Performance measure of a port-valley system: Data availability and their limits in freight transport and logistics

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Performance measure of a port-valley system: Data availability and their limits in freight transport and logistics[*][†]

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Abstract

This article seeks to measure the performance of a complex geoeconomic system such as a "port-valley". Public and private decision-makers involved in the development of a port-valley system need innovative methodological advances in freight transport data collection and production. This research fits into a development process of modelling frameworks in order to overcome different economic geography problems in freight transport and logistics. Within these frameworks, using descriptive statistics and time series analysis techniques, the purpose to be undertaken will allow for efficient and robust indicators which will contribute to measure the performance of this type of geoeconomic system. The study of these spatial and temporal phenomena will be inspired by works in macroeconomics and evolutionary biology in order to provide a general framework that will simplify all stakeholders' decision-making process. In the empirical studies, we will focus our attention on modelling: the dynamics of traffic registered by the seaports of a valley; the synergy of the economic sectors present in a valley and; the main activities of stakeholders involving in specific transport and logistics sector of this valley. However, gaps in terms of availability of data in the fields of economic geography make it difficult to implement this kind of study and indirectly to measure the efficiency in stakeholders' decision-making process. The construction of a database that will reflect current and historical situations of the port-valley's activities stands out as a preliminary and inevitable step.

[*]Keywords: Port-valley system, Spatial-temporal freight data, Markov switching model, Multi-table models.

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1 Introduction

Many scientific studies have helped to get a thorough knowledge of seaports policies, the logistics organization in the hinterland of major seaports and the problematic of the ports competitiveness (Aronietis and al. 2010; DevPort, 2013; Malchow and Kanafani, 2001; Magala and Sammons, 2008; OECD, 2010). In recent decades, these studies showed that the lack of dynamism of a "port corridor" system could be analyzed through different explanatory factors. These factors are linked to regional, national and international economic conditions, but also to the regulations set place in each seaport area. From an economic geography point of view, strong correlations tend to emerge between traffic of goods recorded by major seaports, the volumes of logistics activities of main ports-valleys, their potential effective population and wealth (IRSIT, 2004). In addition, their nodality turns them into key actors in the international trade network. Indeed, ports-valleys appear as multi-modality places which are facilitating convergence between the modes of inland transport and allowing a connection of economic systems with local specificities in the globalization process (Frankel, 1999; Hayuth, 1987; Rodrigue, 1999).

In the actual increasingly competition context, ports-valleys must analyze a complex set of local and international economic factors, before committing strategic and operational decisions (Wackermann, 2005). Under these conditions, the understanding of the complexity of the problems inherent in agents' decision-making process, which are subjects of all stakeholders in this geoeconomic system, represents an essential and prior step to all productive recovery/economic growth stimulation in the territories of the system understudy (figure 1). Furthermore, it seems important to understand the causes and consequences of changes occurring within the port-valley system, insofar as they have strong impacts on the territories performance. Such changes resulting from crises, technological innovations, demographic rotating and/or transformation of a major economy will tend to redistribute roles on the world stage and lead a new territorial division of global growth (Aglietta, 2013). The following diagram highlights the multiple entanglements that may weigh on a port-valley activity.

