

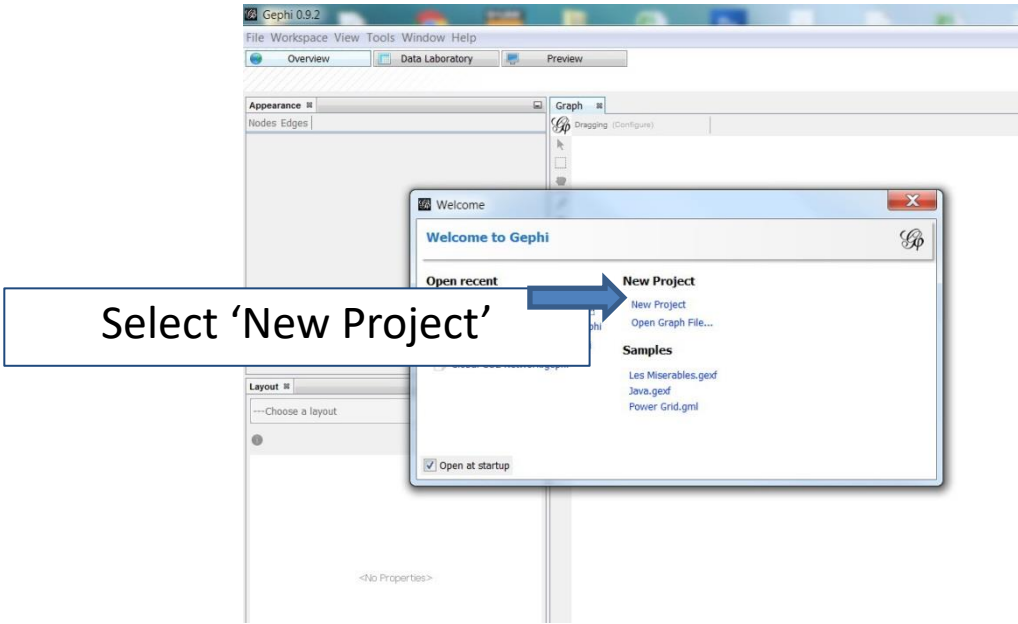
Tutorial: Using Gephi for Analyzing ADB's Global Input- Output Table

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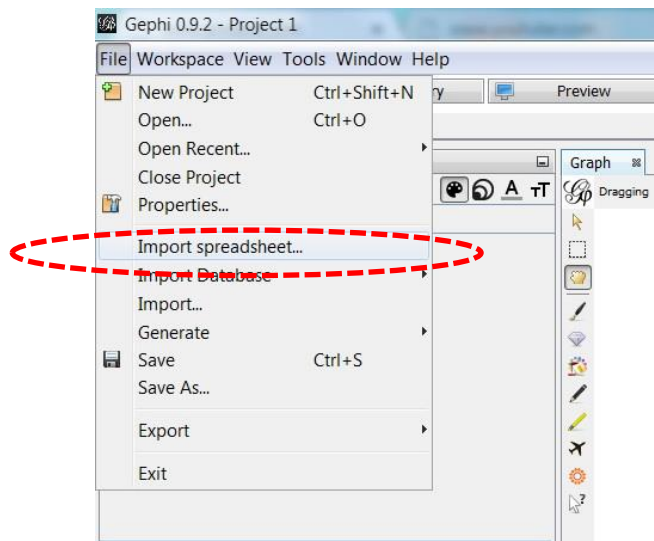
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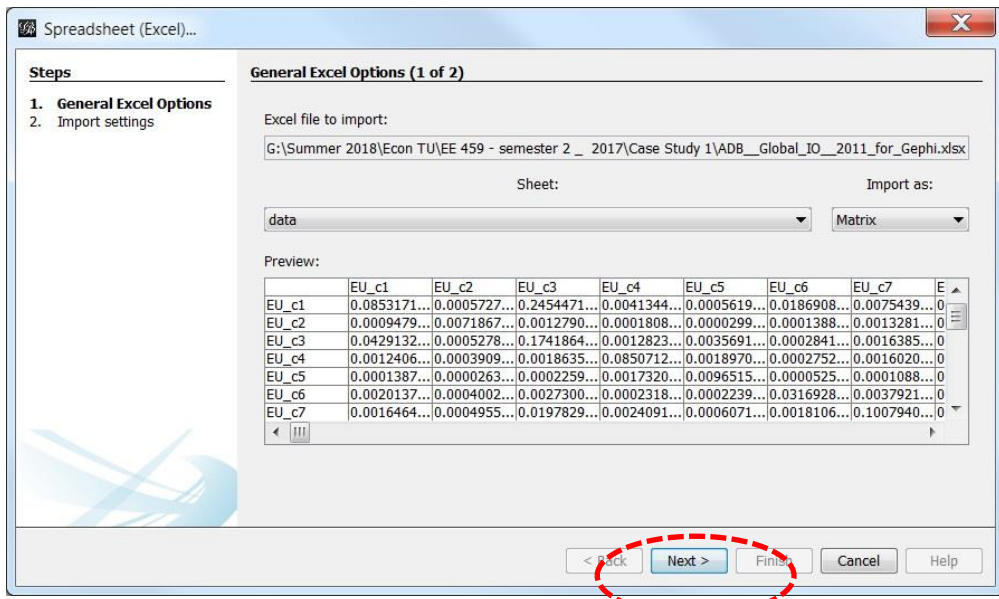
Step 1: Import the Excel data (which is ADB's global IO table of 2011) by selecting 'New Project'.



