International Transport Forum

The Mediterranean Port Economy: The cases of Marseille and Mersin

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THE INTERNATIONAL TRANSPORT FORUM

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1. INTRODUCTION

Ports are no longer perceived as main drivers of urban economic development. A variety of factors have been identified in the academic literature to contribute to urban economic growth, ranging from human capital, entrepreneurial culture, diversity and infrastructure to planning and governance. Port infrastructure is in many cases not even considered as a potential source of economic development. Whereas efficient ports have contributed to a substantial reduction in transportation costs, and thus stimulated external trade and related economic development, the general perception is that most of the gains of external trade have spread out to other regions than the port area or the port region (e.g. Gripaios and Gripaios, 1995). This is related to de-concentration of logistics activity and "port regionalisation" tendencies (Notteboom and Rodrigue, 2005). In contrast, negative impacts related to ports have unevenly affected port-cities, including socio-economic impacts related to a unskilled workforce needed to sustain a port-industrial complexes that have ceased to be labour-intensive. Economic benefits of ports were less ambiguous in the past, when port-cities dominated trade-oriented emerging capitalist economies, as eloquently described in Braudel (1979).

Economic impact of ports has been studied fairly intensively. There is a substantial amount of studies on the economic impacts of particular ports. In addition to these academic studies, there is an even more extensive literature of consultancy reports on the economic impact of ports: Merk (forthcoming) identified more than 150 different port economic impact studies conducted over the last decade. Despite this relative abundance of studies, there are various gaps. First, not all of the studies, in particular the ones of port consultancies, meet rigorous academic standards: some might actually overstate port economic impacts (Hall, 2004). Second, most studies do not identify where the economic impacts take place. The exceptions to this are studies on the economic impact of the port of Santander (Coto-Millán *et al*., 2010), on the port cluster of Friuli Venezia Giulia (Danielis and Gregori, 2013) and on the main ports in North-West Europe (Merk *et al*., 2013). And third, as there are no harmonised methodologies or datasets, it is difficult to compare the results of different port-cities. This article aims to fill these gaps, by using a similar methodology, based on input-output-tables, to assess the economic interrelationships of the ports of Marseille and Mersin, and in addition provide evidence of the inter-regional spillovers related to the port of Marseille.

The relations of ports with their cities, and the evolution of these port-cities have been categorised in different typologies. A well-known typology of port-cities is based on two different indicators: the size of urban or regional population, in relation to the size of port traffic, in order to measure maritime dependence (Vigarié, 1968). Such a relative concentration index has been applied for typologies of Mediterranean port regions (Vallega, 1979), for US port-cities (Kenyon, 1974) and port-cities on a world-wide level (Ducruet, 2004). Depending on the relative dominance of port and city, also indicated as intermediacy and centrality, Ducruet and Lee (2006) have developed a typology of nine different port-cities, ranging from coastal port towns to the world port city. The idea underlying the typology is that similar types of port-cities have similar challenges; e.g. port-cities with relatively small population size and very large ports all face the challenge of an urban

economy that risks being too port-dependent. They calculated relative concentration indices of 653 different port-cities between 1970 and 2005 which allows them to outline different port-city trajectories. Various additions to this general typology have been formulated, which stress the geographical differences that distinguish port-cities in Asia, US and Western Europe (Lee *et al.*, 2008), and differences according to economic specialisations of the region and commodities treated in the port (Ducruet *et al*. 2014).

The evolutions of port development have been described in a separate set of typologies, expressing the development of port growth over time. An often-cited model in this respect is the Anyport-model developed by Bird (1971) to describe how ports develop spatially over time, from setting and expansion to specialisation. Extensions and additions to this model were provided by Taaffe et al (1963), Barke (1986), Hayuth (1981), and Notteboom and Rodrigue (2005). Other models of port development focus on the underlying commercial logic, from trade, industrialisation and globalisation to logistics (Van Klink, 2003). For the purpose of this paper, the most relevant evolutionary model refers to the port-city interface, as developed by Hoyle (1989). He distinguishes five different stages of port-city interactions that go from integration in primitive port-cities, to expanding port-cities, modern industrial port-cities, retreat from the waterfront and finally the redevelopment of the waterfront. This trajectory illustrates the disintegration of port and city in subsequent stages that are placed in time: the period of the modern industrial port-city being the mid-20th century, the retreat from the waterfront from the 1960s to the 1980s and redevelopment of the waterfront between the 1970s and 1990s.

How well can these different models and typologies explain the differences and similarities of Marseille and Mersin? Will the emerging port-city of Mersin follow the same trajectory as Marseille? In addition to providing evidence on the port economic impact, this article aims to shed some light on the applicability of the port-city typologies and port-city trajectories referred to above by confronting the tales of the port-cities of Marseille and Mersin.

2. PORT CHARACTERISTICS AND PERFORMANCE

This article focuses on two Mediterranean port-cities, one in the west and one in the east. The port of Mersin is located in the east of the Mediterranean Sea, in the south of Turkey; the port of Marseille in the south of France, in the western part of the Mediterranean. The section below will assess the different characteristics of these two ports and their performance, in terms of growth and the main determinants of port growth: maritime connectivity, port efficiency, hinterland connectivity and competition.

2.1 Port profile and specialisation

The ports of Marseille and Mersin are similar with respect to the maritime dominance of the city. They have similar container throughput volumes: in 2011 the port of Marseille handled 0.94 million TEUs, this was 1.1 million in Mersin. Both ports are the second container port of their country, positioned after Le Havre (for Marseille) and Ambarli (for Mersin). The cities of Marseille and Mersin have more or less similar size: 850,000 inhabitants and 540,000 inhabitants respectively. The same range of container volumes and population sizes implies a similar dominance of port functions in both port-cities.

There are also geographical similarities. Neither Marseille nor Mersin is located in very close vicinity to the shipping route between Asia and Europe (or between the Suez Canal and Gibraltar, to be more precise), so neither port has much transhipment traffic, both ports are primarily gateways to their region. Finally both ports have challenges that are related to their location close to the city centre, although the case of Marseille is different due to its multi-site character, as will be described below.

The two ports differ with respect to their specialisations. Whereas the port of Mersin is specialised in containers, representing half of the total port tonnage, the port of Marseille has a very dominant specialisation in liquid bulk, in particular crude and refined oil. This represents approximately 70% of the total cargo volume, against only 10% for containerised cargo.

