Working Paper Series
Department of Economics
University of Verona

Extensions of the Traditional Travel Cost Model of Non-Market Valuation to a Collective Framework: Evidence from the Field

Marcella Veronesi, Martina Menon, Federico Perali

WP Number: 42 January 2007

ISSN: 2036-2919 (paper), 2036-4679 (online)

EXTENSIONS OF THE TRADITIONAL TRAVEL COST MODEL OF NON-MARKET VALUATION TO A COLLECTIVE FRAMEWORK: EVIDENCE FROM THE FIELD

Martina Menon, Federico Perali, and Marcella Veronesi*

Forthcoming: *American Journal of Agricultural Economics*, 2014

Abstract. Traditional recreation demand models do not make a distinction between a household and an individual as the reference decision-making unit, thus assuming that a family maximizes a single utility function, even if it consists of different individuals. Such models ignore the possibility of family members' divergent preferences for non-market goods. This study proposes a novel approach—the "collective travel-cost model" (CTCM)—to eliciting *individual* preferences for a non-market good such as a recreation site by using revealed preference data. This approach accounts for the intra-household resource allocation and the role of each household member's preferences. We show that the collective travel-cost model can be applied to estimating a recreation demand model that yields *individual* welfare estimates appropriate for policy analysis of non-market goods, such as the willingness-to-pay to access a recreation site. We find that how resources are distributed within the household reflects significant differences in welfare measures.

Keywords: collective model; intra-household resource allocation; non-market valuation; recreation demand model; sharing rule; travel-cost model; unitary model; willingness-to-pay.

JEL Classification: D13, H41, Q26, Q51.

---

*Martina Menon is an assistant professor at the Department of Economics of University of Verona and member of CHILD. Federico Perali is professor at the Department of Economics of University of Verona and member of CHILD. Marcella Veronesi is an assistant professor at the Department of Economics of University of Verona and research fellow at the Institute for Environmental Decisions, ETH Zurich. Correspondence to be sent to: marcella.veronesi@univr.it; Vicolo Campofiore 2, Department of Economics, University of Verona.

A previous version of this article was developed while at the Department of Agricultural and Resource Economics, University of Maryland. We thank the department for providing support. We would like also to thank Anna Alberini, Nancy Bockstael, Jean-Paul Chavas, Joseph Cooper, Michael Creel, Shelby Gerking, Kenneth E. McConnell, the participants at the 3rd World Congress of Environmental and Resource Economists in Kyoto, at the 15th Annual Conference of the European Association of Environmental and Resource Economists at the University of Macedonia, at the Conference on the Economics of the Family in honor of Gary Becker held in Paris, and at seminars at ETH Zurich for their comments on a previous version of this manuscript. We gratefully acknowledge funding from the "Ente Regionale per i Servizi all'Agricoltura e alle Foreste" (ERSAF) of the Lombardia region. The views expressed herein are those of the author and do not reflect the policies of ERSAF or the Lombardia region. All errors and omissions are the sole responsibility of the authors.

Recent literature has recognized the importance of considering the family as a collection of individuals rather than as a single decision-making unit, and the relevance of inferring how family members allocate household resources among themselves (e.g., Browning, Chiappori, and Weiss 2010; Dunbar, Lewbel, and Pendakur 2013). Since the original studies on the travel-cost model (TCM) by Hotelling (1949) and Clawson (1959), recreation demand models have not made a distinction between a household and an individual as the reference decision-making unit, and have assumed that families maximize a single utility function, even if they consist of different individuals. This approach, defined as the unitary model, implies that the intra-household resource allocation process is irrelevant, or that it can be addressed within a dictatorial decision process. The possibility of family members' divergent interests and preferences for non-market goods is ignored. In the last two decades, the unitary model to household behavior has been widely tested and generally rejected (e.g., Lundberg 1988; Thomas 1990; Fortin and Lacroix 1997; Browning and Chiappori 1998; Chiappori, Fortin, and Lacroix 2002; Cherchye, De Rock and Vermeulen 2009 and 2012). Households consisting of several members do not necessarily behave as a single agent, and individual choices are affected by the presence of other household members. After all, "individuals have utility, not households" (Browning, Chiappori, and Lewbel 2013).

The main contributions of this article are (i) proposing a novel approach to eliciting *individual* preferences for a non-market good such as a recreation site, and (ii) showing how this novel approach can be applied to estimating a recreation demand model that accounts for the intra-household resource allocation and the role of each household member's preferences for consumption choices. We define the implemented model as the "collective travel-cost model"

(CTCM) because it is based on an analogy borrowed from the literature of collective household behavior by Chiappori (1988, 1992).

McConnell (1999) emphasizes that the failure of many recreation studies to distinguish between individual and household results in ambiguous empirical estimates: “economists need to think carefully about the individual versus the household in designing surveys and in measuring welfare” (p. 466). In the context of recreation models, Bockstael and McConnell (2006) note that since the original paper by Becker (1965) on household production “little progress has been made in explaining the intra-household allocation process or in reconciling the distinction between the household as decision maker and the individual members as consumers” (p. 75). The impact of different family types on consumption behavior and of the spouse and children on traveling choices has been recognized in the marketing, transportation, and tourism literature (e.g., Arora and Allenby 1999; Lee and Beatty 2002; Adamowicz et al. 2005; Decrop 2005; Tinson, Nancarrow, and Brace 2008; Hensher, Rose, and Black 2008; Kozak and Duman 2012). In particular, the transportation literature has made significant progress in modeling group decision making and the intra-household interactions (e.g., Vovsha, Petersen, and Donnelly 2003; Bradley and Vovsha 2005; Bhat and Pendyala 2005; Timmerman 2008; Zhang and Daly 2008; Timmermans and Zhang 2009; Zhang et al. 2009).

In addition, a number of articles have investigated the difference between individual and household willingness-to-pay in the context of stated preference methods (e.g., Quiggin 1998; Strand 2007; Munro 2005; Bateman and Munro 2009; Beharry-Borg, Hensher, and Scarpa 2009; Ebert 2009; Lindhjem and Navrud 2009). In particular, Evans, Poulos, and Smith (2011) develop a choice model that accounts for dependency relationships within the collective household model, and they apply contingent valuation to estimate the willingness-to-pay for air quality improvements. Morey and Kritzberg (2012) use choice experiments to show that companions and their level of ability can significantly affect the recreation site choice and the value of site characteristics.

However, to the best of our knowledge, the present study is the first to show how to empirically recover *individual* preferences and *individual* willingness-to-pay for a non-market good such as a recreation site by using revealed preference data and by identifying the rule of intra-household resource allocation. Kaoru (1995) finds that party composition affects recreational site choices and recognizes that budget constraints should be treated differently depending on the types of recreation parties. McConnell (1999) develops a recreation demand model based on two individuals (spouses) sharing income, household production and earning different wages. However, the basic structure of Kaoru's and McConnell's models is the traditional unitary model that assumes income pooling, that a household has a single utility function, and that there is no bargaining and intra-household allocation of resources between household members. Smith and Van Houtven (1998, 2004) describe the implications of the collective model of household behavior for methods used to estimate the economic value of non-market goods. However, they do not present empirical analyses or estimate welfare measures in their studies. Dosman and Adamowicz (2006) investigate intra-household bargaining in the choice of two spouses for a vacation site. They overcome the issue that individual preferences for the site are not observed by using stated preference methods.

We estimate a complete demand system (Deaton and Muellbauer 1980) rather than standard discrete choice models (e.g., Morey and Thiene 2012) for two main reasons. First, the decision about allocating household resources to recreation should explicitly account for the budget constraint and the relative importance of allocation with respect to other household expenses. By incorporating the budget constraint into the analysis, the complete demand system approach implies that an increase in expenditure on one good (e.g., recreation) must be balanced by decreases in expenditure on other goods, *ceteris paribus*. Second, a system approach allows the derivation of exact individual welfare measures that are consistent with the consumer theory.

The collective travel-cost model we estimate allows us to answer the following research questions: (i) Does *how resources* are distributed within the household reflect significant differences in welfare measures? (ii) Do household members have the same preferences for non-market goods and associated willingness-to-pay? In other words, does a survey respondent's willingness-to-pay represent the willingness-to-pay of the other household members? We find that how resources are distributed within the household reflects significant differences in welfare measures, and that household members do *not* have the same preferences and willingness-to-pay for a non-market good such as a recreation site.

Theoretical Model: The Collective Travel-Cost Model (CTCM)

In this section, we develop a new recreation demand model based on the collective theory of household behavior (Chiappori 1988, 1992): the "collective travel-cost model" (CTCM).[1]

---

[1] The non-unitarz approach to the family can be divided into two broad categories: approaches that rely on cooperative solutions to bargaining among individuals and approaches that rely on non-cooperative models. There are two types of cooperative approaches: collective models in which it is assumed only that family outcomes are Pareto efficient, and nothing is assumed a priori about the nature of the efficient decision process (Chiappori 1988, 1992, 1997), and family cooperative models in which the decision process is determined by using bargaining theory (Manser and Brown 1980; McElroy and Horney 1981; Lundberg and Pollak 1993). In contrast to cooperative models, the non-cooperative models do not assume Pareto efficiency, but they assume that individuals within the

Chiappori (1988, 1992) introduces a theoretical household model in which the family is composed of a collection of individuals, each characterized by her/his own preferences for market goods consumed within the family. Assuming that the decision process results in Pareto efficient outcomes, Chiappori (1988, 1992) shows that when agents are egoistic or caring à la Becker and consumption is purely private, revealed preferences data can be used to recover individual preferences and identify the rule that determines the allocation of resources within the family (defined as the *sharing rule*) up to an additive constant. The objective function of the household is a weighted sum of the utility functions of each household member. The weights represent the bargaining power of the household members in the intra-household allocation process.

