Gravity and the tourism trade: the case for Portugal

Á. Matias
Banco de Portugal, International Relations Department, and
Universidade de Évora, Department of Economics, Visiting Professor

Abstract

Tourism economics are still fighting for international academic recognition. This is not surprising considering that the increasingly economic significance of tourism has not yet been accompanied by a parallel development of its theoretical framework. This paper aims to make a further contribution to the theoretical foundations of the emerging subject of tourism economics. Considering the existence of very specific characteristics on tourism goods, tourism analysis requires a non-standardized treatment from economic science, frequently using less usual instruments – as is the case for economic geography. Given the relevance of distance on tourism consumption, we argue that gravitational models can be used to explain tourism flows in general, and the ones towards the Portuguese territory in particular. The estimation of the latter leads to the conclusion that although GDP has an important empirical relevance, the role of (economic) distance is no less relevant in both theoretical and empirical terms. The estimation of this simple model allows us then to confirm empirically the relevance of distance on the determination of annual tourism flows towards Portugal; furthermore, it explains the fact that Spain ranks first among the countries presently supplying tourists to Portugal (with an almost constant 50% ratio over time on the total number of tourists entering Portugal).
Keywords: economic geography, gravity, distance, tourism, tourism flows, tourism goods, externalities, gravitational models.

1 Introduction

Only recently has economic science begun to view tourism in accordance with its growing economic importance. However, this comes without surprise given


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that tourism has only assumed itself as an organized economic activity during the second half of the 20th century (after World War II). Before that the longer working day and hence the limited leisure time made tourism activity a restricted privilege to a few wealthy segments of society.

With the economic prosperity of the post-war period – closely linked to the role of Breton Woods institutions – and the fast development of transports – namely by air – the distance factor appears generally as a new approach in the study of market opportunities. Nowadays, economic distance is therefore surpassing geographical distance. These events were thus extremely favourable to the tourism business, which rapidly gained considerable significance without a simultaneous development of the due theoretical framework within economic science. As a consequence, a considerable number of specificities of the tourism market vis-à-vis the general economic laws, have so far been ignored by the so-called mainframe economics. This fact had inevitable consequences at various levels, namely as regards the attention that for a long time has (not) been paid to tourism by the economic policy decision-makers and the insufficient basic economic training of qualified human resources for tourism.

This article aims precisely at making a further contribution to the systematisation of the theoretical foundations of the emerging subject of tourism economics. For the purpose, it is divided into two parts: the first one draws the attention to the possible role of economic geography on the study of tourism trade; the second one appeals to the use of some instruments from the new economic geography to study the growing industrialization of the tourism sector, namely gravity models.

This second part stresses in particular the fact that tourism, besides being undoubtedly a service-based economic activity, it is also, to a certain extent, an industry, since the tourism product - to appear as such - undergoes production process that from a theoretical-abstract point of view, is all similar to what happens in traditional industries (from the obtaining of raw materials to the resulting final product). Here, a gravitational model has been used to study the tourism flows towards the Portuguese territory, the estimation of which leads to the finding that, although the economic aggregate (GDP used as a proxy) has an empirical relevance to the explanation of these flows, (economic) distance is the key variable.

Finally, considering distance as a relevant factor to tourism demand, the issue of promoting the national tourism destination (territory-country), and having also in mind the specific characteristics of the tourism good, one must consider that there might be a role for some government regulatory intervention in this sector, namely through thorough public policies duly connected with the remaining national economic policy, with a view to optimising the huge potential of this sector to create wealth.

2 A role for economic geography on the study of tourism trade

Although being undeniably a service-based economic activity, tourism is also, to a certain extent, an industry, once that the tourism product, to be considered as

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such, must undergo production process similar to the one of traditional industries (from the acquisition of raw materials to the resulting final product).

As this is an industry based on a tradable good, whose sale is intrinsically directed towards external markets, and with the act of consumption depending on the displacement of the consumer to the marketplace, it is important to assess the extent to which the distance variable becomes a determinant one on the explanation of tourism flows.

As economic geography is a subject where distance rises as a relevant element in the decision making process for market agents (whether relating to production or consumption), one can assume that it has potential to make an important contribution to study the main factors determining tourism demand.

2.1 Why studying economic geography within the scope of tourism economics?

Economic geography is concerned with the fact that the economic activity always takes place in a given special location, whose specific characteristics are not at all irrelevant to economic performance. According to Fujita *et al.* [14], this subject studies "where the economic activity takes place and why".

