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The Economic Importance of Air Travel In High-Amenity Rural Areas

Ray Rasker^{*,a}, Patricia H. Gude^a, Justin A. Gude^b, Jeff van den Noort^a

* Corresponding author's contact information:

Telephone: 406.570.7044

Email address: ray@headwaterseconomics.org

Physical address: 810 N. Wallace, Bozeman, MT 59715, USA

Affiliation:

^a Headwaters Economics, Bozeman, MT 59715, USA

^b Montana Fish, Wildlife and Parks, Helena, MT 59601, USA

Abstract:

The western United States offers a case study on the importance of access to large population centers and their markets, via road and air travel, for economic development. The vast distances between towns and cities in the American West can be a detriment to business, yet they also serve to attract technology and knowledge-based workers seeking to live in a picturesque setting. In spite of the increasing importance of amenities to migration and business location, also needed is access to markets, particularly via commercial air service. We test a new county classification system for the western United States to reflect differing degrees of access to population centers and account for the increasing importance of airports. Past classifications are based on population size and cross-county commuting. We examine the validity of this new classification and test for differences in economic performance among the three county types. Our findings show that there are three distinct Wests that can be classified using economic performance measures and socioeconomic characteristics. The results show that “metro” and “isolated” counties are clearly distinct, but “connected” counties, those that are rural in nature but have ready access to metropolitan areas via air travel, can be difficult to distinguish from “metro” and “isolated” counties. Much of the variation is explained by travel distance to airports. The findings illustrate the importance of airports in rural development, and the limitations facing those communities that are isolated from markets and population centers. The results apply to other parts of the world with similar characteristics that include large expanses of open space, natural amenities that attract migrants and stimulate new business, and different degrees of access to large population centers via road or air travel, and therefore different rates of economic growth.

Keywords: West, natural amenities, county classification, airports.

1. Introduction – The Importance of Transportation

The western United States (the West) contains enormous expanses of publicly owned lands that are not available for development and, because of this, the distances between towns and cities are significant. In this paper, we define the West as the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. Almost half of this region is public land managed by the federal government and includes national parks (*e.g.*, Yellowstone), wilderness areas, wildlife refuges, grazing lands, forests, wetlands, mountain ranges, rivers and lakes (Riebsame et al, 1997).

Historically this isolation has been a challenge, making it difficult to bring products to market, and to unite suppliers, producers and customers. Telecommunications have held some promise, making it possible for business owners to live in remote, picturesque parts of the rural West, even though the clients and factory floor may be at opposite ends of the world (Beyers et al., 1995; McGranahan and Wojan, 2007). Winkler et al (2007) point out that public lands of the West, with rivers, lakes, mountains and recreational opportunities, serve as an attractive backdrop that has transformed the economy from dependence on resource extractive industries to one that has seen growth from in-migration, tourism, and modern economy sectors such as finance, insurance and real estate. Rudzitis (1999, 1996) has shown empirically that the environmental qualities of the rural West play a key role in creating a sense of place and serve as a primary motivation for migrants. However, recent research has shown that opportunities for “footloose entrepreneurs” to live in scenic areas surrounded by public lands are limited by the availability of transportation networks, in particular commercial airports (Rasker, 2006; Rasker and Hansen, 2000).

We offer the American West as a case study because it shares similar characteristic to other parts of the world. One of those characteristics is the presence of open space amenities. The phenomenon of people moving to live and work in areas of high natural amenities, sometimes called amenity migration (Moss, 2006, 2008), is occurring in various parts of the world. This includes the European Alps (Perlik, 2008; Perlik, 2006), Norway (Flognfeldt, 2006), Philippines (Glorioso, 2006), Czech Republic (Bartos, 2008), New Zealand (Hall, 2006) and Argentina (Otero et al, 2008; Otero et al, 2006). As with the American West, these regions show varied rates of growth of population and the economy, and transportation infrastructure that is not evenly distributed.

As is true throughout the world, the degree of isolation of a region has changed with various forms of travel, each in turn representing the latest technology of the age. As transportation networks are developed and improved upon, previously isolated communities become connected to larger population centers and their markets, redefining what it means to be rural, and changing the prospects for economic development.

A review of the development of transformation technology in the U.S. is illustrative. In 1700s ships were the primary means for moving goods and people, and towns in the U.S. sprang up wherever there was navigable water. By the early 1820s and 1830s, railroads quickly accelerated the pace of development. For the first time communities were linked by more than dirt roads and waterways, and settlements inched their way west as explorers discovered gold and other riches.

Cities in distant corners of the West could at last trade with each other. During most of this time, from the late 19th century and into the early part of the 20th, the vast majority of communities were small, and the U.S. Bureau of the Census defined as “urban” any “city” of more than 5,000 people (Bainbridge, 2005).

By the early 1920s the railroads had completed their expansion, which coincided with the rapid development of the automobile, the growing network of paved roads and highways, and the creation of the national highway system (U.S. Department of Transportation, 2008a). Much of this expansion was done through federal spending, including the New Deal program of the Great Depression (Bainbridge, 2005).

World War II also gave rise to an array of new technologies – and federal spending – that would further enlarge the country’s transportation system. By 1938, the idea of an Interstate Highway System was developing as a way to move people and material across the country. The Dwight D. Eisenhower National System of Interstate and Defense Highways was developed partly to assist commerce but, more importantly at the time, as a way to quickly get troops and weapons across the country (U.S. Department of Transportation, 2002).

Another wartime technology also helped change the face of rural America. After World War II, aircraft were developed at a large scale. Private companies adopted technologies developed by the Air Force, and since then the airplane industry has been a driving force in the development of the country. Cities and towns with commercial airports developed rapidly; those without did not (Bainbridge, 2005; Kasarda, 2000a; 2000b).

1.1 *The Importance of Airports in the 21st Century Economy*

According to Toffler (1990) and Kasarda (2000a), for a company to be competitive and successful, it is no longer sufficient to produce a product that is of high quality at a reasonable price. To be successful, the product also has to be delivered on time, and faster than the competition. Because of the premium for ready access to suppliers and clients, airports play a critical role in economic success. Kasarda (2000b) writes that forty percent of world trade goes by air, and two-thirds of U.S. air cargo is transported via 24- to 48- hour door-to-door express shipments.

