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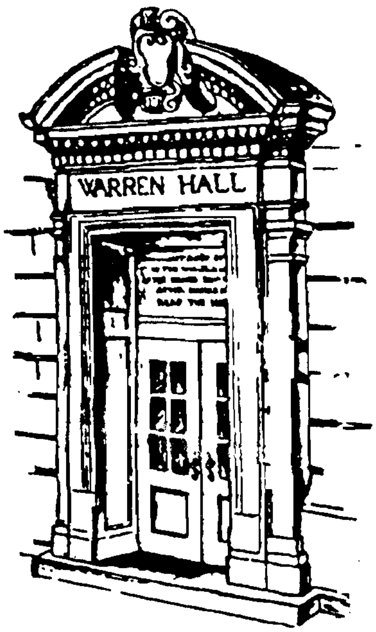

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Demand for Visitation to U.S. National Park Areas: Entrance Fees and Individual Area Attributes

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Abstract

We examine the effects of entrance fees and other factors in visitation to U.S. national park areas under two partially competing hypotheses: 1) fees are significant explanatory variables; and 2) individual area attributes are the primary determinants of visitation rates. (National park areas include natural protected areas, historic areas, and other categories in the national park system). We find that areas comprising natural protected areas behaved like economic substitutes for each other, and historic areas like economic complements. In addition, the results have confirmed the importance of individual park attributes in visitation, but are equivocal on the role of entrance fees. The role of other socio-economic variables and of park size is also analyzed.

Introduction

The effects of entrance fees on visitation to U.S. national parks has been a subject of intense debate since automobile parking fees were introduced to Mt. Rainer National Park in 1908 (Mackintosh 1983). This debate is linked to a popular American view that people who cannot pay should not be denied access to national parks, a view that has apparently encouraged Congress to maintain control over the entrance fee program. In October 1995, however, Congress initiated a Fee Demonstration Program (FDP) which authorized the National Park

Service (NPS), the Fish and Wildlife Service, the Bureau of Land Management and the Forest Service to change fees in the federal lands they control, and to report the effects of the new fees on visitation (Public Law 104-134).

Prior to the FDP, most of the debate on entrance fees was not guided by informed analysis. In addition, initial studies conducted under the FDP have concentrated on visitor attitude towards the fees, and this may not accurately reflect the response by the general public (Lundgren et. al. 1997; Lundgren and Lime 1997; U.S. National Park Service, Fish and Wildlife Service, and Bureau of Land Management 1998). In this paper we use an econometric approach to determine the effects of entrance fees on visitation, and to contribute to the perennial debate on their desirability (see for example U.S. National Park Service 1939, 1986 and numerous Congressional hearings on the subject). We begin by describing the data and clarifying some important terminology.

The U.S. National Park System consists of areas and property managed by the NPS. By 1998 there were about 376 such areas, which included areas of historic, natural, scientific, educational, recreational, and aesthetic importance. These areas are commonly called "national parks", but they are more properly referred to as "national park areas". The NPS classifies the national park areas into 20 categories, 19 of which have most of the included areas reporting data on visitation (Table 1). Category 11 may be confusing because it is also called "national parks". It includes most natural protected areas, which are distinguished by their focus on the preservation of natural landscapes of biological and aesthetic importance. This category also matches the international definition of the term "national park" (I.U.C.N. 1990).

From this point we use the term "national park" to refer to category 11. Likewise, we reserve the phrase "national park area" when there is no need to distinguish an area's category. Whenever we use the term "park" alone, we

Table 1. Categories of U.S. National Park Areas

	Name	Number of Parks	
		Administered	Reporting Visits
1.	International historic site	1	0
2.	National battlefields	11	10
3.	National battlefield parks	3	3
4.	National battlefield sites	1	0
5.	National historic sites	74	67
6.	National historic parks	38	32
7.	National lakeshores	4	4
8.	National memorials	27	26
9.	National military parks	9	9
10.	National monuments	73	69
11.	National parks	54	52
12.	National parkways	4	4
13.	National preserve	16	10
14.	National reserves	2	18
15.	National recreation areas	19	1
16.	National rivers	6	4
17.	National scenic trails	3	0
18.	National wild and scenic Rivers	9	10
19.	National seashores	10	5
20.	Parks – other	11	10

ensure that the context distinguishes the relevant category, otherwise we assume that it refers to any of the national park areas.

