THE ROLE OF INTERMODAL AND INTRAMODAL TRANSPORT COMPETITION IN THE CHOICE OF TOURIST DESTINATIONS[1]

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Abstract

This paper analyses how competition among and within transport modes affects tourists' preferences. Although the relationship between tourism and transport has been widely studied, the theoretical modelization of travel decisions, and particularly the role played in those models by the structure of transport markets has remained under-researched. This paper departs from the classical transport demand literature – the well-known 4-stages nested logit model (William and Ortúzar, 1979; Sheppard, 1995; Fisher, 2000) – and adapts it to the modelization of touristic attractiveness. We show that the (intermodal and/or intramodal) competition level on the transport market serving a given touristic destination affects the travelers' probability of choosing that destination. In particular, it can be proved with a simple example that intermodal competition increases the likelihood for a destination of being chosen (as compared to intramodal competition with the same characteristics). Another interesting result is that introducing transport competition in a destination never yields worst results in term of likelihood of being chosen by tourists, even if this mode is not really competitive. (Transport) Monopolies are bad news for tourism.

Keywords: Tourism, transport; nested logit model; competition.

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1. Introduction

Since the second half of the twentieth century, tourism has progressively become one of the most profitable industries in the world, generating over $852 billion in export revenues with 935 million of tourists in 2009 (UNWTO, 2011). These figures are impressive enough to justify a detailed analysis of all the factors that determine tourism activities. Most of these studies have focused on the factors that determine (or not) a place's attractiveness (defined as its potential ability for the development of touristic business).

From the point of view of microeconomic theory, tourism is a human (rational) decision generally related to travelling to a given place (destination) and there enjoying leisure activities. Tourism decisions are based on tourist preferences, i.e., what moves a tourist to visit a specific place is what (s) he is looking for, (her)his desire or likes. Therefore, the destination attractiveness is often based on its endowment of places of interest, cultural or historical aspects, events, nature, weather or any other characteristics considered by tourists. However, there are other aspects that may affect the destination attractiveness, and one of them is accessibility, which depends on transport and its infrastructures.

This is not a new idea, since tourism growth is considered as a function of the development of the means of transport (Kaul, 1985). "Transport has enabled to go further, at greater speed, for a cheaper price and in greater comfort and safety" (Prideaux, 2000), and, what it is more important, has allowed the development of some isolated destinations that, without transport, would not even exist as a touristic option for most of world population (tourist destinations as Canaries, Hawaii, Caribbean or New Zealand are good examples of this).

Nevertheless, it is relevant to determine how transport system needs to be configured to contribute the most to the attractiveness of a destination, inasmuch as transport and its infrastructures are essential to the tourist development of a specific region (Prideaux, 2000). Thus, it is obvious that links between origin and destination markets become crucial in tourism development; therefore, transport modes which connect them (plane, train, high speed rail, road transport, etc.) and companies which compete within them (airlines, coach companies, etc.) are essential to improve the competitiveness of a tourist destination. The real objective of this paper is to answer the question of what market structure in the transport system is the most suitable in terms of tourism in order to establish some policy recommendations to tourism authorities. To define this transport system, it has to be considered its competitive structure, and (as much as we know) there is no evidence about what is the best structure of transport competition for tourism. Moreover, modeling in tourism transport is an under-explored stage of tourism research (Fennel, 1996; Lew and McKercher, 2005).

Literature review, in section 2, shows that transport competition has been generally modelized departing from the classical transport demand literature. In particular, the traditional 4-stages nested logit model (William and Ortúzar, 1979; Sheppard, 1995; Fisher, 2000) which shows how demand requires four sequential decisions: to travel or not to travel, which destination is chosen, in what transport mode and finally, what route is selected.

Adapting this idea, this paper develops a theoretical nested logit model based answering three specific questions: where to travel, how to get there and with which company. This model implicitly considers that not to travel is one of the destination options that a tourist has and also takes into consideration that tourists do not choose route, but companies which may vary its offer in terms of prices or services. Thus, a 3-stages nested logit model is formed by destination choice, competition between modes of transport (intermodal competition) and competition within a mode (i.e., between companies in the same mode) which is known as intramodal competition. The aim of this paper is to test the impacts on tourists' choice of the level and type of competition, by developing different scenarios of competition.

After the literature review, section 3 describes the 3-stages nested logit model, representing the decision of destination choice facing the users, considering cost function specifications. In section 4, it is analyzed how transport competition affects the choice of a tourist destination, through the theoretical introduction of intra and intermodal transport competition, to test how changes in the competition structure of a destination affects its likelihood of being chosen by users. Section 5 works on a simplified version of the model, taking into account some assumptions, with the aim to compare intra and intermodal competition in a hypothetical scenario. Finally, section 6 illustrates some recommendations in terms of public policies and establishes the main conclusions from this analysis.

2. Literature review

2.1. The relationship between Transport and Tourism

Transport has been essential in the development of tourism industry (Kaul, 1985). Nevertheless, the relationship between both concepts has not only one direction. Transport, as intermediate, provides the necessary links to connect an origin point with a tourist destination, but we have to consider that the industry of tourism (which moves around 1 billion of people, according to World Tourism Organization, UNWTO, 2011) is (and has been) crucial to transport system development, as a determining factor in the increase of world transport demand. Therefore, it is obvious to consider them as interrelated terms. As Kaul establishes, "transport plays an important role in the successful creation and development of new attractions as well as the healthy growth of existing ones. Provision of suitable transport has transformed dead centres of tourist interest into active and prosperous places attracting multitudes of people." In his study, author also sets up some postulates which relate transport and tourism, collected in Table 1.