Curiously, although this is not new to economic science, since some classical authors like Adam Smith (1723-1790) and David Ricardo (1772-1823) had already referred to competitive advantages in international trade, with different resources being strongly determined by the geographical variable, it remains something often neglected in economic literature. This happened mainly with texts originally written in the post Bretton-Woods period in particular, when the world economy underwent a primarily protectionist stage, with national economies living in a relatively closed environment and with significant restrictions in terms of monetary conversion.

Nevertheless, at the current time of free trade (and even of advanced economic integration, as it is the case for the European Union), of new information and communication technologies, and of monetary conversion and increased factor mobility, the economic activity always involves aspects related with the optimal location of production. Insofar the location decision process is beginning to be referenced in economic literature as a strategic management decision, once that the competitive advantages arising from the resulting minimization of transaction costs are an unquestionably relevant factor for the strategic profit maximization underlying the rationality imposed on economic agents operating in growingly global and competitive markets [4]. Or, as mentioned by Smith [25, p.150], *"the three most important factors to consider when starting a business are location, location and location"*. Furthermore, the mere empirical observation shows that location can never be considered as an immutable decision, but rather as a variable to be considered at every single moment in the production function of any company.

However, the sole idea of using economic geography to study the tourism activity may seem – at first sight – not to make much sense, since, with natural resources being the fundamental production factor in tourism, the question of the location of tourism activity should not arise, once that it takes place wherever

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those resources physically exist. A closer analysis leads however to the finding that this is only true for tourism based on natural or historical resources and not for the one based on other resources built by man.

Indeed, as we identify three main types of production factors in tourism: - natural resources (as for instance the famous triple S – *sun, sea & sand*); - historical resources (as it is the case for some types of urban tourism), and; - resources built by man (as special events, museums, theme parks, oceanic aquariums, natural parks, etc.), one can easily conclude that only the first two can be considered as economically fixed production factors, whereas the third one, while being a man's construction can be built at any location chosen by man.

In view of this, and due to the growing importance of tourism flows based on this third factor of tourism production, economic geography will have a word to say, not only as regards the spatial location of tourism supply, but also to explain the reasons underlying some agglomeration effects both on the demand and supply side. Another aspect to be considered is the possibility that some economic geography instruments may be useful for tourism analysis in order to explain certain specific phenomena (an example being the present use of gravitational models to assess the correlation existing in the Portuguese case between tourism flows and the distance vis-à-vis the source country).

After having justified the importance of economic geography to a better understanding of the tourism phenomenon, it is important to attain, even if briefly, how the location theory may contribute to the theoretical framework of tourism economics.

2.2 Location theory and tourism

We know how scarce the production of academic writings on tourism economics in general is. It is therefore no surprise that the same happens with the analysis of spatial location in tourism in particular (an aspect of particular relevance on the case of hotels).

According to Grether [16], the academic researchers interested in questions like marketing and corporate initiative have largely ignored the space and location variables. As the research on tourism (even at university level) has been dominated by the marketing approach, tourism research tends to follow the same pattern. Only very recently has the management school begun to "awaken" to the questions related with location and spatial analysis (see Porter [21]).

Fortunately for tourism researchers, there is already ample literature – both classical, neoclassical and contemporary – on *location economics* (according to Smith's terminology [25]), which simplifies the research on the spatial location determinants in tourism industry.

Naturally the former writings by location theorists do not contain explicit references to tourism, since the tourism industry has only gained momentum during the second half of the 20th century. The first contribution came from the pioneering author of the central location theory – Christaller [10], who in 1964 analyzed the spatial pattern of tourism and observed that it resulted from a process contrary to the one giving rise to central locations, hence to the

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conclusion that tourism was a "peripheral" activity. Obviously this conclusion no longer holds and has to be considered within the context the author created his theory, a period during which tourism was a luxury good only available to the wealthier classes (note that he wrote mainly in the 30s).

Although no explicit references to tourism are to be found in the writings of the remaining theorists of location, the present economic analysis of tourism benefits a lot from the findings of the so-called *location economics*. The development of a number of basic concepts and theories was of particular use for the scientific analysis of development patterns in industrial and urban areas in general and in the areas of tourism location in particular.