Kasarda (2000a) illustrates that airport-dependent businesses, which today means most of the global economy, cluster around an “aerotropolis.” This is Kasarda’s term for the clusters of cities that have sprung up around a central airport core; for example, Amsterdam’s Schiphol airport, Korea’s Media Valley airport, Tennessee’s Memphis International (home of FedEx and distribution centers for barnesandnoble.com, Toysrus.com and williamssonoma.com), and the Los Angeles International airport. The latter alone is responsible for 400,000 jobs in a surrounding five-county area. According to Kasarda, while in the past a company’s ability to compete was determined by “the three Ls” (location, location, location), today’s companies will succeed if they adhere to “the three As” (access, access, access).

The role of airports is generally discussed in terms of being a necessary condition for the competitiveness of cities in a global economy. This is as true for the smaller towns and cities of

the West as it is anywhere. However, the West may have an additional advantage not readily found elsewhere in the world. One of the comparative advantages of the West is its high quality of life, particularly in the form of the environmental and recreational amenities provided by public lands, with vast stretches of wild country, many of them protected as National Parks and wilderness areas (Winkler et al, 2008; Nelson 2006; Lorah and Southwick, 2003; Duffy-Deno, 1998;). Workers in occupations that are flexible in where they can live, in law, finance, insurance, real estate, business, health, and engineering, for example, are attracted to the West in large part because of its amenities (Johnson and Rasker, 1995; Gude et al, 2006).

McGranahan (1999), Cromartie and Wardwell (1999), Nelson (1999), Shumway and Otterstrom (2001), Vivay and Sheldon (2005) and Florida (2000) have shown that natural amenities are a key to attracting knowledge-based workers. This is a term coined by Drucker (1994) for a group of workers that began to emerge at the end of the last century who make a living as analysts, information brokers, and technology workers and who are characterized as earning high wages and requiring a high level of education and ability to acquire and apply theoretical and analytical knowledge.

Rasker (2006) has shown that protected public lands, set aside for conservation and recreation rather than commodity production, are significant drivers of economic growth. However, amenities have been shown to be a necessary but not sufficient condition for economic success. Also needed is ready access to airports with daily flights to major cities and hubs, as well as an educated workforce (Rasker, 2006; Rasker and Hansen, 2000). This is particularly true for the relatively higher wage knowledge-based workers who, although they may live in a picturesque rural community, still need to fly out to visit with clients and suppliers.

This notion that a combination of education and airports could open previously isolated frontiers was discussed by Reich (1991): “So important are these public amenities, in particular the university and the airport, that their presence would stimulate some collective symbolic-analytic effort on parched desert or frozen tundra. A world-class university and an international airport combine the basic rudiments of global symbolic analysis – brains and quick access to the rest of the world.” (pp.238-239). He further wrote: “The university offers a steady supply of bright and eager students ... [the] airport provides access to the rest of the world ... [and] the mountains or seashores offer easy access to recreation.” (p. 238).

While the rise of the internet and delivery services has made it possible to live and work in remote areas, transportation infrastructure continues to determine the type of industry that will flourish (Booth, 1999; Beyers et al., 1995). Technology workers, for example, have been shown to travel by air between 60 percent and 400 percent more frequently than those in the general workforce (Kasarda, 2000; Erie et al., 1999).

2. A New Definition of Rural Based on Access to Transportation

We propose a new classification system for counties in the West that reflects the importance of access between cities and towns via transportation networks, in particular roads and airports. We suggest this new system as a construct to help in understanding the importance of access to markets for economic development, not just in the western U.S., but also to other parts of the

world where large distances between population centers can be a detriment to economic development.

What follows is a brief review of terminology and ways of classifying counties in the U.S. Understanding how government agencies classify regions of the country is important because, if they are accurate, they are useful for understanding both the promise and limitation of economic development options available. If they are inaccurate or outdated, classifications can be misleading and poorly represent opportunities for economic development.

One of the important distinctions is between what is “rural” versus what is “metropolitan.” There are many definitions of the term rural. In the early part of the 20th century, and still in popular use today, rural meant sparsely populated places with farms and ranches, and dirt roads (Bainbridge, 2005). Rural also means to be away from the influence of cities, and is often used interchangeably with “non-metropolitan.”

The terms metropolitan and non-metropolitan are used by the Office of Management and Budget (OMB) synonymously with urban and rural (U.S. Department of Agriculture, 2003). One the roles of OMB is to set the standards and guidelines for statistical surveys (Office of Management and Budget, 2008). OMB’s definitions are therefore commonly used by other agencies, most notably the U.S. Census Bureau (U.S. Census Bureau, 2008) and the Economic Research Service of the U.S. Department of Agriculture (U.S. Department of Agriculture, 2008a).

In 1993, OMB defined as metropolitan (Metropolitan Statistical Area) those counties with an urbanized area of at least 100,000 residents or a core area including one or more cities of at least 50,000 residents. A drawback to this definition is that it also counted as rural those counties with small population sizes that were immediately adjacent to urbanized counties; *i.e.*, potentially within commuting distance.

By 2003, metropolitan was redefined as a cluster of counties consisting of an urban core of 50,000 or more residents, as well as surrounding counties, regardless of population size, where at least 25 percent of the workforce commutes on a daily basis across county lines. OMB also added to the county classification system a new category, called the Micropolitan Statistical Area, defined as a non-metro county of at least 10,000 residents or more, and the outlying counties if at least 25 percent of workers commute to the central county (U.S. Department of Agriculture, 2008a). The advantage of these new definitions is the addition of the concept of access, via roads and highways, to core areas of relatively large population; *i.e.*, a county was now considered part of the metropolitan or micropolitan area if it was in daily commutershed.

The Economic Research Service of the U.S. Department of Agriculture has expanded on the 2003 OMB definitions by creating Rural-Urban Continuum codes, which is a system of classifying counties according to their population size, degree of urbanization, and adjacency to metro areas. According to this system, there are three separate classes of metro and six classes of non-metro, two of which are considered “completely rural.” As with the OMB classification, the emphasis is on relative population size and differing degrees of access via roads and highways (U.S. Department of Agriculture, 2008b).