	Kaul's Postulates
P1	*The evolution of tourism is greatly influenced by and is a function of the development of the means of transport.*
P2	*Tourism is a mass phenomenon as well as an individual activity, which needs transport.*
P3	*Transport facilities are an initial and integral need for tourism and operate both as an expanding as well as a delimiting factor for traffic flows; the quality of transport services offered also influences the type of tourist flow.*
P4	*The planned development, maintenance and operation of transport infrastructure under a well conceived overall transport policy, to meet the present and future technology and demand requirements, is the key to the success of the transport system contributing to the growth of tourism.*
P5	*Transport prices influence elasticity of demand for traffic and diversification of price structure and competition has encouraged price reduction and qualitative improvements amongst modes of transport much to the benefit of tourism.*
P6	*The integration of domestic and international transport systems and parallel co-ordination with other countries contributes to the ease of tourism flow and growth of domestic and international tourism.*

P7	*Transport technological developments would exercise a deep influence on the means and patterns of transportation in both developing and developed societies, with the result that a more efficient, faster and safer transport system, beneficial to the growth and expansion of tourism would emerge and evolve.*
P8	*Accommodation, as an essential ingredient of tourism development and success, must maintain comparative growth to meet the increasing and diverse demands of tourism and transport expansion.*
P9	*The satisfactory development and equipping of terminal and en-route facilities the systematic improvement in infrastructure, the absorption and adoption of new technology and appropriate mass marketing techniques in transport would have a pervasive impact in the continued growth of future world tourism.*

Source: Kaul (1985).

Hall (1999) sheds some light in the conceptualization of tourism transport through a review of transport and tourism literature and also establishes some ideas of equality and externality issues. Regarding to tourism transport, Hall finds four different roles of transport in tourism: "(1) linking the source market with the host destination; (2) providing mobility and access within a destination area/region/country; (3) providing mobility and access within an actual tourism attraction; and (4) facilitating travel along a recreational route which is itself the tourism experience (i.e. cruises)". According to this classification, Hall situates his analysis in the second category, making a qualitative analysis of transport demand. He also presents the relationship between tourism and inequality/externalities issues, paying special attention to the contrast between tourists and local people in certain tourist areas.

Considering Hall's classification, most of research works about the relationship between Tourism and Transport are located in the second category, i.e., providing mobility and access within a destination. In this context, Albalate and Bel (2009) represents one of the few works that establish the tourism impact through the relationship between supply and demand of transport. Their aim is to know if city planners give a response to the tourist demand (which increases local demand) for urban public transport by extending service supply, through econometric estimations of supply and demand functions with a sample of 45 European cities. They find that cities do not expand their services under tourist demand pressure, taking advantage of the funding that tourists provide (and also suffering the imposition of external costs on local population) to finance transport system.

Lew and McKercher (2005) develop an urban transportation theoretical model which reflects tourists' behavior within a tourist destination, with the aim to understand how tourists move within a destination through time and space, especially considering the factors that have a bigger influence on their movements and what are the main implications for infrastructure and transport development, resulting in four key factors: trip origin and destination, the supply or stops, the transportation network and the mode or type of transport used. From this, they establish different types of territorial and linear paths in an intradestination context taking into account previous factors and tourist features.

With respect to modeling of tourists' movements, there are other difficulties such as the quantity of alternative routes of a network. As Lew and McKercher (2005) point out, "the more alternative routes that a network offers, the more difficult it is to accurately model transportation flows on it". Tourism is extremely influenced by tourist preferences and behavior, and it is not so easy to guess what route is going to be selected by a tourist (and obviously what mode of transport) from an origin point to a destination, due to the dependence on personal and latent factors. Meyer and Miller (1984) suppose that majority of tourist will choose the shortest or most-efficient route.

Regarding to Hall's first category, there are not too much studies that analyze the links between source market and the host destination. One of the few is Prideaux (2000), where author find that, from tourist's personal holiday budget, there are three different categories of travel cost: accommodation costs, discretionary spending (costs within destination) and transport costs. The author build up a model of transport costs which interrelates these cost categories through a traditional transport cost model (defining as a function of price of fares, time of journey, comfort travel and transport infrastructure costs) tested in the case of *Cairns* (Australia), and paying special attention to distance as a model variable in his analysis. Hatzinger and Mazanec (2007) study the part that represents the mode of transport in a trip package for business and leisure travelers using an Extended Bradley-Terry Model, finding that mode of transport dominates the assessment of these packages.

Despite the relation between tourism and transport is obvious, and nobody doubts about the important role that transport plays in tourism industry, as it was mentioned, modeling in tourism transport is an under-explored stage of tourism research (Fennel, 1996; Lew and McKercher, 2005). Traditionally, it has been difficult to create models which explain this relationship. As Hall (1999) establishes, "transport forms may be employed for tourism purposes exclusively (charter aircraft, tour coaches, cruise liners, "heritage" transport), partly (scheduled air services, express buses, taxis, hire cars, long distance trains, ferries) occasionally (private cars, local public transport in a seasonal tourism destination) or rarely (private and public commuter transport)". This mixed nature, and specially the existence of modes shared by local population (who may also be considered as a part of tourism impact at the same time, if we consider employees of the tourism industry) and tourists, is one of the reasons why it is so difficult to develop models that summarize the total impact of tourism in transport and vice versa.

