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An Exploration into the Economic Impact of the Wild and Scenic River Designation: A Quasi-Experimental Approach

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AN EXPLORATION INTO THE ECONOMIC IMPACT OF THE WILD AND SCENIC RIVER DESIGNAITON: A QUASI-EXPERIMENTAL APPROACH

By

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The main objective of the Wild and Scenic Rivers Act of 1968 is to preserve the free-flowing nature and outstanding remarkable values of our nation's rivers. There have been a total of 203 rivers designated in 38 states, yet despite the wide application, little is known about the impact these designations have on regional economic growth. Exploiting a unique panel dataset of 3,034 counties from 1970-2009, I construct a treatment and control group by employing the propensity score nearest-neighbor method. I apply a two-way fixed effects model to estimate the average treatment effect on the treated counties. The model is able to explain the variation in 5 year annualized per capita income growth relatively well and indicates that, on average, the Wild and Scenic River designation has a negative and statistically significant impact of 0.3 percentage points on county level per capita income growth. However, the results also indicate that these impacts may be offset by relatively small changes in the socioeconomic composition and presence of particular industries in a county.

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Chapter 1 Introduction

The rivers of our nation have played an enormous role in our history and prosperity, from the iconic image of George Washington crossing the Delaware River during the Revolutionary War to the Mississippi River's ability to provide transportation of commodities during the industrial revolution. Of our nation's largest 150 cities, 130 are located along rivers. It's difficult to measure the impacts of environmental issues such as global warming, deforestation and endangered species in our day-to-day lives (Palmer 2004); however, we don't need to look very far in order to find a river or waterway that is in need of help.

The debate concerning conservation is largely centered around these potential impacts on our daily lives. Many of us are unable to observe the results of conservation; however, we do notice the impact on our wallets. It remains a multifaceted issue due to the transformation occurring in the United States from extractive and manufacturing to more service based industries. The debate was originally viewed as "jobs vs. environment", but recent studies such as Lorah and Southwick (2003) have argued that the real debate should be between "jobs vs. jobs". This change in the debate is based on the theory that as more and more federally protected land is added to the system, the extractive industry might suffer negative effects, while the services industry grows. The "natural amenities" created by the protected area is also believed to attract a workforce and increase employment in the area. The Wild and Scenic River (WSR) designation is similar to the protection offered by such wilderness designations such as National Parks and National Monuments due to the fact that it provides one of the highest levels of protection and preservation a waterway and surrounding riparian area can receive. The main objective of this thesis is to examine the impact that the Wild and Scenic River designations have on county economic growth.

In the early 1900's the United States saw an increase in public works projects including the construction of hydroelectric power plants. By the 1940's seventy five percent of the western United States' electricity was generated by hydroelectric power. Despite the advantages of a clean, renewable source of energy, the ecological damage of such complexes was realized. For example, they decrease the amount of oxygen that gets dissolved, which degrades the water quality, they destroy fish and wildlife habitat, and block the passage of fish to spawning grounds. (Ligon, Dietrich and Trush 1995). Therefore, with the mission of preserving the free-flowing nature of our nation's river systems, the National Wild and Scenic Rivers Act (WSR) was signed into law on October 2, 1968 by President Lyndon B. Johnson. At the time, the Act was part of a much larger environmental movement in the U.S. which also included acts such as the Clean Air Act (1963), Wilderness Act (1964), Water Quality Act (1965), Air Quality Act (1967), Endangered Species Act (1973), among others. In its current amended state the WSR Act remains one of the most important pieces of conservation law.

There are currently 203 river segments protected by the WSR Act comprising approximately 12,600 miles in 38 states and the Commonwealth of Puerto Rico. These segments of river represent a diversity of ecosystems found throughout the U.S., from the artesian spring fed Fossil Creek in the desert of Arizona to the Rio de la Mina in the tropics of Puerto Rico, which provides habitat for parrots and shrimp. Another 3,400 additional segments have been identified as potential additions, in all 50 states including the District of Columbia, highlighting the importance for policymakers to have the ability to accurately assess the economic impacts of such designation in order to make informed decisions on future policy.

The two criteria for a river or segment of river to be designated include: a free flowing nature and one or more Outstanding Remarkable Value (ORV). These values include: scenery, recreation, geology, fish, wildlife, historic and cultural values among others. If the river is found eligible and suitable for inclusion in the national inventory of rivers, one or a combination of three designations are assigned; “Wild”, “Scenic” or “Recreational”. Each designation conveys the degree of development along the river. Past literature suggests that these types of designations may have a potential impact on local economic growth. Weiler and Seidl (2004) point out that, “A site designation conveys a unique set of signals to information-constrained potential visitors.”(p. 97). The WSR designation would theoretically convey these unique set of signals and particular river characteristics to a tourism sector that contributes nearly $730 billion annually to the U.S.’s economy (outdoorindustryfoundation.org 2006). This potential impact would be seen in a local economy that provides these goods and services.

The goods and services provided by local economies are traded in a market place and consequently assigned dollar values; the objective of this research is to measure the change in output of these goods and services that can be attributed to the WSR designation. One key limitation to this research is the inability to account for the value of the non-market services that these aquatic ecosystems provide such as; regulation of climate, water purification, and drought and flood mitigation. Some environmentalists argue that we are unable to assign dollar values to ecosystems due to the intrinsic value that they provide. Nevertheless, it is important to attempt such feats in order to structure policy that can find a balance between economic development and protecting fragile ecosystems (Daily, et al. 1997). There are multiple techniques that have been exploited in the past that attempt to estimate these values, such as: the avoided and replacement cost attributed to the services that the ecosystem provides (i.e. water purification) (Farber, Costanza and Wilson 2002). The value that the designation creates with regards to the additional amenities to local communities also has been estimated using the hedonic pricing and contingent valuation methods.

These amenities or "natural amenities" that the WSR designation provides makes a county a more attractive place to live, play and do business (Power 1995). Multiple studies suggest that these natural amenities are becoming increasingly important to economic development in regions such as the western U.S. (Lorah and Southwick 2003). As you can see, there are many benefits that society gains by preserving the natural condition of these rivers that are not captured in the calculation of a county's GDP, however, this research is limited to such calculation. Given the fact that rivers have been diverted, developed, and used in generating hydroelectric power, irrigating cropland, and providing drinking water, among other functions that have facilitated economic growth, placing restrictions on these types of construction projects could also have adverse effects on a local economy's GDP making it difficult to hypothesize the net effect of the designation.

In order to demonstrate this net impact of the WSR designation I employ a quasi-experimental framework which exploits a unique panel dataset consisting of the contiguous 48 states, 3,034 counties from 1970-2009. I utilize this large reservoir of counties to apply the propensity score matching method to construct a control group. My research specifies a neoclassical growth model using per capita income as the dependent variable that accounts for absolute convergence across the U.S. counties. I then apply a two-way linear model which allows me to make a causal inference regarding the average treatment effect on the treated counties regarding the WSR designation.

Chapter 2 Literature Review

I have been unable to find any research within the environmental economic literature that has directly measured the economic impact of the Wild and Scenic River (WSR) designation. The intent of this research is to fill this gap. In order to accomplish this, I begin by dividing the issue into three lines of research: First, I explore how the values of WSR's have been estimated in the past. Second, I highlight how similar designations, in the form of federally protected land, have impacted economic growth. Finally, I describe how the quasi-experimental design has been applied in order to isolate the designation effects. The values of WSR's have been estimated in the past by using either a stated preference or revealed preference method. One of the earlier studies was done in Colorado and utilized the stated preference method.

The Value of WSR's

In 1986, Colorado had its one and only segment of river added to the WSR inventory, the Cache la Poudre River consisting of 76 miles. However, in the year prior, the state had identified 11 rivers, as possible additions to the inventory. Walsh, Sanders, and Loomis (1985), published a study with the intent of providing river managers, elected officials, outfitters, guides, whitewater enthusiast and sportsman the ability to assign a dollar value to a rivers' free-flowing natural condition, which the designation provides. Their study was based on a sample of 214 Colorado residents conducted by a random mail survey. They received a 51% response rate with 70% of those respondents indicating they favored the WSR designation for all 11 rivers with the Cache la Poudre listed as the most favored. The respondents were then asked to rank the rivers in order of importance and state the maximum amount of money they were willing to pay in order to protect those rivers. The results indicated that residents were willing to pay around $95 per year in 1985 to protect all 11 rivers. After aggregating these benefits across households in Colorado and taking into consideration the cost of the designation, they estimated that the value of the 11 rivers was $599 million. However, the authors caution that the values are sensitive to the fact that over 60% of the value is associated with existence and bequest values and if those values are excluded, the marginal benefit is only slightly larger than the marginal cost of the 11 rivers.

Moore and Siderelis (2001) calculated the travel cost expenditures by visitors in order to derive a demand curve for the Farmington River in Connecticut. In 1994, fourteen miles of the Farmington River were designated “Recreational” as set forth by the WSR act of 1968. The authors conducted their survey in two stages; they intercepted individuals at the river and asked them if they would participate in a mail survey. They obtained only a slightly higher response rate than Walsh, Sanders, and Loomis (1985), at 57%, in which they asked questions ranging from the respondents’ perspective of the quality of the river to annual household income to the cost of an average trip over a 12 month period. They discovered that the most popular activities on the river were, fishing, tubing and kayaking/canoeing. The authors concluded, using direct expenditures, that the economic impact of the river was approximately $3.6 million annually and supported 63 jobs. These conclusions were based on annual visits of 77,400. This impact was considered large given the size of the affected area. However, this study overlooks the overall awareness of the designation itself. At the time of the survey only 47% of the respondents were even aware the designation existed, but after reading a brief description, the vast majority felt it was important or very important. This highlights the importance of making the public aware of the designation. Moore and Siderelis used the Farmington River as an example to measure the economic impact of a “private land river”, where most of the river runs through privately owned land. The authors then focused on the impact of the designation on a "public land river", the Chattooga River, where most of the protected flow runs through land already managed by the USDA Forest Service.

Fifty-eight miles of the Chattooga River in North Carolina were added to the WSR inventory in 1974 and was the first river to be included in the Southeastern United States. Unlike the Farmington River, which was primarily used for day trips, 58% of the recreationalists on the Chattooga River were on an overnight trip, which increases their overall expenditures. Based on the 2001 annual visitation of 42,998, it was concluded that the river had an overall economic impact of $2.608 million and supported 60 jobs in the area. Moore and Siderelis (2003) pointed out that the economic impact, calculated using an input-output method only looks at actual changes in sales revenue, jobs, and other direct expenditures and that it neglects what the river is actually worth to people. Therefore, they examine the economic benefit of the Chattooga River by calculating the travel cost per visitor, and concluded that the total economic benefit, or consumer surplus, was $5.79 million. The economic impact for the surrounding communities for both the Farmington and the Chattooga Rivers are both significant as Moore and Siderelis (2003) point out, however the two studies were conducted in the Eastern and Southeastern part of the United States where timber, mining, and agriculture industries play only a small role in the economy.

The Middle Fork of the Clearwater River in Idaho was one of the "instant" rivers designated by congress in the WSR act of 1968. Unlike the previous studies, Idaho's economy relies heavily on the extractive industries. With this in mind, Brooks and Michalson (1980) examined the effects of the designation on land values and the effects on the extractive industries. The authors refrained from discussing the impacts of recreation on the area despite making the blanket statement that those recreational activities bring a substantial amount of revenue to the area. In order to preserve the qualities set forth by the WSR designation, the U.S. government may utilize a legal instrument called scenic easements in order to use or control private property. The authors found that land sold between 1973 and 1978 located in the river corridor, and were encumbered with these scenic easements, decreased in value by 25-60%. The authors also utilized descriptive analysis and concluded that the restrictions set forth by the WSR designation had no effect on the timber harvest in the area and, in some cases, timber harvest actually increased. The agricultural and mining sectors were found to be insignificant to the local economies and were ultimately excluded from the study. Even though this part of Idaho relied very little on the agricultural industry, there are many other states which do. According to the USDA, close to ninety percent of the total land area in North Dakota is farmland.

The Economic Impact of Federally Protected Land

In 1993, North Dakota introduced two proposals to designate approximately 200,000 acres as Wilderness area, along with two WSR designations. The Department of Agricultural Economics at North Dakota State partnered with the School of Law at the University of North Dakota to examine the Wilderness and WSR designations and determine the potential effects they may have on grazing cattle (Saxowsky, et al. 1994). It was concluded that the WSR designation had the potential to have a more adverse impact on current grazing practices than would the Wilderness designation. They came to this conclusion for two reasons: First, the immediate environment surrounding the proposed WSR was a combination of federally owned land and private ownership. Second, the Wilderness Act includes an explicit exception for grazing while the WSR Act does not, which leaves the discretion to the managing agency to determine how it is controlled. The law review concluded that due to these factors the permittees and private landowners faced a more uncertain future under the WSR Act than the Wilderness Act as it concerns grazing practices. In the intermountain West of the United States where economies were originally based on these extractive industries, like grazing, mining and lumber, the federal government manages, on average, 47% of the land in each state.

Due to the dependency these local communities originally had on extractive industries, there exists a debate between environmental protection and the viability of these communities. This debate is based on the assumption that mining, logging and grazing generate earnings and jobs in the area (Lorah and Southwick 2003). In areas like the Pacific Northwest the logging industry is still very active. In 1994 the federal government reallocated 11 million acres of land from timber production to the protection of old-growth forest in what was called the Northwest Forest Plan (NWFP). Eichman, Hunt, Kerkvliet, and Plantinga (2010) concluded that the land protection resulted in a direct reduction of local employment and increased net migration. The authors criticized earlier studies which examined what they believed to be, unproductive lands, allowing for large lags between land designation and the study period and also for measuring the effects on areas which were too small to produce measurable effects. Using a simultaneous equation framework for employment growth rate and net migration, Eichman et al. concluded that the effects of the NWFP had statistically significant and robust negative effects on employment growth and was only slightly offset by a positive migration to the area. These findings challenge the paradox of the natural resource curse, which states that economies which are endowed and rely on resource industries experience lower levels of economic growth.

The natural resource curse is typically expressed on a national level, however, James and Aadland (2011) disaggregate to the county level. The authors explore evidence of a natural resource curse throughout the United States. With a dataset which consisted of over 3,000 counties across the entire United States between the years of 1980 and 1995. The authors found a negative relationship between the share of income derived from natural resources and the counties' growth rate. These finding could be due to the influx of professional companies in industries like finance and engineering which are thought to be attracted to areas with these added natural amenities.

