

## STREP: A FORECASTING MODEL OF INTERNATIONAL TOURIST FLOWS BY REGION

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### I. INTRODUCTION

Understanding international tourist movement trends, towards one region rather than another –and knowledge of local tourism system performance– is a basic priority faced with the recent evolution of competitive conditions, whose dependence on property value assured by the endowment of primary resources is decreasing in so many cases. Great care is nowadays given to the price/quality relationship; at the same time, competition between similar, and substitute tourist products, is rising very rapidly. Furthermore, international and intra-regional tourism mobility is reaching unknown levels and is expected to grow even more in the near future. All these elements bring into the picture economic conditions and behaviour as the determinants of the decision process of tourists choosing one or another holiday destination. The ability to compete and gain higher market shares in this context –where the globalisation and the internationalisation of tourism demand are the strongest challenges to face– is a preliminary condition that local tourism systems must develop to assure their vitality.

These are crucial problems for the future of the sector that have to be faced with decision.

Among the basic needs to reach these conditions, there is the implementation of methods and tools of analysis which could monitor the evolution of the markets. Forecasting models of international tourist flows towards tourist regions offering similar products are one of them. This tool has to be devised to give information to public and private operators in the field of tourism, on the future dynamics of international tourist flows at a regional level, taking into account both the perspectives of the economic factors feeding world tourism demand and the competing conditions of the different destinations. Then, it has to join high levels of operativeness to suitable methodological approaches and to accurate estimation techniques.

Furthermore, since this forecasting tool has to be used to direct management measures in the different fields of activity, expertise and responsibility, it should give two basic pieces of information: on the potential development of the main markets of origin of tourism demand and on the capacity of attraction of tourist areas representative of the geographic distribution of primary resources, and of the tourist flow concentration.

To this end, the methodological approach must be developed in order to:

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- Analyse tourism demand as part of the consumer-tourist's expenditure decisions;
- explain the mechanism of competitiveness between regions/areas offering similar, and substitute, products. That means to analyse simultaneously a panel of competing regions, instead of each region separately;
- join the needs of regional breakdown, of theoretical structure homogeneity and of statistical efficiency.

Panel data estimation techniques and in particular the formulation of "sliding tourism regional panel" models, represent one of the most suitable methodological choices (1).

The advantages of such a method are applicative besides theoretical:

- a. it permits greater accuracy of the estimates. In fact, when the coefficients of the same variables can be considered statistically equal for two or more of the regions included in the panel, those coefficients can be estimated with a greater amount of data,
- b. it enables differences in the structure across regions to be tested. Testing for parametric differences gives us the possibility to identify in which region and which variables have a different impact on the phenomenon to be analysed.
- c. it gives the possibility of testing the existence of substitution relationships among the tourist products offered by

the regions of the panel, and then to measure their strength through the cross-price elasticities;

- d. it gives results able to capture the comparative dynamics in international tourism demand distribution among competitive regions then to study the trend of the corresponding, market shares;
- e. it produces a flexible tool whose general structure can easily be adapted to the analysis of other groups of homogeneous tourist areas.

This methodology has been developed by the joint Ciset-GRETA research group through the implementation of the **STREP** (Sliding, Tourism **RE**gional **P**anel) model of forecasting international tourist flows towards each Italian region. This model fulfils the analysis carried out for Italy with the **TRIP** (TouRism **I**nternational **P**anel) model, where the determinants of tourist flows from the most important countries of origin to Italy are identified (Carraro-Manente, 1994).

The Veneto region has been the first case study for which two models **W-STREP** Veneto and **M-STREP** Veneto have been carried out. The need to perform two different models comes from the information they can give: the **W-STREP** (World to Region) model evaluates the total international flows to the region; the **M-STREP** (Multi-origin to Region) model estimates international tourist flows to the Veneto from the same 21 countries of origin analysed by the **TRIP** model. The Veneto is studied as part of a tourist area including other three competing

regions, Friuli Venezia Giulia, Trentino Alto Adige and Emilia Romagna.

The paper contains 6 sections. Sections 2, 3 and 4 describe the theoretical approach and the specification of the STREP model, and discuss the variables designed to capture tourist flows at a regional level. Section 5 presents the estimates obtained for the Veneto Region. The final section emphasises the flexibility of the theoretical and methodological approach used: beyond its application to the case of the Veneto Region, the forecasting tool here implemented can easily be adapted to the peculiarities of other tourist regions.

## II. THE THEORETICAL APPROACH

Basic assumptions of tourism demand analysis can be described as follows.

