2007

EVALUATING THE EFFECTS OF WILDERNESS ON POPULATION AND EMPLOYMENT GROWTH IN THE ELEVEN WESTERN STATES

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B. S. Economics, University of Washington, Seattle, Washington, 2002

Thesis

presented in partial fulfillment of the requirements
for the degree of

Master of Arts
Economics

The University of Montana
Missoula, MT

Summer 2007

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Silbaugh, Matthew Larson, M.A., August 2007 Economics

Evaluating the Effect of Wilderness on Population and Employment Growth in the Eleven Western States

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This paper examines the role of protected land on population and employment growth in the eleven Western States, which is an important issue in many counties that have high levels of federally owned land. A Carlino and Mills regional adjustment model is used to examine how these land management policies affect the local population and employment opportunities. This model assumes simultaneity in population and employment, so a two-stage least squares regression is used.

The empirical evidence suggests that population is attracted to land with a conservation mandate, and that this population increases employment. There is also additional evidence that employment opportunities increase as a direct result of protected landscapes. In addition to these primary findings, population was attracted to a more diverse set of conservation land in the 1990s than the 1980s, but the positive effect of conservation land on employment decreased in the 1990s. Nonetheless, there is no evidence that any sector of employment is harmed by land management policies with a conservation mandate.

Acknowledgments

I would like to acknowledge my committee members Dr. Neil Moisey and Dr. Tom Power for their insights concerning the data that I used in the empirical estimation. I would also like to thank Carter Betz at the U.S. Forest Service's Southern Research Station for providing me with the NORSIS database and Dr. Paul Lorah at the University of St. Thomas for providing me with protected land data at the county level. In addition, I would like to thank Matthew Swenson and the department of economics for financial support throughout my graduate studies. And finally, I would like to thank the committee chair, Dr. Doug Dalenberg, who assisted through the entire process, but especially with the model specification and advice on how to organize the ideas in the body of the thesis.

I want to dedicate this thesis to my wife, Caitlin, whose support and patience were invaluable to the completion of this process.

Table of Contents

List of Tables

CHAPTER 1: INTRODUCTION

There are two schools of thought concerning the role of wilderness and forest resources on local economies. One view, the economic base theory, sees natural resources as fundamental to economic success because harvesting those resources brings income into the economy. The other view is that wilderness amenities attract individuals and it is this population growth that drives economic growth. The policy implications are very different for each of these theories and because many counties in the Western United States have large tracts of federally owned land, many residents are very concerned with land management decisions.

Wilderness and national park designation places more restrictions on land use than other federally owned land because its primary purpose is preservation. This designation excludes extractive activities on such federally owned land, which limits employment opportunities and the income generated from these commercial resources. According to the economic base model, natural resources bring external income to the community which is then circulated through the economy. When more land is designated as wilderness, fewer natural resources can be extracted. With fewer natural resources being exported, there is less wealth circulating in the economy. Because this has been the historical view of rural, western economies until recently, federally owned land has been managed to maximize the commercial benefit of forest resources.

An alternate view of the economy is that wilderness areas provide amenities that households find desirable. Because more land is preserved, the area is viewed as a more attractive place in which to live. An increase in population increases the demand for services, which, in turn attracts new firms to relocate because of a suitable local market.

From this perspective of the economic structure, more wilderness and conservation land stimulates the economy. Although some natural resource extraction jobs will be lost, that loss is compensated for by new in-migration and new jobs outside of the resource extraction industries.

Since the economies of the Western United States have traditionally been more dependent upon extractive industries and rural areas tend to have a lot of federally owned land, this is an especially important debate. If the economic base model is correct, then rural communities should encourage more extractive uses of federally owned land. If the amenity view is correct, then local governments should advocate preservation of wilderness.

The fundamental question I address is whether preservation of federal land decreases the number of jobs in the local economies of the eleven western states through direct or indirect effects. I also want to investigate the role, if any, outdoor recreation amenities play in stimulating population and employment growth.

While there are many aspects of protected land that may be attractive to households, such as landscape preservation, environmental quality, and wildlife habitat, only recreational opportunities are included because of data limitations. In the estimation, the coefficients on the protected land variables will include the impact of these individual characteristics, but the estimates will not be able to differentiate between them. Ideally, there would be consistent data measuring each quality of natural lands, but for the entire sample, only recreation measures were available.

These questions are addressed using a Carlino and Mills (1987) regional adjustment model with the assumption that population and employment are determined

simultaneously. The research suggests that between 1990 and 2000 population did, indeed, increase employment, which is consistent with the Carlino and Mills (1987) model. There is evidence that land with a conservation mandate increases population, which in turn attracts employment. In addition, there is some evidence that preserved federal land attracts employment both directly and indirectly.

CHAPTER 2: LITERATURE REVIEW

To examine the effect of wilderness on population and employment growth it is necessary to understand how population and employment growth are connected. Carlino and Mills (1987) and Clark and Murphy (1996) specify a model and add amenity measures to this framework to test the theory that greater amenities increase population growth. They both look at county-level data for the entire United States and find that population and employment are linked. Power (1996) provides the theoretical foundation for the role of amenities in growth, and we will examine the different studies that test his hypothesis that households are attracted to nice places to live.

Carlino and Mills (1987) looked at population and employment growth in the 1970s. They specified two simultaneous equations, one with population density as the dependent variable and the other with employment density as the dependent variable. It is assumed that both firms and households chose where to locate simultaneously. Households attempt to maximize utility from both income and non-market factors and firms try to maximize profits. The exogenous variables for population growth are factors that theoretically increase households' utility. The employment equation was specified with variables that make the county a more or less attractive place to do business. Firms relocate until profits equalize across regions and households relocate until utility is constant between the counties. Carlino and Mills found that population and employment are related and that climate matters to both employers and labor. The climate variable is their only amenity measure, but they do include regional variables. Carlino and Mills found that there is a tendency for Sunbelt states to grow in both jobs and population, all else constant. People may choose this region because of its amenities, but the variable is

too general to know specifically to which amenities households find attractive. In this model, a vector of site-specific amenities can be included to measure their effect on population and employment growth.

Clark and Murphy (1996) used the same model as Carlino and Mills, but updated it with data from the 1980s and added some amenity measures. They included variables for the county's proximity to the coast, the county's crime rate, and variables describing the climate and included them in the population equation. They also used some of the same variables in the employment equation such as the number of heating and cooling days because that could increase the costs that firms face. Like Carlino and Mills (1987), Clark and Murphy found that employment and population are connected, and that the temperature differential and sunny days are significant explanatory variables. This suggests that amenities play a role in a household's decisions about where to live. These two articles found that jobs follow people, and that people relocate based on employment opportunities. Since only broad measures of amenities were included, they suggest that amenities have a role in a household's decision to locate in a specific location, but their exact role was not addressed.

This is the framework that will be used to examine why the population of the eleven western states is growing despite the fact that wages are lower and housing is more expensive than in the rest of the country. There must be some utility that households receive that is not captured in standard models.

It is easy to incorporate amenity variables into the Carlino and Mills model. Power (1996) argues that the amenities specific to the West attract individuals to the area. Open space, mountains, rural communities, and clean air and water, all characteristic of

the West, add to the utility of households. The quality of life is higher so households want to relocate and are willing to accept lower wages in exchange for living in high amenity areas. Households choose to locate based on amenities, and the population shift stimulates employment growth in the Carlino and Mills model.

Power also argues that, in addition to causing households to relocate, the amenities also attract firms that do not rely on site-specific inputs to the areas. There is a low-cost labor force in the West because the amenities provide a "second paycheck." Firms do not need to pay the wage that labor would demand if there were no amenities. Also, decision makers at firms are attracted to the West so that they can enjoy the high quality of life (Power, 1996).

Two articles test these ideas in the Carlino and Mills framework. Both study the changes that took place during the 1980s, but while one looks at the Intermountain West, the other looks at the Northern Forest Region of the Great Lakes and the East Coast.

Duffy-Deno (1998) looks at the effect of federally owned wilderness in the Intermountain West on population and employment density between 1980 and 1990. He finds a positive, but insignificant relationship between wilderness and population and employment growth. This finding suggests that, in general, economic growth is not harmed by wilderness designation; however some resource dependent counties could see adverse affects of preservation of federal land. Duffy-Deno uses the percent of county land that is designated as wilderness or in wilderness study. This does not differentiate between the amenities associated with wilderness. The effects of recreation, scenery preservation, and environmental quality are all grouped together in the coefficient for wilderness.

Lewis and Plantinga (2001) conducted a similar study of the northern forest region of Maine, New Hampshire, Vermont, New York, Michigan, Wisconsin and Minnesota, but instead of using wilderness as an amenity, they used publicly owned conservation land. They theorized that population would be drawn to counties that had preserved their forest resources. They found that conservation land had a direct, positive effect on population density and an indirect effect on employment growth, which supports Power's (1996) theory that population is drawn to areas that have forest amenities.

The land was further classified as multiple use or conservation. The effect of the publicly owned forest on population was largely due to the direct effect that multiple use land, rather than land set aside for preservation, had on population growth. This finding may be due to the fact that land that was set aside for preservation was designated long before 1990 and the equilibrium had already been met. Another explanation offered by Lewis and Plantinga is that multiple use land has better vehicle access and more day-use areas for more recreation opportunities. Either way, they also found that land managed for conservation had no negative impact on the local employment. This research may indicate that different land management policies may have different effects on household location decisions (Lewis and Plantinga, 2001).

These first two studies looked at the changes that took place in the 1980s, but since then there have been changes in the economic structure that could significantly increase the ability of households to choose where to live. Power and Barrett (2001) found that the economic structure of the Rocky Mountain West has been changing. One aspect of what they found was that the decline in wages was not caused by a shift away

from mining and logging but is better described as individuals sacrificing wage income in order to live in a desirable location. They also found that local economies became less dependent on natural resources and increasingly dependent on service sector jobs. This includes not only low-wage jobs like retail and tourist based services, but also well-paying jobs such as, financial services, lawyers and doctors. Another finding was that the rural economies of the Mountain West are becoming more dependent upon retirement income, which seems to suggest that many individuals are no longer tied to a place and have more options about where to live and retire. Consequently, amenities may play a larger role in where people live. Both the Carlino and Mills (1987) and the Clark and Murphy (1996) articles showed that population helped to drive employment growth in the 1970s and 1980s. Because services have a greater share of overall employment, population may have an even greater role in increasing employment opportunities.

This finding is supported by Vias (1999) who, using the Carlino and Mills (1987) model, found that jobs follow people in the Rocky Mountain West, but there is no attempt to identify what makes people relocate. Vias also shows that mining employment has been replaced by employment in the service and trade sector, as a result of the change in population. Amenities are offered as an explanation for the shift in population, but there is no further discussion describing those amenities.

In addition to Duffy-Deno (1998) and Lewis and Plantinga (2001), there have been several articles that indicate that amenities now play a larger role in determining the location decisions of households. The Sonoran Institute found that as of 2000 both population and employment growth were highly correlated with wilderness (Sonoran Institute, 2004). This led them to conclude that wilderness is a necessary condition for

growth, but in itself is not sufficient. The presence of infrastructure to connect with other regions is critical for growth in the "new west" (Rasker 2006). Frentz et al. (2004) document that growth rates in counties with federal land have higher average growth rates, but they vary by managing agency. Since these articles came to these conclusions only through statistical correlations, more rigorous testing needs to be performed.

By extending the variables of amenities beyond the conservation or federal land acreages, some research has included measures of amenities associated with protected land that is not captured by simply including the management agency or land management program.

An article by Carruthers and Vias (2005) uses the Carlino and Mills framework to explain population and employment growth in the Rocky Mountain West, but they do not use wilderness as a variable. Instead, they use a scale to indicate the level of natural amenities. They find that population and employment are both related and causal at a significant level and that the amenity scale is positively related to population and employment growth. This is important because Duffy-Deno (1998) did not find that federal land amenities had a significant effect on population or employment. This may reflect households' flexibility in deciding where to live and the change towards footloose employment. The Carruthers and Vias (2005) article also found that the amenity scale helps attract people to an area, because people like living in a nice place. There is an opportunity to further differentiate between the effects that each amenity plays in determining population growth.

Deller et al. (2001) examine population and employment growth in counties across the country. They are particularly concerned with the role of amenities in

attracting people to an area, and the idea that individuals sacrifice labor income to live in a nice place. They use eigenvectors to define five different amenity measures: Climate, Developed Recreational Infrastructure, Land, Water and Winter. They find no negative relationship between any amenity measure and the dependent variables. The fact that population and employment are not harmed by amenities is consistent with the idea that households choose nice places to live, which, in turn, stimulates employment. The fact that they found that amenities have a positive effect on per capita income seems to suggest that the employment growth has not been in poor paying jobs, or it could suggest that retirees are relocating to high amenity areas and the income growth is due to non-labor income. Like Caruthers and Vias (2005), this article shows that while people now have more flexibility to determine where to live they also use an index that is a broad measure of amenities making it more difficult to interpret the results.

Access to amenities is not necessarily inhibited by the political boundaries of the county. The use of federal acreage contained within a county to measure amenities associated with those lands assumes that people do not enjoy the amenities of adjacent counties. White and Hanink (2004) look at non-metropolitan counties of the Northern Forest Region for a relationship between environmental amenities and employment growth, population growth and income. They found that amenities by themselves were not enough to stimulate growth, but their interaction with interstate highways and proximity to regional population centers did produce growth in the three measures. This suggests that amenities alone do not act to stimulate growth, but, as Rasker concluded, they must also be accessible.

Research by Monchuck (2003) indicates that amenities in adjacent counties are important for population growth in the Midwest because people can enjoy amenities regardless of political boundaries. This finding agrees with Schmidt and Courant (2006) who found that people value being able to enjoy nice places, even if they are not in the immediate vicinity.

Lorah and Southwick (2003) found a correlation that wilderness and conservation land is associated with population, employment and income growth in the eleven Western states. A fifty-mile radius from the county center was used because it measures land that is accessible to county residents via a relatively short trip. Using, instead, amenities that are contained in adjacent counties would not take into account the large size of some counties, especially in the West, where the amenities in the adjacent county may be far from the resident in adjacent counties. Or, conversely, they may be just over the political boundary and easily accessible, but if only in-county amenities are included, those easily accessible amenities would not be included in the regressions.

Carlino and Mills (1987) and Clark and Murphy (1996) laid out a regional adjustment model that connects population and employment growth. This model was extended to include amenity variables and test the amenity view of economic development, but these articles examined the changes that took place during the 1980s (Duffy-Deno, 1998, Lewis and Plantangia, 2001). Literature that uses data from the 1990s (Caruthers and Vias, 2004, Deller et al., 2001, Monchuck, 2003, Schmidt and Courant, 2006, Rasker, 2006, White and Hannick 2003) shows that amenities play a significant role in the location decisions of households, which leads to employment opportunities. This may stem from a shift in the economic structure of rural counties that

took place in the 1990s (Power and Barret, 2001, Rasker, 1994). Each of the articles that study amenities in the regional adjustment model is limited by the measure of amenities that are used in the regressions.

CHAPTER 3: MODEL

Carlino and Mills (1987) set out the general model that will be used to look at the effect of wilderness amenities on county growth. In this disequilibrium adjustment model, households and firms are assumed to be geographically mobile. Households move to maximize utility that comes from a combination of the consumption of private goods and from location specific amenities. It is assumed that the quality of amenities varies between locations. Firms will locate in order to reduce their production costs so that they can maximize profits. Firms will enter and leave regions until profits are equal across regions and households will enter and leave regions until utility is equalized. In this model, population and employment are simultaneously determined, but there are several other factors that affect profit maximizing firms and the location decisions of utility maximizing households.

Specifically, the model can be solved to give two equations, one for population and one for employment where employment is E and population is P. F denotes the variables that affect firm's profits and H represents factors that affect household's relocation decisions. The asterisk indicates equilibrium levels.

$$(1) \quad E_t^* = \alpha_0 P_t + \alpha_1 F_t$$

$$(2) \quad P_t^* = \beta_0 E_t + \beta_1 H_t$$

Since employment and population have substantial lag time in adjusting, Carlino and Mills (1987) include a one-decade lag, denoted by the subscript t-1. λ represents a speed of adjustment coefficients and for stationarity it is assumed that $0 \leq \lambda_E, \lambda_P \leq 1$. This gives the equations:

$$(3)\ E_t = E_{t-1} + \lambda_E (E_t * - E_{t-1})$$

and

$$(4)\ P_t = P_{t-1} + \ \lambda_p (P_t * - P_{t-1})$$

Substituting and rearrangement of terms gives

$$(5)\ E_t = \lambda_E \alpha_E P_t + \lambda_E \alpha_E F_t + (1 - \lambda_E) E_{t-1}$$

and

$$(6)\ P_t = \lambda_P \beta_P E_t + \lambda_P \beta_P H_t + (1 - \lambda_P) P_{t-1}$$

Equations 5 and 6 are simultaneous equations for the variables of population and employment. Equation 5 shows that employment depends on a set of variables that affect firm's profits, F, population (the other endogenous variable) and the lagged employment. Population is determined by a set of variables that affect a household's utility, H, employment (the other endogenous variable) and the lagged population.

Carlino and Mills (1987) discuss population and employment in a general sense, but they provide no justification for the functional form to use. In the original article, they use population and employment densities, but this makes interpretation difficult. Conceptually, the levels of population and employment are easier to understand than densities. With levels as the dependent variable, the coefficient can be interpreted as the number of people, but with densities, it is interpreted as more or less crowded. Other authors have used different specifications, but they do not provide any guidance on the correct empirical specification. An article by Mulligan, Vias and Glavac (1999) examined the issues of simultaneity, stationary and dual causality with different model specifications. They report that there is no theoretical reason that the model should be in

density terms, but this probably was done to reduce heteroskedasticity in the original Carlino and Mills (1987) article.

In fact, there are many different functional forms that have been used when modeling simultaneous population and employment changes. The Carlino and Mills (1987) model is used in much of the research that specifically looks at amenities, but a different model by Greenwood and Hunt (1984) has also been applied. The Greenwood and Hunt (1984) model examines net migration and employment simultaneously, but it has the same basic idea that employment and population are linked. Table 3.1 shows the different functional forms that have been used and the model that was applied.

Table 3.1: Summary of Previous Research with Simultaneous Employment and Population Equations

Author (Yr)	Study Period	Dependent Variable	Amenity Measure	Study Area	Model
Carlino and Mills (1987)	1970-1980	Population and Employment Density	Regional Dummy	Lower 48 States	
Clark and Murphy (1996)	1981-1989	Δ Population Density and Δ Employment Density	Climate, Crime, Coast	Lower 48 States	CM
Greenwood and Hunt (1984)	1958-1975	Net Migration and Δ Employment	Regional Dummy	57 Largest Urban Areas	
Carruthers and Vias (2005)	1982-1997	Population and Employment Density ratio	ERS Natural Amenity Scale	Intermountain West	CM
Deller et al. (2001)	1985-1995	Δ Population, Δ Employment, and Δ PC Income	Eigenvectors for Climate, recreation, Land, Water and Winter	Lower 48 States, Rural Counties	CM
Duffy-Deno (1998)	1980-1990	ln Population Density and ln Employment Density	% NPS, %USFS, %BLM, and %Wilderness	Rural counties for Intermountain West	CM
Lewis and Plantinga (2001)	1990-1997	Net Migration and Job Growth Rate	% Multi-Use conservation and % Preservationist	Northern Forest Region	GH
White and Hannik (2004)	1970-1995	Δ Population and Δ Employment	ERS Amenity Index	Northern Forest Region	CM

The model refers to Carlino and Mills (1987) referred to as CM or Greenwood and Hunt (1984) referred to as GH.

