Section I GENERAL PROVISIONS ON THE ORGANIZATION OF CARRIAGE OF GOODS

Topic 5. The tariffs. Determination of fees for transportation

1. Transportation, Economy and Society
2. Transport Costs and Rates
3. The Financing of Transportation Infrastructure
4. Airline Pricing
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1. Transportation, Economy and Society

Transport systems are closely related to socio-economic changes. The mobility of people and freight and levels of accessibility are at the core of this relationship. Economic opportunities are likely to arise where transportation infrastructures are able to answer mobility needs and insure access to markets and resources. From the industrial revolution in the 19th century to globalization and economic integration processes of the late 20th and early 21st centuries, regions of the world have been affected differently by economic development. International, regional and local transportation systems alike have become fundamental components of economic activities. A growing share of the wealth is thus linked to trade and distribution. However, even if transportation has positive impacts on socio-economic systems, there are also negative consequences such as congestion, accidents and mobility gaps.

Transportation is also a commercial activity that derives benefit from operational attributes such as costs, capacity, efficiency, reliability and speed. Transportation systems are evolving within a complex set of relationships between transport supply, reflecting the operational capacity of the network, and transport demand, the mobility requirements of an economy.

The Economic Importance of Transportation

Development is related at improving the welfare of a society through appropriate social, political and economic conditions. The expected outcomes are

quantitative and qualitative improvements in human capital (e.g. income and education levels) as well as physical capital such infrastructures (utilities, transport, telecommunications). While in the previous decades, development policies and strategies tended to focus on physical capital, recent years has seen a better balance by including human capital issues. Irrespective of the relative importance of physical versus human capital, development cannot occur without both as infrastructures cannot remain effective without proper operations and maintenance while economic activities cannot take place without an infrastructure base.

Because of its intensive use of infrastructures, the transport sector is an important component of the economy and a common tool used for development. This is even more so in a global economy where economic opportunities have been increasingly related to the mobility of people, goods and information. A relation between the quantity and quality of transport infrastructure and the level of economic development is apparent. High density transport infrastructure and highly connected networks are commonly associated with high levels of development. When transport systems are efficient, they provide economic and social opportunities and benefits that result in positive multipliers effects such as better accessibility to markets, employment and additional investments. When transport systems are deficient in terms of capacity or reliability, they can have an economic cost such as reduced or missed opportunities and lower quality of life.

At the aggregate level, efficient transportation reduces costs in many economic sectors, while inefficient transportation increases these costs. In addition, the impacts of transportation are not always intended and can have unforeseen or unintended consequences. For instance, congestion is often an unintended consequence in the provision of free or low cost transport infrastructure to the users. However, congestion is also the indication of a growing economy where capacity and infrastructure have difficulties keeping up with the rising mobility demands. Transport carries an important social and environmental load, which cannot be neglected. Assessing the economic importance of transportation requires a

categorization of the types of impacts it conveys. These involve core (the physical characteristics of transportation), operational and geographical dimensions:

- **Core**. The most fundamental impacts of transportation relate to the physical capacity to convey passengers and goods and the associated costs to support this mobility. This involves the setting of routes enabling new or existing interactions between economic entities.

- **Operational**. Improvement in the time performance, notably in terms of reliability, as well as reduced loss or damage. This implies a better utilization level of existing transportation assets benefiting its users as passengers and freight are conveyed more rapidly and with less delays.

- **Geographical**. Access to a wider market base where economies of scale in production, distribution and consumption can be improved. Increases in productivity from the access to a larger and more diverse base of inputs (raw materials, parts, energy or labor) and broader markets for diverse outputs (intermediate and finished goods). Another important geographical impacts concerns the influence of transport on the location of activities.

The economic importance of the transportation industry can thus be assessed from a macroeconomic and microeconomic perspective:

- At the **macroeconomic level** (the importance of transportation for a whole economy), transportation and the mobility it confers are linked to a level of output, employment and income within a national economy. In many developed countries, transportation accounts between 6% and 12% of the GDP.

- At the **microeconomic level** (the importance of transportation for specific parts of the economy) transportation is linked to producer, consumer and production costs. The importance of specific transport activities and infrastructure can thus be assessed for each sector of the economy. Usually, higher income levels are associated with a greater share of transportation in consumption expenses. Transportation accounts on average between 10% and 15% of household expenditures, while it accounts around 4% of the costs of each unit of output in manufacturing, but this figure varies greatly according to sub sectors.

The added value and employment effects of transport services usually extend beyond those generated by that activity; **indirect effects** are salient. For instance, transportation companies purchase a part of their inputs (fuel, supplies, maintenance) from local suppliers. The production of these inputs generates additional value-added and employment in the local economy. The suppliers in turn purchase goods and services from other local firms. There are further rounds of local re-spending which generate additional value-added and employment. Similarly, households that receive income from employment in transport activities spend some of their income on local goods and services. These purchases result in additional local jobs and added value. Some of the household income from these additional jobs is in turn spent on local goods and services, thereby creating further jobs and income for local households. As a result of these successive rounds of re-spending in the framework of local purchases, the overall impact on the economy exceeds the initial round of output, income and employment generated by passenger and freight transport activities. Thus, from a general standpoint the economic impacts of transportation can be direct, indirect and induced:

- **Direct impacts.** The outcome of improved capacity and efficiency where transport provides employment, added value, larger markets as well as time and costs improvements. The overall demand of an economy is increasing.

- **Indirect impacts.** The outcome of improved accessibility and economies of scale. Indirect value-added and jobs are the result of local purchases by companies directly dependent upon transport activity. Transport activities are responsible for a wide range of indirect value-added and employment effects, through the linkages of transport with other economic sectors (e.g. office supply firms, equipment and parts suppliers, maintenance and repair services, insurance companies, consulting and other business services).

- **Induced impacts.** The outcome of the economic multiplier effects where the price of commodities, goods or services drops and/or their variety increases. For instance, the steel industry requires cost efficient import of iron ore and coal for the blast furnaces and export activities for finished products such as steel booms and

coils. Manufacturers and retail outlets and distribution centers handling imported containerized cargo rely on efficient transport and seaport operations.

Transportation links together the factors of production in a complex web of relationships between producers and consumers. The outcome is commonly a more efficient division of production by an exploitation of geographical comparative advantages, as well as the means to develop economies of scale and scope. The productivity of space, capital and labor is thus enhanced with the efficiency of distribution and personal mobility. Economic growth is increasingly linked with transport developments, namely infrastructures, but also with managerial expertise, which is crucial for logistics. Thus, although transportation is an infrastructure intensive activity, hard assets must be supported by an array of soft assets, namely management and information systems. Decisions have to be made about how to use and operate transportation systems in a manner that optimize benefits and minimize costs and inconvenience.

Transportation and Economic Opportunities

Transportation developments that have taken place since the beginning of the industrial revolution have been linked to growing economic opportunities. At each stage of human societal development, a particular transport technology has been developed or adapted with an array of impacts. Five major waves of economic development where a specific transport technology created new economic, market and social opportunities can be suggested:

- **Seaports**. Linked with the early stages of European expansion from the 16th to the 18th centuries, commonly known as the age of exploration. They supported the early development of international trade through colonial empires, but were constrained by limited inland access. Later in the industrial revolution, many ports became important heavy industrial platforms With globalization and containerization, seaports increased their importance as a support to international trade and global supply chains.

- **Rivers and canals**. The first stage of the industrial revolution in the late 18th and early 19th centuries was linked with the development of canal systems in

Western Europe and North America, mainly to transport heavy goods. This permitted the development of rudimentary and constrained inland distribution systems.

- **Railways**. The second stage of industrial revolution in the 19th century was linked with the development and implementation of rail systems enabling more flexible and high capacity inland transportation systems. This opened up substantial economic and social opportunities through the extraction of resources, the settlement of regions and the growing mobility of freight and passengers.