Duffy-Deno (1998) points out two sides of the debate concerning the effects of federal wilderness on economic growth. Opponents argue that there is a direct loss of employment in the extractive industries followed by a ripple effect through the local economy. Proponents of federal protected wilderness argue that the area's amenity value is enhanced which leads to job creation and simultaneously attracts businesses and increases net migration to the area. Duffy-Deno (1998) utilizes evidence from survey data and previous studies to develop his theoretical model. He concluded that between the years 1980 and 1990, the percentage of federally protected land was a statistically insignificant contribution to population and employment densities in counties located in the intermountain Western United States. Despite the lack of statistical significance found by Duffy-Deno, there have been multiple studies performed since then which have found significant positive correlations.

In 2001, the Clinton administration attempted to restrict the construction of new roads in areas managed by the U.S. Forest Service. Due to the fact that roads are a necessary tool for many of the extractive industries, this attempt was met with heavy resistance. Lorah and Southwick (2003) used a Geographical Information System (GIS) to calculate the amount of federally protected land within 50 miles of the center of each county in 11 Western states. They used a combination of data from the Bureau of Economic Analysis (BEA) and U.S. Census Bureau to calculate growth rates of county level employment, total income, and per capita income. The authors argued that the natural amenities afforded by the added restrictions lead to a more diverse economy based on added tourism. These natural amenities also had the ability to attract small businesses and retirees to the area. Contrary to the authors' hypothesis that the federally protected land would lead to lower wages as employees transitioned from high paying mining and logging jobs to lower wage service jobs, they found that per capita income actually grew faster in the nonmetropolitan counties that contained the highest amount of protected land. These counties grew almost as fast as metropolitan counties which exhibited the highest growth rates.

Rasker (2006) advanced this line of study by not only breaking the 11 Western states into their respective classification of metropolitan or non-metropolitan, but also realized the importance of access to metro areas as centers of commerce. He used commercial airports, defined as having over 25,000 passengers a year, along with commuter sheds of metro areas in 2000 as a measure of access to these areas of commerce. Another distinction from the earlier work by Lorah and Southwick was the addition of different levels of land protection. Rasker found that land with the highest level of protection was positively correlated with growth of personal income for non-metro counties with or without access to an airport or adjacent to metro area through road transportation. However, protected land was not correlated with growth of personal income for metro counties. Pristine land, which is unprotected, was also found to be positively correlated with personal income growth for only non-metro counties without airports. In 1872, Yellowstone was established as the world's first National Park, providing the highest level of protection. Other countries have since realized the importance of these protected lands and followed the United States' example.

In 1967, the Swedish Environmental Protection Agency (SEPA) was established. The amount of land that it manages has grown from 25,000 to 4,000,000 hectares, which is equivalent to around 8% of Sweden's total land area (Lundgren 2009). This dramatic increase in protected land area was used to study the potential impact on economic growth, net migration and employment for 15 municipalities from 1985 to 2001. Using an empirical model set forth by Barro and Sala-i-Martin (2003), which accounts for convergence between regions, Lundgren concluded that environmental protection was favorable for overall economic growth in terms of per capita income and net migration. However, it was also concluded, that the timber industry was harmed by this increase in protected land, but this negative impact was found to be minimal when compared to the positive impacts (Lundgren 2009). An interesting aspect of environmental protection is not only the protection it affords but also the signal it sends to potentially less informed visitors.

The Quasi-Experimental Design

Market failure is a key concept in the field of environmental economics. It expresses the inability for policies to efficiently accomplish their goals as well as account for any unintended consequences. The quasi-experimental approach allows one to test for and observe any externalities that may be present. This is accomplished by comparing a group which has been treated to a group which has not been treated. The field of environmental economics provides many opportunities to apply experimental or quasi-experimental techniques and methods. If these techniques are embraced, society has the ability to increase overall welfare by implementing more efficient policies (Greenstone and Gayer 2009). These more efficient policies would be a product of exposing the unintended externalities and inefficiencies.

Between the years of 1980 and 2000 there were 8 National Monuments re-designated to National Parks. The designation of a National Park is one of the highest levels of environmental protection and aims to preserve historic, scenic or scientific qualities (Weiler and Seidl 2004). Weiler and Seidl (2004) used these re-designations as an opportunity to perform a quasi-experiment on signaling effects on visitation and the impact on local communities. The authors concluded that the site designation lead to a statistically significant increase of 11,642 visitors per year. Taking the Great Sand Dunes National Park designation as an example and using the input-output, it was estimated that the designation accounted for an additional 67 jobs and an estimated $2.4 million to the region.

The Endangered Species Act of 1973 is a hotly debated piece of legislation which was signed into law around the same time as the WSR Act. The law makes it illegal to "take" any fish or wildlife that is listed as endangered or threatened. The definition of "take" includes acts of hunting, trapping, capturing, etc. However, a 1995 Supreme Court ruling adopted the language used by the Department of Interior which includes habitat modification and degradation. The ability to apply a quasi-experimental design to the ESA has proved difficult due to the inability to construct a convincing control group.

Ferraro, McIntosh, and Ospina (2007) overcome this obstacle by using the Natural Heritage Methodology, NatureServe's system. This system assigns scores to each species ranging from extinct (0) to not endangered (5). The researchers then used this information to form the control group. They concluded that the average treatment effect on those species which were listed in the ESA had a positive impact to the change in endangerment scores when accompanied by a high degree of funding. However, if the listing had low funding it resulted in a negative impact. This only represents one example of using the quasi-experimental design in environmental economics. Due to the fact that this application has only recently been applied to this field there exist a limited number of examples. I intend to build upon this framework and application by examining the average treatment effect of the WSR designation. In order to obtain a better understanding of the possible impacts of the WSR designation, the next section provides a detailed overview of the legislation.

Chapter 3 WSR Act

On October 2, 1968, under the recommendation of the Outdoor Recreation Resources Review Commission, Lyndon B. Johnson signed The Wild and Scenic River Act into law and soon become one of the most influential pieces of conservation legislation. A great deal of the language used in the legislature was taken from wildlife biologists Frank Craighead and twin brother and Missoula resident John Craighead. The purpose of the Act is stated in Section 1(b) which says:

It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.

The intent of this chapter is to present a detailed overview by providing specific sections of the WSR Act which describes the process a river goes through in order to achieve the designation, the specific classifications, and how these classifications might affect the way a river corridor is managed through activities and restrictions of water resource projects.

Designation Process

There are two potential means for which a study is initiated, either through Section 5(a) or Section 5(d) (1). Rivers covered in Section 5(a) have been identified by local residents, conservation groups, or possibly an individual congressional delegate that has a personal interest in a river. Section 5(d) (1) rivers have been identified through federal agencies, like the Bureau of Land Management (BLM), National Park Service (NPS) and others, through the agency planning processes. The process for which both of these studies are accomplished are similar, except that rivers which have been identified through Section 5(a) are given a dedicated study budget which sometimes allows for studies to have a longer duration and may also allow for additional technical products to be utilized, which may help in setting benchmarks that can later improve the protection of the river. Rivers identified through Section 5 (d) (1) must absorb the cost of the study through the agency's current budget (The Interagency Wild and Scenic Rivers Coordinating Council 2011).

The first step in the process, regardless of which avenue a study is initiated, is to assemble an interdisciplinary study team (IDT). This team consists of federal and/or contract personnel and is responsible for the study's findings concerning eligibility and suitability. The team is encouraged to seek input from local groups and engage the public in ways which makes certain there is the largest possible participation. In order to determine the eligibility of a river, a record and evaluation of the segment's resources is conducted. This is done in order to determine whether or not the river possess one or more outstandingly remarkable values (ORV). There are eight attributes that the IDT may use in order to better determine the eligibility of a river; they also help to maintain a degree of consistency between WSR's. This criteria as stated in Section 1(b) consists of scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values.

Scenic values may include land formations including, vegetation, color, and seasonal changes. Recreation includes any potential activities that may attract visitors throughout or beyond the region and may also provide a venue for national or regional competitions. Geology includes any geological features that are rare or unique. The IDT may also consider populations or habitat for certain species of fish or wildlife that may rely on a certain river's condition (The Interagency Wild and Scenic Rivers Coordinating Council 2011). These rivers and their immediate environments may also contain historical meaning for Native Americans or listed on the National Register of Historic Places that are associated with a certain individual or event. They also include a general category for "other values" that may include resources related to hydrology, paleontology, and botany.

These values must be determined to be rare, unique or have some regional or national significance. This determination is a professional judgment made by the IDT. It also must be concluded that the river is free-flowing; however this is normally established before the study process is initiated.

Once eligibility has been determined, the amount of human activity and development is used in order to classify each segment of river according to the definitions provided by the Act in Section 2(b):

Wild rivers areas- Those rivers or sections of rivers that are free of impoundment and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Scenic river areas- Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Recreational river areas- Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Some rivers may contain one or more classification; these classifications set the benchmark for the management plan. After a river has been given a classification and determined eligible it must still be found suitable for inclusion in the National Inventory.

Sections 4(a) and 5(c) provide these suitability measures that must be met. The study must address certain questions such as: are the ORV's important enough to preserve or are there alternative uses that may be more important? Can the designation properly preserve the free-flowing nature of the river and is it the best method to do so or is there an alternative method that may be better? Finally, is there enough local support by residents that can ensure the long-term management of the river?

Once eligibility, classification and suitability have been determined the IDT submits a formal WSR study report which is made available to any federal agencies and departments that may be affected for a 90-day review period. Following this period, the study including any comments is submitted to the President who then distributes the report to Congress and the study mandate is completed. However, the process is not complete until Congress acts on the river designation legislation and the bill is passed. This portion of the process may take some time as subcommittees are sometimes formed and testimony is heard. Section 4(a) gives particular priority to rivers that have the greatest threat of development that would result in an alteration of the suitability of a river as well as river corridors which contain a large portion of privately held land (The Interagency Wild and Scenic Rivers Coordinating Council 2011).

Section 2(a) (ii)-Designation by Request of the State Governor

The Primary means to add a segment of river to the National Inventory is through Congressional action, however, an alternative method is available. The Secretary of Interior may designate a segment of river by request of a State's Governor; this requires only administrative action on behalf of Congress, and is described in Section 2(a) (ii) of the WSR Act. This section of the Act is a result over concerns of the federal government management of rivers, resulting in some rivers in the past not being considered for the designation. Congress also realized that federal management is not always required; therefore, designating a river through Section 2(a) (ii) allows rivers to continue to be managed by state or local agencies.

There are several advantages in designating rivers this way compared to relying on congressional action; the process normally takes less time, it requires state and local commitment which is beneficial to the long-term management and it also allows rivers to be protected when there is significant concern over federal condemnation of the surrounding land. However, there are also disadvantages to this method. There may be confusion with regards to management and administration on the state and local level, and there may be no federal funds available for management, forcing local or state agencies to cover costs. In addition, these agencies are sometimes not able to afford professional river managers that are specifically trained in river-related fields.

The process by which a river is added to the inventory through Section 2(a) (ii) has three stages. First, the Governor of a State submits an application to the Secretary of Interior. Second, the National Parks Service (NPS) then evaluates whether or not the requirements have been met. Finally, an assessment of the environmental impacts is prepared. If all the requirements have been met and the NPS is satisfied with the environmental impact report it will recommend the segment of river for designation. The Federal Energy Regulatory Commission (FERC) and any other affected federal agencies are notified and after a 90 day comment period, the river is added to the national system.

Just as with congressionally designated rivers, the segments of river must meet 4 criteria: (1) it must already be protected by the state; (2) contain at least one ORV and be free-flowing;

(3) must be administered by the state except for land which is currently being managed by a federal agency; (4) there must be cooperation with local, state and federal agencies which insure long-term protection.

After a decade the Government Accountability Office (GOA) conducted a study on the WSR Act and found that Section 2(a) (ii) was not working the way they intended it to work (The Interagency Wild and Scenic Rivers Coordinating Council 2011). They found that some states believed it would be "too costly" for them to administer and manage the rivers. They also found that some river banks ran through federally managed land which would violate the provision that the rivers would be managed with no expense to the federal government, this was promptly remedied by adding clarifying language to the Act. There have only been 20 segments of river designated through Section 2(a) (ii) over the 44 year existence of the WSR Act.

Establishing the Boundaries for Wild and Scenic Rivers

Section 3(b) of the Act establishes a guide for determining the boundaries of a river's corridor which will be included in the protection. The administering agency has one year to establish these boundaries which can not exceed 320 miles per mile of designated river. These boundaries are measured from the river's ordinary high water mark. Section 10(a) describes the factors which should be considered when determining the management and therefore the boundaries of WSR's. It states that, "Each component of the national WSR shall be administered in such a way that will protect and enhance the values that caused it to be included in the WSR system". After the boundaries have been established they must be published in the Federal Register and do not become effective until after a 90 day period in which it is forwarded to the president of the senate and speaker of the house. While these boundaries are being established, a temporary boundary is specified in Section 4(d) which is defined as, "an area measured within a quarter mile from the ordinary high water mark". By including the language regarding the high water mark, in Section 3(b) and 4(d), it allows islands and any other land located in the bed of a river to not count towards the 320 mile limit (The Interagency Wild and Scenic Rivers Coordinating Council 2011). In response to concerns by private landowners regarding these boundaries, some agencies have considered a "bank-to-bank" boundary; however it's difficult for agencies to demonstrate their ability to properly protect the river and its immediate environment using this practice.

Activities on WSR's

Section 9 of the act is dedicated to mining and mineral leasing activities. It states that any river or segment of river designated as "wild" is unable to receive any new mining claims or mineral leases and any existing claims or leases may be subject to regulations. A river or segment of river which is designated as "Scenic" or "Recreational" is allowed to obtain new mining claims or mineral leases subject to regulations set forth by the Secretary of Interior or, in the case of national forest lands, the Secretary of Agriculture.

Section 13 of the act addresses any hunting or fishing activities on lands administered as part of the system and reiterates the fact that nothing in the Act will affect the jurisdiction or responsibilities of the States. Other activities enjoyed in the river corridors which are not explicitly referred to in the Act again, shall be administered in a way that follows Section 10(a) (The Interagency Wild and Scenic Rivers Coordinating Council 2011). This means that as long as an activity does not affect the values and free-flowing nature, which allowed it to obtain the WSR designation, the activity should be allowed. In the circumstance where lands are subject to both the Wilderness Act and the Wild and Scenic Rivers Act, Section 10(b) states that the more restrictive conditions should be applied.

