**The Effect of the Internet at Home on National Park Visitation**

James Clark

Southern Utah University 2021

Abstract

This paper examines the effect of the proportion of a state's population that has access to the internet has on that state's national park visitation. The purpose of this study is to provide insight on how the internet affects the quantity of eco-tourists in American National Parks. This study determines using linear regression that as more of a state's population gains access to the internet that state's national park visitation will decrease at the 99% significance level all else held constant.

**Introduction**

The United States has always had a fascination with nature. A large amount of tourism in the country is driven by the nation's national parks. Previous studies have shown that national park attendance per capita has been declining since 1987 (Pergams & Zaradic 2006, 2008). Others have attributed the decline in attendance to the increase in travel costs and entrance fees to the parks (Stevens, More, Markowski-Lindsay 2014). Many people have speculated that as more technology such as television and video games has lowered the desire for nature-based activities. One study found that those that watch the most television had the lowest rates of national park visitation. The same study found that those who used the internet the most had the highest rates of national park visitation. (Warnick, Schuett, and Kuentzel 2010). One study found that an increase in contributions to Italian travel sites from Facebook lead to a significant increase in traffic to Italian tourism sites (Milano, Baggio, and Piattelli 2011). While this is not directly correlated to the number of visitors that Italy received it is a good indicator that the internet can spark interest in Travel.

This study aims to answer the question: Does the proportion of a State's population that has access to the internet at home impact the number of visitors that state's national parks receive? While previous studies have looked at the use of internet by age and other demographic categories, this study aims to answers what effect the availability of internet access at home play on national park attendance. I hypothesize that an increase in the proportion of a state's population that has access to the internet will lead to an increase in that state's national park visitation, because of more available and frequent information about the national parks made possible via the internet. This study can serve as an example of how the growth of internet availability can affect certain sectors of the tourism industry.

**Data**

       The data for this study comes from the National Park Visitors Statistics (NPVS), the National Telecommunications and Information Administration (NTIA), the U.S. Energy Information Administration (USEIA), and the United States Census Bureau (USCB). The data for this study comes from the National Park Visitors Statistics. A national park in the United States is defined as an important scenic or historical area. This study looks at nature based national parks. This would exclude national parks like Ellis Island and the St. Louis Arch and focus on parks that are primarily pure undeveloped nature like the Grand Canyon for instance. The data for this study comes from the 57 of the current 61 national parks that have data from the beginning of our sample until the end (the rest were established as national parks after 1998). This data estimates the number of visitors that each National park receives. This is measured by a traffic loop counter that measures the number of vehicles that enter the park and then that value is then multiplied by a PPV value of people per vehicle that changes by park, month, and entrance to each park. This data is observed from 1979 to 2019. This data is aggregated by state annually for this study because all other available data for this study is measured in annual bases. Total National Park visitation by year is depicted in Figure 1.

