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The Economic Value of Camping Using Administrative Data

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This paper implements a seasonal travel cost model using administrative data from an online camping reservation system on over 71,500 individuals taking 144,000 trips to 68 campgrounds in Alberta, Canada. Using a Kuhn–Tucker modeling framework, the per trip welfare impacts of campground closures ranges from $46 to $144. The substantial heterogeneity in welfare measures across campgrounds in per trip welfare measures for the same recreational activity in the same jurisdiction raises caution about the use of simple unit transfers of recreation values. Furthermore, we assess how the value of campground trips is associated with park attributes, campground amenities, and available activities nearby.

Key words: ecosystem services, Kuhn–Tucker model, recreation demand, travel costs

As one of the clearest expressions of human value for the natural environment, the demand for outdoor recreation has long been of interest to environmental economists (Phaneuf and Smith, 2005). Recreation is often one of many competing uses for public lands, and managers must often make land-use decisions while balancing recreation against alternative industrial and preservation uses. Understanding the economic value the public receives from participating in recreation activities on public lands can help inform current land management decisions. Travel cost models, the workhorse method for estimating recreation demand and associated economic values, rely on the availability of carefully collected trip behavior data, which is typically collected by intercept surveys. There are many well-known challenges and biases from using these surveys to collect and analyze data from people.

In this paper, we use a non-survey source of data to estimate the economic value of camping in public parks and to assess how these values are determined by park attributes, campground amenities, and available activities nearby. We use a large-scale administrative dataset of campground reservations in Alberta, Canada, that contains detailed information on the trips taken by recreationists over a season to a large number of sites. Our analysis sample includes 144,279 trips taken by 71,594 individuals to 68 campgrounds. Besides providing a large dataset of recreation behavior, the automatic online collection of these data also avoids sample representativesness concerns, recall bias, and other issues associated with intercept survey samples.

Obtaining a fully representative sample is time and resource expensive, and intercept surveys tend to oversample more avid recreationalists, resulting in endogenous stratification that must be corrected in the analysis of the data (Englin and Shonkwiler, 1995). Even if a large, perfectly representative sample could be achieved, there are also potential issues with the survey responses themselves and the respondents' cognitive challenges of remembering past recreation behavior

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and associated recall biases (Parsons, 2017). The oversampling of avid users and recall biases are not an issue in our application as we use of an administrative dataset on the entire population of campground users.

We use the trip and travel cost data to estimate a seasonal Kuhn–Tucker (KT) travel cost model, which is appropriate given the multiple discrete-continuous nature of the data and allows us to assess satiation effects in behavior. The KT model explicitly incorporates decision making along the extensive margin (which campground to visit) and intensive margin (how many trips to take) in a utility-consistent framework. Unlike linear-in-parameters discrete choice models, the KT framework does not impose the assumption that each recreation trip to a site provides a person with the same utility. Thus, we accommodate the diminishing marginal utility of recreation trips and are able to test for evidence of satiation effects in recreation trips.

The KT parameter estimates and trip data are used to simulate behavioral responses and welfare impacts of closing each of the 68 campgrounds. We use the conditional approach to welfare measurement (von Haefen and Phaneuf, 2005) by using actual trip behavior to incorporate unobserved heterogeneity and calculate campground-specific welfare measures for every person in our sample. Welfare measures for each campground are calculated per individual, as the aggregate value, and as an average value per trip. We then assess the determinants of campground values by regressing individual- and campground- specific welfare measures on park attributes, campground amenities, and activities available nearby.

The empirical application provides four main sets of results. First, we estimate that the average welfare loss associated with a campground closure is $89 per trip.[1] These economic values can be used to assess the nonmarket losses of campground closures from natural disasters such as recent flooding and forest fire events in Alberta or administrative decisions.[2] Second, there is substantial heterogeneity in per trip welfare measures across campgrounds, ranging from $46 to $144 per camping trip. This finding of differences in economic values from the same activity in the same jurisdiction raises caution for the use of simple unit transfer estimates of recreation values. Third, we identify a nonlinear relationship between utility and the number of trips individuals take, providing evidence for satiation in recreation behavior. These satiation effects are heterogeneous across campgrounds. Fourth, we find that not all available recreational activities nearby have positive associations with campground values; allowing activities such as hunting and fishing may actually diminish the value of camping.

This paper makes two contributions to the literature. First, we contribute to the small recreation demand literature that uses nonsurvey data sources (Kolstoe and Cameron, 2017; Keeler et al., 2015). Keeler et al. (2015) use photo-visitation data from Flickr to assess recreation demand for water quality in the U.S. Midwest. Kolstoe and Cameron (2017) uses eBird data from 221 birders making 1,094 trips to estimate birders' willingness to pay for additional species richness. One concern with the use of social media data is that these sites wax and wane in popularity and the users are likely not representative of recreation population. This study is unique in that, to our knowledge, it is the first to apply a large regional administrative dataset of past trip behavior to estimate seasonal welfare associated with the recreational use of a significant network of public environmental assets (i.e., provincial parks and protected areas).

The vast majority of the recreation demand literature uses intercept surveys. A typical travel cost model application collects data using an intercept survey with only a few potential sites and sample sizes generally under 1,000.[3] We use an administrative database of camping reservations that provides access to over 71,000 individuals taking trips to a large number of sites. The benefit of using

[1] Unless otherwise specified, all monetary values cited are in Canadian Dollars. During the study period, the exchange rate was approximately 1 USD = 1.25 CAD.

[2] For example, Wyndham-Carseland Provincial Park was closed for the 2013 and 2014 season due to flooding, and the Gregoire Lake Provincial Park campground was damaged and closed in 2016 due to a forest fire.

[3] More recent studies have used substantially larger datasets, such as Dundas and von Haefen (2020) who use data on nearly 200,000 anglers choosing from among almost 2,500 sites in their analysis.

these data is that trip data are collected automatically through the reservation system which alleviates concerns of recall bias. Furthermore, intercept survey data can suffer from endogenous stratification because people that take more trips are more likely to be sampled by enumerators (Shaw, 1988). These concerns are alleviated through the use of automatic data collection as part of the online reservation system. Besides these issues, surveys can be time and resource expensive, which limits the number and scope of analyses that can be performed. In some cases, a more systematic evaluation of multiple sites is possible when the breadth of visitor data collection is sufficiently large. In the discussion, we discuss the efficacy of using online reservation databases for this type of research and modeling and suggest ways to improve data collection procedures.

Our second contribution is that this paper provides novel benefit estimates of an important recreation activity. Camping is a popular recreation activity with one in five Canadians having reported participating each year (Federal, Provincial, and Territorial Governments of Canada, 2014); camping is also one of the most popular recreational activities in U.S. National Forests (Bowker et al., 2009). However, only a couple of studies have measured its economic value in North America over the last 20 years.[4] McKean et al. (2005) use trip date from an intercept survey of 332 people in 1998 to estimate a count model of camping trips to the Lower Snake River Reservoir in the United States. Bowker et al. (2009) use trip data from on-site surveys of 68,669 individual recreation visitors between 2000 and 2003. These data are part of the National Visitor Use Monitoring Database (NVUM), which collected information on visitors to 120 National Forests in the United States and represents one of the most extensive recent data collection efforts on recreational use of public lands (English et al., 2002). Bowker et al. (2009) use a count model to estimate that welfare measures range from $25 to $40 ($USD) per person per visit. Sardana, Bergstrom, and Bowker (2016) use the same NVUM dataset to calculate the welfare associated with visits and estimate a consumer surplus value of $50 ($USD) per person per trip. In the Alberta context, an older study by Boxall, McFarlane, and Gartrell (1996) uses a combination of on-site and mail surveys of 740 campers to estimate a truncated Poisson count model in the Rocky-Clearwater Forest and finds that camping is worth $53 ($CDN) per trip.

This paper differs from previous camping demand studies by using a Kuhn–Tucker model instead of a count model, which can more readily accommodate spatial substitution patterns in a unified framework. This also allows us to relax the assumption of constant marginal utility of trips, utilizing choice behavior to estimate the rate of satiation. We also extend the previous analyses by leveraging the large dataset to systematically assess the heterogeneity of economic values for campground attributes. We include attributes of the parks in which our campground sites are located, the amenities offered at the campgrounds themselves, and the availability of various outdoor recreational activities nearby to study how man-made and natural features present at the site are associated with welfare measures.