2.2. Transport Competition and Tourism

Finally, it has to be noted that the aim of this paper is to develop a model which determines the importance of transport competition in tourism. "Competition causes efficient organizations to prosper at the expense or inefficient ones, and that this selection process is good for aggregate efficiency" (Vickers, 1995). As long as we consider transport modes or tourist destinations as different organizations within them, we will reach an idea of how important transport competition is. Traditionally, economic theory has encouraged the benefits of competition. Usual results show that introducing competence in a transport market (which is called intramodal competition) improves the total welfare of its society. However, sometimes, to introduce competition in a specific market drives to worst results (eg, due to the existence of cost subadditivity[3]). This is the reason why another kind of transport competition emerges: intermodal competition. In transport markets, competition between modes of transport that vie in a same route offers to passengers the necessary competition that is non-viable within the same mode (e.g., train) (Baumol *et al*, 1988). The importance of intermodal competition has been acknowledged by European Transport Policy (COM, 2001), which suggests it as a way to generate positive effects to society.

Dixit and Nalebuff (1991) develop one of the most clear theoretical models on intermodal competition through a very simple analysis. In this, authors analyze the modal distribution depending on generalized price concept. Otherwise, regarding to intermodal competition research field, models developed have been discussed from different points of view, establishing some differences between aggregate and disaggregate passenger transport models. Regarding to aggregate ones, some of them have been analyzed considering modal split (Quand and Baumol, 1966; Levin, 1978) or user's behavior (Oum and Gillen, 1979).

[3] Cost subadditivity is present when production of a specific quantity by only one company is socially less expensive than production of the same quantity by several companies. This concept is related with the existence of natural monopolies (Baumol, 1977)

In terms of disaggregate models, McFadden (1973) is considered the main study. In his research, it is built a discrete choice model in which transport user chooses the mode which gives (her) him the greater utility.

More recently, Ivaldi and Vibes (2008) built up a model which is able to analyze simulations on inter and intramodal competition, using game theory methodology. They apply its method to Berlin-Colonia route, with three different modes (train, plane and private cars) and intramodal competition in two of them. The aim of their research is to establish some political recommendations in terms of investments or taxes, confirming that a reduced number of competitors is enough to reach a high level of competition.

Combes and Linnemer (2000) also develop an intermodal competition model. In this study, authors combine intermodal competition with location decisions, through competition *à la Bertrand* in transport modes and *à la Hotelling* in the location stage. Their hypothesis, which is supported by their results, is that the improvement of a transport infrastructure generates a negative impact on social surpluses and creates regional inequalities. Braeutigam (1979) also study intermodal competition, but in his case, using a multiproduct enterprises context. Finally, there are other kind of intermodal competition studies that are concentrated in complete demand systems (Waters, 1989; Oum et al, 1990). As stated in de Rus et al (2003) considering intermodal competition, the key issue is to know what factors determine the passengers' distribution among different modes, i.e., the modal split. The traditional 4-stages nested logit model (William and Ortúzar, 1979; Sheppard, 1995; Fisher, 2000) is based on four sequential decisions: to travel or not to travel, which destination is chosen, in what transport mode and what route it is made. This approach analyzes the process of trip generation, trip distribution, modal split and route assignment by mode.

Although the role of transport competition in tourism has not been analyzed, there are some studies which develop models of tourism destination choices. Huybers (2003) built up a model of domestic tourism choices in Australia, through a stated preferences experiment. The author uses attributes as amenities, crowdedness, environment, events, expenditure per person, season and travel time (transport mode, which is the only reference here to transport issues) to design the experiment. Um and Crompton (1990) analyzes how attitudes are determinants in tourism destination choice, through a 2-stages and longitudinal approach. Seddighi and Theocharous (2002) also propose a methodological framework to analyze the impact of characteristics of a tourism product on foreign travel, by using Lancasterian product characteristics approach with the Koppelman's consumer transportation model (that relates consumers' perceptions with characteristics of the system) (Koppelman, 1980). The aim of their research is to measure the perceptions and feelings of tourists regarding to destinations, using a conditional logit analysis with data of Cyprus tourism, including transportation costs as one of many variables, but not paying special attention to its characteristics. Other studies which establish models of tourism demand are Song and Witt (2000), Syriopoulus (1993) and Morley (1992).

In conclusion, regarding to tourism transport studies, they usually are concentrated on only one mode of transport and, as far as we know, there are no studies which analyze the role of transport competition structure, paying special attention to how intramodal and intermodal competition in transport system affects destinations in terms of tourist arrivals, i.e., in tourism destination choices.

3. Modeling Tourist Destination Choice

Leisure travel experience generates a positive effect to whom practices it. This effect can be called satisfaction, happiness or gross utility. As Huybers (2003) establishes, "the choice modeling method is based on the key premise that consumers base their purchase decisions on the comparative attributes of a relevant choice set of rival products". But tourists do not only enjoy benefits when they travel: travelling generates costs that have to be considered. Thus, tourists (as rational choosers) face costs to this associated "satisfaction" and must determine whether it is profitable to make a travel, this for each destination *d (d* = 1, …, D). However, when a tourist makes a decision, we are only able to analyze a part of the utility that (s) he perceives, the one derived from (her) his actions. We denote V^d as the measurable part of the utility in destination *d* (U^d), and ε^d as the unmeasurable one, therefore:

$$U^d = V^d + \varepsilon^d . \quad (1)$$

Assuming rational tourists, they will choose the destination that report them the higher difference between costs and benefits, i.e.,

$$V^d = B^d - C^d , \quad (2)$$

where V^d represents the utility that a tourist receives through visiting destination *d*, as a difference between benefits and costs of doing it; and B^d and C^d denote the benefits and costs of making the travel to destination *d*, respectively. Furthermore, another alternative has to be considerate: staying at home (*d*=0). This alternative would not bring costs and benefits, i.e.,

$$V^0 = B^0 - C^0 = 0. \quad (3)$$

With this assumption, we ensure that tourists will never choose an alternative that generates them *disutility*.