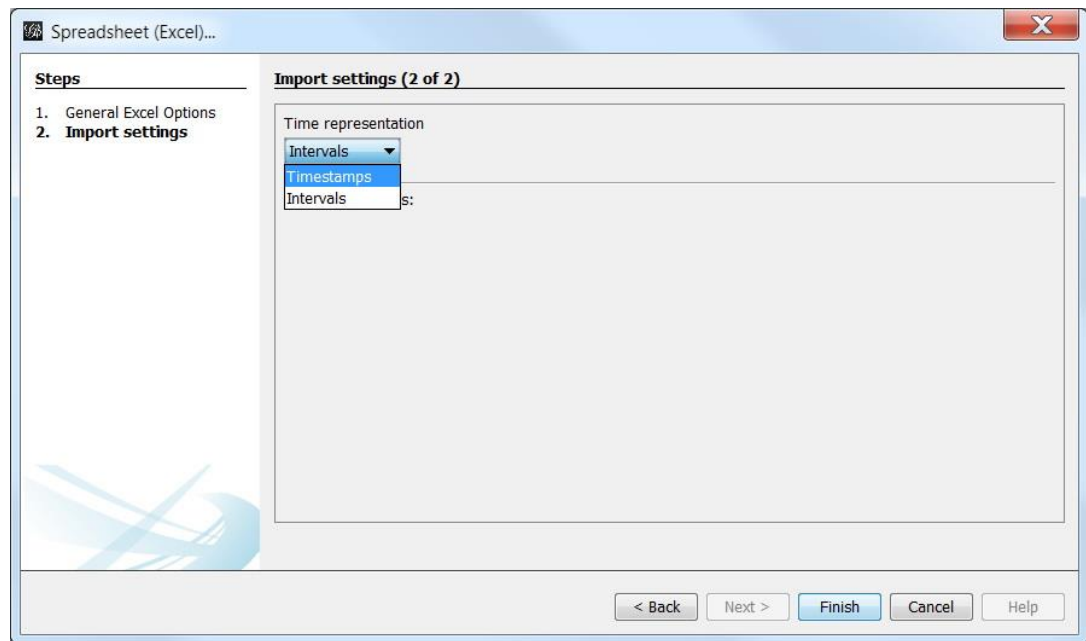
Step 2: On the top menu, select 'File → Import spreadsheet'. Then identify the location of the spreadsheet of ADB's global IO table.



