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Research article

A new strategy for measuring tourism demand features

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Abstract: Understanding tourist behavior, demand elasticities, and the purchasing power of regular tourists visiting a destination is of great interest to the tourism industry for business strategy and to governments for tourism public policy. Here, we propose a new method to empirically estimate the own-price and cross-price elasticities of demand for tourist goods and services, as well as an innovative way to measure the average tourist's marginal utility of income. In the tourism sector, we consider that there are two relevant markets: one for tourist goods and services and the other for accommodation. These are separate but interrelated because of the feedback between demands for lodging and tourism products through a vertical relationship of complementarity. The optimal solution to the tourist choice problem consists of a primary demand for tourist services and a derived demand for overnight stays. We focus on obtaining robust estimates of the elasticities corresponding to the former by forecasting the latter. Most of the empirical modeling of tourism demand consists of ad hoc equations that are not directly attached to a specific theoretical framework. Our paper provides a solid characterization of the empirical linkages between the demands for tourist goods and services and accommodation using economic theory. This paper extends existing theory and makes an important contribution to the empirics of tourism economics, with an application to the tourism database of Australia, Canada, Spain, and the United States that quantifies demand elasticities and identifies the socioeconomic status of their respective tourists.

Keywords: elasticity; overnight stay; preferences; socioeconomic status; tourism demand; tourism destination; tourism economics

JEL Codes: C51, D12, Z3

1. Introduction

Tourism is a major source of economic wealth. It is an important industry in both developed and developing countries, providing jobs and revenues above and beyond other industries. Today, tourism activity contributes well over 10% to GDP and employment in many countries. Moreover, in the last three decades, world tourism has demonstrated significant resilience against external shocks such as geopolitical uncertainty, natural disasters, terrorist attacks, financial and economic crises, and, more recently, the COVID-19 pandemic. Tourism being such an important industry, we cannot rely solely on the successful results of the past; entrepreneurs and policy makers must design medium and long-term viability and sustainability plans. As Aguiló-Pérez et al. (2005) and Rosselló-Nadal et al. (2005) pointed out, it is necessary to know the determinants of demand with precision, a pre-requisite for estimating income and price elasticities that will help to fulfill the goals of the sector. Prices and tourists' income are the most commonly used variables to explain tourism demand, although other factors, ranging from the cultural, natural, and sociopolitical features of the chosen destination to the competitiveness of alternative destinations and tourism advertising campaigns, could also be relevant.

Understanding tourist behavior, demand elasticities, and the purchasing power of regular tourists visiting a destination is of great interest to the tourism industry for business strategy and to governments for tourism public policy. Entrepreneurs and policymakers need accurate forecasts of tourism demand to assist them in their decision-making. Price elasticities of demand and the socioeconomic status of tourists are signals of how tourists may switch destinations and how a destination can change from mass tourism to alternative tourism. The economic agents involved in tourism activity may wish to influence the determinants of demand in order to increase or change it. They realize that the amount of tourist spending in a given destination can be modified by attracting more tourists or by stimulating the arrival of wealthier tourists.

On the one hand, high values of the own-price elasticity of the demand for tourist goods and services imply that there exist close substitute destinations, and the margin for raising prices without losing tourists is very small. There is an inverse relationship between price elasticity and market power that plays in favor of alternative destinations. Second, high values of the cross-price elasticity of the demand for tourist goods and services with respect to the price of accommodation imply that small changes in the price of overnight stays will cause large shifts in the demand for tourism products. This would mean that any intervention on the side of tourist accommodation is of greatest importance for the results in the market for tourist goods and services. Finally, higher values of the marginal utility of income associated with tourists visiting a destination are representative of lower socioeconomic status (lower purchasing power), so one would expect lower tourism expenditure.

The modeling and forecasting of tourism demand have received a great deal of attention in the literature.[1] However, exhaustive statistical information, which is the main support for the economic analysis of tourism, is only available for a period of just over two decades. Even so, it is not unusual to find omitted data holes and records that are not entirely homogeneous in international comparisons or among the different organizations that provide them. These shortcomings weaken the effectiveness of the quantitative study of tourism. In fact, there are no official sources of forecasts for the tourism sector.

[1] The reader is referred to Divisekera (2013), Dwyer et al. (2011), Lim (1997, 2006), Rosselló-Nadal and Santana-Gallego (2022), Song and Li (2008), Song and Turner (2006) and Witt and Witt (1995) for a comprehensive review of the literature on tourism demand modeling and forecasting.

Moreover, the essential tasks of measurement, estimation, and evaluation are very demanding for researchers due to the nature of the sector. Since the usual definitions of tourism are too generic, it is not easy to identify what parts of the firms' activity go to satisfy the demands of tourists and non-tourists, respectively. It is almost impossible to isolate the quantity of goods and services produced for tourism (Ferrari et al., 2022).

These are the challenging conditions under which empirical research in tourism economics must be carried out. In any case, it is absolutely necessary to know the elasticities of tourism demands for any decision or intervention in this sector to be reasonable and reliable. At the firm level, there are several ways of estimating the elasticity of demand: by surveying the attitude of its customers to price changes, by a cross-sectional analysis of the price-demand relationship, by experimenting in the market with a price change over a fixed period of time, and also by making conjectures based on its past pricing experience. However, given the aforementioned shortcomings, perhaps a better strategy is to focus on the tourists themselves and try to estimate the value of tourist spending through surveys or by recording the expenditure as tourism when paying the bill.