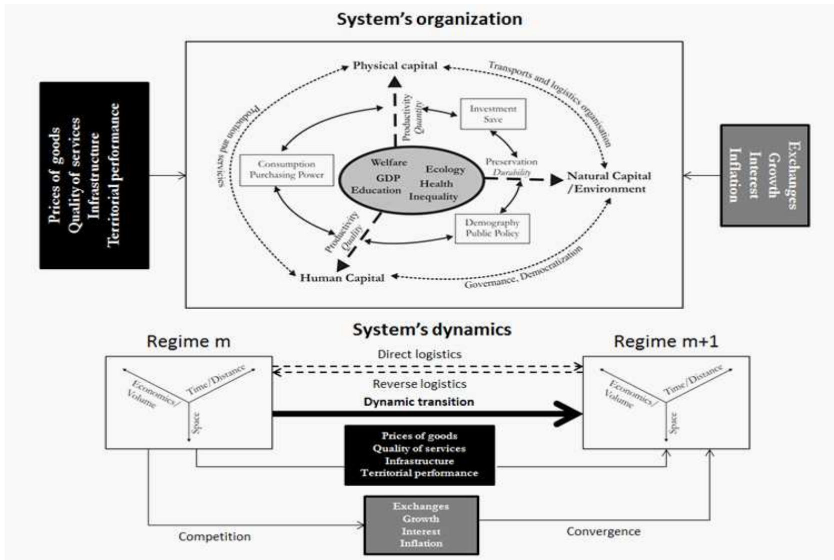


Figure 1. Analytic and organization dynamics of a geo-economic system

The intricacies of these entanglements affect directly or indirectly the seaports economic performance terms as well as the competitiveness of their respective hinterlands (Verny, 2007). The figure 1 also reveals the need to take into account interactions among the decisions of each practitioner (local or foreign) in the dynamic of this geoeconomic system. Moreover, even if these different territorial actors perceive the activities that are occurring therein as a result of their efforts and/or their fundamental strategic choices, the importance of the number of the geoeconomic factors may affect their decision-making process and make their expectations and/or forecasts more difficult and uncertain. Furthermore, under the impact of potentially international goods and services demand acceleration, the use of port-valley system continues to assert itself. This acceleration in the pace of global demand highlights the limits in terms of infrastructure and logistics performance. Thus, it emphasizes on their inability to facilitate the convergence between supply and demand of their respective foreland and hinterland. This inability of some ports-valleys to allow an adequate delivery of increasingly volumes of goods appears as a real limit to their economic development.

In addition, because of the significant changes observed in the last thirty years in (i) the maritime transport sector, (ii) the shortening of the circuit and (iii) the development of alternative distribution modes in the area of mass distribution, heavy brakes could disrupt the global logistics and transport organizations of these kinds of geoeconomic system. The impact of concepts such as intermediation, centralization and proximity to large storage areas appear increasingly in the determination of a port-valley performance. The evolution of this impact (from growth regimes to crisis episodes and vice versa) could be seen as another crucial element having a significant influence on the relative performance of a port-valley system (Fleming and Hayuth, 1994). Similarly, some historical and geographical conditions allowed the emergence of territorial disparities that economic, demographic and/or consecutive ecological changes contribute to strengthening.

2 Empirical framework

Based on these general findings, this paper proposes a series of spatial econometrics analytical frameworks to understand the internal changes in the organization of activities within a geoeconomic system such as a port-valley. This will bring out the relationship between these changes and the economical states of both the local market of a port-valley system and those related to the specificities of competing systems. The idea is essentially to provide an analysis clarifying the complex interactions between macroeconomic circumstances and microeconomic strategies of the studied system actors. Because of the diversity of issues characterizing the existing transport and logistic activities within a geoeconomic system, different modeling approaches can be implemented (figure 2).

2.1 Regime switching in the maritime vessel traffic dynamic

In order to explore some of the fundamental problems linked to seaports activities, such as the evolution of types of freight traffic, a first empirical study framework (Modeling 1) can be used. In this modeling framework, one can focus on understanding the factors influencing the pace of development of all activities around the seaport (Bottasso and al., 2013; Debrie and Guerrero, 2008). These economic geography analyses can be performed using time series methods such as simple linear regression models like OLS or complex nonlinear parametric specifications (Time Varying Parameter (TVP), Markov Switching (MS), etc.). In these modeling frameworks, the evolution of the maritime traffic categories can be studied to determine the potential gains/losses of activity which could face the ports of a particular valley (e.g. Le Havre and Rouen in the Seine valley case) within a competitive port-valley system[1] (e.g. the North-West coast of Europe).

[1] For instance, we could consider the traffic evolution of both Rouen and Le Havre, the Seine valley seaports, compared to their main competitors in the Northern Range in order to identify possible solutions that could enable these French main ports to gain market share over their North-West European competitors. Because of their proximity with the French Nord-Pas-de-Calais region, these French, Belgian and Dutch ports (Amsterdam, Antwerp, Dunkirk, Ghent, Rotterdam and Zeebrugge) seem strongly compete with the ports of Le Havre and Rouen on their captive hinterland, namely the city of Paris and its large area of consumers: the Ile-de-France region. The port of Hamburg could be included in this sample. However, it was considered that its hinterland extends mainly to the Eastern European countries (Poland, Austria) and Northern Europe (Denmark, Sweden, Finland). In addition, special attention

The study of such issues could be in the context of an a priori absence of information considering a class of models describing situations where the observations belonging to a particular traffic regime is presupposed unknown. One of the real contributions of this type of regimes switching models known as "Markov Switching models" is that they allow the description of situations in which the environment states are formally distinct from each other and, at every moment, candidates to explain the economic phenomenon under consideration. The distinctive feature of the majority of these kinds of regime-switching models is probably all assumptions made about the mechanism that governs the change itself.