- **Roads**. The 20th century saw the rapid development of comprehensive road transportation systems, such as national highway systems, and of automobile manufacturing as a major economic sector. Individual transportation became widely available to mid income social classes, particularly after the Second World War. This was associated with significant economic opportunities to service industrial and commercial markets with reliable door-to-door deliveries. The automobile also permitted new forms of social opportunities, particularly with suburbanization.

- **Airways and information technologies**. The second half of the 20th century saw the development of global air and telecommunication networks in conjunction with economic globalization. New organizational and managerial forms became possible, especially in the rapidly developing realm of logistics and supply chain management. Although maritime transportation is the physical lynchpin of globalization, air transportation and IT support the accelerated mobility of passengers, specialized cargoes and their associated information flows.

No single transport mode has been solely responsible for economic growth. Instead, modes have been linked with the economic functions they support and the geography in which growth was taking place. The first trade routes established a rudimentary system of distribution and transactions that would eventually be expanded by long distance maritime shipping networks and the setting of the first multinational corporations managing these flows. Major flows of international migration that occurred since the 18th century were linked with the expansion of international and continental transport systems that radically shaped emerging

economies such as in North America and Australia. Transport played a catalytic role in these migrations, transforming the economic and social geography of many nations. Transportation has been a tool of territorial control and exploitation, particularly during the colonial era where resource-based transport systems supported the extraction of commodities in the developing world and forwarded them to the industrializing nations of the time. The goal to capture resource and market opportunities was a strong impetus in the setting and structure of transport networks. More recently, port development, particularly container ports, has been of strategic interest as a tool of integration to the global economy as the case of China illustrates. There is a direct relation between foreign trade and container port volumes, so container port development is commonly seen as a tool to capture the opportunities brought by globalization. Further, technological and commercial developments have incited a greater reliance on the oceans as an economic and circulation space. Due to demographic pressures and increasing urbanization, developing economies are characterized by a mismatch between limited supply and growing demand for transport infrastructure. While some regions benefit from the development of transport systems, others are often marginalized by a set of conditions in which inadequate transportation plays a role. Transport by itself is not a sufficient condition for development. However, the lack of transport infrastructures can be seen as a constraining factor on development. In developing economies, the lack of transportation infrastructures and regulatory impediments are jointly impacting economic development by conferring higher transport costs, but also delays rendering supply chain management unreliable. A poor transport service level can negatively affect the competitiveness of regions and corporations and thus have a negative impact on the regional added value and employment. In 2007, the World Bank published its first ever report which ranked nations according to their logistics performance based on the Logistics Performance Index. Investment in transport infrastructures is thus seen as a tool of regional development, particularly in developing countries. Transport investments also tend to have declining marginal returns. While initial infrastructure investments tend to have a high return since they

provide an entirely new range of mobility options, the more the system is developed the more likely additional investment would result in lower returns. At some point, the marginal returns can be close to zero or even negative, implying a shift of transport investments from wealth producing to wealth consuming. A common fallacy is assuming that additional transport investments will have a similar multiplying effect than the initial investments had, which can lead to capital misallocation. The most common reasons for the declining marginal returns of transport investments are:

- **High accumulation of existing infrastructure**. In a context of high level of accessibility and transportation networks that are already extensive, further investments usually result in marginal improvements. This means that the economic impacts of transport investments tend to be significant when infrastructures were previously lacking and tend to be marginal when an extensive network is already present. Additional investments can thus have limited impact outside convenience.

- **Economic changes**. As economies develop, their function tends to shift from the primary (resource extraction) and secondary (manufacturing) sectors towards advanced manufacturing, distribution and services. These sectors rely on different transport systems and capabilities. While an economy depending on manufacturing will rely on road, rail and port infrastructures, a service economy is more oriented towards the efficiency of logistics and urban transportation. In all cases transport infrastructure are important, but their relative importance in supporting the economy may shift.

- **Clustering**. Due to clustering and agglomeration, several locations develop advantages that cannot be readily reversed through improvements in accessibility. Transportation can be a factor of concentration and dispersion depending on the context. Less accessible regions thus do not necessarily benefit from transport investments if they are embedded in a system of unequal relations.

Therefore, each transport development project must be considered independently and contextually. Since transport infrastructures are capital intensive fixed assets, they are particularly vulnerable to misallocations and malinvestments.

The standard assumption is that transportation investments tend to be more wealth producing as opposed to wealth consuming investments such as services. Still, several transportation investments can be wealth consuming if they merely provide convenience, such as parking and sidewalks, or service a market size well below any possible economic return, with for instance projects labeled "bridges to nowhere". In such a context, transport investment projects can be counterproductive by draining the resources of an economy instead creating wealth and additional opportunities. Since many transport infrastructures are provided through public funds, they can be subject to the pressures of special interest groups, which can result in poor economic returns. Efficient and sustainable transport markets and systems play a key role in regional development although the causality between transport and wealth generation is not always clear.

Types of Transportation Impacts

The relationship between transportation and economic development is difficult to formally establish and has been debated for many years. In some circumstances transport investments appear to be a catalyst for economic growth while in others, economic growth puts pressures on existing transport infrastructures and incite additional investments. In a number of regions around the world, transport markets and related transport infrastructure networks are seen as key drivers in the promotion of a more balanced and sustainable development, particularly by improving accessibility and the opportunities of less developed regions or disadvantaged social groups. At start there are different impacts on the transport providers (transport companies) and the transport users. There are several layers of activity that transportation can valorize, from a suitable location that experiences the development of its accessibility through infrastructure investment to a better usage of existing transport assets through more efficient management. This is further nuanced by the nature, scale and scope of possible impacts:

- **Timing of the development**. The impacts of transportation can precede (lead), occur during (concomitantly) or take place after (lag) economic development. The lag, concomitant and lead impacts make it difficult to separate the

specific contributions of transport to development. Each case appears to be specific to a set of timing circumstances that are difficult to replicate elsewhere.

- **Types of impacts**. They vary considerably as the spectrum ranges from the positive to the negative. Usually transportation investments promote economic development while in rarer cases they may hinder a region by draining its resources in unproductive transportation projects.

Cycles of economic development provide a revealing conceptual perspective about how transport systems evolve in time and space as they include the timing and the nature of the transport impact on economic development. This perspective underlines that after a phase of introduction and growth, a transport system will eventually reach a phase of maturity through geographical and market saturation. There is also the risk of overinvestment, particularly when economic growth is credit driven, which can lead to significant misallocations of capital. The outcome is a surplus capacity in infrastructures and modes creating deflationary pressures that undermines profitability. In periods of recession that commonly follow periods of expansion, transportation activities may experiment a setback, namely in terms of lower demand and a scarcity of capital investment. Transport, as a technology, typically follows a path of experimentation, introduction, adoption and diffusion and, finally, obsolescence, each of which has an impact on the rate of economic development. The most significant benefits and productivity gains are realized in the early to mid diffusion phases while later phases are facing diminishing returns. Containerization is a relevant example of such a diffusion behavior as its productivity benefits were mostly derived in the 1990s and 2000s when economic globalization was accelerating. Many technologies go through what can be called a "hype phase" with unrealistic expectations about their potential and benefits and many are eventually abandoned as the technology proves ineffective at addressing market or operational requirements, or is simply too expensive for the benefits it conveys. Since transportation is capital intensive, operators tend to be cautious before committing to new technologies and the significant sunk costs they require. In addition, transport modes and infrastructures are depreciating assets that

constantly require maintenance and upgrades. At some point, their useful lifespan is exceeded and the vehicle must be retired or the infrastructure rebuilt. Thus, the amortization of transport investments must consider the lifespan of the concerned mode or infrastructure.

