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A Park by Any Other Name: National Park Designation as a Natural Experiment in Signaling

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Astract: Site designation by the National Park Service conveys a unique set of signals to information-constrained potential visitors. Changes in designation thus offer natural experiments to evaluate the signaling importance of names. This paper estimates the visitation effect of the conversion of National Monuments to National Parks through panel data analyses of the 8 designation changes that occurred between 1979 and 2000. These conversions have substantial and persistent effects on annual visitation, indicating that designation signals are indeed significant and credible. These signals appear to be particularly important to information-constrained visitors from a broad national audience compared to more proximate state and metro populations who have better information about nearby sites. Furthermore, increased annual visitor flows to newly designated parks do not appear to occur at the expense of visitation at alternative sites. Finally, visits to these parks appear to be quasi-inferior goods, as visitation is inversely related to various measures of national income.

Keywords: Information, Signaling, Natural Resources, Recreation

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Names of people, places, or things may be the simplest way of summarizing information, and can send direct signals of character and quality. These name signals are likely to be particularly important in decision-making where incomplete information is pervasive. In this way, the National Park Service's (NPS) system of site designation could be expected to convey significant information to a set of information-constrained visitors regarding the likely quality and character of potential visits. Changes to such designations thus offer a natural experiment in the importance of name signals on consumer decisions. Related work sketches the regional economic impact of such designation evolutions through a combination of statistical and input-output modeling (Weiler and Seidl, 2003), which introduces an alternative analytical template to the standard single-site Travel Cost Model (e.g. Smith & Kaoru, 1990).

This paper focuses specifically on the importance of the designation signal itself, particularly for those facing the greatest information constraints. Exploiting a panel data set of the eight Monument-to-Park redesignations that have occurred since 1979, the principal finding is that National Park designation leads to a strongly significant increase of nearly 13,000 additional visitors per year, even after controlling for likely site acreage expansion and visitation trends at comparable sites. The complementary finding that more information-constrained national visitors are especially sensitive to Park designation relative to more proximate metro area and state populations underscores such signals' importance, as does the evidence of signal credibility through the persistence of the designation effect over time. Furthermore, new visitor flows do not appear to occur at the expense of visitation at other comparable sites. Finally, visitation to these new parks

appears to be a quasi-inferior good, with visitation inversely related to various measures of national income.

The next section motivates the signaling effect of National Park designation. The data and empirical model are described in the second section, with results detailed in the third section. Conclusions are summarized to close the paper.

I. THE PUBLIC LAND DESIGNATION SIGNAL

The National Park Service employs a 16-category typology of public lands designations (NPS, 2000). Each of these categories carries information about the type and size of resource under protection, as well as the permitted uses of the resources under each designation. National Park (Park) and National Monument (Monument) are the top two respective rungs of the 16 categories for visitation, with National Parks recognized as the nation's premier natural sites (e.g. NPCA, 2003).

Parks encompass particularly valuable natural areas that may have historical relevance, while only narrower historical or scientific relevance is required of Monuments. Parks also tend to be larger and more diverse than Monuments. Hunting, mining and other consumptive resource uses are not permitted in Parks, in keeping with the desired preservation of the nation's premier resources, while they may be allowed on federal lands containing Monuments. For these reasons, the political hurdles for Park status are greater as well. An act of Congress is needed for additions to the National Park System, while the President may establish Monuments on existing federal lands using the Antiquities Act of 1906 (NPS 2000, 2001c).

Designations themselves are thus assumed to convey information to an information-constrained set of potential visitors, summarizing the likely character of sites. In that sense, designation takes on a unique signaling role in the spirit of Akerlof (1970), Spence (1974), Rothschild & Stiglitz (1976), and others. Long-distance travelers rely on the National Park Service to sketch the character and quality of a potential site visit through its designation, as travel planning by its nature relies on incomplete information (Loomis and Walsh, 1997). Changes in designation thus offer a natural experiment in the effect of such signals on visitation decisions, with a hypothesized *ceteris paribus* increase in annual visitors from a Monument-to-Park redesignation given the latter's premier status on the NPS hierarchy.

