ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

Inspire policy making by territorial evidence

Accessibility by the sea indicators

D2 - Final Report

Spiekermann & Wegener
Urban and Regional Research (S&W)

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This report is D2, the Final Report of a Service Contract Project conducted within the framework of the ESPON 2020 Programme, partly financed by the European Regional Development Fund.

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This basic report exists only in an electronic version.

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1. Introduction

The objective of this study is to provide indicators on accessibility by sea for Europe and its regions for a most recent year for which data is available and for the trends of the last ten years. The accessibility by sea indicators should be based on existing indicators already developed within the ESPON 2020 programme. Besides the production of the accessibility indicators the study is to produce the corresponding ESPON maps and provide an analysis of recent trends and dynamics of accessibility by the sea.

The set of new accessibility indicators developed enriches ESPON's territorial indicators and will be used by the ESPON 2020 Programme activities; particularly, the indicators shall be used for drafting of a policy brief for the Maltese Presidency of the EU in 2017 and for other ESPON publications.

This Final Report (D2) of the study has the task to provide a detailed overview on data collected, indicators and maps produced together with a brief analysis. To do so, the next chapter gives a brief description of the indicators developed and the basic approach. As indicators are expected to be developed for European ports, and not regions, Chapter 3 gives the spatial reference framework, i.e. a classification of maritime ports in Europe. Chapters 4 - 7 are giving detail on the data collected and are presenting maps and analyses on various kinds of maritime accessibility in Europe as defined for this study.

2. Basic approach

The terms of reference for this study asked for accessibility by sea indicators at port level, namely indicators on transport volumes and flows, for mapping ferry networks and indicators describing hinterland accessibility and accessibility via sea. The different nature of these indicators required three different approaches to develop and implement the indicators. These three basic approaches are outlined below.

Empirical data based indicators

The first two indicators developed and implemented are:

- Transport volume of ports for the most recent year available and a period of 10 years differentiated by total volume passengers and freight and four main types of freight categories.
- Transport flows (port to country, for the most recent year available) differentiated by total volume passengers and freight and four main types of freight.

Base for the development of these indicators was EUROSTAT's port transport statistic. Relevant data sets have been identified, collected and stored in an appropriate way for further analysis.

Map based indicators

The third indicator addresses the ferry network:

- Map of ferry networks: current status, for two periods of time (summer and winter) for passengers.

This indicator required the collection of ferry network information from various sources. The data was collected by analysing information provided by ports, ferry operators and tour agents on the

internet in form of time table information and ferry connections on maps. The information on the ferry networks of the European seas was collected by systematically checking those websites. Information has been stored in an appropriate database. The standard way to present this indicator is in map form.

Accessibility model based indicators

The two remaining indicator types are:

- Hinterland of ports: influence of ports by land: how many people can reach a certain port (travel time by road within four hours)
- Accessibility of ports via sea: relationships between ports based on travel time.

These two types of accessibility by sea indicators could not directly been based on empirical data, but required the application of an appropriate accessibility model. These two indicators were operationalised in the following way:

- The first indicator reflects the hinterland of ports, i.e. land market area, due to the integration of the ports in the land-based networks connecting the hinterland with the ports. For calculating this indicator, S&W's accessibility model for road was modified in a way that it calculates for each port the travel time to all NUTS-3 regions in Europe and then sums up the population that is reachable within the maximum travel time.
- The second indicator reflects the accessibility of ports via sea implemented as an accessibility potential indicator. This means that travel time between ports were used as impedance and that all ports in Europe will serve as destinations. The attractivity of the destination ports is expressed in terms of their transport volumes (derived from the first indicator group above).

3. Maritime ports in Europe

The maritime ports in Europe are very heterogeneously in many respects. To mention only a few types, there are the big multipurpose ports, ports having passenger or goods transport only, ports with specialised goods categories, ports having only ferry traffic or pure touristic marinas. In this study, those ports are treated for which EUROSTAT's maritime transport statistic provides data and those ports which have ferry traffic. In addition, those ports that are classified as maritime ports of the TEN-T network are included.

The main georeferenced database for European ports used in this study is GISCO's port database as part of their transport network. About 2.200 ports are included in this database, however, many of them are inland ports. The ports in GISCO have the UN/location code as attribute. On the other hand, GISCO'S port database does not include all ports used in this study. In particular, smaller ferry ports are not included. Those missing ports were georeferenced by using other sources. In case, UN location codes were not allocable, additional codes were introduced.

Figure 1 shows the classification of maritime ports in Europe:

- EUROSTAT's transport database has two types of ports, first ports for which total maritime transport volume data is available (about 1.470 ports) and secondly, the so-called main ports (about 600 ports) for which more disaggregate data, e.g. flow data, is available.
- The maritime ports in the trans-European transport network (TEN-T) are classified in about 100 ports of the core network and about 225 ports of the comprehensive network.
- Around 1.350 ports in Europe have ferry traffic.

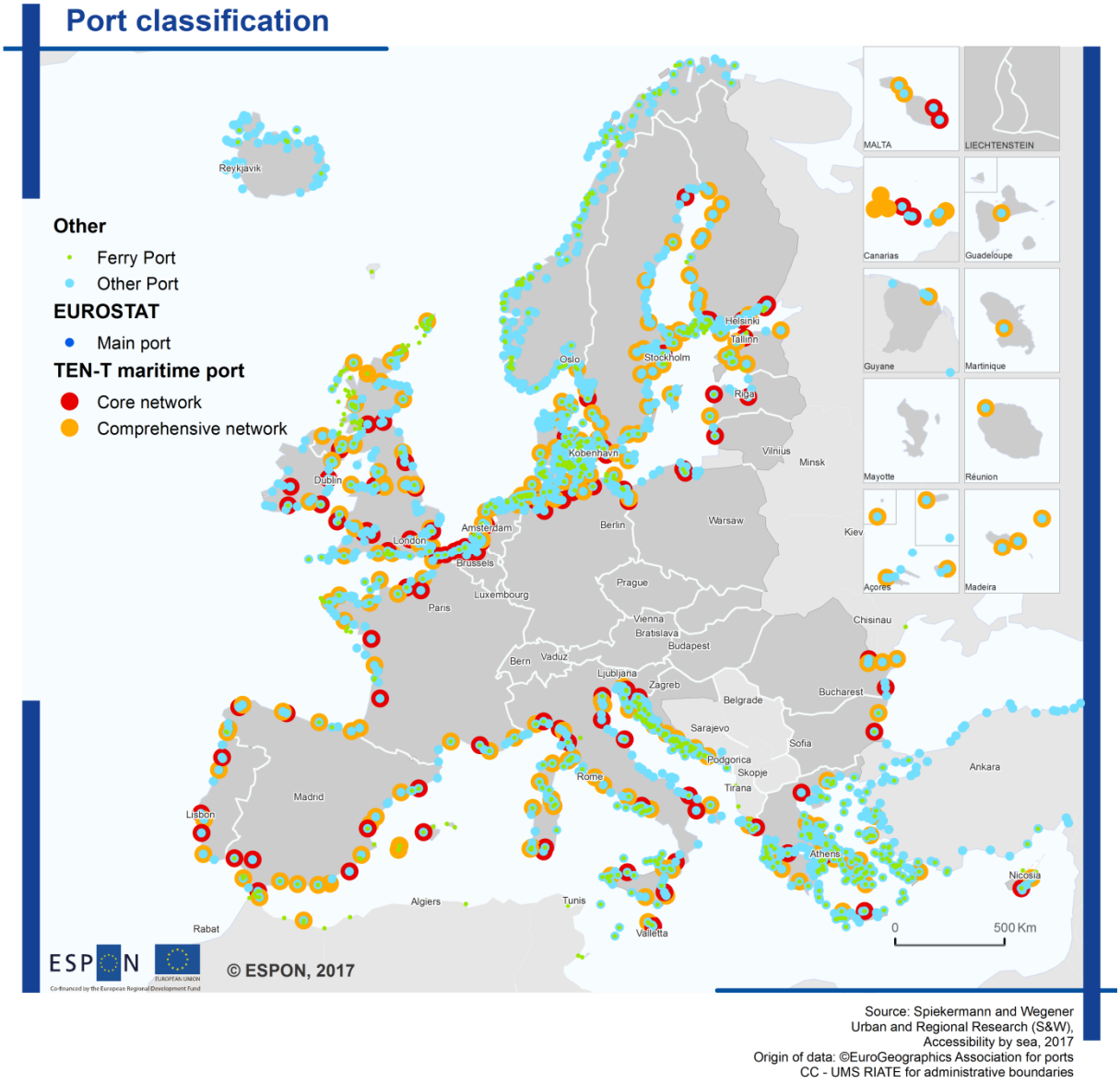


Figure 1. Classification of maritime ports in Europe

4. Transport volumes of ports

The indicators on transport volumes of maritime ports are to display the port traffic in Europe for today and a past period of ten years. There is a differentiation to be made between passenger and freight transport volumes of ports and for the latter also between main types of freight categories.

Passenger transport volume data for ports

For the port transport volume indicators for passengers, data were derived from EUROSTAT's port transport statistic, file mar_pa_aa. It contains annual data on passengers embarked and disembarked in all ports by direction (total, inwards and outwards). The following passenger categories are distinguished.

THS_PAS	Thousand passengers
THS_PASF	Thousand passengers (excluding cruise passengers)
THS_PASC	Thousand cruise passengers starting and ending a cruise
THS_PASE	Thousand cruise passengers on excursion

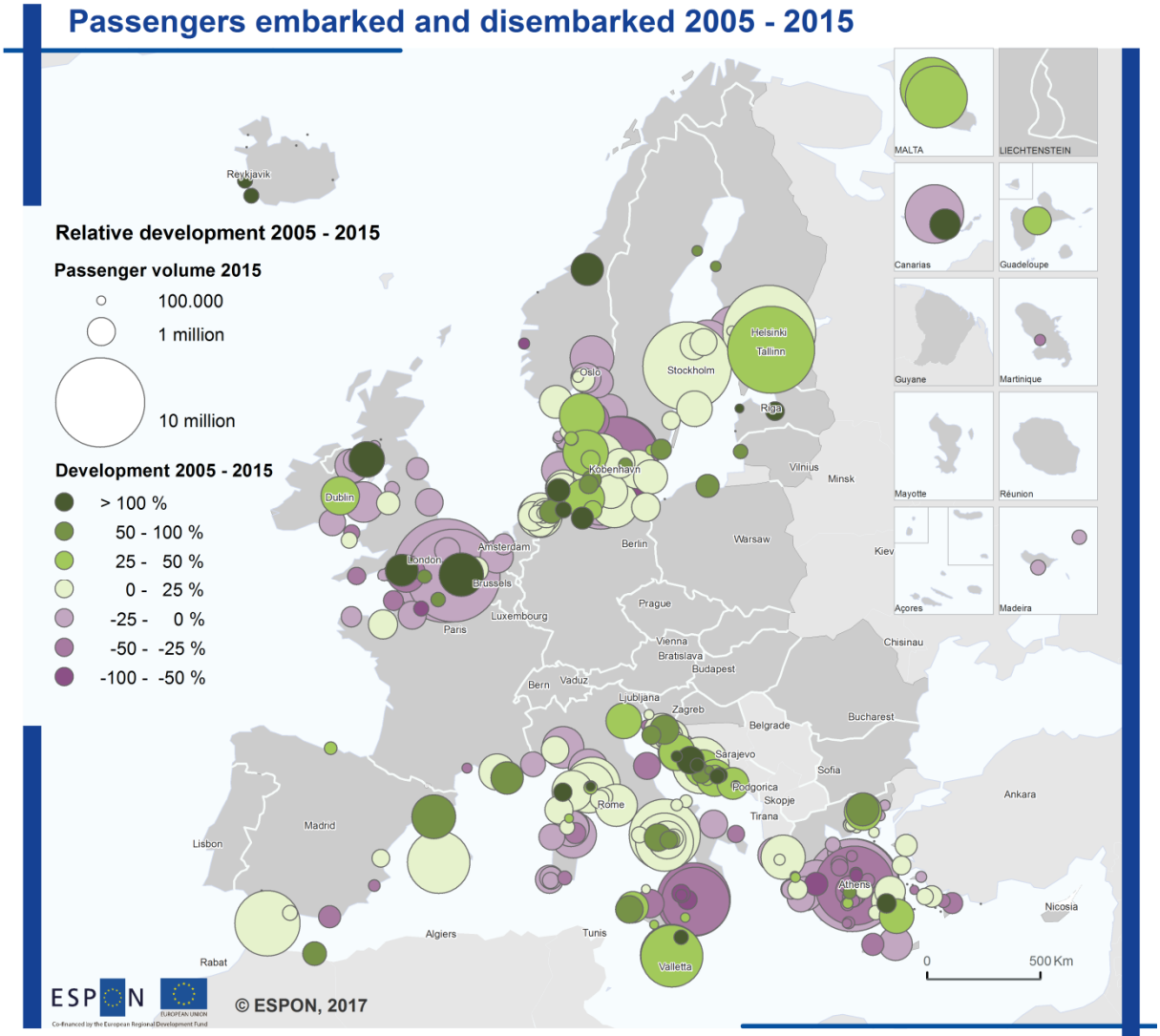
Data have been processed and stored in a way that the relevant maps can be generated. This includes data for the years 2005 up to 2015 as well as the relative and absolute development over this ten-year period.

Although a differentiation by passenger type is not requested by the Terms of Reference, the specific data on cruise passengers have been kept and integrated in the database as these data allow specific insight in port functions and touristic aspects of the maritime sector.

Passenger volumes of ports

A cartographic visualisation of these passenger port volume indicators is presented in a range of maps here. Figure 2 shows total passenger volumes for the year 2015 and the development of this during the last 10 years. Figure 3 is one example of several possible illustrations of the cruise passengers showing total cruise passengers, i.e. those starting or ending a cruise and those that are on an excursion from a port during a cruise. Annex 1 provides additional maps on port passengers (Figures A1.1 and A1.2)

There is a broad range of ports with passenger traffic (Figure 2). In the north-eastern parts of the Baltic Sea maritime passenger traffic is mainly concentrated in a few large port cities, in particular in the capitals Stockholm, Helsinki and Tallinn. A concentration of many smaller and larger ports with maritime passengers is in the Baltic Sea and the North Sea around Denmark, i.e. including northern Germany, southern Sweden and southern Norway. Along the Channel, there are numerous ports with maritime passengers as well as in the Irish Sea between Ireland and the UK. There are almost no ports having maritime passengers along the Atlantic coast. In the western part of the Mediterranean Sea there are only a few ports showing substantial amounts of maritime passengers, a structure similar to the eastern part of the Baltic Sea. However, the middle and eastern parts of the Mediterranean have very dense clusters of passenger ports, in particular along the Italian coasts and islands, along the Croatian coast and on Greek mainland and islands the port density with substantial amounts of maritime passengers is very high.



Source: Spiekermann and Wegener Urban and Regional Research (S&W), Accessibility by sea, 2017
Origin of data: Eurostat (online data code: mar_pa_aa), 2005 & 2015
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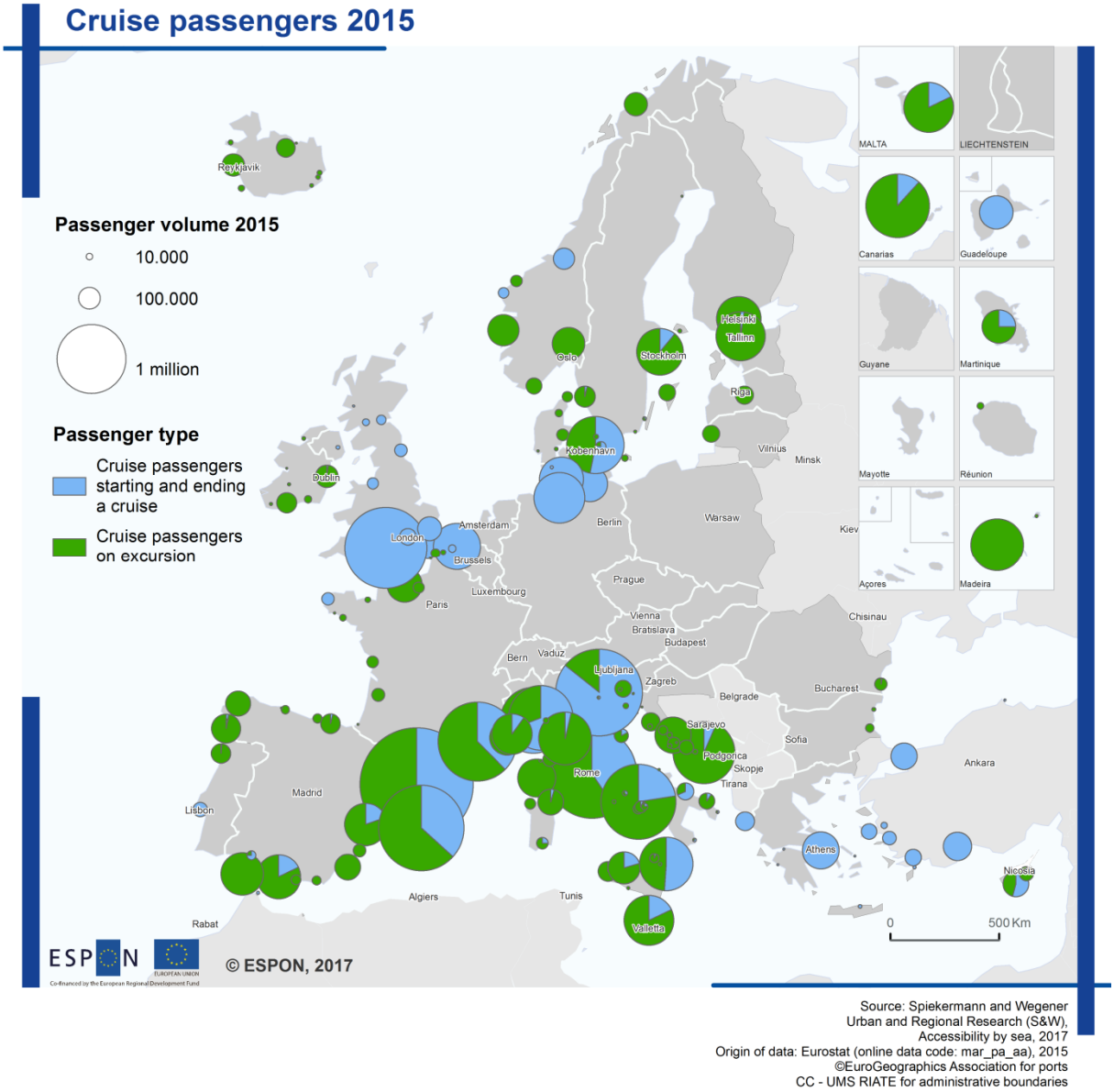
Figure 2. Passengers embarked and disembarked 2015 - relative development 2005 - 2015



Source: Spiekermann and Wegener Urban and Regional Research (S&W), Accessibility by sea, 2017
Origin of data: Eurostat (online data code: mar_pa_aa), 2015
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Figure 3. Cruise passengers 2015

The development of maritime passenger traffic in European ports during the last ten years is very heterogeneous (Figures 1 and A1.2). Most ports have experienced an increase in passenger traffic. This is true, with a few exceptions for ports in the Baltic Sea and the Mediterranean. In Italy, some ports lost passenger traffic, the same happened to the large ports in Greek. Also in the Channel area, the larger ports lost some traffic, but several smaller ports gained. However, ports with a decrease in maritime passengers do mostly have substantial amounts of passenger traffic today.

Maritime passenger traffic in ports comes either from ferry passengers or from tourists doing a cruise. The cruise business has become an important touristic and economic factor for several European port cities. Cruise passenger volume in ports has to be differentiated by those that start or end a cruise in a certain port and those which are on an excursion in the port city because the cruise ship is doing a call at that harbour (Figure 3). In the northern parts of Europe, the ports in the Channel area and in northern Germany typically function as starting and end point of cruises, whereas the other ports in the North Sea and the Baltic Sea mainly serve as interesting interim stop in a cruise. Many port cities in the Mediterranean Sea are called for interim stops of a cruise, larger ports in the northern parts are in addition also start or end points of a cruise.

The maritime passenger traffic of Malta is comparably high due to ferry traffic within Malta and to Italy. Malta is also a starting point and, more important, an excursion point for cruise passengers. Total passenger volume of Malta has substantially increased during the last ten years.

Freight transport volume data for ports

For the port transport volume indicators for freight, data for total volumes were derived from EUROSTAT's port transport statistic, Eurostat file mar_go_aa. The file contains annual data on gross weight of goods handled in all ports by direction (total, inwards and outwards). Data have been processed and stored in a way that the relevant maps can be generated. This includes data for the years 2005 up to 2015 as well as the relative and absolute development over this ten-year period.

A differentiation of the total freight volume by main goods categories was made by processing a different set of EUROSTAT files, i.e. the files mar_go_am_<country>. Those files, i.e. one per country, contain very detailed annual data for main ports on gross weight of goods handled by direction (total, inwards and outwards), cargo type and maritime entity. Data for main ports means that data are available for about 600 ports in Europe, but not for all around 1470 ports for which total transport volumes are available. Maritime entity means the country from which or to which goods are transported, i.e. a data category that will be used later for the flow indicators. The following cargo types are distinguished in the database, however, the last four categories have been aggregated for this study to form a freight category UNITISED:

LBK	Liquid bulk goods
DBK	Dry bulk goods
LCNT	Large containers
RO_MSP	Ro-Ro - mobile self-propelled units
RO_MNSP	Ro-Ro - mobile non-self-propelled units
OTH	Other cargo not elsewhere specified

Another specific, fourth goods type category, namely the number of containers, was considered separately as well. Container traffic is included in the unitised cargo type, but only in terms of weight. As weight might be not the most important category for container transport, an additional way was to analyse the number of containers. EUROSTAT provides quarterly data in the files

mar_go_qm_c>year>. The unit of measurement is TEU (Twenty-foot equivalent unit), a standard unit to recalculate the different container sizes to a comparable unit. The data allows also for an analysis of container flows.

Data have been processed and stored in a way that the relevant maps can be generated. This includes data for the years 2005 up to 2015 as well as the relative and absolute development over this ten-year period.

Goods volumes of ports

The freight volumes of maritime ports are visualised in Figures 4 - 6. Figure 4 shows gross weight of goods handled in the ports in the year 2015 and the relative development since 2005. Figure 5 gives a comprehensive view over the three cargo types in order to allow the detection of port specialisation. Figure 6 displays the number of containers handled in the year 2015 and its development since the year 2005. Figures A1.3-A1.8 in the Annex give some more information on the absolute development of goods transport volumes in European ports and handled volume for the three freight categories liquid bulk goods, dry bulk goods and unitised goods. Those maps show current transport volumes only, but no temporal dynamics. The latter could be displayed based on the processed data base as well.

Maritime freight transport seems to be of higher importance for coastal regions and islands in Europe than maritime passenger traffic. Along all coastal areas in Europe, there is a dense chain of freight ports (Figure 4). The cluster with highest maritime freight volumes is to be found in the Channel and North Sea area. Here, not only the top European ports stand out with highest volumes, in addition a large number of other ports do have substantial volumes of freight handling. The other sea basins of Europe are less dominated by one or two ports, but see a large number of ports in close distance to the next port, but each having substantial amounts of freight volume. The development of maritime freight volumes during the last ten years is very heterogeneous Except some concentration of ports with shrinking volumes in the western Channel area and the UK, all other parts of Europe see growing and shrinking ports. This is probably an outcome of the very different specialisation of individual ports, the development paths of the ports through the years of the crises, but also an indication for the competition and restructuring processes going on in the port business.

Among the freight handling ports there are some ports for which different categories of goods (dry, bulk and unitised goods) have comparable shares in tonnage and some which are more focussed on a certain category (Figure 5). If the latter is the case, those ports are then mostly focussing either on dry or liquid bulk.

Container handling is the most important type of cargo of the unitised goods category. Quite different from maritime freight in general, container handling is very much concentrated in a much lower number of ports in Europe (Figure 6). Most important of these are the large container ports of the Channel and North Sea range. Those ports are the final destination of the huge world-wide operating container ships. From these ports, the containers are carried to their final destinations either via road or rail services or by feeder ships to smaller ports in Northern Europe including the Baltic Sea ports. However, in the Mediterranean Sea the division of labour between the larger ports is somewhat more balanced. There are about a dozen ports in the Mediterranean Sea with a comparable substantial volume of container throughput. The general trend of container traffic in European ports is clear growth. With the exception of very few ports with diminishing container volumes, the growth is mostly larger than 25 or 50 percent during the last ten years, in medium-sized and smaller container ports even more than 100 percent.