**Figure 1.**
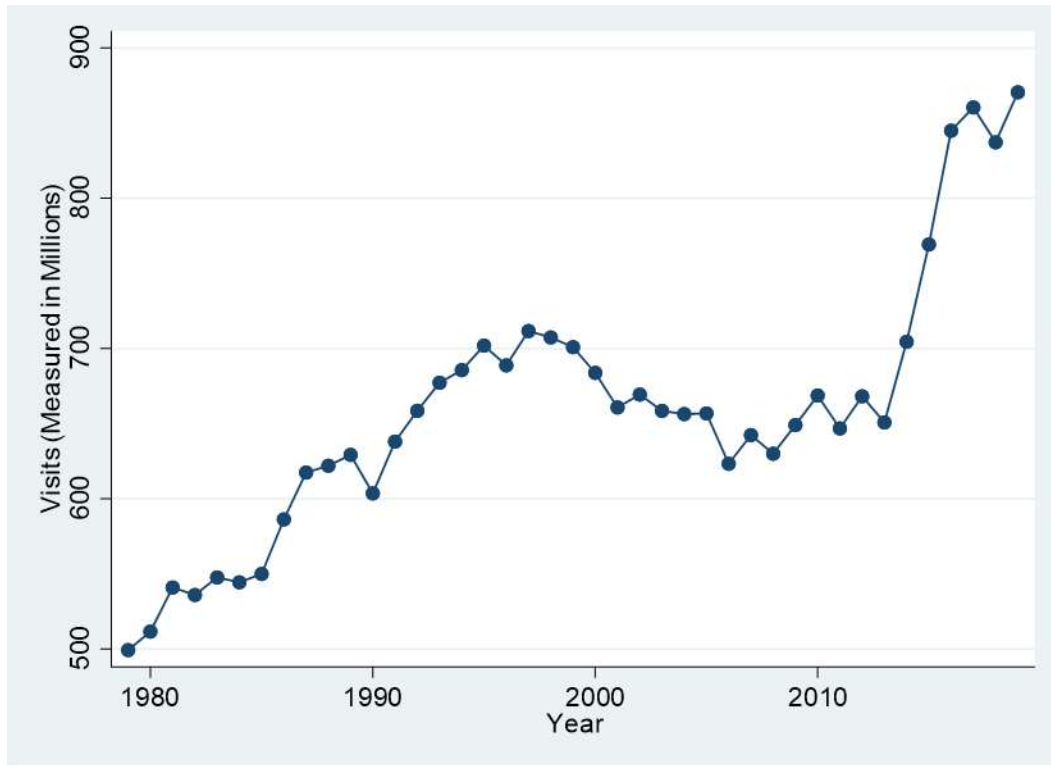


Data is also gathered from the National Telecommunications and Information Administration. This data includes the proportion of a state that has internet access in their household (IAH). This proportion is estimated based off a random sample of the state's population generally every other year starting from 1998. All years that the proportion has been estimated are as follows: 1998, 2000, 2001, 2003, 2007, 2009, 2010,2011,2012,2013, 2015, and 2017. Average gas prices for the United States are gathered from the U.S. Energy Information Administration to account for travel costs. The United States Census Bureau provides median income for each state as well at the estimated population of that state annually. Income is an important variable, because as real income increases people are more likely to travel. All data that is measured on the state level is only collected for the 26 states that have national parks in

their boundaries. Finally, the consumer price index is gathered from the Federal Reserve Bank of Minneapolis to be used to compute gas prices and median income in terms of 2017 dollars.

The distribution of visits that national parks receive by state does not exactly follow a normal distribution as depicted in figure 2 the data is skewed to the right with some states receiving much more than others. The table depicts the average number of visitors that each state has received since 1998.

**Figure 2.**
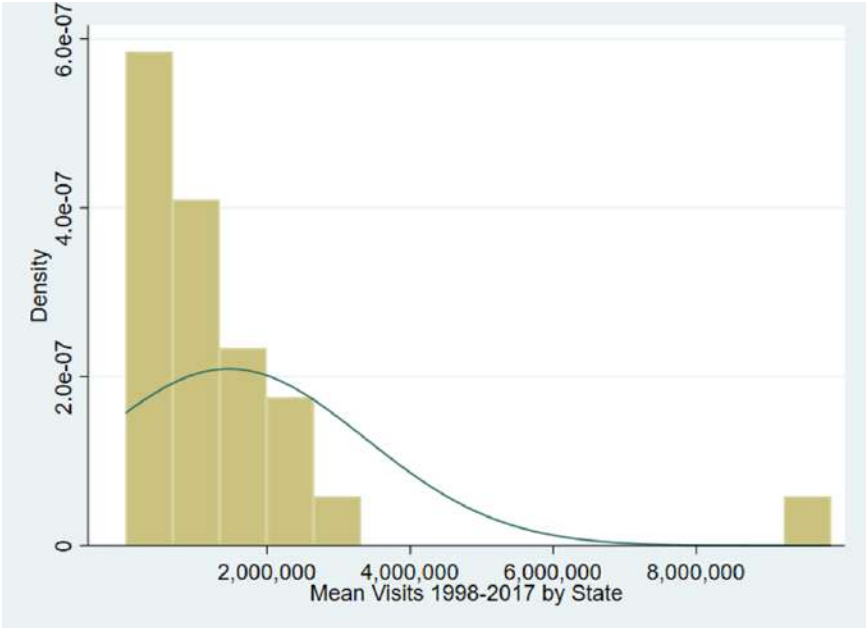


The main variables of interest are summarized in Table 1 on the below.