- the tourist is a consumer who chooses what part of his income and leisure time to devote to a holiday instead of other goods or other tourist services, following a general process of optimal revenue and time allocation through which he distributes his purchasing power amongst alternative uses. In order to achieve a clearer description of the consumer's consumption choice, his decision process can be split into three stages (2):
  - a) in the first stage the consumer allocates his inter-temporal income for either consumption or savings;
  - b) in the second stage he chooses between the consumption of

durables, non-durables, services and other goods, and the "consumption" of tourism, including tourism abroad and tourism at home;

c) finally, in the third stage, he chooses his holiday resort, from the possible tourist destinations abroad. In this step:

- international tourist destinations, including Italy, compete against each other to "capture" the largest possible share in each international tourist market of origin. This competition, which translates itself first of all in different holiday price conditions, needs to model simultaneously several origins and destinations, in order to quantify the relative attractiveness of different destinations and the impact of cross price and supply effects on tourism demand coming from each origin market;
- if such a mechanism of competition operates at a national level it also strongly functions at a local level, and in particular in regions/areas which offer substitute tourist products.

So, starting from these statements, the theoretical structure of the STREP model is based on two fundamental ideas:

- first, that the choice of a specific region as a holiday destination is part of the international consumer-tourist's decision process;
- second, that each "regional tourist product" can be substituted with similar

tourist products offered by regions with similar tourist resources (seaside, mountains, art cities, etc.).

The consequence of the first statement is the need to analyse the choice of an international tourist holidaying in a region inside a country, starting from his decisions to spend for tourism abroad and to holiday in a specific country (Italy in our case). A detailed description of this approach is given in CarraroManente (1994), where the **TRIP** (Tourism International Panel) econometric model is performed by deriving a reduced-form equation of the first two stages a) and b) describes above, and a reduced form equation of the last stage c). More in detail, in the first equation, the number and the dynamics of tourists leaving each of the 21 main countries of origin of tourist demand has been explained by variables such as per capita income, the relative price of tourist services with respect to the price of the other consumption goods, the relative costs of tourism abroad and tourism at home, demographic variables representing both the size and the composition of the population, variables representing consumers' preferences, climatic conditions, and other non-economic variables. In the second equation, the number of tourists coming to Italy from the same 21 countries is estimated as a function of the number of tourists who decide to holiday abroad, and of variables such as the relative price of tourist services in Italy with respect to their price in competitor countries, the cost of reaching Italy from each origin and the availability of different modes of transport, the Italian tourism supply (cultural heritage, natural resources, available facilities), and so on (see Carraro and Manente, 1994). So, the international

tourist's decision to holiday abroad and in Italy has been represented by 42 equations, two per each origin market of the tourist demand.

Once the dynamics of international movement to Italy (**ARRITA**) has been described by suitable explanatory variables and has been forecast, giving the future economic scenario, the next question is: "how can we capture the consumer-tourist's decision process through which he chooses one region as the holiday destination of his stay in Italy, instead of another?"

The structure of the **STREP** model answers this problem. The basic hypothesis is that the substitution between two Italian regional tourist products  $i$  and  $j$  depends mainly on two factors. First, relative prices of tourist services in the region  $i$  (**PT<sub>i</sub>/PTITA**: direct effect of substitution) and relative prices of tourist services in the other competing regions  $j$  (**PT<sub>j#i</sub>/PTITA**: indirect effect of substitution). Second, the relative supply of tourist services and facilities offered by both the productive sectors (**PL<sub>i</sub>/PLITA**, **PL<sub>j#i</sub>/PLITA**) and the primary resources (cultural heritage, natural resources, etc.) of the region  $i$  and the other regions  $j$  of the panel. Undoubtedly offering a varied regional tourist product combining cultural attractions with seaside, lake and mountain resorts is a competitive advantage that some areas have over others.

Nevertheless, environmental decay of such primary resources produces short-to-long run impacts on international tourism demand: events such as the mucillagine in the Adriatic in 1989, or the growing pollution of lakes and rivers, or the congestion affecting

so many art cities can modify international tourist's decision process. Consequently these phenomena have to be modelled by the econometric specification of the **STREP** model, together with the economic variables explaining this step of the tourist's choice.

Let us formalise here the general **STREP** equation for the region  $i$  inside the panel of the competing ones:

$$\text{ARR}_i = f[\text{ARRITA}, (\text{PT}_i/\text{PTITA}), (\text{PT}_{j\neq i}/\text{PTITA}), (\text{PL}_i/\text{PLITA}), (\text{PL}_{j\neq i}/\text{PLITA}), \text{TREND}, \text{DUMMIES}]$$

where the variables above described will be explained more in detail in Session 4 when the specification for the Veneto region will be discussed.

Finally, this theoretical choice requires the use of the estimation method based on panel data, as the competitive regions have to be considered jointly and their equations have to be estimated simultaneously. Thanks to this method, the cross-section dimension and the time dimension of the available historical data for the regions of the panel can be exploited (3)

### III. THE STRUCTURE OF THE STREP-VENETO MODEL

As stated in the previous Section, capturing the dynamics of international tourists towards the Italian regions implies the analysis of the economic and structural characteristics of each region compared to each other and in particular to those which offer a substitute tourist product. Hence a choice was made to model the Veneto region

jointly with three other regions –Friuli Venezia Giulia, Trentino Alto Adige and Emilia Romagna–; the fact of being territorially close to each other and the typology of the tourist product they offer can constitute an alternative choice for international tourism.