Visits to national park areas may occur as recreation or non-recreation visits. The NPS defines recreation visits as "entries of persons onto lands and waters administered by the NPS for recreation purposes, excluding government personnel, through traffic (commuters), trades-people, and persons residing within park boundaries" (U.S. National Park Service 1996). Our focus is on the recreation visits, which in reality may include educational visits by students etc.

Data Collection and Organization

We obtained data on recreation visits to national park areas for the years 1993, 1994 and 1996 from the NPS's Public Use Statistics Program Center in Waso Denver, Colorado (U.S. National Park Service 1993, 1994, 1996). For each park, we obtained the geographic coordinates of its centroid from the NPS's Water Resources Division at Fort Collins, Colorado, and overlay it on a digital U.S. county and territory boundaries map using the Geographic Information System software, Arcview 3.0. We obtained county level total human population- and per capita income- projections from the U.S. Bureau of Economic Analysis (1998). We created new variables from the populations and per capita incomes of counties within one hundred miles of each park's centroid to reflect local population and local per capita income respectively.

We obtained data on the area size (acres) of each park from the Parks Directory of the United States (Smith 1992). We updated these data using the official NPS's public Web-site (U.S. National Park Service 1998). We also used these sources to calculate the total number of state and national park areas in each of the U.S. states and territories. Finally, we obtained data on vehicle and person entrance fees from the NPS's Office of Public Affairs, Washington DC.

Theoretical Expectations on Factors Influencing Visitation

To determine the impact of entrance fees on visitation we analyzed two competing hypotheses. The first hypothesis postulated that price and other economic variables (regional income, national income, and regional population) were significant explanatory variables. This "price hypothesis" was based on the neoclassical expectation that those variables should impact visitation. Consequently, we expected visitation to show the usual negative elasticity with respect to price (person and vehicle entrance fees, Appendix 1, 2). In addition, we expected visitation to increase with the personal incomes of counties near individual parks, and over time with national income.

In the second hypothesis, we propose that individual park attributes were the primary determinants of visitation rates, and that where entrance fees existed, they were too low relative to income and trip expense to affect visitation. We refer to this as the "attribute hypothesis".

Other factors that might affect visitation were also considered. To begin with, we expected larger parks to receive more visits. There are two reasons why this may be the case. Firstly, larger parks usually have more diverse attractions, which normally lure more people. Secondly, larger parks may have their perimeters bordering more extensive non-park areas, which should host a higher population of potential visitors compared to smaller parks with similar characteristics. More directly, we expected those parks surrounded by larger populations to receive more visits, the extent of their perimeter notwithstanding. We also expected visitation to increase with the national population over time.

Some parks have attributes that are beyond the ordinary characteristics of most parks. The fact that Yellowstone is the world's oldest national park, the topography of the Grand Canyon or the nature of Hawaii's Volcanic National Park are clearly beyond the ordinary. Parks with such attributes are usually well known, and we expected that to increase visitation. Yet, many parks may be close substitutes in terms of the opportunities they provide, so that nearby parks reduce visitation to other individual park areas (Burt and Brewer 1971, Chase 1996). Finally, because of growing income and population, changing lifestyles, etc. visitation may show an upward trend with random shifts (Conrad 1997).

The Model

To isolate the effects of prices and other variables we used the data collected above to estimate a multiple regression model of the form:

$$V_{it} = \alpha + \beta_1 \ln A_{it} + \beta_2 P_{Lit} + \beta_3 P_{Nt} + \beta_4 \ln M_{it} + \beta_5 \ln PGDP_t + \beta_6 F_{Pit} + \beta_7 F_{Vit} + \beta_8 S_P + \beta_9 S_{Tt} + \beta_{10} T_t + \varepsilon$$

where:

V_{it} = number of visits to park i over year t

A_{it} = area size of park i in year t

P_{Lit} = regional populations (in counties, 100 miles of park i's centroid)

P_{Nt} = the national population in year t

M_{it} = regional per capita incomes (in counties, 100 miles of park i's centroid)

$PGDP_t$ = the national per capita income in year t

F_{Pit} = person entrance fee to park i in year t

F_{Vit} = vehicle entrance fee to park i in year t

S_P = a joint dummy variable for several parks indicating well known (1) or less well known (0) parks (Appendix 1, 2)

S_{Tt} = total number of competing parks (i.e. number of parks in park i's state)

T_t = a trend variable

The αs and βs are coefficients and ε is the ordinary regression error. The natural logs of income variables and area size were used to allow for expected nonlinear effects of these variables on visitation: First, larger areas are less dense with respect to roads and other facilities and we expected visitation to increase with area size but at a slower rate. Second, we assumed that the elasticity of visitation with respect to income declines as income rises.