Table 1. Summary of Visitation and IAH

| Year | Mean | Std dev | Min | Max | Avg % change /Year |
|---|---|---|---|---|---|
| **1998** | | | | | |
| Visits | 1,231,352 | 1,608,232 | 5,550 | 9,989,395 | - |
| Internet proportion | 0.31 | 0.07 | 0.15 | 0.44 | - |
| **2000** | | | | | |
| Visits | 1,187,450 | 1,612,329 | 2,646 | 10,175,812 | -1.8% |
| Internet proportion | 0.45 | 0.06 | 0.27 | 0.55 | 22.6% |
| **2001** | | | | | |
| Visits | 1,147,577 | 1,491,918 | 4,217 | 9,197,697 | -3.4% |
| Internet proportion | 0.54 | 0.06 | 0.38 | 0.64 | 20.0% |
| **2003** | | | | | |
| Visits | 1,141,023 | 1,504,563 | 4,006 | 9,366,845 | -0.3% |
| Internet proportion | 0.58 | 0.06 | 0.42 | 0.69 | 3.7% |
| **2007** | | | | | |
| Visits | 1,117,109 | 1,511,859 | 847 | 9,372,253 | -0.5% |
| Internet proportion | 0.65 | 0.06 | 0.51 | 0.74 | 3.0% |
| **2009** | | | | | |
| Visits | 1,131,569 | 1,537,538 | 1,879 | 9,491,437 | 0.6% |
| Internet proportion | 0.71 | 0.06 | 0.56 | 0.78 | 4.6% |
| **2010** | | | | | |
| Visits | 1,164,670 | 1,547,455 | 3,164 | 9,463,538 | 2.9% |
| Internet proportion | 0.74 | 0.06 | 0.59 | 0.82 | 4.2% |
| **2011** | | | | | |
| Visits | 1,127,147 | 1,494,872 | 5,158 | 9,008,830 | -3.2% |
| Internet proportion | 0.74 | 0.05 | 0.6 | 0.82 | 0.0% |
| **2012** | | | | | |
| Visits | 1,163,944 | 1,572,431 | 11,639 | 9,685,829 | 3.3% |
| Internet proportion | 0.77 | 0.04 | 0.69 | 0.85 | 4.1% |
| **2013** | | | | | |
| Visits | 1,134,244 | 1,525,051 | 13,000 | 9,354,695 | -2.6% |
| Internet proportion | 0.76 | 0.06 | 0.6 | 0.84 | -1.3% |
| **2015** | | | | | |
| Visits | 1,342,049 | 1,791,499 | - | 10,712,674 | 9.2% |
| Internet proportion | 0.75 | 0.04 | 0.67 | 0.81 | -0.7% |
| **2017** | | | | | |
| Visits | 1,504,326 | 1,948,806 | 15,500 | 11,338,893 | 6.0% |
| Internet proportion | 0.79 | 0.04 | 0.72 | 0.85 | 2.7% |
| | | | | | |
| Observations | 684 | | | | |

Tennessee receives the largest number of visitors of any state. This is because it contains Great Smoky Mountains National Park-the most visited national park. This park is very popular because of two major reasons-it has no entrance fee, and it is close in proximity to major

metropolitan areas. Because Tennessee receives so many visitors it skews the mean number of visitors that other states receive. To account for this Table 2 evaluates the mean number of visits all states except for Tennessee receive.

Table 2. State Visits by Year

| Year | Mean | Std dev | Min | Max |
|------|------|---------|-----|-----|
| 1998 | 1,074,959 | 1,101,783 | 5,550 | 4,239,682 |
| 2000 | 1,026,943 | 1,073,182 | 2,646 | 4,460,228 |
| 2001 | 1,003,825 | 1,032,950 | 4,217 | 4,104,809 |
| 2003 | 994,133 | 1,025,984 | 4,006 | 4,124,900 |
| 2007 | 969,696 | 1,032,525 | 847 | 4,413,668 |
| 2009 | 982,286 | 1,055,289 | 1,879 | 4,348,068 |
| 2010 | 1,016,476 | 1,078,698 | 3,164 | 4,388,386 |
| 2011 | 986,402 | 1,060,957 | 5,158 | 4,298,178 |
| 2012 | 1,011,768 | 1,083,285 | 11,639 | 4,421,352 |
| 2013 | 987,450 | 1,057,107 | 13,000 | 4,564,840 |
| 2015 | 1,174,717 | 1,281,714 | - | 5,520,736 |
| 2017 | 1,328,708 | 1,441,171 | 15,500 | 6,254,238 |
| Total | 1,046,447 | 1,112,089 | - | 6,254,238 |
| Observations | 672 | | | |

Note: These values exclude the State of Tennessee

**Method**

<u>Functional Form</u>

To address the question, we begin with a base model to establish a baseline relationship between national park visitation by state and the proportion of that state's population that has access to the internet at home. The internet proportion variable is transformed into a natural log, so that it will have a more intuitive interpretation. The base linear-log model (Model 1) is as follows:

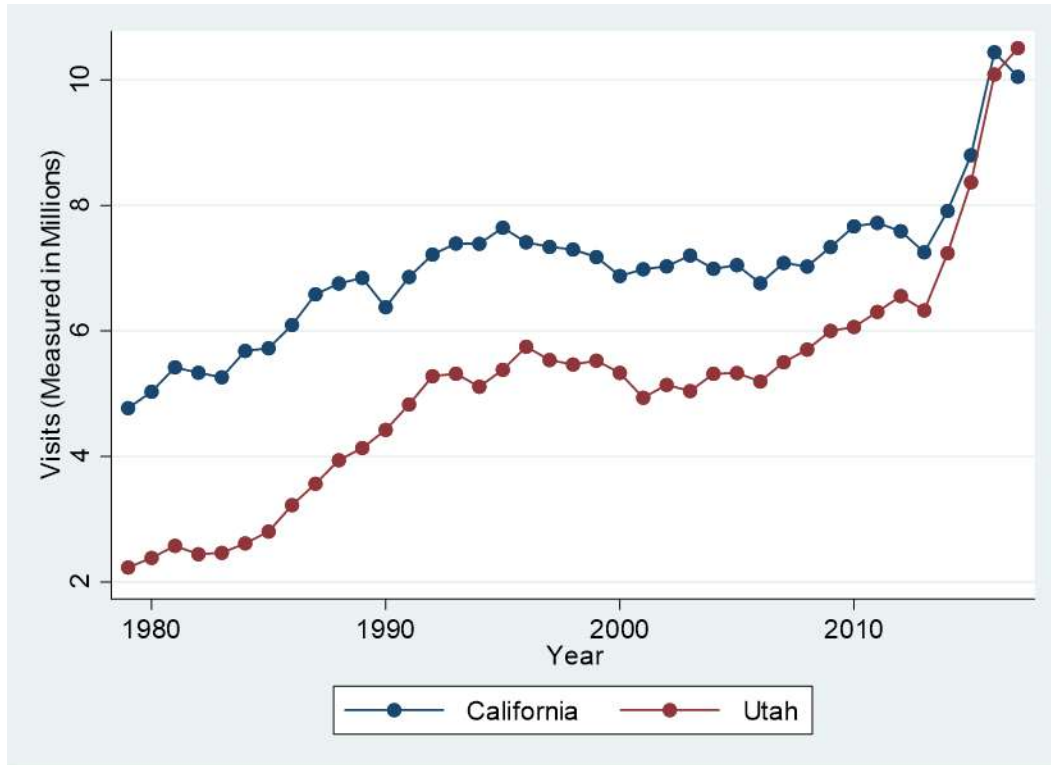$$(1)\ Visitation_{st} = \beta_0 + \beta_1 \ln(InternetProportion)_{st} + u_{st}$$

The model above measures national park visitation aggregated by state s in time t regressed on the natural log of state s's internet proportion. This model leaves a lot unexplained as there is a lot more than can contribute to national park visitation than just the proportion of that state's citizens that have access to the internet in their home. One failure of this model is that is does not account for growth in a national park visitation over time. A year variable is added to the next model (Model 2) to control for growth over time. Another failure of this model is that national park visitation is aggregated by state and not all states have the same number of national parks. California for example, has nine national parks while other states like Oregon only has one. To account to for this, fixed effects for state are added in all subsequent models. The next model (Model 3) is as follows:

$$(3)\ Visitation_{st} = \beta_0 + \beta_1 \ln(InternetProportion)_{st} + \beta_2 year_t + \lambda_s + u_{st}$$

A flaw of this model is that it assumes that all state's national parks will have the same growth rate, which is unlikely. Figure 2 depicts the growth rate of two states with a different number of

national parks and their different growth rates over time. It is interesting to note that California has 9 national parks while Utah has 5.

**Figure 3.**



To account for this, we add an interaction variable to our model (Model 4) to fit the data more accurately. The adjusted model is as follows:

$$(4)\ Visitation_{st} = \beta_0 + \beta_1 \ln(InternetProportion)_{st} + \beta_2 year_t + \lambda_s + \lambda_s * year_t + u_{st}$$

While this model does a much better job at estimating the true effect of the proportion of a state that has internet access at home it still does not account for travel costs. Travel costs are a large component of visitation add control variables for travel costs. We also add the states estimated population for the year as it may impact both the visitation of that state's national parks and the internet proportion of that state's population that has access to the internet.

$$(7) Visitation_{st} = \beta_0 + \beta_1 \ln(InternetProportion)_{st} + \beta_2 year_t + \beta_3 income_{st} +$$

$$\beta_4 fuelprice_t + \beta_5 population_{st} + \lambda_s + \lambda_s * year_t + u_{st}$$