The most popular dependent variable is some form of employment and population densities, likely because that was the dependent variable in the Carlino and Mills (1987) article. There is no evidence that this specification is superior to others, and it may in fact lead to stationarity issues (Boarnet, Saksith, Geho, 2005, and Henry, Schmitt, Piguet, 1999, Hunt 2006). Given the difficulty interpreting the results of using employment and population densities, and the suggestion that this model specification may not have desirable statistical properties, this paper will model the change in population and employment as follows.

$$(7)\ \ln E_t = \lambda_E \alpha_0 \ln P_t + \lambda_E \alpha_1 F + (1-\lambda_E)\ln E_{t-1}$$

and

$$(8)\ \ln P_t = \lambda_P \beta_0 \ln E_t + \lambda_P \beta_1 H + (1-\lambda_P)\ln P_{t-1}$$

Notice that in the estimation, the coefficient for either lagged population or employment variable equals 1-λ. To keep the system stationary, and not increase exponentially, the coefficient for the lagged dependent variable must be between 0 and 1.

CHAPTER 4: EMPIRICAL ESTIMATIONS

In the Carlino and Mills (1987) regional adjustment model, jobs attract people and people attract jobs. This is modeled with two simultaneous equations, one for population and one for employment. Duffy-Deno (1998) used this model to estimate the effect of public land and wilderness on these two variables for the intermountain west and Deller et al. (2001) looked at the effect of amenities, including federal land and recreation opportunities that were measured with eigenvectors, on population and employment growth for the whole country. Duffy-Deno (1998) looked at the change in the 1980s and Deller et al. (2001) looked at the change from 1985 to 1995. My research is concerned with the change from 1990 to 2000. Instead of using an index, I use the number of recreation facilities and the percentage of protected land in order to measure access to outdoor amenities.

Employment Estimation

The percentage change in employment is determined by local factors that impact a firm's profits. If there is an opportunity to take advantage of those local factors, then it is assumed that the number of jobs will grow. These local factors can be divided into five categories so that employment is a function of population, direct costs, secondary costs, amenities and location. Using these categories, the general equation for population can be thought of as:

$$Employment_t = \alpha_1 Population_t + \alpha_2 Employment_{t-1} + \alpha_3 DirectCosts_{t-1} + \alpha_4 SecondaryCosts_{t-1} + \alpha_5 Amenities_{t-1} + \alpha_6 Location_{t-1}$$

Here is a brief description of the categories in this section, but in the following chapter there is a more thorough discussion of each variable. These categories are included to help understand how the variables contribute to employment growth.

Population

Population is expected to increase the employment opportunities as households demand goods and services. There should be more employment growth as population growth creates a new market for firms' goods and services.

Lagged Employment

Lagged employment is included because current levels of employment are likely to be related to previous levels of employment. This also is to stay true to the Carlino and Mills (1987) model.

Direct Costs

Firms are drawn to areas with low costs, so variables are included in an attempt to measure a firm's direct cost. Included are the cost of labor, power and taxes, all direct costs that may vary between counties.

Secondary Costs

The secondary costs all effect the cost to firms, but they are not measured as prices. This includes the existence of other firms, access to markets and the quality of the available labor force. There is also a measure for the amount of public goods that are provided which may reduce the costs of production.

Amenities

Instead of using climactic variables, as other research has (Deller et al. 2001, Duffy-Deno, 1998), an amenity index is used that is designed to measure amenities that do not change over time, and since it does not include recreation or federal land, it can be included in a regression that includes a land management variable.

To measure the impact of protected land within a fifty-mile radius of the county centroid, GAP codes[1] are used. All federal land is assigned a code of 1 to 4, indicating a different level of conservation. This is to measure the impact of being in close proximity to natural areas and also to see if higher levels of protection have a negative impact on employment, specifically natural resource employment.

Some firms may benefit from having access to outdoor activities, so measures of ski areas, boat ramps, campgrounds and hiking trails are included.

Location

There are also variables to measure the location of the county. The county area is included, as are dummy variables indicating what state the county is in, and a dummy variable for its classification along the rural-urban continuum called Beale Codes.

Where available, the exogenous variables are from the beginning of the period. This is to eliminate any simultaneity from using variables that could be determined by employment growth. The amenity index comes from McGranahan (1999) and it is based on variables that do not change. The GAP codes come from 2005, and recreation variables are from NORSIS, which was compiled in 1998. Ideally these would all come from the beginning of the period, 1990, but they are the best measures of these variables available. This assumes that if there is any change in these variables over time that the relative position of the counties remains the same. The underlying assumption is counties with access to a lot of conservation land or recreation opportunities have had access to a lot of conservation land or recreation opportunities since 1980.

Total employment is of the most interest because it reflects how employment growth is doing as whole. For lack of a better term, “resource dependent employment”

refers to industries that may profit from selling natural resources that are removed from private or public land. This category of employment is of interest because when opponents argue against wilderness designation on economic grounds, they claim that these industries will suffer. Natural resource employment is defined by:

$$\text{Re}\,sourceDependentEmployment_{t,i} = MiningEmployment_{t,i} + Agricultural\ \&\ Forest\ Employmnet_{t,i} + ManufacturingEmployment_{t,i}$$

Since nature itself can be considered a natural resource, this may be misleading. There is some employment that depends on visitors to natural areas, such as national park lodging and outfitters that cater to hunters, but this employment is counted in the service sector. It is possible that many firms benefit from their proximity to attractive landscapes and natural amenities; however, this more general definition of natural resources is excluded from natural resource dependent employment.

The service industry is also estimated using the same independent variables. This is because, in the rural West, most of the growth in total employment has been caused by growth in the service sector (Power and Barret, 2001).

Population Estimation

In the Carlino and Mills (1987) framework, population is determined by households attempting to maximize their utility, taking into account local factors. Thus the change in population is a function of four categories of local factors: employment, community characteristics, amenities and location.

The general form of the population equation takes the form:

$$Population_t = \beta_1 Employment_t + \beta_2 Population_{t-1} + \beta_3 CommunityCharicteristics_{t-1} + \beta_4 Amenities_{t-1} + \beta_5 Location_{t-1}$$

The discussion of the following categories is to help understand how they play a role in employment growth. For a more comprehensive description of the variables that are included in each category, and their sources, see the following chapter, Chapter 5: Data.

Employment

Population depends on the other endogenous variable, total employment, because people may choose to relocate based on the availability of jobs.

Lagged Population

Lagged population is included because the current level of population depends on the previous level of population and to stay true to the Carlino and Mills (1987) model.

Community Characteristics

Variables are included that measure community characteristics that households may consider before deciding where to live. These include the tax burden, and the education and police protection that are provided. There is also a measure for how safe the community is, and the level of stability in the community. In addition, there is a measure for the accessibility to the rest of the country. These are used to measure some of the characteristics that may make a county a nice place to live.

Amenities

There is an amenity index that consists of variables that enhance the county as a place of residence. They consist of mild weather, topography, and surface water which are all correlated with population growth.

The same conservation lands, described earlier, are included in both equations. The percent of land designated as each Gap code within a fifty-mile radius of the county

centroid is included to measure protected land. Ski areas are also included, as described in the employment population section.

The population equation includes additional measures of recreation. The number of trailheads in each county is used to measure hiking and backpacking opportunities. The number of boat ramps measures the availability of water recreation. And the number of campgrounds measures the access to recreational camping opportunities.

Location

The population equation also includes the same location variables: area, dummy variables for the Beale classification, and a state dummy variable.

Comparing the Change Between Time Periods

While the description of the equations is for the change from 1990 to 2000, the change from 1980 to 1990 will also be estimated. Where available, the exogenous variables are from the beginning of the period, 1980. The recreation measures will come from NORSIS, which has variables from several years, because it is the best measure of recreation in my dataset. The GAP codes come from 2005, and they are used because it is the only measure of conservation land within a fifty-mile radius in my dataset.

The estimations from the 1990s and the 1980s will allow comparison between the two time periods. It has been suggested that people and firms have more flexibility to choose where to locate, due to better technology and less costly travel (Power and Barrett, 2001, Rasker, 2006). A comparison of the coefficients on the natural amenity variables will show any change on their impact on population and employment.

[1] For the full description of GAP codes, see appendix A: What do the GAP Codes Mean?

CHAPTER 5: DATA

To test this model empirically, data was compiled for counties within the eleven western states: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Washington, Wyoming and Utah. Counties are used because they are the smallest area that has consistent measures of the variables for a long enough time period. Many of the variables are compiled by the federal government and are publicly available.

Population

Households are assumed to maximize their utility by choosing their location based on a set of variables, H, which can be broken into the categories outlined in the previous chapter: employment, community characteristics, amenities, and location.

The dependent variable, the natural log of population in 2000, can be calculated from data available from the US Census. The lagged population, the population from 1990, is also available from the census. A ten-year period was chosen following Carlino and Mills (1987) and Clark and Murphy (1996) because it is assumed ten years is a sufficiently long adjustment period.

Employment

Employment is measured as the number of jobs, both full and part time, within the county boundaries, not the number of working people that live in the county. This variable is available from the Regional Economic Information System from the Bureau of Economic Analysis.

Since economic theory assumes that population and employment are simultaneous, a two stage least squares (2SLS) estimation technique is used. Including the employment on the right-hand side of the population equation introduces bias,

because the error terms are linked to the right-hand side variable, employment. To eliminate this bias, an instrumental variable is used in place of the natural log of employment. The instrumental variable is the estimated employment when regressed on all of the exogenous variables in the system of equations. While the 2SLS eliminates the bias, the standard errors are higher in the estimation.

Community Characteristics

Households should be attracted to counties with relatively low taxes and low property taxes, so per capita taxes and the percent of taxes that are collected in the form of property taxes are included to measure the average tax burden. There are also variables included to measure any benefits that may offset higher taxes such as per capita expenditure on education and per capita expenditure on police. It is assumed that these two variables will have positive coefficients. All four of these fiscal variables are from 1992 and available from USA counties.

Because households are assumed to be attracted to areas with a strong sense of community, the percentage of homes that are owner occupied, which is available from the Census Bureau, is included.

It is also assumed that households are attracted to areas that are accessible to other areas. Consequently the miles of highway per acre of county land is included as well as the number of airports with scheduled commercial service that are within the county. This data comes from the Department of Transportation and the Federal Aviation Administration respectively.

Amenities

Non-market amenities are included with an amenity index including measures for climactic and topographic variables that are theorized to increase population growth. These amenities are climactic variables for the average January temperature, mean hours of sunlight for January, mean temperature for July, and the mean humidity for July. Each of the climactic variables is the mean for the thirty-year period from 1941-1970. Also included are measures of topographic relief and the percent of the county surface area that is water. These six measures are combined in one index and included in the regression as one variable. This amenity index is not designed to measure the scenic beauty from the interaction of these elements; it is intended simply to measure the basic ingredients. Since this variable does not include how the land is managed nor recreation opportunities, it controls for other amenities that are not explicitly measured by the other outdoor amenity variables included in the regression. A description and the index itself are available from the U.S. Department of Agriculture (McGranahan, 1999).

The variables of interest are outdoor recreation opportunities and the amount of protected land that is accessible to county residents. It is assumed that households are attracted to these two site-specific amenities. To measure the impact of protected land within a fifty-mile radius of the county centroid, GAP codes are used. All federal land, and some state and private land with a conservation mandate, is assigned a code of 1 to 4, indicating differing levels of preservation[2]. GAP 1 refers to land that has permanent protection to conserve the natural landscape and there is no attempt to control natural events (*e.g.* floods, fires), which consists mainly of wilderness, national parks, and nature preserves. GAP 2 refers to land that has a mandate to remain in a natural state, but may

be used in ways that degrade existing natural communities, including suppression of natural disturbances. This category consists mainly of state parks and national recreation areas. GAP 3 consists of land that is managed mainly for conservation, but with broad areas of low intensity extraction (logging) or concentrated, high intensity extractive uses (mining). Most lands managed by the BLM, National Forest Service and wildlife management areas are included in this category. The final category, GAP 4, consists of federal land that has no conservation mandate such as land controlled by the Bureau of Indian Affairs and the military (Conservation Biology Institute, 2005).

A fifty-mile radius was chosen as a measure of land that is within commuting distance from the geographic center of the county. This distance is arbitrary, but the percentages do not change to a great extent when the radius is adjusted from 25 to 200 miles (Lorah, 2007).

Recreation variables come from the National Outdoor Recreation Supply Inventory System (NORSIS), compiled from various sources by the Forest Service's Southern Research Station and are the number of recreation facilities included within the county boundary. Trailheads will be used to measure hiking and backpacking opportunities, and they are taken from the various state and federal management agencies that maintain the trails. Designated campgrounds are used to measure recreational camping and include both public and private campgrounds. The respective managing agencies reported the number of public campgrounds and the American Business Inventory (ABI), a survey of local telephone books that looked for campgrounds (NORSIS codebook), provided the number of private campgrounds. Ski areas are included to gauge winter recreation, with data from the Ski Industry Association. Water

recreation will be measured by the number of boat ramps, as reported by respective public management agency. Each of these variables were complied from the various sources and compiled into one data set, NORSIS, provided by the U.S. Forest Service.

Location

Dummy variables that indicate the state and the rural-urban continuum (Beale code) into which the county falls are used. The state variable will pick up any variances between the states, but may not vary within the state. The Beale Code is a definition for a county along the rural-urban continuum (Table 6.1). There are ten different categories that separate the counties. For these regressions, metro counties are defined as having a Beale code of 0-3, which includes central and fringe counties of metro areas of 1 million people or more, counties with 250,000-1 million people and counties with metro areas of fewer than 250,000 people. Beale codes 4 and 5 represent counties with an urban population of 20,000 or more, adjacent and non-adjacent to a metro area respectively. Beale code 6 is for an urban population of 2,500 to 19,999, adjacent to a metro county and Beale code 7 is for the same urban population, but non-adjacent to a metro area.

Table 5.1: Definitions for Beale Codes

Metro counties:
0 Central counties of metro areas of 1 million population or more
1 Fringe counties of metro areas of 1 million population or more
2 Counties in metro areas of 250,000 to 1 million population
3 Counties in metro areas of fewer than 250,000 population
Nonmetro counties:
4 Urban population of 20,000 or more, adjacent to a metro area
5 Urban population of 20,000 or more, not adjacent to a metro area
6 Urban population of 2,500 to 19,999, adjacent to a metro area
7 Urban population of 2,500 to 19,999, not adjacent to a metro area
8 Completely rural or fewer than 2,500 urban population, adjacent to a metro area
9 Completely rural or fewer than 2,500 urban population, not adjacent to a metro area

(McGranahan, 1999)

Beale codes 8 and 9 are for completely rural, or fewer than 2,500 urban population, and adjacent and non-adjacent to a metro area. In the regressions, each Beale code has its own dummy variable, and is available from the economic research service of the U.S. Department of Agriculture.

With these variables defined, the population equation takes the form:

$$\ln Pop_{00,j} = \beta_0 + \beta_1 \ln Emp_{00,total,j} + \beta_2 \ln Pop_{90} + \beta_3 \ln PCTax_{90,j} + \beta_4 \ln \%\,\mathrm{Pr}\, opTax_{90,j} + \beta_5 \ln PCExpenditureLaw_{92,j} + \beta_6 \ln PCExpenditureEducation_{92,j} + \beta_7 \ln \%OwnerOccupied_{90,j} + \beta_8 \ln HwyMilesperAcre_{90,j} + \beta_9 Airport_{90,j} + \beta_{10} \ln CrimeRate_{90,j} + \beta_{11} AmenityIndex_{99,j} + \beta_{12} GAP1_{2005,j} + \beta_{13} GAP2_{2005,j} + \beta_{14} GAP3_{2005,j} + \beta_{15} GAP4_{2005,j} + \beta_{16} Trails_{98,j} + \beta_{17} Boatramps_{98,j} + \beta_{18} Campgrounds_{96,j} + \beta_{19} SkiAreas_{90,j} + \beta_{20} \ln Area_{90,j} + \beta\ BealeD_{93,j} + \beta\ StateD_j + \varepsilon$$

As mentioned previously, the independent variables come from the beginning of the period, when available, to ensure they are exogenous. Table 5.2 displays the summary statistics for the variables that are included in the regressions for the 1990s.

Table 5.2: Summary Statistics: 1990-2000 regression

Variable	mean	min	max	sd
Dependent Variables				
Population 2000	149853.30	492	9546019	577428.80
Population 1990	124973.70	500	8881300	515633.20
Total Employment 2000	88392.65	298	5499228	344619.90
Total Employment 1990	70934.11	275	5353918	311803.60
Service Employment 2000	29191.72	33	2090154	126952.70
Service Employment 1990	20859.27	22	1780566	101269.90
Natural Resource Employment 2000	10446.45	5	711928	44179.53
Natural Resource Employment 1990	10132.08	10	929033	52536.31
Direct Costs/ Community Characteristics				
Per Capita Tax 1992	793.61	89.71	5598.04	533.91
% Property Tax 1992	81.88	36.60	99.90	14.74
Wage 1990	8.98	5.44	17.89	1.96
Electricity $ 1988	0.15	0.05	0.24	0.04
Secondary Costs/ Community Characteristics				
Owner Occupied 1990	68.55	34.50	85.70	7.42
Per Capita Education Exp 1992	1117.02	399.61	4635.20	371.90
Per Capita Police Exp 1992	115.62	25.51	693.24	66.69

Per Capita Public Exp 92	2534.77	811.32	9814.81	1126.86
Highway Miles per Acre 1990	1.91	0.15	21.05	1.77
% High School Education 1990	77.51	53.20	94.80	7.43
Unemployment 1990	7.45	1.30	28.60	3.46
Serious Crimes per 1,000,000 1991	0.04	0.00	0.11	0.02
Amenities				
% Gap 1 (National Parks and Wilderness)	5.00	0.00	61.65	7.58
% Gap 2 (National Rec Areas and St. Parks)	3.92	0.00	52.05	6.09
% Gap 3 (BLM and National Forests)	32.70	0.01	90.04	20.65
% Gap 4 (No Conservation)	11.47	0.00	96.52	20.95
Ski Resorts	0.10	0.00	4.00	0.42
Hiking Trails	3.02	0.00	31.00	5.06
Boat Ramps	1.13	0.00	14.00	2.05
Campgrounds	15.46	0.00	96.00	16.09
Amenity Index	3.58	-3.82	11.17	2.42
Location				
Area 1990	2855.71	47.00	20062.00	2686.50

Each state is broken down into the urban-rural continuum, because some states are more rural or more urban than the others (Table 5.3).

Table 5.3: Urban-Rural Continuum by State, 1993

State	Metro	Beale 4	Beale 5	Beale 6	Beale 7	Beale 8	Beale 9	Total
Arizona	5	3	3	1	3	0	0	15
California	34	4	1	11	5	2	1	58
Colorado	10	0	1	5	19	6	20	61
Idaho	2	1	4	3	20	3	11	44
Montana	2	0	5	1	18	9	21	56
Nevada	3	1	1	2	5	2	3	17
New Mexico	6	1	6	5	8	2	5	33
Oregon	9	5	3	3	10	0	6	36
Utah	4	2	0	6	9	1	7	29
Washington	12	4	4	6	5	4	4	39
Wyoming	2	0	2	1	14	0	4	23
Total	89	21	30	44	116	31	83	411

Gilpin and Summit Counties, Colorado is not included.

Some states, like California, have many counties that are considered metro, so many of the rural counties are adjacent to metro counties, designated by even numbers. Other

states such as Montana and Idaho have very few metro counties, so the rural areas are not adjacent to urban centers, designated with an odd code.

As mentioned previously, two time periods will be studied, but the variable definitions remain the same and only the time period changes. The summary statistics for the regressions for the 1980s is displayed in table 5.4. Most of the variables are collected in regular, five-year intervals so the year closest to the beginning of the decade was used. Some of the variables do not change (amenity measures) and some of the variables are the endpoints of the study period. The dependent variables have values for 1990 that appear in both systems of equations. For the population and employment sectors from the period 1990-2000, the 1990 value is the lagged dependent variable. For the time period from 1980-1990, the values from 1990 are the dependent variable.

