AN ECONOMIC ANALYSIS OF NATIONAL PARK VISITATION RATES

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

ABSTRACT

This thesis estimates visitation to U.S. national parks over the period 1993 - 2010 in attempt to determine what factors influence visitation rates over time. Three factors are predicted to be important determinants of national park visitation rates. These factors are entrance fees, travel costs (represented by driving costs), and income. Both travel costs and income have been shown to be significant determinants of national park visitation rates in the economic literature; however, the effect of entrance fees on visitation rates is inconclusive. Determining how the factors of interest influence visitation rates is accomplished by first developing a theoretical demand and supply model of park visits. The theoretical model informs the empirical model with predictions for how changes in entrance fees affect the quantity of visits when fees are above, below, or at the market-clearing level of the fee. These predictions are tested empirically by estimating a linear model of both annual and monthly park-level visitation to a sample of 165 national parks. The main results of the analysis show that income is not a significant determinant of national park visitation rates, but that both travel costs and entrance fees have a negative effect on visitation. Further, more detailed estimation procedures that analyze visitation to parks pooled based on designation and level of use show that the effect of entrance fees on national park visitation rates is both park-specific and season-specific.

CHAPTER 1

INTRODUCTION

National parks are popular recreation destinations in the United States, drawing upwards of 250 million visits every year.[1] Since Yellowstone was designated as the first national park in 1872, the number of national parks in the United States has grown to include 401 parks across 49 states, with the addition of five new National Monuments coming in 2013. National parks are not only central for preserving landscapes of scenic beauty and historical significance, but are also important as drivers of economic activity. In a report of the economic impact of national park visitation on local communities, the U.S. Department of the Interior estimates that visitors to national parks spent $12.13 billion in the local communities surrounding parks in 2010 (USDI 2011, page 3). The U.S. Department of the Interior estimates that this spending supported 156,280 jobs, and generated $12.96 billion in sales revenue for national park gateway communities (USDI 2011, page 6).

The positive economic impacts of national parks are not strictly confined to gateway communities. On a national scale, visitor spending supported 258,416 jobs in addition to accounting for $31.08 billion in sales revenue in 2010 (USDI 2011, page 7). The National Park Service (NPS) itself employs approximately 22,000 individuals annually, and in 2011 its operation budget was $2.25 billion (USDI 2013, page 32). In

[1] Throughout this thesis, the term "national parks" is used to generally refer to all types of parks operated by the NPS. When referring to specific park types, e.g., National Monuments, the term will be capitalized. Because there are parks designated specifically as National Parks, this capitalized term is not to be confused with the lower case version that is used to generally refer to parks operated by the NPS.

contrast, the NPS generated receipts totaling only $360.4 million in 2011 (USDI 2013, page 36). Of those receipts, $187.5 million came from recreation fees.[2]

Recreation fees for national park use were first implemented at Mount Rainier in 1908, in the form of an entry fee for automobiles. Since then, entrance fees have become relatively commonplace at national parks, despite opposition from those who believe the parks should be provided free of charge to the public. Not all parks levy entrance fees, and those that do are limited in how much they can charge (USDI 2010, pages 28-29). As a result, most parks have entrance fees that are between $5 and $20 for a seven-day vehicle pass. Entrance fee authority for the national parks was reformed in 1996 with the passage of the Recreational Fee Demonstration Program (RFDP), a pioneering piece of legislation that granted parks more autonomy in setting entrance fees and allowed them to keep 80 percent of fee revenues generated as a result of the program. This gave parks more of an incentive to charge entrance fees and the effects of the RFDP were manifest in subsequent years as parks started to increase fees.

Despite the fact that visitation to all national parks in the United States recorded a net increase of 3 percent over the period 1993-2010, downward swings in visitation during that span have been a subject of media attention in recent years. In response to the RFDP and the ensuing Federal Lands Recreation Act (which replaced the RFDP in 2004), national park entrance fees have been a hotly debated topic (particularly within the popular press) over the past two decades, and many interesting economic questions have surfaced as a result. Consequently, the topic of entrance fees and their effect on visitation

[2] Recreation fees include entrance fees as well as expanded amenity fees for specific or specialized facilities, e.g., front-country and back-country camping and special interpretive programs.

is given significant attention in this thesis. Park entrance fees have gained a number of critics, and entrance fees have been targeted in recent years for leading to downward swings in park visitation rates. An op-ed in the *Arizona Republic* advocates for eliminating entrance fees at national parks, arguing that doing so would motivate more individuals to visit the parks (Weiner and Battaglia 2010). Similarly, an article by Schneider (2009) argues "abandoning entrance fees has lots of economic upside and minimal downside." In response to a decline in park visitation in 2005 and 2006, an article in the *USA Today* points to increases in entrance fees as a potential contributor to this decline. It is clear from these articles that declining visitation to the nation's parks is a common concern; and when declining visitation is a concern, park entrance fees are likely to be at the root of the discussion. The question then becomes: are park entrance fees effectively deterring individuals from visiting national parks? This is a question worth analyzing in more detail.

Entrance fees are not the only factor important in determining national park visitation rates. Many economic studies that model the use of outdoor recreation facilities show that use rates at such sites are affected by factors such as travel costs and income. (Beesley 1965; Hagerty and Moeltner 2005; Loomis and Keske 2011). As such, it is plausible to assume that travel costs and income are important determinants of national park visitation. To address this, travel costs (represented solely by factors that influence the cost of driving) and a measure of income are examined alongside entrance fees to determine the extent to which park attendance is affected by these factors.

The economic literature on national park visitation is relatively small in comparison to the body of literature on visitation to other types of recreation areas.

Previous studies that examine data on national park visitation include Factor (2007), Poudyal et al. (2013), Heberling and Templeton (2009), Ngure and Chapman (1999), and Hanink and Stutts (2002). Interestingly, some studies that analyze park visitation data omit entrance fees from their analysis (Poudyal et al. 2013; Hanink and Stutts 2002). Studies argue that other factors, such as park attributes or a park's distance from population centers and substitute destinations, may be more important to determining use patterns (Ngure and Chapman 1999; Hanink and Stutts 2002).

Regarding the literature on national park visitation, this thesis improves upon it by incorporating a revealed preference approach to analyze national park visitation rates. The revealed preference approach employed in this thesis improves upon numerous previous studies that rely on stated preference methods to determine how entrance fees affect visitation (Duffield et al. 2000; Field et al. 1998; Lundgren et al. 1997; Taylor et al. 2011; Ostergren et al. 2005). Other previous studies are lacking in the sense that some only look at aggregate measures of visitation (Poudyal et al. 2013), while others examine visitation over short time periods (Ngure and Chapman 1999; Hanink and Stutts 2002). In addition, some studies only focus on certain types of parks, e.g., National Parks (Factor 2007) and National Battlefields (Hanink and Stutts 2002), and others focus only on one park (Heberling and Templeton 2009; Haspel and Johnson 1982; Mendelsohn et al. 1992).

Questions can be asked about how entrance fee levels are determined. If entrance fees are assumed to be set exogenously by parks, and other factors such as travel costs are assumed to shift the demand for park visits rather than influence the price of a visit, there

is the question of where fees are set in relation to market-clearing fees.[3] Given a certain level of the entrance fee, how does visitation respond to a fee change when the fee is above, below, or at the market-clearing level of the fee? The answers to these questions depend on the underlying demand and supply structure of national parks. Through testable predictions for the effect of entrance fees on visitation under certain conditions, this thesis is able to provide information on where park managers might be setting entrance fees and how those fees influence visitation.[4]

The approach in this thesis is to use a panel dataset of both annual and monthly park-level visitation to a sample of 165 national parks in the United States in an effort to understand what it is that leads to changes in the quantity of visits realized by a park. The three primary factors of interest are entrance fees, travel costs, and income. The time period under analysis, years 1993-2010, is particularly interesting because of unique legislation pertaining to the use of federal lands that was passed during this time – legislation that continues to have unprecedented implications for park fee policy.

In addition, the gas price spikes in 2001, 2005, and 2008 and the economic recession in 2008-2009 make it interesting to study park visitation in the context of changing travel costs and income during this time period. Clear predictions are available

[3] To discuss the idea of market-clearing entrance fees, a demand model that represents willingness-to-pay in terms of the entrance fee is developed in the theory chapter. Typically, in the recreation demand literature, factors such as travel costs are included in the price of a recreation good. It is acknowledged that this is a more accurate way to include travel costs when modeling national park visitation; however, for reasons outlined later in the theory chapter, travel costs are modeled as a demand shifter in order to develop a clearer picture of the relationship between entrance fees and visitation. By modeling travel costs in this way, the relationship between the quantity of visits at a park and the entrance fee can be discussed in terms of market-clearing levels of the entrance fee.

[4] In order for park managers to implement a change in the entrance fee, they must first receive approval from their park's regional director, who, in turn, must receive approval from the NPS Associate Director, Business Services (USDI 2010, pages 28-29).

for the effect of travel costs on the quantity of visits at a park. The expected effect of income is less clear, given that an accurate measure of price is not included in the park visitation model. Predictions for the effect of entrance fees on the quantity of visits are dependent upon the level of the entrance fee in relation to the market-clearing fee, as well as the underlying demand and supply structure of park visits.

The results of estimating park-level visitation at the annual and monthly level show that income is not a significant determinant of visitation. There is, however, sufficient evidence to conclude that travel costs have a negative effect on park visitation rates. When all 165 parks are analyzed together, entrance fees are shown to have a negative impact on visitation rates, an indication that parks are setting entrance fees above the market-clearing level.

Under more detailed estimation procedures it is shown that entrance fees vary in their relation to the market-clearing fee, and thus their effect on visitation, depending on a park's designation and level of use. In addition, entrance fees are shown to have differing effects on visitation rates depending on the season. Overall, the relationship between entrance fees and visitation is shown to be negative; however, it should be noted that when making broad statements about how entrance fees influence visitation to national parks it is important to understand that entrance fees are decidedly park-specific and season-specific in their effect on visitation.

CHAPTER 2

HISTORY OF ENTRANCE FEES AND RECENT FEE POLICY

The first lands in the United States to be designated as National Parks came before the creation of the National Park Service (NPS). These early National Parks, established in the late 1800s and early 1900s, included parks such as Yellowstone, Yosemite, Sequoia, Mount Rainier, Crater Lake and Glacier. Before establishing the National Park Service as the central authority responsible for managing the National Parks, the U.S. Department of the Interior called upon the Army Corps of Engineers and civilian appointees to oversee operation of the parks (Mackintosh 1999).

Congress established the National Park Service on August 25, 1916, placing it within the Department of the Interior. The job of the NPS was to manage the existing National Parks and Monuments in a way so as to

> Conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (Mackintosh 1999).

In addition to managing existing parks, the NPS was directed to search for landscapes of unique natural scenery upon which to designate new parks.

History of National Park Entrance Fees

Early Fees

Entrance fees at national parks preceded the creation of the NPS by eight years. The first entrance fees, authorized by the government, were implemented in 1908 at Mount Rainer National Park in the form of automobile permits. Soon after, several other

parks instituted fees for vehicle entry, including General Grant in 1910, Crater Lake in 1911, Glacier in 1912, Yosemite and Sequoia in 1913, Mesa Verde in 1914, and Yellowstone in 1915. The first fees for seasonal vehicle permits varied from park to park. In 1916, the seasonal vehicle fee at Glacier and Mesa Verde was $2 while the fee at Yellowstone was $10 – these fees are equivalent to $42 and $212 respectively in 2012 dollars.[5] Fees for single trips were lower than the seasonal rates; however, the single trip fee was abolished in 1917 and the seasonal rate was lowered at most sites to the previous single trip rate. The new seasonal vehicle fees ranged from $7.50 ($159) at Yellowstone to $0.50 ($11) at General Grant.

Until 1918, the revenues generated from vehicle fees at the national parks were placed into a special account in the U.S. Treasury. These funds could be used directly for park improvement without explicit approval from Congress. This changed on July 1, 1918, when fee revenues were transferred to the general Treasury account. Fee revenues began to expand as park visitation increased, with system-wide revenues from vehicle fees reaching $210,489 ($2,699,833) in 1921. Despite rising visitation, the goal of the NPS was not to increase fees, but rather to continue to promote public usage of the parks. To ensure entrance fees did not adversely impact visitation, the NPS maintained a policy that "the development of the revenues of the parks should not impose a burden upon the visitor." As such, the NPS reduced fees in 1926. In 1932, NPS director Horace Albright referred to the policy of using entrance fees as a primary source of revenue as "very unpopular" (Mackintosh 1983).

[5] 2012 prices were calculated using the Bureau of Labor Statistics CPI Inflation Calculator. For the remainder of this section, historic fee values will be accompanied by a number in parentheses representing the equivalent 2012 price (rounded to the nearest whole dollar).

The attitude and policy regarding park fees took a new direction under the Roosevelt administration during the mid-to-late 1930s. The new administration called for the NPS to create a consistent fee structure applying to all National Parks and National Monuments. The purpose of this fee structure would be to help the NPS become more self-sufficient. Under the new fee structure, implemented in 1939, many parks began charging fees for the first time, while other parks increased their existing fees. Mount Rainier, Mesa Verde, and Glacier all increased vehicle fees by $0.50 ($8) from $1 ($17) to $1.50 ($25) as a result of the new fee structure. At this time, the vehicle fees at Yellowstone and Yosemite were $3 ($50) and $2 ($33) respectively.

The passage of the Independent Offices Appropriations Act of 1952 (IOAA) gave general authority to federal agencies to charge reasonable fees for any goods or services provided to the public. This authority was intended to help government agencies become more self-sustaining in the goods and services they provide.

> It is the sense of Congress that any work, service, publication, report, document, benefit, privilege, authority, use, franchise, license, permit, certificate, registration, or similar thing of value or utility performed, furnished, provided, granted, prepared, or issued by any Federal agency...to any person...shall be self-sustaining to the full extent possible, and the head of each Federal agency is authorized...to charge such fee, charge, or price....(USDI, USDA 2002, page 2).

The NPS was included under this authority because it provides lands and facilities for outdoor recreation. Park fees implemented as a direct result of this legislation were to be "fair and equitable," and based on the costs to the government, the value of the good or service being provided, public policy or interest served, and other relevant facts (31 U.S.C. Section 9710). Whether or not it was the result of the IOAA legislation, pressure from Congress to increase entrance fees mounted in 1952 and by 1953 park fees rose

again. Parks with camping facilities offered visitors either a 15-day permit or an annual permit for entry into the park. At Yellowstone and Yosemite the price of a 15-day vehicle permit was $3 ($26) and the price of an annual vehicle permit was $6 ($52) (Mackintosh 1983).

Further discussion about raising park entrance fees in the early 1960s prompted Congress to draw up legislation to create a Land and Water Conservation Fund (LWCF), a special account in the U.S. Treasury where all revenues generated from fees on federal lands were to be placed. The LWCF legislation proposed creating user fees for specific activities, such as the use of developed campgrounds, on both national park lands and other federal lands. Also included in the legislation was a proposal for the establishment of an annual automobile permit that would allow access to all federal recreation sites. The LWCF legislation generated much debate over the proposed changes to the fee structure for federal recreation. As a result, the bill was amended multiple times before becoming Public Law 88-578, known as the Land and Water Conservation Fund Act of 1965. With respect to annual per-vehicle entrance fees, the LWCF set the upper bound for these fees at $7 ($51).

The LWCF was amended in 1970 and again in 1972, further affecting entrance fee policy at national parks. The 1972 amendment placed an upper limit on entrance fees at National Parks, National Monuments, National Historic Sites, and National Battlefield Areas. The legislation stated that no more than $10 ($55) could be levied for an annual vehicle permit to these sites.

The Recreational Fee Demonstration Program

The next big change to impact fees at NPS sites came in 1996 when Congress authorized the Recreational Fee Demonstration Program (RFDP) as part of Public Law 104-134. The RFDP was included as part of the greater FY 1996 Department of Interior appropriations bill. The purpose of the RFDP was to grant the Federal land management agencies (NPS, BLM, USFS, and USFWS) autonomy in levying and collecting fees:

> [The federal land management agencies] shall each implement a fee program to demonstrate the feasibility of user-generated cost recovery for the operation and maintenance of recreation areas or sites and habitat enhancement projects on Federal lands (16 U.S.C. 460*l*-6).

Under the RFDP, the NPS was to select between 10 and 100 sites at which to experiment with entrance fee implementation. The RFDP legislation authorized the agency to collect fees for admittance to any park participating in the program, as well as fees for the use of the various services and facilities provided at the park. Each fee charged at an RFDP site was to be set based on cost recovery information and market valuation techniques to ensure that the fees charged were fair and equitable. All the revenue generated from fee collection at the parks would be placed in a special account in the U.S. Treasury, with 80 percent of the fee revenue returning to the site at which it was collected. The remaining 20 percent of fee revenue would be allocated among the parks at the NPS Director's discretion.

Under the previous legislative fee collection authority, The LWCF Act, fee revenues went into the Land and Water Conservation Fund (16 U.S.C. 460*l*-4). And individual parks were not entitled to any portion of their fee revenue. With the passage of the RFDP legislation parks now received 80 percent of their fee revenues. This gave

parks more of an incentive to collect fees for the purpose of generating revenue that could be used to improve the quality of the visitor experience. Fee revenues collected as a result of the RFDP were to be used for enhancing site quality and improving resource protection. To accomplish these goals, fee revenues were to be used only for backlogged maintenance projects, resource preservation, facility improvement, operation expenses, law enforcement, and habitat protection.

Within the NPS, many of the agency's well-known national parks were chosen as fee demonstration sites. This list includes such sites as Arches, Acadia, Big Bend, Bryce Canyon, Crater Lake, Denali, Everglades, Glacier, Grand Canyon, Grand Teton, Mount Rainier, Olympic, Rocky Mountain, Sequoia, Yosemite, Yellowstone, and Zion (USDI, USDA 2000, pages 62-66). RFDP sites were not limited to any one type of park in particular and so included NPS sites designated as National Parks, National Monuments, National Battlefields, and National Historic Parks. The majority of the parks designated as RFDP sites proceeded to increase entrance fees, with most increases taking effect in 1998.