The analyses considered in the context of our study could be implemented under the guise of models for which the distribution of observations with respect to plans is not known (Hamilton, 1989, 1994, 1995). Based on this assumption, the different states of the system can be specified in the context of probabilistic models of Markov type. In this class of models, which consider the fact that regimes change following unknown transition probabilities, different specifications can be tested essentially in two main reasoning angles (Gbaguidi, 2011). First, the argument could focus on the short-term relationship that emerges between the different seaports traffics dynamics. Secondly, the reasoning could be expanded at long-term relationships that may exist between these maritime traffic variables.

Following these two angles, regime switching models could be estimated, based on the idea that changes in the dynamics of each traffic variable are independent of each other. On one hand, the aim would be to consider that regime changes in the freight traffics dynamics of a particular seaport are independent by using a Markov Switching-Vectorial AutoRegressive models (MS-VAR). On the other hand, one can considers a case in which the regime changes in the freight traffics of this particular seaport may be driven by those of one or all of its competitors (Otranto, 2005). This second specification refers to more complex regime switching models called Multi-Chain Markov Switching-Vectorial AutoRegressive models (MC-MS-VAR).

Over a sampling period, a set of parameters characterizing the individual but also collective dynamics of (i) containerized, (ii) liquid bulk, (iii) oil or (iv) dry bulk and (v) conventional general cargo freight traffics, recorded by the seaports could be estimated on an annual basis. Results that would emerge from such estimations could help to better visualize a port-valley choices impacts on its performance. Similarly, this empirical study will seek to identify plans (regulatory, etc.) that could explain specific trajectories of the system's economic performance in relation to those of competing systems. Insofar as the dynamics of these performances can be correlated to changes in the hinterlands of these seaports, this study also aims to verify the claims of the literature concerning the existence of (i.e. French, Belgian, Dutch, Franco-Belgian or Belgian-Dutch) economic activities clusters and the impacts of such complementarities between the

will be paid to the activity of the port of Zeebrugge. The activity of this Belgian port, often associated with the one of the port of Antwerp, seems to concentrate almost 40 % of goods going to the Ile-de-France region.

seaports of these potential clusters on the activity of a benchmark port-valley.

2.2 Synergy between a port-valley economic sectors

The second framework considered in the empirical study (Modeling 2) proposes an approach in which the study will focus on the analysis of a set of the port-valley system's strategic sectors. Indeed, with a territorial coverage of a wide range of production and distribution firms involved in various fields and complementary activities, territories comprising the port-valley system are inherently conducive to the deployment of industrial and commercial sectors both "old" (i.e. automotive, construction) and innovative (waste, new energy).

For instance, the waste industry firms' deployment within the valley territories can reveal this valley real strength to meet tomorrow challenges. The actors of this sector could cover a wide range of expertise which allows them to treat various waste types (e.g. hazardous waste, infectious medical waste risks, waste equipment, electric and electronic waste from building and public works, the ultimate waste, green waste). Furthermore, the eco-design development by the private sector in order to limit the material waste should facilitate the products recycling in the future (Gold and Seuring, 2011). A renewed effort in the waste collection and transport optimization through (i) collaborative operations with the logistics sector, (ii) the deployment of alternative transport modes, and (iii) the development of places of voluntary contribution proximity, appear as local major issues (Mutha and Pokharel, 2009). Similarly, in view of enhancing the residual activity of the port-valley industries, many solutions can be implemented in synergy with logistics (Reverse logistics).

Assuming that transport should not be made empty and that consumers as well as manufacturers can be encouraged to (a) optimize their waste production and (b) register in sorting dynamics, packaging and collection best suited to the requirements of waste management stakeholders, the logistical organization of the valley's territories, in its forward and reverse settings, should allow to increase the competitiveness of all sectors, including waste in parallel or in support of other traditional industrial sectors (Coudun and Gégout 2006). Based on this observation and on audits conducted with firms already established or wishing to establish themselves in the valley's territories, it will determine the current needs in terms of dedicated logistic platforms creation, but to adapt the tax system to the sector particularities, whose is a raw material for industrial products.

The analysis of this kind of questions can be conducted within a modeling framework integrating usual descriptive statistics tools such as Factorial Correspondence Analysis coupled with some techniques borrowed from time series econometrics such as a Factor Augmented - Vectorial AutoRegressive (FA-VAR) modeling framework. It might also be interesting to use some developments in computer imaging as the Procrustean Analysis to estimate the adjustment coefficients of coordinates pertaining to the locations of the industrial sector actors as a basis for those economic entities related to the waste stream in the port-valley. The results of this kind of empirical studies may help to better understand the issues related to actors' geographical location strategies in a given industrial sector.