Empirical Application: Overnight Camping in Parks

The empirical application focuses on the recreational benefits generated by overnight camping trips to provincial parks and protected areas in Alberta, Canada.[5] The government ministry Alberta Environment and Parks (AEP) manages a network of provincial parks and protected areas throughout the province to both conserve natural landscapes and provide the public with the opportunity to access a variety of outdoor experiences. To fulfill the latter objective, AEP maintains campground

[4] In their recent review of the economic value of recreation activities, Rosenberger et al. (2017) report six studies between 1958 and 2015 that valued primitive camping and 22 studies that valued developed camping compared to 120 fishing studies and 64 hunting studies.

[5] Camping is among the most popular outdoor recreation activities in Alberta that residents partake in, with a 2017 public survey finding that 41% of Albertan households reported going on a camping trip during the previous 12 months (Advanis, 2017).

facilities in these parks and supplies a range of services to augment the outdoor experience, including power hookups, firewood, drinking water, and sewage disposal facilities.

Camping Data

Before the introduction of modern online campground reservation systems, physical camping permits could be collected to provide a census of users (Boxall, McFarlane, and Gartrell, 1996). These permits, generally filled out by the campers themselves, often included the information necessary (e.g., home postal code) to specify a basic travel cost model. In 2010, AEP launched an online campground reservation system called Reserve Alberta Parks (RAP). At that time, users could reserve campsites at over 50 provincial campgrounds up to 90 days in advance; since then, RAP been expanded to handle reservations for 170 campground destinations province-wide, including sites designated specifically for group, comfort, and equestrian camping. The web-based service features an interactive map of each provincial campground, allowing users to select and view photographs of their campsite of choice. The system also provides users with information related to site amenities, future availability, and costs. For the majority of campgrounds in the system, campsite reservations can be made for dates beginning in mid-May until early September each year.[6]

To make a reservation, users create an account in the RAP system; as part of this process they enter their contact information, including home postal code. Once they have created an account, future reservations can be made using the same login credentials, which allows the RAP database to track the number of reservations (i.e., trips) made by each user and to which campgrounds. These data form the basis of the choice information used in the KT modeling, with the home postal code used to ascertain trip origin and inform the calculation of travel costs. The reservation made by each user is associated with a unique, anonymized user ID, which allows us to link multiple trips by the same user. As of 2016, the RAP system had over 433,000 registered account holders (Government of Alberta, 2016).

The initial sample included 196,662 reservations made in 2015, and we restricted the analysis to a subset of these data. First, we limit our choice set to 68 campgrounds spanning 51 provincial parks, by removing the 6,255 reservations made for designated group, comfort, and equestrian campsites. These restrictions were set in order to ensure we were analyzing an activity (i.e., outdoor camping trip) that was relatively homogeneous across our sample. For instance, comfort campsites involve pre-setup accommodation and users who take these trips may be distinctly different from those who undertake more conventional camping trips. The remaining sites are all vehicle-access (i.e., *front-country* opportunities) but are geographically spread across the range of Alberta's natural regions (see Figure S1 in the Online Supplement). Second, we focus on users who supplied the RAP database with an Alberta home postal code. Out-of-province users were removed as they were likely to have had other purposes for their trip for which we have no information. Of the remaining total, 9% did not supply a valid postal code and 5% were from other provinces or territories, which left 162,101 eligible reservations. Finally, we focus on reservations with six or fewer reported campers and a total trip length of no more than 7 nights. A final total of 144,279 trip reservations in 2015 met the combined criteria, accounting for approximately 73% of the total reservations recorded in the RAP database that year. These reservations were made by 71,594 distinct users, of whom 42% resided in one of Alberta's two large urban areas (Edmonton and Calgary).

Table S1 in the Online Supplement presents the distribution in the total number of trips taken by each user and the total number of different campgrounds visited. A majority of users (55%) took only one trip to a provincial campground, with a further 23% taking two trips. An even greater majority (82%) of users visited just one campground, and 13% visited two. The spatial locations of the 68 sites, and their relative popularity in terms of number of total visits, is displayed in Figure S1.

[6] We focus here on designated campgrounds, but people can also participate in random camping, where they do not camp at a designated sites. The numbers participating in random camping are unknown, but the majority of people that camp prefer to camp in designated campgrounds rather than random camping (Praxis Group, 2015).

Table S3 reports the number of camping trips in the 2015 season recorded for each of the 68 sites. Information on the attributes of each campground, including recreational activities available and amenities provided, was queried from the AEP website, and natural region categorization and park size calculations were performed using ArcGIS software. Table S2 summarizes the campground summary statistics of each attribute.

Travel Costs

The appropriate specification of travel costs in recreation demand modeling has been the subject of considerable research and ongoing debate (Fezzi, Bateman, and Ferrini, 2014; Parsons, 2017; Lloyd-Smith et al., 2019). This debate has played out in two distinct components of the travel cost variable: how to account for the opportunity cost of travel time and which monetary vehicle costs to include. These assumptions can often lead to substantially different welfare estimations (e.g., Hynes, Hanley, and O'Donoghue, 2009)). To address this inherent uncertainty, we adopt a bounding approach by calculating lower and upper travel cost bounds.[7]

Regarding the opportunity cost of time, we use a fraction of the wage rate reported by the visitor as the shadow value of their time. In the absence of user-specific income information, the median annual household after-tax income reported by the 2016 Canada Census at the dissemination area level was linked to the reported postal code for each user.[8] For the upper travel cost bound, a fraction of two-thirds was used; for the lower bound, one-third was used. The opportunity cost of travel time for each trip was calculated by dividing income by the number of hours worked in a year (assumed 2,040) to obtain an hourly wage rate, multiplying that rate by twice the travel time (to account for a round-trip), and then multiplying by one of the fractions specified above.

For the motor vehicle operation costs borne by the trip taker, we use vehicle cost data from the Canadian Automobile Association's driving cost calculator (Canadian Automobile Association, 2018), which includes figures for depreciation, maintenance, insurance, fuel, and licensing costs.[9] Instead of using the costs for a midsized sedan, which is customary in the literature, we use an average of three categories (compact car, sport utility vehicle, and pickup truck) to reflect the popularity of larger vehicles for recreational use in Alberta. Although drivers incur many costs associated with owning and operating a vehicle, the travel cost variable should include only those that are incurred directly due to the decision to take the recreational trip (i.e., marginal costs). The key assumption is whether consumers consider vehicle depreciation to be a fixed or a marginal cost. This decision has implications for driving behavior and thus for the calculation of welfare measures within a travel cost framework. In a recent review, Hang et al. (2016) found the recreation demand literature to be split on the issue: About half of studies included vehicle depreciation in travel costs and half did not. However, most studies offered little justification for their decision, leading to difficulties in future comparisons of welfare results.[10] For the upper cost bound the complete set of costs were included, resulting in a value of CAD $0.45/km. For the lower cost bound, only widely accepted marginal costs (fuel and maintenance) were included, resulting in a per km value of $0.15.[11]

[7] Distance and time of travel were calculated for each unique combination of postal code (geographic centroid of each postal code polygon) and campground using the *ggmap* package within R statistical software (Kahle and Wickham, 2013).

[8] The median household income among campers in the dataset was $86,870, which is higher than the provincial median reported in the 2016 Census, $76,420 (Statistics Canada, 2016).

[9] We use $1.05/litre as the gasoline cost, which was the province-wide average between May and September 2015 (Statistics Canada, 2016).

[10] Hang et al. (2016) went on to conduct an empirical analysis of driving behavior in the United States using a sample of 200,000 households from the 2009 National Highway Transportation Survey and found that, although depreciation did seem to have a significant negative effect on vehicle miles traveled, the magnitude of the effect was very small relative to fuel cost. Based on this finding, the authors suggested that depreciation either not be including in the per kilometer vehicle costs or be included at a small value.

[11] For comparison, the prevailing Government of Alberta private vehicle mileage rate is set to $0.51, which is widely used in the province for employee reimbursement.

