A THEORETICAL MODEL-BASED INDIRECT ESTIMATION OF THE DIRECT AND CROSS PRICE ELASTICITIES OF DEMAND FOR TOURIST GOODS AND SERVICES

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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. We propose a new method to empirically estimate 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 also 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.

JEL classification: 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 face to external shocks such as geopolitical uncertainty, natural disasters, terrorist attacks, financial and economic crisis and, more recently, the COVID-19 pandemic. Despite this, tourism is such an important industry that we cannot rely on the successful results of the past, and 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) point 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 fulfil 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 policy makers 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 implies that there exists 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. Secondly, 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 the 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 has 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. 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 part of the firms' activity goes 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, whose estimated elasticity is usually greater than unity. 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 minus one, 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 the elasticities is usually

[1] The reader is referred to Divisekera (2013), Dwyer et al. (2011), Lim (1997, 2006), 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.

[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).

concluded with the estimated values of the parameters in a log-linear specification of tourism demand. But 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, 2022; Crouch, 1996). In this field it is well known the shortage of theoretical papers. 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 all suggest similar determinants drawn from a common panel of explanatory variables.

In this paper we propose a new method to empirically estimate 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 just developed in Descals-Tormo and Ruiz-Tamarit (2022). 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 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 destination. Tourism demands can also be characterized with their dependencies on the structural parameters concerning tourist' 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 tourist services and overnight stays. In the following pages we will analyze all these issues from an empirical point of view.

The paper is organized as follows. In the second section we provide a brief outline of the tourism decision theory and characterize the demand functions. In the third section we study tourism demands from an empirical point of view. We find new specifications for the demand equations corresponding to tourist 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 the fourth section we focus on the two main price elasticities of tourism demand for goods and services. In the fifth section we analyze the parameter representing the marginal utility of income and the relationship with the socioeconomic status of tourists. In the sixth section 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 a final section we present our conclusions.

2 Theoretical framework

In a recent paper Descals-Tormo and Ruiz-Tamarit (2022) have developed an innovative theoretical model of the tourist's choice, which allows for new specifications of the tourism demand equations. These equations reveal a causal relationship between the endogenous variables and its determinants. The determinants are essentially a combination of the various expenditures made by tourists and the prices they pay at destination, which are easily observable and simplify significantly 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 choosing the demand for three goods: quantity of tourist services x,[3] number of overnight stays q,[4] and income available to consume other non-tourist products y. The particular utility function that represents the tourist preferences over these goods is

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

which 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, parameter β stands for the constant marginal utility of income, and $\gamma > 0$ implies that reservation prices for the consumer-tourist are finite.[6]

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 services expenditure is the product $p_x x$, being p_x a vector of unit prices of tourist services.

[3] This variable represents a bundle of tourist 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] For the sake of simplicity, we assume that overnight stays, although necessary to enjoy the consumption of tourist services, do not directly provide any utility or disutility.

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

[7] The cost of round-trip transportation between origin and destination, although it may represent a significant part of the tourist's expenditure, is treated as a lump-sum deduction. 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 monetary income, it may affect the quantity of overnight stays and tourist services demanded.

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 $p_y = 1$.

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

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

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

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

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

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

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

being $\Omega = (\alpha, \beta, \gamma, \phi, a)$ the vector of structural parameters of the model. The marginal utility of income is constant, which leads to a constant optimal value of the Lagrangian multiplier $\lambda^* = \beta$. Consequently, demands for tourist services x^* and overnight stays q^* do not depend on the tourist's available total net 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.

The modeling and forecasting of tourism demand has received a great deal of attention in the literature. However, much of the published work consists of empirical models that do not depend directly on a specific theoretical model. These are mostly ad hoc models estimated with different econometric techniques, but 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 services. The slope of the tourism demand is negative, $\frac{\partial x^*}{\partial p_x} < 0$, and complementarity implies that the cross price effect is also negative, $\frac{\partial x^*}{\partial p} < 0$. 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

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

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 consume per day, i.e., the greater the value of coefficient a, the higher the demand for tourist 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 tourism demand from an empirical point of view, focusing on the causal relationship between the dependent variables and their explanatory variables. There are basically two indicators for the dependent variable: one that measures the number of tourist arrivals and overnight stays, and another that measures tourism expenditures at the destination. The empirical literature considers these two tourism demands 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 assumed that overnight stays are complementary to tourist goods and services through a linear function with a fixed coefficient, which represents the number of tourist services that the tourist can consume throughout the day. Based on this, we have deduced simultaneously and within the same theoretical model the two demands for quantities of tourist services and overnight stays.