In empirical studies, income is a recurrent determinant of tourism demand, with an estimated elasticity usually greater than 1. This would mean that tourism is a luxury product. Prices are the other major determinant of tourism demand, but there are different alternatives currently in use.[2] Overall, the estimated direct-price elasticities are around −1, which means that tourism demand is moderately elastic or even inelastic (Forsyth et al., 2014; Song et al., 2010). The concern about the magnitude of elasticities is usually addressed by the estimated parameter values in a log-linear specification of tourism demand. However, given the nature of the tourism product, which is a broad set of heterogeneous goods and services, it is difficult to find standard forecasts based on a general consensus. The specialized literature has used regression analysis to estimate the relationship between tourism demand and its determinants considering different measures of demand: the number of visitor arrivals, the number of overnight stays, and per capita expenditure, each one associated with a different empirical model (Divisekera, 2003; Pyo et al., 1991; Schiff and Becken, 2011; Song et al., 2010). These options are substitutes for each other and, consequently, researchers must make a choice.

For years, econometric studies have estimated tourism demand elasticities, but little effort has been made to integrate these results into a general theory capable of generating principles that reveal underlying invariant patterns in the form of causal relationships (Assaf and Scuderi, 2023; Crouch, 1996). In this field, the shortage of theoretical papers is well known. Much of the published work consists of empirical papers that are not directly attached to a specific theoretical model. They mainly hypothesize ad hoc equations estimated with different econometric techniques. These empirical studies have considered a wide range of independent variables but, in essence, they all suggest similar determinants drawn from a common panel of explanatory variables.

In any case, what emerges from the empirical debate in tourism economics is the unquestionable fact that, in order to predict the effect of a policy change or to launch a business course of action, entrepreneurs and policymakers need to know both the elasticities of demand for tourist goods and services and some particular features of their visitors. In the following pages, we provide an approach that defies traditional procedures and represents an interesting methodological advance. With the explicit support of theory plus a minimum data requirement and without the need for complex

[2] These are prices at destination in absolute terms, or relative to prices at origin, or relative to prices in competing destinations, adjusted to account for exchange rate changes or by putting the effect of exchange rates separately (Crouch, 1996).

estimation methods, we obtain the target elasticities and, in addition, we extract the values of the preference parameters that allow us to classify the tourists.

As mentioned above, in this paper, we propose a new method to empirically estimate the own-price and cross-price elasticities of demand for tourist goods and services. The approach is based on theoretical results derived from a new model of the tourist's choice developed by Descals-Tormo and Ruiz-Tamarit (2024). A tourist journey includes transportation and lodging, but the main purpose of a trip is to consume the tourist services provided at the destinations, i.e., gastronomy, a variety of attractions and guide services, entertainment, shopping, and so on. We abstract from the choice of transportation and the round-trip travel itself because, according to Crouch (1996), the cost of transportation does not influence the estimated elasticity of demand, and no bias appears when it is omitted. It is assumed that there are two relevant markets in the tourism sector: one for tourist goods and services and the other for accommodation. These sub-markets are considered separate but interrelated due to the feedback that exists between tourist services and lodging through a strong vertical relationship of complementarity (Divisekera, 2009a, 2009b).

Once the optimal solution to the tourist choice problem has been obtained, along with the primary demand for tourist goods and services and the derived demand for overnight stays as the main outcomes, we focus on the problem of forecasting these demands and obtaining a consistent estimate of elasticities. The determinants of tourism demands are basically a combination of the various expenditures made by tourists and the prices they pay at the destination. Tourism demands can also be characterized by their dependencies on the structural parameters concerning tourists' preferences and standard of living. The higher the relative attractiveness of a destination as perceived by tourists, the higher the demand for both tourist services and overnight stays. The lower the income level and socioeconomic status of the regular tourists arriving at a destination, the lower the demand for both tourism products and overnight stays.

The paper is organized as follows: In Section 2, we provide a brief outline of the tourism decision theory and characterize the demand functions. In Section 3, we study tourism demands from an empirical point of view. We find new specifications for the demand equations corresponding to tourist goods and services and overnight stays. The equation to be estimated econometrically comes directly from the model discussed in the previous section. In this section, we also identify the relationship between the estimated parameters of the empirical equation and the structural parameters of the theoretical model. In Section 4, we focus on the two main price elasticities of tourism demand for goods and services. In Section 5, we analyze the parameter representing the marginal utility of total expenditure or income and the relationship with the socioeconomic status of tourists. In Section 6, we show the outcome of the quantitative exercise conducted with the databases for Australia, Canada, Spain, and the United States, and discuss some economic implications of these numerical results. In the final Section 7, we present our conclusions.

2. Theoretical framework

In a recent paper, Descals-Tormo and Ruiz-Tamarit (2024) have developed a groundbreaking theoretical model of the tourist's choice, which allows for new specifications of the tourism demand equations. These equations reveal theoretical relationships between the endogenous variables and their determinants. The determinants are essentially a combination of the various expenditures made by tourists and the prices they pay at the destination, which are easily observable and significantly simplify the forecasting process. The following is a brief description of the main building blocks of the model and its most significant results.

Consider a representative tourist consumer who has decided to travel to a specific destination and has to choose the demand for three goods: quantity of tourist goods and services, or vector x,[3] number of overnight stays, or vector q,[4] and income available to consume other non-tourist products, y. The particular utility function that represents the tourist preferences over these goods takes the standard form,

$$W(x,y) = -\alpha\gamma^{\phi} + \alpha(x+\gamma)^{\phi} + \beta y, \tag{1}$$

With the specificity that it does not depend on q.[5] This function is additively separable, strictly concave in x, and linear in income y. Parameters $\alpha > 0$ and $\beta > 0$ are transformation coefficients for each consumption in utility. Moreover, α and the parameter $0 < \phi < 1$ represent the scale and intensity of preferences over x, the parameter β stands for the constant marginal utility of income, and $\gamma > 0$ implies that reservation prices for the consumer-tourist are finite.[6] Since tourists choose the type of destination based on their socioeconomic status, the class of tourists arriving at a given destination shares a certain income range. Therefore, for such a tourist destination and its tourists, it is realistic to assume that the marginal utility of income is constant. Changing this is not an easy task because attracting tourists from other wealth segments requires time and active tourism policy measures.