Initial examination of our data revealed that visitation had declined slightly over the study period (Table 2). In addition, preliminary OLS analysis revealed that the trend variable was highly correlated with the national population. Consequently, we excluded the trend variable from all subsequent analysis.

Multiple collinearity leads to the exclusion of variables initially considered important and raises the difficult question of model specification bias, an occurrence we did not confirm with Ramsey's Reset Test for omitted variables. In contrast, the Breush-Pagan-Godfrey Test suggested heteroscedasticity in our data. Plots of the OLS residuals against the explanatory variables did not isolate the culpable variable(s). As a check on the sensitivity of the OLS results to the heteroscedasticity, we present White's heteroscedasticity-consistent t-statistics alongside the OLS results. Since the results from both procedures are mostly consistent, we base the following presentation on the OLS estimates, only making a note where the conclusion about an independent variable might change with White's method.

We begin our analysis with parks comprising areas of biological and aesthetic importance, which we collectively call natural protected areas. We then estimate a similar model for the national historic areas and for the combined data set for all national park areas with reported visitation data. All money variables are in 1993 real dollars.

Table 2. Annual Summary of Some Relevant Variables

Variable	1993	1994	1996
Natural Protected Areas			
Total visits, V_{it} (millions)	63.323	63.555	63.866
Mean regional population, P_{Lt} (millions)	1.616	1.662	1.631
Regional per capita income, M_{it}	$17,623	$17,444	$17,843
National per capita income, GDP_t, (billions)	$21220	$21505	$22254
National population P_{Nt}, (millions)	258	260	265
Historic Areas			
Total visits, V_{it} (millions)	36.045	35.436	34.785
Mean regional population, P_{Lt} (millions)	6.312	6.339	6.411
Per capita income, M_{it} ($)	$19,348	$19,406	$20,108.
All National Park Areas			
Total visits, V_t, (millions)	269.168	266.268	265.796
Mean regional population, P_{Lt} (millions)	4.333	4.366	4.433
Per capita income, M_t ($)	$18,146	$18,128	$18,735

Data for 1995 are not included in the analysis because that year's data were not available.

Results of the Regression Model

Natural Protected Areas

Among the natural protected areas, each of 5 national parks (category 11) formed a contiguous region with a corresponding national preserve (category 13). We pooled the data of each of these contiguous areas and added the remaining 47 national parks, the remaining five national preserves, the Theodore Roosevelt Island, and one national reserve (category 15), so that our sample contains 59 natural protected areas, and 177 observations.

In this context, park area size (coefficient β_1) is significantly positive[1] (Table 3). This was expected because as mentioned above, larger parks may attract more people, and more so from nearby areas. Indeed, the coefficient for the total population in nearby counties (β_2) is also significant. Regional per capita income is not a significant explanatory variable.

The coefficient for the person entrance fee (β_6) is insignificant, but has the expected sign. That of vehicle entrance fee (β_7) is of the unexpected sign and significant. This result is puzzling. It may reflect management decisions to apply vehicle fees in park areas with higher than average visitation, attempting to attain funds for their high maintenance costs. These two results with entrance fees (positive, significant vehicle fee, and insignificant person fee) are inconsistent with the price hypothesis, but are consistent with the attribute hypothesis.

Surprisingly, the coefficient of the joint variable for well known parks (β_8) is insignificant. This challenges the attribute hypothesis because the variable lumps together parks with unusual attributes. As expected, however, the coefficient for the number of competing parks in the state (β_9) is negative and highly significant. This is important because it suggests that natural protected

[1] White's heteroscedasticity-consistent β_1 has a t-statistic that is almost significant.