Reservation and camping permit fees are also included as part of the total cost of a trip. When making a reservation through the RAP system, a flat fee of \$12 is charged regardless of the length of the reservation. The cost of a camping permit varies by campground and depends on the level of amenities provided at the particular campsite (i.e., unserviced vs. serviced).[12] We use the unserviced rate for each campground, which ranges from \$21 to \$29 per night, and assume that the marginal value of any other amenity provided is accounted for by the difference in permit price paid.

All monetary costs are divided by the number of campers in the party and the lower and upper bound monetary and time travel costs are aggregated with the camping fees to construct the two bounded measures of the travel cost variable. Figure S2 in the Online Supplement displays the distribution in travel cost per trip incurred by campers, illustrating the bounding approach taken. The median upper and lower travel costs per trip were \$231 and \$94, respectively.

Methods

Conceptual Framework

We model seasonal demand for camping trips in Alberta using the Kuhn–Tucker framework (von Haefen and Phaneuf, 2005).[13] Each individual i maximizes utility through the choice of the number of trips to each campground k and a numeraire good, which captures spending on all other goods subject to a monetary budget constraint. The individual's maximization problem is

$$(1) \qquad \max_{x_k, x_1} U(x_k, \boldsymbol{Q}_k, x_1) \quad s.t. \; y = \sum_{k=1}^{K} p_k x_k + x_1, x_k \geq 0, k = 1, \ldots, K,$$

where x_k is the number of trips to campground k, $\boldsymbol{Q}_k$ is a vector of quality characteristics for campground k, x_1 is the numeraire good with the price normalized to 1, y is annual income, and p_k is the round-trip price (i.e., travel cost) of visiting each campground.

The resulting first-order KT conditions that implicitly define the solution to the optimal number of trips (x_k) and numeraire goods (x_1) are

$$(2) \qquad \frac{U_{x_k}}{U_{x_1}} \leq p_k, \; k = 1, \ldots, K,$$

$$(3) \qquad x_k \left[\frac{U_{x_k}}{U_{x_1}} - p_k \right] = 0, \; k = 1, \ldots, K.$$

For campgrounds that an individual visits, the marginal rate of substitution between trips and the numeraire good is equal to the price of a trip. For unvisited campgrounds, the marginal rate of substitution between trips and the numeraire good is less than the price of a trip.

Empirical Model

We use the random utility specification of the multiple discrete-continuous extreme value (MDCEV) model as introduced by Bhat (2008). We assume that the numeraire good acts as the outside good

[12] Campsites may include certain amenities, such as power and water hookups for recreational vehicles.

[13] One limitation of using the seasonal Kuhn–Tucker model is that the framework does not distinguish when the trips are taken, only where and how many trips. Thus, time-varying site attributes such as weather cannot be easily accommodated. We could subdivide the season into multiple time periods to include time-varying site attributes (Lloyd-Smith et al., 2019), but we would lose a lot of the continuous nature of the data and our ability to capture satiation as people would likely only take one trip in each of these subseasonal time periods. Furthermore, we would need to make arbitrary assumptions regarding the appropriate time length of these blocks. We thank a reviewer for raising this point.

and is always consumed. The utility function is specified as

$$(4) \qquad U(x_k, \boldsymbol{Q}_k, x_1) = \sum_{k=1}^{K} \frac{\gamma_k}{\alpha_k} \psi_k \left[\left(\frac{x_k}{\gamma_k} + 1 \right)^{\alpha_k} - 1 \right] + \frac{\psi_1}{\alpha_1} x_1^{\alpha_1},$$

where $\gamma_k \geq 0$ and $\alpha_k, \alpha_1 \leq 1$ for all k are required for this function to be consistent with the properties of a utility function (Bhat, 2008). The ψ_k parameters represent the marginal utility of a trip to campground k when x_k is 0. The γ_k parameters are translation parameters that influence satiation and allow for corner solutions (i.e., 0 trips to a certain campground). The α parameters control the rate of diminishing marginal utility of additional camping trips to a certain site. Weak complementarity, which is a set of restrictions on preferences necessary for unique welfare measurement such that camping is a nonessential good and people do not gain utility from quality changes when trips are 0, is imposed in this specification by adding and subtracting 1 in the campground trip part of the utility function.

To alleviate the identification concerns regarding estimating separate γ_k and α_k parameters for each site, we need to fix a subset of these parameters (Bhat, 2008). We compare two utility function specifications that differ in their treatment of α parameters. The "γ-profile" utility specification fixes the α_k parameter for all camping sites to 0 and estimates the α_1 for the numeraire good. The hybrid-profile specification estimates a single α parameter (i.e., $\alpha_k = \alpha_1 = \alpha$). Both specifications estimate campground-specific γ_k parameters. We find that the γ-profile utility specification fits the data the best and thus we present the results using this model.[14]

We specify the following parameterization of the utility function parameters $\gamma_k = \exp(\gamma_k)$, $\psi_k = \exp(\beta_q \boldsymbol{Q}_k + \beta_s \boldsymbol{S}_i + \varepsilon_k)$, and $\alpha = 1 - \exp(\alpha)$.

The $\boldsymbol{S}_i$ vector contains any individual-specific variables to allow for observed preference heterogeneity, while the ε_k is an error term that allows for the utility function to be random over the population. We assume an extreme value distribution that is independently distributed across alternatives for ε_k, with an associated scale parameter of σ. Note that the ψ_1 parameter for the numeraire is specified as $\psi_1 = exp(\varepsilon_1)$. To clarify the multiple set of indices, k represents a specific campground from the set of all campgrounds K; j represents a specific good from the set of all goods J, including the numeraire (i.e., $K + 1 = J$); and M is the optimal number of goods consumed with positive quantities from J. The resulting model probability of the consumption pattern where M goods are chosen can be expressed as

$$(5) \qquad P(x_1^*, x_2^* \ldots, x_M^*, 0, \ldots, 0) = \frac{1}{\sigma^{M-1}} \left(\prod_{j=1}^{M} c_j \right) \left(\sum_{j=1}^{M} \frac{1}{c_j} \right) \left(\frac{\prod_{j=1}^{M} e^{V_j/\sigma}}{\left(\sum_{j=1}^{J} e^{V_k/\sigma} \right)^M} \right) (M-1)!,$$

where σ is a scale parameter, $V_1 = (\alpha_1 - 1)\ln(x_1)$, $V_k = \beta' \boldsymbol{Q}_k - \ln\left(\frac{x_k}{\gamma_k} + 1\right) - \ln(p_k)$, and $c_j = \frac{1-\alpha_j}{x_j + \gamma_j p_j}$ (Bhat, 2008).

In our application, $K = 68$ as we have a total of 68 campgrounds represented in the data. Because we are interested in the welfare changes from site closures, we include site-specific constants for each campground in the $\boldsymbol{Q}_k$ vector to capture any unique and unobserved preferences for certain sites. The $\boldsymbol{S}_i$ vector includes a single sociodemographic characteristic of whether the individual resides in either of the two large urban areas of Alberta, Edmonton or Calgary.

Our data only include people who actually took camping trips in 2015 and therefore truncates the trip distribution at 1. Following von Haefen and Phaneuf (2005), we estimate models that

[14] Both specification have the same number of estimated parameters and the log-likelihood for the hybrid profile using the high travel costs is estimated to be −451,237 compared to −450,946 for the γ profile. One practical implication of using the γ profile is that welfare measurement is more computationally intensive and takes 3 to 4 times longer than if the hybrid profile were used (see Lloyd-Smith, 2018, for the comparison details). There has not been a comprehensive assessment of the impacts of the various MDCEV utility function structures on welfare, but we leave that for future research.

consistently account for this truncation. Specifically, we divide the conditional likelihood by 1 minus the likelihood of observing 0 trips to all campgrounds. Model estimation and welfare simulation were conducted using the R package *rmdcev* (Lloyd-Smith, 2020).

