Trade Networks

DSTA

1 Ch. 2: Trade networks

1.1 Important concepts

- directed networks
- weighted networks
- sorts, and their quantitites
- time

. . .

discover **multiplex networks**

1.2 Towards Clustering

- reciprocity
- assorativity

. . .

- discover hidden structures

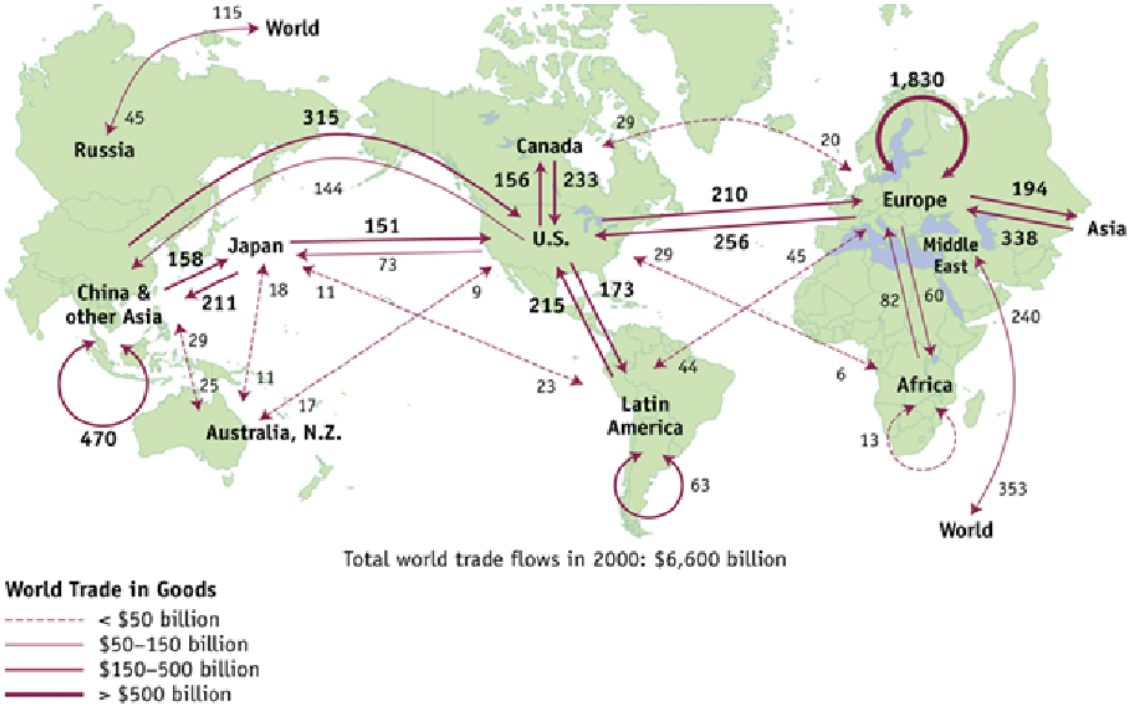
1.3 The directed network model

Theme: discover non-trivial relationships among countries

look at how they trade and what they trade

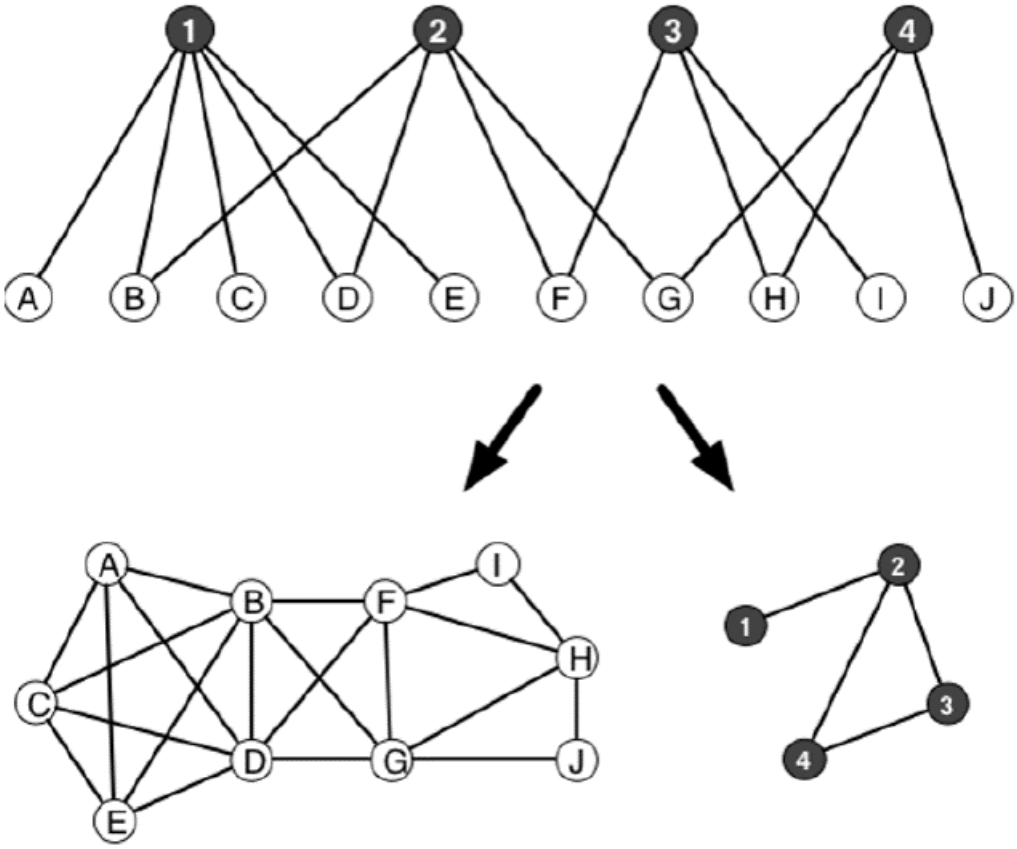
1.4 Weighted networks

The BACI-CEPII dataset:



1.5 Bipartite networks

The country-to-product network induces country-to-country and product-to-product relationships.



1.6 Reconstruction

$$C = M_{cp} \cdot M_{cp}^T$$

$$P = M_{cp}^T \cdot M_{cp}$$

1.7 Analysis of neighbours

For a node i, let k_i be its degree.

For directed networks: $k_i = k_i^{in} + k_i^{out}$.

The distribution of degree $P(k)$ provides a signature of the network.

The average degree is denoted $\langle k \rangle$.

1.8 Reciprocity

For a given directed network, reciprocity is the probability that of having links in both directions between two vertices.

R measures how the economies of two countries become interconnected (or interdependent).

