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Abstract

It is commonly recognized the relevance of transportation costs for studying recreational demand. However, these costs are related with travel and modal choice decisions. This paper offers a theoretical explanation of the new generation of the demand for recreational goods at destiny after the introduction of a new transportation mode that is not the cheapest nor the fastest among the available modes. The main feature of the model deals with the transportation mode-dependent preferences. This set-up allow us to understand some unexplained individual behaviour found in the travel cost method.

Keywords: Budget Set, Temporal Constraint, Transportation Demand, Travel Decision, Modal Choice, Demand Generation, Recreational Demand, Travel Cost Method.

JEL: D11, R41, Q26

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1 Introduction

Undertake leisure activities usually involve transportation decisions. Outdoor recreation or to attend an international opera festival are consumed at a specific site, and show up distinctive quality features and observable travel and entry costs. The consumption of these leisure services depends on the individual's income and time resources, the subjective preferences on commodities, as well as the available transportation modes and the individual's preferences on them. This means that the improvements on a transportation infrastructure will expand leisure opportunities increasing the demand for recreational goods due to a decrease on the costs attached. In fact, the relevance of traveling to a site to consume a recreational good, and the costs involved, has become the travel-cost method into a widely used approach to estimate the demand for a given site. However, a puzzle remains unexplained, as reported in some well-known examples: the new generation of the demand for recreational goods at destiny after the introduction of a new transportation mode that is not the cheapest nor the fastest among the available modes. This paper offers an answer.

We study a simple framework of goods at two spatially separated locations. The consumption of goods at each place requires spending some income and time. Additionally, the leisure activities are developed at the distant place, which require a (round) trip in order to consume a number of units. The analysis is undertaken within a framework in which complementarities are recognized for two dimensions: first, between each commodity and the time spent on its consumption, so that goods may be measured in units of time; and second, between the time spent traveling and the time spent consuming the leisure good at destiny. The budge set is then defined, where both time and income are taken into account to define feasible allocations. In consequence, some allocations are precluded since an agent may not be able to consume them, even though they can be purchased. We may also come across standard microeconomics course result in which a consumer is not able to buy more of some good, despite having plenty of time to consume or enjoy it.

The preferences are defined for the consumption set on local and distant leisure goods, as well as on transportation mode features. Assuming rational preferences (complete and consistent) and monotonicity (convexity could also be considered), we define the set of indifferent baskets. We state a crucial assumption on the preferences: the set of indifferent baskets of final goods, local and distant, will be independent from the preferences on the transportation modes. Thus, we define a utility function that represents these preferences as a mode-dependent function by using a repackaging method for the indifference curves (concerning the literature on quality variety, see Lancaster, 1966, Fisher and Shell, 1971, and Deaton and Muellbauer, 1980, Cap.10). That is, there exists a monotone transformation for each different transportation mode, *but* the same indifferent baskets on final goods are maintained. Although it might be thought of this as a kind of cardinal utility, these mode-dependent preferences allow us to model the subjective intrinsic features of each transportation mode.

A comment on the subjective valuation of travel time, and its opportunity cost, is in order. The literature on transportation economics usually consider transportation as a good whose consumption decrease the agent's welfare (see Jara-Díaz, 1998a and b). Alternatively, the recreational demand analysis sometimes consider that the travel time to some distance place enhance welfare (see, Sellar, Stoll and Chavas, 1985). We will embrace an eclectic position by adopting the standard assumption in the travel cost method: individuals consider that each second of the travel time to some recreational place provides the same welfare reported by each second at the recreational area.

The research program to estimate recreational benefits via the travel cost method (Hotelling, 1949, Clawson, 1959, or Bockstael, McConnell and Strand, 1991, Haab and McConnell, 2002) has established an empirically robust result: site visitation and recreation participation rates decrease as the distance to be traveled increases. Assuming that traveling is costly and the cost increases with distance, then it follows that the visitation rate diminishes as the cost of visitation increases. Although some authors consider that the assumption is so obvious plausible that the conclusion seems hard to challenge (Randall, 1994), two issues remains unsolved. First, the reason why two individuals, who live at the same distance of a site, differ their visiting rates despite having the same income and the same subjective preferences on goods, including recreational good. This literature seems to assume that, in order to consume a recreational good, there exists a simultaneous modal decision, where it is determined implicitly each individual travel cost. In consequence, recreation participation rates decrease as the travel costs, instead of distance to be traveled, increases; whenever several transportation modes are available, it remains an open question why similar individuals make different modal choice. The second issue deals with a given individual living at some distance, who had not been previously demanded for the recreational good, turns on a positive demand after the introduction of a new transportation mode that is not the cheapest nor the fastest. In order to provide an answer to these puzzles, we consider necessary to introduce modal decisions into the microeconomics home production formalization considered for the travel cost methods (see McConnell, 1985); that is, we will focus on travel decisions and then obtain the demand of goods with trip required.

The literature on transportation economics has taken two approaches when addressing why to travel, how many trips and in which mode. One strand analyzes the decision to travel and time allocating to different activities. Becker (1965) introduces the temporal dimension into the neoclassical model, but he does not deal with intermediate goods, such as transportation. DeSerpa (1971) and Evans (1972) present a general microeconomics theory of the economics of time suitable to study the consumption of the transportation good. We will follow Evans' approach, which "generates a more general and meaningful theoretical framework" (Jara-Díaz, 1998a, p.62), because it incorporates the complementarity among transportation and the final goods. The other strand of the literature treats modal choice independently from the reason for traveling. Initially, Beesly (1965), Johnson (1966), and Oort (1969) developed deterministic modal choice models, although none is able to explain why individuals with similar characteristics have different behavior concerning modal decision. Later, McFadden (1973) overcome this problem with a random model for analyzing modal choice. This strand, however, does not deal with travel decision or with the number of trips made: taking that a given trip is made, it focuses on how an agent chooses among different alternatives. Few papers do establish a link between both approaches,[1] although none takes into account the intrinsic subjective features of the transportation modes and the travel/no travel decision.

The main contribution of the paper is to present a simple model to understand leisure demand generation following the changes in features of existing modes or the introduction of a new mode. In order to achieve this goal, first we present a framework that allows us to explain, all at one, the optimal decision of traveling, the optimal number of trips, the optimal modal choice and the demand for leisure goods with trip required: we are linking the theoretical foundation of the literature of recreational goods demand with the literature of transportation economics. The main result lies crucially on the subjective individual preferences on modal features; in contrast with previous literature, this preferences affect on the travel/no-travel decision as well as on the decision of consumption of the final good. As an additional result, the no-travel choice features can be identified (e.g., individual preferences, modes features, etc.): the subsequent repackaging of the indifference map makes optimal for an individual to travel using the new mode while he did not travel before. To the best of our knowledge, the theoretical explanation of this demand generation following the introduction of a new mode is novel in the modal choice literature.[2] This issue can be crucial to policymakers because an improvement in the public infrastructure may provoke an increased demand on recreational goods so that, if not considered, the social return of a

[1]See Truong and Hensher (1985) or Jara-Díaz (1998a and b) for some exceptions. A similar problem was addressed by Hausman, Leonard and McFadden (1995) in environmental valuation for the number of visits to a particular natural resort and the location decision for these visits.