Welfare Estimation

The estimated parameters of the model are used in a simulation-based approach to welfare measurement. The Hicksian compensating surplus (CS^H) for a change in price and quality from baseline levels p^0 and q^0 to new levels p^1 and q^1 using the expenditure function is defined as

$$CS^H = y - e(p^1, q^1, U^0, \boldsymbol{\theta}, \varepsilon), \quad (6)$$

where y is income, $e(.)$ is the expenditure function, $\boldsymbol{\theta}$ is the vector of structural parameters $(\psi_k, \alpha_1, \gamma_k)$, and U^0 is the baseline utility level represented as $U^0 = V(p^0, q^0, y, \boldsymbol{\theta}, \varepsilon)$. Calculating CS^H is not a straightforward task as it depends on both interior and corner solutions for the k campgrounds and is a random variable due to the presence of the ε terms in CS^H, which are assumed to be unknown to the researcher (von Haefen and Phaneuf, 2005). We use the simulation approach described in Lloyd-Smith (2018) to calculate $\mathrm{E}[CS^H]$. We follow von Haefen and Phaneuf (2005) and implement the conditional approach to welfare measurement by simulating the unobserved heterogeneity to ensure the model perfectly predicts reported trips. Thus, the welfare measurement is grounded in the actual trip behavior.

We consider a total of 68 policy scenarios. In each policy scenario, a single campground is closed. For each policy scenario, we calculate the welfare impacts using both high and low travel costs as well as 100 Krinsky–Robb parameter draws and 50 conditional error draws per individual. The conditional errors are drawn using the modified Latin hypercube sampling algorithm (Hess, Train, and Polak, 2006).[15]

Campground Value Heterogeneity

We use these individual- and campground-specific welfare impacts of campground closures and assess how these values are determined by three sets of campground attributes: park attributes, available activities nearby, and campground amenities. For each individual, we calculate the average welfare impact over the 100 Krinsky–Robb draws for each campground. We then estimate the following linear regression model:

$$\begin{aligned} \ln(WTP_{ik}) = \beta_0 &+ \boldsymbol{\beta}_1(\text{Park Attributes})_k + \boldsymbol{\beta}_2(\text{Rec. Activities})_k \\ &+ \boldsymbol{\beta}_3(\text{Campground Amenities})_k + \varepsilon_{ik}, \end{aligned} \quad (7)$$

where the dependent variable is the natural log of the welfare changes for each individual and campground and independent variables include park attributes, such as size of the park and the natural region in which it is located; available recreation activities nearby, such as swimming, fishing, and hunting; and campground amenities, such as whether the campground has a boat launch, flush toilets, and showers.

Because campground and park attributes are not randomly allocated, these relationships should not be interpreted causally. People might visit certain parks because they can fish in the lake, but park managers might install pit vault toilets at parks that are already popular. However, these estimated

[15] The MLHS approach shares many of the same desirable properties as Halton sequences, such as equal spacing of draws, but adds a random element to ensure that different draws are used across dimensions and runs. One challenge with the use of MLHS draws is that the asymptotic properties are not clearly defined, making asymptotic comparisons with other sampling methods difficult (Hess, Train, and Polak, 2006). In our context, the calculated welfare measures are less sensitive to simulation error because we are implementing conditional welfare measurement where errors are drawn to reflect actual behavior rather than unconditionally.

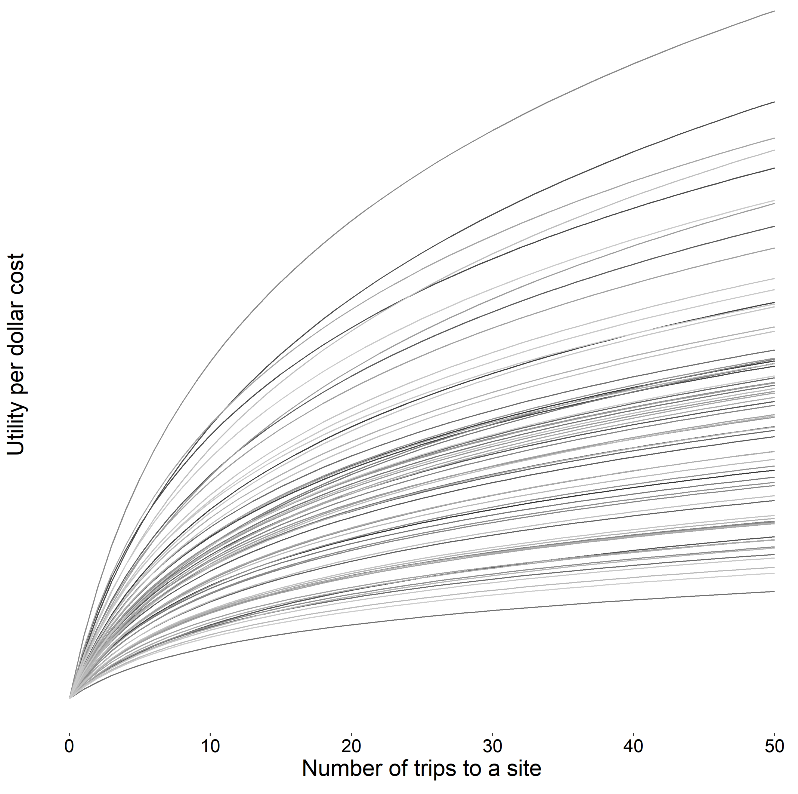

Figure 1. Estimated Utility per Dollar Cost Gained from Trips to 68 Campgrounds

Notes: This figure shows the curvature of the estimated utilities per dollar cost as the number of trips increase for each campground. Each line represents one of the 68 campgrounds.

correlations are still useful for park managers to understand how various aspects of the camping experience are associated with economic values.

Results

Kuhn–Tucker Model Results

Table 1 presents the parameter estimates for the models using low travel costs (Model 1) and high travel costs (Model 2). Both sets of estimates are generated using models that account for the truncation of trips given the fact that all individuals took at least one trip (i.e., we only have data on active participants). The utility function parameters are consistent across the two models, with all variables significantly different from 0. All of the site-specific constants are negative, suggesting that the numeraire is always preferred. The positive and significant coefficient for the urban resident dummy variable suggests that residents of Edmonton and Calgary are more likely to take a camping trip, once travel costs are held constant. The translation parameters (γ_k) influence the propensity toward a corner solution for a given campground and also affect satiation. The greater the value of γ_k, the less the marginal utility of a trip decreases as more trips to a campground are taken (i.e., less satiation). The satiation parameter (α_1) is estimated to be less than 1 but statistically different from 0. The estimated log-likelihood at convergence of Model 2 is closer to 0 than that of Model 1, suggesting that the higher travel cost specification fits the data better.

Table 1. Kuhn–Tucker Model Parameter Estimates

	Model 1: Low Travel Costs	Model 2: High Travel Costs
Number of Individuals	71,594	71,594
Number of Trips	144,279	144,279
Number of Campgrounds	68	68
Final Log-Likelihood	−451,903	−450,946
Parameters	139	139