In general, superscripts index household members and subscripts index goods. As in the traditional TCM, we assume weak complementarity between the number of trips and the quality of the site, that is, if the number of trips to the site is zero, then the marginal utility of quality is zero (Bockstael and McConnell 2006, p. 76). However, for purposes of exposition, we omit the quality of the site because it does not vary across individuals visiting the same site, even though we recognize that quality may affect preferences. In addition, to simplify the notation, we ignore socio-demographic variables that may affect preferences and the decision-making process of the family. Observable heterogeneity will be introduced in the empirical section.

We consider a household comprised of two members: individual $i=r$, the *respondent* of an on-site survey, and individual $i=s$, her/his *spouse* or unmarried partner. Member i privately consumes a Hicksian composite good q^i—we only observe whole family consumption $q = q^r +$

household have different preferences and act as autonomous individuals (Kooreman and Kapteyn 1990; Chen and Woolley 2001).

q^s—and number of trips n^i to a recreation site. For purposes of exposition, we focus on trips to a single site, and assume that the demand for a site does not depend on the price of access to other sites, an assumption that will be relaxed in the empirical section.

Each household member can consume trips together or separately and engage in different recreational activities (e.g., fishing and hiking). The market price of the composite good is observed at the household level; therefore, both household members face the same market price. In addition, because all households face the same market price, the price of the composite good is set to one. The price p_n^i of the *n*th trip for individual *i* is given by the sum of the round-trip travel cost c_{tc}^i and the time cost c_t^i, where the time cost c_t^i is the opportunity cost of member *i* for recreation activities, which is measured as a constant proportion of the wage rate ω^i of member *i* times the hours spent for recreation t^i:[2]

(1) $$p_n^i = c^i{}_{tc} + c^i{}_t = c^i{}_{tc} + \omega^i t^i, \quad i = r, s.$$

When a recreation decision is made within a household, each family member involved in the decision-making process generally takes into account the other members' preferences. It is

---

[2] As McConnell and Strand (1981) and Haab and McConnell (2002, p. 147) emphasize, there is empirical evidence (Calfee and Winston 1998) and several economic reasons, such as disutility from work, positive tax rates, and gross wage rate, that support the assumption that the opportunity cost of time is a constant proportion of the wage rate. As in the traditional recreation demand model, we assume that the travel-cost function is linear in the number of trips. This implies that the marginal travel cost per trip equals the average travel cost per trip. This is a household model that ignores the potential for corner solutions in the labor market, and it does not distinguish between travel time and on-site time. See Bockstael, Strand, and Hanemann (1987), Haab and McConnell (2002, pp. 145-148), and Bockstael and McConnell (2006, chapter 4, sections 4.3.2 and 4.3.3) for a discussion of these limitations. We leave for future research the inclusion of corner solutions and the distinction between travel time and on-site time in the collective travel-cost model.

therefore plausible to assume that each family member has caring preferences à la Becker, in the sense that the level of utility of one member depends on the level of utility of the other member, whose arguments are the number of trips *n* and the composite good *q*:

$$U^i\left(n^i, q^i, n^j, q^j\right) = W^i\left(u^i\left(n^i, q^i\right), u^j\left(n^j, q^j\right)\right), \quad i \neq j = r, s, \tag{2}$$

where W^i is a monotonically increasing function in both arguments aggregating the preferences of both members. The individual sub-utility functions $u^i(.)$ are assumed to be continuous, twice differentiable, increasing, and quasi-concave in all their arguments.

A common representation of W^i (Browning, Chiappori, and Lechene 2006; Bargain and Donni 2007; Lise and Seiz 2011; Browning, Chiappori, and Lewbel 2013) assumes that it is separable in the individual sub-utility functions as follows:

$$U^i = u^i\left(n^i, q^i\right) + \delta^i u^j\left(n^j, q^j\right), \quad i \neq j = r, s, \tag{3}$$

where the weight $\delta^i \in (0,1)$ represents how much a member of the household cares about the other. The amount of caring for the other is assumed to be always lower than the amount of caring the member has for himself.[3] If $\delta^i = 0$, then the altruistic preferences would collapse to the egoistic case.

We further assume that the household maximizes a caring welfare function, where the generalized household utility function $\tilde{U}$ incorporating altruism can be specified as follows:

---

[3] Excessive altruism may lead to unrealistic household outcomes. Therefore, the values taken by the weight δ^i are in general bounded between zero and one (Bernheim and Stark 1988; Bergstrom 1989; Browning, Chiappori, and Weiss 2010).

$$\tilde{U} = \mu U^r\left(n^r, q^r, n^s, q^s\right) \quad (1 \quad \mu) U^s\left(n^s, q^s, n^r, q^r\right)$$

(4)

$$= \mu\left[u^r\left(n^r, q^r\right) + \delta^r u^s\left(n^s, q^s\right)\right] + (1-\mu)\left[u^s\left(n^s, q^s\right) + \delta^s u^r\left(n^r, q^r\right)\right],$$

where $\mu \in [0,1]$ is the Pareto weight that can be interpreted as a measure of individual *r*'s bargaining power in the decision process. The larger the value of μ, the greater is individual *r*'s "weight" in the family. In general, if $\mu = 1$, then the household behaves as though individual *r* has full bargaining power in the family, whereas if $\mu = 0$, then it behaves as though individual *s* is the effective dictator. In the context of caring agents, preferences of member *r* (*s*) are taken into account in the decision-making process even when the scaling function μ is zero (one).

In general, the Pareto weight μ depends upon a set of exogenous variables *z* that can affect the bargaining power in the household and the intra-household allocation of resources (Browning and Chiappori 1998). Further, the scalar function μ is assumed to be continuously differentiable in its arguments and homogeneous of degree zero in prices and income (Browning, Chiappori, and Weiss 2010). If the variables *z* affect the balance of power μ without affecting preferences and the budget constraints, then these variables are defined as *distributional factors*. Possible examples of distributional factors include non-labor income (Thomas 1990), spouses' wealth at marriage (Thomas, Contreras, and Frankenberg 1997), the targeting of specific benefits to particular members (Duflo 2000), sex ratio, and divorce legislation (Chiappori, Fortin, and Lacroix 2002).

Simple manipulation shows that aggregate household preferences $\tilde{U}$ can be rearranged as

(5) $$\tilde{U} = \tilde{\mu} u^r\left(n^r, q^r\right) + \left(1-\tilde{\mu}\right) u^s\left(n^s, q^s\right),$$

where the transformed Pareto weight $\tilde{\mu} = \frac{\mu + (1-\mu)\delta^s}{1 + \mu\delta^r + (1-\mu)\delta^s}$ subsumes the scaling parameter δ_i of both members (Browning, Chiappori, and Lechene 2006; Browning, Chiappori, and Weiss 2010; Lise and Seiz 2011).

The Pareto consumption problem of the family is then described by the maximization of the weighted utility function subject to a linear budget constraint:

$$\max_{n^r, q^r, n^s, q^s} \quad \tilde{U} = \mu U^r\left(n^r, q^r\right) + (1-\mu) U^s\left(n^s, q^s\right) = \tilde{\mu} u^r\left(n^r, q^r\right) + (1-\tilde{\mu}) u^s\left(n^s, q^s\right)$$

(6)

$$\text{subject to} \quad {p_n}^r n^r + {p_n}^s n^s + q^r + q^s = Y,$$

where Y represents the total household expenditure, assumed to be exogenous, and p_n^i is the price of a trip for individual i defined as in equation (1).[4] We assume that the family decision process leads to Pareto-efficient outcomes provided that the utility functions are well-behaved and the budget set is convex (Chiappori 1988, 1992).[5] The assumption that the household outcomes are Pareto efficient does not exclude the situation of a household experiencing marriage dissolution (i.e., divorce). Household members can be viewed as players of repeated games with symmetric information; therefore, efficiency is a reasonable assumption. We will

[4] Throughout the article we use the terms “income” and “total expenditure” interchangeably. The budget constraint derives from solving the time constraint ($t^i n^i + h^i = T^i$, where t^i is recreation time, h^i is working hours, and T^i is the total time available) for working hours, and substituting them into the income constraint ($Y^0 + \omega^r h^r + \omega^s h^s = Y$, where Y^0 is non-labor income, and ω^i is the wage rate).

[5] The underlying motivation of the assumption of Pareto efficiency is that efficient allocations are likely to emerge when agents are able to make binding commitments and have full information, as in the case of households. Pareto efficiency may fail to apply due to existing social norms (Udry 1996), infrequent decisions (Lundberg and Pollak 2003), or problematic communication (Ashraf 2009).

proceed with our analysis in the individual utility space $u^i(n^i,q^i)$ because (i) our main interest is not the identification of the caring weight δ^i; (ii) any allocation that is Pareto efficient for the caring preferences is also Pareto efficient for the egotistic ones when $\delta^i = 0$ for all i and $\tilde{\mu} = \mu$ (Browning, Chiappori, and Weiss 2010, p.131); and (iii) the caring and egoistic utility representation of preferences leads to the same optimal solution (Lise and Seitz 2011).

The collective rationality assumptions of Pareto efficiency and well-behaved individual utility functions allow the decentralization of the household decision process into two stages—a sharing stage and a consumption stage—by implementing the second fundamental theorem of welfare economics, that is, "if there are no externalities, then any efficient outcome can be decentralized by a choice of prices and the (re)distribution of income" (Browning, Chiappori, and Weiss 2010, p. 169). In particular, in the first stage, household members decide how to share household total income Y, and each is assigned a given amount, ϕ^r and ϕ^s, of the household resources.[6] In the second stage, after income has been allocated, each member chooses her/his optimal consumption bundle of recreation trips n^i and composite good q^i by maximizing her/his utility subject to the budget constraint based on her/his respective share of household income ϕ^i. In other words, "the decentralization procedure is simple: each person is given a share of total expenditure and allowed to spend it on their own private goods, using their own private sub-utility function" (Browning, Chiappori, and Weiss 2010, p. 169).

