1. Port industry is still sustainable?
Over the last 20 years the transport industry has experienced an exponential growth in seaport throughput, which reflected a growth in seaborne trade at an annual rate approximately twice as big as industrial production. This growth is in turn a consequence of the global relocation of industrial activities, which started in the late 60s and in the 70s, and of deep geographical changes in raw material markets and consumption patterns.
During this period, competition among ports has been growing systematically, since reduction in transport costs eroded geographical protection of port hinterlands and consequent monopolies. A higher efficiency is now required, port generalised costs decreased (lower monetary costs and turnaround times, higher reliability) and traffic flow in competitive ports grew far more rapidly than production in hinterlands.
Yet, it clearly emerged that increasing throughputs and market shares for most competitive seaports did not mean, alone, a proportional increase of added value and external benefits the port economy. Indeed, it rather shows only that the port service is effective for the shipowner/caller. Some further questions then arise: who actually benefits from the effectiveness of a port? And who actually pays for it? Port can still be considered a profitable business? Profitable for whom? All these questions might even be reduced to one: is nowadays port industry a sustainable industry?

2. The weak link of the logistic chain
Deep changes occurred in the maritime transport and port industry over the last decades have totally transformed the scenario of the port-based economies: the rise in traffic flows and in ships’ size, since the 50s; growth in containerisation and unitisation since the 60s; the changing industrial organization of the transport industry, moving toward a high degree of cooperation between carriers, including strategic alliances, mergers and acquisitions, as well as vertical integration and control on intermodal/logistic cycles and on port and inland terminals, logistics outsourcing of manufacturing firms. Most of these trends caused a number of crucial threats for port economies:
– Due to unitisation/containerisation, and to the growing ships’ size and traffic flows, port operations have become much more capital intensive, labour saving and space consuming;
– Fierce competition and pressure from liner companies caused dramatic cuts in port fares and turnaround times, what in turn caused overcapacity (in order to reduce ships’ queueing times), and a shift of port industry rent from the producers (terminal operators) to the consumers (liners, MTOs) (the caption of economic rent of the port: see Goss, 1990);
– The overall cost of the port node for the transport industry (i.e. generalised costs of the terminal and of the ship, including the opportunity cost of time spent in the port

Port added value at the heart of the city port negotiations

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The added value measures the payback to inputs employed in the production. When referring to the AV of port industry for the local economy, positive externalities and multiplier effects are normally included: this is clearly a macroeconomic issue, and a concept of local added value (the gross benefit of the port for the local economy) must be compared to the benefit potentially coming from alternative use of those inputs (their opportunity cost).

Increasing port throughputs do not necessarily increase added value and benefits for the local economy, since changes in port industry have lowered local benefits because of decreasing demand for local inputs and of low payback of space and public resources. Although different traffic categories have not the same weight as for "local" benefits/costs, low payback for inputs and loss of leadership on port/transport industry can result in a scenario of "demaritisation": ports are seen by local communities more as a threaten than as a source of added value; conflicts arise on land use and pollution. Volatile traffic flows, overlapping hinterlands, high market power of the carriers lead to a demand-driven port development, in search for short term competitive advantages.

Market failures and imbalances between positive and negative externalities might be in theory corrected by economic compensations inversely related to the local added value. Yet, they would be hardly tolerated by the market. Thus, opportunities for local economy must be pursued through new and/or indirect benefits. Local policies should focus on port planning and land use for different traffic categories, measures to attract induced activities (such as logistics services), negotiation between the port and the city, in order to find possible non-monetary compensations. Long term relationships between carriers and ports (possibly dedicated terminals) should also be pursued, in order to involve the former in port investment and reduce the volatility of traffic.
by the ship) significantly shifted from ships to terminals, while at the same time inputs for port operations shifted from labour to capital;

- Space consumption grew because of containerisation, overcapacity, and dramatic increase in throughput, what also caused a higher level of pollution and congestion of land transport networks.

Furthermore, the industrial potential of ports also collapsed, at least in the formerly industrialised countries, because of relocation of formerly port-oriented industries (unitisation and intermodality contributed to weaken or relax spatial constraints for location patterns).

