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Roberto Martinez-Espineira and Joe Amoako-Tuffour

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EERI
Economics and Econometrics Research Institute
Avenue de Beaulieu
1160 Brussels
Belgium

Tel: +322 299 3523
Fax: +322 299 3523
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Multi-destination and multi-purpose trip effects in the analysis of the demand for trips to a remote recreational site.

Running Title: Multi-destination and Multi-purpose trip effects

Roberto Martínez-Espiñeira* and Joe Amoako-Tuffour
Economics, St Francis Xavier University, PO Box 5000, Antigonish, NS, Canada

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Abstract

One of the basic assumptions of the travel cost method for recreational demand analysis is that the travel cost is always incurred for a single purpose recreational trip. Several studies have skirted around the issue with simplifying assumptions and dropping observations considered as non-conventional holiday-makers or as non-traditional visitors from the sample. The effect of such simplifications on the benefit estimates remains conjectural. Given the remoteness of notable recreational parks, multi-destination or multi-purpose trips are not uncommon. This paper examines the consequences of allocating travel costs to a recreational site when some trips were taken for purposes other than recreation and/or included visits to other recreational sites. Using a multi-purpose weighting approach on data from Gros Morne National Park, Canada, we conclude that a proper correction for multi-destination or multi-purpose trip is more of what is needed to avoid potential biases in the estimated effects of the price (travel-cost) variable and of the income variable in the trip generation equation.

Keywords: Travel cost method; multi-purpose trips; multi-destination trips; count data; consumer surplus, endogenous stratification

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Introduction

The most common technique used to value access to the recreational sites is the Travel Cost Method (TCM). The TCM assumes that travel costs incurred to reach a site can be used to approximate the surrogate prices for recreational experiences. A basic assumption is that the travel cost is always incurred for a single purpose recreational trip (Haspel and Johnson 1982; Loomis et. al 2000).

*Corresponding author: Department of Economics, St Francis Xavier University, PO Box 5000, Antigonish, Nova Scotia, Canada B2G 2W5; Tel: 1-902 867 5443. Fax: 1-902 867 3610. E-mail: rmespi@stfx.ca.

That is why the TCM is best-suited to sites which attract only day-trip visitors. In practice, this is not always the case. How to allocate travel costs for trips involving multiple destinations and/or taken for multiple purposes in recreational demand analysis remains an intractable problem, since it involves in essence a problem of allocating joint costs (e.g. Freeman 1993, p. 447; Loomis et al. 2000). Several studies have skirted around the issue with simplifying assumptions that the cost were incurred exclusively to visit a single site, or by excluding those visitors considered as holiday-makers and other non-traditional visitors from the sample (e.g. Smith and Kopp 1980; Loomis and Walsh 1997). Given the remoteness of recreational sites, it is likely that many visitors, especially those traveling from distant communities, will take trips for multiple purposes, including, but not limited to, visiting other recreational sites.

The consequences of not recognizing the multi-destination or multi-purpose nature of recreational travel in the valuation of recreational benefits remain conjectural. Excluding multi-purpose or multi-destination visitors may bias the sample considerably, especially in terms of the demographic and socio-economic characteristics of visitors. *A priori*, the exclusion is likely to underestimate the average consumer surplus and therefore the benefits associated with a site. At the policy level, one consequence is the downgrading of service facilities at the site. On the other hand, simply treating multi-purpose and multi-site trips as if they were single purpose visits to the site concerned will bias the consumer surplus estimate upwards and possibly lead to an overprovision of services at the site.

This paper examines the consequences of allocating travel costs to a recreational site when the trip was taken for purposes other than recreation and/or included visits to other recreational sites. With the benefit of survey data which elicited information on the visitors' decision-making before making the trip, we examine how travel costs may be allocated according to the influence a site may have had in the decision-making process. In particular, we weighted the travel costs for each visitor according to the stated influence Gros Morne National Park had in their decision to vacation in Newfoundland and Labrador, Canada. It may be useful to clarify that the Canadian Province of Newfoundland and Labrador is made up of Newfoundland, an island, and Labrador, which is in the mainland. When relevant, we will use "Newfoundland" when we refer to the insular part of the province, where the studied site is located.

In the next section of the paper, we outline the Travel Cost Method and its application to a single site. This is followed in Section 2 by a review of the issue of multi-purpose and multi-site trips.

The methodology of the survey, the data collection procedures, and data description are included in Section 3, while the description of the variables used for the estimation follows in Section 4. The econometric and estimation issues are dealt with in Section 5 followed by the estimation results in Section 6 and then by the Conclusions.

1 The travel cost method

The Travel Cost Method (TCM) is often used to assess the value of protected forests, national parks, lakes, and other public areas used for recreational purposes that require most users to travel to the site. The method's basic premise is that visitors perceive and respond to changes in travel costs to the site just as they would perceive and respond to changes in an entry fee, so the number of trips to a recreation site should decrease with increases in distance traveled and other factors that raise the total travel cost. This negative relationship can be used to estimate the total benefits derived by visitors and under certain assumptions extrapolated to the general population. It is the weak complementarity (Mäler 1974) of the marketed goods and services required to get to and to enjoy the site that makes it possible to estimate a demand curve for the site and, from it, a measure of the benefit society derives from the site. In this sense, it is clear that the measure of value calculated with the TCM is a measure of only the user value of the site. Examples of the application of the method to value national parks include Beal (1995) and Liston-Heyes and Heyes (1999).

The first step in a Travel Cost study (estimating a trip generating function) can involve one of two types of functions: one based on an individual model, the other based on a zonal model. The type of function determines the dependent variable, which is either the number of trips made by individuals or the number of trips made by those living in a geographical zone. In either case, the independent variables describe the costs of travel. Socioeconomic characteristics of the individuals (or the zone of origin) can also be included, such as zonal populations, socioeconomic characteristics of study participants, information concerning substitute sites, environmental quality indicators, etc. The zonal model used to be more common, but it has now been mostly replaced by the individual approach. The latter requires a more labor-intensive data collection process, as information on all the relevant variables must be collected from each visitor, which increases the length of the questionnaire and the cost of the survey. The individual version of the travel cost method is also more involved analytically, but it is favored in the technical literature, because it yields more precise results than the simple zonal model.

Many aspects of the Travel Cost Method have been the object of critique and subject to extensive research during the last few decades. For example, a rather difficult issue when designing a Travel Cost study is the treatment of the opportunity cost of time. A companion paper by Amoako-Tuffour and Martínez-Espiñeira (2008) focuses on addressing this issue specifically for the case of visits to Gros Morne. In this paper, however, and as explained in Section 4, we adopt a simple accounting approach to the valuation of travel time, since we chose to focus in the present contribution only on the issue of the allocation of travel costs for trips involving multiple destinations and/or taken for multiple purposes. This problem constitutes another intractable difficulty of the Travel Cost Method and is the subject of the next section.

