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EUROSYSTEM

DEPARTMENT OF STATISTICS

THE GREEK SHIPPING ESTIMATION MODEL
METHODOLOGICAL NOTE

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1. Background

The Greek Shipping Estimation Model aims to provide a coherent statistical framework to estimate Balance of Payments items related to shipping activity, based on administrative sources and commercial databases.

Given the multi-territorial nature of the shipping sector and the complex group structures, the estimation of the shipping activity is one of the most challenging tasks in terms of official statistics. This is of particular importance to Greece, since its merchant fleet has a strategic role in the transportation of the trade and energy of many regions in the world and of the EU and shipping activities turnover contributes significantly to Greece's Current Account Balance and the GDP. The statistical framework presented in the current study, can well be applied by other countries for Balance of Payments purposes, as well as by researchers and analysts seeking to estimate revenues and expenses related to shipping activity.

The Greek Shipping model has been developed during the period June 2016 - June 2018. It has been presented (a) in the visit of European Central Bank and Eurostat in the Bank of Greece, in the context of the quality assurance of statistics underlying the Macroeconomic Imbalances Procedure (MIP), on 20-21 November 2017; (b) after invitation by Eurostat, in the Balance of Payments Working Group, on 29-30 November 2017 in Luxembourg and (c) in the first meeting of the Task Force on the recording and compilation of maritime transactions, hosted by Bank of Greece on 18-19 April 2018.

In the Greek Shipping Estimation model a granular level approach is used, with vessel by vessel characterization. A three-stage approach is taken. Firstly, the cluster is defined, the main counterparts and the types of Balance of Payments (BOP) transactions that take place and can be estimated. Secondly, the population is defined, including legal owner companies, operator/ship-manager companies and the vessels to be taken into account. Finally, all BOP transactions for a particular vessel are estimated on a monthly basis.