Section 7-Water Resources Projects

Section 7 of the WSR Act is one of the most powerful pieces of the legislation; it guides federal agencies on how to protect the free-flowing condition and other values with respect to water resource projects. The section prohibits FERC from providing licenses for any construction of hydroelectric facilities on these rivers. It also prohibits any other federal agency to assist in the construction of any water resources project which may have adverse effects on the values of the designated river. It defines a water resource project as, "Any Dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the Federal Power Act (FPA), or other construction developments which would affect the free-flowing characteristics of a wild and scenic or study river."(p.913) Section 7 also establishes the protocol for handling projects located above, below, or on a stream tributary to a WSR. It states that FERC and other federal agencies may license or assist in projects as long as they do not invade or diminish the values of the segment of WSR. After a final application has been submitted for a license concerning a hydroelectric project, FERC should include a determination regarding Section 7 along with its traditional licensing process. The agency which is given responsibility for managing the river should also coordinate with any other potential agency which may be affected by the proposed project. Outlined in Section 404 of the Clean Water Act The Army Corp of Engineers (ACOE) is required to regulate the discharge of dredged or fill material into waters of the U.S. (The Interagency Wild and Scenic Rivers Coordinating Council 2011). A permit from the ACOE requires a Section 7 determination for any proposal on a designated or congressionally authorized study river.

Recently, an exemption was granted by the President and U.S. Congress, allowing for the construction of a bridge across the St. Croix River connecting Minnesota and Wisconsin. The National Park Service had originally concluded that they were unable to grant a permit due to the adverse effects on the scenic values of the river. Some believe that this sets a bad precedent with regards to protecting these rivers in the future.

There are several sources of potential economic impacts that are highlighted in the actual legislations itself. First, the definition of each classification, as defined in Section 2(b), as well as the criteria that a segment of river must meet in order to obtain the designation, provides important information. As Weiler and Seidl (2004) demonstrate, site designations provide this information to potential tourists which are seeking particular attributes in a river. Depending on the particular attribute of a river this could either help or hinder economic growth. Second, despite the explicit language in Section (9) prohibiting any segment of river designated as “wild” from receiving any new mining claims or mineral leases, the Act refrains from prohibiting other activities as long as its’ characteristics, which allowed it to receive the designation in the first place, not be compromised. Finally, any water resource project which would jeopardize the river’s free-flowing nature or other values is strictly prohibited by the Act. Now that the potential economic impacts of the WSR designation have been outlined, I will present the counties which have been affected as well as discuss other factors that I have included in my dataset in order to help explain local economic growth.

Chapter 4 Data

In order to estimate the net effect of the WSR designation with respect to local economic growth, my research will exploit a panel dataset of the lower 48 states. There are a total of 3,172 counties in the contiguous U.S.; however I was unable to use 138 due to missing data for various reasons, this left me with 3,034 counties. After structuring my data in order to employ the quasi-experimental design, I was left with 354 counties from 1970-2009. I arrange the data into 9 periods of 5-year growth. There are many benefits associated with using regional data within a country as opposed to comparing between countries. The main benefit is the high degree of homogeneity with respect to institutions, technology and labor mobility (Barro and Sala-i-Martin 2003). Another benefit of using regional data to explore economic growth is the unusually robust dataset it provides, as opposed to typical growth models which consist of no more than 100 observations.

An additional benefit of exploiting regional data as opposed to different countries is the ability to collect data from a select group of sources, which eliminates any measurement error that may occur when using many sources. All of the data comes from the U.S. Census Bureau and the Bureau of Economic Analysis (BEA). The data for the control variables were collected from the decennial population censuses for 1970, 1980, 1990, 2000, and 2010. These values were then linearly interpolated to fill in the gaps which created a balanced panel dataset.

Demographics

The control variables included have been constructed based on previous growth literature (Higgins, Levy, and Young, 2006; James and Aadland, 2011; Strobl, 2011; Rupasingha and Chilton, 2009). The age variables, young and old, represent the county's share of population ages 14 and younger as well as the share of population 65 and older, respectively. Bloom, Canning, and Malaney (2000) point out that these two demographics tend to consume more output than they produce. Therefore, I hypothesize that the young population will have an inverse relationship with per capita income growth. This theory is also based on the fact that child labor laws prohibit this demographic from working which generates income while at the same time adding to the population figures. The exception is that children ages 12 and under may work on family farms, however this is generally unpaid labor. I suspect the older population will only have a slight impact, if any, on per capita income growth due to the fact that this age group is normally retired and relies only on a fixed income.

The education variables, high school and college, represent the percent of the county's population at least 25 years old who have obtained either a high school diploma (or equivalent) or a 4-year college degree respectively. The high school variable also includes the population with some college education. My hypothesis is that both of these will be positively related to per capita income growth, with college having a larger impact. This is based on a number of studies which indicate that the level of education is a good measure of human capital which drives economic growth (Barro and Sala-i-Martin, 2003; James and Aadland, 2011; Higgins, Levy, and Young, 2006). The last demographic variable, nonwhite, represents the percent of the county's population who are not Caucasian. It includes African-American, Asian, American Indian, Eskimo and other races that aren't specified. When it comes to interpreting the results it allows for a more straight forward interpretation using the Caucasian population as the base group. Based on the results by Rupasingha and Chilton (2009), I hypothesize that the nonwhite coefficient will be negative, indicating that counties which have a higher percentage of minorities will grow at a slower rate.

The poverty variable was also taken from the U.S. Census Bureau, and represents the share of population which is below the poverty line. This information was available per decade and linearly interpolated for the missing values following the methods previously used. The definition for what constitutes the poverty line is updated each decade and is calculated using the Consumer Price Index for All Urban Consumers; for 2009 the weighted average threshold for one person was $10,956. I hypothesize that the percent of the county's population under the poverty line will have a negative impact on economic growth. Due to the fact that the convergence of poorer counties to rich counties is reflected in the initial natural logarithm of a particular county's per capita income, I suspect that the share of individuals in poverty will hinder economic growth.

Wild and Scenic Rivers

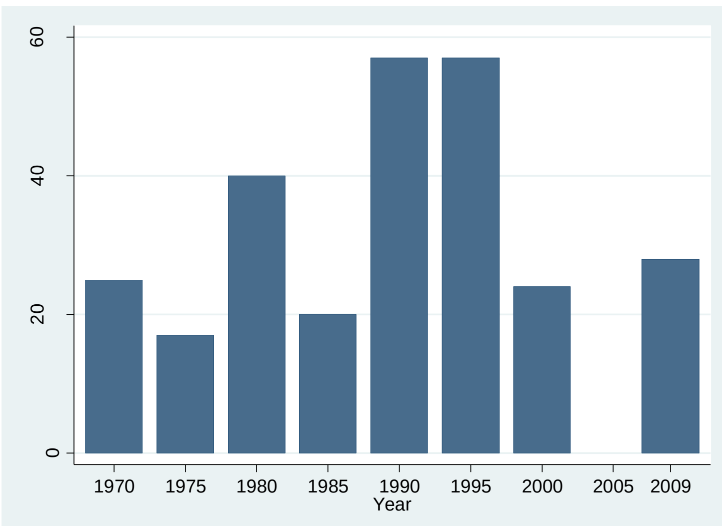
The indicator variable and variable of interest (WSR) was collected using Geographical Information System (GIS). It is a dummy variable indicating if there is a WSR designation within a county's border. The Shapefiles containing these segments of river were collected by a consortium of the USGS National Atlas and the Interagency Wild and Scenic River Coordinating Council[1]. I added a layer for U.S. counties to the WSR map and created a Python script which selected each of the 3,000+ counties individually and clipped the segments of river that fell entirely inside the county, calculated the miles of each river and then created a separate Shapefile for each county. I then appended these separate Shapefiles into one, and extracted the attributes table. This left me with an excel file which contained the county, the river name and the corresponding miles of WSR in each county. Each WSR was then cross referenced with the WSR legislation and the year that particular river was added to the inventory. In the rare case

[1] Available via http://www.rivers.gov/maps.html

that a river was designated in two or more years I used the earlier date. I then imported this data into Stata and collapsed and summed the miles of river by county and year. Finally, I merged this data with the income data collected from the BEA using a unique identifier, created by concatenating the FIPS code and year.

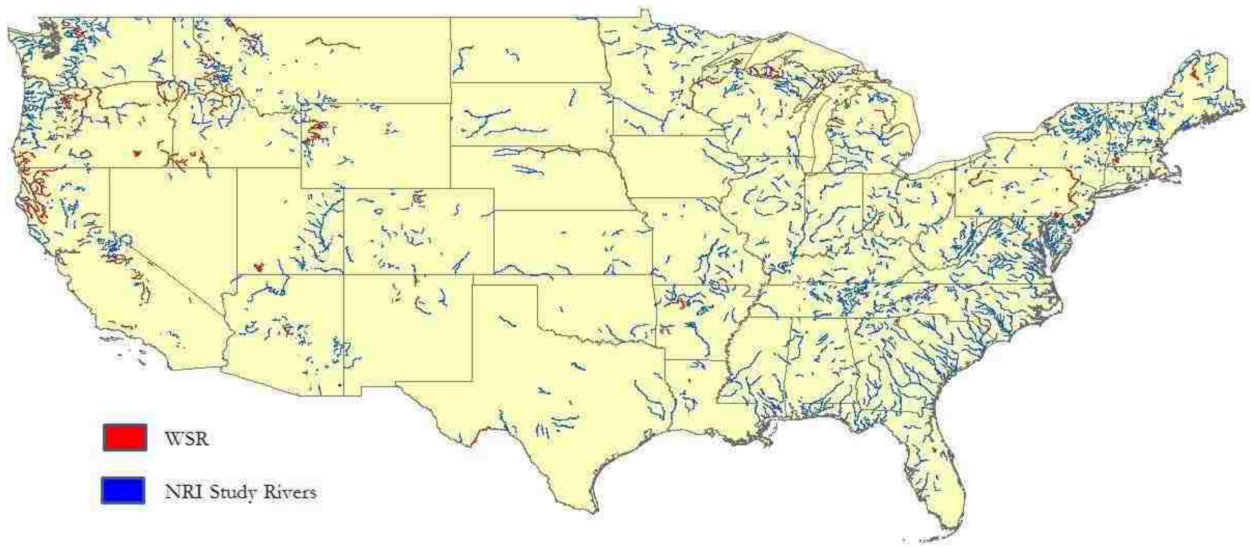
The number of counties that have been impacted by the WSR designation has ranged from approximately 20 to 60 counties over these nine-five year periods, as figure 4.1 illustrates. The only five year span without a designation occurs between 2000 and 2005, when the only additions to the inventory were the three rivers in Puerto Rico. Figure 4.2 reveals the importance and partial motivation for this research. It illustrates the areas where the WSR designation currently impacts, as well as the areas which could potentially be impacted, represented by The Nationwide Rivers Inventory (NRI). The NRI Study Rivers are segments of river that have been identified as free-flowing and possess one or more ORV, however, for one reason or another have not yet been awarded the WSR designation. The segments of WSR's span most of the United States with the majority located in the western region; CA, OR, WA and ID. These four states contain approximately 52 percent of the total miles of WSR in the contiguous U.S. This is not the case for the NRI Study Rivers, which are

Figure 4-1 Number of Counties Receiving a WSR designation



concentrated in the eastern region of the U.S. The map supports the importance of this research for policy makers, as there still remain potential additions to the WSR inventory in all 50 states.

Figure 4-2 WSR and NRI River Segments



Wilderness

The same process used to calculate the indicator variable for WSRs was used to determine whether or not a county contains a National Wilderness area within its border. A dummy variable was included to indicate the year a Wilderness area was designated. This is important in order to isolate the effect of the WSR designation. For example, in 2009 Owyhee County in Idaho received a number of Wilderness designations including the Big Jacks Creek and the Bruneau-Jarbidge Wildernesses and over 300 miles of WSR. By accounting for these other Wilderness designations, stronger inferences can be made about the effect of the WSR designation.

Propensity Score Nearest-Neighbor Matching

An issue which plagues the application of the quasi-experimental design in environmental economic research is the lack of randomness when it comes to the assignment of the "treatment". In a randomized experiment the assignment of the treatment is referred to as "strongly ignorable" (Rosenbaum and Rubin 1983). It is referred to in this manner due to the fact that each individual has the same probability of receiving the treatment. In other words, the assignment of the treatment is conditionally independent of any observed characteristics. This is important because if there are observable characteristics which helped determine whether or not an individual was treated, the results will suffer from "selection bias". Rosenbaum and Rubin (1983) developed a method, called the propensity score, which enables nonrandomized experiments the ability to make the same assumption of "strongly ignorable" treatment assignment given a vector of pre-treatment observables.

The propensity score method has been shown to perform the best when compared to randomized experiments (Michalopoulos, Bloom and Hill 2004). I therefore employ a straightforward version of the propensity score called, nearest-neighbor matching. In order to frame this natural experiment in a way which will closely resemble a true random experiment, the data needs to be structured so that it clearly distinguishes a pre- and post-treatment period. In order to achieve this, any county which received a WSR designation prior to 1975 and after 2005 was dropped from the dataset. This left 114 river designations in 177 counties and represents the treatment group.

The propensity score procedure begins by assigning random id's to each county. It is essential that the id's be random so that they don't contain any information about the county itself. Next, a logit model is estimated using the WSR dummy variable (1=WSR, 0= without WSR) as the dependent variable (y*).

$$y^* = \beta_o + \beta_1 initial + \beta_2\ young + \beta_3 old + \beta_4 hs + \beta_5 college + \beta_6 nonwhite + \beta_7 poverty + \beta_8 ag + \beta_9 min + \beta_{10} man + \beta_{11} service + \beta_{12} const + \beta_{13} gov + \beta_{14} prof + \beta_{15} land + \beta_{16} amenity + \beta_{17} pop + \varepsilon,\ y=1[wsr>0]$$

Equation 1

The conditional variables determine the propensity score, or predicted probability of receiving a WSR designation are based on each county's observed pre-treatment 1970 values[2].

The nearest-neighbor technique allows multiple variations, including the option to replace or not to replace each county when matching as well as match multiple control counties to a single treatment county. By allowing a control county to be used more than once, or replaced into the reservoir of potential control counties, a closer match can be found for each treatment county, therefore reducing the bias that is introduced by comparing substantially different counties. The same situation applies to matching a treated county to multiple control counties; you gain efficiency however you also increase the amount of bias that is introduced due to increased differences in observed characteristics. Again, this bias arises when the ratio of control counties per treated county increases, the ability to match on these characteristics becomes much more difficult. A benefit of having such a robust dataset, consisting of over 3,000 counties, is the large ratio of control counties to treatment counties. With a reservoir to treatment group ratio of greater than 15 ($2{,}799 \div 177$), the bias is substantially reduced using discriminate matching as shown by Rubin, 1979.