Formally, each household member's objective function can be written as follows:

(7) $$\max_{n^i,q^i} \; u^i\left(n^i,q^i\right) \quad \text{subject to } \; p_n{}^i n^i + q^i = \phi^i\left(p_n{}^r, p_n{}^s, Y, z\right),$$

---

[6] The function ϕ^i in consumption models must be positive because the level of expenditure of each family member cannot be zero.

with the optimal solution equal to

(8) $$n^i\left(p_n{}^r, p_n{}^s, Y, z\right) = N^i\left(p_n{}^i, \phi^i\left(p_n{}^r, p_n{}^s, Y, z\right)\right),$$

(9) $$q^i\left(p_n{}^r, p_n{}^s, Y, z\right) = Q^i\left(p_n{}^i, \phi^i\left(p_n{}^r, p_n{}^s, Y, z\right)\right),$$

where under the assumption of Pareto efficiency, the solution to problem (7) must be equal to that obtained solving the household problem (6).

Empirical Model: A Collective Almost Ideal Demand System for Non-Market Valuation

This section extends the almost ideal demand system (AIDS) by Deaton and Muellbauer (1980) to the collective framework.[7] In addition, we show the specification of the sharing rule, and the identification of individual preferences for non-market goods as well as of individual's welfare measures, such as compensating and equivalent variations, in a recreation "collective" context. We adopt a theoretically consistent system rather than *ad hoc* single equation demands for two main reasons: (i) to account for the interactions between the recreation demand and the demands for other goods, and (ii) to derive exact individual welfare measures.

The individual *i*'s collective budget shares of good *k* (w_k^i) is a function of prices *p* and individual incomes y^i:[8]

[7] For a recent survey of the consumer demand system literature, see Barnett and Serletis (2008). On utility functions for continuous demand systems, share equations, and the stochastic specification of share equations see Morey (1984), Morey et al. (1995), and Morey, Breffle, and Greene (2001). See also section A1 of the online supplementary appendix for a discussion of the AIDS compared to other demand models.

[8] For clarity of exposition, we omit, for the time being, observable demographic heterogeneity. We show in section A2 of the online supplementary appendix how the individual budget shares are derived.

$$(10) \qquad w_k^i = \frac{1}{2}\left(\alpha_k + \sum_l \gamma_{kl} \ln p_l\right) + \beta^i{}_k \left(\ln y^i \quad \ln A^i\left(p\right)\right),$$

where α, β, and γ are vectors of parameters, and $\ln A^i\left(p\right)$ and $\ln B^i\left(p\right)$ are differentiable and concave price aggregators with the following functional forms:

$$(11) \qquad \ln A^i\left(p\right) = \frac{1}{2}\left(\alpha_0 \quad \sum_k \alpha_k \ln p_k \quad \sum_k \sum_l \gamma_{kl}^* \ln p_k \ln p_l\right) \quad \text{with} \quad \gamma_{kl}^* = 0.5\gamma_{kl},$$

$$(12) \qquad \ln B^i(p) = \beta_0 \prod_k p_k^{\beta_k^i}.$$

The price aggregator $\ln A^i\left(p\right)$ can be interpreted as individual *i*'s portion of household subsistence expenditure when $U^i = 0$. Moreover, we define $\ln A^i\left(p\right) = 0.5 \ln A\left(p\right)$ by assuming that both members have equal access to household subsistence expenditure $A(p)$ as if both members face the same individual shadow prices. Because in our case individual prices are unknown, we cannot estimate decentralized budget shares as derived in equation (10). Therefore, we construct the observable household budget share of good *k* as the sum of the individual budget shares (10):

$$(13) \qquad w_k = w_k^r + w_k^s = \alpha_k + \sum_l \gamma_{kl} \ln p_l + \beta^r{}_k \left(\ln y^r - \ln A^r\left(p\right)\right) + \beta^s{}_k \left(\ln y^s - \ln A^s\left(p\right)\right).$$

In a recreation context, the collective system of budget shares (13) includes the annual individual shares of household income that individual *r* and *s* spent for the recreation site and the annual household shares spent for alternative sites, other leisure, food, and other goods. The vector of prices *p* includes the travel costs and time costs of individuals *r* and *s* to the recreation site and to alternative sites as defined in equation (1).

To account for observable heterogeneity, we demographically modify the collective share equation (13) as follows:[9]

(14) $$w_k = \alpha_k + t_k(d) + \sum_l \gamma_{kl} \ln p_l + \beta^r{}_k \left(\ln y^{*r} - \ln A^r(p)\right) + \beta^s{}_k \left(\ln y^{*s} - \ln A^s(p)\right),$$

where $t_k(d)$ is a translating demographic function specified as $t_k(d) = \sum_m \tau_{km} \ln(d_m)$, with τ representing a vector of parameters and d_m representing socio-demographic characteristics such as education, sex, age, nationality, and family size; y^{*i} represents individual income modified as $\ln y^{*i} = \ln y^i - \sum_k t_k(d) \ln p_k$. Adding up, homogeneity, and symmetry,[10] treated as maintained hypotheses, imply the following restrictions on the parameters to be estimated:

$$\sum_k \alpha_k = 1,\ \sum_k \beta^i{}_k = 0\ \forall i = r, s,\ \sum_k \gamma_{kl} = 0,\ \sum_l \gamma_{kl} = 0,\ \sum_k \tau_{km} = 0, \gamma_{kl} = \gamma_{lk}.$$

[9] We demographically modify the collective demand system using the Gorman translating method (Pollak and Wales 1978; Perali and Chavas 2000; Perali 2003), which translates the budget line through the fixed cost element, while maintaining the integrability of the demand system. This is a necessary requirement for conducting robust welfare analysis. In our demand specification, individual total expenditure is both scaled, to estimate the sharing rule, and translated, to model demographic transformations as a fixed effect. To keep this transformation as simple and illustrative as possible, the demand system adopted is linear in individual incomes to place special emphasis on individual Engel curves rather than the rank dimension of the Engel space.

[10] The Slutsky conditions satisfied by the centralized and decentralized demand systems are different. Because the Pareto weight is a function of both prices and income, the household utility function is price dependent, and thus the centralized compensated term is not symmetric (Browning and Chiappori 1998). In a centralized framework, a price change affects both the budget constraint and the objective function giving rise to the "symmetry plus rank one" (SR1) condition.

The system of budget shares (14) allows the estimation of the income parameters β^r and β^s at the individual level and the estimation of the parameters α_k, γ_{kl} and the parameters of the scaling function $t_k\left(d\right)$ at the household level.

Sharing Rule Specification

In this section, we show the specification of the sharing rule ϕ^i, which represents the best functional estimate of the unobservable individual income y^i. Chiappori and Ekeland (2009) show that information about the individual consumption of assignable or exclusive goods is sufficient to identify how household resources are allocated among household members. A good is assignable when it is consumed in observable proportions by each household member. A good is exclusive when it is consumed by only one identifiable member and when its price is different from the price of the other exclusive goods consumed within the family (e.g., clothing). In the case of identification of individual preferences in a recreation context, in which household members can travel together or separately, the annual expenditure for the recreation site of individuals *r* and *s* can be assignable, and can be derived by multiplying individual *i*'s average trip cost by her/his annual number of trips to the recreation site. In addition, individual *i*'s number of trips to a recreation site can be considered as an exclusive good since household members can have different time costs and, therefore, different prices for a trip.

The amount of household resources allocated to member *i* is represented by the sharing rule ϕ^i. The sharing rule is specified as a modifying function of individual income y^i and exogenous factors *z* as follows:

(15) $$\phi^i = y^i m^i\left(z\right),$$

where $m^i(z)$ is an income scaling function such that $m^i(z) \in \left(0, Y/y^i\right)$.[11] The sharing rule function ϕ^i can be interpreted as a shadow income allocation. "Shadow" refers to the fact that the researcher does not observe the full amount of resources allocated to each household member but only the portion sufficient for the identification of the sharing rule. The scaling function $m^i(.)$ is analogous to the price scaling function introduced by Barten (1964) or the income scaling function by Lewbel (1985). It explains both the amount and direction of the allocation of resources between household members. It also indicates that the amount of resources allocated to individual i is different from the observed amount of individual spending y^i. For example, the expenditure for a trip of individual i depends on observed costs, such as gasoline and the time cost of the individual i going to the site, but it may also depend on the time cost of the other household member, who may have stayed home to take care of the children.

We then substitute individual income y^{*i} with the sharing rule ϕ^i into equation (14), and introduce additive unobserved heterogeneity ε_k in preferences to obtain the following system of budget shares:

(16) $$w_k = \alpha_k + t_k(d) + \sum_l \gamma_{kl} \ln p_l + \beta_k^r \left(\ln \phi^{*r} - \ln A^r(p)\right) + \beta_k^s \left(\ln \phi^{*s} - \ln A^s(p)\right) + \varepsilon_k,$$

where the error term ε_k is a random variable with mean zero and finite variance, and the individual shadow income is $\ln \phi^{*i} = \ln y^i + \ln m^i(z) - \sum_k t_k(d) \ln p_k$, where the scaling function

[11] The extreme values of $m^i(.)$ are not feasible because in consumption models individual income must be non-negative and cannot exceed total household expenditure Y.