In particular, those who are most information-constrained should also be those most sensitive to park designation signals. Therefore, a broader national audience would be expected to be more designation-sensitive than those in the vicinity of sites. State and nearby metropolitan area residents would presumably have better information about local sites regardless of their designation, while longer-distance travelers may depend more on the designation signal to make visitation decisions. The motor vehicle character of most National Park visitation reinforces this dynamic, as many households target a series of Parks for their vacations. Park designation may add that site to literally thousands of visitation lists.

The eight Parks used in the econometric regressions are detailed in Table 1 (NPS, 2001a). Comparable visitation data exist only since 1979, which dictated the choice of the seven Monument-to-Park conversions during that time, plus the most recent Great Sand Dunes re-designation. Virtually identical results are produced when this most recent

re-designation is excluded. Visitation data was truncated at 2000, given the possible idiosyncratic impact of the September 11th tragedy on ensuing visitation behavior.

TABLE 1: National Monuments Re-designated as National Parks, 1979 to 2000.

Site	Established as Monument	Re-designated as Park
Biscayne, FL	1968	1980
Channel Islands, CA	1938	1980
Great Basin, NV	1922	1986
Joshua Tree, CA	1936	1994
Saguaro, AZ	1933	1994
Death Valley, CA	1933	1994
Black Canyon, CO	1933	1999
Great Sand Dunes, CO	1932	2000

II. DATA AND EMPIRICAL MODEL

Data

The core dataset is a panel of the 8 sites observed across 22 years (1979-2000). The site-specific data compiled to create the econometric regressions come from the National Park Service (NPS, 2001b). For each National Park and Monument, this source provides annual visitation totals including recreation visits, non-recreation visits, total overnight stays, and other types of visitation, comparable from 1979-2000. The most broadly applicable variable was total visitation; substantively identical results occur with the other major category, recreation visits. The total visits variable reflects visitation to each of the 8 focal sites. NPSNetVisitors is a manipulation of total visitation to reflect the number of visits to all NPS sites net of the focal 8 monuments/parks. Federal, non-

federal, and total acreage for each site were also solicited from the NPS. Annual national, state, and metro population figures for the same period were gleaned from the Census, based on July 1st estimates for each calendar year. National and state income data came from the Bureau of Economic Analysis. The two datasets together allow the calculation of per capita income levels as well. Descriptive statistics are summarized in Table 2.

TABLE 2: Descriptive statistics of key variables in final regressions

	Total Site Visits	NPSNetVisitors (Millions)	Federal Acres	State Population	US Pop'n (1000s)	GDP ($billion)
Mean	654,610	360	424,079	13,772,503	249,220	5755.2
Median	337,906	357	77,180	7,102,246	248,141	5646.2
Maximum	3,424,051	429	3,348,929	33,145,121	275,130	9963.1
Minimum	19,950	280	640	765,367	224,567	2566.4
Std. Dev.	721,640	39.297	799,819	12,164,181	15,392	2156.4

N= 176; Cross sections = 8

Empirical model

To analyze these panel data, a fixed effects model of annual visitation was chosen, incorporating a set of population and site characteristic variables alongside a dummy variable that assesses the effect of National Park designation. The fixed effects model assumes a fixed constant intercept for each site. A random effects model is likely to be biased in this case, as there is likely correlation between the individual constants and the key explanatory variable of National Park Designation in particular (Hsiao, 1986). The site effects cannot be considered to be drawn from a random sample, as the focal sample is chosen by the narrow criterion that a Monument-to-Park conversion occurred during the last two decades, as opposed to a broad random sample of public sites.