Table 3. Model Estimates for Natural Protected Areas

Variable	Mean	Coefficient	Value	t-value	Sig. Level	Heteroscedasticity consistent t-values
Constant		α	-567669	-.009	.933	-.023
Log area, $\ln A_{it}$ (acres)	12.65	β_1	134590.85	2.377	.019	1.881
Regional population, P_{Lit} (millions)	1.636	β_2	.24	4.363	.000	2.356
National Population, P_{Nt} (millions)	261	β_3	.00	.008	.994	0.110
Log regional per capita income, $\ln M_{it}$ ($)	9.799	β_4	212064.67	.768	.444	1.121
National per capita income, $\ln PGDP_t$, ($)	9.983	β_5	174896.9	-.002	.998	-.010
Person entrance fee, F_{Pit} ($)	1.486	β_6	-21842.74	-.127	.899	-.233
Vehicle fee, F_{Vit} ($)	2.645	β_7	220959.30	2.435	.016	3.883
Well known parks dummy, S_P	.103	β_8	-295569.91	-.822	.412	-1.165
Number of competing parks, S_{Tit}	114.3	β_9	-6201.38	-3.807	.000	-2.564

Mean visits per area per year = 1.085 million $R^2 = .266$

Durbin-Watson d statistic = 2.035

areas are economic substitutes for each other, and may also offer an explanation on why β_8 is not significant. Perhaps each natural protected area is on average special, and visitor preferences diverse enough to produce the result. Indeed, unusual attributes would not count if most visits were from local areas as the significant coefficient for the regional populations suggests. The national population and the national per capita income are not significant.

Inherent in the formulation of the OLS model is the assumption that differences across individual units can be captured by differences in explanatory variables. In the face of the low R^2 and an insignificant constant term, we ran a fixed effects model by including separate intercept terms for 58 of the fifty-nine natural protected areas. The variables for the natural log of area size, the joint dummy variable for well known parks, and the variable for competing parks in the state were excluded in the process due to collinearity problems associated with the few observations per individual park. From now on we refer to this as the collinearity problem (Berk 1977; Frane 1977; Efroymson, 1960).

Of the 57 intercept terms, only four were not statistically significant. (See Appendix 1: The coefficients of these intercepts are not provided because they are not by themselves economically meaningful.) In the context of our earlier regression, however, they are important in three ways. Firstly, they reduce the importance of the regional populations and vehicle fees as explanatory variables (Table 4). Secondly, the fact that almost all the new intercept terms are significant supports the attribute hypothesis on the importance of individual park attributes. Thirdly, the R^2 is now high at .996 with only a few condition indices suggesting multicollinearity.

Regression Results for National Historic Areas

We now turn to areas of historic importance. We combined 67 historic sites (Category 5), 32 historic parks (Category 6) and the Fort McHenry National

Table 4. Model Estimates for the Natural Protected Areas with Individual Intercepts and a Comparison of the t-Statistics with Those of the Model without the Intercepts

Variable	Coefficient	Value	t statistics (with intercepts)	t statistics (without intercepts)
Constant	α	6520417.4	.118	-.009
Regional population, P_{Lit}	β_2	-0.015	-.122	4.363
National population N_t (millions)	β_3	.005	.115	.008
Log regional per capita income $\ln M_{it}$ ($)	β_4	-5078.121	-.162	.768
National per capita income, $\ln PGDP_t$	β_5	-528531	-.079	.002
Person Fee, F_{Pit}, ($)	β_6	-17275.591	-.512	-.127
Vehicle fee F_{Vit}, ($)	β_7	-11489.138	-.638	2.435

$R^2 = .996$ Durbin-Watson d-statistic = 1.94

Monument and Historic Site, so that this sample includes 100 historic areas, and 300 observations. We applied the model described above to this new sample.

The coefficient for area size, β_1, is positive and significant (Table 5). Although this result is similar to the one obtained for natural protected areas, it was unexpected because historic areas are all relatively small. Since the explanations of more opportunities and contact with larger non-park areas given for the significant β_1 in the regression for natural protected areas may not apply to historic areas, this result may indicate a preference for larger areas in individual visitation decisions. Indeed, the regional populations which should be higher for larger nearby non-park areas are not a significant explanatory variable in visits to historic areas.

Consistent with the price hypothesis, the coefficient for the person entrance fees (β_6) is significantly negative. This is unlike the case of natural protected areas, and contradicts the attribute hypothesis on the unimportance of entrance fees. The coefficient for vehicle fee (β_7) is again significantly positive, contradicting the price hypothesis. Regional per capita incomes are again not significant. Unlike the case of natural protected areas, the coefficient for competing parks (β_9) is positive and significant[2]. This suggests that the presence of other parks may enhance visitation to individual historic areas as with economic complements. The coefficient for the joint variable for well known historic areas (β_8) is also positive and significant. The national income and the national population are both insignificant as in the model for natural protected areas.