Given the regional data from 1980 to 1991, for the Veneto region two models have been set up:

- the first, **W-STREP** (World to Veneto), to monitor the total number of arrivals of foreign tourists in the Veneto, composed of 4 equations, one equation for each region, based on a sample from 1980 to 1991;
- the second, **M-STREP** (Multi-origin to Veneto), to monitor the segmentation of the market through an analysis of the flows from 21 main countries of origin, composed of 21 x 4 equations and based on samples covering the same period of time as above.

The proportion of the total number of foreign tourists in the Veneto to the total number of foreign tourists in Italy ( $\text{ARRVEN}/\text{ARRITA}$ ) was chosen as dependent variable in the model **W-STREP**, with the aim of obtaining more efficient estimates, also taking into consideration the limited amount of data available. Formally, given the selected logarithmic functional structure, the implicit hypothesis is that the elasticity of the arrivals in the Veneto compared to the total of the arrivals of foreign tourists in Italy should be equal to one.

This hypothesis was instead dismissed by

the model **M-STREP** which estimates the international arrivals in the Veneto from 21 countries in absolute values (**ARRVEN**). The construction of such a model needs, furthermore, a methodological system more complex that is expressed in a set of equations with varying parameters. In fact, to be able to estimate a model in which tourist flows are determined simultaneously from 21 countries to the four regions (the Veneto and its three main competitors), it is necessary to differentiate the behaviour of the tourist consumer from one country to another and, towards one region and another. In other words, the panel must contain sufficient inter-regional and inter-national variability.

A model with constant parameters in which, for example, the quota of arrivals in region *j* of foreign tourists from country *i* depends on the relative prices of tourist services in the region, will not be representative because the Veneto attracts more tourists from country *h* than from country *k*. The relative price is in fact the same for all tourists whether they come from *h* or whether they come from *k*. To solve the economic and econometric problem at the same time, it is necessary to hypothesise that, for example, the reaction of the tourist coming from country *h* to a variation of the relative price is different to that of the tourist from country *k*. In more concrete terms, in the model the crucial hypothesis is that the reaction to price variation could be greater for those countries which have a lower income per capita, while countries with a higher income per capita would probably remain untouched by variations in prices.

In the same way it has been hypothesised that a variation in the quality and quantity of

the kind of tourist services offered (basically the number of beds available in hotels and other accommodations) could be considered in a different way by tourists whose average length of stay is fairly high compared to those tourists staying for only a limited period in the region.

To express in formal terms these hypotheses concerning the behaviour of tourists coming from diverse origins terms, the model for the Veneto has had to be written in the following way:

$$\begin{aligned} \log(\text{ARRVEN})_h = & \beta_{0_h} + \beta_{1_h} \log(\text{ARRITA}) + \\ & \beta_{2_{ht}} \log(\text{PTVEN/PTITA-1}) + \\ & \beta_{3_{ht}} \log(\text{PTFVG-EMR/PTITA-1}) + \\ & \beta_{4_{ht}} \log(\text{PLAV/PLAI-1}) + \\ & \beta_{5_{ht}} \log(\text{PLXV/PLXI-1}) + \\ & \beta_6 \text{TREND} + \beta_7 \text{MUCIL} + \\ & + \beta_8 \text{UNSOC} + \beta_9 \text{RECES} \end{aligned}$$

where:

$$\beta_{2_{ht}} = \sigma_{1_h} / \log(\text{PILPC-1})_{ht}$$

$$\beta_{3_{ht}} = \sigma_{2_h} / \log(\text{PILPC-1})_{ht}$$

$$\beta_{4_{ht}} = \sigma_{3_h} / \log(\text{PERMAL-1})_{ht}$$

$$\beta_{5_{ht}} = \sigma_{4_h} / \log(\text{PERMEX-1})_{ht}$$

with:

PILPC-1 = gross domestic product per capita for each country of origin, one year lagged.

PERMAL-1 = average length of stay in the hotels of the Veneto for the countries of origin of tourist flows, one year lagged.

PERMEX-1 = average length of stay in other types of accommodation in the Veneto for the countries of origin of tourist flows, one year lagged.

and furthermore:

$t = 1980, 1981, \dots, 1991$

$h = 1, 2, \dots, 21$ , indicates the countries of origin.

Section 4 gives a detailed description of the explanatory variables used in the **W-STREP** and **M-STREP** Veneto models (4)

#### IV. THE SPECIFICATION OF THE STREP-VENETO MODEL

Let us describe here the variables selected to explain the number of international tourists choosing the Veneto Region:

**International arrivals in Italy**; as already stated, this explanatory variable is used only in the **M-STREP** model. Following the theoretical approach describes in section 2, arrivals of international tourists in the Veneto depend primarily on the total arrivals in Italy. (**ARRITA**). They represent, in fact, the population that tourist regions are competing, to attract. The expected relationship between this variable and the number of tourists choosing the region is obviously positive.

