



# The relationship between high-speed railway realization and economic development: a case study

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## Abstract

The realisation of new transport infrastructures is usually determined by the economic growth; as a matter of fact, in developed countries appropriate transport systems are needed in order to fulfil the ever-growing demand for transportation. In other words, the economic development always lead to a transport demand growth, and to an increase in transport infrastructure.

Nevertheless, contrasting results have been presented in the literature whenever researchers studied how improvements in transportation supply affect the economic development. In fact, public or private investments in transport infrastructure change regional economics depending on the stated socio-economic characteristics of the area where investments are realised.

In this work, the assessment of the economic impacts related to the Genova-Milan high-speed railway realisation is presented and discussed; those impacts are shown in terms of the Genova Metropolitan Area Gross Domestic Product changes.

## 1 Introduction

Economic development is an extensive concept referring to the material aspects of the community welfare. Several aspects of development exist: growth in income and wealth, equitable distribution of income, and other indicators of the quality of life in a region. One consistent factor in any consideration of



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development is economic growth, which is the sustainable increase in community income or wealth. This paper deals with the relationships between new transport infrastructure realisations and economic growth.

As a matter of fact, good transport facilities support economic growth by lowering the costs of goods delivery. Since users' transport costs are reduced, financial resources are made available for other purposes.

In the economic literature, it has become axiomatic to say that growth depends on geography and location of activities. The development of a region is directly related to its physical position relative to the other regions. Transport systems are designed and implemented in order to overcome the obstacles, and distances imposed by geography. In other words, transport systems shape the distribution of activities and influence the share by which each region contributes to the national product (see Vickerman [1]).

There is not a direct implication between the realisation of a new transport infrastructure connecting two different regions and the economics growth of the regions themselves; in most cases, new transport infrastructures make developed region economics to grow, and retarded region economics to decrease (see Morandi and Senn [2]). Nevertheless, if an obsolete transport system is one of the causes, or the most important reason, for a region economics depression, hence investments in transport infrastructures represent a way to help such a region to develop, and to attract activities in which their participation has been historically low (see Kraft, et al. [3]).

Transport theory has limited applicability to explaining regional development; this failure is not due to a logical flaw in the theory itself, but rather to the unrealism or the oversimplification of its assumptions, and to the irrelevance of the problems which it intends to solve. It applies to situations where resources exist and where transport facilities are lacking.

In this paper, the authors present the results of a research study carried out to estimate how the realisation of the new High - Speed railway Milano - Genova will influence the Genova Metropolitan Area economics. The work does not aim to evaluate the influences during the implementation period, but rather to estimate the direct influences of the new freight transport operation on the Gross Domestic Product.

The paper is organised as follows: section 2 aim to describe the current economics and social characteristics of the region case study, and to the transport upgrade intervention. Section 3 is dedicated to the problem description, and to the methodology that had been used to solve it. Section 4 describes the results of the study; then some conclusive remarks will be presented.

### **2 The Genova Metropolitan Area**

This section is dedicated to the description of the geographical, economics, and social characteristics of the Genova Metropolitan Area. Since this work aims to evaluate the influences due to the realisation of a new transport infrastructure in this region in a quantitative way, hence this section is very important. In fact,

the work is based on the following assumption: the Metropolitan Area under study presents a potential development that is currently choked by a lack of transport facilities; if such a lack is reduced or eliminated by an appropriate increase in the transport endowment, the Genova Metropolitan Area should express an impressive economic growth.

### **2.1 The geographical context**

Genova lies in the northern area of the Gulf of Genova, and it is surrounded by the Appennino Ligure Mountain Chain. Its peculiar geographical condition makes the Port of Genova, and Genova itself, particularly appreciated from the climate point of view.

Genova is 120 km far from Milan, 200 km from Turin, 630 km from Munich, 960 km from Vienna, and 520 km from Basel. The geographical context makes Genova to be a very interesting gate for goods transport flows from the Northern Africa, the Middle East, and the Far East to the Central Europe.

Since the geographical position of Genova and its port represents a strategic issue for freight flows attraction, the natural barriers between Genova the Pianura Padana (i.e. the Appennino Ligure), and the Central Europe (i.e. the Alps) are the major obstacles to the economics relations and goods movements through the Port of Genova. At the present time, these obstacles are overcome by the multimodal network, whose main effort is charged to the road transport. Such a transport system configuration is fair in the domestic transport context, but is quite inadequate in the international domain.

### **2.2 The economics domain**

The Genova, Milan and Turin Metropolitan Areas represent the "Italian industrial triangle", that is, Genova usually played a leading role in the economics of the northern part of Italy. As a matter of fact, during the last thirty years several conflicts between different working categories and the local government made the regional economics to decrease. This situation became worst due to the crisis of the iron and steel industry, which was the leading domain of the regional economics.