Another difference relates to the spatial configuration of the port: the port of Mersin is located on one continuous area, whereas the port of Marseille is located on two sites: a site in the city of Marseille (called East Basins) and a port site situated in the municipalities of Fos, Martigues, Port de Bouc, Port Saint Louis du Rhône (called the West Basins), located at approximately 50 km distance from Marseille. Most of the port activities take place in the West Basins, representing half of the calls, over two thirds of the total cargo volume and 95% of the port surface. The port of Fos forms part of a port-industrial complex that includes refineries, storage and other manufacturing activity. The East Basins have a more urban character, with passenger traffic (ferry and cruise), diverse cargo, and many short range and Mediterranean shipping connections. Not only is the spatial configuration different, but also the availability of space: the port of Marseille-Fos has a very large land surface (more than 10,000 hectares), mostly in the West Basins, whereas the container port of Mersin is cramped into 35 hectares.

2.2 Divergent port growth trajectories

The port growth trajectories of Marseille and Mersin are largely divergent. Port activity in Marseille-Fos has been stagnant over the last decades. The average annual throughput in the 1970s was larger than that in the last decade; the largest throughput, namely 109 million tonnes, was recorded in 1974 and in no other year since then has this record been surpassed (Marseille-Fos' throughput in 2011 was 88 million). These disappointing growth rates have led to declining market shares of Marseille-Fos. The share of Marseille-Fos' total port throughput in European port throughput decreased from 3.1% in 2001 to 2.4% in 2010. Similar decreases are apparent with respect to container volumes (from 1.5% to 1.3%). Although Marseille-Fos has seen a certain growth with respect to container volumes handled, they are clearly below those of competitor and neighbouring ports. Ports in the Western Mediterranean which had more or less similar container traffic in 1978 have now double the volume of Marseille-Fos (in Genoa and Barcelona) up to four times Marseille-Fos' traffic volume in Valencia and Algeciras.

In contrast, the port of Mersin has shown impressive long-term growth figures. The average port growth rate between 1971 and 2011 was 5.8%, and 60% per year in container volumes between 1984 and 2011. This port growth has continued over the last decade with an annual port growth rate of 7.3% between 2005 and 2011, almost undisturbed by the global economic crisis with average growth rates of 6.5% per year between 2008 and 2011. Growth in the container sector in Mersin has really taken off in the last decade. The container volume of Mersin has quadrupled over 2001-2011, with Mersin emerging as a relatively large container port in the East Med. Whereas several of the other East Med ports show volatile container developments, the volumes of the port of Mersin have been growing steadily.

2.3 Maritime connectivity

Although neither Marseille nor Mersin is a hub port, they both have a relatively central position in the Mediterranean ports system. This can be concluded from calculated centrality indicators for both ports and their competitors (Merk & Comtois, 2012, Merk & Bagis, 2013).[1]The centrality indicators of Mersin are relatively high compared with other East Med ports, whereas those of Marseille are highly similar to those of other large West Med ports, such as Barcelona, Valencia and Genoa.

Marseille-Fos is fairly well integrated in the intercontinental routes of the largest global container carriers, although less so than other main ports in the Western Med. On the other hand, Mersin is only to a limited extent included in the intercontinental routes of the largest shipping companies of the world. A large number of East Med ports, including Ashdod, Damietta, Piraeus, Istanbul, Izmir and Izmit, are more frequently included in such routes. This can be concluded from analysis of the intercontinental routes of nine of the eleven largest global shipping lines in March 2012 for which these routes are publicly available. In this analysis two types of intercontinental connections were assessed: the Asia-Mediterranean route and the route between North America and the Mediterranean.

The diversity of maritime connections of both Marseille-Fos' and Mersin is relatively limited. Scores for competitor and neighbouring ports of both Marseille and Mersin were all higher, indicating a wider diversity of maritime connections of these ports The can be concluded from its score on a maritime foreland connectivity index, which makes it possible to compare the diversity of maritime of connections of world ports, elaborated in Merk & Comtois (2012) and Merk & Bagis (2013).[2] Most of the maritime connections of Mersin and Marseille-Fos are in the Mediterranean and Europe.

1 The hub-and gateway-functions of ports can be quantified with three different measures: degree centrality, betweenness centrality and clustering coefficients. Degree centrality expresses the number of adjacent neighbours of a node; it is the simplest and most commonly accepted measure of centrality. It often correlates with total traffic (more connections imply more traffic). Betweenness centrality expresses the number of shortest paths going through each node. The clustering coefficient estimates whether the adjacent neighbors of a node are connected to each other (i.e. "my friends are also friends"), thus forming triangles (triplets); the coefficient is the ratio between the number of observed triplets and the maximum possible number of triplets connecting a given node. The ratio goes from 0 (no triplets observed) to 1 (all neighbors connected). When it comes to hub-functions in a transport system, in theory the "pure hub" will have a clustering coefficient near zero because it serves as a pivotal platform redistributing flows to/from satellite platforms (spokes) which are only connected to the hub (star-shaped network). Conversely, values close to 1 depict a denser pattern with more many transversal (and thus less hierarchical) links. In a maritime network, transshipment hubs should have low clustering coefficients as opposed to other configurations where links are more evenly distributed among ports (e.g. absence of hubs such as in the Baltic Sea or in the USA). The different port hub-measures are related, but also complementary to each other. Very central nodes (high betweenness centrality) often act as hubs (low clustering coefficient) and it is common to observe a high correlation between degree centrality and betweenness centrality due to the physical constraint of coastlines for circulation. In some cases such as relay and remote hubs, some nodes can have higher betweenness centrality than degree centrality, i.e. they are very central globally but have only a few links locally. This is because they act as "bridge" between sub-components of the network, such as Anchorage in the global network of air freight being a bridge between Asia and North America.

2 This index is applied to ports' worldwide traffic distribution at country level, and defined as the inverse of the sum of differences in shares compared with world average, applying a methodology developed in Ducruet *et al*. (2011).

The short sea connections of Mersin are large and diverse, and more moderate in Marseille-Fos. This can be concluded when analysing a database on short sea shipping constructed for the purpose of this report. This database is based on the different schedules (service loops) in 2011 of main 34 short-sea shipping companies operating in Europe, counting the frequency of 211 European ports in these service loops, as well as the connections between the ports (Ducruet and Merk, 2012).