**The ratio of the tourist price index in the Veneto to the tourist price index in Italy** (**PTVEN/PTITA**); this accounts for how the decision to choose the Veneto is influenced by the price competitiveness of other regions.

An increase in the Veneto tourist prices compared with the prices in other regions would encourage tourists to decide to holiday in the latter. So, the expected value for the coefficient related to this variable is negative (direct effect of substitution). In the case of the **M-STREP** model, a parameter indirectly linked to the per capita income expressed in dollars in the country of origin (**PILPC**) is associated to this variable, capturing the different reaction to the same price dynamics of tourists coming, from each of the 21 countries considered. As already said, the elasticity of arrivals from the country  $k$  to the relative tourist price increases when the per capita income in the country  $k$  reduces. Once accepted that the nature of tourism is that of a luxury good, the hypothesis is that the less richer countries are the more sensitive to price variations.

**The ratio of the tourist price index in the competing regions to the tourist price index in Italy** (**PTFVG-EMRI/PTITA**); the relative tourist prices in the competing regions can affect international tourist flows to the Veneto. If the "tourist products" offered by the regions of the panel can be hypothesised to be substitute products, then a price increase in these areas should produce a positive effect on the flows to the Veneto (indirect effect of substitution). So, the expected value for the coefficient related to this variable is positive and it measures the level of substitution between the tourist products of the regions included in the panel. The lower its value, the more diverse are the regional tourist products. If it were equal to zero the tourist product of the Veneto would enjoy a quasi-monopolistic position. The best specification of the model has shown the weighted index of tourist relative prices in Friuli Venezia Giulia and

Emilia Romagna (PTFVG-EMR/PTITA) as the more suitable indicator capturing the cross effect of substitution. Relative prices in other regions were tested not to be statistically significant.

As for the previous one in the M-STREP model, this variable has also been related to a variable parameter depending on the per capita Income dynamics in each country of origin. So, a price increase in competing regions should produce a positive effect stimulating more tourists from less rich countries to holiday in the Veneto.

*The ratio of the accommodation and recreational services supply of the Veneto to the supply of Italy* (PLVEN/PLITA); this variable has a two-fold role. First it verifies if the supply side of the market is affected by any restriction; second it evaluates if quantitative and qualitative innovation on the accommodation and recreational services supply can produce growing flows of international tourists, also thanks to a stronger promotional activity. The expected value for the coefficient related to this variable is positive. Different variables have been used to capture these phenomena: number of hotels and other means of accommodation, number of restaurants, of swimming pools, etc. The econometric specification search showed the ratio of the number of beds in the region to the total number of beds in Italy (PLVEN/PLITA) as the more significant variable. The number of beds has been weighted on the grounds of their distribution by typology with the aim of taking into account qualitative information besides the quantitative ones.

This factor has been separated into hotel

and extra-hotel components in the **M-STREP** model. Variable parameters have also been estimated also in this case, the length of stay in the hotel and in extra-hotel accommodation being the element knowing by country of origin of tourist flows and then influencing the value of the elasticity estimated for each of the 21 areas.

The coefficient is expected to be positive: the shorter the length of stay, the higher its value. Longer length of stay, in fact, is normally related to higher fidelity for the destination and to cheaper holiday and overnight solutions. Furthermore, supply changes can persuade marginal tourists who frequently modify their choices and prefer short stays.

*The ratio of the accommodation and recreational services supply of the competing regions to the supply of Italy*; this variable should measure how many tourists decide to overnight in the Veneto because of the worsening of supply services in other regions. Then, the expected value for the coefficient related to this variable is negative. Nevertheless, the econometric specification search found no variable being statistically significant.

*Characteristics of the regional "tourist product"*; each region characterises itself for a more or less composite tourist product which is in any case a unique and unrepeatable endowment. The peculiarity of the tourist product of the Veneto is its strong variety, able to attract a quantity of tourists larger than the other regions do. These aspects are captured by the fixed effect in the panel estimation which value is expected to be higher for the Veneto than for the other regions.



*The distance from the most important countries of origin of the international tourist flows;* since the majority of international tourists in Italy and in the Veneto comes from Europe and in particular from the German-speaking countries, the hypothesis that the distance from the origin country could play a very important role as an explanatory factor of the attractiveness of one region compared to another, has to be evaluated. The Veneto enjoys a privileged position as to the German and Austrian tourist demand and this factor has to be included in the fixed effect of the model.

*Phenomena of congestion and environmental decay;* lake, river and coastal pollution is a growing phenomenon in the majority of Italian regions. The strongest effect was produced in 1989 by the mucillagine in the Adriatic sea which discouraged many tourists from holidaying in the Veneto. For this reason a dummy variable has been introduced in 1989 for the Veneto (MUCIL). Beyond exceptional events, environmental decay is a trend not only due to pollution but also to the increasing congestion of the most important tourist resorts. The role of these phenomena is described by a deterministic trend (TREND) which coefficient, if negative, would indicate a decrease in the tourist movement to the Veneto explained by a worsening in the quality of the regional tourist product.

