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The Recession and the New Economy of the West:
The Familiar Boom and Bust Cycle?

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Abstract
The U.S. West has gone through many periods of economic boom and bust, most of which were associated with rapid rises and declines in commodity markets. The recent structural shift towards a primarily service-based economy begs the question of whether the driving forces behind the cycles of boom and bust also may be shifting away from commodities toward people and their resources. This paper explores several factors that contributed to growth in the 1990s and 2000s: asking whether these factors created any advantages or disadvantages during the most recent recession; and whether the shift away from commodity production to a knowledge and human-capital intensive economy has implications for how local areas experience the boom-bust cycle. Quantitative methods were used to evaluate which factors were associated with variability in the change in unemployment rate from November 2007 (the last month before the recession began) to November 2009 (the official end of the recession). The study focused on the fastest-growing counties in the West, defined as the subset of western counties in the upper quartile of pre-recession population growth, measured as the percent change in population from 2000 to 2007. The results show that, within fast growing counties, several variables were statistically significant in their relationship to the change in unemployment rate after controlling for pre-recession unemployment and population levels. The mean unemployment rate increased with increases in the portion of the jobs that were timber-related, and decreased with increases in the portion of the adult population with a college degree and with the portion of government employment. This research underscores the dangers of over-reliance on single sectors, in particular those, like timber, that fluctuate with commodity markets. Another characteristic shared between this and previous periods of economic contraction is the stabilizing effect of government employment. However, the importance of education is likely a recent development attributable to the emerging global economy in which knowledge and innovation are most highly valued. Jobs that require a college degree are projected to be in highest demand, and, as demonstrated in this study, a better-educated workforce appears to offer a buffer against the effects of economic downturns.

1. Introduction

In part because of its strong symbolic role in U.S. culture and also due to the dramatic nature of some of its historical economic downturns, the U.S. West (the 11 contiguous western states) has offered stark lessons in economic vulnerability to the rest of the nation and even the world. Since the late 19th century, the economy of the West has been characterized by a boom-bust cycle. The development of natural resources, such as minerals and fossils fuels, stimulated rapid economic and population growth, followed by a period of rapid decline due to recessions and falling commodity prices. More recently, the region led the nation during a period of unparalleled growth that took place in the 1990s and early 2000s. As the fastest growing region of the U.S. during the last two decades, the West was emblematic of structural changes at work throughout the global economy. Populations within some counties grew at unprecedented rates. This study focuses on these fast-growing counties to learn how they responded during the most recent recession, and to draw lessons that may be useful in understanding how to overcome the West's boom-bust cycles.

Rather than deriving from the value of primary resources sold through commodity markets, prosperity in the West at the outset of the 21st century hinged on an area's ability to support and integrate with a global economy in which the products and services derived from specialized knowledge and innovation are most highly valued (McGranahan 1999; Power and Barrett 2001; Cromartie and Wardwell 1999; Rasker 2006; Nelson 1999). The factors that contributed to the region's recent growth included the movement of people seeking a higher quality of life, increased transportation and telecommunications technology, an aging population, and the changing structure of the overall economy that allows some people and professions to be away from the city or factory floor, among others. These factors suggest a markedly different economic foundation than in previous periods of expansion. The West's shift from a commodity-based economy to one where people's knowledge, skills, and innovation, are the cornerstone, begs the question of whether the driving forces behind economic cycles of boom and bust may also be shifting away from commodities toward people and their skills. For this reason, this paper focuses on counties with rapid population increases. If people are a key building block of the new economy, then it stands to reason that those counties that experienced the greatest increases in population may be those that are most vulnerable to economic busts.

The purpose of this paper is to evaluate the economic influence of the driving forces of the U.S. West's "New Economy" in light of the most recent recession. The paper asks whether some fast growing counties fared better during the recession than others, and why. Specifically, the paper explores many of the individual factors that contributed to growth in the 1990s and 2000s, and asks whether these factors created any advantages or disadvantages during the recession. In a broad sense, this research helps to address the issue of whether the shift away from commodity production to a knowledge and human-capital intensive economy has implications for how local areas experience the boom-bust cycle. Using regression and graphical methods to test and explore the association of various factors on one fundamental variable (change in unemployment rate), the research reported here evaluates the characteristics of fast growing counties that were either non-significant, exposed the county to risk, or posed clear advantages during the economic contraction.