2 Multi-purpose/Multi-site trips

Another intractable difficulty, and the one that constitutes the focus of the present contribution, has to do with the allocation of travel costs for trips involving multiple destinations and/or taken for multiple purposes. This is because a standard assumption that allows using the travel cost faced by a visitor to a site as a valid proxy for the price of accessing a site is that the travel cost be incurred exclusively to visit that site (Freeman 1993, p. 447). That is, the single-site TCM is based on assuming that travel is for a single purpose (recreation) and to a single site, with the visitor deciding to take her trip to the site before leaving home, traveling directly from home to the site and returning directly home (Loomis et al. 2000). This assumption makes it reasonable to allocate all the travel expenses to the valuation of the site concerned. For this reason, the TCM is best-suited to the valuation of sites that attract only or mainly day-trip visitors.

However, many sites, especially remote ones, such as Gros Morne, will probably be visited by people who are on holiday for an extended time period, or who stop at the site without making the trip exclusively for the purpose of visiting it. Including all the travel costs of the latter visitor seems inappropriate, while including only the local travel costs of the former would also be incorrect. Allocating travel costs among multiple sites (and/or splitting it according to multiple purposes) is inherently a problem of allocating joint costs, so, although several alternatives have been proposed, there is no theoretically defensible way to accomplish the task. The same problem arises when the researcher is interested in estimating the economic value of one particular type of outdoor activity undertaken at a given site but can observe only the overall travel cost for the multi-purpose trip to the site, rather than just the specific activity trip (e. g. Loomis et al. 2000; Yeh Haab and Sohngen 2006).

The travel cost method has been, since its first applications, affected by the practical problem of how to handle multi-destination and multi-purpose trips, since many trips to a site of interest fall within at least one of those categories (Clough and Meister 1991; Hwang and Fesenmaier 2003). Although the issue has received considerable attention in the literature, there is so far no consensus on a satisfactory solution. In fact, empirical applications of the TCM rarely consider any correction for potential biases due to multi-destination trips (MDT henceforth) or multi-purpose trips (MPT henceforth).

The problem is often solved by discarding holiday-makers and other non-traditional visitors from the sample (e. g. Smith and Kopp 1980; Common, Bull and Stoeckl 1999), which may well bias many estimates downwards. Omitting MDT visitors from the sample does not necessarily involve any systematic error, as long as the sample is large enough that data availability does not introduce problems. On the other hand, omitting the MDT visitors may substantially decrease the sample size in some cases. However, by only including single destination visitors, the analysis becomes affected by the likely problem that single destination visitors might differ systematically from MDT visitors in terms of their demographic and socio-economic characteristics. That is, the omission of MDT visitors from the sample does not necessarily result in a systematic error or bias in the calculation of welfare measures, but it is likely to. Single-purpose visitors usually live closer to the site considered than MDT and MPT visitors, so the omission of long-distance multi-destination travelers might leave some important influences of demographic variables undetected because of little variation in the sample. This can also influence the shape of the estimated demand curve, and hence the consumer surplus estimate (Kuosmanen, Nillesen, and Wesseler 2004).

Otherwise, visitors on a MPT may be simply treated as if they were respondents on single purpose trips, which can lead to an overestimation of consumer surplus. Alternatively, one can include a trip-type variable among the explanatory variables. This would be a dummy variable indicating if someone was taking part in an extended trip, a day trip, or just stopping in as part of a multi-purpose trip. This would be equivalent to the separate estimation of demand curves for each group, yet another approach to this issue. Another solution, proposed by Bell and Leeworthy

(1990), is to use the number of days of recreation as the dependent variable, and to handle fixed trip costs in addition to daily on-site costs.

For trips involving multiple destinations (MDT), which pose a similar problem, there is no theoretically-acceptable method of allocating travel costs and the researcher must resort to arbitrary methods, so making no correction at all would be preferable according to some authors (Beal 1995; Beal 1998). On the other hand, treating multiple-destination visitors as single destination ones can be seen as equally arbitrary, as pointed out by Kennedy (1998) in his comment to Beal (1995). However, the bulk of the available empirical evidence suggests that ignoring the MDT visitors can lead to a substantial overestimation (Haspel and Johnson 1982) or underestimation of the value of recreational sites (Mendelsohn, Hof, Peterson and Johnson 1992; Loomis et al. 2000).

An alternative way to handle MDT visitors is to follow Mendelsohn et al. (1992), who proposed including all alternative sites, and combinations thereof, in the estimation of the demand function, which accounts for all the substitution and complementarity possibilities. One obvious problem with this approach is that the number of demand equations rises exponentially with the number of sites to be considered, and the information to be collected increases tremendously (Kuosmanen, Nillesen, and Wesseler 2004). In fact, if the number of observations corresponding to each combination of sites is small, the system cannot be estimated (Loomis 2006), which rules out this solution in most empirical analyses. One rare example of an empirical application of this solution is Ortiz, Motta and Ferraz (2001).

Smith (1971) and Bowker and Leeworthy (1998) suggest using only the travel cost from a temporary residence to the site valued when this site is not the main destination for the trip. This solution was also suggested casually by Brown and Plummer (1990). However, as pointed out by Mendelsohn et al. (1992), this approach based on 'marginal prices' implicitly assumes that having the option of making a trip to the secondary destination does not alter the likelihood or the utility of making the trip to the first destination. Additionally, the researcher has no way of knowing which site was chosen first and which second by the visitor. Ulph and Reynolds (1981, p. 203) also remind us that the approach would lead to biases in those cases where a highly regarded site were just a short distance from a secondary stopover.

Finally, the researcher can try to allocate total costs among multiple destinations. One way to do this is to use a quantifiable variable, such as 'nights spent' at each site, as a proxy for their relative importance (Knapman and Stanley 1991; Stoeckl 1993; Yeh et al. 2006). Another approach would be to directly elicit each visitor's preferences about the importance of each site within the trip to allocate the cost. As Bennett (1995) points out, the second approach is much more subjective, but it takes into account that the importance of visits is unlikely to be simply a function of the time spent by the MDT visitor on each destination. For example, it has been found that MDT visitors sometimes state that they valued a given site more than single destination visitors (Sorg, Loomis, Donnelly, and Nelson 1985). More objective approaches such as using the number of nights spent to weight the importance of a site also usually result in low travel cost values associated with long distance travelers, which undermines the logic of the TCM (Beal 1995; Nillesen, Wesseler and Cook 2005). This makes the strategies based on eliciting visitors' preferences the theoretically preferred approaches (Walsh, Johnson, and McKean 1988; Ward and Beal 2000) .

Loomis et al. (2000) find, using a methodology proposed by Parsons and Wilson (1997), which is in essence a simplified version of the approach suggested by Mendelsohn et al. (1992), that mixing single-destination trip visitors and MDT visitors increases the estimated consumer surplus per trip by at least 20% (and to as much as 70%). However, they also found that MDT value differences were not statistically significant, although they could be still policy relevant. The authors also remind us that, even if omitting MDT users may yield an unbiased estimate of per trip consumer surplus, omission of these MDT will result in an underestimate of *total* site benefits. Loomis (2006) also uses Parsons and Wilson (1997)'s approach to investigate the effect of lumping together multiple destination and single destination trips. Loomis (2006) finds that ignoring the distinction between multiple destination trips and single destination trips results in a substantial underestimation of welfare measures, but that the simplified correction, suggested by by Parsons and Wilson (1997), performs well as compared with a stated preference approach, while being much less data and computationally intensive than the one proposed by Mendelsohn et al. (1992).