We also estimated a fixed effects model for historic areas by including intercept terms for 99 of the one hundred historic areas in the sample. As in the model for natural protected areas, the variable for the natural log of area size, the

[2] White's heteroscedasticity consistent β_9 has a t-statistic in Table 5 that is almost significant.

Table 5. Model Estimates for National Historic Areas

Variable	Mean	Coefficients	Value	t-value	Sig. Level	Heteroscedasticity consistent t-values
Constant		α	2709550.2	.096	.923	.077
Log area, $\ln A_{it}$ (acres)	4.85	β_1	50608.818	2.852	.005	3.293
Regional population, PL_{it} (millions)	6.354	β_2	.009	.884	.378	.872
National Population, P_{Nt} (millions)	261	β_3	-.004	-.181	.857	-.223
Log regional per capita income, $\ln M_{it}$ (log $)	9.982	β_4	29696.598	.205	.838	.391
National per capita income, $\ln PGDP_t$ ($)	9.983	β_5	-217191	-.067	.947	-.040
Person fee, F_{Pit} ($)	.853	β_6	-116386.3	-2.792	.006	-3.586
Vehicle fee, F_{Vit} ($)	.313	β_7	168081.466	4.279	.000	2.570
Well known parks dummy, S_P	.129	β_8	252513.078	2.120	.035	1.811
Competing parks, S_{Tit}	100.2	β_9	2307.441	3.084	.002	1.900

Mean visits per area per year = 356,665 $R^2 = .168$

Durbin-Watson d-statistic = 1.74

joint variable for well-known parks, and the variable for competing parks were excluded in the process, due to the collinearity problem.

The effect of the individual intercept terms is similar to that observed in the regression for the natural protected areas. They reduce the importance of the previously significant coefficients, while those previously insignificant remain unchanged in terms of the level of significance and sign (Table 6). The R^2 is also now high, again with a few condition indices suggesting multicollinearity.

We observed that the significant intercept terms for individual natural protected areas strengthened the attribute hypothesis. The same cannot be said of the historic areas where only 19 out of 99 are significant. While this may challenge the attribute hypothesis, it may also be linked to the fact that historic areas behaved like economic complements, a feature that may have reduced the importance of individual areas separately.

Regression Results for All National Park Areas

We have now examined the two most important categories of national park areas, with no clear indication that entrance fees play a significant role in their visitation. Similarly, the two categories have shown mixed results regarding the role of individual park attributes. In this section we combined the 19 categories of the parks that had reported visitation between 1993 and 1996 and re-estimated the regression model. Our sample now included 328 of the total 376 national park areas and 984 observations.

Consistent with the price hypothesis, and as in the regression for historic areas, the person entrance fee is significantly negative (Table 7). Vehicle fee and area size are again significantly positive. The regional populations are also significantly positive. This is as in the regression for natural protected areas, but it is unlike that of historic areas where the regional populations were not

Table 6. Model Estimates for Historic Areas with Individual Intercepts and a Comparison of the t-Statistics with Those of the Model without the Intercepts

Variable	Coefficients	Value	t statistics (with intercepts)	t statistics (without intercepts)
Constant	α	-159502.9	.021	.096
Regional population, P_{Lit} (millions)	β_2	.022	.969	.884
National population, P_{Nt} (millions)	β_3	-.002	-.288	-.181
Log regional per capita income $\ln M_{it}$ ($)	β_4	-1.497	.000	.205
Per capita national income, $\ln PGDP_t$ ($)	β_5	46555.441	.053	-.067
Person fee, F_{Pit} ($)	β_6	55235.342	.533	-2.792
Vehicle fee, F_{Vit} ($)	β_7	5623.944	.222	4.279

