

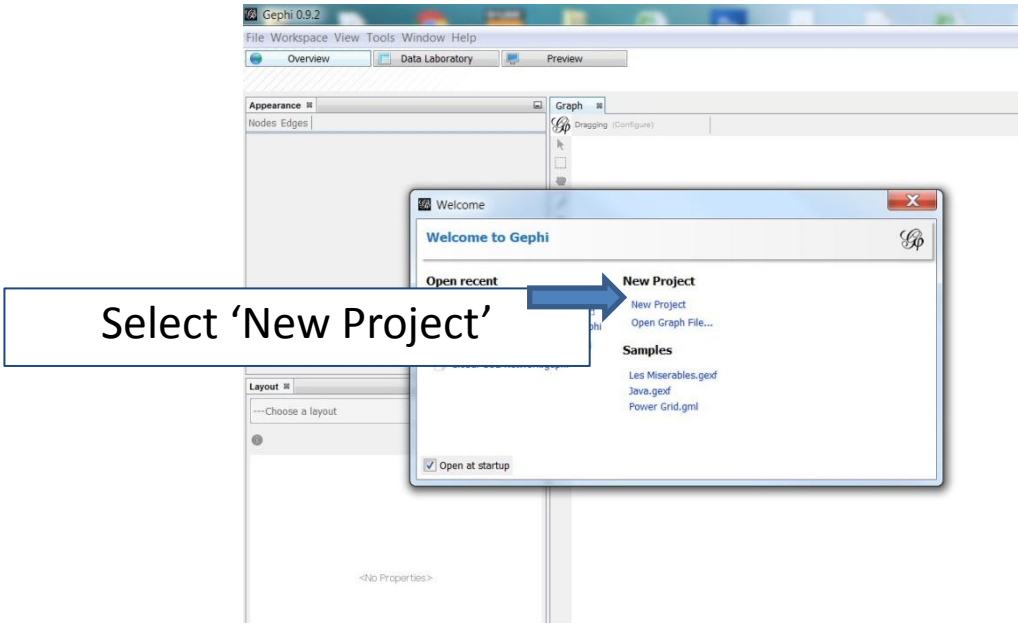
Tutorial: Using Gephi for Analyzing ADB's Global Input- Output Table

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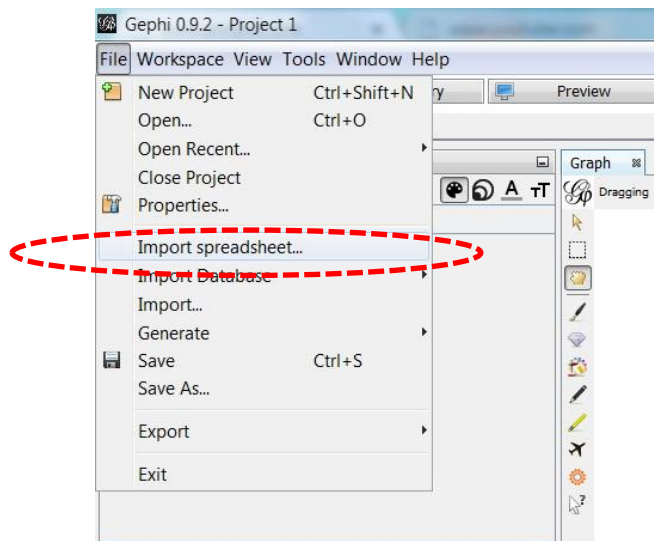
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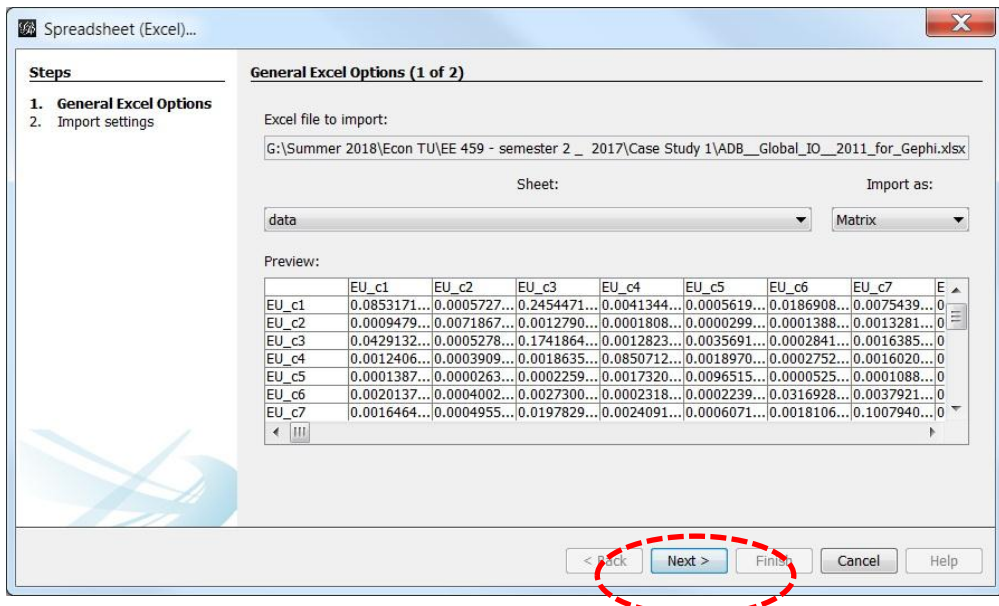
Step 1: Import the Excel data (which is ADB's global IO table of 2011) by selecting 'New Project'.