Kuosmanen et al. (2004) analyze the theoretical effect of MDT on the calculation of consumer surplus estimated by the TCM. They decomposed the MDT effect into two measurable components: the direct effect of the price change, and the indirect effect of the shift of the empirical demand function. These two effects can be visualized by considering that in a linear demand model a downscaling of the price (which is in essence what correcting for the MDT and MPT nature of the trips does) will increase the absolute value of the price coefficient in the *direct* version of the demand curve, while decreasing it in its inverse version, which is the one that is usually depicted graphically. That is, decreasing the price flattens the inverse demand curve, which would increase the consumer surplus if all the observations were rescaled equally. However, since this is not the case (because the travel cost for single purpose/destination trips is not adjusted) there will also be a correction in the intercept of that demand curve, which accounts for the second effect.

Kuosmanen et al. (2004) show that treating MDT as single-destination trips does not involve any systematic upward or downward bias in consumer surplus estimates, because the direct negative effect of a price increase (treating MDT as a single-destination trip) is offset by a shift in the estimated demand curve. However, they warned that ignoring MDT altogether can greatly underestimate or overestimate CS. In their empirical application to Bellenden Kerr National Park in Australia (see also Nillesen et al. 2005) they used ordinal rankings of the alternative MDT sites as a basis for extracting cardinal cost-shares with which to conduct their TCM. Their proposed survey method is described as convenient for respondents, who are only asked to provide ordinal rankings of a small number of alternatives. The complexity of this approach arises, however, when translating the ordinal rankings into cardinal weights.

In this paper we adopt a somewhat similar approach, also based on weighting the price variable in order to adjust for the relative importance of the studied site within the multi-destination/multi-purpose trip. The weights are obtained also from the ordinal responses to a question posed directly to the respondents. Our study differs from the work by Kuosmanen et al. (2004) in that we deal with the individual (rather than the zonal) version of the travel cost method and that we do not use a ranking of several sites but rather a statement of the influence of our single studied site on the decision to take the trip. In this sense, our approach also offers the advantage of simultaneously accounting for the potential issues related to both having multi-destination trips and having multi-purpose trips in the sample.

Furthermore, since we use an ordinal scale (described in Section 4) referring to the influence of the valued site (Gros Morne National Park), we do not face the issue of translating ordinal rankings of the importance of different sites into cardinal cost shares. We simply use the values of the ordinal scale to directly adjust (or weight) the travel costs. We assume that all the visitors interpret the scale equivalently, so the stated values of this scale are reliable for this weighting exercise. This assumption is also made (as noted by Loomis and Ekstrand 1998) to in the context of a similar *weighting exercise* in the valuation literature, namely that of adjusting the responses to willingness to pay questions according to respondent certainty in contingent valuation studies.

3 Data collection

Gros Morne National Park was established in 1973 and identified in 1987 as a UNESCO World Heritage Site, due to its unique geological features. Regarded as one of Canada's most spectacular and unspoiled national parks, it is a key contributor to Newfoundland's appeal as an exotic, high quality wilderness area. About 120,000 visitors come every year to hike in the park and to enjoy the varied and attractive scenery and the opportunities to encounter wildlife (e. g. arctic hare, caribou, and, above all, moose). Other recreational activities include angling, swimming, and whale watching.

An on-site survey of visitors was conducted between June and September 2004. Visitors were intercepted at park entrances and at a series of hotspots within the park. Interviewers were distributed across the park according to a sampling plan developed by Parks Canada, which ensured that visitors from all origins and using different facilities had a known likelihood of being interviewed. The data were therefore not collected randomly, since the sampling plan oversampled visitors from rare origins, so the analysis uses sampling weights to correct for this. Visitors were asked to take with them and mail back a questionnaire after leaving the Park. A total of 3140 questionnaires were administered with 1213 returned, yielding a response rate of 0.386. The format of the survey prevented the use of reminders, since on-site interviewers only asked about zip-codes and postal codes, rather than actual names and addresses. We were satisfied with the relative success of the interviewing effort, since according to Parks Canada representatives, the usual response rate obtained from similar survey efforts is usually lower. We acknowledge, though, that this response rate is relatively low if compared with other similar studies, and cannot make strong claims about the representativeness of the sample. However, whether or not our sample is representative of the whole population of park visitors is not an issue for the present contribution. This is because relative differences in the consumer surplus and in measures of goodness of fit are not affected by low sample response (just the absolute levels of consumer surplus are affected) or the associated issue of non-response bias and because in this paper we are not concerned with generalizing our results to all park visitors, but rather with investigating the effect of alternative ways to deal with MDT and MPT.

The questionnaire included questions on the main reasons for the trip, the number of times the respondent had visited the park in the previous five years, home location, duration of visit, attractions visited, income bracket, travel cost, size and age composition of travel party, and other sites visited during the same holiday.

Within the full sample obtained (N=1213) 18% of the visitors were over 65 years of age, 58% were between 35 and 64 years, 14% in the range of 17 to 34 years and 10.25% were under 17 years. By origin, 41% came from Newfoundland and the other Atlantic provinces, 42% from outside the Atlantic provinces of Canada, 13% from the USA, and 4% from other countries. Most visitors (83%) were from within Canada. The mean income of respondents was $90,000 (in 2004 Canadian dollars). Most visitors (64%) intended this to be a single purpose (vacation or pleasure) trip and about 65% of respondents indicated that Gros Morne National Park either was the main reason or played a major influence in their decision to visit the island. For further details about the survey effort, the questionnaire, and the data set, see Parks Canada (2004a, and 2004b) and D. W Knight Associates (2005).

We dropped from the N = 1213 sample all unusable observations due to item non-response in needed variables other than *income* and *expenses,* for which missing values were imputed and observations referring to trips for which respondents stated a null influence of Gros Morne in the decision to make a trip to Newfoundland or for which information on that variable (*influ*) was missing. This variable is described in more detail in Section 4. The reason why we eliminated from the analysis those observations for which *influ* took the value of zero (which is just equivalent to weighting their travel cost value with a weight of zero, so they would not add to the calculation of consumer surplus at all), because if Gros Morne had no influence in those visitors' decision to make the trip, the logic behind the TCM suggests that their contribution to the value of the site as signalled by their travel cost is null. It is important to stress that this does not mean that the park had no value for those visitors. It could well have existence value for example, but this is not part of the value estimated through the use of the TCM.

This type of elimination is carried out routinely in TCM studies, in a less rigorous manner, by eliminating long-distance travelers, since these travelers are suspected of having a null or at least very low value for what we label *influ* in this study. The advantage provided by our survey is that we can more precisely distinguish between visitors on whose decision to take the trip Gros Morne exerted a null influence and those for whom it exerted at least some influence, independently of their origin. Therefore, we can appropriately weight their contribution to the calculation of consumer surplus, by attaching a weight of zero to the former and a low weight to the latter.

By eliminating the observations with null influence altogether from the sample, we make those observations unavailable also for the regressions that use an unweighted travel cost too, so we make our analysis more comparable to the bulk of the literature, which eliminates observations for which the influence of the site is clearly null.

In intuitive terms, we try to estimate a demand function for trips using the travel cost as a proxy for price and the number of visits as the dependent variable. Those observations whose travel cost value would be adjusted all the way down to zero correspond to visitors who, under the logic of the TCM, paid a null price for their visit, so the values of their characteristics should not enter the estimation of the demand function. In other words, observations from consumers who can get a good for free are not helpful when estimating a demand curve for the good.

