

# WITS GLOBAL NETWORK TOOL

*How to use it*

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*PRELIMINARY DRAFT*

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## Global perspective charts

Global Graphs depict the trade network for a selected HS product. Countries are graphed as Nodes and trade flows as links (i.e. edges) among them. Users can choose among different products and trade flows. Trade data, may come from two different sources: exporting country declarations or mirror importing country declarations. Please note that “Trade Flows” here refers only to the data source – custom declarations – not to the direction of the flow<sup>1</sup>.

Directionality of trade relations can be selected using the available **ViewPoints**: Buyer or Supplier. The Buyer view point shows the role of each country as destination market (node size is proportional to Weighted IN-degree normalized by world trade, i.e. Import market share). The Supplier view point shows the role of each country as source of other nodes imports (node size is proportional to Weighted OUT-degree normalized by world trade, i.e. Export market share).

The degree centrality is the simplest measure of the position of a node in a network. Since trade here is represented as a weighted directed graph, the Degree of each node is given by the volumes exchanged by each country: OUT-degree is the sum of the out coming flows and IN-degree is the sum of the incoming flows. Note that since the graph is normalized by the world trade (i.e. each elementary flow is expressed as world trade share) the OUT-degree is simply the country export market share, while the IN-degree is the import market share.

For any year  $t$  or level of product disaggregation, Table 1 shows an example of trade matrix ( $W$ ) representing bilateral commodity flows; each entry  $w_{ij}$  records the value of the shipment from country  $i$  (origin) to country  $j$  (destination) normalized by the matrix sum (world trade)<sup>2</sup>. Trade flows are represented as a directed graph: implying that  $w_{ij} \neq w_{ji}$ <sup>3</sup>.

**Table 1: Weighted Directed Trade Matrix – Numerical Example, Global Perspective**

Origin $i$ \ Destination $j$	ARG	AUS	AUT
ARG	0.000	0.059	0.065
AUS	0.338	0.000	0.119
AUT	0.325	0.095	0.000

<sup>1</sup> Other else equal, a graph build using export declarations (Trade Flows: Export) should be very similar to the one build using mirror import declarations (Trade Flows: Import).

<sup>2</sup> Defining  $X_{ij}$  as the value shipped from country  $i$  to country  $j$ , the typical entry  $w_{ij}$  will be equal to:

$$\omega_{ij}^{global} = \frac{X_{ij}}{\sum_{i,j} X_{ij}}$$

<sup>3</sup> In order to avoid loops in the graphs the main diagonal is set equal to zero,  $w_{ii} = 0, \forall i$  (i.e. excluding re-imports or re-exports).

Weighted OUT-degree is defined as:  $WDegree_i^{out} = \sum_j \omega_{ij}$

Weighted IN-degree is defined as:  $WDegree_j^{in} = \sum_i \omega_{ij}$

**Table 2: Weighted OUT/IN degree – Numerical Example, Global Perspective**

Dest j \ Origi	ARG	AUS	AUT		OUT-Degree
ARG	0.000	0.059	0.065	→	0.124
AUS	0.338	0.000	0.119	→	0.456
AUT	0.325	0.095	0.000	→	0.420
	↓	↓	↓		
IN-Degree	0.663	0.153	0.184	→	1

In what follows we present an example of WITS network visualizations – Global Perspective – using the following configuration:

- Nomenclature: HS1988/1992,
- Year:2010
- Product: 62
- Trade Flow (source): Export
- Threshold<sup>4</sup>: 0.95