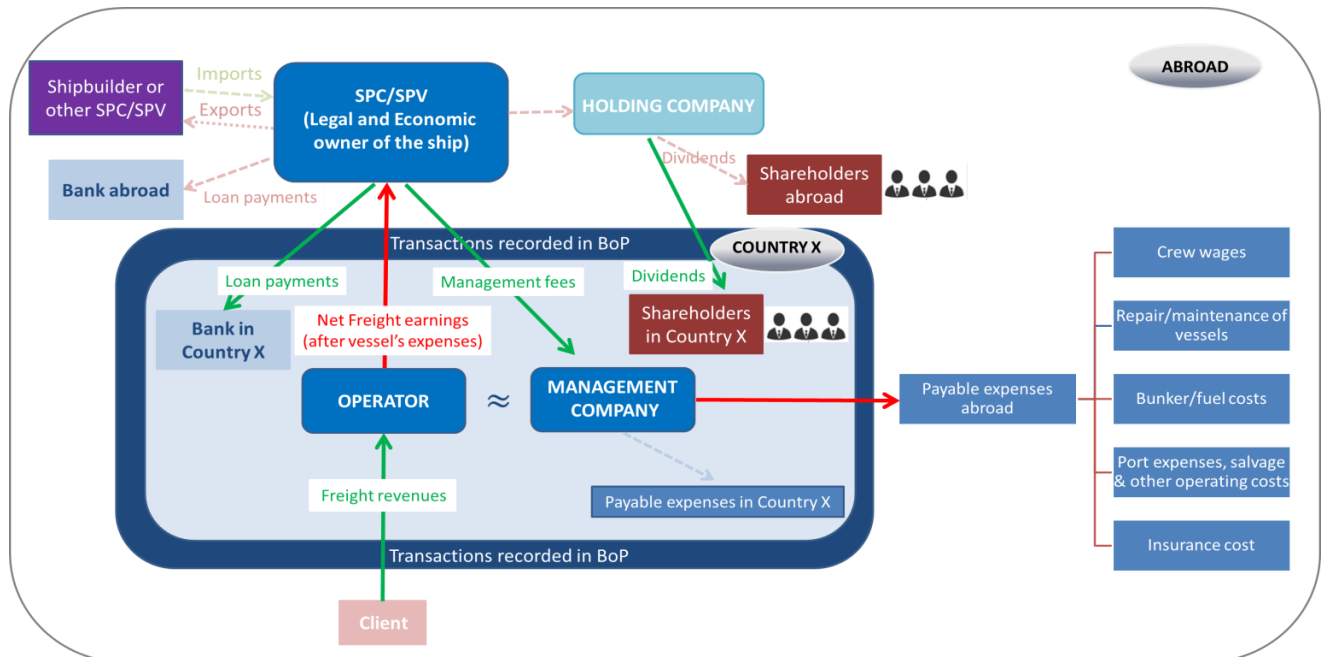
2. The Greek Shipping Cluster

The structure presented in [Figure 1](#) refers to the case of Standard Ship Management Agreement. This has been identified as the most common scenario for the Greek shipping cluster, associated with shipping companies engaged to international carriage of goods by sea, but applies in general to cases of standard ship management agreements. The structure of the cluster has been compiled by combining information from: (a) detailed banking transactions data recorded in BOP, (b) contacts with associated banks, shipping experts and companies and (c) commercial databases.

Typically, there is a ship management company (not depicted in the graph) which is legally registered abroad, with a branch/office whose main activities take place in country X. The activity is attributed to the branch by aligning with the indication of country of domicile as it appears in the commercial databases (as suggested by BPM6 guidelines). The local branch of the ship management company performs acts of operation of the vessel (there are cases where the operator is different to the ship management company, but these are relatively

few). Thus, in Figure 1 the local branch of the ship management company is denoted as the operator and the manager of the vessel.

Figure 1: Standard Ship Management Agreement and BOP transactions



Also there is a fully legitimate ship owning company (SPC/SPV), which is the legal owner of the vessel, most often registered abroad. Note that the ship management company may manage numerous vessels, each one belonging to a different legal owner (each SPC/SPV typically owns a single vessel for risk-exposure and liability purposes). Note that in case the legal owner (SPC/SPV) is incorporated under the laws of country X, the above diagram and the respective transactions are modified by moving the box of SPC/SPV inside country X.

Typical examples of Standard Ship Management Agreements are the BIMCO “SHIPMAN 98” and “SHIPMAN 2009” agreements. According to the standard ship management agreement terms, the freight revenues are received by the ship management company/operator, on behalf of the ship owner. The ship management company uses these freight revenues to pay the operating expenses of the vessel (i.e. crew costs, insurance costs, bunker costs, port expenses and other operational and non-operational costs). The rest of the freight earnings are directed to the legal owner (SPC/SPV), under the form of imports of sea transport services. The ship owning company (SPC/SPV) pays management fees to the ship management company, purchases or sells the vessel and also receives the loan drawdowns and pays capital installments and interest. Also, the ship owning company (SPC/SPV) pays dividends to the shareholders. In case a mother-holding company exists, it is typically the mother-holding company who distributes the dividends to the shareholders, after collecting the earnings from all the SPCs/SPVs of the group.

The above setting is represented in the checklist that follows.

CHECKLIST	LEGAL OWNER (SPC/SPV)	SHIPMANAGER /OPERATOR (Local Branch)
EXPORTS OF VESSELS	✓	
IMPORTS OF VESSELS	✓	
FREIGHT EARNINGS	✓	✓
REPAIR/MAINTENANCE OF VESSELS		✓
BUNKER/FUEL COSTS		✓
PORT EXPENSES, SALVAGE & OTHER OPER. COSTS		✓
INSURANCE COSTS		✓
CREW WAGES		✓
LOAN RECEIPTS	✓	
LOAN INSTALLMENTS	✓	

Note: The above checklist was compiled based on historical bank transaction data recorded in the Greek BOP, after serially matching the transactors' names with the ownership designation provided by the commercial databases; the results have been confirmed by contacts with associated banks, shipping experts and companies. The box ticking is indicative and could vary depending on the specific shipping structure.