Table 5.4: Summary Statistics: 1980-1990 Regression

Variable	mean	min	max	sd
Dependent Variable				
Population 1980	102298.30	400	7503500	425637.80
Total Employment 1980	53758.47	171	4342061	244350.70
Service Employment 1980	12662.44	10	1156050	63826.47
Natural Resource Employment 1980	9149.91	5	985219	53330.04
Direct Costs/ Community Characteristics				
Per Capita Tax 1982	476.95	39.74	2255.53	332.27
% Property Tax 1982	84.36	46.10	99.80	12.73
Wage 1980	6.10	3.64	10.86	1.20
Electricity $ 1980	0.08	0.03	0.16	0.03
Secondary Costs/ Community Characteristics				
Owner Occupied 1980	69.90	33.71	86.90	7.36
Per Capita Education Exp 1982	638.71	298.20	2132.34	210.92
Per Capita Police Exp 1982	60.95	0.00	267.42	28.89
Per Capita Public Exp 1982	1360.92	553.97	3386.76	446.38
Highway mi. per Acre 1981	2.06	0.13	21.00	1.97
% High School Education 1980	72.02	44.10	95.30	8.18
Unemployment Rate 1980	7.35	0.50	27.50	3.93
Serious Crimes per 100,000 1981	0.53	0.00	28.76	2.08
Location				
Area 80	2856.30	46.00	20064.00	2710.75

The variables that are common to both the 1990-2000 and 1980-1990 regressions are included in the table for the 1990-2000 time period.

As with the other variables, the urban-rural continuum can change over a ten-year period. While there is a general trend for counties to become more urbanized, the states that had been rural remained rural, and the states with many metro counties have continued to be more urban.

Table 5.5: Urban-Rural Continuum by State, 1983

State	Metro	Beale 4	Beale 5	Beale 6	Beale 7	Beale 8	Beale 9	Total
Arizona	2	3	4	1	4	0	0	14
California	31	4	3	8	7	4	1	58
Colorado	10	0	1	4	20	6	22	63
Idaho	1	2	4	2	21	1	13	44
Montana	2	0	5	0	19	6	24	56
Nevada	2	1	0	1	6	4	3	17
New Mexico	2	3	6	2	13	1	5	32
Oregon	8	3	5	3	10	0	7	36
Utah	4	1	0	6	8	1	9	29
Washington	11	4	5	6	6	3	4	39
Wyoming	1	0	3	2	13	0	4	23
Total	74	21	36	35	127	26	92	411

La Paz County, Arizona, and Cibola County, New Mexico, are not included.

Employment

The employment equation is defined by variables that can affect a firm's profits. With more opportunity for profits, there will be more firms and, it is assumed, more employment.

The Bureau of Economic Analysis provides the dependent variable, the number of full- and part-time jobs in a county, in the regional economic information system (REIS). This measure of employment is not the number of employed people, nor does one job reflect a full forty-hour workweek, so a county with many part-time jobs will be represented as having more employment opportunities. The Standard Industrial Classification (SIC) is used, because it separates the number of jobs in eleven industries and provides data for the entire study period.[3] In an attempt to understand what is

happening to the economic structure, three regressions will be estimated. Total employment is the most important because it indicates how employment as a whole reacts to wilderness designation, but it is difficult to identify in which sectors changes occur. An estimation of the employment of resource dependent industries, consisting of forest products, mining and manufacturing, will be performed to understand how wilderness designation impacts these industries as well. And for completeness, service employment will be regressed on the same variables. This is only expected to mirror total employment because it is assumed that amenity-led job creation is due mainly to the service sector. There are some disclosure problems, but any missing values can be estimated using a program from the Sonoran Institute (Sonoran Institute, 2002).

The Bureau of Economic Analysis does not publish confidential data that could be used by a firm's competitor, consequently three forms of data gaps are encountered in the data used in this analysis. The first is designated with a D, indicating that data has been suppressed to avoid disclosing confidential information. The second is designated with an L, to show that the data is for a sector with less than ten employees, but it is still included in the total employment data. The final form of disclosure restrictions is for counties in which there is no data. This includes only two counties in our study area, La Paz, AZ and Cibola, NM, which were created in 1982, so there is no data for 1980. In counties with smaller populations there tends to be more suppression of industry specific data and data gaps, and these are the rural counties that are of most interest.

These data restrictions are eliminated with the Sonoran Institute's Economic Profile System (Sonoran Institute, 2002). When data is suppressed because the industry has ten or fewer jobs, the midpoint of five is the estimate. When the data is suppressed

for confidential reasons then the estimates are more sophisticated. First, the number of firms for that industry is taken from the U.S. Census Bureau County Business Patterns. Then the average firm size is calculated for both the state and national level, which is multiplied by the number of firms. These estimates are then scaled either up or down so that the sum of all sectors equals the total number of employees in the county.

Population

Firms may be attracted to areas that have a market within the county to sell their goods and services, so an instrumental variable for population is included. This is the other dependent variable in the system of simultaneous equations.

Lagged Employment

Lagged employment is used to stay true to the Carlino and Mills (1987) model. The Sonoran Institute program was used to fill any gaps in the data that may have resulted in disclosure restrictions.

Direct Costs

Direct costs consist of prices that the firm must pay for inputs. The cost of labor is measured with the average wage per job, and is available from the Bureau of Economic Analysis in the Regional Economic Information System. The cost of electricity is measured as the cost per kilowatt-hour to commercial firms and is published by the Energy Information Administration. The two tax variables, per capita taxes and percent property taxes, included in the population equation are also included in the employment equation.

Secondary Costs

Firms are attracted to regions with a well-educated labor force, which is measured as the percent of the population, 25 years and older, with a high school diploma. This data is available from the U.S. Census Bureau. The unemployment rate is included to measure the available labor for new firms and is provided by the Census. Because firms may accept a higher tax burden if they are compensated for with the provision of public goods (Mofidi and Stone, 1990), per capita expenditure by the government is included, which is available from USA counties.

Amenities

The same variables in the population equation are included in the employment equation.

Variables that are also in the employment equation but discussed in the population section are: per capita taxes, percent property taxes, highway miles per acre, airports, the amenity index, the same protected land variables, outdoor recreation opportunities, county area, and the state and Beale code dummy variables.

With this description of the variables, for county j the employment equation takes the form:

$$\ln Emp_{00,j} = \alpha_0 + \alpha_1 \ln Emp_{90} + \alpha_2 \ln Pop_{00,j} + \alpha_3 \ln PCTax_{90,j} +$$
$$\alpha_4 \ln \%\,\mathrm{Pr}\, opTax_{90,j} + \alpha_5 \ln PctEdu_{90,j} + \alpha_6 \ln Unemployme\, nt_{90,j} + \alpha_7 \ln AvgWage_{90,j} +$$
$$\alpha_8 \ln Elec\,\mathrm{Pr}\, ice_{90,j} + \alpha_9 \ln HwyMilesAc\, re_{90,j} + \alpha_{10} Airport_{90,j} + \alpha_{11} AmenIndex_{99,j} +$$
$$\alpha_{12} \%GAP1_{05,j} + \alpha_{13} \%GAP2_{05.j} + \alpha_{14} \%GAP3_{05,j} + \alpha_{15} GAP4_{05,j} + \alpha_{16} SkiAreas_{90,j}$$
$$+ \alpha_{17} \ln Area_{90,j} + \alpha\ BealeCodeD_{93,j} + \alpha\ StateD_j + \varepsilon_j$$

All of the variables come from the beginning of the time period, *i.e.*, 1990, with the exception of the other dependent variable, which reflects the change over the same

time period, and the conservation and recreation variables. This will hold for both the estimation of the change from 1990-2000 and 1980-1990, but the variables have the same definitions and come from the same sources.

In order to compare the coefficients for the gap codes and outdoor recreation variables, it is assumed that they change very little, if at all.[4] Unfortunately, the GAP codes come from 2005 and the recreation variables come from NORSIS, which was compiled in 1998 instead of the beginning of the period.

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[2] See Appendix 1: What do the GAP codes mean?

[3] The North American Industry Classification System (NAICS) replaced the SIC but has data dating back only to 1997 for the county level.

[4] For five-year periods between 1982 and 1997 the average percentage change in federal land was 0.73%, for all fifty states. The percentage change in federal land with respect to the total state area was 0.09%, for the same five-year intervals. While there may be some change in management policy, a move between GAP codes, it is most likely that the land goes from some conservation, GAP3, to more conservation, GAP1. This happened at least twice in the 1990's, the creation of Death Valley National Park and the creation of Grand Staircase-Escalante National Monument. These both granted more protection to BLM land.

For recreation opportunities, it is unlikely that they change much. A survey of proposed management plans for the national parks found no plans for new trails or campgrounds. The same is likely true for other federal and state agencies, the major supplier of outdoor recreation opportunities. This is due to the lengthy process needed to plan for and build new infrastructure.

Ski areas are unlikely to change much because they require locations with certain attributes, hills that stay snow covered for the length of the winter with little risk of avalanches. These locations have likely already been used for ski areas, so there are few opportunities remaining for new downhill ski areas.

CHAPTER 6: RESULTS

The following results look first at the core relationship between population and employment, with some initial diagnostics included. Then the relationship between population and conservation land is examined, followed by the impact of protected land on total employment. A brief note on any differences between metro and rural counties is followed by a discussion of the effects of protected land on service and natural resource employment. Finally, there is a discussion of the results comparing the two time periods, 1980-1990 and 1990-2000, followed by a general discussion of the variable categories. The chapter concludes with a summary of the results.

Relationship Between the Endogenous Variables

In the population equation (Table 6.1) employment does not have a statistically significant impact on population. That is, people do not appear to be following jobs. This is not consistent with conventional theory that suggests that employment has an important role in determining population. A Hausman specification tests indicates that the 2SLS regression is an appropriate estimation technique. The coefficient for lagged population equals 0.990, which implies the equation is stationary.

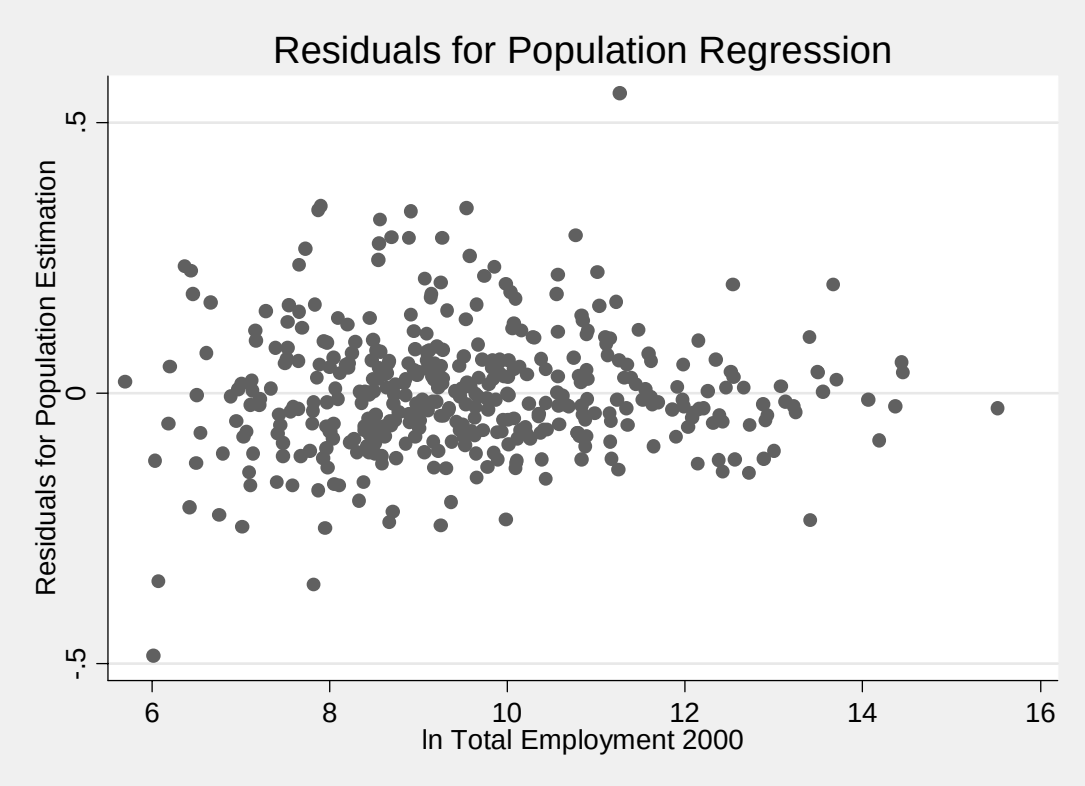
The results for total employment (Table 6.2) show that the number of jobs is positively related to population, with a coefficient of 0.215, indicating that a one percent increase in population increases employment by 0.2 percent. A Hausman test indicates that the 2SLS regression is unbiased and efficient. The lagged employment coefficient equals 0.826, so the system is stationary.

Because of the coefficients for the lagged population and employment variables, the system of equations is stable. In addition, the sign, not the statistical significance, of

the coefficients for population and employment, support the theory of simultaneity in the model and is in agreement with the Hausman test (Mulligan, Vias and Glavac, 1999).

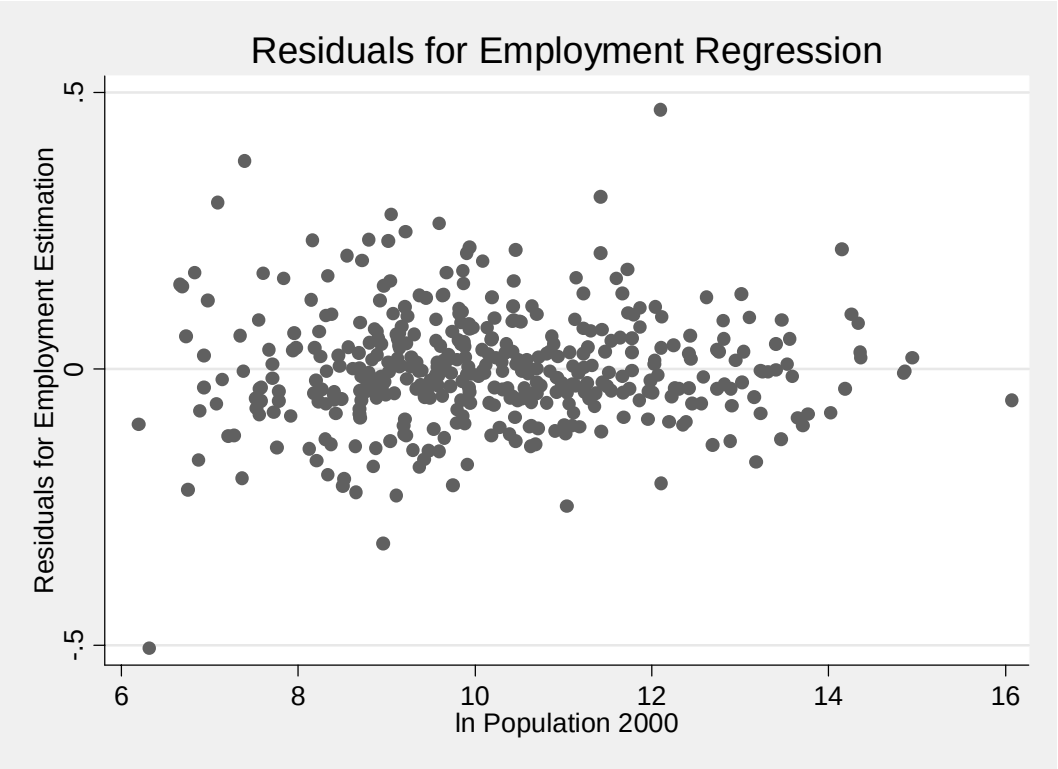
Heteroskedasticity was detected in both the population and employment equations (Plots 6.1 and 6.2), so robust standard errors were used. The equations had adjusted R-squared values of 0.995 for population and 0.996 for the employment estimation.

Plot 6.1: Plot of Residuals for Population Estimation



Pagan-Hall general test statistic: 75.303 Chi-sq(44) , P-value = 0.0023, indicating Heteroskedasticity.

Plot 6.2: Plot of Residuals for Employment Estimation



Pagan-Hall general test statistic: 93.701 Chi-sq(44), P-value = 0.0000, indicating Heteroskedasticity.

Population

Land protected as Gap 1 has a coefficient equal to 0.00224 (Table 6.1), indicating that a ten-percentage point increase in wilderness or national park land will increase population by 2.24 percent, all else constant. The coefficient from the two-stage least-squares regression (2SLS) measures the direct impact that Gap 1 land has on population growth. People are drawn to areas to be near national parks and wilderness areas. Another way to measure the impact that protected land has on population is the total effect, measured with the reduced form equations, which measures those people who relocate to areas because of the employment associated with the wilderness and national parks. This coefficient equals 0.00218, so a ten-percentage point increase in Gap 1 leads to a total increase in population of 2.18 percent, holding all else constant. The reduced

form equations can be found in Appendix C. In either case population is attracted to areas that have access to wilderness areas and national parks.

Gap 2, national recreation areas and state parks, is also positively related to population in both the 2SLS (Table 6.1) and reduced form equations (Appendix C). The coefficient from the 2SLS regression equals 0.00277, indicating that a ten-percentage point increase in Gap 2 land will increase population by 2.77 percent, all else constant. In the reduced form equations, a ten-percentage point increase in Gap 2 land will increase population by 2.61 percent, all else constant.

Even Gap 3 land, BLM and national forest, which is categorized as having the least level of protection is positively related to population growth. In the 2SLS regression (Table 6.1), the coefficient equals 0.000949, indicating that a ten percentage point increase in Gap 3 land will increase population by 0.949 percent, all else constant. The reduced form equations (Appendix C) show that a ten percentage point increase in Gap 3 land increases population by 1.53 percent, all else constant.