$R^2 = .980$ Durbin-Watson d-statistic = 2.001

Table 7. Model Estimates for All National Park Areas

Variable	Mean	Coefficient	Value	t-value	Sig. Level	Heteroscedasticity consistent t-values
Constant		α	-7718905	-.023	.981	.041
Log area, $\ln A_{it}$ (log acres)	7.794	β_1	155868.532	8.756	.000	6.154
Regional population, PL_{it} (millions)	4.346	β_2	.096	5.883	.000	5.842
National population, P_{Nt} (millions)	261	β_3	-.011	-.041	.967	.008
Log regional per capita income, $\ln M_{it}$ ($)	9.808	β_4	56112.826	.243	.808	.437
National per capita income, lnPGDPt ($)	9.983	β_5	925992.130	.023	.891	-.041
Per fee, F_{Pit} ($)	.904	β_6	-232457.446	-3.399	.001	-5.840
Vehicle fee, F_{Vit} ($)	.980	β_7	112782.828	2.660	.008	3.933
Well known parks dummy, S_P	.086	β_8	547579.295	2.735	.006	3.301
Competing parks S_{Tit}	96.89	β_9	-581.385	-.650	.516	-.492

Mean visits per area per year = 830,571.66 $R^2 = .12$

Durbin-Watson d-statistic = 2.030

significant. Regional per capita incomes are again not a significant explanatory variable. The joint variable for well-known parks is significant as in the case of historic areas, while the total competing parks are now insignificant. The national income and the national population are also insignificant.

We also estimated a fixed effects model for all parks by including intercept terms for 327 of the 328 national park areas. The coefficients of the intercept terms are again not included, because they are by themselves not economically meaningful. As with the prior analyses, however, they reduced the importance of all previously significant variables (Table 8). In addition, 284 out of 321 individual area intercepts are significant, reinforcing the attribute hypothesis. The natural log of area size, the joint variable for well-known parks, and the variable for competing parks were again excluded due to the collinearity problem.

Summary and Conclusions

We estimated OLS models for 3 years of visits to: 1) 56 natural protected areas; 2) 100 national historic areas; and 3) a combined data set of 19 categories of national park areas with a total of 328 areas and 984 observations. The analysis was carried out under the premise that entrance fees, and other socio-economic variables were significant explanatory variables. This "price hypothesis" was based on the neo-classical expectation that those variables should significantly impact visitation. We also analyzed an alternative "attribute hypothesis" which postulated that individual park attributes were the primary determinants of visitation rates, and that where entrance fees existed, they were too low relative to income and trip expense to affect visitation.

We began our analysis with the data set including natural protected areas. The results from the initial model suggested the unimportance of economic variables including entrance fees, regional per capita incomes and national

Table 8. Model Estimates for All National Park Areas with Individual Intercepts and a Comparison of their t-Statistics with Those of the Model without the Intercepts

Variable	Coefficient	Value	t-value (with intercept)	t-value (without intercept)
Constant	α	-1091344	-.260	-.023
Regional population, P_{Lit} (millions)	β_2	-.04	-.576	5.883
National Population, PN_t (millions)	β_3	-.01	-.352	-.041
Log regional per capita income, $\ln M_{it}$ ($)	β_4	-3018.25	-.073	.243
National per capita income, lnPGDPt ($)	β_5	164105	.324	.023
Person entrance fee, F_{Pit} ($)	β_6	-7159.67	-.153	-3.399
Vehicle fee, F_{Vit} ($)	β_7	1836.31	.106	2.66

R^2 = .991 Durbin-Watson d-statistic = 2.088

income, supporting the attribute hypothesis. Separate OLS regressions for national historic areas and for the combined data set suggested the importance of individual park attributes by returning a significant coefficient for a joint variable for well known parks. These regressions also returned negatively significant coefficients for the person entrance fee, meaning that the price hypothesis could not be rejected.

A fixed effects version of the OLS model had individual park intercept terms reduce the importance of the significant coefficients from the initial model in the three cases considered. These intercept terms were almost always significant in the model for visits to natural protected areas, and to all the parks together, further supporting the attribute hypothesis on the importance of individual park attributes. In contrast, individual intercept terms for historic areas were mostly insignificant. Although this appears to contradict the attribute hypothesis, it may also be due to complementary effects of the individual historic areas, a feature that can render them less important individually. Indeed, the joint variable for well known parks, which lumps together areas with unusual attributes, was significant for visits to historic areas. This variable was also significant for visits to all the parks together in the initial model.