The authority given to parks to collect fees under the RFDP took effect October 1, 1995, and was set to expire on September 30, 1998; however, the RFDP was extended multiple times in ensuing legislation and remained active throughout the late 1990s and early 2000s (USDI, USDA 2002, page 1).

Development of a Uniform Pricing Structure for the NPS

In 2001, McKinsey and Co. Inc. was hired to work jointly with NPS personnel in an effort to assess the current state of the fee structure used by the NPS. The main

conclusion resulting from the McKinsey study called for a reorganization of the current fee structure. At the time of the study, there was high variation across NPS sites in terms of entrance fees and the length of stay associated with the entrance permits – some were good for seven days, while others were only good for one day. To create a more consistent fee schedule across parks, the NPS decided to implement a group-based pricing structure in response to recommendations offered by the McKinsey study. Beginning in 2006, this new pricing structure places parks into one of four groups depending on their designation (e.g. National Park, National Monument, National Recreation Area, etc.), with each group having its own unique fee schedule. Parks in Group 1 (National Historic Sites, Military Parks, Battlefields, Battlefield Parks, Memorials, Preserves, and Parkways) are allowed to charge nominal fees of up to $5 per person, $10 per vehicle, and $20 for an annual pass for entrance to the site. Group 2 parks (National Seashores, Recreation Areas, Monuments, Lakeshores, and Historical Parks) can charge entrance fees up to $7 per person, $15 per vehicle, and $30 for an annual pass. Groups 3 and 4 are comprised solely of National Parks. Group 3 parks can charge $10 per person, $20 per vehicle, and $40 for an annual pass. Group 4 fees are $12 per person, $25 per vehicle, and $50 for an annual pass (USDI 2010, page 28). Table 1 summarizes this information.

Table 1. Maximum Fees Allowed at Parks Based on Site Designation.

Group	Park Type(s)	Per Vehicle Fee	Per Person Fee	Annual Pass Fee	Motorcycle Fee
Group 1	Historic Sites, Military Parks, Battlefields, Battlefield Parks, Memorials, Preserves, Parkways	$10	$5	$20	$5
Group 2	Seashores, Recreation Areas, Monuments, Lakeshores, Historical Parks	$15	$7	$30	$10
Group 3	National Parks	$20	$10	$40	$20
Group 4	National Parks	$25	$12	$50	$20

The Federal Lands Recreation Enhancement Act

The Recreational Fee Demonstration Program was repealed in December 2004 and replaced with the Federal Lands Recreation Enhancement Act (FLREA). The FLREA was passed in December 2004 as part of Public Law 108-447, the appropriations bill for fiscal year 2005. The federal land management agencies did not see a major change in their ability to charge recreation fees with the passage of the FLREA. The FLREA legislation is nearly identical to the RFDP in terms of its implications for fee collection at federal recreation sites. This means that agencies like the NPS can continue to autonomously set fees for the use of their facilities, and that individual parks still receive 80 percent of the fee revenues they generate. The guidelines for setting fees are still much the same as they were under the RFDP. When setting fees, the Secretary of the Interior must consider the benefits provided to the visitor, the aggregate effect of fees on

recreation users, similar fees charged by other public and/or private agencies providing comparable services, the management objectives behind setting the fee, and anything else the Secretary deems appropriate to consider (16 U.S.C 6801). Like the RFDP, the FLREA also placed restrictions on fee revenue expenditures, limiting spending to include maintenance projects, visitor information and service projects, habitat restoration, law enforcement, and operating costs associated with the fee program.

In the years following the passage of the FLREA, many sites in the NPS increased their entrance fees. Badlands National Park increased its vehicle entrance fee in 2005 from $10 ($12) to $15 ($18). Death Valley National Park doubled its fee, increasing it from $10 ($11) to $20 ($23) in 2006. Other major national parks also implemented fee increases in response to the FLREA legislation, including Glacier, Grand Canyon, Grand Teton, Mount Rainier, Olympic, Rocky Mountain, Shenandoah, Yellowstone, and Zion.

The sunset provision in the FLREA legislation states that the Act will remain effective for ten years following the date of enactment. Under this provision, the fee authority given to the NPS and the other land management agencies is set to expire in December 2014. As such, the FLREA remains the principal fee authority for the NPS.

Evaluation of Recent Fee Policy

Early reports on the Recreational Fee Demonstration Program indicate success. The U.S. General Accounting Office (GAO) conducted an evaluation of the RFDP in 1998. Overall, the GAO found that the RFDP had been successful in raising fee revenues for the NPS through new/increased fees (GAO 1998, page 2). As of 1998 and according to the U.S. Department of the Interior, increased/new fees had not noticeably affected

visitation to parks participating in the RFDP. Moreover, the provision in the RFDP legislation that allowed parks to retain 80 percent of their fee revenues helped contribute to a high rate of public approval for the program (USDI, USDA 1998, page 5). Still, changing entrance fees as a result of the RFDP was an area of concern for many parks in the early stages of the program, particularly for parks that were implementing fees for the first time.

> First time fees take longer to implement, and the public adapts more slowly to new fees than modifications in existing fees. The public more readily accepts fees if there is some recreation development at the site, even if the amenities are relatively minor, such as parking facilities, trash cans, signs, or toilets. (USDI, USDA 1998, page 33).

To further understand the impact of the RFDP, visitor surveys were conducted in 1997 and 1998 to determine how visitors viewed the new fees brought on by the RFDP. A survey in 1997 found that the majority of visitors were not aware of the RFDP and did not know what the entrance fee was going to be prior to their arrival at the park (Lundgren et al. 1997). Given that fee revenues were being used to improve park facilities, 71 percent of visitors thought that entrance fees were "just about right"; 12 percent of visitors thought fees were too low and 17 percent thought they were too high. Visitors were also asked if the new entrance fees would affect their current or future plans to visit national parks. To this question, 96 percent responded that the new fees were not going to alter their visitation decisions.

A comparable survey was conducted in 1998. The results mirror those of the 1997 survey, with 76 percent of visitors feeling entrance fees were "just about right", 7 percent reporting they were too low, and 16 percent thinking fees were too high (Duffield et al. 2000). Visitors indicated the park entrance fee is a small portion of overall expenditures

associated with a park visit. Individual studies at Yellowstone and Yosemite show that entrance fees were 1.2 percent and 1.5 percent, respectively, of overall expenditures (Duffield et al. 2000).

Similarly, managers of the parks included in the RFDP were asked how they thought the new fee legislation affected visitation at their park. In 1997, 87 percent of surveyed managers said they experienced a change in total annual visitation to their park (Field et al. 1998). Of the managers that said they experienced a change in visitation, only 6 percent indicated that they thought it was because of new fees. Indeed, 75 percent of park managers felt that the RFDP did not have a significant effect on visitation. It is important to keep in mind that 1997 was only one year removed from the passage of the RFDP and most parks at this point had not yet initiated fee increases. Most parks implemented fee increases in 1998. Another survey of park managers participating in the RFDP was administered in 1998. The results of the 1998 survey were similar to those from the survey conducted a year earlier. The survey found that 78 percent of park managers did not perceive that increased/new fees had any impact of annual visitation, compared with 75 percent in 1997 (Luloff et al. 1999).

The 1997 and 1998 visitor surveys did not account for the effect of increased/new entrance fees on non-visitors in those years. How many individuals chose not to visit national parks because of increased/new entrance fees? To answer this question a survey was carried out in 2000 to obtain information on how the general public in the United States viewed the fee changes brought on by the RFDP (Solop et al. 2003). The survey found that 95 percent of Americans were not familiar with the RFDP. Of those individuals who were aware of the RFDP, 94 percent supported it. Similar to the 1997

and 1998 findings, 80 percent of visitors viewed entrance fees as “just about right”, with 6 percent seeing entrance fees as too low and 11 percent thinking they were too high. When asked about barriers to visitation, only 7 percent of non-visitor respondents reported that entrance fees were a main concern. Travel costs and time costs were the most important barrier to park visitation, with 37 percent of individuals citing travel distance as a barrier and 38 percent saying they were too busy. Respondents indicated that the total cost of a national park visit (lodging, travel, food expenses, etc.) is more of a barrier to visitation than the entrance fee itself, which is a relatively small portion of total trip expenditures.

A number of issues have been raised in the wake of the RFDP. Concerns about the general use of fees on public lands, fees taking the place of Congressional appropriations, and fee collection costs are common among critics of the RFDP. Such concerns were addressed in the RFDP 2002 Interim Reports to Congress, prepared by the U.S. Department of the Interior and the U.S. Department of Agriculture. As for the general application of fees at NPS sites, fee revenues help parks with their backlogged maintenance needs as well as with supplying other services for visitor enjoyment and resource protection (USDI, USDA 2002, page 22). Because the RFDP required many parks to construct the necessary infrastructure to begin collecting fees, there was concern about the costs of implementing the RFDP outweighing the benefits gained from increased fee revenues. Over the period 1997-2000, fee collection costs for the NPS averaged about 20 percent of total fee revenues. These and other related concerns lasted throughout the life of the RFDP, but parks continued to exercise their authority to charge entrance fees.

The RFDP was repealed and replaced by the Federal Lands Recreation Enhancement Act in December 2004. The FLREA was subject to the same criticisms as the RFDP, and when many parks instituted fee increases in the years immediately following passage of the FLREA, the impact of fees on visitation again became a popular topic of discussion. In response, the NPS contracted with the University of Wyoming in 2008 and 2009 to produce another comprehensive survey of national park visitors and non-visitors (Taylor et al. 2011). When asked about entrance fees, 20 percent of visitors agreed with the statement that entrance fees at national parks are too high, while 28 percent of non-visitors agreed with this statement. More commonly, respondents strongly agreed that hotel and food costs are too high at NPS units (36 percent of visitors and 46 percent of non-visitors). Also, 35 percent of visitors and 49 percent of non-visitors cited travel time as a main reason for not visiting national parks. The findings from this survey suggest that lodging, food, and time costs associated with travelling to a national park are more influential in affecting individual visitation decisions than park entrance fees. For non-visitors, the most common reason listed for not visiting national parks (60 percent of non-visitors agreed with this statement) is that they "just don't know that much about National Park System units."

CHAPTER 3

LITERATURE REVIEW

Outdoor recreation is a popular pastime in the United States, encompassing numerous activities on federal, state, and private lands and waters. Historically, as outdoor recreation in the United States gained popularity, the amount of economic research dedicated to outdoor recreation expanded. Clawson and Knetsch's (1966) seminal book, *Economics of Outdoor Recreation*, provided a basis for much of the early work in the field of outdoor recreation economics, namely studies that focused on the demand for recreation facilities. Recreation demand analysis incorporates a wide variety of recreation sites, including both land-based and water-based facilities. Wilderness areas have been examined, as have developed campgrounds, state parks, and reservoirs.[6] These are all common places where individuals go to participate in outdoor recreation, and as a result, such facilities have received much attention in the recreation demand literature.

Analysis of recreation at national parks accounts for a relatively small portion of the recreation demand literature. As outlined above, most researchers studying outdoor recreation are interested in the factors that influence demand for a recreation site.[7]

Relatively few of these studies involve analysis of recreation at national parks. Heberling and Templeton (2009) use survey data from visitors to Great Sand Dunes National Park to estimate a travel cost demand model of park visits. The authors control

[6] See, for example, Deyak & Smith (1978); Rosenthal (1987); Smith & Kopp (1980); Shaw & Feather (1999); Cesario (1976); McConnell (1999).

[7] A sample of such studies includes: Burt & Brewer (1971); Gum & Martin (1975); Bockstael, Strand, & Hanemann (1987); Smith (1988); Mendelsohn, et al. (1992); Loomis et al. (2001); Loomis & Keske (2011); Landry & McConnell (2007)

for driving costs and the park's entrance fee in their travel cost variable, which they find to have a negative effect on visits. Using a dataset on visits to Bryce Canyon National Park, both Haspel and Johnson (1982) and Mendelsohn et al. (1992) estimate the demand for visits to Bryce Canyon in the context of multiple destination trips. Loomis and Richardson (2006) compare stated preference and revealed preference approaches for estimating how visitation to Rocky Mountain National Park responds to changes in climate. While these studies are similar to the analysis in this thesis in that they examine national park use, they are methodologically different in the sense that they only focus on one park in particular. As such, these studies are not useful for understanding visitation to national parks as a whole. By analyzing visitation data for 165 national parks of varying designations, the thesis provides a clearer picture of which factors are important in determining national park visitation rates in a broad sense.

Ostergren, Solop, and Hagen (2005) conduct a study of public attitudes toward entrance fees at U.S. national parks to see if these fees act as a barrier to visitation. Controlling for factors such as income and race, their results show that national park entrance fees do not significantly deter visitation. Indeed, individuals are more likely to cite overall travel expenditures as a barrier to visitation rather than strictly the entrance fee. This study, along with others (Duffield et al. 2000; Field et al. 1998; Lundgren et al. 1997; Taylor et al. 2011), incorporates a stated preference method for understanding how entrance fees influence national park visitation rates. This thesis improves upon these studies by taking a revealed preference approach to estimating how entrance fees effect park visitation.

The studies most similar to this thesis include Factor (2007), Ngure and Chapman (1999), Hanink and Stutts (2002) and Poudyal et al. (2013). The study by Factor (2007) looks at the effect of per-vehicle entrance fees on park-level visitation rates to National Parks in the United States over the period 1996 - 2006. Factor (2007) performs what he refers to as a difference-in-difference analysis by grouping parks into similar clusters and comparing parks that increased fees to those that did not. He also estimates a regression model to explain visitation using per-vehicle fees, average annual gas prices, and the annual national unemployment rate. He is able to show that gas prices and unemployment rates are negatively related to visitation at National Parks. Using three different regression specifications, he was not able to produce conclusive evidence showing that per-vehicle fees take on an inverse relationship with national park visitation. Factor attributes this inconclusive result to the numerous other factors that influence national park visitation rates. He also states that national park entrance fees are a relatively negligible component of aggregate travel expenses.

This thesis improves upon the analysis by Factor (2007) by analyzing NPS sites other than National Parks. While Factor's (2007) analysis is informative for understanding how certain factors influence visitation to National Parks, his findings cannot be used to describe how visitation at other national parks is affected by these factors. The approach in this thesis estimates park-level visitation to a sample of parks of various designations. As such, the results provided in this thesis are much more representative of how visitation to any given national park responds to changes in entrance fees, travel costs, and income.

A study by Ngure and Chapman (1999) focuses on whether entrance fees or park specific attributes are more important in influencing visitation to national parks. The authors present two main hypotheses in their paper: 1) entrance fees and other economic variables (income and population) are important in explaining national park visitation; and 2) park-specific attributes are the predominant factor for influencing use. They test these hypotheses using data on park-level visitation to three park categories, which they refer to as natural protected areas, national historic areas, and all national park areas. They collected these data for the years 1993, 1994, and 1996. Their results suggest entrance fees and income are statistically insignificant in explaining visitation to all three park categories. Park attributes (represented as park fixed effects) are significant for natural protected areas and all national park areas, supporting the hypothesis that park-specific attributes are an important determinant of visitation for parks in these categories. Ngure and Chapman (1999) are not able to reject the hypothesis that entrance fees have no effect on visitation to national parks, but they do provide evidence that park-specific attributes are important in determining visitation rates.

Ngure and Chapman (1999) do not include a measure of travel costs in their analysis of national park visitation. When modeling the use of outdoor recreation sites, many studies show that travel costs are an important factor to consider.[8] It is possible that Ngure and Chapman (1999) made a specification error by failing to control for travel costs in their model of national park visitation. This thesis is similar to Ngure and Chapman (1999) in the sense that data on park-level visitation to multiple park types is examined; however, the empirical analysis in this thesis advances that of Ngure and

[8] See, for example, Beesley 1965; Hagerty and Moeltner 2005; Ceasrio 1976; Shaw and Feather 1999.

Chapman (1999) because visitation is analyzed over an 18-year period rather than a three-year period, and a measure of travel costs is included in the model.

Previous studies such as Hanink and Stutts (2002) and Poudyal et al. (2013) do not include entrance fees in their analysis of national park visitation. Hanink and Stutts (2002) argue that entrance fees are a trivial component of demand and omit them from their model of demand for parks in a category they refer to as national battlefield parks. Hanink and Stutts (2002) use a spatial demand and supply framework to estimate visitation rates, testing the assumption that the location of a site is the prominent factor in its use. The authors represent the demand for a battlefield park by the park's location relative to large U.S. population centers (they refer to this as the market potential of the park, characterizing the variable as population divided by distance). Park supply is represented by a park's location relative to other similar sites (which they refer to as competing destinations). They conclude that a national battlefield park's location relative to population centers and other battlefield parks is important in influencing use. A park's proximity to population centers has a positive effect on visitation while a park's proximity to other parks has a negative effect on visitation.

A recent study by Poudyal et al. (2013) evaluates how economic recession affects visitation to national parks. Using aggregate monthly visitation data for all parks operated by the NPS, the authors employ a Generalized Method of Moments (GMM) technique to estimate the effect of recession on visitation. They use a GMM model to reduce bias that may be caused by measurement error in some of their independent variables (e.g., population). Five different specifications of their model (each including a different measure of economic recession) are estimated to determine the impact of economic

recession on visitation. Their results indicate that economic recession is an important determinant of visitation, with all of the recession variables showing statistical significance. Consumer confidence is shown to have positive relationship with park visitation. Personal saving was also positively related to park visitation. The national unemployment rate, the business cycle index, and consumer expected inflation were all negatively related to visitation. The results presented by Poudyal et al. (2013) provide evidence that macroeconomic factors play a role in determining aggregate national park visitation rates.

This thesis improves upon the studies by Hanink and Stutts (2002) and Poudyal et al. (2013) by including entrance fees in the analysis. A number of the National Battlefields included in the analysis by Hanink and Stutts (2002) are examined in this thesis as well. In terms of how entrance fees affect visitation to National Battlefields, this thesis provides information that Hanink and Stutts (2002) do not. Similar to Poudyal et al. (2013), this thesis controls for the effect of economic recession through a measure of per capita income. The empirical analysis in this thesis advances the analysis of Poudyal et al. (2013) in two important ways; first, by estimating monthly visitation at the park-level, and second by including entrance fees into the model.

