



# Methods and Sources: Methodological Notes

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## Survey on International Merchandise Transport

### Estimate of average freight rates: the methodology

The main goal of the survey on the international transport of merchandise is to collect the unit costs of transport for homogeneous groups representing standard shipment types defined by the mode of transport used, the distance involved (country or geographical area of origin or destination), the direction of the flow and the type of cargo or merchandise.<sup>1</sup> Examples of standard shipment types are crude oil imports (by bulk sea transport) from the Middle East or exports of food products by truck to the Iberian Peninsula.

In practice, prices can be defined in weight units (metric tonnes) or in cargo units (vehicle or container), more rarely in volume or by number of individual items. Whatever the unit used, the prices are always converted to rates per metric tonne for consistency with the data on foreign trade, which use that unit of measure (and by which they are multiplied to obtain the value of the service provided). Furthermore, a distinction is made between 'pure' freight rates and the other components, i.e. ancillary services (typically the loading and unloading of cargo) and agents' and brokers' fees.

The modes of transport – which are identified based on homogenous characteristics of means of transport, merchandise and freight rates – are:

#### 1. Ship

- Liquid bulk cargo: transport of oil and oil products and liquid chemical products.
- Dry bulk cargo: transport of fossil raw materials (coal, bauxite, iron ores etc.) and food commodities (grain and equivalents).
- Container: transport of merchandise in containers.
- General cargo: a residual category for the transport by sea of merchandise that cannot be loaded into a container and does not fall under the category of liquid or dry bulk.
- Ro-Ro (Roll on-Roll off): the transport by sea of an entire road vehicle (with or without its tractor unit).

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<sup>1</sup> The number of standard shipment types that occur is actually much lower than the theoretical maximum given by all the possible combinations of the variables because most of the combinations do not occur in practice. For example, air transport is almost exclusively used for certain types of merchandise, in many cases the direction of the transport flow is not relevant, and so forth.

## 2. Rail

- Container (either intermodal or combined): transport of 'unitized' loads, i.e. packed into a unit such as containers, swap bodies or 'rolling motorways' (a type of rail freight in which the road vehicle, with or without its tractor unit, is loaded onto the train).
- Traditional (or bulk): non-unitized cargo transported on dedicated rail cars.

## 3. Road: for this mode of transport a distinction is made between freight rates for full truck loads (with prices generally denominated in euros per vehicle) and groupage loads, when the vehicle is loaded with cargo from different clients (in highly variable quantities ranging from 100 kg to 5 tonnes and with prices determined by weight).

## 4. Air

## 5. Pipeline

The distribution by geographical area of the partner countries based on distance is defined according to the volumes of foreign trade and varies depending on the transport mode. The type of merchandise or cargo may refer to specific commodity sectors (as defined by the Standard Goods Classification for Transport Statistics, 2007) within a given mode of transport, or to special ways of loading, e.g. groupage in road transport.

Once the standard shipment types to be used in recording unit costs have been defined, the interviews with transportation and logistics companies begin, divided by mode of transport.

The identification of 'typical shipments' does not constitute sample stratification but rather the variable to be estimated, with respect to which the respondents provide an average assessment (mean unit rate). In fact, information on the same kind of shipping can be collected from different categories of transport company, and individual operators can spread their activity over more than one mode of transport, thus providing data on more than one 'typical shipment'. Operators can be classified on the basis of three main characteristics of their business:

- carriers, i.e. the entity directly handling the transport;
- the forwarder or multimodal transport operator, and;
- the intermediary (agent or broker) that manages the contracts of affreightment, especially for sea and air transport.

The names of the operators to be interviewed are drawn randomly from lists according to company size as measured by turnover. The sampling lists are based on the records kept by trade associations and international organizations or those made available by specialized publications.

The survey was conducted among around 200 international freight transport operators on a quarterly, six-monthly or annual basis depending on the level of variability of freight rates displayed by the type of transport.