These few considerations show that, in the last few years, the Genova Metropolitan Area faced with several problems, which make this area to deal with a severe economic recession.

### **2.3 The transport infrastructure domain**

As it was previously suggested, Genova and its Port represent a very important gate for trades between Europe, the Mediterranean Countries, and the Far East. At this aim, Genova was provided with several transport infrastructures to connect this area to the north of Italy, and Europe. At the present time, these infrastructures are not adequate to perform cost - effective freight transport, but different interventions are planned to be realised in the future. In this paper, the authors intend to focus the attention on two main interventions, i.e., the Genova Milan high speed railway, and the extension of the Voltri Port. The latter, which



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can be defined a huge container terminal, is almost complete, and is already in use, even if its plain capacity has not yet been exploited.

The incomplete exploitation of the Voltri terminal is due to both the current start up phase, which has not yet been completed, and the lack of transport links between the terminal itself and the European Transport Network. It is authors' opinion that the latter represents the most influencing obstacle to the Voltri Terminal expansion, and to the economic development of the Genova Metropolitan Area.

These considerations put into evidence the need for an appropriate assessment of the economic development due to the railway realisation, in order to stress the usefulness of the transport infrastructure implementation.

### 2.4 The railway upgrade

In this section, a brief description of the new high speed railway linking Genova and Milan will be provided. Such a description refers to the latter project of the Genova - Milan railway line; unfortunately, this project does not seem to be the ultimate one. Hence, the characteristics reported below are suitable to be changed (see Conciato, et al. [4]).

Nevertheless, since the aim of this work is to consider the relationships between the rail service and regional economic development, this lack of technical knowledge does not infer the results of the research.

The Genova - Milan high speed railway is divided into three parts: a hill part, a valley part, and the Milan Metropolitan Area part. The first one is 41 km long, the second one is 59 km long, and the third one is 26 km long.

The railway leaves Genova entering the Monte Moro Tunnel, and goes towards north; the line average slope is 10.75 %. The project presents three tunnels linked by bridges. Between the 9th and the 11th km, the high speed railway project allows a railway junction to the Port of Genova Voltri. Nearby km 11, the project shows a 16.5 km long tunnel, which leads the railway to the Pianura Padana.

Nearby km 41 the railway enters the Pianura Padana, and it begins the 59 km long lowland section. This section ends at km 100, where the high speed railway enters the Milan Metropolitan Area.

The latter part of the Genova - Milan high speed railway starts at km 100 and ends at km 126, nearby Milano Rogoredo Station.

The railway is connected to the national railway network by two junctions: the Genova Voltri Port junction and the Milan - Turin line junction.

**Table 1. Percentage of manufactures**

Classification	Total Length	Percentage
Projecting	71.4 km	53 %
Cutting	14.1 km	11 %
Natural Tunnels	34.1 km	26 %
Created Tunnels	3.8 km	2 %
Viaducts	9.9 km	8 %

### 3 The Problem and the Method

In this section, the problem description and the method of the analysis are detailed. The aim of this work is to analyse the relationships between the realisation of a new railway and the regional economic development, taking care of a particular aspect of such relationships; that is, to study the influence of the new freight transport supply on the Gross Domestic Product of the Genova Metropolitan Area.

As it was shown in the previous sections of this paper, Genova presents a very important port which is suitable to be the main gate between Europe and both the Middle East and the Far East. The Port of Genova is allowed to play this role only if the transport infrastructures connecting the Port itself to the Central Europe will be realised [5]. At the present time, even if a great effort to develop the Port of Genova is performed, such an effort is not enough to produce impressive spin off effects on the Genova economics, cause of the lack of appropriate freight transport infrastructures.

This study is based on the assumption that the current transport supply is not adequate to support a tremendous increase of the demand for freight transport; furthermore, the current cost of both rail and road transport is not competitive with respect to those of other Mediterranean or Northern Europe ports. These two circumstances make freight flow to avoid the transit through the Genova port, and to choose other ports instead. So, the lack of appropriate transport infrastructure represents the bottleneck of the whole system; that is to say that the transport network of the area case study does not support this aspect of the economic development.

In this work, the authors perform an evaluation of the influence due to a hypothetical, and tremendous, growth of freight flows through the Port of Genova on the Gross Domestic Product (GDP), by assessing the percentage of the Genova GDP that is due to the container handling in the Port of Genova itself. The expected increase in the number of containers handled by terminal operators in the Port of Genova is justified by the growth of the terminal facilities and by the realisation of the new high speed railway. In fact, these two interventions aim to leave out the current bottleneck of the freight transport supply.

In this work, the authors collected a large amount of historical data (from now on the panel) related to both the GDP and the freight volumes which transit through the Port of Genova. The panel gathers information on the amount of goods that have been carried by road and train, entering or leaving the Port during the last 25 years [6].