Economic owner of the vessel (i.e. the good, which is associated with imports/exports and the capital costs) is the legal owner (SPC/SPV). The ship management company acts for and on behalf of the ship owning company (SPC/SPV). However the ship management company provides the commercial operation of the vessel, i.e. the transport service and is responsible for the commercial decisions concerning the employment of the ship, and provides also management services.

The transactions reported in BOP of country X are:

- all the transactions between the SPV and the operator/management company (management fees and net freight earnings);
- freight revenues from the clients to the operator/management company;
- all the management/operation related expenses to the companies abroad;
- loan and interest receipts and payments between the SPC/SPV abroad and the domestic banks;
- paid dividends to the family of major stakeholders in country X.

3. Data Sources

In order to define the population and estimate the relevant items of the Balance of Payments we have used an exhaustive list of databases, domestic and international, and additional valuable information from relevant maritime legislation, governmental sources and shipping experts both from the academia and the industry. The main data-sources used are presented in the list that follows.

Main data sources used in the Greek Shipping Estimation Model:

- Ministry of Mercantile Marine, Aegean and Island policy: List of the management companies established in the country along with the vessels they manage.
- IHS Maritime and Trade: Detailed monthly data (on a vessel basis) for various types

of ownership, vessel characteristics, new deliveries/deaths, sales, crew. (Subscription fee required).

- Lloyd's List intelligence: Detailed monthly data (on a vessel basis) for various types of ownership, vessel characteristics, new deliveries/deaths, port movement (on a 10 day interval), speed, draft etc. (Subscription fee required).
- Clarksons Shipping Intelligence Network: Detailed monthly time charter rate data by type of vessel (tanker, bulker, etc.), deadweight and year built. (Subscription fee required).
- Drewry: Data regarding operating expenses by vessel type and build year: manning, insurance, stores and spares, maintenance, administrative costs and management fees. (Subscription fee required).
- World Bunker Prices: Bunker Index. (Publicly available).
- Port Expenses: Pricing policy of largest ports worldwide. (Publicly available).
- Banking data, DIRECT: Analysing correlations and trends among BOP shipping items.

Note that whenever a variable appears in more than one database, cross-validations are performed. The above are the main data-sources used for the needs of the compilation of Balance of Payments items. Various other databases were also consulted for developing the Greek Shipping Estimation Model, including the Greek Shipping Directory, a traditional domestic database for Greek shipping; Bloomberg; Greek Maritime Laws; BIMCO types of agreements; UNCTAD; ITF types of agreements; Petrofin; data collected by companies involved in the shipping sector and other.

4. Defining the Population

4.1 Background

The Greek Shipping Estimation Model is vessel-based, so that for each vessel included in the registry, revenues and expenditures are calculated, according to BOP requirements. Thus, one must select the vessels to include in the registry, applying the residency and economic ownership principle. For each vessel there exist one or many linked companies, including the legal (registered) owner, the shipmanager, the commercial operator, the beneficial owner and potentially the technical manager and/or the third party operator.

The relationships among the different players are very complex and identifying their roles is not always easy, having in mind that in the commercial databases are used definitions and terminology not always aligned with the statistical ones. In [Table 1](#) are presented the different types of ownership as used in the Lloyd's Intelligence List and IHS Maritime & Trade databases.