Multicollinearity among our explanatory variables raises some difficult questions of interpretation. Statistically, it may leave the variance of the estimating equation without serious bias. However, it can increase the standard error of individual coefficients, thereby reducing the t-statistics of the estimated coefficients (Gujarati 1994). In the context of this work then, it is not possible to conclude that variables with insignificant t-statistics are unimportant. We may conclude, however, that significant coefficients with the expected signs are important.

In the context of these results, it is reasonable to conclude that the importance of individual park attributes in visitation have been confirmed. With respect to the entrance fees, however, their importance has been suggested but not unequivocally. In addition, the significantly positive coefficient for vehicle fee across the three data sets in the initial model may reflect management decisions to apply vehicle fees in park areas with higher than average visitation, attempting to attain funds for their high maintenance costs. The extent that this may actually happen is, however, unclear given that entrance fees are still mostly under Congressional control.

Since our results are inconclusive about the role of entrance fees, we have not estimated elasticities of visitation, nor have we calculated the consumers' value or consumers' surplus for national park areas.

The results from the OLS model also allowed us to draw conclusions on some other variables. First, the coefficient for the number of competing parks was significantly negative for natural protected areas, but significantly positive for historic areas. From this we may conclude that natural protected areas are economic substitutes, and that historic areas are economic complements. Second, the number of competing parks was not a significant explanatory variable for all the parks together, perhaps reflecting the mixed effects of both complements and substitutes among the different categories of national park areas. Finally, the consistently significant coefficient for log area suggests individual preference for larger areas in visitation decisions.

Policy implications

These results have policy implications because the National Park Service (NPS) has often argued, as in the attribute hypothesis, that entrance fees have been too low to affect visitation (U.S. Senate Committee on Energy and Natural

Resources 1979, 1987 pages 34-36 and 49-49, 1997). The service has used the argument in its requests to Congress for more authority in the design of the entrance fee program. Under the Fee Demonstration Program described earlier, the NPS has substantially increased entrance fees to many parks. Initial visitor reaction to the new fees has been mixed (Lundgren et. al. 1997; Lundgren and Lime 1997). Although our results are inconclusive with respect to the role of entrance fees, we speculate that much higher fees would significantly affect park visitation levels, and the NPS, the Congress and the general public may need to consider this in the debate on entrance fees.

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APPENDIX 1

National Protected Areas: Parks (NP) Preserves (NPPRES) and Reserve used in the Model

	Protected Area	Vehicle Fee (V) Person Fee (P)	Well known Parks (S_p) Yes (1), No (0)	Individual Park Intercept t – values
1.	Acadia NP	V/P	0	2.934
2.	Arches NP	V/P	0	-7.308
3.	Badlands NP	V/P	0	-13.151
4.	Big Bend NP	V/P	0	-21.397
5.	Big Cypress NPRES	V	0	-5.819
6.	Big Thicket NPRES	none	0	-8.722
7.	Biscayne NP	none	0	-14.441
8.	Bryce Canyon NP	V/P	0	-8.598
9.	Canyonlands NP	V/P	0	-15.034
10.	Capitol Reef NP	V/P	0	-11.394
11.	Carlsbad Caverns NP	none	0	-11.601
12.	Channel Islands NP	none	0	-1.534
13.	City of Rocks National Reserve	none	0	-14.965
14.	Crater Lake NP	V/P	0	-20.131
15.	Death Valley NP	V/P	0	-3.320
16.	Denali NP and NPRES	P	0	-16.615
17.	Dry Tortugas NP	none	0	-14.782
18.	Everglades NP	V/P	1	-12.903
19.	Gates of the Arctic NP & NPRES	none	0	-14.888
20.	Glacier Bay NP and NPRES	P	0	-14.590
21.	Glacier NP	V	0	-3.7456
22.	Grand Canyon NP	V/P	1	12.047
23.	Grand Teton NP	V/P	0	2.122
24.	Great Basin NP	none	0	-14.887
25.	Great Smoky Mountains NP	none	0	12.397
26.	Guadalupe Mountains NP	none	0	-14.007
27.	Haleakala NP	V/P	0	-8.662
28.	Hawaii Volcanoes NP	V/P	1	-10.198
29.	Hot Springs NP	none	0	-4.065
30.	Isle Royale NP	none	0	-14.974
31.	Joshua Tree NP	V/P	0	-1.660
32.	Kenai Fjords NP	none	0	-14.019
33.	Kings Canyon NP	V/P	0	-7.320
34.	Kobuk Valley NP	none	0	-14.893
35.	Lake Clark NP and NPRES	none	0	-15.078
36.	Lassen Volcanic NP	V/P	0	-15.639
37.	Mammoth Cave NP	none	0	-0.875
38.	Mesa Verde NP	V/P	0	-7.851
39.	Mount Rainier NP	V/P	0	-3.330
40.	Noatak NPRES	none	0	-14.838
41.	North Cascades NP	none	0	-7.122
42.	Olympic NP	V/P	0	2.320