*Life-cycle variables;* these have long-run dynamics too, linked to the fact that some forms of tourism in the Veneto are mature products whose life-cycle approaches the steady-state. Its effect cannot be distinguished by that of the environmental phenomena, but is similar since it reduces the

number of tourists choosing the Veneto as their holiday destination. For this reason and to avoid multicollinearity, this variable has also been captured by a deterministic trend (TREND).

*Exceptional events;* in order to account for some phenomena of an exceptional nature that have influenced tourist flows towards the Veneto several dummy variables have been used, in particular in the **M-STREP** model. Those with a statistically significant effect on the tourist arrivals in the Veneto are the following. The first one is related to the tourist arrivals from Ireland which registered a strong increase in 1990 thanks to the Soccer Cup and the celebrations for the Holy Year. Since these events did not affect the Veneto, but the arrivals in the region depend on the arrivals in Italy, the estimated flows in the Veneto coming from Ireland in that year were overestimated. So, a dummy (UNSOC) was necessary to correct the results of the model: the expected relationship is negative.

A dummy reflecting the recession effects produced in the UK at the beginning of the '80 by Government measures has been used. It should capture the negative impact of such resolutions on the propensity to travel for the UK and Ireland in 1981 (RECES).

Finally, in adopting a specific functional form, a log-linear functional form has been assumed. In this way, the coefficients are easily explained in terms of elasticity. The functional specification has been tested by means of suitable statistics and could not be rejected. Estimate results are discussed in the next Section.

## V. ECONOMETRIC ESTIMATES

### V.1. The Estimates of the W-STREP-Veneto model (World to Veneto)

Table 1 summarises the results obtained with the model **W-STREP**, while Figure 1 represents the historical and estimated values of the arrivals of foreign tourists in the Veneto: the econometric model captures very well the turning points and gives a precise picture (the adjusted R<sup>2</sup> is 0.997) of the trend in international tourist flows in the region.

In addition, from the point of view of coherence of the theoretical model, the estimates represent the expected economic phenomena; the direct effect of substitution (a reduction in the number of foreign tourists in the Veneto due to an increase in the relative prices in the region) is equal to  $-0.88\%$ , while the indirect effect of substitution (an increase in the number of foreign tourists in the Veneto due to an increase in the relative prices in Friuli Venezia Giulia and Emilia Romagna) is equal to  $2.15\%$ . Hence signifying that if relative prices in the Veneto increase by  $1\%$ , the quota of foreign tourists in the Veneto falls by  $0.88\%$ ; while, if relative prices in the two competing regions increase by  $1\%$ , the quota of foreign tourists in the Veneto rises by  $2.15\%$ . Note how the second result is even greater than the first, emphasising a strong possibility of substituting the tourist product of the Veneto with one of the other two regions. Note too, that the impact of a variation in the relative prices only becomes significant after a delay of one year. However, there seems to be no significant effect of price substitution in Trentino A.A (5).

The number of beds also have a meaningful significance. An increase of  $1\%$  in accommodation capacity in the Veneto, instigates a  $0.21\%$  increase in the number of foreign tourists who decide to holiday in the Veneto. This variable, as with the relative prices, has a significant impact on the number of foreign tourists after a delay of one year.

Finally, the least positive aspect for the tourist economy in the Veneto must be pointed out. The trend is negative, in that the quota of foreign tourists who choose the Veneto out of the total number of tourists who come to Italy is on a downhill trend. In other words, the long-term effects underlined above (the level of "maturity" of the product, environmental pollution, congestion) tend to have negative repercussions on the number of foreign tourists arriving in the Veneto. Consequently, in spite of the fact that arrivals in the Veneto are growing and that the model **W-STREP** forecasts improved strength for the tourist economy in the Veneto with respect to other regions during the downswing of the economic cycle, in the medium-long term a relative demand contraction has to be expected.

The parameter which measures the effect of variables with a temporal low dynamics (the distance from the main countries of origin, the characteristics of the artistic-cultural heritage of the region, the multi-faceted tourist supply in the Veneto) on the number of tourists arriving in the Veneto, or rather, the fixed effect on the econometric model, takes on a negative value only because the functional form of the model is logarithmic. Once transformed, the value of this parameter, which represents the quota of the average tourist, independent from

variations in economic and non-economic factors as considered above, is 0.366 in the Veneto, 0.066 in Friuli Venezia Giulia, 0.123 in Emilia Romagna and 0.258 in Trentino Alto Adige. This therefore confirms the hypothesis that, *ceteris paribus*, the variety on tourist supply in the Veneto tends to attract a greater number of tourists to the region compared to other regions.