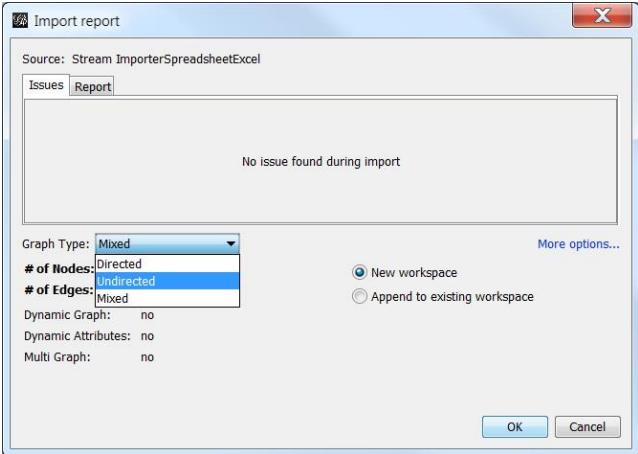
Step 3: The spreadsheet import window will be displayed. Select 'Next'.



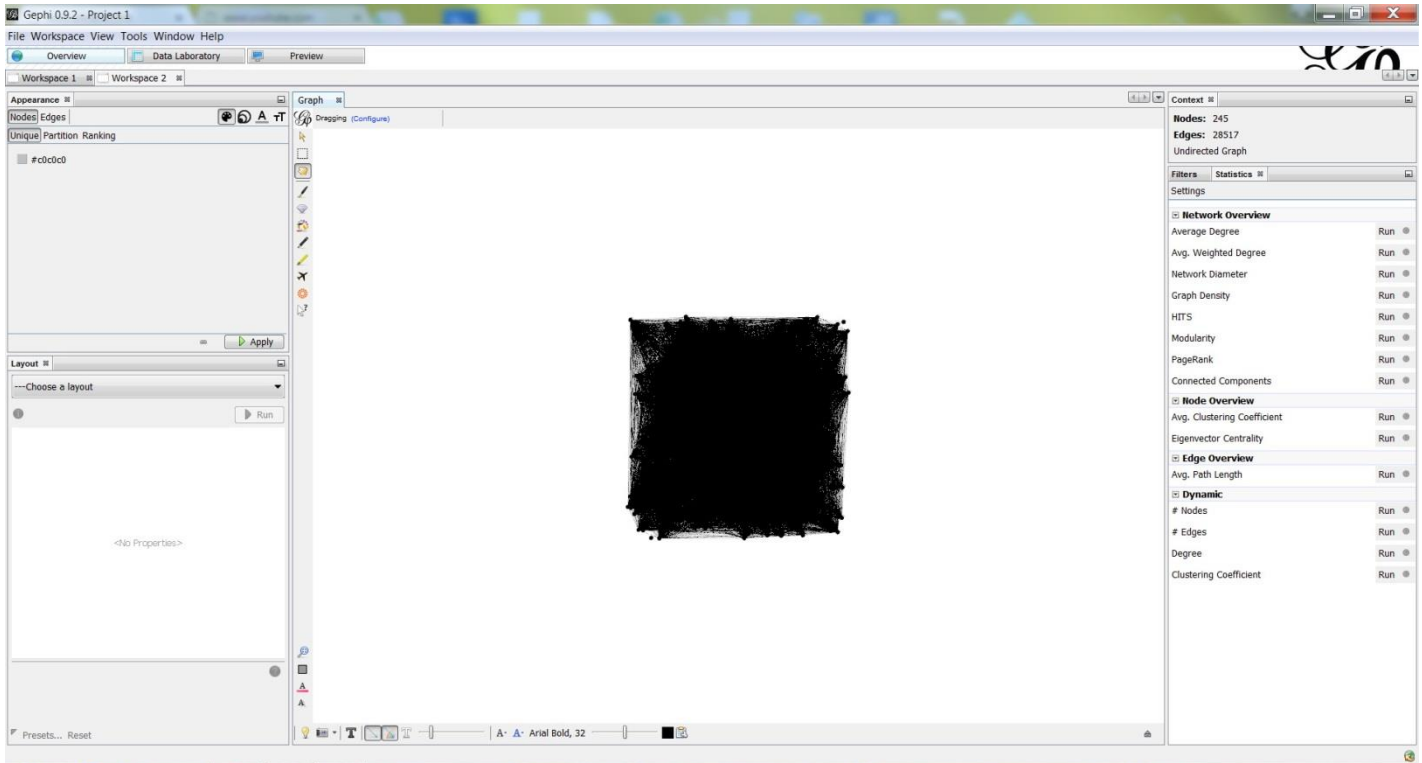
Step 4: Select the time representation as 'Timestamps' because this is just the single year data.