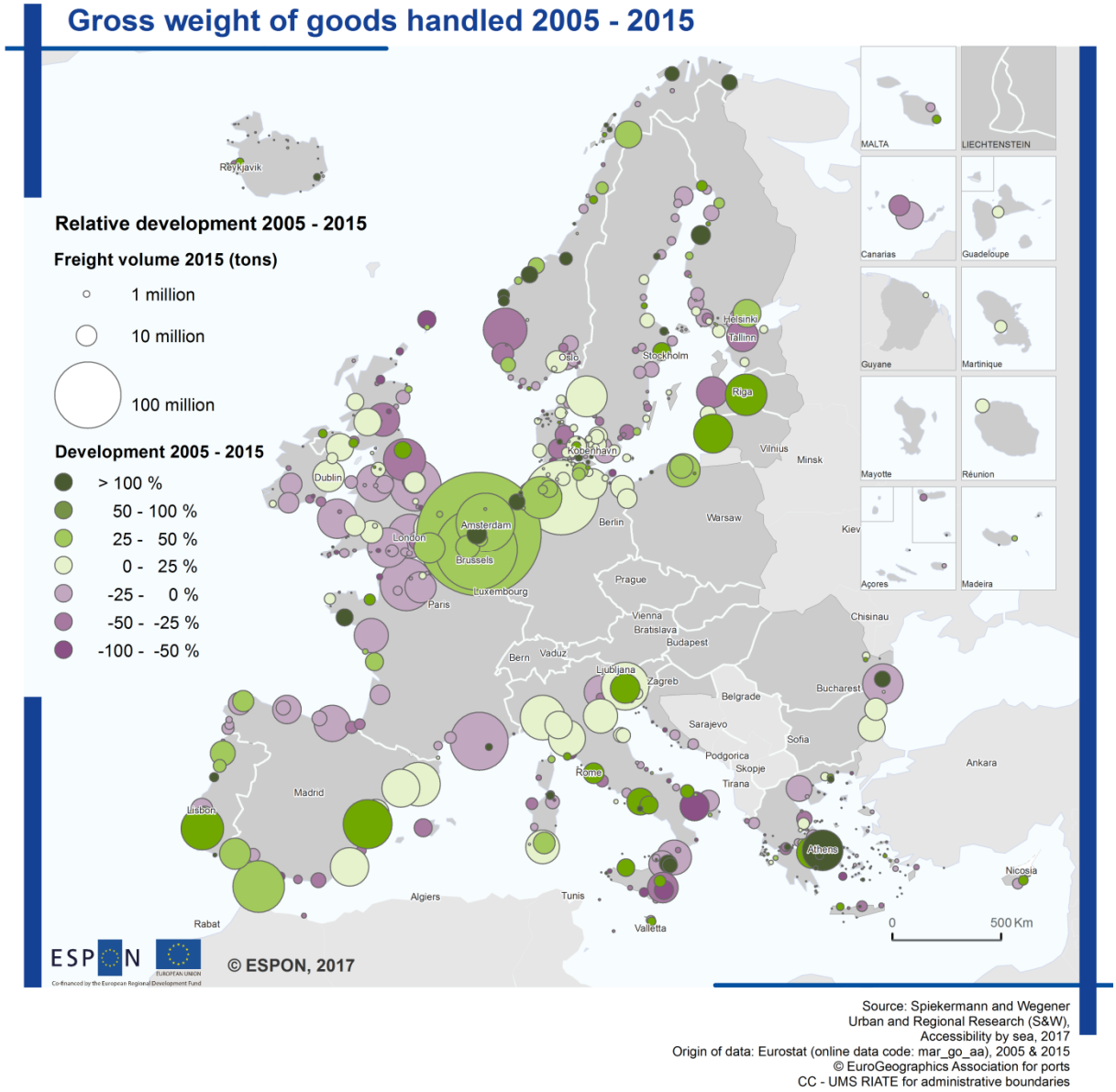
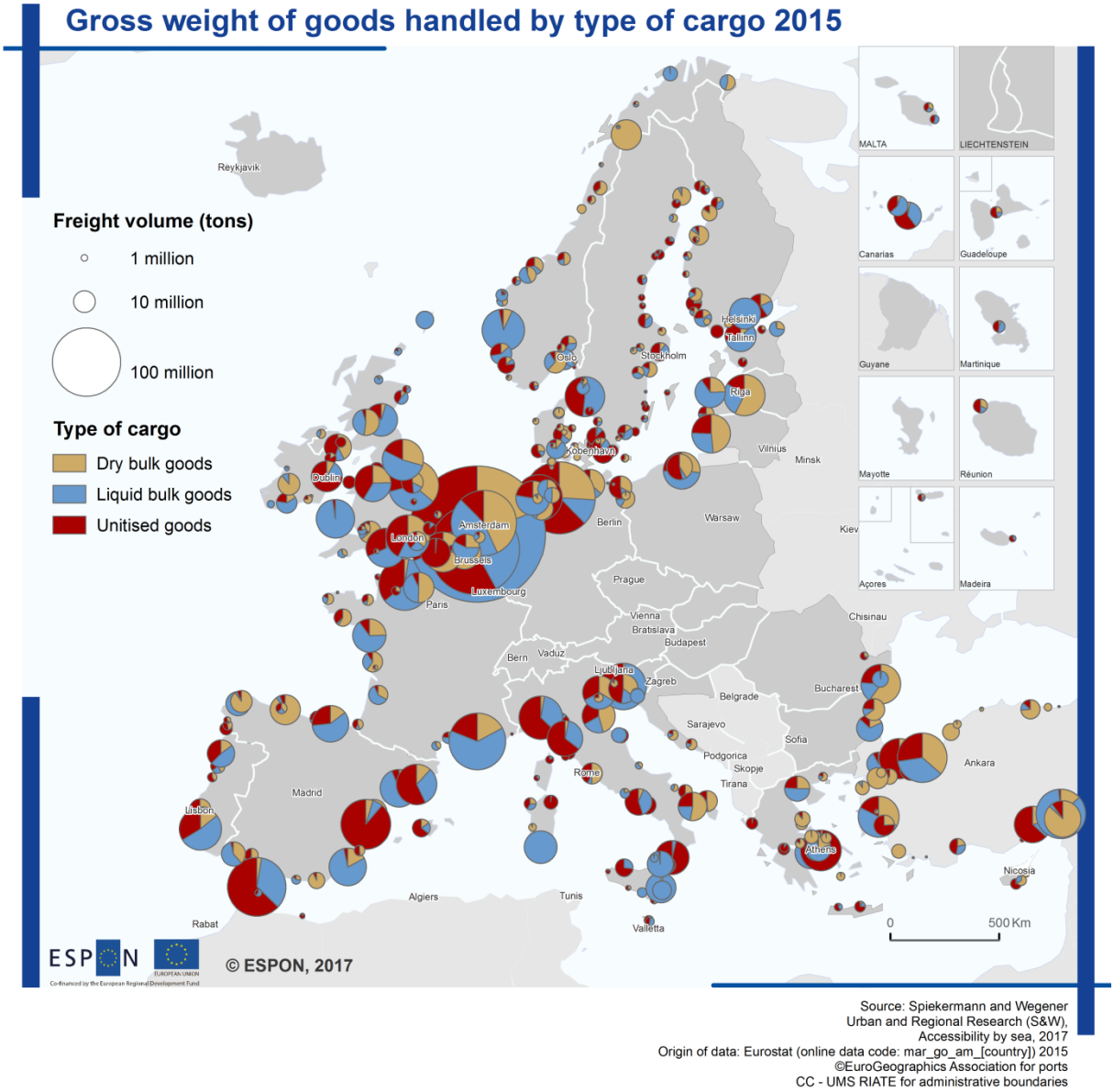


Figure 4. Gross weight of goods handled 2015 - relative development 2005-2015



Source: Spiekermann and Wegener
Urban and Regional Research (S&W),
Accessibility by sea, 2017
Origin of data: Eurostat (online data code: mar_go_am_[country]) 2015
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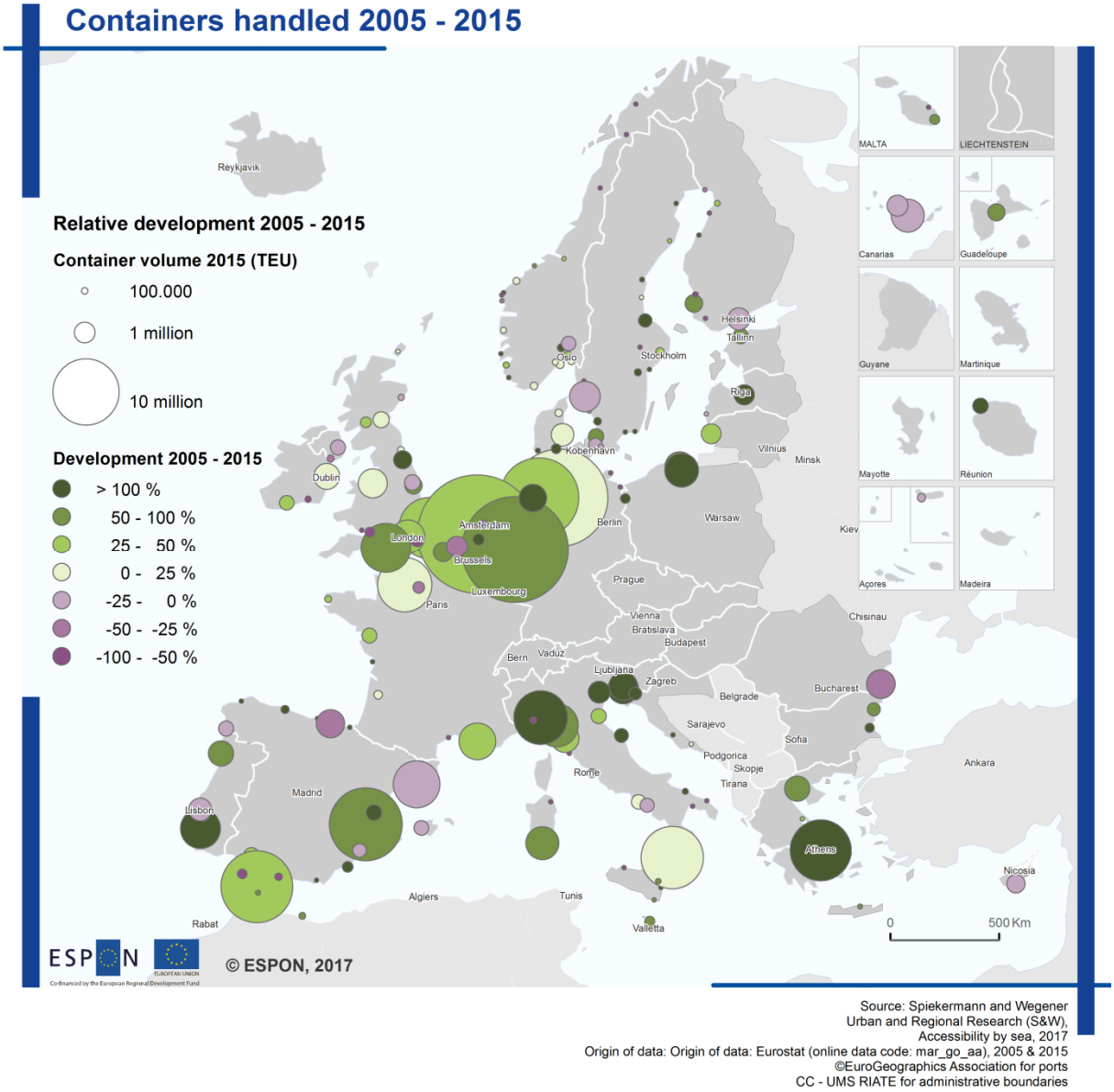
Figure 5 Gross weight of goods handled by type of cargo 2015



Source: Spiekermann and Wegener
Urban and Regional Research (S&W),
Accessibility by sea, 2017
Origin of data: Origin of data: Eurostat (online data code: mar_go_aa), 2005 & 2015
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Figure 6 Container handled 2015 - relative development 2005 - 2015

5. Maritime transport flows of ports

The indicators on transport flows are to show the spatial interlinkages of the European ports. The maritime flow indicators should only show the current situation, i.e. no temporal dynamics was analysed.

Maritime flow data for ports

Flow data for European ports is available at EUROSTAT's transport statistic site. However, data are limited in their spatial resolution, i.e. flow data for ports are to or from ports to countries only, for very few countries also to subsets of the country. That means that the flow matrices generated from that data is a matrix between ports and countries and not between ports and ports. However, even this aggregation to countries on the one side gives very valuable information on the spatial relationships and specialisations of European ports.

Passenger flow data are available from EUROSTAT, i.e. the files mar_pa_qm_<country>. Those files, i.e. one per country, contain very detailed quarterly data for main ports on passengers by direction (total, inwards and outwards) and maritime entity. Data for main ports means that data are available for 600 ports in Europe, but not for all around 1.470 ports for which total transport volumes are available. Quarterly data means that data have to be collected for four quarters of a year and then aggregated to get annual figures. Maritime entity means the country from which or to which passengers are transported. Passenger flow data are still to be processed. This will follow the way, goods flow data have been treated as described in the following sections.

The setting up of a goods maritime flow database for the total freight volume and main goods categories was made by further processing EUROSTAT files mar_go_am_<country>. Those files, i.e. one per country, contain very detailed annual data for main ports on gross weight of goods handled by direction (total, inwards and outwards), cargo type and maritime entity. Data for main ports means that data are available for 600 ports in Europe, but not for all around 1.470 ports for which total transport volumes are available. Maritime entity means the country from which or to which goods are transported. The seven available cargo types distinguished in the database are again aggregated so that the database contains flow data for liquid bulk goods, dry bulk goods and unitised goods.

Data for the year have been processed and stored in a way that the relevant maps can be generated. As the EUROSTAT file contains also the country of the vessel registration as an attribute, a huge amount of data per country had to be processed in order to derive at the indicators of relevance in this study. Just to give an example for a small country with few ports: Only for extracting the very few freight data values for the four Belgian main ports, a EUROSTAT file with 220000 lines and 30 columns had to be processed.

Freight flows of European ports

Flow matrix data can hardly be displayed fully on a map. The overlay of lines usually leads to an unreadable ball of lines. To overcome this issue, three ways of presenting the flow data in map form are presented here:

- The first way of presenting the flow data is to aggregate the origins and destinations of the flows to world macro regions, i.e. Europe, America, Africa and Asia and Australia. Figures 7-

10 show for total goods and for container flows stacks indicating the origin or destination macro region of the flows for each main port in Europe. Additional maps are presented in the Annex for incoming and outgoing flows by broad goods type (Figures A.2.1-A.2.6)

- In Figure A2.7 in the Annex, the stack technique is used for the example of incoming dry bulk goods to show the European origin country of that cargo type for each main port.
- Figures 11 and 12 show for one selected port the inward and outward flows of goods between that port and the European countries. The database allows to generate such maps for each European main port. The Annex contains more such examples (Figures A3.1-A3.8)

The European ports are very much linked with the world. Many ports have goods flows with all continents (Figures 7 and 8). However, for most ports the maritime flows with other European ports is much more important in terms of flow volumes. Ports at the Baltic Sea have almost no direct maritime transport linkages with ports outside Europe. For several ports at the Mediterranean Sea and some along the Channel the imports from Asia has a significant importance.

For maritime container transport, origins and destinations outside Europe have a much higher importance (Figures 9 and 10). In Particular, the container traffic from and to Asian destinations makes an important share of all container traffic of ports in the Mediterranean or along the Channel. Container traffic from and to America is mainly handled in the largest ports in the Channel and North Sea area and some larger ports in the western Mediterranean Sea. Again, the Baltic Sea ports are concentrating on European origins and destinations for maritime container traffic.

The maritime flows of goods from outside Europe to European ports and between European ports is a rather complex pattern. Figures 11 and 12 display the maritime goods flows of the port of Valencia in Spain by the three main goods categories. Highest inward flows for Valencia are from other countries located at the Mediterranean Sea, most important are imports from France, Italy and Turkey. Inward maritime flows from northern European countries are of less importance for Valencia. The most important goods type is unitised. However, from countries at the Black Sea it is dry bulk good and from Portugal it is liquid bulk good. Maritime outward flows from Valencia are mainly unitised goods. Italy is the main destination. However, the northern European countries have higher importance as destinations than as origins for inward flows.

Even smaller ports have very widespread freight linkages. Ports as the one of Valetta in Malta have imports and exports of maritime freights with nearly all European countries (Figures A3.7 and A3.8). Italy is dominating as country from which Malta is importing goods via sea followed by other countries in the Mediterranean basin. However, in terms of goods handling, the Maltese ports are of minor importance in Europe today.

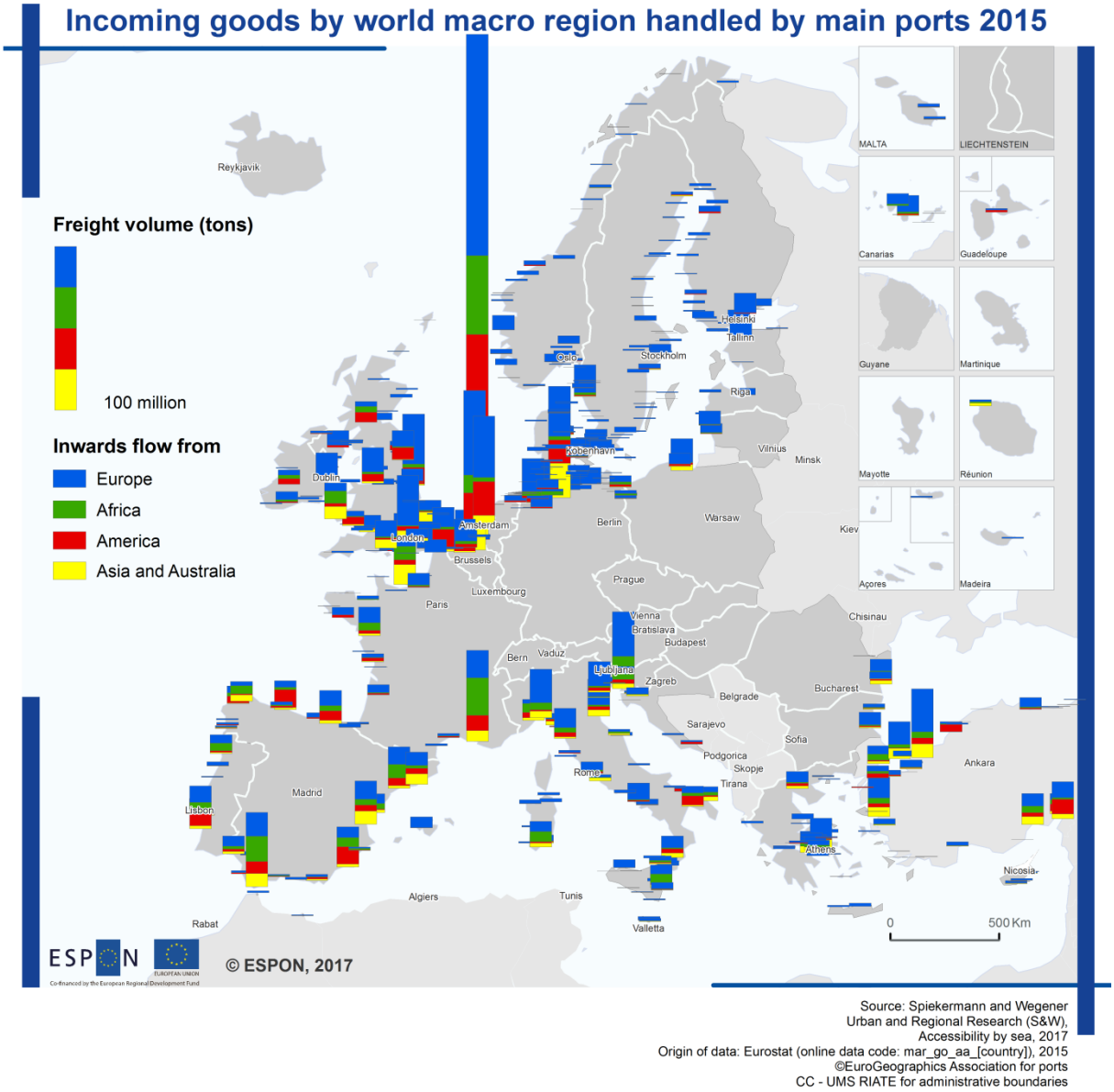


Figure 7. Gross weight of incoming goods by world macro region handled by main ports 2015

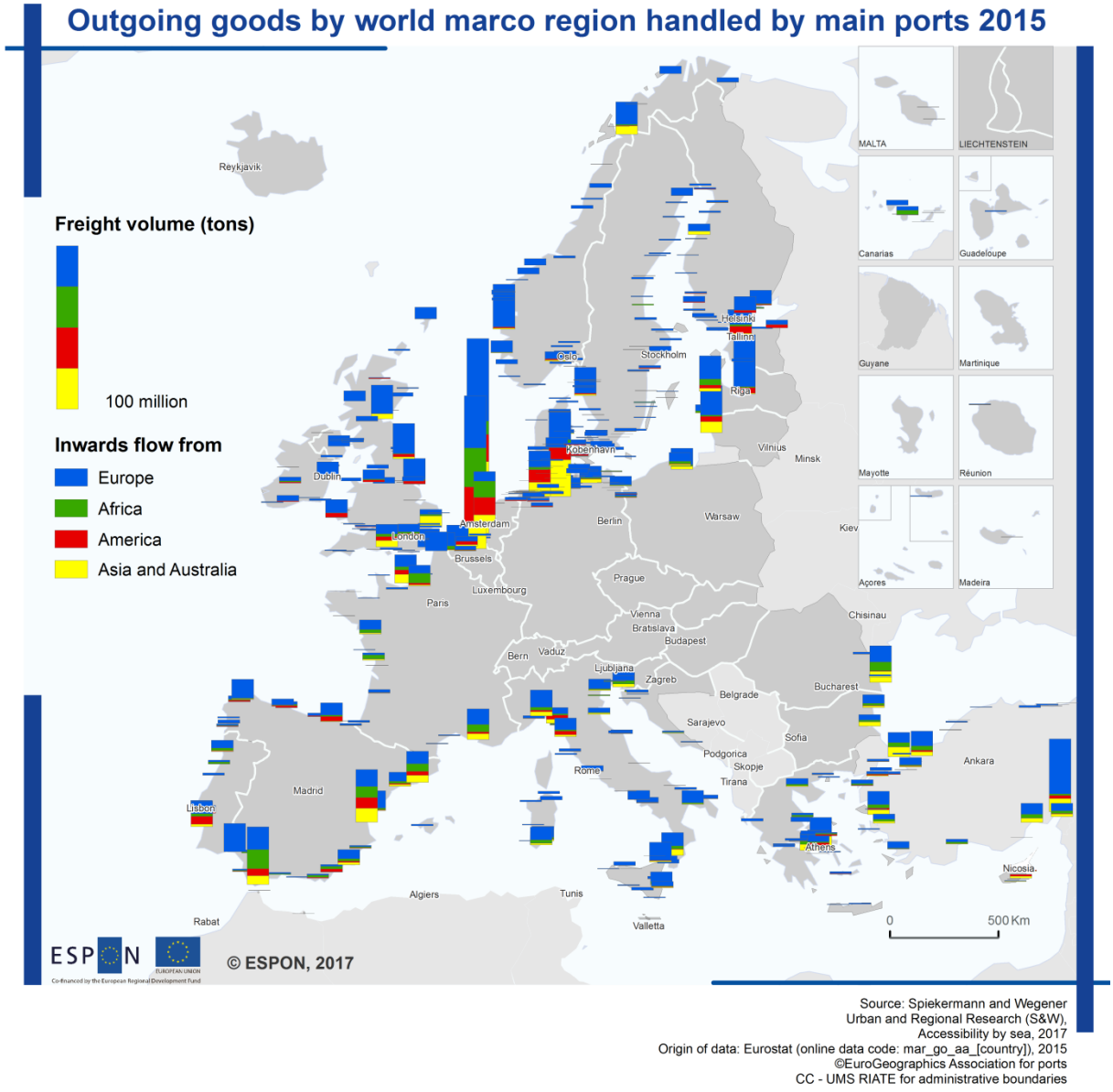


Figure 8. Gross weight of outgoing goods by world macro region handled by main ports 2015

