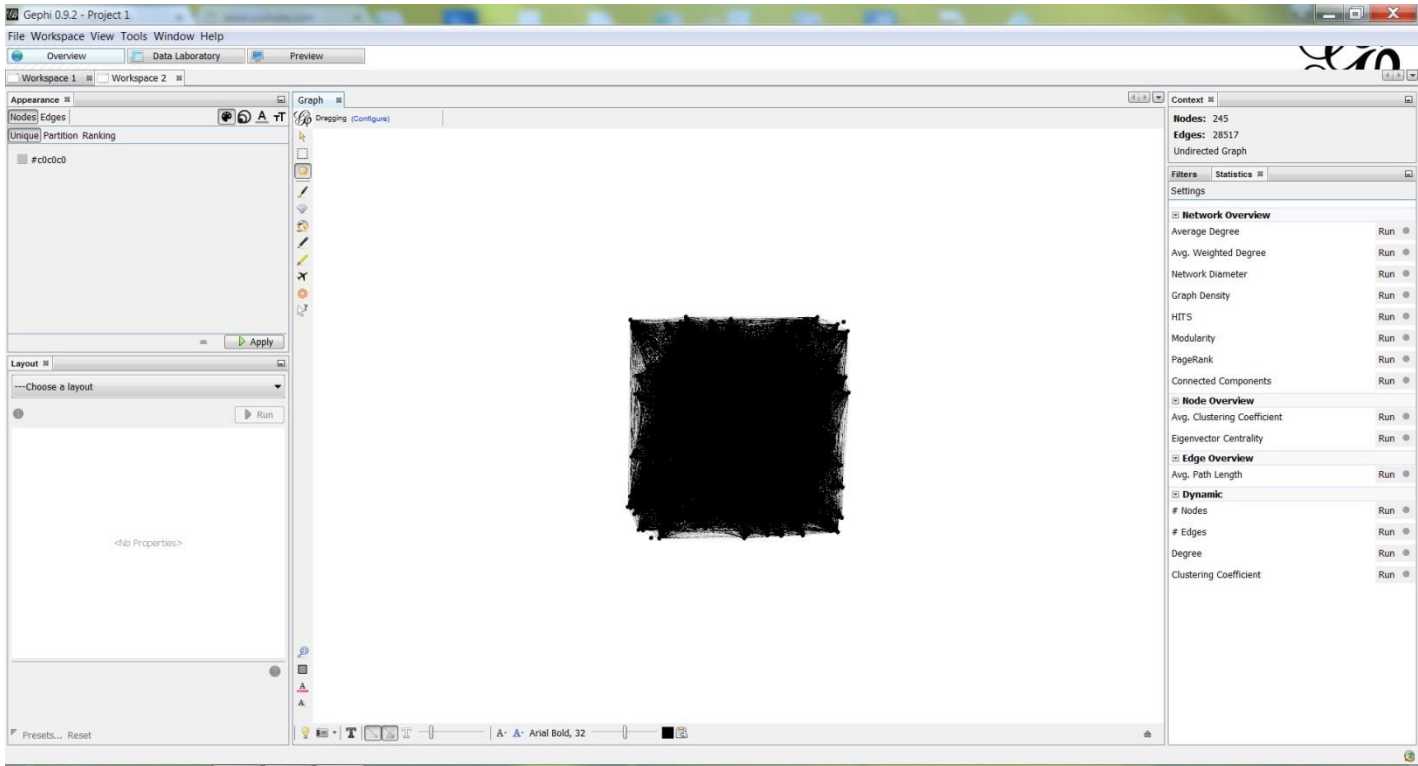
Step 4: Select the time representation as 'Timestamps' because this is just the single year data.



Step 5: Select the graph type as 'Undirected'. Then select 'OK'. (Note: the 'Undirected' indicated that the direction of flows in the table is ignored. To identifying both the direction and the magnitude of flows, please select 'Directed'.)



Step 6: The main window of Gephi will then display the network graph of imported data.