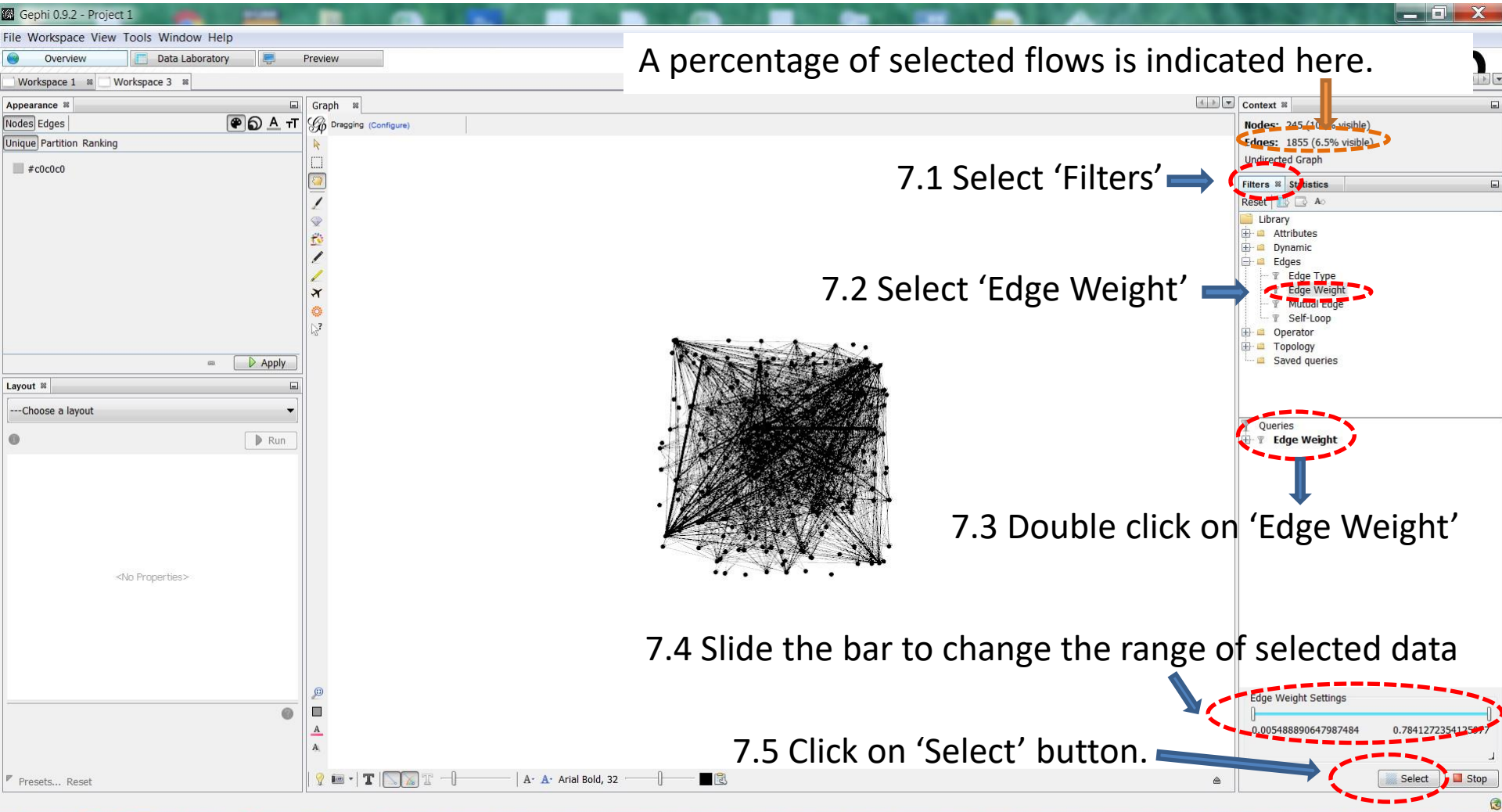
Step 5: Select the graph type as 'Undirected'. Then select 'OK'. (Note: the 'Undirected' indicated that the direction of flows in the table is ignored. To identifying both the direction and the magnitude of flows, please select 'Directed'.)