According to Smith [25, p.153], the fundamental contributions of *location economics* to the economic analysis of tourism can be summarized as follows:
1. Spatial location is an important theoretical and practical determinant of the size and success of any given company; 2. The choice of the best location involves trade-offs between transportation costs, availability of resources and market accessibility; 3. The size of the population and the number and location of competing companies may limit the creation of new corporate initiatives; 4. The economic activities too dependent on particularly bulky production factors or on very specific resources (natural or not) tend to choose a localization near those resources; similarly the companies that produce too bulky products tend to be localized as close as possible to their target-market.

If some of these contributions only very recently (namely with the "new geographical economy" in particular) have been duly systematized (as it is the case with the second aspect mentioned above), others (as for instance the first one) can already be found in the writings of the first theorists of location (as Von Thünen, Weber, Moses or Hotelling).

2.3 The origins of gravitational models

After Isaac Newton (1642-1727) has discovered the basic equation of his theory of gravitational attraction between two objects, the use of this equation was not limited to Physics and has spread to other areas of scientific knowledge, including – more recently – economics itself.

A very wise and eclectic man, Newton followed a heterodox line of thought that gave him a strong creative detachment vis-à-vis everything that drew his attention. Although approaching such different areas of knowledge as, for instance, philosophy, mathematics (a subject he taught for many years at Cambridge University) and religion, he got a wider recognition in physics with his *Law of Universal Gravitation"*, originally expressed by his famous gravity equation:

$$F = G\frac{m_1 m_2}{d^2} \tag{1}$$

where F is the gravitational force; m_1 and m_2 are the masses of objects 1 and 2, respectively; d is the distance between the objects; and G is the universal gravitational parameter (thus described by Newton because he believed this parameter to be constant regardless of time or space).

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The first application, known so far, of the gravity concept to explain space interactions of human activities was developed by Carey [9], although in his case specifically directed to social-economic aspects. It was then necessary to wait until the 60s of the twentieth century to find the first applications of gravitational models to international trade (independently developed by Tinbergen [26] and Pöyhönen [22], as we shall see below).

Newton's law, widely used by various sciences, was therefore also welcomed by the economic science. Reilly's *Law of Retail Gravitation* [23], although focusing the analysis on urban economics (more precisely on the factors attracting retail trade to larger cities), strongly encouraged other authors after him to use the same concept of gravity to other areas of research, likewise international trade.

Even though, gravity models continue to be considered poor in microeconomic terms. Presently, however, this argument is not very well accepted anymore by some authors. According, to Smith [25, p.133], for example, *"a long standing criticism of gravity models has been that they have no theoretical basis (...); [although] historically correct, this criticism is now irrelevant and no longer valid. Stewart (1948) and Zipf (1946), who independently developed the concept of the gravity model, based their formulations explicitly on an analogy to Newton's law of gravitation."*.

Recently, gravity models are being increasingly used, namely by economic geography (see, for example, Brakman *et al.* [8]), since it's internal logic allows – among other possible applications – for the use of the distance element in the analysis of the economic relations between countries or regions.

2.4 Theoretical framework and applications on gravity and trade

In spite of everything else, one must recognize that within the scope of the theoretical framework of gravitational models, the main aspect derives precisely from the fact that these models have a very strong intuitive basis, instead of relying on duly justified restrictive hypothesis – as usual in the economic science. They are, therefore, simple and intuitive instruments for empirical economic analysis, rather than elegant and formally sophisticated theoretical models very difficult to transpose into reality.

Even so, several attempts of theoretical grounding can be found in the relating literature. As mentioned above, Reilly [23] used the gravitational principle to explain the stronger attraction of larger trade areas in his *retailling models*. For a long time the empirical relevance of gravitational models – see, for instance, Isard [17] and Tinbergen [26] – has outdone its theoretical grounding, which gained momentum when, around the 80s, some authors as Anderson [3] and Bergstrand [6,7] have finally made strong theoretical contributions. The same happened with Anas [2], who demonstrated that gravity models, as *logit* type models alike, can be derived from the maximization of a random utility and succeeded thus in inserting these models in the central theoretical body of economic theory.

More recently, Brakman *et al.* [8], for example, state that the gravitational model was more widely accepted by the international trade theory, precisely

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because its basic equation – eqn (2) – can be derived from the *new trade theory*. Fujita and Thisse [15, p.220] – apropos the theory of urban center formation under imperfect competition – mention that consumers' incomplete information is an agglomerative (or centripetal) force as *"the expected utility of visiting a cluster of firms increases with its size, which is a reminiscent of the gravity principle"*.