$m^i(z)$ takes an exponential functional form $m^i(z) = \Pi_{g=1}^{G} z_g$, and $\ln y^i = \sigma^i \ln Y$ with σ^i being individual i's resource share such that $\sigma^r + \sigma^s = 1$.[12]

However, we do not observe individual expenditures for all purchased items. At the individual level we observe only the consumption of assignable or exclusive goods that are a small portion of individual budgets. This implies that the resource share σ^i is not known as exactly as it would be if all expenditures were observed at the individual level, but it comprises the information about the consumption of exclusive goods that is sufficient to identify the sharing rule (Chiappori and Ekeland 2009; Menon and Perali 2012). We exploit the available information about the private consumption of trips to a recreation site, and adopt the following approximation. First, we fairly allocate the same proportion of the expenditure of non-assignable goods to each household member. Second, we sum up the assignable expenditure of each individual for the recreation site to the fair division of non-assignable household expenditure. The assumption of fair division of expenditures of non-assignable goods is used in Browning et al. (1994) and Lise and Seiz (2011) to fully identify the sharing rule. Menon and Perali (2012) show that this definition of the resource share is sufficient to fully identify the sharing rule, and that the fair division does not affect the identification of the partial effects of the sharing rule.[13]

[12] The estimation of the sharing rule is conditional on the functional specification of the sharing rule and the restriction $\sum \ln \phi^i = \ln Y$, which implies that $\ln m^r(z) = -\ln m^s(z)$, which in turn is equivalent to writing $\ln m^r(z) = \ln m(z)$ and $\ln m^s(z) = -\ln m(z)$.

[13] A similar identification strategy is also pursued by Dunbar, Lewbel, and Pendakur (2013).

Welfare Measures at the Individual Level

The collective AIDS can yield welfare estimates appropriate for policy analysis of non-market goods, such as compensating and equivalent variations at the individual level. In particular, in a recreation setting, the collective AIDS allows the estimation of the individual value (willingness-to-pay) to access a recreation site.

Let individual *i*'s log-expenditure function be

(17) $$\ln E^i(p,U^i) = \ln A^i(p) + U^i \ln B^i(p) - \ln m^i(z) + \sum_k t_k(d) \ln p_k$$

where $U^i \ln B^i(p) = \ln \phi^{*i} - \ln A^i(p)$, with $\ln \phi^{*i} = \ln y^i + \ln m^i(z) - \sum_k t_k(d) \ln p_k$; $m^i(z)$ is the aforementioned income scaling function, $t_k(d)$ is a function of socio-demographic characteristics as previously defined, and $\ln A^i(p)$ and $\ln B^i(p)$ the price aggregator defined as in equations (11) and (12).

Then, let $p_n^{i,1}$ be the choke price, which is the travel cost that drives to zero individual *i*'s demand for trips to a recreation site. Let $p_n^{i,0}$ be the observed travel cost, and p_{-1}^0 the observed prices of all the other goods in the complete demand system. Let $U^{i,0}$ be the utility level of individual *i* at the observed travel cost $p_n^{i,0}$, and $U^{i,1}$ the utility level of individual *i* at the choke price $p_n^{i,1}$. Let $\ln A^i(p_n^{i,1}, p_{-1}^0)$ and $\ln B^i(p_n^{i,1}, p_{-1}^0)$ be defined as in equations (11) and (12), with only one difference: they are evaluated at the choke price $p_n^{i,1}$. The compensating variation (CV) and the equivalent variation (EV) for individual *i* can be written as

(18) $$CV^i = E^i\left(p_n^{i,1}, p_{-1}^0, U^{i,0}\right) - E^i\left(p_n^{i,0}, p_{-1}^0, U^{i,0}\right),$$

(19) $$EV^i = E^i\left(p_n^{i,1}, p_{-1}^0, U^{i,1}\right) - E^i\left(p_n^{i,0}, p_{-1}^0, U^{i,1}\right),$$

where $E^i\left(p_n^{i,1}, p_{-1}^0, U^{i,0}\right)$, $E^i\left(p_n^{i,0}, p_{-1}^0, U^{i,0}\right)$, $E^i\left(p_n^{i,1}, p_{-1}^0, U^{i,1}\right)$, and $E^i\left(p_n^{i,0}, p_{-1}^0, U^{i,1}\right)$ are the expenditure functions evaluated at $\left(p_n^{i,1}, p_{-1}^0, U^{i,0}\right)$, $\left(p_n^{i,0}, p_{-1}^0, U^{i,0}\right)$, $\left(p_n^{i,1}, p_{-1}^0, U^{i,1}\right)$, and $\left(p_n^{i,0}, p_{-1}^0, U^{i,1}\right)$, respectively.

For example, policy makers can use the equivalent variation to infer individual i's willingness-to-pay to access a recreation site. This information can then be used to regulate access to the area, make policy decisions about recreation and competing uses of the resource, and target programs to individuals in certain recreation activities groups.

Study Site and Data Description

The sample was drawn from an on-site survey conducted on the west side of Garda Lake in Northeast Italy from June to October 1997. This survey was part of an integrated analysis of the multi-functionality of the West Garda Regional Forest to define cooperative policies between institutions, local operators, and visitors. This area was chosen because there was enough variation in distance travelled, and in time and trip costs due to Garda Lake's popularity with tourists coming from abroad and throughout the country. The total number of respondents was 361. Respondents were asked to recall the number of trips made to the West Garda Regional Forest and the number of trips to other natural areas during the year. To double check the declared costs, visitors were asked to specify their place of residence, the distance travelled between the natural area and their residence, the journey time, and, for those who were on vacation, the distance from the forest to their vacation lodgings.

In addition, the following data were collected: means of transportation used, number of passengers per means of transportation, number of the passengers that were family members, number of passengers who shared the expense of the trip, whether stops were made at other places before arriving to the natural area, number of days the trip lasted, and socio-economic and demographic characteristics such as age, education, gender, nationality, occupation, weekly number of hours of work, number of children less than twelve years old in the household, household income, and monthly household expenditure in food and leisure. The expenditure on alternative sites was derived by using information on the distance from the residence, the number of visits to each alternative site, the quality of the area, and the purpose of the trip.

Our recreation survey is unique because it includes individual information on the expenditure for the recreation site of the respondent *and* her/his family members. The knowledge of the individual expenditure for a good represents the minimal requirement for applying the collective travel-cost model, identifying the sharing rule, and recovering individual welfare measures. For the purpose of our study, we select only married people. The final sample size includes 225 observations.

Results

According to the idea of the demand system approach, visitors to the West Garda Regional Forest allocate total income among the broad groups food, leisure, and other goods. They also decide how to distribute the expenditure for leisure in trips to West Garda Regional Forest, trips to other sites, and other leisure. Other leisure is total expenditure for leisure minus expenditure in trips to West Garda Regional Forest and to other sites. The expenditure for leisure in trips to the West Garda Regional Forest is assigned to the respondent and to her/his family members. In our empirical application $i = r$ refers to the respondent, and $i = s$ to the group “other family members”, that is, the spouse with children, when children are present. This implies that when there are children in the household we interpret the utility of the spouse in equation (2) as the joint utility of herself/himself and the children. Future research should relax this assumption accounting also for children preferences.

The vector of budget shares *w* consists of the shares of total household income that the respondent and the other household members spent on trips to the West Garda Regional Forest (respectively, *Garda_trips_r* and *Garda_trips_s*), and of the shares of total household income that the household (*hh*) spent in food (*food_hh*), in trips to other recreation sites (*other_trips_hh*), in other leisure (*other_leisure_hh*), and in other goods (*other_goods_hh*). The shares of each good are specified as in equation (16). The independent variables are the logarithm of the prices of the goods, gender (= 1 if male), nationality (=1 if Italian), age, number of years of education, number of family members, whether there are dependent children less than twelve years old, and the duration of the visit to the West Garda Regional Forest. Tables 1 and 2 present the definition and descriptive statistics for the selected variables.[14]

[TABLE 1 ABOUT HERE]

[TABLE 2 ABOUT HERE]

Zero observed shares such as the household share expenditure for other recreation sites or the other family members' share expenditure in trips to the West Garda Regional Forest are addressed by applying the generalized corner solution model (Phaneuf 1999; Shonkwiler and

[14] Future studies should also include the site characteristics among the independent variables. In our case study, the area is quite homogenous in objective site characteristics, and we decided to omit them to decrease the computation burden related to the estimation of a large vector of parameters.

Yen 1999; von Haefen, Phaneuf, and Parsons 2004). Table 3 shows the estimated parameters. The signs are consistent with the underlying theory. The price parameters are statistically significant and with the expected sign. With the exception of age, education, and nationality the demographic characteristics significantly affect the expenditure shares of trips to the West Garda Regional Forest. For instance, the presence of children and being male have a positive statistically significant effect on the individual expenditure share of trips, *ceteris paribus.*

[TABLE 3 ABOUT HERE]

Table 4 shows income, demographic, and compensated price elasticities computed at the mean of budget shares by using numerical procedures. We evaluated the standard errors of the elasticities by bootstrapping using 10,000 draws. The signs are as expected: positive for the income elasticities and negative for the own-price elasticities. Trips to the West Garda Regional Forest represent the goods most responsive to income and price changes, while food is the most necessary and least elastic good. The presence of children and family size have a positive significant impact on the trips to the recreation area and a negative significant impact on food (at the 1% statistical level). This is consistent with what is found in other papers (Arias et al. 2003; Koc and Alpay 2003). The respondent’s number of trips to the West Garda Regional Forest is complementary with other family members’ number of trips to the West Garda Regional Forest, but it is a substitute for food and other goods. The duration of the visit to the natural area has a negative significant effect on the trips to the other recreation sites (at the 1% statistical level).