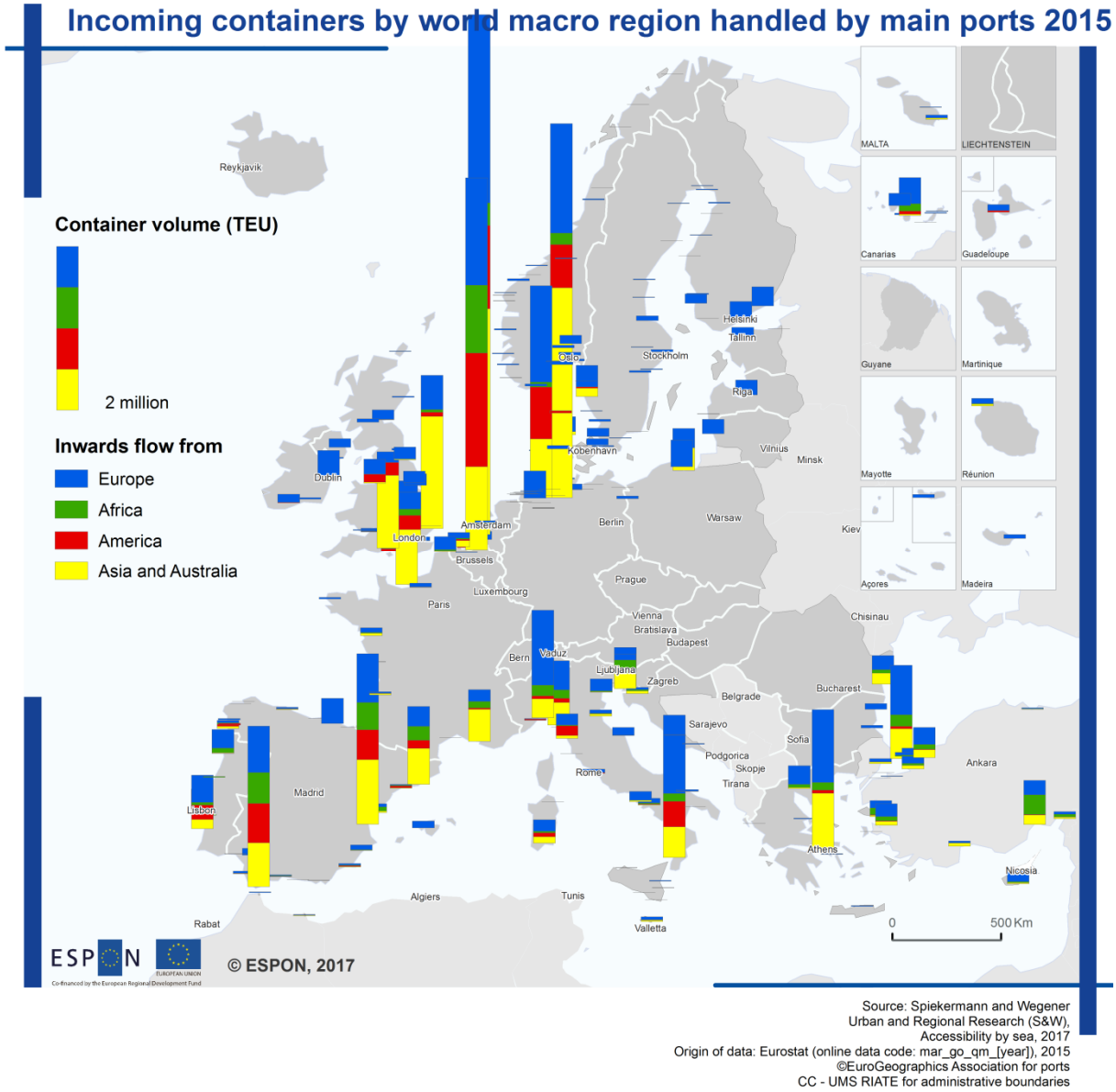


Figure 9. Incoming containers by world macro region handled by main ports 2015

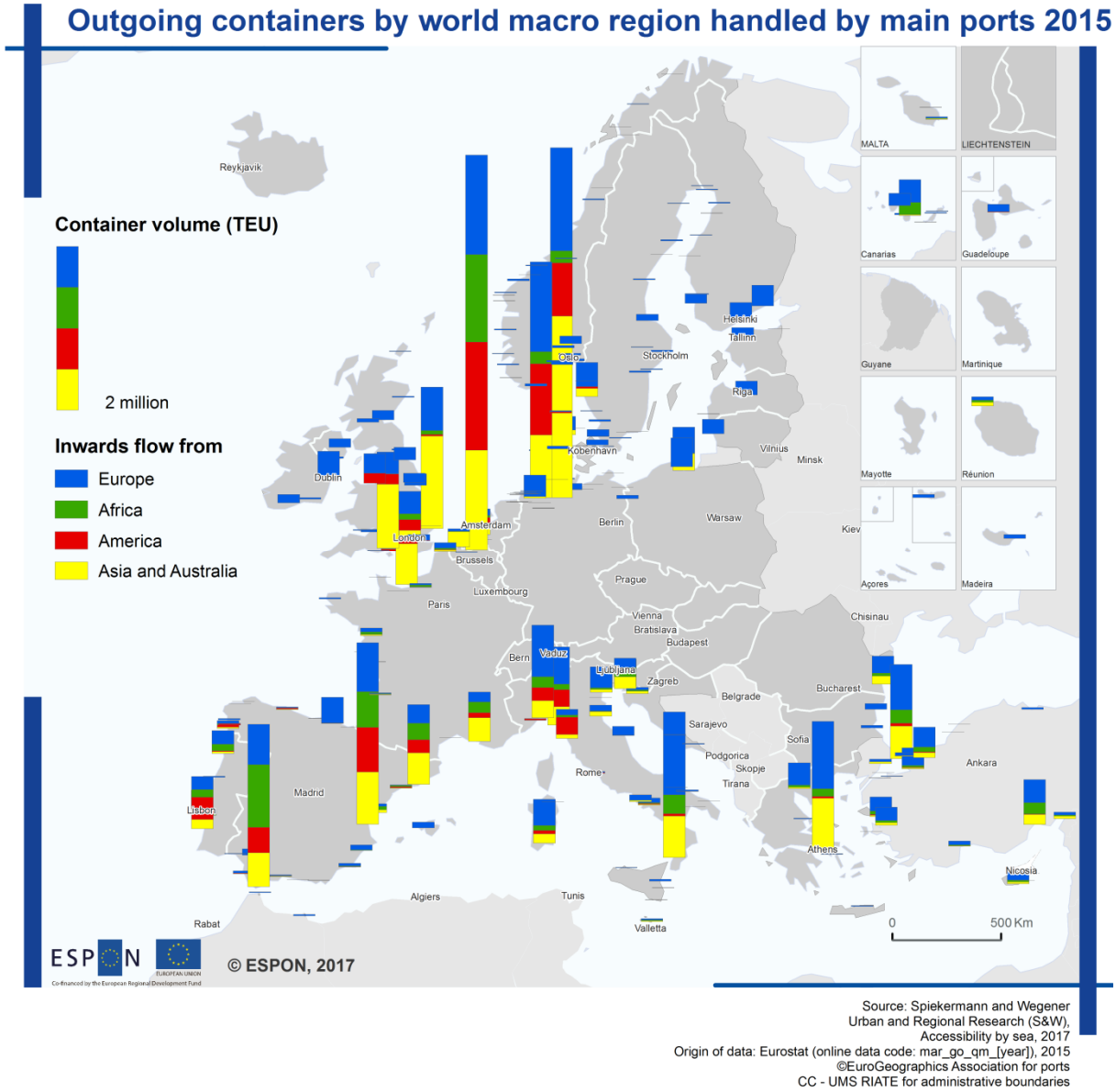


Figure 10. Outgoing containers by world macro region handled by main ports 2015

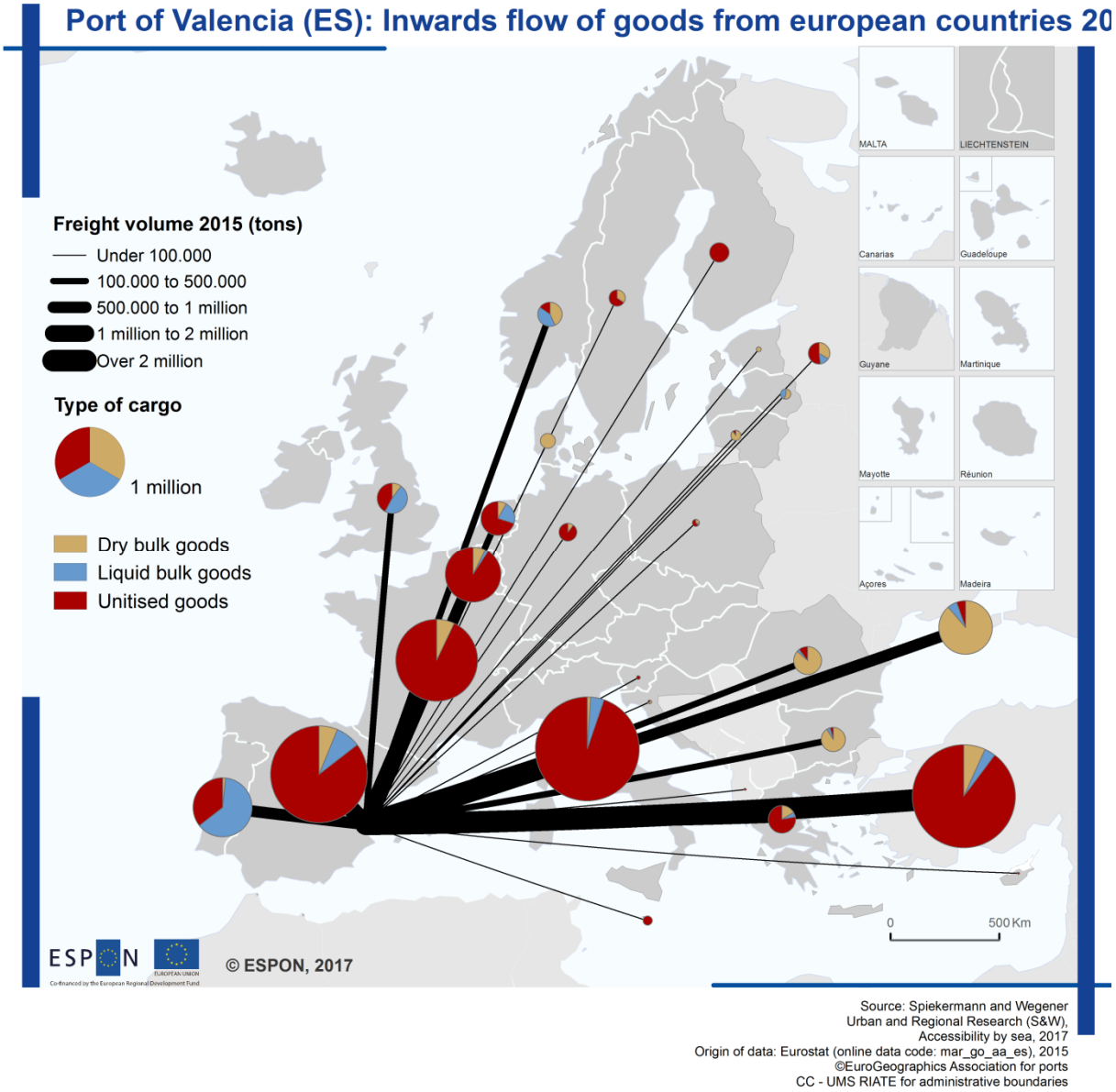


Figure 11. Port of Valencia (ES): Inward flow of goods by type of cargo from European countries 2015

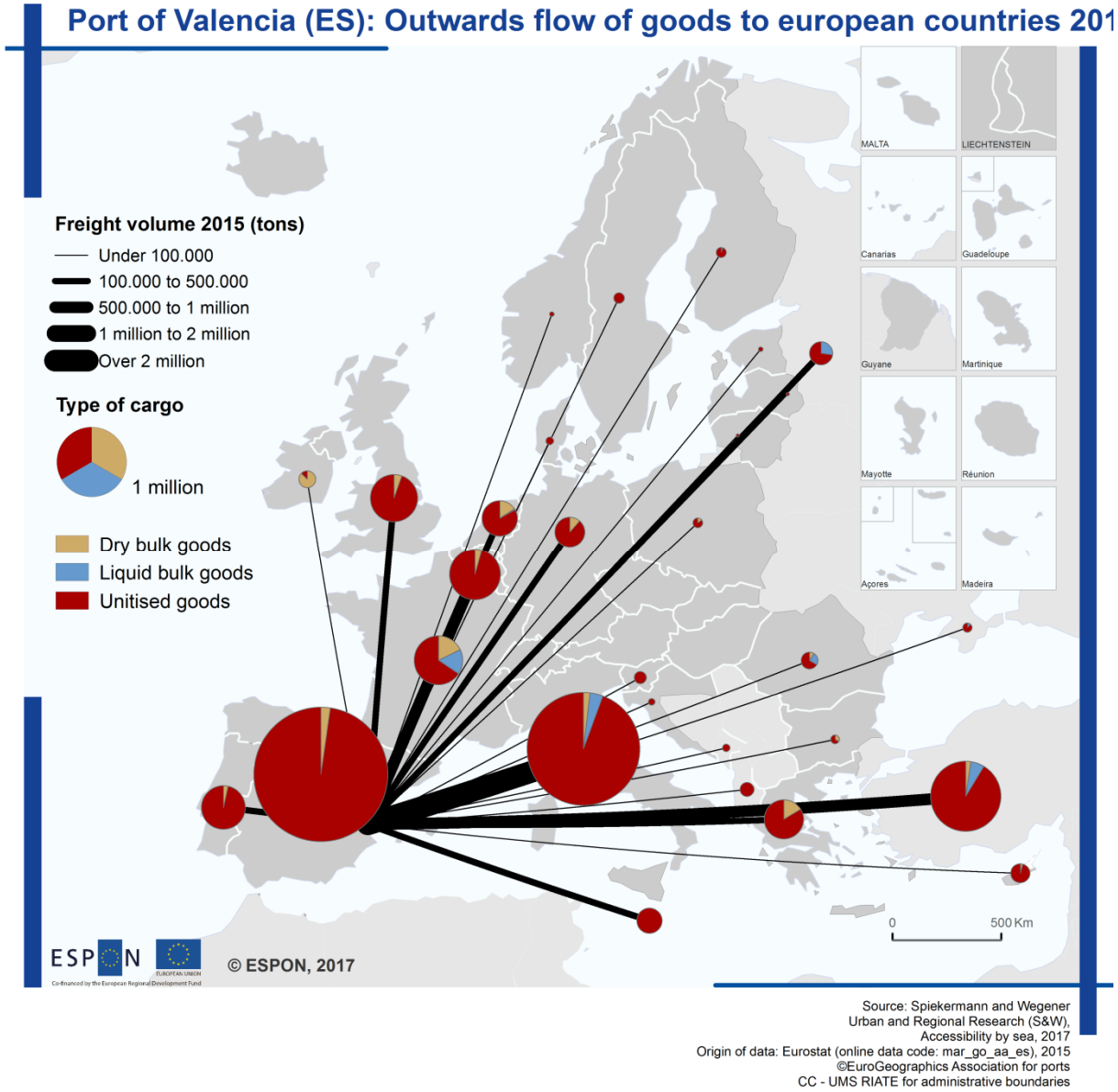


Figure 12. Port of Valencia (ES): Outward flow of goods by type of cargo from European countries 2015

6. European ferry network

An important way of passenger transport via the seas is via ferries. Ferries are an important mean of daily transport for inhabitants, but in tourist regions in particular also for the visitors. In consequence, one task of the study was to map the European ferry network. As there are seasonal differences of the ferry services a distinction was made between ferry networks for summer and winter time.

Coding a ferry network for Europe

For mapping the European ferry network a huge bulk of ferry route information was collected from various online resources. The data was collected by analysing information provided by ports, ferry operators and tour agents on the internet in form of time table information and ferry connections on maps. The information on the ferry routes of the European seas was collected by systematically checking those websites. The ferry routes include also many shorter routes linking smaller islands with the mainland. Information has been stored in an appropriate database.

As GISCO's port database does not contain all ferry ports in Europe, manual identification and digitising of around 700 smaller ferry ports had to be done in consequence.

The standard way to present this indicator is in map form. Figure 13 shows the current European ferry network for August 2016, Figure 14 for November 2016. As the ferry network database generated has also an indication of the frequency, which was not requested by the Terms of Reference, the importance of the ferry connections can also be displayed in form of frequency maps. One sample zoom-in map for the eastern Mediterranean is presented here for the ferry lines in August 2016 (Figure 15) and for the ferry services available in November 2016 (Figure 16). Further zoom-in maps for the ferry networks with frequencies are in the Annex showing the western Mediterranean Sea and the ferry routes in northern Europe the North Sea and Baltic Sea (Figures A4.1-A4.4).

It can be depicted from the map that European coastal regions and islands have developed a rather dense ferry network. These ferry lines provide important services for that types of regions. In several areas, ferry lines are important for daily life. However, the handling of touristic traffic, freight traffic and related economic impacts might be more important for the development of those regions.

Rather dense ferry networks with medium and longer travel distances are to be found in the Baltic Sea connecting all countries there, in the Channel area linking the UK to the European mainland, in the Irish Sea linking the UK and Ireland, in the Mediterranean linking the larger islands to the mainland and linking also African ports to Europe and along the Croatian coast and in Greece linking also smaller islands with each other and to the ports at the mainland.

There are some differences in the ferry services between summer and winter time. However, these differences might be smaller than expected. Some ferry lines are out of operation, but most ferry line continue to operate during winter time. However, on several routes, mainly to touristic destinations, the frequency of services goes down, but lower frequencies do guarantee a certain level of connectivity via the seas.