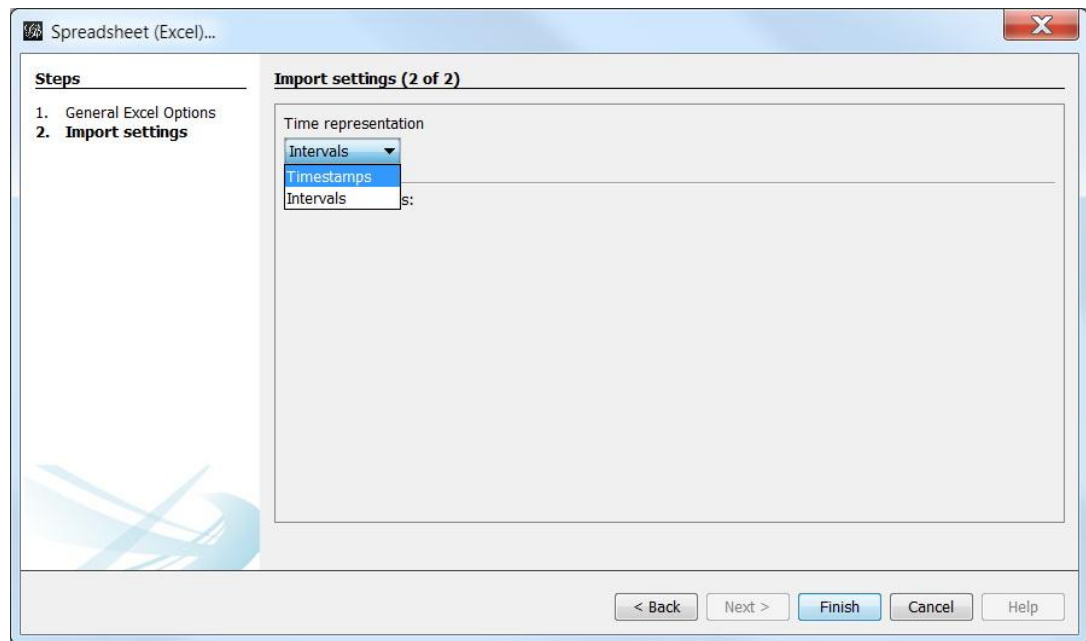
Step 2: On the top menu, select 'File → Import spreadsheet'. Then identify the location of the spreadsheet of ADB's global IO table.



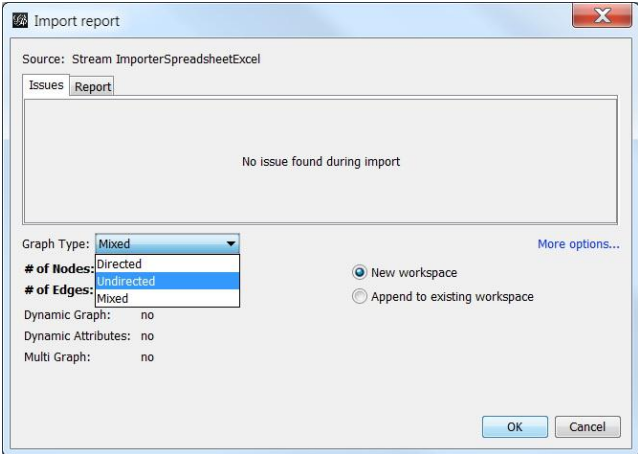
Step 3: The spreadsheet import window will be displayed. Select 'Next'.