The literature on the general topic of recreation demand is a vast, comprehensive body of research. Even so, there are gaps in this literature when it comes to recreation at national parks. Studies exist that focus on national park use, but they are limited in number and in scope. This thesis contributes to the existing literature on national park visitation by adding an in-depth analysis of national park visitation rates.

CHAPTER 4

THEORY ON NATIONAL PARK VISITATION

A simple demand and supply framework is used to model national park visitation. As discussed previously, there is a large body of research on the demand for outdoor recreation, and the content within this literature guides the theoretical analysis below.

Demand for Park Visits

Individuals make recreation decisions based on their preferences and these decisions are subject to budget and time constraints. National park visitor's budget constraints include prices such as park entrance fees. Generally, there are three fee options available to park visitors. Visitors can purchase an annual pass, or pay an individual per-person fee or per-vehicle fee at the gate. Of these three fee options, the majority of visitors pay the per-vehicle fee.[9] While the per-vehicle fee represents the price of admission to a park, it is not equivalent to the full price of a visit. When constructing the price of a recreation good such as a national park visit, many factors in addition to entrance fees must be taken into account. Individuals often incur travel expenses in the form of fuel and lodging costs. These factors add to the price of a park visit, as do time costs (in terms of forgone wages) and congestion costs. Because all of the appropriate costs associated with a park visit are not bundled into the entrance fee, the entrance fee should not be viewed as the price of a park visit when factors such as travel

[9] A product summary report produced by Yellowstone National Park in August, 2012, gives a breakdown of the fees paid by visitors during the 2011 calendar year. Of all fees paid by visitors, 73 percent were per-vehicle fees.

costs, time costs, and congestion costs are present, but rather the price of admission to a park.

Park entrance fees do not behave like typical prices, in that they are not determined by fluctuations in demand and supply, but rather are set by the federal government. When shifts in demand or supply occur, entrance fees do not adjust to the market-clearing level. This characteristic of entrance fees suggests they are exogenous to visitation. That is, entrance fees are likely not simultaneously determined with the quantity of visits.[10] Because entrance fees are assumed to be set exogenously, predictions exist regarding how changes in entrance fees affect the quantity of visits.

Before discussing predictions for the effect of entrance fees, travel costs, and income on visitation, it is important to discuss the demand curve for visits that will be used in the theoretical analysis of park visitation (refer to Figure 1 for a visual representation). The demand curve labeled D_0 in Figure 1 represents the total willingness-to-pay for a park visit when factors such as entrance fees, travel costs, lodging costs, and time costs are components of price. Along D_0, P^0 represents the marginal willingness-to-pay for the quantity of visits Q_v^0. There is a demand curve that can be derived from D_0 that represents the willingness-to-pay for a quantity of visits in terms of strictly the entrance fee. This demand curve, D_1, is net of all factors that influence the price of a park visit save for the entrance fee. As such, D_1 measures the willingness-to-pay for a visit in terms of the entrance fee given a certain level of costs associated with travel, lodging, and time. D_1 lies inside D_0 and the difference between the two curves represents the level of

[10] Some discussion of the endogeneity of entrance fees and visitation is presented in chapter 6, along with empirical evidence that supports the argument that entrance fees are exogenous to visitation, as is assumed in this chapter.

other trip related costs that are netted out of D_0, thus leaving the "residual" demand curve D_1. For D_1, factors such as travel costs are no longer included in the price of a visit, but rather act as shifters of demand. The price P^1 represents the marginal willingness-to-pay for the quantity of visits Q_v^0 in terms of only the entrance fee. By modeling the demand for park visits using a demand curve analogous to D_1, the entrance fee can be used as a measure of the price of a visit. This allows for more simplicity in modeling park visitation, particularly in the context of determining where parks are setting entrance fees in relation to market-clearing fees, the topic of the next section.

This notion of representing the demand for park visits as net of costs other than the entrance fee is similar to Barzel (1974), who defines demand curves with and without time costs. To avoid confusion with the total willingness-to-pay demand curve for park visits, the demand curve represented by D_1 in Figure 1 will be referred to as the residual demand curve.[11] Changes in entrance fees will cause movements along the residual demand curve and are predicted to be negatively associated with the quantity of visits demanded. That is, an increase in the entrance fee is expected to result in a reduction in the quantity demanded of visits. This prediction is appropriate when discussing a model of park visitation that consists of just the residual demand curve for visits. For reasons that will be discussed in further detail in the next section, there is no clear prediction for the effect of entrance fees on visitation when supply is introduced into the model.

[11] The model of residual demand is contrary to some of the thoughts outlined in the first paragraph of this section regarding the relationship between the entrance fee and the price of a visit. A conventional demand curve for a recreation good such as a national park visit would include travel costs and time costs as components of price rather than as demand shifters. Even though this is certainly the correct way to specify demand for a recreation good, the demand for park visits is modeled using the entrance fee as the price of a visit in order to better understand how changes in entrance fees affect the quantity of visits at a park.

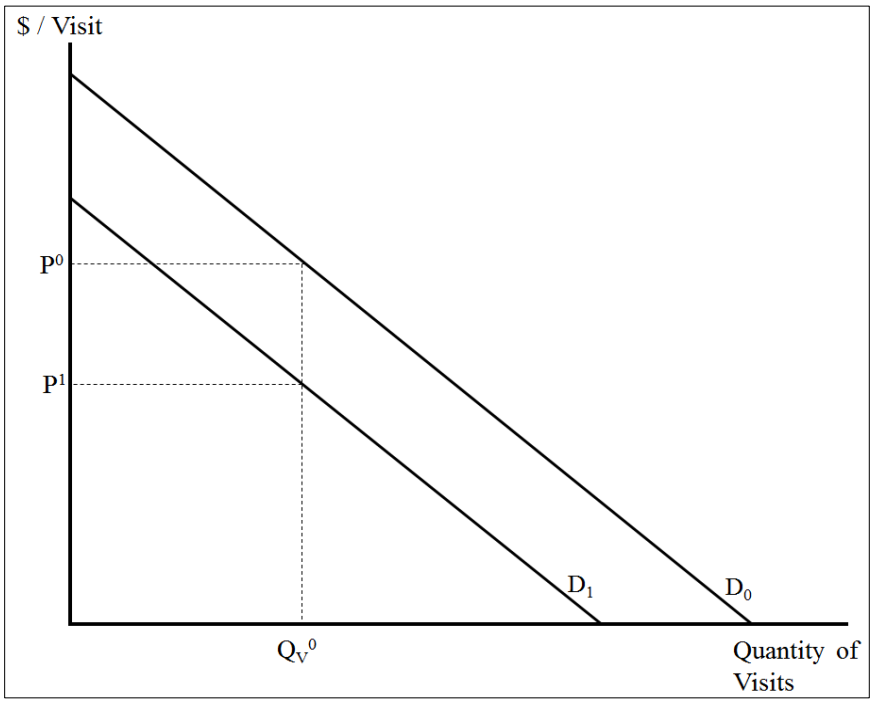

Figure 1. Residual Demand Curve for Park Visits.

Factors that influence the cost of travel to a park, such as the price of gas and vehicle fuel efficiency, will lead to shifts in the residual demand curve. If it is assumed that the overwhelming majority of visitors travel to parks via automobile, then an increase in the price of gas is predicted to lead to inward shifts of the residual demand curve for park visits. In addition, factors such as increased vehicle fuel efficiency act to reduce the cost of travel and so are predicted to result in outward shifts of the residual demand curve. A park's accessibility also factors into travel costs. If a park is only a short distance away, the travel costs required to access the park will be small relative to the costs required to access parks farther away. Thus, parks in relatively remote locations are expected to have residual demand curves that lie inside those for parks located closer to population areas. Income is expected to influence visitation via shifts in the residual

demand curve. All else equal, increases in income are predicted to lead to an increase in the demand for park visits.

Along with factors such as entrance fees, travel costs, and income, site-specific attributes are likely to be a component of the demand for park visits. This may be especially true in the case of national parks. National parks include areas with spectacular scenery as well as areas with historical and cultural significance, and are popular because of the unique experiences they provide. Individuals have preferences for certain types of park attributes, and when deciding which park(s) to visit, they will choose the park(s) whose attributes match their preferences. For example, Yellowstone may be such a highly visited park, in part, because it offers such a diverse set of attributes. Parks that offer a wide range of activities may attract more visitors simply because there is something for everyone to enjoy.

Weather patterns and other environmentally-related factors can also influence the demand for park visits. Assuming that individuals prefer visits of higher quality, they will demand more visits in the presence of favorable environmental factors and less visits in the presence of unfavorable environmental factors. Abnormal temperatures, wildfires, and precipitation are examples of factors that may alter the quality of a visit and lead to shifts in the residual demand curve.

Determining where Parks are Setting Entrance Fees

To understand how visitation responds to entrance fee changes, it is important to recognize where fees are in relation to the market-clearing fee.[12] To model this, the residual demand curve is combined with a representation of park supply. Park supply is assumed to be perfectly inelastic given the spatial capacity constraints parks face. Analyzing entrance fees within this demand and supply framework will inform how fee changes from initial levels that vary in relation to the market-clearing level affect the quantity of visits. Moreover, it will inform how the empirical analysis can be used to determine where parks are setting entrance fees. To outline these ideas in more detail, three scenarios are examined to determine how the quantity of visits is affected by a change in the entrance fee when the fee is initially set below, above, or at the market-clearing level.

The predicted effect of a fee change on the quantity of visits is dependent upon the level of the entrance fee in relation to the market-clearing fee. If the entrance fee is below the market-clearing level, then the expected effect of a fee change on visits is zero given the assumption of perfectly inelastic supply. If the entrance fee is above the market-clearing level, then the expected effect of a fee change is negative. If the entrance fee is initially set at the market-clearing level, then an infinitesimal change in the fee will have no effect on the quantity of visits. Alternatively, a finite change in the entrance fee from the market-clearing level will have either no effect or a negative effect on visits,

[12] It is unknown whether park entrance fees are set at the market-clearing level; however, given that identical entrance fees exist across parks that differ greatly in characteristics such as visitation, individual attributes, input costs, and capacity, it seems plausible that the majority of entrance fees are not set at the market-clearing level.

depending on the direction of the fee change. To explain the logic underlying these statements, refer to figures 2, 3, and 4.

In Figure 2, the initial level of the entrance fee, Fee^0, is set below the market-clearing level. At Fee^0, visitation is constrained by the supply curve, and the resulting quantity of visits is Q_v^0. Fee^0, though, is not representative of the full fee that visitors incur when they visit the park. Since at Fee^0 the quantity of visits demanded is actually Q_v^D, rationing occurs (most likely via congestion costs) to bring the quantity of visits to Q_v^0 and the full fee to Fee^R (Barzel 1997).

Empirically, when Fee^0 is observed, its location relative to the market-clearing fee is not known. When the fee changes from Fee^0 to Fee^1, the resulting change in the quantity of visits signals whether the fee was originally above, below, or at the market-clearing fee. Because the supply curve is perfectly inelastic, the quantity of visits remains constant at Q_v^0 when the fee increases from Fee^0 to Fee^1. At Fee^1, there is excess demand, as the quantity demanded of visits, $Q_v^{D'}$, is greater than the quantity supplied of visits, Q_v^0. The excess demand is once again alleviated through rationing. The resulting quantity is Q_v^0 and the full fee paid by visitors is the same as before, Fee^R. In this case, the increased entrance fee leads to no effect on the quantity of visits realized by the park. A decrease in the entrance fee from an initial level below market-clearing would have the same result, visitors would end up paying Fee^R and the quantity of visits would remain constant at Q_v^0. Thus, when visitation is unresponsive to entrance fee changes, it provides evidence that the initial level of the fee was below the market-clearing level.

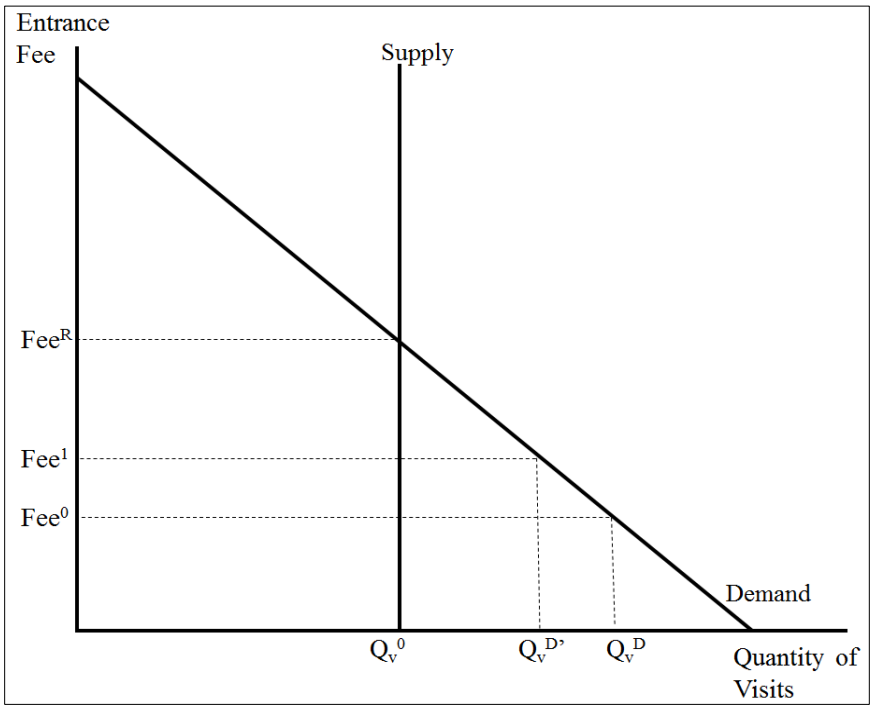

Figure 2. Entrance Fee Below Market-Clearing Level.

Figure 3 depicts the setting where the value of the entrance fee is originally above the market-clearing level. This scenario is more straightforward because visits are constrained by the demand curve. In a competitive market setting, a price above the market-clearing level leads to competition among suppliers to receive the higher price. This form of supply-side rationing causes the price received by suppliers to decrease in a similar fashion that demand-side rationing causes the price paid by consumers to increase. In the case of national parks, supply-side rationing does not occur when entrance fees are above the market-clearing level and park supply is perfectly inelastic, because there is no portion of park visits in the public domain.[13] When the fee is set at Fee^0, the resulting quantity demanded of visits is Q_v^0. A fee increase from Fee^0 to Fee^1

[13] See Barzel (1997) for discussion of the public domain and how rationing occurs to allocate goods that are placed in the therein.

results in a decrease in visitation from Q_v^0 to Q_v^1. Thus, a negative relationship between the entrance fee and visitation is observed when the fee changes from an initial value above the market-clearing level.

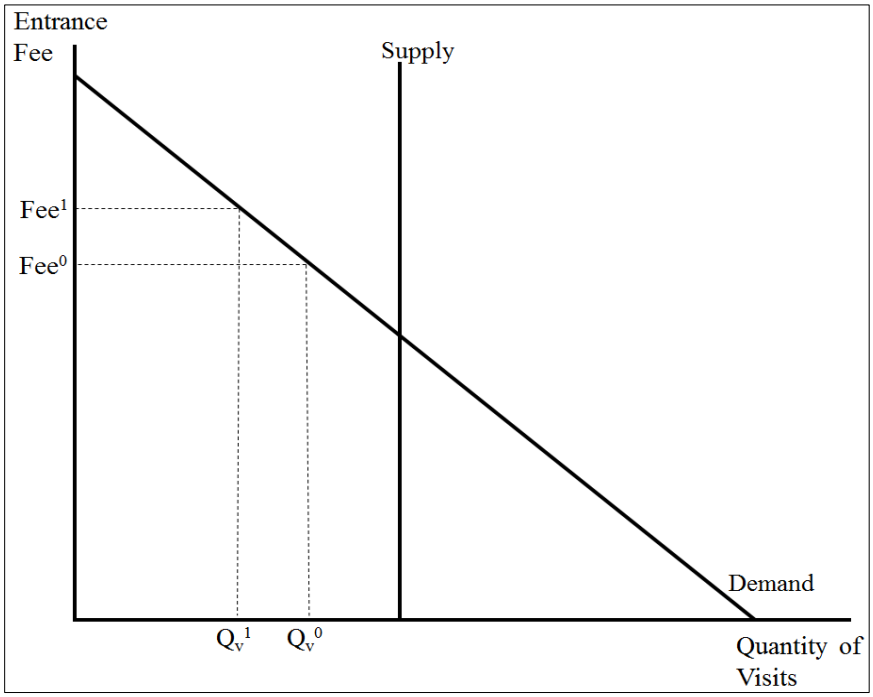

Figure 3. Entrance Fee Above Market-Clearing Level.

In Figure 4, the market-clearing fee is represented by *Fee** and the market-clearing quantity is represented by Q_v^*. It was mentioned previously that infinitesimal changes in the entrance fee from the market-clearing level do not have an effect on the quantity of visits. When finite changes in the entrance fee are considered, the direction of the movement away from the market-clearing fee will determine how visitation responds. If the entrance fee increases from Fee^* to Fee^1, the resulting movement along the demand curve reduces the quantity of visits from Q_v^* to Q_v^1. If the entrance fee decreases from Fee^* to Fee^2, movement occurs along the supply curve which leads to no change in the

number of visits. Excess demand exists when the fee is at Fee^2 (the quantity demanded of visits is Q_v^D) and so rationing occurs among visitors to bring the fee back to Fee^* and the quantity of visits to Q_v^*.