1.1 The U.S. West at Forefront of New Economy

From 1990 to 2008, the population in the West grew by 35 percent. By comparison, during the same time the population of the U.S. grew by 22 percent, and that of the second fastest growing region, the Southeast, grew by 29 percent. Some western states experienced very fast growth. From 1990 to 2008,

the population of Nevada grew by 114 percent; Arizona's grew by 76 percent; while Colorado, Utah and Idaho all saw their populations grow by more than 50 percent (U.S. Department of Commerce 2010a). Much of the growth was due to in-migration. According to the 2000 Census, the West had the fastest migration rates during the 1990s (20 percent, compared to 13.2 percent for the nation) (Travis 2007). The U.S. Census Bureau estimates that the growth will continue. Compared to 2000, by 2030 the West's population is projected to grow 45.8 percent, the fastest of any region in the nation, and faster than 29.2 percent projected for the nation (U.S. Department of Commerce 2010c).

The economy of the West has also grown faster than the nation. From 1990 to 2008, employment and real total personal income in the West grew by 40 percent and 68 percent, respectively. By comparison, employment and real total personal income in the U.S. grew by 31 percent and 54 percent, respectively (U.S. Department of Commerce 2010a).

A number of reasons have been offered for the rapid growth. One reason is the restructuring of the global economy, wherein some professions, such software developers, financial consultants, engineers, architects and other so-called "knowledge-based" service occupations have been able to "de-couple" from the city and the factory floor, thereby becoming "footloose," able to live almost anywhere (Beyers and Lindahl 1996; McGranahan and Wojan 2007; Johnson and Rasker 1995; Gude et al. 2006; Cromartie and Nelson 2009; Via et al, 2002). These transformations of conventional constraints on business location opened up parts of the country that were historically excluded from national and international business networks, including much of the West.

A broad economic shift is clearly evident in regional economic statistics. Of the more than 11.7 million new jobs created in the West from 1990 to 2008, 90 percent were in service-related jobs, with the fastest growth in health services (13 percent of new jobs) and professional and technical services (12 percent of new jobs) (U.S. Department of Commerce 2010a). Importantly, some the fastest growth in jobs was in high-wage jobs such as professional and technical services (with average annual wages of $74,000) and medium-wage services such as health services (with average annual wages of $42,000) (U.S. Department of Labor 2010a).

In contrast, the perceived traditional staples of the economy of the rural West grew slowly and played a smaller and smaller role in the overall economy. Cumulatively, farming, ranching, forestry, lumber and wood products manufacturing, hard rock mining, and fossil fuel development contributed less than 3 percent of total new jobs from 1990 to 2008 (U.S. Department of Commerce 2010a). In 2008, these sectors combined constituted roughly 5 percent of all jobs in the non-metropolitan West, and 1 percent in the West as a whole (U.S. Department of Commerce 2010b).

Retirees have also played a role in economic development in the West, as in-migrants that import non-labor income and spur demand for housing and services. Areas of the West with amenities desirable among retirees, such as affordable housing and fair climates, were among the fastest growing parts of the country during the 1990s (McGranahan 1999; Frey 2006; Vias 1999).

Winkler et al. (2007) point out that public lands in the West, along with wild rivers, lakes, mountains and plentiful recreational opportunities, serve as attractants to both business owners and retirees. As a recent review of the amenity migration literature from around the world observed, "the American West is perhaps the most often-cited example of a region experiencing high rates of population growth related to amenity migration" (Gosnell and Abrams 2009; see also Rudzitis and Johansen 1989; Rudzitis 1993, 1999; Vias and Carruthers 2005).