In any case, and despite all the efforts made, it continues notoriously difficult to derive gravitational models from microeconomic principles. One of the most recent attempts was made by Deardorff [11], an author who demonstrated that the gravity equation is consistent with a number of models commonly used by economic science. Note that this author succeeded in deriving a version of the gravity equation that includes transportation costs (using for the purpose the cif and fob measures of trade flows). This was a further step towards a complete theorization of this kind of models.

All the known attempts to establish a theoretical framework for these models have shown some insufficiencies and it is precisely because of the still existing insufficiencies in the theoretical grounding of gravitational models that the option was taken to refer, in this article, to the possible applications of the gravity equation. Now, for the same kind of reasons, tourism economics – also a very recent subject of economic science – is one of the high potential fields for possible estimations of the gravity equation.

As a matter of fact, taking the *Newton's law*, and by doing the necessary adjustments, it is possible to build a theoretical formulation to the intuitive notion that trade flows tend to be larger between neighboring countries. This idea of gravity applied to international trade was early considered attractive from a theoretical point of view, since it permitted to find within the scope of the economic theory of international trade a basis for the statistical fact that geographically adjacent countries or regions had higher trade volumes.

Having in mind the need to search in economic theory a theoretical basis for the observation of trade flows directed to Portugal we propose here an application of the gravity equation to the study of Portuguese tourism market. However, it is important that, before going further into a specific application to a given sub-sector of international trade – as it is the case of tourism – we crosscheck the evolution of the first applications of the gravity principle to international trade.

The first known application of the gravity equation to international trade was, in fact, independently developed by Tinbergen [26] and Pöyhönen [22], who stated that the negative correlation between trade flows and distance (between origin and destination markets) is generally true for all countries, regardless of their differences in terms of wealth, development, culture, political system, history and social organization.

Later, other developments of the same kind were made by Linneman [20], Aitken [1], Leamer [18], and, more recently, Deardorff [12], to mention just a few. All these developments suggested an integration of the gravity equation in economic theory through international trade. Whereas Linneman tries to do it through a Walrasian general equilibrium system, Deardorff succeeds in deriving

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the gravity equation from the neoclassical Hecksher-Ohlin's factorial endowments.

Aitken and Leamer, in turn, were concerned with more operational aspects of the basic gravity equation. The former suggests that the size of the population must be added to the mass variable (usually expressed by GDP), whereas the latter suggests, when referring to distance, that, despite the major changes of second half of the 20th century, trade continues to exhibit a higher trend volume between neighboring countries, although, as Baptista [5] correctly observes, the concept of "neighbor" used by Leamer must be understood as "in the vicinity" rather then "adjacent to", although this kind of vicinity being not exclusively geographic but also cultural, linguistic, etc. This contribution, refined by Leamer and Storper [19], by referring to the concept of economic distance, gives the location element an important potential as a source of competitiveness.

In short, the gravity equation (in its non-stochastic form), when applied to trade flows, shows as follows:

$$E_{ij} = cY_i^{\theta_1} Y_j^{\theta_2} D_{ij}^{-\theta_3} \tag{2}$$

E_{ij} are the exports between country i and country j; c is a constant; Y_i is the national income on country i, Y_j is the national income on in country j, and D_{ij} is the distance between country i and country j, with θ being the parameter to be estimated, representing the income and distance elasticities of exports. A dummy type variable can be added whenever one identifies possible influences from special factors, such as the cultural proximity between country i and country j, the use of the same language, or any other.

As a result of using logs on eqn (2) it can be now written as follows:

$$\ln E_{ij} = \ln c + \theta_1 \ln Y_i + \theta_2 \ln Y_j + \theta_3 \ln D_{ij} \tag{3}$$

Note that in the above eqns., the estimations for parameters θ_1 and θ_2 are supposed to be positive, whereas for θ_3 the estimation must be negative, as distance is supposed to have a negative effect on trade flows. Fujita *et al.* [14, p.98) even observe that distance has always a high statistical significance in empirical tests, "*typically with the elasticity of trade with respect to distance being of the order – 0,6 to – 1,0".*

This procedure of log-linearization of the gravity equation, followed by an estimation under the usual minimum squares methodology (OLS), depends, as referred by Santos Silva and Tenreyro [24, p.3], on the residuals being statistically independent from regressors. Unfortunately, the variance of residuals is however highly unlikely to be independent from the GDP of countries i and j or from the distance between them (regardless of the concept of distance considered). Under these conditions the OLS estimation must provide inconsistent estimators for the θ parameters in question.