Transportation as an Economic Factor

Contemporary trends have underlined that economic development has become less dependent on relations with the environment (resources) and more dependent on relations across space. While resources remain the foundation of economic activities, the commodification of the economy has been linked with higher levels of material flows of all kinds. Concomitantly, resources, capital and even labor have shown increasing levels of mobility. This is particularly the case for multinational firms that can benefit from transport improvements in two significant markets:

- Commodity market. Improvement in the efficiency with which firms have access to raw materials and parts as well as to their respective customers. Thus, transportation expands opportunities to acquire and sell a variety of commodities necessary for industrial and manufacturing systems.
- Labor market. Improvement in the access to labor and a reduction in access costs, mainly by improved commuting (local scale) or the use of lower cost labor (global scale).

Transportation provides market accessibility by linking producers and consumers so that transactions can take place. A common fallacy in assessing the importance and impact of transportation on the economy is to focus only on transportation costs, which tend to be relatively low; in the range of 5 to 10% of the value of a good. Transportation is an economic factor of production of goods and services, implying that it is fundamental in their generation, even if it accounts for a small share of input costs. This implies that irrespective of the cost, an activity cannot take place without the transportation factor. Thus, relatively small changes in transport cost, capacity and performance can have substantial impacts on dependent economic activities.An efficient transport system with modern infrastructures favors

many economic changes, most of them positive. The major impacts of transport on economic factors can be categorized as follows:

- Geographic specialization. Improvements in transportation and communication favor a process of geographical specialization that increases productivity and spatial interactions. An economic entity tends to produce goods and services with the most appropriate combination of capital, labor, and raw materials. A region will thus tend to specialize in the production of goods and services for which it has the greatest advantages (or the least disadvantages) compared to other regions as long as appropriate transport is available for trade. Through geographic specialization supported by efficient transportation, economic productivity is promoted. This process is known in economic theory as comparative advantages.

- **Large scale production**. An efficient transport system offering cost, time and reliability advantages enables goods to be transported over longer distances. This facilitates mass production through economies of scale because larger markets can be accessed. The concept of "just-in-time" in supply chain management has further expanded the productivity of production and distribution with benefits such as lower inventory levels and better responses to shifting market conditions. Thus, the more efficient transportation becomes, the larger the markets that can be serviced and the larger the scale of production. This results in lower unit costs.

- **Increased competition**. When transport is efficient, the potential market for a given product (or service) increases, and so does competition. A wider array of goods and services becomes available to consumers through competition which tends to reduce costs and promote quality and innovation. Globalization has clearly been associated with a competitive environment that spans the world and enables consumers to have access to a wider range of goods and services.

- **Increased land value**. Land which is adjacent or serviced by good transport services generally has greater value due to the utility it confers to many activities. Consumers can have access to a wider range of services and retail goods while residents can have better accessibility to employment, services, and social networks,

all of which transcribes in higher land value. In some cases, transportation activities can lower land value, particularly for residential activities. Land located near airports and highways, near noise and pollution sources, will thus be impacted by corresponding diminishing land value.

Transport also contributes to economic development through job creation and its derived economic activities. Accordingly, a large number of direct (freighters, managers, shippers) and indirect (insurance, finance, packaging, handling, travel agencies, transit operators) employment are associated with transport. Producers and consumers take economic decisions on products, markets, costs, location, prices which are themselves based on transport services, their availability, costs and capacity.

2. Transport Costs and Rates

Transport systems face requirements to increase their capacity and to reduce the costs of movements. All users (e.g. individuals, enterprises, institutions, governments, etc.) have to negotiate or bid for the transfer of goods, people, information and capital because supplies, distribution systems, tariffs, salaries, locations, marketing techniques as well as fuel costs are changing constantly. There are also costs involved in gathering information, negotiating, and enforcing contracts and transactions, which are often referred as the cost of doing business. Trade involves transactions costs that all agents attempt to reduce since transaction costs account for a growing share of the resources consumed by the economy. Frequently, enterprises and individuals must take decisions about how to route passengers or freight through the transport system. This choice has been considerably expanded in the context of the production of lighter and high value consuming goods, such as electronics, and less bulky production techniques. It is not uncommon for transport costs to account for 10% of the total cost of a product. This share also roughly applies to personal mobility where households spend about 10% of their income for transportation, including the automobile which has a complex cost structure. Thus, the choice of a transportation mode to route people and freight

between origins and destinations becomes important and depends on a number of factors such as the nature of the goods, the available infrastructures, origins and destinations, technology, and particularly their respective distances. Jointly, they define transportation costs.

Transport costs are a monetary measure of what the transport provider must pay to produce transportation services. They come as fixed (infrastructure) and variable (operating) costs, depending on a variety of conditions related to geography, infrastructure, administrative barriers, energy, and on how passengers and freight are carried. Three major components, related to transactions, shipments and the friction of distance, impact on transport costs.

Transport costs have significant impacts on the structure of economic activities as well as on international trade. Empirical evidence underlines that raising transport costs by 10% reduces trade volumes by more than 20% and that the general quality of transport infrastructure can account for half of the variation in transport costs. In a competitive environment where transportation is a service that can be bided on, transport costs are influenced by the respective rates of transport companies, the portion of the transport costs charged to users.

Rates are the price of transportation services paid by their users. They are the negotiated monetary cost of moving a passenger or a unit of freight between a specific origin and destination. Rates are often visible to the consumers since transport providers must provide this information to secure transactions. They may not necessarily express the real transport costs.

The difference between costs and rates either results in a loss or a profit from the service provider. Considering the components of transport costs previously discussed, rate setting is a complex undertaking subject to constant change. For public transit, rates are often fixed and the result of a political decision where a share of the total costs is subsidized by the society. The goal is to provide an affordable mobility to the largest possible segment of the population even if this implies a recurring deficit (public transit systems rarely make any profit). It is thus common for public transit systems to have rates that are lower than costs and

targeted at subsidizing the mobility of social groups such as students, the elderly or people on welfare.For freight transportation and many forms of passenger transportation (e.g. air transportation) rates are subject to a competitive pressure. This means that the rate will be adjusted according to the demand and the supply. They either reflect costs directly involved with shipping (cost-of-service) or are determined by the value of the commodity (value-of-service). Since many actors involved in freight transportation are private rates tend to vary, often significantly, but profitability is paramount.

Costs and Time Components

Transportation offers a spectrum of costs and level of services, which results in substantial differences across the world. The price of a transport service does not only include the direct out-of-the-pocket money costs to the user but also includes time costs and costs related to possible inefficiencies, discomfort and risk (e.g. unexpected delays). However, economic actors often base their choice of a transport mode or route on only part of the total transport price. For example, motorists are biased by short run marginal costs. They might narrow down the price of a specific trip by car to fuel costs only, thereby excluding fixed costs such as depreciation, insurance and vehicle tax. Many shippers or freight forwarders are primarily guided by direct money costs when considering the price factor in modal choice. The narrow focus on direct money costs is to some extent attributable to the fact that time costs and costs related to possible inefficiencies are harder to calculate and often can only be fully assessed after the cargo has arrived. Among the most significant conditions affecting transport costs and thus transport rates are:

- **Geography**. Its impacts mainly involve distance and accessibility. Distance is commonly the most basic condition affecting transport costs. The more it is difficult to trade space for a cost, the more the friction of distance is important. It can be expressed in terms of length, time, economic costs or the amount of energy used. It varies greatly according to the type of transportation mode involved and the efficiency of specific transport routes. Landlocked countries tend to have higher transport costs, often twice as much, as they do not have direct access to maritime

transportation. The impact of geography on the cost structure can be expanded to include several rate zones, such as one for local, another for the nation and another for exports.

- **Type of product**. Many products require packaging, special handling, are bulky or perishable. Coal is obviously a commodity that is easier to transport than fruits or fresh flowers as it requires rudimentary storage facilities and can be transshipped using rudimentary equipment. Insurance costs are also to be considered and are commonly a function of the value to weight ratio and the risk associated with the movement. As such, different economic sectors incur different transport costs as they each have their own transport intensity. With containerization the type of product plays little in the transport cost since rates are set per container, but products still need to be loaded or unloaded from the container. For passengers, comfort and amenities must be provided, especially if long distance travel is involved.