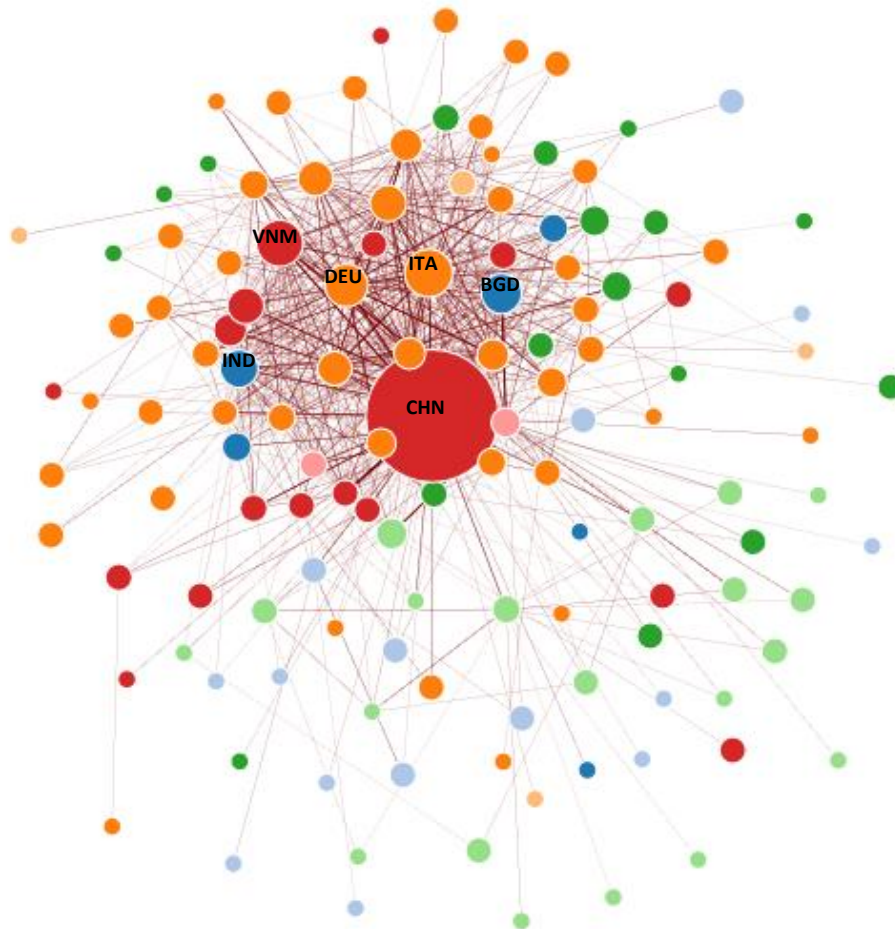
<sup>4</sup> To improve the readability of the graph only the top 95 % of world trade is shown. By default the threshold is set at 0.95 (i.e. 95%). Note that setting a value above 0.95 will significantly slow down the optimization process.

## Global perspective - View point: Supplier

The following graph depicts the trade network for “Articles of apparel, accessories, not knit or crochet” (Product 62) according to the HS 1988/1992 classification (Nomenclature) for year 2010, based on exporting countries customs declarations (Trade Flow: Export).

Supplier View Point shows the role of each country as a world supplier in the specified product. The size of each node (country) depends on the Weighted OUT-degree; it is proportional to the share of world trade in a given product originated from the country (world export market share). The thickness of each link (elementary flow) is proportional to the share of the individual flow on world trade in a given product.

**Figure 1: World trade network for Apparel (HS62) – year 2010 – Main Suppliers**



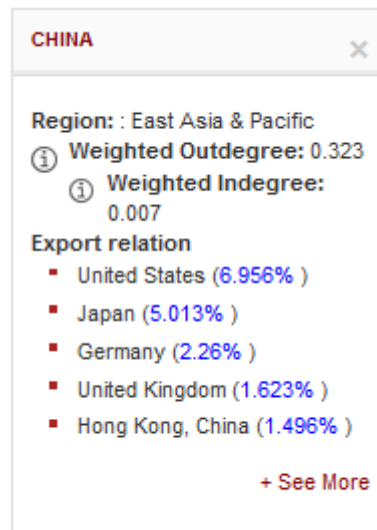
The position of nodes in the trade network is defined using what is called a force-directed algorithm. Being simplistic, the algorithm acts as a balanced spring system that minimizes the energy in the system. In other words, it is as if countries were linked through springs: countries which are connected tend to stay close, while countries which are not connected tend to be placed far apart.

The position of each country does not depend only on its bilateral links but also on the indirect effect of others: the trade partners of its trade partners will contribute to the determination of the country's position in the network. The represented graph allows capturing the multilateral effect on bilateral flows, giving to every country a position relative to all the other countries in the trade network and depending on the entire trading system.

The benefit of representing international trade as a network is therefore the possibility to visualize the effect of the relationship between the trading countries and the structure of the network itself revealing patterns that are difficult to see using other approaches<sup>5</sup>.

China is by far and large the main world supplier of “Articles of apparel, accessories, not knit or crochet”, with an export market share of 32.3% (i.e. weighted OUT degree). Other main players in the South Asian region are Bangladesh 4.1% of the world exports and Vietnam 3%.