[TABLE 4 ABOUT HERE]

We also estimate the unitary AIDS for recreation demand as reported in the online supplementary appendix (section A1). The functional form of the estimated budget shares is specified in equation (A1) and the estimated parameters are shown in table A1. The estimation of the unitary demand system can be used to test whether or not there are differences between $\hat{\beta}_k^i$ (*i* = *r* or *s*) of the collective AIDS (equation (16) and table 3) and the estimated parameter $\hat{\beta}_k$ of the unitary AIDS (equation (A1) and table A1). We test whether $(\hat{\beta}_k^r - \hat{\beta}_k) = 0$ and $(\hat{\beta}_k^s - \hat{\beta}_k) = 0$ for each budget share *k*. If the hypotheses are rejected, we can conclude that the system of budget shares fits into the structure of collective model (16). Table A5 of the online supplementary appendix shows Wald test statistics. In general, the null hypotheses are rejected emphasizing the existence of individual Engel curves, and thus, supporting the collective model of equation (16).

The Sharing Rule

We use as factors *z* affecting the distribution of resources within the household, the number of children, wages, and an interaction term that captures whether the individual is a hunter or a fisherman and travels without family members (table 5). Distribution factors z are not necessary for the identification of the sharing rule, but when present, they can improve the robustness of the estimation (Dunbar, Lewbel, and Pendakur 2013). Wages have a positive and significant effect (at the 5% statistical level) on the sharing rule: individuals with higher wages tend to retain more resources for themselves. The number of children affects negatively the sharing rule at the 1% statistical level, while the interaction term is not a significant driver of the intra-household resource allocation. These results provide evidence in support of the collective model of equation (16). Indeed, according to the unitary model no distribution factor should affect behavior.

[TABLE 5 ABOUT HERE]

Figure 1 shows the relative sharing rule, that is the sharing rule divided by the total household income, differentiated by the number of children in the household. We find that the share of resources allocated to the respondent decreases as the number of children increases.

[FIGURE 1 ABOUT HERE]

Welfare Comparisons and Individual Willingness-to-Pay

The estimated collective AIDS allows us to derive the equivalent variation for the respondent and the other family members, that is the individual willingness-to-pay to access the West Garda Regional Forest (*CTCM_WTP*, expressed in euros), by substituting the estimated parameters of table 3 into equation (19).[15] Because the willingness-to-pay figures presented in table 6 are divided by the actual annual number of trips, they refer to the WTP per one trip to the West Garda Regional Forest. Similarly, the respondent's WTP per one trip to the recreation site of the traditional unitary TCM is derived by using the estimated parameters of the unitary AIDS (table A1 of the online supplementary appendix).

We test (1) whether the respondent's WTP per one trip to the recreation site estimated by the traditional unitary travel-cost model (*TCM_WTP_r*) is significantly different from the respondent's WTP obtained by applying the collective travel-cost model (*CTCM_ WTP_r)*; and

[15] The choke price $p_{tc}^{i,1}$, which drives the number of trips to zero, was calculated by using numerical procedures.

(2) whether two spouses have equal or different WTP to access the recreation site ($CTCM\_WTP\_r = CTCM\_WTP\_s$).

With regard to test (1), panel (1) of table 6 shows that the traditional unitary travel-cost model and the collective travel-cost model give significantly different WTP estimates at the 5% statistical level. The traditional unitary travel-cost model, which does not consider the intra-household allocation of resources and assumes that all the resources are pooled, overstates the respondent's WTP.[16]

[TABLE 6 ABOUT HERE]

With regard to test (2), the null hypothesis of no difference in WTP between the two spouses, we select households with only two family members to avoid the inclusion of other family members in the spouse WTP. This sub-sample comprises 69 observations. We reject the null hypothesis at the 1% statistical level (table 6, panel (2)). The respondent's WTP is significantly higher than the spouse's WTP. This finding implies that the respondent cannot be considered as

[16] We use the Wilcoxon matched-pairs signed rank test. We also estimate a unitary single equation recreation demand model in which the dependent variable is the respondent's number of trips to the site, and we control for the travel cost, demographic and site-specific characteristics (table A2 of the online supplementary appendix). We find that the WTP derived from the unitary single equation model overestimates the respondent's WTP derived from the collective model at the 1% statistical level (table A3, p-value = 0.0001). In addition, we find that the WTP derived from the unitary AIDS overestimates the WTP derived from the single equation demand model, difference significant at the 5% statistical level (table A4, p-value = 0.0155).

the representative individual in the household. Her/his WTP does not represent the WTP of the other household members.[17,18]

Aggregate Welfare Measures

The estimated WTP can be used to show the difference in aggregate welfare measures when we apply the traditional unitary travel-cost model versus the collective travel-cost model. We multiply the average WTP of the respondent by the annual number of visitors to the West Garda Regional Forest, which we assume to be about 300,000 based on information provided by the Tourist office of Brescia province. Our results suggest that using the respondent's mean WTP estimated by the traditional unitary TCM (about 9 euros) yields to an aggregate welfare measure of about 2,700,000 euros while using the respondent's WTP estimated by the CTCM (about 5 euros) yields to an aggregate welfare measure of about 1,500,000 euros. Our results suggest that using the traditional unitary TCM to estimate the average WTP of a visitor to access a recreation site may significantly overestimate aggregate WTP (the aggregate welfare measures are significantly different at the 1% level).

---

[17] The respondent's WTP in panel (2) is significantly higher than the WTP in panel (1) (at the 1% statistical level). This might be due to the fact that in terms of equivalent income, couples are significantly richer than households with more than two household members at the 1% statistical level (15,883 euros versus 11,667 euros).

[18] We also test whether the respondent's WTP estimated by the travel-cost model is significantly different from the individual WTP derived by applying the contingent valuation method. We find that contingent valuation method and travel-cost model do not yield statistically different results when we apply the collective travel-cost model (3.8 euros versus 4.9 euros), while the difference is statistically significant at the 1% level when we apply the traditional unitary travel-cost model (3.8 euros versus 9 euros).

In addition, we perform a second aggregation of the welfare measures where we consider the WTP of both the respondent and the spouse. As in table 6, we focus on households with only two family members to ease the comparison, and to avoid the inclusion of other family members in the spouse WTP. In our sample, about 31% of households are two-member households. We assume that the number of two-member households visiting the site is about 93,000 (i.e., 31% of 300,000). The average respondent's WTP estimated by the traditional unitary TCM for a two-member household is about 10 euros. Thus, the corresponding aggregate welfare measure is about 1,900,000 euros (i.e., $10.3354 \times 2 \times 93{,}000$) if we apply the traditional unitary TCM, which assumes that household members have the same preferences. However, the aggregate welfare measure for two-member households is about 2,000,000 euros (i.e., $(13.3899 + 8.2945) \times 93{,}000$) if we apply the CTCM (panel (2) of table 6). The two aggregate welfare measures are statistically different at the 1% level. This result suggests that the unitary TCM modestly underestimates the aggregate WTP if both household members' WTP is taken into account.

Conclusions

The main contribution of this article to the literature is twofold. First, we formulated and estimated a new model—the "collective travel-cost model" (CTCM)—that applies the collective theory of household behavior originally proposed by Chiappori (1988, 1992) to a recreation setting; and second, we showed how to recover *individual* preferences and welfare measures such as equivalent and compensating variations to infer *individual* willingness-to-pay for a non-market good such as a recreation site, by deducing how resources are allocated within the household.

We found that how resources are distributed within the household reflects significant differences in welfare measures. The traditional TCM, expressed in per capita terms, significantly overstates the willingness-to-pay of the respondent compared to the CTCM. We also found that the respondent and her/his spouse have different willingness-to-pay to access the recreation site. The practice of picking an adult at random from the household, as representative of the preferences of the other family members, is not supported by the recent empirical evidence and economic theory of household behavior. Our results also suggest that using the traditional unitary TCM to estimate the average WTP of a visitor to access a recreation site may significantly overestimate aggregate WTP. However, we find that the unitary TCM modestly underestimates aggregate WTP when we consider the WTP of both the respondent and the spouse in the aggregation. Our empirical finding is consistent with the theoretical result by Ebert (2013). Ebert (2013)'s general framework shows that the sum of the individual WTP is an upper bound for the household WTP since the latter does not distinguish between household members and does not take into account the household's interdependence.

In conclusion, this article shows that the CTCM developed in this study can be used to yield *individual* welfare estimates appropriate for policy analysis of non-market goods to be conducted at the individual level. This approach would allow analysts to provide policy makers with more efficient and accurate estimates of the value of non-market goods. In the future, non-market valuation researchers may consider designing *ad hoc* questionnaires that incorporate the collective perspective, as suggested by the UNECE Commission (2007). In particular, a traditional travel-cost questionnaire should include some additional questions about the monthly household expenditures in leisure and food, the number of annual trips to the recreation site, the travel cost, and the demographic characteristics of both spouses, including their hourly wages.

The expenditure information requested is commonly included in traditional nationally representative surveys such as the U.S. Consumer Expenditure Survey (CE).[19] Bonke and Browning (2009 and 2011) use the Danish Household Expenditure Survey (DHES) to show that it is feasible to ask respondents "who gets what" within the households. However, the inclusion of each household member's information implies that the questionnaire and the duration of the interview will be longer than in traditional travel-cost studies. This might lead to an increase in non-response bias and measurement error.[20] Another open research question involves whether our method is robust to which member of the household is selected to complete the survey. There might be a bias due to the fact that a household member sometimes travels without a spouse and is therefore likely to be the one with the strongest preferences for the site.[21] Further empirical evidence is needed to test the magnitude of this bias.

Future research should also consider the theoretical issue of the potential for corner solutions in the labor market, and should relax two assumptions: first, the assumption that the utility function of the spouse refers to the joint utility function of the spouse and her/his children; and second, that the model does not take into account the behavior of groups consisting of

[19] The Consumer Expenditure Survey provides information on the buying habits of American consumers and their characteristics, including data on their expenditures and income (http://www.bls.gov/cex).