- **Economies of scale**. Another condition affecting transport costs is related to **economies of scale or the possibilities to apply them** as the larger the quantities transported, the lower the unit cost. Bulk commodities such as energy (coal, oil), minerals and grains are highly suitable to obtain lower unit transport costs if they are transported in large quantities. A similar trend also applies to container shipping with larger containerships involving lower unit costs.

- **Energy**. Transport activities are large consumers of energy, especially oil. About 60% of all the global oil consumption is attributed to transport activities. Transport typically account for about 25% of all the energy consumption of an economy. The costs of several energy intensive transport modes, such as air transport, are particularly susceptible to fluctuations in energy prices.

- **Empty backhauls**. Many transport interactions involve empty backhauls since it is uncommon to have a perfect match between an inbound and a return trip. Commuting patterns involve imbalanced flows and empty return trips. For international trade, imbalances between imports and exports have impacts on transport costs. This is especially the case for container transportation since trade

imbalances imply the repositioning of empty containers that have to be taken into account in the total transport costs. Consequently, if a trade balance is strongly negative (more imports than exports), transport costs for imports tend to be higher than for exports. Significant transport rate imbalances have emerged along major trade routes. The same condition applies at the national and local levels where freight flows are often unidirectional, implying empty backhaul movements.

- **Infrastructures**. The efficiency and capacity of transport modes and terminals has a direct impact on transport costs. Poor infrastructures imply higher transport costs, delays and negative economic consequences. More developed transport systems tend to have lower transport costs since they are more reliable and can handle more movements.

- **Mode**. Different modes are characterized by different transport costs, since each has its own capacity limitations and operational conditions. When two or more modes are directly competing for the same market, the outcome often results in lower transport costs. Containerized transportation permitted a significant reduction in freight transport rates around the world.

- **Competition and regulation**. Concerns the complex competitive and regulatory environment in which transportation takes place. Transport services taking place over highly competitive segments tend to be of lower cost than on segments with limited competition (oligopoly or monopoly). International competition has favored concentration in many segments of the transport industry, namely maritime and air modes. Regulations, such as tariffs, cabotage laws, labor, security and safety impose additional transport costs, particularly in developing countries.

- **Surcharges**. Refer to an array of fees, often set in an arbitrary fashion, to reflect temporary conditions that may impact on costs assumed by the transporter. The most common are fuel surcharges, security fees, geopolitical risk premiums and additional baggage fees. The passenger transport industry, particularly airlines, has become dependent on a wide array of surcharges as a source of revenue.

The transport time component is also an important consideration as it is associated with the service factor of transportation. They include the transport time, the order time, the timing, the punctuality and the frequency. For instance, a maritime shipping company may offer a container transport service between a number of North American and Pacific Asian ports. It may take 12 days to service two ports across the Pacific (transport time) and a port call is done every two days (frequency). In order to secure a slot on a ship, a freight forwarder must call at least five days in advance (order time). For a specific port terminal, a ship arrives at 8AM and leaves at 5PM (timing) with the average delay being six hours (punctuality).

Types of Transport Costs

Mobility is influenced by transport costs. Empirical evidence for passenger vehicle use underlines the relationship between annual vehicle mileage and fuel costs, implying the higher fuel costs are, the lower the mileage. At the international level, doubling of transport costs can reduce trade flows by more than 80%. The more affordable mobility is, the more frequent the movements and the more likely they will take place over longer distances. Empirical evidence also underlines that transport costs tend to be higher in the early or final stages of a movement, also known as the first and the last mile. A wide variety of transport costs can be considered.

Terminal costs. Costs that are related to the loading, transshipment and unloading. Two major terminal costs can be considered; loading and unloading at the origin and destination, which are unavoidable, and intermediate (transshipment) costs that can be avoided. For complex transport terminals, such as ports and airports, terminal costs can involve a wide array of components, including docking / gate fees, handling charges and pilotage / traffic control fees.

Linehaul costs. Costs that are a function of the distance over which a unit of freight or passenger is carried. Weight is also a cost function when freight is involved. They include labor and fuel and commonly exclude transshipment costs.

Capital costs. Costs applying to the physical assets of transportation mainly infrastructures, terminals and vehicles. They include the purchase or major

enhancement of fixed assets, which can often be a one-time event. Since physical assets tend to depreciate over time, capital investments are required on a regular basis for maintenance.

Transport providers make a variety of decisions based on their cost structure, a function of all the above types of transport costs. To simplify transactions and clearly identify the respective responsibilities specific commercial transportation terms have been set. While the transport price plays an important role in modal choice, firms using freight transport services are not always motivated by notions of cost minimization. They often show "satisficing behavior" whereby the transport costs need to be below a certain threshold combined with specific requirements regarding reliability, frequency and other service attributes. Such complexities make it more difficult to clearly assess the role of transport price in the behavior of transport users. The role of transport companies has sensibly increased in the general context of the global commercial geography. However, the nature of this role is changing as a result of a general reduction of transport costs but growing infrastructure costs, mainly due to greater flows and competition for land.

Each transport sector must consider variations in the importance of different transport costs. While operating costs are high for air transport, terminal costs are significant for maritime transport. Several indexes, such as the Baltic Dry Index, have been developed to convey a pricing mechanism useful for planning and decision making. Technological changes and their associated decline in transport costs have weakened the links transport modes and their terminals. There is less emphasis on heavy industries and more importance given to manufacturing and transport services (e.g. warehousing and distribution). Indeed, new functions are being grafted to transport activities that are henceforward facilitating logistics and manufacturing processes.

Relations between terminal operators and carriers have thus become crucial notably in containerized traffic. They are needed to overcome the physical and time constraints of transshipment, notably at ports. The requirements of international trade gave rise to the development of specialized and intermediary firms providing

transport services. These are firms that do not physically transport the goods, but are required to facilitate the grouping, storage and handling of freight as well as the complex paperwork and financial and legal transactions involved in international trade. Examples include freight forwarders, customs brokers, warehousing, insurance agents and banking, etc.

Recently, there has been a trend to consolidate these different intermediate functions, and a growing proportion of global trade is now being organized by multi-national corporations that are offering door to door logistics services. They are defined as third party logistics providers.

3. The Financing of Transportation Infrastructure

Private Participation in Transport Infrastructure

Infrastructures can be funded, implying that the public sector provides capital from general funds or taxation and this capital is not expected to be recovered. Infrastructures can also be financed, mostly by private sources, and in this case capital recovery is expected. Transportation infrastructure, like several infrastructure classes, has a significant level of public involvement ranging from direct ownership and management to a regulatory framework that defines operational standards for dominantly privately owned infrastructure. Conventionally, transportation, particularly roads, was seen as a public good not to be subject to market forces and be free of access. A similar trend applied to port and airport infrastructures that were placed under the management of public authorities. A similar situation applies to rail systems where the infrastructure is dominantly private and where operations are being privatized. Although rail freight has essentially been a private endeavor in the United States, it was significantly regulated by the Interstate Commerce Commission in terms of fares and level of service. In many jurisdictions the government roles involve well defined responsibilities that are not expected to change. Rail terminals are mostly managed by private rail operators while the warehousing / distribution industry is almost completely private.