	β_q		γ		β_q		γ	
Campground	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Aspen Beach: Brewer’s	−3.34	0.089	4.33	0.138	−4.28	0.109	3.48	0.111
Aspen Beach: Lakeview	−3.27	0.088	4.35	0.094	−4.25	0.108	3.49	0.083
Beauvais Lake	−3.44	0.091	6.61	0.161	−4.36	0.109	5.24	0.148
Beaver Lake	−3.45	0.090	4.66	0.081	−4.42	0.111	3.73	0.068
Boulton Creek	−3.26	0.088	5.54	0.115	−4.17	0.107	4.43	0.086
Bow Valley	−3.32	0.089	5.62	0.104	−4.26	0.109	4.47	0.081
Brazeau Res. West Canal	−3.93	0.089	4.91	0.114	−4.99	0.115	3.92	0.107
Brazeau Reservoir	−3.69	0.091	4.58	0.117	−4.69	0.110	3.67	0.074
Calling Lake	−3.47	0.090	5.42	0.229	−4.47	0.107	4.34	0.180
Carson-Pegasus	−3.09	0.088	5.00	0.256	−3.97	0.108	3.98	0.211
Chain Lakes	−3.73	0.089	5.11	0.373	−4.72	0.110	4.14	0.267
Cold Lake	−3.21	0.089	4.80	0.202	−4.12	0.107	3.81	0.134
Crimson Lake	−3.15	0.089	4.27	0.276	−4.08	0.109	3.45	0.199
Crimson Lake: Twin Lakes	−4.09	0.087	6.35	0.138	−5.20	0.111	5.03	0.115
Cross Lake	−3.28	0.089	6.43	0.200	−4.27	0.108	5.12	0.155
Cypress Hills: Battle Creek	−4.07	0.092	4.90	0.175	−5.14	0.113	3.92	0.150
Cypress Hills: Beaver Creek	−3.34	0.089	5.02	0.660	−4.42	0.111	3.79	0.476
Cypress Hills: Elkwater	−2.99	0.089	5.48	0.332	−3.95	0.106	4.31	0.256
Cypress Hills: Ferguson Hill	−3.53	0.088	4.63	0.136	−4.47	0.110	3.70	0.125
Cypress Hills: Firerock	−3.06	0.088	5.16	0.527	−3.95	0.109	4.20	0.400
Cypress Hills: Lakeview	−3.48	0.089	4.82	0.953	−4.56	0.112	3.47	0.682
Cypress Hills: Lodgepole	−3.58	0.087	4.54	0.389	−4.55	0.112	3.60	0.315
Cypress Hills: Old Baldy	−3.38	0.090	4.98	0.224	−4.42	0.109	3.97	0.216
Cypress Hills: Reesor Lake	−3.60	0.086	4.70	0.218	−4.55	0.108	3.75	0.156
Cypress Hills: Spruce Coulee	−3.87	0.093	5.13	0.264	−4.89	0.113	4.18	0.238
Dillberry Lake	−3.58	0.090	4.24	0.273	−4.59	0.113	3.40	0.161
Dinosaur	−3.11	0.089	6.50	0.143	−3.97	0.107	5.15	0.092
Dunvegan	−3.83	0.095	4.62	0.285	−4.99	0.113	3.70	0.226
Elkwood	−3.25	0.088	4.87	0.466	−4.15	0.109	3.81	0.360
Etherington Creek	−3.65	0.091	5.37	0.110	−4.67	0.108	4.28	0.095
Fish Lake	−3.42	0.089	4.50	0.222	−4.38	0.108	3.60	0.156
Franchere Bay	−3.44	0.090	4.76	0.175	−4.42	0.109	3.69	0.128
Garner Lake	−3.56	0.088	4.61	0.095	−4.53	0.110	3.68	0.080
Gregoire Lake	−3.31	0.089	5.03	0.325	−4.36	0.109	4.02	0.277
Hilliard’s Bay	−3.17	0.088	4.63	0.169	−4.06	0.106	3.73	0.124
Jarvis Bay	−3.36	0.089	4.85	0.109	−4.35	0.108	3.88	0.118
Kinbrook Island	−3.21	0.088	4.69	0.241	−4.11	0.107	3.75	0.212
Lac Des Arcs	−3.89	0.090	4.94	0.233	−4.97	0.110	4.03	0.225
Lesser Slave Lake: Marten River	−3.21	0.088	5.01	0.210	−4.08	0.108	4.06	0.175
Little Bow	−3.21	0.089	5.19	0.148	−4.10	0.108	4.14	0.135
Little Elbow	−3.81	0.090	4.80	0.119	−4.90	0.109	3.82	0.105
Long Lake	−3.21	0.089	6.85	0.149	−4.14	0.108	5.43	0.098
McLean Creek	−3.60	0.089	4.22	0.212	−4.64	0.108	3.38	0.178
Medicine Lake	−3.65	0.088	4.91	0.321	−4.69	0.109	3.98	0.325
Miquelon Lake	−3.45	0.089	5.40	0.109	−4.48	0.108	4.29	0.098
Moonshine Lake	−3.64	0.095	4.65	0.184	−4.72	0.110	3.74	0.163
Moose Lake	−3.77	0.090	4.64	0.135	−4.81	0.109	3.70	0.121
North Buck Lake	−3.57	0.090	5.92	0.117	−4.55	0.108	4.73	0.090
Oldman Dam: Cottonwood	−3.69	0.091	5.14	0.162	−4.67	0.113	4.06	0.116
Park Lake	−3.53	0.089	4.79	0.307	−4.57	0.108	3.85	0.225

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Table 1. – continued from previous page

	Model 1: Low Travel Costs				Model 2: High Travel Costs			
	β_q		γ		β_q		γ	
Campground	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Pelican Point Park	−3.82	0.090	4.59	0.119	−4.86	0.111	3.70	0.109
Pembina River	−3.46	0.088	4.69	0.220	−4.44	0.107	3.81	0.165
Pierre Grey's Lakes	−4.02	0.104	4.72	0.178	−5.13	0.116	3.77	0.133
Pigeon Lake	−3.34	0.089	4.34	0.447	−4.30	0.108	3.49	0.386
Pigeon Lake: Zeiner	−3.64	0.089	5.61	0.496	−4.68	0.110	4.51	0.485
Red Lodge	−3.60	0.088	4.86	0.185	−4.60	0.109	3.88	0.165
Saskatoon Island	−3.91	0.092	4.76	0.077	−5.11	0.108	3.80	0.059
Sir Winston Churchill	−3.20	0.089	4.68	0.401	−4.16	0.109	3.72	0.323
Tillebrook	−3.47	0.089	5.21	0.192	−4.46	0.112	4.16	0.153
Vermilion	−3.52	0.088	4.99	0.315	−4.51	0.110	3.98	0.273
Wabamun Lake	−3.41	0.087	6.39	0.237	−4.43	0.108	5.07	0.161
Whitney Lakes: Ross Lake	−3.47	0.090	5.30	0.257	−4.45	0.109	4.27	0.218
Whitney Lakes: Whitney Lake	−4.05	0.094	4.70	0.185	−5.14	0.115	3.75	0.162
William A. Switzer: Gregg Lake	−3.02	0.089	4.83	0.206	−3.88	0.108	3.86	0.164
William A. Switzer: Jarvis Lake	−3.45	0.091	5.30	0.284	−4.45	0.112	4.25	0.213
Writing-on-Stone	−3.07	0.088	4.72	0.128	−3.91	0.107	3.79	0.089
Wyndham-Carseland	−3.84	0.089	4.09	0.554	−4.93	0.108	3.40	0.496
Young's Point	−3.27	0.089	4.79	0.282	−4.18	0.110	3.84	0.238
Urban resident (β_s)	0.01	0.006	–	–	0.06	0.006	–	–
Satiation parameter (α_1)	0.36	0.008	–	–	0.25	0.010	–	–
Scale parameter (σ)	0.28	0.001	–	–	0.35	0.001	–	–

Notes: All models have been adjusted for truncation of data. Urban resident is a dummy variable if the individual resides in either Edmonton or Calgary, Alberta's two largest cities.

The parameter estimates for the MDCEV model are not easily interpretable due to the nonlinearities of the utility function. Another way to illustrate parameter estimates is to calculate the utility gained per dollar cost for each site over a range of visitation frequency.[16] Figure 1 presents the estimated average utility per dollar cost as the number of trips to a campground increase. The concave shape of the curves reflects the decreasing marginal utility of trips to each of the sites, providing evidence for satiation. There is substantial heterogeneity in utility curves for each campground, with varying levels of satiation.

Economic Value of Campgrounds

For the welfare analysis, we calculate the individual-specific welfare impacts of closing each of the 68 campgrounds separately. The welfare estimates represent the amount of income an individual would need to be exactly compensated for the loss of access to the campground in 2015. Table S3 in the Online Supplement reports the total number of trips and three welfare measures using the low and high travel costs for each campground. There is substantial variation in the number of camping trips to each campground, with the most popular sites receiving over 8,000 visits and the least popular sites receiving fewer than 100 trips. The first welfare measure is the average annual Hicksian welfare estimates per person for each campground. The average per person welfare estimates for a site closure range from a low of \$0.03–\$0.07 for a closure of Pierre Grey's Lakes campground to a high of \$5.04–\$10.25 for a closure of the Lakeview Campground in Aspen Beach Provincial Park. The welfare changes using the high travel costs are on average more than double the welfare changes using the low travel costs.

The second welfare measure multiplies the per person measure by the total number of people to yield a total welfare change resulting from a campground closure. Closing a campground can result

[16] The estimated utility is calculated using the using the high travel cost model and is divided by the average travel cost to each site.

in welfare losses as little as a few thousand dollars for the infrequently visited campgrounds to several hundreds of thousands of dollars for the more popular campgrounds. Similar to the average per person welfare changes, the total welfare impacts are largely driven by the number of trips to each of the campgrounds.