## V.2. The Estimates of the M-STREP-Veneto model (Multi-origin to Veneto)

Table 2 summarises the results of the estimates of the model M-STREP, presenting the estimated parameters for each country of origin and each variable tested to be statistically significant, and corrected with

the values of the dummies introduced to capture the peculiarities of each region and of the countries of origin (6).

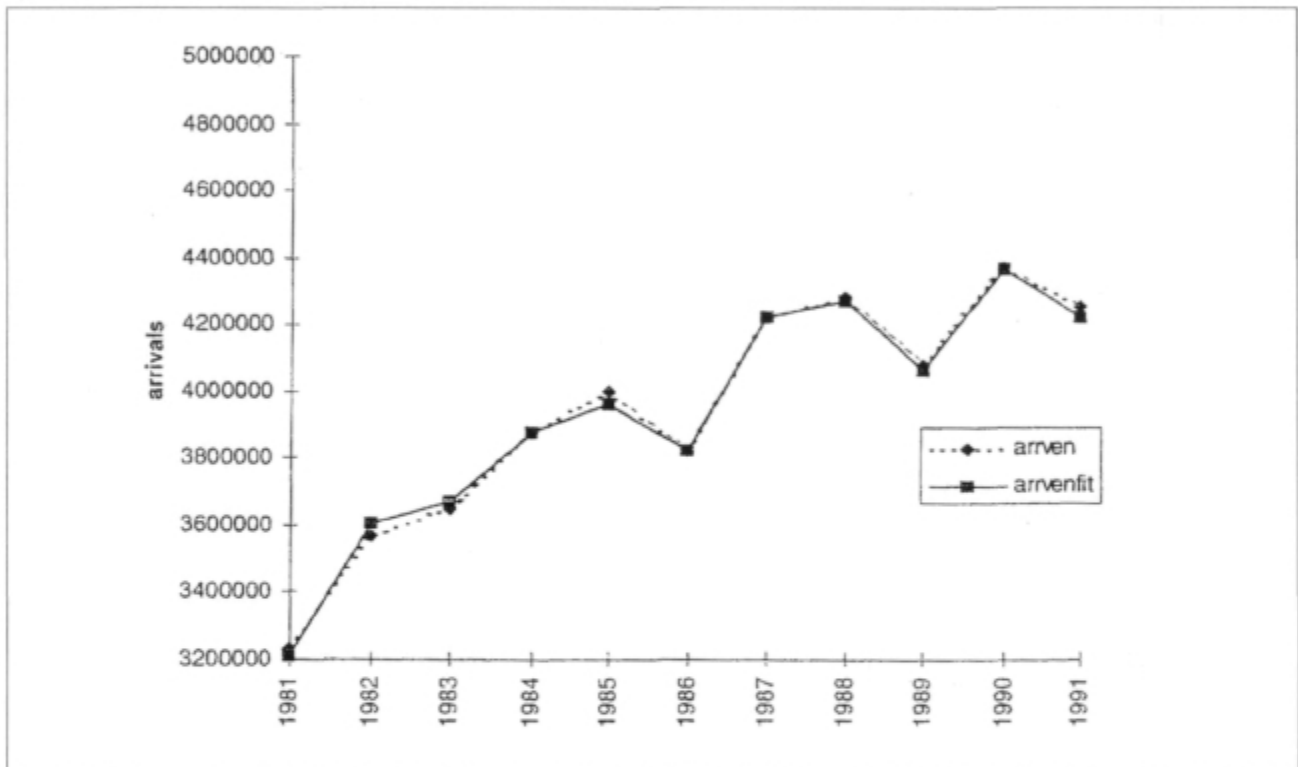
The parameters which define the elasticity of each of the 21 markets of demand with reference to every variable considered assume values fairly close to the estimated average elasticity in the model W-STREP.

The estimate of the elasticity of arrivals in the Veneto compared to the arrivals in Italy was shown to be fairly similar and very close to the unit for all the countries considered. In particular, the value of this parameter is higher for the Veneto compared to the competing regions, a further confirmation of the ability of the region to attract foreign tourists who choose Italy for their holiday destination.

**Table 1**  
**Reduced from Arrivals in Veneto: estimated coefficients of W-STREP Veneto Model**

DEPENDENT VARIABLE: LOG(arrivals in Veneto/arrivals in Italy)		
R-Squared = 0.998		Adjusted R-Squared = 0.997
VARIABLES:		
	Estimated Coefficient	T-statistic
FIXED EFFECT	-1.00	-3.67
TREND	-0.15	-1.35
PTVEN/PTITA(-1)	-0.88	-1.21
PTFVG-EMR/PTITA(-1)	2.15	1.48
PLVEN/PLITA(-1)	0.21	1.96
MUCIL	-0.09	-6.47

**Figure 1**  
**W-STREP Veneto Model: historical and fitted values and forecasts of international tourism arrivals in Veneto**



Relative prices (PTVEN/PTITA) became significant for most of the countries after a delay of one year. It is obviously reasonable to suppose that gathering information in order to programme a holiday would take place before the holiday itself. However, tourists from countries further away (USA, Canada, Australia, Japan) who also have to sustain considerable travel expenses are revealed as being more sensitive to the current variation in prices, as are tourists from not so well-off countries (Spain, Portugal, Greece, Ireland). In particular, a 1% increase in relative prices in the Veneto would reduce the tourist movement from Ireland by 5.81%.