Table 1: The types of ownership as defined according to IHS Maritime & Trade and Lloyd’s Intelligence List

IHS Maritime & Trade	Lloyds List Intelligence
Registered owner (country of registration, country of domicile, country of control)	Registered owner country
Ship Manager (country of registration, country of domicile, country of control)	Commercial operator country
Commercial Operator (country of registration, country of domicile, country of control)	
Group beneficial owner (country of registration, country of domicile, country of control)	Beneficial owner country
Bareboat charterer (country of registration, country of domicile, country of control)	Third party operator country
Technical manager (country of registration, country of domicile, country of control)	Technical manager country
DOC company (country of registration, country of domicile, country of control)	‘DOC’ owner country

The IHS Maritime & Trade uses three types of countries for each type of ownership, defined as:

- Country of Registration: The country in which the company or entity is legally incorporated.
- Country of Domicile: This is also known as Country of Residence and points to the country of location of that ownership, management or operating entity. This is the physical location of the company, i.e. where that company is located. 'Brass plate' companies will usually be shown as 'care of' the commercial manager and reflect the same Country of Domicile.
- Country of Control: The country where the controlling interest in the company is held. This may differ from the Country of Domicile.

Lloyds List Intelligence currently records the country of main operations/head offices and is more related to the country of domicile reported by IHS Maritime & Trade.

4.2 Population of vessels to be included in Balance of Payments and economic ownership

According to BOP compilation manuals and guidelines and given the Task Force on the recording and compilation of maritime transactions consultation, in the majority of cases, the economic ownership can be identified on the basis of the transport agreement among the legal shipowner (SPC/SPV) and the operator/shipmanager. There have been identified three representative cases of agreements:

- Time or Voyage Charter (Case A);
- Standard Bareboat Charter (Case B);
- Standard Management Agreement (Case C).

Note that as described in [Chapter 2](#), the Standard management Agreement (Case C), is the most common for the Greek case.

In cases of Time or Voyage Charter (Case A) and in Standard Management Agreement (Case C), the legal shipowner (SPC/SPV) is considered as the economic owner of the vessel. The operator/management company acts for and on behalf of the legal shipowner; the legal shipowner receives earnings from the economic activity (in terms of daily fee in Case A and net freight earnings in Case C), whereas the asset (vessel) and the liabilities are attributed to the legal shipowner (SPC/SPV).

In cases of Standard Bareboat Chartering Agreement, the economic ownership can be transferred by the legal shipowner to the operator (chartered) of the vessel, depending on the conditions set in the agreement and whether they fulfill the indicative criteria set in the manuals (see ITGS CG).

In commercial databases the name of the legal shipowner (SPC/SPV), is denoted in the column “Registered owner” and its location in the column “Registered owner country of registration”. Note that after analysis of available microdata, the country of domicile in the commercial databases is more related to the location of the shipmanager/operator and not that of the legal shipowner; thus “country of registration” is recommended to be used to identify the location of the legal shipowner.

In IHS Maritime & Trade the name of the Bareboat charter, is denoted in the column “Bareboat Charterer” and its location in the column “Bareboat charterer country of registration”; and if the company’s main activities take place in another country, in the column “Bareboat charterer country of domicile”. In Lloyd’s List Intelligence “Third Party Operator” includes bareboat charterers, as well as long-term (i.e. above 6 months) time charterers or pool operators.

Although not related to economic ownership, in terms of Balance of Payments transactions, there is also the need to identify the location of the shipmanager/operator. It might be the case there exists a management company legally registered abroad (country Y), with a branch located in country X. If the main operations are held by the branch then, in the commercial databases, country Y will be denoted as the “country of registration” and country X as the “country of domicile”. If there is no branch, or the main activities are held abroad, the country of registration and domicile will coincide (country Y). The same stands for bareboat charterer, third party operator and technical manager types of ownership.

Thus, in order to identify the residency of an entity, it is recommended for the legal shipowner to employ the “Registered owner country of registration” variable, whereas for shipmanager, commercial operator, third party operator the respective “country of domicile” variable.

With respect to the Beneficial Owner (UBO)/Group Beneficial owner (GBO), this turns to be in the commercial databases either the same entity with the commercial operator/shipmanager, or the holding company/trading name of a group. As indicated

above, UBO/GBO is not related to the economic owner, unless it coincides with the legal shipowner or the bareboat charterer.