The tourist's budget constraint is,

$$m = p_x x + pq + y, \tag{2}$$

where m represents the total money income net of the round-trip travel fare.[7] The tourist expenditure on goods and services is the product $p_x x$, being p_x a vector of unit prices corresponding to tourist goods and services. The expenditure allocated to overnight stays is pq, where p is the vector of unit prices of accommodations, and the expenditure in other goods is $p_y y$, where y plays the role of *numéraire* and its price is normalized assuming $p_y = 1$.

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[3] This variable represents a bundle of tourism products supplied at the destination, which includes tourism attractions and guide services, nature, adventure, culture, sport, business, leisure, local transportation, food and beverage gastronomy, entertainment, shopping, and so on.

[4] These can be carried out in different types of establishments such as hotels, apartments, campsites, cottages, guest houses, visitor flats, and non-market tourist accommodation.

[5] This means that overnight stays, although necessary to enjoy the consumption of tourist goods and services, do not directly provide any utility or disutility. This assumption could be considered somewhat unrealistic to characterize the specific case of leisure tourism, since it is mainly associated with relaxation activities and sun and beach consumption, and the characteristics and quality of different types of lodging establishments are probably relevant for leisure tourists' decisions. However, in characterizing tourism as a whole, we consider that tourists demand tourism products for which accommodation is necessary, but not a major determinant. Therefore, in the most general context, the assumption that overnight stays do not appear explicitly in the utility function seems a reasonable simplifying assumption.

[6] The slope of indifference curves on the y-axis takes the value $dy/dx = -(\phi\alpha/\beta\gamma^{1-\phi})$.

[7] The cost of round-trip transportation between origin and destination, F, although it may represent a significant part of the tourist's expenditure, is treated as a lump-sum deduction, $m = M - \mathrm{F}$, being M the total money income. This cost could play a role in the decision to travel or not, but only in the case of large differences will it affect the choice of destination. Of course, by decreasing the net money income, it may affect the quantity of overnight stays and tourist goods and services demanded.

The demand for accommodation is a derived demand since the only way to enjoy tourist goods and services is by staying at the destination. Overnight stays are assumed to depend linearly on the demand for tourist goods and services according to a fixed proportion,[8] i.e.,

$$q = \frac{x}{a} \geq 1,\ \forall p \leq p_R^q,\ \text{otherwise}\ q = 0. \tag{3}$$

The proportion is the reciprocal of a, the number of tourist goods and services that our representative tourist consumes per day, and p_R^q stands for its reservation price for accommodation. Moreover, no matter how strong the tourist's preference for x is, if the associated price exceeds the corresponding reservation price p_R^x, the tourist will choose another destination, cancelling out the demands of x and q.

The static constrained optimization problem to be solved by the representative consumer is: $\max_{\{x,y\}}(1)\ s.t.$ (2) and (3), which may be written under the following Lagrangian form,

$$\max_{\{x,y,\lambda\}} \mathcal{L} = -\alpha\gamma^{\phi} + \alpha(x+\gamma)^{\phi} + \beta y + \lambda\left(m - \left(p_x + \frac{p}{a}\right)x - y\right). \tag{4}$$

From the first-order conditions, we draw the following demand functions for the two main endogenous variables of the model,

$$x^*(p_x, p, \Omega) = -\gamma + \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{1}{\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}}, \tag{5}$$

$$q^*(p_x, p, \Omega) = \frac{x^*}{a} = -\frac{\gamma}{a} + \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{1}{a\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}}, \tag{6}$$

Bing $\Omega = (\alpha, \beta, \gamma, \phi, a)$ the vector of structural parameters of the model. The marginal utility of money is constant, which leads to a constant optimal value of the Lagrangian multiplier $\lambda^* = \beta$. Consequently, demands for tourist goods and services x^* and overnight stays q^* do not depend on the tourist's available total net money income m but only on prices and parameters. In this context, the only relationship between demands and income is indirect and related to the parameter β, which depends on the purchasing power of tourists visiting a destination.[9]

The modeling and forecasting of tourism demand has received a great deal of attention in the literature, but the bulk of the work focuses on empirical models that do not depend directly on a specific theoretical model. These are mostly ad hoc models estimated with different econometric techniques,

[8] Although there is no empirical evidence, it is plausible to assume a monotonically increasing relationship. However, the choice between a strictly convex or concave relationship is not so obvious, since they represent that the number of goods and services consumed per day decreases or increases, respectively, with the demand for tourist goods and services. In this context, we have opted for the intermediate case of a linear relationship.