Step 7: Since the initial network graph includes all flows (i.e. all transactions on the global IO table), we can filter these data by selecting the option in the right-hand -side box. Specifically, select Filters → Edges → Edge Weight. Then, double click on 'Edge Weight' and change the range of selected data by scrolling the Edge Weight Settings bar. The percentage of selected data will be shown on the top-right box as % of visible Edges.

A percentage of selected flows is indicated here.

7.1 Select 'Filters' →

7.2 Select 'Edge Weight' →

7.3 Double click on 'Edge Weight'

7.4 Slide the bar to change the range of selected data

7.5 Click on 'Select' button.

The screenshot shows the Gephi 0.9.2 interface. The main window displays a network graph with many nodes and edges. The left sidebar has tabs for 'Appearance' and 'Layout'. The right sidebar has tabs for 'Context' and 'Queries'. The 'Context' tab is active, showing a tree view of the graph's structure. The 'Filters' tab is selected, and the 'Edge Weight' filter is applied. The 'Edge Weight Settings' bar is visible, showing a range from 0.005488890647987484 to 0.7841272354125777. The 'Select' button is highlighted.

Step 8: Now we will calculate all indicators indicating the characteristics of this network. In the right-hand-side box, select 'Statistics'. Then, click on the 'Run' button to activate the related computation of single-year data.

The computations of some indicators will display the new windows asking for specifying options or parameters of that particular computation. For each case, please use the default value and selection as shown below.

Filters

Statistics %

Settings

Network Overview

Average Degree

Avg. Weighted Degree

Network Diameter

Graph Density

HITS

Modularity

PageRank

Connected Components

Node Overview

Avg. Clustering Coefficient

Eigenvector Centrality

Edge Overview

Avg. Path Length

Dynamic

Nodes

Edges

Degree

Clustering Coefficient

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Run

Options for computing 'Network Diameter'.

Options for computing 'Modularity'.

Options for computing 'PageRank'.

Graph Distance settings

Distance

The average graph-distance between all pairs of nodes. Connected nodes have graph distance 1. The diameter is the longest graph distance between any two nodes in the network. (i.e. How far apart are the two most distant nodes).

Directed

Undirected

Normalize Centralities in [0,1]

Betweenness Centrality:

Measures how often a node appears on shortest paths between nodes in the network.

Closeness Centrality:

The average distance from a given starting node to all other nodes in the network.

Eccentricity:

The distance from a given starting node to the farthest node from it in the network.

OK

Cancel

Modularity settings

Modularity

Community detection algorithm.

Randomize

Produce a better decomposition but increases computation time

Use weights

Use edge weight

Resolution:

Lower to get more communities (smaller ones) and higher than 1.0 to get less communities (bigger ones).

1.0

OK

Cancel

Page Rank settings

PageRank

Ranks nodes "pages" according to how often a user following links will non-randomly reach the node "page".

Directed

Undirected

Probability (p):

0.85

Used to simulate the user randomly restarting the web-surfing.

Epsilon:

0.001

Stopping criterion, the smaller this value, the longer convergence will take.

Use edge weight

OK

Cancel

Step 9: We will classify each node into groups based on the result obtained from 'Modularity' previously computed. On the top-left window of Appearances. Select 'Node' and 'Partition'. In the drop-down menu, select 'Modularity Class'. This process will color each node based on the distribution of affiliation shown in the Appearances box. Then select 'Apply' button.