While the new definitions are an important step in the right direction by accounting for cross-county commuting, we propose a new classification system, using the American West as an example, with the hope that it will stimulate broader thinking about the role of transportation in economic development. This new classification builds on existing definitions by taking into account another form of transportation technology – the airplane. Under this new system, there are three types of counties:

- 1) Metro: counties classified by OMB as metropolitan statistical areas.
- 2) Connected: non-metro counties with population centers that are within a one-hour drive of the nearest major airport with daily passenger service.
- 3) Isolated: non-metro counties further than a one-hour drive time from the nearest major airport with daily passenger service.

The underlying logic behind this system is that opportunities for economic development, and people's opportunities for employment, are limited by distance and access. Those living in "metro" counties and their commutersheds have access to large and diversified labor markets. They either live in those markets, or are within commuting distance. Others live in counties that are seemingly rural, but are connected to metro counties via air travel (the "connected" counties). Here entrepreneurs may live in a remote setting, but travel occasionally to the city to visit with colleagues, clients and suppliers. Yet, others are truly remote and isolated (the "isolated" counties) and therefore have limited opportunities, normally constrained to natural resources, such as farming, ranching and resource extraction.

This system is primarily an economic typology. The advantages are that it expands the idea of connectivity beyond surface commuting to include air travel, an important consideration in today's economy. Because access is important to some forms of business more than others, it is a system that can be used to describe the economic potential of different counties. Finally, this system accounts for the new economy's "footloose businesses" and telecommuters, the knowledge-based and technology workers who can live in a rural setting and work in occupations previously limited to urban areas.

In this paper we evaluate the hypotheses that there are three Wests that are socio-economically distinguishable from each other, and that differences in economic performance can be explained in large part by differences in access to major population centers and markets. In the sections that follow we: (1) examine the importance of access to airports for economic development; (2) develop and quantify a new classification system for the West, dividing the region into the Three Wests – Metro, Connected, and Isolated and; (3) test specific hypotheses regarding differences in economic performance and socioeconomic characteristics among the three county types.

2.1 *The importance of airports*

In order to investigate the relationship between airport access and economic performance, the mean drive time to the nearest major airport was plotted against several economic measures by county and least squares regression equations were fit.

Major airports were identified as those with greater than 15,000 passenger boardings per year in 2005. Below this cutoff point, airports often lack direct flights to large hubs, defined by the Federal Aviation Administration (FAA) as airports with greater than one percent of annual passenger boardings in the US. The cutoff is slightly more restrictive than the FAA's "primary airports" category, defined as airports with more than 10,000 passenger boardings each year, and is based, in part, on the authors' extensive experience traveling via commercial airplanes throughout the West. While the cutoff of 15,000 "enplanements" is admittedly an arbitrary cutoff, the precise number of enplanements is less important than the fact that this level represents airports where residents have the choice of several commercial flights per day. Three airports that fell just below this threshold were included because they provide direct flights to large hub airports: Riverton Regional Airport in Lander, Wyoming, Rock Springs Airport in Rock Springs, Wyoming, and Cedar City Municipal Airport in Cedar City, Utah.

Travel time to the nearest major airport was calculated using cost-distance grid functions incorporating distance and automobile speed limits, following the methods of Nelson (2001). Roads were assigned a "travel cost" inversely related to average speeds at which vehicles travel on various types of roads, including interstates, highways, and secondary roads. Point locations of major airports and the travel cost values served as inputs into a GIS (Geographic Information System) cost distance grid function. The grid resulting from the GIS function described travel time to the nearest major airport from any other point on a road.

For each county in the West, the mean drive time to the nearest major airport was plotted against four measures of economic performance: per capita income in 2005 (including non-labor sources such as retirement and investment income), mean earnings per job in 2005, the percent of employment in services and professional jobs in 2005, and the degree of economic specialization in 2005 (Figure 1). This last measure is the opposite of a diverse economy, which is generally more desirable for economic growth, stability and lower unemployment (Malizia and Shazi, 2006; Siegel et al 2006).