Finally, less sensitivity to variations in prices as shown by the countries of Central Europe could be interpreted as a manifestation of a greater affection and sense of royalty towards holidaying in the Veneto. The number of arrivals from these countries would only fall by about 1.4% if faced by 1% increase in regional relative prices.

The model M-STREP also underlines a strong indirect effect of substitution (PTVFG-EMR/PTITA): the value of elasticity for all countries is around 2%. If relative prices in Friuli Venezia Giulia and Emilia Romagna rose by 1%, arrivals in the Veneto would

increase by more than double that amount. This increase is even greater for those countries who have a lower income per capita (Greece, Ireland, Spain, Portugal), demonstrating a stronger reaction to price variations.

Neither relative prices of tourist services in the Veneto, nor the relative prices of tourist services in the competing regions, were significant for countries in Latin America and Africa, probably because of the particular composition of tourist flows from these areas to the Veneto (very rich segments, ethnic tourism, immigration phenomena).

As has already been seen from the estimates obtained with the model **W-STREP**, an increase in accommodation capacity increases the number of tourists who decide to holiday in the Veneto. In more detail, the model **M-STREP** demonstrates how tourists coming from countries belonging to the macro-region made up of the USA, Canada, Australia, and Japan are the very ones who show a greater appreciation for the quality of hotel facilities. In fact, tourists from these countries choose the Veneto above all as a destination for cultural tourism and as part of package tours which also visit other Italian and European cities and can only but include hotel stays. Instead, tourism in the Veneto from Central European countries which choose mainly seaside resorts, lakes and mountains, is effected positively by an increase in other types of accommodation.

As far as the other variables of the model are concerned, a downward trend in tourism from Austria, the United Kingdom and Holland should be pointed out. While a

positive trend has been indicated in arrivals in the Veneto of tourists from Australia.

The model **M-STREP** also pinpointed the effects of environmental pollution in the Adriatic Sea, which come to a head in 1989. Those countries which react in a significantly negative way to this phenomenon are those which generally choose a seaside holiday in the Veneto: Austria, France, Germany and Switzerland.

Finally, the value of the fixed effect, measuring the different types of impact of all the variables with a temporal low dynamic on the demand for tourism as expressed by each of the countries involved, reveals that the Veneto wields a strong power of attraction on flows from the USA, Canada, Japan, Australia, Latin America and Africa.

## VI. CONCLUSIONS

This report has presented the theoretical framework and the econometric models used to forecast the short to medium-run magnitude of tourist flows at a regional level.

The results from the **STREP-Veneto** model, in both the implementations, "World to Region" and "Multi-origin to Region", seem to confirm how effective the theoretical approach and of the estimation method adopted are. Nevertheless, a positive appraisal has to be given by checking, the ability of the models to capture the analysed phenomena, their operativity and their application flexibility.

As far as the first aspect is concerned, it is made certain by the fairly good estimates and

**Table 2**  
**Reduced form of Arrivals in Veneto: estimated coefficients of M-STREP**  
**Veneto Model**

DEPENDENT VARIABLE = LOG(ARRIVALS IN VENETO)

R-SQUARED = 0.933

COUNTRIES	VARIABLES											
	FIXED EFFECTS	ARRITA	PTVEN/PTITA(-1)	PTVEN/PTITA	PTVG-EMR/PTITA(-1)	PLAY/PLAI(-1)	PLXV/PLXI(-1)	TREND	MUCIL	UNSOC	RCES	R-SQUARE
Austria	-1.14	1.06	-1.44		2.21	0.09	0.09	-0.47	-0.26			0.96
Belgium-Lux.-	-2.25	1.06	-1.45		2.23	0.09	0.09					0.76
Denmark	-4.05	1.25	-2.66		2.15	0.03						0.92
Finland	-4.51	1.25	-2.59		2.15	0.03						0.95
France	-1.99	1.06	-1.43		2.19	0.13	0.14		-0.30			0.71
West Germany	-2.22	1.06	-1.42		2.17	0.08	0.09		-0.15			0.96
Greece	-2.72	1.11		-2.60	2.47	0.07						0.89
Ireland	-2.00	1.06		-5.81	2.33	0.11	0.15			-0.25	-0.19	0.78
Norway	-4.18	1.25	-2.60		2.11	0.04						0.92
Netherlands	-1.30	1.06	-1.44		2.21	0.11	0.09	-0.90				0.81
Portugal	-2.72	1.11		-2.74	2.61	0.06						0.89
United Kingdom	-1.91	1.13	-1.45		2.22	0.10	0.11	-1.23			-0.19	0.79
Spain	-2.72	1.11		-2.51	2.38	0.07						0.79
Sweden	-4.73	1.25	-2.64		2.14	0.04						0.94
Switzerland	-2.21	1.06	-1.37		2.09	0.09	0.09		-0.22			0.88
Canada	-1.29	1.00		-2.92	2.10	0.12						0.93
USA	-1.29	1.00		-2.86	2.06	0.14						0.97
Australia	-1.29	1.00		-3.03	2.18	0.12		0.22				0.96
Japan	-1.29	1.00		-2.98	2.14	0.21						0.99
Latin America	-0.72	0.94					0.10					0.84
Africa	-0.72	0.94					0.09					0.80