[9] The diagrammatic representation of the two tourism sub-markets, their interdependencies, and the comparative statics are shown in Figures A.1 and A.2 in the Appendix.

which basically propose similar determinants drawn from a common panel of explanatory variables, regardless of the fact that their format and units of measurement vary considerably across studies. The main concern shown in the literature when studying tourism demand is centered on the different elasticities yielded by the estimated values of the parameters in the log-linear specification. In this paper, Equations (5) and (6) represent our theoretical demands for tourist services and overnight stays. Before going on to study these functions from an empirical point of view, we will characterize some of their properties by making explicit the main price elasticities involved and the dependencies of the demands on the structural parameters. Accommodation and tourism products are complementary. The demand for overnight stays is derived from the demand for tourist goods and services. The slope of the tourism demand is negative, $\partial x^*/\partial p_x < 0$, and complementarity implies that the cross-price effect is also negative, $\partial x^*/\partial p < 0$. Therefore, the own-price elasticity of the demand for tourist goods and services is,

$$\left|\varepsilon_{p_x}^{x}\right| = \frac{p_x}{(1-\phi)\left(p_x+\frac{p}{a}\right)}\frac{x^*+\gamma}{x^*}, \tag{7}$$

And the corresponding cross-price elasticity is,

$$\left|\varepsilon_{p}^{x}\right| = \frac{p}{a(1-\phi)\left(p_x+\frac{p}{a}\right)}\frac{x^*+\gamma}{x^*}. \tag{8}$$

These two elasticities are related to each other in the following way,

$$\left|\varepsilon_{p_x}^{x}\right| = \frac{ap_x}{p}\left|\varepsilon_{p}^{x}\right|, \tag{9}$$

And,

$$\left|\varepsilon_{p_x}^{x}\right| + \left|\varepsilon_{p}^{x}\right| = \frac{1}{1-\phi}\frac{x^*+\gamma}{x^*}. \tag{10}$$

Our tourism demands can also be characterized with respect to the model parameters. First, the higher the relative attractiveness of a destination as perceived by tourists and captured by the values of α and ϕ, which depend on factors like political stability, transport facilities, and qualitative aspects of the tourism supply, the higher the demand for both tourist services and overnight stays. Second, the lower the income level and socioeconomic status of the regular tourists arriving at a destination, which are expressed in higher values of the parameter β, the lower the demand for both tourist services and overnight stays. Third, the bigger the number of goods and services the tourist consumes per day, i.e., the greater the value of coefficient a, the higher the demand for tourist goods and services, but most likely the lower the demand for overnight stays. Finally, the lower the reservation prices, which correspond to higher values of parameter γ, the lower the demand for both tourist services and overnight stays.

3. Empirical model

Taking a step further, in this section we study the tourism demand from an empirical point of view focusing on the statistical relationship between the dependent variables and their explanatory variables.

The literature considers basically two indicators to quantify the dependent variable: the number of tourist arrivals and/or overnight stays, and the expenditures on tourist goods and services at the destination (Aguiló-Pérez et al., 2017; Rosselló-Nadal and He, 2020; Tran et al., 2018; Tran et al., 2020). Empirical studies treat these two measures of tourism demand as substitutes for each other, and researchers tend to choose one or the other according to their own criteria or depending on data availability. However, in the previous section, we have shown that it is better to look at overnight stays as complementary to tourist goods and services. We assume a linear function that connects the two through a fixed coefficient representing the number of tourist goods and services that the tourist can consume throughout the day. Based on this, we have deduced simultaneously and within the same theoretical model the demand functions for quantities of tourist goods and services and overnight stays.

Regarding the explanatory variables, there is a wide range of factors affecting the dependent variable (Brida and Scuderi, 2013). However, most empirical studies assign a central role to income, prices (adjusted for the exchange rate), the level of economic activity, and population as the most salient determinants (Song and Turner, 2006). The usual study of tourism demand estimates an equation in which the variables are expressed in nominal or real terms, in levels or per capita, per visitor, or per day (Crouch, 1996; Lim, 1997; Witt and Witt, 1995). According to our approach, the determinant of both endogenous variables is a combination of the various expenditures made by tourists and the prices they pay at the destination, which are easily observable or proxied.

Substituting Equation (3) into Equation (5), we can express the demand for tourist goods and services x as depending on the expenditure on tourist goods and services $g^x = p_x x$, and the expenditure on accommodation $g^q = pq$. However, the tourism product is a collection of very diverse goods and services provided by multiple suppliers and industries. Actually, it is a multidimensional vector including a great variety of products. Because of this broad conceptualization, it is very difficult, if not impossible, to obtain direct data on the quantity corresponding to each component of the vector. Even so, there is an alternative to overcome this problem because it is easier to obtain data on total expenditure. From the data on total expenditure, it is possible to approximate the aggregate quantity of tourist goods and services purchased by dividing total expenditure by the level of the price index. That is, in the case of the tourism sector, we can measure market demand by deflating the sum of monetary expenditures. Then, Equation (5) can be rewritten as,

$$\frac{g^x}{p_x} = -\gamma + \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} p_x^{\frac{-1}{1-\phi}} \left(1 + \frac{g^q}{g^x}\right)^{\frac{-1}{1-\phi}}. \quad (11)$$

However, this expression shows that we will face important statistical problems if we decide to estimate directly the demand for tourist goods and services. It is evident that both variables g^x and p_x appear on both sides of the equation, and this reveals a clear endogeneity problem. We therefore conclude that Equation (5) is worthless from the point of view of empirical analysis, and we need to find a global alternative to achieve our goals.