The powerful attraction of amenities have helped to transform the economy of many parts of the rural West 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. This transformation has been aided by the advancement of telecommunications technology, efficient delivery services (e.g., FedEx, UPS), and the growth of regional transportation networks (Levitt 2002; Booth 1999; Beyers and Lindahl 1996). While in the past the vast distances of the West were an impediment to business because it made it difficult to get products to markets, in today's economy, these wide-open spaces are for some communities an asset that attracts people and business (Deller et al. 2001; Nelson 2006; Lorah and Southwick 2003; Duffy-Deno 1998).

However, environmental amenities are not the only element needed for economic success and an emerging literature has established a more complex picture of the links between natural amenities and other drivers of growth (Deller et al. 2001; Green et al. 2005; Gude et al. 2006, Rasker et al. 2009). For example, recent studies have shown that it is easier to capitalize on environmental amenities if the local economy also has access to larger markets, especially via air travel (Rasker et al. 2009). According to Kasarda (2000) 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. Air travel is especially important for technology workers, who travel by air between 60 percent and 400 percent more frequently than those in the general workforce (Kasarda 2000; Erie et al. 1999).

The structural shift in the economy towards a primarily service-based economy underscores the importance of education. If almost all new jobs are in services, the key to economic success, and what will differentiate one county from another, is the ability to capture the relatively higher-wage component of the service industries. According to analysis by the Bureau of Labor Statistics, jobs that are projected to be in highest demand and are growing the fastest also require a college degree. These include the fields of health care and education, and occupations in management, engineering, and business and financial services (Liming and Wolf 2008).

Education rates also make a difference in earnings and unemployment rates. In 2008, the national average weekly earnings for a person with an undergraduate degree was $978, compared to $626 per week for a high school graduate. While in 2008 the unemployment rate among college graduates was 2.8 percent, for high school graduates it was 5.7 percent (U.S. Department of Labor 2010c).

The growth of the West into a primarily service-based economy is not limited to the big cities. In the non-metropolitan counties of the West, more than 1.4 million jobs were created from 1990 to 2008, with 80 percent of them in service-related jobs (with roughly half of the service industry growth from health care and professional and technical services) (U.S. Department of Commerce 2010a). The bulk of the remainder of the job growth was in government. In many small communities in the West, government is a source of relatively high-wage jobs.

2. Data and Methods

The study focused on the fastest-growing counties in the West, defined as the subset of western counties in the upper quartile of pre-recession population growth, measured as the percent change in population from 2000 to 2007 (1). This group of counties included 104 of the 413 counties in the continental western U.S., including Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming. While the selected cutoff is admittedly arbitrary, it is based, in part, on the authors' extensive experience working throughout the West and includes well-known

fast-growing areas such as Las Vegas, Nevada; Tucson, Arizona; the Front Range of Colorado, and well-known “amenity-driven” growth communities such as Jackson, Wyoming; Bend, Oregon; Bozeman, Montana; and Coeur d’Alene, Idaho.

Statistical analyses were conducted to identify characteristics of these rapidly growing western counties that were most strongly related to the change in unemployment rates during the height of the most recent economic recession. The response variable, shown in Figure 1, was the change in unemployment rate (ΔUNR) by county from November 2007 and November 2009.