In this article, however, as the empirical application considered below is based on a small sample (N = 12), which by its own nature cannot be extended, the consistency problem does not apply, the results being rather considered as good as it gets for the present purpose. Note however that for larger samples the estimation of gravity models must follow an alternative method to the OLS – as

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suggested by Santos Silva and Tenreyro [24] – so as to avoid the possible estimation of inconsistent estimators for the θ parameters.

Table 1: Foreign trade intra and extra EU as a percentage of total.

	1960	1970	1980	1990	2000	2001
Exports:						
Intra-EU15	71,3	75,7	79,3	79,3	82,4	80,5
Extra-EU15	28,7	24,3	20,7	20,7	17,6	19,5
Imports:						
Intra-EU15	70,3	74,5	75,1	78,0	81,9	81,0
Extra-EU15	29,7	25,5	24,9	22,0	18,1	19,0

Source: Eurostat Datashop, National Statistics 2003

Although initially used to explain why trade flows were larger between neighboring countries (namely those with terrestrial boundaries), the gravity equation has been also used for other purposes in economic science. Following Dentinho [13], *"gravitational models are used to describe and predict the flows of persons, goods and information through space"*. Among the various possible applications of these models, one must emphasize the study of changes occurred in spatial separation structures (as pay tolls, bridges and new roads), the effects of spatial redistribution of urban activities (for example new residential areas, industrial areas, supermarkets, schools or hospitals), the development of input-output multiregional models, or the space attrition and factors of attraction/rejection present in different places, just to mention a few. This last aspect is of utmost importance in the study of the tourism market as the attraction factor is known as one of the fundamental variables of the tourism demand function.

In general, one can argue that there is a stronger economic motivation for trade to occur between two neighboring countries or regions (at least, due to the fact that the inherent transportation costs are smaller). This argument, also known as *distance deterrence*, implies that the trade flows between two areas is inversely related with the distance between them.

Finally, it is also important to consider that, in the European Union in particular, the vicinity approach gains ground due to the reduction of economic distance resulting from the on ongoing economic integration process.

In this case, as in others, there is an effect of (economic) proximity that surpasses the physical – geographical, which has mostly to do with cultural and linguistic aspects, such ad others of the same nature (besides the obvious reduction on transaction costs deriving from the above mentioned economic integration).

Reality suggests, indeed, that the European Union tends to concentrate more and more its trade flows within the scope of its economic space (see Table 1). In fact, at the beginning of the 21st century, the trade volume of the European Union (EU15) with extra-EU countries accounted for nearly 20%, with 80% of the trade within the European Union taking place between its members (intra-

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European trade), a fact that clearly fits within the gravitational principle in question.

3 An application of the gravity equation to the Portuguese tourism market

The theoretical concept of gravity is here applied to tourism exports with a double purpose of both helping on the explanation of some reality trends on Portuguese tourism flows, and also to provide an empirical measure of the importance of gravity (distance) in the tourism demand function.

Indeed, the gravity principle is here used not only to find in economic theory an explanation for some statistical observations that can be drawn from the mere observation of reality – as is the case for the strong concentration of Portuguese tourism demand on the Spanish market, which historically accounts for nearly 50% of total tourism demand for Portugal (see Table 2) – but also to determine how much does distance matters as an exogenous variable in the tourism demand function vis-à-vis the remaining demand variables, namely the income (economic mass).

By comparing Table 2 and Table 3 there is one question arising immediately: - if Spain ranks first in terms of number of tourists arriving annually to Portugal, why does it gives place to the UK in terms of annual tourism revenues in that country? A common sense answer to this question would be that probably the higher average income of the British tourists would be enough to overcame (through a higher average expense) their lower number comparing to Spanish tourists. But in this case the hypothesis in question would be that income (purchasing power) matters more than proximity (distance) on the Portuguese tourism demand function. As we will see through the model proposed in the next section that is not really the case. On the contrary, the gravity model proposed will tell us that gravity matters more than income on what respects the main forces behind Portuguese tourism demand.

3.1 A simple gravity model

The simple model we now propose uses then a specific application of economic theory to tourism – a gravitational model – to demonstrate, firstly, that the statistical fact of having half of the tourism demand for Portugal coming from a single adjacent country (Spain) is entirely in accordance with the basic gravitational principle associated with international trade theory. Secondly, it will result simultaneously obvious that the Portuguese tourism demand has a higher degree of dependence on distance rather than on any other exogenous variable, namely income.

