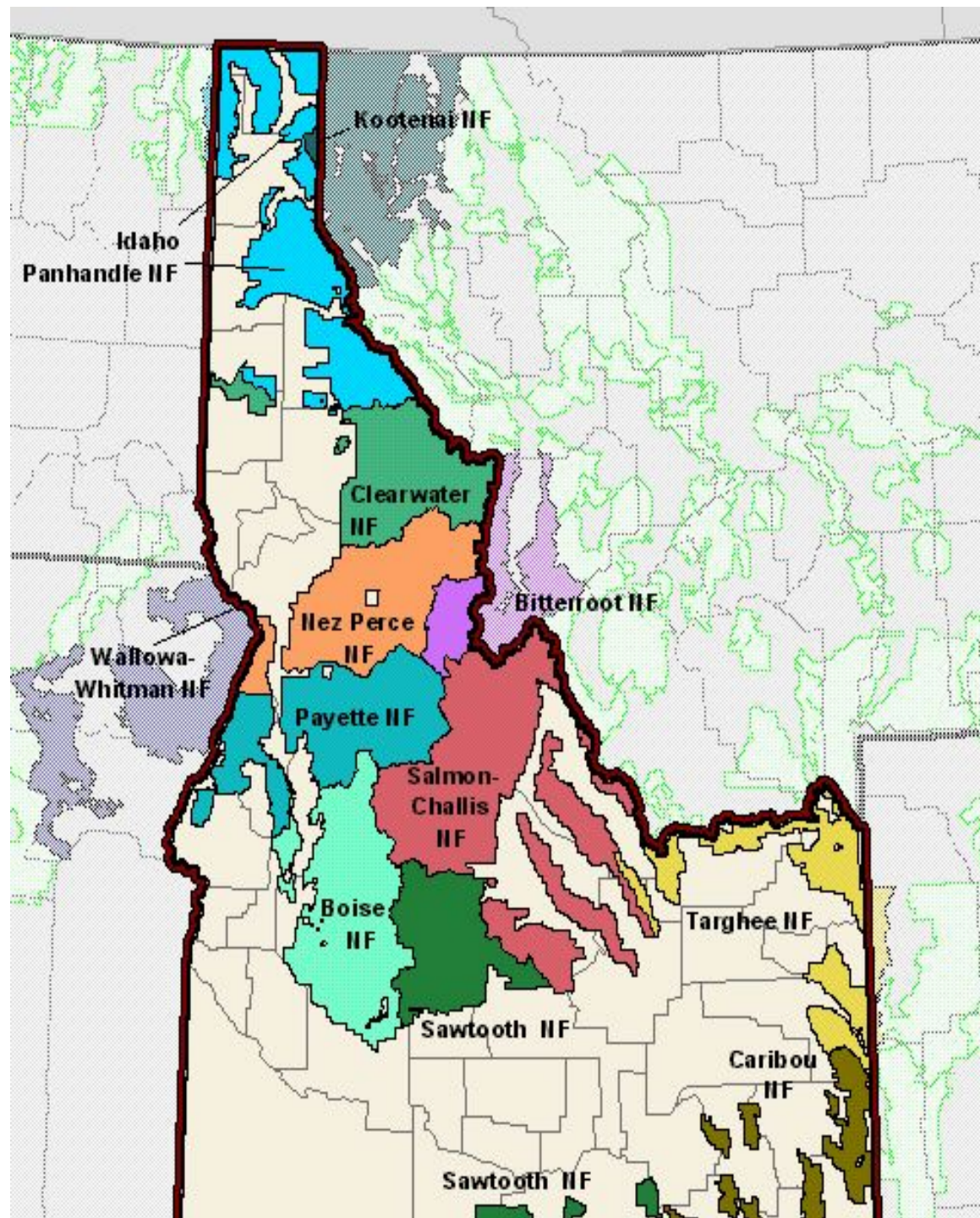# EVALUATING COMPETING TRAVEL COST METHOD RECREATION DEMAND MODELS: THE CASE OF RAFTING AND OTHER WHITEWATER BOATING IN CENTRAL IDAHO

VALUING WHITEWATER RECREATION

Recreation use value is found for boating (rafting, kayaking, canoeing, jet boating) on the Salmon, Selway, Little Salmon, Clearwater, & Lochsa rivers, in central Idaho.