However, this issue immediately suggests the potential for selection bias, as unobserved characteristics may in fact be responsible for the change in designation. In particular, designation may be driven by visitation patterns themselves, with popular monuments targeted for park status. To test this proposition, probit tests were conducted of the likelihood of park designation across the potential sites that could be so redesignated (i.e. all National Monuments), the 8 focal monuments that were in fact redesignated, and those remaining monuments that were not redesignated. Four annual lags of visitation growth were included to explain redesignation, with all coefficients across the three site types found insignificant. Selection bias through endogeneity of the redesignation decision therefore does not appear to be an issue.

Preliminary evidence suggests that linear trends drive changes in yearly visitation. Population is the most direct measure of the general source of site visitors, and is a logical trend variable for visitation. While national sites draw upon a wide national population, residents of the state in which the sites are situated often are the dominant source of visitors (Weiler et al, 2002). The empirical model below will assess whether these sources play a significant role in determining site visitation. The importance of designation signaling can be further tested by evaluating whether the broader national populace, who is presumably more dependent on such informational signals, is in fact more sensitive to such name changes.

The chosen baseline regression model is

$$\mathbf{V}_{it} = a_i + b\,\mathbf{StPop}_{it} + c\,\mathbf{USPop}_t + d\,\mathbf{NPSNetVisitors}_t + f\,\mathbf{Income}_t + g\,\mathbf{Acre}_{it} + h\,\mathbf{NP}_{it} + \mathbf{e}_{it}$$

with the error term assumed to be an independent identically distributed random variable with mean zero and variance σ_μ^2. The model estimates total visitation, **V**, at site *i* at time

t. The site-specific constants are represented by a_i. **StPop** and **USPop** represent the July 1st population of the state for a given resident site along with the nation respectively, the latter measured in thousands; both are expected to be positively related to visitation. As discussed below, distance to and population of the nearest metropolitan area as well as multiplicative interactions offer no discernible additional explanatory power to that provided by site state population. **NPSNetVisitors** is likely to have a positive relation with focal site visits, insofar as visitation to the latter sites follows the general trends of comparable areas.

Income represents measures of national gross income. These coefficients offer a unique opportunity to test for the normal good nature of site visits. Income would positively impact visitation if visitation were a normal good. However, there has been anecdotal evidence that such less-expensive vacation options may in fact reflect quasi-inferior goods which become more attractive during more difficult economic circumstances. In such a case, the income coefficient would be negative and significant. As discussed below, various state income metrics do not help explain site visitation.

Federal public-use acreage, **Acre**, is included to control for site size effects, as Park designations often entail considerable expansions. Acreage itself is also a useful proxy for the variety of potential activities and experiences as well as an indirect measure of congestion; greater land area for a single site suggests less crowding, *ceteris paribus*. Therefore, acreage is expected to have a positive impact on visitation. As only federal lands are fully open to public use, federal acreage was chosen as the variable of choice; non-federal acres were not significantly related to visitation in any model.

Finally, **NP** designates the Park designation dummy, the focal signaling variable of interest. NP has a value of 0 when the site is a National Monument, and 1 in the first full year that the site is designated a National Park and thereafter. The first year of National Park status would logically shift the annual visitation trend upwards/positively with the change in designation, with the consequent hypothesis that NP's coefficient should be significantly greater than zero. In addition to assessing the long-term effect of the conversion through the Park status variable, this metric can also be lagged to ascertain the time pattern of changes in visitation following redesignation. Announcement effects can similarly be assessed with positive lags.

III. ECONOMETRIC EVIDENCE OF SIGNALING

A variety of functional forms were tested, including log-linear, log-log, quadratic, time trend, and single constant models. While regressions using first-differenced dependent and explanatory variables yield substantively identical results, this paper focuses on the greater information provided by a levels analysis. All final regression residuals exhibit stationarity. Linear models' results appeared strongest by standard diagnostic measures, as discussed below. Annual dummy variables were incorporated to control for time-specific factors affecting visitation, but had no significant impact on the results and were omitted to preserve degrees of freedom.