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



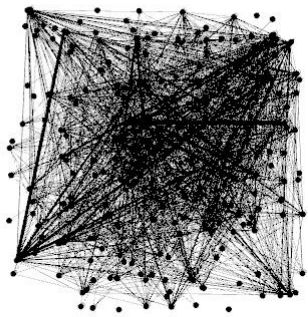
Step 7: Since the initial network graph includes all flows (i.e. all transactions on the global IO table), we can filter these data by selecting the option in the right-hand -side box. Specifically, select Filters → Edges → Edge Weight. Then, double click on 'Edge Weight' and change the range of selected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

Nodes: 245 (100% visible)
Edges: 1855 (6.5% visible)

Filters | Statistics

- Library
 - Attributes
 - Dynamic
 - Edges
 - Edge Type
 - Edge Weight
 - Mutual Edge
 - Self-Loop
 - Operator
 - Topology
 - Saved queries

Edge Weight

Edge Weight Settings
0.005488890647987484 0.7841272354125977

Select Stop

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.

The screenshot shows a 'Filters' panel with a 'Statistics' tab selected. The panel is divided into sections: 'Network Overview', 'Node Overview', 'Edge Overview', and 'Dynamic'. Each section contains a list of metrics with a 'Run' button next to it. The 'Run' buttons for 'Average Degree', 'Avg. Weighted Degree', 'Network Diameter', 'Graph Density', 'HITS', 'Modularity', 'PageRank', 'Connected Components', 'Avg. Clustering Coefficient', 'Eigenvector Centrality', 'Avg. Path Length', '# Nodes', '# Edges', 'Degree', and 'Clustering Coefficient' are all circled in red.

Options for computing 'Network Diameter'.

The 'Graph Distance settings' dialog box shows options for computing 'Network Diameter'. It includes a 'Distance' section with 'Directed' and 'Undirected' radio buttons, and a 'Normalize Centralities in [0,1]' checkbox. It also includes definitions for 'Betweenness Centrality', 'Closeness Centrality', and 'Eccentricity'. The 'Undirected' option is selected.

Options for computing 'Modularity'.

The 'Modularity settings' dialog box shows options for computing 'Modularity'. It includes a 'Modularity' section with 'Randomize' and 'Use weights' checkboxes, and a 'Resolution' input field. The 'Randomize' and 'Use weights' options are checked, and the 'Resolution' is set to 1.0.

Options for computing 'PageRank'.

The 'Page Rank settings' dialog box shows options for computing 'PageRank'. It includes a 'PageRank' section with 'Directed' and 'Undirected' radio buttons, and input fields for 'Probability (p):', 'Epsilon:', and 'Use edge weight'. The 'Undirected' option is selected, 'Probability (p):' is 0.85, and 'Epsilon:' is 0.001.

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.

The screenshot shows a software interface with several panels. At the top, there are tabs for 'Overview', 'Data Laboratory', and 'Preview'. Below these are workspace tabs for 'Workspace 1' and 'Workspace 3'. The main area is divided into three sections: 'Appearance', 'Graph', and 'Context'.