The third measure divides the total welfare changes associated with each campground by the total number of trips to yield the average welfare change per trip. This measure allows the relative welfare impacts of camping trips to be compared, rather than campgrounds themselves, and produces per trip welfare measures comparable to more standard travel cost models such as count models. However, these per trip values represent an average and ignore the clear nonlinear relationship between utility and the number of trips presented in Figure 1. The per trip results find substantial heterogeneity in welfare that is not primarily driven by trips. The range of welfare associated with a camping trip ranges from a low of \$23–\$46 at Wyndham-Carseland Campground to a high of \$63–\$144 for the Gregg Lake Campground in William A. Switzer Provincial Park. The correlation between the number of trips to a campground and the per trip welfare measure is -0.03. Across all sites, the average welfare associated with a camping trip is estimated to be \$40–\$89.

Figure 2 graphically shows the per trip welfare values using low and high travel costs for each of the 68 campgrounds. The error bars represent the 95% confidence interval for each welfare estimate. The difference in travel cost assumptions leads to large differences in per trip welfare values compared to the statistical uncertainty associated with each estimate. The large differences in values across the 68 campgrounds suggests that campgrounds may have particular characteristics that are associated with these differences, which we assess in the next section.

Determinants of Campground Economic Value Heterogeneity

To help explain the large heterogeneity in campground values, we model the individual- and campground-specific economic values as a function of various campground attributes. Table 2 shows the results of three specifications of the campground value heterogeneity linear regression model. The first column includes park attributes, the total number of recreational activities, and campground amenities as variables. Campgrounds with a beach are associated with higher economic values. The value of a campground increases by 2% for a 10% increase in the size of the park in which it is located. The natural region in which a campground is located also affects its value, with campgrounds in the Rocky Mountains being the most valued. While the number of campground amenities has a positive association with campground values, each additional recreational activity available is associated with a small decrease in campground values. The second column includes recreational activities as variables but excludes all campground amenity information. While some activities such as golfing and mountain biking are associated with higher campground values, many recreational activities are associated with lower values. When fishing and hunting are listed as available activities near the campground, the economic value for camping is lower. The third column adds the campground amenity to the specification. In general, these amenities have a positive association with campground values, as we would expect. For instance, the availability of firewood, the presence of a playground, and both water hookups and sewage disposal facilities for recreational vehicles are all associated with increased economic values. In general, we find that campground attributes have both positive and negative associations with campground values. However, these results should not be interpreted causally due to the potential endogeneity discussed earlier in the paper.

Discussion

This paper has used a Kuhn–Tucker model to estimate the welfare changes from campground closures using data on over 144,279 trips taken by 71,594 individuals in Alberta, Canada. If we aggregate the welfare changes across all sites, we can derive an overall annual welfare impact of

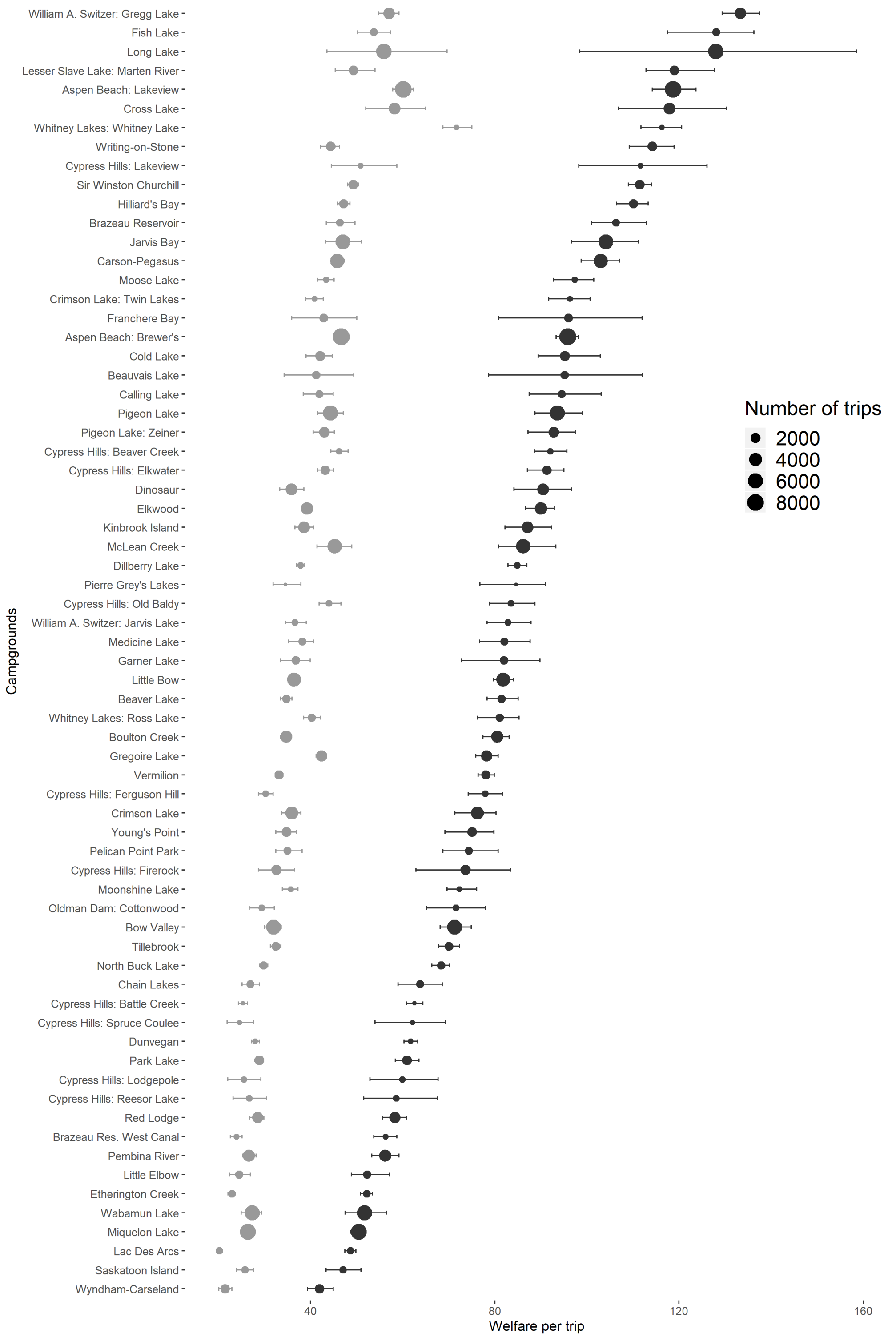

Figure 2. Average Welfare Impacts per Trip of Campground Closures

Notes: This figure shows average welfare impacts per trip of closing each of the 68 campgrounds separately. The darker circles and 95% confidence intervals use the high travel cost specification and the lighter colors use the low travel cost specification.

Table 2. Determinants of Campground Economic Values

Dep. Variable: $\ln(wtp_{ik})$	1	2	3
Park attributes			
Beach	0.238 (0.004)	0.168 (0.006)	0.164 (0.007)
Park size: ln(hectares)	0.023 (0.001)	0.052 (0.001)	0.006 (0.001)
Natural region: foothills	0.050 (0.006)	−0.022 (0.007)	0.269 (0.010)
Natural region: grassland	0.030 (0.005)	0.083 (0.008)	0.146 (0.009)
Natural region: parkland	−0.012 (0.006)	0.177 (0.008)	−0.029 (0.009)
Natural region: Rocky Mountain	0.350 (0.008)	0.296 (0.012)	0.524 (0.013)
Recreational activities			
Number of activities	−0.032 (0.001)		
Swimming		0.077 (0.006)	−0.030 (0.008)
Birding		−0.083 (0.005)	−0.044 (0.005)
Fishing		−0.511 (0.009)	−0.125 (0.009)
Wildlife viewing		−0.105 (0.005)	−0.110 (0.005)
Hunting		−0.478 (0.019)	−0.076 (0.021)
Hiking, backcountry		−0.246 (0.007)	−0.350 (0.008)
Mountain biking		0.075 (0.005)	0.230 (0.007)
Horseshoes		−0.035 (0.005)	0.016 (0.006)
Hiking, interpretive		−0.300 (0.009)	−0.212 (0.009)
Canoeing, kayaking		−0.110 (0.009)	−0.126 (0.010)
Equestrian		−0.065 (0.009)	0.110 (0.011)
Power boating		0.080 (0.009)	0.023 (0.011)
Water skiing		0.150 (0.008)	0.049 (0.008)
Sailing		−0.219 (0.007)	−0.282 (0.007)
Wind surfing		0.087 (0.008)	0.338 (0.010)
Golfing		0.295 (0.011)	0.057 (0.014)
Campground amenities			
Number of amenities	0.102 (0.001)		
Boat launch			0.042 (0.005)
Firewood			0.205 (0.006)
Playground			0.173 (0.005)
Power			−0.011 (0.007)
Shelter picnic			0.081 (0.005)
Interpretive viewpoint			0.295 (0.008)
Grocery supply store			0.177 (0.008)
Water hookup			0.233 (0.009)
Sewage disposal			0.320 (0.006)
Pit vault toilets			−0.127 (0.007)
Constant	−20.910 (0.010)	−20.234 (0.012)	−20.952 (0.018)
No. of obs.	4,868,392	4,868,392	4,868,392
R^2	0.004	0.005	0.008