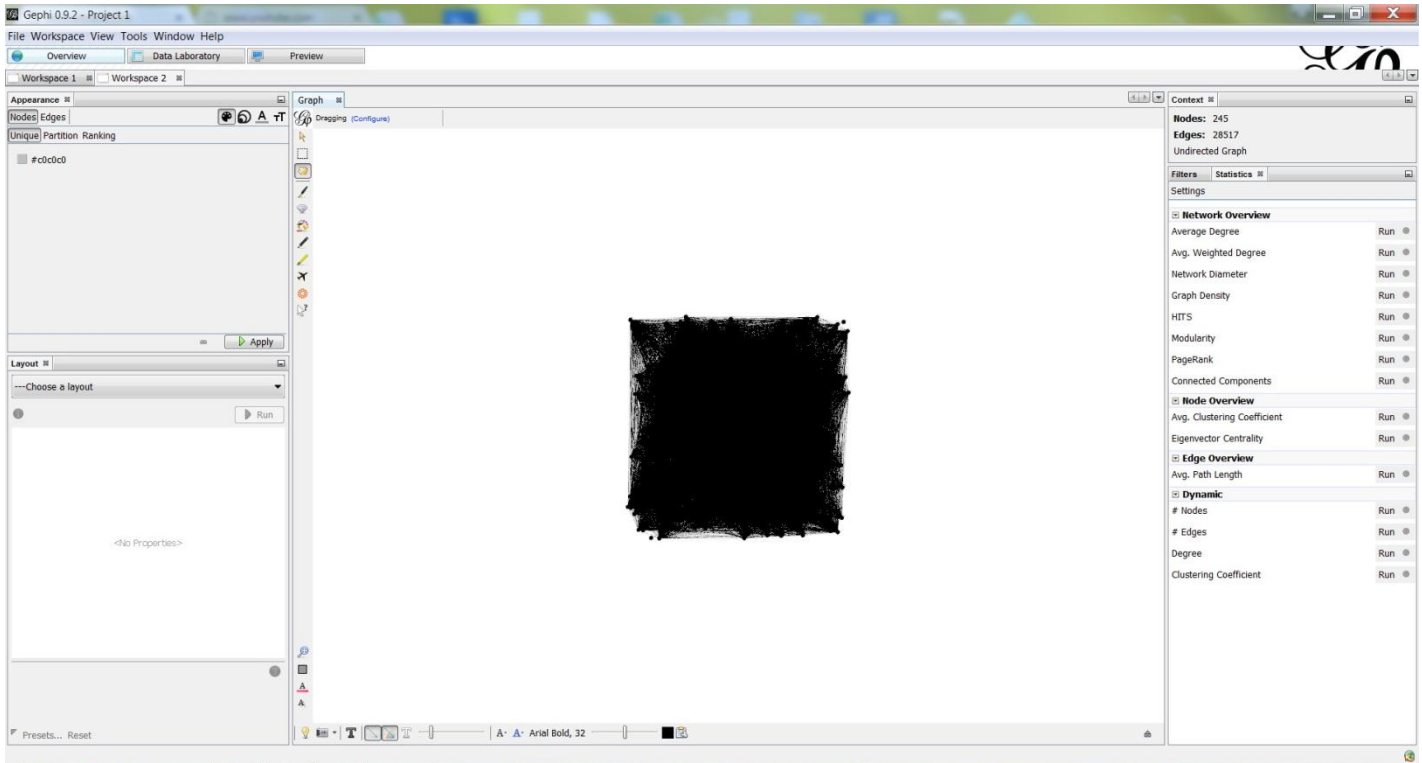
Step 4: Select the time representation as 'Timestamps' because this is just the single year data.