Overview

Data Laboratory

Preview

Workspace 1

Workspace 3

Appearance

Nodes Edges

Unique Partition Ranking

Modularity Class

61 (14.69%)

0 (13.88%)

2 (13.88%)

8 (13.47%)

6 (12.24%)

39 (1.63%)

44 (1.22%)

9 (0.82%)

14 (0.82%)

15 (0.82%)

51 (0.82%)

Palette

Apply

Layout

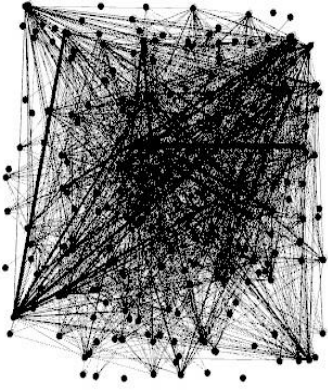
---Choose a layout

Run

<No Properties>

Graph

Dragging (Configure)



Context

Nodes: 245 (100% visible)

Edges: 1855 (6.5% visible)

Undirected Graph

Filters

Statistics

Settings

Network Overview

Average Degree

Avg. Weighted Degree

Network Diameter

Graph Density

HITS

Modularity

PageRank

Connected Components

Node Overview

Avg. Clustering Coefficient

Eigenvector Centrality

Edge Overview

Avg. Path Length

Dynamic

Nodes

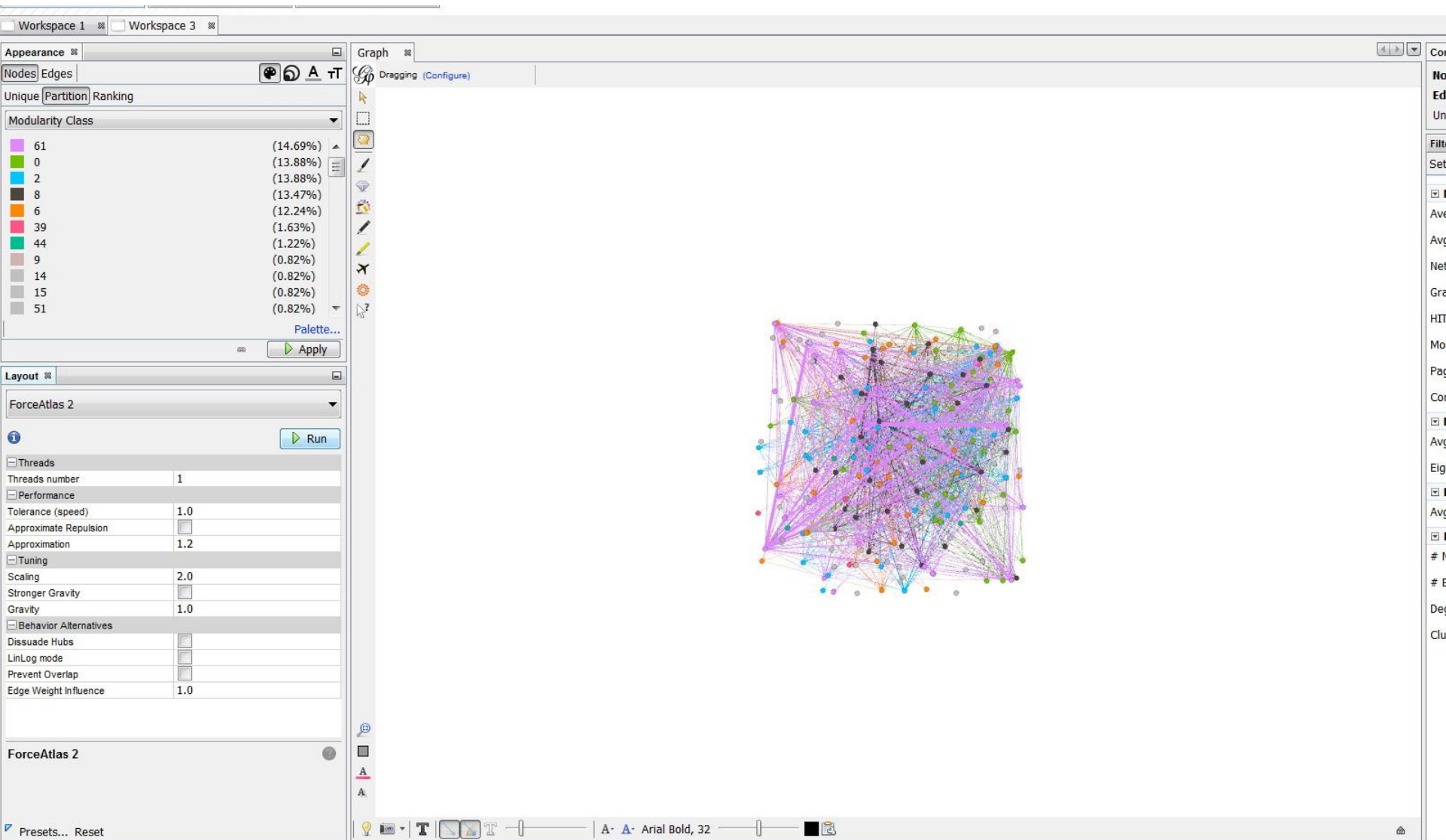
Edges

Degree

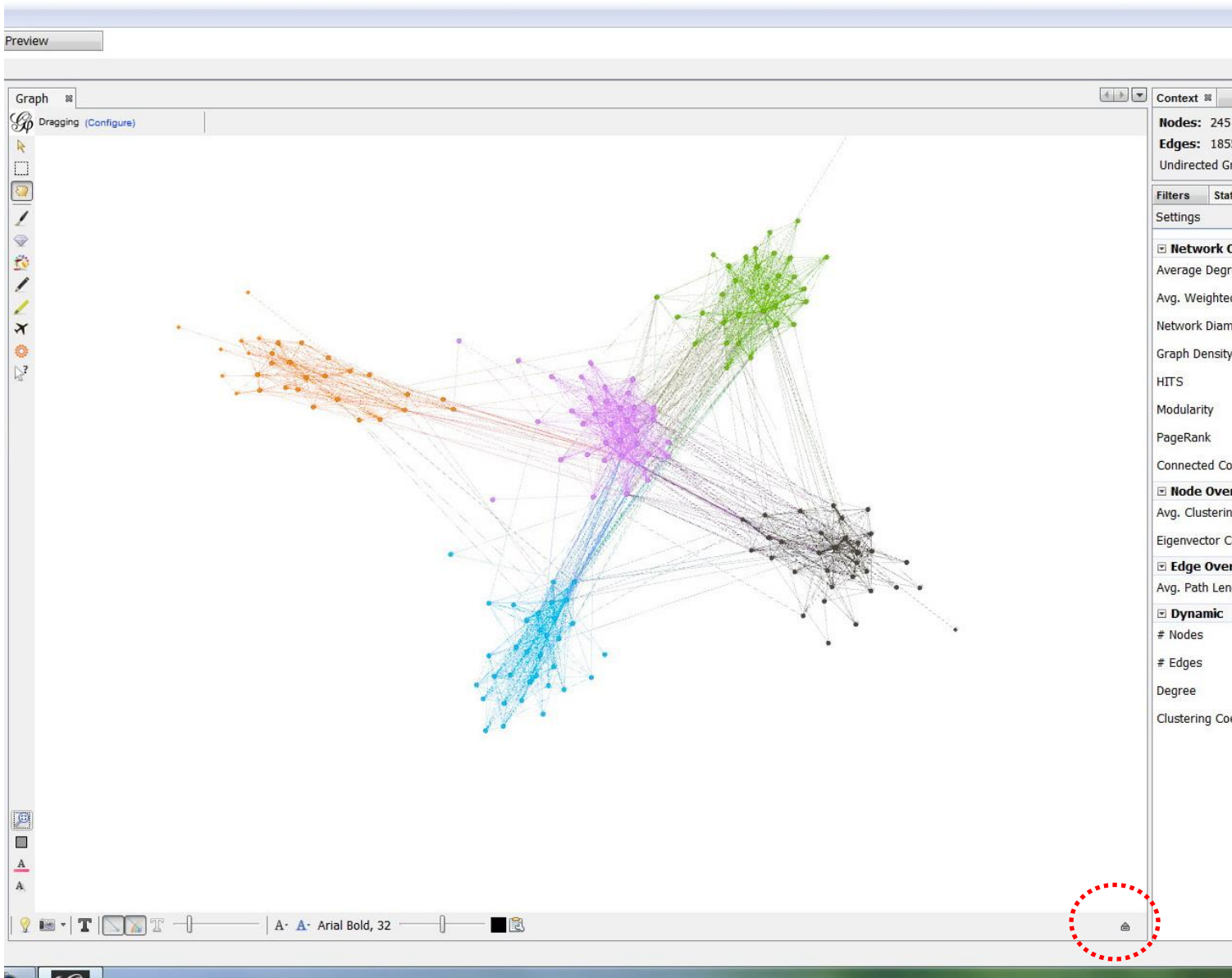
Clustering Coefficient

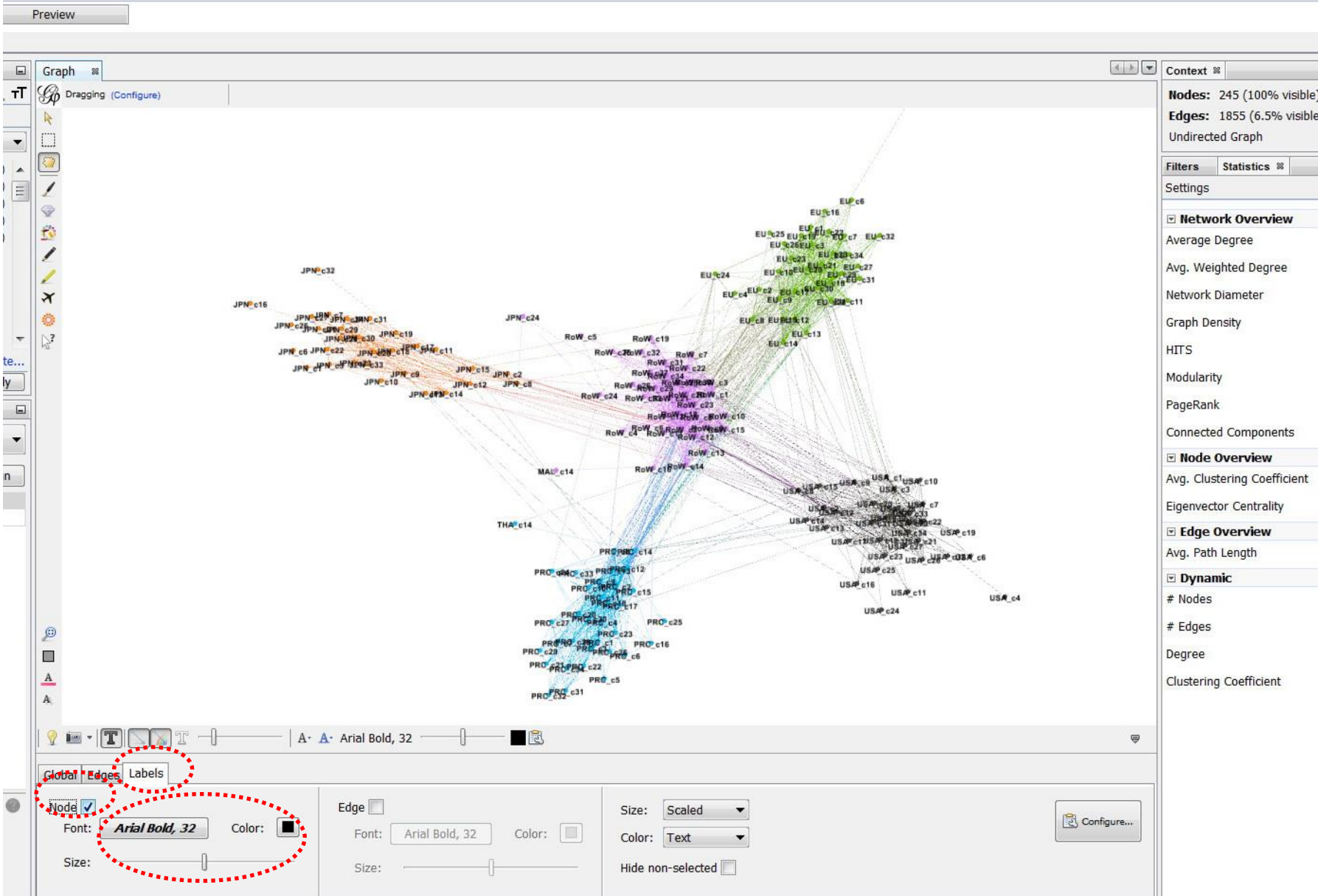
Apply the current transformation to the graph