2.3 Micro-economic coverage of a port-valley system

The third empirical framework emphases on the micro-economic performance measure of a port-valley system (Modeling 3). It also aims to establish the mapping of the organization of services activities in logistics areas and their periodic evolution. Similarly, the impact of features attached to the infrastructure network which benefits the host community of the port-valley, the organizational efficiency of logistics platforms and the quality of services they induce on territorial development could be analyzed. In this context, it seems relevant to reason at a referential geo-statistical unit level (a finer division of the territorial system in areas/employment areas of activity) to highlight a number of keys aspects that can characterize specific settlement logics of transport and logistics activity categories (Strale, 2013).

This analysis of settlement logics and performance dynamics of the system's territories, in terms of goods/services production, could be performed using multidimensional descriptive statistics models such as multi-table models. In the field of economic geography, the study of a system through the place, infrastructure, planners and their interactions in a space-time dimension, leads to the production of a complex three-dimensional data (variables x area x time) that can naturally be organized in the form of multiple tables. In statistics, the so-called multi-table methods were specifically created to simultaneously analyze multiple data tables. However, although these methods seem perfectly suited to the processing of data incorporating time and space factors, their use in economic geography is, to our knowledge, not yet widespread[2]. By entering the interface of statistical and spatial econometric, our modeling frameworks want to assess the extent to which multi-tables analysis methods actually answer the questions asked by economists and geographers within the spatial-temporal studies of a port-valley system.

The proposed methods seem theoretically well suited to the issues raised by geographers and economists. In particular, they allow addressing the problems of spatial and temporal structures identification and studying the permanence of these structures in time and/or space. Similarly, the ability to analyze K data tables simultaneously lets to consider the spatial or temporal permanence of the relationship between economic phenomena and geographical areas. The interest of these multi-table methods is strongly linked to the goal targeted by the study and the degree of accuracy desired by economist/geographer at the exploitation of results. Thus, a major challenge is the absolute necessity to formulate precisely the objective during their implementation. To the variety of possible questions responds a variety of possible ways of looking at the data set

[2] Despite the complexity of their underlying theoretical foundations, the ability of these methods to answer "accurately" as many different questions about the permanence of structures should give a wider dissemination in economic geography.

- variables x area x time -, and therefore the choice of perspective is a critical element for the analysis.

Among those multi-table methods, one could focus mainly on the three indexes-tables structuring method (in French: Structuration des Tableaux A Trois Indices de la Statistique, or STATIS) (Lavit, 1988; Lavit and al., 1994). The latter is in fact considered with multiple factor analysis (in French: Analyse Factorielle MULTiple, or AFMULT) as a primary method of simultaneous ordination of several tables whose essence is Euclidean (Bove and Di Ciaccio, 1994). These methods have been recently presented by Dazy and Le Barzic (1996) in a book on evolutionary data analysis in the field of socio-economics. Similarly, we could focus on the analysis of Multiple Co-Inertia (in French: Analyse de Co-inertie Multiple, or ACOM), whose basic principles are similar to those of the Generalized Canonical Analysis (in French: Analyse Canonique Généralisée) (Carrol, 1968; Kettering, 1971; Chessel and Hanafi, 1996). The general principle of these methods is to define at first the common structure, called "compromise", of a set of K tables, then to study the variability of this structure through each table[3].