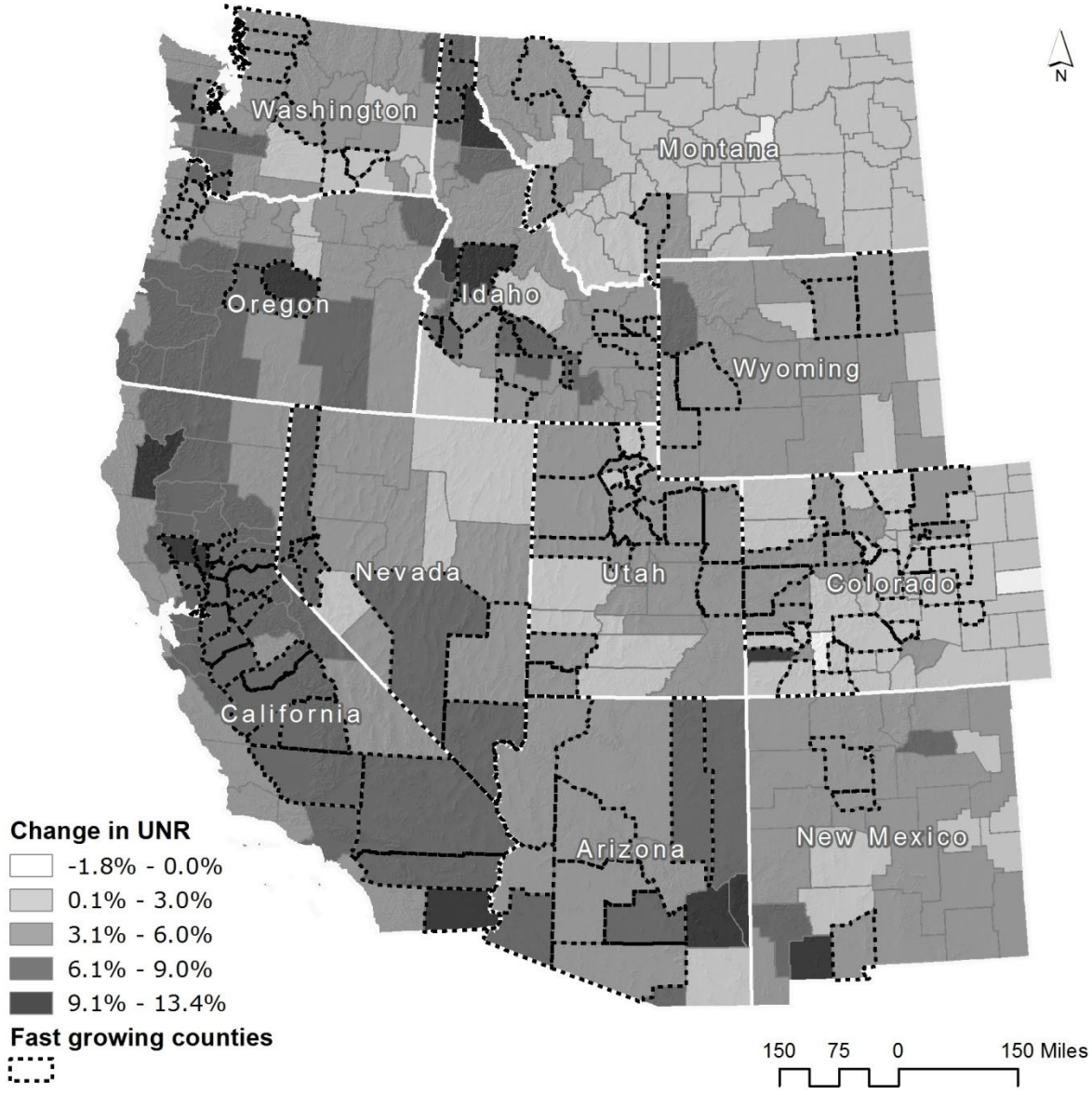

FIGURE 1. Change in Unemployment Rate by County, Nov. 2007 to Nov. 2009

The start date for the response variable was selected as November 2007 because that was the last month before the recession began. The end date of November 2009 was used because that was the official end of the recession (National Bureau of Economic Research, 2010). No adjustments were made for seasonal variation in employment because the analyses focused on the change in unemployment rate and used data from the same month for both 2007 and 2009.[1] The source data for this information was the Bureau of Labor Statistics' Local Area Unemployment Statistics (U.S. Department of Labor 2010).

2.1 Explaining Variable Performance among Fast Growing Counties

To evaluate which factors were associated with the variability in economic performance within counties in the upper quartile of population growth, it was necessary to develop a set of potential factors driving economic change based on the literature on regional economic growth and to test the relationship between those factors and economic performance in the context of the recession. The following section describes each explanatory variable.