Table 6.1: 2SLS Results for Population

	All Counties ln Population	Non Urban ln population	Rural ln population	1980s[5] ln population
Employment				
ln total employment	0.0441	0.0397	0.0486	0.0548
	(0.89)	(0.72)	(0.87)	(0.99)
Lagged Population				
ln population	0.990***	1.004***	0.995***	0.982***
	(18.87)	(16.96)	(16.60)	(16.35)
Community Characteristics				
ln per capita tax	0.0233	0.0181	0.0206	-0.0398*
	(1.10)	(0.84)	(0.93)	(-2.12)
ln % property tax	0.0696	0.0596	0.0590	-0.0632
	(1.22)	(0.96)	(0.87)	(-0.87)
ln per capita police exp.	-0.0555*	-0.0612*	-0.0569*	0.0137
	(-2.27)	(-2.31)	(-2.06)	(0.48)
ln per capita education exp.	-0.0412	-0.0299	-0.0361	-0.0754*

	(-1.29)	(-0.85)	(-0.96)	(-1.99)
ln % owner occupied	0.117	0.0130	0.0286	0.297**
	(1.56)	(0.16)	(0.27)	(3.04)
Crimes per 100,000	0.200	0.0506	-0.000371	0.00304
	(0.30)	(0.06)	(-0.00)	(0.72)
ln highway mi. per acre	-0.0519**	-0.00512	-0.00958	-0.0265
	(-2.75)	(-0.21)	(-0.36)	(-1.20)
Airports	-0.00133	0.0237	0.0334	0.0156
	(-0.09)	(0.99)	(1.13)	(0.84)
Amenities				
Amenity index	0.00637	0.00920*	0.0141**	0.000807
	(1.64)	(2.02)	(2.75)	(0.20)
% Gap 1 (Wilderness and National Park)	0.00224*	0.00150	0.000871	0.00309**
	(2.01)	(1.28)	(0.64)	(3.10)
% Gap 2 (State parks and National Recreation Areas)	0.00277*	0.00245*	0.00172	0.00119
	(2.37)	(2.20)	(1.56)	(0.91)
% Gap 3 (BLM and National Forest)	0.000949*	0.00118**	0.00117*	-0.000035
	(2.39)	(2.77)	(2.39)	(-0.08)
% Gap 4 (Federal Land with no Conservation Mandate)	0.00101*	0.00114	0.000954	0.00105*
	(2.26)	(1.90)	(1.28)	(2.20)
Ski resort	0.0483	0.0956**	0.0788*	0.0430*
	(1.95)	(2.70)	(2.07)	(2.20)
Hiking Trails	-0.0000342	-0.000605	0.000402	0.000112
	(-0.02)	(-0.32)	(0.20)	(0.08)
Boat Ramps	0.00608*	0.00375	0.00197	-0.00434
	(2.06)	(1.16)	(0.63)	(-1.53)
Campgrounds	-0.0000792	0.000564	0.000576	0.000950
	(-0.13)	(0.72)	(0.63)	(1.68)
Location[6]				
ln area	0.0177	-0.0261	-0.0235	0.0145
	(1.19)	(-1.33)	(-1.04)	(0.83)
Beale Dummy	Yes	Yes	Yes	Yes
State Dummy	Yes	Yes	Yes	Yes
Intercept				
_cons	-0.816	-0.0735	-0.151	-0.830
	(-1.57)	(-0.14)	(-0.22)	(-1.40)
N	411	322	271	410
R^2	0.996	0.991	0.987	0.995
adj. R^2	0.995	0.990	0.986	0.995

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Each of the land use categories that indicates a conservation mandate is positively related to population in both the 2SLS and reduced form equations. Wilderness and national parks, Gap 1, and national recreation areas and state parks, Gap 2, attract population at a faster rate than national forest and BLM land, Gap 3.

Total Employment

The results for the Gap codes indicate that conservation land does not harm employment, and there is some evidence that it actually increases employment. Power (1996) argues that employment should increase with natural amenities, because it is easier to attract labor to nice places to live, so a one-sided test can be used to test statistical significance. On the other hand, one argument against wilderness designation is that it actually harms employment, meaning that a two-sided test should be used in hypothesis testing. Only with a one-sided test are the gap codes that represent conservation land significant at the five percent error level.

In the 2SLS estimation (Table 6.2), the coefficient for wilderness and national park land, Gap 1, equals 0.00163 indicating that a ten-percentage point increase in protected land will increase employment by 1.63 percent, all else constant. Using a one-sided test, the reduced form equations (Appendix C) suggest similar results. The coefficient for national park and wilderness land in the reduced form equations equals 0.00207, indicating that a ten-percentage point increase in Gap 1 land will have a total effect of increasing employment by 2.07 percent, all else constant.

The coefficient for national recreation and state park land, Gap 2, equals 0.00188 which indicates that a ten-percentage point increase in Gap 2 land increases employment by 1.88 percent, all else constant. The reduced form equations reveal that the total effect

of Gap 2 land is also positive. The coefficient equals 0.00236, meaning that a ten-percentage point increase in national recreation area or state park land will increase employment by 2.36 percent, all else constant.

The only land category that represents some level of conservation that is not significant at the five-percent error level is Gap 3, BLM and National Forest. In addition, none of the recreation variables are significant at the five-percent error level.

Table 6.2: 2SLS results for Total Employment

	All Counties ln total employment	Non-Metro ln total employment	Rural ln total employment	1980s[7] ln total employment
Population				
ln population	0.215***	0.193***	0.181***	0.233***
	(4.78)	(3.67)	(3.25)	(3.00)
Lagged Employment				
ln total employment	0.826***	0.854***	0.862***	0.813***
	(17.38)	(15.42)	(14.54)	(10.30)
Direct Costs				
ln per capita tax	0.0658***	0.0628***	0.0613**	-0.000135
	(3.41)	(3.08)	(2.68)	(-0.01)
ln wage	-0.298***	-0.327***	-0.322***	-0.333***
	(-5.44)	(-5.35)	(-4.81)	(-4.83)
ln % property tax	0.0288	0.0448	0.0211	0.0104
	(0.51)	(0.74)	(0.32)	(0.09)
ln electricity $	-0.0263	-0.0268	-0.0211	-0.0615
	(-0.30)	(-1.09)	(-0.54)	(0.65)
Secondary Costs				
ln per capita public exp.	-0.0528*	-0.0495	-0.0640*	0.00166
	(-1.57)	(-1.42)	(-1.70)	(0.04)
ln highway miles per acre	-0.0391*	-0.0284	-0.0309	-0.0147
	(-2.13)	(-1.22)	(-1.21)	(-0.64)
Airports	0.00391	0.0197	0.0318	0.0308
	(0.31)	(0.98)	(1.19)	(1.91)
Unemployment	0.0000309	0.0000222	0.0000199	0.00449
	(1.04)	(0.65)	(0.54)	(1.91)
High School Education.	0.00880***	0.00765***	0.00877***	0.776***
	(6.91)	(5.32)	(5.36)	(5.94)
Amenities				
Amenity index	-0.00307	-0.000385	0.00117	-0.00201
	(-0.97)	(-0.10)	(0.24)	(-0.43)
% Gap 1 (National Park	0.00163	0.00114	0.000580	0.00269*

and Wilderness)				
	(1.90)	(1.16)	(0.49)	(2.19)
% Gap 2 (State Parks and National Recreation areas)	0.00188*	0.00161	0.000915	0.00241
	(2.02)	(1.79)	(0.93)	(1.89)
% Gap 3 (BLM and National Forest)	0.000399	0.000527	0.000616	0.000874
	(1.08)	(1.29)	(1.30)	(1.67)
% Gap 4 (Federal Land with no Conservation Mandate)	0.00107**	0.00139**	0.00127	0.000719
	(2.63)	(2.70)	(1.76)	(1.38)
Ski resort	0.0255	0.0401	0.0203	0.0620**
	(1.65)	(1.62)	(0.77)	(3.06)
Hiking trails	0.000458	0.0000798	0.00100	0.000239
	(0.36)	(0.06)	(0.60)	(0.15)
Boat ramps	0.00424	0.00424	0.00313	-0.00574
	(1.87)	(1.56)	(1.06)	(-1.65)
Campgrounds	0.000102	0.000558	0.000443	-0.000289
	(0.20)	(0.86)	(0.54)	(-0.43)
Location[8]				
ln area	-0.00362	-0.0194	-0.0115	0.0120
	(-0.30)	(-1.09)	(-0.54)	(0.65)
Beale Dummy	Yes	Yes	Yes	Yes
State Dummy	Yes	Yes	Yes	Yes
Intercept				
_cons	-0.587	-0.424	-0.300	-0.840
	(-1.35)	(-0.96)	(-0.63)	(-1.15)
N	411	322	271	410
R^2	0.997	0.992	0.988	0.993
adj. R^2	0.996	0.991	0.987	0.993

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

There is no evidence that employment is harmed by wilderness or national park designation. At most, land set aside for conservation has no impact on the number of jobs, but it is likely that it actually attracts employment. The only land variable that is insignificant at the five-percent error level is BLM and National Forest land, which is surprising because these management policies allow some removal of timber and minerals by the natural resource sector.

Differences in Urban and Rural Counties

The results for the population and total employment sectors follow the same pattern as counties go from metro to rural. The protected land variables are more important for attracting population and employment in the metro counties, and the magnitude of the coefficients decrease as counties become more rural. The protected land variables are also insignificant at the five percent error level in the rural counties.

The diminishing effect of protected lands on rural counties may be because there is undeveloped private land in these counties, so protected federal land is less important to attract population and employment. In metro areas with higher population densities any additional open space is important for recreation and scenery preservation, but in rural areas there may be diminishing marginal returns to additional conservation land.

Natural Resource and Service Employment

Natural Resource Employment

Natural resource employment was estimated because opponents of wilderness designation argue that these are the jobs that will be affected negatively by less access to natural resources. There is no evidence of this in either the 2SLS or reduced form equations. There is also no evidence that BLM and forest service land, Gap 3, increases employment in the natural resource sector, despite the fact that these land management practices allow the removal of inputs used by this sector.

The results show that population increases natural resource employment, but economic theory assumes that these industries rely less on local markets for their goods. The positive relationship between population and natural resource employment may be

due to these firms seeking large labor forces or an overall shift to urban areas and away from rural areas.

Table 6.3: 2SLS Results for Natural Resource Employment

	All Counties ln natural resource employment	Non-Metro ln natural resource employment	Rural ln natural resource employment	1980s[9] ln natural resource employment
Population				
ln Population	0.227***	0.257***	0.260***	0.340***
	(3.44)	(3.41)	(3.36)	(4.23)
Lagged Natural Resource Employment				
ln natural resource employment	0.851***	0.858***	0.853***	0.671***
	(16.27)	(15.10)	(13.37)	(10.64)
Direct Costs				
ln per capita tax	0.121	0.142	0.160	-0.0539
	(1.67)	(1.78)	(1.90)	(-0.65)
ln wage	-0.957***	-1.052**	-1.126**	-0.222
	(-3.31)	(-3.17)	(-3.13)	(-0.61)
ln % property tax	0.340	0.436*	0.432	-0.211
	(1.84)	(2.04)	(1.80)	(-0.75)
ln electricity $	-0.307***	-0.431***	-0.514***	0.151
	(-3.49)	(-4.09)	(-4.46)	(1.17)
Secondary Costs				
ln per capita public exp.	-0.0815	-0.0730	-0.0987	-0.0430
	(-0.88)	(-0.76)	(-0.95)	(-0.32)
ln highway miles per acre	-0.108*	-0.131	-0.166*	0.102
	(-2.04)	(-1.95)	(-2.29)	(1.64)
Airports	0.0310	0.0513	0.122	-0.0164
	(0.92)	(0.95)	(1.35)	(-0.43)
Unemployment rate	-0.0000870	-0.000115	-0.0000828	0.00881
	(-0.97)	(-1.10)	(-0.75)	(1.04)
% High School Education	0.0000896*	0.0000886	0.0000969	0.0000467
	-0.0815	-0.0730	-0.0987	-0.0430
Amenities				
Amenity index	-0.0166	-0.00987	-0.0139	-0.00609
	(-1.68)	(-0.83)	(-0.96)	(-0.48)
% Gap 1 (National Parks and Wilderness)	-0.00217	-0.00489	-0.00637	0.00191
	(-0.72)	(-1.45)	(-1.61)	(0.57)
% Gap 2 (State Parks and National Recreation Areas)	0.00133	0.00160	-0.000354	-0.000752
	(0.37)	(0.39)	(-0.08)	(-0.16)

% Gap 3 (BLM and National Forest)	0.00173	0.00155	0.00105	0.000938
	(1.51)	(1.24)	(0.73)	(0.69)
% Gap 4 (Federal land with no conservation mandate)	-0.000207	-0.000243	-0.00121	0.000710
	(-0.17)	(-0.15)	(-0.56)	(0.42)
Ski Resort	0.0484	0.0891	0.0563	0.0228
	(1.20)	(1.18)	(0.70)	(0.45)
Hiking Trails	0.00210	0.00264	0.00399	0.00462
	(0.57)	(0.61)	(0.77)	(0.99)
Boat Ramps	0.00786	0.00552	0.00398	-0.0112
	(1.10)	(0.73)	(0.46)	(-1.15)
Campgrounds	-0.00319*	-0.00485*	-0.00419	-0.00236
	(-2.11)	(-2.41)	(-1.74)	(-1.40)
Location[10]				
ln area	0.0314	0.0623	0.102	0.0139
	(0.74)	(1.07)	(1.48)	(0.27)
Beale Dummy	Yes	Yes	Yes	Yes
State Dummy	Yes	Yes	Yes	Yes
Intercept				
_cons	-1.956	-3.351**	-3.645*	0.783
	(-1.78)	(-2.58)	(-2.54)	(0.47)
N	411	322	271	409
R^2	0.975	0.951	0.932	0.955
Adj. R^2	0.973	0.944	0.922	0.951

t statistics in parentheses
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Service Employment

Service sector employment is estimated because amenity-led development depends on attracting population. The new population will demand goods and services. The strong relationship between population and service jobs is consistent with the economic theory that these firms exist to serve people. Firms that rely on the local demand for services, may benefit from locating nearer to those services, which in some cases may be a shift from rural areas to regional population centers.

In the 2SLS equation (Table 6.4), neither the coefficient for national parks and wilderness, Gap 1, nor the coefficient for BLM and National Forest, Gap 2, are

significant at the five-percent error level. This means that the two land categories with the highest level of protection did not have a direct effect on service employment. In the 2SLS equation, any service employment growth due to population moving into these counties is measured with the coefficient for population, which is statistically significant. The reduced form equations (Appendix C) do not show that Gap 1 or Gap 2 land has an effect on service employment either, so it is somewhat surprising that there is no evidence that natural areas influence service employment.

The coefficient for Gap 3 indicates that during the 1990s BLM and national forest land were positively associated with service employment. The 2SLS results indicate that a ten-percentage point increase in Gap 3 land increases service employment by 1.62 percent, all else constant. The reduced form equations (Appendix C) have a coefficient of 0.00180, indicating that a ten-percentage point increase in BLM and national forest land increases service employment by 1.8 percent, holding all else constant.

Table 6.4: 2SLS Results for Service Sector Employment

	All Counties ln service employment	Non Metro ln service employment	Rural ln service employment	1980s[11] ln service employment
Population				
ln population	0.194***	0.183**	0.178**	0.308***
	(3.87)	(2.99)	(2.85)	(5.63)
Lagged Service Employment				
ln service Employment	0.869***	0.871***	0.868***	0.718***
	(19.64)	(16.81)	(16.28)	(15.17)
Direct Costs				
ln per capita tax	0.0417	0.0319	0.0250	-0.0181
	(1.19)	(0.80)	(0.57)	(-0.46)
ln wage	-0.323**	-0.333**	-0.299*	0.0507
	(-3.10)	(-2.74)	(-2.26)	(0.50)
ln % property tax	0.0436	0.0563	0.0359	-0.117
	(0.39)	(0.44)	(0.26)	(-0.90)
ln electricity $	0.0427	0.0719	0.146	-0.107*
	(0.69)	(0.97)	(1.72)	(-2.03)
Secondary Costs				

ln per capita public exp.	-0.0526	-0.0588	-0.0720	-0.0109
	(-0.97)	(-0.95)	(-1.05)	(-0.20)
ln highway miles per acre	-0.0297	-0.0307	-0.0261	0.00479
	(-1.04)	(-0.70)	(-0.54)	(0.15)
Airports	0.00600	-0.00672	-0.00533	0.0683**
	(0.29)	(-0.22)	(-0.12)	(2.81)
Unemployment rate	0.000130*	0.000142*	0.000134	-0.000578
	(2.33)	(2.22)	(1.95)	(-0.17)
% HS education	0.000116***	0.000117***	0.000126***	0.000113***
	(5.46)	(4.42)	(4.09)	(6.49)
Amenities				
Amenity index	0.00743	0.01000	0.0130	-0.00381
	(1.46)	(1.56)	(1.63)	(-0.70)
% Gap 1 (National Park and Wilderness)	0.00170	0.00172	0.00174	0.00473**
	(1.33)	(1.12)	(0.92)	(2.82)
% Gap 2 (State Parks and Nat. Recreation Areas)	0.00276	0.00148	0.00160	0.00649***
	(1.42)	(0.70)	(0.69)	(3.54)
% Gap 3 (BLM and National Forests)	0.00162*	0.00162	0.00187	0.00135
	(2.24)	(1.93)	(1.93)	(1.91)
% Gap 4 (Fed land with no conservation mandate)	0.00252***	0.00264**	0.00302**	0.00170*
	(4.05)	(2.96)	(2.65)	(2.31)
Ski resort	0.00136	0.0164	0.00532	0.0979**
	(0.07)	(0.48)	(0.14)	(3.25)
Hiking trails	0.000907	0.00102	0.00127	0.000176
	(0.45)	(0.43)	(0.45)	(0.08)
Boat ramps	0.000439	-0.000766	-0.00279	-0.0122
	(0.11)	(-0.16)	(-0.48)	(-1.67)
Campgrounds	-0.0000191	0.0000109	0.000214	0.00169
	(-0.02)	(0.01)	(0.15)	(1.34)
Location[12]				
ln area	-0.0143	-0.0140	-0.0133	-0.0382
	(-0.72)	(-0.41)	(-0.33)	(-1.36)
State Dummy	Yes	Yes	Yes	Yes
Beale Dummy	Yes	Yes	Yes	Yes
Intercept				
_cons	-0.843	-0.618	-0.305	-1.070
	(-1.10)	(-0.65)	(-0.30)	(-1.22)
N	411	322	271	410
R^2	0.992	0.982	0.974	0.991
adj. R^2	0.991	0.980	0.970	0.990

t statistics in parentheses
*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Comparing the 1990s to the 1980s

Table 6.5 summarizes the comparison between the two time periods. It shows the coefficients from Tables 6.1 and 6.2 for the three gap codes that represent land management practices that have a conservation mandate.

Table 6.5: An Excerpt of Conservation Variables

	1990s (All Counties) ln Population	1980s (All Counties) ln population	1990s (All Counties) ln total employment	1980s (All Counties) ln total employment
% Gap 1 (National Park and Wilderness)	0.00224*	0.00309**	0.00163	0.00269*
	(2.01)	(3.10)	(1.90)	(2.19)
% Gap 2 (State Parks and National Recreation Areas)	0.00277*	0.00119	0.00188*	0.00241
	(2.37)	(0.91)	(2.02)	(1.89)
% Gap 3 (BLM and National Forests)	0.000949*	-0.0000352	0.000399	0.000874
	(2.39)	(-0.08)	(1.08)	(1.67)

Recall that during the 1990s, all three levels of protected land attracted population at the five-percent error level. In the 1980s, only the Gap 1 land, wilderness and national parks, was significant at the five-percent error level, but these areas drew population at a faster rate than in the 1990s. Wilderness and national parks were attractive destinations for households to relocate during the 1980s while other areas became more attractive for people wishing to live near natural areas in the 1990s.

One explanation is that counties with access to national parks and wilderness areas were an obvious destination for households that wanted to relocate to be near natural amenities. As these counties became more populated through the 1980s, other areas became more attractive in the 1990s. National park and wilderness land still attracts population, but lands that have a conservation mandate have become an alternative for households seeking to relocate near natural areas.

For the total employment estimates, recall that Gap 1 and Gap 2 land attracted employment at the five-percent error level. Protected land attracted jobs at a faster rate in the 1980s than in the 1990s. One explanation for the larger coefficients may be visitation or in-migration increased in the 1980s and this initial expansion was able to fill some of the market in the 1990s. Only if the demand for goods and services is above the capacity of the existing firms will employment increase, so it is possible that some of the demand in the 1990s was met by preexisting labor.

Taking into account the evidence from both the total employment and the population estimates, it seems that during the 1980s population growth and employment growth were focused in counties with access to national parks and wilderness areas. In the 1990s, households looking to relocate were attracted to a more diverse set of natural areas. This may be due to the fact that counties that are near wilderness and national parks have become more inhabited, so other natural areas have become more attractive alternatives. Growth is no longer limited to the areas with the strictest land management policies, but has expanded to areas that have less protection like state parks and national recreation areas. Employment caused by protected land has slowed, which may be due to the existing supply of goods and services.

In addition to the most pristine areas becoming more crowded, the difference between land management practices may not be as great. If the national forest and BLM land are now managed in a stewardship capacity rather than an industrial one, then these areas may be comparable to areas classified with higher levels of protection.