2.4 Port efficiency

Both Mersin and Mersin are relatively efficient ports. They score both more or less in line with the Mediterranean average with regards to the turn-around time of vessels in ports. The average container handling time in the second quarter of 2011 in Marseille-Fos was 1.16 days for 1000 TEUs and 1.15 days for Mersin. Both ports are doing well in comparison with most Med ports, despite a few exceptions including Barcelona, Tangier-Med, Piraeus, Valencia and Gioia Tauro. Turn-around time of vessels in ports is here considered to be the average time that a vessel stays in a port before departing to another port, which is known through detailed vessel movement data, as collected by Lloyd's Marine Intelligence Unit (LMIU). This turn-around time is generally considered to be an important determinant of port competitiveness as quick turn-around allows for reduction of port congestion and larger port throughputs. Time efficiency of main European ports was measured using a LMIU-dataset over May 2011 and container throughput data from Eurostat over the second quarter of 2011 and using a methodology elaborated in Ducruet and Merk (2013).

2.5 Hinterland connectivity

Most of Mersin's hinterland is captive; that is, it can hardly be contested by other ports. Approximately a third of total container volumes of Mersin port is connected to the two cities of Mersin and Adana; around half of total container throughput is related to hinterlands that are within 300 km reach of the port of Mersin. Main hinterlands are located in the East of Turkey and to a lesser extent Iraq (6%). Turkey's largest metropolises, such as Istanbul, Ankara and Izmir are to a certain extent serviced by the port of Mersin, but these container flows are relatively limited. Considering that there are not many container ports surrounding Mersin, most of its hinterlands could be considered captive.

Marseille also has a natural hinterland, the south of France, that is to a certain extent captive. According to the French Ministry of Transport, the port of Marseille-Fos has a 60% market share in the main southern regions in France, Midi-Pyrenees and Rhône-Alpes. Most of the rest of the hinterland in France is dominated by the port of Le Havre, apart from the local hinterlands surrounding the secondary ports in France. The Benelux ports, in particular Antwerp and Rotterdam, are mostly dominant in the north and east of France. The hinterland of the port of Marseille-Fos currently does not include nearby foreign countries of regions, such as Switzerland, Germany or Northern Italy.

2.6 Port competition

Port competition in Mersin can be considered limited. There are not many container ports close to Mersin, which gives it more or less free rein for being a regional gateway. In addition to that, there is no intra-port competition with respect to cargo handling. The concession in 2007 that transferred port operations in Mersin to the private sector covered all cargo handling operations and was granted to one consortium: PSA/Akfen. As a result, MIP enjoys a relative monopoly position.

This situation is comparable to Marseille's position in the past, although it has become increasingly subject to competition. Marseille-Fos is by far the most important French Med port, representing around 90% of total French Med port volume and 100% of its container traffic. The other Mediterranean ports in France such as Sète, Toulon, Nice and Port-La-Nouvelle are very small, specialised, without any regional gateway functions. This situation is hugely different for the main Spanish Med ports and the Ligurian ports in Italy that compete amongst each other for regional gateway functions, whereas Marseille-Fos can take this for granted.[3] Over the last decade, however, increased inter-port competition has started to emerge from North-West Europe, in particular Le Havre and Antwerp. What were once captive hinterlands of Marseille-Fos, such as metropolitan Lyon, have increasingly become contestable hinterlands, with Antwerp, Le Havre and even Rotterdam attempting to grasp market shares.

3. ASSESSMENT OF PORT ECONOMIC IMPACTS

Despite many similarities, port growth trajectories of Marseille and Mersin have been different; what does that mean for economic impact generated by the port? Three different sorts of economic impact will be assessed below: port-related employment, port-related value added and the presence of maritime advanced producer services. Each section provides the data and methodology applied, followed by the main results

3.1 Port-related employment

3.1.1 Data and methodology

There is a significant difference in availability of data on port-related employment in Marseille and Mersin. Calculations or estimations of port-related jobs in Mersin are absent, whereas various studies on Marseille have been conducted in this respect. Consequently, our own estimations can be confronted with existing data in Marseille, whereas this is not the case for Mersin.

Previous studies on port-related employment in Marseille were based on a micro-analysis of responses to surveys to firms, indicating a relation with the port or not. This study (Entreprises et Territoires, 2009) also gives a detailed overview of which sorts of jobs can be found in which local governments. In a comparative study on port-related employment in France by the Port Observatory of the national federation of urban planning organisations, this same study was used, but a few port-related categories (e.g. yachting) were added (FNAU, 2009). These studies have indicated that employment related to the port of Marseille-Fos amounts to approximately 40,000 to 45,000 jobs. According to *Entreprises et Territoires* (2009) more than half of the port-related jobs were logistics related, around a third related to manufacturing, and approximately 5% was service employment mainly based in the city of Marseille.

3 There is also fairly limited intra-port competition. With the creation of the Fos 2XL-container terminal in 2010 has some form of intra-port competition been introduced, with one of the terminals operated by CMA-CGM and DP World and the other one by MSC. In practice, however, much of the container traffic remains very dependent on CMA-CGM.

Although these studies certainly have their merits, their methodology is based on a more or less discretionary definition of port-related employment, which makes comparison with other port-cities difficult. In France alone several port-cities use their proper definition of port-related employment, coloured by different local contexts, which means that certain sectors (e.g. in manufacturing) are in some port-cities counted as port-related employment, but not in others. The shortcomings of this are well recognised by the national federation of urban planning organisations (FNAU) that has proposed a common framework to count port-related employment and the statistical employment codes linked to it (FNAU, 2009). This framework makes it possible to estimate port-related employment in France in a comparative way, which will be shown below.

Calculation of port-related employment in Turkey is more complicated. Fairly detailed employment numbers per economic sub-sector exist, but only at the national level. Even if we would assume that the port-related employment in Mersin would be proportional to its share of port volume in the national port volume this would require a definition of port-related employment that is difficult to establish. A well-known problem in defining port-related employment is its discretionary character: what is considered port-related employment in one location is not considered as such in another place. There are methodologies to solve this problem (Musso *et al*. 2000), but that would require detailed employment data per locality and at sub-sector level, which do not exist in Turkey.