Like many civil engineering sectors, the private sector can be involved in transportation project delivery, which can include design and construction, project management such as maintenance and operations and project financing, namely raising capital. Contemporary transportation infrastructure financing is facing the following challenges:

- **Lack of funding**. Transport funding initiatives are generally not sufficient for maintaining and improving the performance of transport systems. This was a major driver behind privatization and deregulation in the passenger and freight transport industries worldwide. The infrastructure financing model is gaining momentum.
- **Divergence of purpose**. Transport finance initiatives should be designed to promote productivity gains, such as increased accessibility, capacity and performance. Many investment projects are politically instead of commercially driven, which creates a divergence in the purpose of transportation.
- **Uncertainty in outcome**. Transport finance initiatives differ in their probable impacts on transport system performance. This underlines the difficulty of assessing multiplying effects linked with specific infrastructure investment projects.
- **Time frame misalignment**. There is often a misalignment between the time range of the infrastructure project and the time range of the financing. This underlines the paradigm between the long term character of infrastructure and the short term perspective prevailing in finance.

The trend towards greater private involvement in the transportation sector initially started with the privatization (or deregulation) in the 1980s of existing transportation firms. New relationships started to be established with financial institutions since public funding and subsidies were substantially reduced and new competitors entered the market. Then, many transportation firms were able to expand through mergers and acquisitions into new networks and markets. Some, particularly in the maritime and terminal operation sectors, became large multinational enterprises controlling substantial assets and revenues. As the freight transport sector became increasingly efficient and profitable it received the attention

of large equity firms in search of returns on capital investment. The acquisition costs of intermodal terminals, particularly port facilities, has substantially increased in recent years as large equity firms are competing to acquire facilities with secure traffic (and thus low risks). A new wave of mergers and acquisitions took place at the global and national levels as equity firms see terminals as an asset class with different forms of value proposition:

- **Asset (intrinsic value)**. Globalization and the growth of international trade have made many terminal assets more valuable since they are key elements in establishing and maintaining global supply chains. Terminals occupy premium locations conferring accessibility to either maritime, rail or road transport systems. These locations, such as waterfronts, are rare and cannot easily (if at all) be substituted for other locations. Traffic growth is commonly linked with valuation growth of a transport infrastructure since the same amount of land generates a higher income. Thus, terminals and some transport infrastructure are seen as fairly liquid assets with an anticipation that they will gain in value.

- **Source of income (operational value)**. In addition to be an asset, intermodal terminals also guarantee a source of income linked with the traffic volume they handle. They have a constant revenue stream with a fairly limited seasonality (unlike many bulk terminals), which make terminals particularly attractive in light of substantial traffic growth that most terminal facilities have experienced. Traffic growth expectations result in income growth expectations.

- **Diversification (risk mitigation value)**. Intermodal terminals offer a form of functional and geographical asset diversification for a holding company and help lower risks. Terminals represent an asset class on their own. They also offer a potential of geographical diversification as holding terminals at different locations help mitigate risks linked with a specific regional or national market. Financial problems related to the residential real estate sector are likely to incite many holding companies to diversify their assets, even outside the United States.

Causes and Forms of Public Divesture

Facing the growing inability of governments to manage and fund transport infrastructure, the last decades has seen deregulation and more active private participation. Many factors have placed pressures on public officials to consider the privatization of transport infrastructure, including terminals:

- **Fiscal problems**. The level of government expenses in a variety of social welfare practices is a growing burden on public finances, leaving limited options but divesture. Current fiscal trends clearly underline that all levels of governments have limited if any margin and that accumulated deficits have led to unsustainable debt levels. The matter becomes how public entities default on their commitments. Since transport infrastructures are assets of substantial value, they are commonly a target for privatization. This is also known as "monetization" where a government seeks a large lump sum by selling or leasing an infrastructure for budgetary relief.

- **High operating costs**. Mainly due to managerial and labor costs issues, the operating costs of public transport infrastructure, including maintenance, tend to be higher than their private counterparts. Private interests tend to have a better control of technical and financial risks, are able to meet construction and operational guidelines as well as providing a higher quality of services to users. If publicly owned, any operating deficits must be covered by public funds, namely through cross-subsidies. Otherwise, users would be paying a higher cost than a privately managed system. This does not provide much incentives for publicly operated transport systems to improve their operating costs as inefficiencies are essentially subsidized by public funds. High operating costs are thus a significant incentive to privatize.

- **Cross-subsidies**. Several transport infrastructures are subsidized by revenues from other streams since their operating costs cannot be compensated by existing revenue. For instance, public transport systems are subsidized in part by revenues coming from fuel taxes or tolls. Privatization can thus be a strategy to end cross-subsidizing by taping private capital markets instead of relying on public debt. The subsidies can either be reallocated to fund other projects (or pay existing debt) or removed altogether, thus reducing taxation levels.

- **Equalization**. Since public investments are often a political process facing pressures from different constituents to receive their "fair share", many investments come with "strings attached" in terms of budget allocation. An infrastructure investment in one region must often be compensated with a comparable investment in another region or project, even if this investment may not be necessary. This tends to significantly increase the general cost of public infrastructure investments, particularly if equalization creates non-revenue generating projects. Thus, privatization removes the equalization process for capital allocation as private enterprises are less bound to such a forced and often wasteful redistribution.

One of the core goals of privatization concerns the derived efficiency gains compared to the transaction costs of the process. Efficiency gains involve a higher output level with the same or fewer input units, implying a more productive use of the infrastructure. Transaction costs are the costs related to the exchange (from public to private ownership) and could involve various buyouts, such as compensations for existing public workers. For public infrastructure, they tend to be very high and involve delays due to the regulatory changes of the transaction.

Privatization and Financing Models

Once privatization is considered, an important issue concerns which form it will take. There are several options ranging from a complete sale of the infrastructure to a management contract where the public sector retains ownership and a share of the revenues. Three forms of privatization are particularly dominant:

- **Sale or concession agreement (lease) of existing facilities**. Divesture is part of a political agenda which began with deregulation. As discussed before, budget relief is sought because of mismanagement; the public sector is essentially forced to sell or lease some of its infrastructures. For a sale, the infrastructure is transferred on a freehold basis with the requirement that it will be used for its initial purpose, unless another agreement was negotiated and in this case the outcome is an abandonment of the infrastructure. This is the case when an infrastructure is obsolete and it is more suitable to build a new one at another more suitable site. For a concession agreement, it commonly takes the form of a long term lease with the

requirement that the concessionaire maintains, upgrade and build infrastructure and equipment.

- **Concessions for new projects**. Tap new sources of capital outside conventional public funding. It can take place in the context of fiscal restraints or as a way to experiment with a more limited form of privatization since existing assets remain untouched. It also confers the advantage of getting the latest technical and managerial expertise for the infrastructure project.
- **Management contract**. While ownership remains public, management is given to a private operator, commonly through a bidding process. This strategy has been particularly popular in the terminal operation business as many rail and maritime terminals are managed by private operators who do not own the facilities but have long term leases. The outcome commonly involves efficiency improvements.

Concessions are a simple and fair strategy involving a bidding process, which underlines the importance to have it take place in a transparent and open way. This is particularly relevant in the current context as retirement funds, sovereign wealth funds, investment banks and other financial institutions are increasingly involved in the funding of transportation infrastructure. A lack of transparency can be perceived negatively by the general public and can transform a simple transaction into a complex political process. Since some concessions are set over long time periods (50-75 years), they bring the issue of changing market conditions that may force a renegotiation of the contract. It is next to impossible to foresee long term market changes and traffic levels, so a provision for renegotiation should be considered in concession agreements. Again, this renegotiation can be subject to controversy and public debate, particularly if performed in an un-transparent manner.

Due to their nature and function, several other forms of privatization can be established for intermodal freight terminals. Considering that intermodal terminals have an intensive use of equipment, leasing agreements are an important dimension of privatization and of the strategies of existing private infrastructure operators.

Limitations of Private Capital

Even if public and private actors have established institutional and finance arrangements, many have been hard pressed to meet the demands imposed by growing volumes of passengers and freight traffic. Shifts in regional and global patterns of trade patterns associated with trade agreements and globalization have also created pressures to develop infrastructures supporting global supply chains.