[2] The results of the logit model are found in Appendix A Table A1

Once each of the 3,034 counties receives a propensity score, counties that contain a WSR designation are matched with those that share similar observed characteristics but don't contain a WSR designation. Each control county is replaced back into the reservoir of possible matches in order to alleviate the selection bias. The control counties that go unmatched are dropped from the sample and I'm left with a treatment group of 177 and a control group of 143 for a total of 320 counties that are similar in all of the observed characteristics besides the WSR designation. Figure 4.3 illustrates the geographical locations for the treatment and control counties. As you would expect, the treated counties are clustered around the segments of river that have been designated, whereas the control counties are spread evenly across the U.S. There are several advantages of this distribution of control counties: First, you are able to make a more widespread inference regarding the impact of the designation instead of limiting the results to certain regions. Second, there is less of a chance for any spatial dependence between counties' growth rates which could bias the results.

Figure 4-3 Treatment and Control Counties

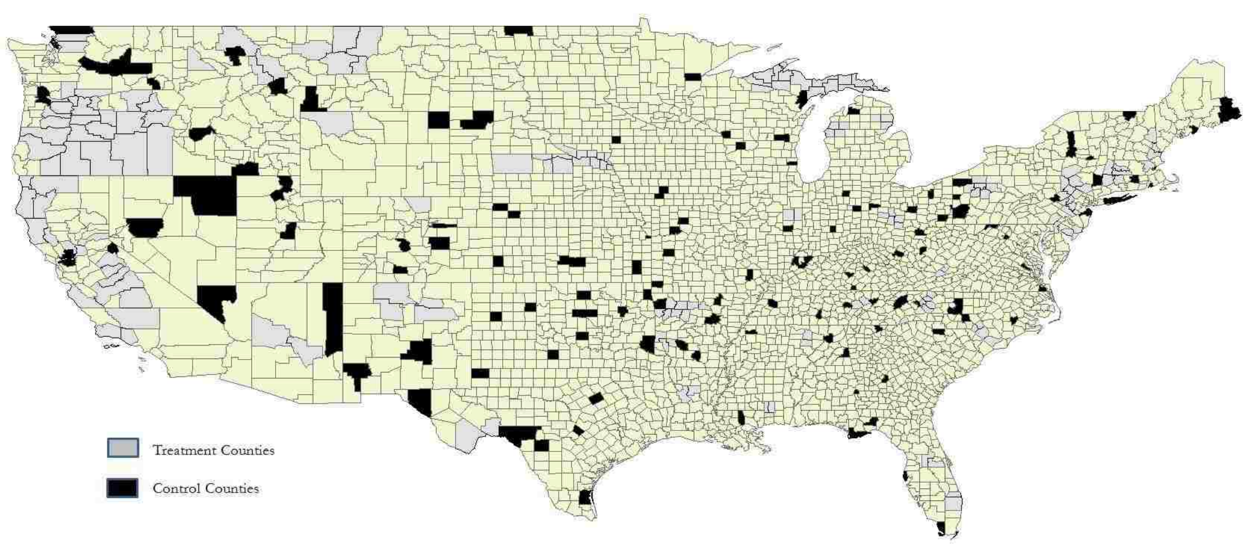
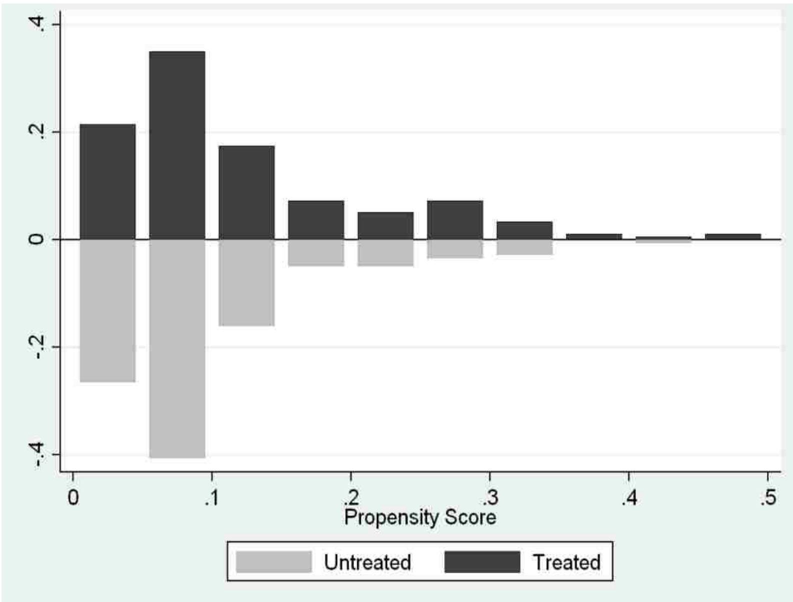


Figure 4.4 illustrates the similarities between these counties that have received a WSR designation (Treated) and those which have not (Untreated). The propensity score represents the probability of receiving the designation based on observable and measurable characteristics, the histogram conveys the density of counties which fall within each score. The treated and untreated counties share the same distribution, therefore, we have a degree of confidence that the two groups are similar.

Figure 4-4 Propensity Score Histogram by Treatment Status



Natural Amenities

The natural characteristics of each county are captured in the Natural Amenities Scale which was developed by the U.S. Department of Agriculture in 1999. This scale was designed with the objective to examine the impact of natural amenities on the growth of population in rural areas (McGranahan 1999). This scale uses a ranking system from 1(low) to 7(high), and assigns each county a rank depending on its deviation from the mean. The scale includes a topography code depending on the land surface form ranging from plains to hills and mountains. It controls for urban influences by including a code for the proximity to metro areas as well as including the Rural-Urban Continuum code ("Beale codes") for each county. Finally, it controls for climate by including a 30 year average (1941-1970) for the temperature and hours of sunlight during the month of January and temperature and relative humidity during the month of July.

The land area variable was collected from the U.S. Census Bureau and is measured in square miles. This allows further comparisons of similar counties, and when added to the county's population, controls for the density of each county.

Industries

Earnings from seven industries are utilized in the propensity score procedure and analysis, all of which has been gathered from the BEA REIS program. These variables represent the share of total earnings derived from particular industries for each county. The analysis is performed on a county level and there are instances where the data is either not disclosed, not available, or simply below $50,000 and therefore not reported. In order to fill the gaps in the data I followed a process set forth by Headwaters Economics, a nonprofit research group located in Bozeman, MT, who has partnered with the Bureau of Land Management and the U.S. Forest Service to develop the EPS-HDT (Economic Profile System-Human Dimensions Toolkit) software. This process consisted of two-stages; first, the states share of total earnings derived from each industry was calculated and averaged over the time frame. Second, the missing values were calculated by taking the average share of earnings for a particular industry multiplied by the total states earnings for that particular year. A second issue with the data is the change in classifications from SIC to NAICS in 2000. This is partially addressed by the use of time fixed effects, which will account for any changes in measurement that are common across counties.

The Agriculture variable includes agricultural services, forestry and fishing. As evidenced in Table 4-2, the counties in the sample rely very little on this industry. The maximum share of earnings derived from agricultural industries is in Del Norte County in

California at about 11%. Del Norte County contains the Klamath and Smith WSR's and is also home to a commercial fishing port.

The Mining variable includes mining activities associated with metal and coal mining as well as oil and gas extraction. Shoshone County in northern Idaho derived over 50% of its earnings from this industry in 1985. Shoshone County is commonly referred to as the "Silver Valley" due to its abundance of silver, lead and zinc. This county is also home to over 60 miles of the Saint Joe WSR which was designated in 1978.

The Government variable includes all earnings derived from federal, military, state and local employment. Chouteau County in Montana had the highest percent of earnings derived from this sector with over 65% in 1985. The county also contains approximately 80 miles of the Missouri WSR which was designated in 1976.

The Services variable might include the widest range of sectors; it includes hotels and other lodging, automotive repair, health services, educational services and museums. Mariposa County in California contains portions of Yosemite National Park and the Merced WSR and in 2009 had over 65% of its earnings derived from the services sector.

The Construction variable includes earnings derived from general building, heavy construction and special trade contractors. Interestingly the county which has experienced the highest level of earnings derived from this industry is Skamania County in Washington, which is home to Mount St. Helens. On May 18, 1980 Mount St. Helens erupted which resulted in widespread destruction from not only the volcanic eruption but also from the earthquake it triggered. Not surprisingly, between 1975 and 1980 the share of earnings derived from the construction industry went from just under 10% to over 55%. Skamania County is also home to the White Salmon WSR which was designated in 1986.

The Professional industries include earnings from finance, insurance and real estate. Hartford County in Connecticut, home of the Farmington WSR had the highest percentage of earnings from this industry at over 20% in 2005. The Manufacturing variable includes durable and nondurable goods ranging from stone, clay and glass products to printing and publishing. Union County in Ohio is home to the Big and Little Darby Creek WSR and some large manufacturing plants including Honda and Goodyear, among others. In 1990, it derived over 70% of its earnings from this industry.

Table 4-1 Descriptive Statistics for the Treatment and Control Groups

Variable	Description	Treatment Counties					Control Counties				
		N	Mean	S.d.	Min	Max	N	Mean	S.d.	Min	Max
Growth	5 year annual growth rate of real per capita income (2009 Dollars)	1416	0.014	0.020	-0.167	0.184	1144	0.015	0.018	-0.108	0.113
Initial	Natural log of per capita income	1416	10.160	0.287	8.976	11.100	1144	10.170	0.260	9.322	11.000
Agriculture	Share of per capita income derived from the Agriculture sector	1415	0.013	0.015	0.000	0.109	1144	0.011	0.017	0.000	0.189
Mining	Share of per capita income derived from the Mining sector	1413	0.014	0.038	0.000	0.511	1144	0.027	0.072	0.000	0.724
Government	Share of per capita income derived from the Government sector	1416	0.238	0.107	0.038	0.655	1144	0.219	0.114	0.034	0.778
Service	Share of per capita income derived from the Service sector	1416	0.205	0.097	0.019	0.660	1144	0.199	0.101	0.022	0.909
Construction	Share of per capita income derived from the Construction sector	1416	0.064	0.034	0.001	0.559	1144	0.068	0.038	0.000	0.605
Professional	Share of per capita income derived from the Professional sector	1416	0.039	0.025	0.000	0.215	1144	0.040	0.027	0.000	0.288
Manufacturing	Share of per capita income derived from the Manufacturing sector	1416	0.180	0.140	0.000	0.704	1144	0.199	0.154	0.000	0.789
Young	Percent of population ages 14 and under	1416	0.214	0.034	0.089	0.337	1144	0.221	0.037	0.125	0.405
Old	Percent of population ages 65 and older	1416	0.146	0.041	0.066	0.307	1144	0.138	0.039	0.040	0.288
Hs	Percent of population age 25 and older with a High School Degree (or equivalent)	1416	0.570	0.091	0.168	0.786	1144	0.562	0.097	0.172	0.772
College	Percent of population age 25 and older with a college degree (4yr)	1416	0.159	0.077	0.032	0.484	1144	0.158	0.073	0.038	0.433
Nonwhite	Percent of population non-Caucasian	1416	0.113	0.123	0.001	0.706	1144	0.121	0.125	0.002	0.805
Poverty	Percent of population below the poverty line	1416	0.149	0.063	0.025	0.503	1144	0.146	0.067	0.045	0.476
Pop	Total Population of County	1416	118632	221777	493	1499316	1144	112202	228837	414	1893719
Land	Land Area (Square Miles)	1416	1703	1971	180	10203	1144	1320	2071	10	17179
WSR	Containing a Wild/Scenic/Recreational or combination (0,1)	1416	0.629	0.483	0.000	1.000	1144	0.000	0.000	0.000	0.000
WSR_Period1	Containing a Wild/Scenic/Recreational or combination for 5 years or less (0,1)	1416	0.125	0.331	0.000	1.000	1144	0.000	0.000	0.000	0.000
WSR_Period2	Containing a Wild/Scenic/Recreational or combination between 6-15 years (0,1)	1416	0.227	0.419	0.000	1.000	1144	0.000	0.000	0.000	0.000
WSR_Period3	Containing a Wild/Scenic/Recreational or combination for 16 years or more years (0,1)	1416	0.254	0.435	0.000	1.000	1144	0.000	0.000	0.000	0.000
Wild	Containing a river designated Wild Only (0,1)	1416	0.027	0.162	0.000	1.000	1144	0.000	0.000	0.000	0.000
Scenic	Containing a river designated Scenic Only (0,1)	1416	0.100	0.300	0.000	1.000	1144	0.000	0.000	0.000	0.000
Recreational	Containing a river designated Recreational Only (0,1)	1416	0.064	0.245	0.000	1.000	1144	0.000	0.000	0.000	0.000

There are 177 counties that contain a segment of at least one river with the Wild and Scenic designation. From Table 4.1, we see that after matching these counties with a control county, the control variables are quite similar in nature. A two-sample *t*-test for each variable was conducted, as well as a two-group Hotelling test on all the variables. In each case I failed to reject the null hypothesis that the means were equal between the two groups[3]. A glaring outlier in the summary statistics is the maximum population of one county, which is over 1 million; this county is Middlesex County in Massachusetts, the most populous county in New England. The Sudbury, Assabet, and Concord rivers are located just west of Boston and provide recreational opportunities for millions of residents in the area. The Old North Bridge is located on the Concord River and is the location of the 1775 revolutionary *Shot Heard 'Round the World.*

Dependent Variable- Per Capita Income Growth

County level per capita personal income was collected from the BEA Regional Economic Information System (REIS) which is available from 1969 to 2009. The BEA defines per capita personal income as income received from all sources including personal interest income, rental income, personal dividend income and personal transfer receipts. This figure is then divided by the county's population which is taken from the U.S. Census Bureau's annual midyear estimates. I convert these nominal figures to constant 2009 dollars using the U.S. consumer price index. I then calculated the average 5 year growth rates between 1970 and 2009. The formula for average annual growth rate is:

[3] Refer to Appendix A Table A2 for the results of these tests

$$Average\ Annual\ Growth\ Rate = (\ln(Per\ Capita\ Income_t) - \ln(Per\ Capita\ Income_{t-1})) * 1/T$$

Equation 2

Table 4.2, the average 5 year growth rate of per capita income for counties without a WSR is 1.5%, where the average 5 year growth rate of per capita income for counties with a WSR is 1.4%. However, the high standard deviations relative to the means indicates that these growth rates vary considerably over time and between counties within the U.S.