2.1.1 Explanatory Variables

The analyses evaluated factors (listed in Table 1) that fall into six broad categories that have been documented in previous studies on growth in the U.S. West as driving forces of economic change: the pre-recession population and unemployment levels, the composition of the county economy by sector, the quality of a county's human resources, the presence of natural amenities, and access to markets and transportation infrastructure.

Pre-Recession Population and Unemployment Levels

The study included two variables that likely represented how the rapidly growing counties were positioned prior to the recession: the average unemployment rate in 2007 (U.S. Department of Labor 2010b) and the total population in 2007 (U.S. Department of Commerce 2010c). The authors suspected that fast growing counties with elevated UNR prior to the recession were likely more vulnerable to heightened job loss during the recession. Similarly, metropolitan counties were thought to have been most affected by the recession, independent of the other variables we included. We evaluated these two variables individually and as potential confounders of the subsequently described variables.

Employment by Sector

Several explanatory variables were used to represent those industries that previous literature has established as factors in economic performance for the period 1990 through 2007. This includes industries associated with growth, such as services and government, as well as those linked to poor performance, such as construction and timber.

The data source for employment in manufacturing, construction, farming and government in 2007 was the Bureau of Economic Analysis' Regional Economic Information System (REIS) (U.S. Department of

[1] Comparisons between different months would have required adjustments for seasonal employment since some counties have higher or lower unemployment rates depending on the month.

Commerce 2010a). REIS is a preferred data source for representing employment by industry because the data cover nearly the entire population of workers, including several classes of workers that are not represented in the Census Bureau's County Business Patterns (CBP) data (U.S. Department of Commerce 2010b). In fewer than 20 cases, values for employment in construction or manufacturing were not disclosed for the sample counties by REIS. Estimates were used to fill these data gaps (Rasker 2010). CBP does not report data for workers classified as proprietors, self-employed, agricultural, domestic, armed forces, or those on unpaid leave, however CBP offers a more detailed break-out of industries.

Table 1. Potential explanatory variables of change in unemployment rate.

Variable	Description	Data Source
UNR2007	Annual average unemployment rates (2007)	BLS[1]
Population	Population (2007)	Census Bureau
Manufacturing	Percent of employment in Manufacturing (2007)	REIS[3]
Farming	Percent of employment in Farming (2007)	REIS[3]
Government	Percent of employment in Government (2007)	REIS[3]
Timber	Percent of employment in Timber (2007)	CBP[4]
Construction	Percent of employment in Construction (2007)	REIS[3]
Services High	Percent of employment in High Wage Services (2007)	CBP[4]
Services Low	Percent of employment in Low Wage Services (2007)	CBP[4]
Non-Labor	Percent of Personal Income from Non-Labor (2007)	REIS[3]
College	Percent of Population > 25 years of age with Bachelors (2000)	Census Bureau
Protected	Percent of land that is "Protected Public"	Various[2]
Amenities	Natural Amenities County Index	McGranahan, 1999
3-Wests	Counties defined as "Metro", "Connected", or "Isolated"	Rasker et al., 2009
Airport	Travel time to nearest major airport	Rasker et al., 2009

[1]U.S. Department of Labor. 2010. Bureau of Labor Statistics, Local Area Unemployment Statistics

[2]Conservation Biology Institute 2006, 2008; AZ Land Resources Information System 2009; MT Natural Heritage Program 2008

[3]U.S. Department of Commerce. 2010. Bureau of Economic Analysis, Regional Economic Information System

[4]U.S. Department of Commerce. 2010. Census Bureau, County Business Patterns

CBP data was therefore used to calculate the percent of 2007 employment in high wage services, low wage services, and timber, which are not available in the REIS database. High wage services were defined as the following industries: information (NAICS 51), finance and insurance (NAICS 52), real estate and rental and leasing (NAICS 53), professional, scientific, and technical services (NAICS 54), management of companies and enterprises (NAICS 55), utilities (NAICS 22), educational services (NAICS 61) and health care and social assistance (NAICS 62). These are also occupations that are likely to require a college degree (Liming and Wolf 2008). Low wage services were defined as all other services

(NAICS 42, 44, 48, 56, 71, 72, and 81). Timber was defined to include the manufacturing of wood products and paper (NAICS 113, 1153, 321, and 322). Both REIS and CBP report employment by place of work, whereas unemployment rates are reported by place of residence. This discrepancy may have introduced noise that dampened the effect between the employment variables and change in unemployment rate, but should not have biased results in a particular direction. In addition to the employment variables, REIS was also used as the data source for percent of personal income from non-labor sources (dividends, interest, rent and transfer payments) in 2007.