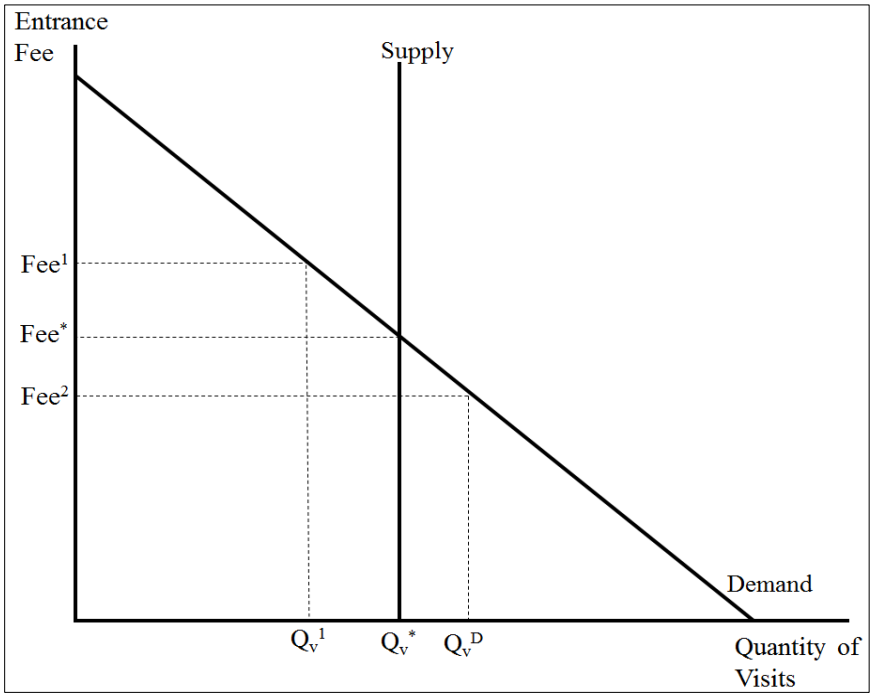

Figure 4. Entrance Fee at Market-Clearing Level.

In terms of predictions for where fees might be in relation to market-clearing fees for national parks, it might be plausible to assume that for most parks fees are below the market-clearing fee. Given the level of use at parks such as Yellowstone and Zion, both of which receive in excess of 2 million visits per year, it is likely that the fee visitors are willing to pay for entry is above the $25 entrance fee currently charged by these parks. The first entrance fees charged by parks were much higher than they are today in real terms, and were set without all the government regulation that pertains to the current operation of parks (Mackintosh 1983). This may be evidence that those early fees were

more representative of market-clearing fees for visits. If so, then many of the fees currently charged by parks would be considered to be below the market-clearing level. The theoretical framework described above informs what the expected effect of a change in the entrance fee will be depending on where fees are initially set.

CHAPTER 5

DATA AND DISCUSSION OF VISITATION RATES

Data

The National Park Service keeps data on the total number of recreation visits at each park in the system by month and year.[14] Annual and monthly visitation data were collected for the years 1993 - 2010 from the National Park Service's Public Use Statistics Office. The visitation numbers were collected for 165 national parks, including 113 parks that charge entrance fees and 52 that do not charge entrance fees. Multiple park types are represented in the data, including: National Parks, National Monuments, National Historic Sites/Parks, National Battlefields, National Military Parks, National Recreation Areas, National Seashores/Lakeshores, and more.

A NPS Program Analyst for the National Recreation Fee Program provided the entrance fee data used in this thesis.[15] In response to a request for historical information on national park entrance fees, a dataset was obtained consisting of 139 national park sites and their respective annual entrance fees. After cleaning the data, the number of parks with usable fee data came to 113. The parks in this dataset participated in the Recreational Fee Demonstration Program and so possessed the ability to change entrance fees over this time period. Per-vehicle fees are the entrance fees of primary interest in this

[14] Based on information from the NPS Public Use Statistics Office, parks vary in how they count recreation visits. Some parks use traffic counters to determine the number of vehicles that enter the park, and then multiply the number of vehicles by a person multiplier to get the number of recreation visits. Parks without traffic counters typically count the number of individuals that enter the visitor center and then multiply this number by some number greater than 1 to account for visitors that do not enter the visitor center.

[15] Data received courtesy of Chris Williamson, Program Analyst, National Recreation Fee Program.

thesis. Entrance fees are adjusted for inflation using the Consumer Price Index with 2000 as the base year.

To complement the visitation and entrance fee data, annual and monthly gas prices were collected from the U.S. Energy Information Administration. Annual per capita GDP data were gathered from the Bureau of Economic Analysis. Both state-level and national-level data were collected for the variables listed above. Like entrance fees, gas prices and per capita GDP are adjusted for inflation using the Consumer Price Index with 2000 as the base year. Average annual fuel efficiency data for automobiles were collected at the national level from the U.S. Department of Energy.[16] Gas prices are divided by vehicle fuel efficiency to create a proxy for the cost of driving. The driving cost data are measured in cents per mile. Descriptions of the variables used for the empirical analysis are provided in Table 2. Descriptive statistics for the national data are presented in Table 3, and descriptive statistics for annual and monthly data are shown in Tables 4 and 5. Correlation matrices for the variables are provided in Tables 6 and 7. Each variable is collected for the time period 1993-2010, resulting in the creation of one national dataset of aggregate visitation to all national parks in the United States and two panel datasets of park-level visitation to the sample of 165 parks. The two park-level datasets consist of one for annual visitation and one for monthly visitation. The panel dataset for annual visitation has 2,496 observations, and the panel dataset for monthly visitation has 29,952 observations.

[16] Linear interpolation was used to create monthly observations for per capita GDP because the BEA does not provide these data at the monthly level. Monthly data are not available for the average fuel efficiency of vehicles in the United States. To use the fuel efficiency data for estimation of monthly visitation, it is assumed that the average fuel efficiency of vehicles does not change significantly from month to month (there is a concern associated with this assumption that will be discussed in the next chapter).

Table 2. Variable Descriptions.

Variable	*Cross-Section Observation Level*	*Time-Series Observation Level*	*Description*	*Source*
Visits	National Aggregate Individual Park	Annual Monthly	Total recreation visits.	NPS Public Use Statistics Office
Entrance Fee	Individual Park	Annual Monthly	Fee per vehicle for a 7-day pass.	Received directly from a program analyst for the National Fee Recreation Program
Gas Price	National State	Annual Monthly	Average price of gasoline.	Energy Information Administration
Per Capita GDP	National State	Annual	Total GDP divided by state population.	Bureau of Economic Analysis
Miles per Gallon	National	Annual	Average fuel efficiency in miles per gallon across all vehicle makes and models.	U.S. Department of Energy
Driving Cost	National State	Annual Monthly	Price of gas divided by miles per gallon. Units in cents per mile.	-

Table 3. Descriptive Statistics for National-Level Data.

Variable	N	Mean	Std Dev	Minimum	Maximum
Visits (millions)	18	276.43	6.85	265.80	287.13
Entrance Fee (annual average)[1]	18	3.76	0.89	2.38	4.72
Gas Price ($/gallon)	18	1.79	0.73	1.07	3.30
Per Capita Real GDP (thousands)	18	34.71	2.70	29.65	38.43
Miles per Gallon	18	23.32	0.54	22.67	24.97
Driving Cost (cents per mile)	18	5.41	1.93	3.14	9.53

[1]Vistation-weighted annual average for 165-park sample.

Table 4. Descriptive Statistics for Annual Park-Level Data.

Variable	N	Mean	Std Dev	Minimum	Maximum
Visits (thousands)	2496	981.21	2007.65	2.98	21538.76
Entrance Fee	2496	4.04	4.83	0.00	21.35
State Gas Price ($/gallon)	2496	1.25	0.45	0.64	2.69
State per Capita GDP (thousands)	2496	34.12	5.68	20.92	58.30
Miles per Gallon	2496	23.32	0.52	22.67	24.97
Driving Cost (cents per mile)	2496	5.36	1.89	2.71	11.45

Table 5. Descriptive Statistics for Monthly Park-Level Data.

Variable	N	Mean	Std Dev	Minimum	Maximum
Visits (thousands)	29952	81.76	192.76	0	2899.58
Entrance Fee	29952	4.10	4.83	0	21.71
State Gas Price ($/gallon)	29952	1.25	0.49	0.50	3.36
State Unemployment Rate	29952	5.45	1.85	2.10	14.2
State per Capita GDP (thousands)	29952	34.31	5.66	20.92	58.30

Table 6. Correlation Matrix of Variables Used in the National-Level Analysis.

	Visits	Gas Price	Miles per Gallon	Driving Cost	Per Capita GDP	Year
Visits	1	-	-	-	-	-
Gas Price	0.06	1	-	-	-	-
Miles per Gallon	0.54	0.41	1	-	-	-
Driving Cost	-0.06	0.98	0.26	1	-	-
Per Capita GDP	0.27	0.83	0.33	0.77	1	-
Year	0.27	0.90	0.53	0.82	0.92	1

Table 7. Correlation Matrix of Variables Used in the Park-Level Analysis.

	Visits	Entrance Fee	State Gas Price	Miles per Gallon	Driving Cost	Per Capita GDP	Year
Visits	1	-	-	-	-	-	-
Entrance Fee	0.10	1	-	-	-	-	-
State Gas Price	-0.004	0.18	1	-	-	-	-
Miles per Gallon	0.003	0.07	0.32	1	-	-	-
Driving Cost	-0.005	0.18	0.99	0.26	1	-	-
Per Capita GDP	0.06	0.13	0.44	0.18	0.44	1	-
Year	-0.01	0.19	0.82	0.52	0.81	0.44	1

Visitation Rates (1993-2010)

Visitation to 165-park Sample

Aggregate visitation to all parks in the 165-park sample, along with aggregate annual visitation to all parks operated by the NPS is displayed in Figure 5. Figure 6 plots monthly visitation for the 165-park sample. The vertical line labeled “Fee Increase” shown in Figure 5 signifies when most parks participating in the RFDP implemented increases in entrance fees. The vertical lines labeled “Economic Recession” signify when

the U.S. economy was in a period of recession as defined by the National Bureau of Economic Research (NBER).[17] In Figure 5, visitation to the 165-park sample fluctuated up and down from 1993 - 1996, and then began a three-year climb from 1996 - 1999. A significant decline in visitation occurred from 1999 to 2003, dropping off by approximately 14 million visitors. After 2003, park attendance remained relatively constant around 131 million before falling again from 2005 - 2008. Visitation was at its lowest value during the time period at 126.5 million in 2008, the first year of the most recent economic recession and the year in which national gas prices reached record high levels. Following 2008, visits rose in 2009 and again in 2010. Visitation to the 165-park sample appears to have trended downward over the entire time period, falling by 8 percent from 1993 to 2010. In constrast, while some of the year-to-year fluctuations are similar to those present in visitation to the 165-park sample, visitation to all parks in the NPS system recorded a net increase of 3 percent from 1993 to 2010.

[17] The NBER defines economic recession as: "A significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales." According to this definition, the U.S. economy was in recession from March 2001 to November 2001 and from December 2007 to June 2009.

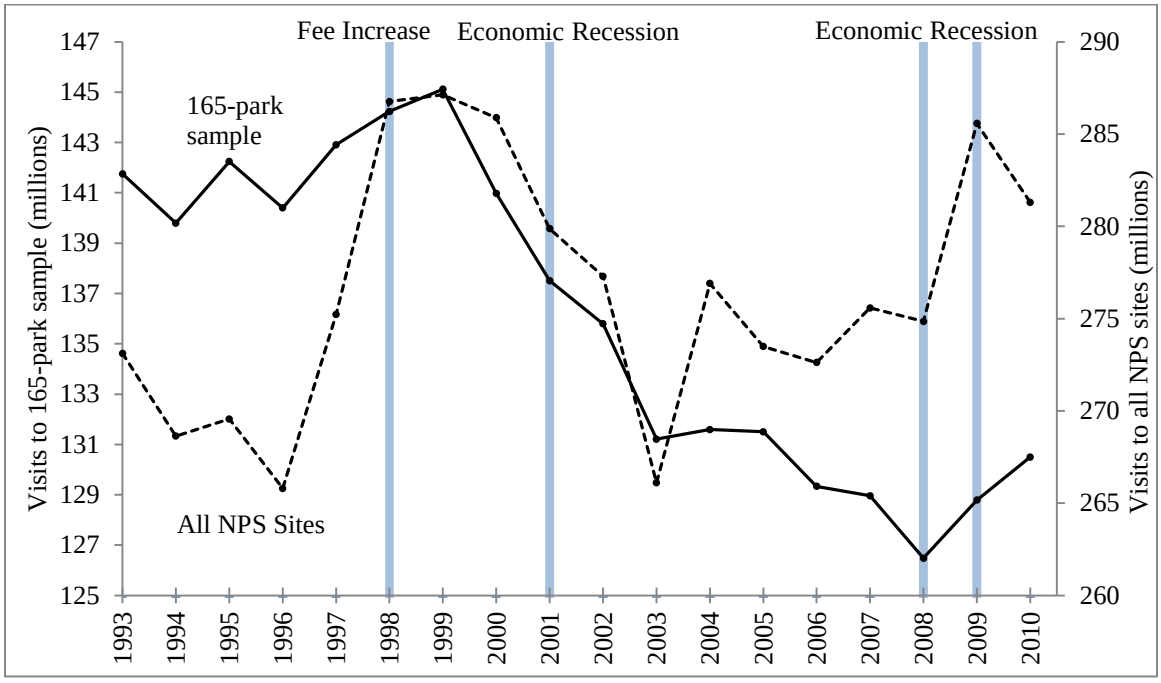

Figure 5. Total Visitation to 165-Park Sample vs. Total Visitation to all NPS Units.

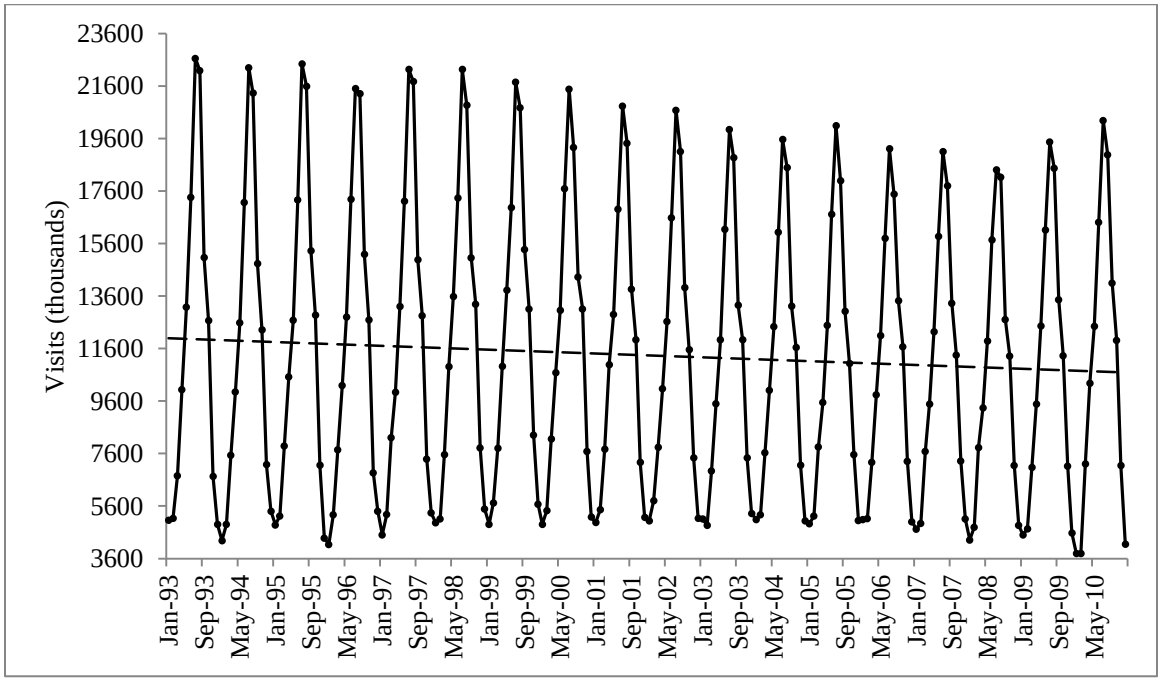

Figure 6. Total Monthly Visitation to 165-Park Sample.

The fall in visitation that occurred from 1999 - 2003 was preceded by a significant increase in the average entrance fee charged by parks. Figure 7 plots total visitation against the average entrance fee for parks in the sample.[18] Over the 1993 - 2010 time period, visitation fell by 8 percent while the average entrance fee across parks increased by 131 percent. Many parks increased entrance fees in 1998 as a result of the RFDP legislation passed in 1996. Fees rose again in 2000, dipped slightly in 2001, and then followed a steady upward path from 2001 – 2007, recording a net increase of approximately 18 percent over the period 2000 - 2007. Overall, park attendance decreased by 11 million visitors, roughly 9 percent, from 2000 to 2007, at the same time the average entrance fee at parks increased by a little over $1 from approximately $5.60 to $6.80. Entrance fees remained relatively constant around the $6.50 mark from 2007 - 2010, while visitation recorded a net increase of approximately 1.6 million visitors. In general, the trend in visitation during the span 1993 - 2010 was downward and the trend in park entrance fees was upward (the correlation coefficient between the two is 0.10). Looking more carefully at Figure 7, it can be seen that changes in entrance fees do not necessarily line up too closely to changes in visitation. In particular, the large increase in entrance fees that occurred in 1998 is not immediately followed by a decline in visitation. Instead, visitation increases from 1997 - 1999 and does not fall until 2000, two years after the fee spike.

[18] The average fee calculated is a visitation-weighted average.

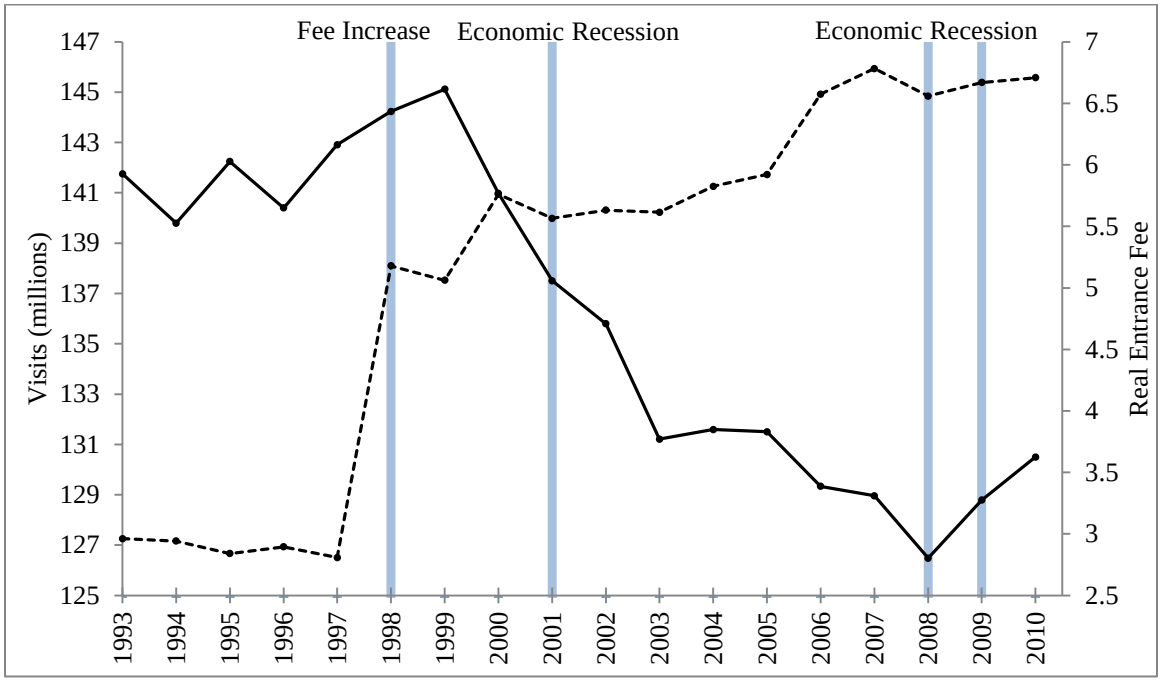

Figure 7. Total Visitation to 165-Park Sample vs. Average Entrance Fee.