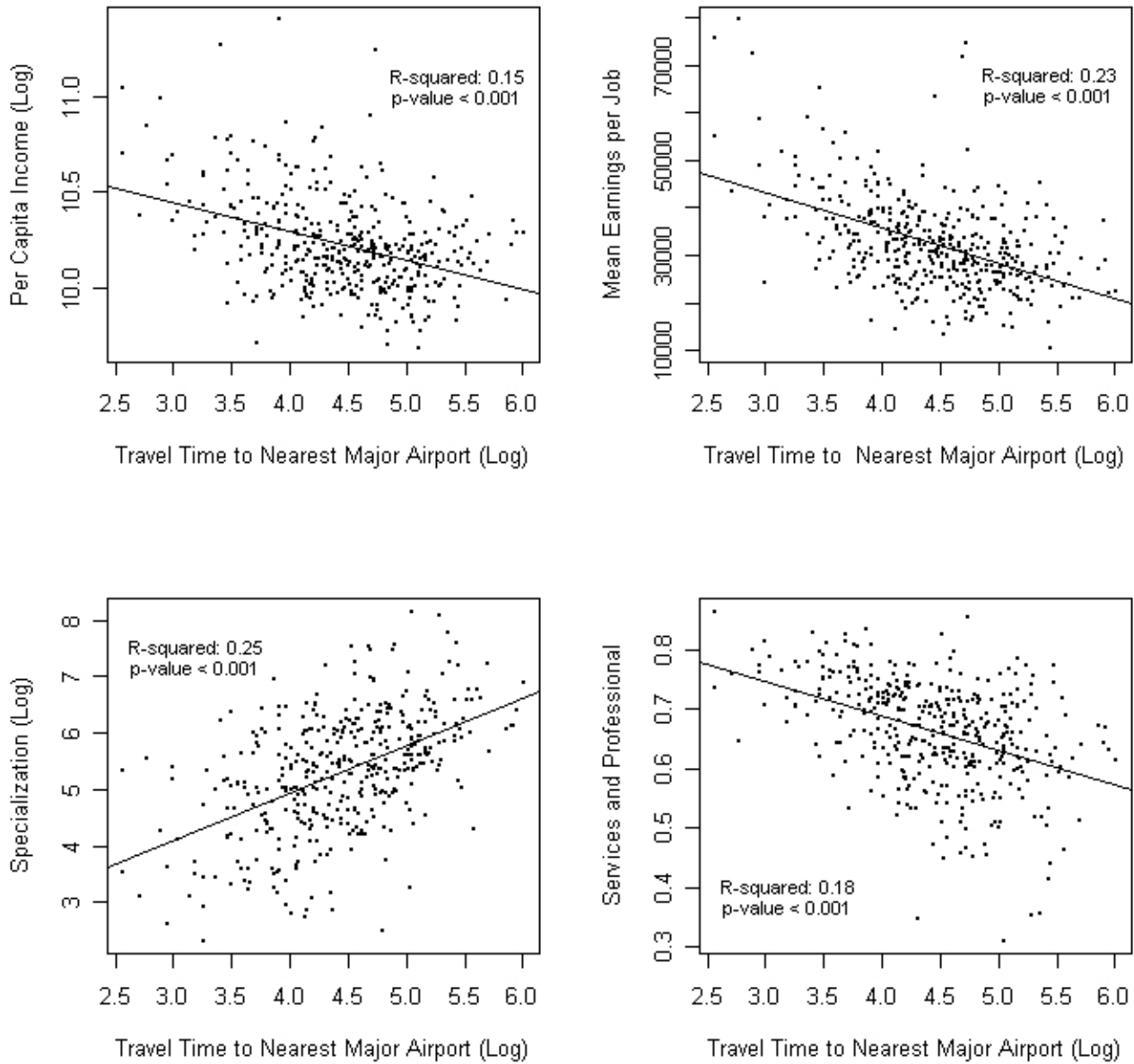


Figure 1. For each county in the West, mean travel time to the nearest airport was plotted against four measures of economic. Least square regression equations were fit to show the degree of association between proximity to major airports and economic performance.

The data source for both per capita income and mean earnings per job was the Regional Economic Information System (REIS)¹ (U.S. Department of Commerce, 2007). The specialization index was based on information in the 2000 Decennial Census of Population and Housing² (U.S. Census Bureau, 2000), and was calculated by summing the squares of the difference in shares between the local economy and the U.S. for all sectors in the economy. For each county (i=1 to 414) and each industry (j=1 to 20), we calculated the economic specialization index as:

$$\text{SPECIAL}_i = \sum ((\text{EMP}_{ij}/\text{EMP}_i) - (\text{EMP}_{usj}/\text{EMP}_{us}))^2,$$

Where

SPECIAL_i = specialization of economy in county i,
 EMP_{ij} = employment in industry j in county i,
 EMP_i = total employment in county i,
 EMP_{usj} = employment in industry j in US, and
 EMP_{us} = total employment in US.

This equation measures the degree of similarity between each county and the US in terms of the distribution of economic sectors. The percent of employment in services and professional jobs was used as a measure of participation in today's service-based economy. Data were obtained from the 2000 Census³ (U.S. Census Bureau, 2000). Service and professional occupations were defined as the sum of employment in: wholesale trade, retail trade, transportation and warehousing, utilities, information, finance and insurance, real estate and rental and leasing, professional, scientific, and technical services, management of companies and enterprises, administrative and support and waste management services, educational services, health care and social assistance, arts, entertainment, and recreation, accommodation and food services, and other services⁴.

Least squares regression equations were fit to show the degree of association between proximity to major airports and economic performance. For each of four relationships, a simple linear regression model was fit using travel time from the nearest major airport as the explanatory variable. In all cases, travel time in minutes from the nearest major airport had to be log transformed in order for the relationships to be linear. For each regression model, diagnostics showed no apparent violations of model assumptions. Although each scatter plot (Figure 1) shows the presence of several outliers, removal of these data points did not influence the significance of the F or T-statistics or the R-squared values of the regression models.

We found that travel time from major airports explained between 15 and 25 percent of the variation in the four measures of economic performance considered (Figure 1). The p-values were significant for each model (< 0.001). We found that per capita income tends to drop with

¹ Table CA30

² Summary File 3, Table P49

³ Summary File 3, Table 049

⁴ Census employment codes: emp035, emp036, emp038, emp039, emp040, emp042, emp043, emp045, emp046, emp047, emp049, emp050, emp052, emp053, emp054.

increasing distance from major airports (Intercept 10.90 [SE 0.08], Slope -0.15 [SE 0.02], R-squared: 0.15). We also found negative relationships between access to major airports and the percent of employment in services and professional jobs (Intercept 0.92 [SE 0.03], Slope -0.06 [SE 0.01], R-squared: 0.18) and mean earnings per job (Intercept 65283.53 [SE 3032.80], Slope -7410.80 [SE 675.57], R-squared: 0.23). Lastly, we found that the degree of economic specialization, the opposite of economic diversity, increases with increasing distance from major airports (Intercept 1.61 [SE 0.32], Slope 0.83 [SE 0.07], R-squared: 0.25).

These results support the idea that access to markets via air travel is important for economic development. A long drive time to the nearest airport means a higher likelihood of lower earnings per job and per capita income, a more specialized economy and less of a service-based economy.

3. The “Three Wests”- a classification

In light of the increasing importance of airports in allowing for access to major markets and thus economic opportunity, we developed and tested a new classification of western counties that incorporates connectivity via air travel. In this new classification, each of the 414 counties in the West was assigned to one of three classes: Metro, Connected or Isolated (Figure 2). For the metro class, we deferred to the list of 128 western counties designated by the OMB as metropolitan statistical areas. Non-metro counties were assigned to the connected class if either of the two largest population centers within the county were within a one-hour drive of the nearest major airport, defined as those with greater than 15,000 passenger boardings per year in 2005. This criterion resulted in 80 western counties being assigned to the connected class. The remaining 206 western counties were assigned to the isolated class.