[2]For example, if the new mode is not the fastest or the cheapest, the choice of travelling of an individual who did not travel before, appears to be inconsistent with Johnson (1966) and Oort's (1969) results.

public project cannot be properly gauged.[3] In consequence, transportation policy must be taken into account like a strategic tool within tourist or regional development programs.

This set-up allows us to draw comparative statics as well, also undertake within the travel cost method. We may, for example, to understand travel choice in the case of increasing the commodity prices at destiny. An appreciation of the dollar, for instance, would mean that US prices would be relatively higher for Europeans, consumption of leisure goods (e.g., tourism activities) would be reduced due to US goods are normal and the number of transatlantic trips Europeans make, then, would also be reduced.

The paper is developed as follows. Section 2 comprises the theoretical contribution of the paper. A microeconomics founded model is presented and the issues of why to travel, the number of trips, the modal decisions and, then, the consumption of recreational good at destiny are resolved. Section 3 discusses the results and explains the recreational demand generation after the introduction of a new mode. Section 4 presents the microeconomic foundation of the travel cost method as a particular case of the model presented in section 2. Some conclusions and extensions are presented in Section 5.

2 A model of consumer recreation and modal choice.

The framework consists of a consumer, endowed with an exogenous monetary income $\bar{M}$ and $\bar{T}$ fixed units of time, that lives at some location, who may consume goods at two spatially-separated locations $d/2$ kilometers far. There exists three commodities: a local good c_1, a distant good, c_2, and a good c_{0s} that may be consumed in either of the two locations $s = 1, 2$. This good c_0 is introduced only for technical reasons and to fulfill the consumer restrictions, and plays no role in the economy due to, as will be assumed below, it does not enhance any welfare to individuals.[4] The monetary price per unit of each good is $\bar{p}_0$, $\bar{p}_1$ and $\bar{p}_2$, respectively.[5]

We will consider that the number of units consumed of each good c_k is the outcome of a subjective individual Leontiev technology $f(n_k, \bar{q}_k)$ on the total number of units of time devoted to consuming each good, n_k, as well as the intrinsic qualities of the good,[6] $\bar{q}_k$, for $k = 0, 1, 2$. Given that the consumer will not be able to choose among local and distant goods of the same type with different qualities nor the level of quality of the good, we will

[3] This new demand may take on huge volumes, as is the case with the Spanish high-velocity train AVE, for which 40% of the trips are new, greatly expanding the recreational demand (e.g., tourism in Seville).

[4] In fact, since the good 0 may be consumed at either $s = 1$ or 2, we can determine that $c_0 = c_{01} + c_{02}$.

[5] For example, $\bar{p}_2$ is considered as the "admission fee per day of visit" in the environmental literature.

[6] For example, q_2 is often considered as the "environmental quality at the site" in the environmental literature.

assume that the quality of each good is always in excess. That is, if we additionally assume that the consumption of any unit of good k requires the same units of time, denoted by $\bar{\tau}_k$, the Leontiev coefficients are considered to be constant $1/\bar{\tau}_k$, that is $c_k = n_k/\bar{\tau}_k$, for $k = 0$, 1, 2.

In order to consume the distant goods a trip is required. Suppose that there exists J transportation modes, i.e. $\mathcal{J} = \{1, .., j, ..., J\}$ and, for notational purposes, we will denote the no-travel option as $j = 0$. A transportation mode j is defined as a pair $\{\bar{t}_j, \bar{\phi}_j\}$ for $j \in \mathcal{J}$, where $\bar{t}_j$ are the units of time spent traveling, and $\bar{\phi}_j$ is the per-kilometer of travel for each of the x_j round trips made at mode j by the consumer.

We will also consider that there is a constant number of units of the good consumed at location $s = 2$ on each of the trips, which is independent of the mode j used. That is, for each of the trips x_j the consumer will consume (for example, on average) a constant number α of units of the leisure good 2, or spend α days in the recreational site. Then, the *time consumption constraint*[7] is[8] $c_2 = \alpha x_j$ for each mode $j \in \mathcal{J}$. This assumption will show to be useful in the next section for two reasons. First, it will allow to define the average per-kilometer cost per unit of consumed commodity at location $s = 2$: $\bar{f}_j = \frac{\bar{\phi}_j}{\alpha}$, which, in fact, will result as an increase in the price of the recreational good 2. Second, this is equivalent to set the number of trips at the utility function, as is usual in the travel cost method literature.

2.1 The consumer budget set and the consumption set.

The set of feasible allocations for a consumer who lives at the particular location $s = 1$ is restricted to all baskets that can simultaneously be bought, including the trip costs, i.e., the monetary budget constraint, and be spent, including travel time, i.e., the temporal constraint. The restrictions here presented are similar to those found in the travel cost literature.

The monetary budget set. We first present the set of all allocations that the consumer can buy, given her exogenous monetary income $\bar{M}$. There exists $J + 1$ possible budget constraints, one for each of the transportation choices $j \in \mathcal{J}$ and for the no travel decision $j = 0$. The budget set for each $j \in \mathcal{J} \bigcup \{0\}$ is given by 4-upla (c_0, c_1, c_2, x_j) such that

$$\bar{p}_0 c_0 + \bar{p}_1 c_1 + \bar{p}_2 c_2 + \bar{\phi}_j d x_j \quad \leq \quad \bar{M},$$

[7] We make use of the terminology used in DeSerpa (1972). Although we understand that some goods can be consumed at the same time in the same location, for the explanatory purposes of this work, we will assume that this constraint is always binding.

[8] Since the good 0 can be consumed at either of the two locations $s = 1$ or 2, there would be also a *time consumption constraint* for the good c_{02}: $c_{02} = \alpha_0 x_j$.

given $\bar{\phi}_j$. Commodities are labeled as "units of the good." We claim, however, that time is important for an allocation to be feasible. Therefore, we will measure goods into temporal units, i.e., in the "units of time required to consume each unit of good". Consequently, after substituting the Leontiev technology in units of time, the time consumption constraint, and the average per-kilometer cost per unit of consumed commodity at location $s = 2$ defined above, the budget set for each $j \in \mathcal{J} \bigcup \{0\}$ in units of time is given by 3-upla (n_0, n_1, n_2) such that[9]

$$\frac{\bar{p}_0}{\bar{\tau}_0} n_0 + \frac{\bar{p}_1}{\bar{\tau}_1} n_1 + \frac{\bar{p}_2 + \bar{f}_j d}{\bar{\tau}_2} n_2 \quad \leq \quad \bar{M} \tag{1}$$

given $\bar{f}_j$.