Other Variables

In the population equation, the community characteristics did not have the expected sign, but only two were significant at the five-percent error level. Since these variables attempt to measure characteristics such as community participation, quality of public goods and isolation of a county, variables that are not easily measured, these results are not surprising, albeit disappointing.

In the employment estimations the signs were much more encouraging, having the sign that theory predicts. The direct costs were negative, except for the tax variables, which have been shown to be positive if firms receive something in return. Mofidi and Stone (1990) argue that if not all of the public expenditure categories are included in regressions with the tax level, then the coefficient on the tax variable does not measure the true cost of the tax. Secondary costs measuring the quality of an available workforce had the expected sign, and only the measure for the provision of public goods had the opposite sign from the theory.

For the location variables, smaller urban counties and counties adjacent to urban areas attracted population relative to metro counties of one million or more. Counties in California and Montana seemed to lose population, while counties in Colorado grew, all else constant. Urban and adjacent to urban counties also increased in total employment, but counties in Nevada increased in employment while Idaho lost employment, holding all else constant. This does not mean that counties in these states lost population (employment), but the growth was due to the combination of other variables and the growth rate was lower than if the counties were in a different state.

Unfortunately, the recreation variables included in the regressions were not very often significant. The number of ski areas within a county was significant the most often, but that was only in five of the possible sixteen equations. The other variables were rarely significant at the five-percent error level, and sometimes had the opposite sign than expected from the theory. Perhaps this was due to the inevitable data limitations and the definitions of the variables. For example, the number of trailheads came from the federal management agency, which excludes any municipal or county trails. Also, this measure consists only of federally maintained trails, not user trails or trails that are maintained by volunteers. Boat ramps face similar issues: only designated launch sites managed by federal agencies are included. For instance, there are many places in Missoula County where boaters can access lakes and rivers, but the variable used in the NORSIS database is zero. Ski areas is the only recreation variable that seems to have a definition that is consistent with actual access to winter recreation, which may be why this variable was significant most often.

Summary

There is evidence that conservation land increases population and this increase in population increases employment. There is also evidence that preserved land increases employment, rather than doing it harm. While these results are statistically significant, they are not large in percentage or actual terms. There may be counties were conservation land has a large impact on population and employment growth, but for counties across the Western United States as a whole the effect is small.

In addition to this primary result, there is evidence that households now view areas such as state parks and national recreation areas as alternatives to wilderness and

national parks, but there does not seem to be a correlated increase in employment. Instead employment growth has decelerated, perhaps a result of the increase in employment in the 1980s, rather than natural areas becoming less attractive places to do business. The results show that areas with stricter land management policies do not decrease employment in any sector, and there is some evidence that there are actually more jobs because of protected federal land.

This research is limited to a discussion of the effect of protected land on the number of people and the number of jobs within a county. It did not examine the role that amenities play in the well being of communities across the Western United States, merely their relationship to population and employment growth. There is some concern that there is a "crowding out" effect in counties that are in attractive natural settings; local residents are unable to continue to live in communities adjacent to protected land. As the amount of land set aside for conservation increases, there is less that can be developed and inhabited, effectively decreasing the supply of private land, which may increase property values. Finally there are many possible conflicts between long-time residents and new in-migrants that have real consequences on a community's character (Lorah, 2000, Ghose, 2004). While these issues deserve attention, they are outside the scope of this research.

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[5] The right hand side variables have the same definitions, but where possible come from the beginning of the period. For the full Rural-Urban continuum, see appendix E.
[6] For the full regression results that include the state and Beale codes, see Appendix D.
[7] The right hand side variables have the same definitions, but where possible come from the beginning of the period. For the full Urban-Rural continuum for the 1980s, see appendix E.
[8] For the full regression results that include the state and Beale codes, see Appendix F.
[9] The right hand side variables have the same definitions, but where possible come from the beginning of the period. For the full Urban-Rural continuum for the 1980s, see appendix I.
[10] For the full regression results that include the state and Beale codes, see Appendix H.
[11]The right hand side variables have the same definitions, but where possible come from the beginning of the period. For the full Urban-Rural continuum for the 1980s, see appendix K.

[12] For the full regression results that include the state and Beale codes, see Appendix J.

CHAPTER 7: CONCLUSION

This paper looked at land management decisions and their effect on population and employment in the eleven western states. Since many of these counties have extensive federal lands, how that land is managed has a direct impact on the local economic conditions of the counties. One theory suggests that federal land should be opened up for extractive uses, which will benefit local employment and increase overall economic activity. Another view, amenity-led development, is that land that is set aside for conservation purposes will make a county a more attractive place to live which will increase population. The population growth will increase employment as these new in-migrants demand goods and services, which will stimulate economic activity.

A Carlino and Mills (1987) regional adjustment model was used to examine the relationship between protected land and population and employment for the Western United States during the 1990s. In this model, population and employment are determined simultaneously, so a two-stage least squares estimation was used. The employment equation included variables that may impact firms' profits and, in the population equation, had variables that would indicate if an area is a nice place to live. Both equations included a county's access to protected federal land, so that the direct effect of conservation land could be measured on both population and employment.

The primary finding of the estimations is that population is attracted to counties with access to protected federal land and this population creates employment. There is also some evidence that conservation land attracts employment directly and that the number of jobs in the natural resource industries does not decrease. This research also examined differences between the impact of federal land in the 1990s and the 1980s. It

suggests that population is attracted to more and different types of areas that have been set aside for conservation purposes, but the rate has slowed for national parks and wilderness areas. Employment growth has slowed in counties with access to protected federal land, but this land still stimulates employment growth.

The difference in coefficients from the two time periods does not measure the response to a change in federal land designation. Instead it either measures a change in preferences or a change in land management practices within federal agencies. If the way that land is managed has not changed, then the difference in the coefficients measures a change in preferences. If the management of the Gap 2 and Gap 3 land has changed and has a stricter conservation goal, then it may be that these types of land are comparable to Gap 1, national park and wilderness areas. If this change took place around 1990, then households may be more attracted to these lands because environmental quality of these lands has improved. Because of data limitations, it is not clear if the difference in coefficients between the two time periods is due to a change in preferences or a change in land management policies.

In response to opponents of wilderness designation, there is no evidence that protected federal land harms total employment growth or that it decreases the natural resource sector in particular. In fact, the evidence supports the theory that protecting land can increase population and that this increases employment. The results are statistically significant, but ultimately quite small. This research used a sample of all of the counties in the western United States, and for that sample there was no evidence that the number of natural resource jobs decreased, but they may have gone from full time to part time. In a few local communities wilderness designation may hurt the natural resource sector, but

this depends on if the proposed wilderness area is being used for extractive purposes. In most cases, wilderness areas have never been logged or mined, and industrial landscapes are not candidates for wilderness designation.

The view of amenity-led development has been tested with previous research, but because of the model specification, the access to amenities has been underestimated and the interpretation has been difficult. The first attempts used only federal land contained within county boundaries, implicitly implying that people do not enjoy amenities just across political boundaries. Another issue is the fact that densities were used, and when access to amenities was used, they include an amenity index or score. This makes interpretation difficult and about the only conclusion that can be made is that population and employment are either positively or negatively related. The research in this paper uses the percentage of land within a fifty-mile radius of the county center to measure access to amenities. In addition, the time period is extended to include the change that took place in the 1990s and it includes all of the eleven western states, rather than just the Rocky Mountain West.

Further lines of research should focus on examining what aspects of protected open space attract population and employment by differentiating between the effects of environmental quality, scenic beauty and recreation. A similar improvement would be to differentiate between national parks and wilderness areas. Another avenue to study would focus on the accessibility of natural areas and, instead of using a fifty-mile radius from the county center, use the distance from the population center or the area accessible by a given travel time. With the increasing availability of GIS databases, more data will become available for these studies. A final potential research topic is to use protected

land variables that change over time, rather than include one measure for a number of different time periods.

Appendix A: What do the GAP codes mean?

Gap 1

An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.

Examples: National Parks, Nature Preserves, Wilderness Areas

Gap 2

An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

Examples: State Parks, National Wildlife Refuges, National Recreation Areas

Gap 3

An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.

Examples: National Forests, most Bureau of Land Management Land, Wildlife Management Areas

Gap 4

There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout.

http://consbio.org/cbi/projects/PAD/index.htm, *accessed April 10, 2007.*

Appendix B: Metadata for Protected Land Data

Originator: Conservation Biology Institute
Publication_Date: 200501
Title: **CBI Protected Areas Database, Version 3**
Geospatial_Data_Presentation_Form: Map
Publication_Information:
    Publication_Place: Corvallis, OR
    Publisher: Conservation Biology Institute
Other_Citation_Details:
Online_Linkage: D:\Data\USA\PAD\PAD3_Jan05\CBI Protected Areas Database.html

Cell size = 500 square meters

Appendix C: Reduced Form Equations, 1990-2000

	Population	Total Employment	Service Employment	Natural Resource Employment
	ln population	ln total employment	ln service employment	ln nat resource
Lagged Endogenous Variables				
lpop90	1.043***	0.210***	0.203***	0.245**
	(23.99)	(3.66)	(3.60)	(3.09)
ln total employment	0.0110	0.844***		
	(0.26)	(14.65)		
ln service			0.878***	
			(18.78)	
ln natural resource employment				0.846***
				(14.90)
Dierct Costs/ Community Characteristics				
ln wage	-0.288***	-0.359***	-0.382**	-0.982**
	(-4.79)	(-5.18)	(-3.23)	(-2.99)
ln Electricity $	-0.310	-0.310	0.101	-2.174**
	(-1.26)	(-1.17)	(0.20)	(-3.19)
ln per capita tax	0.0586**	0.0810***	0.0557	0.159*
	(2.67)	(3.42)	(1.37)	(1.99)
ln % property taxes	0.0661	0.0526	0.138	0.378
	(1.11)	(0.78)	(1.12)	(1.79)
Secondary Costs/ Community Characteristics				
ln per capita public exp.	-0.0681*	-0.0434	-0.0107	-0.0170
	(-2.23)	(-0.99)	(-0.15)	(-0.16)
Unemployment rate	0.0000416	0.0000432	0.000148**	-0.0000630
	(1.43)	(1.31)	(2.65)	(-0.73)
% HS education	0.0000452**	0.000095***	0.000115***	0.0000885
	(3.00)	(5.64)	(4.58)	(1.81)
ln per capita police exp.	-0.0188	-0.0111	0.0379	-0.0387
	(-0.74)	(-0.36)	(0.75)	(-0.50)
ln per capita education exp.	0.0169	-0.0376	-0.142*	-0.148
	(0.43)	(-0.76)	(-2.07)	(-0.91)
ln % owner occupied	0.0730	0.109	0.192	0.159
	(0.90)	(1.06)	(1.64)	(0.70)
Crime rate	0.0352	-0.0973	-0.653	-0.543
	(0.05)	(-0.12)	(-0.59)	(-0.27)
ln highway miles per acre	-0.0499*	-0.0513*	-0.0419	-0.119*
	(-2.54)	(-2.34)	(-1.31)	(-2.01)
Airports	-0.000691	0.00520	0.00730	0.0325
	(-0.05)	(0.35)	(0.33)	(0.88)
Amenities				

Amenity index	0.00408	-0.00241	0.00577	-0.0171
	(1.07)	(-0.58)	(1.00)	(-1.51)
% Gap 1 (National Parks and Wilderness)	0.00218	0.00207	0.00239	-0.00173
	(1.92)	(1.86)	(1.62)	(-0.54)
% Gap 2 (National Recreation Areas and State Parks)	0.00261*	0.00236	0.00343	0.00165
	(2.00)	(1.96)	(1.48)	(0.44)
% Gap 3 (BLM and National Forest)	0.00153***	0.000699	0.00180*	0.00201
	(3.42)	(1.55)	(2.24)	(1.59)
% Gap 4 (Federal Land with no Conservation Mandate)	0.00128*	0.00133**	0.00286***	-0.0000113
	(2.56)	(2.66)	(4.14)	(-0.01)
Ski resort	0.0348	0.0338	0.0121	0.0618
	(1.52)	(1.61)	(0.46)	(1.40)
Hiking trails	0.00000083	0.000492	0.000990	0.00226
	(0.00)	(0.31)	(0.45)	(0.58)
Boat ramps	0.00638*	0.00572	0.00184	0.0101
	(2.20)	(1.94)	(0.43)	(1.32)
Campgrounds	-0.00111	-0.0000919	-0.000168	-0.00308
	(-1.71)	(-0.14)	(-0.17)	(-1.83)
Location				
ln area	0.0243	0.000639	-0.0130	0.0317
	(1.70)	(0.04)	(-0.59)	(0.71)
Beale1	0.176*	0.110	0.117	-0.0675
	(2.01)	(1.18)	(1.78)	(-0.56)
Beale2	0.0388	0.0264	-0.0172	0.00508
	(1.24)	(0.77)	(-0.38)	(0.06)
Beale3	0.0121	-0.00926	0.0193	-0.0790
	(0.38)	(-0.28)	(0.42)	(-0.88)
Beale4	0.0207	0.0382	0.0216	-0.0669
	(0.49)	(0.93)	(0.38)	(-0.69)
Beale5	-0.0227	0.0138	0.0647	-0.150
	(-0.53)	(0.34)	(1.03)	(-1.49)
Beale6	0.0569	0.0534	0.0799	-0.0619
	(1.19)	(1.15)	(1.12)	(-0.54)
Beale7	-0.0399	-0.0217	0.00433	-0.166
	(-0.77)	(-0.46)	(0.06)	(-1.43)
Beale8	0.127	0.0562	0.137	-0.156
	(1.85)	(0.85)	(1.31)	(-0.94)
Beale9	-0.00766	0.00291	0.0419	-0.216
	(-0.11)	(0.05)	(0.42)	(-1.43)
CA	-0.152***	-0.142**	-0.137*	0.0575

	(-4.39)	(-3.02)	(-2.12)	(0.44)
CO	0.0187	0.0353	0.151*	-0.220
	(0.46)	(0.72)	(2.11)	(-1.38)
ID	-0.0605	-0.0569	0.0439	-0.356
	(-1.26)	(-0.97)	(0.50)	(-1.83)
MT	-0.195***	-0.154**	-0.0387	-0.415*
	(-4.28)	(-2.77)	(-0.46)	(-2.45)
NM	0.00111	0.0288	0.151	0.0267
	(0.02)	(0.57)	(1.91)	(0.17)
NV	0.0552	0.0347	-0.0523	0.195
	(0.92)	(0.49)	(-0.58)	(0.95)
OR	-0.105*	-0.114*	0.0488	-0.189
	(-2.17)	(-1.97)	(0.57)	(-1.03)
UT	-0.0419	0.000623	0.143*	-0.197
	(-0.96)	(0.01)	(2.18)	(-1.30)
WA	-0.0584	-0.123*	0.0431	-0.165
	(-1.16)	(-2.05)	(0.46)	(-0.95)
WY	-0.101*	-0.0648	0.124	-0.109
	(-2.17)	(-1.15)	(1.45)	(-0.60)
Intercept				
_cons	-0.752	-0.909	-1.891*	-1.322
	(-1.24)	(-1.42)	(-2.04)	(-0.79)
N	411	411	411	411
R^2	0.996	0.996	0.992	0.974
adj. R^2	0.995	0.995	0.991	0.971

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Base Case: Arizona and Beale 0.

Appendix D: Population Estimation with State and Beale Code Dummies, 1990-2000

	All Counties ln population	Non Urban ln population	Rural ln population
Employment			
ln total employment	0.0441	0.0397	0.0486
	(0.89)	(0.72)	(0.87)
Lagged Population			
ln lagged population	0.990***	1.004***	0.995***
	(18.87)	(16.96)	(16.60)
Community Characteristics			
ln per capita tax	0.0233	0.0181	0.0206
	(1.10)	(0.84)	(0.93)
ln % property tax	0.0696	0.0596	0.0590
	(1.22)	(0.96)	(0.87)
ln per capita police exp.	-0.0555*	-0.0612*	-0.0569*
	(-2.27)	(-2.31)	(-2.06)
ln per capita education exp.	-0.0412	-0.0299	-0.0361
	(-1.29)	(-0.85)	(-0.96)
ln % owner occupied	0.117	0.0130	0.0286
	(1.56)	(0.16)	(0.27)
crime rate	0.200	0.0506	-0.000371
	(0.30)	(0.06)	(-0.00)
ln highway miles per acre	-0.0519**	-0.00512	-0.00958
	(-2.75)	(-0.21)	(-0.36)
Airports	-0.00133	0.0237	0.0334
	(-0.09)	(0.99)	(1.13)
Amenities			
Amenity index	0.00637	0.00920*	0.0141**
	(1.64)	(2.02)	(2.75)
% Gap 1 (National Park and Wilderness)	0.00224*	0.00150	0.000871
	(2.01)	(1.28)	(0.64)
% Gap 2 (National Recreation Areas and State Parks)	0.00277*	0.00245*	0.00172
	(2.37)	(2.20)	(1.56)
% Gap 3 (BLM and National Forest)	0.000949*	0.00118**	0.00117*
	(2.39)	(2.77)	(2.39)
% Gap 4 (Federal land with no conservation mandate)	0.00101*	0.00114	0.000954
	(2.26)	(1.90)	(1.28)
Ski resort	0.0483	0.0956**	0.0788*
	(1.95)	(2.70)	(2.07)
Hiking trails	-0.0000342	-0.000605	0.000402
	(-0.02)	(-0.32)	(0.20)

Boat ramps	0.00608*	0.00375	0.00197
	(2.06)	(1.16)	(0.63)
Campgrounds	-0.0000792	0.000564	0.000576
	(-0.13)	(0.72)	(0.63)
Location			
ln area	0.0177	-0.0261	-0.0235
	(1.19)	(-1.33)	(-1.04)
Beale1	0.188*		
	(2.27)		
Beale2	0.0707*		
	(2.42)		
Beale3	0.0292		
	(0.98)		
Beale4	0.0471	-0.0458	
	(1.16)	(-0.92)	
Beale5	-0.00604	-0.106*	
	(-0.15)	(-2.25)	
Beale6	0.0789	0.0245	0.0245
	(1.75)	(0.73)	(0.72)
Beale7	-0.0216	-0.0671*	-0.0659*
	(-0.45)	(-2.52)	(-2.46)
Beale8	0.148*	0.127***	0.125***
	(2.28)	(4.00)	(3.94)
Beale9	0.0134		
	(0.21)		
AZ	0.0498	0.0368	0.0590
	(1.29)	(0.80)	(0.97)
CA	-0.0983*	-0.129**	-0.142**
	(-2.57)	(-3.08)	(-3.07)
CO	0.107***	0.0723*	0.0650*
	(3.45)	(2.45)	(2.08)
ID	0.0260	0.000994	0.00509
	(0.71)	(0.03)	(0.12)
MT	-0.0773*	-0.0749*	-0.0708*
	(-2.37)	(-2.24)	(-2.06)
NM	0.0533	0.0619	0.0679
	(1.31)	(1.42)	(1.34)
NV	0.0690	0.0213	0.00219
	(1.18)	(0.33)	(0.03)
OR	-0.0200	-0.0541	-0.0382
	(-0.58)	(-1.44)	(-0.95)
UT	0.0520	0.0574	0.0452
	(1.59)	(1.71)	(1.32)
WA	0.0380	0.0192	0.0306
	(1.25)	(0.61)	(0.87)

Intercept			
_cons	-0.816	-0.0735	-0.151
	(-1.57)	(-0.14)	(-0.22)
N	411	322	271
R^2	0.996	0.991	0.987
adj. R^2	0.995	0.990	0.986

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Base case: Wyoming and Beale Code 9.