With respect to the costs, as Prideaux (2000) establishes, there are three different categories of travel cost (C^d) for the tourists: accommodation costs (AC^d), transport costs (TC^d) and discretionary expenditure costs (costs within destination, DEC^d), i.e.:

$$C^d = AC^d + TC^d + DEC^d \quad \text{for} \quad d = 1, \ldots, \text{D}. \quad (4)$$

Transport costs can be considered as the sum of two different concepts. On one hand, costs derived from the existence of several modes of transport (C_m^d, for m = 1, …, M) which may offer different characteristics, and on the other hand, costs derived from the existence of different companies providing the transport service in a same mode ($C_n^{d,m}$ for n = 1, …, N). Thus,

$$TC^d = C_{m,n}^d = C_m^d + C_n^{d,m}. \quad (5)$$

Each transport mode has its own features. This is the reason why several modes may coexist in a competitive system. It is obvious that a plane is faster than a train, but maybe train is more comfortable than the plane. The aim of this example is to show that the differentiation in characteristics is the reason why competition between modes exists. If one of the modes were better in every single characteristic than the others, there would not be any modal split. In our model, modal cost is defined as

$$C_m^d = v \cdot \left(\frac{km^d}{S_m} + numb_m \cdot t_m^e \right) + \alpha_m - Q_m. \quad (6)$$

where v denotes the value of time, km^d as distance from origin point to destination *d*, S_m as mode speed, $numb_m \cdot t_m^e$ as total waiting time (number of stops multiplied by average waiting time per stop), α_m as access costs to the mode and Q_m as comfort (a quality proxy variable). For now on, travel time will be expressed as,

$$t_m^d = \frac{km^d}{S_m} + numb_m \cdot t_m^e. \tag{7}$$

With respect to the costs derived from the existence of different companies offering the transport service in the same mode, i.e., $C_n^{d,m}$, it will depend only on price. In turn, price will depend on the market structure of the mode considered (competitive and non-competitive structures, monopolies regulated and non-regulated by law, etc).

To sum up, the category of transport costs (TC^d) is composed by

$$TC^d = C_{m,n}^d = C_m^d + C_n^{d,m} = v \cdot t_m^d + \alpha_m - Q_m + p_n, \tag{8}$$

Therefore the total travel cost (C^d) will be

$$C^d = AC^d + \left[v \cdot t_m^d + \alpha_m - Q_m + p_n \right] + DEC^d. \tag{9}$$

Equation (9) reflects the total cost incurred by a tourist when (s) he chooses an specific destination *d*. In our model, we will have as many equations as combinations considered by the tourist in (her) his travel choice. With this, tourist choice among destinations will be obtained by solving the equation (10):

$$d^*, \text{ such } V^{d^*} = \max\left\{ V^{d=1},\ V^{d=2},\ V^{d=3},\ \dots,\ V^{d=d^*},\ \dots,\ V^{d=D} \right\} \tag{10}$$

where

$$V^d = B^d - \left[AC^d + \left[v \cdot t_m^d + \alpha_m - Q_m + p_n \right] + DEC^d \right]. \tag{11}$$

Let us assume that accommodation and discretional expenditure costs are the same among destinations. This hypothesis is perfectly comprehensible if we think about destinations which have similar characteristics regarding to living standards (e.g., competing destinations in a same country). Another assumption is done about benefits B^d. According to the same previous idea, we consider that benefits are the same among destinations. In essence, this latter assumption is logical if we think about a tourist who faces a set of destinations to travel and who considers cost attributes of each one of them to take a decision. This model is not valid for a tourist who has a strong preference for a specific destination, for the simple reason that this type of tourist would not choose among alternative destinations to make (her) his decision. Hence, our model is created for rational tourists who compare costs and benefits among destinations.

Therefore, according to the previous assumptions, the total tourist's total utility will depend on three choices: destination *d* (*d* = 1, …, D), mode of transport *m* (*m* = 1, …, M) and transport company *n* (*n* = 1, …, N).

$$U_{m,n}^{d} = U^{d} + U^{m} + U^{n}, \tag{12}$$

$$U_{m,n}^{d} = V_{m,n}^{d} + \varepsilon_{m,n}^{d} = V^{d} + V^{m} + V^{n} + \varepsilon^{d} + \varepsilon^{m} + \varepsilon^{n}. \tag{13}$$

Let us consider now the unmeasurable part of utility, i.e., $\varepsilon_{m,n}^{d}$. This part cannot be observed, so introduces an error in the estimation of total utility. Error terms of modes in a same destination or companies in a same mode (and in a same destination at the same time) are independent. Likewise, subsets of choice alternatives are correlated between them. These ideas support the choice of nested model.[4] The aim of this paper is to explain the importance and the impact of intra and intermodal competition on the destination choice, *ceteris paribus*. With this purpose, it is necessary to express the likelihood of choosing a specific destination over others. In this model, likelihood is expressed as

$$Prob(d^*, m^*, n^*) = Prob(d^*) \cdot Prob\left({m^*}/{d^*} \right) \cdot Prob\left({n^*}/{m^*} \right), \tag{14}$$

where

$$U(d^*, m^*, n^*) > U(d', m', n'); d^* \neq d', m^* \neq m', n^* \neq n'. \tag{15}$$

The likelihood of choosing a specific tourist destination is the result of multiplying the probability of choosing company conditioned by mode (*Prob (n*/m*)*) , mode conditioned by destination (*Prob (m*/d*)*) and destination itself (*Prob (d*)*). Assuming that errors are

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[4] This specification is based on the idea of allowing correlation in the model, assuming that there is no independence of irrelevant alternatives, i.e., errors are not random. In present case, correlation appears between groups of alternatives. If there were any other type of correlation, the model would be solved only by Probit or Mixed Logits (McFadden 1973; 1974; 1978).

distributed as a Gumbel distribution,[5] the model adopts a nested logit specification, where probabilities are established as the following expression:

$$Prob(d^*, m^*, c^*) = \frac{e^{V_{m^*,n^*}^{d^*}}}{\sum_{c=c'}^{C}\sum_{m=m'}^{M}\sum_{d=d'}^{D} e^{V_{m',n'}^{d'}}}. \tag{16}$$

Assuming *D* destinations, *M* modes of transport and *N* companies, the theoretical nested logit model takes the figure 1 representation, which summarizes the three questions that a tourist has to answer in order to choose a specific tourist destination, according to the model: where to go, how to get there and which company to do it.

