The Relations Between Regional Economic Development And Evolution Of Transport Demand In Italy

Agostino Cappelli
Università IUAV di Venezia
Corresponding author: cappelli@iuav.it

Alessandra Libardo
Università IUAV di Venezia

Silvio Nocera
Università IUAV di Venezia

Synopsis

The field of transportation plays an essential role both in the economy and the society: a direct relationship between growth of the Gross Domestic Product (GDP) and tendency of the transport demand can be therefore reasonably stated.

First of all, it is quite logical to assume that the economic growth induces person and freight mobility: increasing the production of goods (either in absolute or in added value) means inducing bigger movements of persons (in order to produce and to consume) and visible trades of freight.

The second reason is both practical and historical: even if lots of social and economical phenomena are strongly influenced from their initial conditions, a wide-ranging regularity does not completely guarantee an univocal future evolution.

In the present case, on the contrary, both an in-depth study of Leontieff's input-output matrices and the reading of the available data and estimations confirm that the GDP and transport demand have had concordant trends. In other words, the whole economical system was shown to have the "quality" of stability: its floating data population evolves through intermediate states, which can be observed and controlled. In Italy, this procedure was introduced for the first time by Wassily Leontieff and Paolo Costa for the 1986 General Transport Plan (PGT). The method was then nationwide used in various studies, becoming a standard procedure, which often applied the same Leontieff's evolution ratios (recently, it was expounded again to national level - Iannone, 2003). The same procedure is been used in recent European Union White Paper (2001).

This study intends to verify the correlation level between variations in GDP and variations in national traffic flows in Italy also on a regional scale. The values of GDP, from 1980 to 2003, are related to the flows of passenger and freight traffic (passenger-km, tons-km) by rail (source: Trenitalia) and motorway traffic road (source: Italian Association of Motorway and Tunnel Concessionaire Company, AISCAT) over the same period. Having confirmed the substantially linear dependency and the very high index of correlation of the variables, the respective elasticity function is studied and the elasticity index (relation between demand and GDP) for the four flow variables calculated.

Our analysis shows an elasticity in excess of 1 for road traffic flows (1.71 for passenger traffic and 1.23 for freight traffic) and less than 1 for rail traffic (0.76 for passenger traffic and 0.81 for freight traffic). This means that the elasticity of the road traffic system is considerably higher (for every point of growth in GDP we have a 1.71 growth for passenger traffic and 1.23 for freight). In contrast with the analysis conducted by Leontieff for PGT of 1986 (for both the road and rail sectors systems), the elasticity of passenger flows is higher than that of freight flows in the road traffic sector (the data of 1986 indicate an elasticity of more than 1 for freight and less than 1 for passengers). It should be borne in mind that the calculations for the road traffic system used motorway traffic data, since these are the only uniformly available data over the entire period at issue. Nonetheless, an access to short and medium trip length data, especially that for urban traffic, would probably bring to even higher elasticity values. Indeed, the effect of economic growth would certainly have a stronger effect on short trip passenger traffic flows, in which mobility for reasons of work and acquisition of freight and services dominates, as shown in the latest ASSTRA-ISFORT annual report (2005), according to which "trips within city boundaries, in the period 2000 to 2004, have grown by 12.3% (passenger-km)".

In the case of rail traffic, the lower values of elasticity confirm the loss of competitiveness of the rail system and the growing difference between the two modes.

After analysing the national situation, the study then concentrates on the regional scale level, only for the road system, since regional rail traffic flow data are not available, and only for those regions in which motorway administration is contracted out (16 out of 20).

The obtained results, while requiring cautious evaluation given the use of macro-economic demand forecast models and the considerable terms of extrapolation, enable to analyse with sufficient reliability the progress of demand at the national and regional scales and, in particular, to use the elasticity indexes calculated for the single regional systems.

The Relations Between Regional Economic Development And Evolution Of Transport Demand In Italy

INTRODUCTION

Once the current demand for transport as a result of origin/destination surveys is known, their dynamics over time should be inquired - in other words, the objective is to estimate the origin/destination matrix for future years, in order to be able to quantify the possible needs of transport services and infrastructures.

The most correct procedure is to attempt to determine the law which rules the mobility in a given territory (**territorial interaction models** – the well-known **three-stage models**: generation/attraction, distribution, modal split): it aims at constructing and calibrating a simulation model which gives as output the demand changes as a consequence of changes in the characteristic variables of the territory at issue. Once this law has been determined, it can be used to estimate the progress of mobility over time. It is thus assumed that the variables governing future land use will be available as inputs, a condition which is not always satisfied.

In all cases in which:

- The available data for the future development of the territory are not reliable,
- Transport studies refer to vast territories (national plans, corridor infrastructure feasibility studies), for which no current and future territorial data are available at the desidered scale,

forecast of demand with territorial interaction models is highly problematic. In such cases, it is now established practice to use models based on historical records of observed flows (trends) or macro-economic models.

Trend models (extrapolations of observed flow trends over the various modes of transport) are extremely simple, based on empirical records of traffic data (for example, flows paid for at motorway tollbooths or measured by road infrastructure and transport service managers).

The forecast procedure is as follows:

In other words**:**

$H_f = H_a \times K$, where:

$[H_f]$: Future flow OD
$[H_a]$: Current flow OD
$[K]$: Coefficient of development over time

In some cases, it is possible that the development coefficient is broken up into areas and zones (depending on the available data) and hence applied to parts of the origin/destination matrix.

Note that caution is required by the theorems of numerical analysis, which indicate that extrapolations are only reliable for very short terms relative to the period of observation. In other terms, these models multiply the current matrix by a coefficient of growth, on the assumption that economic and territorial variables remain constant over time and, hence, that the evolution of demand in the future will follow the trends observed in the past.

Macro-economic models assume that transport demand depends essentially on a single variable which summarises and comprehends all partial economic and territorial variables. The most detailed application of this method to the Italian case was done for the General Transport Plan of 1986 by the 1973 Nobel Laureate for Economics Wassily Leontieff, and the economic variable used in his analysis was the Gross Domestic Product (GDP), which represents the monetary value of the total wealth produced in the country.

These models have proved to be nationwide very reliable for large scale evaluations, since GDP predictions are available from national (Government, ISTAT, Bank of Italy) and international (EU, European Investment Bank, international financial bodies) studies.

In such models, the flows of transport demand are correlated with economic development indexes (GDP graphs).

The macro-economic model can thus be written as follows:

Hij (future) = Hij (current) x K(GDP)

where:

Hij = flow of traffic between two zones

K(GDP) = Ke x predicted rate of growth of GDP in the future

Ke = Coefficient of elasticity = mean value of the ratio between growth rate of demand and growth rate of GDP (empirical observation).

These models assume that there is a direct linear relation between the growth of demand and the growth of the economy (measured by GPD), and that this relation, even if observed in the past, can be extrapolated into the future.

In the remainder of this study, we shall first verify the existence of the supposed linear relation between growth of transport demand and growth of the economy, and then determine the coefficient of elasticity for Italy as a whole and for all Italian regions for which flow data are available.

The results confirm the general interpretation and thus enable us to use macro-economic models at the national and regional scale, as confirmed by correlation analysis of the economics and transport variables for the period 1980 – 2003.

ANALYSIS OF THE ELASTICITY OF DEMAND FOR ITALY

As already explained, forecasts concerning the demand of a transportation system are normally carried out to evaluate:

- its future, potential critical states;
- the effective performance of the transportation net;
- the benefits for the users and the community;
- the possible sources of economical gain.

In other words, forecasts allow to define the effectiveness of an intervention on the transportation system and both its economical (for the community) and financial (for the operator) feasibility.

The evaluation of the relationships between mobility and economical development can be drawn investigating the data sets of GDP, passenger and freight mobility (see table 1).