Appendix E: Regression Results for Population, 1980-1990

	All Counties ln population	Non-Metro ln population	Rural ln population
Total Employment			
ln total employment	0.0548	0.0631	0.0328
	(0.99)	(1.01)	(0.50)
Lagged Population			
ln lagged population	0.982***	0.996***	1.032***
	(16.35)	(14.91)	(14.75)
Community Characteristics			
ln per capita tax	-0.0398*	-0.0387*	-0.0307
	(-2.12)	(-2.12)	(-1.43)
ln % property tax	-0.0632	-0.115	-0.129
	(-0.87)	(-1.47)	(-1.45)
ln per capita police exp.	0.0137	0.0143	0.0177
	(0.48)	(0.51)	(0.58)
ln per capita education exp.	-0.0754*	-0.0749*	-0.0785
	(-1.99)	(-1.98)	(-1.77)
ln % owner occupied	0.297**	0.195	0.189
	(3.04)	(1.84)	(1.60)
Crime rate	0.00304	0.00602	0.00598
	(0.72)	(1.24)	(1.21)
ln highway miles per acre	-0.0265	0.0107	0.0128
	(-1.20)	(0.41)	(0.46)
Airports	0.0156	0.0608*	0.0826
	(0.84)	(2.23)	(1.76)
Amenities			
Amenity index	0.000807	0.00470	0.00559
	(0.20)	(1.07)	(1.04)
% Gap 1 (National Park and Wilderness)	0.00309**	0.00187	0.00241*
	(3.10)	(1.84)	(1.96)
% Gap 2 (National Recreation Areas and State Parks)	0.00119	0.00141	0.00165
	(0.91)	(1.02)	(1.06)
% Gap 3 (BLM and National Forests)	-0.0000352	-0.000304	-0.000245
	(-0.08)	(-0.69)	(-0.46)
% Gap 4 (Federal Land with no Conservation Mandate)	0.00105*	0.00126*	0.00158
	(2.20)	(2.40)	(1.96)
Ski resort	0.0430*	0.0493	0.0482
	(2.20)	(1.71)	(1.39)
Hiking trails	0.000112	-0.000501	-0.000970
	(0.08)	(-0.31)	(-0.48)
Boat ramps	-0.00434	-0.00483	-0.00961**

	(-1.53)	(-1.56)	(-2.77)
Campgrounds	0.000950	0.000991	0.00123
	(1.68)	(1.40)	(1.29)
Location			
ln area	0.0145	-0.0129	-0.0177
	(0.83)	(-0.59)	(-0.76)
Beale1	0.108*		
	(2.05)		
Beale2	0.0305		
	(0.64)		
Beale3	0.0467		
	(0.78)		
Beale4	0.0682	-0.112*	
	(1.01)	(-2.40)	
Beale5	0.00752	-0.193***	
	(0.11)	(-4.23)	
Beale6	0.112	-0.0123	-0.0176
	(1.24)	(-0.40)	(-0.53)
Beale7	0.0335	-0.0840***	-0.0932***
	(0.37)	(-3.71)	(-3.97)
Beale8	0.179	0.0904**	0.0809*
	(1.61)	(2.75)	(2.39)
Beale9	0.0745		
	(0.67)		
AZ	0.140**	0.0936	0.0565
	(2.62)	(1.68)	(0.62)
CA	0.107*	0.0672	0.0571
	(2.33)	(1.35)	(0.95)
CO	0.0572	0.0203	0.0306
	(1.48)	(0.52)	(0.67)
ID	-0.00971	-0.0169	-0.000393
	(-0.22)	(-0.38)	(-0.01)
MT	0.00598	0.0160	0.0315
	(0.17)	(0.43)	(0.74)
NM	0.0338	0.0115	0.0588
	(0.67)	(0.22)	(0.86)
NV	0.267***	0.255***	0.298***
	(4.08)	(3.56)	(3.72)
OR	0.0479	0.00637	0.0236
	(1.23)	(0.15)	(0.48)
UT	0.0460	0.0494	0.0617
	(0.99)	(1.04)	(1.14)
WA	0.0175	-0.0276	-0.0118
	(0.39)	(-0.60)	(-0.21)
Intercept			
_cons	-0.830	-0.0564	-0.0587

	(-1.40)	(-0.08)	(-0.07)
N	410	336	279
R^2	0.995	0.991	0.986
adj. R^2	0.995	0.990	0.984

t statistics in parentheses
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$
Base Case: Wyoming and Beale 9.

Appendix F: Total Employment Estimates with State and Beale Code Dummies, 1990-2000

	All Counties ln total employment	Non-Metro ln total employment	Rural ln total employment
Population			
ln population	0.215***	0.193***	0.181**
	(4.78)	(3.67)	(3.25)
Lagged Total Employment			
ln lagged total employment	0.826***	0.854***	0.862***
	(17.38)	(15.42)	(14.54)
Direct Costs			
ln per capita tax	0.0658***	0.0628**	0.0613**
	(3.41)	(3.08)	(2.68)
ln wage	-0.298***	-0.327***	-0.322***
	(-5.44)	(-5.35)	(-4.81)
ln % property tax	0.0288	0.0448	0.0211
	(0.51)	(0.74)	(0.32)
ln electricity $	-0.0263	-0.0268	-0.0211
	(-0.88)	(-0.85)	(-0.59)
Secondary Costs			
ln per capita public expenditure	-0.0528	-0.0495	-0.0640
	(-1.57)	(-1.42)	(-1.70)
ln highway miles per acre	-0.0391*	-0.0284	-0.0309
	(-2.13)	(-1.22)	(-1.21)
airports	0.00391	0.0197	0.0318
	(0.31)	(0.98)	(1.19)
Unemployment rate	0.0000309	0.0000222	0.0000199
	(1.04)	(0.65)	(0.54)
% High School Education	0.0000880***	0.0000765***	0.0000877***
	(6.91)	(5.32)	(5.36)
Amenities			
Amenity index	-0.00307	-0.000385	0.00117
	(-0.97)	(-0.10)	(0.24)
% Gap 1 (Wilderness and National Park)	0.00163	0.00114	0.000580
	(1.90)	(1.16)	(0.49)
% Gap 2 (National Recreation Areas and State Parks)	0.00188*	0.00161	0.000915
	(2.02)	(1.79)	(0.93)
% Gap 3 (BLM and National Forest)	0.000399	0.000527	0.000616
	(1.08)	(1.29)	(1.30)
% Gap 4 (Federal land with no conservation mandate)	0.00107**	0.00139**	0.00127
	(2.63)	(2.70)	(1.76)
Ski resort	0.0255	0.0401	0.0203

	(1.65)	(1.62)	(0.77)
Hiking trails	0.000458	0.0000798	0.00100
	(0.36)	(0.06)	(0.60)
Boat ramps	0.00424	0.00424	0.00313
	(1.87)	(1.56)	(1.06)
Campgrounds	0.000102	0.000558	0.000443
	(0.20)	(0.86)	(0.54)
Location			
ln area	-0.00362	-0.0194	-0.0115
	(-0.30)	(-1.09)	(-0.54)
Beale1	0.00163	0.00114	0.000580
	(1.90)	(1.16)	(0.49)
Beale2	0.00188*	0.00161	0.000915
	(2.02)	(1.79)	(0.93)
Beale3	0.000399	0.000527	0.000616
	(1.08)	(1.29)	(1.30)
Beale4	0.00107**	0.00139**	0.00127
	(2.63)	(2.70)	(1.76)
Beale5	0.0255	0.0401	0.0203
	(1.65)	(1.62)	(0.77)
Beale6	0.000458	0.0000798	0.00100
	(0.36)	(0.06)	(0.60)
Beale7	0.00424	0.00424	0.00313
	(1.87)	(1.56)	(1.06)
beale8	0.000102	0.000558	0.000443
	(0.20)	(0.86)	(0.54)
Beale9	0.0768		
	(1.01)		
AZ	0.0158		
	(0.56)		
CA	-0.0148		
	(-0.53)		
CO	0.0326	-0.00819	
	(0.96)	(-0.18)	
ID	0.0178	-0.0255	
	(0.52)	(-0.62)	
MT	0.0434	0.0245	0.0291
	(1.10)	(0.78)	(0.90)
NM	-0.0125	-0.0283	-0.0272
	(-0.31)	(-1.22)	(-1.16)
NV	0.0322	0.0333	0.0347
	(0.57)	(1.11)	(1.14)
OR	0.00611		
	(0.12)		
UT	0.0386	0.0721	0.123
	(0.82)	(1.31)	(1.56)

WA	-0.0696	-0.0934*	-0.0906
	(-1.92)	(-2.19)	(-1.74)
Intercept			
_cons	-0.587	-0.424	-0.300
	(-1.35)	(-0.96)	(-0.63)
N	411	322	271
R^2	0.997	0.992	0.988
adj. R^2	0.996	0.991	0.987

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Base Case: Wyoming and Beale Code 9.

Appendix G: Regression Results for Total Employment, 1980-1990

	All Counties ln total employment	Non Metro ln total employment	Rural ln total employment
Population			
ln Population	0.233**	0.238*	0.214*
	(3.00)	(2.55)	(2.47)
Lagged Employment			
ln Total Employment	0.813***	0.820***	0.834***
	(10.30)	(8.30)	(8.96)
Direct Costs			
ln Per Capita Taxes	-0.000135	0.000299	-0.00762
	(-0.01)	(0.01)	(-0.26)
ln Wage	-0.333***	-0.332***	-0.342***
	(-4.83)	(-4.45)	(-4.32)
ln % property tax	0.0104	-0.0314	-0.0364
	(0.09)	(-0.24)	(-0.28)
ln Electricity $	-0.0615	-0.0418	-0.0214
	(-1.38)	(-0.84)	(-0.42)
Secondary Costs			
ln Per Capita Public Expenditure	0.00166	0.00470	0.00544
	(0.04)	(0.10)	(0.10)
ln Highway Miles per Acre	-0.0147	-0.0101	-0.00418
	(-0.64)	(-0.33)	(-0.13)
Airports	0.0308	0.0683**	0.0972*
	(1.91)	(2.72)	(2.41)
Unemployment Rate	0.00449	0.00424	0.00625*
	(1.91)	(1.60)	(2.23)
% High School Education	0.00776***	0.00615***	0.000102***
	(5.94)	(3.66)	(5.62)
Amenities			
Amenity Index	-0.00201	-0.00160	-0.00473
	(-0.43)	(-0.26)	(-0.66)
% Gap 1 (National Park and Wilderness)	0.00269*	0.00208	0.00213
	(2.19)	(1.60)	(1.44)
% Gap 2 (National Recreation Areas and State Parks)	0.00241	0.00351**	0.00386**
	(1.89)	(2.69)	(2.73)
% Gap 3 (BLM and National Forest)	0.000874	0.000846	0.00117
	(1.67)	(1.45)	(1.96)
% Gap 4 (Federal Land with no Conservation Mandate)	0.000719	0.000532	0.00154
	(1.38)	(0.77)	(1.46)

Ski resort	0.0620**	0.0942**	0.0861**
	(3.06)	(3.14)	(2.63)
Hiking trails	0.000239	-0.00142	-0.00201
	(0.15)	(-0.72)	(-0.83)
Boat ramps	-0.00574	-0.00711	-0.00880
	(-1.65)	(-1.82)	(-1.89)
Campgrounds	-0.000289	0.000287	-0.000491
	(-0.43)	(0.32)	(-0.42)
Location			
ln area	0.0120	0.00839	0.0120
	(0.65)	(0.32)	(0.45)
Beale1	0.0814		
	(1.82)		
Beale2	-0.0400		
	(-1.06)		
Beale3	-0.0147		
	(-0.31)		
Beale4	-0.0293	-0.0959	
	(-0.57)	(-1.65)	
Beale5	-0.0654	-0.155**	
	(-1.29)	(-2.94)	
Beale6	-0.00468	-0.0485	-0.0310
	(-0.07)	(-1.59)	(-0.96)
Beale7	-0.0525	-0.0995***	-0.0838**
	(-0.77)	(-3.40)	(-2.88)
Beale8	-0.0270	-0.0510	-0.0552
	(-0.28)	(-1.25)	(-1.36)
Beale9	0.0254		
	(0.31)		
AZ	0.138	0.0868	0.111
	(1.95)	(1.18)	(1.03)
CA	0.0632	0.0447	0.0627
	(0.98)	(0.63)	(0.82)
CO	0.0555	0.0226	0.0240
	(1.12)	(0.44)	(0.43)
ID	-0.0297	-0.0400	-0.0539
	(-0.60)	(-0.74)	(-0.89)
MT	-0.0249	-0.0279	-0.0187
	(-0.71)	(-0.75)	(-0.48)
NM	0.119	0.0676	0.119
	(1.47)	(0.75)	(1.22)
NV	0.371**	0.368**	0.356*
	(2.82)	(2.59)	(2.30)
OR	0.0192	0.00408	0.0160
	(0.47)	(0.09)	(0.29)
UT	0.0328	0.0136	0.00691

	(0.61)	(0.25)	(0.12)
WA	0.00838	-0.0184	-0.0184
	(0.15)	(-0.31)	(-0.27)
Intercept			
_cons	-0.840	-0.536	-0.707
	(-1.15)	(-0.64)	(-0.77)
N	410	336	279
R^2	0.993	0.985	0.977
adj. R^2	0.993	0.983	0.974

t statistics in parentheses
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$
Base Case: Wyoming and Beale 9

Appendix H: Natural Resource Employment Estimates with State and Beale Code Dummies, 1990-2000

	All Counties ln Natural Resource Employment	Non Metro ln Natural Resource Employment	Rural ln Natural Resource Employment
ln Population	0.227***	0.257***	0.260***
	(3.44)	(3.41)	(3.36)
ln Natural Resource Employment	0.851***	0.858***	0.853***
	(16.27)	(15.10)	(13.37)
ln per capita Tax	0.121	0.142	0.160
	(1.67)	(1.78)	(1.90)
ln per capita Public Exp.	-0.0815	-0.0730	-0.0987
	(-0.88)	(-0.76)	(-0.95)
ln Highway Miles per Acre	-0.108*	-0.131	-0.166*
	(-2.04)	(-1.95)	(-2.29)
Airports	0.0310	0.0513	0.122
	(0.92)	(0.95)	(1.35)
Unemployment Rate	-0.0000870	-0.000115	-0.0000828
	(-0.97)	(-1.10)	(-0.75)
% HS Education	0.0000896*	0.0000886	0.0000969
	(2.08)	(1.80)	(1.73)
ln wage	-0.957***	-1.052**	-1.126**
	(-3.31)	(-3.17)	(-3.13)
ln % Property Taxes	0.340	0.436*	0.432
	(1.84)	(2.04)	(1.80)
ln Electricity $	-0.307***	-0.431***	-0.514***
	(-3.49)	(-4.09)	(-4.46)
ln Area	0.0314	0.0623	0.102
	(0.74)	(1.07)	(1.48)
Amenity Index	-0.0166	-0.00987	-0.0139
	(-1.68)	(-0.83)	(-0.96)
% Gap 1 (Wilderness and National Parks)	-0.00217	-0.00489	-0.00637
	(-0.72)	(-1.45)	(-1.61)
% Gap 2 (National Recreation Areas and State Parks)	0.00133	0.00160	-0.000354
	(0.37)	(0.39)	(-0.08)
% Gap 3 (BLM and National Forest)	0.00173	0.00155	0.00105
	(1.51)	(1.24)	(0.73)
Gap 4 (Federal Land with no Conservation Mandate)	-0.000207	-0.000243	-0.00121
	(-0.17)	(-0.15)	(-0.56)
Ski Resort	0.0484	0.0891	0.0563

	(1.20)	(1.18)	(0.70)
Hiking Trails	0.00210	0.00264	0.00399
	(0.57)	(0.61)	(0.77)
Boat Ramps	0.00786	0.00552	0.00398
	(1.10)	(0.73)	(0.46)
Campgrounds	-0.00319*	-0.00485*	-0.00419
	(-2.11)	(-2.41)	(-1.74)
Beale1	-0.0876		
	(-0.85)		
Beale2	-0.0101		
	(-0.13)		
Beale3	-0.0842		
	(-0.99)		
Beale4	-0.0710	0.0496	
	(-0.79)	(0.42)	
Beale5	-0.146	-0.0231	
	(-1.52)	(-0.19)	
Beale6	-0.0640	0.101	0.108
	(-0.59)	(1.23)	(1.31)
Beale7	-0.152	0.0263	0.0187
	(-1.37)	(0.38)	(0.27)
Beale8	-0.169	0.0265	0.0270
	(-1.08)	(0.28)	(0.28)
Beale9	-0.211		
	(-1.46)		
AZ	0.104	0.204	0.683**
	(0.65)	(1.02)	(2.90)
CA	0.208	0.286*	0.368*
	(1.81)	(2.02)	(2.15)
CO	-0.0879	-0.0785	-0.0415
	(-1.04)	(-0.85)	(-0.43)
ID	-0.201*	-0.179	-0.148
	(-2.07)	(-1.73)	(-1.28)
MT	-0.221**	-0.201*	-0.198*
	(-2.63)	(-2.23)	(-2.00)
NM	0.115	0.146	0.157
	(0.71)	(0.80)	(0.78)
NV	0.265	0.361	0.505*
	(1.55)	(1.69)	(2.00)
OR	-0.0434	0.00182	0.0460
	(-0.53)	(0.02)	(0.46)
UT	-0.0630	-0.00434	0.0537
	(-0.70)	(-0.04)	(0.48)
WA	-0.0991	-0.0404	-0.0810
	(-1.11)	(-0.39)	(-0.65)
_cons	-1.956	-3.351*	-3.645*

	(-1.44)	(-2.08)	(-2.18)
N	411	322	271
R^2	0.975	0.951	0.932
adj. R^2	0.973	0.944	0.922

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Base Case: Wyoming and Beale 9

Appendix I: Natural Resource Employment, 1980-1990

	All Counties ln Natural Resource Employment	Non Metro ln Natural Resource Employment	Rural ln Natural Resource Employment
Population			
ln Population	0.340***	0.383***	0.403***
	(4.23)	(4.38)	(4.28)
Lagged Natural Resource Employment			
ln Natural Resource Employment	0.671***	0.645***	0.609***
	(10.64)	(9.55)	(8.56)
Direct Costs			
ln per capita Tax	-0.0539	-0.0362	-0.0441
	(-0.65)	(-0.42)	(-0.49)
ln Wage	-0.222	-0.173	0.00407
	(-0.61)	(-0.46)	(0.01)
ln % Property Tax	-0.211	-0.312	-0.0616
	(-0.75)	(-0.95)	(-0.19)
ln Electricity $	0.151	0.185	0.204
	(1.17)	(1.27)	(1.33)
Secondary Costs			
ln per capita Public Expenditure	-0.0430	-0.0290	-0.0971
	(-0.32)	(-0.20)	(-0.60)
ln Highway Miles per Acre	0.102	0.122	0.121
	(1.64)	(1.46)	(1.42)
Airports	-0.0164	-0.0212	0.0247
	(-0.43)	(-0.35)	(0.24)
Unemployment Rate	0.00881	0.0119	0.0140
	(1.04)	(1.34)	(1.53)
% High School Education	0.0000467	0.0000391	0.0000910
	(1.16)	(0.80)	(1.69)
Amenities			
Amenity Index	-0.00609	-0.0102	-0.0103
	(-0.48)	(-0.65)	(-0.55)
% Gap 1 (Wilderness and National Parks)	0.00191	0.00317	0.00286
	(0.57)	(0.84)	(0.66)
% Gap 2 (National Recreation Areas and State Parks)	-0.000752	0.00201	0.00196
	(-0.16)	(0.37)	(0.34)
% Gap 3 (BLM and National Forest)	0.000938	0.00128	0.00217
	(0.69)	(0.84)	(1.31)
% Gap 4 (Federal Land with No Conservation Mandate)	0.000710	0.000846	0.00373
	(0.42)	(0.39)	(1.36)