Sample size is defined as a function of the variability of the unit costs of transport. The findings of the surveys conducted in previous years are used to determine the (minimum) sample size for the number of questionnaires to be administered to individual companies (each type of shipment has its own questionnaire) as well as the minimum number of companies to be included. Further information on sample selection methods, sampling lists, questionnaires and sampling error calculations can be found in other publications by the Bank of Italy.<sup>2</sup>

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<sup>2</sup> Available on the Bank of Italy's website at :<http://http://www.bancaditalia.it/statistiche/tematiche/rapporti-estero/trasporti-internazionali/index.html>.

## Estimate of the average freight rates: modes of transport

Data on road freight rates are collected both at full truck load, with prices normally per vehicle and denominated in euros, and partial truck load (groupage), where the quantities being transported are highly variable ranging from 100 kg to 5 tonnes and with prices determined by weight. Groupage freight rates are much higher than full truck load ones as they entail the use of other vehicles for the collection and distribution, warehousing and composition of the cargo; these auxiliary logistical activities have significant costs. Groupage rates tend to decrease as the weight of the load increases. Ancillary services are mainly in the form of freight forwarders' and agents' fees, tolls and cargo handling (loading/unloading) fees.

Rail transport is divided into two main categories: intermodal and traditional (bulk). In the first case the prices collected from the operators are expressed in euros per crate (or container), in the second case in euros per wagon (or full train). The freight rates are then converted into euros per metric tonne. Ancillary services are essentially cargo handling fees and agents' and freight forwarders' fees.

Air freight is carried out not only through dedicated aircraft but also using the cargo holds of commercial airliners (but not low-cost carriers, which do not offer the service). While air transport is marginal in terms of total volumes, its role in value terms is not negligible. The goods transported by air are normally of high value and low volume. The freight rates are structured as a base rate plus additional charges, and are typically denominated in the currency of the exporting country; the data are collected as half-yearly averages and converted into euros per metric tonne. The main additional charge is a fuel surcharge, which is frequently the most important element in determining the freight rate. Security surcharges have recently become important in relation to the security checks required for shipping. At the same time, airlines are displaying a growing tendency to set all-in rates. Ancillary services are essentially cargo handling fees and agents' and freight forwarders' fees.

Container sea freight is a type of highly standardized liner shipping. The freight rate is structured as a base component, which differs for each type of container (20 ft, 40 ft and 40 ft high cube) plus some surcharges. Further differentiation of the container (e.g. dry box or open top) can constitute an additional charge. The other main surcharges are the Bunker Adjustment Factor (BAF), which covers fluctuations in the cost of fuel, and the Currency Adjustment Factor (CAF), which normally applies to changes in the exchange rate of the US dollar as rates are normally dollar-denominated, and is used by ship owners to hedge against risk. Other surcharges include those for war or piracy risk, port congestion, dangerous goods, and transit through the Suez and Panama canals. The freight rates are measured as quarterly averages in dollars per twenty-foot equivalent, or TEU (for other container sizes the rates are converted back into dollars per TEU). The cost per metric tonne can be calculated by estimating the average container load. Ancillary services mainly consist of Terminal Handling Charges (THC), i.e. the costs involved in loading and unloading the containers, and the International Ship and Port Facility Security surcharge, both applied in ports.

The survey is conducted quarterly among bulk sea transport operators; the sample includes ship owners, agents and some large importing companies and is supplemented with information taken from specialized publications.<sup>3</sup> Therefore the 'shipment types' are examined together with the respondents on the basis of ancillary information such as voyage time, loading and discharge time, fuel consumption, port costs and fuel costs.

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<sup>3</sup> *The Drewry Monthly* (Drewry) and *Shipping Statistics and Market Review* (ISL).

A database is accordingly available for estimating the total freight rate per voyage. Once converted into prices per metric tonne per single voyage, the rates may be grouped into two types of cargo and four types of merchandise: a) liquid bulk, which is further broken down into oil and oil products versus chemical products, and b) dry bulk, which can be divided into grain and agricultural commodities versus coal and metal ores. Ancillary services are mainly port costs and agents' and shippers' fees and, for dry bulk, handling costs (the loading and unloading of the merchandise).