Separate slope coefficients for each site's resident state population may be valuable, given that different states may feature varying responses to changes in their population, possibly due to differing tastes for site visitation. Confidence intervals,

though, indicate that virtually all such slope coefficients are statistically indistinct from one another, leading to a common slope parameter in the final estimates.

Distance from and size of the nearest metropolitan area could also affect visitation. However, distance measures introduced both on their own and interacting with metro population measures do not add significant insight, yielding generally insignificant results ranging from inconsequential to contradictory. In sum, resident state population appears to be the more relevant and consistent indicator for visitation patterns from localized audience bases. Overall, the findings are remarkably robust to varying specifications, suggesting that core underlying relationships are being captured by the focal regressions.

Table 3 summarizes the baseline regression results. All regressions use cross-sectional weights, while standard errors incorporate White Heteroskedasticity adjustments. Unweighted results are substantively similar. A first-order Cochrane-Orcutt autoregressive process was included given the unsurprising evidence of autocorrelation in uncorrected regressions. Site constants are both significant and generally statistically distinct from one another, justifying the fixed effects model choice.

TABLE 3: Regression Results — Visitation Impact of National Park Designation.

Total annual visits =	Coefficient	Standard Error
National Park Designation	12,813.17*	1349.784
Federal Acres	0.115849*	0.013169
NPS Net Visitors	0.000169*	0.000024
State Population	0.056890*	0.008847
National Population	2.787599*	0.579582
Gross Domestic Product per capita	-7,482,946*	842,804.0
Intercept—Joshua Tree	-1,310,873*	234,071.3
-- Black Canyon	-544,104.3*	103,278.1
-- Saguaro	1,955,382*	733,606.0
-- Great Basin	-606,967.2*	116,663.3
-- Great Sand Dunes	-526,641.0*	116,354.9
-- Death Valley	-1,664,143*	227,225.5
-- Channel Islands	-1,976,467*	225,766.7
-- Biscayne	-962,973.7*	204,225.2
AR1	0.807655*	0.080981
Weighted statistics		
R-squared	0.968	
Adjusted R-squared	0.965	
Durbin-Watson	2.01	
F-statistic	331.2	
Unweighted statistics		
R-squared	0.972	
Adjusted R-squared	0.970	
Durbin-Watson	2.18	

N= 176; 22 observation time series (1979 to 2000) x 8 sites
Generalized Least Squares estimation technique with cross sectional weights
White Heteroskedasticity-consistent standard errors and covariance
* = p<0.01

Most importantly, the coefficient for the key explanatory variable, NP, is both positive and strongly statistically significant. The National Park designation signal yields 12,813 additional annual visitors to each newly designated site's specific long-run visitation trend. These designation impacts control for size effects, which suggest that 116 new annual visitors are attracted by a 1000 acre addition to a National Monument/Park, as well as net visitor trends in other NPS sites.

The absolute visitation change due to Park designation implies widely varying relative impacts on site visitation, from a large effect on a small base in Great Basin to a tiny relative effect on a large Death Valley base. The log-linear model findings suggest increases in visitation of 6.0%, which would then result in varying absolute changes by site. However, coefficients of the log-linear model have considerably weaker significance, with the overall model providing less explanatory power in normalized goodness-of-fit measures. Elasticity log-log models perform even more poorly. The relative robustness of the linear-linear model indicates that there is a constant marginal set of visitors interested in National Park designations in themselves.

Anecdotally, a substantial number of households clearly plan National-Park-oriented trips annually, with a new Park apparently adding a further visit to thousands of such lists. New visitors may see Park designation providing particular amenities for visitors, such as special services and access, and coordinate their visits beginning with the year of designation. More generally, travel planning seems to target national parks precisely for the premier status that such sites' designation promises, with atlas and Internet citations being updated following redesignation. Designation indeed appears to be issuing a direct signal of site quality and interest.