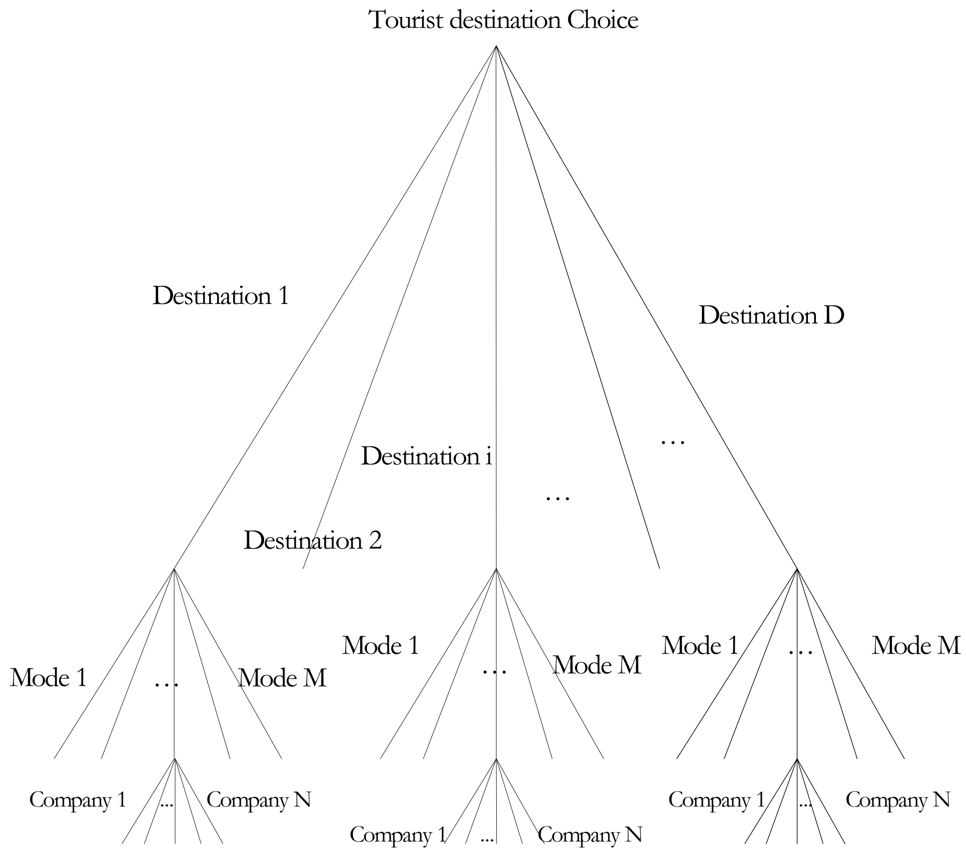

Figure 1. Decision-tree of a Tourist destination choice

From the above theoretical model, tourist will have a set of destination choices as (Destination *d*, Mode *m*, Company *n*).

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[5] This assumption is necessary in order to simplify analysis and to get the likelihood expressions. One of the advantages of this distribution is that it approximates to a Normal distribution (Hunt, 2000) and can be calculated without using numerical integration or simulation methods (Koppelman and Bhat, 2006).

Combinations Set = [(Destination 1, Mode 1, Company 1), … , (Destination 1, Mode 1, Company N), …, (Destination 1, Mode M, Company 1), … , (Destination D, Mode 1, Company 1), … , (Destination D, Mode M, Company N), (Home)]

The model will be solved by calculating the Expected Maximum Utility[6] (EMU or logsum) of each nest, i.e., there is a utility associated to Mode 1 in Destination 1 composed by

$$EMU^1_{1,N} = \ln\left(e^{V^1_{1,1}} + e^{V^1_{1,2}} + \ldots + e^{V^1_{1,N}}\right), \tag{17}$$

$$V^1_{1,N} = \phi \cdot EMU^1_{1,N} + \theta \cdot W. \tag{18}$$

where *W* denotes a set of users common characteristics between modes.[7] Regarding to ϕ [8] and *θ*, represent mode and common characteristics weights on mode 1 total utility, respectively.

Then, the likelihood of choosing destination d* is:

$$Prob(d^*) = \frac{e^{V^{d^*}_{M,N}}}{e^{V^1_{M,N}} + e^{V^2_{M,N}} + e^{V^3_{M,N}} + e^{V^4_{M,N}} + \ldots + e^{V^{d^*}_{M,N}} + \ldots + e^{V^{D-1}_{M,N}} + e^{V^{D}_{M,N}} + 1}, \tag{19}$$

Where the denominator is the utility provided by all destinations, including staying at home ($e^{V^0} = e^0 = 1$), and numerator is composed of the destination considered utility.

4. How transport competition affects tourist destination choice

According to the previous theoretical model, it is possible to test how transport competition affects the choice of a tourist destination. The aim of this idea is to reach a conclusion about what competition effects are and what type of competition needs to be promoted in terms of increase the likelihood of being chosen that a destination has.