The temporal set. The total time devoted to consuming each commodity and to traveling by each mode j must be equal to the total endowment of time, $\bar{T}$. Again, there exists $J+1$ possible temporal constraints. After substituting the Leontiev technology in units of time and the time consumption constraint for the recreational good 2, i.e., $c_2 = \alpha x_j$ and $n_2 = c_2 \bar{\tau}_2$, the temporal set is given by 3-upla (n_0, n_1, n_2) such that

$$n_0 + n_1 + n_2 \left[1 + \frac{\bar{t}_j}{\alpha \bar{\tau}_2} \right] \quad \leq \quad \bar{T}, \tag{2}$$

given $\bar{t}_j$. Observe that the higher the ratio travel time per trip by mode j to location 2 and the time spent to consume the goods at location 2 each trip, i.e., $\frac{\bar{t}_j}{\alpha \bar{\tau}_2}$, the more expensive the leisure good 2 is in temporal terms.

The budget set. The feasible constrained set includes all feasible baskets that can be bought and exist enough time to enjoy for each of the existing mode chosen $j \in \mathcal{J}$ and the non travel feasible set. That is, the budget set is the correspondence

$$\beta(\overrightarrow{p}, \bar{M}, \bar{T}) \quad = \quad \bigcup_{j \in \mathcal{J} \bigcup \{0\}} \left\{ (n_0, n_1, n_2) : \text{ such that (1) and (2) are fulfilled, given } \bar{f}_j \text{ and } \bar{t}_j \right\}$$

where $\overrightarrow{p} = (\bar{p}_0, \bar{p}_1, \bar{p}_2)$. Figure 1 represents the four possible shapes of the budget set for some transportation mode $j \in \mathcal{J}$. Cases b) and d) represent atypical situations where

[9] Observe that $\bar{M}$ could also be considered the product of the total units of time devoted to work, t_w, by the nominal wage per unit of time, w: $\bar{M} = w t_w$. The time endowment $\bar{T}$ would be endogenous, and it should then be replaced by $\bar{\bar{T}} - t_w$ in order to include labor time, where $\bar{\bar{T}}$ is exogenous. This means that the consumer is able to choose the number of hours to work. The same would be found if we interpreted the residual good n_0 as labor, with $\bar{p}_0 = -\bar{w} < 0$. However, for simplicity we will treat this income as exogenous. This could be thought as the consumer is not able to expand her working time, so the labor schedule is fixed, like in Johnson (1966) and Oort (1969) and Bockstael, Strand and Hanemann (1987).

consumption of local goods is limited by the temporal restriction. Case d) displays an extremely high income agent that cannot be spent due to lack of time. A consumer in case b) would be in a paradoxical situation, having less time to consume the local goods and plenty of time to consume the goods at a spatially-separated location. Agents are usually faced with cases a) and c). The traditional neoclassical microeconomics picture is represented by case c), where agents' decisions are not bound by any temporal constraint, and the consumer has only to decide the best way to allocate monetary resources. In fact, this is the budget set facing the unemployed and retirees with plenty of disposable time. Case a) represents the most common situation in transportation economics. Here, the consumer has monetarily and temporally limited consumption of the distant goods because of the traits of the existing mode: travel time, t_j, and transportation cost (fare), f_j.

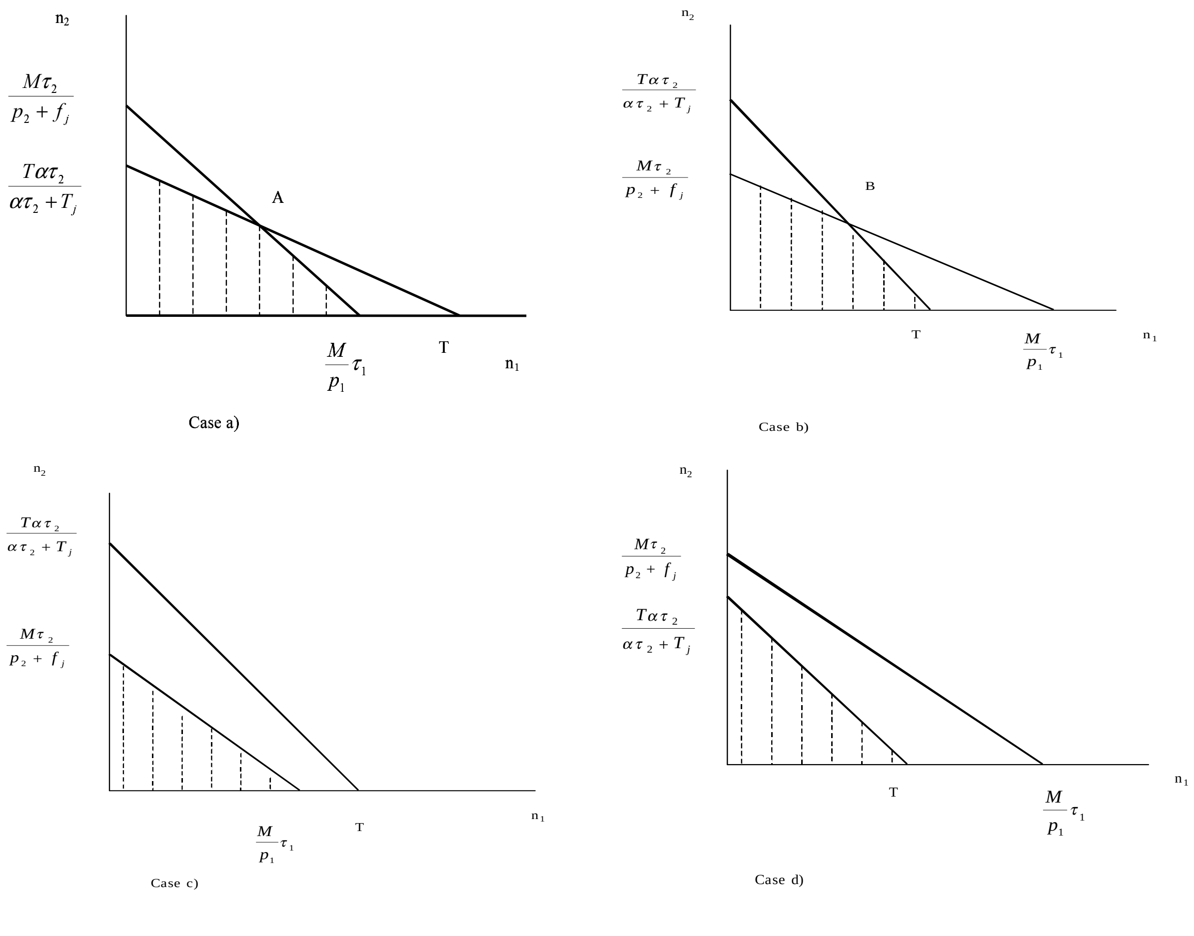

Figure 1: Budget Sets

The consumption set Finally, given the above notation, we define the consumption set as the compact close set $X \equiv \bigcup_{j \in \mathcal{J} \bigcup \{0\}} X_j$, where

$$X_j \equiv \left\{ (n_0, n_1, n_2) : \text{ such that } n_0 \in [0, \bar{T}],\ n_1 \in [0, \bar{T}] \text{ and } n_2 \in [0, \bar{T}\alpha\bar{\tau}_2 / \left(\alpha\bar{\tau}_2 + \bar{t}_j\right)] \ \right\}$$

with $\bar{t}_0 = 0$ for the no travel case, X_0.