Italian statistical data were deduced from available databanks of Italy's National Statistical Institute (ISTAT), Italian Association of Motorway and Tunnel Concessionaire Company (AISCAT) and Trenitalia Service Company (TRENITALIA).

Tab. 1: Gross Domestic Product and mobility of passengers and freight in Italy in the years 1980 – 2003 (**Sources**: AISCAT, ISTAT, TRENITALIA)

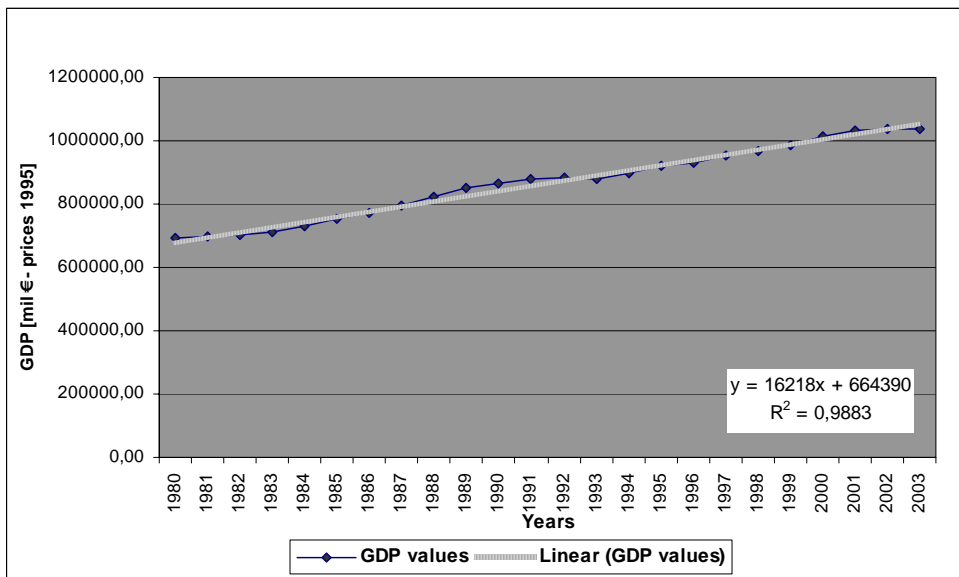| Year	Road Passengers [pass*km*1000]	%	Railway Passengers [pass*km*1000]	%	Road Freight [t * km]	%	Railway Freight [t * km]	%	GDP [mil € - prices 1995]	%
1980	36.788		39.587		49.535		18.384		692.427,19	
1981	38.007	3,31	40.090	1,27	51.207	3,38	17.115	-6,90	697.844,51	0,78
1982	39.851	4,85	39.542	-1,37	51.430	0,44	16.904	-1,23	702.235,71	0,63
1983	40.412	1,41	38.840	-1,78	51.221	-0,41	16.746	-0,93	710.948,22	1,24
1984	42.872	6,09	39.045	0,53	52.801	3,08	17.870	6,71	730.556,87	2,76
1985	45.339	5,76	37.401	-4,21	40.493	-23,31	17.968	0,55	752.321,04	2,98
1986	49.083	8,26	40.500	8,29	42.225	4,28	17.410	-3,11	771.336,10	2,53
1987	53.481	8,96	41.395	2,21	45.627	8,06	18.625	6,98	794.288,12	2,98
1988	58.376	9,15	43.343	4,71	49.821	9,19	19.663	5,57	825.574,22	3,94
1989	62.212	6,57	44.443	2,54	54.110	8,61	20.587	4,70	849.402,06	2,89
1990	64.717	4,03	44.709	0,60	56.539	4,49	21.170	2,83	866.196,46	1,98
1991	66.094	2,13	45.065	0,80	59.747	5,67	21.680	2,41	878.216,68	1,39
1992	68.435	3,54	44.409	-1,46	61.524	2,97	21.349	-1,53	884.787,87	0,75
1993	69.943	2,20	42.720	-3,80	61.459	-0,10	19.965	-6,48	877.043,75	-0,88
1994	72.252	3,30	43.375	1,53	64.676	5,23	22.515	12,77	896.455,56	2,21
1995	74.347	2,90	43.859	1,12	67.957	5,07	24.050	6,82	922.687,07	2,93
1996	75.318	1,31	44.782	2,10	68.638	1,00	23.314	-3,06	932.530,59	1,07
1997	78.033	3,60	43.591	-2,66	72.142	5,11	25.228	8,21	951.372,74	2,02
1998	81.321	4,21	41.392	-5,04	75.789	5,06	24.704	-2,08	968.457,14	1,80
1999	83.182	2,29	43.424	4,91	79.638	5,08	23.781	-3,74	984.403,72	1,65
2000	85.802	3,15	47.133	8,54	83.942	5,40	24.995	5,10	1.014.190,43	3,03
2001	89.419	4,22	46.752	-0,81	86.283	2,79	24.352	-2,57	1.032.210,64	1,78
2002	91.821	2,69	45.957	-1,70	89.181	3,36	23.060	-5,31	1.036.029,94	0,37
2003	94.528	2,95	45.221	-1,60	91.781	2,92	22.457	-2,61	1.039.366,82	0,32
%: Annual fluctuation										

A first analysis was run to determine whether it was possible to construct a trend line of the same kind for all the considered variables.

Observing the historical values of GDP [€, at 1995 values], for the years from 1980 to 2003, it is possible to see a slightly sinusoidal evolution of this variable over time in comparison with the tendency line. Referring particularly to the trend in growth rates, it can be said that:
- A local minimum in 1982 (0.63% growth over the previous year)
- A maximum in 1988 (3.94% growth over the previous year)
- A minimum in 1993 (-0.88% over the previous year)
- A new local maximum in 2000 (+3.3%)
- A fall over the last three years with values of around 0.32%

The overall valuation (for the whole period) of these fluctuations shows that the growth of this indicator can indeed be approximated by a linear equation (see graph 1). It follows that the average annual growth in the period in question is 1.7%.

GDP [mil € - prices 1995]

$$y = 16218x + 664390$$
$$R^2 = 0,9883$$

GDP values   Linear (GDP values)

Years

Graphic 1 Trend of GDP [1980-2003]. Source: ISTAT, our results.

The curve for the growth of road passenger-km follows the GDP curve described above (graph 2), even though the absolute percentage variation is higher. Referring particularly to the trend in growth rates, it can be observed that:
- A local minimum in 1983 (+1.41% growth over the previous year)
- A maximum in 1988 (+9.15% over 1987)
- A local minimum in 1993 (+2.2%)
- Relatively high values for the period 1998 to 2001 (+3-4% annual)
- A slight drop over the last two years with values around 2.6%.

As the following graph 2 shows, the growth of road passenger-km can be effectively approximated by a straight line (R^2 round 0.98), whose positive gradient indicates a sustained overall growth.
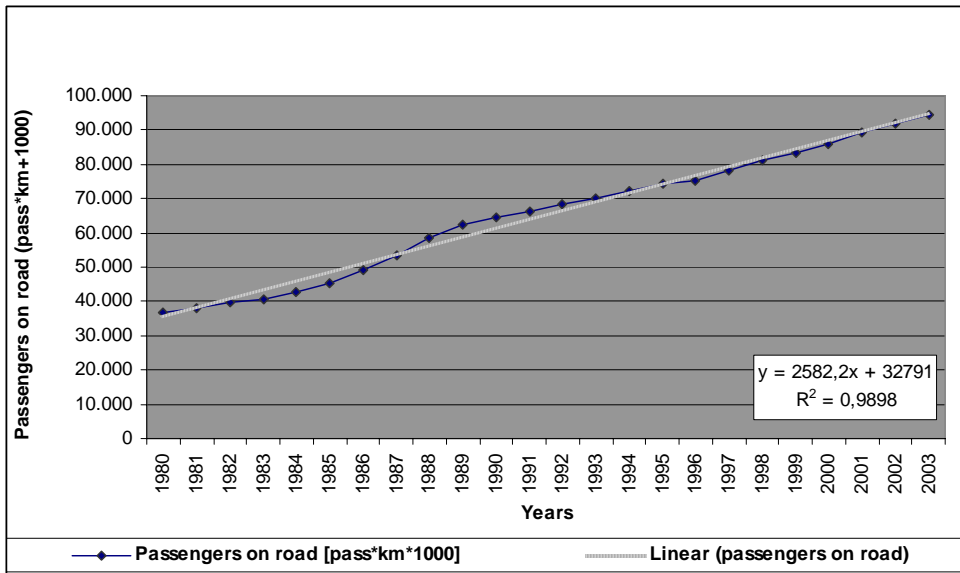
Graphic 2 Trend of passengers on road [1980-2003]. Source: AISCAT, our results.