Ski Resort	0.0228	0.0291	0.0269
	(0.45)	(0.40)	(0.32)
Hiking Trails	0.00462	0.00323	0.00306
	(0.99)	(0.57)	(0.45)
Boat Ramps	-0.0112	-0.0190	-0.0308*
	(-1.15)	(-1.73)	(-2.39)
Campgrounds	-0.00236	-0.00324	-0.00566*
	(-1.40)	(-1.39)	(-1.99)
Location			
ln Area	0.0139	-0.00596	0.0290
	(0.27)	(-0.08)	(0.39)
Beale1	0.115		
	(1.11)		
Beale2	0.0567		
	(0.53)		
Beale3	-0.0232		
	(-0.20)		
Beale4	-0.0443	-0.227	
	(-0.31)	(-1.49)	
Beale5	-0.0395	-0.200	
	(-0.28)	(-1.45)	
Beale6	-0.0314	-0.185	-0.150
	(-0.18)	(-1.92)	(-1.54)
Beale7	-0.0771	-0.236**	-0.215**
	(-0.43)	(-2.72)	(-2.60)
Beale8	-0.127	-0.287*	-0.306*
	(-0.61)	(-2.17)	(-2.26)
Beale9	0.141		
	(0.68)		
AZ	-0.175	-0.347	-0.343
	(-0.82)	(-1.38)	(-1.09)
CA	0.0211	-0.141	-0.0944
	(0.12)	(-0.71)	(-0.44)
CO	-0.0442	-0.188	-0.0321
	(-0.35)	(-1.18)	(-0.22)
ID	0.250	0.127	0.234
	(1.75)	(0.74)	(1.39)
MT	-0.0155	-0.126	-0.0357
	(-0.15)	(-0.77)	(-0.32)
NM	-0.208	-0.384	-0.116
	(-0.92)	(-1.73)	(-0.45)
NV	0.391	0.311	0.330
	(1.31)	(0.99)	(0.95)
OR	0.158	0.0503	0.166
	(1.46)	(0.34)	(1.22)
UT	-0.151	-0.296	-0.250

	(-1.18)	(-1.72)	(-1.71)
WA	0.124		0.161
	(0.91)		(0.94)
WY		-0.0945	
		(-0.60)	
Intercept			
_cons	0.783	1.262	-0.358
	(0.41)	(0.57)	(-0.16)
N	409	335	278
R^2	0.955	0.913	0.881
adj. R^2	0.951	0.902	0.865

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Base Case: Wyoming and Beale 9

Appendix J: Service Employment with Beale and State Dummies, 1990-2000

	All Counties ln Service Employment	Non Metro ln Service Employment	Rural ln Service Employment
ln population	0.194***	0.183**	0.178**
	(3.87)	(2.99)	(2.85)
ln Service Employment	0.869***	0.871***	0.868***
	(19.64)	(16.81)	(16.28)
ln per capita Taxes	0.0417	0.0319	0.0250
	(1.19)	(0.80)	(0.57)
ln per capita Public Expenditure	-0.0526	-0.0588	-0.0720
	(-0.97)	(-0.95)	(-1.05)
ln Highway Miles per Acre	-0.0297	-0.0307	-0.0261
	(-1.04)	(-0.70)	(-0.54)
Airports	0.00600	-0.00672	-0.00533
	(0.29)	(-0.22)	(-0.12)
Unemployment Rate	0.000130*	0.000142*	0.000134
	(2.33)	(2.22)	(1.95)
% High School Education	0.000116***	0.000117***	0.000126***
	(5.46)	(4.42)	(4.09)
ln Wage	-0.323**	-0.333**	-0.299*
	(-3.10)	(-2.74)	(-2.26)
ln % Property Taxes	0.0436	0.0563	0.0359
	(0.39)	(0.44)	(0.26)
ln Electricity $	0.0427	0.0719	0.146
	(0.69)	(0.97)	(1.72)
ln Area	-0.0143	-0.0140	-0.0133
	(-0.72)	(-0.41)	(-0.33)
Amenity Index	0.00743	0.01000	0.0130
	(1.46)	(1.56)	(1.63)
% Gap 1 (Wilderness and National Parks)	0.00170	0.00172	0.00174
	(1.33)	(1.12)	(0.92)
% Gap 2 (National Recreation Areas and State Parks)	0.00276	0.00148	0.00160
	(1.42)	(0.70)	(0.69)
% Gap 3 (BLM and National Forest)	0.00162*	0.00162	0.00187
	(2.24)	(1.93)	(1.93)
% Gap 4 (Federal Land with No Conservation Mandate)	0.00252***	0.00264**	0.00302**
	(4.05)	(2.96)	(2.65)
Ski Resort	0.00136	0.0164	0.00532
	(0.07)	(0.48)	(0.14)
Hiking Trails	0.000907	0.00102	0.00127
	(0.45)	(0.43)	(0.45)

Boat Ramps	0.000439	-0.000766	-0.00279
	(0.11)	(-0.16)	(-0.48)
Campgrounds	-0.0000191	0.0000109	0.000214
	(-0.02)	(0.01)	(0.15)
Beale1	0.0807		
	(1.45)		
Beale2	-0.0350		
	(-0.89)		
Beale3	-0.00447		
	(-0.11)		
Beale4	0.00184	-0.00261	
	(0.04)	(-0.03)	
Beale5	0.0519	0.0613	
	(0.91)	(0.78)	
Beale6	0.0638	0.0496	0.0554
	(0.99)	(0.80)	(0.86)
Beale7	-0.000341	-0.0128	-0.00646
	(-0.00)	(-0.29)	(-0.15)
Beale8	0.102	0.0815	0.0824
	(1.07)	(1.33)	(1.36)
Beale9	0.0252		
	(0.27)		
AZ	-0.125	-0.124	-0.271**
	(-1.71)	(-1.39)	(-2.72)
CA	-0.238***	-0.287***	-0.348***
	(-4.01)	(-3.85)	(-3.82)
CO	0.0142	0.000695	-0.0219
	(0.28)	(0.01)	(-0.35)
ID	-0.0380	-0.0498	-0.0735
	(-0.67)	(-0.76)	(-0.95)
MT	-0.108*	-0.117*	-0.123*
	(-2.32)	(-2.24)	(-2.11)
NM	0.00885	-0.0110	-0.0337
	(0.10)	(-0.11)	(-0.29)
NV	-0.183*	-0.207*	-0.300*
	(-2.12)	(-1.96)	(-2.47)
OR	-0.0700	-0.0597	-0.0448
	(-1.57)	(-1.15)	(-0.76)
UT	0.0124	0.0224	-0.0289
	(0.23)	(0.36)	(-0.42)
WA	-0.0823	-0.0678	-0.0325
	(-1.67)	(-1.09)	(-0.42)
_cons	-0.843	-0.618	-0.305
	(-1.10)	(-0.65)	(-0.30)
N	411	322	271
R^2	0.992	0.982	0.974

adj. R^2	0.991	0.980	0.970

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Base Case: Beale 9 and Wyoming

Appendix K: Full Rural-Urban Continuum for Service Employment, 1980-1990

	All Counties ln Service Employment	Non Metro ln Service Employment	Rural ln Service Employment
Population			
ln Population	0.308***	0.334***	0.332***
	(5.63)	(5.56)	(5.35)
Lagged Service Employment			
ln Service Employment	0.718***	0.702***	0.697***
	(15.17)	(13.59)	(13.11)
Direct Costs			
ln per capita Taxes	-0.0181	-0.0195	-0.0262
	(-0.46)	(-0.47)	(-0.56)
ln Wage	0.0507	0.0804	0.113
	(0.50)	(0.76)	(1.02)
ln % Property Taxes	-0.117	-0.133	-0.156
	(-0.90)	(-0.93)	(-0.98)
ln Electricity $	-0.107*	-0.102	-0.0657
	(-2.03)	(-1.73)	(-1.09)
Secondary Costs			
ln per capita Public Expenditure	-0.0109	-0.0237	-0.0465
	(-0.20)	(-0.40)	(-0.71)
ln Highway Miles per Acre	0.00479	0.0169	0.0244
	(0.15)	(0.40)	(0.51)
Airports	0.0683**	0.103**	0.175**
	(2.81)	(2.62)	(3.09)
Unemployment Rate	-0.000578	-0.00200	-0.00206
	(-0.17)	(-0.54)	(-0.52)
% High School Education	0.000113***	0.0000871***	0.0000878***
	(6.49)	(4.10)	(3.42)
Amenities			
Amenity Index	-0.00381	-0.00556	-0.00629
	(-0.70)	(-0.81)	(-0.77)
% Gap 1 (National Parks and Wilderness)	0.00473**	0.00432*	0.00455*
	(2.82)	(2.39)	(2.02)
% Gap 2 (National Recreation Area and State Parks)	0.00649***	0.00819***	0.00905***
	(3.54)	(4.03)	(4.11)
% Gap 3 (BLM and National Forest)	0.00135	0.00141	0.00155
	(1.91)	(1.82)	(1.74)
% Gap 4 (Federal Land with no Conservation Mandate)	0.00170*	0.00154	0.00188

	(2.31)	(1.70)	(1.42)
Ski Resort	0.0979**	0.172***	0.170***
	(3.25)	(4.94)	(4.28)
Hiking Trails	0.000176	-0.00218	-0.00341
	(0.08)	(-0.84)	(-1.05)
Boat Ramps	-0.0122	-0.0160	-0.0198*
	(-1.67)	(-1.90)	(-2.04)
Campgrounds	0.00169	0.00307	0.00338
	(1.34)	(1.80)	(1.48)
Location			
ln Area	-0.0382	-0.0526	-0.0652
	(-1.36)	(-1.39)	(-1.56)
Beale1	0.102*		
	(2.04)		
Beale2	-0.0221		
	(-0.47)		
Beale3	0.0457		
	(0.81)		
Beale4	0.00997	-0.0553	
	(0.16)	(-0.84)	
Beale5	-0.0417	-0.129*	
	(-0.66)	(-2.03)	
Beale6	0.0345	-0.00947	-0.00525
	(0.41)	(-0.22)	(-0.12)
Beale7	-0.0392	-0.0829*	-0.0843*
	(-0.48)	(-2.23)	(-2.24)
Beale8	0.0586	0.0381	0.0315
	(0.52)	(0.74)	(0.61)
Beale9	0.0199		
	(0.20)		
AZ	0.170	0.0894	0.0219
	(1.84)	(0.84)	(0.16)
CA	0.0602	0.0312	0.00731
	(0.77)	(0.36)	(0.07)
CO	0.156**	0.122	0.103
	(2.59)	(1.89)	(1.43)
ID	-0.0468	-0.0803	-0.115
	(-0.65)	(-1.03)	(-1.28)
MT	0.0352	0.0234	0.0267
	(0.64)	(0.40)	(0.40)
NM	0.174	0.121	0.131
	(1.93)	(1.22)	(1.19)
NV	0.316**	0.312**	0.289*
	(2.92)	(2.63)	(2.19)
OR	0.0630	0.0244	0.0189
	(0.98)	(0.34)	(0.23)

UT	0.169*	0.141	0.110
	(2.05)	(1.66)	(1.15)
WA	-0.103	-0.137	-0.151
	(-1.19)	(-1.46)	(-1.35)
Intercept			
_cons	-1.070	-0.717	-0.226
	(-1.22)	(-0.73)	(-0.21)
N	410	336	279
R^2	0.991	0.980	0.971
adj. R^2	0.990	0.978	0.967

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Base Case" Beale 9 and Wyoming

Appendix L: Reduced Form Equations, 1980-1990

	Population ln Population	Total Employment ln Total Employment	Service Employment ln Service Employment	Natural Resource Employment ln Natural Resource Employment
Lagged Endogenous Variables				
ln Population	1.131***	0.272*	0.375***	0.379***
	(22.59)	(2.33)	(4.86)	(4.43)
ln total Employment	-0.0725	0.796***		
	(-1.41)	(7.00)		
ln Service Employment			0.700***	
			(11.56)	
ln Natural Resource Employment				0.630***
				(9.37)
Direct Costs/ Community Characteristics				
ln Wage	-0.283***	-0.413***	-0.0285	-0.355
	(-5.56)	(-4.97)	(-0.24)	(-0.90)
ln Electricity $	-0.404	-0.792	-1.456	2.140
	(-0.74)	(-1.20)	(-1.77)	(1.18)
ln per capita Taxes	-0.00552	-0.0318	-0.0505	-0.117
	(-0.27)	(-1.01)	(-1.15)	(-1.30)
ln % Property Taxes	-0.0538	0.0557	-0.0688	-0.156
	(-0.78)	(0.43)	(-0.44)	(-0.49)
Secondary Costs/ Community Characteristics				
ln per capita Public Exp.	-0.0150	-0.0257	-0.0706	-0.241
	(-0.32)	(-0.47)	(-0.83)	(-1.61)
Unemployment Rate	0.00553**	0.00509	0.0000498	0.00974
	(2.76)	(1.87)	(0.01)	(1.05)
% HS Education	0.00527***	0.00832***	0.0100***	0.00516
	(4.25)	(4.81)	(5.32)	(1.25)
ln per capita Police Exp.	0.0506	0.109**	0.0649	0.347**
	(1.82)	(2.78)	(1.13)	(3.19)
ln per capita Education Exp.	-0.00598	-0.0126	0.0184	0.135
	(-0.13)	(-0.19)	(0.22)	(0.93)
ln % Owner Occupied	0.227*	0.0557	0.0780	0.0540
	(2.40)	(0.48)	(0.46)	(0.20)
Crime Rate	-0.00201	0.00492	0.0186	-0.0322**
	(-0.44)	(1.28)	(1.94)	(-3.16)
ln Highway Miles per Acre	-0.0388	-0.0164	-0.00509	0.0857
	(-1.73)	(-0.60)	(-0.13)	(1.26)
Airports	0.0133	0.0238	0.0632*	-0.0385

	(0.78)	(1.23)	(2.11)	(-0.86)
Amenities				
Amenity Index	-0.00272	-0.00308	-0.00285	-0.000917
	(-0.68)	(-0.56)	(-0.43)	(-0.07)
% Gap 1 (National Park and Wilderness)	0.00342***	0.00354**	0.00567**	0.00328
	(3.47)	(2.77)	(3.09)	(0.90)
% Gap 2 (National Recreation Areas and State Parks)	0.000649	0.00268	0.00709***	-0.00166
	(0.52)	(1.83)	(3.42)	(-0.32)
% Gap 3 (BLM and National Forests)	0.000300	0.000577	0.000945	0.000811
	(0.68)	(0.97)	(1.11)	(0.54)
% Gap 4 (Federal Land with No Conservation Mandate)	0.00126*	0.00101	0.00186*	0.00147
	(2.36)	(1.70)	(2.26)	(0.81)
Ski Resort	0.0293	0.0680**	0.122**	0.00599
	(1.74)	(2.63)	(3.02)	(0.10)
Hiking Trails	-0.0000827	0.000500	-0.0000648	0.00634
	(-0.05)	(0.28)	(-0.03)	(1.24)
Boat Ramps	-0.00610*	-0.00720	-0.0142	-0.0184
	(-2.06)	(-1.71)	(-1.83)	(-1.64)
Campgrounds	0.000152	-0.000488	0.00155	-0.00290
	(0.26)	(-0.63)	(1.26)	(-1.54)
Location				
ln Area	0.0288	0.0199	-0.0279	0.0392
	(1.58)	(0.91)	(-0.92)	(0.72)
Beale1	0.0571	0.108*	0.144*	0.103
	(1.07)	(2.00)	(2.15)	(0.81)
Beale2	-0.0203	-0.0374	-0.0144	0.0234
	(-0.40)	(-0.75)	(-0.22)	(0.21)
Beale3	-0.00115	-0.00208	0.0705	-0.0671
	(-0.02)	(-0.03)	(0.88)	(-0.50)
Beale4	0.0175	-0.00928	0.0631	-0.102
	(0.25)	(-0.14)	(0.71)	(-0.66)
Beale5	-0.0232	-0.0517	-0.00645	-0.108
	(-0.33)	(-0.75)	(-0.07)	(-0.69)
Beale6	0.0628	0.0350	0.128	-0.0997
	(0.67)	(0.38)	(1.08)	(-0.50)
Beale7	-0.00492	-0.0264	0.0360	-0.177
	(-0.05)	(-0.29)	(0.31)	(-0.90)
Beale8	0.114	0.0303	0.200	-0.213
	(0.95)	(0.25)	(1.32)	(-0.88)
Beale9	0.0359	0.0654	0.130	0.0557

	(0.31)	(0.59)	(0.93)	(0.24)
AZ	-0.217**	-0.240*	-0.223*	-0.532*
	(-3.05)	(-2.25)	(-1.99)	(-2.29)
CA	-0.290***	-0.353**	-0.371***	-0.369
	(-4.79)	(-3.28)	(-3.41)	(-1.46)
CO	-0.339***	-0.333**	-0.231	-0.329
	(-5.60)	(-2.88)	(-1.96)	(-1.24)
ID	-0.387***	-0.434**	-0.471***	-0.0112
	(-5.34)	(-3.27)	(-3.44)	(-0.03)
MT	-0.409***	-0.416**	-0.364**	-0.312
	(-5.52)	(-3.01)	(-2.76)	(-1.00)
NM	-0.302***	-0.291**	-0.250**	-0.640**
	(-5.12)	(-3.19)	(-2.70)	(-2.98)
OR	-0.358***	-0.366**	-0.349**	-0.0831
	(-4.90)	(-2.70)	(-2.63)	(-0.25)
UT	-0.347***	-0.363**	-0.253*	-0.472
	(-5.22)	(-3.22)	(-2.14)	(-1.81)
WA	-0.364***	-0.393***	-0.513***	-0.196
	(-4.89)	(-3.33)	(-3.89)	(-0.70)
WY	-0.412***	-0.415**	-0.406**	-0.384
	(-5.21)	(-2.86)	(-2.95)	(-1.21)
Intercept				
_cons	-1.109	-0.826	-0.938	-0.355
	(-1.64)	(-0.97)	(-0.81)	(-0.16)
N	410	410	410	409
R^2	0.996	0.992	0.989	0.954
adj. R^2	0.995	0.991	0.988	0.949

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Base Case: Beale 0 and Nevada