Step 10: The colored graph of network is still incomprehensive. Gephi allows an user to format the layout of network graph with many computational techniques, listed in the drop-down menu of 'Layout' window. In this study, we will use ForceAtlas2 as the layout-formatting method, arranging most significant nodes in the core of the network.



Step 11: ForceAtlas2 method has revealed that the core of global trade is composed of 5 groups of nodes. To add the labels and other details of this network graph, select the small arrow icon located in the bottom-right of the main window.





Step 13: The visualization of network graph can be modified in order to create the professional-looking output. Please select the 'Preview' tab. All graphical properties of the network graph can be refined by selecting options listed on the left-hand-side box. After the adjustment, please click on the Refresh button for displaying the updated graph.

Workspace 1Workspace 3

Preview Settings

Presets

Default

SettingsManage renderers

Nodes

Border Width1.0

Border Colorcustom [0,0,0]

Opacity100.0

Per-Node Opacity

Node Labels

Show Labels

FontArial 10 Plain

Proportional size

Colorcustom [0,0,0]

Shorten label

Max characters30

Outline size0.0

Outline colorcustom [255,255,255]

Outline opacity80.0

Box

Box colorparent

Box opacity100.0

Edges

Show Edges

Thickness1.0

Rescale weight

Min. rescaled weight0.1

Max. rescaled weight1.0

Colormixed

Opacity100.0

Curved

Radius0.0

Edge Arrows

Size3.0

Edge Labels

Show Labels

FontArial 10 Plain

Colororiginal

Shorten label

Max characters30

Outline size0.0

Outline colorcustom [255,255,255]

Preview ratio: 100%

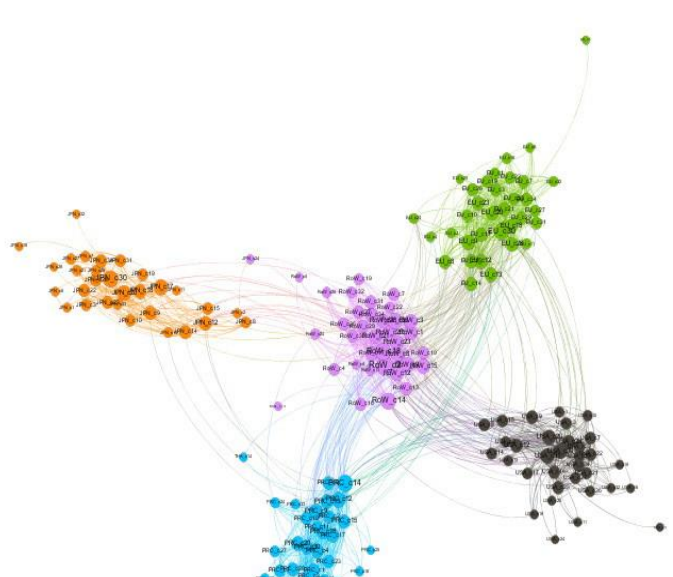
Export: SVG/PDF/PNG

Background Reset zoom - +

FileWorkspaceViewToolsWindowHelp

OverviewData LaboratoryPreview

Preview



Step 14: Clicking on ‘Data Laboratory’ tab will display outcomes obtained from all computations of network indicators. These indicators can be sorted and filtered. Also these data can be exported by clicking on ‘Export table’ button.