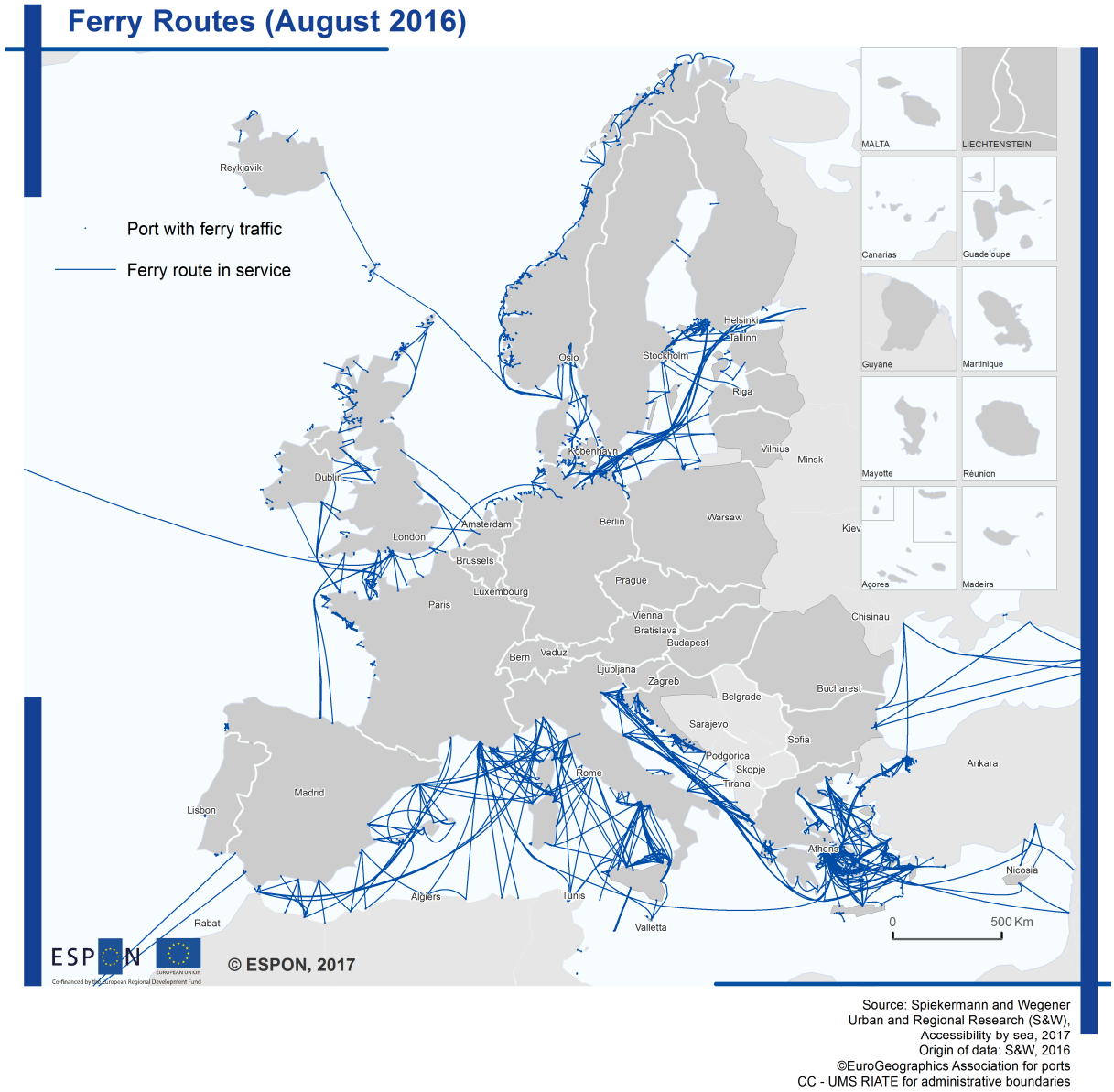


Figure 13. European ferry network, August 2016

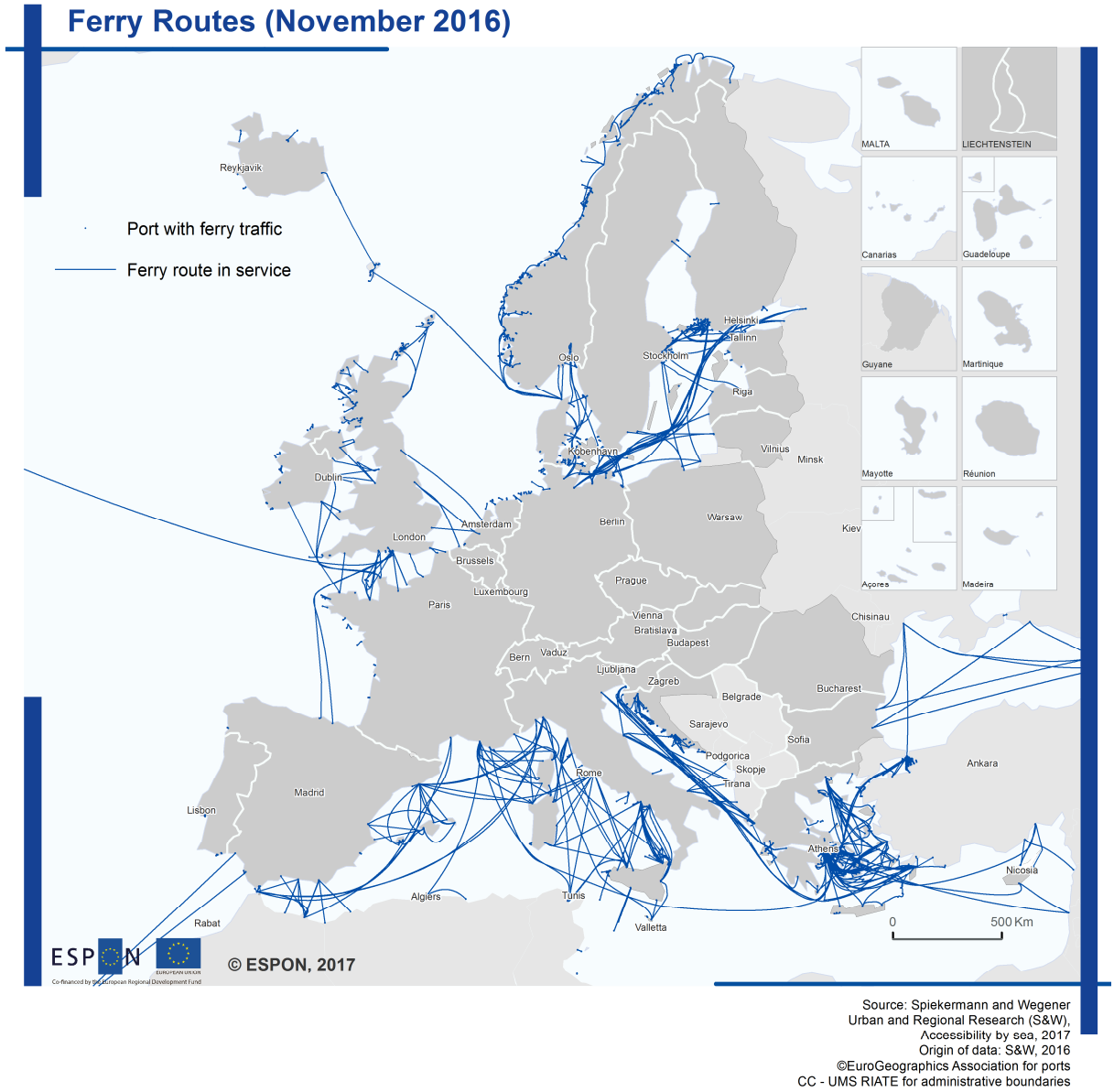


Figure 14. European ferry network, November 2016

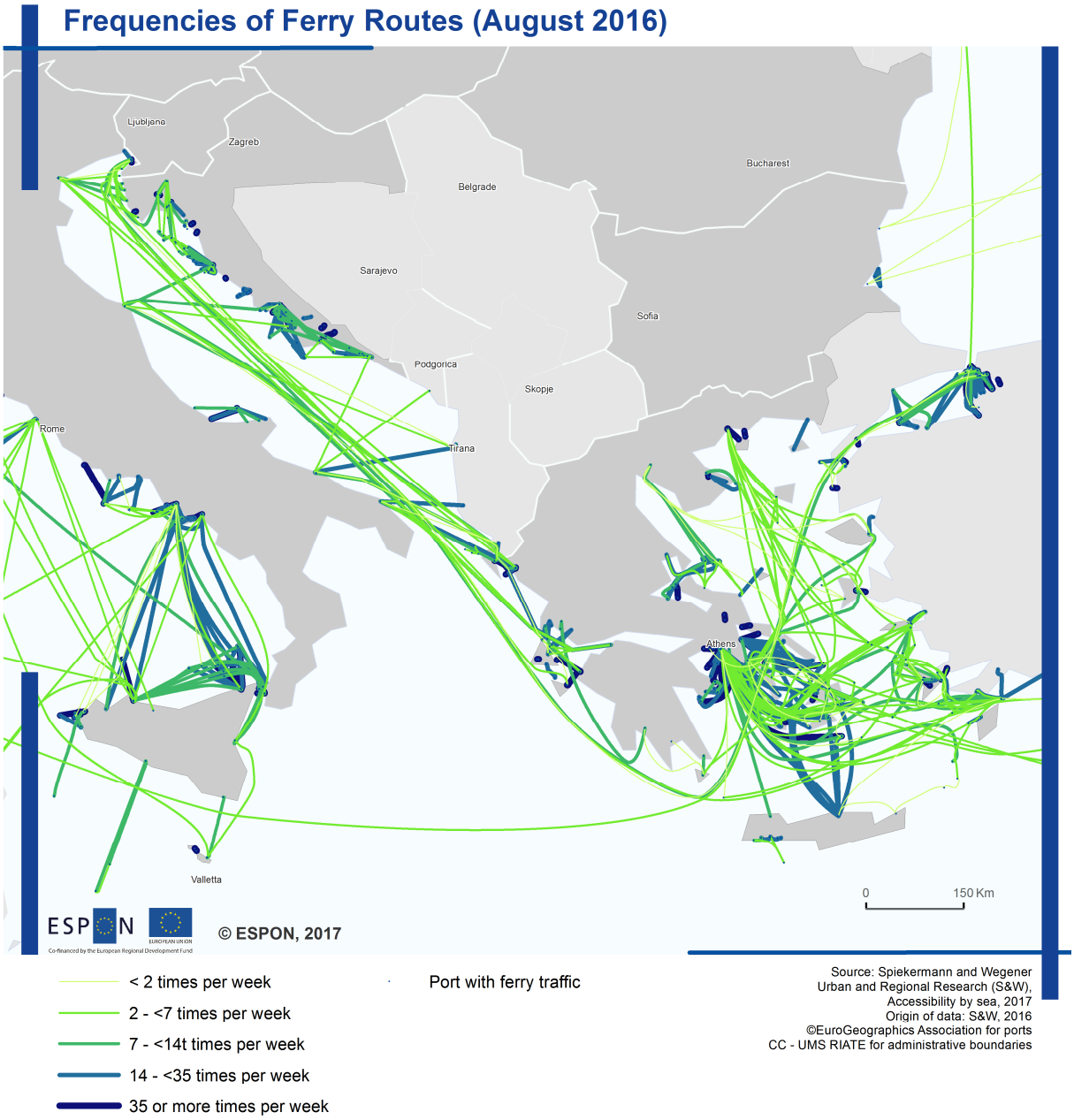


Figure 15. Frequency of ferry lines in the eastern Mediterranean, August 2016

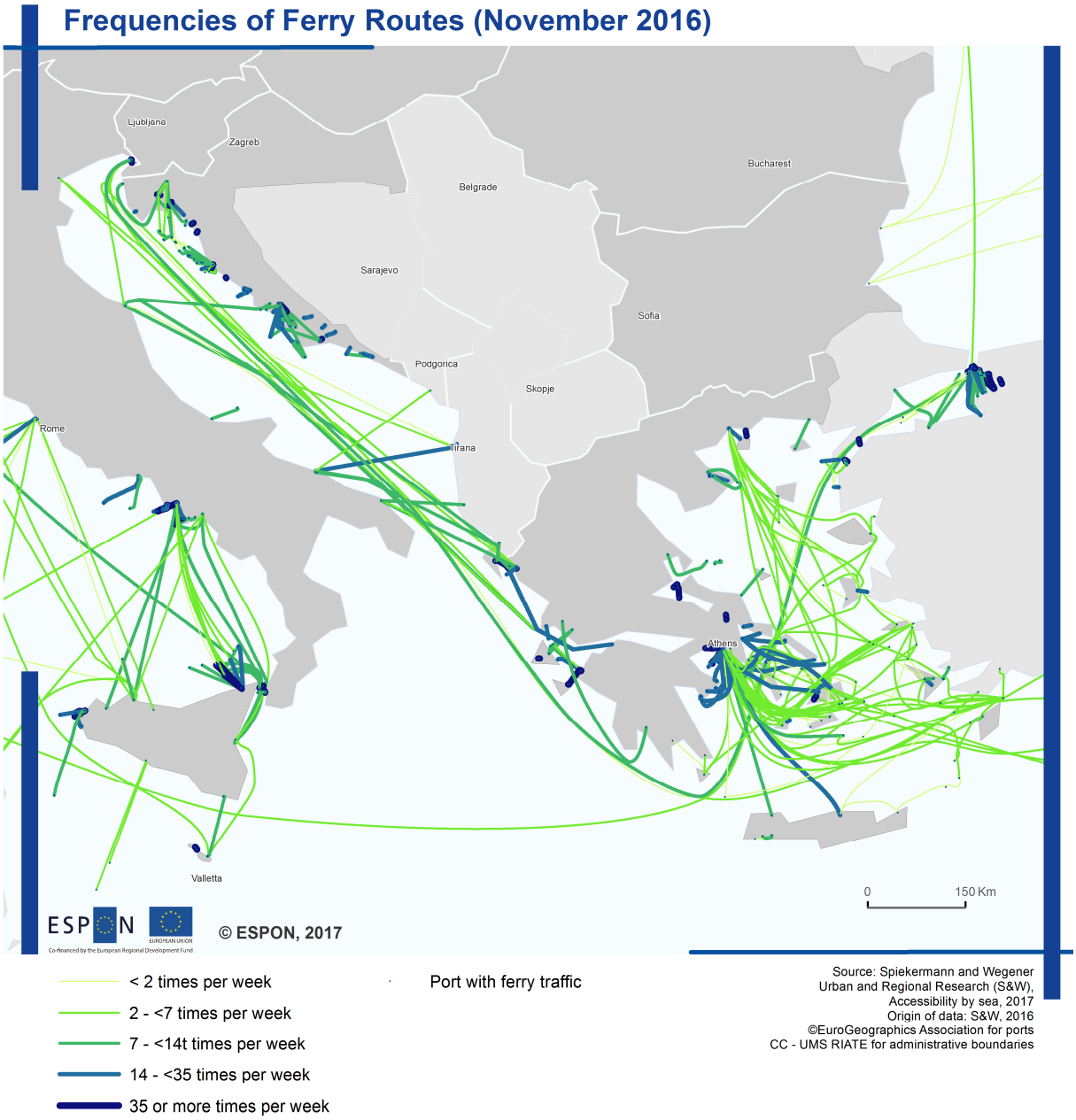


Figure 16. Frequency of ferry lines in the eastern Mediterranean, November 2016

7. Maritime accessibility

The final two indicators address accessibility in its traditional sense, i.e. the indicator values are based on a function that links travel impedance with opportunities to be reached. The first one assess the hinterland of ports, i.e. the land-side accessibility of ports, the second addresses the sea-side accessibility of ports.

Calculating hinterland and maritime accessibility

These indicators cannot be derived from statistical databases, but require the application of an appropriate accessibility model. For this, the two indicators were operationalised by using S&W's accessibility model which was already used for several ESPON indicators before.

For the hinterland of port accessibility, the accessibility model for road was modified in a way that it calculates for each port the travel time to all NUTS-3 regions in Europe and then sums up the population that is reachable within a maximum travel time of four hours. Figure 17 shows the result for this accessibility indicator.

The other indicator addressing the accessibility of ports via sea is in form of an potential accessibility indicator. This means that maritime travel time between ports will be used as impedance and that all main ports in Europe will serve as destinations. The attractivity of the destination ports is expressed in terms of their transport volumes.

As important as the sea-side connections of the European ports is the land-side connection. As a proxy for the hinterland accessibility of ports and their market area, the amount of population that can be reached from a port within four hours of road travel time is calculated. It is interesting to note that hinterland accessibility is rather balanced in Europe (Figure 17). Rather low numbers of population in the hinterland can only be found in the sparsely populated Nordic regions, the Baltic States and on most of the islands in Europe. All other ports can potentially serve a hinterland population of at least five million persons, in many cases this is more than 20 million persons.

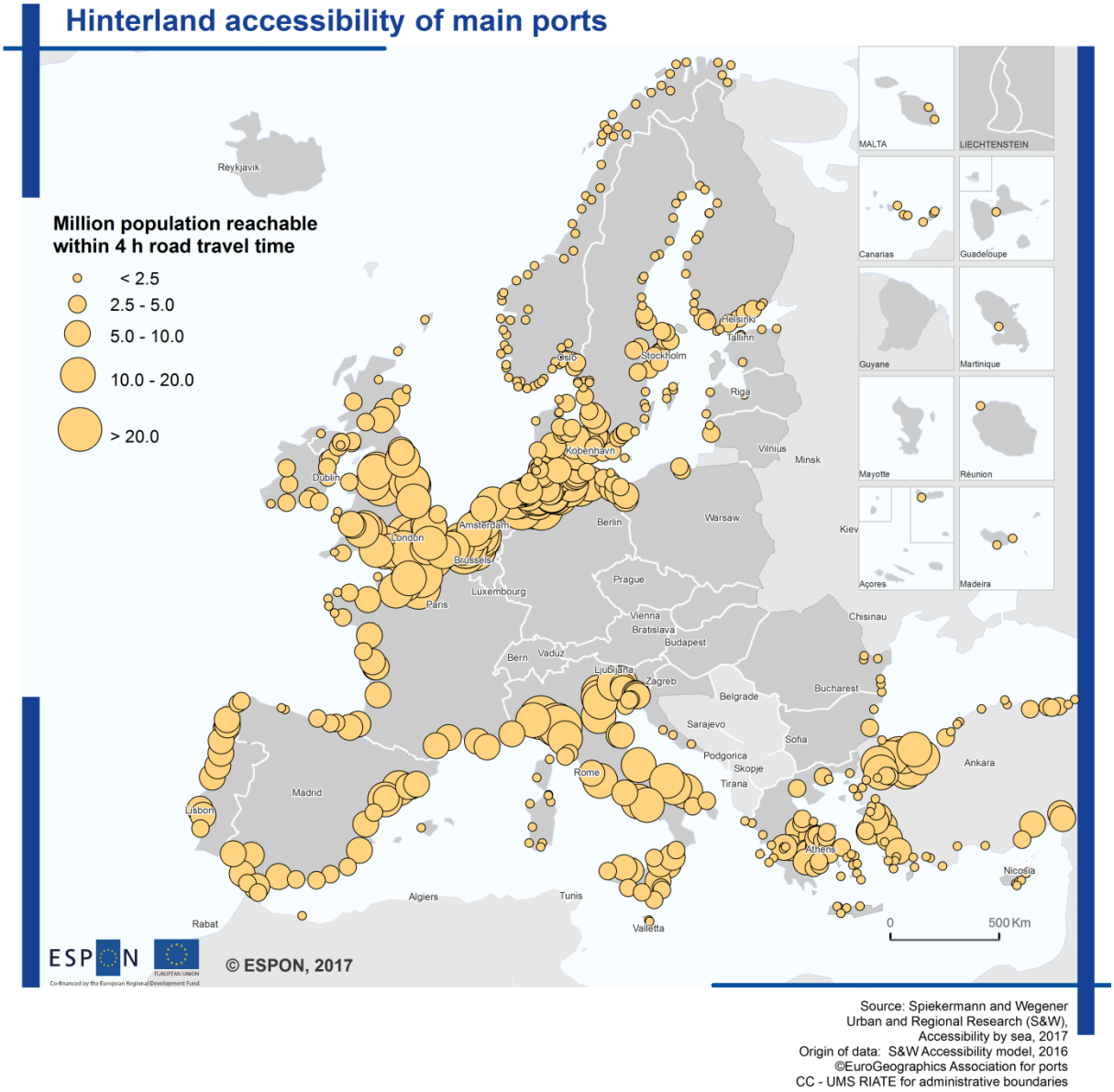


Figure 17. Hinterland accessibility of main ports

Annexes

Annex 1 Additional maps on transport volumes of European ports

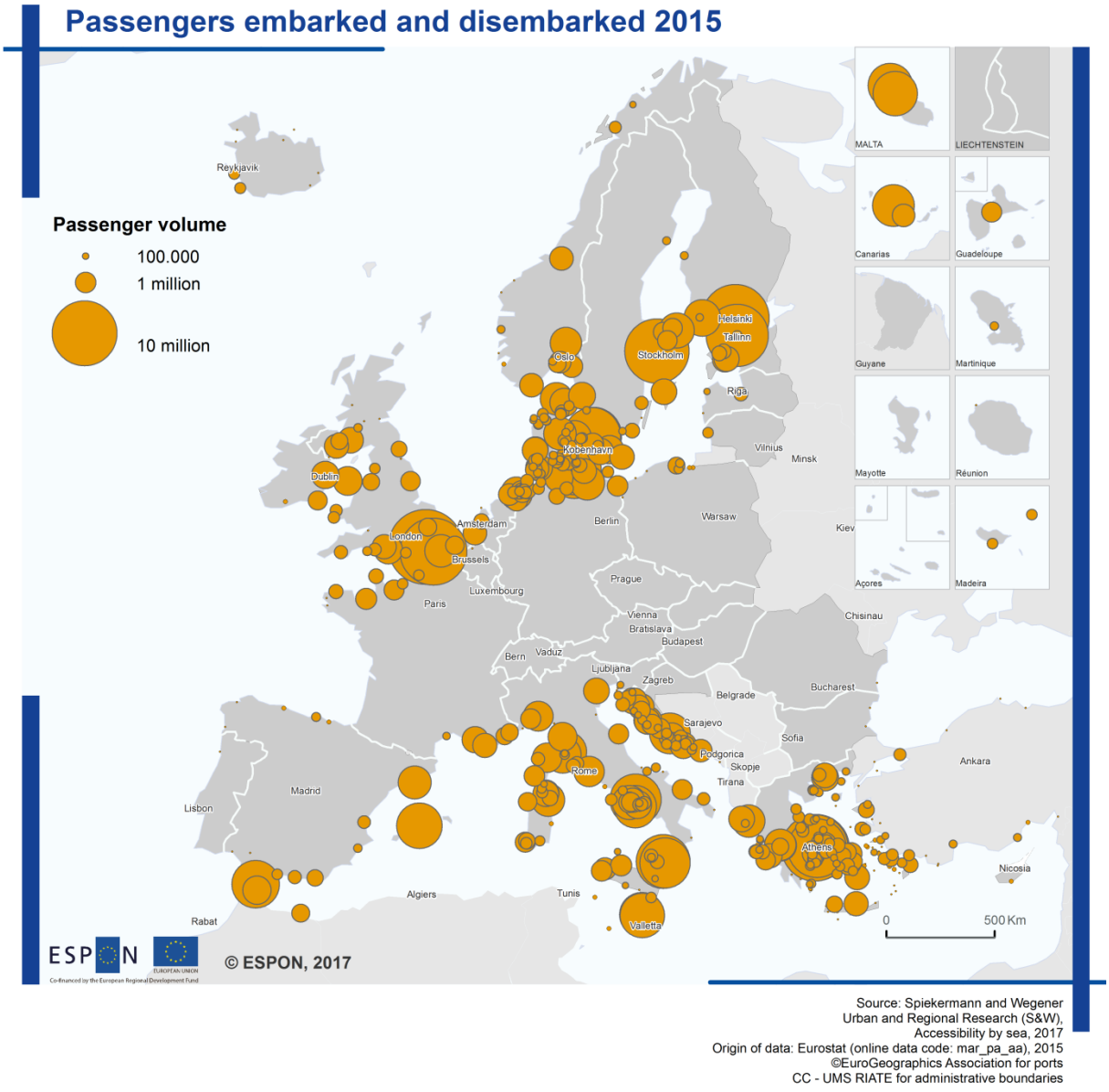


Figure A1.1 Passengers embarked and disembarked 2015

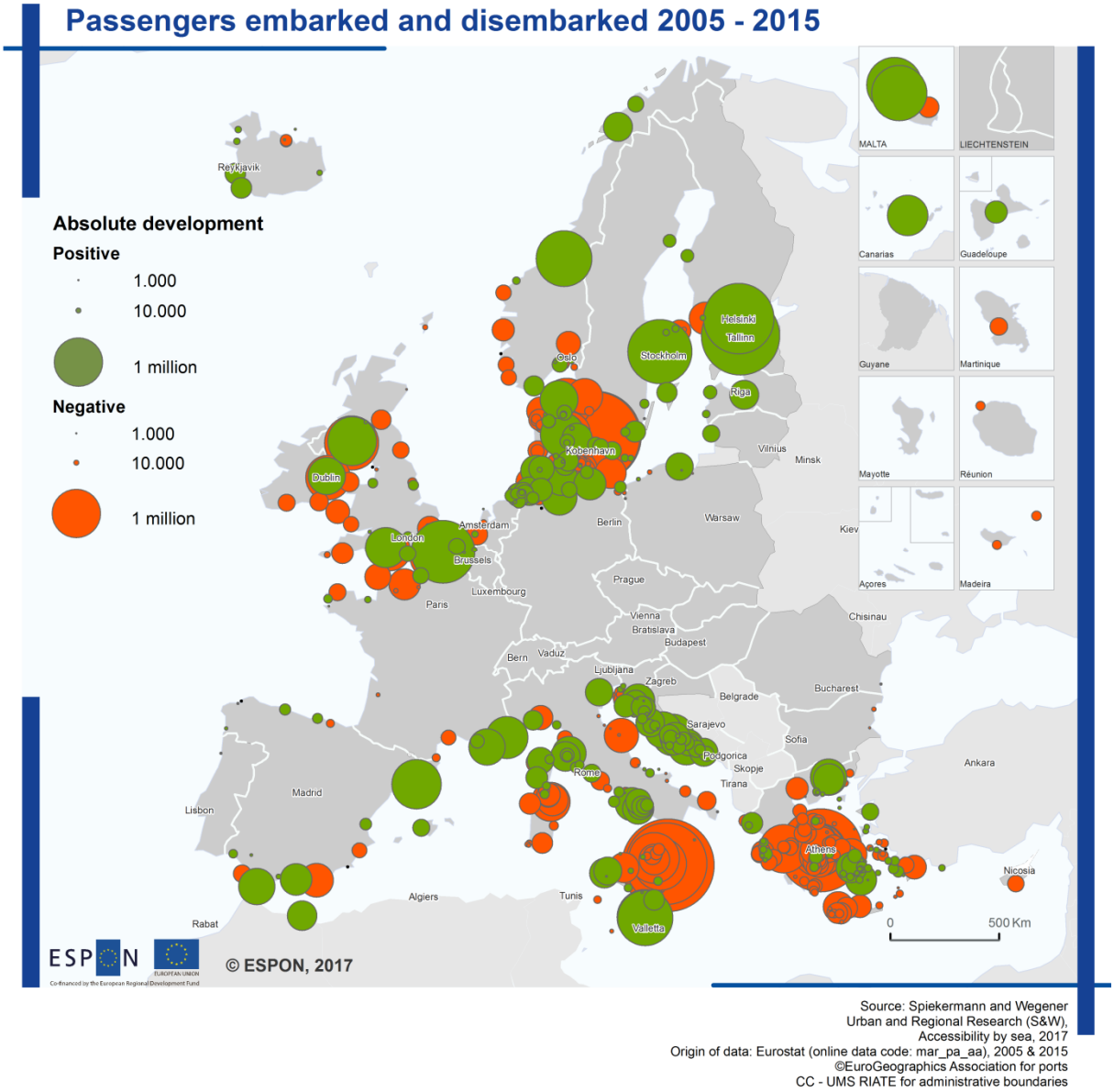


Figure A1.2 Passengers embarked and disembarked - absolute development 2005 - 2015

