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A MODEL FOR THE PORTUGUESE TOURISM MARKET

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Abstract: The discussion of tourism problems is classical and many developments have brought tourism models to the actual debate. In a moment when global crisis is painful for many economies mainly in many developed countries, this topic is now particularly relevant. In this study, factors explaining demand, supply and prices are discussed. At macroeconomic level, it is seen how they contribute to model the Portuguese tourism market. A relationship among the variables is analyzed and its modeling is represented mathematically. The model allows us to conclude about the contribution of this kind of model to show the importance of these variables and relationships to the determination of the macroeconomic aggregates in the Portuguese tourism market.

Keywords: Tourism, Portuguese Market, Tour Operator, Tourism Demand, Tourism Supply

Introduction

The tourism in Portugal is very important in terms of macroeconomic aggregates. And very particularly, there are several Portuguese regions in which tourism is the main contributor sector for Gross National Product.

A Report of World Tourism Organization (UNWTO, 2008) showed how tourism is important as economic activity in Portugal. According to this Report, Portugal is one of the 20 most visited countries. In that year, more than 12 million people visited Portugal, more than the Portuguese population. In 2008, according to INE preliminary data (Instituto Nacional de Estatística, 2009), tourism has generated about 5% of GVA of Economy, which is approximately 7.3 billion Euros. According to the Report on Competitiveness of Travel and Tourism, 2008 (World Economic Forum (2008)), Portugal occupied the 15th place that year, in a list of 130 countries in the ranking of competitiveness of the tourism sector. Overall climbed seven positions compared to 2007 and four positions in all 27 EU countries (Portugal Digital, 2008). Amador and Cabral (2009) present a detailed analysis of the evolution of the services sector in Portugal and show that this favorable trend is verified in this sector in general and in particular that Portugal reveals a comparative advantage in the sector of Travel and Tourism.

These facts explain why a model like the one developed in this study for tourism market in Portugal is so relevant. The model implemented considers a set of variables and relationships that will be explained in the next chapter.

Main Features of the Model and Theoretical Concepts

The model main features for the Portuguese tourism market are the following aspects:

- The study of the market of the tour operator (travel agency);
- A strong support on microeconomic theory;
- It is supported on 3 items: demand, supply and prices;
- It permits to obtain results associated to exogenous variables and to tourism rents.

In fact, the macroeconomic building of a model like this one is supported on a set of suppositions around the tourism product, economic agents and the several different types of existing markets.

Tourism Product

Tourism Product is the trip plan of a tourist, self-made or not, being the overnight staying/revenue per bed the variable to be quantified. If a tourist is not national, this product is obtained in the market buying a "package" supplied by the tour operator. Taking into account that plans and programs are well diversified, it is considered that the variable "overnight staying" is good enough to be an approximation to the Homogeneous Product.

Economic Agents

In the Portuguese tourism market it is relevant to consider three economic agents:

- The tour operator/travel agency
- The accommodation company/hosting company (hotels, hostels, etc)
- The tourist.

Tour Operator

Headquartered in the emitters, the tour operator is responsible for a big part of tourists that come to Portugal from abroad.

The tour operator is the main agent on this market. Tour operators are near the tourist and have lots of possible destinations available to send tourists to. Besides, several tour agents have a significant part of market share and this is quite relevant to be considered in the analysis.

Their positioning in the market and their economic capacity allow them to be very accurately vigilant to the features of the markets and to be aware of changes in the habits and economic conditions of the tourists.

This shows how important is their great bargaining power among firms that offer services in the country, especially in companies for accommodation (hotels and similar).

It is particularly impressive the power of intervention on prices and the possibility of withdrawal of accommodation services if they do not have enough demand for the programs they offer. The costs of this operator will thus be closely linked to the acquisition of services to include in the package.

Company for accommodation / hosting company

The hosting company emerges as the main supporting infrastructure for tourists. Its short-term, goals are to increase occupancy and to improve the revenue per bed. The tour operator is its main interlocutor, that makes it a price taker (can' not enforce the rack rate, which is the price that would maximize its utility function).