Educational Attainment

The percent of the population greater than 25 years of age with Bachelor's degrees was acquired from the Decennial Census of Population and Housing (U.S. Department of Commerce 2002). Education was used as a measure of the quality of human resources and the potential for economic development: i.e., occupations such as engineering, architecture, finance, health care, and other jobs that require college educated workers. The total county population in 2007 was also collected from the Census Bureau (U.S. Department of Commerce 2010c).

Natural Amenities

The study also used as an explanatory variable the percent of land in each county considered to be "Protected Public." Land ownership types classified as "Protected Public" are listed in Table 2. This variable was included to evaluate whether counties with substantial protected areas benefitted economically from this natural amenity during the course of the past recession.

Table 2. Land ownership classes considered to be "Protected Public" lands.

Variable
Any areas designated as:
National Parks (NPS)
National Conservation Areas (BLM)
National Monuments (NPS, FS, BLM)
Wilderness (NPS, FWS, FS, BLM)
National Recreation Areas (NPS, FS, BLM)
National Wild and Scenic Rivers (NPS)
National Wildlife Refuges (FWS)
Waterfowl Production Areas (FWS)
Wildlife Management Areas (FWS)
Wilderness Study Areas (NPS, FWS, FS, BLM)
Inventoried Roadless Areas (FS)
The subset of the following areas that fit two criteria*:
Forest Reserves (BLM)
Public Domain Lands (BLM)
National Forests (FS)
National Grasslands (FS)
National Preserves (NPS)

*Adjacency/connectivity to Class 1 lands, and Class 1 lands made up greater than 10 percent of lands with a 50 kilometer radius

The study also included as a potential explanatory variable McGranahan's (1999) basic scale of natural amenities that includes measures of climate, topography, and water area (lakes, ponds, and oceans).

Transportation and Access to Markets

Another potential explanatory variable was access to major airports. The mean drive time to the nearest major airport was calculated, following the methods of Rasker et al. (2009). Major airports were identified as those with greater than 15,000 enplanements per year in 2005. This level of traffic represents airports where residents have the choice of several commercial flights per day (Rasker et al. 2009). Travel time to the nearest major airport was calculated using cost–distance grid functions incorporating distance and automobile speed limits. We also incorporated into the analysis a county classification system that reflects differing degrees of access to population centers and accounts for the increasing importance of airports. The three classes in this system are "metro" counties, those classified by the Office of Management and Budget as metropolitan statistical areas, "connected" counties, those that are rural in nature but have ready access to metropolitan areas via air travel, and "isolated" counties (Rasker et al. 2009).

2.1.2 Statistical Analyses

All analyses were conducted within the R statistical environment (R Development Core Team 2010). Our analysis goal was to develop regression functions allowing for inferences describing relationships between county-level predictors and the response of interest (ΔUNR). We began by producing a matrix of scatter plots containing the response and all predictors. This allowed us to view the relationship between the response and each predictor, as well as relationships among predictors. LOWESS smoothers were added to the plots (Cleveland and Devlin 1988), which suggested three of the relationships with the response were nonlinear. To establish linear relationships, the UNR 2007 variable was transformed to its square root, and the Population and Timber variables were transformed to their natural logs. These transformations were supported by profile likelihood plots of the λ parameter of the Box-Cox power transformation (Box and Cox 1964), which were calculated using the boxcox function in R (Venables and Ripley 2002).