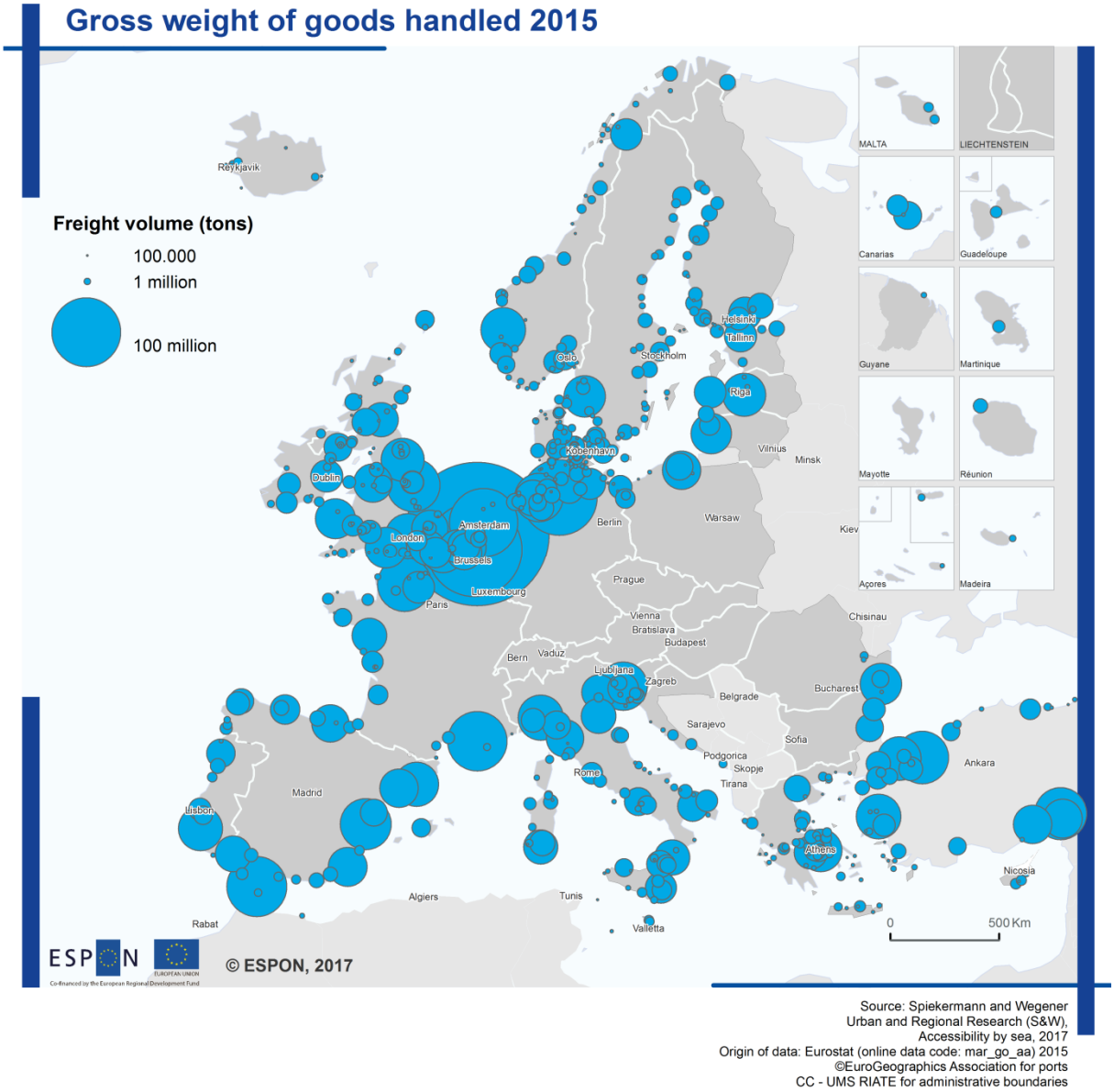


Figure A1.3 Gross weight of goods handled 2015

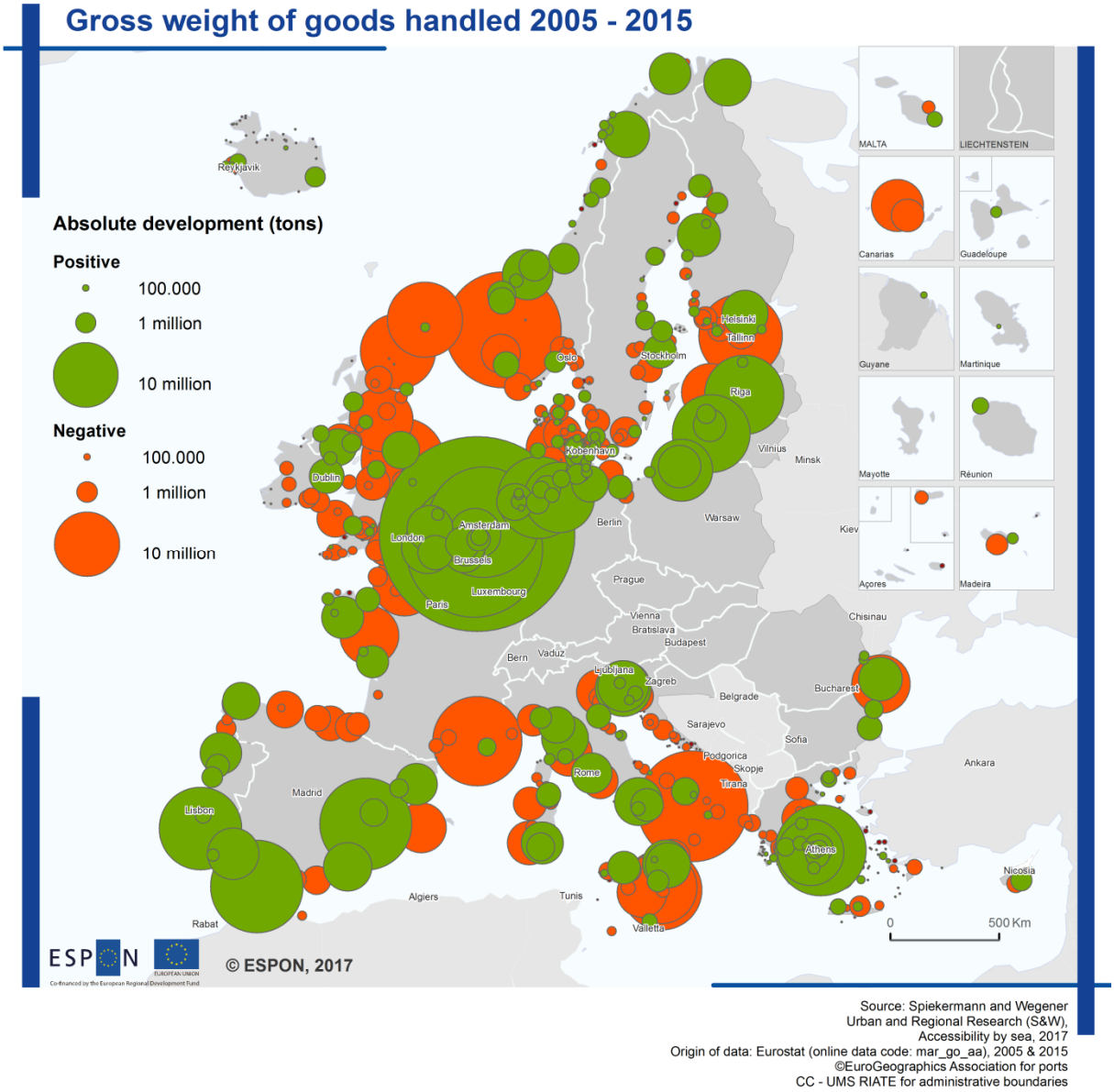


Figure A1.4 Gross weight of goods handled 2015 - absolute development 2005-2015

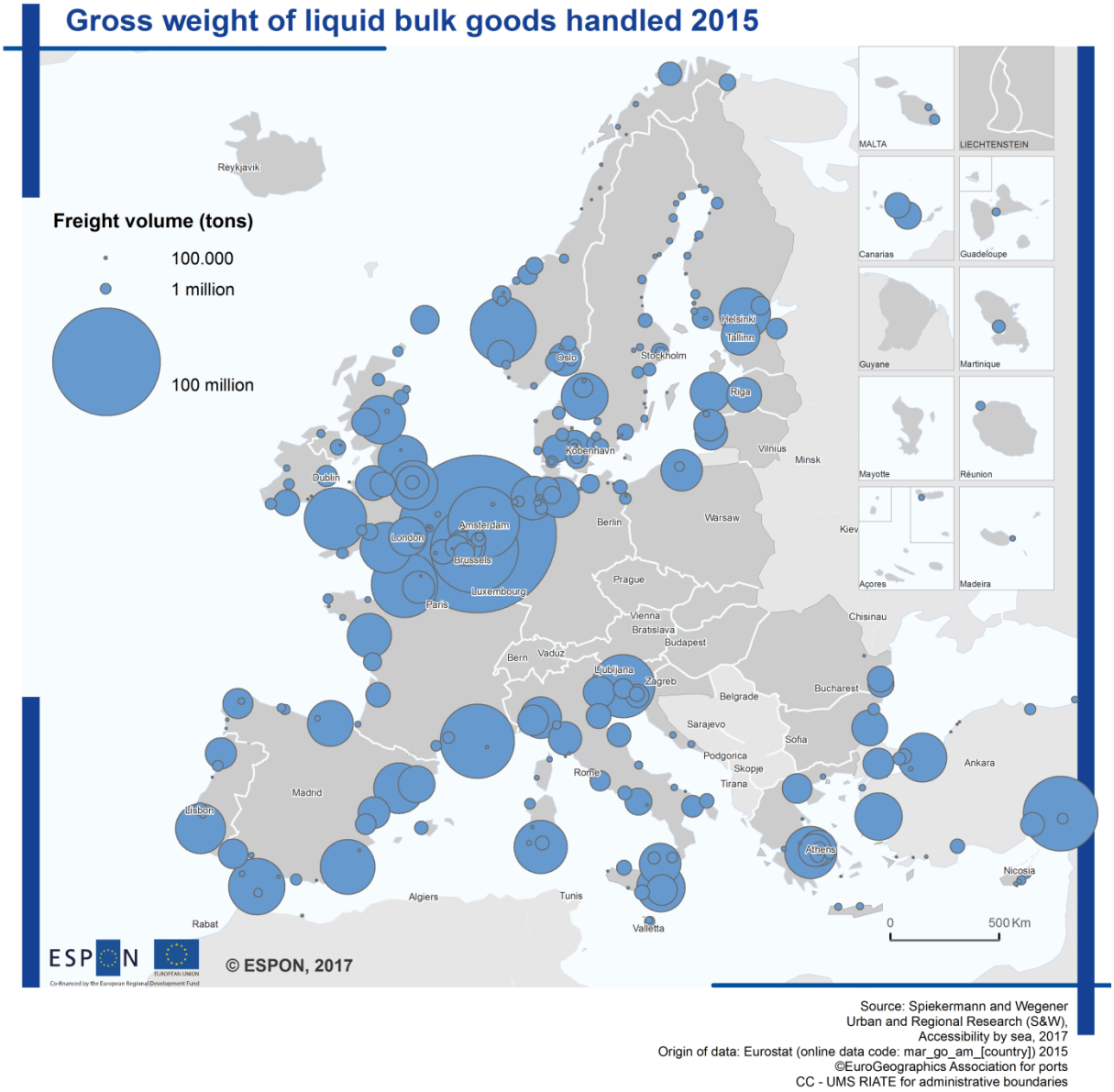


Figure A1.5 Gross weight of liquid bulk goods handled 2015

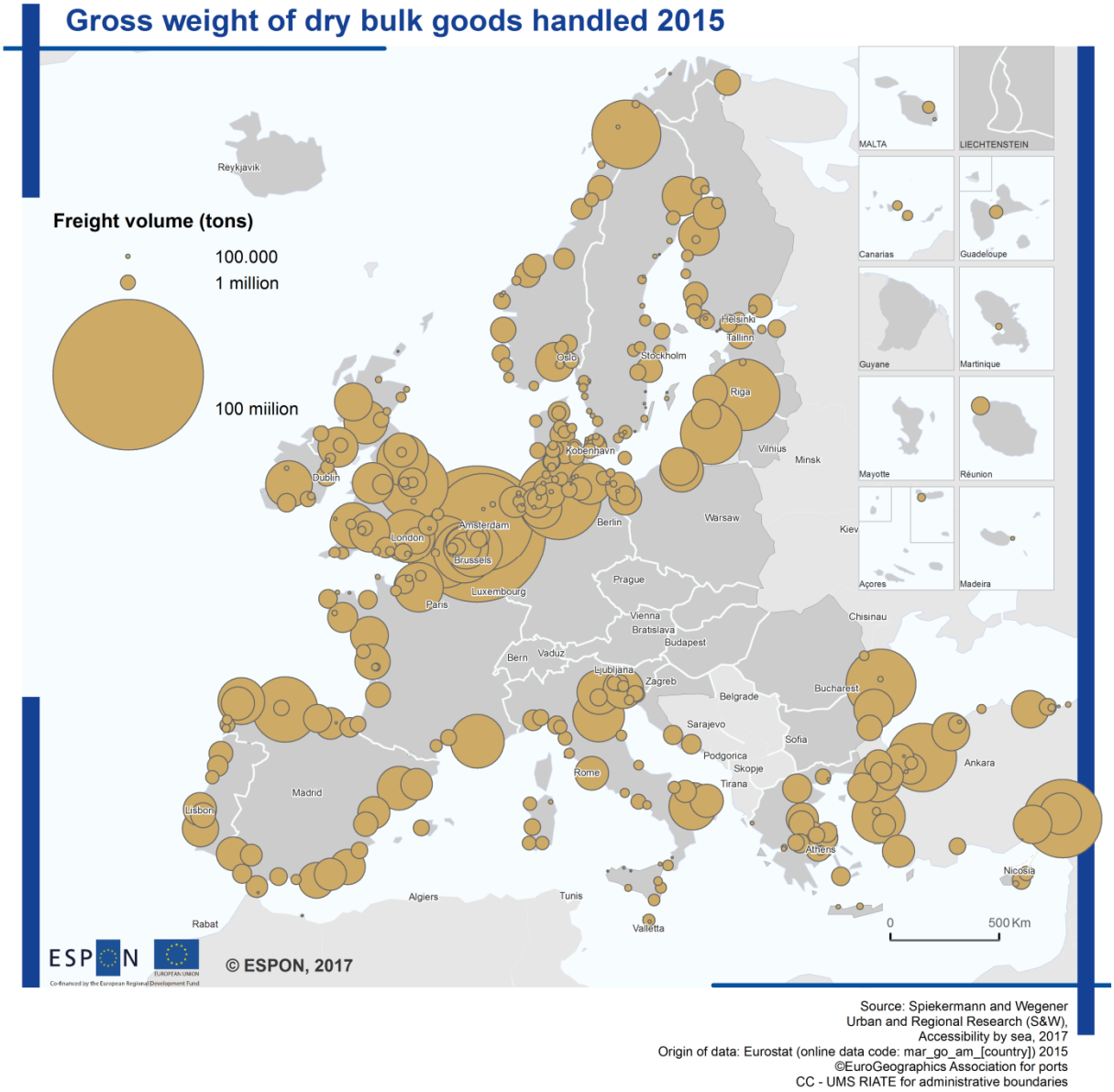


Figure A1.6 Gross weight of dry bulk goods handled 2015

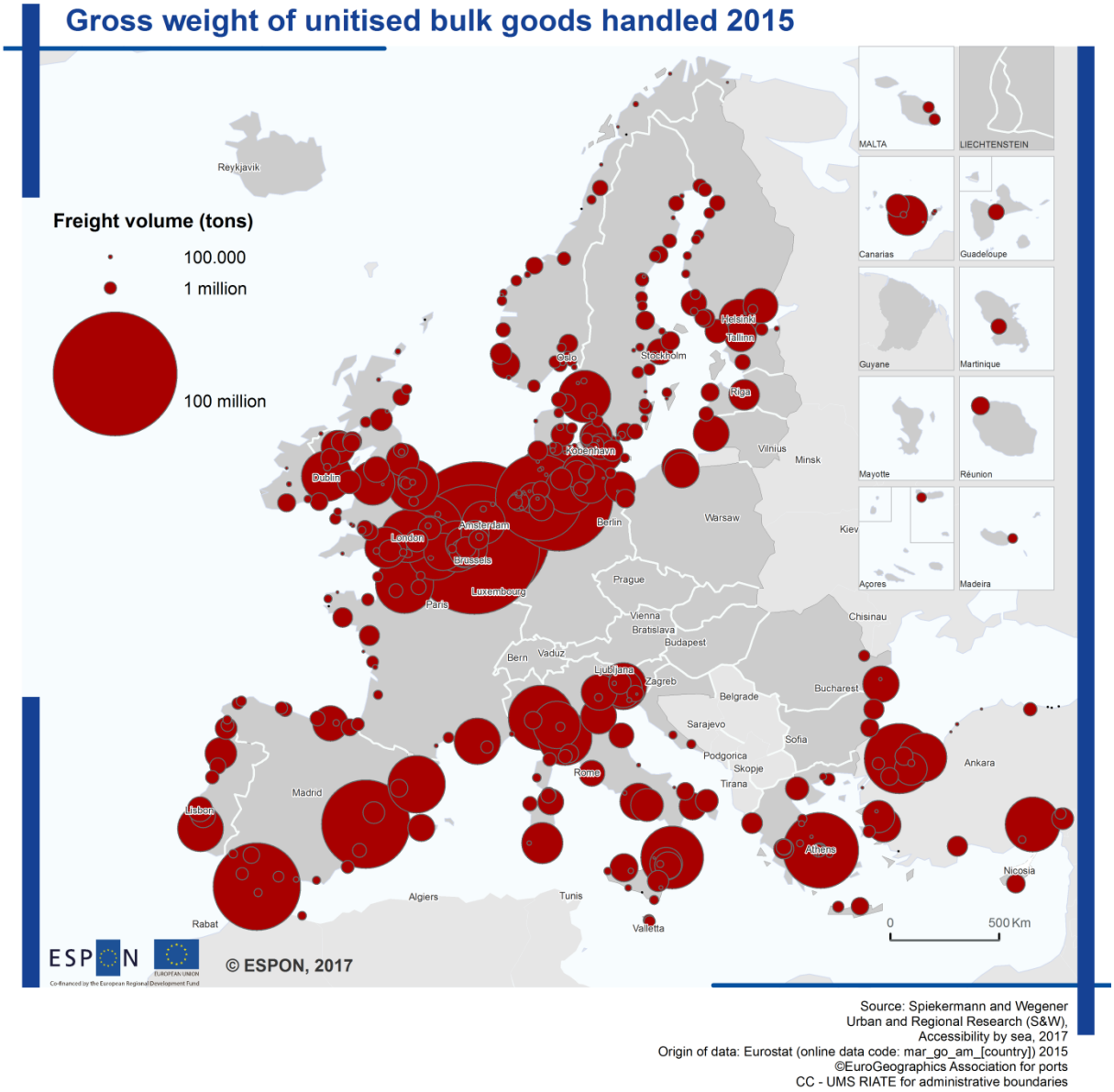


Figure A1.7 Gross weight of unitised goods handled 2015

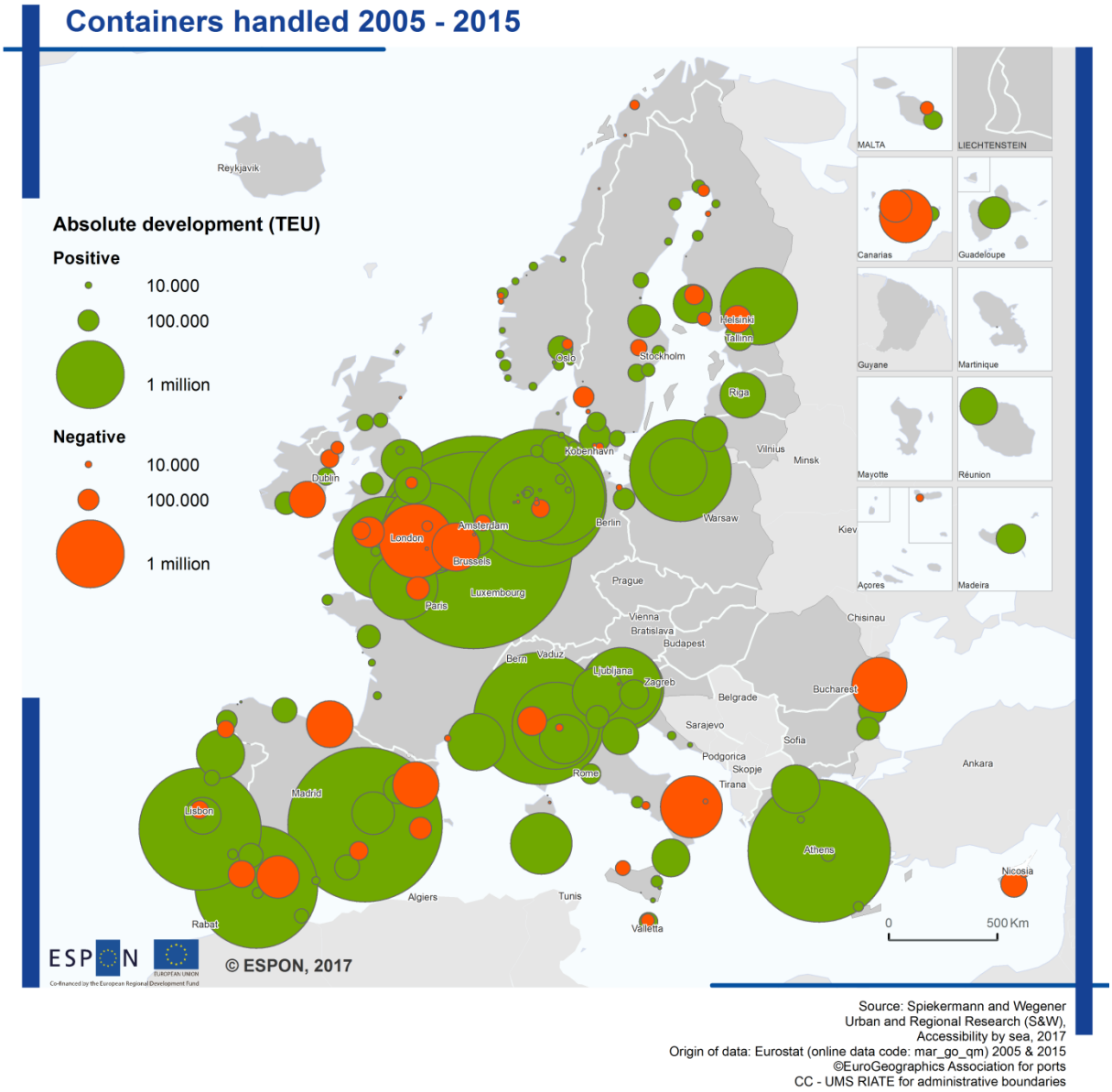


Figure A1.8 Containers handled, absolute development 2005 - 2015

Annex 2 Additional maps on maritime transport flows of European ports

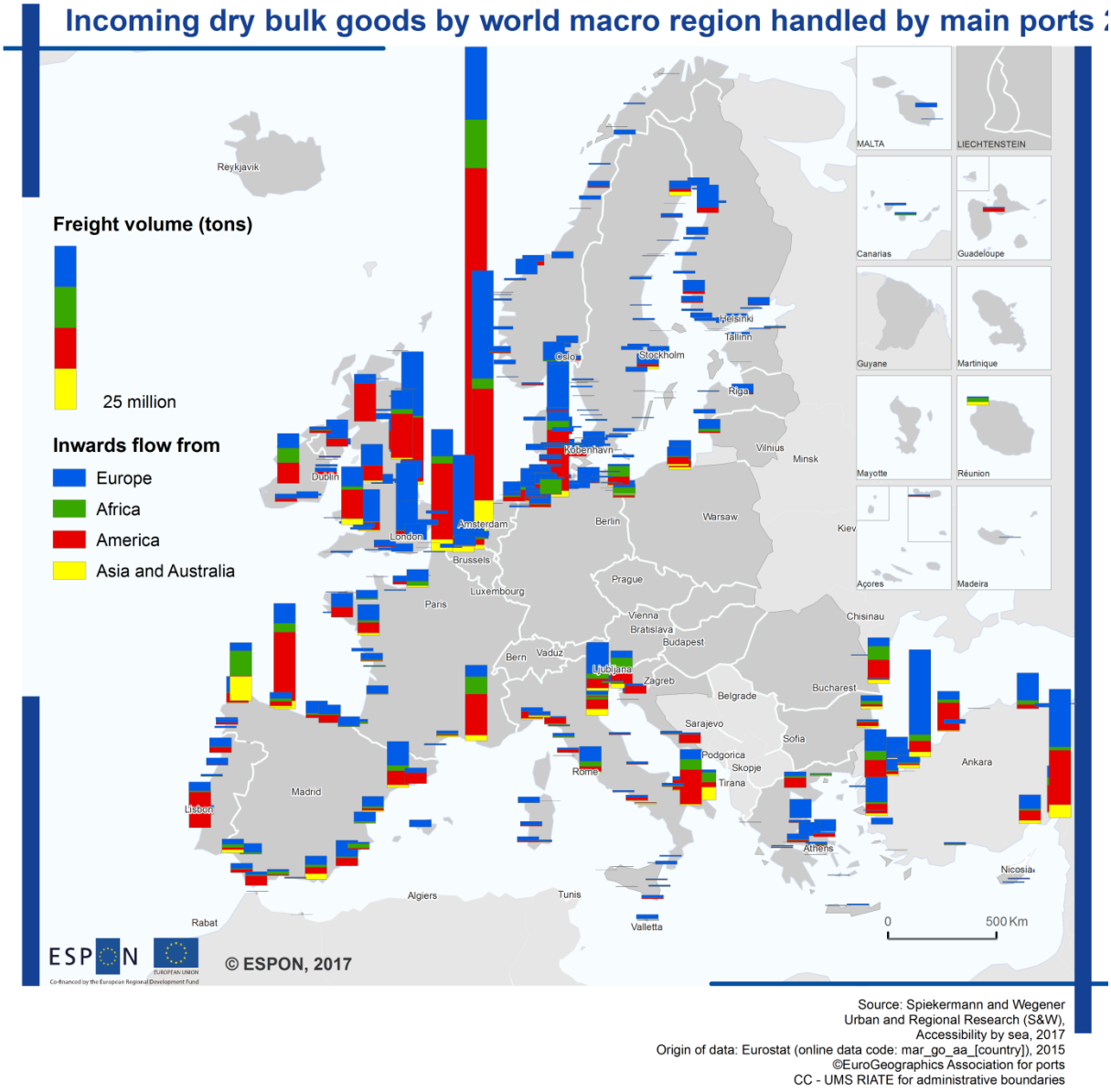
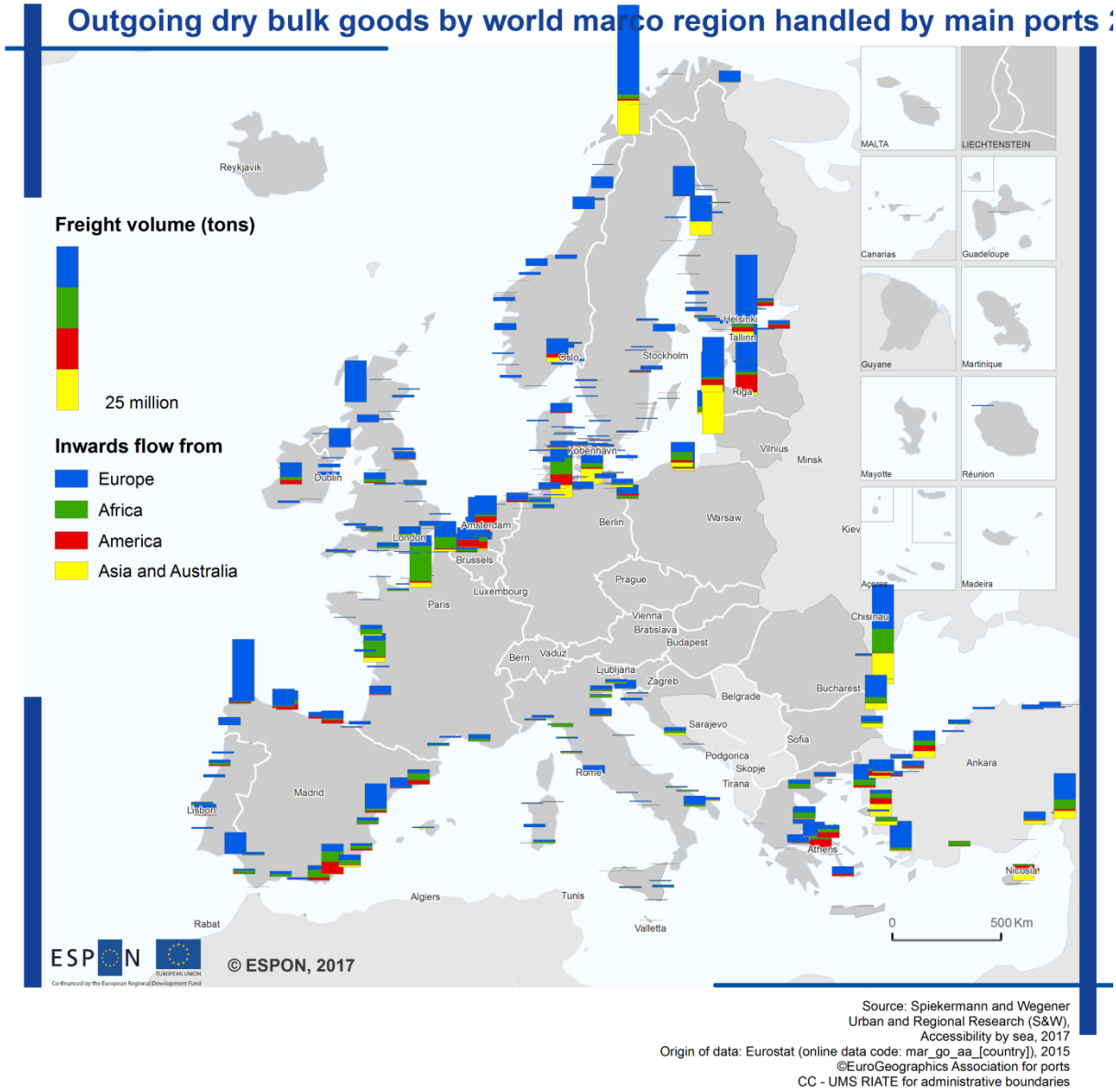