In view of the above the population included in the registry relevant for the Greek Shipping Estimation Model is determined as follows:

Cases for which gross revenues and expenditures related to shipping services are included in the Greek BOP:

- Based on the list of management companies provided by the Ministry of Maritime, identify the companies and their vessels, which are listed in the commercial databases as commercial operators with country of domicile Greece (checking logical coherence between the databases). Exclude from these cases the third party operator is abroad.

Cases for which economic ownership lies in Greece and import/exports of vessels (as well as shipping services) are included in BOP:

- Identify ship owning companies and their vessels, with country of registration of legal owner Greece. Exclude from these cases there is bareboat chartering abroad. Include cases there is bareboat chartering in Greece (these are rare/few cases for the Greek case).

We also exclude vessels from the calculation of revenues and expenditures related to shipping services, that are either dead or new constructions, as well as vessels older than 30 years, that has not observed port movement from 2000 onwards. Note that vessels converting/rebuilding, laid up, in casualty or repairing remain in the registry, since there are specific types of monthly expenses related to them.

The vessel's registry is updated on a monthly basis by incorporating the new information of the commercial databases.

5. Estimation of Balance of Payments Items

Given the population of vessels included in the shipping registry (see [Chapter 4](#)), the revenues and expenditures by vessel, coded by BOP item and counterpart country must be calculated.

The complete list of BOP items to estimate includes (in correspondence with [Figure 1](#)):

Vessel's revenues:

- 1) Freight revenues

Vessel's voyage expenses:

- 2) Bunkers/fuel cost
- 3) Port Expenses

Vessel's operating expenses:

- 4) Manning costs
- 5) Vessel Insurance costs
- 6) Maintenance and dry docking costs
- 7) Stores, spares and lubricant oils costs
- 8) Flag state expenses and voluntary tax
- 9) Administrative costs

Transactions between Commercial Operator and Legal owner (SPC/SPV):

- 10) Management fees
- 11) Net freight earnings

Other BoP items to estimate:

- 12) Imports/exports of vessels
- 13) Loan and interest payments and receipts
- 14) Dividends

5.1 Vessel's revenues

The estimation of shipping services revenues (exports of services) for each vessel requires four steps. At the first step we identify whether the vessel is hired; at the second step we estimate the expected revenues, provided it is hired; at the third step we allocate the revenues to the respective BPM6 code and at the fourth step we allocate the amounts to the respective counterpart countries.

Step 1: Identify based on the commercial databases if the vessel is hired:

Since there is no direct information of whether a vessel is hired, this can be indirectly inferred from its draft. A draft above 20-30% of its max depth signals the vessel holds cargo. Also if there is port movement and a few days later the vessel holds cargo, then one can also assume it was hired.

Port Movement + Draft = the vessel is hired

A simpler approximation (which seems to work reasonably well, in terms of average utilization rates) is to observe the draft data 3 times a month (i.e. every 10 days); note that from the commercial databases we have movement data on the 10th, 20th and at the last date of each month. If at least one of the three observations shows increased draft, then one can assume the vessel was hired the reference month.

Also, if there is port movement and the vessel is not laid up or under repair, one can also assume the vessel is hired; note that there are types of vessels (i.e. passenger, tugs) not relevant for draft.

Step 2: Estimate expected revenues for each vessel hired:

For each vessel hired, we calculate expected revenues by vessel type and size (deadweight/TEU) using the respective, monthly Clarksons' time charter rate. Since rates are provided for specific deadweights/teu's, we use linear percentage differences, among two adjacent deadweight/teu categories, to calculate each vessels' revenues, based on the observed exact vessel's deadweight/teu provided by commercial databases. Moreover, Clarksons' rates are provided in \$ per day. Thus these rates are multiplied by the number of days of each month to approximate the monthly revenues of the vessel.