Regarding the explanatory variables, there is a wide range of factors affecting the dependent variable. However, most of the empirical studies assign a central role to income, prices (own and substitute, and adjusted by the rate of exchange), economic activity level and population as the most salient determinants (Song and Turner, 2006). The typical tourism demand model estimates an equation where 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 destination, which are easily observable or proxied.

Substituting from 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 the market demand by deflating the sum of monetary expenditures. Then, equation (5) can be rewritten as

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

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 for which there are reliable records of data on quantities,[8] and then use the results to infer the parameters of the demand for tourist services. From (6), under the simplifying assumption that γ is close to zero, and taking logarithms we get

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

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

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

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.[9] The variable π_{it} is defined as the ratio between the tourism expenditure on tourist goods and services, g^x_{it}, and the tourism expenditure on accommodation, g^q_{it}, both referred to destination i in period t, that is

$$\pi_{it} = \frac{g^x_{it}}{g^q_{it}} > 0. \tag{14}$$

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

$$\rho_i = \frac{1}{1-\phi_i} > 1, \tag{15}$$

[8] 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.

[9] 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) investigates the evidence for the use of the CPI as a proxy for the TPI, and shows that tourism prices are highly correlated with general consumer prices. However, Divisekera (2003) still proposes price proxies that reflect the cost of a common basket of goods and services consumed by tourists at the destination.

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

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

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.[10]

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

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

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

The coefficient a can be directly computed from the database. 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 income equal to unity, $\beta_{\bar{\imath}} = 1$. For this particular destination we just identify the value $\alpha_{\bar{\imath}} = \widehat{\left(\frac{\alpha}{\beta}\right)}_{\bar{\imath}}$. Here, for the sake of simplicity, we assume that tourists' preferences in all destinations share the same value $\alpha_{\bar{\imath}}$.[11] In this way we arrive at the values of the constant marginal utility of income that characterize tourists in different destinations

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

[10] 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).

[11] 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 in 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 with parameters α and ϕ. In consequence, we can account for the degree of substitutability between destinations by referring only to the parameter ϕ.

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

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 of demand for tourist services and the value of the cross price elasticity of demand for tourist 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 grater than unity and the second term is lower than unity. In addition, as long as π_{it} is greater than unity 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

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

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

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 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 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 has 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 feature the destination with their marginal utility of income, 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 income 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: $\frac{\partial x^*}{\partial \beta} < 0$ and $\frac{\partial q^*}{\partial \beta} < 0$. That is, the higher the purchasing power of the class of tourists, the greater the demands for both tourist services and overnight stays.[12]

From (18) and (21) we arrive at the following expression that allows us to rank destinations according to the marginal utility of income calculated for each of them

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

In this equation we also find

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

Moreover, from Descals-Tormo and Ruiz-Tamarit (2022) we know that the values of the direct price elasticity and cross price elasticity of demand for tourist services are related to

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

the income level and the corresponding socioeconomic status of tourists as follows

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

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 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.[13] 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 $\ln CPI_{it}\left(1 + \frac{1}{\pi_{it}}\right)$, as well as the values of their main descriptive statistics calculated country by country, can be observed in Figures A.1 to A.4 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 on the basis of the observed profile of the data series corresponding to the variables in equation (13).[14] 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

[13]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.

[14]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.

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, except in the case of the United States where the Durbin-Watson test is inconclusive and both the Durbin alternative test and the Breusch-Godfrey test, which are more accurate for small samples, do 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.

[**TABLE 1**]

[**TABLE 2**]

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 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 preferences for Spanish tourist goods and services 25% less intense than the corresponding to 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 unity, 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. But also that 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; 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 unity 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 in shifting demand for tourist goods and services.

Finally, parameter β is the constant marginal utility of income. 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 demands 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 in order by tourists coming to the United States, the country we have taken as a reference and for which β equals unity. 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 towards 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 policy makers 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 he/she wants to purchase and the number of overnight stays required to enjoy of 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 in 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 unity, 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 assumed 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 policy makers 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 goods and services will hardly be reduced by the application of a tourism tax that does not raise the price of lodging above the reservation price.