The resulting scenario is characterised by volatile traffic flows, overlapping hinterlands, high market power of the carrier, aiming at reducing costs and times and increasing flexibility in ports. Ports operators and bodies become the weaker contractual part, with the result of a demand-driven port planning and development, searching for short term competitive advantages. Labour per cargo units collapses, capital and entrepreneurship shift outside the local control (because of vertical and horizontal integration), while the financial strength of port bodies is not comparable to great carriers nor to international stevedoring groups (Blomme, 2000). Moreover, land price for port uses is low due to competition and short term opportunity costs. Terminal overcapacity and substantial negative externalities emerge. Finally, regional keynesian multipliers become lower and lower.

The microeconomic role of the port within the logistics industry clearly prevails on the macroeconomic role of the port in the regional economy. While the strategies related to the former tend to the effectiveness for port users and terminal operators, the relevant features for local economy should be the demand for local inputs, and consequently the (local) added value. It is then necessary a proper assessment of port local economic impact, i.e. of the net benefit caused by the port to the local economy.

3. Port impact

The assessment of net benefits for the local economy implies a comparison between, on one side, revenues of inputs purchased locally, positive externalities, and keynesian multiplier effects; and, on the other side, the opportunity cost of inputs and negative externalities.

This is the origin of the wide field of surveys known as “port impact studies” (PIS), including models of port demand, economic-base approaches, keynesian income-expenditure models, input-output matrixes/models, regional economics models (see: Waters, 1977; Chang, 1978; Davis, 1983; Yochum and Agarwal, 1987, 1988; Warf and Cox, 1989; DeSalvo and Fuller, 1994, 1995; Verbeke and Debisschop, 1996; Villaverde Castro and Coto Millan, 1998; Musso, Benacchio and Ferrari, 1999). Yet a number of non scientific surveys, mainly funded by port authorities themselves, and normally based on interviews to managers/executives of the port industry, appear quite empirical, lack a clear and reliable methodology, and clearly aim to provide arguments to port players to support their growing demand for land or public investment. An overestimation of the positive impact of port for regional economy and its development has often been claimed (Goss, 1990b; Grippaio and Grippaio, 1995; Grippaio, 1999).

Indeed, deep changes in transport and port industries have deeply transformed the demand for local inputs and the markets of inputs of port industry:

- The demand for direct employment in handling activities has fallen dramatically, often even in absolute terms notwithstanding traffic growth;
- The demand for space has increased (except for some specialised cycle in bulk traffic), due both to traffic growth and to the development of intermodal and hub-and-spoke cycles, aimed at pursuing higher economies of density for the ships (the container cycle experienced the most relevant increase in the land/traffic ratio);
- The demand for capital strongly increased, but just for this reason (and for horizontal and vertical integration of stevedoring activities), is nowadays mainly, if not solely, oriented outside the local economy;
- The same occurs for the demand for entrepreneurship, which faces nowadays a much higher complexity in the management of terminals (due to higher competition among operators), while the horizontal international integration of terminal operators provides more and more international managers/executives; as a result, entrepreneurship is gradually shifting from local to international supply;
- The demand for collective resources strongly increased due to traffic increase, even if the average external costs per ton are lower due to pollution control and improvements in safety/environment legislation concerning navigation and port operations.

It is then necessary to compare the remuneration of inputs that port industry still demands to the local economy and the opportunity or external costs generated by the port in the local theatre. This comparison should then consider mainly:

- The labour market, including not only manpower directly employed in handling, but the overall employment due to the presence (even historical) of the port in the city/region;
- Land and other collective resources, namely coasts, the sea and the set of infrastructure of land transport networks.

3.1 Employment

Obviously, if we consider only manpower directly employed in handling and other port activities we would heavily underestimate the actual impact of the port on the labour market; particularly in the recent years, since direct employment has been falling dramatically and is no longer the most relevant part of employment impact of port.

The above mentioned port impact studies (PIS) are a possible technique for assessing the link between throughput and employment. While direct employment per unit of throughput has been collapsing, an increasing share of port related
employment is now less strictly linked to throughput, although still induced by the port industry.