A challenge resides in identifying the respective roles and competencies of the public and private sectors, which varies substantially depending on the concerned mode. Although a level of privatization is commonly perceived as a desirable outcome for the efficient use and operation of transportation infrastructures, privatization comes with limitations. In some instances privatization can be unsuccessful. The main reasons are linked with the private contractor unable to honor the commitments (which is rare) or the new cost structure is perceived to be unfair by users since the privatized infrastructure now offers market pricing (more common). If customers are used to low and subsidized costs they will not well respond to market prices, particularly if they are not introduced in an incremental manner. Although private initiatives commonly result in efficiency gains, private capital involves many limitations concerning capital costs and the issue of domestic versus foreign capital:

- **Capital costs**. Nominal costs for private capital are often higher than for public debt, since the later is guaranteed by the full faith in the credit of the state. This can create a moral hazard as the capital costs and their risks are transferred to the public in terms of guarantees to cover operating costs (cross-subsidy) or bail-outs in case of default. This process is very common in a variety of public enterprises which is spite of acute losses operate on the assumption that their financial shortfalls will be covered by the state. Thus, depending on the size and capitalization of a transport operator, capital costs can be higher than for a public counterpart.

- **Domestic vs. foreign finance**. Local private capital markets can be very limited, particularly in developing countries. Transportation assets are also so substantial that they are only accessible to the largest equity firms. Modern

transportation infrastructure projects are easily beyond the range of local and regional governments. Finance can thus be tapped from foreign markets. Even in the United States, terminal assets are mainly accessible only to a few large equity firms, many of which are foreign owned. This can be controversial as the case of Dubai Ports World purchasing the port terminal assets of P&O in 2006 demonstrated. Because of political pressures DPW was forced to sell the American port assets of the transaction to the AIG holding company. Fluctuations in exchange rates can also be a significant risk factor, but if a currency is undervalued (debased), investments can pour in to take advantage of the discount to capture valuable and revenue generating assets.

Private - Public Partnerships

Public – private partnerships (PPP) are contractual agreements between a public agency (federal, state or municipal) and a private sector entity that allow for the design, building, operation or financing of transport infrastructure. They thus confer a wide range of options in terms of capital allocation and respective levels of participation. They can simply cover the standard design / build contracting process common in many road projects or involve innovative approaches where a private operator takes charge of the construction and management of a transport infrastructure over a long term concession. This business model has been in use for centuries, particularly in the public utilities sector.

PPP take place in situations where stakeholders alone cannot clearly evaluate the respective advantages of the investment and find it too risky to finance. The public sector thus helps leveraging the position of the private sector, which commonly results in a better allocation of resources than if they would have done so independently. While the public perception tends to relate PPP to toll roads, the reality places these initiatives in every segment of the transportation industry from modes to terminals. PPP take a particular dimension in the freight sector as freight transportation is much the realm of the private sector with public interests mainly covering the regulatory framework. The most significant infrastructure assets are related to freight transport terminals, particularly ports and rail, a reason why they

are dominantly owned or operated by large private interests, which makes public involvement problematic. There is thus a conventional approach to PPP which is gradually been supplemented by an emerging framework where private entities are taking a higher level of responsibility, so the term private - public partnerships appears increasingly more appropriate.

However, like most initiatives where governments are involved, there are unintended consequences, implying a difference between the expected and the real outcomes. The two most prominent unintended consequences of a PPP involve undermining innovation and risk:

- **Innovations**. Since a PPP results in less competition as the private company is securing an intrinsic monopoly, there are limited incentives to innovate, particularly for the purpose of reducing operating costs. Innovations, such as new management methods and new infrastructures, may also be impaired by regulations and conditions related to the contract. Therefore, as long as the contract remain effective, inertia (status quo) will endure, which means that long term contracts can become factors delaying innovation. It can also be expected that investment capital commonly the outcome of the accumulation of profits would come from the public sector. Since governments often put maximum profits clauses in contracts (windfall profits), there are limited incentives to use innovations to increase productivity and profits above the arbitrary threshold.

- **Risk**. Strategies involved in the exploration of new market opportunities, such as new services for customers, are common business practices and always involve a level of risk. While a PPP may reduce several risk factors because of the implicit public support, both from a financial and regulatory perspective (the government retains its potential to tax and coerce to achieve its goals), the abatement of risks also has unintended consequences. The goal becomes compliance to government policies at the expense of focusing on new opportunities and mitigating the associated risk. Thus, the rewards of risk taking are essentially removed. This can be seen as a reverse form of moral hazard where a government guarantee undermines the risk taking behavior of private enterprises.

4. Airline Pricing

Air cargo is generally sold for a fixed price or a fixed rate per kilogram, often with a minimum charge to cover basic expenses of shipment handling. Customers (forwarders) with a continuous demand of space on one or more specific routes, or with a continuous turnover with the airline overall, will negotiate and contract their own space and pricing details with the airline. Sometimes also so-called 'spot rates' can be requested for ad-hoc shipments. And it is also possible the airline offers special rates to assure the aircraft's capacity will be filled. Take a look here on ezinearticles if you want to know a bit more about by whom and how air freight rates are calculated. Basic air cargo rules and rates are laid down in IATA's TACT (The Air Cargo Tariff) ; rates are negotiable based on your shipped volumes and on capacity vs demand on the requested routes.

An important factor in air cargo pricing (with the airlines, but also with the large integrators DHL, FedEx, UPS and TNT) is the dimensional weight conversion. As stated here on Wikipedia: by charging only by weight, lightweight, low density packages become unprofitable for freight carriers due to the amount of space they take up in the (often very expensive) truck/aircraft/ship capacity in proportion to their actual weight. The concept of Dimensional Weight has therefore been adopted by the transportation industry worldwide as a uniform means of establishing a minimum charge for the cubic space a package occupies. Therefore the volume is converted into a (higher) weight / price class. Take a look here on Export911 to see the weight or measure factors for different transport modes.

Another factor in air cargo pricing are the surcharges that can be added by the airline (and therefore also the forwarder). A fuel surcharge can be added to cover the additional costs of increasing fuel-prices ; these will generally follow a certain index. A security surcharge can be added to cover the additional costs of the increasing number of security checks and related administration that are legally required by the authorities.

There is a lot of discussion these days whether or not these costs should actually be a part of the overall air cargo rate, as these surcharges tend to be even higher than the actual air cargo rate sometimes.

Of course the airline will try to optimize their expensive cargo capacity on board of the aircraft, and try to sell this capacity at the highest revenues. This is called airline cargo revenue management ; look at some of the principles and challenges for this here in Sabre Airline Solutions' Whitepaper

Cargo airport economics

The opportunities for establishing a cargo-intensive airport are limited by economics. Without revenues from passenger flights, it is difficult to operate an existing airport much less develop a new airport. For example, an airport capable of supporting all-weather operations and handling wide-bodied aircraft would require a runway of 3,200-3,500 meters with a parallel taxiway, and air traffic control systems including ILS. The cost for the runway and taxiways is on the order of $100–200 million including earth moving but not land acquisition, which can be considerable since airports typically require at least 1,500 hectares, With a cost of capital of 10 percent and an annualized maintenance cost including renewals, of 1.5 percent=2 percent, of capital cost, the average cost for the airside infrastructure would be $13–27 million per year. Adding the costs for airside structures and equipment plus the basic terminal operations including traffic control, safety, security, and administration, a simple cargo airport would cost as least $15–32 million per year.

The revenues from aeronautical fees would be derived primarily from landing fees and parking fees. For a wide-bodied aircraft, these would be on the order of $2,000–3,000.22 Assuming that the typical aircraft transfers an average of 50–70 tons per landing, this would amount to $30–60 per ton of cargo. In order to cover the basic airport costs, a minimum annual volume of about 0.5-1.0 million tons (60–120 aircraft movements per day) would be required. For an existing airport, which is converted to cargo operations, the costs would be less. Assuming that the conversion cost is 1/4 of the capital cost for a new airport, this implies a minimum

annual volume of 175–400 thousand tons. In 2006, only 115 airports reported handling cargo volumes in excess of 150,000 tons.