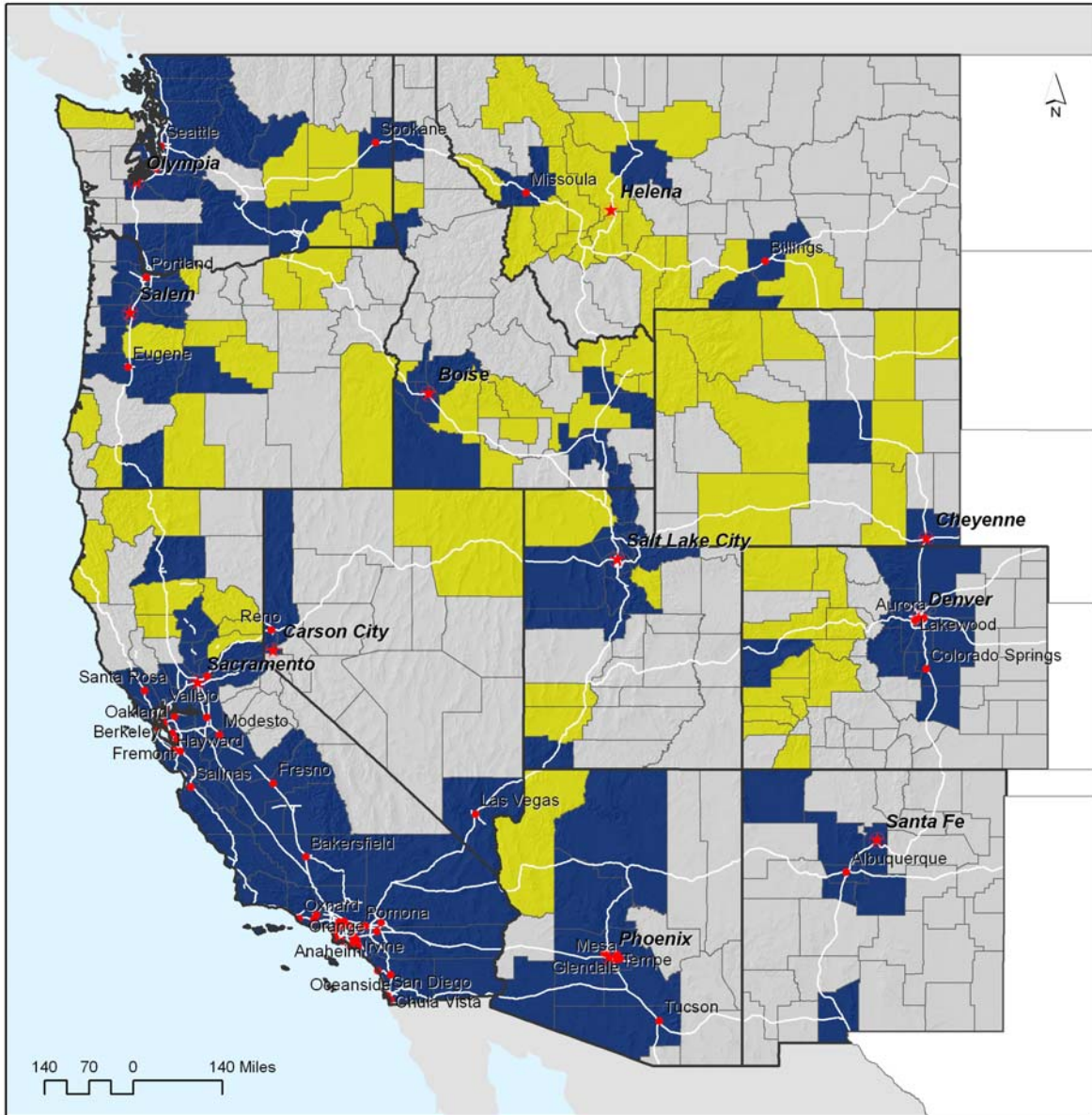
3.1 The distinctness of the “Three Wests”

The uniqueness of the three West classes and the relative importance of economic and demographic variables in distinguishing among the classes of counties were investigated using linear discriminant analysis (LDA). This technique estimates linear functions of variables that maximize the ratio of between-group variance to within-group variance (*i.e.*, maximize the separation between the three classes of counties). The ability of these functions to separate the classes was checked by comparing the percent of counties correctly and incorrectly classified by the functions. The sizes of the coefficients in these functions were used to assess the relative importance of variables in separating the classes.

Our hypothesis in this analysis was that the three West classes would be distinguishable based on socioeconomic characteristics. These are: variables representing age structure, education levels, employment by industry, non-labor sources of income, and variables representing growth in population, employment and real personal income.

Age structure was measured using data from the Census as the percent of the population in 2000 that were either more than 65 years of age, or less than 21 years of age. Education also was measured using Census data, and was represented as the percent of the adult population with a bachelor’s degree or higher in 2000. We used education as a measure of the potential for

Three Wests



Three Wests

- Metro Counties
- Connected Counties
- Isolated Counties

Major Cities

- ★ State Capital
- Population > 100,000

Major Roads

- Limited Access Highway

Data Sources: US Census, US Geological Survey
 World Mercator Projection
 Map Date: 4/18/2008



Figure 2. The “Three Wests” classification of counties reflects the importance of access between cities and towns via transportation networks including airports.

economic development: *i.e.*, occupations such as engineering, architecture and finance, which are examples of knowledge-based jobs, require college educated workers.

Employment by sector was defined as the percent of the workforce employed in agriculture, energy, services and professional sectors and manufacturing. The latest published statistics that were free of disclosure restrictions (data gaps) were used. The percent of the workforce in 2005 employed in agriculture was obtained from REIS⁵: Farm Employment (U.S. Department of Commerce, 2007). The percent of the workforce in 2005 employed in energy development was obtained from the Census' County Business Patterns (CBP) databases (U.S. Census Bureau, 2007), and was defined as oil and gas extraction⁶, coal mining⁷, and support activities for mining⁸. The percent of the workforce employed in manufacturing was obtained from the 2000 Decennial Census of Population and Housing⁹.