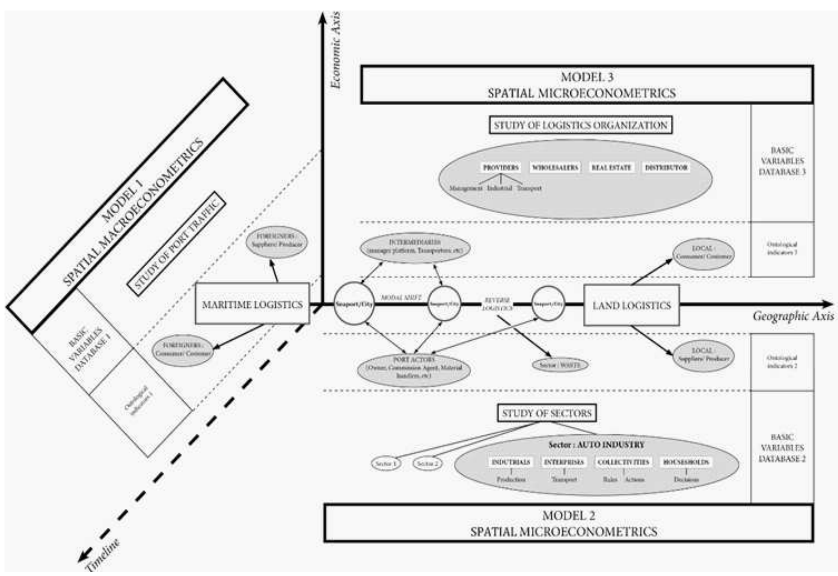


Figure 2. Modeling a port-valley transport and logistics activities

[3] If the tables do not have the same number of rows and columns, they are not directly comparable and STATIS method itself known under the name of "STATIS on operators" is then used. When the numbers of rows and columns are identical, we can directly calculate a "compromise" table corresponding to a weighted sum of tables, using partial triadic analysis or Foucart's AFC.

3 Data, discussion and perspective

The different estimates of these econometric models are designed to identify the existence of potential episodes of cyclical or structural breaks in the development of geoeconomic system activities. Similarly, the implementation of these statistical methods helps to understand the reasons and effects of transport and logistics institutions geographical relocations operated in a given sampling period. Moreover, this type of analysis leads to the development of a mapping series regarding socio-economic performance, by transport and logistics activity, across different employment areas of the port-valley system. Fitting in this context of a port-valley activities modeling, and without addressing in detail the issues inherent in conducting such a study, this article focuses in particular on issues related to availability and limitations of data.

3.1 Importance of freight data for decision-making

What do we need in addition, if we already have freight data? Today, through interconnected digital networks, it seems very easy to collect freight data. But in some cases, these data are often confidential for reasons of reliability and/or commercial competition. For instance, the seaports do not share statistics based on individual productions, shipping lines or other means which would make agents activities easily discernible. Although one can consider that economic agents and institutions have access to a wealth of freight data on different areas of their activities, the collection and manipulation of these data require large investments of time, effort and resources as well human and material[4].

For a majority of public and private actors the question of how data can be used to improve the quality of decisions is a central point in the process of strategic and operational choices of an organization. In economic geography, the use of economic and financial data relating to the transport and logistics activities by the main actors involved in the process of territorial development becomes increasingly significant. Most of the research works have been listed in frames called rational approaches to decision making as they assume the use of such data to highlight the causes and/or consequences of the choices implemented by the economic agents. However, these approaches based on the use of information extracted from data have been criticized because data and information are immediately considered as facts or truths. Similarly, some researchers consider that the way to collect data, both historically and theoretically implicitly provides oriented information on the public and private decision-makers.

In addition, the context of data collection can significantly affect their quality and resulting interpretations. Therefore, special care should be taken when using data for a purpose other than that for which they were originally collected. Furthermore, although there are plenty of tools and techniques to help making better information from the data, many policymakers are often « drowned » in the abundance of these data. To extract a maximum of information from the

[4] Similarly, these methods are relevant for qualitative data describing economic agents' beliefs and practices.

available data in an attempt to facilitate economic decision-makers, one needs a structured statistical approach. In this context, one has to define the data that will be required for analyses purposes, how they are collected, analyzed or interpreted, but also what the main contributions of these analyses can be in economic agents' decision-making process.

3.1.1 Methodologic bases for freight data identification

Despite the availability of a wide range of different data in some field of operational research, a significant number of decision-makers are underinvesting in the level of analysis necessary for processing the data. Various statistical institutes produce data at a much faster stage that very few statisticians are truly able to manage and develop. The need to store such large amounts of data, implying the involvement of increasingly growing it, leads organizations to be overwhelmed with data and parallel to this, the usefulness of the data collapses. In 2008, the round table organized by the International Transport Forum and the OECD in Boston on the economic benefits of expanded transport (planning tools, macro, meso and micro-economic evaluations) revealed the gap between data available and imperfections of the analytical frameworks used to further prevent regular analysis in the context of empirical studies in economic geography.

In fact, one of the most striking features in the context of information analysis is that policymakers focus too much on the data control and not enough on the transformation of the latter into information and knowledge that will lead to statistical and economical significant results. Literature addressing the issues of decision-making and use of information are multidisciplinary and cover topics such as economics, management, social sciences or information technology. Several subjects draw their own point of view[5] (Kennerley and Mason, 2008). Extracting quality information from data should be the main objective of each decision maker. The use of information to improve decision-making and operational performance is a topic that receives considerable attention from academic and institutional actors. The process of decision-making on the basis of data should to be the easiest way to maximize the efficiency in the decision-making path.