The company has significant fixed costs. The "variable costs" are the variable that has a direct and proportional connection with "overnight stays".

The supply of accommodation is in turn a function of the stock of fixed capital, which combined with the staff, ensures the service to be provided to tourists.

Tourist

Moving from his/her place of habitual residence, whether abroad or in Portugal, for a period exceeding 24 hours, the tourist accommodation is the main support infrastructure in place he/she is visiting.

The tourist is a consumer who seeks the tourism product because he needs it and because he has financial capacity to acquire it.

This "good" or tourism product results from a concrete plan that tourists draw up, or results from one plan accepted by the tourist that is drawn up by the operator. It includes the location or destination (possibly several), and the activities he wants to accomplish and yet the cost travel.

It is considered that tourists from abroad primarily use the services of tour operators ('packages' or holiday programs). National tourists, in turn, project (produce) their holiday program, which leads them to directly contact the housing companies.

Tour operator, hosting company and tourist represent the major economic players in the Portuguese tourism market. Each one of them wants to maximize its respective utility function and will have its own restrictions. The tour operator may not sell more "packages" than the acquired overnights. The hosting company has the housing capacity as the main obstacle to an increased supply of overnight stays. Tourists will naturally be dependent on either their needs or their ability to purchase travel.

The Design of the Model and Theoretical Discussion

Some blocks for the model

In this model of the tourism market in Portugal there are three blocks: the demand, supply and prices.

Demand

It is considered that tourism demand is explained by exogenous variables, by policy and by prices.

Demand functions are developed for national tourists, for foreign tourists by emitter countries, and a global demand function.

Demand function for foreign visitors by country

For emitter countries of foreign tourists in Portugal (Spain, France, Holland, Germany and UK are the main tourists' suppliers for the Portuguese market), the main determinants of overnights (variable to be explained) relate to the following variables:

- non-essential consumption of households in the emitters;
- Purchasing power of the currency of the emitters;
- Price of accommodation in Portugal corrected by the exchange rate of the emitter country, if it is the case;
- Price of goods and services in Portugal weighted by competition from other countries of destination;
- Overnights spent in the previous year,
- Time (trend effect).

For each of these variables the following explaining factors are listed:

a) Purchasing power of the currency of the emitters (*PCME*);

This variable relies on the assumption that tourists are sensitive to changes in exchange rates and price increases in tourist destinations, compared with prices at the place of residence or in the emitter country. Its calculation is derived from the knowledge of inflation rates in the country of destination adjusted by the existing ones in the country of origin. This will deflate the exchange rates, showing how much the holiday in a tourist destination costs in real terms, compared with its cost at the place of residence.

b) non-essential consumption of households in the emitters (*CPNE*)

For establishing the values of this variable was considered as non-essential consumption the one that does not include expenditure on (statistical aggregates):

- Food, beverages and tobacco;
- Clothing and Footwear;
- Housing;
- Medicines and medical care.

These items appear in the National Accounts as part of final consumption of households on the economic territory.

This represents the hypothesis that the families will travel in tourism after the guaranteed expenditure on goods and basic services.

c) the price of accommodation in Portugal adjusted by the exchange rate of the emitter country ($PHTC$)

This variable is considered as associated with the average price of "packages" sold in the UK, weighted by the exchange rate of each emitter country (if considering just the main non-euro emitter country).

d) Price of goods and services (IPC) in Portugal weighted by the prices of goods and services (IPC) of competing countries.

The purpose of this variable is not only to measure the relationship between the prices of goods and services between sender and receiver country weighted by their exchange rate, but also to include the competitiveness of other destinations comparatively to Portugal, via weights which result from the market share for these countries (destinations) to the main flows of tourists travelling to Portugal.

e) Overnight stays in the previous year (D_{-1})

The purpose of a visit that took place recently, either to repeat or to inform others, influences the flow of tourists away.

f) Trend effect (T)

Broadening the scope of the previous variable, this effect has structural characteristics that, in tourism, in many situations can' not be neglected (habits, knowledge to be extended or the pleasure of seeing landscapes and climates can be explained by the trend).