Since the increase of freight traffic is expected in containerised transport, a particular care had been taken in order to gather data related to the combined transport. Such an expected increase of freight traffic is due to the impressive growth in the number of combined transport facilities in the Port of Genova. As a matter of fact, the Genova Voltri basin had recently been equipped with 14 cranes and several inner transport tools, suitable to perform fast loading, discharging and stocking operations on a wide area. The site is able to handle up



to 2.5 million of containers a year, in the case it is supported by an adequate set of transport infrastructure.

The Genova Voltri basin presents a potential demand for transportation that reaches the maximum capacity of the site. That is to say, if a suitable endowment of transport infrastructure is made allowable, hence a freight volume equal to 2.5 million of containers per year is expected to flow through the Port of Genova. Otherwise, the capacity will be reduced to 1.5 million of containers per year, which is the maximum throughput of the current freight transport system.

The authors evaluate the relationships between the historical evolution of freight flow through the Port of Genova and the Genova Metropolitan area economics. On the basis of these relationships, the authors present three scenarios of economic evolution: one "natural", one "increased", and one "extended". The first one shows the natural trend of the regional economics (i.e. assuming that the container flow through the Port of Genova behaves in the same way it did during the last few years - the panel observation period). The second one assumes an increase of freight traffic which is just related to the development of the Voltri Port (i.e., the container throughput will reach the maximum capacity of the transport network - 1,500,000 TEUs per year). The latter is based on the influence of the high speed railway realisation (assuming that such a railway will be used for both passengers and freight). Finally, the prediction of the Genova GDP for each scenario is assessed.

## 4 The Results

In this section, a summary of the main research achievements is presented and discussed. The results are provided as the assessment of the Genova Metropolitan Area GDP of each economic activity branch (i.e., agriculture, industry, transport, commerce, credit and insurance, other services, and non trade services). In this work, two different time horizons, or milestones, have been taken into account: 1998, that represents the completion time of the Genova Voltri Container Terminal, and 2005, which is the due date of the new Genova - Milan high speed realisation. The assessment of the GDP evaluated for each milestone is provided for each scenario. The GDP unit of measure is the 1994's Italian Lira; furthermore, the results have also been indexed with respect to the 1970's GDP.

Table 2 shows the results of the regression by considering the natural scenario. These results are used to match the GDP prediction at the milestones versus the natural regional economic development. Moreover, table 2 provides appropriate information to describe the Genova Metropolitan Area stated economics.

Table 3 shows the expected value of the Genova GDP at the milestones. The *natural* scenario row expresses the growth of the regional economics in absence of infrastructure realisation (i.e., neither the Genova Voltri Terminal, nor the Genova - Milan high speed railway). In the next two rows, table 4 shows the increase in the whole Genova Metropolitan Area GDP, which is expected to be

0.8% in 1998 (300 billions of 1994's Italian Liras). This gap grows up to the 1.3% for the *increased* scenario and to 2,6% for the *extended* scenario at the second milestone (i.e., 2005), which respectively mean 500 and 1000 billions of 1994's Italian Liras. The difference between these two estimated GDPs is due to the 1,000,000 of TEUs which are expected to be transported through the new high speed railway.

**Table 2. Results of the regression (*natural* scenario)**

Economic activity Branch	1998 GDP (indexed)	1998 GDP (billions of 1994's Italian Lira)	2005 GDP (Indexed)	2005 GDP (billions of 1994's Italian Lira)
Agriculture	67	235	58	203
Industry	162	8,884	175	6,967
Transport	139	5,219	150	5,632
Commerce	247	6,970	285	8,043
Credit and Insurance	184	1,571	194	1,657
Other services	273	6,991	319	8,170
Non profitable services	343	5,316	404	6,262

**Table 3. Genova Metropolitan Area GDP (*natural, increased, and extended* scenarios)**

Genova Metropolitan Area GDP	1998 (billions of 1994's Italian Lira)	2005 (billions of 1994's Italian Lira)
Natural scenario	35,153	39,586
Increased scenario	35,446	40,089
Extended scenario	35,446	40,604

## 5 Conclusive Remarks

In this paper, a methodology suitable to assess the relationships between the realisation of a new high speed railway and the regional economic development had been presented. Obviously, the revenues that had been taken into account in this paper are just a small subset of the whole relationships; nevertheless, the main aim of this work is to provide some quantitative estimate of such relationships, in order to show that the regional economics grows with transport infrastructure if the latter represents the major obstacle against the development.

It is very important to note that the authors assume the Genova - Milan high speed railway to be appropriate for the shared use between freight and



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passengers; such an hypothesis is justified by the several projects of the future railway that have been designed in order to allow the mixed use.

At the present time, works are still in progress in order to make the research achievement much more precise, by taking into account the cross-relations existing between the several branches that compose the Gross Domestic Product.

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