2.2 Preferences

The consumer enhance welfare by consuming goods 1 and 2, so that a binary relation may be defined for the goods baskets in the consumption set, Agents do not derive any welfare from the consumption of good 0, which plays a residual role in this model. A straightforward reinterpretation can be made for time spent on the consumption of such goods, n_1 and n_2. Additionally, if the recreational good 2 is consumed a trip must be taken, so the characteristics of transportation mode j also affect the consumer's welfare (e.g., comfort, security, etc.). We may define for any consumer h a binary relation $\tilde{\succeq}^h$ on the consumption set X^h, jointly with the features of the J modes in the case of traveling, i.e., $\{\theta_j\}$. We are going to undertake a detailed study of preferences by distinguishing the travel/no-travel and the modal decisions. Note that the consideration of the features of transportation modes is the key difference of the travel cost method set-up and ours.

As denoted above, the consumption of a positive quantity of the recreational good 2 requires necessarily to take a transportation mode. Hence, a binary relation $\succeq^h$ is defined on the travel extended consumption set $\bigcup_{j=1}^{J} \left(X_j^h \times \theta_j \right)$. In fact, we can first define for consumer h a mode-dependent binary relation $\succeq_j^h$ on the mode-j consumption subset X_j^h and each of the features of the J transportation modes; then, we can show a set of modal qualified binary relations $\{\succeq_j^h\}_{j \in \mathcal{J}}$ where the modal features of each mode j are considered. That is, on one hand, we find that modal choice affects the consumption of leisure goods due to the monetary and temporal resources spent; on the other hand, each individual's subjective valuation of the features of the existing mode of transportation affects her welfare, as well. The present study of transportation has a particular feature: in order to consume the recreational good 2, transportation at some mode $j \in \mathcal{J}$ is required. The welfare derived from traveling by this mode must be understood in terms of preferences; however, we will assume that the indifferent baskets of leisure goods are independent from the transportation mode chosen to consume the good-with-trip-required. Formally, this condition is expressed by the following assumption:

> **Assumption:** Independence of individual preferences between final goods and intermediate modes. Let us take the basket set X_j^h and a set of modal qualified binary

relations $\{\succeq_j^h\}_{j\in\mathcal{J}}$ defined on this set for a given consumer h. If for any pair of baskets (n_1^a, n_2^a) and $\left(n_1^b, n_2^b\right) \in X_j$, it is verified that $(n_1^a, n_2^a) \succeq_j^h \left(n_1^b, n_2^b\right)$ for some mode-dependent binary relations $\succeq_j^h$, then it holds for all binary relations $\{\succeq_j^h\}_{j\in\mathcal{J}}$.

Now, if we assume that the preferences $\succeq^h$ are rational and monotone (convexity could also be assumed), the indifferent basket sets can be identified along with a utility function that labels these indifferent basket sets (see Varian, 1992, Chap.3 and 4.) First, given these assumptions, we can define any indifference set as

$$I_{(n_1^a,n_2^a,j^a)} = \left\{(n_1, n_2, j) \mid (n_1, n_2, j) \succeq^h (n_1^a, n_2^a, j^a) \text{ and } (n_1^a, n_2^a, j^a) \succeq^h (n_1, n_2, j)\right\} \quad (3)$$

With the previous assumption in mind where preferences for final goods are not affected by the intermediate modal good taken to consume the recreational goods-with-trip-required, we can define indifferent baskets for commodities independently of the transportation mode used; that is, for all $j \in \mathcal{J}$

$$I_{(n_1^a,n_2^a)} = \left\{(n_1, n_2) \mid (n_1, n_2) \succeq_j^h (n_1^a, n_2^a) \text{ and } (n_1^a, n_2^a) \succeq_j^h (n_1, n_2)\right\} \quad (4)$$

Second, a real function $u^h(n_1, n_2, j)$ could be defined by labeling each of the indifference sets (3). Again, given the independence assumption, a real function may label each mode-dependent indifferent basket set (4). This real function represents the welfare derived from the consumption of goods, qualified by the particular (and subjective) characteristics of any mode j used:[10] $u_j^h(n_1, n_2) = u^h(n_1, n_2, \theta_j)$ for each $j \in \mathcal{J}$. Two consequences arises. Analytically, the previous assumption implies that the utility function u^h is the composition of two real functions: $u^h(n_1, n_2, j) = \psi_j^h \circ v^h(n_1, n_2)$, where $v^h(n_1, n_2)$ is a benchmark utility function for the consumption of the local good 1 and the recreational good 2, with $n_2 > 0$, regardless of the mode used; and ψ_j^h is a monotonic function that represents the agent h's subjective valuation of the mode j (e.g., comfort, service, security, etc.).[11] This function will include a number of subjective parameters for the mode j denoted by θ_j^h. In what follows, and avoiding any confusion, we will drop the consumer subscript h.

Analogous to (4), the final goods baskets belonging to the same indifferent curves can be

[10] This utility function is very close to the one formulated by Evans (1972), although we could make a reinterpretation with only one mode available.

[11] This function also could show the possibilities for undertaking simultaneous activities when travelling (e.g., reading, sightseeing, etc.). For the sake of simplicity, we have precluded any simultaneous activities in this work.

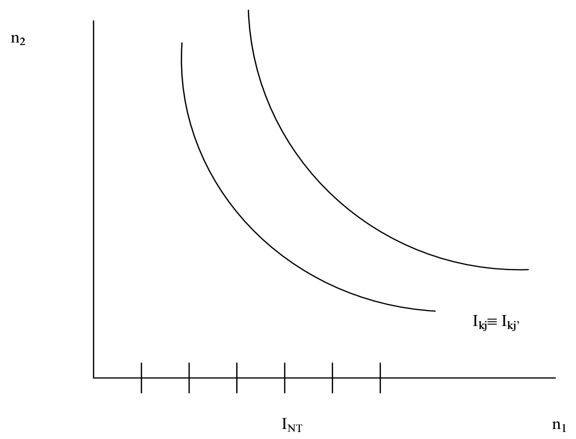

Figure 2: The indifferent baskets for different transportation modes, and the no travel indifference. (**change order** $I_{k'_{j'}} \equiv I_{k_j}$)

represented independently of the transportation mode $j \in \mathcal{J}$ used, i.e.,

$$I_k = \{(n_1, n_2) \mid v(n_1, n_2) = k \text{ and } n_2 > 0\}$$

To incorporate the (dis)utility derived for travelling at mode j, the indifference curve labels are changed to introduce a welfare dimension for the individual's subjective features of each transportation mode j. The independence assumption implies that indifferent baskets for goods are the same for any mode, although they are "repackaged" differently according to the transportation mode used (in the terminology used by Fisher and Shell, 1971, and Deaton and Muellbauer, 1980, Cap.10). That is, different modes are a monotone transformation of each other. For example, given any pair of modes j and j', there exists a label for each one, $\hat{k}_j$ and $\hat{k}'_{j'}$ such that the indifferent baskets are the same $I_{\hat{k}'_{j'}} \equiv I_{\hat{k}_j} \equiv I_{\hat{k}}$. (See Figure 2.) Consequently, it is possible for any basket that the welfare derived from the consumption of a given basket of final goods $(\bar{n}_1, \bar{n}_2)$ when travelling by mode j, e.g. by train, is greater than when the trip is made by mode j', e.g, by plane, i.e., $u_j(\bar{n}_1, \bar{n}_2) > u_{j'}(\bar{n}_1, \bar{n}_2)$. In fact, the independence assumption allows us to show by using a 2-dimensional picture, a 3-dimension space, in which the indifferent baskets are the same for all modes, but are "repackaged" differently depending the transportation mode used.