This rational view of decision-making is implicit in a large majority of economics studies. The fundamental assumption in this rational approach is to assume that agents have reliable data to help to retrieve adequate information and knowledge to facilitate their decision making process. Basically, the conversion of data into information and then into knowledge is supposed to streamline the choices that are made. In line with these arguments and following the "cause to effect" dogma, many statistical tools, based on recent technological advances allowing the conversion of data into meaningful information, have been developed. These tools and techniques are expected to improve the return on

[5] For instance, many literatures addressing the Information Systems (IS) focus on their own properties and not on the properties of the whole socio-technical system. Conversely, much of the literature in microeconomics focuses primarily on the study of behavior or preferences of economic agents.

investment made in collecting information.

However, for many researchers knowledge and decision are not only rational processes. Even if it appears important to consider the rational model, it may be useful to discuss the weaknesses of this rational view of decision-making by confronting it with alternative approaches. In general, the process of decision-making is not purely linear or typically sequential and more complex set of actions should be implemented in any procedural logic using data to help the decision makers to evaluate their choices. While relying on predictive models but away from the rationality assumption in socio-economic interactions, different points of view examine the issue of bias and emotion in the economic agents decision-making process (Angeletos and La'o, 2009; Shiller, 2005; Sims, 2006). In a dynamic environment, it appears important to build models that can quickly be restructured to take into account changes in the system and improve the decision maker knowledge as generally, each step of the decisional corpus can be carried independently.

In order to know the type of data needed to provide a basis for decision-making, the main point that needs to be addressed remains the full and effective availability of data regarding the considered problematic. Not only the type of data affects the nature of the decision, but in many circumstances, the data may determine the time of the decision. In addition, the development of statistical techniques shows that the type and amount of data collected predefine the model that will be used to understand an entity or phenomenon about which a decision must be made.

3.1.2 Freight data choice, collection and analysis in the decision making process

In economic geography, variables such as trafficking of goods, storage areas of goods, the number of firms in a sector, the location of these companies or their turnover are fundamental descriptive elements to understand the performance of a port-valley system. To build such a database, one has to collect the data from the various identified sources. This collection stage can be divided into two steps; one will have to define more specifically the problematic, type and/or volume of data to be collected, and the other focuses specifically on the mode of data collection itself.

The definition of data to be collected is a crucial step that can have a significant impact on the decision-making effectiveness. At this point, an inventory of already available data from multiple private sources or public and official statistics institutes should be undertaken. The outcome of this inventory induces the general framework of the database and initiates an effective and efficient procedure for the consolidation of this database. The collection of these qualitative and/or quantitative (discrete or continuous) data is an important step that must be achieved while defining the operational framework of their used. If all the values from this first collection are not statistically usable, one will have to complete the database and/or resize the sample[6] in so far as this partial

[6] The sample must be representative of the population as a whole and reflect the contribu-

lack of data will significantly influence the perspicacity of the information they are supposed to provide to the analyst/decision maker.

Once specified, it seems important to consider the purpose of the analysis because the use of data is part of a proactive/predictive modeling framework in the efficiency of the decision-making process. The data should then enable the deployment of predictive abilities of the economic system in order to manage risk and promote effective integration of changes, whether structural or cyclical, affecting the system. This predictive ability of the model promotes a "robust" identification of the states in which the economic system is waterproof/resistant to threats and disruptions/socio-economic crises faced by the decision-makers. The predictive model is thus asking a two-stage process. One is to browse the past with a view to consider the future on the basis of existing data. The other is to propose a regular update procedure of the model basics over time to overcome cognitive biases and inaccuracies. In this context, data covering a longest period and the periodic reviews of the models appear essential for assessing the organizational performance of an economic system. Many researchers have noted that the effectiveness and the quality of the decision-making process are significantly correlated with a provision of real-time data. Similarly, models of dynamic systems appear as powerful tools that help to identify the complexity of real economy activity and describe the scope of the decision.

After collecting the needed data produced through a process ensuring their reliability, the next stage is to trying to answer the question of what the data tell us. At this stage, based on existing statistics technics, freight data start to turn into information. The statistical analysis tools used can dissect data while providing clarifications on the information contained therein. Finally, the data interpretation is a key step in the decision-making process. The aim is to convert freight data in intelligible terms so that they become information.