Visitation is plotted alongside the average annual gas price in Figure 8. Overall, gas prices recorded a net increase of about $1 from 1993 to 2010. When the average price of gas was at its lowest value of $0.75, park attendance was just shy of its peak, at 144.2 million visitors. Gas prices were in flux while visitation was falling during 1999 -2003. During 2003 - 2008, when gas prices were rising steadily (recording a net increase of 104 percent), visitation experienced a net decrease of approximately 5 million visitors, a decline of 4 percent. The 2008 peak in the price of gas occurred in the same year that total visitation reached its trough. In 2009, when the price of gas dropped by $0.70 per gallon, visitation increased by 2.6 million visitors. Visitation reached its near peak in the same year the price of gas reached its lowest value. Ten years later, visitation hit its trough at the same time the price of gas attained its maximum. The overall trends in visitation (downward) and the price of gas (upward) shown in Figure 8 appear to provide

circumstantial evidence that visitation is negatively associated with the price of gas. The timing of significant changes in the price of gas, however, do not line up very well with significant changes in visitation. Additionally, the pairwise correlation between the price of gas and visitation is -0.004, a low correlation coefficient.

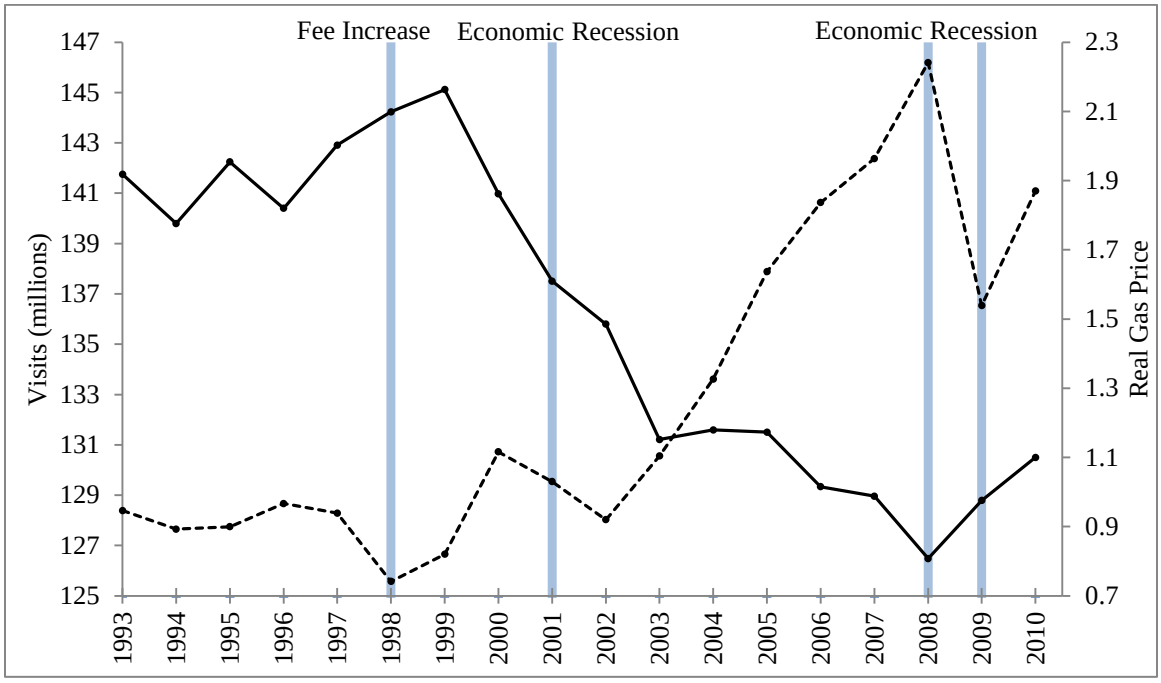

Figure 8. Total Visitation to 165-Park Sample vs. Average Gas Price.

Figure 9 shows visitation plotted against average per capita GDP. Per capita GDP was on a steady upward trend from 1993 - 2000. The economy fell into recession in 2001, and visitation was down in 2000, 2001 and in the two years following. Per capita GDP took a slight dip in 2000 and 2001 and then began rising again in 2002. From 2003 - 2007, visitation fell from 131.2 million to 128.9 million visitors and per capita GDP increased from $34,700 to $38,100. The economy once again entered a recessionary period during 2008 and 2009. The fall in income that occurred from 2007 to 2008 was

accompanied by decline in park attendance to its lowest number. Visitation rebounded in 2009 while per capita GDP continued to fall. The relationship between visitation and income is a bit ambiguous given the data displayed in Figure 9. A correlation coefficient for these two varaibles of 0.05 does not indicate that a strong relationship exists between them.

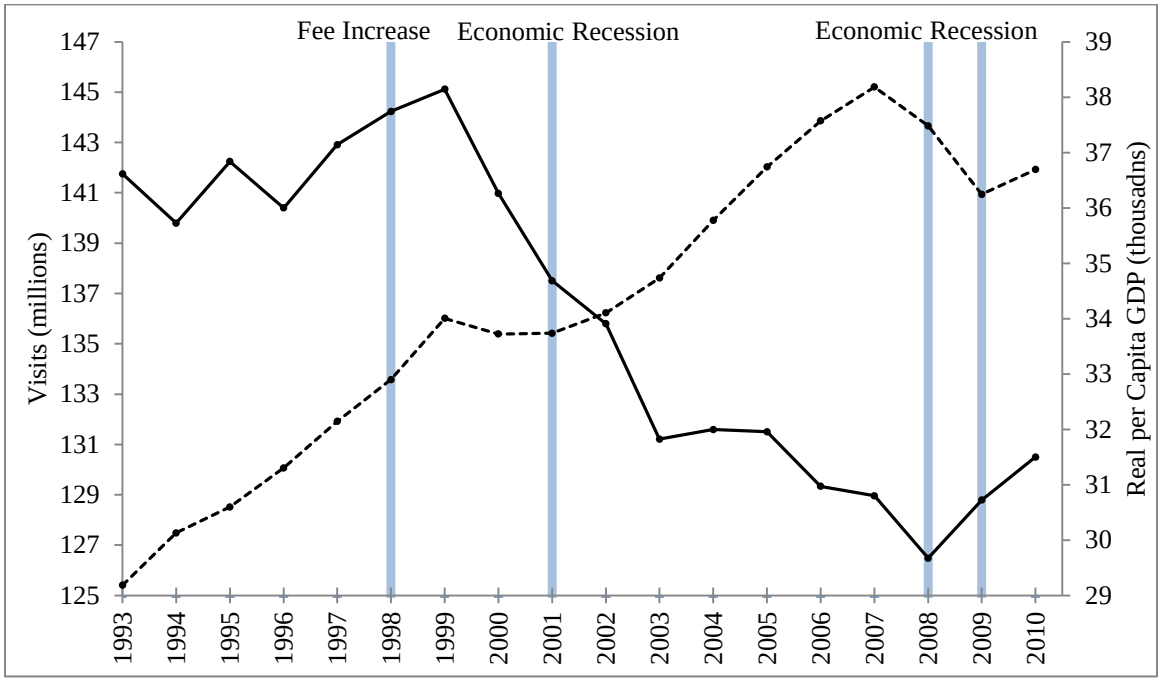

Figure 9. Total Visitation to 165-Park Sample vs. Real per Capita GDP.

Visitation to Select Individual National Parks

For further visualization of the data used in this thesis, plots of visitation are constructed for the six most popular (in terms of visitation) fee-charging National Parks in the 165-park sample over the time period 1993 -2010. These parks are Grand Canyon, Yosemite, Olympic, Yellowstone, Rocky Mountain, and Acadia. Figures 10 - 15 present visitation plots for the six parks. Trend lines are included in the plots for simple

comparison of visitation across parks. The trend in visitation to Grand Canyon, Olympic, and Rocky Mountain is slightly downward. Visitation exhibits a stronger downward trend for Yosemite and Acadia. Yellowstone shows a slightly increasing trend in visitation.

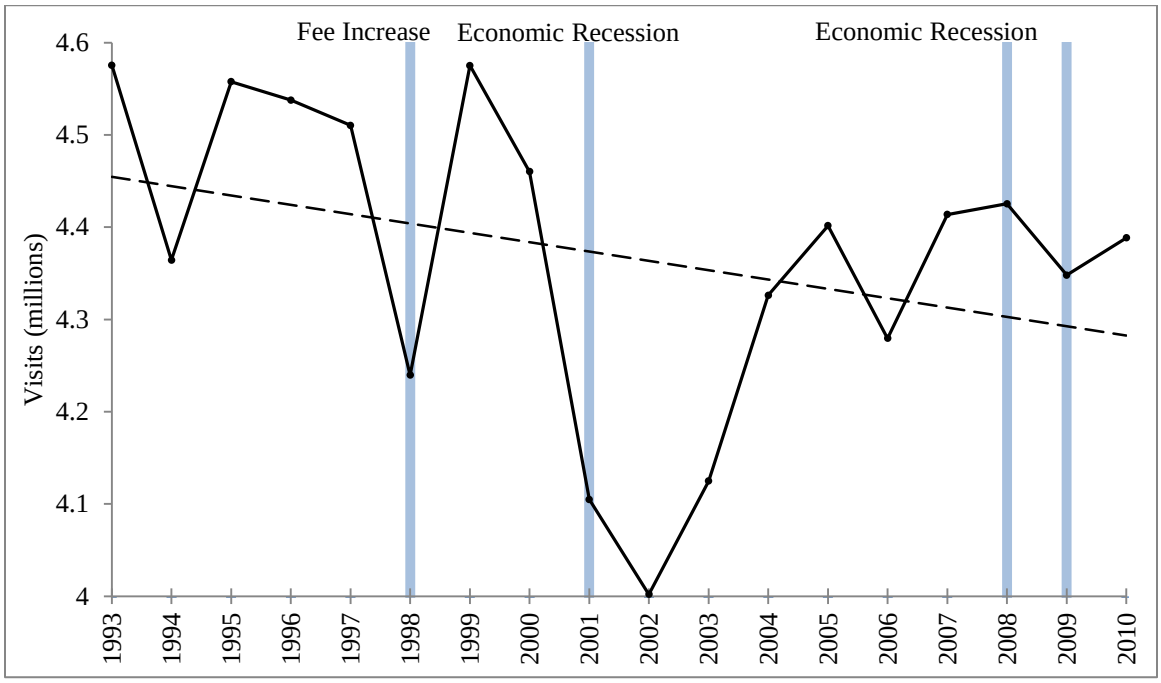

Figure 10. Total Visitation to Grand Canyon National Park.

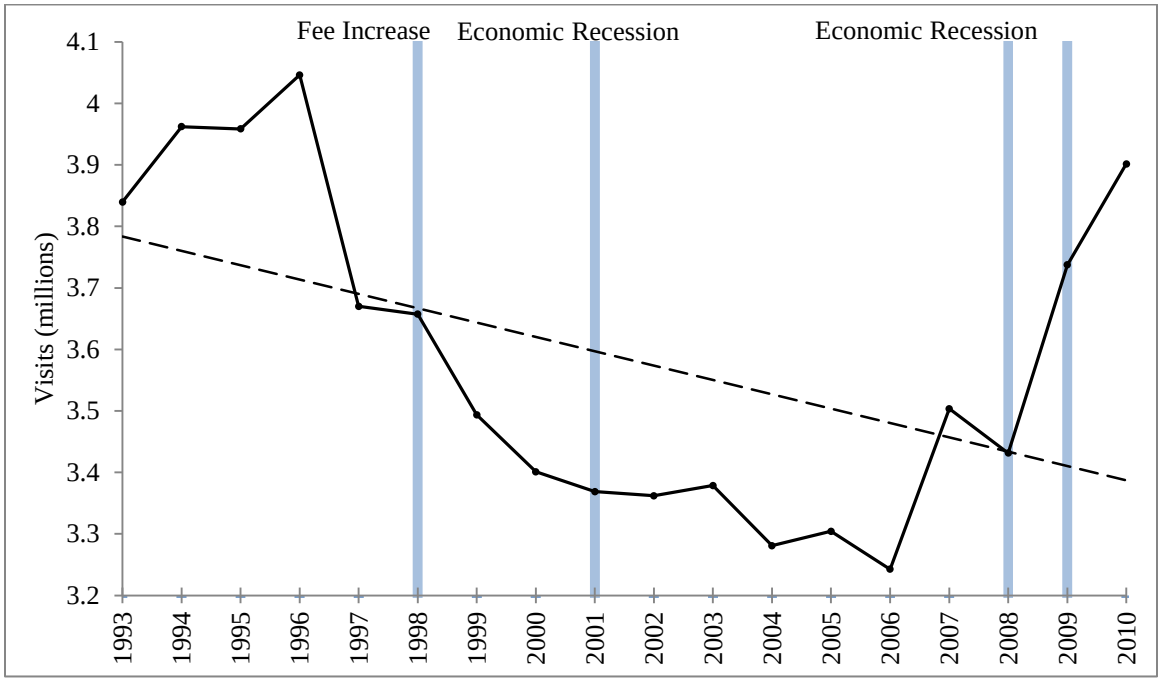

Figure 11. Total Visitation to Yosemite National Park.

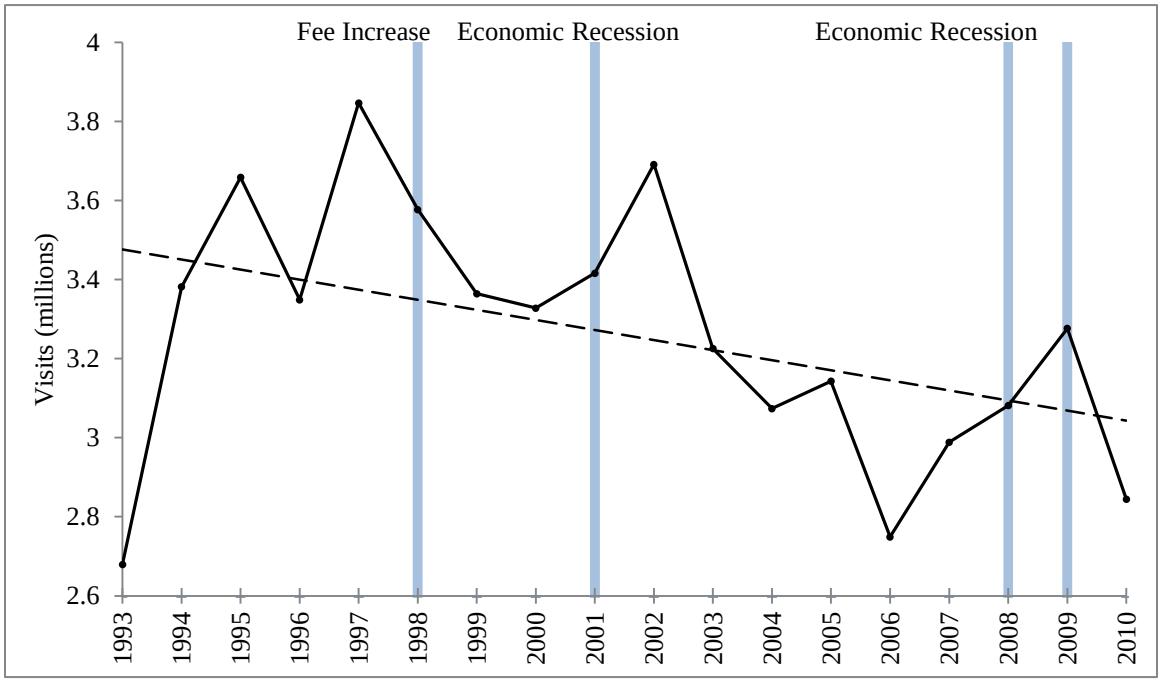

Figure 12. Total Visitation to Olympic National Park.