[20] In our study, respondents spent about thirty minutes answering all the questions in the questionnaire, which can be considered an acceptable duration for in-person interviews. However, we cannot test the magnitude of the non-response bias since we do not have a comparable sub-sample of respondents who completed the same questionnaire without the expenditure and the spouse-specific questions, as in traditional travel-cost studies. Further empirical evidence is needed to test the magnitude of this bias.

[21] We thank the editor for raising these concerns.

individuals from different households who have chosen to take a trip together. Relaxing these assumptions will be the subject of forthcoming research (Morey and Kritzberg 2012).

References

Adamowicz, W., M. Hanemann, J. Swait, R. Johnson, D. Layton, M. Regenwetter, T. Reimer, R. Sorkin. 2005. Decision Strategy and Structure in Households: A Groups Perspective. *Marketing Letters* 16(3):387–399.

Arias, C., V. Atella, R. Castagnini, and F. Perali. 2003. Estimation of the Sharing Rule between Adults and Children and Related Equivalence Scales within a Collective Consumption Framework. in *Household Behaviour, Equivalence Scales, Welfare and Poverty*, C. Dagum and G. Ferrari, eds., New York: Physica-Verlag.

Arora, N., and G. Allenby. 1999. Measuring the Influence of Individual Preference Structures in Group Decision Making. *Journal of Marketing Research* 36(4):476–487.

Ashraf, N. 2009. Spousal Control and Intra-Household Decision Making: An Experimental Study in the Philippines. *American Economic Review* 99(4):1245-1277.

Bargain, O., and O. Donni. 2007. A Theory of Child Targeting. IZA Discussion Papers 2669, Institute for the Study of Labor (IZA).

Barnett, W. A., and A. Serletis. 2008. Consumer Preferences and Demand Systems. *Journal of Econometrics* 147(2):210-224.

Barten, A.P. 1964. Family Composition, Prices and Expenditure Patterns. in P. Hart, G. Mills and J.K. Whitaker, eds., *Econometric Analysis for National Economic Planning: 16th Symposium of the Colston Society*. London: Butterworth.

Barten, A.P. 1969. Maximum Likelihood Estimation of a Complete System of Demand Equations. *European Economic Review* 1(1):7-73.

Bateman, I., and A. Munro. 2009. Household Versus Individual Valuation: What's the Difference? *Environmental and Resource Economics* 43(1):119-135.

Bhat, C.R. and R.M. Pendyala. 2005. Modeling Intra-household Interactions and Group Decision-making. *Transportation* 32(5):443-448.

Becker, G.S. 1965. A Theory of the Allocation of Time. *Economic Journal* 75(299):493-517.

Beharry-Borg N., D.A. Hensher, and R. Scarpa. 2009. An Analytical Framework for Joint vs Separate Decisions by Couples in Choice Experiments: The Case of Coastal Water Quality in Tobago. *Environmental and Resource Economics* 43(1):95-117

Bergstrom, T. 1989. Love and Spaghetti, the Opportunity Cost of Virtue. *Journal of Economic Perspectives* 3(2):165-173.

Bernheim, B.D., and O. Stark. 1988. Altruism within the Family Reconsidered: Do Nice Guys Finish Last? *American Economic Review* 78(5):1034-1045.

Bockstael, N.E., and K.E. McConnell. 2006. *Environmental and Resource Valuation with Revealed Preferences: A Theoretical Guide to Empirical Models*, Dordrecht, The Netherlands: Springer.

Bockstael, N.E., I.E. Strand, K.E., and W.M. Hanemann. 1987. Time and the Recreation Demand Model. *American Journal of Agricultural Economics* 69(2):293-302.

Bonke, J., and M. Browning. 2009. The Allocation of Expenditures within the Household: A New Survey. *Fiscal Studies* 30(3/4):461-481.

Bonke, J., and M. Browning. 2011. Spending on Children: Direct Survey Evidence. *Economic Journal* 121(554):F123–F143.

Bradley, M., and P. Vovsha. 2005. A Model for Joint Choice of Daily Activity Pattern Types of Household Members. *Transportation* 32(5):545–571.

Browning, M., and P.A. Chiappori. 1998. Efficient Intra-Household Allocations, A General Characterization and Empirical Tests. *Econometrica* 66(6):1241-1278.

Browning, M., F. Bourguignon, P.A. Chiappori, and V. Lechene. 1994. Incomes and Outcomes: a Structural Model and some Evidence from French Data. *Journal of Political Economy* 102(6):1067-1096.

Browning, M., P.A. Chiappori, and A. Lewbel. 2013. Estimating Consumption Economies of Scale, Adult Equivalence Scales, and Household Bargaining Power. *Review of Economic Studies*, doi:10.1093/restud/rdt019: in press.

Browning, M., P.A. Chiappori, and V. Lechene. 2006. Collective and Unitary Models: A Clarification. *Review of Economics of the Household* 4(1):5-14.

Browning, M., P.A. Chiappori, and Y. Weiss. 2010. *Family Economics,* Cambridge University Press, Cambridge, in press.

Calfee, J., and C. Winston. 1998. The Value of Automobile Travel Time: Implications for Congestion Policy. *Journal of Public Economics* 69(1):83-102.

Chen, Z. and F. Woolley. 2001. A Cournot-Nash Model of Family Decision Making. *Economic Journal* 111(474):722–748.

Chiappori, P.A. 1988. Rational Household Labor Supply. *Econometrica* 56(1):63-89.

Chiappori, P.A. 1992. Collective Labor Supply and Welfare. *Journal of Political Economy* 100(3):191-209.

Chiappori, P.A. 1997. Introducing Household Production in Collective Models of Labor Supply. *Journal of Political Economy* 105(1):191-209.

Chiappori, P.A., and I. Ekeland. 2009. The Microeconomics of Efficient Group Behavior: Identification. *Econometrica* 77(3):763-799.

Chiappori, P.A., B. Fortin, and G. Lacroix. 2002. Marriage, Market, Divorce Legislation, and Household Labor Supply. *Journal of Political Economy* 110(1):37-72.

Clawson, M. 1959. *Method for Measuring the Demand for, and Value of, Outdoor Recreation*. Resources for the Future, 10, Washington, DC.

Deaton, A., and J.J. Muellbauer. 1980. The Almost Ideal Demand System. *American Economic Review* 70(3):312-326.

Decrop, A. 2005. Group Processes in Vacation Decision-Making. *Journal of Travel & Tourism Marketing* 18(3):23-36.

Dosman, *D*., and W. Adamowicz. 2006. Combining Stated and Revealed Preference Data to Construct an Empirical Examination of Intrahousehold Bargaining. *Review of Economics of the Household* 4(1):15-34.

Duflo, E. 2000. Child Outcomes in Africa. Child Health and Household Resources in South Africa: Evidenced from the Old Age Pension Program. *American Economic Review: Papers and Proceedings* 90(2):393-398.

Dunbar, G., A. Lewbel, and K. Pendakur. 2013. Children's Resources in Collective Households: Identification, Estimation and an Application to Child Poverty in Malawi. *American Economic Review* 103(1):438-471.

Ebert, U. 2009. Household Willingness To Pay and Income Pooling: A Comment. *Economics Letters* 107(1):7-9.

Ebert, U. 2013. The Relationship between Individual and Household Measures of WTP and WTA. *Social Choice and Welfare* 40(2):367-390.

Evans, M.F., C. Poulos, and V.K. Smith. 2011. Who Counts in Evaluating the Effects of Air Pollution Policies on Households? Non-Market Valuation in the Presence of Dependencies. *Journal of Environmental Economics and Management* 62(1):65-79.

Haab, T., and K.E. McConnell. 2002. *Valuing Environmental and Natural Resources: The Econometrics of Non-market Valuation.* New Horizons in Environmental Economics. Edward Elgar Publishers, UK.

Hensher, D.A., J.M. Rose, and I. Black. 2008. Interactive Agency Choice in Automobile Purchase Decisions: The Role of Negotiation in Determining Equilibrium Choice Outcomes. *Journal of Transport Economics and Policy* 42(2):269–296.

Hotelling, H. 1949. Letter, In: *An Economic Study of the Monetary Evaluation of Recreation in the National Parks*, Washington, DC: National Park Service.

Kaoru, Y. 1995. Measuring Marine Recreation Benefits of Water Quality Improvements by the Nested Random Utility Model. *Resource and Energy Economics* 17(2):119-136.

Koc, A.A. and S. Alpay. 2003. Estimation of Complete Demand System under Data Limitation. *Eastern European Economics* 41(3):70-86.

Kooreman, P. and A. Kapteyn. 1990. On the Empirical Implementation of some Game Theoretic Models of Household Labor Supply. *Journal of Human Resources* 25(4):584-598.

Kozak, M., and T. Duman. 2012. Family Members and Vacation Satisfaction: Proposal of a Conceptual Framework. *International Journal of Tourism Research* 14(2):192-204.

Lee, C.K.C., and S.E. Beatty. 2002. Family Structure and Influence in Family Decision Making. *Journal of Consumer Marketing* 19(1):24-41.

Lewbel, A. 1985. A Unified Approach to Incorporating Demographic or other Effects into Demand System. *Review of Economic Studies* 70(1):1-18.

Lindhjem, H., and S. Navrud. 2009. Asking for Individual or Household Willingness to Pay for Environmental Goods? Implication for Aggregate Welfare Measures. *Environmental and Resource Economics* 43(1):11-29.

Lise, J., and S. Seitz. 2011. Consumption Inequality and Intra-Household Allocations. *Review of Economic Studies* 78(1):328-355.