The 'Appearance' panel on the left has a 'Nodes Edges' tab selected. Underneath, there are three sub-tabs: 'Unique', 'Partition', and 'Ranking'. The 'Partition' sub-tab is active, showing a 'Modularity Class' dropdown menu. The dropdown is open, displaying a list of classes with their corresponding percentages:

Modularity Class	Percentage
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%)

Below the list is a 'Palette' button and an 'Apply' button. A red dashed box highlights the 'Apply' button. A tooltip above it reads 'Apply the current transformation to the graph'. The 'Graph' panel in the center shows a dense network graph with many nodes and edges. The 'Context' panel on the right displays network statistics:

- Nodes: 245 (100% visible)
- Edges: 1855 (6.5% visible)
- Undirected Graph

Below the statistics are tabs for 'Filters' and 'Statistics'. The 'Network Overview' section is expanded, showing various metrics like 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), and Dynamic (Number of Nodes, Number of Edges, Degree, Clustering Coefficient).

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.

The screenshot displays the Gephi software interface. The 'Appearance' window is open, showing the 'Nodes' tab with 'Edges' selected. The 'Modularity Class' is set to 'Partition', and a list of nodes is displayed with their respective colors and percentages. The 'Layout' window is also open, showing the 'ForceAtlas 2' algorithm selected. The 'Run' button is visible. The network graph is visualized in the center, showing a dense network of nodes and edges, with nodes colored according to their modularity class.

Modularity Class	Percentage
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%)

ForceAtlas 2 Settings:

- Threads: 1
- Tolerance (speed): 1.0
- Approximate Repulsion:
- Approximation: 1.2
- Scaling: 2.0
- Stronger Gravity:
- Gravity: 1.0
- Dissuade Hubs:
- LinLog mode:
- Prevent Overlap:
- Edge Weight Influence: 1.0

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.

The screenshot displays a network graph visualization software interface. The main window shows a complex network graph with five distinct clusters of nodes, colored in orange, purple, green, blue, and black. The interface includes a toolbar on the left with various icons for editing and viewing. On the right side, there is a 'Context' panel with the following information:

- Nodes:** 245
- Edges:** 1855
- Undirected Gr

Below this, there are sections for 'Filters' and 'Settings'. The 'Dynamic' section is expanded, showing the following metrics:

- # Nodes
- # Edges
- Degree
- Clustering Coe

At the bottom of the interface, there is a status bar with a font size of 'Arial Bold, 32'. A small arrow icon in the bottom-right corner of the main window is circled in red, indicating the location where the user should click to add labels and other details to the network graph.

Step 12: The label of each node can be displayed by selecting 'Labels' and then check the box of 'Node'. The specification of font and color can also be adjusted.

The screenshot shows a network graph visualization software interface. The main area displays a dense network of nodes and edges. Nodes are labeled with codes such as JPN_c16, EU_c6, RoW_c5, MAUP_c14, THAI_c14, PRO_c14, and USA_c4. The nodes are grouped into clusters, with colors like orange, blue, and purple used to distinguish different regions or categories. The edges are thin lines connecting the nodes.