General cargo sea transport is used for residual categories of products for which neither container nor bulk shipping is possible and which are therefore, difficult to standardize and normally not performed by liner shipping. The type of merchandise transported by general cargo is quite diverse and, consequently, so are the freight rates. For some products (e.g. building materials, timber and metallic products), the freight rate is determined by weight, while for others (e.g. machinery and equipment) it is frequently set by volume or by item (but in any case converted into prices per metric tonne). This entails a high proportion of ancillary services, mainly in the form of the loading and unloading of cargo. The freight rates are reported as annual averages in US dollars. Ancillary services mainly consist in port costs, agents' and shippers' fees and handling costs.

Ro-Ro sea freight (Roll on-Roll off), which includes 'motorways of the sea', is the transport of entire road vehicles (with or without their tractor units) and displays some of the features of container shipping as both types of freight constitute unitized liner shipping. The base freight rate depends, among other things, on the kind of vehicle being transported (semi-trailer, trucks etc.). The main surcharges are those for changes in fuel costs, eventual overnight accommodation for the drivers, the handling of driverless vehicles and special transports (live animals or refrigerated vehicles). The data on freight rates are reported as annual averages and are priced in euros as this type of transport is by and large limited to the Mediterranean area. Ancillary costs are mainly linked to stowage and to the storage of driverless semi-trailers.

The costs of transporting natural gas by pipeline were recorded for the first time in the 2016 survey on Italy's International Freight Transport: the market is highly concentrated with a handful of major players. Average transport costs were estimated in interviews conducted mainly in Italy, primarily with gas importers, taking care to ensure that for each pipeline it was possible to collect at least two separate pieces of information to ensure that the data matched (with the exception of Gela which de facto has just one utilizer). To gain a broad overview of the sector, Italy's Authority for Electricity, Gas and Water was also interviewed. This, by virtue of its role, notifies and manages the costs of transport throughout Italy, for the main network and distribution network, starting with the entry points for natural gas imported from abroad (Tarvisio for gas originating in Russia, Mazara del Vallo for Algeria, Passo Gries for Norway and the Netherlands, Gela for gas from Libya).

## Mode-of-transport adjustment of foreign trade data

One of the purposes of the survey is to adjust the mode of transport matrix of foreign trade data by volume and value to ensure a greater level of detail and better quality of the data on the demand for transport and to make up for some of the shortcomings of official statistics. Istat collects data on foreign trade only, distinguishing between four modes of transport (sea, rail, road and air), with no further breakdown;<sup>5</sup> moreover, the quality of the data is affected by the respondents' statistical 'myopia' (which is discussed below).

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<sup>4</sup> 'Sea motorways' is a system of combined road-sea freight transport by means of Ro-Ro ships, the purpose being the transfer of a share of road transport from motorways to sea lanes.

<sup>5</sup> Data on the share of merchandise shipped by container would be available, for sea freight and for non-EU trade only, but a comparison with other statistical sources shows that those data underestimate the share commanded by container ships to the detriment of the other types of sea freight transport.

These data, therefore, need to be adjusted using a number of industry-specific datasets (Italian and international) on merchandise transport for which the main sources are:

- the data on transport collected and published on a regular basis by Eurostat for the European Commission's DG MOVE;<sup>6</sup>
- the CAFT database<sup>7</sup> produced every five years by Switzerland, Austria and France;<sup>8</sup>
- Trenitalia data on imports, exports and international transit flows.<sup>9</sup>

The use of these sources makes it possible to allocate Istat's foreign trade data into the different types of transport identified for sea and rail freight. It also makes it possible to change the breakdown by mode of transport between the main four categories in order to remove the overestimate that structurally affects road transport to the detriment of the three other multimodal modes, especially rail.<sup>10</sup> In fact, the importing and exporting firms tend to identify the mode of transport on the basis of the means of transport used as the first or last link in the chain, the road truck, which often only performs feeder service (thus the statistical 'myopia'). Finally, as regards EU trade data (Intrastat), it makes it possible to estimate the modal breakdown of transactions that fall under the minimum reporting threshold for which the information on the mode of the transport used is not mandatory.