Note, for the purpose, that if we consider tourism as an intrinsically export good, eqn (2) can be directly applied to the tourism sector. It is enough, for the purpose, to consider in E_{ij} only the exports of *tourism goods* between country i and country j (in this case j = P = Portugal), the θ parameter being then interpreted as the elasticity of *tourism* exports relating to income and distance.

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As far as continental tourism is concerned, note also that the means of transportation to be used is not necessarily the airplane – as it is usually the case with insular tourism. This allows for a reduction of transportation costs and will make the distance factor have a significant (negative) impact on tourism flows. Obviously the same will also happen with insular tourism, but with the impact here being smaller, since in this case the consumer has fewer alternatives to reach the place of destination (only by boat), which will diminish the relative weight of the distance factor on the consumer's decision.

Table 2: Portugal: Tourism demand by origin markets in 1998.

	Countries	Tur_i	GDP_i
1	Spain	5756	553
2	United Kingdom	1723	1357
3	Germany	870	1877
4	France	697	1427
5	The Netherlands	435	382
6	Italy	254	1172
7	Belgium*	233	248
8	United States of America	228	8230
9	Sweden	126	226
10	Switzerland	102	264
11	Austria	55	212
12	Japan	41	3783

Notes:

Tur_i = Number of tourists from country i (thousands)
GDP_i = GDP from country i (USD billions)
* includes Luxemburg

Sources: Tur_i - Direcção Geral de Turismo, PT; PIB_i - OECD in Figures 1999.

Thus, the tourism flows directed towards a continental destination, as it is the case with Portugal, must exhibit a negative correlation vis-à-vis the distance from the country of origin, since transportation costs are narrower for shorter distances. Note that if the country of destination has terrestrial boundaries with the country of origin, it is even possible to use transportation by car as an alternative to the airplane. Besides, the car alternative becomes more viable in a unified economic space – with factors and goods moving freely – as it is presently the case with the European Union.

This hypothesis can be tested with a gravity equation derived from eqn (2), where the dependent variable is tourism revenues and the exogenous one is the distance between the countries.

As a result, eqn (2) can now be written as follows:

$$\ln TR_i^P = \ln c + \theta_1 \ln d_{iP} + \theta_2 \ln GDP_i \qquad (5)$$

Table 3 shows tourism Portuguese revenues disaggregated by the main origin markets in 1998. The simple observation of these data leads to the conclusion that the main tourism flows take place with European Union countries, with

Spain - the only country holding terrestrial boundaries with Portugal - ranking third. This observation suggests at once that, in the case of Portugal, the distance factor has certainly a strong influence on the tourism flows towards the Portuguese market.

Table 3: Portugal: - Tourism demand by origin markets in 1998 measured in terms of tourism revenues.

Countries		TR_i	GDP_i	d_{iP}
1	United Kingdom	847	1357	2227
2	France	803	1427	1815
3	Spain	793	553	636
4	Germany	577	1877	2887
5	Belgium*	303	248	2114
6	United States of America	254	8230	5733
7	Switzerland	132	264	2230
8	Italy	125	1172	2709
9	The Netherlands	120	382	2485
10	Japan	54	3783	11140
11	Sweden	52	226	3886
12	Austria	33	212	3200

Notas:

TR_i = Portuguese tourism revenues (10^6 €) from country i (demand origin).

GDP_i = GDP from country i (USD billions)

d_{iP} = Distance between country i and Portugal (Km)

* includes Luxemburg

Sources: TR_i - Direcção Geral de Turismo, PT; PIB_i - OECD in Figures 1999;
DiP - Brittanica Atlas and http://www.wcrl.ars.usda.gov to USA and Japan.

Naturally, although distance being only one among various factors determining tourism flows, it impacts on the final price of tourism products due to the aggravation of transportation costs, which does not leave room to many doubts on their negative influence on those flows.

The economic mass (the best proxy being, in this case, GDP), must, on the other hand, impact positively on tourism flows towards Portugal, once that the existence of a high purchasing power level in the country of origin is a basic determinant to the existence of tourism demand itself.

The estimations for the θ_i parameters must therefore be robust so as to allow for their unquestionable estimated negative sign in the case of parameter θ_1 (distance elasticity) and also unquestionable positive sign in the case of parameter θ_2 (mass or income elasticity), a condition for parameters θ_i to be considered structural in this model.