Due to these differences in data availability, different approaches have been used to estimate port-related employment in Mersin and Marseille. Port-related employment in Mersin has been assumed to consist of employment in the port itself, employment of members registered in the Mersin Chamber of Shipping and employment in the Free Trade Zone of Mersin, functionally integrated in the port, and the Free Trade Zone of Adana, the other large city in the region. This estimation in these categories is based on employment numbers provided by the Mersin International Port (MIP), the Mersin Chamber of Shipping, the Free Trade Zone of Mersin and the Free Trade Zone of Adana. We consider the number of staff by MIP as maritime transport, the employment of the members of the Mersin Chamber of Shipping as maritime services, whereas the employment in the free trade zones is both trade and manufacturing. As the proportion between trade and manufacturing jobs for the Free Trade Zone in Mersin was provided by their authorities, a further breakdown in manufacturing was made on the basis of the number of firms in the different subsectors, assuming the same average number of staff in each sub-sector. Based on these data and assumptions, a total number of port-related jobs was derived, as well as a number of jobs according to sector. For the calculation of port-related employment in Marseille, a common framework, as developed by the national federation of urban planning associations in 2009, was used to determine port-related employment. As such, the main categories within this definition consist of maritime transport, land transport, logistics and trade, exploitation of marine resources, ship-building and reparation, port industries, marinas and tourism.[4]

4 Maritime transport is considered as: auxiliary services for water transport (NAF 2008 Code: 5222Z), Maritime and coastal transport of passengers (5010Z), Maritime and coastal transport of freight (5020Z), Port cargo handling (5224A), Services to ships (9420Z). Land transport is considered as: road transport (4941ABC, 5229A), other land transport (5030Z, 4950 Z, 7712Z). Logistics and trade is considered as: Logistics and trade (5229B), Storage and non-port cargo handling (5224B). Exploitation of marine resources is considered as: Fishing and sea products (0311Z), Fishing industry (1020Z). Ship-building and reparation is considered as: Construction of ships and floating structures (3011Z). Port industries are considered as: Chemicals, petrochemicals and refinery (C20), Metallurgy (C24), Agro-foods (C10). Marinas is considered as: Construction of yachts (3012Z). Tourism is considered as: Tourist buses, travel agencies (7911Z).

3.1.2 Main results

Using these data and methodologies, we find that the number of port-related jobs in Mersin is at least 16,800 and almost double that number (32,400) in Marseille. The largest port-related sector in Mersin is maritime transport and services, representing 10,000 jobs; other sectors with port-related jobs are wholesale and retail trade, the food products and beverages sector, and the textile-manufacturing sector (Table 1). More than half of the port-related employment in Marseille is in maritime and land transportation; less than a third of the employment is in port-related manufacturing, such as the petro-chemical industry, metallurgy and the food industry, according to our analysis (Table 2). The number of port-related jobs found in Marseille-Fos is almost certainly an underestimation considering that jobs in several sub-sectors could not be included, because it was unknown which parts of these subsectors were actually port-related; these are subsectors like public services related to the port (customs, fire services, rescue workers), restaurants and hotels, public works and port-related services, such as engineering services, technical inspections, insurance, research etc.

Table 1. **Port-related jobs in Mersin (number of jobs, 2012)**

Sector	**Number of jobs 2012**
1. Maritime services	8600
2. Food products and beverages	3600
3. Wholesale and retail trade	1500
4. Maritime transport	1400
5. Textile industry	600
6. Other	1100
Total	**16,800**

Source: Author's elaboration based on data of INSEE and Eurostat

Table 2. **Port-related employment in Marseille-Fos (number of jobs 2011)**

Sector	**Number of jobs 2011**
1. Maritime transport	8533
2. Land transport	9792
3. Logistics and trade	3619
4. Exploitation of marine resources	97
5. Ship-building and reparation	24
6. Port industries	9632
7. Marinas	23
8. Tourism	672
Total	**32,392**

Source: Author's elaboration based on data of INSEE and Eurostat

Two thirds of these port-related jobs are located in the city of Marseille, many of which in maritime and land transportation, logistics and port-related manufacturing. These jobs represent around 7% of the total city employment. The shares of port-related employment are much higher in the municipalities surrounding the West Basin of the port of Marseille-Fos, ranging from 10% in Martigues to almost 50% in Fos-sur-Mer. The only exception is Marignane, where port-related employment represents only 5% of total local employment. The profile of the port-related employment is markedly different among these small municipalities, with relative specialisations in metallurgy (Fos), petro-chemical industry (Martigues), maritime transport (Port-de-Bouc) and land transportation (Châteauneuf and Port St. Louis du Rhône).

Table 3. **Local employment related to the port of Marseille-Fos**

	Mar-seille	Marig-nane	Mar-tigues	Fos-sur-Mer	Port de Bouc	Château-neuf	Port St Louis	Aix	Vi-trolle
1. Maritime transport	7578	36	126	314	467	2	10	32	0
2. Land transport	7364	125	371	462	196	289	225	681	1913
3. Logistics and trade	2574	587	110	465	148	157	98	75	504
4. Marine resources	38	0	0	0	12	0	0	0	43
5. Shipbuilding/repair	13	0	7	0	4	0	0	0	0
6. Industries	4501	112	1018	3884	43	58	63	1003	388
7. Marinas	17	0	6	0	0	0	0	0	0
8. Tourism	643	8	12	3	1	5	0	307	12
Total port-related jobs	22728	878	1650	5128	871	511	396	2098	2860
% port-related jobs	7%	5%	10%	47%	20%	12%	20%	2%	11%

Source: Author's elaboration based on data of INSEE and Eurostat

We conducted an additional estimation, building on a proposal in Musso *et al*. (2000) to define port-related employment according to the extent to which it is overrepresented in regions with large ports, instead of using own assumptions on which industries are port-related or not. The approach follows different logical steps. As a start, two different groups of regions are defined: port regions and non-port regions; the different industries in which these two groups as a whole are specialised are identified. For the industries in which port regions as a whole are specialised the specialisation index of each individual port region is identified in order to assess how many port regions are specialised in these industries. This information is then compared to a standard probability distribution in order to identify to what extent the employment in these industries can really be attributed to the presence of a port. The more unlikely it would be to find similar specialisations in a random set of regions, the higher is the percentage of the employment in that sector that will be considered "port-related employment". This approach has been followed for France, using a dataset of all municipalities with their employment in 732 sectors in 2011. For this analysis the agglomerations connected to the seven large maritime ports ("*Grands Ports Maritimes*") were considered to be port-cities; all the other municipalities were considered to be the non-port localities.