[6] It represents the maximum utility that it is expected from the nest considered (Ortúzar, 2000)

[7] These common characteristics represent tourist features that remain constant for each mode. They (traditionally considered in nested models) are not deeply analyzed is this model, assuming a representative tourist.

[8] If ϕ =0, model will turn into a multinomial logit, because it means that alternatives are not correlated. There is correlation, and therefore it is a nested logit model, when 0< ϕ <1. This would mean that there is independence of irrelevant alternatives. There is a deeply detailed explanation in McFadden (1973; 1974; 1978; 1981)

Therefore, the objective is to test and compare the effects of intra and intermodal competition.

4.1. Introducing intramodal competition

From the previous model, let us assume that a new company is established in mode 1 (intramodal competition), in destination 1. For example, a new airline in a route considered, i.e.:

Combination Set = [d, m, c] = [(Destination 1, Mode 1, Company 1), … , (Destination 1, Mode 1, Company N), (Destination 1, Mode 1, Company N+1), …, (Destination 1, Mode M, Company 1), … , (Destination D, Mode 1, Company 1), … , (Destination D, Mode M, Company N), (Home)]

With this, combination set is increased by one more possibility (Destination 1, Mode 1, *Company N+1*). So the EMU and indirect utility of this mode is:

$$EMU^{1}_{1,N+1} = \ln\left(e^{V^{1}_{1,1}} + e^{V^{1}_{1,2}} + \ldots + e^{V^{1}_{1,N}} + e^{V^{1}_{1,N+1}}\right) > \ln\left(e^{V^{1}_{1,1}} + e^{V^{1}_{1,2}} + \ldots + e^{V^{1}_{1,N}}\right) = EMU^{1}_{1,N}, \quad (20)$$

$$V^{1}_{1,N+1} = \phi \cdot EMU^{1}_{1,N+1} + \theta \cdot W > \phi \cdot EMU^{1}_{1,N} + \theta \cdot W = V^{1}_{1,N}. \quad (21)$$

If *company* N+1 generates utility to tourists, i.e.,

$$V^{1}_{1,N+1} = B^{1}_{1,N+1} - C^{1}_{1,N+1} > 0. \quad (22)$$

then utility with the new company is greater than without it, assuming that ϕ is positive (it represents the effect of difference between benefits and costs on tourist utility). Even if costs were greater than benefits, the effect on total utility will be zero, because of model mathematical specifications. This represent another result: introducing competition in a destination never yields worst results in term of likelihood of being chosen by tourists, even if this mode is not really competitive. Assuming this difference as positive,

Proposition 1: Introducing a new company in a mode increases its likelihood of being chosen by a tourist as destination, *ceteris paribus*.

Proof:

$$\begin{aligned} EMU^{1}_{M,N+1} &= \ln\left(e^{V^{1}_{1,N+1}} + e^{V^{1}_{2,N}} + \ldots + e^{V^{1}_{M,N}}\right) > \\ &> \ln\left(e^{V^{1}_{1,N}} + e^{V^{1}_{2,N}} + \ldots + e^{V^{1}_{M,N}}\right) = EMU^{1}_{M,N}, \end{aligned} \quad (23)$$

$$V^1_{M,N+1} = \phi \cdot EMU^1_{M,N+1} + \alpha \cdot Z > \phi \cdot EMU^1_{M,N} + \alpha \cdot Z = V^1_{M,N}. \quad (24)$$

where Z represents a vector of common tourist features between destinations (i.e., age, nationality, gender, socioeconomic aspects, etc.).

It is demonstrated that destination 1 utility is increased by adding a new company in one of its modes. Furthermore, it is straightforward to show how the likelihood of being chosen increases in the case of Destination 1, i.e.:

$$V^1_{M,N+1} > V^1_{M,N}, \quad (25)$$

$$Prob^1_{M,N+1} = \frac{e^{V^1_{M,N+1}}}{e^{V^1_{M,N+1}} + e^{V^2_{M,N}} + \ldots + e^{V^D_{M,N}} + 1}, \quad (26)$$

$$\frac{\delta Prob^1_{M,N+1}}{\delta e^{V^1_{M,N+1}}} = \frac{e^{V^2_{M,N}} + \ldots + e^{V^D_{M,N}} + 1}{\left(e^{V^1_{M,N+1}} + e^{V^2_{M,N}} + \ldots + e^{V^D_{M,N}} + 1\right)^2} > 0. \quad (27)$$

It has been shown that introducing a new company in a mode increases its likelihood of being chosen by a tourist as destination. This result drives to encourage intramodal competition in order to increase the competitiveness of a tourist destination.

4.2. Introducing intermodal competition

Let us now assume that a new mode (*M+1*) is developed in destination 1. Suppose that an airport is built in destination 1, increasing the transport structure in a new mode (plane). In this case, combinations set will be increased in a number depending on airlines that compete within it:

Combinations Set = [(Destination 1, Mode 1, Company 1), … , (Destination 1, Mode 1, Company N) ,…, (Destination 1, Mode M, Company 1), … , (Destination 1, Mode M+1, Company 1),…, (Destination 1, Mode M+1, Company N),…,(Destination D, Mode 1, Company 1), … , (Destination D, Mode M, Company N), (Home)]

$$EMU^1_{M+1,N} = \ln\left(e^{V^1_{1,1}} + e^{V^1_{1,2}} + \ldots + e^{V^1_{1,N}}\right). \quad (28)$$

Again, if costs were greater than benefits for all companies in mode *M+1*, then the effect on total utility will be zero. This support previous result: introducing intermodal competition in a destination never yields to worst results in term of likelihood of being chosen by tourists, even if companies within this mode are not really competitive. Assuming this difference as positive (that will occur even if only one company offer benefits to tourist),

Proposition 2: Introducing a new mode in a destination increases its likelihood of being chosen for a tourist, *ceteris paribus*.