Growth variables were gathered from REIS and were measured in terms of change in the size of the population, employment, and personal income in constant 2005 dollars. Two periods of time were used: 1982-1990, which reflects a period of recovery from the last major national recession, in 1981; and 1990 to 2005, a period of unprecedented growth in the U.S. economy (Siglitz, 2003). This was also a time of rapid growth in the West, stimulated in large part by amenity-driven migration and a boom in energy development (the latter occurred mostly after 2000). The non-labor share of income¹⁰ was included because of the growing importance of retirement and investment-related income.

The LDA resulted in 84 percent of the counties being correctly classified, supporting our hypothesis that metro, connected, and isolated counties are distinguishable based on socioeconomic characteristics. Correct classification of the metro counties was highest (90 percent accurate), followed by isolated (89 percent accurate), and connected (60 percent accurate) (Table 1).

Table 1

	Metro	Connected	Isolated
LDA* Metro	90%	16%	3%
LDA* Connected	6%	60%	8%
LDA* Isolated	3%	24%	89%

* Classified by Linear Discriminant Analysis

Table 1. The percent of counties correctly classified (shown in bold) by the linear discriminant functions indicates the degree to which the three wests classes are unique in their socioeconomic characteristics. The degree of classification accuracy was generally high, although connected counties appear to be similar in some ways to both metro and isolated counties.

⁵ Table CA25N

⁶ North American Industrial Classification Code 211

⁷ North American Industrial Classification Code 2121

⁸ North American Industrial Classification Code 213

⁹ Summary File 3, Census employment code 034

¹⁰ REIS, Table CA05: Dividends, Interest and Rent, and Transfer Payments

Two functions accounted for 100 percent of the separation in the three classes (Table 2). Each function represents a dimension that differentiates a county into one of the three classes based on coefficients assigned to the explanatory variables. The larger the absolute value of the coefficient, the bigger the role that variable plays in the new LD variable. The first function, which is the most powerful in differentiating the classes, has the largest values for growth variables (income and population) that measured socioeconomic performance immediately following the 1981 recession. The fact that performance among the classes differed during this period of recovery is likely due to access to markets facilitating recovery in metro and connected counties. Isolated counties generally recover more slowly from recessions. The second function has the largest values for growth variables (income and employment) during the economic boom of 1990 to 2005.

Table 2

Variable	LD1* Coefficient	LD2* Coefficient
Income Growth Rate, 1990-2005	-5.1	20.6
Employment Growth Rate, 1990-2005	6.7	-18.6
Income Growth Rate, 1982-1990	-10.5	-12.5
% of Adults with a BA or Greater, 1990	4.5	14.9
Population Growth Rate, 1982-1990	8.3	6.0
% of Adults with a BA or Greater, 2000	-6.8	-5.1
Manufacturing, 2005	7.3	-4.1
Population Growth Rate, 1990-2005	1.6	7.9
Nonlabor Share of Income, 2005	-7.0	-1.9
Unemployment Rate, 2005	2.0	-6.7
Energy, 2005	-6.0	2.4
Employment Growth Rate, 1982-1990	5.6	-1.6
% of Population 21 and Under, 2000	-2.8	3.1
Agriculture, 2005	5.2	0.3
% of Population 65 and Up, 2000	-0.3	-3.5
Services and Professional, 2005	1.8	-0.8

* Two functions (LD1 and LD2) account for 100 percent of the separation in the three classes of counties

Table 2. The sizes of the coefficients in the linear discriminant (LD) functions can be used to assess the relative importance of variables in separating the three classes of counties. The 15 variables shown in this table are the more influential variables with coefficient sizes greater than one standard deviation from the mean.

The analysis showed that the highest accuracy in distinguishing among the classes was achieved through emphasizing the industry occupation, growth, and education-related variables. In total, 16 variables had coefficients that were greater than one standard deviation from the mean coefficient size. These variables were most important in separating the three classes of counties (Table 2), and included population, employment and income growth rates from 1990-2005, and from 1982-1990, the trough-to-peak period after the 1981 recession. Other characteristics that were important in distinguishing between the three West classes were the percent of employment in manufacturing, services and professional sectors, and energy related industries and agriculture. Also important were the percent of adults with a bachelors degree or higher, the percent of the population over 65 years of age, the percent of the population under 21 years of age, the unemployment rate in 2005 and the share of income in 2005 from non-labor sources.

The two largest sources of error in separating the three classes involved 24 percent of connected counties being misclassified as isolated, and 16 percent of connected counties being misclassified as metro. Connected counties appear to be similar in some ways to both metro and isolated counties. It is possible that the connected counties are in transition from isolated to metropolitan states as access to the airport is improved and likely, as the size of the airport increases. We found that connected counties that resembled isolated counties were, on average, 25 minutes further from major airports than connected counties that resembled metro counties. In other words, differences in the degree of connectivity within the connected class likely explain some of the difficulty in distinguishing these counties from metro and isolated counties.

The LDA showed that there is evidence of at least two distinct Wests (“metro” and “isolated”), and one category that is on a continuum between the two (“connected”), that can be classified using measures of industry occupation, growth and education.

4. Comparisons between metro, connected, and isolated counties

The socioeconomic variables identified by the LDA as being important distinguishing characteristics of the three classes were further investigated using a protected ANOVA framework (Scheiner and Gurevitch, 2001). This procedure allowed us to test specific hypotheses regarding the differences between the three classes of counties. This first involved fitting a maximum likelihood multivariate linear model to the dataset, treating the economic and demographic variables as response variables and the categorical “Three Wests” as the predictor variables. The linear model was then analyzed using a MANOVA to test whether at least one response variable showed different means among the three types of counties, accounting for a family-wise Type I error rate (p -value < 0.001). Following this test, individual ANOVA’s were conducted on each socioeconomic variable to determine if at least one of the county typologies had a different mean than the other county typologies for each response.

Both the MANOVA and ANOVA tests assume that the data follow a multivariate normal distribution. This assumption was violated in several cases primarily because the data were represented as percentages. However, the major implication for violating this assumption is a loss of power to detect significant results, and we found that there were no borderline p -values that might change with more normally distributed data.