Furthermore, this is a suitable framework for understanding the travel/no travel choice. A binary relation $\succeq_0^h$ is defined on the no-travel restricted set $X_0 \times \theta_0$. The consumer chooses not to travel while simultaneously choosing not to consume the leisure good 2, i.e., $n_2 = 0$. In this no-travel case she derives a *reserve* utility, a kind of *inertia* when not traveling. Since only a welfare benefit can be measured for the local good 1, the utility function $u_0(n_1, 0)$ becomes an increasing function in the first argument. In this case the indifference curves (i.e., baskets over the X-axis in Figure 2) are independent from the rest of the indifference map. This utility has nothing to do with the asymptotic value of an indifference curve when approaching the intercept.[12]

It is noteworthy that the travel/no travel choice can be analyzed whether there exists at least one mode j for which the welfare derived from the positive consumption of some unit of the recreational good 2 is higher than the utility in the case where all time is devoted to the consumption of the local good 1. That is, $u_j(n_1, n_2) > u_0(\bar{T}, 0)$ for some feasible (n_1, n_2), with strictly positive n_2.

Finally, it must be said that we are dealing with a notion of "cardinal" utility, rather than ordinal utility. However, this aids in better understanding several issues, including the generated demand or why travelers are inclined to choose a slower and more expensive mode. The utility function described here also permits us to explain the subjective valuation of several attributes of the different transportation modes.

2.3 The consumer choice

Each consumer must take two optimal decisions: first the travel/no-travel decision and then, if she travels, her optimal modal choice. We will analyze the consumer's problem backwards: first, by studying the second step decision, in which the consumer has decided to travel and will then choose the optimal allocation of goods and mode;[13] subsequently, we examine the first step decision, where we will juxtapose the welfare derived from optimal allocation in the case of no trip, with the welfare derived from the allocation obtained in the second stage. In this way, we will determine the optimal choice and, if travel is involved, the modal decision and the number of trips. This strategy will simultaneously address why people travel, how many times and in what mode.

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[12] Consideration of the intercept for the utility functions, i.e. $u_j(n_1, 0)$ for any $j \in \mathcal{J}$, does not make sense. Suppose first some preferences $\widetilde{\succeq}_j$ that label baskets with $n_2 = 0$, for any mode $j \in \mathcal{J}$. Then, if transportation mode j is chosen there will be two indifferent baskets $n = (n_1, n_2)$ and $n' = (n_1, 0)$, such that $n \sim n'$, labeled k_j by the utility function u_j, i.e., n, $n' \in I_{k_j}$. Suppose that basket n' is labeled k'_0 by the utility function u_0, i.e., $n' \in I_{k'_0}$. In this case if basket n' is chosen, i.e., no travel, and $k_j > k'_0$ then the consumer would be better off choosing the following: travel at mode j and no consumption of the good $k = 2$, that is, no travel.

[13] We will assume that all trips are made by the same mode, whatever it may be.

2.3.1 Second step decision: modal choice and the number of trips

Throughout this section, we will work under the assumption that the consumer has made the decision to travel and, consequently, we will focus our attention on analyzing the number of trips and by what mode.

Given the mode-dependent preferences represented by a set of utility functions $\{u_j(n_1, n_2)\}_{j=1}^J$, the individual income $\bar{M}$, the price of the goods $\bar{p} = (\bar{p}_0, \bar{p}_1, \bar{p}_2)$, the time spent consuming each of the goods $\bar{\tau} = (\bar{\tau}_0, \bar{\tau}_1, \bar{\tau}_2)$, and the fare and travel time for the different J modes, $\{(f_j, t_j)\}_{j\in\mathcal{J}}$, we can define the modal choice problem for the consumer.[14] First, we present the consumer's problem for any transportation mode $j \in \mathcal{J}$, and find the mode-j dependent optimal allocation for each good.

$$(P_j)\left\{\begin{array}{lrcl} \max_{n_1,n_2} & u_j(n_1,n_2) & & \\ \quad s.t. & \frac{\bar{p}_0}{\bar{\tau}_0}n_0 + \frac{\bar{p}_1}{\bar{\tau}_1}n_1 + \frac{\bar{p}_2+f_jd}{\bar{\tau}_2}n_0 & \leq & \bar{M} \\ & n_0 + n_1 + n_2\left[1 + \frac{t_j}{\alpha\bar{\tau}_2}\right] & \leq & \bar{T} \\ & n_0, n_1, n_2 & \geq & 0 \\ \text{given} & (t_j, f_j) & & \end{array}\right.$$

Given that transportation mode j is taken, let us denote the multipliers of the budget restriction as λ_M^j, the temporal restriction as λ_T^j, and the non-negative Lagrangian multiplier as μ_k^j for $k = 0,\ 1,\ 2$ the Lagrangian function can be defined as

$$\mathcal{L}\left(n_0, n_1, n_2, \lambda_M^j, \lambda_T^j, \bar{t}_j, \bar{f}_j\right) = u_j(n_1, n_2) - \lambda_M^j\left\{\frac{\bar{p}_1}{\bar{\tau}_0}n_0 + \frac{\bar{p}_1}{\bar{\tau}_1}n_1 + \frac{\bar{p}_2 + \bar{f}_jd}{\bar{\tau}_2}n_2 - \bar{M}\right\} - $$
$$-\lambda_T^j\left\{n_0 + n_1 + n_2\left[1 + \frac{\bar{t}_j}{\alpha\bar{\tau}_2}\right] - \bar{T}\right\} - \sum_{k=0,1,2}\mu_k^j n_k \tag{5}$$

The mode-j dependent demand functions can be written as follows for each of the $j \in \mathcal{J}$ modes:

$$n_{1j}^*\left(t_j, f_j; \bar{p}_1, \bar{p}_2, \bar{\tau}_1, \bar{\tau}_2, \bar{M}, \theta_j\right)$$
$$n_{2j}^*\left(t_j, f_j; \bar{p}_1, \bar{p}_2, \bar{\tau}_1, \bar{\tau}_2, \bar{M}, \theta_j\right)$$

Observe that the demand function of mode j is

$$x_j^*\left(t_j, f_j; \bar{p}_1, \bar{p}_2, \bar{\tau}_1, \bar{\tau}_2, \bar{M}, \theta_j\right) = \frac{1}{\alpha\bar{\tau}_2}n_{2j}^*\left(t_j, f_j; \bar{p}_1, \bar{p}_2, \bar{\tau}_1, \bar{\tau}_2, \bar{M}, \theta_j\right)$$

[14]The model could also be used to study the value of travel time, as in Johnson (1966), Oort (1969), DeSerpa (1970) or Evans (1973).