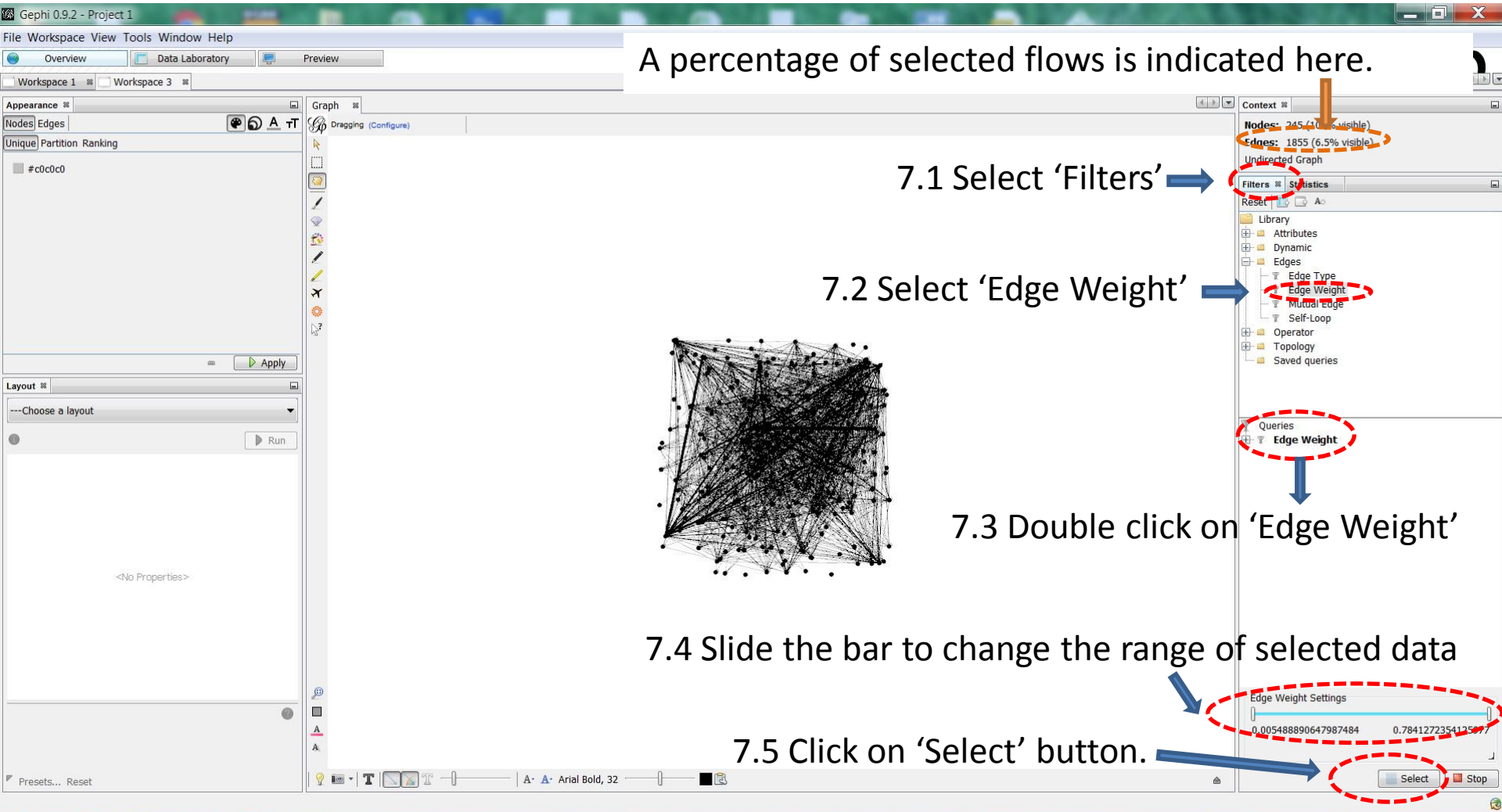
Step 5: Select the graph type as 'Undirected'. Then select 'OK'. (Note: the 'Undirected' indicated that the direction of flows in the table is ignored. To identifying both the direction and the magnitude of flows, please select 'Directed'.)