Proof:

$$EMU^1_{M+1,N} = \ln\left(e^{V^1_{1,N}} + e^{V^1_{2,N}} + ... + e^{V^1_{M,N}} + e^{V^1_{M+1,N}}\right) > \\ > \ln\left(e^{V^1_{1,N}} + e^{V^1_{2,N}} + ... + e^{V^1_{M,N}}\right) = EMU^1_{M,N}, \tag{29}$$

$$V^1_{M+1,N} = \phi \cdot EMU^1_{M+1,N} + \alpha \cdot Z > \phi \cdot EMU^1_{M,N} + \alpha \cdot Z = V^1_{M,N}. \tag{30}$$

which it is greater than without this new mode. With this,

$$V^1_{M+1,N} > V^1_{M,N}, \tag{31}$$

$$Prob^1_{M+1,N} = \frac{e^{V^1_{M+1,N}}}{e^{V^1_{M+1,N}} + e^{V^2_{M,N}} + ... + e^{V^D_{M,N}} + 1}, \tag{32}$$

$$\frac{\delta Prob^1_{M+1,N}}{\delta e^{V^1_{M+1,N}}} = \frac{e^{V^2_{M,N}} + ... + e^{V^D_{M,N}} + 1}{\left(e^{V^1_{M+1,N}} + e^{V^2_{M,N}} + ... + e^{V^D_{M,N}} + 1\right)^2} > 0. \tag{33}$$

It has been demonstrated that introducing a new mode in a destination increases its likelihood of being chosen for a tourist. This result also encourages intermodal competition in order to increase the competitiveness of a tourist destination.

5. A theoretical comparison between intra and intermodal competition

It has been demonstrated that both types of competition improve the competitiveness of a tourist destination. Now, the aim is to compare both effects, to determine what competition mode is better in terms of tourism. In previous sections, it has been shown that the likelihood of being chosen as a destination increases when its utility does. Therefore, the objective is to know what type of competition increases utility further.

Let suppose a hypothetical scenario with D destinations that have the same characteristics between them in terms of number of intra and intermodal competitors: three modes and two companies per mode. According to this scenario, situation is represented in figure 2.

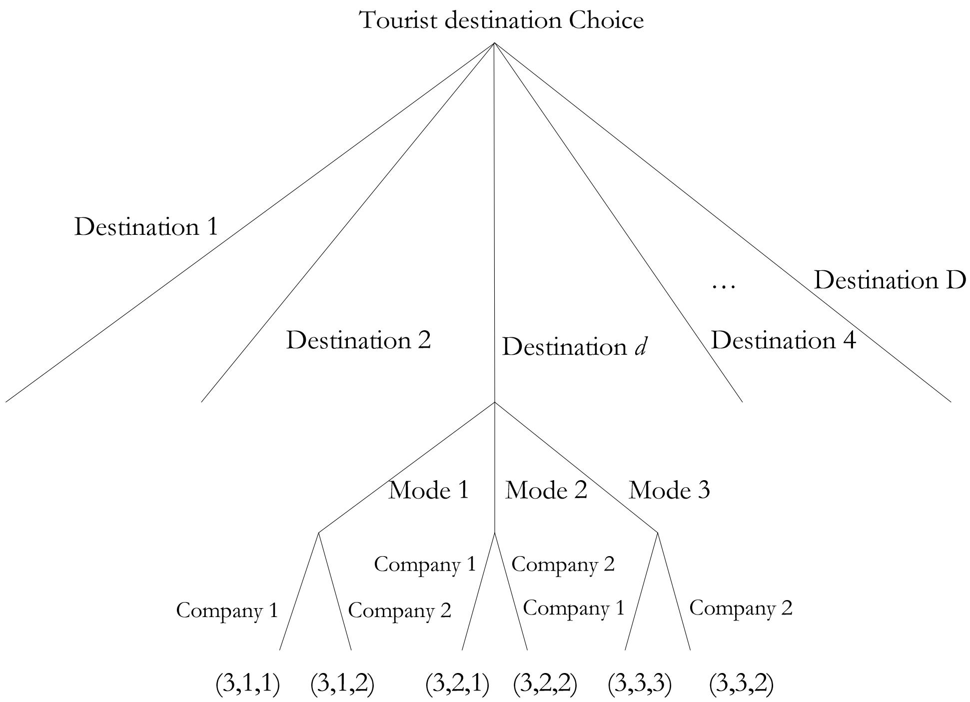

Figure 2. Decision-tree of a Tourist destination choice. A specific scenario.

and logit function specifications

$$EMU_{m,N}^{d} = \ln\left(e^{V_{m,1}^{d}} + e^{V_{m,2}^{d}}\right);\ m = 1,2,3, \tag{34}$$

$$V_{m,N}^{d} = \phi_2 \cdot EMU_{m,N}^{d} + \theta \cdot W;\ m = 1,2,3, \tag{35}$$

$$EMU_{M,N}^{d} = \ln\left(e^{V_{1,N}^{d}} + e^{V_{2,N}^{d}} + e^{V_{3,N}^{d}}\right);\ d = 1,...,D, \tag{36}$$

$$V_{M,N}^{d} = \phi_1 \cdot EMU_{M,N}^{d} + \alpha \cdot Z;\ d = 1,...,D. \tag{37}$$

In order to simplify cost functions and nested logit specifications, some assumptions are taken. Variables as access costs, quality of modes, time of journey and also discretional and accommodation costs are considered as equal between modes. Including these variables would imply that specific values of them would be necessary to test which type of competition is better to increase the likelihood of being chosen as tourist destination.