Gephi 0.9.2 - Project 1

FileWorkspaceViewToolsWindowHelp

Overview

Data Laboratory

Preview

Workspace 1Workspace 3

Data Table

NodesEdgesConfigurationAdd nodeAdd edgeSearch/ReplaceImport SpreadsheetExport tableMore actions

Filter:Id

Id	Label	Timestamp	Degree	Weighted Degree	Eccentricity	Closeness Centrality	Harmonic Closeness Centrality	Betweenness Centrality	Authority	Hub	Modularity Class	PageRank	Component ID	Clustering Coefficient	Number of triangles	Eigenvector Centrality
EU_c1	EU_c1	22	0.743749	4.0	0.413965	0.475402	25.7332	0.076707	0.076707	0	0.003063	0	0.761905	160	0.387371	
EU_c2	EU_c2	13	0.246163	4.0	0.420253	0.459839	2.351668	0.051483	0.051483	0	0.002009	0	0.848485	56	0.260054	
EU_c3	EU_c3	28	1.380213	4.0	0.420253	0.493474	36.526397	0.094162	0.094162	0	0.003751	0	0.757835	266	0.476137	
EU_c4	EU_c4	12	0.297982	4.0	0.412935	0.451305	32.577859	0.0364	0.0364	0	0.001938	0	0.618182	34	0.189128	
EU_c5	EU_c5	3	0.025583	5.0	0.30855	0.334739	0.0	0.004069	0.004069	0	0.000873	0	1.0	1	0.020984	
EU_c6	EU_c6	10	0.185764	5.0	0.364035	0.404016	0.104994	0.029322	0.029322	0	0.001684	0	0.944444	34	0.150083	
EU_c7	EU_c7	28	0.687919	4.0	0.413965	0.486948	24.188516	0.089696	0.089696	0	0.00378	0	0.760684	267	0.454935	
EU_c8	EU_c8	33	0.988658	4.0	0.459834	0.534137	110.17001	0.115327	0.115327	0	0.004465	0	0.566532	281	0.580507	
EU_c9	EU_c9	41	1.154396	3.0	0.530351	0.59739	522.463135	0.137742	0.137742	0	0.005396	0	0.444872	347	0.706586	
EU_c10	EU_c10	22	0.447377	4.0	0.417085	0.47741	11.939739	0.079545	0.079545	0	0.003044	0	0.771429	162	0.402738	
EU_c11	EU_c11	18	0.386775	4.0	0.41604	0.468373	3.263482	0.06576	0.06576	0	0.002588	0	0.852941	116	0.333192	
EU_c12	EU_c12	37	2.080823	4.0	0.497006	0.569277	184.613034	0.130792	0.130792	0	0.004862	0	0.561905	354	0.668765	
EU_c13	EU_c13	38	0.995993	4.0	0.492582	0.568273	231.909668	0.134842	0.134842	0	0.004976	0	0.543544	362	0.696143	
EU_c14	EU_c14	33	1.048858	3.0	0.494048	0.558233	212.418016	0.121183	0.121183	0	0.004384	0	0.586694	291	0.620595	
EU_c15	EU_c15	30	1.406607	4.0	0.481159	0.543675	227.716725	0.101921	0.101921	0	0.004157	0	0.534483	217	0.526162	
EU_c16	EU_c16	16	0.228284	4.0	0.395238	0.443273	4.287506	0.050124	0.050124	0	0.002403	0	0.828571	87	0.256506	
EU_c17	EU_c17	33	1.276086	4.0	0.449864	0.526104	60.109202	0.112749	0.112749	0	0.004364	0	0.669355	332	0.569251	
EU_c18	EU_c18	35	2.117775	4.0	0.475645	0.550201	120.364073	0.118701	0.118701	0	0.004619	0	0.634581	356	0.606005	
EU_c19	EU_c19	26	0.472929	4.0	0.408867	0.47741	2.680779	0.088493	0.088493	0	0.003503	0	0.903333	271	0.449655	