The observed values of rail passenger-km yield a more alternating development (graph 3): successive years show very significant negative and positive increments (e.g. –4.21% in 1985 and +8.29 in 1986), and the straight line trend shows a mean square deviation of little more than 0.64.
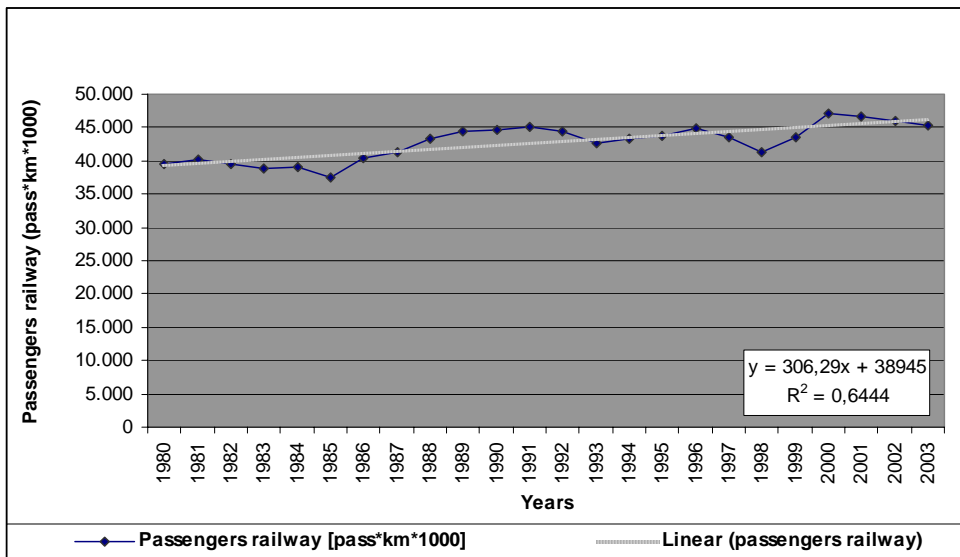
Graphic 3 Trend of passenger railway [1980-2003]. Source: TRENITALIA, our results.

Similarly, the oscillations in value of freight transport (road and rail) show a higher number of ascending and descending phases relative to the GDP and road passenger-km variables, but the approximation by trend lines can be taken to be realistic inasmuch as the mean square deviation is higher than 0.8 (see graphs 4 and 5).
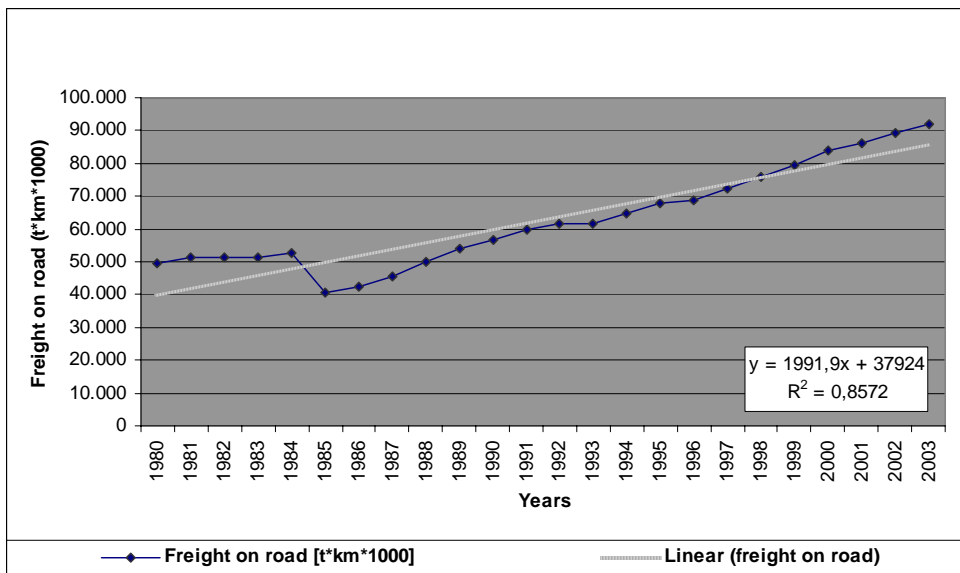
Graphic 4 Trend of freight on road [1980-2003]. Source: AISCAT, our results.
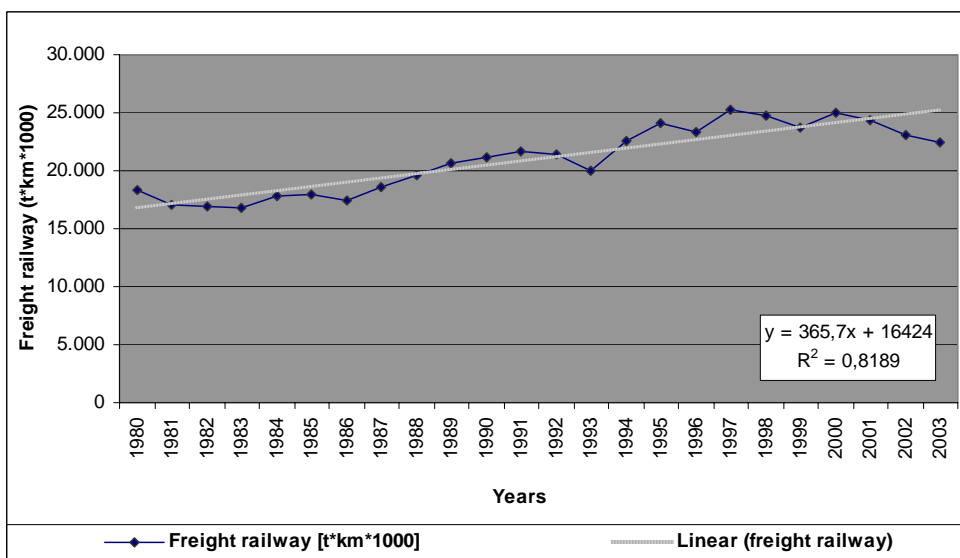
Graphic 5 Trend of freight railway [1980-2003]. Source: TRENITALIA, our results.