Hopefully, we can estimate the demand for overnight stays q for which there are reliable records of data on quantities,[10] and then use the results to infer the parameters of the demand for tourist goods and services x. From Equation (6), under the simplifying assumption that γ is close

[10] Unlike information on different tourism expenditures, there is a large amount of statistical information on tourist arrivals, departures, and overnight stays that can be used for the analysis of structural aspects of the tourism sector.

to zero, which means that the reservation prices p_R^q and p_R^x for tourists are high enough, and taking logarithms, we get,

$$\ln q = \ln\left(\frac{1}{a}\left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}}\right) - \frac{1}{1-\phi}\ln p_x\left(1+\frac{g^q}{g^x}\right). \quad (12)$$

It is now possible to specify an empirical equation to be estimated econometrically,

$$\ln q_{it} = C_i - \rho_i \ln CPI_{it}\left(1+\frac{1}{\pi_{it}}\right) + \varepsilon_{it}. \quad (13)$$

The dependent variable q_{it} represents the number of overnight stays at the destination i in period t. The variable CPI_{it} is the consumer price index at the destination i in period t.[11,12] The variable π_{it} is defined as the ratio between the tourism expenditure on tourist goods and services, g_{it}^x, and the tourism expenditure on accommodation, g_{it}^q, both referred to destination i in period t, that is,

$$\pi_{it} = \frac{g_{it}^x}{g_{it}^q} > 0. \quad (14)$$

With respect to the coefficients in Equation (13), the slope is exclusively related to the intensity of preferences over the tourist goods and services supplied at the destination i,

$$\rho_i = \frac{1}{1-\phi_i} > 1, \quad (15)$$

And the other coefficient C_i is a destination-specific constant reflecting a nonlinear combination of the preference parameters α, β and ϕ,

$$C_i = \frac{1}{1-\phi_i}\ln\left(\frac{\phi_i\alpha_i}{\beta_i}\right) - \ln a_i. \quad (16)$$

[11] Although the price of some tourist goods and services is available, a single price cannot be taken as the tourism price because the tourist's consumption basket includes many items. Then, the problem is how to price the composite good. Since the tourist price index (TPI) is usually not available, the consumer price index (CPI) in the tourist destination is used as a proxy. Morley (1994) investigated the evidence for the use of the CPI as a proxy for the TPI and showed that tourism prices are highly correlated with general consumer prices. However, Divisekera (2003) proposed using price indexes that reflect the cost of a specific basket of goods and services consumed by tourists at the destination or, alternatively, the average observed expenditure per diem, because she considered that using the CPI rather than the TPI may result in biased price elasticities. Ultimately, the researchers find no clear advantage in using one or the other.

[12] In general, in tourism demand studies, the use of a specific TPI for a destination is usually accompanied by the exchange rate if the study refers to inbound international tourism. However, this requires that data on international tourists visiting a destination be broken down by country of origin, which imposes a strong fragmentation of the hypothesized international tourism demand when we analyze highly popular and consolidated destinations. In any case, the exchange rate is only relevant for international tourists from countries that do not belong to an economic space with a common currency and if, in addition, bilateral exchange rates between the countries of origin and destination are not fixed or are not sufficiently stable.

Finally, ε_{it} is an unknown variable representing the random disturbance. Under the proviso that this error term be independently and identically distributed (*i.i.d.*), we can perform an efficient estimation of coefficients.[13]

Having reached this point, we can use the estimated values of coefficients ρ_i and C_i to approximate the values of the structural parameters of the tourism model,

$$0 < \hat{\phi}_i = \frac{\hat{\rho}_i - 1}{\hat{\rho}_i} < 1, \tag{17}$$

$$\widehat{\left(\frac{\alpha}{\beta}\right)}_i = exp\{(1 - \hat{\phi}_i)(\hat{C}_i + \ln a_i) - \ln\hat{\phi}_i\} > 0. \tag{18}$$

The coefficient α can be directly computed from the database according to Equation (3). Let us first consider, for any given destination, the time series,

$$a_{it} = \frac{g_{it}^{x}}{q_{it}CPI_{it}}, \tag{19}$$

And then we associate to each destination the sample mean of the series,

$$a_i = \frac{1}{T}\sum_{t=1}^{T} a_{it}. \tag{20}$$

Now, we can choose a reference destination $\bar{\imath}$ for which we assume a constant marginal utility of total expenditure or income equal to unity, $\beta_{\bar{\imath}} = 1$. For this particular destination, we just identify the value $\alpha_{\bar{\imath}} = \widehat{(\alpha/\beta)}_{\bar{\imath}}$. Here, for the sake of simplicity, we assume that tourists' preferences in all destinations share the same value $\alpha_{\bar{\imath}}$.[14] In this way, we arrive at the values of the constant marginal utility of income that characterize tourists in different destinations,

$$\hat{\beta}_i = \frac{\alpha_{\bar{\imath}}}{\widehat{(\alpha/\beta)}_i}. \tag{21}$$

These values, greater or smaller than 1, are an indicator of the position in terms of wealth status associated with the predominant tourist in each destination. Of course, this measure is relative to the wealth status of tourists coming to the destination taken as a reference.

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13 Although the majority of studies have used ordinary least squares (OLS), other estimation techniques have also been used (Morley, 1996, 2009; Song and Li, 2008).

14 Recall that α is a scale parameter that determines the position of an ordinal utility function, while the parameter ϕ is concerned with the curvature of that function and the intensity of preferences for tourist goods and services. These two parameters go hand in hand with the demands for tourist services and overnight stays. In addition, the attractiveness of competing destinations as perceived by tourists, which depends on political considerations, transports facilities and characteristics, and qualitative aspects of the tourism supply, is represented by parameters α and ϕ. In consequence, we can account for the degree of substitutability between destinations by referring only to the parameter ϕ.