This robust dataset allows me to apply the neoclassical growth model to U.S. counties in order to help explain their long-run economic growth. This model is also helpful in analyzing short-run or transitional dynamics that public policy may have on county's steady states (Barro and Sala-i-Martin 2003).

Chapter 5 Model

The foundation of the growth model is based on standard neoclassical theory which accounts for cross-county income convergence (Barro and Sala-i-Martin, 2003; Higgins, Levy, and Young, 2006; Strobl, 2011; James and Aadland, 2011). I use this design to perform a quasi-experiment by applying a two-level linear model transformation, which accounts for time period and county fixed effects. This procedure allows for estimation of the average treatment effect on the treated (ATT) of the WSR designation on the growth of county level per capita income.

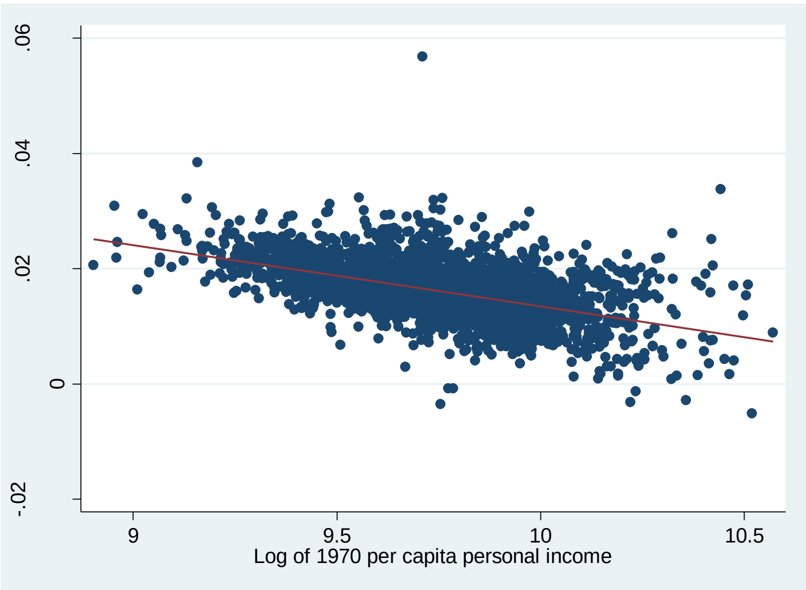
Neoclassical Model

The growth model is derived from a production function that consists of three inputs; capital (K), labor (L) and the level of technology (T). In order for a production function to be considered *neoclassical* three conditions must be met. First, the function must display constant returns to scale, that is to say it must be homogenous of degree one in K and L. Second, capital and labor must also exhibit positive and diminishing marginal products. Third, the Inada conditions must be met. The Inada conditions state that the marginal products of either capital or labor approaches infinity as capital (labor) goes to 0 and similarly must approach 0 as capital (labor) goes to infinity (Barro and Sala-i-Martin 2003).

Some studies have shown that wilderness designations lead to a negative shock to physical capital (Eichman, et al. 2010). This is due to the protection it creates for natural resources which eliminates factors of production. However, James and Aadland (2011) discover that economies that rely heavily on these resource based industries show a slower growth rate compared to those that do not. This slower growth rate could be attributed to a lack of trade liberation on a national level or an underinvestment of human capital on a regional level. The designation could also provide a positive shock to human capital due to the increased inflow of professional workers that the natural amenities attract. One of the main objectives of the WSR designation, as stated in the legislation, is preservation, (i.e. prohibit the construction of hydroelectric dams and development along the banks of WSR Rivers), making it difficult to hypothesize what the net effect will be on the growth of per capita income.

There are multiple benefits of studying the growth rates of regions within a country. Differences in technology, preferences, and institutions are likely to be smaller than across countries. Due to this degree of homogeneity, I suspect these counties have similar steady states and therefore will exhibit absolute convergence. Absolute convergence is simply the neoclassical idea that poorer counties will "catch up" or grow at a faster rate than rich counties. The negative relationship between a county's initial level of per capita income and its' growth rate is seen in figure 5.1. This graph shows the growth rate of per capita income from 1970-2009 in relation to the county's initial per capita income in 1970.

Figure 5-1 Absolute convergence of personal income across U.S. Counties: 1970-2009



The assumption of a closed economy, which is a condition of the standard neoclassical model, is likely to be violated when examining economies within a country. Barriers which exist between countries such as legal, cultural, linguistic and institutional tend to be far smaller across regions

(Barro and Sala-i-Martin 2003). However, this assumption isn't entirely violated due to the fraction of capital stock which is immobile. The higher degree of mobility will only increase the rate of convergence as pointed out by Higgins, Levy, and Young (2006) and Evans (1997).

Using a Cobb-Douglas production function as specified by Higgins, Levy, and Young (2006) and Barro and Sala-i-Martin (2003), the neoclassical growth model implies, $\hat{y}(t) = \hat{y}(0)e^{-\beta t} + \hat{y}^* (1 - e^{-\beta t})$, which shows that the log of per capita income (ŷ) in time t, is a function of its initial value of income $\hat{y}(0)$ and its steady state $\hat{y}^*$. In this model, β represents a function of various parameters which determines the rate at which the economy reaches its steady state. The average annual growth rate of per capita income between time 0 and *T* can then be represented by:

$$\frac{1}{T}[\, y(T) - y(0)] = z + \frac{\left(1 - e^{-\beta t}\right)}{T}[\hat{y}^* - \hat{y}(0)]$$

Equation 3

which includes a term for exogenous technological progress given by z. By replacing these expressions with representative variables the empirical specification takes the following two-level linear form:

$$GROWTH_{\ i,t-1\rightarrow t} = \alpha + \beta_1\,(y_{i,t-1}) + \beta_2 WSR_{it} + \gamma X_{it} + \pi_t + \mu_i + \epsilon_{it}$$

Equation 4

where the economic growth rate in county i from t-1 to t is represented by GROWTH = (1/T)[$\hat{y}(T) - \hat{y}(0)$]. The constant term, α, represents exogenous technological progress, the coefficient $\beta_1 = \frac{(1-e^{-\beta t})}{T}$ determines the speed of adjustment to the steady state, WSR is an incidence dummy accounting for whether or not a designation has occurred in county *i* in time *t*,

X is a set of socio-economic control variables which determines the steady state, π and μ are the unobserved time and county-specific effect respectively and ϵ is an idiosyncratic error term.

Quasi-Experimental Approach

Random experiments are typically used in the psychology, medical, and biological fields and they allow the researchers to control the environment and apply a true random treatment to their subjects. Due to the fact that economists are rarely able to perform these types of experiments, we rely on quasi-experiments, or natural experiments, which is a situation where a policy or event occurs that changes the way an individual functions. Although the field of environmental economics lends many opportunities to apply such techniques, there are aspects which threaten the validity of the inference (Greenstone and Gayer 2009).

The difficulty of drawing causal inference arises in the quasi-experimental framework due to the fact that we are unable to view the counterfactual. Ideally, we would want to measure the same group after the event has occurred with and without the treatment.

$$T = \{E[Y_{i,1} | D_i = 1] - E[Y_{i,0} | D_i = 1]\}$$

Equation 5

Equation 5 represents the average treatment effect on the treated (T), where the first expression on the right-hand side is the growth rate of the i^{th} county ($Y_{i, 1}$), if it received the treatment and ($Y_{i, 0}$) otherwise. The Variable D_i=1 indicates that the county was assigned to the treatment group and 0 otherwise. Because we are unable to view a county in two different states in the same time period we must construct a control group which resembles the treatment group. The procedure for this was detailed in the data chapter of this paper under the propensity score nearest-neighbor section. Now that a control group has been established the average treatment effect can be represented by:

$$T = \{E[Y_{i,1}|D_i = 1] - E[Y_{i,0}|D_i = 1]\} + \{E[Y_{i,0}|D_i = 1] - E[Y_{i,0}|C_i = 1]\}$$

Equation 6

The first term on the right-hand side represents the average treatment effect described in equation 5, which we are unable to observe. The second term is the difference between the unobserved outcome of a county assigned to the treatment group but not receiving the treatment and the outcome of a control county (C_i=1) which also goes untreated. This term represents the potential selection bias that may be present (Greenstone and Gayer 2009). If the control group is substantially different than the treatment group the larger this term becomes and the more bias is introduced to our coefficients. However, by utilizing the propensity score method to limit the observed differences I hope to make the assumption of a "strongly ignorable treatment assignment". Recall that after matching treatment counties with control counties the two groups are statistically similar on observables and this assumption is reasonable.

Once we have identified the treatment and control groups the calculation for identifying the effect takes the difference between the treatment and control groups before and after the event, ($Y_{2,T}$-$Y_{2,C}$)-($Y_{1,T}$-$Y_{1,C}$). The subscripts 1 and 2 refer to the time periods before and after, respectively, and T and C represent the treatment and control groups. This leaves you with the "difference-in-difference" between the two groups, or average treatment effect, because you are measuring the effect of the "treatment" on the average outcome of Y (Wooldridge 2006). Due to the panel nature of the data, including county and time period specific effects, allows for the estimation of the average treatment effect (ATE) of the WSR designation on per capita income growth.

Fixed vs. Random Effects

There are two methods for handling the county effects and it relies on whether or not you believe these unobserved effects are correlated or uncorrelated with each of the explanatory variables in all time periods (Wooldridge 2006). If there is a correlation between the counties that receive the WSR designation and the explanatory variables we should treat that group of counties with fixed effects which eliminates any bias due to these unobserved effects. However, if the control variables included in the model do a good job of capturing the characteristics of each county, any heterogeneity that is not captured may only induce serial correlation with the error term and not cause any correlation between the error term and the explanatory variables and therefore we should treat the counties as random effects. (Wooldridge 2006).

If the counties are treated with fixed effects we eliminate any characteristics that are unobservable or immeasurable in each county and the estimation results produce the *within* estimator. The within estimator uses the time variation in the growth of per capita income as well as the time variation in each control variable within each county to calculate the average treatment effect. Each county serves as their own control group, eliminating any bias that may be present due to omitted covariates. This is accomplished by averaging the equation for a specific county *i* for each time period:

$$\overline{GROWTH}_{i} = \alpha + \beta_1 (\bar{y}_i) + \beta_2 \overline{WSR}_i + \gamma \bar{X}_i + \pi_t + \mu_i + \bar{\epsilon}_i$$

Equation 7

where $\overline{GROWTH}_{\iota} = T^{-1} \sum_{t=1}^{T} GROWTH_{it}$ and is repeated for each county-level variable. When equation (7) is subtracted from equation (4), the fixed effects, or unobserved effects, of each county, μ_i, are eliminated and you are left with time-demeaned variables:

$$(GROWTH_{it} - \overline{GROWTH}_{i})$$

$$= \alpha + \beta_1 (y_{it-1} - \bar{y}_i) + \beta_2(WSR_{it} - \overline{WSR}_i) + \gamma(X_{it} - \bar{X}_i) + (\varepsilon_{it} - \bar{\epsilon}_i)$$

Equation 8

Since we are comparing very similar counties based on observed characteristics, determined by the propensity score nearest-neighbor matching, one could make the argument to treat the counties as a random sample of the larger population. If we assume that the unobserved effects are uncorrelated with each explanatory variable in all the time periods, and we use the transformation to eliminate μ_i it results in inefficient estimators. The composite error (v_{it}) of the random effects model is the product of the unobserved effect (a_i) and the error term (ε_{it}), and due to the fact that a_i is present in each time period the composite error is serially correlated across time. In order to eliminate this serial correlation we need to transform equation (2) just as we did for fixed effects. Following Wooldridge 2006, we define:

$$\lambda = 1 - [\sigma_\varepsilon^2/(\sigma_\varepsilon^2 + T\sigma_a^2)]^{1/2}$$

Equation 9

where σ_a^2 = Var (a_{it}), σ_ε^2 = Var (ε_{it}) ,and T represents the number of time periods, the product; λ produces a fraction which we use in the transformation giving us the following equation:

$$(GROWTH_{it} - \lambda\overline{GROWTH}_{i})$$

$$= \alpha(1-\lambda) + \beta_1 (y_{it-1} - \lambda\bar{y}_i) + \beta_2(WSR_{it} - \lambda\overline{WSR}_i) + \gamma(X_{it} - \lambda\bar{X}_i)$$

$$+ (v_{it} - \lambda\bar{v}_i)$$

Equation 10

Equation (10) is using quasi-demeaned data on the variables. It's referred to as quasi-demeaned because it only subtracts a fraction of the time averages, which in turn allows you to include variables that don’t vary over time (i.e. the land area of each county). Hausman’s specification test is performed in order to determine whether or not there is a statistically significant difference between the two models coefficients. If the difference is statistically significant the fixed-effect model is considered more appropriate.

Chapter 6 Results

Table 6.1 summarizes the estimation results for the sample of 177 treated counties and 143 matched control counties. This control group was constructed using the propensity score nearest-neighbor method with replacement. However, the results prove to be robust using up to 5 control counties and the no replace option[4]. The main focus of this study is to determine the impact of the WSR designation on per capita income growth. This is accomplished three ways: First, by examining the overall effect of the three designations (Wild, Scenic and Recreational); second, analyzing whether the designations have a short, medium or long-term effect and third, by separating the three designations in order to establish if there are effects attributed to particular designations.

The Hausman test produces a fairly large statistic (λ^2=800.29; p<.0001) therefore, rejecting the null hypothesis that the random effect models produces consistent estimators. Thus, only the fixed effects model will be employed in the forthcoming tables. Columns 1, 2 and 3 report the regression results of only including the designation variables in estimating the growth of per capita income. This provides a sensitivity test of omitted variable bias. It is evident that the coefficients remain relatively consistent between columns 1, 2 and 3 and the full set of control variables, in columns 4 and 5. This provides additional support that even if there were omitted variables in my model the results remain relatively unaffected. The OLS regression in column 5 of table 6.1 exhibits a relatively low degree of multicollinearity (mean VIF=2.31), which I expected due to such a robust dataset. Because there is a relatively large cross sectional dimension (N=320) compared to the time dimension (T=9) I am unable to perform the Breusch-Pagan test for heteroskedasticity. However, a similar test for cross-sectional dependence of the

[4] The OLS regression results using these methods can be seen in Appendix A Table A3.

fixed effects model using the methods set forth by Pesaran (2004) can be performed. The results of the test reject the null hypothesis of cross section independence, which indicates that heteroskedasticity may be present. I therefore utilize robust standard errors in order to correct any bias. The overall significance of the OLS regression on county level per capita income growth is statistically significant ($F=41.92$; $p<.0001$) (Table 6.1 Column 5) and is able to fairly accurately estimate the variation ($R^2 \approx 0.442$).