Now that we have confirmed the linear trend of the variables, we can go on, and verify the existence of correlations between the macro-economic indicator (GDP) and the flows in question.
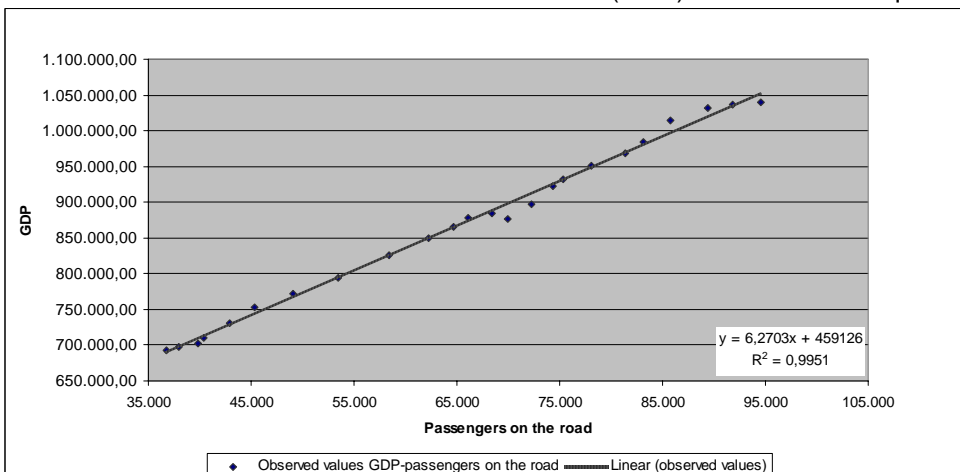
Graphic 6 Relation between GDP and Passengers on the road

The similarity in the graphs shown above is verified by the direct relation between GDP and road passenger-km, to such an extent that the trend line approximates a "cloud of points" with mean square deviation equal to 0.99, in other words, nearly perfectly (see graph 6).

$$y = 36,271x - 684347$$
$$R2 = 0,7197$$
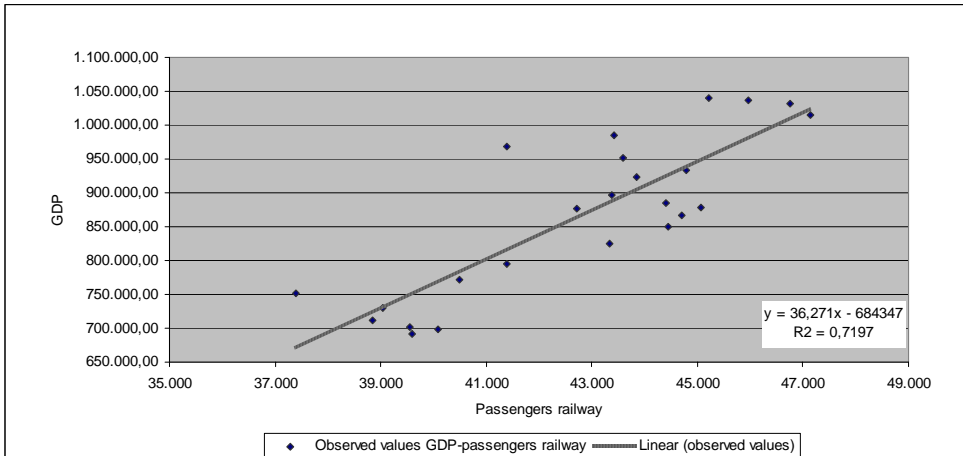
Graphic 7 Relation between GDP and Passengers railway

The dispersion of the observed values is greater in the case of the relation between GDP and rail passenger-km due to the less linear nature of the rail data. Evidently, these data are more subject to external structural modifications which affect their naturally sinusoidal graph (graph 7), so that the trend line approximates the existing correlation with an R^2 circa equal to 0.7.

$$y = 6,9458x + 430759$$
$$R^2 = 0,8391$$
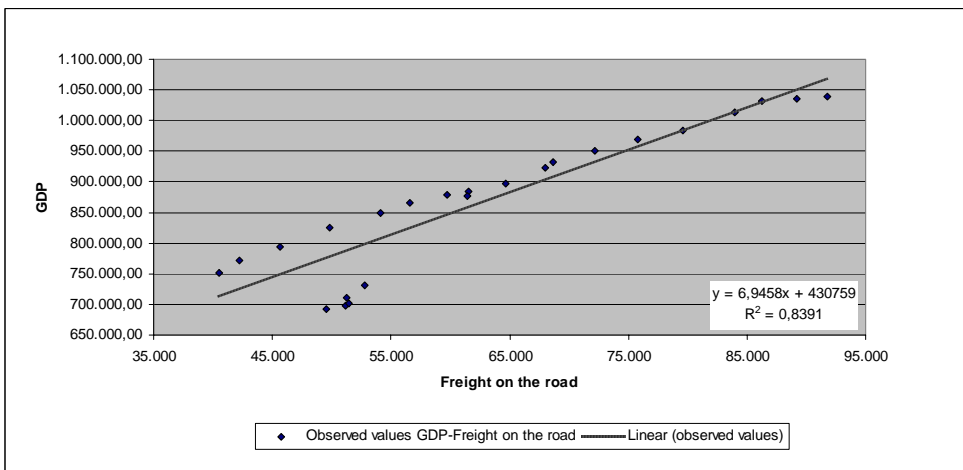
Graphic 8 Relation between GDP and freight on the road

$$y = 37,141x + 87318$$
$$R^2 = 0,8465$$
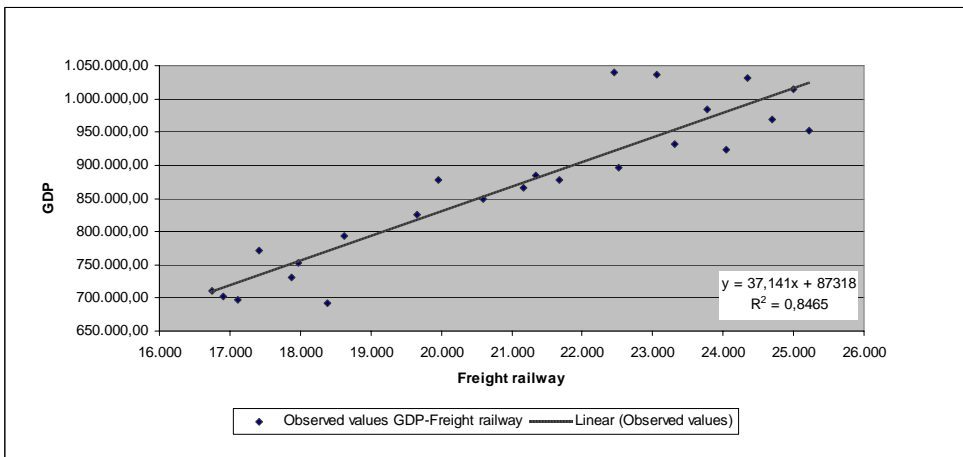
Graphic 9 Relation between GDP and freight railway

Finally, we can see the correlation between GDP and freight transport (road and rail): the observed values for the two cases are close to the regression line (see graphs 8 and 9).

These tendencies can be at least partially explained through economical considerations. Italian entrepreneurs are expected to try to deal with production in the areas where the incidence of labour on the total cost is as low as possible. This carries to a reduction in the general amount of costs, but to a greater necessity of freight movements at the same time. This tendency has then created a new strict dependence between global networks and regional economic systems, in which the Italian enterprises, which are mostly small-sized, store raw materials and semi-finished products to be used both in the production and sale.

These considerations determine greater distances covered and therefore greater traffic streams.
An efficient method to forecast these distances was found by Leontieff (1986), who showed the existence of a relation between GDP and transport demand through some mathematic tools called "Input-Output Matrices".

Basing on that, and using the already showed tendency data, elasticity coefficients for Italy can be easily obtained.
From table 1, rates concerning growth of transportation demand and GDP can be worked out (table 2):

Tab. 2: Growth of transportation demand and GDP for Italy – years 1980-2003 (Sources: AISCAT, ISTAT & TRENITALIA)

	Passengers - Road	Passengers - Railway	Freight - Road	Freight - Railway	GDP
Growth overall rate – yrs 1980-2003	156,7%	14,2%	85,0%	22,2%	50,1%
Growth average rate per year	4,01%	0,55%	2,60%	0,80%	1,71%

From table 2, elasticity ratios between transportation demand and GDP can be worked out (table 3):

Tab. 3: Elasticity ratios between transportation demand and GDP for Italy – years 1980-2003

	Passengers – Road / GDP	Passengers – Railway/ GDP	Freight – Road / GDP	Freight – Railway /GDP
Ratio	1,71	0,76	1,23	0,81

These ratios can be used to forecast future transportation demand in different economic scenarios through the following formula:

$$t_{d,f} = \frac{k \cdot GDP_f}{100} + 1$$, where:

$t_{d,f}$ is the coefficient of transportation demand t_d in the future period f;
k is the ratio, as calculated in table 3;
GDP_f is the believed trend of GDP in the future period f.