Actually, most PIS refer to the assessment of overall (direct and induced) port related employment. Yet a major theoretical problem seems to be how to estimate to what extent non direct port activities are actually related to the port. A lot of surveys are quite discretionary on this point, which is expected to be more and more important since direct employment impact is clearly decreasing. A more proper assessment can be achieved through input-output techniques or regional analysis techniques based on location quotient, shift share analysis, control regions (Musso, Benacchio and Ferrari, 1999).

Surveys on the Italian case for the '90s showed that these two approaches, albeit completely different in methodology, led to convergent results. Yet, this surveys show that in Italian port cities in the '90s, i.e. in a period of rapid growth of throughput for Italian ports (Table 1; Fig.1)

- the overall port induced employment appears to be slightly decreasing even in absolute figures;
- comparing throughput in different port with figures on port induced employment, it seems that the relation between throughput and employment is not so strong.

Three major doubts can arise about the results of this kind of analysis:

- how well the importance of port industry in a port city/region is measured by port throughput (without forgetting, anyway, that most external costs of port industry are directly related to throughput, although with a different weight of different categories);
- how reliable are surveys estimating the link between port industry and induced employment through the observation of present and past figures on a limited number of ports (22, only a few of which being internationally relevant);
- which part of the overall (induced) employment impact of ports is by now locating outside port city/regions.

These topics are obviously relevant for future research agenda.

\begin{table}
\centering
\begin{tabular}{|l|c|c|c|c|c|}
\hline
\textbf{PORTS} & \textbf{YEARS} & \textbf{FEA}_{1}\% & \textbf{FEA}_{2}\% & \textbf{FEA}_{3}\% & \textbf{Total Census Employment} & \textbf{FEA/\textit{Total Census Employment}} \\
\hline
Savona & 1991 & 5.026 & 178 & 5.204 & 18.326 & 26% \\
 & 1996 & 4.797 & 126 & 4.925 & 16.843 & 29% \\
Genova & 1991 & 34.191 & 213 & 34.404 & 183.012 & 19% \\
 & 1996 & 34.545 & 349 & 34.894 & 172.060 & 20% \\
La Spezia & 1991 & 6.734 & 204 & 6.938 & 30.115 & 23% \\
Carrara & 1991 & 1.891 & 165 & 2.065 & 16.633 & 12% \\
 & 1996 & 2.166 & 133 & 2.289 & 16.365 & 14% \\
Livorno & 1991 & 10.964 & 144 & 10.206 & 58.860 & 26% \\
Pomino & 1991 & 1.345 & 76 & 1.421 & 13.131 & 11% \\
 & 1996 & 1.527 & 94 & 1.621 & 10.616 & 15% \\
Napoli & 1991 & 59.729 & 47 & 59.777 & 212.147 & 28% \\
 & 1996 & 56.689 & 23 & 56.712 & 202.452 & 28% \\
Salerno & 1991 & 7.791 & 133 & 7.921 & 33.124 & 24% \\
Sora Vito & 1991 & 614 & 42 & 656 & 2.442 & 27% \\
Trieste & 1991 & 15.213 & 341 & 15.554 & 60.911 & 26% \\
 & 1996 & 13.233 & 208 & 13.431 & 57.179 & 23% \\
Reggio & 1991 & 6.128 & 217 & 6.346 & 43.218 & 15% \\
 & 1996 & 6.233 & 251 & 6.484 & 43.306 & 15% \\
Ancona & 1991 & 8.485 & 45 & 8.526 & 34.631 & 25% \\
 & 1996 & 8.716 & 90 & 8.906 & 33.249 & 26% \\
 & 1996 & 20.152 & 87 & 20.239 & 80.480 & 25% \\
Brindisi & 1991 & 3.865 & 52 & 3.907 & 22.358 & 18% \\
Taranto & 1991 & 6.085 & 283 & 6.368 & 53.004 & 12% \\
 & 1996 & 6.010 & 90 & 6.100 & 45.514 & 13% \\
Palermo & 1991 & 33.686 & 152 & 33.838 & 115.650 & 25% \\
 & 1996 & 28.274 & 130 & 28.404 & 100.315 & 28% \\
Messina & 1991 & 12.064 & 396 & 12.460 & 44.137 & 28% \\
 & 1996 & 11.217 & 159 & 11.376 & 37.941 & 30% \\
 & 1996 & 12.736 & 200 & 12.906 & 63.563 & 20% \\
Augusta & 1991 & 1.638 & 48 & 1.686 & 7.750 & 22% \\
 & 1996 & 1.312 & 107 & 1.419 & 6.856 & 21% \\
\hline
\textbf{TOTALE} & 1991 & 294.874 & 3.496 & 298.370 & 1.252.842 & 23% \\
 & 1996 & 275.076 & 3.214 & 278.290 & 1.177.709 & 24% \\
\hline
\end{tabular}
\caption{Port related employment in Italian seaports, 1991-1996 (Musso, Benacchio and Ferrari, 1999)}
\end{table}