Table 6-1. County-Level Growth Regressions (WSR with Control Group)

Variables	(1)	(2)	(3)	(4)	(5)
WSR	-0.003***	-0.001	-0.002*	-0.003**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$Agriculture_{t-1}$					0.057
					(0.052)
$Manufacturing_{t-1}$					0.021***
					(0.008)
$Mining_{t-1}$					0.017
					(0.019)
$Government_{t-1}$					0.023*
					(0.012)
$Service_{t-1}$					0.046***
					(0.018)
$Professional_{t-1}$					0.041
					(0.034)
$Construction_{t-1}$					0.007
					(0.016)
$Initial_{t-1}$				-0.136***	-0.125***
				(0.010)	(0.010)
$Young_{t-1}$				-0.225***	-0.224***
				(0.061)	(0.062)
Old_{t-1}				-0.034	-0.043
				(0.063)	(0.067)
HS_{t-1}				-0.006	-0.007
				(0.016)	(0.017)
$College_{t-1}$				0.155***	0.135***
				(0.028)	(0.028)
$Nonwhite_{t-1}$				-0.028*	-0.027
				(0.016)	(0.017)
$Poverty_{t-1}$				-0.219***	-0.207***
				(0.029)	(0.029)
Metro				0.001	0.001
				(0.002)	(0.002)
Wilderness				-0.004*	-0.003*
				(0.002)	(0.002)
Year FE	no	yes	yes	yes	yes
County FE	no	no	yes	yes	yes
Constant	0.016***	-	-	-	-
	(0.000)				
Observations	2,560	2,560	2,560	2,560	2,558
R-squared	0.005	0.098	0.104	0.433	0.442
Number of counties	320	320	320	320	320
F statistic	13.74***	39.58***	49.40***	53.39***	41.92***

note: estimated with OLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Wild and Scenic River Designation

The indicator variable for the WSR designation captures the estimated combined average treatment effect of all three possible designations on the treated counties. This variable does not control for the amount of time a designation has been in place, it is strictly looking at the net effect after designation. The results reported in table 6.1, column 5; indicate that the average treatment effect of the WSR designation on the treated counties is negative and statistically significant ($\beta \approx -0.003$; $p \approx 0.039$). It indicates that, holding all else constant, the WSR designation leads to a 0.3 percentage point reduction in annual growth of per capita income. The magnitude of this impact is better understood when comparing the change in a county's standards of living. The average annual growth rate for the control group is approximately 1.5%, therefore if a county started with a per capita income of $25,000, the average per capita income in that county after one year would be $25,375. On the other hand if that county contains a WSR designation, on average, the annual growth rate would be 1.2% leading to a per capita income of $25,300, only a $75 decrease in per capita income. This figure is actually less than the amount Colorado residents were willing to pay in 1980 in order to protect the 11 possible additions to the WSR inventory (Walsh, Sanders and Loomis 1985).

An important limitation with estimating growth of per capita income (income/population) is that you are unable to distinguish between which variable is more impacted. Lorah and Southwick (2003) show that individuals are attracted to areas which contain high levels of protected land (i.e. national parks, wilderness). Therefore if the population of a county is growing at a greater rate than income, the county would experience a slower growth of per capita income. However, it could work in the other direction as well, if the counties' population remains constant and income decreases, the coefficient will again be negative. With this limitation in mind, this study is not focused on net migration, but rather the growth and living standards of these counties; this is captured by the per capita income variable.

Wilderness

The coefficient on the indicator dummy variable for whether or not a county received a National Wilderness Area designation (Wilderness) is negative and statistically significant ($\beta \approx -0.003$; $p \approx 0.083$). It indicates that the National Wilderness Area designation leads to a 0.3 percentage point reduction in annual growth of per capita income, ceteris paribus. When transforming this impact on per capita income growth to standards of living, is it identical to the WSR designation at an annual decrease of $75 in the first year.

There are four main reasons why my results may contradict previous literature: First, my dependent variable is significantly different from Rasker (2006) and Lorah and Southwick (2003), both use long-term growth from 1970-2000 whereas I use annualized five year growth from 1970-2009. This allows me to pick up the designation effect, however it is also more susceptible to fluctuations in the business cycle. Second, my sample consists of counties from across the entire contiguous U.S. whereas Rasker (2006) and Lorah and Southwick (2003), use only the western 11 states. Only 36 percent of my counties are located in this region and the impact of federally protected land may vary across the U.S. Third, the main findings of Rasker (2006) are based on a two-sided Pearson correlation. When my OLS results are compared to Rasker (2006) OLS results, our findings are not vary far apart. Rasker's results are driven by those counties which are classified as "Industrial" which do not include any protected land. He also finds that the highest level of protected land, as well as the combined effect of all protected land, was statistically insignificant to personal income growth. Finally, I am comparing counties which are similar in all observable characteristics, including amenity values. The impact of federally protected land may vary for counties which possess certain characteristics that are associated with WSR's.

Convergence

The convergence variable (Initial) is negative and statistically significant at a 1 percent level, with coefficients ranging from 12.5 to 13.6 percent. Compared to the pooled OLS regression (not shown), which does not contain fixed effects, the coefficient on the convergence variable was a significantly smaller negative number. This difference is due to the considerable bias that is introduced in the pooled OLS regression caused by the unobserved characteristics of each county that are constant over time as well as the characteristics of each time period that are constant between counties (Rupasingha and Chilton 2009). The negative sign reinforces the concept of absolute convergence between U.S. counties and validates my hypothesis. The neoclassical concept of absolute convergence, as covered earlier, states that U.S. counties will tend to converge to similar steady states. Therefore, counties which start off at a lower capital-labor ratio, due to previous negative shocks, "catch up" to those counties which start off with higher ratios (Barro and Sala-i-Martin 2003).

A convergence rate of 12.5 percent is relatively high; however it is in line with previous growth literature which uses county level data. Rupasingha and Chilton (2009) find for all U.S. counties between 1990 and 2000 a convergence rate of over 11 percent. Higgins, Levy, and Young (2006) also find overall convergence rates ranging between 5 to 11.5 percent for regions of the U.S between the years of 1970 and 2000. The highest rate of convergence was found when the authors separated metro and non-metro counties. Metro counties in the Western region, where the majority of the WSRs are found, had a convergence rate of close to 14 percent and non-metro counties had a convergence of approximately 8.5 percent. Labor mobility also plays a large role in how fast economies converge, Rappaport (2005) shows that convergence rates may range between 7.7 to 12.3 percent depending on whether there is zero or high-labor-mobility.

Demographics

Age

The estimated coefficient regarding the impact of the share of the population under the age of 14 (young) is -0.224 and is statistically significant ($p<0.001$). This finding is in line with previous literature and theory which suggests that this demographic is unfavorable to economic growth due to the fact that they are unable to participate in the labor force.

The estimated coefficient on the impact of the share of the population over the age of 65 (old) is -.043, however is statistically insignificant ($p \approx 0.524$). This finding is in line with Higgins, Levy, and Young (2006) who also estimate that this demographic is insignificant to economic growth. Strobl (2001) finds a negative and statistically significant relationship between the share of senior citizens and growth rates.

The results however contradict James and Aadland (2011) who find a positive and statistically significant correlation between this population and economic growth. However, I believe that my results are more in line with economic theory for two reasons; productivity and saving rates. The individuals in each category are either excluded from the labor force or less productive, they also tend to have lower saving rates compared to individuals between the ages of 15 and 64.

Education

The impact of the amount of education a county's population has received has mixed effects on economic growth. The percent of the population ages 25 and over with at least a high school diploma has a slight negative impact with a coefficient of -0.007 however statistically insignificant ($p \approx 0.697$). These results are inline with Higgins, Levy, and Young (2006), who separate this variable into two. They find a small positive relationship between the percent of the population with a high school diploma and personal income growth. However, the share of the population with some college education had a negative relationship. My variable combines these two groups and may explain the reason for the insignificant coefficient.

The percent of the population ages 25 and over with at least a bachelors degree has a relatively larger impact with a coefficient of 0.135 and statistically significant ($p<0.001$). These results are in line with economic theory and previous literature (Higgins, Levy, and Young, 2006; Rupasingha and Chilton, 2009; James and Aadland, 2011). The skills received by attending college increases a county's human capital and therefore productivity.

Race and Poverty

The nonwhite variable is negative however statistically insignificant ($\beta \approx -0.027$; $p \approx 0.116$), this indicates that the percentage of minorities in a county has no impact to per capita income growth rates. The poverty variable is also negative and statistically significant ($\beta \approx -0.207$; $p<0.0001$), this indicates that counties with a high percentage of individuals below the poverty line experience lower growth rates. This matches previous literature and economic theory which suggests that the number of individuals in poverty is a direct indication of the degree of human capital and productively of the population (Higgins, Levy, and Young, 2006; Barro and Sala-i-Martin, 2003; James and Aadland, 2011)

Industries

Service

The seven industry variables represent how the presence of each industry influences annual per capita income growth. The share of total earnings derived from the service industries is positive and statistically significant (β≈0.046; p≈0.009). The coefficient tells us that holding all else constant, a 1 percentage point increase of the share of per capita income derived by the services industry leads to a 0.046 percentage point increase in annual per capita income growth. The positive coefficients on the professional and services industries is not surprising, these industries are often associated with driving growth (Power, 1995; Higgins, Levy, and Young, 2006).

Manufacturing

The coefficient for the share of earnings derived from the manufacturing sector is positive and statistically significant (β≈0.021; p≈0.010). These results match James and Aadland (2011) however contradict Higgins, Levy and Young (2006), where they find a negative relationship between manufacturing of nondurables and economic growth and a statistically insignificant relationship between manufacturing of durables and economic growth. The coefficient suggests that holding all else constant, a 1 percentage point increase of the share of per capita income derived by the manufacturing industry leads to a 0.021 percentage point increase in annual per capita income growth.

Government

The share of total earnings derived from the public sector is positive and statistically significant (β≈0.023; p≈0.066). The role of the public sector with regards to economic growth has been explored to great extent. Higgins, Levy and Young (2006) find a negative relationship between economic growth and the county's share of population employed in all three levels of government (Federal, State, and Local). On the other hand, Duffy-Deno (1998) concludes that the share of the population employed in the public sector is statistically insignificant. My public sector variable includes earnings from the military, for which these two studies omit, and may explain the difference in results.

Agriculture and Mining

The share of total earnings derived from the agriculture and mining sectors are positive however statistically insignificant ($\beta \approx 0.057$; $p \approx 0.274$), ($\beta \approx 0.017$; $p \approx 0.377$). This differs from the results found by James and Aadland (2011) and Rasker (2006), who found that counties which relied heavily on natural resources grew at a slower rate. However, our econometric models differed in two important ways: First, they use all 3,000+ counties in their regression whereas I am examining a very specific group of counties. Second, they also combine the agriculture, mining and in (Rasker 2006) the manufacturing industries whereas I leave them separated.

Professional

The coefficient on the earnings derived from the professional industries is positive however statistically insignificant ($\beta \approx 0.041$; $p \approx 0.231$). These results fail to support the link which has been shown in past studies, between financial intermediation and economic growth (Higgins, Levy and Young 2006). This means that individuals who have savings and are willing to lend, are able to connect with those individuals looking to borrow. Again, my research is only using a small slice of counties in the U.S. and may explain the lack of significance.

Construction

The coefficient on the earnings derived from the construction industry is positive however statistically insignificant ($\beta \approx 0.007$; $p \approx 0.677$). This again differs from Higgins, Levy and Young (2006) who find a positive and statistically significant relationship between the share of the population employed in the construction industry and per capita income growth. This study is using the share of earnings derived from the construction industry and not employment, which may be the cause for the different results.

Table 6-2. County-Level Growth Regressions (Short, Medium and Long-Term with Control Group)

VARIABLES	(1)	(2)	(3)	(4)	(5)
WSR_Period1	-0.007***	-0.005***	-0.006***	-0.004**	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
WSR_Period2	-0.003***	-0.003***	-0.004***	-0.004***	-0.005***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
WSR_Period3	-0.003***	0.000	-0.001	-0.002	-0.002
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Agriculture_{t-1}					0.056
					(0.052)
$\text{Manufacturing}_{t-1}$					0.021***
					(0.008)
Mining_{t-1}					0.017
					(0.019)
Government_{t-1}					0.022*
					(0.012)
Service_{t-1}					0.047***
					(0.017)
$\text{Professional}_{t-1}$					0.042
					(0.034)
$\text{Construction}_{t-1}$					0.006
					(0.016)
Initial_{t-1}				-0.135***	-0.124***
				(0.010)	(0.010)
Young_{t-1}				-0.222***	-0.221***
				(0.061)	(0.062)
Old_{t-1}				-0.035	-0.043
				(0.064)	(0.068)
HS_{t-1}				-0.004	-0.005
				(0.016)	(0.017)
College_{t-1}				0.158***	0.137***
				(0.028)	(0.028)
Nonwhite_{t-1}				-0.028*	-0.026
				(0.016)	(0.017)
Poverty_{t-1}				-0.218***	-0.206***
				(0.029)	(0.028)
Metro				0.001	0.001
				(0.002)	(0.002)
Wilderness				-0.003*	-0.003*
				(0.002)	(0.002)
Year FE	no	yes	yes	yes	yes
County FE	no	no	yes	yes	yes
Constant	0.016***	-	-	-	-
	(0.000)				
Observations	2,560	2,560	2,560	2,560	2,558
R-squared	0.012	0.104	0.110	0.436	0.444
Number of counties	320	320	320	320	320
F statistic	8.86***	32.85***	42.45***	51.05***	40.97***

note: estimated with OLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Wild and Scenic River Designation (Short, Medium and Long-Term)

Table 6-2 displays the results of disaggregating the designation into short, medium and long term which enables me to pinpoint approximately how long the impact lasts. The coefficient on period 1 is negative and statistically significant ($\beta \approx -0.004$; $p \approx 0.035$). It suggests that there is an initial negative impact on income growth for a county that receives a WSR designation. The coefficient on period 2 is also negative and statistically significant ($\beta \approx -0.005$; $p \approx 0.006$). In period 3 the coefficient remains negative however, becomes statistically insignificant ($\beta \approx -0.002$; $p \approx 0.267$).