Figure A2.1 Gross weight of incoming dry bulk goods by world macro region handled by main ports 2015



Source: Spiekermann and Wegener
Urban and Regional Research (S&W),
Accessibility by sea, 2017
Origin of data: Eurostat (online data code: mar_go_aa_[country]), 2015
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Figure A2.2 Gross weight of outgoing dry bulk goods by world macro region handled by main ports 2015

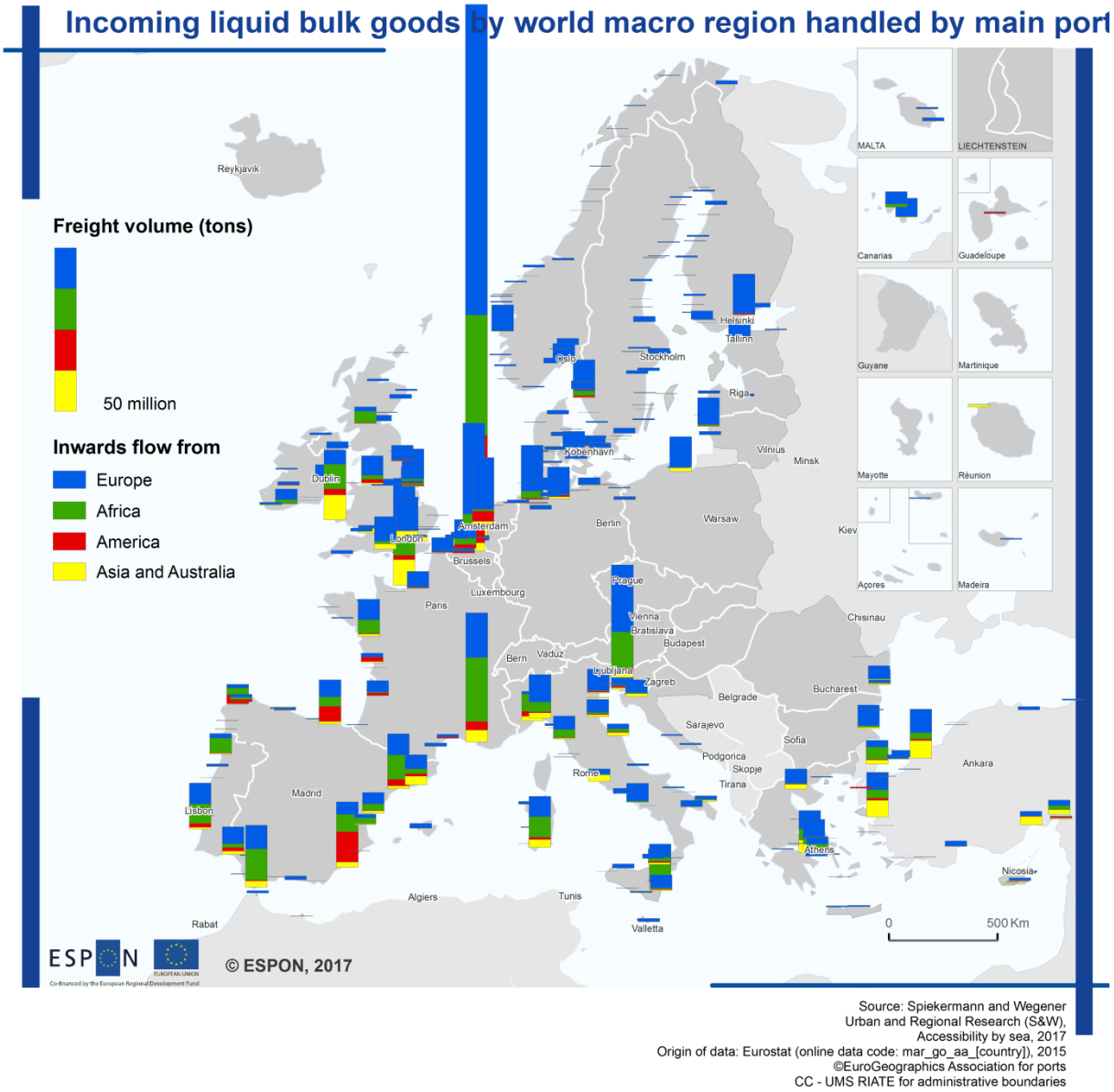


Figure A2.3 Gross weight of incoming liquid bulk goods by world macro region handled by main ports 2015

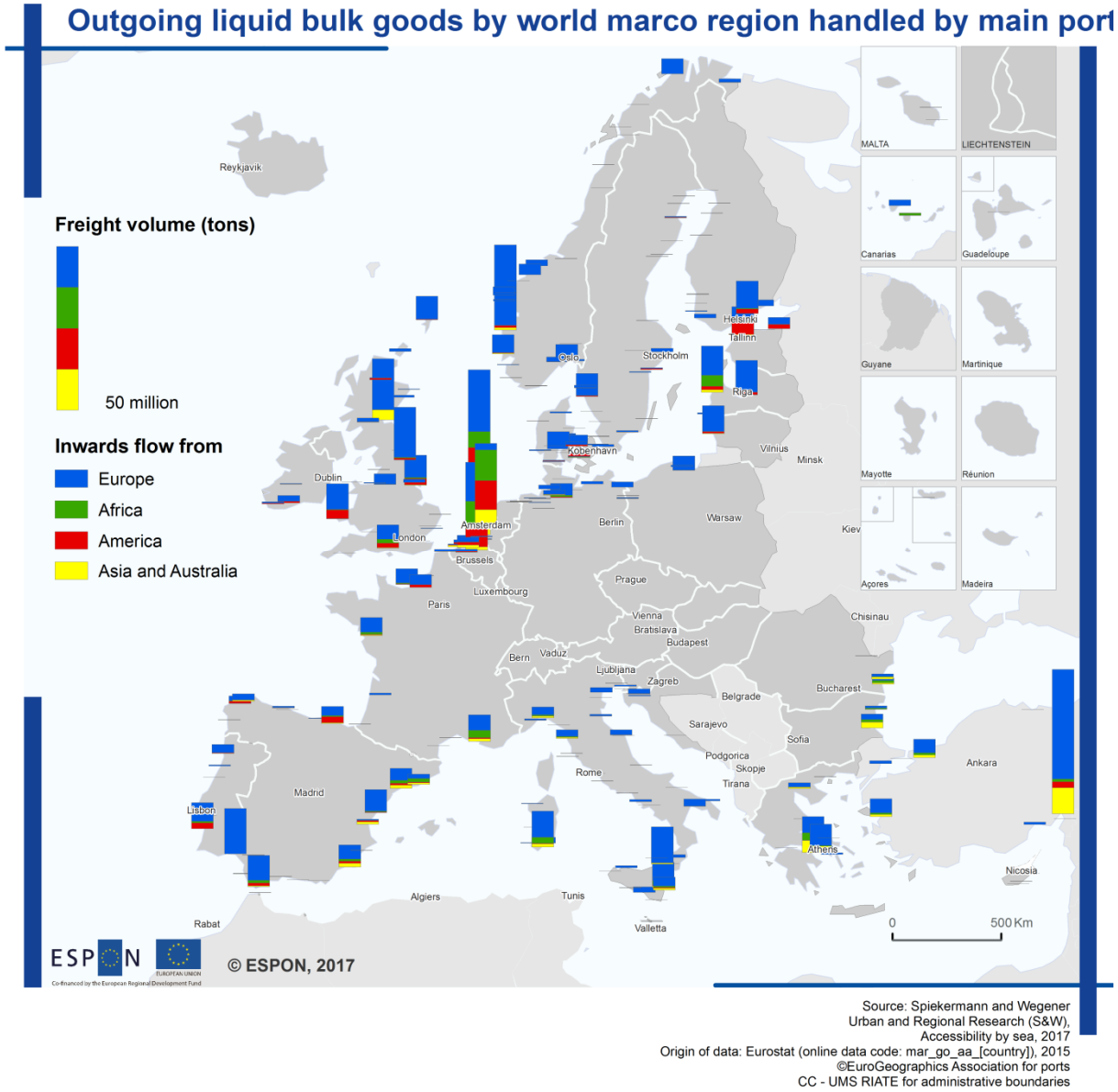


Figure A2.4 Gross weight of outgoing liquid bulk goods by world macro region handled by main ports 2015

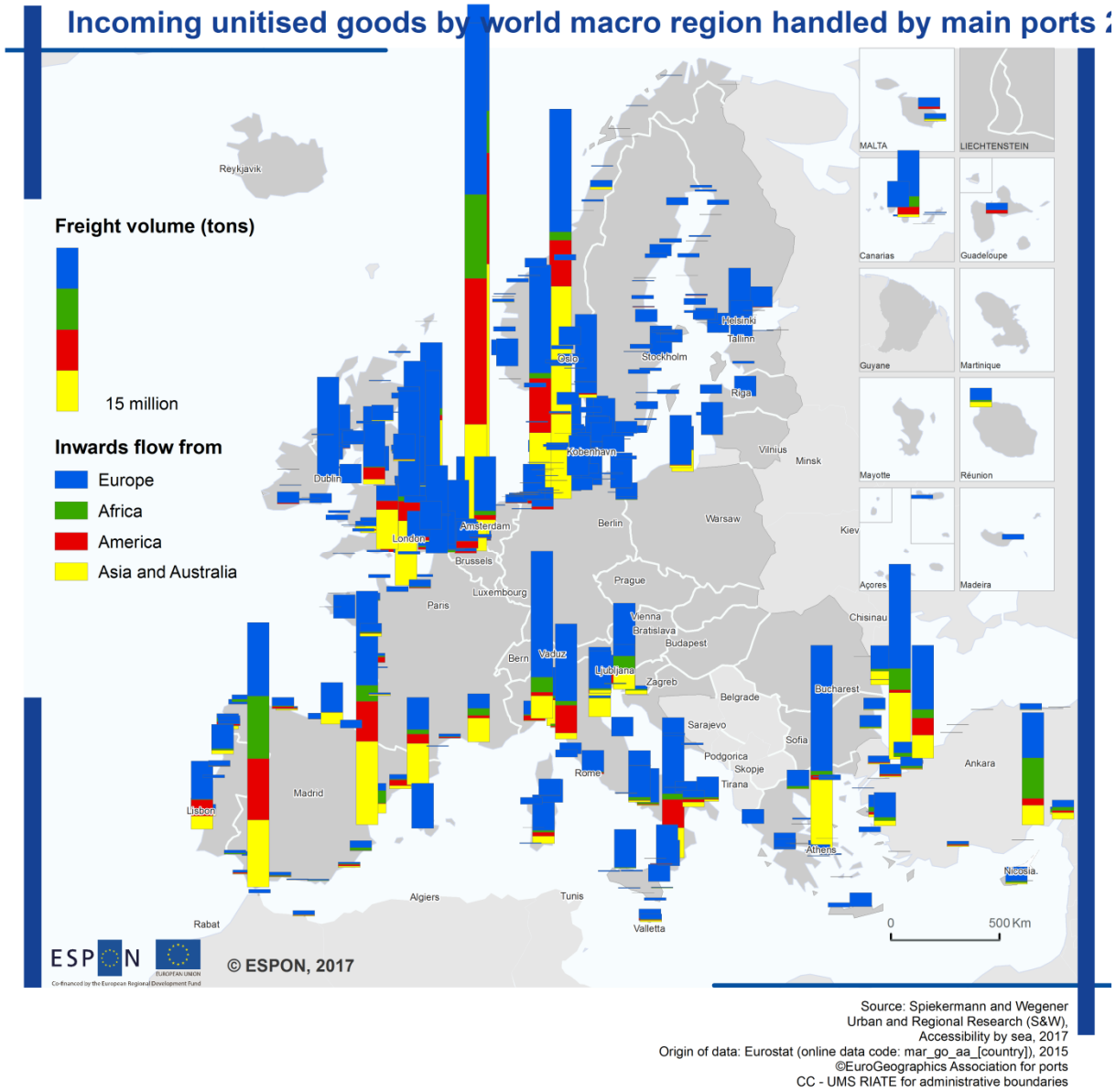


Figure A2.5 Gross weight of incoming unitised goods by world macro region handled by main ports 2015

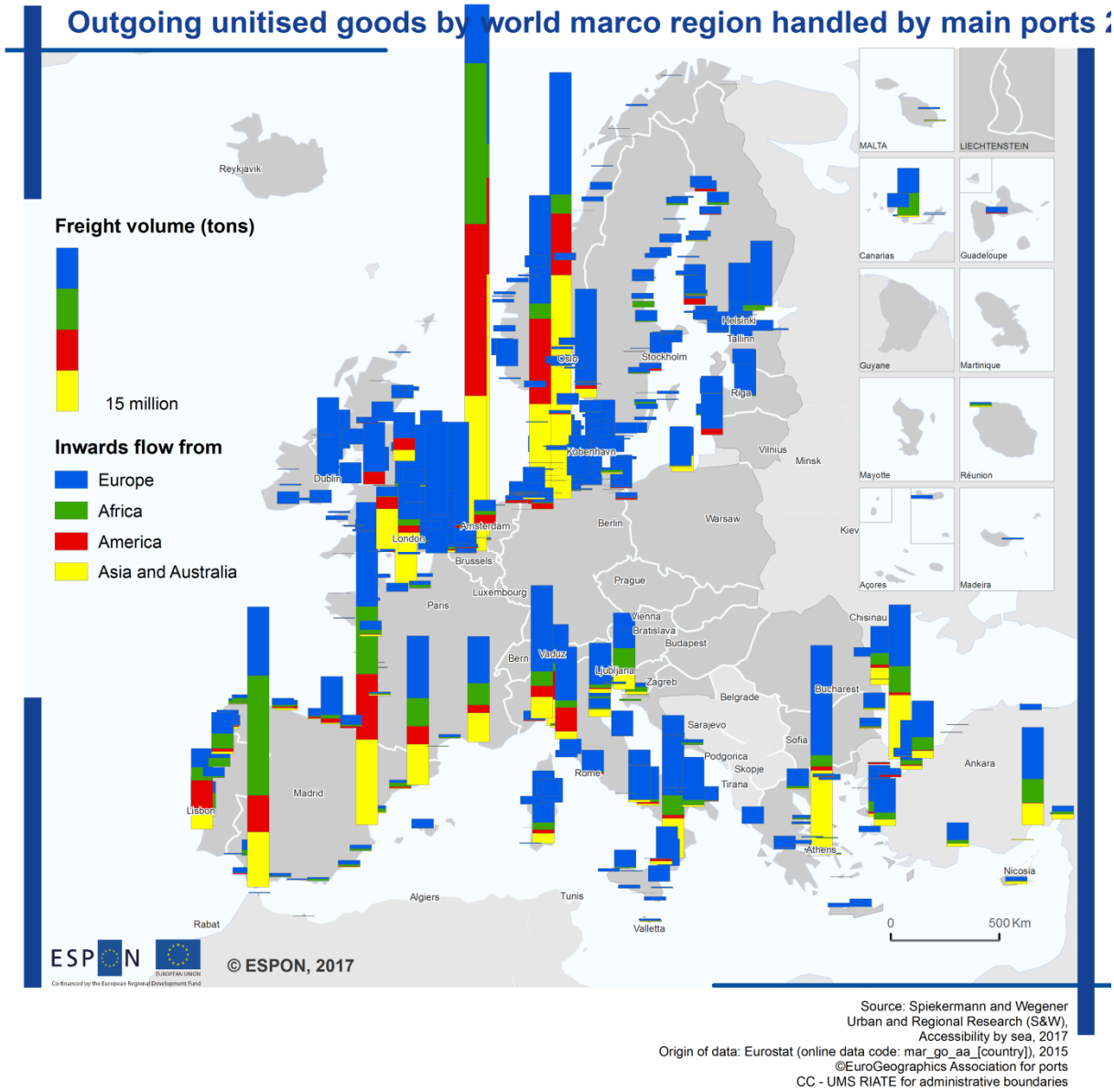


Figure A2.6 Gross weight of outgoing unitised goods by world macro region handled by main ports 2015

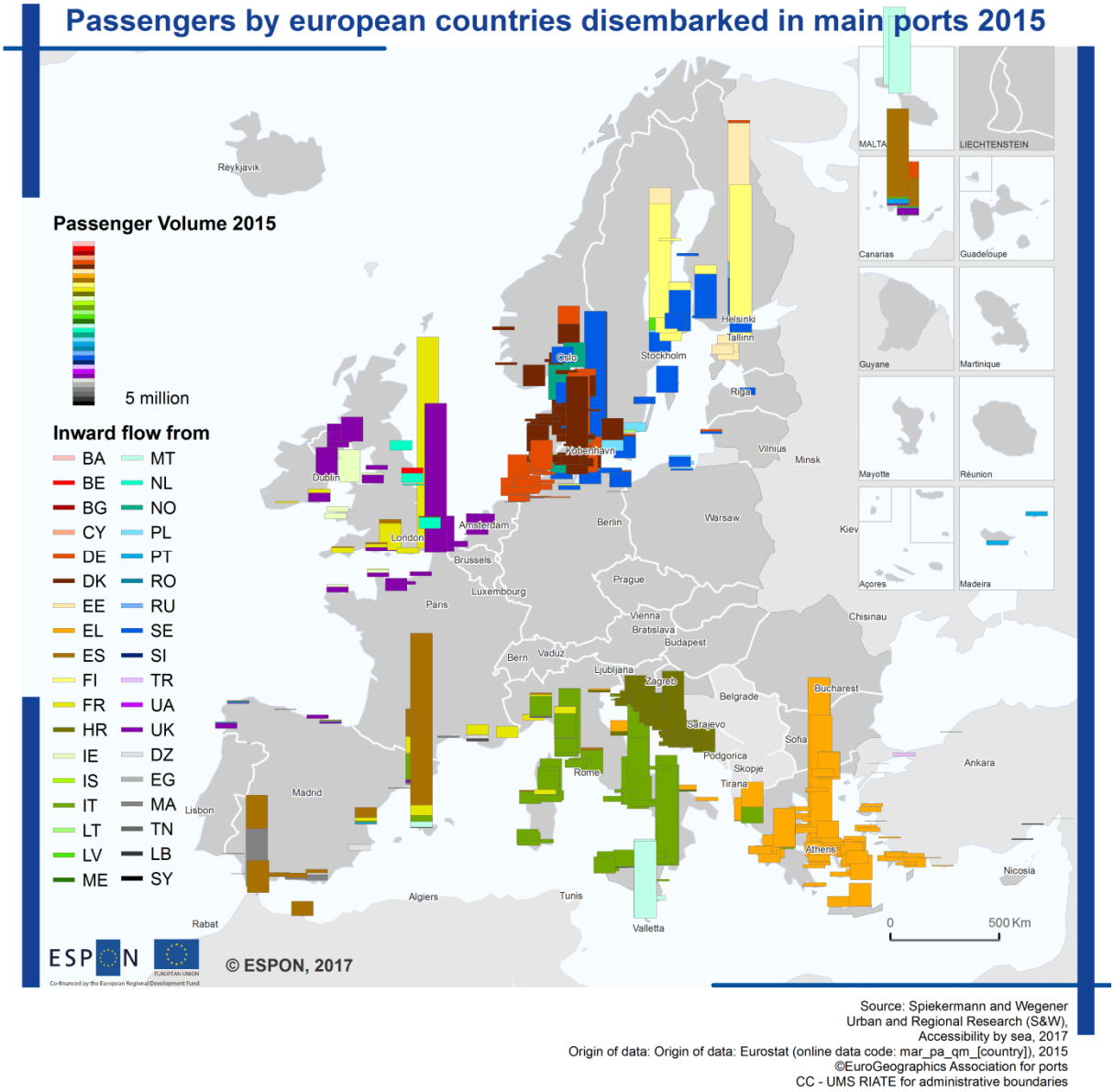
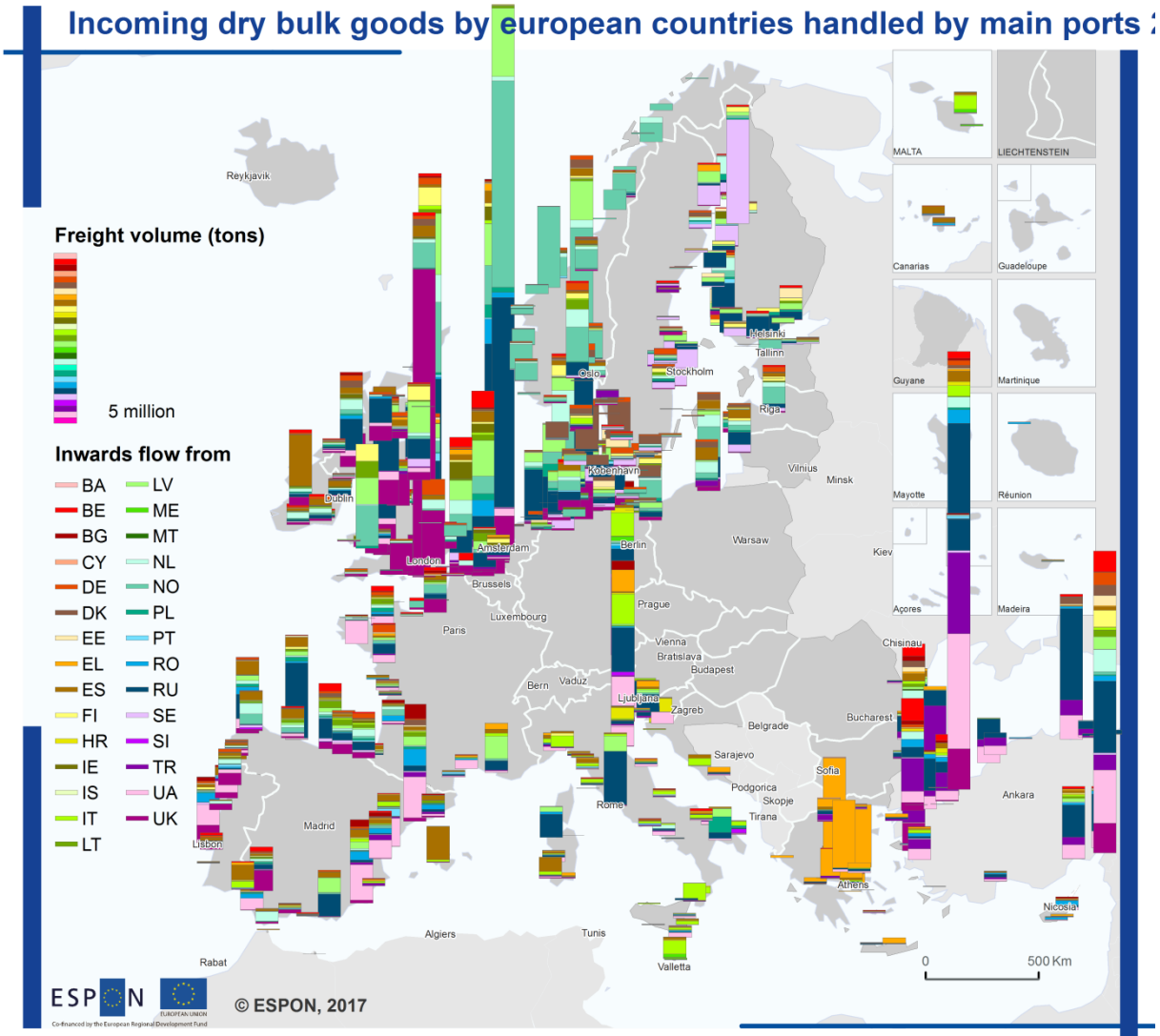