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

Country	Australia	Canada	Spain	U.S.
	(1)	(2)	(3)	(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 tests				
Durbin-Watson d	1.524	1.445	1.528	1.007
[d_L-d_U] at the 1%	[*0.70-1.252*]	[*0,981-1.305*]	[*0.773-1.411*]	[*0.882-1.407*]
Durbin's alternative	1.584	0.499	2.034	3.847
p-value	*0.2523*	*0.6148*	*0.1677*	*0.0406*
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	Canada	Spain	U.S.
	(1)	(2)	(3)	(4)
$\hat{\phi}_i = \dfrac{\hat{\rho}_i - 1}{\hat{\rho}_i}$	0.4394	0.7945	0.5399	0.7208
$\widehat{\lvert\varepsilon_{p_x}^{x}\rvert}_i$	1.4670	3.4232	1.5305	2.5911
$\widehat{\lvert\varepsilon_{p}^{x}\rvert}_i$	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).

APPENDIX

Table A.1 Data sources. Inbound tourism.

	AUSTRALIA	CANADA	SPAIN	U.S.
Accommodation	Total overnights Units: Thousands Period: 2008-2019 Source: UNWTO Period: 2005-2007 Number of arrivals Source: The World Bank	Total overnights Units: Thousands Period: 1995-2019 Source: UNWTO	Total overnights Units: Thousands Period: 2000-2019 Source: UNWTO	Overnights in hotels and similar establishments Units: Thousands Period: 1997-2019 Source: UNWTO Period: 1996 Number of arrivals Source: The World Bank
Tourism Expenditure	Expenditure Inbound Units: US$ Millions Period: 1995-2019 Source: UNWTO Total international tourism consumption Units: Chain volume measure (2020-21) Period: 2005-2019 Source: ABS	Expenditure Inbound Units: US$ Millions Period: 1995-2011 Source: UNWTO Foreign demand Units: Millions of $, 2012 constant prices Period: 1995-2019 Source: Statistics Canada	Expenditure Inbound Units: US$ Millions Period: 1995-1998 Source: UNWTO Incoming tourist consumption Units: Millions of € Period: 2000-2019 Source: INE International tourist expenditure Units: Millions of € Period: 2009-2015 Source: EGATUR, Turespaña	Expenditure Inbound Units: US$ Millions Period: 1995-2019 Source: UNWTO Total demand by Nonresidents Units: Millions of $ Period: 1998-2019 Source: BEA
Passenger Transport Expenditure	Units: US$ Millions Period: 1995-2019 Source: UNWTO	Units: US$ Millions Period: 1995-2011 Source: UNWTO Units: Millions of $, 2012 constant prices Period: 1995-2019 Source: Statistics Canada	Units: US$ Millions Period: 1995-1998 Source: UNWTO Transport of passengers Units: Millions of € Period: 2000-2019 Source: INE	Units: US$ Millions Period: 1995-2019 Source: UNWTO Passenger transportation services (nonresidents) Units: Millions of $ Period: 1996-2019 Source: BEA
Accommodation Expenditure	Units: Chain volume measure (2020-21) Period: 2005-2019 Source: ABS	Units: Millions of $, 2012 constant prices Period: 1995-2019 Source: Statistics Canada	Accommodation services Units: Millions of € Period: 2000-2019 Source: INE International tourist expenditure Units: Millions of € Period: 2009-2015 Source: EGATUR, Turespaña	Traveler accommodations (nonresidents) Units: Millions of $ Period: 1996-2019 Source: BEA
Prices Index	Consumer Price Index Period: 2005-2019 Source: The World Bank	Consumer Price Index (base 2012) Period: 1995-2019 Source: The World Bank	Consumer Price Index Period: 2000-2019 Source: The World Bank	Consumer Price Index Period: 1996-2019 Source: The World Bank

We obtain information about inbound tourism from The World Tourism Organization (UNWTO), which covers the activities of non-resident visitors within the country of reference on an inbound tourism trip. This information is available from the UNWTO website at https://www.unwto.org/tourism-statistics/key-tourism-statistics.

When data are not available from UNWTO, we use information from the national accounts of each country, namely The Tourism Satellite Account (TSA). The TSA includes information from both the demand and supply sides of the economy. We are interested in data from the demand side, specifically inbound tourism spending on lodging and transportation for each country considered.