Application of this less discretionary methodology confirms that the largest share of port-related employment in Marseille is in transport and logistics. The estimated total port-related employment is in the same range that was found in earlier studies, between 40,000 and 45,000 jobs.[1] However, findings differ with respect to the distribution of employment over sectors. The largest port-related sector is transport, storage and communication, representing almost 15,000 jobs. However, a large part of the port-related jobs are in non-market services and some major industrial services, including mining quarrying and energy supply; real estate, renting and business activity and other manufacturing. In addition to these sectors, there are port-related jobs in several other industrial and services sectors.

3.2 Port-related value added

3.2.1 Data and methodology

Port-related value added in Marseille and Mersin has been calculated using input-output-tables. These i-o-tables describe monetary transactions between sectors in a country. Input-output tables focus on interrelationships between industries in the economy with respect to production and use of their products. Total turnover of a sector is broken down in forward and backward linkages. The forward linkage of an industry comprises the domestic intermediate deliveries to other sectors, export, and final consumption (including household final consumption, government final consumption and fixed capital formation). So, the

forward linkage is the output coefficient (row coefficient). The backward linkage (input coefficient) comprises of the goods and services bought from other domestic sectors (intermediate use), inputs bought abroad (import), and the monetary value of labour, capital and profit.

The advantage of using an input-output table is that it provides a comprehensive framework for analysing the structure of the economy within the system of national accounts. From all the economic sectors in the model it is quantitatively known how they contribute to the national economy and to what extent they are related with the rest of the world. As such, and in order to capture the effect of changes in sectoral demand and supply on industry output, it is possible to calculate so-called multiplier effects. Multipliers capture the effect of one euro change of turnover of one sector in a national economy and the impact it has on extra expenditure through extra inputs from supplying sectors.

There are no input-output tables available at the level of the functional port area. In order to measure the impact of the port of Marseille-Fos, the national input-output table has been broken down to the regional level and the level of the functional port area in several steps. We started with the national I/O-tables for EU-countries for 2005. First, the gross production (turnover) of sectors is broken down in several regions by making use of the regional accounts of Eurostat. That database provides information on a limited number of sectors on gross turnover, value added, intermediate use and labour. We disaggregated each of these tables, to include different regions based on regional productivity, value added, population, employment and wage data by region. The European Regional Database of Cambridge Econometrics contains a consistent set of this data at the NUTS 1/NUTS 2 level. We used this data to redistribute the final demand and value added block and, subsequently, intermediate consumption towards the different regions (Merk *et al*, 2013).

A functional definition (i.e. the companies directly dependent on the port are included as part of the port) of the port sector has been used based on value added of the port and port-related sectors. To obtain the disaggregation of the regional tables towards the level of the different ports, local studies of employment and value added of the port-related sectors have been used.

In the cases where only employment numbers, but no value added per sector was available, the value added for that sector in the port was estimated using the average national productivity numbers for that specific sector multiplied by the port-specific employment numbers. The Leontief multiplier has been calculated per economic sector and for selected regions, including the "own region", "neighboring regions", and the "dominant economic regions" in the country.[5]

Unlike France and many other European countries, Turkey does not have *multi-regional* input-output-tables, but is does have national input-output-tables. Neither does it have the detailed data (e.g. on employment per sub-sector per region) that would make it possible to construct regional input-output-tables. This means that it is not possible to provide a fully accurate assessment of forward linkages of maritime transport in Mersin. In order to get an impression of what the forward linkages might be, we assume that their extent is similar in Mersin as they are in the whole of Turkey.

[5] Leontief multiplier is the input coefficient: the column coefficient $a_{ij} = \frac{z_{ij}}{X_j}$ (flow of input from industry I to industry j divided by total output of industry j)

3.2.2 Main results

The port-related value added in Marseille-Fos amounts to approximately EUR 4 billion, representing approximately 3% of the GDP of the PACA region. More than one third of the port-related value added is in the mining, quarrying and energy supply sector (related to the metallurgy sector and petro-chemical sector). More than a fourth of the port-related value added is in transport, storage and communications. Other relatively large sectors are in real estate, renting and business activities, and other manufacturing. Direct value added of the port of Mersin can be estimated at EUR 0.2 billion.[6]

The backward linkages multiplier of the Mersin port cluster is 1.73, and 2.01 for the Marseille port cluster; this means that one euro of new demand within the port cluster leads to one additional euro of supply in the French economy. This overall multiplier is the sum of sectoral multipliers weighted by the sectoral shares in the final demand in the port of Marseille-Fos. The multipliers for Marseille-Fos and Mersin are slightly lower than the overall multiplier found for Le Havre-Rouen (2.47), but slightly higher than the one for Hamburg (1.71) and considerably higher than the multipliers for Rotterdam (1.13) and Antwerp (1.18). These differences can be explained by the country and port size of these respective cases, with the cases of Rotterdam and Antwerp being cases of very large ports in relatively small countries, and Le Havre, Hamburg, Marseille-Fos and Mersin being smaller ports in much larger countries. The considerable multiplier for both the port of Marseille-Fos and Mersin indicates substantial indirect economic impacts on economic sectors in France and Turkey.

Table 4. **Backward linkage multipliers of various port clusters**

	Multiplier
Marseille-Fos	2.01
Mersin	1.79
Le Havre-Rouen	2.47
Hamburg	1.71
Antwerp	1.18
Rotterdam	1.13

Source: Author's own calculations and Merk et al. 2013

The largest economic links are with transport equipment sector, the food industry as well as the petro-chemical sector. In these sectors the multiplier effect almost reaches three, which means that one euro of new demand within the Marseille-Fos port clusters leads to almost two additional euro of supply in these sectors. Other economic sectors that are relatively strongly linked to the Marseille-Fos port cluster are 'other manufacturing', electrical and optical equipment, as well as mining, quarrying and energy supply. The multiplier effects for traditional port-related sectors, such as transport, storage and communications, as well as wholesale and retail trade, are fairly high, although not among the sectors with the highest

6 This figure can be derived at by making several assumptions. First of all, it is assumed that the direct value added of the ports sector can be defined as water transport, for which some data for Turkey as a whole are collected by the Turkish Statistical Institute. The value added of the total water transport sector in Turkey amounts to EUR 2.8 billion, representing 0.93% of total GDP in Turkey. These data only exist at the national level, so a second assumption is needed to translate this into a figure for Mersin, namely that Mersin's share in Turkish port value added is proportional to its share in total Turkish port volume. This share is approximately 7%; applying this share to the total port value added of Turkey gives a number of EUR 0.2 billion port value added for Mersin.

multipliers. Sectors with which the indirect links of the Marseille-Fos port cluster are weakest are non-market services and the real estate sector.