It is worth noting one important expected difference between those for whom Gros Morne was not an attractor into the province and the rest of sample: among the former, only 64.58% stated that they had planned to visit Gros Morne before leaving home, while among the rest 93.18% planned to visit Gros Morne before leaving home. This still leaves almost 7% of visitors stating that the park had some influence in their decision to visit the province, but who had not definitely decided to visit the park before leaving home. This could be because: they decided to visit Newfoundland after leaving home, they left home planning to visit Newfoundland and being influenced by the uncertain prospect of visiting Gros Morne, they had another strong reason to visit the province and considered that the park visit, although a planned activity, would not be at all affecting their decision, and/or, hopefully in a minority of cases, they provided inconsistent answers to both questions (about when they had planned to visit the park and how heavily it influenced their decision). With these caveats in mind for the exceptional 7% of cases, these figures confirm that the variable *influ* helps identify very accurately those visitors who should be considered in the estimation of the trip generation function.

The analyses below were based on the resulting subsample containing 985 usable observations, obtained after removing observations for which *influ* was null or missing, summarized in Table 1. A few (slightly over 10%) of these observations presented missing values for *income* and *expenses* which were substituted by the mean values obtained from the complete observations in the rest of the sample. For these observations affected by item nonresponse, we assigned a value of one to the variables *missincome* and/or *missexpenses* respectively, so we could then test the effect of imputing the missing values in the final estimations.

Within this sample (N=985), 83.45% of visitors declared to have taken the trip into Newfoundland for the main reason of "vacation or pleasure"; an additional 7.11% were residents of Newfoundland, while for the rest (slightly less that 10%), the main reason included attending a convention or conference, visiting friends/relatives, or "other reason". However, closer inspection of these further described *other reasons* showed that they could mostly be safely classified within some of the main headings.

{INSERT TABLE 1 ABOUT HERE}

4 Model specification and variable definitions

Within the framework of the individual Travel Cost Method, the single-site demand function for the i_{th} visitor is

$$Y_i = f(TC_i, S_i, D_i, I_i, V_i) \tag{1}$$

where TC_i is travel cost, S_i is information on substitutes sites, D_i represents demographic characteristics of the respondent and the visitor party, I_i is a measure of income, and V_i captures features of the current visit to the park. The variables in Expression 1 were constructed on the basis of answers to the questionnaire and further details on the transformations involved in the construction of most of these variables are available Martínez-Espiñeira and Amoako-Tuffour (2008). Additionally, the full text of the four-page 27-question survey is available upon request.

The dependent variable (Y_i) was constructed as a *person-trip,* the product of the size of the traveling party during the current trip (*partysize*), and the number of times the respondent visited Gros Morne during the previous five years (including the current trip). This type of variable was suggested by Bowker at al. (1996) to ameliorate the lack-of-dispersion affecting the Individual Travel Cost Method (Ward and Loomis 1986). Bhat (2003) also used this variable in the study of the Florida Keys, where group travel by car is very common (Leeworthy and Bowker 1997), as it is in visits to Gros Morne. Note that, following the usual practice in individual TCM studies, we made the implicit simplifying assumption that *partysize*, as well as other variables referring to features of the current trip, took the same value for all the trips made to the park during the five-year period considered. This simplification is necessary, because asking respondents to report values for all their different trips would be too burdensome for them.

Travel cost (*tc*) is measured in CAN$ 1000 per year and was calculated on the basis of the *distance* traveled from the visitor's residence and an assumed cost per Km dependent on the mode of transportation used.

The main aim of this study was the comparative analysis of the effects of handling multipurpose trips in different ways, so we adopted many simplifications commonly applied in the TCM literature to other aspects of the analysis. For example, we used a simple proxy of the cost of time: the round trip time times 1/3 of the wage rate to proxy the opportunity cost of travel (*ttc*). The wage rate was proxied by annual income divided by 1880 hours of work per annum. Travel time was calculated from the estimated travel distance by assuming a driving average speed of 80 Km/hour and a flying average speed of 600 Km/hour. Although more rigorous treatments of travel time have been suggested (e. g. Bockstael, Strand, and Hanemann 1987; Shaw 1992; Larson 1993; McConnell 1999; Shaw and Feather 1999 Larson and Shaikh 2001 2004; McKean et al. 2003) we followed many previous recreation demand analyses by applying a simple *ad-hoc* specification. For further insights on the issue of estimating the cost of travel time for the same study site see Amoako-Tuffour and Martínez-Espiñeira (2008). It should be noted that, although this simple approach has clear limitations, these do not affect the main results of this paper, since, as explained below, our contribution involves the comparison of two approaches to handle multi-purpose and multi-site trips an both of them are affected in the same way by the limitations in the estimation of the cost of travel time. Furthermore, some of the most common approaches to rigorously model the opportunity cost of travel time require information on travel times and time budget shares which were not available from our survey.

The estimated travel cost (*tc*) is divided by *partysize* before adding it to the estimated cost of travel time (*ttc*) to compute the total travel cost to the park, CTC, measured in CAN$ 1000 that acted as a price in Expression 1 (Cesario 1976). Due to the high collinearity between the two measures, it was not possible to enter them separately in the model. Note that this variable did not include any on-site expenses (see variable *expenses* below).

For the main contribution of this paper, the treatment of multisite and multipurpose trips, in this paper we decided to take advantage of one of the questions included in the questionnaire. It reads as follows:

> *On a scale of 0 (zero) to 10, where 0 indicates no influence and 10 indicates the main single reason, how much influence would you say that the Gros Morne National Park area*

had in your decision to vacation in Newfoundland and Labrador? (For NL residents, this refers to your decision to vacation within the province versus opting for a trip outside of the province.)

and it should be noted that the note in brackets applied to 87 observations in our sample (N=985).

With the values of the resulting variable (*influ*) we weighted the travel cost as previously calculated (CTC) for each visitor into the new variable $WCTC$, a *weighted combined travel cost.* The construction of the variable $WCTC$ was simply the result of the following transformation:

$$WCTC = \frac{CTC \cdot \mathit{influ}}{10}$$

In this way, for those visitors for which Gros Morne was a key determinant of their trip the value of travel cost was not reduced (since *influ* took the value of 10 for those visitors), while for those for whom Gros Morne was not a key influence (because they traveled to Newfoundland for other purposes and/or to visit other recreational sites), the travel cost was adjusted downwards (since *influ* took a value of less than 10 for them).

In order to illustrate how the proposed weighting scheme works consider a group of visitors from The Netherlands who flies to attend a wedding in New York, USA. They decide after arriving in the US that while in New York they will visit the Statue of Liberty. It is close by so the cost of reaching it is negligible. Measuring the value of a visit to the Statue of Liberty by looking at the cost of their flight from Europe would clearly again exaggerate the CS of the site. Therefore, we downweight that travel cost to zero. This is not to say that the Statue of Liberty had no value for this visitors, but simply that their travel cost of flying from Europe to New York cannot be used as a proxy for the price they faced for visiting that site.