4. Evaluating price elasticities of demand for tourist goods and services

From Equations (9) and (10), given (3) and (14), and keeping in mind the assumption that γ is asymptotically equal to zero, we find the following relationships between demand elasticities, tourists' expenditures, and tourists' preferences:

$$\frac{\left|\varepsilon_{p_x}^{x}\right|_{it}}{\left|\varepsilon_{p}^{x}\right|_{it}} = \pi_{it}, \tag{22}$$

And,

$$\left|\varepsilon_{p_x}^{x}\right|_{it} + \left|\varepsilon_{p}^{x}\right|_{it} = \frac{1}{1-\phi_i}. \tag{23}$$

Then, the estimated $\hat{\phi}_i$ values for each destination along with the values of π_{it} at the destination i in period t allow us to derive the value of the direct-price elasticity and the value of the cross-price elasticity of demand for tourist goods and services, $\left|\varepsilon_{p_x}^{x}\right|_{it}$ and $\left|\varepsilon_{p}^{x}\right|_{it}$, respectively. These can be easily calculated as follows:

$$\widehat{\left|\varepsilon_{p_x}^{x}\right|}_{it} = \frac{1}{1-\hat{\phi}_i}\frac{\pi_{it}}{1+\pi_{it}}, \tag{24}$$

$$\widehat{\left|\varepsilon_{p}^{x}\right|}_{it} = \frac{1}{1-\hat{\phi}_i}\frac{1}{1+\pi_{it}}. \tag{25}$$

In these two expressions, the first term on the right-hand side is greater than 1 and the second term is lower than 1. In addition, as long as π_{it} is greater than 1, we find that $\widehat{\left|\varepsilon_{p_x}^{x}\right|}_{it} > \widehat{\left|\varepsilon_{p}^{x}\right|}_{it}$. It is easy to check that, for each destination, the sum of the two elasticities is constant. Finally, it follows that,

$$\frac{\partial\widehat{\left|\varepsilon_{p_x}^{x}\right|}_{it}}{\partial\hat{\phi}_i} > 0, \frac{\partial\widehat{\left|\varepsilon_{p_x}^{x}\right|}_{it}}{\partial\pi_{it}} > 0, \tag{26}$$

$$\frac{\partial\widehat{\left|\varepsilon_{p}^{x}\right|}_{it}}{\partial\hat{\phi}_i} > 0, \frac{\partial\widehat{\left|\varepsilon_{p}^{x}\right|}_{it}}{\partial\pi_{it}} < 0. \tag{27}$$

On the one hand, a low value of $\hat{\phi}_i$, which is associated with a low value of $\hat{\rho}_i$, also implies low values for both the direct-price elasticity and the cross-price elasticity of demand for tourist goods and services. On the other hand, a high value of π_{it}, which is representative of high spending on tourist goods and services relative to spending on accommodation, implies high values for the direct-price elasticity of demand for tourist goods and services, but low values for the corresponding cross-price elasticity.

5. Tourism destinations and the socioeconomic status of their tourists

In this paper, we have assumed that people have constant marginal utility of income; as an individual's income changes by one additional euro, the extra utility for that individual remains unchanged. In the case of tourists, such a representation of preferences leads to demands for x and q that are independent of m, as in Equations (5) and (6). This simplifying assumption is indeed quite realistic because tourism destinations are matched with classes of tourists characterized by a common socioeconomic status. In other words, tourists who share similar levels of income and wealth mostly choose the same destination and thus contribute to featuring the destination with their marginal utility of money, that is, the value of parameter β. However, an extra euro given to a rich tourist increases his total utility less than it increases the total utility of the poor tourist if he is given the same euro. Therefore, we will consider a constant marginal utility of total expenditure within each group of tourists visiting a destination but allow for different levels associated with different destinations. Consistent with this, our model predicts the following dependencies of the demands for tourist services and overnight stays: $(\partial x^*/\partial\beta) < 0$ and $(\partial q^*/\partial\beta) < 0$. That is, the higher the purchasing power of the class of tourists, the greater the demands for both tourist services and overnight stays.[15]

Parameter β is not objectively observable, but from Equations (18) and (21) we arrive at the following expression that allows us to calculate and rank destinations according to their average tourist's marginal utility of income.

$$\hat{\beta}_i = \alpha_{\bar{\imath}}\, exp\left\{-\left(1-\hat{\phi}_i\right)\left(\hat{C}_i + \ln a_i\right) + \ln\hat{\phi}_i\right\} > 0. \tag{28}$$

In this equation, we also find,

$$\frac{\partial\hat{\beta}_i}{\partial\hat{\phi}_i} > 0, \frac{\partial\hat{\beta}_i}{\partial a_i} < 0. \tag{29}$$

Moreover, from Descals-Tormo and Ruiz-Tamarit (2024), we know that the values of the direct-price elasticity and cross-price elasticity of demand for tourist goods and services are related to the income level and the corresponding socioeconomic status of tourists as follows:

$$\frac{\partial\widehat{\left|\varepsilon_{p_x}^{x}\right|}_{it}}{\partial\hat{\beta}_i} > 0, \frac{\partial\widehat{\left|\varepsilon_{p}^{x}\right|}_{it}}{\partial\hat{\beta}_i} > 0. \tag{30}$$

6. Numerical results and analysis

In accordance with the methodology detailed in the previous sections, we focus on the demand for overnight stays to gather information on the most relevant parameters of the theoretical model and thus obtain the value of the direct and cross-price elasticity of the demand for tourist goods and services through indirect channels. The first step of this new path leads us to estimate the empirical Equation (13). All our calculations and equation estimations have been carried out considering only inbound tourism data from four countries: Australia, Canada, Spain, and the United States. Inbound tourism includes the activities of non-resident international tourists visiting a destination country on a trip. The

[15] People's income influences their propensity to travel. This could increase tourism expenditure by increasing the demand for tourist goods and services, increasing overnight stays, upgrading their accommodation, increasing the frequency of travel, or traveling in higher classes. But it can also cause tourists to change their destination if they adapt their itinerary to the new economic conditions.

data series used here are drawn from the World Tourism Organization (UNWTO), the National Accounts of each country (in particular the Tourism Satellite Account, TSA, when available), and The World Bank database. A detailed description of these data sources is provided in the Appendix.