We found that for all but one of the 16 socioeconomic variables determined by the LDA to be most important in separating the three classes of counties (Table 2) at least one class had a significantly different mean than the other two classes (p -value < 0.01). The mean unemployment rate in 2005 was not significantly different between the Three West classes. Although we had hypothesized unemployment rates would be highest in isolated counties, the ongoing energy boom in some rural, isolated counties may bring the rate closer to that of connected and metro counties. It is also possible that people relocate to areas with more opportunities when unemployed.

After these tests, we used multiple contrast procedures to examine several *a priori* hypotheses concerning which types of counties may have higher or lower means for each socioeconomic variable. There were 30 hypotheses (Table 3), and we adjusted the p -values from each hypothesis test to account for this (Benjamini and Hochberg, 1995). Without this adjustment, we would expect one in twenty tests to be significant by chance alone (Scheiner and Gurevitch, 2001). With this adjustment, the study-wide alpha level is corrected to 0.05, such that the chance of all tests being significant simultaneously is one in twenty.

The multiple contrasts showed that there was support for the majority of the *a priori* hypotheses presented. Measures of growth (percent change in population, employment and real personal income) support the idea that the three Wests behave differently from each other. From 1990 to 2005, as well as from 1982 to 1990, metro counties grew faster than connected counties. Both of these, in turn, experienced higher rates of growth than the isolated counties. In other words, growth is influenced by access to markets and the easier the access the faster the growth.

A comparison of the mean growth rates shows that for the connected counties there is a difference in growth rates during the post-recession recovery period (1982 to 1990) and recent

Table 3

Variable	Hypothesis	Adjusted p-value	Metro Mean	Connected Mean	Isolated Mean
<i>Growth Rates (percent change, annualized)</i>					
Population Growth Rate, 1990-2005	M and C > I	0.000	0.022	0.017	0.007
Population Growth Rate, 1990-2005	M > C	0.002	0.022	0.017	0.007
Employment Growth Rate, 1990-2005	M and C > I	0.000	0.028	0.024	0.017
Employment Growth Rate, 1990-2005	M > C	0.022	0.028	0.024	0.017
Income Growth Rate, 1990-2005	M and C > I	0.000	0.035	0.028	0.018
Income Growth Rate, 1990-2005	M > C	0.007	0.035	0.028	0.018
Population Growth Rate, 1982-1990	M and C > I	0.000	0.020	0.004	-0.002
Population Growth Rate, 1982-1990	M > C	0.000	0.020	0.004	-0.002
Employment Growth Rate, 1982-1990	M and C > I	0.000	0.034	0.018	0.011
Employment Growth Rate, 1982-1990	M > C	0.000	0.034	0.018	0.011
Income Growth Rate, 1982-1990	M and C > I	0.000	0.037	0.018	0.011
Income Growth Rate, 1982-1990	M > C	0.000	0.037	0.018	0.011
<i>Economic Sectors (percent of total employment)</i>					
Services and Professional, 2005	M and C > I	0.000	0.710	0.663	0.634
Services and Professional, 2005	M > C	0.000	0.710	0.663	0.634
Manufacturing, 2005	M and C > I	0.000	0.110	0.081	0.058
Manufacturing, 2005	M > C	0.000	0.110	0.081	0.058
Energy, 2005	I > M and C	0.020	0.002	0.017	0.017
Agriculture, 2005	I > M and C	0.000	0.038	0.080	0.117
<i>Non-labor Income Sources (percent of total income)</i>					
Non-labor Share of Income, 2005	I > M and C	0.000	0.310	0.376	0.416
Non-labor Share of Income, 2005	C > M	0.000	0.310	0.376	0.416
<i>Age (percent of total population)</i>					
Population 21 and Under, 2000	M and C > I	0.000	0.334	0.323	0.311
Population 21 and Under, 2000	M > C	0.062	0.334	0.323	0.311
Population 65 and Up, 2000	I > M and C	0.000	0.111	0.127	0.153
Population 65 and Up, 2000	C > M	0.998	0.111	0.127	0.153
<i>Education (percent of adult population)</i>					
Adults with a BA or Greater, 2000	M and C > I	0.000	0.244	0.218	0.173
Adults with a BA or Greater, 2000	M > C	0.022	0.244	0.218	0.173
Adults with a BA or Greater, 1990	M and C > I	0.000	0.205	0.184	0.144
Adults with a BA or Greater, 1990	M > C	0.020	0.205	0.184	0.144
<i>Unemployment (percent of labor force)</i>					
Unemployment Rate, 2005	M > C	0.054	0.048	0.044	0.047
Unemployment Rate, 2005	I > M, C	0.232	0.048	0.044	0.047

Table 3. Hypotheses related to socioeconomic differences between the three classes of counties were tested using multiple contrast procedures. The a priori hypotheses listed below describe which types of counties (metro [M], connected [C], and isolated [I]) had higher or lower means for each of the socioeconomic variables. All income data were adjusted to 2005 dollars.

growth (1990 to 2005). From 1982 to 1990, the differences between mean values for population, employment and income growth were greater between connected and metro counties than between isolated and connected counties (Figure 3). This indicates that in the recovery period following the 1981 recession (1982 – 1990), connected counties behaved more like isolated counties. From 1990 to 2005, the differences between the mean values for population, employment and income growth were greater between the connected and isolated counties than they were between the connected and metro counties. During these years the connected counties behaved more like metro counties in terms of the rate of growth in real personal income, employment and population.

There are several possible explanations why the connected counties behaved more like the metro counties later on in time. One of them is the emergence of the relatively recent phenomenon of amenity-driven migration. Places that have environmental amenities, but also have ready access to markets, attract a type of business that can exist in a seemingly rural setting, as long as there is easy access to metro areas by airport. Part of this explanation holds that the emergence of modern telecommunications, and efficient postal delivery services (UPS, FEDEX, etc.) have helped to make this possible (Salazar, 2004; Levitt, 2002). Past research has shown that the ultimate combination for economic growth is the combination of amenities, telecommunications and increasing availability of air travel (Rasker, 2006). However, the availability of air travel is variable; and when distances to airports between classes were compared, connected counties that resembled isolated counties were also further from airports.