Now imagine some other Dutch party coming to the same wedding mainly because attending would allow them to take a walk to the Statue of Liberty, so they state that the visit to the Statue of Liberty was a major influence in their decision to fly to New York. In this case, we can learn about the value of the Statue of Liberty for these people by looking at how much they paid for crossing the Atlantic. We will likely want to adjust this cost slightly downwards (because the wedding itself had some influence). Perhaps they would have stated a value of 8 when responding to the question on *influ* of the Statue of Liberty, but they would not have stated a value of zero, like those in the party previously described.

In the examples above, one can just substitute "going to a wedding" or "going to visit friends" with "visiting additional National Park Y" to understand how our weighting scheme deals with the issue of multi-site trips too, and not only with the issue of multi-purpose ones.

We expected that this weighting procedure would improve the goodness of fit of the regression relative to the traditional approach that treats MDT/MPT observations as if they were single purpose/trip observations. This is because the travel cost method assumes that the number of trips taken to visit a site is the result of a decision made taking into account the cost of reaching the site. When visiting the site is not a strong influence in the decision to travel, it is likely that the cost of traveling to it is less of a determinant factor in the decision to travel. In essence, we expect that the travel cost method is best suited to model the decisions on single purpose and single site trips, so we expect that a correction that downplays the effect of the travel cost variable for MDT/MPT on the number of trips will improve the performance of the model.

We discarded observations for which *influ* took the value of zero or had a missing value. If Gros Morne had no influence in the decision to make the trip for some visitors, it would not be appropriate to include their information in the construction of the trip demand function. The values taken by this variable in the sample analyzed are summarized in Table 1. We ran separate regressions with either CTC and $WCTC$, so we could analyze the effect of weighting the travel cost variable.

This treatment of MPT and MDT requires much less information than the one proposed by Mendelsohn et al. (1992), since it does not require information on the travel costs of reaching secondary destinations and also accounts for MPT, rather than correcting only for MDT. It also provides more flexibility than the one proposed by Parsons and Wilson (1997), which uses information about side trips or joint trips, in their terminology, to make an all-or-nothing correction that represents a simplification on the solution proposed by Mendelsohn et al. (1992), while our approach allows for different degrees of influence of the valued site on the decision to take the trip. Furthermore, our approach enjoys the added advantage of making use of information directly elicited from the visitors themselves about the degree to which the visit to the valued site influenced their decision to make the trip, while Parsons and Wilson (1997) in fact obtain only binary answers ('yes' or 'no') about whether trips had been influenced by other secondary purposes or sites. Another advantage of our proposed approach is that it readily lends itself to handle multiactivity trips to a single site when the researcher is interested in valuing the site for a given activity only, multi-destination trips, multi-purpose (for recreation purposes and other purposes) trips, and combinations thereof.

Our expectation was that weighting the travel cost according to *influ* would decrease the predicted consumer surplus per trip on the one hand, but also increase the expected overall consumer surplus by correcting the predicted number of trips upwards. These two effects are described in detail by Kuosmanen et al. (2004) for the similar type of correction they proposed. Since the correction exerts two countervailing effects, its overall effect on the estimated aggregate welfare measures is ambiguous.

The influence of *income*, which we measured as the mid-points in thousands of dollars of seven brackets suggested in the questionnaire, is often (but not always, Bin et al. 2005) found negative and/or non-significant (Creel and Loomis 1990; Liston-Heyes and Heyes 1999; Sohngen, Lichtkoppler, and Bielen 2000; Loomis 2003). In principle, however, because of the remoteness of Gros Morne, we would expect *income* to exert a positive effect on the number of visits, even though residents of Newfoundland, whose average income is relatively low, would have of course visited very often.

Apart from the variables related to price and income, the demand model considered additional variables. The expected effect of the time spent on the site (*daysspent*) was uncertain *a priori*, although Bell and Leeworthy (1990); Creel and Loomis (1990); and Shrestha, Seidl, and Moraes (2002) found that the longer the time spent on site the fewer the trips taken. We asked visitors if they had visited other sites during the current trip (national parks in the Atlantic region, as in Liston-Heyes and Heyes 1999) and kept in the final model a dummy for Terra Nova National Park ($TerraNova$), located in Central Newfoundland.

We also collected information on the number of people in the visitor group sharing travel expenses during the current trip (*partysize*) as in Liston-Heyes and Heyes (1999) and Hesseln et al. (2003) and the age composition of the visitor group in the current trip (Siderelis and Moore 1995). In addition to *income*, the proportion of party members under seventeen ($propou17$) and of adults between the ages of 34 and 65 ($prop34$-65), the *partysize*, whether the visitor entered Newfoundland by plane ($flew$), were used in the final parametrization of the overdispersion parameter α.

Finally, different aspects of the visitor experience during the current trip were considered, including an estimate of out-of-pocket spending in the Gros Morne area per member of the visiting party (*expenses*, in thousands of $CAN). Visitors were asked about the time at which they made the decision to visit the park and whether and to which degree it was influenced by a variety of activities (hiking, backpacking) within the park and by different features (the fact that it is a World Heritage site, etc.) of the park. The variable *camping* (about the influence of camping) and *geology* (about the influence of the Tablelands' geology) were used as additional information to parameterize the overdispersion parameter (α) in the final model.

5 Econometric Analysis

Given the nature of *persontrips,* the dependent variable in the demand equation, count data regression methods were used in its estimation. Count data models are routinely applied in single-site recreation demand models (Creel and Loomis 1990; Englin and Shonkwiler 1995; Gurmu and Trivedi 1996; Shaw and Jakus 1996; Chakraborty and Keith 2000; Curtis 2002; Shrestha et al. 2002; Bin et al. 2005; Hynes and Hanley 2006; Shrestha, Stein and Clark 2007). For details about regression models for counts see for example Cameron and Trivedi (1998; 2001). Englin, Holmes, and Sills (2003) summarize the history of the application of count data models to recreation demand analysis, while further details and comparative analyses on the econometric issues involved in the use of single site visitation data collected on-site are available in Haab and McConnell (2002, p. 174-181); Loomis (2003); Martínez-Espiñeira and Amoako-Tuffour (2008); Martínez-Espiñeira and Hilbe (2008).

Hellerstein and Mendelsohn (1993) justify the use of count data models in recreational demand analysis because on any choice occasion, the decision whether to take a trip or not can be modelled with a binomial distribution. As the number of choices increases, the binomial asymptotically converges to a Poisson distribution. This Poisson-based model can be extended to a regression framework by parameterizing the relation between the mean parameter and explanatory variables.

The first two moments (mean and variance) of the Poisson distribution are equal, a property known as *equidispersion.* However, data on the number of trips are often substantially overdispersed in practice: the variance is larger than the mean for the data, because a few visitors make a large number of trips while most visitors make only a few. This overdisperion therefore makes the Poisson model overly restrictive. Overdispersion has qualitatively similar consequences as heteroskedasticity in the linear regression model. However, as long as the conditional mean is correctly specified, the

Poisson maximum-likelihood estimator with overdispersion is still consistent, but it underestimates the standard errors and inflates the t-statistics in the usual maximum-likelihood output. As a consequence, it can be shown that welfare measures obtained from an analysis based on the Poisson distribution exaggerate the value of recreational destinations.

For cases where the overdispersion problem is serious, a widely-used alternative is the negative binomial model. This is commonly obtained by adding an additional parameter (usually denoted α) that reflects the unobserved heterogeneity that the Poisson fails to capture. A likelihood-ratio test based on the parameter α can be employed to test the hypothesis of no overdispersion.