These results support the earlier claim of a negative impact of the WSR designation, however this impact appears to dissipate after 15 years and economic growth in the long run is unaffected. This result translated into standards of living implies that a county which received a WSR designation will end up with approximately $2,200 less in per capita income than a similar county that did not receive a WSR designation after 15 years[5]. After this period, the small difference disappears and the per capita incomes are statistically similar.

[5] Initial Per Capita Income of $25,000

Table 6-3. County-Level Growth Regressions (Wild, Scenic and Recreational Designations with Control Group)

VARIABLES	(1)	(2)	(3)	(4)	(5)
Wild	-0.004*	-0.002	0.002	-0.004	-0.004
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Scenic	-0.002	0.000	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Recreational	-0.004**	-0.003	0.002	-0.003	-0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Agriculture$_{t-1}$					0.090
					(0.057)
Manufacturing$_{t-1}$					0.022**
					(0.010)
Mining$_{t-1}$					-0.002
					(0.051)
Government$_{t-1}$					0.009
					(0.014)
Service$_{t-1}$					0.044*
					(0.025)
Professional$_{t-1}$					0.072
					(0.055)
Construction$_{t-1}$					0.016
					(0.032)
Initial$_{t-1}$				-0.092***	-0.088***
				(0.011)	(0.014)
Young$_{t-1}$				-0.279***	-0.290***
				(0.106)	(0.106)
Old$_{t-1}$				-0.152*	-0.186**
				(0.083)	(0.091)
HS$_{t-1}$				-0.010	0.004
				(0.021)	(0.025)
College$_{t-1}$				0.045	0.028
				(0.043)	(0.053)
Nonwhite$_{t-1}$				0.026	0.035
				(0.026)	(0.027)
Poverty $_{t-1}$				-0.124***	-0.114***
				(0.037)	(0.042)
Metro				0.001	0.001
				(0.002)	(0.002)
Wilderness				-0.003	-0.003
				(0.003)	(0.003)
Year FE	no	yes	yes	yes	yes
County FE	no	no	yes	yes	yes
Constant	0.015***	-	-	-	-
	(0.001)				
Observations	760	760	760	760	760
R-squared	0.009	0.145	0.155	0.387	0.398
Number of counties	95	95	95	95	95
F statistic	2.71**	12.44***	14.57***	25.69***	22.42***

note: estimated with OLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Wild, Scenic and Recreational Designations

Table 6-3 reports the regression results disaggregated by designation in an attempt to pinpoint whether a particular designation carries a larger impact. The sample of counties which have only received one of the three designations throughout the 39 year period is much smaller at 56 counties[6]. Because I'm interested in the specific impact of the particular designations, I need to structure my data in a way so that the counties that I am using as a comparison do not contain any combination of the designations. After I remove these counties which contain multiple designations and their corresponding control counties, the sample is reduced to 95[7]. The coefficients on each designation are negative; "Wild" ($\beta \approx -0.004$; $p \approx 0.247$), "Scenic" ($\beta \approx -0.001$; $p \approx 0.688$), and "Recreational" ($\beta \approx -0.003$; $p \approx 0.253$), however all are statistically insignificant. An issue associated with reducing a sample size so dramatically is that the standard error's increase, holding all else constant, and could provide an explanation on the insignificance of the coefficients.

These regressions serve as a robustness test for the overall negative effect of the combined designations. The consistent negative relationship supports the earlier findings, however, the insignificance of the coefficients fails to provide additional insight into which designation/s have larger impacts. The results on the "Wild" and "Scenic" designations make sense due to the location and inaccessibility of these designated rivers. My hypothesis was that the "Recreational" designation would be the one that was driving the negative results. Recall, that this designation is given to those rivers that are highly accessible and are located in more developed areas than the "Wild" and "Scenic" designations. Therefore, the designation was hypothesized to inhibit the development around these protected river corridors which, unlike the

[6] 8 Wild, 27-Scenic and 21-Recreational
[7] 56 Treated Counties, 39 Control Counties

“Wild” and “Scenic” designations, are located in more urban settings. The Farmington River in Connecticut provides a good example of how this hypothesis was developed. The designation was able to limit the severity of development in 1986 when there was a plan to pipe water from the Farmington River to the City of Hartford. This motivated a WSR study and by 1994, 14 miles were designation “Recreational” (Palmer 2004). These results however, do not support this anecdotal evidence and the designation which drives the overall negative effect is inconclusive.

Pre- Post Test Design without a Control Group

A quasi-experimental framework which takes advantage of the properties of a panel dataset which consists of multiple treatments is referred to as “A Pre-Post Test Design without a control group”. A benefit of using only those counties that have ever received a WSR designation is that it eliminates the selection bias that may exist due to differences between the treatment and control groups. Table 6-4, Table 6-5 and Table 6-6 contain the regression results using only those counties that have received a WSR designation between 1975 and 2005, allowing for at least one pre- and post-period. An issue with this type of design is that you are unable to make any inferences outside of the sample. Therefore, the coefficients represent the partial effect on only those counties that have ever received a WSR designation. This model serves as another robustness test and is able to do a slightly better job at estimating the variation in per capita income growth ($R^2 \approx 0.446$). The coefficients on the other control variables are relatively unchanged therefore I’ll refrain from interpreting those coefficients.

Table 6-4. County-Level Growth Regressions (WSR without Control Group)

VARIABLES	(1)	(2)	(3)	(4)	(5)
WSR	-0.004***	-0.004**	-0.006***	-0.007***	-0.007***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Agriculture$_{t-1}$					0.167**
					(0.073)
Manufacturing$_{t-1}$					0.018**
					(0.009)
Mining$_{t-1}$					-0.015
					(0.016)
Government$_{t-1}$					0.030*
					(0.016)
Service$_{t-1}$					0.046**
					(0.023)
Professional$_{t-1}$					0.017
					(0.062)
Construction$_{t-1}$					-0.005
					(0.022)
Initial$_{t-1}$				-0.134***	-0.120***
				(0.013)	(0.015)
Young$_{t-1}$				-0.237**	-0.213**
				(0.095)	(0.093)
Old$_{t-1}$				-0.045	-0.070
				(0.091)	(0.099)
HS$_{t-1}$				0.000	-0.009
				(0.025)	(0.026)
College$_{t-1}$				0.162***	0.135***
				(0.039)	(0.039)
Nonwhite$_{t-1}$				-0.046**	-0.050**
				(0.022)	(0.023)
Poverty $_{t-1}$				-0.208***	-0.201***
				(0.047)	(0.048)
Metro				0.000	0.001
				(0.002)	(0.002)
Wilderness				-0.005**	-0.006***
				(0.002)	(0.002)
Year FE	no	yes	yes	yes	yes
County FE	no	no	yes	yes	yes
Constant	0.017***	-	-	-	-
	(0.001)				
Observations	1,416	1,416	1,416	1,416	1,414
R-squared	0.011	0.104	0.111	0.433	0.446
Number of counties	177	177	177	177	177
F statistic	15.95***	29.94***	30.01***	34.02***	30.05***

note: estimated with OLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Wild and Scenic River Designation

The coefficient on the WSR designation is again negative and statistically significant ($\beta \approx -0.007$; $p \approx 0.001$). This represents the average treatment effect on the treated counties and suggests that, holding all else constant, a county which receives a WSR designation experiences on average, a 0.7 percentage point slower growth rate of per capita income. The coefficients on the WSR and Wilderness designations are very similar, as we would expect due to their resemblance and translates into an annual impact on the populations' standards of living of only $175[8].

[8] Calculated using an initial per capita income of $25,000

Table 6-5. County-Level Growth Regressions (Short, Medium and Long-Term without Control Group)

VARIABLES	(1)	(2)	(3)	(4)	(5)
WSR_Period1	-0.009*** (0.002)	-0.008*** (0.002)	-0.009*** (0.003)	-0.007*** (0.002)	-0.006*** (0.002)
WSR_Period2	-0.005*** (0.001)	-0.006*** (0.002)	-0.007** (0.003)	-0.009*** (0.003)	-0.009*** (0.003)
WSR_Period3	-0.005*** (0.001)	-0.003 (0.003)	-0.005 (0.005)	-0.009** (0.004)	-0.009** (0.004)
$Agriculture_{t-1}$					0.173** (0.074)
$Manufacturing_{t-1}$					0.018** (0.009)
$Mining_{t-1}$					-0.017 (0.017)
$Government_{t-1}$					0.028* (0.015)
$Service_{t-1}$					0.044* (0.023)
$Professional_{t-1}$					0.019 (0.060)
$Construction_{t-1}$					-0.006 (0.022)
$Initial_{t-1}$				-0.133*** (0.013)	-0.120*** (0.015)
$Young_{t-1}$				-0.232** (0.096)	-0.209** (0.095)
Old_{t-1}				-0.041 (0.092)	-0.066 (0.101)
HS_{t-1}				0.000 (0.025)	-0.009 (0.026)
$College_{t-1}$				0.158*** (0.040)	0.133*** (0.039)
$Nonwhite_{t-1}$				-0.045** (0.022)	-0.049** (0.023)
$Poverty_{t-1}$				-0.207*** (0.047)	-0.200*** (0.047)
Metro				0.001 (0.002)	0.001 (0.002)
Wilderness				-0.006** (0.002)	-0.006*** (0.002)
Year FE	no	yes	yes	yes	yes
County FE	no	no	yes	yes	yes
Constant	0.018*** (0.001)	-	-	-	-
Observations	1,416	1,416	1,416	1,416	1,414
R-squared	0.025	0.115	0.123	0.438	0.451
Number of counties	177	177	177	177	177
F statistic	9.68***	18.88***	29.64***	36.75***	34.30***

note: estimated with OLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Wild and Scenic River Designation (Short, Medium and Long-Term)

The coefficients on period 1 ($\beta \approx -0.006$; $p \approx 0.005$), period 2 ($\beta \approx -0.009$; $p \approx 0.003$) and period 3 ($\beta \approx -0.009$; $p \approx 0.037$) are now all statistically significant at a 5 percent level and below. These results differ from the results found in Table 6-2 which suggested that the effect of the WSR designation became insignificant in the long-run. Not only is there a long-term effect of the designation but the effect seems to get larger as time passes, going from 0.7 to 0.9 percentage point. This increase in average treatment effect could be partially explained by the pool of control counties for this group. Because we include only the counties which have ever received a WSR designation the number of control counties by period 3 have diminished greatly. Since the variable for period 3 represents the average treatment effect for counties that have had a WSR designated for 16 years or longer. The effect on standards of living in these counties has the potential to be relatively large depending on how long the impact lasts. The overall impact, if compounded over a 16 year period, translates into an approximate decrease of $4,000[9] in per capita income and a reduction in standards of living of 13%. On the other hand, if a county contained an "instant" river, which was designated in the initial legislature in 1968, the potential impact would be compounded for 40 years, translating into over a $13,000[10] decrease in per capita income and reduction of living standards of 30%.

[9] An initial per capita income of $25,000

[10] An initial per capita income of $25,000

Table 6-6. County-Level Growth Regressions (Wild, Scenic and Recreational Designations without Control Group)

VARIABLES	(1)	(2)	(3)	(4)	(5)
Wild	-0.004	-0.001	0.002	-0.001	-0.003
	(0.003)	(0.003)	(0.002)	(0.004)	(0.004)
Scenic	-0.002	0.001	-0.001	0.000	0.001
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Recreational	-0.004**	-0.002	0.002	-0.002	-0.001
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
$Agriculture_{t-1}$					0.222***
					(0.060)
$Manufacturing_{t-1}$					0.014
					(0.014)
$Mining_{t-1}$					-0.056
					(0.075)
$Government_{t-1}$					0.010
					(0.014)
$Service_{t-1}$					0.048
					(0.034)
$Professional_{t-1}$					0.166*
					(0.098)
$Construction_{t-1}$					0.033
					(0.045)
$Initial_{t-1}$				-0.090***	-0.087***
				(0.014)	(0.017)
$Young_{t-1}$				-0.428**	-0.410**
				(0.194)	(0.180)
Old_{t-1}				-0.254**	-0.328**
				(0.109)	(0.133)
HS_{t-1}				-0.015	0.005
				(0.030)	(0.035)
$College_{t-1}$				0.087	0.064
				(0.059)	(0.072)
$Nonwhite_{t-1}$				-0.013	-0.016
				(0.038)	(0.033)
$Poverty_{t-1}$				-0.072	-0.067
				(0.054)	(0.067)
Metro				0.002	0.001
				(0.003)	(0.003)
Wilderness				-0.003	-0.003
				(0.003)	(0.003)
Year FE	no	yes	yes	yes	yes
County FE	no	no	yes	yes	yes
Constant	0.015***	-	-	-	-
	(0.002)				
Observations	448	448	448	448	448
R-squared	0.011	0.172	0.183	0.414	0.435
Number of counties	56	56	56	56	56
F statistic	1.59	8.07***	10.15***	24.75***	32.08***

note: estimated with OLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Wild, Scenic and Recreational Designations

Table 6-6 reports the regression results disaggregated by designation, without a control group, in another robustness check in order to pinpoint whether a particular designation carries a larger impact. The sample of counties which have only received one of the three designations throughout the 39 year period is much smaller at 56[11]. The coefficients on the "Wild" (β≈-0.003; p≈0.494) and "Recreational" (β≈-0.001; p≈0.827 designations are negative, however, statistically insignificant. The coefficient on the "Scenic" (β≈0.001; p≈0.664) designation is surprisingly positive however, it is still statistically insignificant. Again, due to such a reduced sample size it is difficult to make any conclusive statements regarding these results.