43.	Petrified Forest NP	V/P	0	-11.451
44.	Redwood NP	none	0	-12.447
45.	Rocky Mountain NP	V/P	0	3.300
46.	Saguaro NP	V/P	0	-3.903
47.	Sequoia NP	V/P	0	-3.197
48.	Shenandoah NP	V/P	0	-1.152
49.	Theodore Roosevelt Island	none	1	-2.456
50.	Theodore Roosevelt NP	V/P	1	-18.528
51.	Timucuan Ecological & Hist. Preserve	none	0	-3.575
52.	Voyageurs NP	none	0	-13.622
53.	Wind Cave NP	none	0	-10.748
54.	Wrangell-St. Elias NP and NPRES	none	0	-14.628
55.	Yellowstone NP	V/P	1	4.760
56.	Yosemite NP	V/P	1	3.488
57.	Yukon Charley Rivers NPRES	none	0	-15.109
58.	Zion NP	V/P	0	Base

Note: The SP variable here was used in the regression reported in Table 3. The t-statistics for individual area intercepts are from the regression summarized in Table 4. The Virgin Islands NP was not included in the analysis because of missing data.

APPENDIX.2

National Historic Areas: Historic Sites (NHS) and Parks (NHP) used in the Model

	Protected Area	Vehicle Fee (V) Person Fee (P)	Well known Parks (S_p): Yes (1), No (0)	Individual Park Intercept t – values
1..	Abraham Lincoln NHS	none	1	1.746
2..	Adams NHS	P	0	-0.492
3..	Allegheny Portage Railroad NHS	none	0	1.009
4..	Andersonville NHS	none	0	1.170
5..	Andrew Johnson NHS	none	0	0.154
6.	Appomattox Court House NHP	P	0	0.561
7.	Bent's Old Fort NHS	P	0	0.145
8.	Boston African-American NHS	none	0	2.399
9.	Boston NHP	none	0	14.708
10.	Carl Sandburg Home NHS	P	0	-0.126
11.	Chaco Culture NHP	V/P	0	0.180
12.	Charles Pinckney NHS	none	0	0.497
13.	Chesapeake and Ohio Canal NHP	V/P	0	6.324
14.	Clara Barton NHS	none	0	-0.196
15.	Colonial NHP	V/P	0	8.735
16.	Craters of the Moon NMON	none	0	5.283
17.	Dayton Aviation NHP	none	1	0.142
18.	Edgar Allan Poe NHS	none	0	-1.007
19.	Edison NHS	P	0	-1.693
20.	Eisenhower NHS	P	0	-0.250
21.	Eleanor Roosevelt NHS	none	0	-0.702
22.	Eugene O'Neil NHS	none	0	-0.581
23.	Ford's Theater NHS	none	0	6.655
24.	Fort Bowie NHS	none	0	0.502
25.	Fort Davis NHS	P	0	0.226
26.	Fort Laramie NHS	P	0	0.262
27.	Fort Larned NHS	P	0	0.164
28.	Fort McHenry NMON	P	0	1.825
29.	Fort Point NHS	none	0	10.495
30.	Fort Raleigh NHS	none	0	1.879
31.	Fort Scott NHS	P	0	0.091
32.	Fort Smith NHS	P	0	0.221
33.	Fort Union Trading Post NHS	none	0	0.637
34.	Fort Vancouver NHS	P	0	0.863
35.	Frederick Douglas NHS	none	0	0.227
36.	Frederick Law Olmsted NHS	none	0	-0.493
37.	Friendship Hill NHS	none	0	0.034
38.	George Rogers Clark NHP	P	1	0.367
39.	Golden Spike NHS	V/P	0	0.142
40.	Grant-Kohrs Ranch NHS	P	0	0.129
41.	Hampton NHS	none	0	-0.312
42.	Harpers Ferry NHP	V/P	0	0.513

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