It must be remembered that several optimal solutions are feasible: corner solutions, a solution with one of the two restrictions binding, or a solution with both restrictions binding. So there are several candidates to be an optimum. Therefore, assuming that the consumer travels, the optimal basket $(n^*_{1j^*}, n^*_{2j^*})$ travelling at mode j^* is the one that achieves the greatest level of welfare $u_{j^*}(n^*_{1j^*}, n^*_{2j^*})$ among all mode-j dependent optimal choices; that is, the optimal discrete modal choice is

$$(n^*_{1j^*}, n^*_{2j^*}) = argmax_{j \in \mathcal{J}} \left\{ u_j(n^*_{1j}, n^*_{2j}) \right\} \tag{6}$$

where j^* is the mode chosen to make the $x^*_{j^*} = \frac{1}{\alpha \bar{\tau}_2} n^*_{2j^*}$ trips. In section 4 we show that this result is analogous to that obtained in the literature about probabilistic modal choice, where an individual who undertakes a fixed number of trips has to choose the optimal transp ortation mode (see McFadden, 1973).

At this point, we can identify a set of parameters of transportation modes that provides for indifference modal choice between any pair of modes j and $j' \in \mathcal{J}$, i.e., $u_j(n^*_j) = u_{j'}(n^*_{j'})$. That is, there is a function

$$\Phi_{jj'}\left(t_j, t_{j'}, f_j, f_{j'}; \bar{p}_1, \bar{p}_2, \bar{\tau}_1, \bar{\tau}_2, \theta_j, , \theta_{j'}\right) = 0$$

which, given the price of the goods, displays a three-dimension relationship among fares $(\bar{f}_j, \bar{f}_{j'})$, time $(\bar{t}_j, \bar{t}_{j'})$ and other intrinsic features $(\theta_j, \theta_{j'})$ of modes j and j'. The introduction of subjective preferences into the mode means that the usual computation of indifferent value of time between modes may not be valid (e.g., Beesley, 1965).

2.3.2 First step decision: the travel/no-travel choice

Finally, we will examine the reasons an individual travels. This decision will hinge on the welfare derived from the optimal decision when travelling, found in (6), as compared to not travelling. With respect to the latter, if the consumer decides not to travel denoted by, $j = 0$, the optimal allocation will be

$$\begin{aligned} n^*_{10}\left(\bar{p}_1, \bar{\tau}_1, \bar{M}\right) &= \min\left\{\frac{\bar{M}\bar{\tau}_1}{\bar{p}_1}, \bar{T}\right\} \\ n^*_{20} &= 0 \end{aligned}$$

Now it is possible to ascertain the consumer's optimal decision, in which the number of units consumed of the local and the recreational goods, the travel/no travel decision, the number of trips and the modal choice are all chose simultaneously. That is, we will extend the maximization of (6) to the no-travel choice:

$$(n_1^*, n_2^*) = argmax \left[\max_{j \in \mathcal{J}} \left\{ u_j(n_{1j}^*, n_{2j}^*) \right\}, u_0(n_1^*, 0) \right] \tag{7}$$

This is an integrated solution in which the travel decision and modal choice are made at once.

Example 1. Let us suppose that the individual's preferences $u_j^h = \psi_j^h \circ v^h$ are given by $v^h(c_1, c_2) = c_1 + \beta c_2$, and $\psi_j^h(v) = (1 - \theta_j^h)v$. There are four types of feasibility constrained sets, as depicted in Figure 1. The slopes of the monetary and temporal constraints, (1) and (2), are $m_j^M = -\frac{\tau_2}{\tau_1} \frac{p_1}{p_2 + f_j}$ and $m_j^t = -\frac{\alpha \tau_2}{\alpha \tau_2 + t_j}$, respectively. The marginal rate of substitution is $MRS = -\frac{1}{\beta}$.

We will find a corner solution if one of the monetary or temporal constraints becomes ineffective, as in cases c) and d). If (1) is and $|MRS| > |m_j^M|$ for all $j \in \mathcal{J}$, the agent will choose not to travel, i.e., $(c_1^*, c_2^*) = (\frac{\bar{M}}{\bar{p}_1}, 0)$. The same is verified if (2) is active and $|MRS| > |m_j^t|$ for all $j \in \mathcal{J}$, i.e., $(c_1^*, c_2^*) = (\frac{\bar{T}}{\bar{\tau}_1}, 0)$.

By way of illustration, we will focus on case c) where the monetary constraint (1) is the only active one. With the set of modes $J_M = \{j \in \mathcal{J} \mid |m_j^M| > |MRS|\}$, J_M corner candidates for optimum exist where at least one trip is carried out, $\left\{(c_{1j}, c_{2j}) = (0, \frac{\bar{M}}{\bar{p}_2 + f_j})\right\}_{j \in J_M}$. The non-trip allocation $(c_{10}, c_{20}) = (\frac{\bar{M}}{\bar{p}_1}, 0)$ is also a candidate for optimum, due to the repackaging of indifference curves where subjective mode features are taken into account. If all modes were subjectively identical for consumer h and if no disutility ensued from travel, i.e., $\psi_j^h = i$, where i is the identity function, then consumer h would choose the mode that provides for maximum consumption of goods $i = 2$, i.e., $j^* = argmax_{j \in J_M}\{|m_j^M|\}$. But this is not necessarily true when the modes are subjectively different and yield some degree of disutility.[15] The case of $\psi_j^h(v) = (1 - \theta_j^h)v$ penalizes each trip at mode j;[16] that is, we may regard θ_j^h as the subjective disutility of making x_j trips at mode j, which includes subjective valuation of intrinsic features of the mode (time and fare), other subjective mode features (like comfort or mode preferences), and an individual's socioeconomic variables; e.g., $\theta_j^h = \frac{1}{\alpha}\left[\theta_M^h t_j + \theta_T^h f_j + \hat{\theta}_j^h\right]$. Returning to case c), we see that no mode would be

[15]This is the same idea as Deaton and Muellbauer (1980, Chap. 10.3) in their explaination of a simple repackaging model for perfect substitute varieties. These authors maintain that goods are bought differently by the rich and the poor because the linear indifferent curves between varieties change slope as households become better off by including a slope parameter that changes with utility; that is, $u(c_1, c_2) = \theta_1(u)c_1 + \theta_2(u)c_2$. We are conducting a similar process by assigning changes in parameters to the features of the mode and, then, introducing its features subjectively.

[16] Given the preferences stated, it is easy for us to view the repackaging function ψ_j as a function that penalizes the number of trips at mode j, i.e., $u_j(0, c_2) = \beta c_2(1 - \theta_j) = \beta(c_2 - \frac{1}{\alpha}\theta_j x_j)$.

chosen if the following were verified: $u_j(0, c_{2j}) = \frac{\beta \bar{M}(1-\theta_j)}{\bar{p}_2+f_j} < \frac{\bar{M}}{\bar{p}_1} = u_0(c_{10}^*, 0)$ for any mode $j \in \mathcal{J}$. A direct consequence of this is that travel generation can be explained even for the condition that the introduction of a new mode j', with some specific features, verifies $u_{j'}(0, c_{2j'}^*) = \frac{\beta \bar{M}(1-\theta_{j'})}{\bar{p}_2+f_{j'}} > \frac{\bar{M}}{\bar{p}_1} = u_0(c_{10}, 0)$.