3.2 Land use and collective resources

As far as land and other collective resources are concerned, the comparison should be between their remuneration and their opportunity cost. On this point a clear and consistent empirical evidence is still missing. Yet some theoretical assumption are strengthened by at least partial evidence:

- the remuneration of space is normally low, since port competition pushes service prices towards short run marginal costs (which are low when fixed costs are high), and this in turn puts a strong pressure on the input markets;
- while the opportunity cost of space can be very high, namely if it is scarce, because of the great potential for other uses (tourism, industrial, urban, etc.), the short run

![Fig. 1 Port related employment and throughput]

\textit{Source: Musso, Benacchio and Ferrari (2000)}
opportunity cost becomes very low (virtually zero) once it has been transformed into a port terminal/area, and cannot be reconverted to a different use without huge investments;
- Marginal cost pricing, even when applied, doesn’t payback port investments (although they are normally not paid by the local community, which for this reason tends to consider them as a benefit instead of a cost);
- There is a split between the long term land market, where land use is decided by port authorities and other public bodies through port (and city) planning, and the allocation market, in which terminals are assigned to terminal operators, once port use is virtually irreversible, short term opportunity cost is close to zero and price can be very low; due to this split, the double role of landlord port authorities in land market (on the demand side in the long term market, on the supply side in the allocation of terminals) gives place to potentially ambiguous aims and strategies.

4. Port and the city: the end of the affair?

For all these reasons, some ports are growingly seen by local communities much more as a threat than as a source of added value. Conflicts between ports and port cities arise, namely concerning land use and pollution. While globalisation increases the importance of ports in the world economy, an unfair geographical distribution of benefits and costs they bring about is possible, or at least is considered possible. Benefits for port cities/regions may be lower because of the reduced demand for local inputs and of low remuneration for the use of space and other public resources. Lower benefits and the loss of local control and leadership on port and transport industry, as well as reduced remuneration for local traditional inputs, bring about a scenario of “demaritimisation”.

Opportunities for local economy must then be pursued through new and/or indirect benefits, and/or through negotiations between the port and the local economy.

To this respect, throughputs in different traffic categories have not the same weight as for benefits and costs they bring about to local economy, depending on how many induced activities can be related to any specific traffic category, and how many of them may or have to be located close to the port.

Since this is unanimously acknowledged, research has been developed in order to assess the economic weight of different traffic categories. A number of weighing techniques have been developed, since the so called “Hamburg Rule” (1976), to the “Bremen Rule” (1982), “Rotterdam Rule” (1982), “Dupuydauby Rule” (1986), “Range Rule” (1991), “Antwerp rule” (2000) (see Haezendonck, 2001). They are mostly based on interview to a panel of experts, propose different sets of weight which should approximate the added value and/or employment of different traffic categories.

Notwithstanding, conflicts between port and cities, and the so called “demaritimisation” of seaports don’t affect all seaports. On the contrary, most of them seem not incur in these perspective. It is not easy to understand why this happens, but the key elements seem to be:
- The amount of direct and induced employment impact, what makes the mission of the port shared by the majority of the local community;
- The amount of opportunity costs (due to the actual scarcity) of land and other resources employed;
- The capacity of governance and planning by port bodies and city/regional government, and the consequent quality of the planning process concerning port, its interface with the city, and possible decentralisation of the activities which cost more in terms of land use and external cost.