More specifically, we use time series for the number of overnight stays q_{it}, the consumer price index CPI_{it}, the tourism expenditure on accommodation g_{it}^{q}, and the expenditure on tourist goods and services g_{it}^{x}.[16] The sample period depends on data availability and is slightly different for each country. In any case, beyond differences in the starting period, the samples span from the mid-1990s to 2019, the year before the COVID-19 pandemic. The graph with the temporal profile of the dependent variable $\ln q_{it}$ and the independent variable $\ln CPI_{it}(1 + 1/\pi_{it})$, as well as the values of their main descriptive statistics calculated country by country, can be observed in Figures A.3–6, together with Table A.2 in the Appendix.

Table 1 shows the results of the parameter estimation by OLS. We include a linear trend in our regression analysis based on the observed profile of the data series corresponding to the variables in Equation (13).[17] The goodness of fit, as measured by the adjusted R-squared shown in the last row of the table, is high enough, standing in all four cases between 80% and 90%. The results of the autocorrelation, heteroscedasticity, and normality tests for the residuals of each of the estimates are displayed in the middle boxes of the table. First, the serial autocorrelation tests show that the null hypothesis of no serial correlation cannot be rejected for any of the estimates; the Breusch-Godfrey test, which is more accurate for small samples, does not reject the null hypothesis at the 1% significance level. Second, the Breusch-Pagan test for heteroscedasticity and the White test both support the non-rejection of the null hypothesis, suggesting that the regression residuals are homoscedastic. Finally, we find the Jarque-Bera normality test and the Sktest (skewness and kurtosis tests for normality) adjusted for the sample size. The corresponding results show that in none of the cases can the null hypothesis be rejected, which means that it is very likely that the estimated residuals follow a normal distribution.

In the upper block of Table 1, we can see that the estimated parameters in each country-specific regression have the expected sign and are statistically significant. The coefficient ρ_i, as detailed in Equation (15), is directly and univocally related to the average intensity of preferences for tourist goods and services offered in a particular destination. The country-specific constant C_i, according to Equation (16), is just a nonlinear combination of the parameters that shape the tourist's utility function. From these estimated coefficients of the accommodation demand equation, we can recover the values of the structural parameters of the tourism model $\hat{\phi}_i$ and $\hat{\beta}_i$, for each country, using Equations (17) and (28), respectively. In addition, we can also calculate the two price elasticities of the demand for tourist goods and services by means of Equations (24) and (25). The average values of these parameters and elasticities for the sample period, which is different for each of the countries, are reported in Table 2.

[16] The series of tourism expenditure on goods and services is obtained by the difference between the series of total tourism expenditure and that corresponding to transportation and accommodation.

[17] In the estimation of this equation for Spain and the United States, a time dummy variable has also been included to capture the lagged average differential effect that certain exceptional events had on the dependent variable in 2009 in Spain and in 2003 in the United States.

Table 1. Demand for overnight stays: econometric estimation. Dependent variable: $\ln q_{it}$.

Country	Australia (1)	Canada (2)	Spain (3)	U.S. (4)
C_i	11.4768***	11.3405***	13.3720***	12.8878***
	(0.1858)	(0.3950)	(0.2267)	(0.3762)
$\ln CPI_{it}(1 + 1/\pi_{it})$	−1.7836***	−4.8660***	−2.1733***	−3.5822***
	(0.3689)	(1.4528)	(0.4242)	(1.0603)
Trend	0.0470***	0.1256***	0.0661***	0.1229***
	(0.0078)	(0.0294)	(0.0095)	(0.0254)
Autocorrelation test				
Breusch-Godfrey LM(2)	1.805	0.594	2.251	3.594
p-value	*0.2141*	*0.5618*	*0.1420*	*0.0486*
Heteroskedasticity tests				
Breusch-Pagan	1.33	3.05	0.31	1.14
p-value	*0.2491*	*0.0805*	*0.5759*	*0.2847*
White's test	9.33	6.35	5.67	10.17
p-value	*0.0966*	*0.2734*	*0.4611*	*0.1177*
Normality tests				
Jarque-Bera	0.294	0.168	5.863	1.005
p-value	*0.8630*	*0.9193*	*0.0533*	*0.6049*
Skewness and kurtosis	0.07	0.30	7.28	1.19
p-value	*0.9668*	*0.8626*	*0.0262*	*0.5511*
Period (yearly data)	2005−2019	1995–2019	2000–2019	1996−2019
Adj. R^2	0.8392	0.8641	0.8859	0.7991

Notes: OLS estimation. Standard errors are in parentheses. Coefficients are statistically significant at * p < 0.1, ** p < 0.05, and *** p < 0.01.

Table 2. Demand for tourist goods and services: values of parameters and elasticities.

Country	Australia (1)	Canada (2)	Spain (3)	U.S. (4)
$\hat{\phi}_i = \frac{\hat{\rho}_i - 1}{\hat{\rho}_i}$	0.4394	0.7945	0.5399	0.7208
$\lvert\widehat{\varepsilon^x_{p_x}}\rvert_i$	1.4670	3.4232	1.5305	2.5911
$\lvert\widehat{\varepsilon^x_p}\rvert_i$	0.3166	1.4429	0.6429	0.9908
$\hat{\beta}_i$	0.0063	7.1802	0.0361	1.0000

Notes: These figures are the average values corresponding to the sample periods for each country. To compute the price elasticities, we use Equations (24) and (25); for $\hat{\beta}_i$, we use Equation (28).