Figure A2.7 Passengers by European countries desimbarked in main ports 2015



Source: Spiekermann and Wegener
Urban and Regional Research (S&W),
Accessibility by sea, 2017
Origin of data: Eurostat (online data code: mar_go_aa_[country]), 2015
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Figure A2.8 Gross weight of incoming dry bulk goods by European countries handled by main ports 2015

Annex 3 Additional maps on maritime transport flows of individual ports

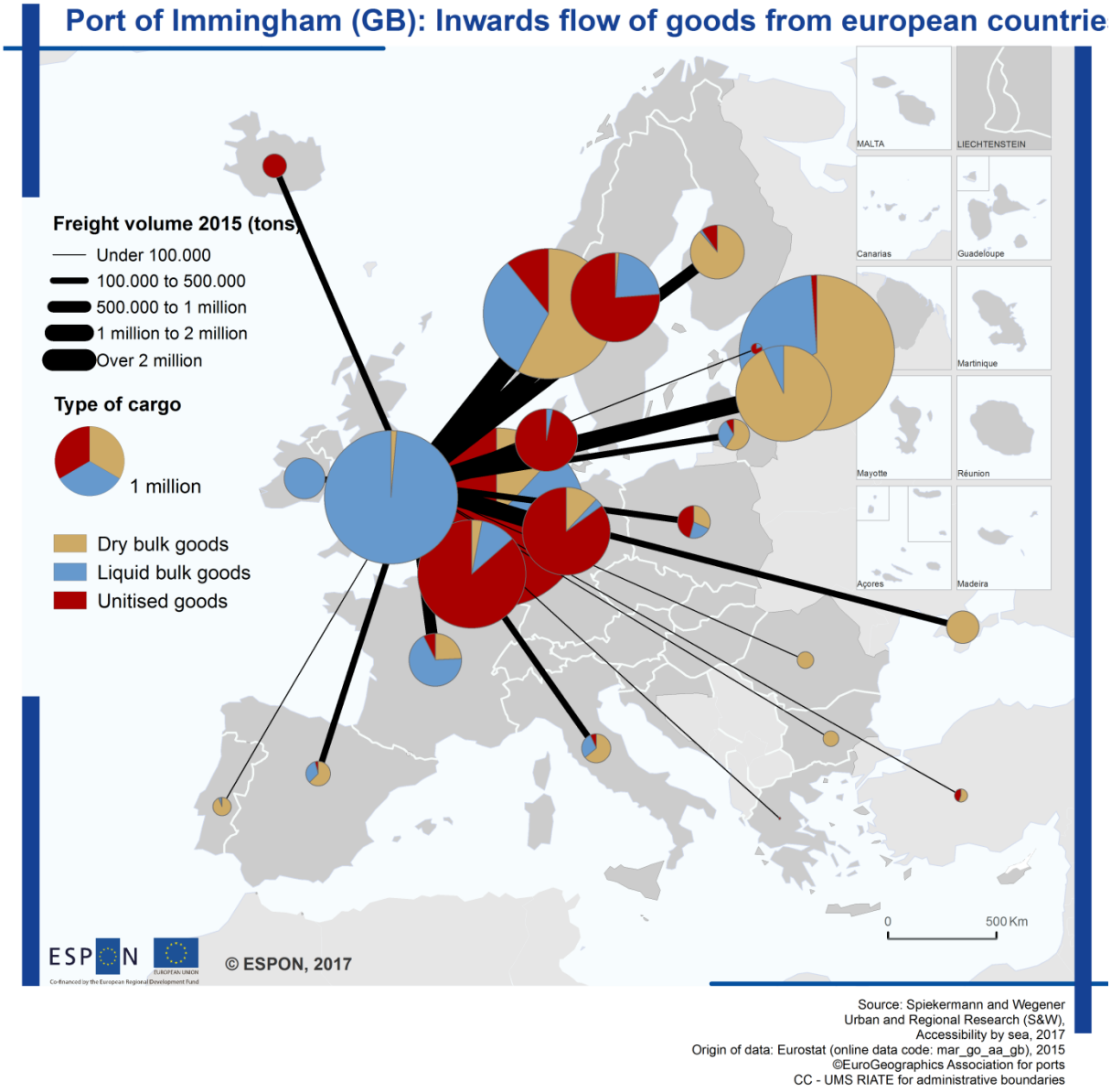

Figure A3.1 Port of Immingham (UK): Inward flow of goods by type of cargo from European countries 2015

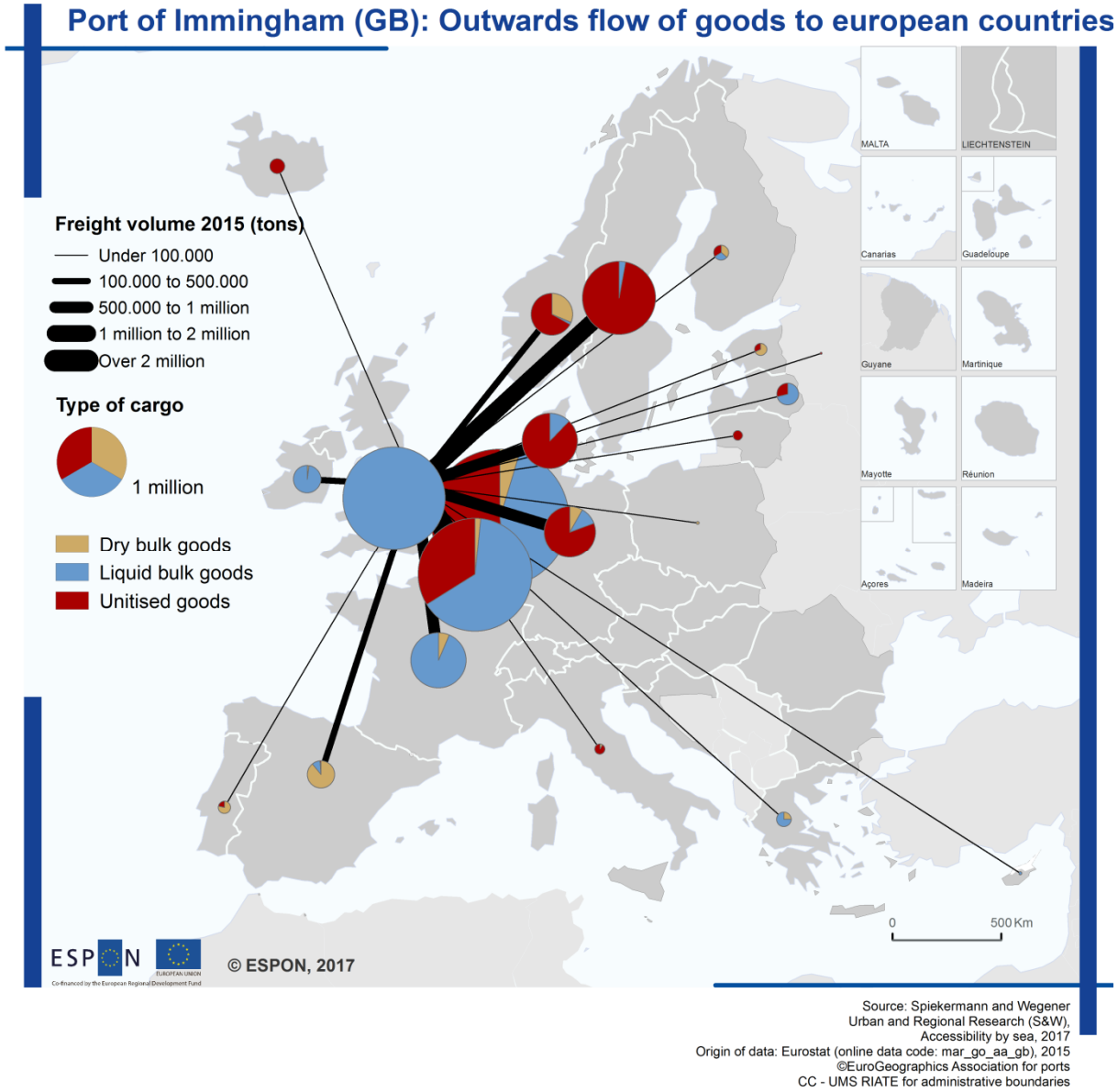

Figure A3.2 Port of Immingham (UK): Outward flow of goods by type of cargo from European countries 2015

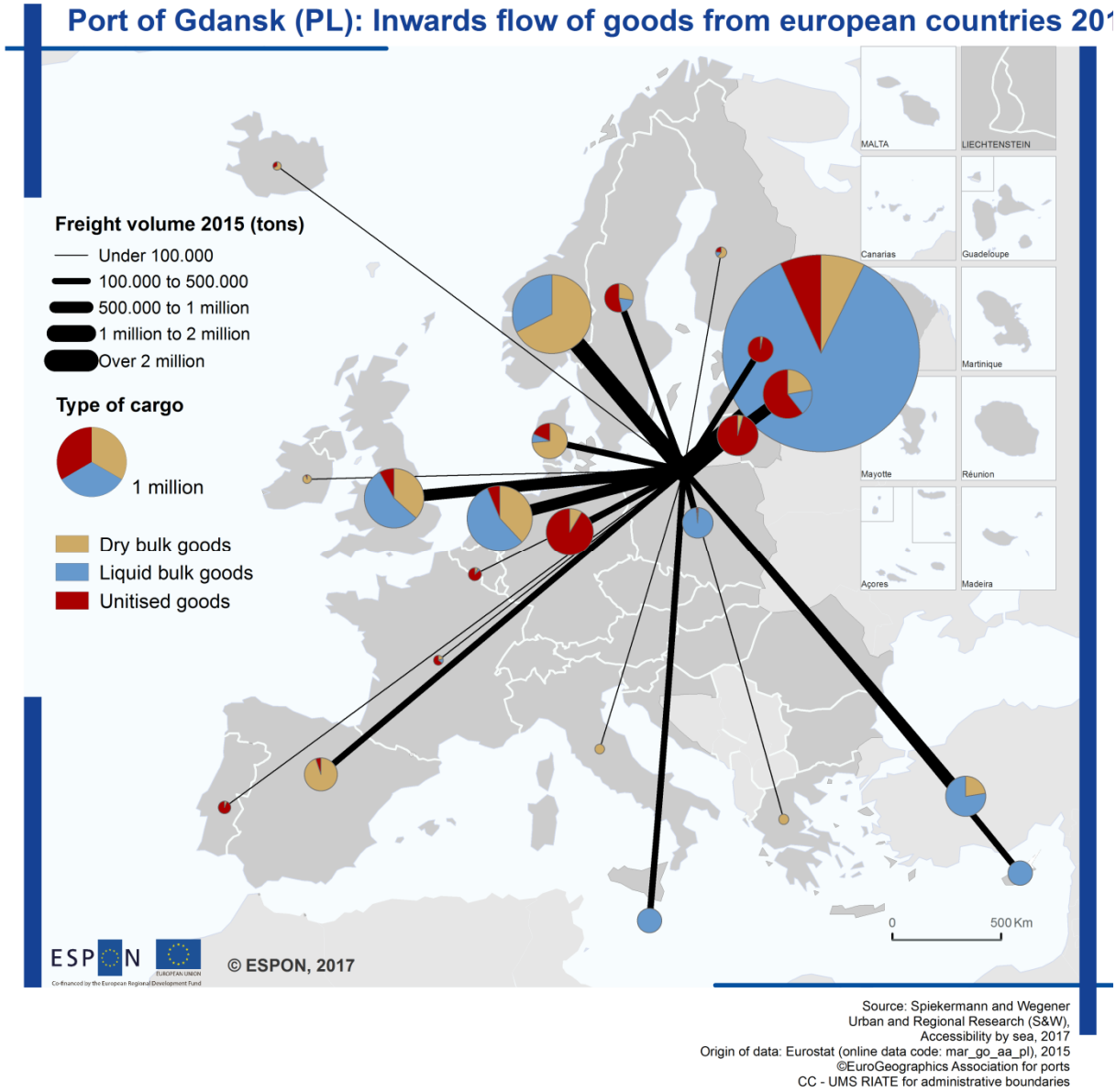

Figure A3.3 Port of Gdansk (PL): Inward flow of goods by type of cargo from European countries 2015

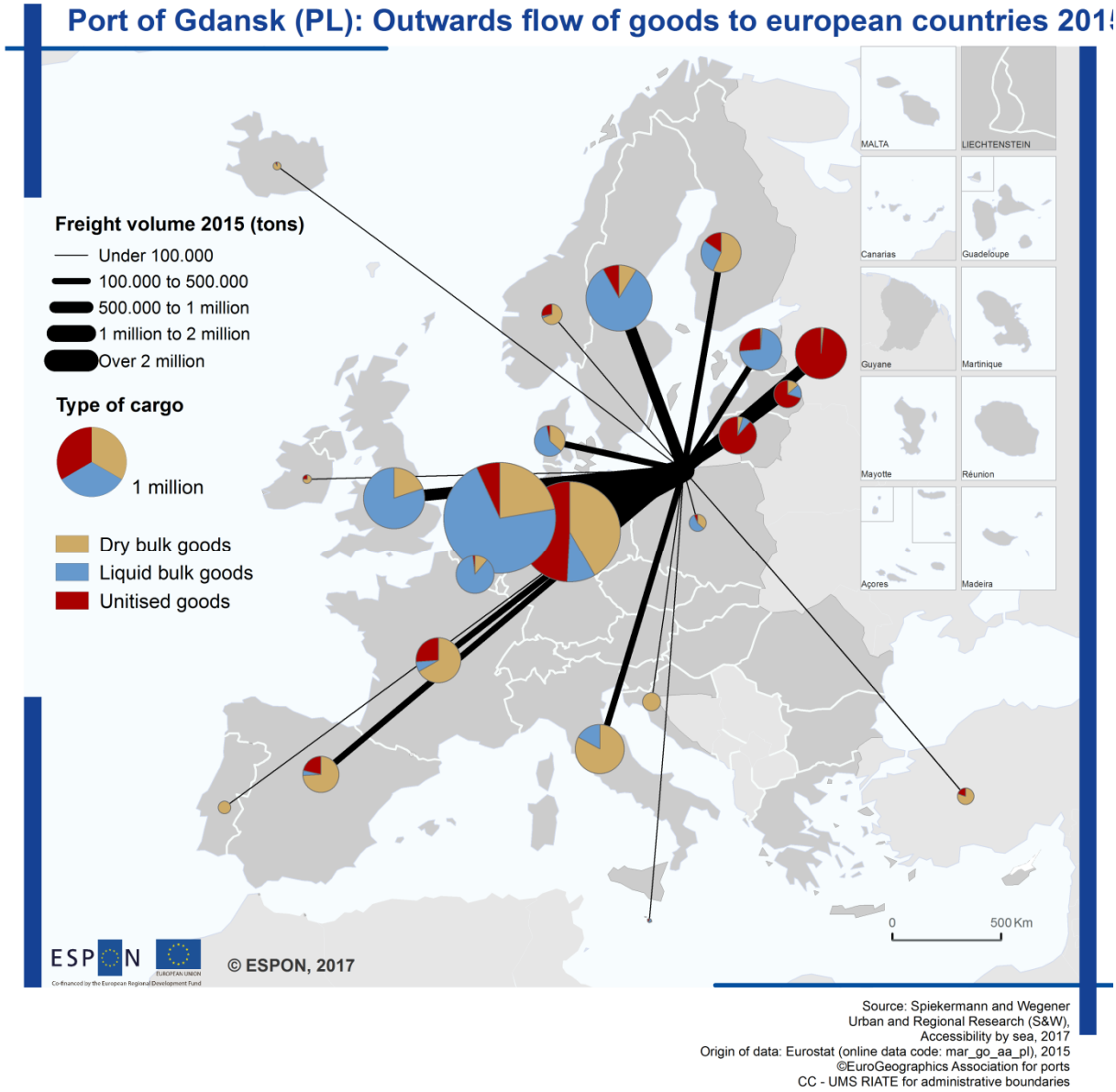

Figure A3.4 Port of Gdansk (PL): Outward flow of goods by type of cargo from European countries 2015

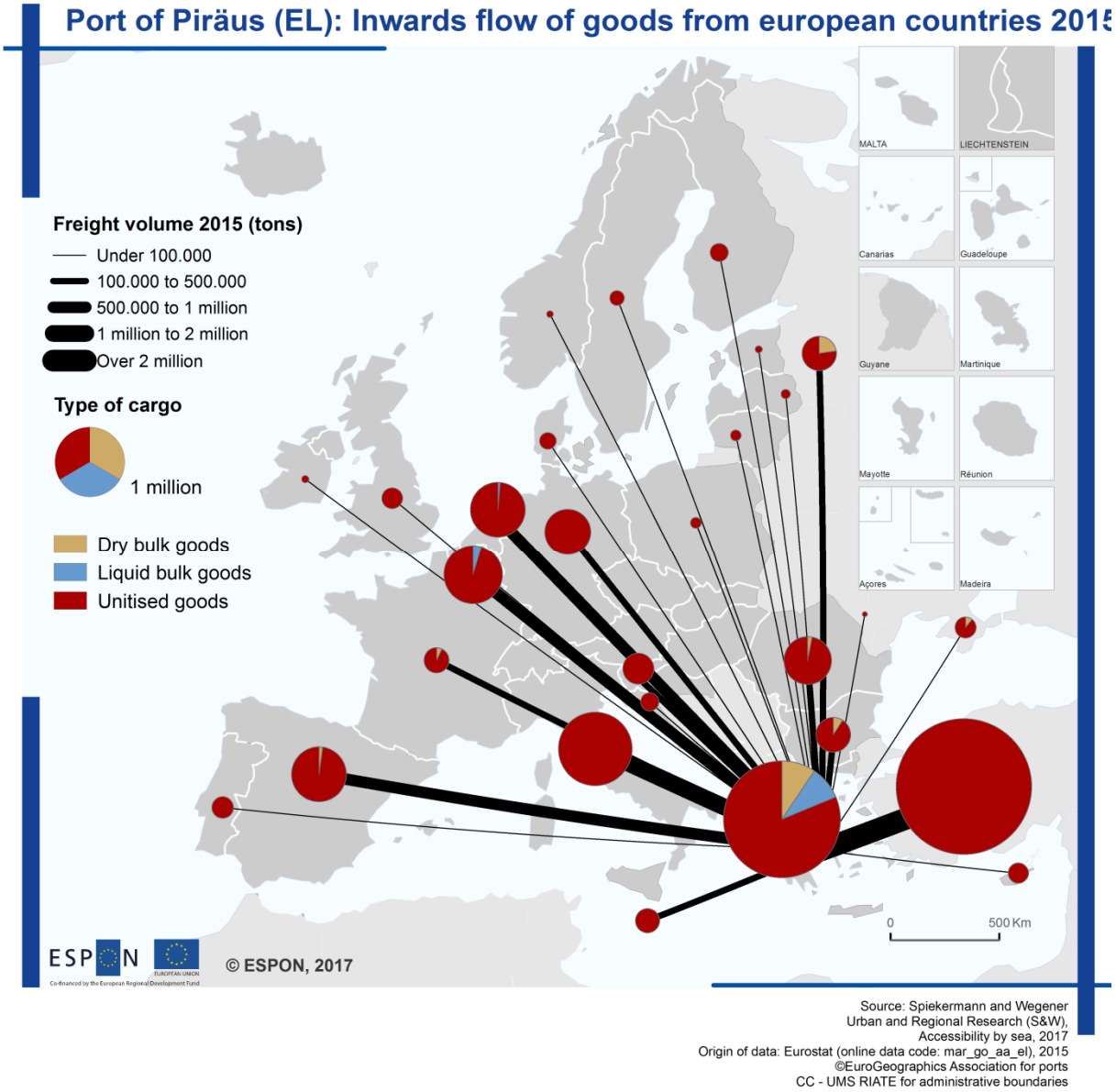

Figure A3.5 Port of Piräus (EL): Inward flow of goods by type of cargo from European countries 2015

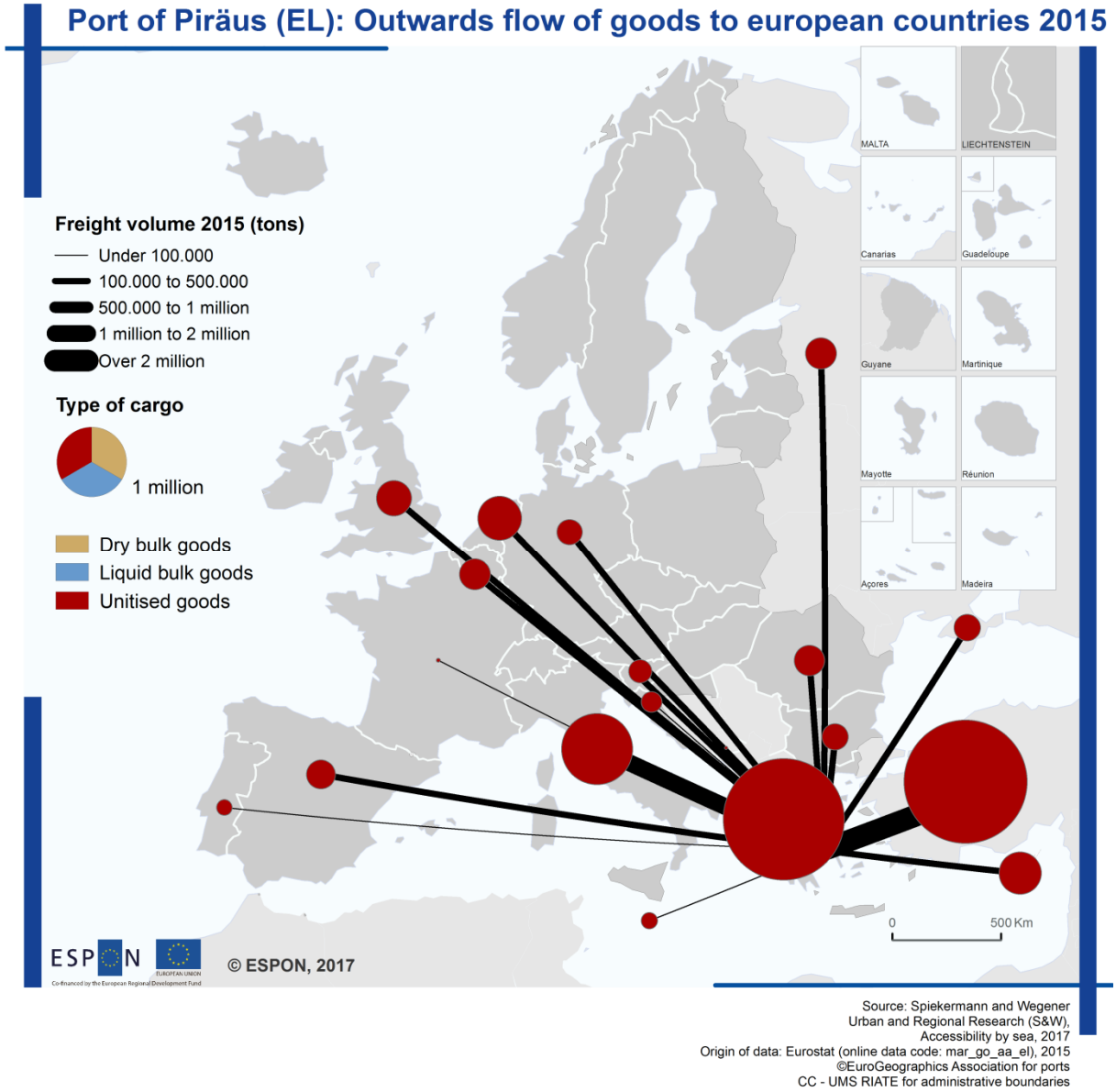

Figure A3.6 Port of Piräus (EL): Outward flow of goods by type of cargo from European countries 2015