[11] 8 Wild, 27-Scenic and 21-Recreational

Table 6-7. County-Level Growth Regressions (Summary of Coefficients)

VARIABLES	(1)[12]	(2)[13]	(3)[14]	(4)[15]	(5)[16]	(6)[17]
Wsr	-0.003***			-0.007***		
	(0.001)			(0.002)		
WSR_Period1		-0.004**			-0.006***	
		(0.002)			(0.002)	
WSR_Period2		-0.005***			-0.009***	
		(0.002)			(0.003)	
WSR_Period3		-0.002			-0.009**	
		(0.002)			(0.004)	
Wild			-0.004			-0.003
			(0.003)			(0.004)
Scenic			-0.001			0.001
			(0.002)			(0.003)
Recreational			-0.003			-0.001
			(0.002)			(0.003)
Year FE	yes	yes	yes	yes	yes	yes
County FE	yes	yes	yes	yes	yes	yes
Observations	2,558	2,622	760	1,414	1,414	448
R-squared	0.442	0.444	0.398	0.446	0.451	0.435
Number of counties	320	320	95	177	177	56
F statistic	41.92***	40.97***	22.42***	30.05***	34.30***	32.08***

note: estimated with OLS
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

[12] Results from Table 6-1 Column 5
[13] Results from Table 6-2 Column 5
[14] Results from Table 6-3 Column 5
[15] Results from Table 6-4 Column 5
[16] Results from Table 6-5 Column 5
[17] Results from Table 6-6 Column 5

Discussion

Table 6.7 summarizes the coefficients of interest for both experimental designs. It reinforces the fact that the WSR designation has a statistically significant impact on economic growth. The magnitude of the impact is also apparent with coefficients of up to 0.9 percentage points which translates into a significant impact to a county's measurable income per capita. It's important however not to dismiss the positive coefficients on the other control variables as they have the ability to counteract the negative impact of the designation.

If the percent of a county's population with a college degree increases by one standard deviation (s.d.≈0.077) the county will experience, on average, a 1.0 percentage point increase in annual per capita income growth, holding all else constant. This is over three times larger than the negative overall average treatment effect of the WSR designation (0.3 percentage points) and larger than the combined effects of the WSR and National Wilderness Area designations. Also, it would only take approximately a 6.5 percentage point increase in the share of earnings derived from the service industries or a 14.3 percentage point increase in the share of earnings derived from the manufacturing industries to counter the negative effect of the WSR or Wilderness designations. Both percentage point increases are less than their respective standard deviations found in table 4.1 and far less than the estimated increase that may be contributed to the increase in natural amenities (Vias 1999).

By comparing the two groups of results it also provides insight into the direction of possible selection bias that may be present in the quasi-experimental design with a control group. All of the coefficients in columns 4, 5 and 6 are slightly more negative than the coefficients in 1, 2 and 3. Suggesting that the selection bias may be slightly positive and therefore, if anything, the model understates the impact of the designation in the quasi-experimental design.

It is important to reiterate the scope of this research and the disregard for the non-market value of the vital ecosystems that are being preserved. Many of us take for granted the services provided by ecosystems such as; air and water purification, waste management, regeneration of soil fertility and climate regulation (Daily, et al. 1997). The total economic value of aquatic ecosystems has been estimated to be anywhere between $10 and $230 annually per capita even in developing countries (Korsgaard and Schou 2010). This could offset the negative impact of the WSR designation, which has shown to decrease per capita income between $75 and $175 in the first year. The standards of living calculation also neglects the quality-of-life aspect that these rivers contribute to the natural amenities of an area.

Power (1995), stresses the role of natural amenities in attracting populations to certain areas and the pay-cut that individuals take in order to do so. There exists a trend, especially in the Rocky Mountain West, were highly mobile labor forces are migrating to areas with high rents and lower wages, which is counterintuitive, so that they may live in areas that contain these high-amenity values (Vias 1999). Due to the growing importance of these natural amenities and quality-of-life considerations to a workforce, it's critical to develop regional public policy that account for these non-market services. Research which ignores these contributions result in biased analysis and poor policy (Marcouiller and Deller 1996). However, that being said, integrating these amenities which are produced by conserving open spaces and the natural conditions of rivers and streams into public policy have proven to be difficult. The process to create these amenities usually take a long time and are very hard to reverse (Gottlieb 1994).

Chapter 7 Conclusion

The intent of this research was not to assess whether or not the WSR designation is "working" or "failing", the main objective of the WSR Act was not to promote economic growth but to preserve these rivers and ecosystems. This research has provided consistent estimates of the economic impact of the WSR designation by applying a two-level linear model. In order to accomplish this task, a propensity score was calculated by applying a logit model and constructing a control group in order to provide a counterfactual. The main objective was to estimate the impact of the WSR designation with regards to county level living standards. It is shown that on average, the overall impact is negative and statistically significant. The negative impact is relatively short lived however, ranging between 6 to 15 years. It translates into approximately a $2,200 decrease in a county's per capita income[18]. In the long-run, the difference between a county with a WSR designation and one without is statistically insignificant. In previous literature these rivers have been shown to be extremely valuable to their immediate residents and larger ecosystems (Walsh, Sanders, and Loomis, 1985; Moore and Siderelis, 2003; Moore and Siderelis, 2001).

Potential avenues for further research include estimating the impact on particular industry growth. The rational for this is two-fold: first, policymakers with a particular demographic of constituents may be interested in the impact on certain industries if that region relies heavily in one industry. Second, this research has also identified industries which promote economic growth; therefore, if the designation attracts that industry to the region the negative impact of the designation could be offset by the growth in this area. Also, by focusing on standards of living I

[18] Starting with a per capita income of $25,000 over 15 years

neglected the net migration and employment impacts of the designation, both of which might serve to be promising topics of research.

Additional research should also focus on the potential impacts on different subgroups (Ferraro and Hanauer, 2011). Admittedly the areas where these designations occur vary immensely, and by isolating the impacts on different types of land uses you can further tailor these designations for more effective public policy throughout areas of the U.S. Also, it may be worthwhile to isolate designations by the avenue for which they were designated (i.e. through congressional action or through section 2(a)(ii)). Segments of river designated through Section 2(a)(ii) usually garner more local support which is vital for the long-term conservation of the segment of river.

Using Ferraro and Hanauer (2011) as an example, the NRI Study Rivers provide an ideal set of control counties. These rivers have been identified as satisfying the two criteria of the WSR designation, which are difficult to control for, they are: free-flowing and contain at least one ORV. By limiting the control group to these counties, you will be able to make a stronger inference regarding what the impact of the WSR designation is, as well as what the potential impact would be if these segments of river were to be added in the future. Finally, as the GIS maps become more detailed, the ability to separate the particular designations on all of the designated rivers will provide the ability to pinpoint particular designation effects as well as provide much more information to policy makers.

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Appendix A

Table A1- Propensity Score (Logit regression results)

VARIABLES	
initial	-0.370
	(0.725)
young	-3.628
	(3.685)
old	-5.126
	(4.063)
hs	10.610
	(3.322)
college	6.996
	(5.672)
nonwhite	-3.828
	(0.999)
poverty	4.349
	(1.896)
pct ag	3.339
	(6.043)
pct const	1.428
	(1.787)
pct gov	1.833
	(0.949)
pct man	2.771
	(0.731)
pct min	-6.174
	(2.437)
pct prof	-5.792
	(6.414)
pct service	1.020
	(1.408)
amenityn2	-1.559
	(1.108)
amenityn3	-0.249
	(1.057)
amenityn4	-0.210
	(1.062)
amenityn5	0.335
	(1.074)
amenityn6	0.622
	(1.092)
amenityn7	1.098
	(1.145)
pop	0.000
	(0.000)
Land	0.000
	(0.000)
cons	-0.978
	(7.399)
Log-likelihood value	-595.09
Pseudo R-Squared	0.112

Table A2 –PSTEST (two-group t-test)

Variable	Sample	Treated	Control	%bias	%reduct |bias|	t-test t	p>|t|
initial	Unmatched	9.809	9.761	19.70		2.660	0.00800
	Matched	9.806	9.802	1.700	91.50	0.150	0.878
young	Unmatched	0.284	0.287	-10.40		-1.230	0.220
	Matched	0.284	0.281	8.900	14.40	0.820	0.414
old	Unmatched	0.116	0.121	-13.40		-1.620	0.106
	Matched	0.116	0.118	-5.200	61	-0.460	0.644
hs	Unmatched	0.170	0.155	31.60		3.870	0
	Matched	0.169	0.168	2.100	93.50	0.200	0.843
college	Unmatched	0.0445	0.0384	32		4.230	0
	Matched	0.0445	0.0461	-8.700	72.80	-0.740	0.458
nonwhite	Unmatched	0.0584	0.105	-36.60		-3.980	0
	Matched	0.0588	0.0590	-0.200	99.50	-0.0200	0.982
poverty	Unmatched	0.180	0.207	-25		-3.160	0.00200
	Matched	0.181	0.183	-1.800	92.70	-0.170	0.862
pct ag	Unmatched	0.0104	0.0104	-0.100		-0.0100	0.993
	Matched	0.0104	0.0125	-15.9	-22244	-0.950	0.342
pct const	Unmatched	0.0671	0.0650	4.600		0.580	0.560
	Matched	0.0666	0.0654	2.500	44.90	0.240	0.809
pct gov	Unmatched	0.205	0.181	24.40		2.990	0.00300
	Matched	0.205	0.210	-4.900	80.10	-0.410	0.681
pct man	Unmatched	0.218	0.198	12.50		1.610	0.109
	Matched	0.218	0.207	7.100	43.30	0.650	0.515
pct min	Unmatched	0.0141	0.0277	-22		-2.410	0.0160
	Matched	0.0144	0.0128	2.500	88.70	0.340	0.732
pct prof	Unmatched	0.0290	0.0298	-4.600		-0.570	0.566
	Matched	0.0291	0.0290	0.700	85	0.0700	0.946
pct service	Unmatched	0.130	0.121	16.60		2.180	0.0290
	Matched	0.130	0.126	7.500	54.90	0.690	0.490

Table A3-Sensitivity Testing (Propensity Score Methods)

VARIABLES	replace	replace	replace	noreplac	noreplac	noreplac	5_nn	5_nn	5_nn
WSR	-0.003***			-0.003**			-0.002		
	(0.001)			(0.001)			(0.001)		
WSR_Period1		-0.004**			-0.004**			-0.003*	
		(0.002)			(0.002)			(0.002)	
WSR_Period2		-0.005***			-0.005***			-0.004***	
		(0.002)			(0.002)			(0.001)	
WSR_Period3		-0.002			-0.002			-0.001	
		(0.002)			(0.002)			(0.002)	
Wild			-0.004			-0.005*			-0.006**
			(0.003)			(0.003)			(0.003)
Scenic			-0.001			-0.002			-0.001
			(0.002)			(0.001)			(0.001)
Recreational			-0.003			-0.007**			-0.007*
			(0.002)			(0.003)			(0.004)
$Agriculture_{t-1}$	0.057	0.056	0.090	0.052	0.050	0.053	0.028	0.027	0.029
	(0.052)	(0.052)	(0.057)	(0.048)	(0.047)	(0.048)	(0.044)	(0.044)	(0.044)
$Manufacturing_{t-1}$	0.021***	0.021***	0.022**	0.022***	0.022***	0.020***	0.015***	0.015***	0.015***
	(0.008)	(0.008)	(0.010)	(0.008)	(0.008)	(0.008)	(0.005)	(0.005)	(0.005)
$Mining_{t-1}$	0.017	0.017	-0.002	0.028*	0.028*	0.029*	0.012	0.011	0.012
	(0.019)	(0.019)	(0.051)	(0.017)	(0.017)	(0.017)	(0.010)	(0.010)	(0.010)
$Government_{t-1}$	0.023*	0.022*	0.009	0.018	0.017	0.017	0.008	0.008	0.008
	(0.012)	(0.012)	(0.014)	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)
$Service_{t-1}$	0.046***	0.047***	0.044*	0.038**	0.038***	0.037**	0.030***	0.030***	0.030***
	(0.018)	(0.017)	(0.025)	(0.015)	(0.015)	(0.015)	(0.009)	(0.009)	(0.009)
$Professional_{t-1}$	0.041	0.042	0.072	0.042	0.043	0.042	0.036*	0.036*	0.036*
	(0.034)	(0.034)	(0.055)	(0.032)	(0.032)	(0.032)	(0.021)	(0.021)	(0.021)
$Construction_{t-1}$	0.007	0.006	0.016	-0.000	-0.000	-0.001	0.002	0.002	0.002
	(0.016)	(0.016)	(0.032)	(0.016)	(0.015)	(0.015)	(0.009)	(0.009)	(0.009)
$Initial_{t-1}$	-0.125***	-0.124***	-0.088***	-0.127***	-0.127***	-0.129***	-0.136***	-0.136***	-0.137***
	(0.010)	(0.010)	(0.014)	(0.010)	(0.010)	(0.009)	(0.008)	(0.008)	(0.008)
$Young_{t-1}$	-0.224***	-0.221***	-0.290***	-0.198***	-0.195***	-0.194***	-0.122***	-0.121***	-0.120***
	(0.062)	(0.062)	(0.106)	(0.057)	(0.057)	(0.056)	(0.039)	(0.039)	(0.038)
Old_{t-1}	-0.043	-0.043	-0.186**	-0.031	-0.031	-0.024	0.014	0.014	0.017
	(0.067)	(0.068)	(0.091)	(0.060)	(0.060)	(0.058)	(0.037)	(0.037)	(0.036)
HS_{t-1}	-0.007	-0.005	0.004	-0.002	-0.000	-0.008	-0.003	-0.003	-0.006
	(0.017)	(0.017)	(0.025)	(0.016)	(0.016)	(0.016)	(0.011)	(0.011)	(0.011)
$College_{t-1}$	0.135***	0.137***	0.028	0.145***	0.147***	0.140***	0.119***	0.120***	0.117***
	(0.028)	(0.028)	(0.053)	(0.028)	(0.028)	(0.028)	(0.023)	(0.023)	(0.022)
$Nonwhite_{t-1}$	-0.027	-0.026	0.035	-0.027*	-0.027*	-0.030*	-0.020*	-0.020*	-0.021**
	(0.017)	(0.017)	(0.027)	(0.016)	(0.015)	(0.015)	(0.011)	(0.010)	(0.010)
$Poverty_{t-1}$	-0.207***	-0.206***	-0.114***	-0.200***	-0.199***	-0.204***	-0.228***	-0.227***	-0.229***
	(0.029)	(0.028)	(0.042)	(0.028)	(0.028)	(0.028)	(0.024)	(0.024)	(0.024)
Metro	0.001	0.001	0.001	0.000	-0.000	-0.000	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Wilderness	-0.003*	-0.003*	-0.003	-0.003	-0.003	-0.003*	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
County FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	-	-	-	-	-	-	-	-	-
Observations	2,558	2,558	760	2,827	2,827	2,827	6,401	6,401	6401
R-squared	0.442	0.444	0.398	0.437	0.439	0.439	0.441	0.442	0.442
Number of counties	320	320	95	354	354	354	801	801	801

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10