Table 5. **Backward linkages multipliers of Marseille-Fos per sector**

Sector	Multiplier
Transport equipment	2.83
Agro-food business	2.69
Petro-chemical industries	2.67
Other industries	2.57
Electrical and optical equipment	2.51
Mining, extraction and energy supply	2.45
Agriculture	2.27
Hotels and restaurants	2.18
Construction	2.17
Financial intermediation	1.96
Transport, storage and communication	1.92
Wholesale and retail trade	1.90
Real estate, rents and business activity	1.48
Non-market services	1.39
Total multiplier	**2.01**

Source: Author's elaboration based on data of INSEE and Eurostat

The backward linkages multiplier of maritime transport in Mersin is 1.79. This means that a one-euro expansion in the final demand for water transport services will lead to an increase of EUR 1.79 in the total output of the whole economy, including an increase of EUR 1.56 in the sectoral outputs of the port-related economic water transport cluster shown in the table 6. This table also represents the sectors most related to water transport in terms of deliveries to water transport services. It presents the largest coefficients of the water transport column of the full requirements matrix from the standard demand-driven input-output model. The entries in the table represent extra demand for these sectors' outputs given a one-euro increase in the final demand for water transport services. These are the sectors that benefit most in terms of demand for their products with the expansion of the water transport sector. These sectors include other transport modes (delivering goods to/from ports), petroleum and gas products (supplying fuels and lubricants for shipping), repair services for ships, financing of shipping, other transport equipment.

Table 6. **Full requirement coefficients for water transport (demand model)**

Sector	Co-efficient
Water transport services	1.1046
Supporting and auxiliary transport services, travel agency	0.1118
Land transport, transport via pipeline services	0.0860
Petro-chemical industries	0.0620
Crude petroleum and natural gas, services incidental to extraction	0.0352
Trade, maintenance and repair motor vehicles, retail sale of automotive fuel	0.0328
Financial intermediations services, except insurance and pension funding services	0.0287
Basic metals	0.0278
Other transport equipment	0.0252
Machinery and equipment n.e.c.	0.0219
Wholesale trade and commission trade services, except motor vehicles	0.0211
Sub-total for the above sectors	**1.5571**
Total for economy	**1.7897**

Source: Author's elaboration based on Eurostat – I/O-table for Turkey, 2002

The port of Mersin has important forward linkages with the trading and manufacturing sectors. Forward linkages describe the use of a sector, in this case of water transport services, by other sectors of the economy. These forward linkages can be established through analysis of detailed input-output tables of a national economy. The most recent input-output table that is available for Turkey dates from 2002.

The forward linkages multiplier is 2.2; this means that one extra euro of maritime transport outputs in Mersin leads to 1.2 euro of additional output in the economy. A large part of this multiplier takes place is the sectors that are most dependent on water transport, such as retail trade, wholesale trade and land transportation. Analysis of this table learns that 62% of intermediate input originating in the water transport sector in Turkey goes into manufacture and retail and wholesale trade. Trade consumes more water transport services (37%) than manufacture (26%) due to importance of imported finished consumer goods in the Turkish economy. This set of sectors can be considered a port-related economic cluster because of its dependence on water transport services. The most important manufacturing sectors dependent on water transport are textiles and food products and beverages (Table 7). This table shows the most important users of the water transport services, i.e. the water transport cluster in terms of the forward linkage of the water transport sector. The coefficients in the table present the largest coefficients in the water transport row of the full requirement matrix of the supply input-output model. The supply input-output model, a.k.a. the Ghosh model, relates the final demand and intermediate output (both taken as endogenous) to the sectoral outputs looked at as exogenous resources. In this setup, the direct requirement matrix is defined as the ratio of intermediate use and the output taken as the row total of the input-output table. This differs from the more standard, demand-driven Leontieff input-output model, where the direct requirements matrix is defined as the ratio of intermediate use and the output by the column total of the input-output table.

Table 7. **Full requirement coefficients for water transport (supply model)**

Sector	Co-efficient
Water transport	1.076
Retail trade, except of motor vehicles, repair of personal and household goods	0.130
Wholesale trade and commission trade, except of motor vehicles	0.111
Land transport, transport via pipelines	0.087
Manufacture of food products and beverages	0.069
Manufacture of textiles	0.063
Construction	0.058
Public administration and defense, compulsory social security	0.047
Sale, maintenance & repair of motor vehicles, retail sale of automative fuel	0.043
Manufacture of basic metals	0.043
Subtotal for the port-related sectors	1.727
Total for economy	**2.204**

Source: Author's elaboration based on Eurostat – I/O-table for Turkey, 2002.

3.2.3 Inter-regional spillovers

Many of the backward and forward linkages, as described for Mersin, take place through functional relations between the port of Mersin and the various Organised Industrial Zones (OIZs) in Turkey. OIZs are manufacturing clusters created by the Turkish government through favourable conditions and incentives, in order to create economies of scale and synergy effects. In 2009 there were 265 of such OIZs throughout Turkey. The Turkish "Port Masters Plan 2010" gives the ports that are most frequently used by the different OIZs; according to this plan, there are 13 OIZs that mostly use the port of Mersin, including

Mardin, Kayseri, Yozgat, Kırsehir, Aksaray, Konya Center, Nigde and Konya Eregli (Merk and Bagis, 2013). Due to the lack of multi-regional I/O-tables and the data to construct these, there is no possibility to quantify these inter-regional spillovers of the port of Mersin. The analysis below will focus exclusively on the inter-regional spillovers from the port of Marseille-Fos.