Note again that the results shown below are intended to be mainly illustrative for the Portuguese case, and should hold (with the corresponding elasticity variability applying) for any other continental destinations. This, together with the small size of the sample and the limited ensuing statistical inference, led us to disregard the study of residuals and the stationarity of variables. This option does

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not affect our conclusions, however, namely because we want to focus primarily on the underlying theoretical logic of the model, bearing in mind that the strict econometric validation of the results could always be achieved with an adequate calibration for the model considered.

3.2 Some results and implications

The OLS estimation produces the following results for this simple model (*t* statistics between round brackets):

$$\boxed{\ln TR_i^P = 13.073 - 1.574 \ln d_{iP} + 0.7 \ln GDP_i} \qquad R^2 = 0.78 \qquad (6)$$

$$(-5.3514) \qquad (4.2026)$$

The reasonable R^2 obtained (apparently explaining 78% of the tourism flows) indicates that the dispersion level of the dependent variable allows for a good adjustment, thus confirming that the Portuguese tourism demand is inversely related with the distance from the country(ies) of origin of the tourism flows directed to the Portugal and directly related with the income of said country(ies). We may then conclude that tourism income depends negatively on the distance and positively from the GDP of country *i*, although the estimation for the parameter representing the distance elasticity (θ_1 = - 1,574) being more significant than the estimation for the parameter representing the mass/income elasticity (θ_2 = 0,7).

It is, however, curious to note that if fully determined by distance, from an analytical point of view it would mean to set $\theta_2 = 1$ (income elasticity equal to one), in which case the following transformation would be valid for the original model:

$$\boxed{\theta_2 = 1} \Rightarrow \ln TR_i^P = \ln C + \theta_1 \ln d_{iP} + 1 \ln GDP_i \Leftrightarrow$$

$$\Leftrightarrow \ln TR_i^P - \ln GDP_i = \ln C + \theta_1 \ln d_{iP} \Leftrightarrow$$

$$\Leftrightarrow \ln \left(\frac{TR_i^P}{GDP_i} \right) = \ln C + \theta_1 \ln d_{iP} \Leftrightarrow$$

$$\Leftrightarrow \boxed{\ln TR_i^{P*} = \ln C + \theta_1 \ln d_{iP}}$$

In other words, if the elasticity of the tourism demand of country *P* relating to the income of country *i* is equal to one, then the equation explaining tourism demand has only one variable – the distance between i and P – and therefore, after making the above transformation for the dependent variable, the model becomes a simple linear regression model.

This particular case of our model explains also tourism demand for θ_2 = 1 and is in line with the work developed by Brakman *et al.* [8, pp.12-15], who suggest to correct trade flows for the demand effect generated by a bigger economic mass (income) in larger countries. This corresponds therefore to a particular case in our model where the income elasticity is equal to one.

Under these conditions, the new regression to be estimated would be:

$$\ln TR_i^{P*} = \ln C^* + \theta^* \ln d_{iP} \tag{7}$$

With the following corresponding new regression results adjusted by income (*t* statistic between round brackets):

$$\ln TR_i^{P*} = 12.9667 - 1.8142 \ln d_{iP} \quad R^2 = 0.80 \tag{8}$$

$$(-6.242)$$

As can be seen, the negative estimation for θ^*, together with a significant absolute value (≈1,8), shows a high elasticity of TR_i^{P*} relating to d_{iP}, all this for a considerable quality adjustment ($R^2 = 0,8$).

Comparing these results with the ones obtained with the non-adjusted simple regression, $\ln TR_i^P = \ln C + \theta \ln d_{iP}$, we shall easily conclude that the results of the estimation would not be very satisfactory. Indeed, in this case, the estimation by the OLS would produce a much lower distance-elasticity ($\theta^* - 1,018$) and also a much worse R^2 (0.36). The lower R^2 obtained in this case (accounting only for 36% of tourism flows) would indicate that the level of dispersion of the dependent variable does not allow for a better adjustment.

It shows then as appropriate a methodology as the one proposed by Brakman *et al.* (2001), which provides better results both from an econometric point of view (a significantly higher R^2 hence the same happening with the *t* statistics), and as regards the estimation of the θ^* parameter, which has a higher value, thus conferring a steeper inclination to the adjustment function and expressing a stronger (negative) impact from distance on tourism flows.