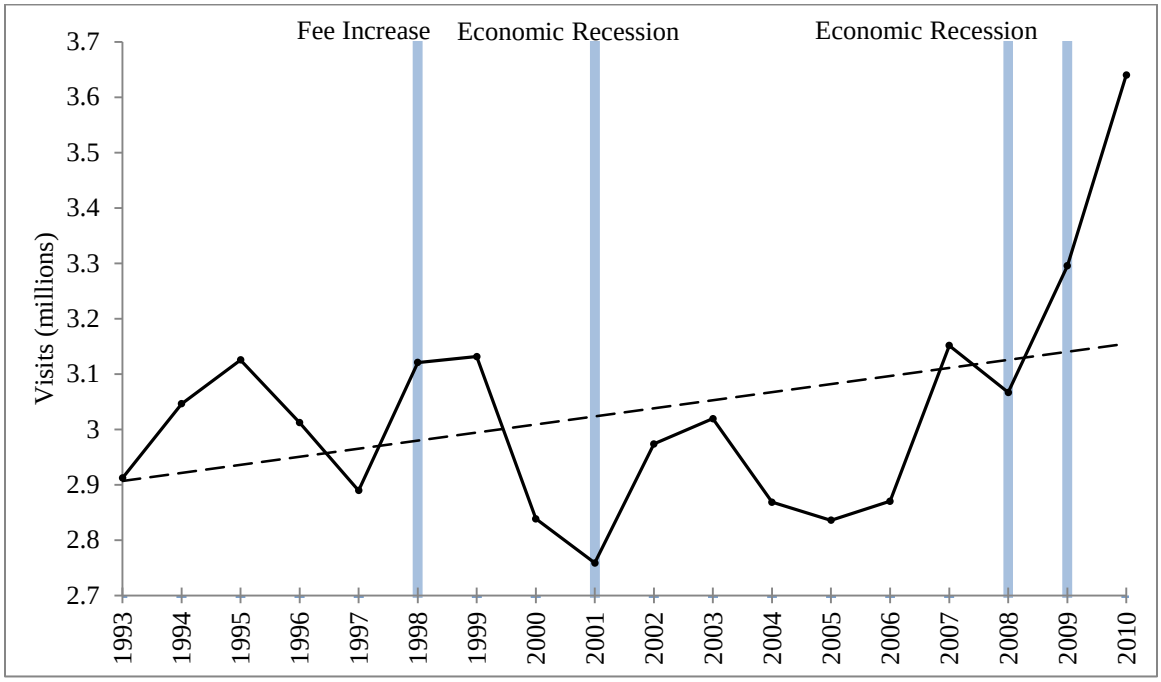

Figure 13. Total Visitation to Yellowstone National Park.

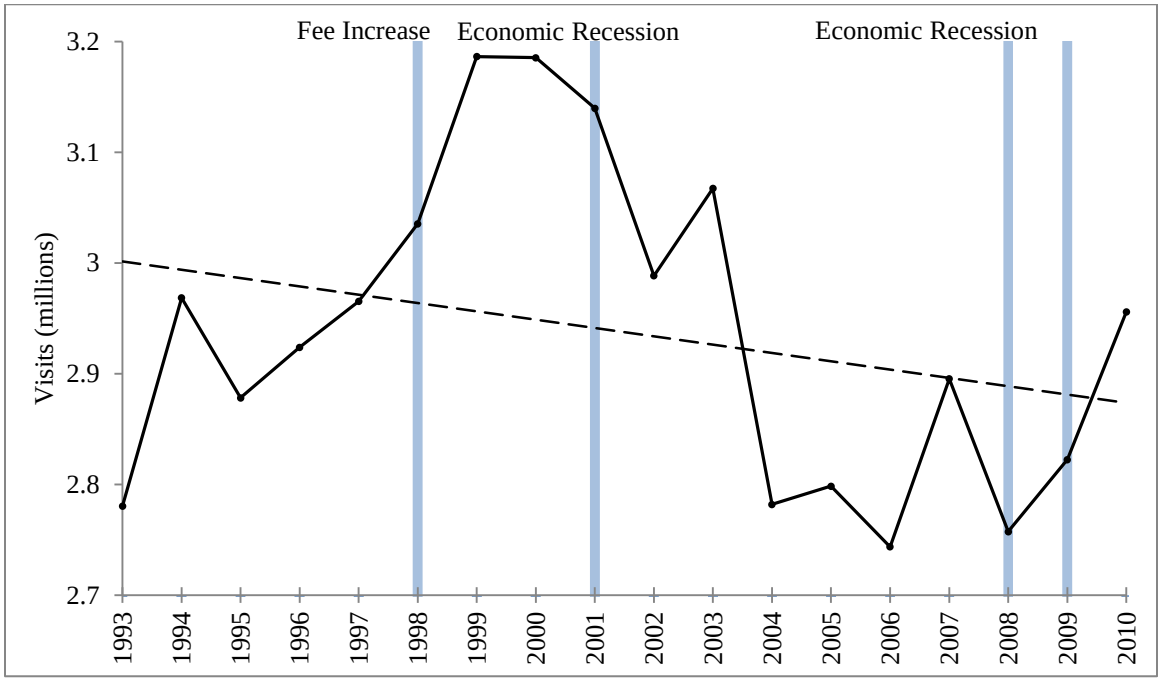

Figure 14. Total Visitation to Rocky Mountain National Park.

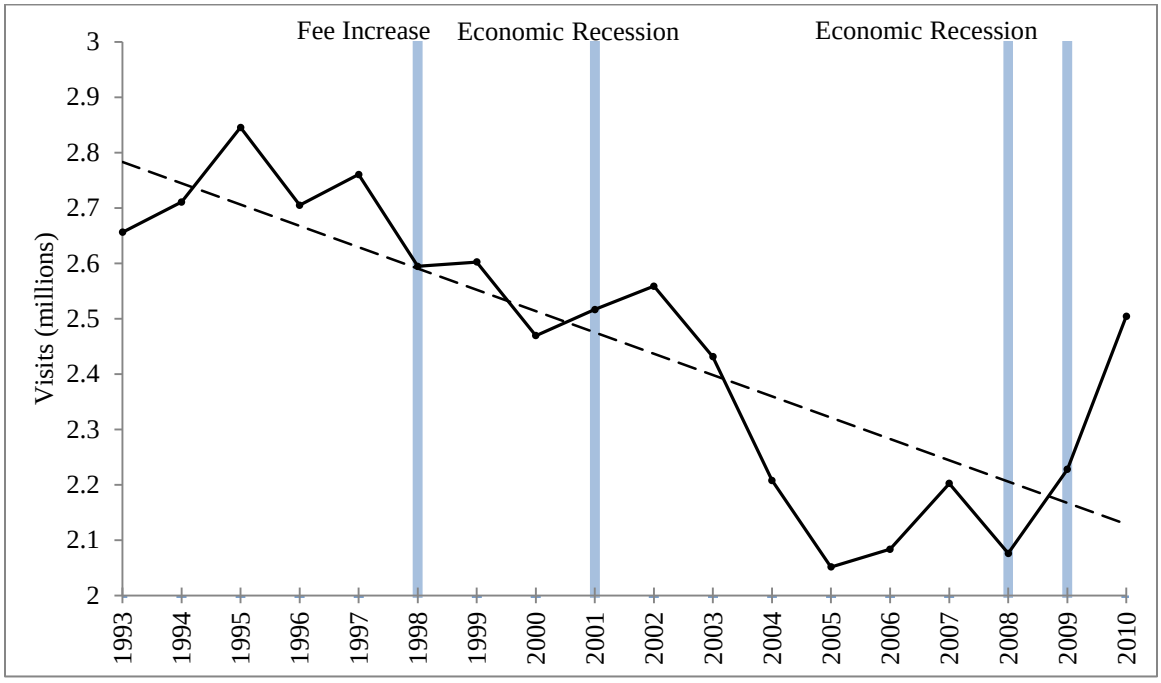

Figure 15. Total Visitation to Acadia National Park.

CHAPTER 6

EMPIRICAL STRATEGY AND RESULTS

Empirical Strategy

The empirical analysis for modeling national park visitation proceeds on levels, beginning with a national-level visitation model and then building upon that with a model of park-level visitation. The data for the national-level analysis includes total visitation numbers to all units operated by the National Park Service during the period 1993 - 2010 (this includes National Parks, National Monuments, and all other designations). The purpose of this estimation is to examine the extent to which aggregate visitation to all national parks is determined by changes in the variables of primary interest in this thesis. The three variables of primary interest at this stage in the analysis are the price of gas, income levels, and entrance fees charged by the parks.[19] The general specification of these regressions is as follows:

$$Visits_t = \alpha_0 + \alpha_1 Income_t + \alpha_2 GasPrice_t + \alpha_3 FuelEfficiency_t + \alpha_4 DrivingCost_t$$
$$\alpha_5 EntranceFee_t + \varepsilon_t \quad (1)$$

where $Visits_t$ is total visitation to all park units operated by the NPS in year t, $Income_t$ is the national income in year t, $GasPrice_t$ is the average national gas price in year t, $FuelEfficiency_t$ is an average measure of vehicle fuel efficiency in year t, $DrivingCost_t$ is

[19] The measure of income included in Equation 1, and in Equation 2 below, is per capita GDP. This variable serves the purpose of controlling for income as well as population. As a result, there is no need to include a separate population variable in Equations 1 and 2.

a measure of the cost of driving in year *t*, and $EntranceFee_t$ is the average entrance fee charged by parks in year *t*. The error term in year *t* is ε_t.

In addition to the national-level park visitation model, a model of park-level visitation is estimated for the same time period. Entrance fees, gas prices, and income remain the three variables of interest for the park-level visitation model. State-level instead of national-level measures are used for the independent variables, and entrance fees are specific to each park. Various empirical specifications are used to model visitation at the park level. The general specification of the park-level regressions is as follows:

$$Visits_{ist} = \alpha_0 + \alpha_1 Income_{st} + \alpha_2 GasPrice_{st} + \alpha_3 FuelEfficiency_t + \alpha_4 DrivingCost_{st} \alpha_5 EntranceFee_{ist} + Z_i + V_m + \tau_i T + \varepsilon_{ist} \quad (2)$$

where $Visits_{ist}$ is visitation to park *i* in state *s* in year *t*, $Income_{st}$ is the income level for state *s* in year *t*, $GasPrice_{st}$ is the gas price for state *s* in year *t*, $FuelEfficiency_t$ is an average measure of vehicle fuel efficiency in year *t*, $DrivingCost_{st}$ is a measure of the cost of driving in state *s* in year *t*, and $EntranceFee_{ist}$ is the entrance fee for park *i* in state *s* in year *t*. Z_i represents park fixed effects, V_m represents month-of-year effects, and park-specific linear trends are represented by $\tau_i T$. The error term for park *i* in state *s* in year *t* is ε_{ist}. Standard errors are corrected for clustering at the park level (Bertrand et al. 2004).

Park fixed effects account for the unique qualities of parks that draw visitors (e.g., scenery, historical significance) as well as the unique characteristics of demand. The inclusion of park fixed effects controls for characteristics of both the supply and demand

of park visits that are otherwise unobservable.[20] Month-of-year effects are included to account for the seasonality of park visitation. Park-specific linear trends are included to control for unobserved, visitation-altering factors that are unique to individual parks that evolve smoothly over time.

Results

Before presenting the results and discussing their implications it will be helpful to describe the progression in which the results will be presented in the following pages. The results from the national visitation model in Equation 1 are presented first, beginning with the national aggregate visitation regressions and then moving to the regressions for aggregate visitation to the 165-park sample. Next, the main results from Equation 2 are presented, which consist of regressions for annual and monthly park-level visitation to the 165-park sample. To complement the main results, Equation 2 is used to estimate visitation to parks that are grouped based on two different metrics. The first is to group parks by NPS designation (e.g., National Park, National Monument) and estimate both annual and monthly visitation for each designation group. Second, parks are grouped into quintiles based on their level of use. Annual and monthly visitation is then estimated for each quintile. By presenting the results in this manner, there is a natural progression from a broad measure of visitation to increasingly more specific measures of visitation. This allows for a more complete picture of visitation, and aids in understanding where the variation in visitation is originating.

[20] Ngure and Chapman (1999) found the inclusion of park fixed effects representing park-specific attributes to be important in explaining national park visitation.

Aggregate Visitation Analysis

The results from the aggregate visitation analysis are presented in tables 8 and 9. Note that the regression results in these tables are based only on 18 observations. Table 8 shows the effect of travel costs and income on aggregate visitation to all national parks in the United States. Entrance fees are not included because a national average measure of the entrance fee for all parks in the NPS system could not be obtained. The columns in Table 8 differ in how travel costs are represented. Columns (2) and (3) are preferred because they control for both the price of gas and vehicle fuel efficiency, whereas (1) only controls for the price of gas. In (2), gas price and vehicle fuel efficiency are included separately and in (3) they are included together in the driving cost variable.

Both income and travel costs are significant with the expected signs in columns (2) and (3).[21] Interpreting the coefficient estimates in terms of levels, a $1,000 increase in national per capita GDP will lead to a 1.99 million increase in aggregate visitation to all parks. For the effect of travel costs, a one-cent increase in the cost of driving will reduce aggregate national visitation by 2.35 million individuals. Interpreting the effect of driving cost on visits in terms of a percent change from the mean, a 20 percent increase in the cost of driving leads to a 0.85 percent decrease in visitation. For income, a 28 percent increase in per capita GDP leads to a 0.7 percent increase in national visitation (from here on, all interpretation of coefficient estimates will be in terms of a percent change from the mean). National visitation appears to be more responsive to changes in driving cost than to changes in income.

[21] The term "significant" refers to significance at the 10 percent level or lower. One-tail tests are used for variables with clear predictions and two-tail tests are used for variables without clear predictions.

Table 8. Annual Aggregate Visitation to all Parks Operated by the NPS.

Dependent Variable: Visits (millions)	(1)	(2)	(3)
GDP per Capita (thousands)	1.74	1.78*	1.99**
	(1.07)	(0.87)	(0.90)
Gas Price ($/gallon)	-4.70	-7.20**	-
	(3.95)	(3.33)	
Miles per Gallon	-	7.83***	-
		(2.66)	
Driving Cost (cents per mile)	-	-	-2.35**
			(1.26)
Intercept	224.56***	44.81	220.25***
	(31.6)	(66.3)	(26.2)
Mean of Visits	276.43	276.43	276.43
N	18	18	18
R^2	0.15	0.36	0.17

Estimates are reported with standard errors in parentheses. One-tail test is used for variables with clear predictions (gas price, miles per gallon, driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To introduce the data for the 165-park sample, Table 9 presents the results of estimating annual aggregate visitation to all parks in the sample using the same national-level variables as in Table 8, but including a variable representing the visitation-weighted average entrance fee across all parks in the sample. Income is not a significant determinant of aggregate visitation to the 165-park sample. Driving cost is significant with a negative sign, supporting the prediction that increases in travel costs reduce visitation. Again, the preferred columns in Table 9 are (2) and (3) where travel costs are measured by both gas price and fuel efficiency. At the mean, a 55 percent increase in the price of gas will reduce aggregate visitation by 5 percent. Comparatively, a 4 percent increase in vehicle fuel efficiency will increase aggregate visitation by 1.8 percent. Of the two components of travel cost, aggregate visitation appears to be more responsive to changes in vehicle fuel efficiency than to changes in the price of gas.

The coefficient for the entrance fee variable is statistically insignificant in all columns in Table 9. This result provides evidence that entrance fees are being set below the market-clearing level at parks. Additionally, the insignificance of the fee variable suggests that the supply of park visits is inelastic because an increase in the entrance fee leads to no change in the quantity of visits. The next section will estimate park-level visitation data to provide further evidence for determining where park entrance fees are being set in relation to market-clearing fees.

Table 9. Annual Aggregate Visitation to 165-Park Sample.

Dependent Variable: Visits (millions)	(1)	(2)	(3)
GDP per Capita	-0.43	0.006	-0.26
(thousands)	(0.87)	(0.85)	(0.88)
Gas Price	-6.28***	-7.10***	-
($/gallon)	(1.74)	(1.68)	
Miles per Gallon	-	2.53**	-
		(1.41)	
Driving Cost	-	-	-2.16***
(cents per mile)			(0.59)
Entrance Fee	-0.03	-0.82	-0.74
	(1.39)	(1.36)	(1.39)
Intercept	162.3***	93.9*	160.7***
	(23.0)	(43.9)	(23.0)
Mean of Visits	136.06	136.06	136.06
N	18	18	18
R^2	0.76	0.81	0.78

Estimates are reported with standard errors in parentheses. One-tail test is used for variables with clear predictions (gas price, miles per gallon, driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Main Results

Building upon the aggregate visitation analysis, the results in this section consist of park-level annual and monthly visitation for the 165-park sample. The results from the

annual analysis are presented in Table 10 and the results from the monthly analysis are shown in Table 11.

Annual Park-Level Analysis: There are six different regression specifications estimated for the annual analysis of park-level visitation. Referring to Table 10, columns (1) - (3) differ from columns (4) - (6) in how travel costs are represented. Columns (1) - (3) include gas price and vehicle fuel efficiency separately, while columns (4) - (6) include them together in the driving cost variable. The inclusion of park fixed effects and park-specific linear trends differs among columns (1), (2), and (3) and among columns (4), (5), and (6). The purpose for including various combinations of park fixed effects and park-specific linear trends is to see how the estimation results are affected when these two variables are omitted or included.

As mentioned previously, park fixed effects control for unobservable attributes that are unique to parks as well as to visitors. It is clear from comparing the columns without park fixed effects to the columns with park fixed effects that park attributes have a substantial effect on model specification. The adjusted R^2 in the specifications without park fixed effects is low at 0.02. In comparison, the R^2 in the specifications with park fixed effects is high at 0.99. Park fixed effects are accounting for 97 percent of the variation in annual park-level visitation. To determine the preferred combination of park fixed effects and linear trends for the annual park-level regressions (as well as all subsequent regressions), an F-test for joint significant is used. The F-test shows that park fixed effects and linear trends are jointly significant when included together in the

model.[22] As such, the columns of primary interest in Table 10 are the columns that contain the specification where both park fixed effects and linear trends are included (columns (3) and (6)).

Annual park-level visitation for the 165-park sample is not significantly affected by changes in income in Table 10. Travel costs appear to be a statistically significant determinant of visitation. The price of gas is insignificant in column (3), but vehicle fuel efficiency positively influences visitation. Driving cost is significant and negative in column (6). At the mean, a 20 percent increase in the cost of driving (represented by a one-cent increase in the price per mile) will reduce visitation by 1.2 percent.

The effect of entrance fees on annual park-level visitation is not consistent with the findings from the aggregate visitation analysis. In columns (3) and (6), the coefficient on the entrance fee variable is significantly negative. This suggests that, for the parks in the 165-park sample, entrance fees are located above the market-clearing level because fee increases are causing movement along the demand curve. At the aggregate visitation level, entrance fees are shown to be below the market-clearing level; recall, however, that this result is based on relatively few observations. The magnitudes of the effect of a increase in the entrance fee on visitation in columns (3) and (6) are close in size. In column (3), a 25 percent increase in the entrance fee leads to a reduction in visitation of 0.9 percent. In column (6), the same percentage increase in the entrance fee reduces visits by 1 percent.

[22] An F-test for joint significance of year effects was also conducted. The result of the test showed that there was not enough evidence to reject the null hypothesis of no joint significance.