Step 3: Allocate the revenues to the respective BPM6 code

The revenues calculated above are allocated to either (a) Passenger sea transport, (b) freight sea transport, (c) sea transport among third countries (cross trading) and (d) other sea transport services.

The allocation to the respective category is based on the vessel's type as well as last port visited. In more detail, ROPAX vessels' revenues are attributed to Passenger sea transport, Tugs and Platform Supply vessels' revenues are attributed to Other sea transport services and for the rest types of vessels (Tankers, Bulkers, Containerships, PCTCT, Roll on Roll off, LNG, LPG), if Greece is included as a port visited in any of three dates movement is observed, their revenues are attributed to freight sea transport, otherwise are attributed to sea transport among third countries. ROPAX vessels moving exclusively inside the country (the revenues of which from non-resident passengers are included in travel services) are not included in the Passenger sea transport item.

Step 4: Allocate revenues to the respective counterpart countries

The country of non-resident is set to be the country of the last port visited, which is provided by commercial databases three times a month (at 10th, 20th and the end of each month). Then, for the specific 10-day interval the revenues are attributed to the country of the respective port. Although this might not be always exact, it is the best possible proxy on basis of available information and it is aligned with the statistical guidelines.

5.2 Bunkers cost

To calculate Bunkers cost, it is first calculated the fuel consumption of each vessel and then world bunker prices are used to approximate the actual bunker expenses. Then, these are allocated to counterpart countries on basis of the last port visited.

Commercial databases provide for each vessel the typical fuel consumption (in tonnes per day) at a given (cruising) speed. However it is common practice for vessels to travel at reduced speeds, for fuel economy purposes. Thus, we must also take into account the actual observed speed at a 10-day interval.

There is a well-known theoretical formulae, that links fuel consumption with the third power of speed (see for example, Ronen, 2011¹):

Given the consumption F_0 at speed V_0 , fuel consumption at speed V_i is equal to:

$$F_i = F_0(V_i/V_0)^3,$$

which can be directly calculated on basis of the variables that are available by the commercial databases, as described above.

Having calculated the actual fuel consumption (in tonnes per day) by vessel, we rely on world bunker indices to calculate the monthly fuel costs. We use:

- Bunker Index for all commercial vessels except LNG; note that fuel oil 380 CST is the most common type of fuel used, especially in large cross-trade vessels.
- Global LNG Prices for LNG.

Bunker expenses are then allocated by country on basis of the ports visited.

5.3 Port Expenses

To calculate port expenses, first we find on basis of commercial databases, the ports and canals worldwide most often visited by vessels included in the registry. Then, we find the pricing policy of these ports, which is publicly available (most of the times in their webpage).

Main expenses include Berthing (a fee when entering the port) and Dockage (a fee while staying in the dock). These fees typically depend on Gross/Net Tonnage or Length and duration of stay. Duration of stay can be calculated either on basis of the commercial databases (on basis of last arrival day and last sailed date by vessel), or use average time in port, provided by the port. Related data are also available by UNCTAD (Review of Maritime Transport). In most of the cases these are up to to 1-2 days.

In the final step, we find whether a vessel has reached a port on basis of the last arrival date, which is available, along with the port visited in the commercial databases (observed every 10 days). If there is an arrival to a port within the respective 10 day interval of the month, then the vessel is assumed to pay the port expenses calculated above.

For ports we have not retrieved detailed pricing data, we use the average cost paid by vessels of the same type and size in ports of the same country that we have the related data. If we do not have the pricing policy of any port in that country, we use the global average. Finally, port expenses are allocated on basis of the country of the port visited.

5.4 Manning costs

In the first step we attribute to each vessel, the expected manning cost, depending on their type, deadweight and age. These data are based on Drewry. The data have been cross-

¹ Ronen D. 2011. "The effect of oil price on containership speed and fleet size, Journal of the Operational Research Society", 62, 211-216.

checked with International Transport Workers' federation "TCC" collective agreements, as well as data obtained from crew management companies and seem to adequately depict the average manning cost of each type of vessel.