**Table 3.**

Table 3. Estimates of a Percentage Change in IAH effect on National Park Visitation

| Independent Variables | Dependent Variable: National Park Visits | | | | | | |
|---|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 |
| State Internet Proportion | 424446.6 | 512552.6 | -1057733.0*** | -960939.3*** | -846862.8*** | -513932.3*** | -455246.4*** |
| | [451753.2] | [834057.0] | [177410.9] | [134935.4] | [129391.7] | [131552.2] | [131767.4] |
| Year | | -5718.1 | 66201.1*** | 131871.7*** | 113588.1*** | 122411.9*** | 123797.3*** |
| | | [45472.9] | [9259.5] | [17630.0] | [17012.6] | [15915.5] | [15732.0] |
| Median Income (2017 Dollars) | | | | | 33.04*** | 16.34** | 17.82** |
| | | | | | [5.941] | [6.132] | [6.083] |
| Average Gas Price (2017 dollars) | | | | | | -226077.1*** | -218731.1*** |
| | | | | | | [35712.5] | [35386.6] |
| State Population | | | | | | | -0.901** |
| | | | | | | | [0.333] |
| Constant | 2846981.6*** | 14374107.9 | -130844640.3*** | -101622270.4** | -115471977.0*** | -124115296.9*** | -133461307.8*** |
| | [273983.7] | [91669088.6] | [18673030.7] | [33661575.2] | [31967607.3] | [29822402.9] | [29665157.5] |
| State Fixed Effect | NO | NO | YES | YES | YES | YES | YES |
| Interaction Model | NO | NO | NO | YES | YES | YES | YES |
| Observations | 312 | 312 | 312 | 312 | 312 | 312 | 312 |
| R Squared | 0.003 | 0.003 | 0.970 | 0.986 | 0.987 | 0.989 | 0.989 |
| Standard errors in brackets | "* p<0.05 | ** p<0.01 | *** p<0.001" | | | | |

**Results**

Models 1 and 2 show that an increase in the proportion of residents that have access to the internet at home has a not statistically significant effect on that state's national park visitation. However, without fixed effects and other controls this result is not very meaningful. Models 3-7 in Table 3 show a negative impact on national park visitation with an increase in the proportion of a State's population that has access to the internet significant at the 99% confidence level. Model 7 shows that a one percent increase in the proportion of a State that has access to internet in their home leads to an estimated loss of about 455 thousand less visitors to a that state's national park(s) annually all else held constant. To put the coefficient in perspective from 2015 to 2017 we saw an average growth rate of IAH of 2.7% nationwide; that equates to an estimated loss of 1.2 million visitors from a state's national park all else held constant. That is a very large decrease considering that for all years in our sample except for 2013 the average number of visitors that each state received is less than 1.2 million (excluding Tennessee) as

depicted in Table 2. It is important to acknowledge that in terms of statistical significance the results from models 3-7 are robust. However, in terms of economic significance the results are not very robust. From model 3 to 7 the coefficient for State internet proportion varies by about a 600 thousand visits and while a 1% change in the proportion of residents that have access to the internet at home is a large increase the coefficient still varies substantially. This is more visits than some state's national parks receive in a year. While that is not a complete estimate, because it does not consider state fixed effects, fixed effects*year etc. that is still a large amount for the coefficient to vary.

**Assumptions and Limitations**

There are some limitations associated with the model shown in equation 7. One limitation is that there are several variables that could be cause changes in internet availability in the home as well as national park visitation. One example could be lifestyle. Some states may have populations that are very avid about having the internet in their homes and spend a lot of time in national parks while others do not, and this is near impossible to measure. Another failure of this model is that not all visitors of a national park are residents of that State, so they may come from a state that has a completely different availability of internet in the home. While it is reasonable to assume that lodging accommodations will likely have similar access to the internet as a household would there are likely significant differences on a state basis. This becomes more complicated when international visitors are considered.

**Conclusion**

The results of this study suggest that the internet is a substitute for spending time in national parks. One possible explanation is that recreation via the internet comes with a much lower opportunity cost with no travel time or added expenses. Many forms of recreation are

available via the internet, and it appears that as these become increasingly available people are less interested in visiting national parks. Some national parks such as Zion and Glacier National park suffer from severe overcrowding and could use less visitors a year. However, this is not a viable solution as residents cannot be made to have the internet in their homes and there are many other variables that drive national park attendance. National park visitation on a national basis is still continually increasing as well (see figure 1.).  An increase in internet availability could have a negative impact on smaller and less popular national parks that may need more funding which mostly comes from park entrance fees. While availability on the internet is driving park attendance down, we are still seeing park visitation increase see Figure 1.

# References

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