Central Idaho

Area:

- 12 million acres of public land (USFS) forest
- Hells Canyon National Recreation Area
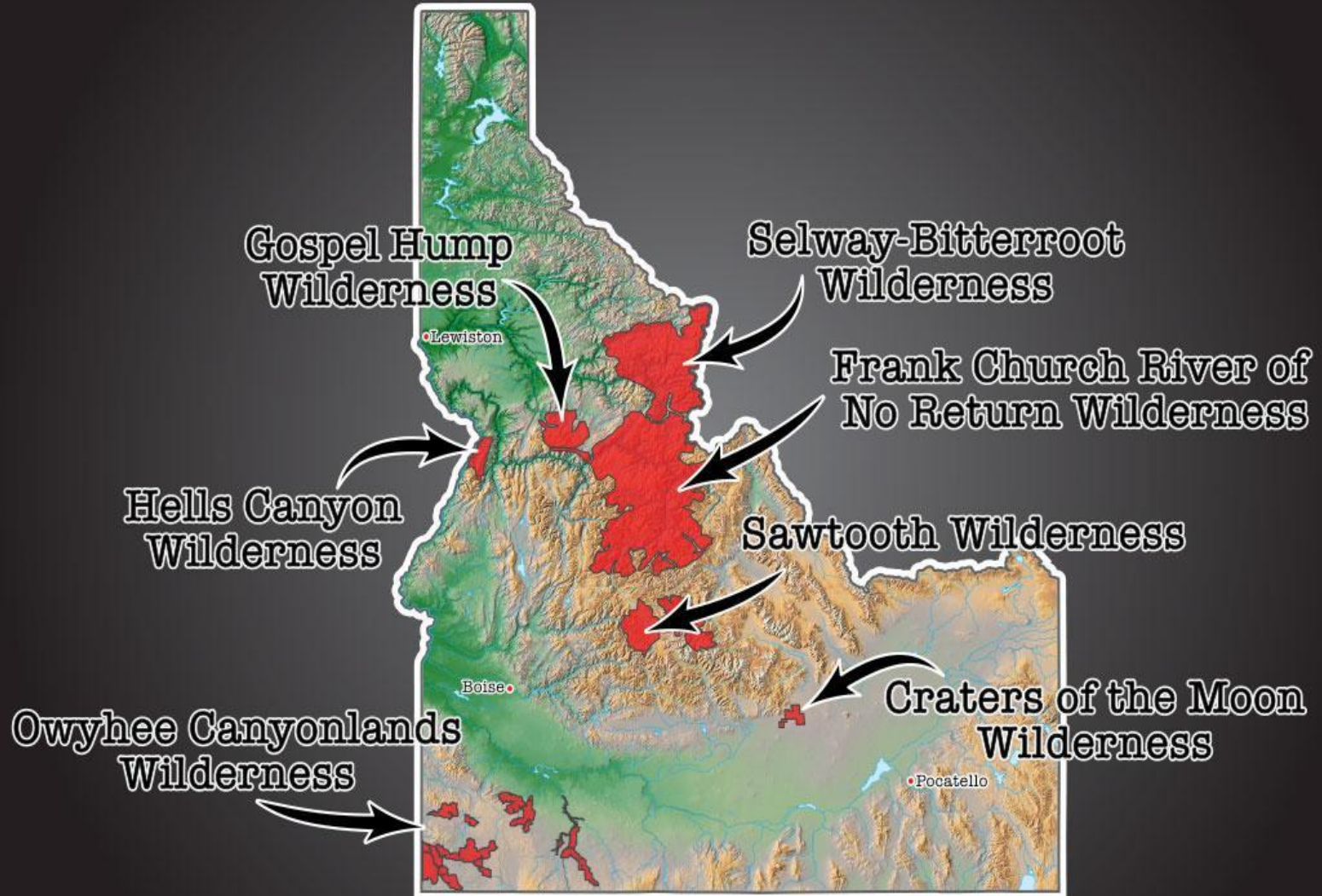- Frank Church Wilderness (largest outside Alaska)

River recreation:

- Wild & Scenic Rivers: Selway, Main & Middle Fork of the Salmon River
- Nation's top white water rafting site

Three Models Tested

- A Becker time allocation-based traditional recreation demand model

- A Hybrid model that defines variables as Becker-type for 54 boaters that forfeited income to go boating & short-run decision variables otherwise

- A short-run decision recreation demand model

IDAHO WILDERNESS

The Trip-Generating Function

TCM demand model specification:
- Trip price (travel cost)
- Time required for a trip
- Leisure free time constraint
- Income constraint
- Price & time spent on closely related goods
- Consumer tastes & preferences.