$$r = \frac{L^{\leftrightarrow}}{L}$$

$L^{\leftrightarrow}$: number of reciprocal links

L: total number of links.

1.9 Assortativity

Do vertices tend to connect with those with similar/dissimilar degree? Compute

. . .

- the avg. degree of node i's neighbors:

$$K_{nn}(i) = \frac{\sum_{\langle ij \rangle} k_j}{k_i}$$

. . .

- Next, the avg. K_{nn} for the n_d nodes which have degree d

$$K_{nn}(d) = \frac{\sum_{i:k_i=d} K_{nn}(i)}{n_d}$$

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Are d and $K_{nn}(d)$ close?

Does assortativity grow over time?

1.10 Balassa's RCA

The export matrix M is an adjacency matrix which reprents a bipartite graph.

Each scalar value M_{cp} corresponds to the aggregated export of product p by country c.

We can compute fractional ownership of export, product by product.

Many countries export coffee, so none really controls it.

Italy exports 100% of Bergamot oil (cfr. Prince of Wales tea).

The Revealed Comparative Advantage (RCA) is in controlling a high fraction of some product.

$\sum_{p'} M_{cp'}$: total value of export by country c.

. . .

$$\mathrm{RCA}_{cp} = \frac{\frac{M_{cp}}{\sum_{p'} M_{cp'}}}{\frac{\sum_{c'} M_{c'p}}{\sum_{c'} \sum_{p'} M_{c'p'}}}$$