Within this context, over the next few years the port industry will have to redefine the very concept of port competitiveness, which is not only the ability of providing port services at a low generalised cost, but to ensure a satisfactory results for all players involved in port industry, ranging from final users (the shipowners), to terminal operators, to port bodies, to city/local government, to local business community and households (Fig.2).

![Figure 2 Port competitiveness: different concepts](image)

This issue has much to do with the above mentioned double role of the port: microeconomic, for the efficiency and effectiveness of the logistic cycle, and macroeconomic, for the port regional economy and for the hinterland. So far, competitiveness has been seen as a matter of efficiency and effectiveness of port node within the logistic cycle, what implies the minimisation of cost and above all of handling/queueing times. This in turn allows the economies of scale/density of the ship. Dedicated terminals as well as systematic overcapacity of port terminals are largely explained by this purpose. Yet, overcapacity means higher space consumption, and increases port infrastructure costs in order to reduce ships’ cost. Dedicated terminals have the relevant positive effect to reduce volatility of traffic and to strengthen links between ports and users; yet they also bring about higher opportunity costs for land. Both strategies result into higher and growing costs for ports, with prevailing fixed costs which in turn enhance price competition.

What is needed today is rather a more comprehensive
concept of competitiveness, which implies effectiveness for shippers, and sustainability for local economies as for the use of local resources.

5. Added value, benefits and costs for the port economy
The "added value" is a concept derived from microeconomics, indicating the difference between the price at which the product is sold and the sum of prices paid for purchasing goods and services from other firms. In other words, the added value measures the remuneration to production factors employed in the (port) economic activity.

Yet, when we refer to the added value of port industry for the (local) economy, we normally mean that port also generates positive externalities and multiplier effects. This issue is clearly a macroeconomic one. As a matter of fact, while nowadays port operators (the entrepreneur) as well as other production factors normally come from outside the local economy, what is relevant for the local economy is which production factors, private or public resources, are purchased locally and how much they are paid.

So, the problem normally referred to is rather one of local added value. To some extend, this concept will approximate the gross benefit of the port for the local economy, and must be compared to the benefit potentially coming from alternative use of those inputs, which is their opportunity cost.

Obviously, the quantity of throughput that a terminal operator is willing to produce will depend on its goals and strategies, namely to its own equilibrium between costs and revenues (e.g., he could try to equal direct marginal costs to direct marginal revenues). Therefore, as far as the use and remuneration of local production factors is concerned, there is no reason to assume that the optimum for the firm will correspond to the optimum for the local economy.

The problem is well known to spatial economics, namely in the comparison of benefits and costs of concentration (e.g.: the optimal size of a city: see Alonso, 1971), and whenever a problem of (positive and negative) externalities arises, giving place to a market failure. The market failure can be then corrected through an economic compensation (e.g.: an environmental tax) which allows to internalise the externalities. The optimum quantity of output for the community is then achieved.

In port industry, because of relevant positive and negative externalities, the throughput which balances marginal direct benefits and costs for the terminal operator is normally different from the throughput that balance local added value and opportunity costs, i.e. benefits and costs for the local economy. Moreover, as mentioned, benefits seem to be growingly independent from throughput. The correction to this market failure should be, in principle, fixing a positive or negative compensation equal to the difference between opportunity costs of locally purchased resources and their remuneration (i.e. the local added value).

In Fig.3, if LAV is the local added value and LOC is the opportunity cost, the (positive or negative) compensation for the local economy asked to the port industry should be

$$C = LOC - LAV$$

(1)

LAV is different for different traffic categories, and may differ from port to port, because of differences in competitiveness, in the ability of attract the location of related activities, etc. LOC is a different function of throughput in different traffic categories, and varies from port to port, partly due to natural or geographical characteristics (e.g. space availability) and partly due to different institutional capacity of port economies (the institutional and management model, the ability in governance and planning functions, a different organisation of the labour market) which results in different costs and elasticity of supply of inputs. (For the institutional capacity building: see Healey, 1997, 1998).