**Figure 2: Supplier View point, Export relations for a given country**



Within the **Supplier View Point** double click on a particular node shows the detailed export patterns for that country. Figure 2, for instance, shows the top 5 destination for China exports, in terms of world trade share: the single export flow from China to USA is worth 6.9% of world exports in apparels, while the one from China to Japan 5%.

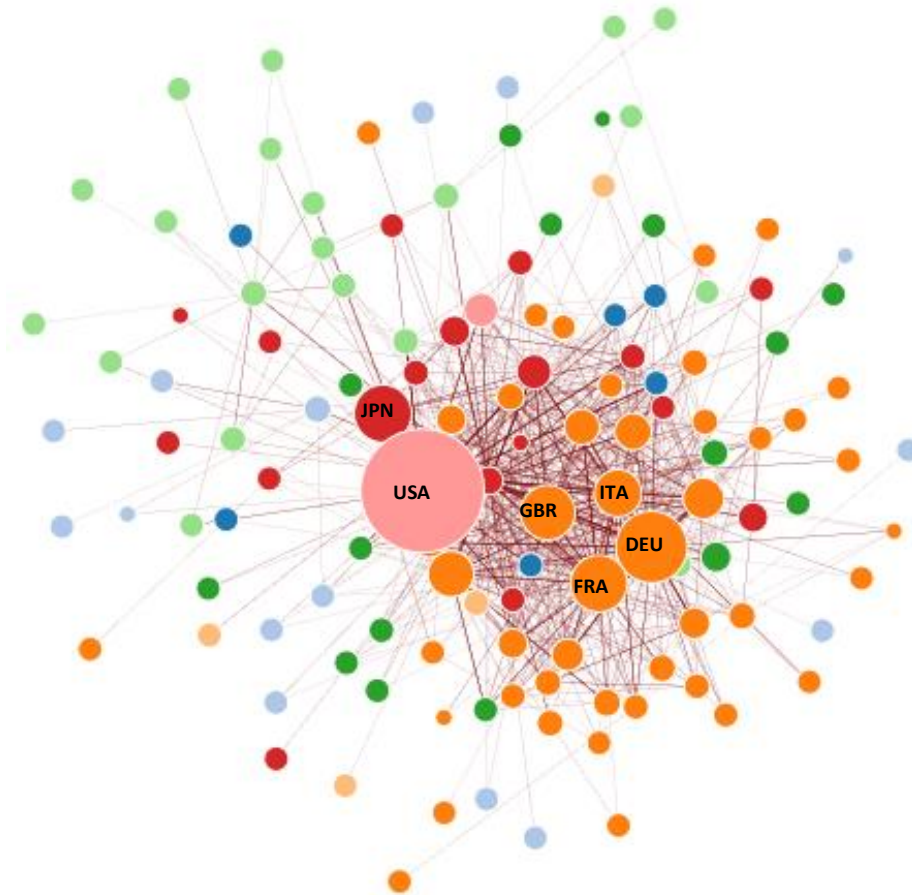
#### Global perspective - View point: BUYER

The following graph depicts the trade network for “Articles of apparel, accessories, not knit or crochet” (Product 62) according to the HS 1988/1992 classification (Nomenclature) for year 2010, based on exporting countries customs declarations (Trade Flow: Export).

Buyer View Point shows the role of each country as a destination market in the specified product. The size of each node (country) depends on the Weighted IN-degree; it is proportional to the share of world trade in a given product absorbed by the country (world import market share). The thickness of each link (elementary flow) is proportional to the share of the individual flow on world trade in a given product or aggregate.

<sup>5</sup> The description is taken from: De Benedictis Luca & Nenci Silvia & Santoni Gianluca & Tajoli Lucia & Vicarelli Claudio, 2014. "Network Analysis of World Trade using the BACI-CEPII Dataset," Global Economy Journal, De Gruyter, vol. 14(3-4), pages 57, October.

**Figure 3: World trade network for Apparel (HS62) – year 2010 – Main Buyers**



The overall structure of the graph -Figure 3 - is similar to Figure 1 the only difference is that the node size is proportional to the Weighted IN-degree, in order to stress the role of each country as buyer of articles of Apparel (HS62). On a global scale USA is the most relevant destination market for apparel, absorbing 20.1% of world trade, followed by Germany 9.5% and Japan 6.7%.

As described before (see Figure 2) double click on a particular node show the detailed trade patterns, in the **Buyer View Point** the country table will show the top 5 origin of imports (always expressed in terms of world trade share).