EU_c20	EU_c20	37	1.615025	4.0	0.44504	0.532631	241.896706	0.117541	0.117541	0	0.00508	0	0.574603	362	0.59589	
EU_c21	EU_c21	31	1.10661	4.0	0.41604	0.494478	17.549918	0.096291	0.096291	0	0.004158	0	0.751724	327	0.490422	
EU_c22	EU_c22	24	0.540229	4.0	0.409877	0.475904	10.310986	0.082687	0.082687	0	0.003269	0	0.87747	222	0.418641	
EU_c23	EU_c23	34	0.943136	4.0	0.437995	0.520582	43.389202	0.114	0.114	0	0.004487	0	0.657197	347	0.575252	
EU_c24	EU_c24	14	0.146315	4.0	0.431169	0.47239	36.308732	0.054482	0.054482	0	0.00219	0	0.538462	42	0.269839	
EU_c25	EU_c25	6	0.105092	4.0	0.36971	0.403112	0.113509	0.025308	0.025308	0	0.001448	0	0.933333	14	0.124137	
EU_c26	EU_c26	26	0.885838	4.0	0.425641	0.493474	16.985331	0.089823	0.089823	0	0.003597	0	0.79	237	0.454927	
EU_c27	EU_c27	24	0.68575	4.0	0.430052	0.493474	34.297051	0.081473	0.081473	0	0.00328	0	0.869565	220	0.418872	
EU_c28	EU_c28	39	1.890737	4.0	0.464986	0.552711	178.249134	0.139305	0.139305	0	0.005141	0	0.477952	336	0.70113	
EU_c29	EU_c29	28	1.179436	4.0	0.426735	0.498494	31.86659	0.091758	0.091758	0	0.003766	0	0.811966	285	0.469379	
EU_c30	EU_c30	51	4.120313	4.0	0.533762	0.620482	756.333238	0.167091	0.167091	0	0.006724	0	0.355918	436	0.865652	
EU_c31	EU_c31	26	0.555019	4.0	0.419192	0.48745	6.942534	0.091168	0.091168	0	0.003502	0	0.86	258	0.461988	
EU_c32	EU_c32	16	0.25167	5.0	0.368071	0.422088	0.0	0.051429	0.051429	0	0.002353	0	0.980952	103	0.261465	
EU_c33	EU_c33	23	0.725981	4.0	0.409877	0.472892	10.474837	0.077654	0.077654	0	0.003163	0	0.848485	196	0.393873	
EU_c34	EU_c34	28	0.900548	4.0	0.419192	0.491466	14.347426	0.093918	0.093918	0	0.003751	0	0.80057	281	0.475721	
EU_c35	EU_c35	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	0.000757	1	0.0	0	0.0	
PRC_c1	PRC_c1	24	1.319522	4.0	0.41604	0.481426	102.071941	0.03871	0.03871	2	0.003824	0	0.557312	141	0.262781	
PRC_c2	PRC_c2	23	0.978245	4.0	0.43342	0.492972	29.534985	0.038742	0.038742	2	0.003569	0	0.774892	179	0.276256	
PRC_c3	PRC_c3	25	1.43707	4.0	0.42132	0.487952	46.680095	0.037461	0.037461	2	0.003878	0	0.699275	193	0.273291	
PRC_c4	PRC_c4	28	1.34613	4.0	0.42132	0.491968	98.077618	0.037591	0.037591	2	0.004459	0	0.609687	214	0.278316	

Add columnMerge columnsDelete columnClear columnCopy data to other columnFill column with a valueDuplicate column

Create a boolean column from regex matchCreate column with list of regex matching groupsNegate boolean valuesConvert column to dynamic

Note: In this study, we will use PageRank and Eigenvector Centrality as main indices identifying the centrality role of each node to the global trade network.