An additional feature of the distribution of the dependent variable is that it is truncated at zero, since the data collection was done on-site. Failing to account for truncation leads to estimates that are biased and inconsistent because the conditional mean is misspecified (Shaw 1988; Creel and Loomis 1990; Grogger and Carson 1991; Yen and Adamowicz 1993; Englin and Shonkwiler 1995). The standard Poisson model is unbiased even with overdispersion but this is not the case of the truncated version of Poisson. If there is overdispersion, the truncated Poisson model yields inconsistent and biased estimates (Grogger and Carson 1991). In that case, the truncated negative binomial is in order. This model has been applied in several contributions to the literature during the last decade (Bowker et al. 1996; Liston-Heyes and Heyes 1999; Zawacki and Bowker 2000; Shrestha et al. 2002). Yen and Adamowicz (1993) and, more recently, Loomis (2003) and Martínez-Espiñeira, Amoako-Tuffour and Hilbe (2006) compare welfare measures obtained from truncated and untruncated regressions.

Finally, and also because the data were obtained on-site, the sample is also endogenously stratified: each visitor's likelihood of being sampled is positively related to the number of trips they made to the site (e.g. Shaw 1988; Englin and Shonkwiler 1995). Under equidispersion, standard regression packages can be used to estimate a Poisson model adjusted for both truncation and endogenous stratification. This is because, as shown by Shaw (1988) it suffices to run a plain Poisson regression on the dependent variable modified by subtracting 1 from each of its values (Haab and McConnell 2002, p. 174-181). This strategy has been followed in several earlier works (Fix and Loomis 1997; Hesseln et al. 2003; Loomis 2003, Bin et al 2005; Hagerty and Moeltner 2005; Martínez-Espñeira et al. 2006), under the assumption that overdispersion is not significant.

However, for cases in which the overdispersion is significant, the density of the negative binomial distribution truncated at zero and adjusted for endogenous stratification for the count variable (y), derived (Englin and Shonkwiler 1995) as

$$\Pr[Y = y|Y > 0] = y_i \frac{\Gamma(y_i + \alpha_i^{-1})}{\Gamma(y_i + 1)\Gamma(\alpha_i^{-1})} \alpha_i^{y_i} \mu_i^{y_i - 1} (1 + \alpha_i \mu_i)^{-(y_i + \alpha_i^{-1})} \quad (2)$$

cannot be manipulated into an easily estimable form, so it needs to be programmed as a maximum-likelihood routine. The associated increase in computational burden probably explains why applications of this model are more rare (Englin and Shonkwiler 1995; Ovaskainen, Mikkola, and Pouta 2001; Curtis 2002; Englin et al. 2003; McKean et al. 2003; Martínez-Espiñeira, Loomis, Amoako-Tuffour and Hilbe 2008). Most of these applications are based on a version of Expression (2) that restricts the overdispersion parameter α to a common value for all observations (so $\alpha_i = \alpha$).

In this contribution we use a negative binomial model that corrects simultaneously for overdispersion, truncation at zero, and endogenous stratification. We also report regressions based on allowing the overdispersion parameter to vary according to the characteristics of the visitor (*WGTSNB* and *GTSNB*) and compare them with the more restrictive approach (*WTSNB* and *TSNB*). The software code is available for STATA 9.1 as downloadable commands *NBSTRAT* (Hilbe and Martínez-Espiñeira 2005) and *GNBSTRAT* (Hilbe 2005). The former restricts the overdispersion parameter to a constant, while the latter generalists the approach to allow that parameter to vary across respondents.

Further details on the evolution of these count data models, their theoretical properties, and their empirical application can be found in Martínez-Espiñeira and Amoako-Tuffour (2008) and Martínez-Espiñeira and Hilbe (2008).

6 Results

{INSERT TABLE 2 ABOUT HERE}

Three types of econometric specifications were initially considered, all of which accounted for endogenous statification and zero-truncation in the distribution of the variable persontrip, including one based on the Poisson distribution. However, since, as described below, there proved to be significant problems of overdispersion, only the results of regressions based on negative binomial models, which correct for overdispersion, are reported in Table 2.

For each of these regressions, we report both the results obtained with a plain travel cost variable and the results obtained with a travel cost variable weighted according to the influence of Gros Morne in the decision to take the trip. The latter are signified by the letter W at the start of the relevant acronym used to label the set of regression results. The first two specifications are thus labeled $WTSNB$ and $TSNB$ and they correct for endogenous stratification and zero-truncation and overdispersion, assuming a constant overdispersion parameter α. The last two reported models ($WGTSNB$ and $GTSNB$) further generalize the previous specification by allowing the overdispersion parameter α to vary across observations.

The first type of specification used for $WTSNB$ and $TSNB$ is nested in the second one, which allows us to use likelihood-based tests to choose between both specifications. However, it should be noted that the "likelihood" for regressions that use probability weights (which is our case, due to the sampling strategy followed for the survey) is not a true likelihood, that is, it is not the distribution of the sample. When proportionality weights are used, the "likelihood" does not fully account for the randomness of the weighted sampling. Therefore the standard likelihood-ratio test should not be relied on. For this reason, we report diagnostic statistics based on the versions of each specification that did not use sampling weights. This does not affect in any way the comparison among price specifications, though, which is the focus of our paper.

The results show that the model specified appears highly robust in the sense that there are no sign changes across specifications and only the statistical significance and the goodness of fit differ. These differences confirm that accounting for the effects of using on-site sampling largely improves the efficiency and consistency of the estimates. In fact, Table 2 also shows that the econometric specification that best fits the data is the one that accounts not only for the truncation, but also for endogenous stratification affecting the dependent variable, while allowing the overdispersion parameter a to vary across visitors according to characteristics of the visitor group.

The overdispersion parameter (α) is significant in the truncated negative binomial models, which confirms that overdispersion is a problem. A likelihood-ratio test of *WTSNB* versus the equivalent model based on a Poisson distribution yields a test statistic $\overline{\chi}^2(1) = 1453.46$, while $\overline{\chi}^2(1) = 1411.92$ for the comparison between the unweighted *TSNB* and its Poisson-based counterpart. In both cases $Prob > \chi^2 = 0.0000$, further confirming the superiority of the negative binomial specification over the Poisson. Therefore, the models based on the Poisson distribution are overly restrictive, since they fail to account for the fact that many visitors take a few trips, while only a few take many trips. The coefficients of all the covariates in the equation whose dependent variable is the overdispersion parameter α are highly significant, confirming that using the same overdispersion parameter for all observations would be overrestrictive.

We can see that the goodness of fit as measured by the log-likelihood estimate improves as the model becomes more flexible. A likelihood-ratio test comparing $WGTSNB$ and $WTSNB$ yields a test statistic of $\overline{\chi}^2(6) = 357.67$ ($Prob > \chi^2 = 0.0000$). For the unweighted case (*GTSNB* versus *TSNB*) $\overline{\chi}^2(6) = 350.03$ ($Prob > \chi^2 = 0.0000$).