Mathematically tourism demand for the emitter country can be expressed as follows:

$$DEST = D_1 + D_2 = f(CPNE, PCME, PHTC, PR, DEST(-1), T, DU)$$

Being:

$DEST$ - a measure of demand for Portuguese tourism services, here represented by the number of overnight stays of foreigners (for the emitter country) annually considered;

$PCME$ - purchasing power of the currency of the emitters;

$CPNE$ - non-essential consumption of households in the emitters;

$PHTC$ - the price of accommodation in Portugal adjusted by the exchange rate of the emitter country;

PR - the price of goods and services in Portugal weighted by the prices of goods and services by major competitors in tourism;

$DEST(-1)$ - a measure of demand, represented by the number of overnight stays of foreigners in the previous period;

T - the tendency or effect "trend-time";

DU - the "DUMMY" variable.

It is expected that variables $PCME$, $CPNE$, $DEST(-1)$ and T are directly related with dependent variable $DEST$, this is $\frac{\partial(DEST)}{\partial(PCME)} > 0$, $\frac{\partial(DEST)}{\partial(CPNE)} > 0$, $\frac{\partial(DEST)}{\partial(DEST(-1))} > 0$ and $\frac{\partial(DEST)}{\partial(T)} > 0$. Otherwise, it is expected that variables $PHTC$ and PR are inversely related to dependent variable $DEST$, as follows: $\frac{\partial(DEST)}{\partial(PHTC)} < 0$ and $\frac{\partial(DEST)}{\partial(PR)} < 0$.

To estimate the impact of changes in the variables in tourism demand, the coefficients associated with this impact need to be estimated, and the previous equation be expressed in the following way:

$$DEST = a_0 CPNE^{a_1} PCME^{a_2} PHTC^{a_3} PR^{a_4} [DEST(-1)]^{a_5} T^{a_6} E$$

Using the method of least squares regression, and after a logarithm, this equation can be estimated as presented below, introducing DUMMY variable (just now for reasons of mathematical operating of the model):

$$\ln DEST = \ln a_o + a_1 \ln CPNE + a_2 \ln PCME + a_3 \ln PHTC + a_4 \ln PR + a_5 \ln DEST(-1) + a_6 \ln T + \lambda DU + \ln E$$

So it is allowed the coefficients to be interpreted as the elasticity of the dependent variable for each of the explanatory variables.

Demand global function for foreign visitors

The explanatory variables in global demand for foreign visitors presented in this model are:

• Private consumption in EU countries;

• Housing Prices in Euro;

• Purchasing power of the Euro (once United Kingdom is an important issuing country - one of the five most important - it is used the relationship Euro *versus* British Pound); and just considered the exchange rate Euro / Pound).

The approach made to the variables used in the demand function by the issuing country has some limitations, which are related to the failure to achieve overall series for those variables and not considering appropriate to proceed to a mere sum of the grades obtained for each issuing country.

In its algebraic presentation, this function comes with the following form:

$$DEG = f(CP, PHEURO, PCEURO)$$

And
DEG is a measure of demand for Portuguese tourism services, represented by the number of overnight stays of foreigners;
CP is Private consumption in EU countries.
$PHEURO$ is the housing price in Euros, running the Euro as reference currency for all emitting countries (excluding UK; it will be considered its exchange rate with the pound sterling).
$PCEURO$ is the purchasing power of the Euro in relation to the pound.

It will be used the same method of the previous equation.

Demand function for the National Tourists

To explain the nights spent by Portuguese Tourists in national hotels (D_p), the variable private consumption (CP) and trend (T) are considered as the major determinants.

Algebraically this function will be:

$$D_p = f(CP, T)$$

It will be used the same method of the previous functions.

Supply

Function of Tourism Production

The tourism production consists of the nights spent, considering the maximum capacity of companies. The potential production will result from considering the effective overnight bed occupancy.

This potential production is correlated with investment which changes will be reflected in the stock of capital, and with staff admitted in a situation of rigidity.

Moreover, it is admitted the existence of constant returns on scale, with a Cobb-Douglas function, and it will be established a relationship between the average productivity of labour and the coefficient of capitalistic intensity, emerging the capital as an explanatory variable.