Notes: Numbers in parentheses are robust standard errors clustered at the individual level. The Natural Region Boreal Forest is the omitted category.

overnight camping in provincial parks in Alberta of \$81–\$178 per person, or \$5.8– \$12.7 million in total. This aggregate welfare measure provides insights into the overall economic benefits people receive from camping in Alberta's provincial parks but is likely an underestimate of the total economic value of parks for three reasons. First, the welfare analysis closed each campground individually, allowing people to substitute to other campgrounds compared to the less realistic scenario of closing all campground sites. Second, the study used only a subset of reservation visits, as group, comfort, equestrian, and out-of-province campers were not included in the analysis. Third, these welfare estimates represent recreational use values, and provincial parks also provide many other ecosystem service values (e.g., carbon sequestration, biodiversity, and habitat services) as well as potential nonuse values that have been recognized in the literature (Pascual et al., 2010).

These economic values can be used in a variety of analyses. Understanding the societal benefits generated by park visitation can be compared to other economic activities, such as logging, which are typically not permitted within park boundaries. Similarly, the administrative costs to the public of maintaining campground infrastructure can also be compared against the benefits accrued to recreationists. The values can also be used to determine economic losses from a site closure, whether through a natural disaster or an administrative decision (Richardson, Huber, and Loomis, 2017). The majority of the natural disaster literature measures direct market costs (Kousky, 2014), and this study provides complementary information on the nonmarket costs. The Alberta government has recently proposed closing several provincial parks due to budget concerns, and the estimates in this paper can help inform the decision of which parks have the least overnight camping recreation value (Bell, 2020).

We find that per trip welfare estimates can be 3 times higher for certain sites compared to others, which raises cautions for the use of simple per trip unit transfers of recreation values. If we use the average per trip welfare measure instead of the campground-specific per trips measures, we would underestimate and overestimate welfare impacts by up to 50% for some campgrounds. While generating these site-specific welfare measures requires detailed trip data, the use of administrative recreation datasets is one approach to reduce the time and resource costs of obtaining reliable trip data.

We have demonstrated how administrative datasets such as Reserve Alberta Parks are a promising source for recreation data with key advantages over conventional methods such as intercept surveys but also come with limitations. In terms of advantages, the database provides access to the entirety of trip reservations made instead of just a sample, alleviating concerns of sample representativeness, endogenous stratification, and recall bias. Furthermore, once the online system is set up, data collection is automatic, reducing future data collection efforts and costs. However, the administrative data also have limitations for demand modeling. An intercept survey typically contains additional questions besides trip behavior such as site attribute perceptions, travel mode, and sociodemographic information such as income, which are not available with current administrative data. The reservation data only record whether a reservation was made, not if the actual trip was taken. While the reservation fee serves to limit the number of "no-shows," there might be some discrepancies between the reserved and actual data. Also, we did not have access to data on when the reservation was made, which does not allow for individual-specific choice sets to be calculated if campgrounds were fully reserved when someone made the reservation. These limitations provide future avenues for improving the data collection procedures to help maximize the value of online reservation data for nonmarket recreation demand estimation.

Other jurisdictions have made recent efforts to centralize and automate their recreation data gathering strategies. For example, the U.S. government launched the Recreation Information Database as part of the Recreation One Stop (Rec1Stop) Project.[17] This database both to collects and disseminates information around recreational opportunities on federally managed lands throughout the United States, including providing functionality for campsite reservations. Although trip information from this database has not yet been used for recreation demand modeling, similar potential exists as with the database utilized in the present study.

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[17] The data are available at www.ridb.recreation.gov.

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Online Supplement: The Economic Value of Camping Using Administrative Data

Patrick Lloyd-Smith and Marcus Becker

Table S1. Trip Distribution across 71,594 Campers

Number of trips	**Number of users**	
1	39,329	54.9%
2	16,153	22.6%
3	6,845	9.6%
4	4,031	5.6%
5	1,987	2.8%
6	1,257	1.8%
7	676	0.9%
8	431	0.6%
9	294	0.4%
10+	591	0.8%
Number of campgrounds visited	**Number of users**	
1	58,838	82.2%
2	9,213	12.9%
3	2,444	3.4%
4	743	1.0%
5+	356	0.5%

Table S2. Campground Attributes Summary Statistics (*N* = 68)

Park Attributes	**% Campgrounds[a]**
Beach	62%
Mean park size (ha)	5,667
Natural region: boreal	37%
Natural region: foothills	15%
Natural region: grassland	26%
Natural region: parkland	10%
Natural region: Rocky Mountain	12%
Recreational Activity	
Swimming	66%
Birding	63%
Fishing	88%
Wildlife viewing	51%
Hunting	15%
Hiking, backcountry	10%
Mountain biking	54%
Horseshoes	37%
Hiking, interpretive	22%
Canoeing, kayaking	93%
Equestrian	25%
Power boating	72%
Water skiing	54%
Sailing	57%
Wind surfing	66%
Golfing	19%
Campground amenities	
Boat launch	41%
Firewood	56%
Playground	81%
Power	74%
Picnic shelter	13%
Interpretive viewpoint	8%
Supply store	18%
Water hookup	18%
Sewage disposal	68%
Pit vault toilets	81%

Notes: [a] All variables except park size are percentage of campgrounds.