For the same airport with a mix of passengers and freight, a large part of the airside cost would be covered from the aeronautical fees for scheduled passenger flights. Assuming an average of 120 passengers per aircraft movement23 with slightly lower aeronautical fees reflecting the wider range of aircraft, a million passengers would generate $5.2-$6.5 million thereby covering 1/5–1/3 of the costs for a new airport but a majority of the costs for a converted airport.24 In 2006, there were over 470 airports that handled in excess of 1 million passengers. While the operating costs for a passenger airport, which includes the passenger terminal and baggage handling systems, are much higher, these costs are usually covered by a combination of passenger charges and fees for parking and other concession.

While the economics of all-cargo airports are difficult, the principal impediment to the establishment of these airports is the economics of the airlines. The integrators are the only freight airlines with sufficient volumes to reach the scale of operations necessary to cover even the operating costs of the airport, let alone debt service, on the initial outlay. With the exception of Alliance, every one of their all-cargo airports was an underutilized brown-field, rather than green-field site. Also, all-cargo airports must capture sufficient domestic cargo. This typically requires participation of the national passenger airlines that carry the local cargo but are reluctant to use an all cargo airport offering less frequency and route diversity.

5. Maritime Economics

An important feature of the economics of shipping relates to its capital costs, which requires financing. Because of their size, ships represent a significant capital outlay. Cruise ships represent the most expensive class of vessels, with an Oasis Class cruise ship costing $1.2 billion, but even container ships of the largest class represent an initial capital outlays of $190 million. The annual cost of servicing the purchase of these vessels represents the largest single item of operating expenditures, typically accounting for over half of the annual operating costs. Container shipping requires the deployment of many vessels to maintain a regular

service (14 ships in the case of a typical Far East – Europe service), which is a severe constraint on the entry of new players. On the other hand, older second-hand vessels may be purchased for much smaller amounts, and sometimes the purchase price can be easily covered by a few successful voyages. In some regards, therefore, the shipping industry is quite open and historically has provided opportunities for entrepreneurs to accumulate large fortunes. Many of the largest fleets are in private hands, owned by individuals or by family groups.

The main advantage of maritime transportation is obviously its economies of scale, making it the cheapest per unit of all transport modes, which fits well for heavy industrial activities. On the other hand, maritime transportation has one of the highest entry costs of the transport sector. This is part of the maritime life cycle that includes building, registration, operations and the final scrapping of the ship. Typically, a ship has an economic life between 15 and 20 years and thus represents a significant investment that must be amortized. For instance, a Panamax containership can cost $50,000 per day to operate with most of the expenses related to fuel and port charges. The operation of the maritime transport system requires financing that can come from two sources:

- **Public**. The public sector is commonly responsible for guidance infrastructures (beacons and charts), public piers, dredging, security and in several cases of the administration of ports (under the umbrella of port authorities).
- **Private**. The private sector is mostly concerned about specific facilities such as piers, transshipment infrastructures and ships, which are commonly owned by private maritime companies.

In the past, governments have intervened, often massively, in the maritime sector to fulfill different goals such as economic development, national defense, prestige, balance of payments, and the protection of the national industry. To reach those goals, governments relied on methods such as regulations, subsidies, national fleets, preference of cargo and ports of entry.

Cabotage regulations have been one of the privileged measures to protect the national maritime transportation industry.

Cabotage. Transport between two terminals located in the same country irrespective of the country in which the mode providing the service is registered. Cabotage is often subject to restrictions and regulations. Under such circumstances, each nation reserves for its national carriers the right to move domestic freight or passengers traffic.

Many cabotage laws were implemented, such as the Passenger Services Act of 1886, which placed cabotage restrictions on seaborne passenger travel in the United States. In the same line, the Merchant Marine (Jones) Act of 1920 implemented cabotage regulations for freight. The emergence of short sea shipping has challenged this setting in recent years. Defining short sea shipping is complex as it can involve different vessels (container feeder vessels, ferries, fast ships, etc..), tramp or liner operations, a variety of cargo handling techniques (horizontal, vertical or a mixture of both) and different types of ports of loading or discharge. In an intermodal freight context, two major types of short sea shipping can be distinguished:

The Economic Impacts of Port Investments

Ports and Economic Change A port generally offers a value proposition to its regional since it offers economic and social benefits, but is also prone to environmental constraints. Significant increases in port throughput, particularly in the containerized sector, have put pressures for the development of new port infrastructures on existing facilities, and also for entirely new developments when additional capacity cannot be developed on existing sites. Ports are capital intensive infrastructures that are associated with a wide array of economic impacts. Port development and world trade are closely interrelated. There are numerous expectations by the public sector, which is often providing substantial capital investments (through the port authority or general funds), to see concrete and measurable economic impacts and benefits resulting from these investments. However, the existing literature is relatively scarce about the formal impacts of ports on regional development. Evidence is usually related to a single port over a narrow range of impacts, which makes general assessments difficult to make. Economic

impacts concern the wide range of changes brought buy infrastructure investment projects while economic benefits tend to be directly measurable impacts in terms of a monetary value. However, many of these impacts can only be observed after the investments have been made and the benefits measured. An ex-ante (forecasting) exercise is hazardous and commonly lead to inaccurate assessments. Port forecast models are rarely accurate. The bottom line is that the estimation of economic impacts of port investments is an inexact field, which focus on the effectiveness of transport infrastructure as a catalyst of indirect and induced benefits. Further, these investments are contingent to the scale and scope of changes in which they are taking place. Among the most relevant changes that have impacted ports and maritime transport:

- **Economic changes**. Seaborne trade has increased substantially, in part because of the massive redistribution of manufacturing to low cost locations (outsourcing) and in part because of ongoing economic growth. This underlines the growing importance of logistics to organize the resulting complex distribution system.

- **Technical changes**. The growth in ship size to better achieve economies of scale has been a prevalent technical change, particularly since the 1990s when post-Panamax containerships were first introduced. There is also a growing level of ship specialization (containerships, bulk carriers, car carriers, and even cruise ships) that required dedicated port terminal facilities. All of the above has been placing pressures on ports to upgrade and improve their facilities.

- **Organizational changes**. The maritime and port industry are increasingly controlled by large shipping companies and terminal operators that have engaged in strategic alliances as well as mergers and acquisitions. Their goal is to provide a level of vertical and horizontal integration, which is improving the performance of the port transport chain. This has led in a number of ports to the setting of inland terminals.

The outcome of these changes have involved port developments that are more capital intensive, while relying on less labor and consuming more land. The

imperatives of maritime shipping companies have been felt on ports as they increasingly tend to compete to attract traffic, particularly since hinterlands tend to be more contested. The industry is expecting lower tariffs and lower port times in light of a highly competitive environment and low profit margins. Ports acting in a monopolistic fashion are finding themselves with less leverage, with negative impacts on their activity and regional economies. The spatial framework of the port is also changing. Many port areas have seen the relocation of port industries to new sites, either within the region or to another country altogether. These changes have been associated with a dislocation of the relationships of many ports with their localities and regions; this has been labeled as port regionalization. While the port remains a strategically important infrastructure, its economic benefits are less directly apparent within the community with weaker but more complex relations at the regional versus global levels. The impacts of port infrastructure investments are expect of a positive influence of port throughput on local economic development. However, evidence across the world underlines that this influence is weak, with elasticity levels between throughput and employment that are typically less than 0.05 jobs per 100 tons. This implies growth in traffic volumes are not associated with significant direct gains in employment. This elasticity is among the weakest in the transport sector, particularly in regard to airports, which are the infrastructure with the highest elasticity. Still, the employment impacts of ports are positive and are usually higher for the service sector than for the industrial sector. Empirical evidence underlines that port infrastructure investment projects do foster economic development and are important when a port is nearing its operational capacity. Under such circumstances, the lack of investments will clearly lead to additional externalities, namely congestion, which will undermine the competitiveness of a whole region, if not a nation.