Lundberg, S. 1988. Labor Supply of Husbands and Wives: A Simultaneous Equations Approach. *Review of Economics and Statistics* 70(2): 224-235.

Lundberg, S., and R. Pollak. 1993. Separate Spheres Bargaining and the Marriage Market. *Journal of Political Economy* 101(6):988-1010.

Lundberg, S., and R. Pollak. 2003. Efficiency in Marriage. *Review of Economics of the Household* 1(3):153-167.

Manser, M., and M. Brown. 1980. Marriage and Household Decision-Making: A Bargaining Approach. *International Economic Review* 21(1):31-44.

McConnell, K.E. 1999. Household Labor Market Choices and the Demand for Recreation. *Land Economics* 75(3):466-477.

McElroy, M., and M.J. Horney. 1981. Nash-bargained Household Decisions: Toward a Generalization of the Theory of Demand. *International Economic Review* 22(2):333-349.

Menon, M., and F. Perali. 2012. The Sharing Rule: Where Is It?. Working Paper 16, Department of Economics, University of Verona.

Morey, E.R. 1981. The Demand for Site-Specific Recreational Activities: A Characteristics Approach. *Journal of Environmental Economics and Management* 8(4):245-271.

Morey, E.R. 1984. The Choice of Ski Areas: Estimation of a Generalized CES Preference Ordering with Characteristics. *Review of Economics and Statistics* 66(4):584-590.

Morey, E.R., W. Breffle, and P. Greene. 2001. Two Nested Constant-Elasticity-of-Substitution Models of Recreational Participation and Site Choice: An “Alternatives” Model and an “Expenditures” Model. *American Journal of Agricultural Economics* 83(2):414-427.

Morey, E.R., and D. Kritzberg. 2012. It’s Not Where You Do It, It’s Who You Do It With? *Journal of Choice Modelling* 5(3):176-191.

Morey, E.R., and M. Thiene. 2012. A Parsimonious, Stacked Latent-Class Methodology for Predicting Behavioral Heterogeneity in Terms of Life-Constraint Heterogeneity. *Ecological Economics* 74:130-144.

Morey, E.R., D. Waldman, D. Assane, and D. Shaw. 1995. Searching for a Model of Recreation Demand that Admits Boundary and Interior Solutions. *American Journal of Agricultural Economics* 77(1):129-131.

Munro, A. 2005. Household Willingness To Pay Equals Individual Willingness To Pay if and Only if the Household Income Pools. *Economics Letters* 88(2):227-230.

Perali, F., and J.P. Chavas. 2000. Estimation of Disaggregated Censored Demand Equations from Large Cross-section Data. *American Journal of Agricultural Economics* 82(4):1022-1037.

Perali, F. 2003. *The Behavioral and Welfare Analysis of Consumption*, Kluwer Academic Publisher, Dordrecht, The Netherlands.

Phaneuf, D.J. 1999. A Dual Approach to Modeling Corner Solutions in Recreation Demand. *Journal of Environmental Economics and Management* 37(1):85-105.

Pollak, R.A., and T.J. Wales. 1978. Estimation of Complete Demand Systems from Household Budget Data: The Linear and Quadratic Expenditure Systems. *American Economic Review* 68(3):348-59.

Quiggin, J. 1998. Individual and Household Willingness-to-pay for Public Goods. *American Journal of Agricultural Economics* 80(1):58-63.

Shonkwiler, J.S., and S.T. Yen. 1999. Two-Step Estimation of a Censored System of Equations. *American Journal of Agricultural Economics* 81(4):972-982.

Smith, V.K., and G. Van Houtven. 1998. Non-market Valuation and the Household. Discussion Paper 98-31, Resources for the Future.

Smith, V.K., and G. Van Houtven. 2004. Recovering Hicksian Consumer Surplus within a Collective Model: Hausman's Method for the Household. *Environmental and Resource Economics* 28(2):153-167.

Strand, J. 2007. Public-good Valuation and Intrafamily Allocation. *Environmental and Resource Economics* 38(4):527-543.

Thomas, D. 1990. Intra-household Resource Allocation: An Inferential Approach. *Journal of Human Resources* 25(4):635-664.

Thomas, D., D. Contreras, and E. Frankenberg. 1997. Distribution of Power within the Household and Child Health. Manuscript, RAND Corp., Santa Monica, CA; Univ. of California, Los Angeles.

Timmermans, H.J.P. 2008. Analyses and Models of Household Decision Making Processes. In: Proceedings of the 11th International Conference on Travel Behaviour Research, Kyoto, August 16–20.

Timmermans, H.J.P., and J. Zhang. 2009. Modeling Household Activity Travel Behavior: Examples of State of the Art Modelling Approaches and Research Agenda. *Transportation Research Part B* 43(2):187-190.

Tinson, J., C. Nancarrow, and I. Brace. 2008. Purchase Decision Making and the Increasing Significance of Family Types. *Journal of Consumer Marketing* 25(1):45–56.

Udry, C. 1996. Gender, Agricultural Production, and the Theory of the Household. *Journal of Political Economy* 104(5):1010-1046.

UNECE. 2007. Rural Households' Livelihood and Well-Being - Statistics on Rural Development and Agriculture Household Income. United Nations, Geneva.

von Haefen, R., D. Phaneuf, and G. Parsons. 2004. Estimation and Welfare Calculation with Large Demand Systems. *Journal of Business and Economic Statistics* 22(2):194-205.

Vovsha, P., E. Petersen, and R. Donnelly. 2003. Explicit Modeling of Joint Travel by Household Members: Statistical Evidence and Applied Research. In: Proceedings of the 82nd Annual Meeting of Transportation Research Board, Washington DC.

Zhang, J. and A. Daly. 2008. Group Behavior Modeling. In: Proceedings of the 11th International Conference on Travel Behaviour Research, Kyoto, August 16–20.

Zhang, J., M. Kuwano, B. Lee, and A. Fujiwara. 2009. Modeling Household Discrete Choice Behavior Incorporating Heterogeneous Group Decision-Making Mechanisms. *Transportation Research Part B* 43(2):230-250.

Table 1. Variables' Definition

Variable	Description
Shares	
food_hh	Household annual expenditure share in food
Garda_trips_r	Respondent's annual expenditure share in trips to West Garda Regional Forest
Garda_trips_s	Spouse's annual expenditure share in trips to West Garda Regional Forest
other_trips_hh	Household annual expenditure share in other recreation trips
other_leisure_hh	Household annual expenditure share in other leisure
other_goods_hh	Household annual expenditure share in other goods
Prices in Euros	
income	Household annual income
log*p*(food_hh)	Ln(household annual expenditure in food)
log*p*(Garda_trips_r)	Ln(respondent's annual expenditure in trips to West Garda Regional Forest)
log*p*(Garda_trips_s)	Ln(spouse's annual expenditure in trips to West Garda Regional Forest)
log*p*(other_trips_hh)	Ln(household annual expenditure in trips to other recreation sites)
log*p*(other_leisure_hh)	Ln(household annual expenditure in other leisure)
log*p*(other_goods_hh)	Ln(household annual expenditure in other goods)
Demographic variables	
male	=1 if male; 0 if female
age	Age / 10
education	Number of years of school /10
family size	Number of household members
children_dummy	= 1 if there are children < 12 years old in the household; 0 otherwise

Italian	= 1 if Italian; 0 otherwise
visit duration	Number of days of visit to West Garda Regional Forest
Sharing rule's regressors	
number of children	Number of children in the household
log(wage)	Ln(wage)
hunt_fish*no_family	Interaction term: hunt_fish = 1 if hunter or fisherman; 0 otherwise; no_family = 1 if travelling without family members; 0 otherwise

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
Shares				
food_hh	0.2602	0.1485	0.0321	0.7692
Garda_trips_r	0.0105	0.0182	0.0002	0.1751
Garda_trips_s	0.0024	0.0082	0.0000	0.1039
other_trips_hh	0.0027	0.0041	0.0000	0.0231
other_leisure_hh	0.0915	0.0715	0.0010	0.4689
other_goods_hh	0.6328	0.1814	0.0476	0.9464
Expenditure and prices in Euros				
Income/1000	25.2083	13.5262	7.4370	67.4906
log*p*(food_hh)	8.4964	0.4623	7.2402	9.6482
log*p*(Garda_trips_r)	3.5872	1.1810	0.0324	6.8009
log*p*(Garda_trips_s)	3.1334	0.8982	0.9487	6.4838
log*p*(other_trips_hh)	3.1157	1.1194	0.1865	6.0610
log*p*(other_leisure_hh)	7.2969	0.8403	3.7213	9.7615
log*p*(other_goods_hh)	9.4809	0.8215	6.4293	10.9347
Demographic variables				
male	0.6178	0.4870	0	1
age	4.4418	1.1330	2.2	7.7
education	1.2342	0.4241	0.5	2.1
family size	3.2489	1.0692	2	7
children_dummy	0.3333	0.4725	0	1

Italian	0.7822	0.4137	0	1
visit duration	5.6133	10.0772	1	90
Sharing rule's regressors				
number of children	0.5067	0.8405	0	4
log(wage)	2.5213	0.5115	1.3541	4.0622
hunt_fish*no_family	0.0578	0.2338	0	1

Note: Number of observations = 225.