POTENTIAL DEMAND VARIABLES

Q annual trips to site – dependent variable
Out-of-pocket travel cost
Round trip travel time
Trip time Spent on Other Recreation
Family Wage & Nonwage Income
Free Time
Experience - years at recreation site
Age

THE BECKER TRAVEL COST MODEL

The traditional travel cost model (TCM) monetizes time, assuming that time is fungible.

"Full" price of a recreation trip in the Becker-type model is the out-of-pocket travel cost plus the monetized travel time requirement.

The opportunity cost of time is assumed to be some fraction of the wage rate.

THE SHORT-RUN DECISION TCM MODEL

Recreationists make short-run consumption decisions
- Constrained by their endowments of income & leisure time.
- Income & free time are determined by long-run decisions on education, occupation, residence location, etc.

Short-run decision TCM demand:
- Dependent Variable: Annual recreation trips.
- Explanatory variables: money cost of a trip, travel time required, money cost of closely related goods, consumption time for closely related goods, income, available leisure time, tastes, age, other explanatory variable.

Time is not monetized – rationed rather than priced.

BECKER'S OPPORTUNITY COST OF TRAVEL TIME

Travel time (t_s) is monetized by a fraction (K) of the wage rate W.

Money travel cost plus the opportunity cost of travel time is Becker's price of a trip - the"full" price of a trip is $P_s + KW(t_s)$.

Recreationists have the same coefficient on money travel cost (P_s) as on their monetized opportunity time cost of travel.

ESTIMATION

The dependent variable (annual boating trips)
is a nonnegative integer from an on-site sample truncated at 1 trip.

Overdispersion exists (Variance of dependent variable not equal its mean). Truncated negative binomial regression is appropriate.

Adjusted for endogenous stratification.

Values updated to $2022 using the CPI.

ENDOGENOUS STRATIFICATION

Self-selection bias can occur if persons who visit the site more often are over-represented in the sample or if persons with a high value for their time are less likely to respond to the mail survey. Thus, we estimate the boater demand models with an adjustment for endogenous stratification.

EXTREME EXCESS RAFTING DEMAND

Four rivers in central Idaho are currently subject to severe lottery rationing of rafting during the summer months.

Small probabilities of success - Hells Canyon of the Snake River at 12.9%, Selway River at 1.6%, Main Salmon River at 3.9%, & Middle Fork of the Salmon River at 3.3%.

CURRENT RATIONING OF RAFTING

Estimation of individual observation TCM models based on current trip data for boating in central Idaho is not possible because of the imposition of severe rationing on whitewater boating.

POTENTIAL BECKER-TYPE VARIABLES

Variable Label / Units / Description

Q_s / trips per year / Annual round trips from home to the Central Idaho boating site, the dependent variable (all models)

$t_s W + P_s$ / dollars per trip / The product of the travel time & the wage rate plus out-of-pocket round trip travel cost to the boating site

$t_{os} W + P_{os}$ / dollars per trip / The product of the on-site time at the boating site & the wage plus on-site spending

Continued

Variable Label / Units / Description

$t_{as}W + P_{as}$ / dollars per trip / The product of time spent at an alternate site during the trip & the wage rate plus spending at the alternate site

$WFT + Inc$ / dollars per year / The product of the wage rate & free time plus money income

W / dollars per hour / The after-tax wage rate

BECKER-TYPE DEMAND MODEL WITH "FULL" PRICES & INCOME

Variable	Coefficient	t-Ratio
constant term	-9.38	
$t_s W + P_s$	-0.00752	-7.03
$Ln(t_{os} W + P_{os})$	0.04709	0.50
$Ln(t_{as} W + P_{as})$	0.32155	4.09
$Ln(WFT + Inc)$	-0.44005	-0.91

Truncated negative binomial regression adjusted for endogenous stratification. Q_s, river recreation trips per year to Central Idaho is the dependent variable. Sample Size = 189.