The economic links of the Marseille-Fos port cluster with its region (the PACA region) are relatively strong. There are indirect economic spillovers from the Marseille-Fos port cluster: new port demand of one euro leads to 6 euro-cents additional supply in the region of Provence-Alpes-Côte d'Azur. Although this effect might seem small, it is in fact large compared to the regional effects of other large ports, in particular Rotterdam and Hamburg. The indirect economic links with the region are particularly large in the petro-chemical sector, food, transport equipment and mining, quarrying and energy supply. The petro-chemical and chemical industry is also in other places (Rotterdam, Antwerp, Le Havre) the industry with relatively close links to the port. The regional transport, storage and communications sector in the PACA-region is less strongly linked with the port than is the case in Rotterdam and Antwerp.

In addition, the Marseille-Fos port cluster has indirect economic links with important neighbouring regions, such as Rhône-Alpes, but the effects on Ile-de-France and the rest of France are more important. The indirect economic linkages of the port of Marseille-Fos with the Rhône-Alpes region are actually larger than those with the PACA region, with a multiplier of 0.10 against 0.06. The largest effect is with the transport equipment sector (0.19). The Rhône-Alpes-region is home to the second largest metropolitan economy of France, Lyon, neighbouring the PACA-region and also the port of Marseille-Fos' natural hinterland, so the indirect economic linkages are not surprising. What is perhaps more surprising are the large linkages of the port of Marseille-Fos with the metropolitan economy of Île de France, in which Paris is located: almost a third of the additional supply due to new demand in the Marseille-Fos port is taking place there.

Table 8. **Multiplier effects within the port region**

	Marseille-Fos	Le Havre	Hamburg	Antwerp	Rotterdam
Petro-chemical industry	0.11	0.06	0.03	0.05	0.05
Transport equipment	0.09	0.08	0.03	0.05	0.01
Agro-food business	0.10		0.03	0.02	0.04
Transport, storage, communication	0.06	0.03	0.02	0.13	0.07
Wholesale and retail trade	0.06	0.03	0.01	0.03	0.01
Total multiplier	0.06	0.05	0.02	0.03	0.01

Source: Author's elaboration based on data of INSEE and Eurostat

Table 9. **Multipliers of Marseille-Fos per sector and region in France**

	Marseille -Fos	PACA	Rhône-Alpes	Ile-de-France	Bour-gogne	Languedoc -Roussillon	Rest of France	Total
Transport equipment	1.00	0.09	0.19	0.52	0.04	0.03	0.96	**2.83**
Agro-food business	1.00	0.10	0.15	0.42	0.05	0.05	0.92	**2.69**
Petro-chemical industries	1.01	0.11	0.18	0.49	0.04	0.04	0.80	**2.67**
Other industries	1.00	0.09	0.17	0.46	0.04	0.04	0.77	**2.57**
Electrical optical equipment	1.00	0.08	0.18	0.45	0.04	0.03	0.73	**2.51**
Mining, extraction and energy supply	1.01	0.10	0.15	0.42	0.03	0.04	0.70	**2.45**
Agriculture	1.00	0.07	0.12	0.32	0.04	0.04	0.69	**2.27**
Hotels and restaurants	1.00	0.07	0.11	0.34	0.03	0.03	0.60	**2.18**
Construction	1.00	0.07	0.13	0.35	0.03	0.03	0.56	**2.17**
Financial intermediation	1.00	0.06	0.08	0.41	0.02	0.02	0.37	**1.96**
Transport, storage and communication	1.00	0.06	0.09	0.32	0.02	0.02	0.41	**1.92**
Wholesale and retail trade	1.00	0.06	0.09	0.33	0.02	0.02	0.39	**1.90**
Real estate	1.00	0.03	0.05	0.18	0.01	0.01	0.20	**1.48**
Non-market services	1.00	0.03	0.04	0.13	0.01	0.01	0.18	**1.39**
Total multiplier	**1.00**	**0.06**	**0.10**	**0.32**	**0.02**	**0.02**	**0.48**	**2.01**

Source: Author's elaboration based on data of INSEE and Eurostat

3.3 Advanced producer services

Major port cities are privileged locations of order centers and convergence of information on monetary transactions, commodity exchanges, the price of chartering vessels and the rules of organization of the maritime industry. Major port-cities differ according to their weight in the provision of maritime services measured by the presence of banking, financial and stock market and the consolidation of insurance companies, the corporate headquarters of carriers and global terminal operators, and the authority to impose standards organizations in the maritime industry, among other sectors (Merk and Comtois, 2012).

Existing studies do not consider Marseille, or Mersin to be one of these leading international maritime services centres. One of the existing studies looks at the leading cities in advanced maritime producer services, defined as multi-office firms for maritime insurance, law and consultancy (Jacobs *et al*. 2010). In this study Marseille and Mersin do not figure among the top 20 European cities with the largest number of establishments for Advanced Producer Services (APS). Another study identifies main cities from which container shipping companies are run, analysing the global office structures of 35 of the largest container shipping companies and global terminal operators (Verhetsel and Sel, 2009). Based on the global connectivity of these cities in terms of multi-office networks, six levels of world maritime cities were identified. Despite the presence of the CMA-CGM headquarters, Marseille scored only 38th out of 50 world maritime cities and was qualified as a level 6 world maritime city, whereas Mersin is absent from this ranking.

This perception of Marseille and Mersin is confirmed by our own collection of datasets on port-related maritime services, including ship brokering, ship finance, dredging, ship building and maritime engineering services. From many of these databases, Piraeus emerges as the leading centre in the Mediterranean, as well as various others, but the role of Marseille and Mersin is limited. The international role of Marseille and Mersin is also limited with respect to patent applications in port-related sectors (shipping, petroleum, food etc) based on the OECD Patent Database and with respect to port-related research based on a count of the city affiliations of the authors and co-authors of 576 port-related articles published in leading peer-reviewed academic journals between 1997 and 2011.

4. PORT ECONOMIC TRAJECTORIES

The port-city of Marseille has been characterised as a "maritime city" by Ducruet and Lee (2006), one of the articles cited in the introduction. It has high centrality in terms of urban functions and medium intermediacy with respect to port functions, which means that port functions are efficient in spite of a large urban environment. As such, the port-city of Marseille falls in the same category as Barcelona, Cape Town and Buenos Aires. The port-city of Mersin is not included in the article by Ducruet and Lee, but considering the similarity of Mersin in terms of population size and container port size, it can be argued that Mersin would also qualify as a "maritime city" and thus have similar challenges and opportunities.