As already said, the elasticity coefficients are not expected to be valid in every scenario, as they derive from a rigid extrapolation of past data to a future period. This is the same as saying that the phenomena which caused the past economical tendency are supposed to generate the same effects without any alteration, or rather that the constraints imposed from the structure and the development of external environment are supposed to be unchanging in the future.
This consideration has special emphasis, as the development of certain economical and social phenomena is strongly dependent from the initial situation. Besides that, even a more durable regularity does not assure an unique future evolution.
However, the system can be supposed to be steady also when some variations occur, as long as their interaction net preserve its identity. In other words, the mutation of some components of the system does not necessarily carry to a significant variation of its stability.

ANALYSIS OF THE ELASTICITY OF DEMAND FOR ITALIAN REGIONAL SYSTEMS

This section is based on an aggregation of the available data of AISCAT and ISTAT concerning traffic demand on Italian highways in the period 1980-2003 and Italian regional GDP, respectively.

Such data have allowed to consider the development of GDP and of traffic figures concerning both freight and passenger mobility for every Italian region crossed from a toll highway (16 of 20 overall), as well. Italian Railway Company TRENITALIA assures that drawing out such railway data is merely impossible.

The analysis of this section will include only these 16 regions, for which figures as in the foregoing section are drawn out. Data from other sources (for instance, Italian Road Board ANAS, or Italian Provinces) are not considered, because, as known, they may present some methodological unreliability and inconsistency in the different areas.

Italian economical structure is prevalently based on small-sized enterprises, which cope the competition of foreign countries, above all China and India. To beat competition, Italian enterprises aim at developing products and at building enterprise nets, able to raise quality and win new markets - hereby the necessity of efficient and possibly not too expensive transportation services. This is the main reason for which it is absolutely necessary to consider region-scaled disaggregate data instead of referring to Italy. A complete review of the data for the 16 taken in account regions can be found in appendix 1. Elasticity ratios are showed in table 4.

Tab. 4: Growth of road transportation demand and GDP for 16 regions of Italy – years 1980-2003 (Sources: AISCAT & ISTAT)

Region	Passengers growth overall rate	Passengers growth average rate per year	Freight growth overall rate	Freight growth average rate per year	GDP growth overall rate	GDP growth average rate per year
Val d'Aosta	143,4%	3,78%	73,8%	2,33%	31,3%	1,14%
Piemonte	172,5%	4,27%	87,6%	2,66%	35,9%	1,29%
Liguria	117,9%	3,30%	103,2%	3,00%	26,7%	0,99%
Lombardia	156,1%	4,00%	79,4%	2,47%	56,2%	1,88%
Veneto	170,5%	4,23%	99,7%	2,92%	64,1%	2,09%
Trentino Alto Adige	119,8%	3,33%	83,5%	2,56%	49,2%	1,68%
Friuli V.G.	249,7%	5,35%	309,1%	6,05%	58,5%	1,94%
Emilia R.	146,1%	3,82%	58,3%	1,93%	50,7%	1,72%
Toscana	119,3%	3,33%	60,9%	2,00%	47,1%	1,62%
Marche	179,1%	4,37%	98,5%	2,90%	54,9%	1,84%
Lazio	176,8%	4,33%	88,3%	2,67%	60,3%	1,99%
Abruzzo	205,4%	4,76%	150,8%	3,91%	54,0%	1,82%
Molise	183,7%	4,44%	109,0%	3,12%	42,8%	1,50%
Campania	149,4%	3,88%	77,9%	2,43%	46,3%	1,60%
Puglia	180,2%	4,39%	78,8%	2,45%	46,3%	1,60%
Sicilia	171,8%	4,25%	41,4%	1,45%	38,2%	1,36%
Italy	156,7%	4,01%	85,0%	2,60%	50,1%	1,71%

As seen in the foregoing section, elasticity ratios can be calculated. The results are showed in the table 5 and in graph 10:

Tab. 5: Elasticity ratios between road transportation demand and GDP for 15 regions of Italy – years 1980-2003

Region	Passengers/ GDP Ratio	Freight/ GDP Ratio
Val d'Aosta	1,85	1,32
Piemonte	2,01	1,38
Liguria	1,72	1,60
Lombardia	1,64	1,15
Veneto	1,65	1,22
Trentino Alto Adige	1,47	1,23
Friuli V.G.	2,58	2,21
Emilia R.	1,63	1,05
Toscana	1,49	1,09
Marche	1,80	1,28
Lazio	1,73	1,18
Abruzzo	1,98	1,63
Molise	1,99	1,46
Campania	1,70	1,22
Puglia	1,92	1,22
Sicilia	1,97	1,02
Italy	1,71	1,23

	Valle d'Aosta	Piemonte	Liguria	Lombardia	Veneto	Trentino-Alto Adige	Friuli-Venezia Giulia	Emilia-Romagna	Toscana	Marche	Lazio	Abruzzo	Molise	Campania	Puglia	Sicilia	ITALY
■ Freight elasticity	1,32	1,38	1,60	1,15	1,22	1,23	2,58	1,05	1,09	1,28	1,18	1,63	1,46	1,22	1,22	1,02	1,23
☐ Passenger elasticity	1,85	2,01	1,72	1,64	1,65	1,47	2,21	1,63	1,49	1,80	1,73	1,98	1,99	1,70	1,92	1,97	1,71
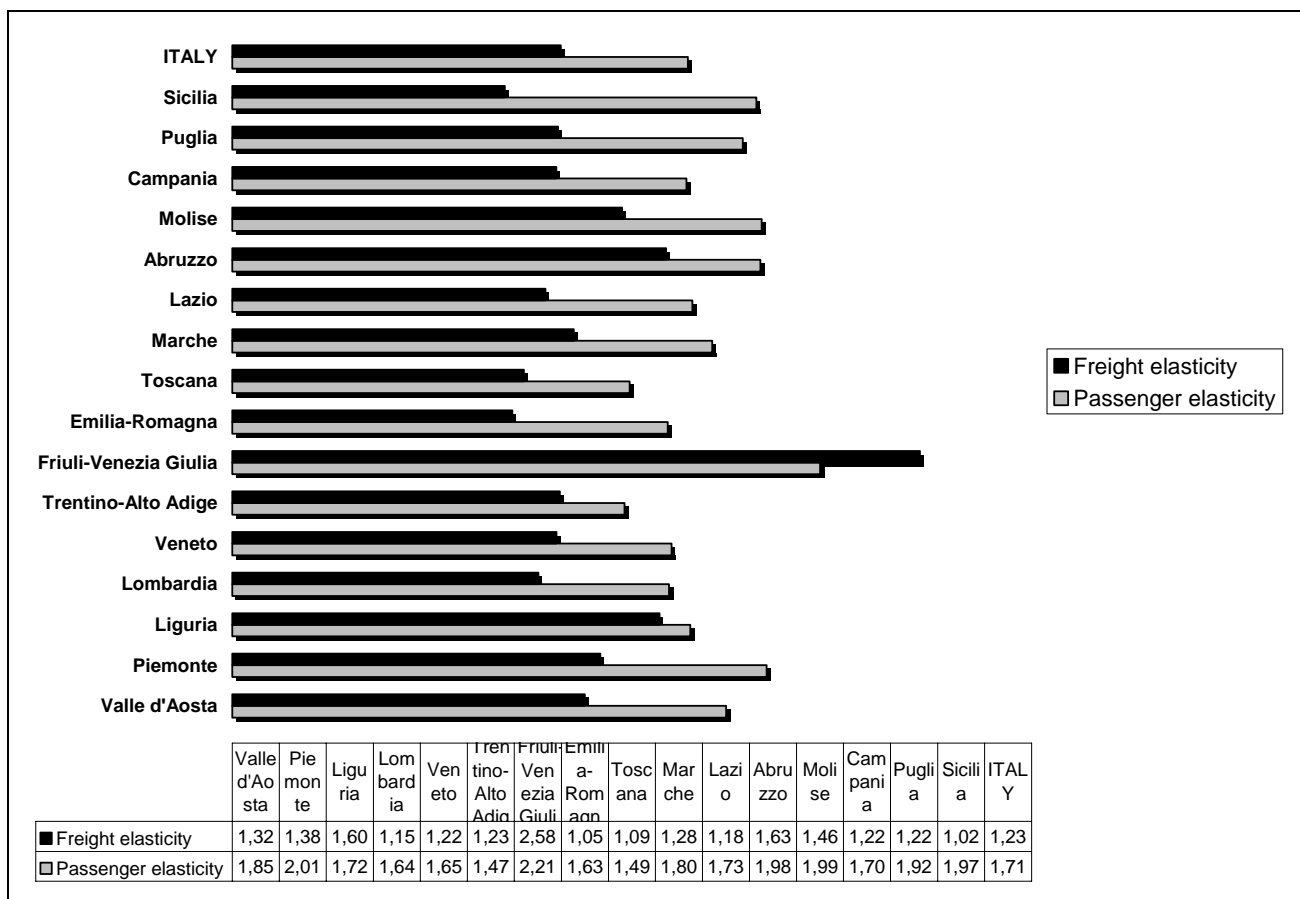
Graphic 10: Elasticity ratios between road transportation demand and GDP for 15 regions of Italy – years 1980-2003