Thus

$$X = f(L, K)$$

And

X is the potential tourism production that is represented by tourists' overnights;

L is the labour factor, given by the average of workers in service during the year;

K is the effective capital stock.

So, not forgetting the trend,

$$X = AL^{1-a}K^a e^{T^t}$$

or

$$\frac{X}{L} = A(\frac{K}{L})^a e^{T^t}$$

after the application of logarithms, it comes

$$\ln(\frac{K}{L}) = \ln A + a\ln(\frac{K}{L}) + T^t$$

In this model, tourism production can be compared to the tourism demand.

Prices

It is considered that the price will influence demand, through supply side.

At first, we have the price of the "package" offered by tour operator (linked to exogenous variables such as inflation in the emitters) to establish the international demand for tour "packages". This price also influence the supply of housing.

In turn, the hosting company submit a higher price (the price of "counter") for taking up excess capacity. For the definition of this price, this company will carry out an analysis of the costs.

An estimate of the cost-function in the hosting company will assume the dependent variable (variable costs) will be explained by overnights and by the prices of goods and services purchased by this company (intermediate consumption).

Formalization

The Demand

Be

$$D = D_1 + D_2 + D_3$$

Where

D is the total number of overnight stays in housing companies;

D_1 is the number of nights spent by foreigners, in group;

D_2 is the number of nights spent by foreigners, individually;

D_3 is the number of nights spent by nationals;

$D_1 + D_2$ is the total number of nights spent by foreigners in the accommodation companies.

$D_1 + D_2 = DEST = f(Y_1, Y_2, Y_3, Y_4, Y_5, Y_6)$

and

Y_1 - Nonessential consumption of foreign tourists

Y_2 - Purchasing power of the currency of the country of residence of foreign tourist

Y_3 - Price of the "package" for Portugal weighted by the exchange rate

Y_4 - Price of goods and services in Portugal weighted by the price of goods and services from competing countries of Portugal

Y_5 - Nights of the previous year

Y_6 - Trend

$D_3 = f(Y_7)$

Being

Y_7 the private consumption in Portugal.

Supply

Be

$$X = f(L, K)$$

In which

L is the number of people working in hosting companies;

K is the fixed capital stock for hosting companies.

And

$$C = f(D_1 + D_2 + D_3)$$

Being C the total variable costs of hosting companies.

The market and the determination of prices

Tour Operator and Its Utility Maximization (Profit)

Be

$$L = p_v q_1(p_v) - p_c q_2(p_c)$$

In which

L is the profit of the foreigner tour operator

p_v is the selling price of touristic product (D) to the tourist, sold by tour operator;

p_c is the buying price of the touristic product (D) by the tour operator to the hosting company ;

q_1 is the touristic product (D) sold by the tour operator to the foreigner tourists – the quantities are measured in terms of overnights;

q_2 is the touristic product (D) bought by foreigner tour operator to the hosting company.

For the maximization of profit, we will have the following model:

$$MaxL(p_v, p_c) = p_v q_1(p_v) - p_c q_2(p_c)$$

Sub. to

$$q_1(p_v) - q_2(p_c) \le 0,$$

$$p_v, p_c \ge 0.$$

The Lagrange function is

$$Z(p_v, p_c, s, \lambda) = p_v q_1(p_v) - p_c q_2(p_c) + \lambda(-q_1(p_v) + q_2(p_c) - s)$$

Being s an auxiliary variable and λ the Lagrange multiplier.

After considering Kuhn-Tucker conditions, and if $\lambda = 0$:

$$q_1 = A\frac{1}{p_v}, A \in R$$

$$q_2 = B\frac{1}{p_c}, B \in R$$

Once

$q_1(p_v) + p_v \frac{\partial q_1}{\partial p_v} = 0$,

$q_2(p_c) + p_c \frac{\partial q_{12}}{\partial p_c} = 0$ and

$-q_1(p_v) - q_2(p_c) - s = 0$, being $s \geq 0$ the auxiliary variable.