In the second step we form the distribution of ethnicities and officers/ratings by vessel type and size, based on data of the commercial databases. Commercial databases provide for the majority of vessels total number of crew by nationality, as well as number of officers and ratings. On basis of these data we calculate the distribution of number of ratings and officers by ethnicity and vessel type.

In Step 3 we allocate the manning cost of each vessel to the respective ethnicity, weighted by the ratio of the rates received by officers with respect to rest of crew.

5.5 Vessel insurance costs

Drewry reports annually average vessels' insurance costs by vessel type, deadweight and age. Cross checks are done with results from annual reports of listed companies. We associate the respective expected insurance cost with each vessel in the registry on basis of its actual characteristics.

To allocate the insurance costs to counterpart countries we use market information and historical bank data. For the Greek case, ITRS data show that most of the insurance costs are traditionally attributed to UK; other countries include Italy, Germany, Norway, USA, Switzerland.

5.6 Maintenance and dry docking costs

Drewry reports into two separate categories Repair & Maintenance costs and Dry docking costs by vessel type, deadweight and age. If the status of the vessel is "In Service/Commission" or "Laid-Up", we assign the respective maintenance costs to the specific vessel on basis of its characteristics. If the status of the vessel is "In Casualty or Repairing" or "Converting/Rebuilding" we assign the respective Dry Docking costs to that vessel.

Country allocation of repair costs is related to the port dry docking and maintenance takes place, which is available on a 10-day interval.

5.7 Stores, spares and lubricant oils costs

Drewry reports stores, spares and lubricant oils costs by vessel type, deadweight and age. We assign these costs to a vessel, provided its status is "In Service/Commission". Most of these expenses are paid to suppliers and companies that have long term general agreements with the operator. Since, no other information exist, we assign these costs to the country of domicile of the operator.

5.8 Flag state expenses and voluntary tax

Drewry reports average flag state expenses by vessel type and deadweight. We allocate the respective amount calculated for each vessel on basis of its characteristics, to counterpart countries, on basis of its flag.

In addition, vessels managed by a shipping company (or branch) located in Greece, pay voluntary tonnage tax, whereas vessels with Greek flag pay tonnage tax in the country. This tax is allocated to all vessels for which according to the databases the commercial operator or bareboat charterer country of domicile is Greece, or the legal owner is registered in Greece, or vessels with the Greek flag. The allocation is based on their gross tonnage.

5.9 Administrative costs

Drewry reports expected administrative costs by vessel type, deadweight and age, which is available in the commercial databases for each vessel in the population. Administrative costs are divided into two categories.

The first category includes expenses when the vessel is in service and includes costs such as waste & garbage disposal, local transport, masters entertainment etc. These expenses are attributed to the country of the last port visited. The second category includes administrative costs paid even when the vessel is not in service such as Classification fee, PSC charges, communications printing IT & postage, vetting, internal auditing & inspection, training etc. These expenses are attributed, on basis of the available information, to the country of domicile of the commercial operator.

5.10 Management fees

As depicted in [Figure 1](#), in [Chapter 2](#), management fees are paid by the legal owner (SPC/SPV) to the Commercial Operator. Average annual management fees by type, size and age of vessel are reported by Drewry. Thus, on basis of the commercial databases we find the counterpart country of registration of the legal owner (SPC/SPV) that pays the corresponding management fees to the commercial operator.

5.11 Net freight earnings

Net freight earnings are paid by the Commercial Operator to the legal owner (SPC/SPV); see [Figure 1](#), in [Chapter 2](#).