CONCLUSION

This study confirms the validity of the tools used from 1986 Italian General Transport Plan for the forecast of the transport demand flows. It has therefore updated the 1986 out-of-date elasticity coefficients, to this day still used in several transportation issues.

In the application of these new proposed coefficients, the following warnings have to be taken into account.

- Both the interdependence law between GDP and traffic flows and the related elasticity functions have to be constantly monitored, as they can be strongly influenced from possible technological and organizatiorial modifications, both in production and in transport.
- In any case, elasticity coefficients can be used only for small periods of time (between 5 and 10 years depending from the observed stability of the phenomenon).

Headlines from European Commission have not to be ignored in this interpretation: as a steady increase in traffic flows can not be considered consistent with the goals of the White Paper, it is necessary to apply the proposed procedure in conformity to those measures which are to be applied from European Commission.

REFERENCES

AISCAT (1980-2003), "Aiscat informazioni" – *Notiziario trimestrale a cura dell'Associazione Italiana Società Concessionaria Autostrade e Trafori.* Rome, Italy

ASSTRA-ISFORT Elaborations – website: www.ricerchetrasporti.it

Bayliss B. (1988), "The Measurement of Supply and Demand in Freight Transport", Avebury, UK

Cappelli A., Nocera S., and Salerno G. (2005), "Affidabilita' delle Indagini Conoscitive e Coerenza delle Basi Informative per la Costruzione e Calibrazione di Modelli di Scelta Modale Merci", (forthcoming)

European Commission (2001). "White Paper: European transport policy for 2010: decision time". Brussels, Belgium

Fadda P. (2002), "Concezione dei progetti di trasporto in ambiente sistemico". Rubbettino, Catanzaro, Italy.

Iannone F. (2003). "Crescita economica e crescita dei trasporti", *ItaliaMondo Logistica & Intermodalità* 59: p. 4-11

ISTAT – website: www.istat.it

Italian Ministry of Transport (1986). "General Transport Plan", *DPCM 10-4-1986: "Approvazione del Piano generale dei trasporti ai sensi della legge 245-1984"; Gazzetta Ufficiale della Repubblica Italiana*, 111/1986

FS S.p.A., "Italian Railway Transport Data", Rome

Leontief W. (1986), "Input-Output Economics" 2nd Edition, Oxford University Press, Oxford, UK

Libardo A. (2004), " Libardo A. (2004): Veneto, modelli di produzione, infrastrutture e comportamenti modali. Proceedings of National Conference of Italian Society of Transportation Professors, Rome, September, 23rd – 24th, 2004

ACKNOWLEDGEMENTS

REVIEW OF THE DATA FOR THE 16 TAKEN IN ACCOUNT ITALIAN REGIONS

Tab. A1-1: GDP and mobility of road passengers and freight in the Region "Val d'Aosta" – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	69,25	18,61	2175,83
1981	67,74	16,77	2213,90
1982	71,01	16,13	2229,65
1983	72,11	16,05	2255,78
1984	73,35	16,57	2354,79
1985	75,62	16,58	2448,57
1986	81,27	17,39	2519,79
1987	88,71	19,27	2531,78
1988	97,73	21,74	2580,22
1989	104,47	24,26	2635,01
1990	108,27	25,94	2672,87
1991	106,87	29,52	2716,67
1992	111,87	30,34	2742,39
1993	110,41	30,71	2706,18
1994	118,48	32,04	2702,77
1995	136,40	39,09	2714,65
1996	134,64	38,40	2713,72
1997	138,22	39,74	2687,44
1998	139,58	41,52	2811,75
1999	125,45	22,01	2815,36
2000	126,32	17,73	2781,22
2001	134,34	20,04	2880,02
2002	156,30	25,91	2858,23
2003	168,56	32,35	2857,37

Tab. A1-2: GDP and mobility of road passengers and freight in the Region "Piemonte" – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	1909,99	853,92	64488,68
1981	1938,66	846,37	64139,08
1982	2004,35	835,03	63137,66
1983	2017,56	804,09	64239,96
1984	2106,14	844,13	65412,90
1985	2202,42	644,92	67737,38
1986	2355,74	666,01	69996,72
1987	2539,77	716,29	71303,05
1988	2842,78	794,94	74569,60
1989	3117,14	885,26	76107,53
1990	3307,83	936,49	76914,75
1991	3353,34	1002,21	76756,13
1992	3474,90	1023,84	77325,63
1993	3556,85	1052,52	75880,22
1994	3712,09	1124,06	78261,66
1995	3941,47	1198,88	81112,76
1996	4052,86	1215,35	80830,82
1997	4210,76	1282,28	82764,23
1998	4375,64	1344,04	83503,64
1999	4433,95	1392,98	85080,59
2000	4531,04	1454,82	87427,53
2001	4759,54	1502,09	88090,71
2002	4954,89	1546,91	87666,18
2003	5205,04	1602,12	87621,43

Tab. A1-3: GDP and mobility of road passengers and freight in the Region "Liguria" – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	1896,17	497,79	24891,88
1981	1877,76	492,41	24704,20
1982	1956,17	491,92	24301,31
1983	1956,29	500,70	24263,87
1984	2045,77	527,45	25228,14
1985	2153,74	424,60	26134,32
1986	2334,32	444,47	26043,79
1987	2511,70	487,32	26019,72
1988	2730,14	531,89	26464,34
1989	2967,69	576,99	27455,37
1990	3007,76	591,02	28020,16
1991	3024,22	630,70	28405,59
1992	3146,51	657,24	27868,48
1993	3132,22	644,39	27140,58
1994	3215,66	678,48	27430,63
1995	3292,08	720,91	27998,94
1996	3341,36	731,40	28264,03
1997	3470,42	767,36	28806,78
1998	3613,16	811,05	29045,28
1999	3705,65	859,42	29568,50
2000	3792,34	907,96	30700,52
2001	3885,30	939,77	31586,66
2002	4015,38	977,36	31262,32
2003	4132,08	1011,68	31549,38