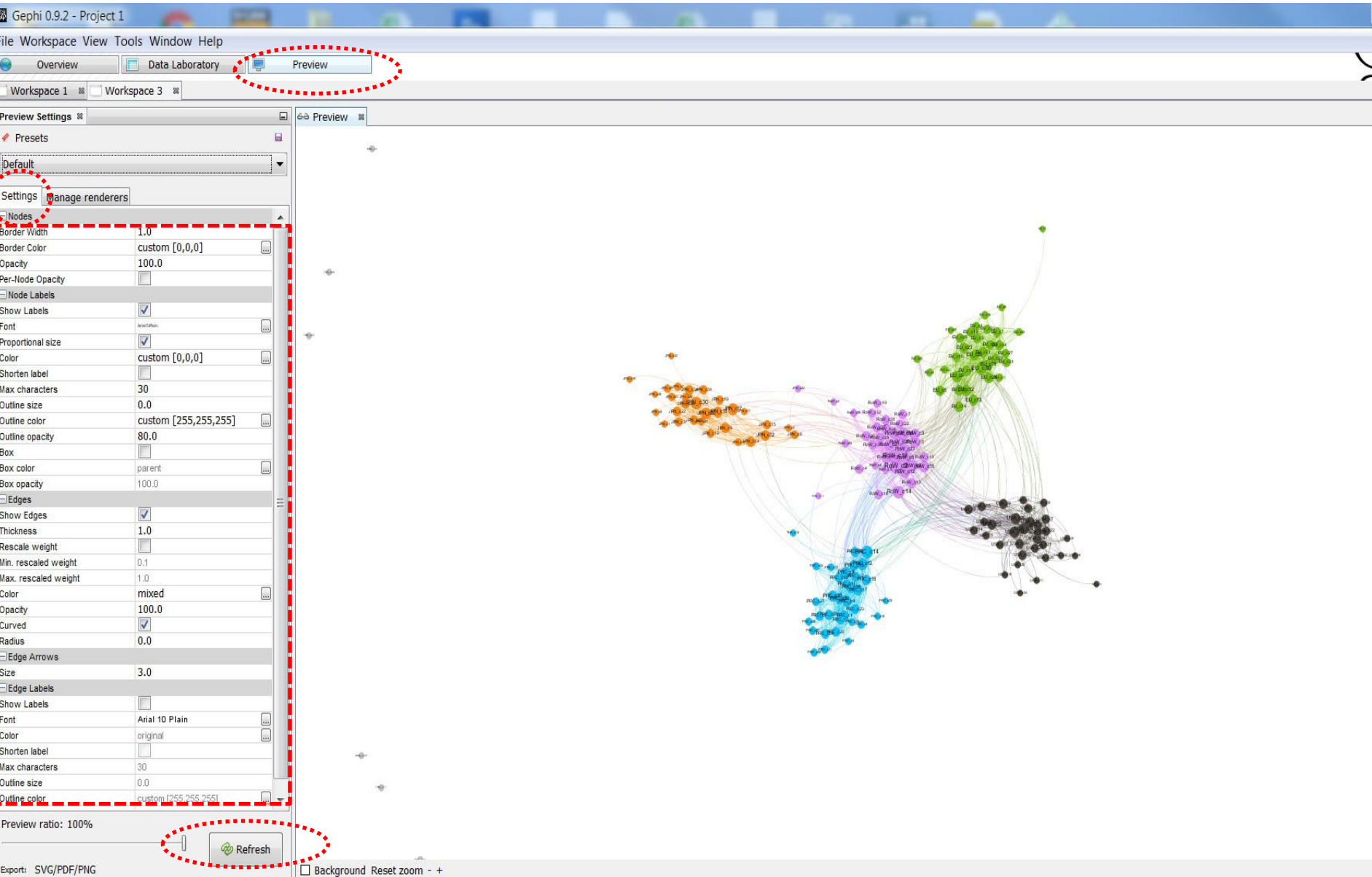
On the right side, there is a sidebar with the following sections:

- 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

At the bottom, there is a configuration panel for 'Global Edges Labels' with the following options:

- Global Edges Labels** (selected)
- Node** (checked)
- Edge** (unchecked)
- Font**: Arial Bold, 32
- Color**: [Black color swatch]
- Size**: [Slider]
- Edge Font**: Arial Bold, 32
- Edge Color**: [Light gray color swatch]
- Edge Size**: [Slider]
- Size**: Scaled (dropdown)
- Color**: Text (dropdown)
- Hide non-selected** (unchecked)
- Configure...** button

Step 13: The visualization of network graph can be modified in order to create the professional-look 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.



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.

The screenshot shows the Gephi 0.9.2 - Project 1 interface. The 'Data Laboratory' tab is active, displaying a table of network indicators. The table has columns for various indicators and their values. The 'Export table' button is highlighted with a red dashed circle. Below the table is a toolbar with various data manipulation options.

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	0.800575	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	

Toolbar options:

- Add column
- Merge columns
- Delete column
- Clear column
- Copy data to other column
- Fill column with a value
- Duplicate column
- Create a boolean column from regex match
- Create column with list of regex matching groups
- Negate boolean values
- Convert 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.