Additionally, we use information on prices from The World Bank databank, namely the Consumer Price Index (CPI), available at https://data.worldbank.org/indicator/FP.CPI.TOTL.

The country-specific sources are as follows:

1) For Australia, the Tourism Satellite Account is used to obtain the series of expenditure on accommodation. The sample period for Australia is 2005-2019 because TSA data is only available for these years in the Australian National Accounts, Australian Bureau of Statistics (ABS), https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-tourism-satellite-account.

To approximate the number of overnight stays from 2005 to 2007, we use information on overnights (or "guest nights") from UNWTO and the number of international tourist arrivals from the World Development Indicators in The World Bank databank. Available at https://data.worldbank.org/indicator/ST.INT.ARVL.

2) For Canada, expenditure data from Tourism Demand in Canada, Statistics Canada 1995-2019, have been used. In particular Table 36-10-0230-01 available at https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610023001.

3) For Spain, the expenditure series are obtained from the Tourism Satellite Account of Spain from the Spanish Statistical Office, INE. These data are available on its website at https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736169169&menu=resultados&idp=1254735576581.

4) For the US, the expenditure series used are from the Tourism Satellite Account for the period 1998-2019, provided by the Bureau of Economic Analysis (BEA). The data can be accessed from the BEA's website https://www.bea.gov/data/special-topics/travel-and-tourism/tourism-satellite-accounts-data-sheets. For the period 1996-97, the information used was obtained from "U.S. Travel and Tourism Satellite Accounts for 1996 and 1997", Survey of Current Business, July 2000, Volume 80, number 7. Bureau of Economic Analysis.

Finally, to approximate the number of overnight stays in 1996, we use information on overnight stays (or "guest nights") from the World Tourism Organization (UNWTO) and the number of international tourist arrivals from the World Development Indicators, as recorded in The World Bank databank available at https://data.worldbank.org/indicator/ST.INT.ARVL.