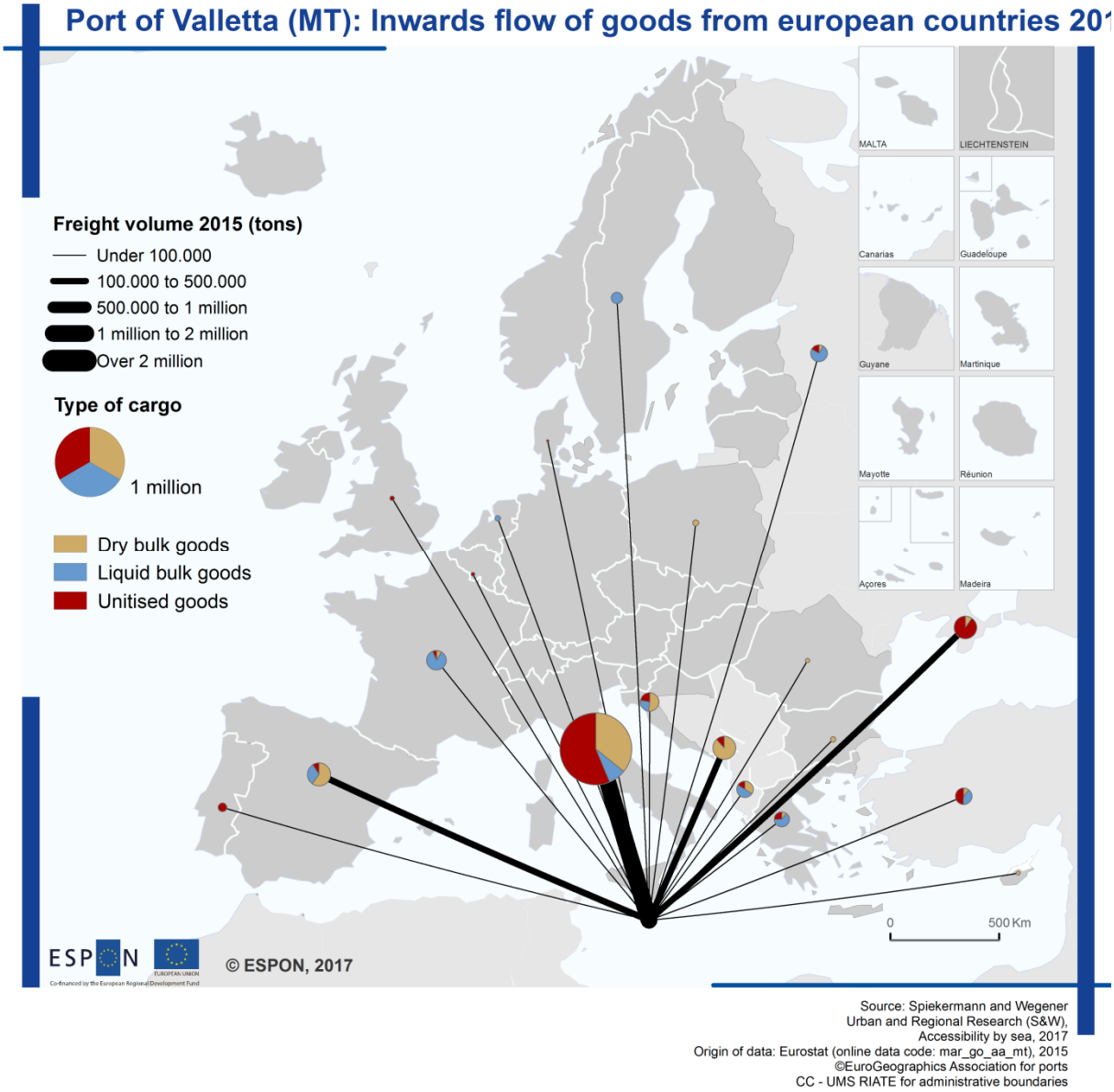

Figure A3.7 Port of Valetta (MT): Inward flow of goods by type of cargo from European countries 2015

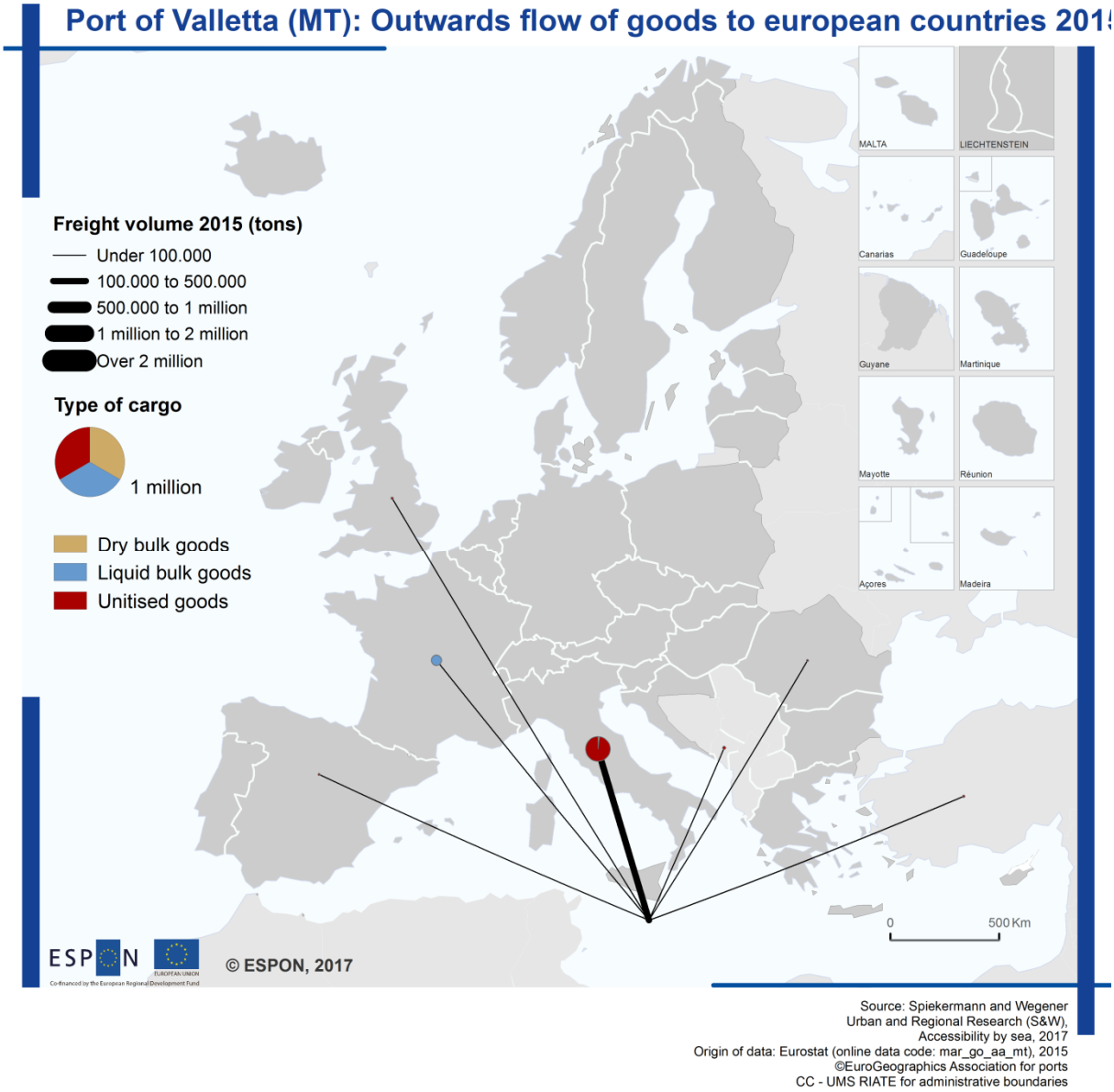

Figure A3.8 Port of Valetta (MT): Outward flow of goods by type of cargo from European countries 2015

Annex 4 Additional maps on the European ferry network

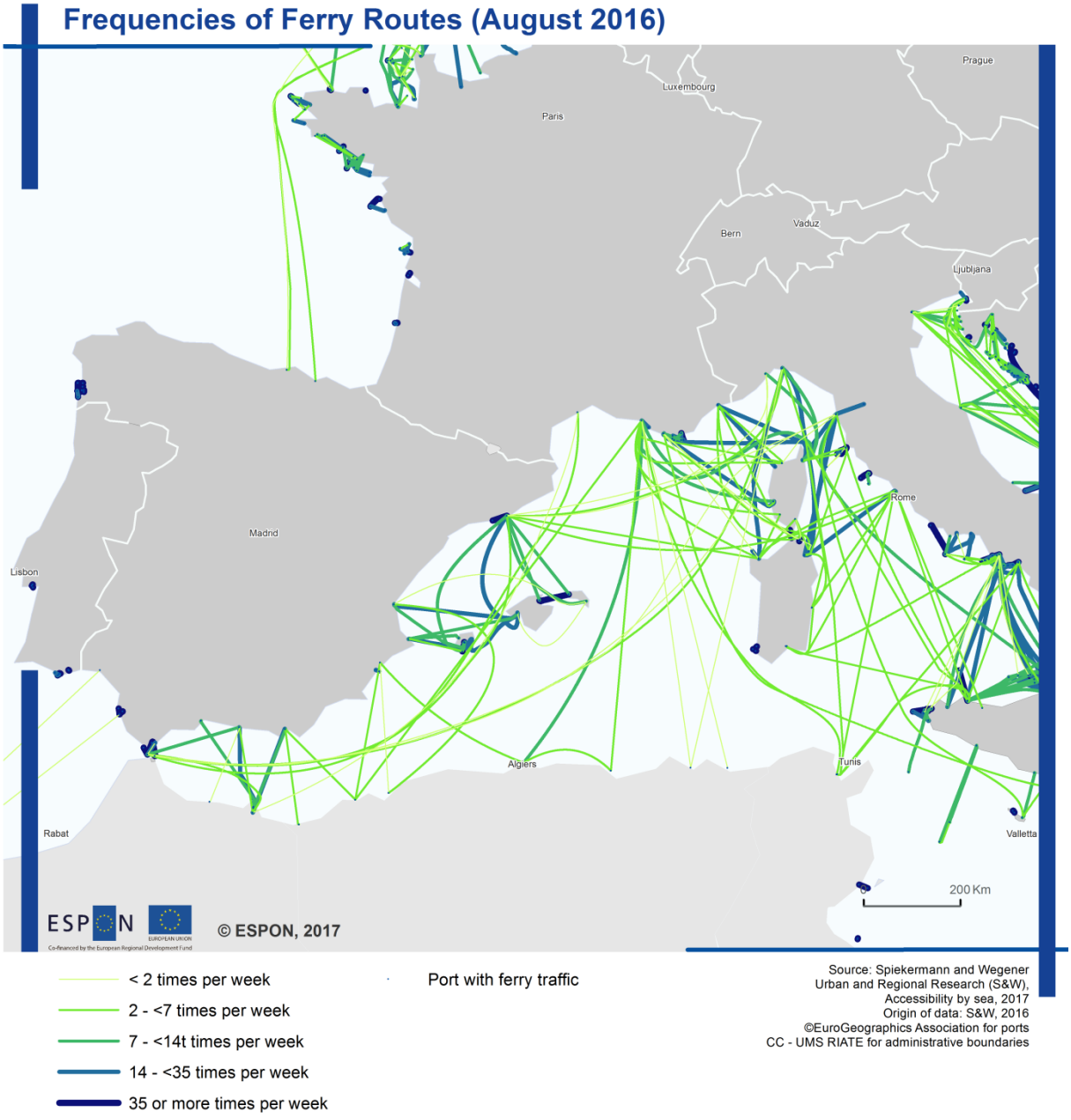

Figure A4.1 Frequency of ferry routes in the western Mediterranean, August 2016

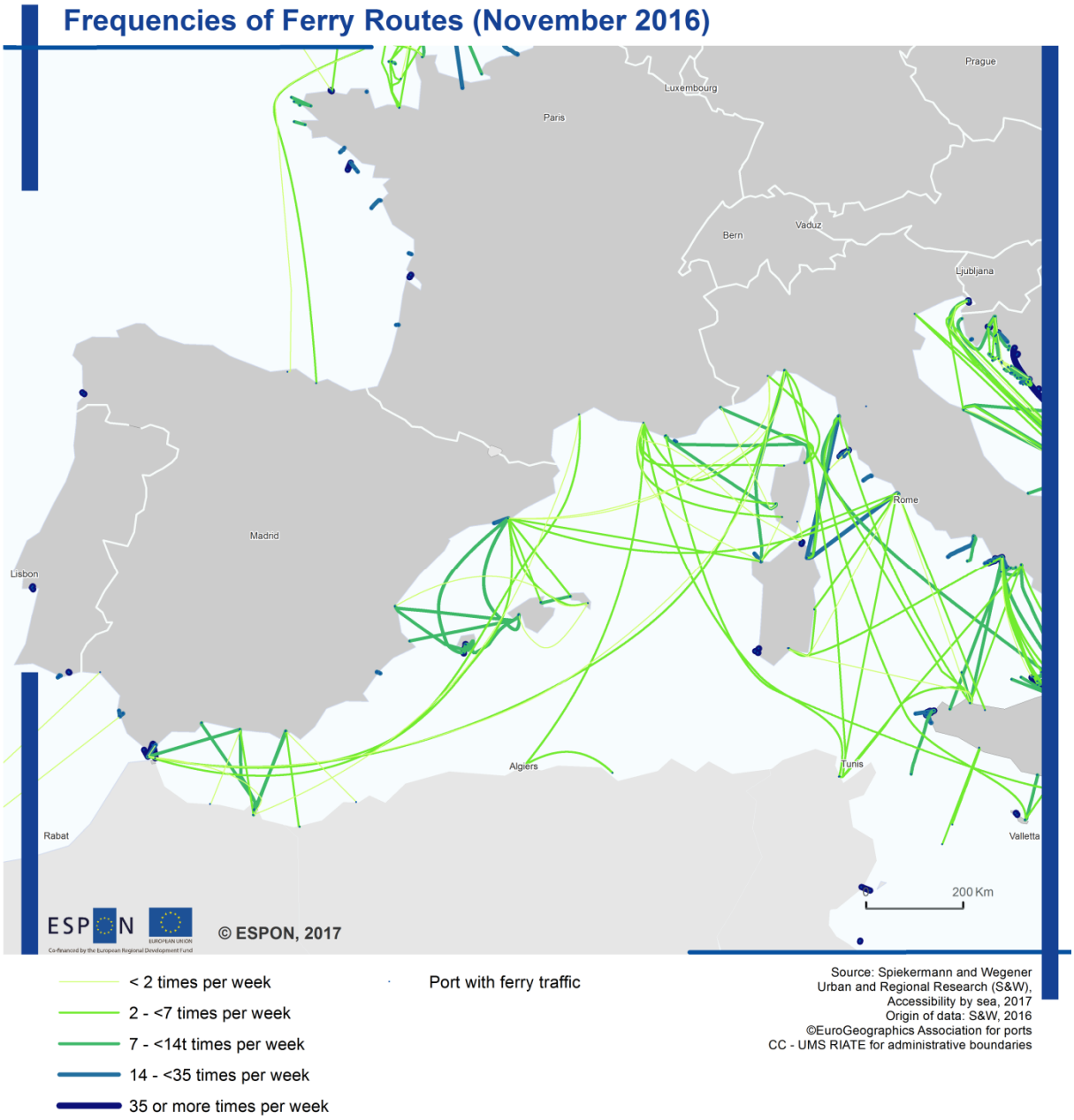

Figure A4.2 Frequency of ferry routes in the western Mediterranean, November 2016

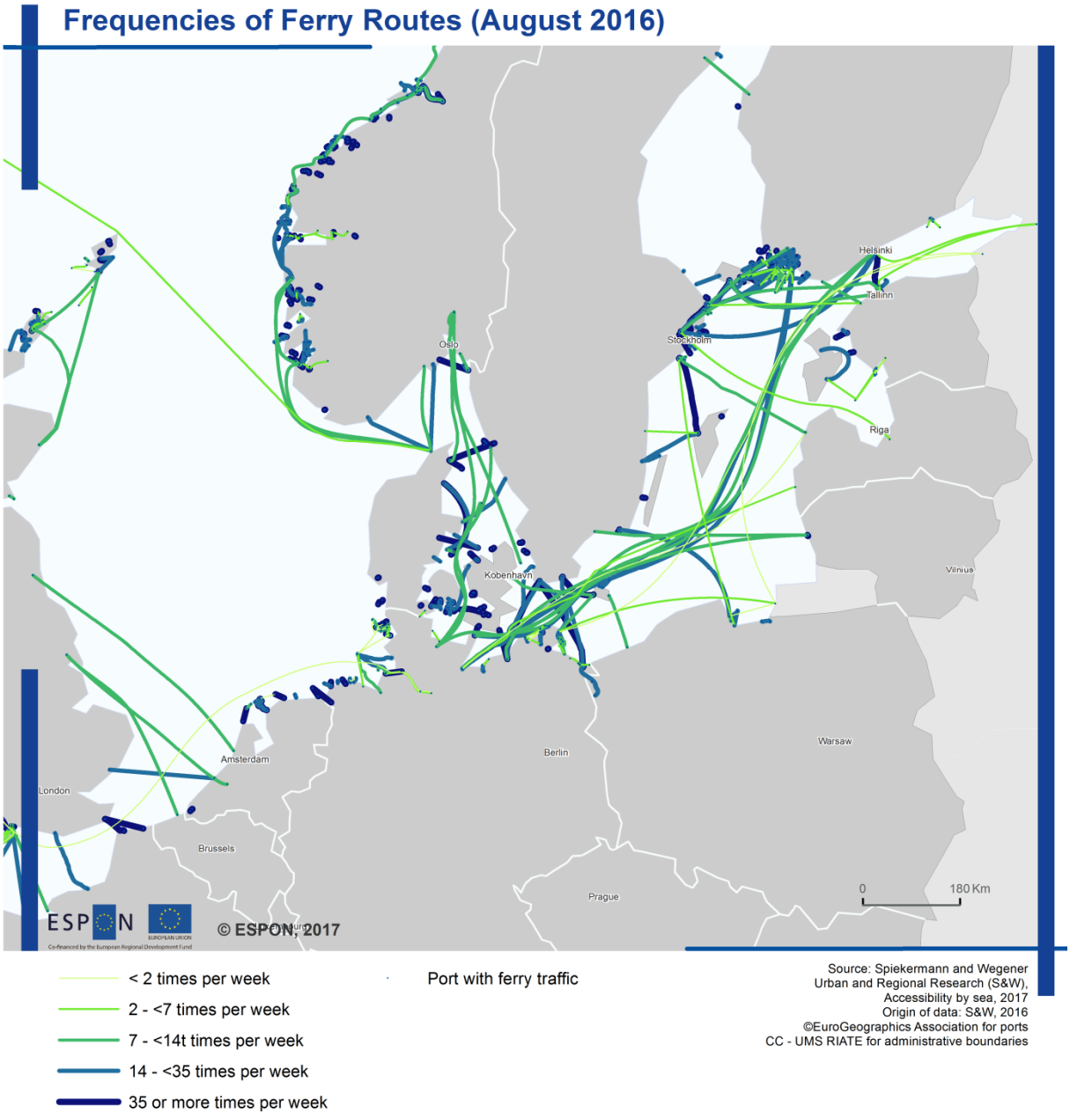

Figure A4.3 Frequency of ferry routes in the North Sea and the Baltic Sea, August 2016

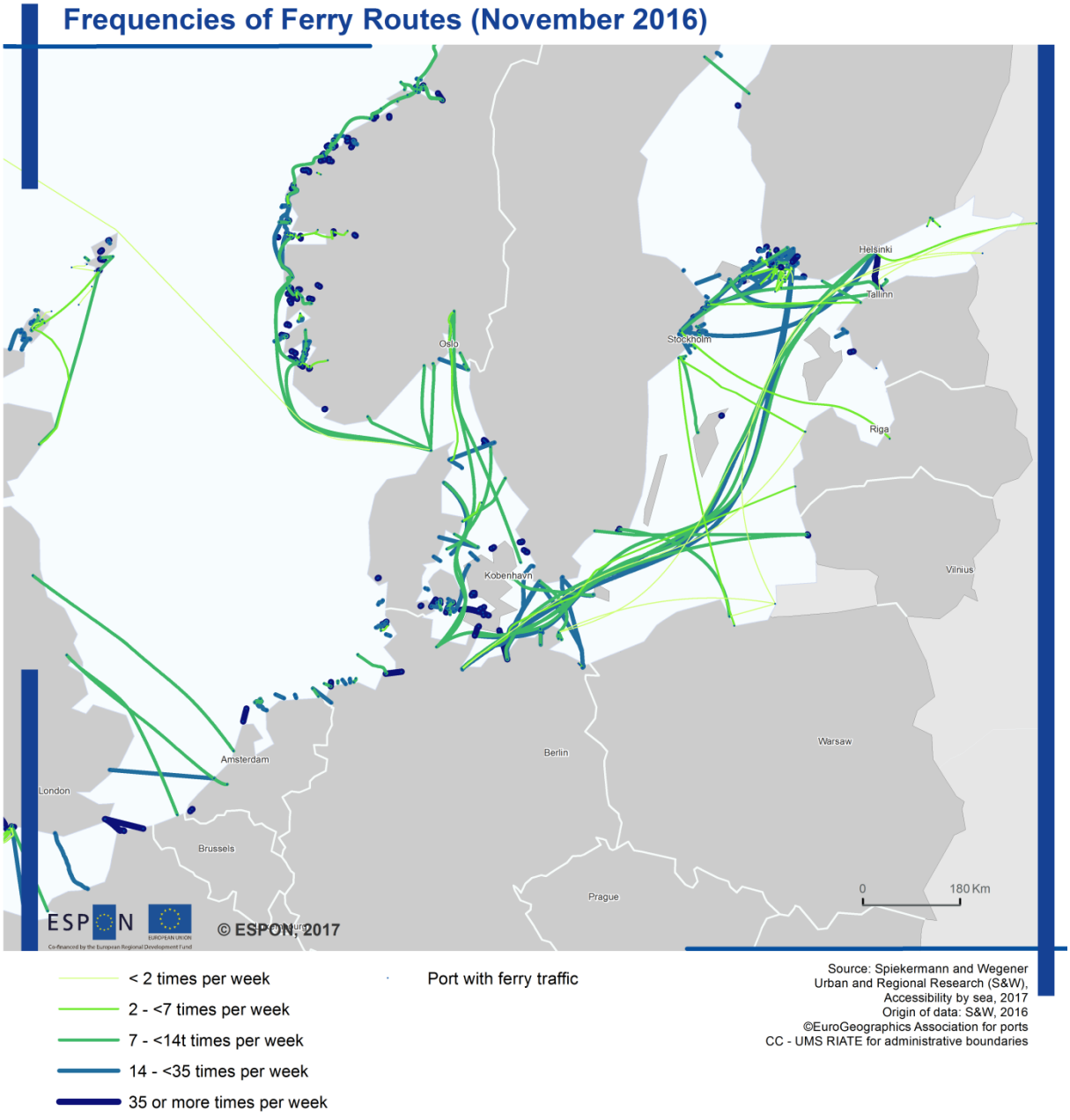

Figure A4.4 Frequency of ferry routes in the North Sea and the Baltic Sea,, November 2016

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