Furthermore, let suppose that companies compete in price within a mode, which is called *competition à la Bertrand*. Its result is that price matches marginal costs, the same for all companies. Due to the only variable which may affect to companies is price, then companies within a mode will report the same utility to tourists, i.e.,

$$V_{m,1}^{d} = V_{m,2}^{d} = ... = V_{m,N}^{d}. \tag{38}$$

Therefore, the expression of total utility reported by a destination is solved, according to the theoretical model,

$$EMU_{m,2}^{d} = \ln\left(2 \cdot e^{V_{m,1}^{d}}\right), \tag{39}$$

$$V_{1,2}^{d} = \phi_2 \cdot \ln\left(2 \cdot e^{V_{1,1}^{d}}\right) + \theta \cdot W = V_{2,2}^{d} = V_{3,2}^{d}, \tag{40}$$

and

$$EMU_{3,2}^{d} = \ln\left(3 \cdot e^{\phi_2 \cdot \ln\left(2 \cdot e^{V_{1,1}^{d}}\right) + \theta \cdot W}\right); d = 1, ..., D, \tag{41}$$

$$V_{3,2}^{d} = \phi_1 \cdot \ln\left(3 \cdot e^{\phi_2 \cdot \ln\left(2 \cdot e^{V_{1,1}^{d}}\right) + \theta \cdot W}\right) + \alpha \cdot Z. \tag{42}$$

In general,

$$V_{M,N}^{d} = \phi_1 \cdot \ln\left(M \cdot e^{\phi_2 \cdot \ln\left(N \cdot e^{V_{1,1}^{d}}\right) + \theta \cdot W}\right) + \alpha \cdot Z. \tag{43}$$

From the equation (43), another interesting result can be obtained: transport monopolies are bad for tourism. By analyzing the expression, it is observed how a greater number of inter and intramodal competitors increase the destination utility and, therefore, its likelihood of being chosen by tourists. From this result, a transport structure composed by one mode (and one company in it) in a destination, i.e., a monopoly would provide the smallest utility, *ceteris paribus*.

At the same time, through previous function, it is possible to determine what type of competition is better in terms of tourism, knowing that the type that increases utility further will also increases further the likelihood of a destination to be chosen by tourists. With this purpose, we compare the introduction of a new company in each mode with the introduction of a new mode (with the same characteristics as the others) in a destination. Therefore,

$$V^{i}_{3,2+1} = \phi_1 \cdot \ln\left(3 \cdot e^{\phi_2 \cdot \ln\left(3 \cdot e^{V^{i}_{1,1}}\right) + \theta \cdot W} \right) + \alpha \cdot Z, \quad (44)$$

$$V^{i}_{3+1,2} = \phi_1 \cdot \ln\left(4 \cdot e^{\phi_2 \cdot \ln\left(2 \cdot e^{V^{i}_{1,1}}\right) + \theta \cdot W} \right) + \alpha \cdot Z, \quad (45)$$

$$V^{i}_{3+1,2} > V^{i}_{3,2+1}. \quad (46)$$

Although this result is conditioned by the assumptions (specially by the one that consider the same number of competitors within a mode), it shows how intermodal transport competition increases the likelihood of being chosen as destination by tourists further than intramodal transport competition does, considering the same characteristics.

6. Conclusions

This paper provides a theoretical analysis of how competition in transport markets affects tourism decisions, and its results allow us to derive several recommendations in terms of tourism and transport policy, encouraging intermodal and intramodal transport competition in order to increase the attractiveness of a particular destination.

Through a decision-tree representation, based on a 3-stages nested logit specification, it has been shown that competition in transport markets determines tourism destination choice: *Ceteris paribus*, introducing a new mode (company) in a given destination (mode) increases its likelihood of being chosen by a rational tourist as his(her) destination. Both hypothetical situations are perfectly possible. As an example, we can consider the case of the entry of a new airline on an existing route, competing with the existing incumbent companies (the entrance of the company *Ryanair* in Gran Canaria – Frankfurt route); or the case where the High Speed Rail (HSR) comes to compete with (conventional) train, plane, coach and private car in a route which links a source market with a touristic destination in the same country (for example, the Madrid – Barcelona route in Spain). From these results, it could be interesting to develop an accessibility index of each tourist destination, composed by number of modes and companies in each mode, in order to test empirically the evidences shown in the previous modelization.

Furthermore, another interesting result derived from the model is that introducing competition in a destination (mode) never yields a worst result in term of the likelihood of being chosen by tourists, even if this mode (company) is not really competitive. This result is directly obtained from the mathematical specification of the model, and can be applied to any particular study that uses it.

We have also studied a hypothetical scenario with several simplifying assumptions concerning the cost functions. In this case we have proved that introducing intermodal transport competition increases the likelihood of being chosen as tourist destination further than introducing intramodal competition. The economic intuition is simple: through intermodal competition, there are different combinations of variables that can be appreciated for tourists more than the introduction of a new company which would offer similar characteristics than others companies in the same mode. In the same line, accessibility must be considered as a source of improvement introduced by intermodal transport competition. Variables such as access costs, quality, speed or waiting times and stops vary among modes more than among companies in a same mode, and a more extended intermodal net let offer different combination of these variables and, therefore, may attract to tourist with different preferences regarding transport.

Finally, it is shown that a transport structure composed by one mode (and one company in it) in a destination, i.e., a transport monopoly, would provide the smallest utility, *ceteris paribus*. In other words, (transport) monopolies are bad news for tourism.

To summarize, this paper encourages intermodal and intramodal transport competition in a tourist destination context and suggests tourism authorities to stimulate transport competition in order to increase the attractiveness of their destinations.

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