However, and contrary to our *a priori* hypothesis, weighting the travel cost variable according to the influence of the park in the decision to take the trip does not improve the goodness of fit. In fact, that correction results in a very slight decrease in goodness of fit, as measured by the Akaike Information Criterion. However, and as expected, accounting for the multi-purpose/multi-destination nature of trips does correct the estimate of consumer surplus downwards quite substantially. This is, of course, more likely to have policy implications than the effects on statistical goodness of fit.

The usual approach of dropping observations suspected to correspond to MDT and or MPT arguing that they would not fit so well with the travel cost model might be somewhat misguided. A proper correction for the importance of MDT and MPT is more what is needed to avoid biased estimates of consumer surplus.

Apart from the price variable (the travel cost variables *CTC* and *WCTC*), which presents the expected negative sign, the trip generation equation includes as additional variables *income*, *expenses, dayasspent*, *TerraNova* and dummies for the cases with imputed *income* and *expenses.* Table 2 shows that *income* has a positive effect on the number of trips, making visit to Gros Morne a normal good.

Often income is found to be non-significant in travel cost studies. The remote location of Gros Morne makes the visit expensive enough for many visitors for visits to be a normal good. However, it is noteworthy that this effect appears significant only when the overdispersion parameter α is allowed to vary according to several characteristics of the traveling party. These are *camping* (importance of camping activities in the decision to visit Gros Morne), the size (*partysize*) and age composition of the traveling party, through variables *prop34-65* (proportion of members between the ages of 34 and 65) and *propu17* (proportion of members of the traveling party under seventeen years of age); *flew*, which identifies those visitors who entered Newfoundland by air and *income* itself. One of the effects of parameterising the overdispersion parameter consists of refining the estimated coefficients in the main equation (Martínez-Espiñeira and Hilbe 2008), so it is not surprising that allowing *income* to affect the degree of overdispersion in the distribution of the variable *persontrip* helps bring significance to this variable in the main equation.

Those who spent more during their last visit to the park tend to have made fewer trips to the park in the previous five years. This probably reflects that expenses are related to variable costs associated with staying at the park. Avid visitors will have invested in equipment (such as tents, recreational vehicles, etc.) that can substantially reduce the variable cost of the visit. Experienced outdoor enthusiasts may also have the extra knowledge that allows them to make their stays cheaper, something which would also apply to those who are more knowledgeable about Gros Morne and its facilities because they made more trips in the past.

The effect on trips of the length of stay (*daysspent*) on the number of trips is significantly positive. This result agrees with the finds of Bowker et al. (1996) but it is at odds with those of Shrestha et al. (2002), Creel and Loomis (1990) and Bell and Leeworthy (1990). The fact that the length of stay appears positively correlated with the frequency of visits may be due to the remote geographical location of Gros Morne and the type of recreational activities that it offers.

Visitors were asked about whether they had visited a series of other recreational sites in Atlantic Canada. The variable *TerraNova* enters the final model with a negative sign. This confirms the a priori expectation that first time visitors to Gros Morne from outside Newfoundland were more likely to take advantage of the trip to also visit Terra Nova National Park. On the other hand, residents of Newfoundland and Labrador and more experienced and knowledgeable visitors were less likely to visit Terra Nova, since Gros Morne appears, according to park officials and informal comments made by visitors, to be the clearly preferred choice among most visitors to the province who have already experienced both sites in the past. An additional explanation, of course, as pointed out by an anonymous referee, is that current visitors to Gros Morne are the result of a self-selection over those who would prefer Terra Nova for their repeat visits instead, and had the survey been conducted in Terra Nova, visits to Gros Morne during the same trip would likely enter with a negative sign too.

The non-significance of the variable *missincome* suggests that those who did not to reveal their income range were not significantly different in terms of their recreational demand from those with an average income level. However, we suspect that those who failed to suggest a value for *expenses* appear to have expenses likely higher than the average visitor. This is because *expenses* itself has a negative effect on *persontrips* and *missexp* has a positive and somewhat significant effect on *persontrips.*

7 Welfare estimations

In Table 2, we report the corresponding estimated measures of consumer surplus per *persontrip.* These are obtained as the inverse of the negative of the travel cost coefficient. We use only the estimated coefficient of either *CTC* or *WCTC* to calculate welfare measures. The coefficient on the variable *expenses* is not considered, since these expenses are mainly endogenous, a choice of the user. It is true that *expenses* include some component of user fees, but these are usually relatively small compared with the full cost of the visit. In any event, the welfare measures reported should be regarded as a conservative lower bound for the full benefit derived by users.

It is noteworthy that the weighting of the travel cost according to the influence the site had in the decision to make the trip brings down the estimate of consumer surplus per *persontrip* (equal to $-1/\widehat{\beta}_{(W)CTC}$) from \$1,734 to \$2,528 under the most flexible specification. This suggests that for the present data set, which includes many long distance travelers (average distance traveled is 2,878.3 Km) and therefore many MDT and MPT visitors, the estimate of consumer surplus would be exaggerated in almost 50% by ignoring the MDT and MPT nature of some of the trips. The adjustment affects in a very similar way the consumer surplus estimates obtained by the other econometric specifications since \$1,135/\$1,686 = 0.67 and \$585/\$836 = 0.70. The latter ratio corresponds to the Poisson specification results, not reported but available upon request.

These estimates of consumer surplus are clearly larger than those estimated by Martínez-Espiñeira and Amoako-Tuffour (2008) from the same general dataset. This is partly because in the analysis presented here we do not drop the observations corresponding to those visitors traveling more than 7,500 Km to reach Gros Morne nor do we eliminate from the sample those visitors who declared not having been strongly influenced by Gros Morne when deciding to visit Newfoundland and Labrador. Under the weighted models, we only adjust downwards, but do not altogether eliminate, the consumer surplus for visitors who took MDT and/or MPT. And it is, as noted by Martínez-Espiñeira and Amoako-Tuffour (2008), likely that most of these MDT/MPT are long-haul visitors. However, even after the downward correction imposed by the weighting procedure used here, visitors who bear the travel cost of a very long trip add substantially to the average consumer surplus per trip.

However, not only are the estimates of consumer surplus larger than those estimated by Martínez-Espiñeira and Amoako-Tuffour (2008), but also the difference between CS under *TSNB* and under *GTSNB* is also much larger than it was in that earlier analysis. This is likely also because here we do not discard those visitors traveling the longest distances. For these visitors, the improvement in the estimation of the effect of *income* on the number of trips we achieve by allowing the overdispersion parameter to vary across observations and which makes the *income* coefficient significant in the trip generation equation is obviously much more relevant. Underestimating the effect of income for those consumers leads to a much more substantial overestimation of the effect of the price (travel cost) variable and therefore a much more substantial underestimation of the consumer surplus. This is because longer trips are more expensive, so their number is more strongly affected by the purchasing power of the visitor. Further, and for the same reasons, income is more statistically significant in the analysis of the larger sample presented here than in Martínez-Espiñeira and Amoako-Tuffour (2008).

In more conventional samples, made up of visitors living all relatively close to the site, this would likely not be the case. But then again, the procedure suggested here is meant to avoid the need to trim the sample in order to make it fit better the requirements of single site single purpose of the traditional TCM. Because long haul travelers are assumed to be not well described by the conventional recreational demand model, they are often dropped from the sample (e. g. Beal (1995); Bowker at al. 1996, Bin et al. 2005).