Actually, differences due to competitiveness or institutional capacity of ports should not be compensated, otherwise this would be a subsidisation for inefficiency. On the contrary, differences in LAV for different traffic categories and differences in LOC for natural/geographical conditions, should in principle be object of compensation.

Therefore, this means that, as far as local added value is concerned, and given the opportunity cost, the smaller is the added value, the bigger should be the compensation. (On the other side, given the local added value, if opportunity costs are different due to natural/geographical supply conditions, compensation should also be different in principle, although this would hardly be tolerated by an highly competitive market.) Different compensations (due to their different added value) for different traffic categories would work since there are different demand curves, and would prevent ports from specialise solely in traffic category with the highest added value (with consequent overcapacity), while at the same time other categories might meet severe shortages of handling capacity.

The compensation technique would ensure to each port the balance between added value and opportunity cost, but not automatically ensure a proper overall supply (for an entire port range serving a given hinterland) for each traffic category.
Nonetheless, the overall (i.e. for the entire port range) demand and supply of port capacity for each traffic category will reach an equilibrium through the prices of port services.

![Figure 4: Local added value and opportunities costs for two throughputs, with land capacity constraint](image)

Finally, we must consider that if equilibrium throughput is reached in every traffic category by equalising LAV to LOC through a proper compensation, the overall throughput might well incur in an overall capacity constraint.

In Fig.4, the straight f represents the technical constraint given, for example, by available space. This means that, given two (or n) traffic categories, total throughput cannot exceed production combinations lying on the straight. If the combination of optimal throughput exceed the technical constraint, the optimal combination will correspond to the combination on the segment AB for which marginal benefits of two traffic categories will be equal.

While the outlined framework could work in theory, it is likely to meet some major problems in real life, since:
- Most variables involved cannot be easily quantified, so it would be not easy to determine compensations;
- Local added value depend on a number of factors not easy to define and to measure, and moreover it seems to be growingly independent from throughput;
- All variables directly or indirectly involved (i.e., the added value per category, the opportunity costs, and the price of port services) are determined exogenously:
  - Prices are growingly taken by the market; terminal operators are becoming price-taker, thus compensation is hardly tolerated by the market since it can give place to higher prices;
  - Opportunity costs are given by natural and institutional conditions of the supply of resources;
  - Added value are largely a technical function of the category of traffic;

what means that no price compensation would be tolerated by the market.

Then, which are the degrees of freedom of the problem?

Some relevant policy issues can be the following:
- It is possible operate on quantity of resources (namely space, in the long run) to be used in the different traffic categories, since this influences the marginal opportunity cost. More space should be given to activities with higher LAV and lower or no space to the other ones: the market should then compensate the scarcity of the latter and penalize the relative abundance of the former, thus establishing a compensation for the lower LAV.
- Port and port cities should enhance their institutional capacity (Healey 1997, 1998; Cristoforetti and Ghiara, 2002): if skills of port bodies, local regional institutions, business and social communities allow a higher quality of land planning, governance, participation and communication, the demand of space and other public resources per unit of throughput (and its opportunity cost) will eventually fall.
- Following the previous point, a clear negotiation can be established between the port and the city, in order to find possible non monetary compensations to the local community: the redevelopment of waste waterfront of old ports is a clear example of urban re-use of formerly port spaces: relevant benefits can be ensured by this way to the urban community.
- The added value is nowadays related to induced activities ("value added services", distribution and logistic activities) much more than to port operation itself. A key point is to enhance the location of induced activities, most of them are quite footloose, and will look for favourable condition for location. The location of such service would then increase the LAV per unit of throughput.
- A long term relation should be encouraged between the carrier and the port. This can be done through dedicated terminals (albeit they normally cause a rise in the opportunity cost of space) or through a high involvement in port investment; the result is to reduce the degree of volatility of traffic and of competition among ports.
- Negative externalities of the port might be reduced through port decentralisation and networking with other ports and inland terminals.

The goal of most of these policy issues is clearly to compensate unbalances between benefits and costs of the port by reinforcing the link between the port and local community/economy. So, all these issues require that goals and tools should be clear and shared by the local community, as well as rules and practices on land use should be equally clear and shared.

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