Table S3. Welfare Changes of Campground Closures

Campground	Total Trips	Per Person B		Aggregate C=B × 71,594		Per Trip D=C/A	
	A	Low	High	Low	High	Low	High
Aspen Beach: Brewer's	8,311	$4.38	$9.23	$313,633	$661,039	$38	$80
Aspen Beach: Lakeview	7,746	$5.04	$10.25	$361,100	$733,534	$47	$95
Beauvais Lake	993	$0.52	$1.25	$37,357	$89,384	$38	$90
Beaver Lake	1,057	$0.70	$1.62	$50,114	$115,900	$47	$110
Boulton Creek	3,275	$1.76	$4.06	$126,066	$290,392	$38	$89
Bow Valley	5,897	$2.94	$6.58	$210,182	$470,824	$36	$80
Brazeau Res. West Canal	272	$0.13	$0.30	$9,156	$21,217	$34	$78
Brazeau Reservoir	745	$0.44	$1.06	$31,841	$75,595	$43	$101
Calling Lake	830	$0.55	$1.23	$39,721	$88,058	$48	$106
Carson-Pegasus	5,134	$3.24	$7.47	$232,317	$535,107	$45	$104
Chain Lakes	917	$0.38	$0.89	$27,294	$63,999	$30	$70
Cold Lake	1,904	$1.28	$3.08	$91,430	$220,633	$48	$116
Crimson Lake	4,129	$2.39	$5.14	$171,140	$368,305	$41	$89
Crimson Lake: Twin Lakes	248	$0.14	$0.34	$9,894	$24,024	$40	$97
Cross Lake	3,209	$2.07	$4.25	$148,096	$304,077	$46	$95
Cypress Hills: Battle Creek	77	$0.03	$0.08	$2,229	$5,577	$29	$72
Cypress Hills: Beaver Creek	391	$0.28	$0.55	$20,206	$39,111	$52	$100
Cypress Hills: Elkwater	1,634	$1.17	$2.48	$83,511	$177,397	$51	$109
Cypress Hills: Ferguson Hill	500	$0.25	$0.62	$17,852	$44,248	$36	$88
Cypress Hills: Firerock	2,155	$1.27	$2.88	$90,815	$206,331	$42	$96
Cypress Hills: Lakeview	281	$0.22	$0.48	$15,976	$34,541	$57	$123
Cypress Hills: Lodgepole	408	$0.18	$0.42	$13,037	$30,299	$32	$74
Cypress Hills: Old Baldy	460	$0.28	$0.54	$20,376	$38,804	$44	$84
Cypress Hills: Reesor Lake	494	$0.18	$0.40	$12,869	$28,551	$26	$58
Cypress Hills: Spruce Coulee	163	$0.06	$0.16	$4,647	$11,324	$29	$69
Dillberry Lake	464	$0.25	$0.55	$17,761	$39,365	$38	$85
Dinosaur	3,168	$1.93	$4.77	$138,009	$341,209	$44	$108
Dunvegan	227	$0.12	$0.26	$8,457	$18,285	$37	$81
Elkwood	3,593	$2.10	$4.83	$150,112	$345,797	$42	$96
Etherington Creek	822	$0.39	$0.87	$27,688	$62,203	$34	$76
Fish Lake	848	$0.59	$1.39	$41,885	$99,468	$49	$117
Franchere Bay	1,247	$0.74	$1.60	$52,714	$114,542	$42	$92
Garner Lake	1,171	$0.62	$1.40	$44,583	$100,091	$38	$85
Gregoire Lake	2,652	$2.22	$4.28	$159,232	$306,318	$60	$116
Hilliard's Bay	1,355	$0.90	$2.12	$64,492	$152,019	$48	$112
Jarvis Bay	5,707	$3.18	$7.24	$227,937	$518,549	$40	$91
Kinbrook Island	3,226	$1.81	$4.15	$129,326	$296,816	$40	$92
Lac Des Arcs	677	$0.28	$0.65	$19,852	$46,770	$29	$69
Lesser Slave Lake: Marten River	1,816	$1.25	$3.08	$89,764	$220,400	$49	$121
Little Bow	4,920	$2.72	$6.23	$194,939	$445,895	$40	$91
Little Elbow	990	$0.37	$0.78	$26,160	$55,945	$26	$57
Long Lake	6,343	$4.13	$9.03	$295,782	$646,811	$47	$102
McLean Creek	5,463	$2.93	$5.92	$209,459	$423,679	$38	$78
Medicine Lake	892	$0.49	$1.07	$35,294	$76,901	$40	$86
Miquelon Lake	7,116	$3.13	$6.03	$224,434	$431,421	$32	$61
Moonshine Lake	290	$0.15	$0.31	$10,861	$22,300	$37	$77
Moose Lake	385	$0.23	$0.51	$16,238	$36,389	$42	$95
North Buck Lake	1,005	$0.50	$1.14	$35,745	$81,636	$36	$81
Oldman Dam: Cottonwood	504	$0.24	$0.57	$16,995	$40,951	$34	$81
Park Lake	1,721	$0.75	$1.62	$53,542	$115,876	$31	$67
Pelican Point Park	878	$0.41	$0.89	$29,397	$63,549	$33	$72
Pembina River	3,445	$1.45	$3.08	$103,845	$220,437	$30	$64
Pierre Grey's Lakes	50	$0.03	$0.07	$1,994	$4,659	$40	$93
Pigeon Lake	6,242	$3.40	$7.39	$243,719	$528,997	$39	$85
Pigeon Lake: Zeiner	2,271	$1.14	$2.50	$81,909	$179,040	$36	$79
Red Lodge	2,632	$1.05	$2.16	$75,031	$154,661	$29	$59

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	Total Trips	Per Person B		Aggregate C=B × 71,594		Per Trip D=C/A	
Campground	**A**	**Low**	**High**	**Low**	**High**	**Low**	**High**
Saskatoon Island	676	$0.26	$0.48	$18,402	$34,277	$27	$51
Sir Winston Churchill	1,694	$1.25	$2.83	$89,726	$202,342	$53	$119
Tillebrook	1,291	$0.62	$1.36	$44,669	$97,100	$35	$75
Vermilion	1,377	$0.77	$1.82	$55,118	$130,629	$40	$95
Wabamun Lake	6,261	$2.67	$5.14	$191,274	$367,685	$31	$59
Whitney Lakes: Ross Lake	995	$0.59	$1.23	$42,001	$87,841	$42	$88
Whitney Lakes: Whitney Lake	211	$0.18	$0.35	$13,055	$24,966	$62	$118
William A. Switzer: Gregg Lake	2,904	$2.57	$5.85	$183,957	$418,694	$63	$144
William A. Switzer: Jarvis Lake	503	$0.30	$0.69	$21,768	$49,266	$43	$98
Writing-on-Stone	1,791	$1.20	$3.06	$85,609	$219,093	$48	$122
Wyndham-Carseland	1,525	$0.50	$0.98	$35,545	$70,140	$23	$46
Young's Point	1,701	$0.94	$2.05	$67,068	$146,499	$39	$86
Total	144,279	$81.23	$177.69	$5,816,207	$12,717,782	$40	$89

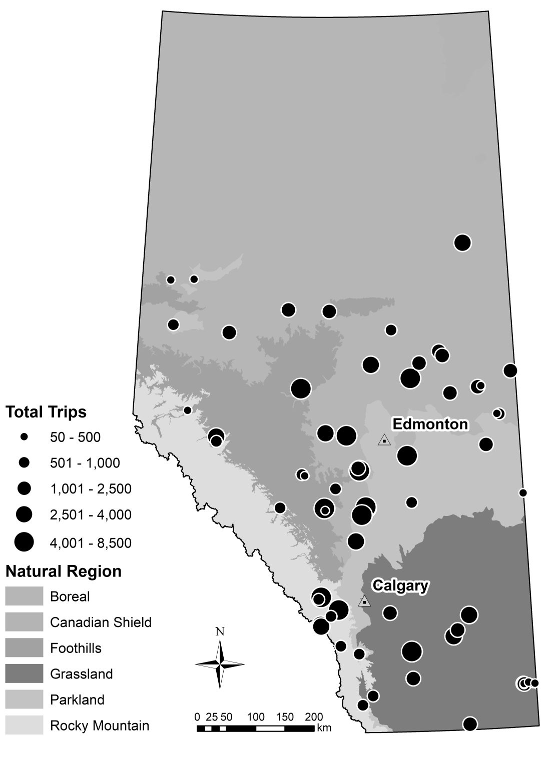

Figure S1. Map of Alberta and Spatial Location of the 68 Campgrounds

Notes: This figure shows the spatial location and 2015 trip counts to each of the 68 campgrounds, the natural regions of the province, and the two largest cities (Calgary and Edmonton) in Alberta.

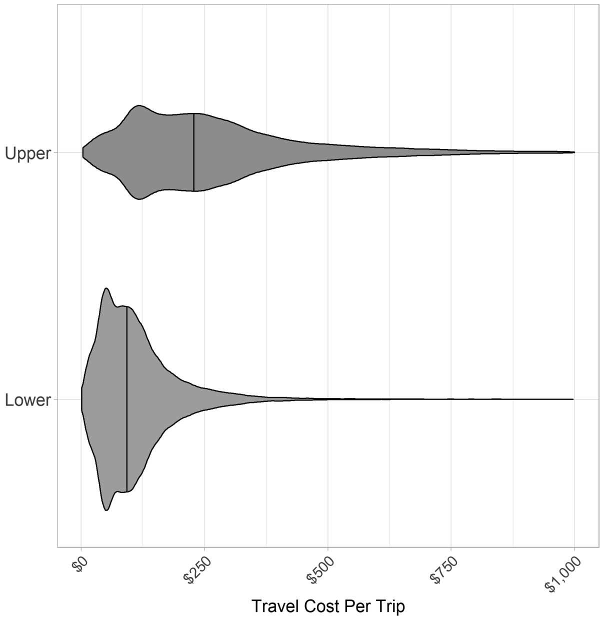

Figure S2. Distribution in Calculated Lower and Upper Travel Costs per Camping Trip

Notes: This figure shows the distribution in travel costs per trip for both the upper and lower bounds. Travel costs displayed here include both driving costs and the opportunity cost of time, but not reservation and camping permit fees.