3.2 Ontological indicators of the system performance

The three analytical approaches considered in the empirical study of a port-valley system can lead to part of the main expectations that may be issued by regional, national and European public authorities in terms of territorial development policies. These approaches provide a strategic perspective that is to be able to boost the quality and contribution of the various economic spheres that composed a port-valley system. Moreover, this empirical study, divided into three parts, each corresponding to the specific modeling frameworks, should lead to the extraction of a group of indicators whose ontological intricacies and aggregation should result to the identification of a measure of the port-valley's overall performance (figure 3).

These ontological indicators could be used as statistical support to the realization of an Information System both Geographic and Economic (ISGE) characteristic of the studied port-valley's activities (industrial, transport, logistics, regulatory, ecological, etc.). To achieve the issues covered by such an empirical

tion of each of the key variables characterizing this population.

study, it may be appropriate and essential to build a sub-regional network of professionals which can initiate processes of economic collaboration and territorial reorganization to achieve a synergistic efficiency between the industrial and logistical actors of the geoeconomic system.

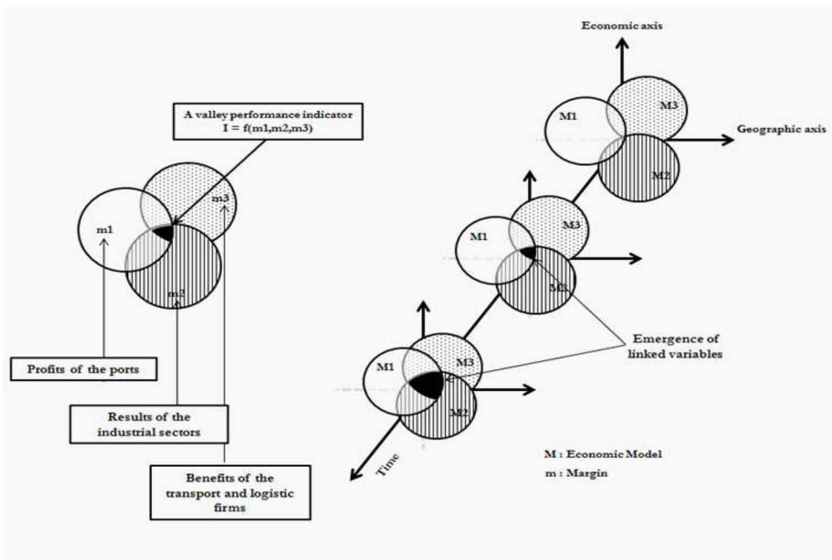
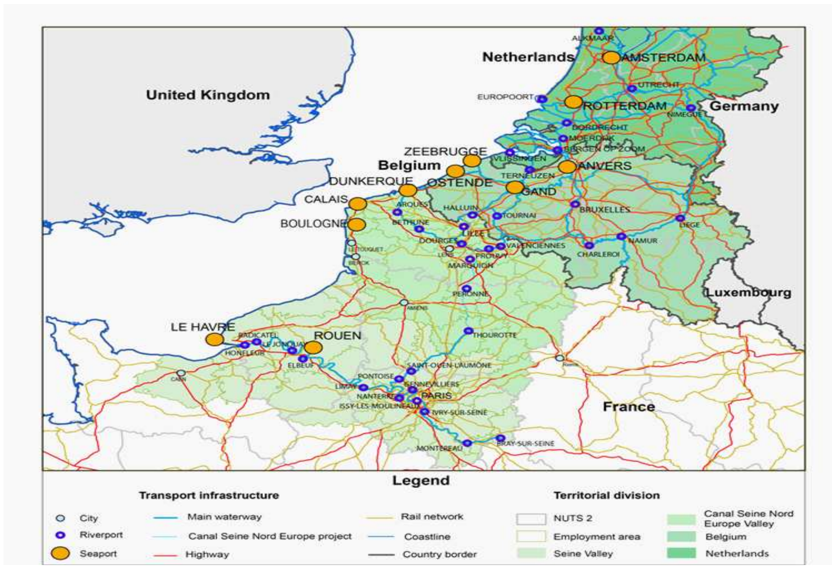