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



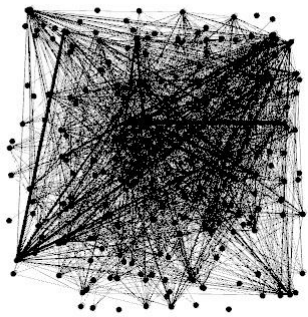
Step 7: Since the initial network graph includes all flows (i.e. all transactions on the global IO table), we can filter these data by selecting the option in the right-hand -side box. Specifically, select Filters → Edges → Edge Weight. Then, double click on 'Edge Weight' and change the range of selected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

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 software interface with a 'Filters' tab set to 'Statistics'. A list of network indicators is displayed, each with a 'Run' button circled in red. The indicators are grouped into sections: Network Overview, Node Overview, Edge Overview, and Dynamic.

- 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.

Options for computing 'Network Diameter'.

The 'Graph Distance settings' dialog box shows options for computing 'Network Diameter'. The 'Distance' section is selected. The 'Directed' radio button is unselected, and the 'Undirected' radio button is selected. The 'Normalize Centralities in [0,1]' checkbox is unselected. The 'Betweenness Centrality', 'Closeness Centrality', and 'Eccentricity' sections are visible but not expanded.

Options for computing 'Modularity'.

The 'Modularity settings' dialog box shows options for computing 'Modularity'. The 'Modularity' section is selected. The 'Randomize' checkbox is checked. The 'Use weights' checkbox is checked. The 'Resolution' is set to 1.0.

Options for computing 'PageRank'.

The 'Page Rank settings' dialog box shows options for computing 'PageRank'. The 'PageRank' section is selected. The 'Directed' radio button is unselected, and the 'Undirected' radio button is selected. The 'Probability (p)' is set to 0.85. The 'Epsilon' is set to 0.001. The 'Use edge weight' checkbox is unselected.

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' 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. The 'Apply' button at the bottom of this panel is highlighted with a red dashed circle. A tooltip above the button reads 'Apply the current transformation to the graph'.

The 'Graph' panel in the center shows a network graph with nodes and edges. The 'Context' panel on the right provides statistics for the graph: 245 nodes (100% visible) and 1855 edges (6.5% visible). It also lists various network metrics and filters.

| 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%) |

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 with the ForceAtlas2 layout algorithm applied to a network graph. The interface is divided into several panels:

- Appearance Panel:** Shows the 'Nodes Edges' tab with 'Partition' selected. A table lists 'Modularity Class' values and their corresponding percentages.
- Layout Panel:** Shows the 'ForceAtlas 2' layout algorithm selected. A 'Run' button is visible.
- Graph Panel:** Displays the network graph with nodes colored according to the modularity classes and arranged in a complex, interconnected layout.

| 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

Threads

Threads number: 1

Performance

Tolerance (speed): 1.0

Approximate Repulsion:

Approximation: 1.2

Tuning

Scaling: 2.0

Stronger Gravity:

Gravity: 1.0

Behavior Alternatives

Dissuade Hubs:

LinLog mode:

Prevent Overlap:

Edge Weight Influence: 1.0

Presets... Reset

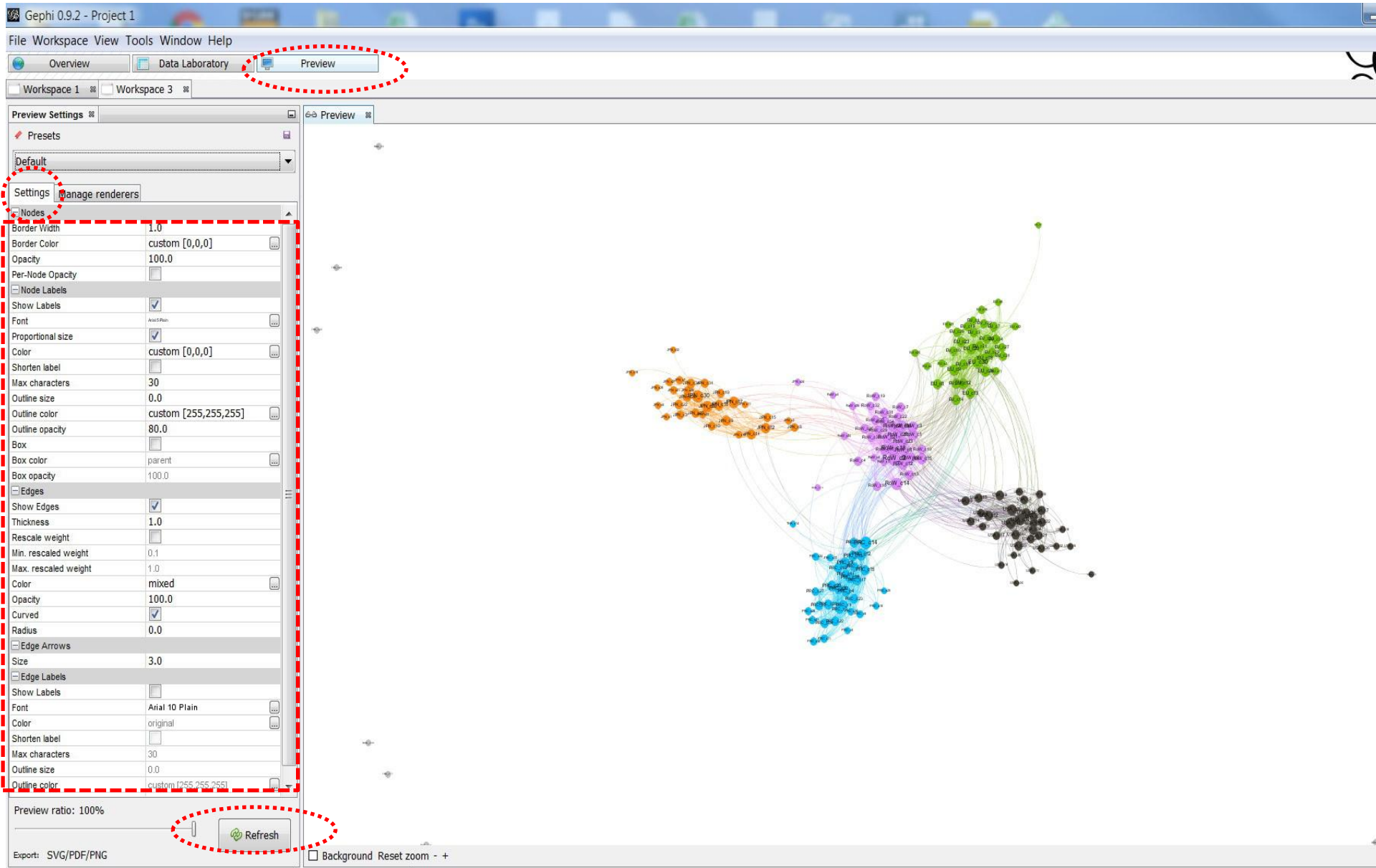
Step 11: ForceAtlas2 method has revealed that the core of global trade is composed of 5 groups of nodes. To add the labels and other details of this network graph, select the small arrow icon located in the bottom-right of the main window.

The screenshot displays a network visualization software interface. The main window shows a network graph with 245 nodes and 1855 edges, visualized using the ForceAtlas2 method. The graph is composed of five distinct clusters of nodes, each highlighted with a different color: orange, purple, green, blue, and black. The nodes are interconnected by edges, forming a complex network structure. The interface includes a toolbar on the left with various icons for graph manipulation, a 'Context' panel on the right showing network statistics and filters, and a status bar at the bottom. A red dashed circle highlights a small arrow icon in the bottom-right corner of the main window, which is the target for the next step in the process.

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 displays a network graph visualization software interface. The main window shows a dense network of nodes and edges, with nodes labeled by region and country code (e.g., JPN_c16, EU_c6, RoW_c5, USA_c1). The interface includes a toolbar on the left with various editing tools, a 'Preview' button at the top left, and a 'Context' panel on the right. The 'Context' panel shows statistics: Nodes: 245 (100% visible), Edges: 1855 (6.5% visible), and Undirected Graph. Below this are sections for 'Filters', 'Statistics', and 'Settings'. The 'Settings' section includes '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), and 'Dynamic' (# Nodes, # Edges, Degree, Clustering Coefficient). At the bottom, there are configuration panels for 'Global', 'Edges', and 'Labels'. The 'Labels' panel is highlighted with a red dashed circle, showing the 'Node' checkbox checked and the font set to 'Arial Bold, 32'.

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 | 0.005008 | 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 | 0.051429 | 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 | |

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.