Lastly, case d) is analogous; except for making use of restriction (2) and slope m_j^t, and the analysis develops along the same lines for cases a) and b).[17]□

3 Discussion: the new demand generation of recreational good

The model described above furnishes a microeconomic founded for both the optimal travel decision (travel/no travel) and the discrete mode choice (once the travel decision is made, mode j is chosen). In addition, the optimal number of trips allows to determined the optimal number of visits and, them, the units of consumption of the recreational good.

The model has the following features. First, it includes both monetary and temporal dimensions. Second, transportation is considered an intermediate commodity, which has a key complementarity with some final goods that enhance welfare. Third, the preferences are represented by a utility function which includes subjective characteristics for of the modes. Due to the assumption of the independence of preferences for final goods with respect to intermediate modes, we find that the indifferent baskets for final goods remain the same for all modes, and that a monotone transformation for each mode introduces the mode features. Fourth, it allows us to identify the no-travel choice features, which depends on preferences, valuation of time, etc.; that is, since in this case $n_2^* = 0$, we have the corner solution: $u_0(n_1^*, 0)$. Fifth, it permits us to study the travel decision, the optimal number of trips, and the modal choice among existing alternative transportation modes.

Sixth, the introduction of a new mode is easily adapted by a repackaging of the indifference map, so the introduction of a new mode will result in a monotone transformation. Consequently, and seventh, demand generation can be easily interpreted. With the introduction of a new mode j', the subsequent repackaging of the indifference map $u_{j'}(n_1, n_2)$ may imply that an individual, who did not travel before, would now travel. To the best of our knowledge this is novel in the literate on demand generation following the introduction of a new mode.[18] This could be understood because the new repackaging provides greater utility

[17]For example, we will focus on case a) where $|m_j^M| > |RMS| > |m_j^t|$, because otherwise we return to cases c) and d). The basket $A \in X_j$, placed at the intersection of constraints (1) and (2), is the best feasible basket for travelling by mode j, enhancing welfare defined by the indifferent curve I_{k_j}, with $k_j = u_j(A_1, A_2)$. The optimal choice will be mode j^* or not to travel, depending on $j = argmax_{j \in \mathcal{J} \bigcup \{0\}} \{k_0, \{k_j\}_{j \in \mathcal{J}}\}$, where k_j are the labels of the indifferent curves. Case b) is analogous for basket B.

[18] This new demand may take on huge volume, as is the case with the Spanish high-velocity train AVE,

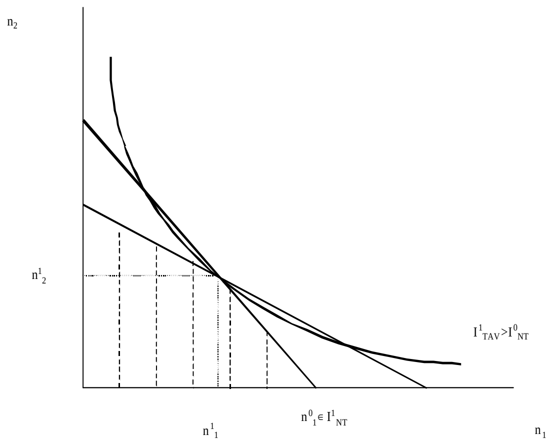

Figure 3: Travel generation under the introduction of a new transportation mode

than the "reservation welfare"; that is, since $u_{j'}(n^*_{1j'}, n^*_{2j'}) > u_0(n^*_1, 0)$ an individual would choose to travel at mode j' several times. We may also understand that the introduction of a new mode will not generate new trips using alternative modes.[19] See figure 3.

Finally, this approach enables us to draw comparative statics, which, in turn, may be used to understand travel choice when commodity prices at destiny increase. For example, if n_2 are goods consumed in New York, an appreciation of the dollar would mean that US prices p_2 have increased relatively for Europeans; hence, the feasible baskets for each mode j are reduced, and consumption would be reduced due to US goods are normal, i.e. $\frac{\partial n^*_2}{\partial p_2} < 0$. The number of transatlantic trips Europeans make, then, would also be reduced. Another example is that the introduction of a new, faster transportation mode. In this scenario new allocation of goods would be feasible and some welfare properties could present themselves. Time-restricted consumers would have more gains than income-restricted consumers, if there are time reductions, as in case a). In some cases, more allocations with positive consumption of the goods-with-trip-required are now feasible. This formalizes the intuition that the introduction of intercontinental flights has permitted some European citizens to consume goods (i.e., theater or concerts) in New York never available to them before.

for which 40% of the trips are new.

[19]The constrained set and the indifference map for each of the existing modes will not be affected if a new mode is introduced. Consequently,the best choice for goods n^*_j and for trips x^*_j remains the same, following the introduction of a new mode j'.

4 A particular case: the travel cost method

The travel cost method has become one of the most widely use to estimate the demand for recreational goods. Its microeconomic foundations rely on the introduction of the temporal dimension into the neoclassical model is due to the seminal work by Becker (1965), see McConnell (1985) and Brockstael (1995). This set-up, however, is not a suitable model to study modal choice decisions, since it ignores the existence of complementarities between intermediate goods and other final goods.[20]

The model shown in section 2 proposes a two-stage maximization model in which the first step decision is the decision to travel or not, and the second step decision consists of the modal choice among $j \in \mathcal{J}$ modes, once the decision to travel has been taken. Below, we will present an extension of the travel cost method foundation, i.e. Becker's (1965) work, as a specific transportation model by considering complementarities between travelling and consuming. We obtain the travel decision, the number of trips and the modal choice simultaneously. In addition, the model shown here can offer some insight regarding other issues like demand generation.

Local and leisure goods choice model with local labor decision. We will add the following assumptions to the model presented in the previous section: i) good 0 is labor, with $\bar{p}_0 = -\bar{w} < 0$, where w is wages, and $\tau_0 = 1$; and ii) for simplicity, the consumption of local good $k = 1$ is instantaneous , i.e., $\tau_1 = 0$.