The percent of employment in services and professional sectors, as well as manufacturing, was the highest in metro counties and lowest in isolated counties. This means the ability of a community to create or retain jobs in manufacturing or service and professional industries is limited by distance and access to markets. These sectors are therefore least likely to be found in isolated counties, more likely to be in counties that are connected via airports, and most likely to exist in metropolitan counties. Conversely, employment in energy-related industries and agriculture – those that rely primarily on natural versus human resources - were highest in isolated counties.

We used education as a measure of the potential for economic development since knowledge-based occupations, such as engineering, architecture and finance, require college educated workers. The findings show that the percent of the adult population with a bachelor's degree or higher was highest in metro counties and lowest in isolated counties. Along with lack of access to markets, the relatively low rates of education helps explain the slow growth rates in the isolated communities. The fact that rural areas have lower education rates may also reflect that some rural jobs do not require as much education (for example, in a lumber mill or on an oil-drilling platform).

The share of income from non-labor sources was highest in isolated counties, followed by connected counties, and lowest in metro counties. This is not surprising given the slow growth rates of isolated counties. It may be that for many counties a high proportion of non-labor income is an indication of relatively little labor income. However, it could also point to an opportunity. A comparative advantage of isolated counties may be the ability to attract retirees and people with investment income, especially if the cost of living is lower.

Isolated counties also had the highest percent of the population greater than 65 years of age. However, the hypothesis that the percent of the population over 65 years of age was greater in connected than in metro counties was not supported. In other words, the idea that the connected counties, *i.e.* the metro-like counties in a rural setting, attract more people of retirement age than metro counties is not supported by the analysis. Perhaps this means some of the necessary attractants for retirees (*e.g.*, health care) are more available in metro counties and, despite recent growth, have not yet developed sufficiently in connected counties. Alternatively, it could mean the connected counties are successful in attracting both the young professionals and retirees, so that the proportion of retirees is not greater than the proportion of retirees in metro counties.

Metro and connected counties had a significantly greater proportion of the population under 21 years of age, consistent with the finding that the isolated counties have the oldest population. The hypothesis that metro counties had the greatest proportion of the population under 21 years of age was only weakly supported ($p\text{-value} = 0.062$).

Several other hypotheses were not supported by the analysis. The 2005 rate of unemployment was not found to be significantly higher in the isolated counties than in metro and connected counties, possibly because of the temporary surge in employment in some isolated counties caused by the recent energy boom. Also, while the analysis did confirm that isolated counties have the largest proportion of the population over 65 years of age, the share of retirement-aged persons was not found to be significantly higher in connected counties than metro counties. It may be that the university students and young professionals offset the numbers of retirees that are drawn to some connected counties.

5. Further research and methods to explore

It is likely that as accessibility to major markets increases, the economies of connected counties evolve to become more like metro areas. If that is the case, there may not be natural break points in socio-economic characteristics that can be used to cleanly classify between isolated, connected and metro counties. Rather, there may be a need for a classification system that is updated continuously to reflect improvements in transportation infrastructure. As access to markets improves, counties transition from isolated to connected and from connected to metro. The connected class will always contain variation attributable to this transition over time and to the differing degrees of airport access that exist within connected counties. This is one possible interpretation of the results of the linear discriminant analysis presented in this paper. Both the isolated and metro counties were found to be socio-economically unique, while the connected class of counties was more difficult to distinguish from isolated and metro counties based on demographic and economic characteristics alone.

It is also possible that if we had used different thresholds in defining the Three Wests, the resulting classes would have been more socio-economically distinct. For example, the metropolitan statistical area definition used in this study, although a standard, does result in the inclusion of some counties that share little in common with large urban areas, and are included in OMB's definition of metropolitan solely for their proximity and cross-county commuting. Eighteen western metropolitan statistical area counties have populations less than 25,000, such as Power County, Idaho (population 7,761), Juab County, Utah (population 9,165), and Carbon

County, Montana (population 9,895). Are these counties truly metro? These counties likely share more in common with our connected class, which is based on connectivity via air travel. Perhaps these counties should be classified as connected since their proximity to urban areas allows people to commute to large markets for work. Further research should explore whether socio-economic characteristics are clustered and can point to meaningful breakpoints for thresholds for refining the classification of metro, connected, and isolated counties.

6. Conclusions

On the one hand, the vast distances between towns and cities of the West are a challenge to economic development. On the other hand, the amenities of the public lands of the West that create those vast distances are an asset that attracts and retains people and business. Yet, amenities by themselves are not a sufficient condition for economic development. Past studies have shown that access to markets via transportation infrastructure, in particular airports, is also important.

This paper tests a classification system for the counties of the West, based on varying degrees of access to major cities and markets, with emphasis on the importance of air travel. There are three types of western counties that were shown to have different economic performance and socioeconomic characteristics. The “metro” and “isolated” counties are the most distinct, while the counties that are “connected”, in a rural setting but with airports, show the highest variation. Much of this variation is likely due to varying travel distances to airports. Those closest to the airport have opportunities that more closely approximate that of metropolitan areas, with high growth rates, an educated workforce, and employment in manufacturing and services and professional industries. Those further away are more likely to behave like rural, isolated counties, with slow growth rates, a higher dependence on investment and retirement income, and employment that is more likely to be in energy development or agriculture.

The implications of our findings are that it is important to move beyond the simple “metro” versus “rural” distinctions if we are to understand the possibilities for rural development. There are, in the American West as well as elsewhere in the world, places that appear “rural” in terms of their natural setting, but that are connected to major population centers and their markets via air travel. They are neither completely rural nor completely metropolitan, and should be viewed as a distinct category with different rates of growth and economic structure. The implication for rural development is that the easier it is to access an airport with daily commercial service to major cities, the more the rural area becomes transformed into an economy that behaves like a metropolitan area, including the attraction of knowledge-based workers. Finally, while past literature has shown that natural amenities serve to attract people and their businesses to rural areas, the expectation that amenity-migration will result in a fast-growing, diverse economy has to be moderated to include a discussion on the availability of transportation infrastructure, including access to airports.

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