the tests performed. These results are due not only to the good specification of the explanatory variables, but also to the use of the panel data estimation technique. The choice of modelling simultaneously more than one region, in fact, is coherent with the methodological approach described in section 2 and used also for the implementation of the **TRIP** model. Furthermore it gives undoubted advantages in the application phase. As already said, in fact, the estimate precision obtained by modelling the Veneto together with Emilia Romagna, Trentino Alto Adige and Friuli Venezia Giulia is better than the

one coming from a procedure modelling only one region. The reason stands on the possibility to exploit the cross-section dimension and the time dimension of the data, and to take into account both tourist characteristic similarities of the regions and the intra-regional variability.

Following this approach, all Italian regions should have been introduced in the panel analysis both to increase the amount of data and to study the whole direct and indirect effects of substitution. A cost-benefit analysis led us to a cheaper choice, but richer in

results. In fact, if the 20 Italian regions had been included, 20 x 21 equations would have been performed, where both the direct price effects and the 19 cross-price effects would have been considered. Furthermore, both the direct and the cross-effect of variations on the accommodation supply should have been tested. So, the number of variables would have been enormous and difficult to manage and multicollinearity among price series would have happened. For these reasons the analysis has been focused only on the group of regions for which the economic analysis was significant.

From the point of view of the operativity of the methodology used, the good quality of the estimates seems to indicate that the research effort has achieved its main goal: the construction of a reliable forecasting tool at a regional level. Moreover, the demand segmentation analysis allowed by the **M-STREP** model, makes this tool an important aid for private and public tourist programming.

Finally, this effort is a good start leading to the generalisation of the methodology to all the regions. The analysis for the Veneto, in fact, will be able to assume greater importance if it can be compared with the results for other tourist areas coming from specifications of the same approach here discussed. From this point of view let us stress the flexibility of the STREP model which can be adjusted to the needs and the objectives of each tourist region.

## REFERENCES

CARRARO, C., PERACCHI, F. and WEBER, G., eds.

(1993), *The Econometrics of Panels and Pseudo Panels*, special issue of the *Journal of Econometrics*, North Holland, Amsterdam.

CARRARO, C. and MANENTE, M. (1994), "The **TRIP** Forecasting Models of World Tourist Flows from and to Italy", *Quaderno* n. 8.2/94, Ciset, Oriago (VE).

CARRARO, C., COSTA, P. and MANENTE, M. (1994), "Il modello STREP di previsione dei flussi turistici internazionali in Veneto. Struttura teorica, parametrizzazione e previsioni al 1995", *Quaderno* n. 8.4/94, Ciset, Oriago (VE).

HSIAO, C. (1986), *The Econometrics of Panel Data*, Cambridge University Press, Cambridge.

## NOTES

(1) The word "Sliding" means that the group of competing regions changes according to the specific region to be studied. The word "Panel" means that the equations for the chosen group of regions are estimated simultaneously, thus exploiting both the cross-section dimension and the time dimension of the data base.

(2) This division implies appropriate assumptions — that are a standard practice in applied consumption analysis — on the separability of the utility functions describing the consumer's preferences. These assumptions, here adopted, isolate the set of relative prices that determine the consumer-tourist's decision at each different stage.

(3) See Hsiao (1986) and Carraro-Peracchi-Weber (199j) for a detailed presentation of the adopted methodology

(4) Differences on the economic and tourist structure of the regions and/or on the behaviour of the tourists coming from the 21 origins have been tested including a dummy for each explanatory variable per region and per country of origin of tourist flows.

(5) The low value of test t relates to these two parameters is tied to the reduced dimension of the sample (in spite of the framework of the panel, there are only 48

observations). Therefore, in structuring the model it was preferred to optimise, the adjusted R2 criteria, for which, using the theorem of Pesaran, all the variables with a test t superior to 1 were considered significant.

(6) In order to make easier the reading and the interpretation of the results, the estimates of the elasticity

of price and of the elasticity with regards to accommodation capacity have been reported in terms of the average value, taking into account the estimated parameter, and calculated respectively using the average data for the period 1981-1991 of the GDP per capita of each country, and the average length of stay specific for each country for the period 1981-1991.