POTENTIAL SHORT-RUN DECISION VARIABLES

Variable Label / Units / Description

Q_s / trips per year / Annual round trips from home to the Central Idaho boating site, the dependent variable

P_s / dollars per trip / Out-of-pocket round trip travel cost to the boating site

t_s / hours per trip / Round trip travel time to the recreation site

t_{os} / hours per trip / The time spent at the boating site

t_{as} / hours per trip / Time spent during the trip at an alternate recreation site

Inc / dollars per year / Wage & non-wage income

FT / days per year / Discretionary free time available per year

W /dollars per hour / The after-tax wage rate

HYBRID DEMAND MODEL

Variable	Coefficient	t-Ratio
constant term	-13.17	
P_s or		
$t_s W + P_s$	-0.01032	-8.11
$Ln(t_{os})$ or		
$Ln(t_{os} W + P_{os})$	-0.16163	-2.75
$Ln(t_{as})$ or		
$Ln(t_{as} W + P_{as})$	0.16150	2.16
$Ln(Inc)$ or		
$Ln(WFT + Inc)$	0.01781	0.90
$Ln(W)$	0.66708	4.08

Truncated negative binomial regression adjusted for endogenous stratification. Q_s, river recreation trips per year to Central Idaho is the dependent variable. Sample Size = 189.

SHORT-RUN DECISION DEMAND MODEL

	Unadjusted Boating Demand			Adjusted for Endogenous Stratification		
Variable	Coefficient	t-Ratio		Coefficient	t-Ratio	
Constant term	3.8775	1.19		2.3915	0.77	
P_s	−0.009799	-2.26		-0.00878	-2.04	
Ln(ts)	-0.4010	-2.17		-0.4429	-2.57	
Ln(tos)	0.2825	3.10		0.2894	3.36	
Ln(INC)	-0.1775	-0.97		-0.2805	-1.64	
Ln(FT)	0.3496	1.91		0.4439	2.75	
Ln(EXP)	0.6882	3.72		0.6967	4.66	
Ln(AGE)	-1.1168	-1.57		-0.1.0322	-1.75	

EFFICACY OF THE 3 MODELS

The Becker-type model has 2 significant coefficients (t-Ratio greater than 2)

The Hybrid model has 4 significant coefficients.

The Short-Run Decision model has 5 significant coefficients & 2 weakly significant – but a much smaller t-Ratio on Price.

(The Becker coefficients often apply to 2 variables – "full" prices & "full" income.)

THE HYBRID MODEL

When we focused the TCM model, the variables containing wage-based opportunity time cost that were non-significant in the unfocused Becker model became significant. (Including the wage rate, W, the opportunity time cost of pure leisure.) The implication is that the Becker model applies only to 28.6 percent of the sample (or less) who make consumption decisions partly based on foregone earnings.

WHITEWATER BOATING USE VALUES

Use Value = -1/(the coefficient on price) for a semi log demand function.

Use value per person per trip in the Becker-type model is $239 ($2022).

Use value per person per trip in the Hybrid model is $174 ($2022).

Use value per person per trip in the Short-Run Decision model is $204 ($2022).

OTHER USE BENEFITS OF RIVERS

Boating is a small part of the total recreation activity in central Idaho & northeast Oregon.

The pristine rivers contribute to the benefits received by visitors – viewing wildlife, hikers, campers, winter sports, other visitors.

ANNUAL RIVER RECREATION VISITS

Forest Service Visitor Use Reports indicate that about 87 thousand annual boater visits occurred in Central Idaho in recent years.

OTHER USE BENEFITS OF RIVERS

Boating makes up a small part of the total recreation activity in central Idaho & the presence of the pristine rivers also contributes to the benefits received by hikers, campers, pleasure drivers, winter sports, & other visitors.

ANNUAL VISITOR COUNT

Total Forest Service visits 1,250,000
Whitewater boating 49,000 visits (3.9%)
Motor boating 38,000 visits (3.1%)

ANNUAL BOATING USE VALUE $2022

87,000 X $239 = $20,793,000 Becker Model
87,000 X $174 = $15,138,000 Hybrid Model
87,000 X $204 = $17,748,000 Short-Run Model