The assumption underlying the adjustment of the Istat matrix of trade flows is that the import and export totals, by quantities transported and by monetary value, are substantially accurate, save for small adjustments such as subtracting bunkering (refuelling), for which it does not make sense to calculate the cost of transport. Therefore, only the breakdown by mode of transport is changed, without significantly affecting the breakdown by geographical area or product.

## Estimate of carriers' market shares by nationality

The estimate of the breakdown of trade volumes between Italian and foreign carriers is calculated for the various modes of transport using different sources: administrative ones for air and rail, and sample surveys for sea and road.

For air transport mainly external administrative sources are used; the data are supplied by the Italian Civil Aviation Authority (ENAC) and from Assoaeroporti, Italy's airport industry association, and provide information on the annual volumes transported by carriers, broken down by country of residence. The same holds true for rail transport, for which the administrative data are drawn mainly from Italy's rail safety agency ANSF and Istat.<sup>11</sup> Here data collection has only begun in recent years as a consequence of privatization in the sector. Moreover, the market shares only refer to the Italian stretch of the flows between Italy and abroad.

For road transport the data used are those collected as part on the Bank of Italy's Survey on International Tourism in Italy.<sup>12</sup>

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<sup>6</sup> For sea transport the sources are the statistics provided by the individual ports, which for Italy are the statistics on maritime transport in Italian ports compiled by Istat. These sources provide data on the types and quantities of merchandise loaded and unloaded in Italian ports by country of origin and destination. Data on rail transport are taken from the national statistics. For air freight, they are collected in all airports.

<sup>7</sup> CAFT (Cross Alpine Freight Transport), see <https://www.bav.admin.ch/bav/it/home/temi/indice-alfabetico-dei-temi/trasferimento-del-traffico/rapporti-e-dati.html>.

<sup>8</sup> The CAFT survey is coordinated by the Swiss Ministry of Transport and is based on vehicle counts and interviews carried out at border crossings, providing data on cross-alpine transport flows. Its precise and accurate statistical criteria make it a robust and reliable source of data for analysing cross-Alpine freight traffic, though the fact that it does not include Slovenian border crossing diminishes its importance.

<sup>9</sup> The data are broken down by Italian region of origin/destination, by foreign network of origin/destination, and by conventional versus intermodal transport.

<sup>10</sup> For multimodal transport the mode of transport reported is the dominant one, i.e. the one used for the longest stretch or for the international segment of the transport.

<sup>11</sup> For the ANSF data, see its annual report on rail safety; for the Istat data see, for example, <http://www.istat.it/it/archivio/79224>.

In counting the number of vehicles entering/leaving the country by road border crossing, a specific count is made for trucks, classified by size and licence plate nationality. The share held by resident carriers is then estimated by looking at the trade volumes of each road border crossing.

For the estimate of market shares in sea transport the methodology relies on:

- the IHS *Fairplay* Sea-web database which contains detailed information on the world fleet;<sup>13</sup>
- the selection of a sample of ships/international flows recorded in a given period of time in a significant number of Italian ports.

More than 5,000 ships were included in the survey, accounting for over 20,000 transport flows. The sample represents a very high share of Italy's overall international freight traffic, accounting for over 80 per cent of transport flows.

Once the sample is extracted, the target population defined and the Sea-web database acquired, it is possible to identify the ship owner and operator for each vessel.

The market share is then estimated for each port and type of shipload included in the sample, broken down by residence of the ship operator. The total market share for Italy is obtained by weighting the data for the single ports by the total quantities loaded and unloaded.

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<sup>12</sup> Information on the data (including the microdata from the sample survey) and on the proceedings of conferences on international tourism in Italy are available on the Bank of Italy's website at <http://www.bancaditalia.it/statistiche/tematiche/rapporti-estero/turismo-internazionale/index.html?com.dotmarketing.htmlpage.language=1>.

<sup>13</sup> For further information see the Sea-web site at [http://www.sea-web.com/seaweb\\_welcome.aspx](http://www.sea-web.com/seaweb_welcome.aspx).