We calculate net freight earnings, by subtracting from the total freight revenues all the vessel's expenses that are paid by the commercial operator both inside the country and outside the country, i.e. manning, insurance, stores, spares and oils, maintenance and drydocking costs, flag and voluntary tax, administrative expenses (except management fees that are considered as income to the operator), bunker costs and port expenses:

$$\text{Net freight earnings} = \text{Freight revenues} - \text{Vessel's voyage and operating expenses}$$

Then, on basis of the commercial databases we find the country of registration of the legal owner (SPC/SPV) that receives the net freight earnings from the commercial operator.

Net freight earnings enter the Balance of Payments as imports of sea transport services. Although not the typical case, net freight earnings can turn negative for specific vessels and dates. This is the case when vessel's expenses are above the freight revenues for the specific time period and the operator asks for extra cash (cash call) from the ship owner (SPC/SPV). In this case, net freight earnings are incoming amounts in the country and are considered as exports of sea transport services in the BOP.

5.12 Imports and exports of vessels

As analysed in [Chapters 2 and 4](#), economic owner of the vessel is the legal owner (SPC/SPV) in case of time/voyage chartering, as well as in case of standard management agreement. A change in the economic ownership may occur only if there is bareboat chartering. Thus on basis of both administrative data (ship register, bank data and customs data) and commercial databases one can identify the vessels bought/sold by resident legal owners (SPC/SPVs). To these data are to be added cases of bareboat chartering by a domestic company (imports) or abroad (exports), which however is rare for the Greek case.

5.13 Loan and interest payments and receipts

Loan agreements are signed between the legal owner (SPV) and the bank (domestic or foreign). Loans and related interest payments and receipts of domestic legal owners vis-a-vis non-resident banks, are collected on basis of the standard data collection system (Direct, ITRS etc.)

To calculate the loans and related interest payments and receipts of domestic banks vis-a-vis non-resident legal owners, we rely on balance sheet bank data. Moreover we survey domestic banks on the interest rate charged on shipping loans, their commitment fee and arrangement fee.

5.14 Dividends

Dividends are paid either by the legal owner (typically located abroad), or the holding company (if exists) to physical persons or other companies in Greece. Relevant BOP transactions are collected on basis of the standard data collection system (Direct, ITRS etc.)

6. Conclusions and way forward

We have developed a comprehensive framework for calculating all Balance of Payments items related to the shipping activity. The Greek Shipping Estimation Model is, to our knowledge, the first holistic methodological attempt in the EU, to estimate on basis of statistical modelling all Balance of Payments (BOP) items related to shipping activity, using commercial databases in conjunction with administrative data.

It is clear that in order to perform such a task, there were significant challenges to overcome, since a new methodological approach had to be developed, specific for each BOP item. Also in practical terms, combining information from many different and large databases, required database subscriptions, advanced statistical programming and big data management. Indicatively, detailed estimates by vessel, on a 10-day basis, have been produced for all vessels' revenues and expenses (by BOP item) and by counterpart country. Moreover, a detailed transaction tool has been developed, to transform these estimates to approximately 200,000 transactions every month to enter the Balance of Payments.

The model needs to be continuously updated to meet the changing shipping environment. Besides the fact that even the commercial databases are changing over the time their fields (i.e. new indices are published and others stop reporting; new types of vessels appear), the mobility of the shipping business sector is continuously growing. The increased competition from Eastern countries, in conjunction with the new environmental framework for the shipping sector and the developments in the world trade, cause many shipping companies (especially SPC/SPVs) to close and others to open even on a daily basis, purchases, sales and conversions/rebuilds of vessels to increase (including new eco-friendly types), new routes to open and high volatility in freight rates and in operating and voyage expenses.

The Greek Shipping Estimation Model can be readily applied by other member states, as well as countries outside EU, to estimate some or all of the items in Balance of Payments, related to shipping activity. We believe the current methodological framework can set new standards in official statistics, in terms of both using statistical modelling to incorporate information from commercial databases, as well as on how to handle off-shore companies when there is no information on their income and expenses. Finally, it is hoped that this work can form a basis for future research in shipping, in both the academia and the industry.