According to our model, the parameter ϕ represents the intensity of preferences for tourist goods and services being offered in the destination country. These preferences, and hence the market demand, may be affected by social, political, and economic factors. Then, according to the first row of Table 2, international tourists visiting Canada show the highest preference for tourist goods and services provided in that country. The preferences of international tourists visiting the United States are also strong, but 10% lower. On the low side, international tourists visiting Spain show 25% less intense preferences for Spanish tourist goods and services than the corresponding tourists visiting the United

States. Finally, the lowest intensity of preferences is among international tourists visiting Australia, which only slightly exceeds 50% of the intensity shown by tourists visiting Canada.

The demand for tourist goods and services in a particular destination depends on the price of those goods and services, as well as on the price of accommodation. We then compute the elasticity of demand with respect to these two determinants. The second row of Table 2 shows the estimated absolute values of the own-price elasticity for the tourism demand of international tourists in each of the countries. All these elasticities are above 1, but they are not too high. Empirical studies show that the demand for accommodation is quite inelastic to price, while supply is much more elastic. Also, the demand for tourist goods and services is moderately elastic in response to price, while supply is significantly inelastic (Forsyth et al., 2014; Johnson and Thomas, 1992; Morley, 1998; Peng et al., 2015; Song et al., 2010). According to our computations, the lowest elasticities stand at around 1.5 in Australia and Spain, while they are somewhat higher in the United States and, especially, in Canada. Based on the elasticity values, the Lerner index suggests that the tourism industries in Australia and Spain enjoy strong market power when it comes to tourism demand from international tourists visiting those countries. Conversely, the market power of the tourism industry in the two North American countries is significantly lower.

In the third row of Table 2, we find the absolute values of the cross-price elasticity. All these elasticities, country by country, are lower than the corresponding price elasticities. This is consistent with Equation (22) because the ratio of tourism expenditure on goods and services to tourism expenditure on accommodation is greater than 1 in all countries (the sample means are 2.38 in Canada, 2.39 in Spain, 2.63 in the United States, and 4.65 in Australia). The low values recorded for the cross-price elasticity in Australia and Spain mean that any changes in the accommodation market that affect prices will have little effect on shifting demand for tourist goods and services.

Finally, parameter β is the constant marginal utility of money, income, or total expenditure. The value of this parameter characterizes the socioeconomic status of international tourists visiting each country and thus allows us to make international comparisons. A higher value of β in a given destination means that the group of tourists visiting it shares, on average, a lower level of purchasing power. Moreover, as mentioned above, the higher the value of β, the lower the demand for both tourist goods and services and overnight stays. According to our estimates, international tourists visiting Australia are wealthier than international tourists visiting Spain. They are followed by tourists coming to the United States, the country we have taken as a reference and for which β equals 1. Closing the ranking we find tourists visiting Canada with the lowest purchasing power. Of course, this result should be independently verified, for example, using information from surveys that directly ask departing tourists about their socioeconomic profile, their attitudes toward the destination's tourism offer, and other questions related to their recent tourism experience.

Overall, there is one remarkable feature that emerges from Table 2: the order of the countries according to the value of any of the parameters in the table does not change. This result is a direct consequence of the model predictions, as can be seen from the signs of the derivatives in Equations (26), (27), (29), and (30).

7. Conclusions

This paper addresses the problem of the empirical modeling of the tourism demand function from a new perspective. Many empirical studies on tourism demand are grounded on ad hoc formulations with little connection to theoretical models. Moreover, it is widely recognized that there is a shortage of theoretical papers in tourism economics. Our paper, however, is a theoretical-empirical contribution that provides a detailed characterization of the linkages between the demand for tourist goods and services and the demand for accommodation using economic theory.

In order to understand the mechanics of a sector as strategic as tourism and to make sound decisions and recommendations, the entrepreneurs and policymakers involved need an accurate theoretical representation that captures the interdependencies between the relevant variables and their relationship with the parameters. Our model of tourism choice is a model in which the representative tourist arriving at a destination decides the amount of goods and services they want to purchase and the number of overnight stays required to enjoy such tourism consumption. These two decisions are separate but interrelated because of the feedback between demands for lodging and tourism products through a vertical relationship of complementarity.

Overall, this work extends existing theory and also makes a contribution to the empirics of tourism economics. The latter consists of an application to the tourism database of Australia, Canada, Spain, and the United States that quantifies demand elasticities and identifies the socioeconomic status of their respective tourists. Our approach focuses on estimating the demand for overnight stays from which we retrieve the value of the parameters that allow us to compute the elasticities corresponding to the demand for tourist goods and services. Simultaneously, we also derive the marginal utility of income that characterizes tourists in different destinations. In doing so, the paper opens new ways of thinking about and understanding complex phenomena and can be a reference for future empirical and theoretical studies on tourism economics.

In conclusion, the model and application discussed in these pages represent an alternative way to have a complete characterization of demand functions and to obtain the estimation of their elasticities. Our results show that the own-price elasticity of the demand for tourist goods and services is not much higher than 1, particularly in Australia and Spain. In addition, the cross-price elasticity of the demand for tourist goods and services is substantially lower than the previous one, which means that price changes in the accommodation market will have little effect on the demand for tourist goods and services. On the other hand, based on empirical studies, we also assume that while the supply of accommodation is very elastic, the demand is pretty inelastic to price.

The relevance of these results is due, among other reasons, to the controversial debate between lodging entrepreneurs and policymakers on the convenience of taxing tourism with a tax on overnight stays. Without entering into the discussion about the many compelling reasons that would recommend taxing tourism, even under the assumption of perfect competition and in the absence of market failures, the estimated values of the elasticities suggest that the tourist tax will not have a significant negative impact on the level of competitiveness, tourism activity, or the number of visitors. Consequently, the revenues of both accommodation providers and suppliers of tourist services will hardly be reduced by the application of a tourism tax that does not raise the price of lodging above the reservation price.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

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