Under these conditions, equations (1) and (2) are yielded by

$$\begin{aligned} \bar{p}_1 c_1 + \frac{\bar{p}_2 + \bar{f}_j d}{\bar{\tau}_2} n_2 &\leq \bar{w} n_0 + \bar{M} \\ n_0 + n_2 \left[1 + \frac{\bar{t}_j}{\alpha \bar{\tau}_2} \right] &\leq \bar{T} \end{aligned}$$

and the maximization problem can be transformed into

$$u_j \left(\frac{\bar{w}\bar{T} + \bar{M}}{\bar{p}_1} - \frac{\alpha(\bar{p}_2 + \bar{\tau}_2 \bar{w}) + (\alpha f_j d + \bar{w} t_j)}{\alpha \tau_2} n_2, \frac{n_2}{\tau_2} \right)$$

for each mode $j \in \mathcal{J}$. If the consumer preferences for any mode are the same, i.e., $\bar{\phi}_j = i$,

[20] If transportation is a commodity that precludes the consumption of other goods that enhance utility because some monetary and temporal resources must be devoted to it, then the optimal individual choice would be (obviously) to consume positive units of the consumption goods in origin and destiny, and to assign both zero units of time and zero expenditure to travel. This point seems to be misunderstood by Truong and Hensher (1985) in analyzing the modal choice in DeSerpa's (1971) theoretical setup, although it was intuited by Bates (1987).

the consumer will choose the one with the lower *generalized price* $g_j = \bar{\phi}_j + \bar{w}\bar{t}_j$. Observe here that the subjective monetary cost of travel time consists of its opportunity cost, i.e., labor earnings.[21]□

Example 2. Let us suppose that the individual's preferences $u_j^h = \psi_j^h \circ v^h$ are given by $v(c_1, c_2) = c_1 + \beta\varphi(c_2)$, with $\varphi(c_2) = \frac{c_2^{1-\sigma}-1}{1-\sigma}$, and that $\psi_j(v) = (1-\theta_j)v$, penalizing the number of trips.[22] For this scenario, there are two feasible solutions. First, for the non-travel solution, $(c_{10}, c_{20}) = (\frac{\bar{w}\bar{T}+\bar{M}}{\bar{p}_1+\bar{w}\bar{\tau}_1}, 0)$, where the indirect utility function is given by $u_0^*(\bar{w}, \bar{T}, \bar{M}, \bar{p}_1, \bar{p}_2, \bar{\tau}_1, \bar{\tau}_2) = \frac{\bar{w}\bar{T}+\bar{M}}{\bar{p}_1+\bar{w}\bar{\tau}_1} - \frac{\beta}{1-\sigma}$. Second, for the mode j travel solution

$$(c_{1j}, c_{2j}) = \left(\frac{\bar{w}\bar{T}+\bar{M}}{\bar{p}_1+\bar{w}\bar{\tau}_1} - \beta \left[\frac{1}{\beta} \frac{\alpha(\bar{p}_2+\bar{\tau}_2\bar{w})+g_j}{\alpha(\bar{p}_1+\bar{\tau}_1\bar{w})} \right]^{\frac{\sigma-1}{\sigma}}, \left[\frac{1}{\beta} \frac{\alpha(\bar{p}_2+\bar{\tau}_2\bar{w})+g_j}{\alpha(\bar{p}_1+\bar{\tau}_1\bar{w})} \right]^{\frac{-1}{\sigma}} \right),$$

where $g_j = \phi_j + \bar{w}t_j$. It should be noted that $\sigma > 0$, due to the expectation that, after an increase in the generalized price of travelling g_j, the consumption of good $k = 2$ will decrease. The indirect utility function then is

$$v^*(\bar{w}, \bar{T}, \bar{M}, \bar{p}_1, \bar{p}_2, \bar{\tau}_1, \bar{\tau}_2, g_j) = \frac{\bar{w}\bar{T}+\bar{M}}{\bar{p}_1+\bar{w}\bar{\tau}_1} + \frac{\beta}{1-\sigma} \left\{ \left[\frac{1}{\beta} \frac{\alpha(\bar{p}_2+\bar{\tau}_2\bar{w})+g_j}{\alpha(\bar{p}_1+\bar{\tau}_1\bar{w})} \right]^{\frac{\sigma-1}{\sigma}} \sigma - 1 \right\}$$

Therefore, the optimal decision is reduced to finding the allocation that yields the highest utility between no-travel, $u_0^*(c_{10}, 0) = \Delta_0$, and travel by some mode j, i.e., $u_j^*(c_{1j}, c_{2j}) = \left[\Delta_0 + \Delta_1(\Delta_2 + g_j)^{\frac{\sigma-1}{\sigma}}\right](1-\theta_j)$ where Δ_i are modal-independent parameters, with $i = 0$, 1, 2. The optimal solution is arrived at as in (6). For example, for the case in which the consumer dislikes all existing modes, i.e., θ_j sufficiently high for all $j \in \mathcal{J}$, the optimal choice is not to travel. If we then contemplate the introduction of new mode j' such that $\theta_{j'} << \theta_j$ for all modes, a possible occurrence could be that the agent, instead of not travelling, likes the new mode j', generating a demand never existing before. This is a result that would never have been possible in Becker's model.□

[21] The same result would be reached if we considered $\bar{M}$ the product of the total units of time devoted to work, t_w, by the nominal wage per unit of time, w: $\bar{M} = wt_w$, and considered that the time endowment $\bar{T}$ would be endogenous and it should be then replaced by $\bar{\bar{T}} - t_w$ in order to account for labor time, where $\bar{\bar{T}}$ is exogenous.

[22] That is, if we define the preferences as $u(c_1, c_2, x_j) = c_1 + \beta\frac{c_2^{1-\sigma}-1}{1-\sigma} - \beta_j\frac{x_j^{1-\sigma}-1}{1-\sigma}$ and suppose that only one unit of good $k = 2$ is consumed at each trip, $\alpha = 1$, then $u(c_1, c_2, x_j) = c_1 + \beta[1 - \frac{\beta_j}{\beta}]\frac{c_2^{1-\sigma}-1}{1-\sigma}$. We are able to see similarities with the preferences described by $u_j(c_1, c_2) = (1-\theta_j)[c_1 + \beta\frac{c_2^{1-\sigma}-1}{1-\sigma}] = c_1 + \beta[1-\theta_j]\frac{c_2^{1-\sigma}-1}{1-\sigma} - \theta_j c_1$, judging that $\theta_j c_1$ could be thought of as non-travel inertia.

5 Conclusions and Extensions

The main contribution of this paper is to present a simple microeconomics founded model that is able to explain demand generation for recreational activities. Changes in the transportation supply can modify the travel/no-travel decision or can change the optimal number of trips, and consequently the recreational demand, both of which may occur with the introduction of a new mode or with modifications in the time, price or other existing features of existing modes. This is analyzed in a set-up where it is taken simultaneously the travel decision, the number of trips, and the modal choice. The model has two key features. First, transportation is fully recognized as a complementary commodity toward the consumption of goods spatially-separated; and, second, preferences are represented by a utility function that includes subjective features of the modes by means of a repackaging of mode-independent indifferent baskets of final goods. The model also permits us to analyze the effects of transportation demand after any change in variables not directly related to the transportation commodity, such as a change in the relative prices of the economy.

The model shows strong links with previous literature on recreational economics. . In particular including work decision can reproduce the travel cost method foundations

Some extensions might be made to this paper. On one hand, our methodology is ready for empirical analysis as a tool for policy-makers, as the travel demand generation following the introduction of a new mode.

On the other hand, the theoretical model can be enriched in several ways. First, the time spent working or traveling are considered that is valued equivalently than the time spent on recreational activities. Technically this shortcoming could be avoided by introducing labor time and travel time in the consumer preferences. Due to the treatment in the literature on transportation and on recreational economics differs, we take up this issue and followed the standard assumption in the travel cost method. Second, the model is not able to explain why some agents choose different transportation modes for the same type of journey. For example, the preferences for the variety as individual's modal preferences may change with the number of trips.

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