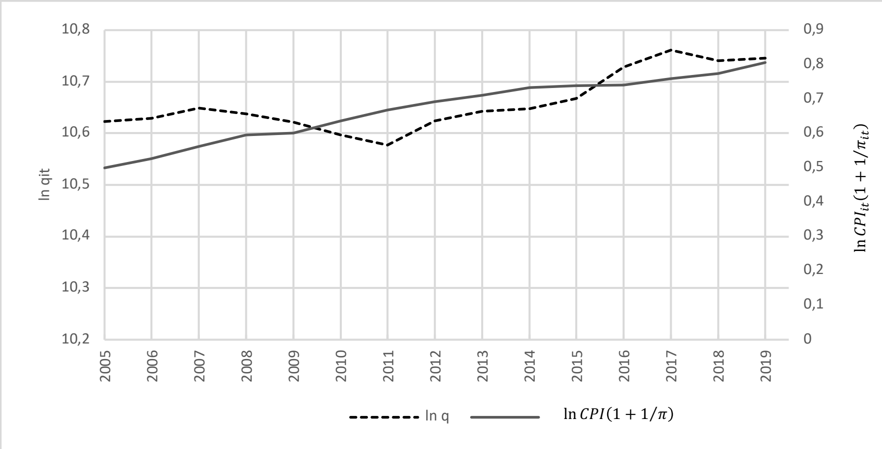

Figure A.1. Australian series

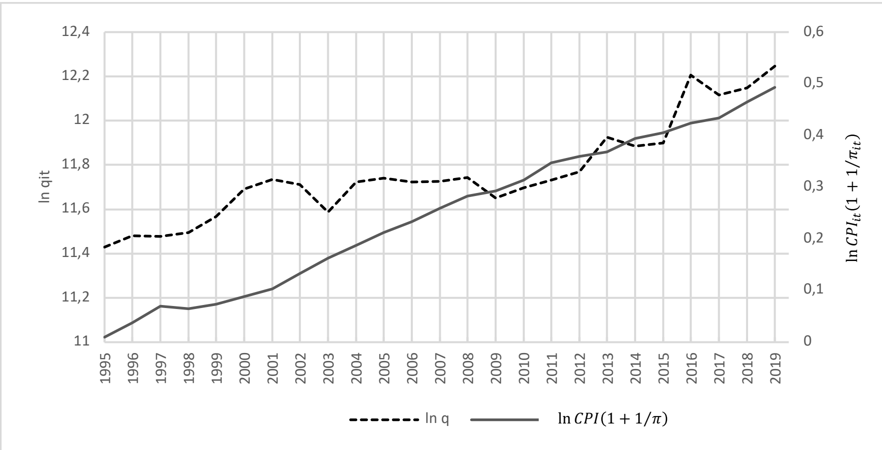

Figure A.2. Canadian series

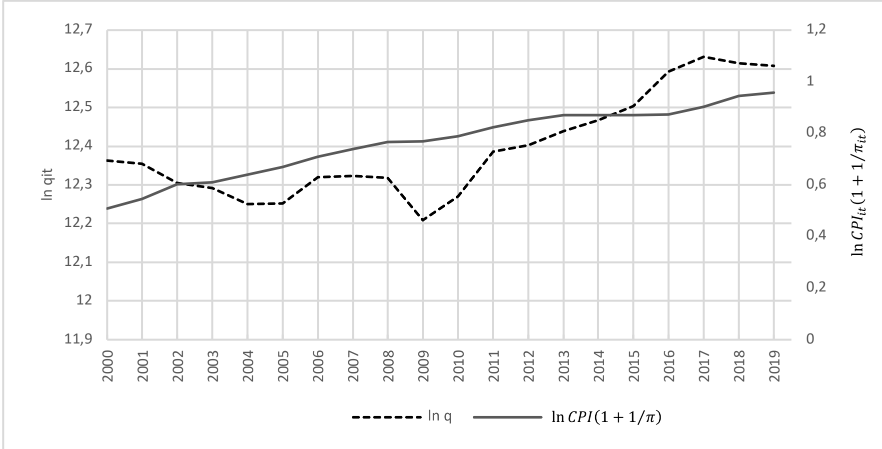

Figure A.3. Spanish series

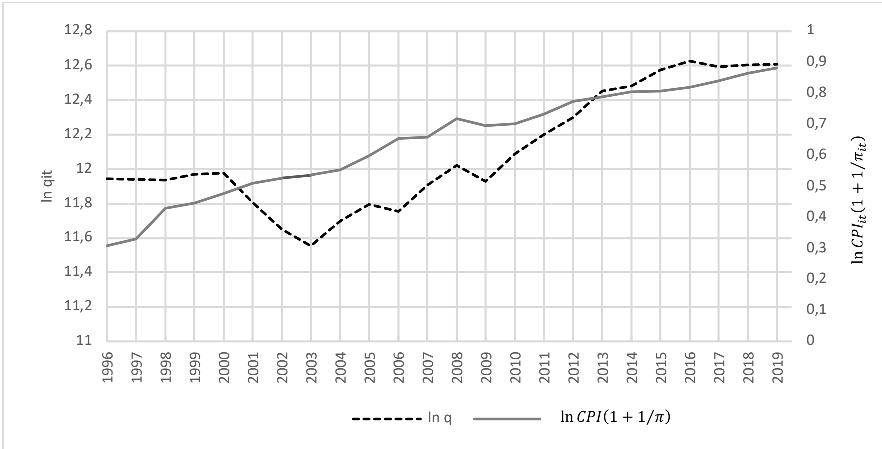

Figure A.4. U.S. series

Source: Own elaboration from statistical information Table A.1

Table A.2. Main descriptive statistics.

Variable	Obs.	Mean	Std. dev.	Min.	Max.
ln q_{it} Australia	15	10.6594	0.0571	10.5772	10.7613
ln q_{it} Canada	25	11.7643	0.2241	11.4293	12.2463
ln q_{it} Spain	20	12.3952	0.1332	12.2088	12.6310
ln q_{it} U.S.	24	12.1008	0.3443	11.5544	12.6272
ln $CPI_{it}(1+1/\pi_{it})$ Australia	15	0.6693	0.0947	0.4995	0.8057
ln $CPI_{it}(1+1/\pi_{it})$ Canada	25	0.2484	0.1489	0.0097	0.4930
ln $CPI_{it}(1+1/\pi_{it})$ Spain	20	0.7656	0.1333	0.5084	0.9577
ln $CPI_{it}(1+1/\pi_{it})$ U.S.	24	0.64408	0.1696	0.3084	0.8818

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