Tab. A1-4: GDP and mobility of road passengers and freight in the Region "Lombardia" – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	3838,22	1768,07	134005,28
1981	3927,01	1791,57	136118,47
1982	4085,50	1809,29	136710,32
1983	4101,27	1755,79	138678,90
1984	4424,63	1841,08	141972,04
1985	4594,57	1461,35	148437,10
1986	4975,04	1538,75	154325,74
1987	5430,90	1624,31	159351,69
1988	5905,78	1750,47	167838,27
1989	6150,80	1919,14	174715,46
1990	6493,46	1997,36	178898,91
1991	6713,26	2058,00	181230,46
1992	6954,43	2132,22	180548,63
1993	7193,85	2133,95	178001,47
1994	7457,82	2302,60	184234,48
1995	7676,71	2409,82	189934,31
1996	7847,95	2456,87	192574,49
1997	8190,35	2584,99	196009,75
1998	8567,48	2717,45	199448,53
1999	8810,21	2817,93	201044,07
2000	8990,50	2954,52	206101,11
2001	9374,34	3030,91	210025,56
2002	9516,25	3087,12	210481,08
2003	9829,26	3172,74	209324,29

Tab. A1-5: GDP and mobility of road passengers and freight in the Region "Veneto" – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	2174,95	1082,43	57539,50
1981	2196,03	1108,56	58846,75
1982	2278,30	1099,60	60031,97
1983	2272,58	1104,37	59866,70
1984	2427,53	1149,76	62321,99
1985	2555,85	835,10	63851,22
1986	2782,21	881,18	64756,62
1987	3024,75	971,63	67255,03
1988	3338,27	1059,85	70343,03
1989	3489,13	1134,53	72942,87
1990	3576,10	1210,60	74788,38
1991	3668,76	1256,15	75791,60
1992	3798,67	1307,60	77006,15
1993	4059,38	1352,03	77560,77
1994	4272,05	1449,97	79849,14
1995	4460,16	1532,57	83952,55
1996	4545,54	1566,82	85307,94
1997	4737,55	1651,48	88418,66
1998	4978,69	1744,45	89316,26
1999	5188,93	1865,17	90872,61
2000	5279,10	1973,61	94152,73
2001	5549,89	2024,87	94742,93
2002	5681,63	2112,33	94039,16
2003	5883,38	2161,17	94429,62

Tab. A1-6: GDP and mobility of road passengers and freight in the Region "Trentino A. A." – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	515,80	240,56	14883,05
1981	489,22	246,00	14686,43
1982	515,47	242,10	14991,56
1983	511,11	252,66	14963,62
1984	523,54	258,10	15793,46
1985	539,46	165,55	15846,50
1986	586,01	175,16	16023,44
1987	644,94	190,69	16512,57
1988	696,99	204,24	17483,05
1989	716,85	211,67	17786,78
1990	702,52	243,15	18444,85
1991	759,59	259,37	18760,61
1992	758,90	268,88	19040,68
1993	775,97	262,62	18935,48
1994	820,78	282,36	19406,38
1995	855,04	307,47	19552,95
1996	869,22	310,11	20127,46
1997	889,51	321,30	20027,11
1998	933,89	342,85	20828,09
1999	990,81	381,08	20845,39
2000	986,60	404,65	21949,42
2001	1050,25	405,69	22050,28
2002	1106,11	440,45	22134,00
2003	1133,72	441,40	22212,63

Tab. A1-7: GDP and mobility of road passengers and freight in the Region "Friuli Venezia Giulia" – years 1980-2003

Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	471,94	166,78	15685,67
1981	493,70	177,51	15601,65
1982	497,78	177,06	15748,53
1983	499,85	173,18	15450,48
1984	536,53	179,72	15881,77
1985	594,99	134,99	16238,23
1986	715,13	147,13	16632,34
1987	839,85	174,25	17273,00
1988	942,24	193,18	18032,97
1989	995,32	215,38	19157,30
1990	1101,75	235,95	19601,55
1991	1027,44	303,54	19779,47
1992	1048,74	301,35	19850,85
1993	1239,80	363,30	19865,15
1994	1338,95	402,60	20742,61
1995	1413,48	393,81	22215,96
1996	1258,57	420,86	22381,38
1997	1316,18	458,72	22218,54
1998	1369,03	491,93	22448,57
1999	1468,61	538,88	22909,20
2000	1526,46	591,58	23751,03
2001	1581,08	623,65	24185,21
2002	1609,05	658,81	24482,17
2003	1650,43	682,37	24862,69

Tab. A1-8: GDP and mobility of road passengers and freight in the Region "Emilia Romagna" – years 1980-2003

Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	2906,06	1719,22	60770,35
1981	3016,08	1769,63	61354,77
1982	3170,03	1748,02	60711,94
1983	3207,73	1716,47	59711,97
1984	3410,38	1762,93	61283,76
1985	3592,80	1283,45	62230,68
1986	3881,78	1332,61	62962,50
1987	4205,22	1444,27	66001,95
1988	4498,42	1547,02	69420,23
1989	4690,89	1657,92	70985,04
1990	4937,88	1714,15	72210,75
1991	5001,60	1808,08	72969,32
1992	5136,28	1870,08	74088,48
1993	5248,99	1862,47	74246,57
1994	5470,81	1968,08	76673,66
1995	5673,67	2083,83	80829,17
1996	5756,23	2101,62	81640,01
1997	6008,36	2191,63	82923,71
1998	6305,25	2296,75	84289,48
1999	6394,85	2417,98	85786,74
2000	6577,20	2528,00	89550,42
2001	6872,98	2595,59	90727,17
2002	7007,81	2656,43	91330,39
2003	7153,10	2721,55	91560,50

Tab. A1-9: GDP and mobility of road passengers and freight in the Region "Toscana" – years 1980-2003

Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	2296,88	981,73	47683,07
1981	2362,74	989,38	49193,09
1982	2480,01	993,15	49911,94
1983	2510,29	998,92	49128,63
1984	2670,81	1020,23	49656,61
1985	2795,39	810,14	51815,97
1986	3001,62	831,93	52553,26
1987	3242,41	897,84	53350,98
1988	3454,12	964,69	54619,86
1989	3697,41	1023,14	56058,66
1990	3760,44	1069,62	56892,84
1991	3681,12	1118,36	58079,56
1992	3767,35	1142,00	58440,40
1993	3814,43	1105,88	58642,44
1994	3944,34	1135,29	59623,30
1995	4036,40	1176,18	62061,70
1996	4069,14	1194,71	63002,53
1997	4207,09	1250,93	63949,09
1998	4380,87	1311,01	65048,21
1999	4450,36	1385,96	66788,05
2000	4585,47	1444,89	68943,54
2001	4765,64	1479,57	70101,95
2002	4919,97	1533,22	69948,41
2003	5037,95	1579,48	70131,21

Tab. A1-10: GDP and mobility of road passengers and freight in the Region "Marche" – years 1980-2003

Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil €- prices 1995]
1980	1019,89	517,50	17359,98
1981	1061,86	561,97	17340,61
1982	1128,89	564,29	17297,28
1983	1146,45	563,24	17508,15
1984	1209,41	575,78	17579,73
1985	1326,00	446,79	18069,02
1986	1443,18	473,06	18603,91
1987	1572,49	518,58	19185,08
1988	1654,78	554,12	19515,56
1989	1721,82	601,91	20187,89
1990	1824,91	617,42	20654,71
1991	1880,78	663,01	20912,37
1992	1970,03	689,09	21422,06
1993	1997,08	684,75	21278,44
1994	2069,98	721,75	22248,86
1995	2159,08	764,16	23410,89
1996	2207,43	773,52	23798,13
1997	2296,61	810,38	24731,73
1998	2416,29	847,30	24859,70
1999	2482,61	897,66	25675,96
2000	2589,78	947,95	26335,79
2001	2714,07	977,63	26791,46
2002	2796,71	1007,04	26701,08
2003	2846,45	1027,41	26895,44