Table 3. Estimates of the Collective Almost Ideal Demand System

		Dependent Variables: Expenditure shares											
Variable		food_hh		Garda_trips_r		other_goods_hh		Garda_trips_s		other_trips_hh		other_leisure_hh	
		Param.	Std.Err.	Param.	Std. Err.	Param.	Std. Err.	Param.	Std. Err.	Param.	Std. Err.	Param.	Std. Err.
Constant	$\hat{\alpha}_k$	0.2745 ***	0.0664	0.0477	0.0314	0.4138 ***	0.0710	0.0075	0.0291	0.0267 ***	0.0101	0.2298 ***	0.0061
Prices													
log*p*(food_hh)	$\hat{\gamma}_{kl}$	0.1780 ***	0.0071	-0.0017	0.0023	-0.1513 ***	0.0044	0.0001	0.0021	-0.0019 **	0.0009	-0.0232	0.0584
log*p*(Garda_trips_r)				0.0037 **	0.0314	-0.0013	0.0017	0.0000	0.0010	0.0010 **	0.0004	-0.0017	0.0032
log*p*(other_goods_hh)						0.1962 ***	0.0039	-0.0032 **	0.0015	-0.0019 ***	0.0006	-0.0385 ***	0.0016
log*p*(Garda_trips_s)								0.0038 ***	0.0011	-0.0003	0.0004	-0.0004	0.0025
log*p*(other_trips_hh)										0.0032 ***	0.0004	-0.0001	0.0013
log*p*(other_leisure_hh)												0.0639 ***	0.0027
	$\hat{\beta}_k^r$	-0.0163	0.0108	0.0205 ***	0.0050	-0.0093	0.0100	0.0103 **	0.0046	0.0028 *	0.0016	-0.0080 ***	0.0005
	$\hat{\beta}_k^s$	-0.0140 *	0.0081	0.0029	0.0053	0.0088	0.0101	-0.0018	0.0043	0.0003	0.0013	0.0038	0.0110
Demographic variables													
male	$\hat{\tau}_{km}$	0.0035	0.0049	0.0063 ***	0.0019	-0.0075	0.0049	0.0040 *	0.0023	-0.0002	0.0008	-0.0061	0.0074
age		-0.0030	0.0023	0.0000	0.0008	0.0019	0.0023	0.0004	0.0011	-0.0002	0.0004	0.0009	0.0052
education		-0.0043	0.0063	0.0003	0.0022	0.0071	0.0061	-0.0008	0.0031	0.0008	0.0010	-0.0031	0.0024
family size		0.0027	0.0074	0.0150 ***	0.0033	-0.0191 **	0.0095	0.0107 ***	0.0033	0.0026 *	0.0014	-0.0119 *	0.0067
children_dummy		-0.0003	0.0084	0.0106 **	0.0043	-0.0082	0.0106	0.0147 ***	0.0042	0.0015	0.0014	-0.0183 ***	0.0079

Italian	0.0051	0.0078	0.0009	0.0030	-0.0048	0.0079	0.0039 *	0.0035	0.0018	0.0013	-0.0069	0.0086
visit duration	-0.0029	0.0025	0.0061 ***	0.0009	-0.0048 **	0.0025	0.0011	0.0013	-0.0008	0.0005	0.0013	0.0074

Notes: hh: household; r: respondent; s: spouse; $\hat{\alpha}_k$, $\hat{\gamma}_{kl}$, $\hat{\beta}_k^r$, $\hat{\beta}_k^s$, and $\hat{\tau}_{km}$ are the estimated parameters of the collective share equations (16). * Significant at the 10% level; ** 5% level; *** 1% level. Number of observations = 225. See table 1 for variable definition.

Table 4. Income, Demographic and Compensated Price Elasticities

	food_hh	Garda_trips_r	other_goods_hh	Garda_trips_s	other_trips_hh	other_leisure_hh
Income elasticities						
income	0.9422***	1.6824***	1.0039***	1.4674***	1.2264***	0.9970***
	(0.0021)	(0.0409)	(0.0002)	(0.0436)	(0.0125)	(0.0010)
Compensated own and cross price elasticities						
	food_hh	Garda_trips_r	other_goods_hh	Garda_trips_s	other_trips_hh	other_leisure_hh
food_hh	-0.0451***	0.016***	0.0808***	0.0094***	-0.0009**	0.0004
	(0.0158)	(0.0008)	(0.0096)	(0.0004)	(0.0004)	(0.0061)
Garda_trips_r	0.0090	-0.8506***	-0.1388***	-0.0525***	0.0552***	-0.1053**
	(0.0008)	(0.0081)	(0.0486)	(0.0043)	(0.0030)	(0.0117)
other_goods_hh	0.0186***	0.0114***	-0.0542***	0.0003	0.0021***	0.0266***
	(0.0096)	(0.0008)	(0.0060)	(0.0004)	(0.0003)	(0.0037)
Garda_trips_s	0.1338***	-0.1291***	-0.7018***	-0.3177***	-0.0718***	-0.0777***
	(0.0004)	(0.0127)	(0.1172)	(0.0586)	(0.0067)	(0.0144)
other_trips_hh	-0.1618***	0.1547***	0.0296	-0.0711***	-0.3685***	0.0422***

	(0.0004)	(0.0074)	(0.0307)	(0.0043)	(0.0335)	(0.0036)
other_leisure_hh	-0.0025	-0.0015	0.2171***	0.0015***	0.0045***	-0.1754***
	(0.0061)	(0.0010)	(0.0164)	(0.0005)	(0.0003)	(0.0313)

Demographic elasticities

	food_hh	Garda_trips_r	other_goods_hh	Garda_trips_s	other_trips_hh	other_leisure_hh
male	0.0077***	0.5699***	-0.0119***	0.8508***	0.0007*	-0.0738***
	(0.0003)	(0.0356)	(0.0002)	(0.0741)	(0.0005)	(0.0036)
age	-0.0118***	0.004***	0.0029***	0.0812***	-0.0428***	0.0103***
	(0.0004)	(0.0003)	(0.0001)	(0.0069)	(0.0023)	(0.0005)
education	-0.0156***	0.0085***	0.0112***	-0.172***	0.1539***	-0.0356***
	(0.0005)	(0.0009)	(0.0002)	(0.0152)	(0.0082)	(0.0017)
family size	-0.0072***	1.3971***	-0.0303***	2.2902***	0.6042***	-0.1434***
	(0.0004)	(0.0872)	(0.0006)	(0.1993)	(0.0330)	(0.0069)
children_dummy	-0.0161***	1.0220***	-0.0131***	3.0172***	0.3698***	-0.2146***
	(0.0006)	(0.0638)	(0.0002)	(0.2618)	(0.0202)	(0.0103)
Italian	0.0160***	0.1274***	-0.0077***	0.8053***	0.3817***	-0.0808***

	(0.0006)	(0.0083)	(0.0001)	(0.0700)	(0.02070)	(0.0039)
visit duration	-0.0158***	0.5262***	-0.0077***	0.2635***	-0.1333***	0.0142***
	(0.0006)	(0.0326)	(0.0001)	(0.0230)	(0.0071)	(0.0007)

Notes: hh: household ; r: respondent; s: spouse. Bootstrapped standard errors are in parentheses (number of draws: 10,000). * Significant at the 10% level; ** 5% level; *** 1% level. Number of observations = 225. See table 1 for variable definition.

Table 5. Sharing Rule Parameter Estimates

	Parameter		Std. Error
number of children	-0.4395	***	0.1384
log(wage)	0.6065	**	0.2826
hunt_fish*no_family	0.1671		0.2477

Notes: Number of observations = 225. ** Statistically significant at the 5% level; *** Statistically significant at the 1% level. See table 1 for variable definition.

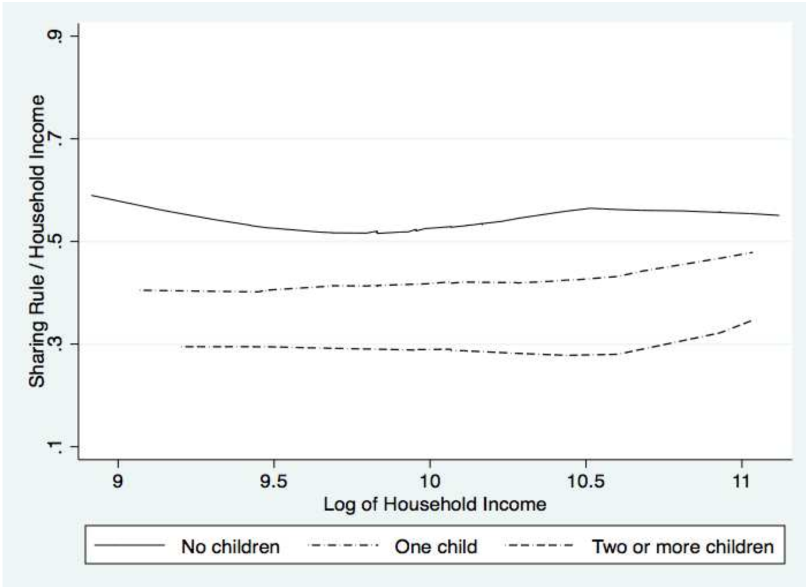

Figure 1. Relative sharing rule by number of children

Table 6. Welfare Comparisons

Panel (1) – Comparison between traditional unitary TCM and CTCM.

H_0: TCM_WTP_r = CTCM_WTP_r

		Mean	Std. Error
TCM_WTP_r	Respondent's WTP (traditional unitary travel-cost model)	8.9690	1.6140
CTCM_WTP_r	Respondent's WTP (collective travel-cost model)	4.9369	0.4324

Notes: Values are in euros. p-value = 0.0129. Number of observations = 225.

Panel (2) – Comparison between respondent's and spouse's WTP.

H_0: CTCM_WTP_r = CTCM_WTP_s

		Mean	Std. Error.
CTCM_WTP_r	Respondent's WTP (collective travel-cost model)	13.3899	0.6877
CTCM_WTP_s	Spouse's WTP (collective travel-cost model)	8.2945	0.2821

Notes: Values are in euros. p-value = 0.0000. Sub-sample of couples without children. Number of observations = 69.