Despite being the same type of port-city, the outlook for both port-cities is mostly determined by their different trajectories in the past. Marseille is an illustration of a port-city trajectory that is characterised by the ambition to maintain port functions although they have become less important for the local economy (Ducruet and Lee, 2006). This is mainly driven by the declining port volumes (in tonnage) and the relatively stagnating container volumes. The reverse is the case for Mersin, where container volumes have quadrupled over the last decade outpacing urban population growth; so port functions have become more important for the local economy there. The tale of Mersin is centered on the development of new gateway functions, whereas Marseille is preoccupied with recapturing lost hinterlands. Past growth performance also determines to a large extent current port challenges, with the potential of Mersin hindered by capacity constraints and Marseille by demand constraints. Not surprisingly, main policy discussions in Mersin have centered on building up new container handling capacity, whereas main proposals in Marseille aim at improving hinterland connectivity in order to optimise utilisation of existing container terminals. These dissimilarities also translate in different challenges vis-à-vis the local population: the need to sustain local support in the view of rapid growth with the related impacts (Mersin) and the need to regain this local support within the context of increased scepticism about the potential role of the port for the local community (Marseille).

Another typology of port-cities, mentioned in the introduction, is based on the main economic functions of the cities, related to main commodities handled at the port (Ducruet *et al*. 2014). Marseille is in that study qualified as an A-type port-city, which is characterised by high port traffic volume and diversity with advanced economic functions, important market size and major regional economic dimensions. Turkish port-cities are not included in that study, so we can only speculate as to how Mersin would have been qualified. Factors that Mersin has in common with A-type European port-cities are high traffic volumes, important market size and major regional economic dimensions. Where it might be different is with regards to the advanced economic functions. Average regional GDP per capita is below the national average in Turkey, and, as can be observed in our assessment of the economic impact of the port of Mersin, a significant share of the Mersin economy is taken up by manufacturing, including labour-intensive manufacturing such as textiles. In contrast, the advanced services industry (finance, business services) is relatively underdeveloped. The port of Mersin plays an important role in the export-driven economic strategy of the national government, connected as it is to the organised industrial zones, in which industrial policy has found its spatial expression. A similar centrally-driven aim to connect the port with

industrial development was at the basis of the development of the West Basins of the port of Marseille in the 1960s and 1970s and the related petro-chemical industry. The current image of this development is one of restructuring, within the context of closure and decline of refinery industries and a search for new industrial roles for the sites.

The economic functions of the port of Marseille, in particular the East Basin close to the city centre, have become interwoven with a diversified urban economy. Cruise and ferry traffic are interlinked with an active tourism sector, supported by large events, such as those related to its status as European Cultural Capital in 2013, to underline the cultural – and maritime – heritage of the city. The strong maritime tradition in Marseille has also facilitated the emergence of a maritime community, even if it is far from being a leading European or international maritime centre. Similar functions are lacking in Mersin. There is hardly any cruise traffic, even if debates are ongoing on developing a cruise terminal. Most of the advanced maritime services in the region are located in Istanbul or Piraeus. The lack of urban attractiveness or visibility for international workers would seem to preclude any significant maritime cluster-building ambitions that Mersin might have in the future.

The spatial development of the ports of Marseille and Mersin is fundamentally different. Marseille follows closely the spatial port-city models in the literature, e.g. the port-city evolution as assessed by Hoyle (1989), referred to in the introduction. The case of Marseille and its port expansion more than 50 kilometres to the west, and partial redevelopment of the urban port, formed indeed the inspiration of this model and is extensively described in the Hoyle article. The case of Mersin does not for the moment follow the same spatial development. The port area, dominated by container traffic, is located just next to the city centre, and further port expansions – and indeed the construction of a whole new container port – are foreseen just next to the current port site. Whereas part of the East Basins of the port of Marseille have been reconverted to increase urban usage of the area, similar waterfront developments have not taken place in Mersin, nor are they currently foreseen.

What does this tell us about the practical applicability of the different port-city typologies? Both Marseille and Mersin could be considered "maritime cities" and at first sight there are many similarities between the two ports and port-cities that would confirm the accuracy of putting them in the same category. The two ports have similar scores on many of the determinants for port competitiveness: relatively modest maritime connectivity, reasonably efficient port operations and fairly limited amounts of competition. Their economic impacts also show various similarities: multipliers with comparable magnitudes and relatively strong regional embeddedness, as illustrated by diverse and considerable links to industrial and manufacturing activity. However, the similarities stop there. The main challenges and opportunities are different: Mersin is constrained by capacity, Marseille by demand; Mersin will expand its gateway functions for an export-oriented and emerging economy, whereas Marseille has to cope with declining industries and find new roles, either by industrial conversion or development towards an international maritime services cluster.

One might argue that these differences are related to the different development phases of Marseille and Mersin, that is: the difference between an advanced services economy and an emerging manufacturing region. Simple typologies based on the maritime orientation of the city indeed tend to ignore this and would need to be complemented with notions on past trajectories and regional economic profiles. Such notions have been developed separately, as described in this article, but integration or alignment of the different port-city typologies might give rise to a more holistic port-city typology that has more explanatory power and relevance for public policies.

However, not everything can be explained by different development phases. The models for spatial port-city development apply well to Marseille – if only because models were based on Marseille's experiences – but less so to Mersin, where the port remains spatially connected to the city. Despite clustered industrial development and adaptation to modern maritime technology, facilitated by the presence of a global terminal operator, the port of Mersin has not retreated from the waterfront, nor does it intend to do so in the nearby future, quite the contrary. Spatial development along the lines of the Marseille-Fos, namely concentration of port activity on a non-urban spacious greenfield site and transformation of the old urban port site (at least partially), has taken place in regions with similar development levels as Mersin; one could mention the development of Tangiers-Med and transformation of the Tangiers harbour in Morocco. However, such dynamics are less frequent than the spatial port-city development models would predict. There is a range of urban ports in developing and emerging countries that do not retreat from urban waterfronts, even in cases where a new non-urban port has been developed. Exploring the persistence of urban ports, in defiance of spatial logic, could provide a challenging research challenge for the future.

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