Table 10. Annual Park-Level Visitation for 165-Park Sample.

Dependent Variable: Visits	(1)	(2)	(3)	(4)	(5)	(6)
State Per Capita GDP (thousands)	23555.5	5508.5	6749.2	23597.6	5608.1	5621.0
	(16224.0)	(6457.3)	(7837.3)	(16166.8)	(6419.4)	(8423.8)
State Gas Price ($/gallon)	-242627***	-66974.6**	-38725.1	-	-	-
	(83095.5)	(36409.5)	(45303.9)			
Miles per Gallon	6915.0	5761.0	24865.9**	-	-	-
	(25215.6)	(14887.2)	(14434.0)			
Driving Cost (cents per mile)	-	-	-	-57520.9***	-15573.3**	-11995.6*
				(20114.8)	(873167.3)	(9243.7)
Entrance Fee	44033.6	-11514.0*	-9582.9**	44051.7	-11519.9*	-10644.6**
	(31634.9)	(6629.8)	(4844.6)	(31609.9)	(6597.3)	(4569.1)
Park Fixed Effects	N	Y	Y	N	Y	Y
Linear Trends	N	N	Y	N	N	Y
Intercept	142117	2249611***	2146710***	306295	2380496***	2755118***
	(477701)	(364165)	(302071)	(450999)	(215732)	(182977)
Mean of Visits	981,208	981,208	981,208	981,208	981,208	981,208
N	2,496	2,496	2,496	2,496	2,496	2,496
R^2	0.02	0.99	0.99	0.02	0.99	0.99

Estimates are reported with standard errors in parentheses. Standard errors clustered at the park level. One-tail test is used for variables with clear predictions (gas price, miles per gallon, driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

If it is assumed that the majority of parks have fees below the market-clearing level due to the many recreation goods and services parks offer to visitors and the costs to the park associated with supplying these goods and services, then the negative impact of entrance fees on visitation in Table 10 is not consistent with predictions of where these fees are in relation to market-clearing. Nonetheless, the results in columns (3) and (6) indicate that fees are being set at a level where changes in the entrance fee are causing movements along the demand curve. For this to be the case, park entrance fees must be either above or at the market-clearing level.[23] If parks want to avoid having to turn visitors away at the entrance gates, then they may choose to set fees at a level that constrains visitation by the demand curve rather than the supply curve. Setting a fee that is above the market-clearing fee will ensure that visitation is constrained by the demand curve, preventing parks from experiencing excess demand that results in them having to close their gates to visitors.[24] Before anything conclusive can be said about entrance fees in relation to market-clearing fees, further analysis is warranted in order to better understand what is driving the negative coefficient on the fee variable. Later on, visitation will be analyzed in more detail, but first it is useful to present and discuss the results of monthly park-level visitation to the 165-park sample.

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[23] When the entrance fee is at the market-clearing level, a finite change in the fee will either lead to a movement along the demand curve or a movement along the supply curve depending on the direction of the fee change. A fee decrease will cause movement along the supply curve and, assuming inelastic supply, will result in an insignificant coefficient for the fee variable. A fee increase will cause movement left along the demand curve, resulting in a negative coefficient for the fee variable. The coefficient estimates for the fee variable in columns (3) and (6) in Table 10 indicate that fee increases at parks are causing movement left along the demand curve for park visits.

[24] Yosemite had to turn visitors away at the entrance gates on at least two occasions in the 1990s. In 1993, heavy winter snowfall prevented the park's high country from being opened on time. As a result, there was excess demand for the areas of the park that were open and visitors had to be turned away (Arax 1993). Similarly, heavy summer use in 1995 lead Yosemite to turn visitors away who did not have camp or lodging reservations (Cross 1996).

Monthly Park-Level Analysis: There are eight different regression specifications estimated for the monthly park-level visitation analysis presented in Table 11. The columns differ in how travel costs are represented, and in the combination of park fixed effects, month-of-year effects, and park-specific linear trends included. An F-test of joint significance shows that the columns of interest are (4) and (8), where park fixed effects, month-of-year effects, and linear trends are all included in the specification. One concern with the monthly model of visitation is that measurement error may be present in the miles per gallon variable. Because vehicle fuel efficiency data are not available at the monthly level, the measure of fuel efficiency used in the annual analysis is also used in the monthly analysis. There is likely inconsistency in combustion efficiency throughout the year that causes fuel efficiency to vary from month to month, which is not controlled for by using an annual measure of vehicle fuel efficiency. The inclusion of month effects in the model, however, mitigates this issue by absorbing fluctuations in combustion efficiency that are attributed to seasonality.

For the columns of interest in Table 11, income is not a significant determinant of monthly park-level visitation. Per capita GDP has a statistically insignificant coefficient in both columns (4) and (8). The vehicle fuel efficiency portion of travel costs is significant and positive in column (4). Interpreted as a percent change from the mean, a 4.3 percent increase in vehicle fuel efficiency will lead to a 2.6 percent increase in monthly visitation to park *i*. In column (8), the coefficient on the driving cost variable says that an 18.5 percent increase in the cost of driving will reduce monthly visitation to park *i* by 1 percent.

Table 11. Monthly Park-Level Visitation for 165-park Sample.

Dependent Variable: Visits	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Per Capita GDP (thousands)	-1228.7*** (421.6)	342.0 (676.2)	436.7 (492.6)	523.2 (612.3)	-1308.7*** (429.4)	-278.8 (671.3)	445.7 (491.5)	388.2 (662.7)
State Gas Price ($/gallon)	16206.6 (2667.3)	30351.7 (4455.8)	-5137.3** (2788.9)	-3159.3 (3208.2)	-	-	-	-
Miles Per Gallon	-2354.5 (1408.2)	5634.4*** (1231.2)	473.0 (1165.4)	2166.1** (1110.1)	-	-	-	-
Driving Cost (cents per mile)	-	-	-	-	3791.3 (629.3)	6464.9 (973.1)	-1194.4** (670.2)	-914.6* (677.8)
Entrance Fee	-1366.9** (603.4)	-48.7 (539.2)	-943.3* (560.2)	-764.0 (500.2)	-1387.5** (603.2)	-350.2 (553.6)	-940.5* (556.0)	-834.7* (498.2)
Park Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Month Effects	N	N	Y	Y	N	N	Y	Y
Linear Trends	N	Y	N	Y	N	Y	N	Y
Intercept	279324*** (34831)	71411** (33638)	141811*** (28331)	125549*** (27019)	226848*** (16923)	218024*** (16993)	152521*** (19493)	179184*** (20019)
Mean of Visits	81,769	81,769	81,769	81,769	81,769	81,769	81,769	81,769
N	29,952	29,952	29,952	29,952	29,952	29,952	29,952	29,952
R^2	0.74	0.75	0.78	0.79	0.74	0.75	0.78	0.79

Estimates are reported with standard errors in parentheses. Standard errors clustered at the park level. One-tail test is used for variables with clear predictions (gas price, miles per gallon, driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The coefficient for the entrance fee variable is insignificant in column (4), but significantly negative in column (8). Given this, it is important to note that these two coefficient estimates do not differ drastically in their significance levels, but it happens that they differ across the threshold of 10 percent significance. The absolute value of the t-statistic for the entrance fee coefficient in column (8) is 1.68, making the estimate statistically significant just inside the 10 percent level. In comparison, the absolute value of the t-statistic for the entrance fee coefficient in column (4) is 1.53, making the estimate significant at the 13 percent level, but statistically insignificant at conventional levels. Consequently, the results in column (4) are somewhat inconsistent with the annual results in terms of the level of the entrance fee in relation to the market-clearing fee. On the one hand, the insignificant coefficient for the entrance fee in column (4) suggests that fees are being set below the market-clearing level, and that visitation is constrained by an inelastic supply curve. On the other hand, the negative coefficient for the entrance fee in column (8) indicates that entrance fees are above the market-clearing level, a finding consistent with the park-level annual analysis. As for the magnitude of the effect of a fee change in column (8), a 24.3 percent increase in the entrance fee will lead to a decrease in monthly visitation of 1 percent. Compare this with the effect of an increase in driving cost mentioned above, and it appears that visitation fluctuates more in response to changes in the cost of driving than changes in the entrance fee. This is to be expected as driving costs make up a larger portion of visit expenses than the entrance fee.

Taken together, the results from the annual and monthly analyses of park-level visitation indicate that income is not a significant determinant of demand, but that travel costs and entrance fees are important components of demand. The estimated coefficients

for the entrance fee variable suggest parks are setting fees above the market-clearing level, thus constraining the quantity of visits by the demand curve and causing the quantity to move in the opposite direction of a fee change. Indeed, parks may be doing this in order to prevent a situation where they must turn visitors away due to excess demand. To better understand the results presented in this section, the next section analyzes visitation for subsets of parks in effort to pinpoint where the variation is visitation is originating and if there are systematic differences across parks in terms of where entrance fees are set.

Supplemental Results

Parks are grouped into categories based on two different metrics, park designation and level of use. By estimating park-level visitation to parks that vary by designation, it can be seen if certain types of parks (e.g., National Parks, National Monuments) are driving the results outlined in the previous section Similarly, estimating park-level visitation to parks that vary by their level of use is informative for understanding if parks that receive relatively little visitation are different from parks that receive relatively high visitation. Results from each of these two estimation strategies are discussed in turn in this section. From here on, travel costs are represented solely by the driving cost variable. The results of including gas price and vehicle fuel efficiency separately for the two methods presented in this section are available upon request.

Park Designation Analysis: Parks are divided into six different categories based on their designation. These categories include National Parks, National Monuments, National Historic Sites, National Battlefields, National Recreation Areas, and Other

Parks.[25] Visitation for each park designation is estimated at the annual and monthly level. The results from the annual analysis are presented in Table 12 and the results from the monthly analysis are presented in Table 13. There are no clear predictions for where entrance fees might be in relation to the market-clearing level for the different park designation categories. Each category includes parks that vary widely in terms of factors such as individual attributes and level of use. As a result, entrance fee levels may differ across parks within each designation category.

Consistent with the main results, income remains to be a nonfactor in the demand for park visits in Table 12. Travel costs are a factor for National Parks and National Battlefields, as displayed by the significant and negative effect of the driving cost variable. For National Parks, an 18 percent increase in the cost of driving to these parks will lead to a decrease in annual visitation to park *i* of 1.6 percent. In comparison, a 19 percent increase in the cost of driving to National Battlefields will reduce annual visitation to park *i* by 3 percent. Visitation to National Battlefields appears to be more responsive to changes in travel costs than visitation to National Parks.

[25] Areas of historical significance are often classified as National Historic Sites, but can also be classified as National Historic Parks, National Historic Areas, or National Historic Landmarks, among others. For the purposes of the park designation analysis, any park that is a designated area of historical significance is classified as a National Historic Site. The same goes for National Battlefields, which will be the term used to denote any park that has military significance. The Other Parks category includes parks that fall under the designation of National Seashore, National Lakeshore, Park, National Preserve, Parkway, National River, and National Scenic River.

Table 12. Comparison of Parks Based on Designation (Annual Park-Level Data).

Dependent Variable: Visits	National Parks	National Monuments	National Historic Sites	National Battlefields	National Recreation Areas	Other Parks
Per Capita GDP	7353.7	3438.2	-9389.4	9071.3	-18606.3	111064.7
(thousands)	(8706.4)	(4563.8)	(11845.5)	(18695.1)	(23292.0)	(131517.5)
Driving Cost	-23704.1*	-18149.2	13852.7	-11451.2*	13324.6	-36381.7
(cents per mile)	(14701.4)	(15164.4)	(9414.3)	(8185.1)	(15354.3)	(50368.4)
Entrance Fee	-11650.0*	47.5	-6249.8	-11503.9	-10176.9	-56533.5
	(6584.4)	(3392.3)	(7925.4)	(7627.2)	(13727.4)	(34079.1)
Park Fixed Effects	Y	Y	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y	Y	Y
Intercept	2747339***	371378***	352135	-41889	715163	-2332330
	(184940)	(81570)	(319730)	(572276)	(472912)	(4102903)
Mean of Visits	1,481,327	383,020	419,887	387,767	2,352,615	2,617,506
N	709	669	623	171	126	198
R^2	0.99	0.95	0.96	0.98	0.99	0.99

Estimates reported with standard errors in parentheses. Standard errors clustered at the park level. One-tail test is used for variables with clear predictions (driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Of all six designation categories, entrance fees are only significant for National Parks. This result is contrary to Factor (2007) and Ngure and Chapman (1999), who find the effect of entrance fees on visitation to National Parks to be inconclusive. The Other Parks category has an entrance fee coefficient that is significant at the 13 percent level. While this is worth noting, the fee coefficient for Other Parks is still statistically insignificant from zero at conventional significance levels. The coefficient estimate for National Parks shows that a 12 percent increase in the entrance fee will reduce annual visitation to park *i* by 0.7 percent. This result indicates that National Parks have entrance fees that are above the market-clearing level, which is consistent with the main results. The insignificance of the fee coefficient for the five other designation categories suggests that for most parks fees are below the market-clearing level and that the supply curve is inelastic. Given this, it appears that National Parks are driving the significant and negative effect of entrance fees for the annual-level analysis of the 165-park sample.

Table 13 shows the estimation results for monthly visitation to each of the park designation categories described above. Again, income is not a significant determinant of park use for any of the designation categories. Travel costs are significant for National Monuments, National Battlefields, and National Recreation Areas. An 18 percent increase in the cost of driving to a National Monument will reduce monthly visitation by 3.4 percent. The same percentage increase in the cost of driving to a National Battlefield will reduce monthly visitation by 2.8 percent. For National Recreation Areas, a 19 percent increase in the cost of driving to those sites will result in a decrease in monthly visitation of 1 percent. Of the parks that are significantly impacted by changes in travel costs, visitation to National Monuments is most responsive to these changes.

The Other Parks category is the only designation category for which visitation is significantly affected by changes in the entrance fee. The coefficient for the entrance fee at National Battlefields is close to conventional significance levels, displaying significance at the 13 percent level. This result suggests that Hanink and Stutts (2002) may not have been incorrect when they assumed entrance fees to be a trivial component of demand for National Battlefields. For the parks in the Other Parks category, a 34 percent increase in the entrance fee will result in a 1.3 percent decrease in monthly visitation. Just like National Parks appear to be driving the negative and significant result for the entrance fee in Table 10, columns (3) and (6), it appears the variation in monthly visitation that can be attributed to entrance fees in Table 11, column (8), is coming from the parks included in the Other Parks category. The coefficient estimate shows that these parks are setting fees above the market-clearing level. All other designation categories in Table 13 have insignificant entrance fee coefficients, indicating that fees at these parks are being set below the market-clearing level and that the supply curve is inelastic.

Given the results presented in tables 12 and 13, there are two park designation categories that seem to be contributing to the negative effect of fees for the 165-park sample. At the annual level, National Parks are responsible for the variation in visitation that is being attributed to changes in entrance fees. At the monthly level, parks in the Other Parks category are responsible for this variation. Overall, the results from the park designation analysis provide strong evidence that entrance fees at most parks are below market-clearing levels. In addition, the insignificant coefficients show that the supply curve for these parks is inelastic.

Table 13. Comparison of Parks Based on Designation (Monthly Park-Level Data).

Dependent Variable: Visits	National Parks	National Monuments	National Historic Sites	National Battlefields	National Recreation Areas	Other Parks
Per Capita GDP	300.0	270.5	-703.4	685.0	-1996.0	9042.3
(thousands)	(715.7)	(324.6)	(940.3)	(1445.1)	(1682.4)	(9900.6)
Driving Cost	-736.5	-1078.7*	462.3	-922.5*	-2121.4**	-3256.8
(cents per mile)	(1158.3)	(674.7)	(422.7)	(560.2)	(964.9)	(3703.9)
Entrance Fee	-466.0	-60.4	16.4	-893.3	-1478.2	-2911.5**
	(667.0)	(252.1)	(188.4)	(527.3)	(1243.0)	(1264.0)
Park Fixed Effects	Y	Y	Y	Y	Y	Y
Month Effects	Y	Y	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y	Y	Y
Intercept	150769***	12147	9791	-22917	-12423	-364649
	(22121)	(10923)	(25942)	(55202)	(50867)	(341553)
Mean of Visits	123,449	31,918	34,990	32,314	196,051	218,125
N	8,508	8,028	7,476	2,052	1,512	2,376
R^2	0.73	0.77	0.77	0.74	0.91	0.82

Estimates reported with standard errors in parentheses. Standard errors clustered at the park level. One-tail test is used for variables with clear predictions (driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Park Use Analysis: Parks are grouped into quintiles based on their level of use, which is defined as average visitation over the years 1993 - 2010. The quintiles are defined as very low use, low use, medium use, high use, and very high use. Each quintile contains 33 parks. As in the park designation analysis, annual and monthly visitation is estimated for each quintile. The results from the annual estimation are presented in Table 14 and the results from the monthly estimation are presented in Table 15. In addition to showing where entrance fees are set at parks that vary by their level of use, analyzing parks by use level can signify whether or not entrance fees might be endogenous to visitation. Entrance fees may be endogenous to visitation if park use is a determining factor for the level of the entrance fee. That is, park managers act to adjust entrance fees based on visitation levels. If entrance fees are endogenous to visitation, then it is expected that parks with higher use (e.g., the high-use, and very-high-use quintiles) would have a coefficient estimate on the entrance fee that is positive and significant.

At the annual level, income is not a significant determinant of visitation for any of the quintiles of park use. Travel costs have a negative impact on the demand for visits at very-low-use parks and very-high-use parks. It is unclear what is driving this result, as each quintile contains parks that are diverse in terms of their location relative to densely populated areas. The coefficients on the entrance fee variable for high-use and very-high-use parks support the argument that fees are set exogenous to visitation. Because visitation does not respond positively to changes in entrance fees at parks with high levels of use, this indicates that park managers are not adjusting entrance fees based on fluctuations in visitation, but rather set them exogenously at some level.