The results also clarify the normal good character of visitation. The coefficients for various measures of national income are negative and significant. While the tables detail the findings for current GDP per capita to avoid collinearity with national population, other real and current national income measures yield substantively identical results. Interestingly, in contrast to the dual role of state and national population discussed below, inclusion of various Gross State Product measures do not change the

GDP results, and themselves have insignificant impacts on visitation either in isolation or when included with national measures. The overall findings regarding negative national income effects imply that visits to (new) parks are a quasi-inferior good, as leisure travelers tend towards less expensive vacation alternatives during economic slowdowns. Such an effect has often been noted anecdotally, such as during the economic slowdown of 2001-2003; these results provide broader empirical support for such a hypothesis.

Both national and state populations are significant determinants of site visitation, with each respective population's coefficients remaining nearly identical when introduced individually or together. As indicated by the noted rejection of separate state slopes, state population effects themselves are consistent across a wide range of state populations, from California's 33+ million 2000 peak to Nevada's 1979 headcount of 765,000. The results suggest that 56.9 new site visits occur for every 1000 person increment in resident state population. Such commonality across states/sites is intriguing and instructive, implying that local residents recognize the value of a particular site regardless of designation.

In fact, a direct hypothesis from this paper's signaling hypothesis is that visitors from a broader national audience would rely more on the signals from site designation given their greater information constraints. More proximate state residents may be familiar with a site's character regardless of designation. In contrast, visitors from across the wider United States might target sites precisely by their premier National Park status. The key question is whether the national and/or state population relationship/s with visitation change following Park designation. The empirical model structure allows such a test.

Given that designation itself significantly increases visitation, we construct two new variables reflecting the multiplicative interaction between the significant dummy and the two potential source populations, namely those from the resident state and the broader national audience. Introducing these variables alongside the overall state and national population effects should indicate whether park designation changes the state- and/or national-population/visitation relationship.

As noted in Table 4, the Park*National-Population coefficient is strongly positive and significant, while the Park*State-Population coefficient is statistically indistinguishable from zero. Nevertheless, the underlying state- and national-population/site-visitation relationships are substantively unaffected. Park designation effectively boosts the national-population/visitation relationship, indicating that these dispersed visitors indeed rely on the designation signal. In contrast, the insignificance of the Park*State-Population coefficient reflects the fact that state residents are likely to have knowledge about a state site's characteristics regardless of the premier Park moniker. These results underline the importance of designation signaling to an information-constrained audience, in this case that of potential national visitors.

TABLE 4: Regression Results
Post-Designation National and State Population Source Effects

Total annual visits =	Coefficient	Standard Error
Park Designation*National Population	0.050713*	0.006093
Park Designation*State Population	-0.000887	0.000820
Federal Acres	0.137377*	0.022177
NPS Net Visitors	0.000170*	0.000024
State Population	0.057318*	0.008852
National Population	2.712867*	0.591707
Gross Domestic Product per capita	-7,414,956*	853,249.6
Intercept—Joshua Tree	-1,308,750*	234,893.5
-- Black Canyon	-528,643.6*	105,997.2
-- Saguaro	1,975,482*	741,478.5
-- Great Basin	-591,260.7*	119,329.0
-- Great Sand Dunes	-511,820.0*	119,114.1
-- Death Valley	-1,704,098*	227,798.8
-- Channel Islands	-1,943,949*	227,050.1
-- Biscayne	-941,865.8*	207,190.9
AR1	0.809096*	0.081185
Weighted statistics		
R-squared	0.968	
Adjusted R-squared	0.965	
Durbin-Watson	2.02	
F-statistic	306.5	
Unweighted statistics		
R-squared	0.972	
Adjusted R-squared	0.970	
Durbin-Watson	2.18	

N= 176; 22 observation time series (1979 to 2000) x 8 sites
Generalized Least Squares estimation technique with cross sectional weights
White Heteroskedasticity-consistent standard errors and covariance
* = p<0.01

Pre-designation "announcement" effects and post-designation visitation trends were tested using a variety of lags, using coefficient significance and model fit as the basic criteria for assessing the relevance of these temporal factors. No consistent announcement effects were identified in the 3-4 years leading to the actual Park designation. Redesignation then effectively ratchets annual visitation upwards in the first

year of National Park status, with no further ratchets detected in the following years. The fact that there is no eventual systematic visitation decline in newly designated sites suggests that the designation signal is credible; non-credible signals would be overwhelmed by negative reputation effects with increased visitor experience over time.