So,

$$-A\frac{1}{p_v} + B\frac{1}{p_c} - s = 0 \text{ and so}$$

$$-A\frac{1}{p_v} + B\frac{1}{p_c} \leq 0 .$$

Finally,

$$A\frac{1}{p_v} \leq B\frac{1}{p_c} \quad \text{or} \quad p_c \leq \frac{B}{A} p_v .$$

Let be $\frac{B}{A} = D$, considering $0 < D < 1$,

$p_c = Dp_v$ and consequently

$$p_c < p_v$$

Now, if $s = 0$ (the case in which the restriction equals 0),

$$Z(p_v, p_c, \lambda) = p_v q_1(p_v) - p_c q_2(p_c) - \lambda(q_1(p_v) - q_2(p_c))$$

After first order conditions,

$$\lambda = \frac{q_1(p_v)}{\frac{\partial q_1}{\partial p_v}} + p_v$$

$$\lambda = \frac{q_2(p_c)}{\frac{\partial q_2}{\partial p_c}} + p_c$$

And so,

$$\frac{q_1(p_v)}{\frac{\partial q_1}{\partial p_v}} + p_v = \frac{q_2(p_c)}{\frac{\partial q_2}{\partial p_c}} + p_c ,$$

Resulting, after some operations,

$$\frac{p_v}{p_c} = \frac{1 + \frac{1}{e_{q_2}}}{1 + \frac{1}{e_{q_1}}}$$

If p_v is considered fixed, p_c will depend on the demand functions.

With the conditions of saturation $(q_1 = q_2)$, and $p_v > 0$ and $p_c > 0$, each elasticity will be studied through

$$\frac{p_v}{p_c} = \frac{1 + \frac{1}{e_{q_2}}}{1 + \frac{1}{e_{q_1}}} > 0$$

Five scenarios are possible:

- $e_{q_2} < -1$ and $e_{q_1} < -1$
- $e_{q_2} < -1$ and $e_{q_1} > 0$
- $e_{q_2} > 0$ and $e_{q_1} < -1$
- $e_{q_2} > 0$ and $e_{q_1} > 0$
- $-1 < e_{q_2} < 0$ and $-1 < e_{q_1} < 0$

Considering the first scenario ($e_{q_2} < -1$ and $e_{q_1} < -1$), $p_c < p_v$ and conditions of saturation $q_1 = q_2$,

$$\frac{\partial q_1}{\partial p_v} > \frac{\partial q_2}{\partial p_c} .$$

For the model purposes, this result shows a bigger variation rate in the market of products (overnights, bought by tourists to the tour operators after prices' changes) than in the market of factors (overnights bought by tour operators to the hosting houses).

An example can be found when $q_1 = \frac{A}{p_v} + B$. On this situation there is an inverse relationship between price (p_v) and overnights (q_1) but also an important representative variable of, for instance, the fidelity rate in relation to a destination region.

And now for e_{q_1} (the same procedure for e_{q_2}):

$$\frac{\partial q_1}{\partial p_v}\frac{p_v}{q_1} = -\frac{A}{(p_v)^2}\frac{p_v}{\frac{A}{p_v}+B} = -\frac{A}{A+p_vB} < -1.$$

Considering a lesser elasticity for overnights demanded by tourists and the values for each elasticity, for example:

$e_{q_1} = -1.2$ and $e_{q_2} = -1.7$,

$$\frac{p_v}{p_c} = \frac{1+\frac{1}{e_{q_2}}}{1+\frac{1}{e_{q_1}}} = \frac{0.41}{0.17} \cong 2.41$$

This means that there is a relationship between prices of about 2.41 independently of the value of each one.

Hosting Company and Its Utility Maximization (Profit)

After fixing p_v by tour operator and being p_c determined, it is now just necessary that hosting company use this price to the maximization of its profit. So,

$$\Pi = \overline{P_1}\overline{D_1} + P_2D_2 + \overline{P_3}\overline{D_3} - C(\overline{D_1} + D_2 + \overline{D_3}).$$

Being

$P_3 = P_2$ and $\overline{D_1} + D_2 = f(P_2)$, and so $D_2 = f(P_2) - \overline{D_1}$, in which

P_1 = Price of foreigners' overnights, in group. It is given to the company, once it is determined by tour operator.