Appendix M: Stata Program

```
//Thesis Data
//Master_with_Estimates
//3/2/07
//Log Log Model

version 9
capture log close
set more off
cd "E:\Thesis\"
use master,clear
rename chgnre chgnre00
summarize

//state dummy variables
egen st=group(state)
gen az=st
replace az=0 if az==2 |az==3 |az==4 |az==5 |az==6 |az==7 |az==8 |az==9
|az==10| az==11
gen ca=st
replace ca=0 if ca==1 |ca==3 |ca==4 |ca==5 |ca==6 |ca==7 |ca==8 |ca==9
|ca==10 | ca==11
replace ca=1 if ca==2
gen co=st
replace co=0 if co==1 |co==2 |co==4 |co==5 |co==6 |co==7 |co==8 |co==9
|co==10 | co==11
replace co=1 if co==3
gen id=st
replace id=0 if id==1 |id==2 |id==3 |id==5 |id==6 |id==7 |id==8 |id==9
| id==10 |id==11
replace id=1 if id==4
gen mt=st
replace mt=0 if mt==1 |mt==2 |mt==3 |mt==4 |mt==6 |mt==7 |mt==8 |mt==9
|mt==10 |mt==11
replace mt=1 if mt==5
gen nv=st
replace nv=0 if nv==1 |nv==2 |nv==3 |nv==4 |nv==5 |nv==6 |nv==8 |nv==9
|nv==10 |nv==11
replace nv=1 if nv==7
gen nm=st
replace nm=0 if nm==1 |nm==2 |nm==3 |nm==4 |nm==5 |nm==7 |nm==8 |nm==9
|nm==10 | nm==11
replace nm=1 if nm==6
gen or=st
replace or=0 if or==1 |or==2 |or==3 |or==4 |or==5 |or==6 |or==7 |or==9
|or==10 |or==11
replace or=1 if or==8
gen ut=st
replace ut=0 if ut==1| ut==2| ut==3| ut==4| ut==5 |ut==6| ut==7 |ut==8|
ut==10| ut==11
replace ut=1 if ut==9
gen wa=st
replace wa=0 if wa==1| wa==2| wa==3| wa==4| wa==5| wa==6| wa==7| wa==8|
wa==9| wa==11
replace wa=1 if wa==10
```

```
gen wy=st
replace wy=0 if wy==1| wy==2|wy==3| wy==4| wy==5 | wy==6| wy==7| wy==8|
wy==9| wy==10
replace wy=1 if wy==11

//1983 Beale Code Dummys
gen beale0_83=beale83
replace beale0_83=0 if beale0_83==1 |beale0_83==2| beale0_83==4 |
beale0_83==3 |beale0_83==6| beale0_83==5 |beale0_83==7 |beale0_83==8
|beale0_83==9
replace beale0_83=1 if beale0_83==0

gen beale1_83=beale83
replace beale1_83=0 if beale1_83==0 |beale1_83==2| beale1_83==4 |
beale1_83==3 |beale1_83==6| beale1_83==5 |beale1_83==7 |beale1_83==8
|beale1_83==9
replace beale1_83=1 if beale1_83==1

gen beale2_83=beale83
replace beale2_83=0 if beale2_83==0 |beale2_83==1| beale2_83==4 |
beale2_83==3 |beale2_83==6| beale2_83==5 |beale2_83==7 |beale2_83==8
|beale2_83==9
replace beale2_83=1 if beale2_83==2

gen beale3_83=beale83
replace beale3_83=0 if beale3_83==0 |beale3_83==1| beale3_83==4 |
beale3_83==2 |beale3_83==6| beale3_83==5 |beale3_83==7 |beale3_83==8
|beale3_83==9
replace beale3_83=1 if beale3_83==3

gen beale4_83=beale83
replace beale4_83=0 if beale4_83==0 |beale4_83==1| beale4_83==2 |
beale4_83==3 |beale4_83==6| beale4_83==5 |beale4_83==7 |beale4_83==8
|beale4_83==9
replace beale4_83=1 if beale4_83==4

gen beale5_83=beale83
replace beale5_83=0 if beale5_83==0 |beale5_83==1| beale5_83==2 |
beale5_83==3 |beale5_83==6| beale5_83==4 |beale5_83==7 |beale5_83==8
|beale5_83==9
replace beale5_83=1 if beale5_83==5

gen beale6_83=beale83
replace beale6_83=0 if beale6_83==0 |beale6_83==1| beale6_83==2 |
beale6_83==3 |beale6_83==5| beale6_83==4 |beale6_83==7 |beale6_83==8
|beale6_83==9
replace beale6_83=1 if beale6_83==6

gen beale7_83=beale83
replace beale7_83=0 if beale7_83==0 |beale7_83==1| beale7_83==2 |
beale7_83==3 |beale7_83==5| beale7_83==4| beale7_83==6  |beale7_83==8
|beale7_83==9
replace beale7_83=1 if beale7_83==7

gen beale8_83=beale83
```

```
replace beale8_83=0 if beale8_83==0 |beale8_83==1| beale8_83==2 |
beale8_83==3 |beale8_83==5| beale8_83==4 |beale8_83==7 |beale8_83==6
|beale8_83==9
replace beale8_83=1 if beale8_83==8

gen beale9_83=beale83
replace beale9_83=0 if beale9_83==0 |beale9_83==1| beale9_83==2 |
beale9_83==3 |beale9_83==5| beale9_83==4| beale9_83==6  |beale9_83==8
|beale9_83==7
replace beale9_83=1 if beale9_83==9

//1993 Beale Code Dummys
gen urban=beale93
replace urban=1 if urban==0| urban==1| urban==2| urban==3
replace urban=0 if urban==4| urban==5| urban==6| urban==7| urban==8|
urban==9

gen beale0=beale93
replace beale0=0 if beale0==1 | beale0==2 | beale0==3 | beale0==4 |
beale0==5 | beale0==6 | beale0==7 | beale0==8 | beale0==9
replace beale0=1 if beale0==0

gen beale1=beale93
replace beale1=0 if beale1==0 | beale1==2 | beale1==3 | beale1==4 |
beale1==5 | beale1==6 | beale1==7 | beale1==8 |beale1==9

gen beale2=beale93
replace beale2=0 if beale2==0 | beale2==1 | beale2==3 |beale2==4 |
beale2==5 | beale2==6 | beale2==7 | beale2==8 | beale2==9
replace beale2=1 if beale2==2

gen beale3=beale93
replace beale3=0 if beale3==0 |beale3==1| beale3==2 | beale3==4
|beale3==5| beale3==6 |beale3==7 |beale3==8 |beale3==9
replace beale3=1 if beale3==3

gen beale4=beale93
replace beale4=0 if beale4==0 |beale4==1| beale4==2 | beale4==3
|beale4==6| beale4==5 |beale4==7 |beale4==8 |beale4==9
replace beale4=1 if beale4==4

gen beale5=beale93
replace beale5=0 if beale5==0 |beale5==1| beale5==2 | beale5==3
|beale5==6| beale5==4 |beale5==7 |beale5==8 |beale5==9
replace beale5=1 if beale5==5

gen beale6=beale93
replace beale6=0 if beale6==0 |beale6==1| beale6==2 | beale6==3
|beale6==5| beale6==4 |beale6==7 |beale6==8 |beale6==9
replace beale6=1 if beale6==6

gen beale7=beale93
replace beale7=0 if beale7==0 |beale7==1| beale7==2 | beale7==3
|beale7==5| beale7==4| beale7==6  |beale7==8 |beale7==9
replace beale7=1 if beale7==7

gen beale8=beale93
```

```
replace beale8=0 if beale8==0 |beale8==1| beale8==2 | beale8==3
|beale8==5| beale8==4 |beale8==7 |beale8==6 |beale8==9
replace beale8=1 if beale8==8

gen beale9=beale93
replace beale9=0 if beale9==0 |beale9==1| beale9==2 | beale9==3
|beale9==5| beale9==4| beale9==6  |beale9==8 |beale9==7
replace beale9=1 if beale9==9


/*
gen totempden90=totemp1990/area90
gen totempden80=totemp1980/area80
gen natresempden90=natres90/area90
gen natresempden80=natres80/area80
gen serden90=service1990/area90
gen serden80=service1980/area80
*/

replace crime1981=crime1980 if crime1981==.
gen crimerate1981=crime1981/(pop80)
gen crimerate1991=crime1991/(pop90)

replace ntlpark_pct=0 if ntlpark_pct==.
replace gap1_pct=0 if gap1_pct==.
replace gap2_pct=0 if gap2_pct==.
replace gap3_pct=0 if gap3_pct==.
replace gap4_pct=0 if gap4_pct==.

**scaleing the perrcentage terms
//Change to percentage points
replace chgpop90=chgpop90*100
replace chgpop00=chgpop00*100
replace owner00=owner00*100
replace owner90=owner90*100
replace owner80=owner80*100
replace hsedu00=hsedu00*100
replace hsedu90=hsedu90*100
replace hsedu80=hsedu80*100
replace coledu00=coledu90*100
replace coledu90=coledu90*100
replace coledu80=coledu80*100
replace prop82=prop82*100
replace prop92=prop92*100
replace unemployment00=unemployment00*100
replace unemploymentrate90=unemploymentrate90*100
replace unemploymentrate80=unemploymentrate80*100
replace chgnre90=chgnre90*100
replace chgnre00=chgnre00*100
replace chgser90=chgser90*100
replace chgser00=chgser00*100
replace tot90=tot90*100
replace tot00=tot00*100
replace gap1_pct=gap1_pct*100
replace gap2_pct=gap2_pct*100
replace gap3_pct=gap3_pct*100
replace gap4_pct=gap4_pct*100
```

```
replace ntlpark_pct=ntlpark_pct*100

replace medianhomevalue90=medianhomevalue90/100000
replace medianhousevalue80=medianhousevalue80/100000
replace medianhhinc90=medianhhinc90/1000
replace medianhhinc80=medianhhinc80/1000
replace highway1990=highway1990/1000
replace highway1981=highway1981/1000
replace elc1988=elc1988/1000
replace elc1980=elc1980/1000
gen edu90=hsedu90+coledu90
gen edu80=hsedu80+coledu90
gen wild_pct=gap1_pct-ntlpark_pct

//Employment and Population Density
gen totempden90=totemp1990/area90
gen totempden80=totemp1980/area80
gen serden90=service1990/area90
gen serden80=service1980/area80
gen natresden90=natres90/area90
gen natresden80=natres80/area80
gen popden00=pop00/area00
gen popden90=pop90/area90
gen popden80=pop80/area80

gen totempden00=totemp2000/area00
gen natresempden00=natres00/area00
gen serden00=service2000/area00

foreach i of varlist pop00 pop90 pop80 totemp2000 totemp1990 totemp1980
pctax92 pctax82 prop92 prop82 ///
service1980 service1990 service2000 natres80 natres90 natres00 ///
pcedu92 pcedu82 pcpol92 pcpol82 pcexp92 pcexp82 owner90 owner80
highway1990 highway1981 wage1990 wage1980 elc1988 elc1980 ///
area90 area80 crimerate1991 crimerate1981 medianhhinc90
medianhomevalue90 hsedu90 hsedu80 unemploymentrate90 unemploymentrate80
{
gen l`i'=log(`i')
}

drop if newcounty == 1
drop if fips == 8047
drop if fips ==8117
**-------------------------Summary Statistics-------------------------
------------------

tabstat pop00 pop90 totemp2000 totemp1990 service2000 service1990
natres00 natres90 pctax92 owner90 pctax92 ///
prop92 pcedu92 pcpol92 pcexp92 highway1990 wage1990 elc1988 area90
crimerate1991 gap1_pct-gap4_pct skiresort hikingtrails boatramps ///
campgrounds amenindex hsedu90 unemploymentrate90, statistics (mean min
max sd) columns(s)

tabstat pop80 totemp1980 service1980 natres80 pctax82 owner80 pctax82
prop82 pcedu82 pcpol82 pcexp82 highway1981 wage1980 ///
elc1980 area80 crimerate1981 hsedu80 unemploymentrate80,
statistics(mean min max sd) columns(s)
```

```
**--------- Change 1990's---------------------------------
**------------ Population -------------------------------
ivreg2 lpop00 (ltotemp2000= ltotemp1990 lpcexp92 unemploymentrate90
lwage1990 ///
hsedu90 lelc1988) lpop90 lpctax92 lprop92 lpcpol92 lpcedu92 lowner90
crimerate1991 larea90 lhighway1990 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust rf
predict epop, resid
est store tslspop

ivreg2 lpop00 (ltotemp2000= ltotemp1990 lpcexp92 unemploymentrate90
lwage1990 ///
hsedu90 lelc1988) lpop90 lpctax92 lprop92 lpcpol92 lpcedu92 lowner90
crimerate1991 larea90 lhighway1990 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>3, robust
est store nonurbanpop

ivreg2 lpop00 (ltotemp2000= ltotemp1990 lpcexp92 unemploymentrate90
lwage1990 ///
hsedu90 lelc1988) lpop90 lpctax92 lprop92 lpcpol92 lpcedu92 lowner90
crimerate1991 larea90 lhighway1990 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>5, robust
est store ruralpop

**-----------  Employment ----------------------------------------------
---

ivreg2 ltotemp2000 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) ltotemp1990 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust rf
predict eemp, resid
est store tslsemp

ivreg2 ltotemp2000 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) ltotemp1990 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>3, robust
est store nonurbanemp

ivreg2 ltotemp2000 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) ltotemp1990 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>5, robust
```

```
est store ruralemp

**----------- Service Employment ------------------------------------
-------------------------
ivreg2 lservice2000 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) lservice1990 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store service

ivreg2 lservice2000 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) lservice1990 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>3, robust
est store nonurbanservice

ivreg2 lservice2000 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) lservice1990 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>5, robust
est store ruralservice

**--------------------- Natural Resources ----------------------------
--------------------------
ivreg2 lnatres00 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) lnatres90 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store nre

ivreg2 lnatres00 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) lnatres90 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>3, robust
est store nonurbannre

ivreg2 lnatres00 (lpop00=lpop90 lpcpol92 lpcedu92 lowner90 ///
crimerate1991) lnatres90 lpctax92 lpcexp92 lhighway1990 airports
unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90  ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy if beale93>5, robust
est store ruralnre

**------------ Ordinary Least Squares --------------------------------
----------------------------
```

```
reg lpop00 ltotemp2000 lpop90 lpctax92 lprop92 lpcpol92 lpcedu92
lowner90 crimerate1991 larea90 lhighway1990 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store olspop

reg ltotemp2000 lpop00 ltotemp1990 lpctax92 lpcexp92 lhighway1990
airports unemploymentrate90 hsedu90 lwage1990 lprop92 lelc1988 larea90
///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store olsemp

**--------------------  Hausman Tests ---------------------------------
------------------------------
**hausman tslspop olspop
**hausman tslsemp olsemp

**-------------------- Reduced Form Estimates ------------------------
------------------------------
**-------------------- Population -----------------------------------
------------------------------
reg lpop00 ltotemp1990 lpcexp92 unemploymentrate90 lwage1990 ///
hsedu90 lelc1988 lpop90 lpctax92 lprop92 lpcpol92 lpcedu92 lowner90
crimerate1991 larea90 lhighway1990 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store netpop

**------------------ Employment -------------------------------------
------------------------------
reg ltotemp2000 ltotemp1990 lpcexp92 unemploymentrate90 lwage1990 ///
hsedu90 lelc1988 lpop90 lpctax92 lprop92 lpcpol92 lpcedu92 lowner90
crimerate1991 larea90 lhighway1990 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store netemp

**-------------------- Service Employment ----------------------------
------------------------------
reg lservice2000 lservice1990 lpcexp92 unemploymentrate90 lwage1990 ///
hsedu90 lelc1988 lpop90 lpctax92 lprop92 lpcpol92 lpcedu92 lowner90
crimerate1991 larea90 lhighway1990 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store netservice

**------------------  Natural Resources ----------------------------
------------------------------
reg lnatres00 lnatres90 lpcexp92 unemploymentrate90 lwage1990 ///
hsedu90 lelc1988 lpop90 lpctax92 lprop92 lpcpol92 lpcedu92 lowner90
crimerate1991 larea90 lhighway1990 airports ///
```

```
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0-beale9 ///
az ca co id mt nm nv or ut wa wy, robust
est store netnre

**-------------------- Tables ----------------------------------------
------------------------------
esta tslspop nonurbanpop ruralpop using pop00.rtf, compress nogaps
replace r2 ar2
esta tslsemp nonurbanemp ruralemp using emp00.rtf, compress nogaps
replace r2 ar2
esta service nonurbanservice ruralservice using service00.rtf, compress
nogaps replace r2 ar2
esta nre nonurbannre ruralnre using nre00.rtf, compress nogaps replace
r2 ar2

esta netpop netemp netservice netnre using net00.rtf, compress nogaps
replace r2 ar2

**--------------- Change in the 1980's --------------------------------
----------
drop if newcounty==1

**-------------- Population ------------------------------------------
------------
ivreg2 lpop90 (ltotemp1990= ltotemp1980 lpcexp82 unemploymentrate80
lwage1980 ///
hsedu80 lelc1980) lpop80 lpctax82 lprop82 lpcpol82 lpcedu82 lowner80
crimerate1981 larea80 lhighway1981 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store pop90

ivreg2 lpop90 (ltotemp1990= ltotemp1980 lpcexp82 unemploymentrate80
lwage1980 ///
hsedu80 lelc1980) lpop80 lpctax82 lprop82 lpcpol82 lpcedu82 lowner80
crimerate1981 larea80 lhighway1981 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>3, robust
est store nonurbanpop90

ivreg2 lpop90 (ltotemp1990= ltotemp1980 lpcexp82 unemploymentrate80
lwage1980 ///
hsedu80 lelc1980) lpop80 lpctax82 lprop82 lpcpol82 lpcedu82 lowner80
crimerate1981 larea80 lhighway1981 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>5, robust
est store ruralpop90

**----------------- Total Employment ------------------------------------
-----------------
ivreg2 ltotemp1990 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) ltotemp1980 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu80 lwage1980 lprop82 lelc1980 ///
```

```
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store emp90

ivreg2 ltotemp1990 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) ltotemp1980 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu80 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>3, robust
est store nonurbanemp90

ivreg2 ltotemp1990 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) ltotemp1980 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu90 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>5, robust
est store ruralemp90

**----------------- Service Employment -------------------------------
----------------
ivreg2 lservice1990 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) lservice1980 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu90 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store service90

ivreg2 lservice1990 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) lservice1980 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu90 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>3, robust
est store nonurbanservice90

ivreg2 lservice1990 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) lservice1980 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu90 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>5, robust
est store ruralservice90

**--------------------- Natural Resources ----------------------------
-----------------------------
ivreg2 lnatres90 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) lnatres80 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu90 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store nre90
```

```
ivreg2 lnatres90 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) lnatres80 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu90 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>3, robust
est store nonurbannre90

ivreg2 lnatres90 (lpop90=lpop80 lpcpol82 lpcedu82 lowner80 ///
crimerate1981) lnatres80 lpctax82 lpcexp82 lhighway1981 airports
unemploymentrate80 hsedu90 lwage1980 lprop82 lelc1980 ///
larea80 amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy if beale83>5, robust
est store ruralnre90

**------------------ Reduced Forms, 1980's ---------------------------
-----------------------------
regress lpop90 ltotemp1980 lpcexp82 unemploymentrate80 lwage1980 ///
hsedu80 lelc1980 lpop80 lpctax82 lprop82 lpcpol82 lpcedu82 lowner80
crimerate1981 larea80 lhighway1981 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store netpop90

regress ltotemp1990 ltotemp1980 lpcexp82 unemploymentrate80 lwage1980
///
hsedu80 lelc1980 lpop80 lpctax82 lprop82 lpcpol82 lpcedu82 lowner80
crimerate1981 larea80 lhighway1981 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store netemp90

regress lservice1990 lservice1980 lpcexp82 unemploymentrate80 lwage1980
///
hsedu80 lelc1980 lpop80 lpctax82 lprop82 lpcpol82 lpcedu82 lowner80
crimerate1981 larea80 lhighway1981 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store netservice90

regress lnatres90 lnatres80 lpcexp82 unemploymentrate80 lwage1980 ///
hsedu80 lelc1980 lpop80 lpctax82 lprop82 lpcpol82 lpcedu82 lowner80
crimerate1981 larea80 lhighway1981 airports ///
amenindex gap1_pct-gap4_pct skiresort hikingtrails boatramps
campgrounds beale0_83-beale9_83 ///
az ca co id mt nm nv or ut wa wy, robust
est store netnre90

**----------------- Tables for 1980's -------------------------------
-----------------------------
esta pop90 nonurbanpop90 ruralpop90 using pop90.rtf, compress nogaps
replace r2 ar2
```

```
esta emp90 nonurbanemp90 ruralemp90 using emp90.rtf, compress nogaps
replace r2 ar2
esta service90 nonurbanservice90 ruralservice90 using service90.rtf,
compress nogaps replace r2 ar2
esta nre90 nonurbannre90 ruralnre90 using nre90.rtf, compress nogaps
replace r2 ar2

**---------------  Reduced Form Table ---------------------------------
--------------------
esta netpop90 netemp90 netservice90 netnre90 using net90.rtf, compress
nogaps replace r2 ar2
```

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