Figure 3. Defining a port-valley performance measure

The different models and estimation techniques implemented as part of this study should precise the overall view of the transports and logistics problematic mentioned in the introduction of this text. This analysis aims to provide evidences in the understanding process of ports-valleys activities but also to overcome the difficulties related to their respective competitiveness. Thus, this study will take place in different geographic and econometric settings which seeks to achieve a set of objectives leading to a better understanding of the dynamics of different economic activities implemented in any port-valley system. Methodologically, the purpose is to examine the spatial-temporal behavior of most of the economic variables commonly considered in the literature of economic geography. In that context, the different econometric specifications tested were selected to the extent that, for the vast majority of researchers, many economic relations can be described in a potentially non-linear spatial-temporal framework in which, for structural reasons, the values of some parameters can changing over time. Most often, these parameters are supposed to change a fixed number of times due to economic crises or structural reforms implemented by the regulatory authorities to control the fluctuations of the real activity to which the system could be subjected. In the RISC project, we consider the following sample of ports-valleys systems (Map 1) as geoeconomic entities in the various empirical studies that will be implemented.



Map 1. The Northern range's ports-valleys

Considering this sample of ports-valleys, the "MOBIS database" comes in various sub-thematic bases from which will be implemented all the empirical analyses previously described. The general organization of the database can be described using the following scheme (figure 4).

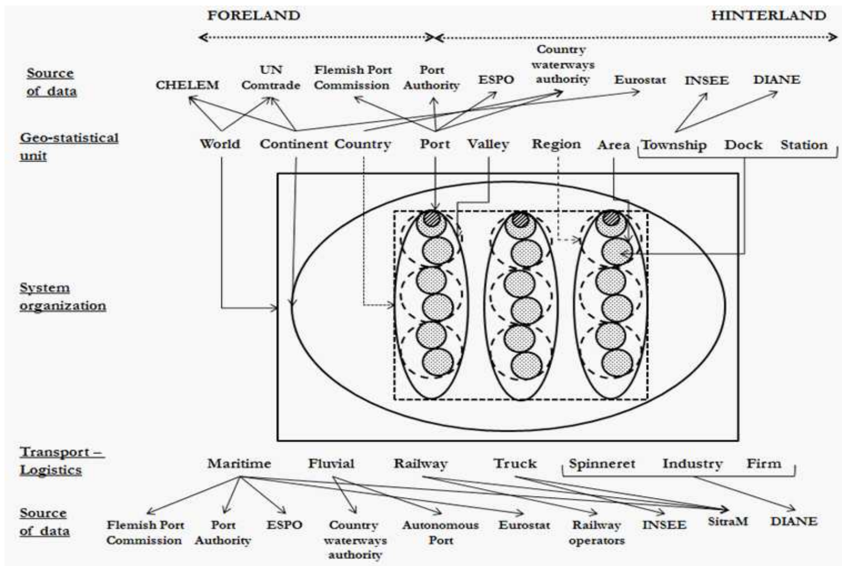


Figure 4. Elements of the MOBIS database

4 Conclusion

Based on this database, in the first modeling framework, we will successively analyze questions such as (i) the economic and regulatory impacts on these Northern Range seaports' traffics dynamics, (ii) the Belgian diversion of the Seine valley seaports' traffics and (iii) the impact of the activity of the Belgian and Dutch seaports on the Seine valley seaports. These studies aims to (1) identify the changes in the position of the "Seine port-valley system" compared with the ones of its competitors in terms of trade repartition and the logistic organization, (2) identify the potential explanatory tracks of the "Anvers-Rotterdam ports-valleys" supremacy's situation over its competitors, and (3) provide actionable insights to a better understanding of the realities of any port-valley system. In the second empirical framework, many problematic, such as (i) how the concepts of the reverse logistics can induce solid bases for the development of a performant waste sector in the Seine valley, (ii) how logistic can encourage the re-industrialization of the Seine valley or (iii) the control of the environmental (or ecological) impacts of logistics activities in the Seine valley, can be considered. The objectives considered in this context could be to (1) foster the re-establishment and restructuring of all traditional industrial sectors as input provider for the waste industry at the end of the logistic chain in the port-valley system; (2) optimize the sorting, the collection, the storage, the transport and the development of technologies for industrial waste recovery and (3) create in a reverse logistics framework a territorial synergy between all the industrial sectors and the waste one. Beyond these objectives, it seems relevant to connect professionals from different sectors and improve the flow of industrial waste for firms in the sector but also to stimulate the deployment of alternative modes of transport such as inland waterways and/or rail transport in the context of the decongestion of roads and the limitation of the negative externalities associated with this mode of transport. In the third modeling framework, one can try to respond to questions regarding (i) the changes in the location of logistics activities in the Seine valley or (ii) the place of the Seine valley seaports in the supply of the major distribution in France.

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