In the case of high-use and very-high-use parks, the annual level of the entrance fee appears to be above the market-clearing level. For very-low-use parks, the positive and significant coefficient on the entrance fee shows that entrance fees at these parks are below the market-clearing level. This is a curious result, as parks with relatively high levels of demand might be thought to have entrance fees below the market-clearing level, while parks with relatively low levels of demand might be thought to have fees above the market-clearing level. It is possible that seasonal variation in visitation is driving the results for the entrance fee variable in Table 14. To determine if this is true, monthly visitation is estimated for each quintile of park use.

Table 14. Comparison of Parks Based on Level of Use (Annual Park-Level Data).

Dependent Variable: Visits	Very Low Use	Low Use	Medium Use	High Use	Very High Use
Per Capita GDP	-283.3	-764.4	-1356.9	-8441.7	-28456.4
(thousands)	(515.4)	(1828.9)	(2592.5)	(14703.6)	(26353.8)
Driving Cost	-725.6*	3586.5	3857.0	-3918.8	-56261.2*
(cents per mile)	(450.9)	(3843.6)	(2931.5)	(11360.3)	(34997.2)
Entrance Fee	959.3**	-424.4	1233.9	-16283.5**	-18040.5*
	(481.8)	(2380.0)	(2957.1)	(6095.0)	(10419.8)
Park Fixed Effects	Y	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y	Y
Intercept	30177*	116560**	212593**	1282329***	2336144***
	(15508)	(50660)	(83969)	(403952)	(564340)
Mean of Visits	37,145	113,627	276,134	750,314	3,221,242
N	451	433	516	522	574
R^2	0.90	0.58	0.83	0.77	0.99

Estimates reported with standard errors in parentheses. Standard errors clustered at the park level. One-tail test is used for variables with clear predictions (driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In estimating monthly visitation for each park-use quintile, a dummy variable is included to control for the season.[26] This dummy variable is interacted multiplicatively with the entrance fee to control for how entrance fees might vary in their effect on visitation depending on the season. In employing this estimation strategy, the predictions for the effect on entrance fees on visitation are ambiguous. Nonetheless, the model is useful in that it will show empirically where entrance fees are in relation to market-clearing fees based on the season. In addition, it will also be informative for understanding the nature of park supply. The results of this analysis are provided in Yable 15.

Neither income nor the cost of driving is an important factor to visitation for any of the five park-use quintiles. The intriguing results in Table 15 are those associated with the interaction terms between the entrance fee and the season dummy variables. The omitted category is the shoulder season, and so the coefficient on the entrance fee shows the impact of a fee change during the shoulder season months. As such, the coefficient estimates for the interaction terms between the peak season and the entrance fee and the off-peak season and the entrance fee are to be interpreted in relation to the estimate on the entrance fee variable. This will show how the level of the entrance fee varies depending on the season. Dummy variables for peak season and off-peak season are included to allow for shifts in the intercept. The coefficient estimates for these two variables have the expected signs (visitation is higher in peak season and lower in off-peak season) and are highly significant for all levels of park use.

[26] The three seasons are the peak season, the off-peak season, and the shoulder season. The peak season consists of the months of highest use, June, July, and August. The off-peak season is the months of lowest use, January, February, and December. The remaining months are categorized as the shoulder season.

Table 15. Comparison of Parks Based on Level of Use (Monthly Park-Level Data).

Dependent Variable: Visits	Very Low Use	Low Use	Medium Use	High Use	Very High Use
Per Capita GDP	-47.8	-95.8	-175.6	-501.9	1740.2
(thousands)	(43.5)	(139.8)	(246.9)	(1118.8)	(2065.5)
Driving Cost	7.6	321.6	318.1	343.0	-373.2
(cents per mile)	(32.9)	(211.7)	(150.0)	(480.4)	(1689.0)
Entrance Fee	72.8	-136.5	-124.4	-1709.0**	-4157.6***
	(82.9)	(117.4)	(433.8)	(653.4)	(1112.5)
Fee*Peak Season Dummy	337.4	-46.6	1342.4	2015.1	8246.5**
	(207.3)	(430.2)	(1611.3)	(1623.8)	(3856.3)
Fee*Off-Peak Season Dummy	-208.4***	-316.5***	-334.8	-576.1	3739.9
	(71.3)	(111.1)	(200.0)	(906.9)	(4009.2)
Peak Season Dummy	1540.2***	5201.6**	17858.9**	34041.8***	142993.3***
	(457.5)	(2082.9)	(7063.7)	(12394.5)	(40236.0
Off-Peak Season Dummy	-1429.2***	-4455.1***	-10034.8***	-24849.9***	-161448.6***
	(227.3)	(423.9)	(1144.3)	(6442.9)	(53903.6)
Park Fixed Effects	Y	Y	Y	Y	Y
Linear Trends	Y	Y	Y	Y	Y
Intercept	3047**	11576***	17274**	96852***	196088***
	(1290)	(3874)	(7999)	(31373)	(44824)
Mean of Visits	3,095	9,468	23,011	62,526	268,443
N	5,412	5,196	6,192	6,264	6,888
R^2	0.58	0.43	0.49	0.46	0.81

Estimates reported with standard errors in parentheses. Standard errors clustered at the park level. One-tail test is used for variables with clear predictions (driving cost). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Entrance fee changes during shoulder season months at very-low-use parks do not have a noticeable effect on visitation in those months, as shown by the insignificant coefficient on the entrance fee variable for very-low-use parks. The coefficient on the interaction term between the entrance fee and the peak season dummy variable shows that fee changes during the peak season do not have a significantly different impact on visitation compared to shoulder season fee changes. This result suggests that entrance fees are below the market-clearing fee in both the shoulder season and the peak season for very-low-use parks. Also, the insignificant coefficients suggest that the supply curve for these parks is inelastic.

Entrance fees in the off-peak season appear to be above the market-clearing level for very-low-use parks, as indicated by the negative and significant coefficient on the interaction term between the entrance fee and the off-peak season dummy variable. Relative to the shoulder season, fee changes during the off-peak season act to reduce the quantity of visits at very-low-use parks. To correctly interpret the effect of a fee change on off-peak visitation to very-low-use parks, the coefficient on the interaction term between the entrance fee and the off-peak season dummy must be added to the coefficient on the entrance fee variable. By doing this, the net effect of a fee change in the off-peak season is obtained. Because the coefficient estimate for the effect of entrance fees on visitation in the shoulder season is not statistically different from zero, the effect of a fee change in the off-peak season for very-low-use parks is simply the coefficient estimate on the interaction term between the entrance fee and the off-peak season dummy variable. The magnitude of the estimate can be interpreted as a 56 percent increase in the entrance

fee during the off-peak season leading to a 6.8 percent reduction in visitation in those months.

The results for low-use parks are similar to the results for very-low-use parks. Entrance fees are below the market-clearing level in the shoulder season and the peak season and above the market-clearing level in the off-peak season. Also, the supply curve for low-use parks appears to be inelastic given that entrance fee changes during the shoulder and peak seasons (when the fee is below market-clearing) do not have a significant effect on the quantity of visits. A 49 percent increase in the entrance fee during the off-peak season at low-use parks has the effect of reducing visitation in those months by approximately 2.7 percent.

Entrance fees are insignificant determinants of visitation in all seasons for medium-use parks. This outcome supports the above result that entrance fees are below the market-clearing level and that supply is inelastic during the shoulder season and the peak season. Entrance fees are shown to be above market-clearing fees during the off-peak season for very-low-use and low-use parks, but this is not the case for medium-use parks. The coefficient on the interaction term between the entrance fee and the off-peak season dummy variable is insignificant from the coefficient on the entrance fee variable, showing that entrance fees are also below the market-clearing fee during off-peak season months for medium-use parks. These results indicate that the supply curve for medium-use parks is inelastic.

High-use parks have a negative and significant coefficient estimate for the effect of fee changes in the shoulder season. Interpreting this coefficient says that a 19.6 percent increase in the entrance fee during shoulder season months will have the effect of

reducing visitation in those months by 1.7 percent. This effect is the same in peak season and off-peak season months, indicating that entrance fees at high-use parks are above the market-clearing fee year-round. It is plausible that high-use parks are setting fees above the market-clearing level for all seasons to avoid encountering a situation where they must prohibit visitors from entering the park due to overcrowding. The results for high-use parks do not say anything about the shape of the supply curve for these parks.

Similar to high-use parks, entrance fees at very-high-use parks are above the market-clearing level in the shoulder season. The coefficient for the interaction term capturing the effect of entrance fees in the off-peak season is insignificant, showing that visitation responds the same to an entrance fee change in off-peak season months as it does to a fee change in shoulder season months. Thus, entrance fees are above the market-clearing level in the off-peak season as well. For both off-peak season and shoulder season, a 15.6 percent increase in the entrance fee will reduce visitation in those months by 2 percent. Relative to the negative effect of entrance fees in the shoulder season and off-peak season, the effect of fees during peak season is significantly different from negative, as indicated by the positive and significant coefficient on the entrance fee and peak season interaction term. While this outcome shows that entrance fees are below the market-clearing level during the peak season, it does not provide information on whether fees have a positive or zero effect on visitation.

To test for the effect of entrance fee changes on peak season, monthly attendance to very-high-use parks, visitation is estimated with peak season as the omitted dummy variable category. By doing this, the entrance fee variable directly represents the effect of a fee change in the peak season, and the sign of its coefficient will inform the shape of

park supply. If the coefficient has a positive sign and the estimate is statistically significant, then fee increases lead to increases in visitation which means that the supply curve is elastic. An insignificant coefficient will provide evidence for the supply curve being inelastic. Indeed, when visitation to very-high-use parks is estimated with peak season as the omitted category, the coefficient estimate is 4,088.9 and is statistically indistinct from zero, with a t-statistic of 1.09. As a result, it can be said that the supply curve for very-high-use parks is inelastic because changes in the entrance fee during the peak season (where the fee is below the market-clearing level) do not lead to significant changes in the quantity of visits.

Discussion

The purpose of the empirical analysis is to understand how entrance fees, travel costs, and income influence national park visitation rates. Throughout the analysis, income is shown to be an insignificant determinant of park visitation rates. This outcome is inconsistent with Factor (2007) and Poudyal et al. (2013), who both find that unemployment rates (which can be thought of as a measure of income) are negatively associated with visitation to national parks. The insignificant effect of income does support the findings of Ngure and Chapman (1999), who show that a measure of regional per capita income is not important for explaining visitation to national parks.

Travel costs, represented by factors that influence the cost of driving to a park, are shown to have a significant and negative effect on visitation in the main results section, when all 165 parks are analyzed together. In the supplemental results, the effect of travel costs is more ambiguous. Taking the annual and monthly results from the park

designation analysis together, travel costs negatively affect visitation to four out of the six designation categories. In the park-use analysis, travel costs are significantly negative for very-low-use parks and very-high-use parks. Given that travel costs are a negative determinant of demand for the 165-park sample, and for two of the six park-use categories and four of the six designation categories, it can be said that, in general, increases in the cost of travelling to national parks will reduce visitation rates.

The main results indicate that the overall effect of entrance fees on visitation is negative, indicating that, in general, parks are setting fees above market-clearing levels. The supplemental results indicate that it is National Parks and Other Parks, along with parks in the high-use and very-high-use categories that are responsible for the negative effect of fees in the main results. Because the high-use and very-high-use categories are comprised mainly of parks designated as National Parks and Other Parks, it seems clear that entrance fees at these types of parks are being set above the market-clearing level, which causes the quantity of visits to move in the opposite direction of a fee change. This finding that entrance fees at National Parks are a deterrent to visitation does support the conclusions from Factor (2007) and Ngure and Chapman (1999), who both determine the effect of entrance fees on visitation to National Parks to be inconclusive.

Based on the findings from the supplemental results, the effect on entrance fees on visitation appears to be highly park-specific. In addition to being park-specific, the effect of entrance fees is also shown to be season-specific. In estimating monthly visitation to parks that vary by their level of use, while controlling for seasonal effects of entrance fees, it is determined that entrance fees are at different levels in relation to

market-clearing fees depending on the season. This analysis also provides evidence that the shape of park supply is inelastic.

Taking the results for the effect of entrance fees on visitation together, it can be said that for parks in general entrance fees are being set above market-clearing fees and have an inverse relationship with visitation. This finding lends support to media claims that fee increases at national parks brought about by the RFDP and FLREA had an adverse effect on park visitation rates. It is still important, however, to note that the effect of entrance fees on visitation is shown to be decidedly park-specific and season-specific.

CHAPTER 7

CONCLUSIONS AND FURTHER RESEARCH

Understanding fluctuations in national park visitation in the context of entrance fees, travel costs (represented by factors that influence the cost of driving), and income is the main objective of this thesis. Media reports often rely on circumstantial evidence to support assertions that the aforementioned factors are impacting park attendance rates. Critics of park entrance fees argue that fee increases brought about by the Recreational Fee Demonstration Program have led to declining visitation rates at national parks. The RFDP had unprecedented implications for national park fee policy, as it allowed individual parks more autonomy in setting entrance fees. Under this program, parks were permitted to keep 80 percent of the revenues generated from fee collection. As a result, parks participating in the RFDP had more of an incentive to use entrance fees as a source of significant revenue. The RFDP continues under the Federal Lands Recreation Enhancement Act, with the provisions allotted to parks under the RFDP remaining intact under the FLREA.

Given the substantial amount of negative press associated with park entrance fees, the question remains if these fees truly have an adverse impact on visitation rates. There are studies that examine the effect of entrance fees on visitation to national parks, but the results are mixed. Ostergren, Solop, and Hagen (2005) find that entrance fees have no effect on aggregate visitation to U.S. national parks. Studies by Factor (2007) and Ngure and Chapman (1999) find that the effect of entrance fees on visitation is inconclusive. A consensus on how national park visitation reacts to changes in entrance fees is lacking in

the literature, and this thesis works to fill that void by providing evidence that the effect of entrance fees on visitation is negative, but with a park-specific and season-specific component.

When fees are initially determined for parks, it is unknown whether these fees are set above, below, or at the market-clearing level. It is assumed that park managers set entrance fees exogenously to visitation, and the results from an analysis of parks pooled by their level of use supports this assumption. Predictions for the effect of entrance fees on visitation depend on where fees are set in relation to market-clearing fees. A theoretical framework for the demand and supply of park visits helps inform how the empirical model can be used to test for where parks are setting entrance fees, and how these fees influence visitation rates.

A "residual" demand curve is used to model park visitation in a theoretical context. By using this residual demand curve, entrance fees can be represented as the price of a park visit and all other factors that influence the use of a park are included as shifters of the residual demand curve. In terms of predictions, changes in entrance fees are expected to have a negative effect on visitation through movements along the residual demand curve. Increases in travel costs are predicted to adversely impact visitation through inward shifts of the residual demand curve, and increases in income are expected to positively influence visitation through outward shifts in the residual demand curve. In combining the residual demand curve with a representation of park supply (assumed to be inelastic given the spatial capacity constraints of parks), a theoretical model of park visitation is developed that is informative for understanding how visitation is predicted to respond to fee changes when fees are above, below, or at the market-clearing level.

To empirically test for where parks might be setting entrance fees, this thesis uses data on annual and monthly visitation to a sample of 165 national parks for the period 1993-2010. The estimation of these data proceeds on levels, beginning with an analysis of national aggregate visitation and ending with an analysis of park-level visitation to parks that are pooled first by designation and then by level of use. Throughout the empirical analysis, income is shown to be an insignificant determinant of visitation rates, a result consistent with Ngure and Chapman (1999), but inconsistent with Factor (2007) and Poudyal et al. (2013). From the main analysis, travel costs are significant in influencing park-level visitation for the 165-park sample and have a negative effect on attendance rates. In addition, the cost of travel is important for determining visitation rates at National Parks, National Monuments, National Battlefields, and National Recreation Areas, as well as for parks with very low use and parks with very high use.

At the aggregate level, entrance fees appear to be an insignificant factor in determining visitation; however, this result is based on only 18 observations. In the main analysis, where both annual and monthly park-level visitation is estimated for the 165-park sample, entrance fees are found to have a negative effect on visitation. Based on the theoretical model, this indicates that parks are setting entrance fees above the market-clearing level. Estimating visitation to parks that are categorized by designation and level of use, there is evidence that suggests high-use and very-high-use parks in the National Parks and Other Parks categories are responsible for the variation is visitation that is being attributed to the entrance fee in the main analysis. Visitation to these types of parks responds negatively to increases in entrance fees, a finding that is contrary to Factor

(2007) and Ngure and Chapman (1999), both of whom find that entrance fees at National Parks have an inconclusive effect on visitation.

An analysis of monthly visitation to parks that vary by their level of use shows that entrance fees influence visitation differently depending on the season. The results indicate that in the off-season entrance fees are typically above the market-clearing level and in the peak season they are typically below the market-clearing level. Shoulder season fees vary in their level in relation to the market-clearing fee. In addition, there is evidence from this analysis that suggests the supply of park visits in inelastic, as entrance fee changes in seasons where the fee is below the market-clearing level do not lead to significant changes in visitation.

While the main results of the empirical analysis show that national park visitation responds adversely to increases in entrance fees, the findings from the supplemental results provide strong evidence that the effect of entrance fees on visitation is highly park-specific as well as season-specific. As such, the media may need to take more care when making generalized claims that rising entrance fees are leading to reduced visitation to U.S. national parks.

To complement and improve upon the analysis presented in this thesis, there are many avenues that can be taken for further research. Data on individual-level characteristics of park visits would undoubtedly be an improvement over using aggregate park-level visitation data. Using individual-level data would provide more information about the determining factors that influence individuals' decisions to recreate at national parks. Additionally, gathering data that is representative of park supply (e.g. information

on park capacity, input costs, etc.) would improve model specification and inform the researcher about how factors that influence the supply of visits impact attendance rates.

Currently, the Federal Lands Recreation Enhancement Act is set to expire in 2014; however, if it is extended beyond 2014 or replaced by a new and different piece of federal fee legislation, there will continue to be implications for park fee policy. Because the federal government runs the national parks, the daily operation of the parks will continuously be affected by political decision-making. The current sequestration, for example, has already impacted the daily operations of Yellowstone National Park (Rein 2013). Thus, it would be prudent for future research on national park visitation to keep close tabs on how government legislation impacts the operation of the parks Wallace Stegner referred to as "America's best idea."[27]

[27] 1983 quote from American historian and novelist Wallace Stegner. Quote retrieved from NPS History E-Library.

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