As shown in Table 2, where E($\widehat{persontrip}$) is the mean of the predicted number of *persontrips* under each specification, the weighting of the travel cost according to the influence of the site in the decision to make the trip has the expected effect of decreasing the predicted consumer surplus per trip, but it also exerts a countervailing effect on the expected overall consumer surplus by correcting the predicted number of trips upwards. These two effects are analogous to the two effects (direct and indirect) that Kuosmanen et al. (2004) postulated when applying a similar type of correction to the demand for trips. The calculation of the average consumer surplus per trip is based only on information about the estimated coefficient on the travel cost variable ($\widehat{\beta}_{(W)CTC}$), while the prediction of the expected number of trips uses information also about the model intercept. More precisely, the prediction of the number of trips under the truncated and endogenously stratified negative binomial models is based on $E(Y_i/x_i) = \lambda_i + 1 + \alpha_i\lambda_i$ (Englin and Shonkwiler 1995), which accounts not only for the value of the overdispersion parameter α but also the predicted count rate λ, which is determined by the values of all the coefficients in the model. Again, which of the two effects prevails will vary on a case-by-case basis.

8 Conclusions and suggestions for further research

In this paper we show the effects of correcting trip demand curves and associated consumer surplus measures to account for the fact that some visitors include the visit to a recreational site only as part of a more comprehensive trip and/or consider that visit only one of the purposes of the trip. We address this problem by weighting the values of the travel cost according to the influence visitors declared the visit to the site considered, Gros Morne National Park, had in their decision to vacation in Newfoundland and Labrador.

We find that for the case of a remote site such as the one analyzed the effect of this correction can be very substantial. The policy implications of this result are associated with the correction of the values of the estimated welfare measures. If site managers ignore the effect of multi-purpose or multi-destination visits when estimating the benefits visitors obtain from a site, they will misallocate resources when making decisions about how much to invest in conservation and enhancement of a site. This effect, as suggested by the theoretical literature on the travel cost method, is usually stronger in the case of long distance visitors, so more effort should be spent on the problem when a large proportion of visitors travel long distances to access the site valued. Therefore, it would be recommended that researchers routinely ask respondents about the influence of the valued site on the decision to make the trip when long distances from large urban centers are involved, like in our case, but also when several recreational attractions are clustered together, since the effect of multi-site trips would be strong in that case too.

We also show that the effect over total estimated consumer surplus can be the result of countervailing effects on the estimated consumer surplus per trip and the predicted number of trips. Intuitively, adjusting the travel cost of multi-site and multi-purpose trips downwards to account for the fact that not all the travel cost incurred is due to the intention to visit the studied site will lead to a downward correction of the estimated consumer surplus but an upward correction of the predicted number of trips.

Accounting for MDT and MPT does not seem to improve in this particular case goodness of fit measures relative to the often applied strategy that treats both types of trips as single purpose/destination trips.

The results suggest that it would be desirable for researchers to inquire about the nature of trips for the visitors when conducting surveys aimed at developing travel cost method analyses. This confirms recommendations from the previous literature that favor the use of approaches based on information from the visitors to handle the problem of multipurpose and multi-destination trips.

While beyond the scope of the current contribution, a natural extension of this analysis would consider the comparison of results obtained for this same dataset using alternative methods of handling multi-purpose and multi-destination trips.

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Variable	Mean	Std. Dev.	Min	Max
camping	3.3746	3.7634	0	10
CTC (combined travel cost)	1.4512	1.2891	0.0055	8.8513
daysspent (length of stay)	3.7768	2.4917	0	30
expenses (expenses other than travel cost)	0.2520	0.2412	0	3
flew (takes value of 1 if visitor entered province through an airport)	0.3716	0.4835	0	1
income (mid-point of income bracket)	88.4568	41.9736	20	160
influ (stated influence of Gros Morne in the decision to visit Newfoundland)	6.7421	2.5199	1	10
missexp (takes value of 1 if variable expenses was originally missing)	0.1086	0.3113	0	1
missincome (takes value of 1 if variable income was originally missing)	0.1066	0.3088	0	1
partysize (size of traveling party during current trip)	2.6152	1.3094	1	13
persontrip (product of partysize times number of trips in the last 5 years)	3.7299	5.8668	1	91
prop34-65 (proportion of members aged 34 to 65 in traveling party)	0.6144	0.4113	0	1
propu17 (proportion of members under 17 in traveling party)	0.0631	0.1677	0	1
TerraNova (takes value of 1 if Terra Nova was visited during current trip)	0.3218	0.4674	0	1
WCTC (combined travel cost adjusted by influ)	0.9366	0.9285	0.0052	7.4977

Table 1: Summary descriptives of sample used in the regressions (N=985).

	Variable	WTSNB	TSNB	WGTSNB	GTSNB
persontrip	(W)CTC	-0.8810***	-0.5930***	-0.5766***	-0.3955***
		(-9.02)	(-9.57)	(-8.48)	(-8.33)
	income	0.0012	0.0013	0.0057***	0.0056***
		(0.62)	(0.64)	(3.90)	(3.91)
	expenses	-1.3335***	-1.3937***	-0.5211**	-0.5676***
		(-3.70)	(-3.75)	(-2.44)	(-2.60)
	daysspent	0.1109***	0.0904***	0.0541***	0.0425**
		(3.30)	(2.76)	(2.63)	(2.01)
	missincome	0.1376	0.1545	0.3046	0.3102
		(0.53)	(0.60)	(1.45)	(1.51)
	missexp	0.2485	0.2672	0.2993*	0.3070*
		(1.10)	(1.17)	(1.82)	(1.87)
	TerraNova	-0.3591***	-0.3093**	-0.2464***	-0.2081***
		(-2.75)	(-2.42)	(-3.28)	(-2.74)
	cons	0.1409	0.2637	0.0558	0.1397
		(0.35)	(0.65)	(0.28)	(0.71)
ln(α)	income			-0.0138***	-0.0136***
				(-3.57)	(-3.44)
	camping			0.0883***	0.0853***
				(2.78)	(2.68)
	prop34-65			0.8214***	0.7877**
				(2.64)	(2.51)
	propu17			1.7577***	1.7507***
				(2.88)	(2.85)
	partysize			0.4843***	0.4813***
				(5.73)	(5.62)
	flew			-1.0304***	-1.0561***
				(-3.98)	(-3.92)
	cons	1.2861**	1.2343**	-0.9308	-0.9288
		(2.35)	(2.28)	(-1.53)	(-1.56)
Statistics	ll	-2322	-2317	-2116	-2114
	χ^2	101	109.8	108.5	103.6
	AIC	4661.755	4652.696	4261.502	4257.395
	$\widehat{CS}$	$1,135	$1,686	$1,734	$2,528
	E($\widehat{persontrip}$)	4.387	4.289	4.497	4.408
legend: *= p<0.1; ** p<0.05; *** p<0.01. T-ratios are shown in brackets.					

Table 2: Dependent variable is persontrips in the first equation and the log of the overdispersion parameter (α) in the second equation. TSNB = Truncated and endogenously stratified negative binomial; GTSNB = Generalised truncated and endogenously stratified negative binomial. W signifies the use of the weighted travel cost variable (WTCT) rather than the unweighted one (CTC). N = 985 .