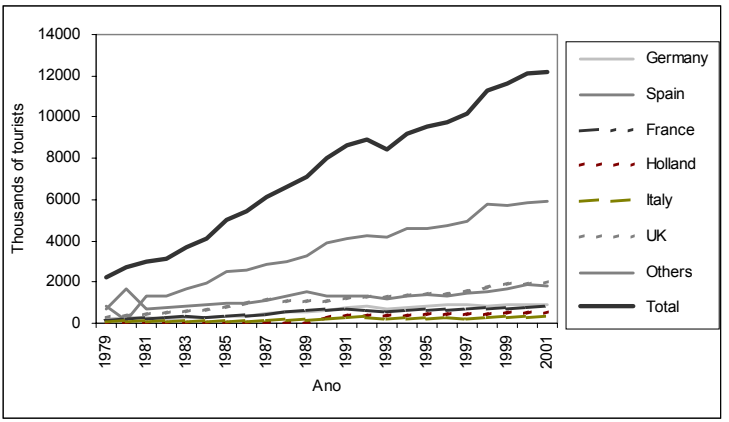
It can thus be concluded that this application of the gravity equation shows distance prevailing on economic mass to explain the Portuguese tourism income. Moreover, this result can be inferred either on the basis of the model as a multiple linear regression [eqn (5)], with the estimator for parameter θ_2 tending to equal one; or by having the model as a simple linear regression [eqn (7)], without the correction of tourism revenues by income, resulting on a non satisfactory econometric result.

Note also that – by comparing it with eqn (6) – the estimator for parameter θ_1^* is now more representative (-1,8 against -1,5), which is not a surprise, as by withdrawing the GDP variable from the base equation we also withdraw the wealth element, hence gaining the distance variable full preponderance on the decision to travel.

The similarity of this estimation (constant term, θ coefficient and also R^2) vis-à-vis those obtained with the original multiple regression model (with $\theta_2 \neq 1$), also confirm the argument of Brakman *et al.* [8], according to whom, although the economic mass is important in the gravitational model, the most relevant

element to determine the trade flows between two countries is the distance between them.

Besides, this similarity of results with $\hat{\theta}_2 = 0,7$ indicates that the simple regression works for values of θ_2 close to one, but not necessarily equalling one. As to the quality of the statistical inference, the observations made over the estimation of the multiple regression model above remain valid.



Source: Own (data: ICEP).

Figure 1: Portugal: - Evolution of the 6 main tourism origin markets 1979-2001.

At this point, our conclusion is that the Portuguese geographical proximity to the Spanish territory is determinant to the attraction of tourism flows into Portugal, being even of a higher importance than the income level (which is lower in Spain than in the UK, in particular).

Generalising, and bearing in mind what has been said above about the characteristics of continental tourism, one can even state that this statistical relevance of the gravitational principle must appear as a rule in any type of continental tourism. The same cannot however be said about insular tourism for the reasons discussed.

Moreover, Figure 1 shows that, for the Portuguese case in particular, the Spanish market has been growing since the 70s at a faster pace than the remaining markets, being presently the first main supplier of tourists to Portugal (Table 2) and the third in terms of the total tourism revenues generated (Table 3).

4 Conclusions

Having in mind that tourism has only recently assumed itself as an organized economic activity, the time has come to the establishment of an according development of its theoretical framework. While being aware that the specific characteristics of tourism goods require, when considered as a whole, a non-

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standardized treatment from economic science, one must consider a tailored approach for the study of tourism economics, frequently using less usual instruments of economic analysis – as is the case for economic geography as suggested here.

Using a simple gravity model, we have shown that distance matters more than income on the determination of tourism flows in continental destinations in general and in Portugal in particular.

Once that distance is accepted as a relevant factor to tourism demand, and mostly when it matters more than income of the origin country, one must then consider the implications of this result on the issue of promoting a national tourism destination. Namely when considered together with the specific characteristics of the tourism good, the empirical importance of distance in this context suggests that there may be a role for some Government regulatory intervention in the tourism sector, notably with a tourism policy duly connected with the remaining national economic policies, with a view to optimizing the huge potential of this sector to create economic wealth.

In terms of normative policy implications, on one hand the statistical relevance of distance on the explanation of tourism flows implies that efforts (namely financial ones) should focus firstly on marketing the home destination in the closest countries (economic distance), and, on the other hand, whenever the tourism demand is highly country-concentrated (as is the case for Portugal, with 90% of total demand concentrated in just 5 countries – SP, UK, DE, FR and NL) it matters not only to keep those markets under control but also to put in place some diversification in order to reduce the dependence degree on the markets in question.

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