The Economic Benefits of Ports: Direct, Indirect and Induced Effects

Several economic impacts of port infrastructure investments obviously result into economic benefits. Economic theory often refers to ports as important factors of economic development, particularly from an historical standpoint where they

promoted commerce and the welfare of nations. It is not surprising to realize that most of the world's major cities are port cities, even if in many cases port activity now plays a rather small role in the general economic framework of their regions. The basic argument is that ports expand the market opportunity of both national and international firms. By expanding the market areas of firms, ports increase competition, resulting in lower prices for the consumers of the port traffic. These involve all sectors of economic activity, including manufacturing firms, heavy industries, resource extraction industries or retailers. Therefore, the economic benefits of ports are specific to the nature of the hinterland they service. They can be straightforward for hinterlands heavily dependent on resources, since the output is directly handled by the port, or more nuanced when the hinterland is involving manufacturing firms producing intermediate goods. Increasing competitiveness brought by port investments can also be a double-edged sword for a national economy. It enables foreign firms to better access a national economy and thus compete with national firms, with some sectors being put out of business. However, the benefits of having better access to foreign markets and cheaper goods usually far exceeds the risk of having inefficient national firms being undermined. At the aggregate level, increasing competitiveness promotes positive economic benefits, but these benefits are not uniformly distributed among sectors and geography. Ports can be considered as "funnels" to economic development since they act as a catalyst and incite development to take place in specific economic sectors and locations nearby ports or along corridors. The economic benefits of ports are commonly categorized as direct, indirect and induced. Indirect and induced benefits are far from being clearly identifiable since it is difficult to demonstrate that the economic activity and use of the related resources would only occur as a result of the port investment. When port investment does lead to increased economic activity, the benefit is properly measured by the net value of the additional output. The direct benefits to the port are financial in nature and would be taken into account in any financial appraisal as well as in economic appraisals. However, the financial

benefits would be valued somewhat differently, with economic appraisals using a social discount rate and for some inputs possibly valuing them at shadow prices.

Assessing the Economic Benefits of Port Investments

The economic benefits of ports are usually measured at an aggregate level by indicators such as value added, employment, taxation revenue and return on investment. These indicators are primordial for the decision to invest in port development and must take into consideration:

- **Demand forecasts** trying to evaluate the expected traffic that the investment will support and facilitate.
- **Liner shipping strategies**, particularly how they service markets and how the port fits within their service configuration in terms of ship capacity and frequency. While some ports are acting as load centers, others are transshipment hubs. The function of transshipment is often the outcome of the strategy of a shipping company to service specific regions.
- **Hinterland transport** capacity and accessibility is contingent to the cargo that is bound to and originating from the port. It defines the existing and potential cargo base that could be handled by the port.
- **Competition between terminals**, since there may be competing terminals within the same port facility. Terminals in a monopolistic situation usually have more pricing power but can be linked with higher returns.
- **Financing of investment** relates to the capital source and conditions. Large port infrastructure projects are usually financed by bonds issued by port authorities or by investments made by international financial institutions such as development banks, sovereign wealth funds or pension funds.

Assessing this information can involve different methodologies:

- **Surveys** based on interviews and questionnaires or microeconomic data on firms. They try to identify and quantify the relationships between the various port actors, often from a qualitative perspective, but commonly in terms of employment. These studies have underlined the important relationships between freight

forwarders and agents and that the economic benefits of ports are reflected in the complex system of transactions of the actors involved.

- **Input-output models** that seek to identify inter-sectorial multipliers, such as between port traffic and regional employment. They underline the agglomerating effects of port activities, either around the port or around the port region. Such studies have underlined low levels of elasticity between port traffic and service sector employment.

- **Comparative analysis** inferring economic benefits observed at a reference port, particularly its economic base. This approach tries to infer the economic changes that have already taken place in a comparable port setting (similar traffic and composition of traffic) to the port being investigated. Since local and regional economic conditions are not similar, such studies do not provide particularly accurate results. Still, they provide useful guidelines about what could happen to a port and its regional economy once an investment takes place.

Port activities have multiplying effects within an economy, which are much larger than the port itself. While the economic importance of port grows, particularly for the sectors they are connected to, their relative importance within the region they are servicing is often declining. There are thus diminishing total economic benefits for a regional economy as this economy grows and become more complex. The following are the most commonly observed economic benefits of ports on regional employment:

- Port throughput is in general positively related to employment in port regions, implying that the higher the throughout the more employment. Employment impacts are more substantial in the industrial than in the service sector.

- Employment impacts vary by commodity sectors. Container and break bulk traffic have usually twice the employment impact than dry and liquid bulk traffic.

- Private ports usually have more regional employment impacts than public ports since they are usually servicing commercial supply chains.

- Each direct port employment is commonly associated with about 3 to 4 indirect jobs, although such figures vary widely according to the surveys and the context. There is limited empirical evidence about job multiplier figures.

However, the economic benefits per unit of port cargo handled, either in terms of employment or economic activity, usually increase with economic growth. The lower relative benefits of port investments are thus masked by economic growth, while in fact the economic importance of ports is increasing. The economic benefits are less directly related to port activities, but more related to the dynamics of the supply chains they support. This support becomes operational and functional, a benefit which is as crucial to national competitiveness. Therefore, global trends underline a decline of the direct economic benefits of ports, but a notable rise in their indirect and induced economic benefits. This trend is challenging because direct economic benefits can be readily assessed while indirect and induced effects are complex to capture.

Global-Local Mismatch of the Economic Benefits of Ports

With the setting of global supply and transport chains, there has been a growing level of mismatch between the benefits of port activities and the scale and scope of these benefits. While at the aggregate level it is clear that port investments have economic benefits, the spatial and sectorial distribution of these benefits is far less evident. One particular mismatch concerns local (community) versus regional / national / global benefits. The following points underline this mismatch:

- **Labor** usually comes from the local community and its benefits (mostly wages) are derived in the region, particularly indirect job multipliers. As port employment went down because of mechanization and containerization, so did the local labor benefits. Yet, several port jobs are remunerated at a wage which is much higher than those usually found in the manufacturing sector.

- **Capital** usually does not come from the community, but is either provided by national and international funding sources, such as investment banks, pension funds and terminal operators. The return on this capital (e.g. loan or operational

revenues) thus does not accumulate in the port region but along global financial centers.

- **Firms** can be local in ownership but the commercial trends discussed above have underlined vertical and horizontal integration in the port industry. This means for instance that terminal operation at one port is usually part of a portfolio of terminals located in different ports across the region or even the world. Thus, profits derived from terminal operations are not necessarily invested in the port they were generated.

- **Port land use** is usually regulated by leasing and concession contracts, but quite often land prices are a tool for attracting investors and they usually do not reflect real value. This underlines that the impacts of ports on real estate values are not necessarily fully accounted.

- **Local transport infrastructure**, namely roads, are usually provided for free (or at a fee lower than costs). This represents a form of local or regional subsidy for globally focused activities.

- **Taxes and custom duties** are just partly earned by the port region. They are usually a national source of income used to fund for other social and infrastructure programs.

- **Environmental** (pollution) and social (noise, accidents) externalities are assumed by the community while the generators of these externalities usually bear only a fraction of them.

Port benefits are therefore increasingly distributed across actors and concern a geography that transcends the local community and at times the region. This trend skews the assessment of the benefits of port investments, where the local impacts can be much less significant than those at the regional or national levels. Conflicts or pressures can result from local communities that may be disappointed because their expectations about the economic benefits of port activities may not be met. Still, in spite of the complexity of assessing their economic impacts, ports remain fundamental to the economic well being of the nations, regions and localities they are embedded in.