P_2 = Price of foreigners' overnights, individual

P_3 = Price of nationals' overnights

So,

$$\Pi = P_2(f(P_2) - \overline{D_1}) + \overline{P_3}\overline{D_3} + \overline{P_1}\overline{D_1} - C(\overline{D_1} + D_2 + \overline{D_3})$$

The hosting company will maximize its profits and deplete its offer capacity, having by restriction the installed capacity.

$$Max\Pi = P_2(f(P_2) - \overline{D_1} + \overline{D_3}) + \overline{P_1}\overline{D_1} - C(f(P_2) + \overline{D_3})$$

Subj. to

$$\overline{D_1} + D_2 + \overline{D_3} = \overline{X}$$

(Or $D_2 = \overline{X} - \overline{D_1} - \overline{D_3}$ or yet $\overline{D_1} + D_2 + \overline{D_3} - \overline{X} = 0$).

Considering the Lagrange function and using conditions for maximization, then

$$P_2 = -\frac{\overline{X}}{\frac{\partial f}{\partial P_2}} + \frac{\overline{D_1}}{\frac{\partial f}{\partial P_2}} + \frac{\partial C}{\partial D}$$

$$P_2 = -\frac{\overline{X} - \overline{D_1}}{\frac{\partial f}{\partial P_2}} + \frac{\partial C}{\partial D}$$

Finally,

$$P_2 = -\frac{1}{\frac{\partial f}{\partial P_2}}(\overline{X} - \overline{D_1}) + \frac{\partial C}{\partial D}, \text{ being } -\frac{1}{\frac{\partial f}{\partial P_2}} = K,\ K > 0.$$

This means that an hypothesis for resolution can be presented having in account a first order linear differential equation with constant coefficients (see Ferreira and Amaral, 1988)[1].

Besides,

$$P_2 = -\frac{\partial P_2}{\partial D_2}(\overline{X} - \overline{D_1}) + \frac{\partial C}{\partial D}$$

or

$$\frac{\partial P_2}{\partial D_2}(\overline{X} - \overline{D_1}) + P_2 = C'$$

being

$$\frac{\partial C}{\partial D} = C'.$$

Solving the homogeneous equation $\frac{\partial P_2}{\partial D_2}(\overline{X} - \overline{D_1}) + P_2 = 0$, which solution can give us some clues about the stability of the complete solution, it is obtained:

$$P_2 = Ce^{\frac{D_2}{(\overline{X} - \overline{D_1})}}$$

A particular solution is:

$P_2 = K$. With $K = C'$ will be

$P_2 = C'$.

The general solution:

[1] The solution is not presented in this paper, because it is very difficult to interpret it in the considered practical situation.

$$P_2 = \overline{P_2} + P_2^* = Ce^{\frac{D_2}{(\overline{X}-\overline{D_1})}} + C'$$

And

$\overline{X} = \overline{D_1} + D_2 + \overline{D_3} + D^*$, and D^* is the non-used capacity

- If $D^* = 0$ and $\overline{D_3} = 0$, it comes

$$\frac{D_2}{(\overline{X}-\overline{D_1})} = 1$$

- If $\overline{D_3} \neq 0$

$$\frac{D_2}{(\overline{X}-\overline{D_1})} < 1$$

- If $D^* \neq 0 \wedge \overline{D_3} \neq 0$, it comes

$$0 < \frac{D_2}{(\overline{X}-\overline{D_1})} \leq 1$$

Conclusion

A model for Portuguese tourism market has been made considering demand, supply and prices. The model is a mathematical formulation of Portuguese tourism and shows how these factors can contribute to explain the market and the impact on hosting rents. It also permits to make a design of the Portuguese tourism market considering tour operators.

The proposal of this model it to be workable by using the total rents of hosting companies, aiming to analyze the quantitative economic impact of these rents in the Portuguese National Product.

Such a model like the one developed represents a tool for tourism companies to improve their results and the services they provide. It has been tested successfully in Algarve, one of the most important Portuguese touristic regions.

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