Such new designations may also affect visitation in other similar sites given potential fungibility in visitation patterns. Park visitors may simply be substituting their visit to the "new" Park for visits that would have occurred otherwise in an "old" Park. Chandra & Thompson (2000) uncovered a parallel substitution effect in their study of economic impacts of interstate highway location, as economic activity is diverted away from areas adjacent to counties with new highways.

The impact of designation timing on visitation to other sites was therefore statistically evaluated to assess such potential visitation fungibility. Six focal inquiries were pursued to weigh new designations' effects on both the level and growth of visitation at National Parks, National Monuments, and overall NPS visits. Net NPS visits and national population were the control variables for National Park and Monument regressions, while national population was retained for the NPS analysis. No significant effects were found in any of the six permutations, indicating that Park designation does not in fact divert visitation from other sites but rather adds net new visitors to the NPS system. Such additions can most easily be visualized as vacation travelers specifically targeting regional National Parks, with a new designation simply adding the new Park to many such lists.

IV. CONCLUSIONS

The site designation power of the National Park Service provides a natural experiment in the effect of name signaling to a set of information-constrained potential consumers. The econometric results suggest such signals are indeed significant, persistent, and credible, with a constant marginal set of annual visitors apparently adding a new national park to their vacation lists without reducing visitation at comparable sites. Furthermore, evidence indicates that these new visitors come from a broader national population source, who are precisely those most likely to rely on designation signals due to their particularly imperfect information on site characteristics. Finally, vacationers appear to treat such natural site visits as quasi-inferior goods during periods of economic struggles.

REFERENCES

Akerlof, George. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." *The Quarterly Journal of Economics*, August 1970, 84(3), pp. 488-500.

Chandra, Amitabh and Thompson, Eric. "Does Public Infrastructure Affect Economic Activity? Evidence From The Rural Interstate Highway System." *Regional Science and Urban Economics*, July 2000, 30(4), pp. 457-490.

Hsiao, Cheng. *Analysis of Panel Data*. Econometric Society Monographs, 11. Cambridge: Cambridge University Press. 1986.

Loomis, John B. and Walsh, Richard G. *Recreation Economic Decisions: Comparing Benefits and Costs (2nd ed.).* State College, PA: Venture Publishing. 1997.

National Parks Conservation Association (NPCA). http://www.npca.org/. 2003.

National Park Service. *Designation of National Park System Units*. http://www.nps.gov/legacy/nomenclature.htm. 2000.

National Park Service. http://www.nps.gov/. 2001a.

National Park Service. http://www2.nature.nps.gov/stats. 2001b.

National Park Service. *National Park System: Caring for the American Legacy*. http://www.nps.gov/legacy/mission.htm. 2001c.

Rothschild, Michael and Stiglitz, Joseph E. "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information." *Quarterly Journal of Economics*, November 1976, 90(4), pp. 629-649.

Smith, V. Kerry and Kaoru, Yoshiaki. "What Have We Learned Since Hotelling's Letter? A Meta-Analysis." *Economic Letters,* March 1990, 32(3), pp. 267-272.

Spence, Michael. *Market Signaling*. Cambridge, MA: Harvard University Press. 1974.

Weiler, Stephan and Seidl, Andrew. "What's In A Name? The Impact of National Park Designation." *Journal of Regional Science*, 2004, 44(2), 245-264.

Weiler, Stephan; Loomis, John; Richardson, Robert and Shwiff, Stephanie. "Driving Regional Models with a Statistical Model: Possibilities for Hypothesis Tests on Economic Impacts." *Review of Regional Studies*, Winter/Spring 2002, 32(1), pp. 97-111.