Tab. A1-11: GDP and mobility of road passengers and freight in the Region "Lazio" – years 1980-2003			
Year	Road passengers [v km * 10⁶]	Road freight [v km * 10⁶]	GDP [mil €- prices 1995]
1980	1814,21	734,15	65621,12
1981	1891,69	767,17	66376,44
1982	2014,31	784,68	67344,74
1983	2063,10	788,75	70563,45
1984	2206,28	809,94	73277,75
1985	2328,82	598,24	75378,28
1986	2514,09	615,09	78933,93
1987	2741,62	653,77	81887,13
1988	3100,06	746,69	83216,18
1989	3400,52	837,97	84453,72
1990	3518,29	881,38	87348,41
1991	3705,92	969,71	89107,10
1992	3895,62	998,24	91255,30
1993	3904,11	959,08	90231,63
1994	3908,53	967,71	90733,73
1995	3957,01	985,40	92639,35
1996	3998,16	1005,31	93413,47
1997	4121,19	1071,61	93896,10
1998	4272,98	1123,66	97057,54
1999	4359,47	1196,73	97510,99
2000	4525,80	1247,30	100021,48
2001	4690,07	1276,98	102470,47
2002	4863,49	1326,27	104006,16
2003	5021,46	1382,73	105181,82

Tab. A1-12: GDP and mobility of road passengers and freight in the Region "Abruzzo" – years 1980-2003			
Year	Road passengers [v km * 10⁶]	Road freight [v km * 10⁶]	GDP [mil €- prices 1995]
1980	819,05	272,30	12922,47
1981	876,84	316,84	13010,27
1982	941,42	328,28	13325,16
1983	958,64	340,04	13581,01
1984	1008,18	311,05	14029,66
1985	1134,10	278,82	14342,89
1986	1243,59	292,65	14840,85
1987	1361,94	320,74	15267,86
1988	1468,10	372,83	15899,59
1989	1625,88	413,20	16584,77
1990	1670,29	421,35	16884,99
1991	1705,89	461,51	17269,29
1992	1811,72	479,67	17550,44
1993	1813,81	468,02	16976,82
1994	1845,61	482,38	17227,61
1995	1871,20	496,29	17673,98
1996	1917,89	498,97	17916,15
1997	1985,74	523,65	18330,71
1998	2080,08	546,62	18395,73
1999	2147,64	578,88	18608,46
2000	2256,53	614,38	19561,01
2001	2358,58	639,33	19908,64
2002	2448,23	665,02	19925,99
2003	2501,20	682,92	19905,22

Tab. A1-13: GDP and mobility of road passengers and freight in the Region "Molise" – years 1980-2003			
Year	Road passengers [v km * 10⁶]	Road freight [v km * 10⁶]	GDP [mil €- prices 1995]
1980	104,28	48,93	3247,07
1981	110,28	58,41	3171,77
1982	117,03	60,15	3109,85
1983	118,53	60,90	3141,76
1984	125,28	62,85	3250,53
1985	144,81	52,89	3373,65
1986	157,53	55,68	3472,45
1987	173,58	60,99	3535,66
1988	182,61	66,18	3785,32
1989	193,83	69,27	3871,36
1990	198,48	69,27	3908,03
1991	200,31	73,44	4005,28
1992	209,67	75,90	4077,74
1993	202,98	73,98	3987,36
1994	207,21	74,58	4117,76
1995	212,64	75,48	4136,56
1996	217,62	74,91	4168,43
1997	224,58	77,22	4343,04
1998	238,62	80,64	4369,69
1999	249,18	86,43	4324,86
2000	263,43	92,52	4488,89
2001	277,41	96,66	4583,76
2002	291,15	99,60	4691,91
2003	295,86	102,24	4637,11

Tab. A1-14: GDP and mobility of road passengers and freight in the Region "Campania" – years 1980-2003			
Year	Road passengers [v km * 10⁶]	Road freight [v km * 10⁶]	GDP [mil €- prices 1995]
1980	2056,66	578,88	46714,51
1981	2275,79	635,62	46779,58
1982	2400,64	665,51	48965,95
1983	2528,43	677,51	49283,62
1984	2656,28	705,30	50806,19
1985	2803,69	524,95	52848,16
1986	2970,65	545,50	52542,83
1987	3268,64	584,28	53473,33
1988	3666,45	659,12	55852,13
1989	3929,49	713,34	57271,40
1990	4124,40	753,96	57892,44
1991	4218,02	763,54	57743,50
1992	4375,65	790,43	58358,75
1993	4416,08	779,18	57631,84
1994	4448,89	782,23	58134,87
1995	4423,67	785,03	58508,58
1996	4470,87	802,75	58247,15
1997	4512,45	836,34	60512,79
1998	4584,9	867,38	62176,66
1999	4685,63	908,84	63167,48
2000	4834,06	942,04	65084,47
2001	4946,98	961,23	66849,51
2002	5016,79	994,45	68009,32
2003	5128,84	1029,91	68332,06

Tab. A1-15: GDP and mobility of road passengers and freight in the Region "Puglia" – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil € - prices 1995]
1980	610,78	264,76	33239,17
1981	647,60	301,36	32565,45
1982	687,00	305,04	32545,05
1983	703,66	306,44	33762,03
1984	747,76	318,90	34620,12
1985	836,74	267,72	35274,11
1986	916,54	274,84	36947,33
1987	1006,40	296,04	38134,14
1988	1073,68	320,62	40204,31
1989	1189,80	342,22	40756,45
1990	1185,74	339,80	41258,71
1991	1181,76	348,98	42303,35
1992	1233,86	359,02	42790,06
1993	1199,56	355,96	41614,19
1994	1295,34	354,66	42842,27
1995	1316,00	355,36	42821,66
1996	1331,44	353,28	43223,05
1997	1382,34	367,22	43758,36
1998	1451,86	385,64	44973,69
1999	1486,56	412,80	47093,02
2000	1546,68	430,52	48113,43
2001	1601,60	442,40	48737,99
2002	1674,26	457,20	49024,67
2003	1711,34	473,46	48613,12

Tab. A1-16: GDP and mobility of road passengers and freight in the Region "Sicilia" – years 1980-2003			
Year	Road passengers [v km * 10^6]	Road freight [v km * 10^6]	GDP [mil € - prices 1995]
1980	484,40	161,30	45224,12
1981	528,20	162,00	45752,25
1982	559,20	165,80	45707,47
1983	590,10	170,50	46926,72
1984	622,90	176,40	48529,75
1985	657,90	152,50	48574,06
1986	717,90	153,60	49793,68
1987	772,50	165,20	51802,38
1988	832,90	176,60	52850,48
1989	891,20	195,80	53203,94
1990	965,60	204,50	54457,54
1991	1004,80	174,40	55467,37
1992	1077,70	178,90	54842,92
1993	1094,00	181,10	54144,62
1994	1030,80	176,40	53571,61
1995	1041,70	183,30	53326,09
1996	1055,00	182,60	54794,58
1997	1079,30	193,40	55925,41
1998	1113,30	206,00	56725,35
1999	1150,20	209,60	57387,09
2000	1209,60	215,80	59086,54
2001	1262,40	216,70	60955,55
2002	1261,20	222,80	61382,30
2003	1316,70	228,00	62481,27