After transformations we entered all predictors additively into an ordinary least squares (OLS) model and mapped the residuals. Spatial clustering of the county-level residuals was clearly visible, and a global Moran's I test for spatial autocorrelation in residuals (Cliff and Ord 1981, Bivand et al. 2008) provided additional evidence of violation of the independence assumption (p = 0.034). Because OLS is inefficient with biased standard errors under lack of independence (Schabenberger and Gotway 2004), we fit subsequent models using spatially autoregressive (SAR) models, which can account for spatial dependencies in areal data through the use of neighborhood weights matrices. These models come in two primary forms: the spatial lag model and the spatial error model. We chose to fit the spatial error SAR model using the spdep library in R (Bivand et al. 2008, Bivand 2010), the details of which we will now briefly describe.

As with the OLS model, the SAR model can be written $Y \sim N(X\beta, \Omega)$, where Y is a vector of observed response values, X a model design matrix, β a vector of regression coefficients, and Ω a response covariance matrix. However it differs from OLS in that it does not constrain Ω to $\sigma^2 I$ but to $(I - B)^{-1}\Sigma(I - B)^{-1}$ where Σ is diagonal and $B = \rho W$, with ρ a spatial autocorrelation parameter

and W a matrix of neighbor weights[2]. Therefore, SAR does not assume independence of errors conditional on observed covariates, but instead accounts for autocorrelation through non-zero off-diagonals of the error covariance matrix structured through an autocorrelation parameter and neighbor weights (for further details see Schabenberger and Gotway 2005, pg. 336).

At this point, we selected which SAR models to draw inferences from. One approach would have been to fit a single large model containing all predictors; however the matrix of scatter plots indicated that there were linear relationships among the predictors (e.g., Manufacturing was positively related to Ln(Timber) and negatively related to Protected and College, which in turn were positively related to each other and negatively related to Ln(Timber)). Because multicollinearities could obscure coefficient interpretations we decided a more sensible analysis was to test the relationships between the response and each predictor after controlling for just the two variables we believed *a priori* to be important confounders: UNR 2007 and Population. We therefore fit 13 separate models, each containing the two control variables plus the predictor of interest. For each of these models we assessed the significance of the predictor of interest based on Wald-type *p*-values[3]. For all models we created diagnostic plots to assess regression assumptions. We assessed error heteroscedasticity by plotting model residuals versus both fitted values and model residuals. We then assessed normality by producing QQ-plots of residuals. We concluded analyses by calculating marginal increases in Nagelkerke's pseudo-R^2 (Nagelkerke 1991) when adding each predictor of interest to the model containing only the intercept and two control variables.

3. Results

A map of the change in unemployment rates (ΔUNR) from November 2007 to November 2009 (Figure 1) shows that counties where UNR increased the most tended to be concentrated in the Pacific states as well as Idaho and Arizona, with California suffering the largest increases overall. The less populated portions of states tended to fare better. ΔUNR was less in Montana, Colorado, and Utah than in other western states. With the exception of Colorado, fast growing counties appear to have experienced greater levels of job loss on average. Among the fast growing counties, the five counties with the smallest change in UNR were Mineral County, CO (0.1); Crowley County, CO (1.6); Cache County, UT (1.8); Benton County, WA (1.9); and Franklin County, WA (2.0). The five fast growing counties that experienced the largest change in UNR were Sutter County, CA (9.4); Imperial County, CA (9.5); Colusa County, CA (9.8); Crook County, OR (10.8); and Valley County, ID (11.4).

3.2 Explaining Variable Performance among Fast Growing Counties

The dot plot shown in Figure 2 shows observed mean ΔUNR by quartiles of the observed predictor values within the fast growing counties. Each variable is split into quartiles (shown on the y-axis), represented by the four gray lines. The location of the dot on each line indicates the mean ΔUNR (shown on the x-axis) of counties that fall within that quartile. Unlike the models described below, the patterns indicated by the dot plot do not control for pre-recession population and unemployment levels, and are summarized here to augment familiarity with the data:

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[2] In our use, Σ was set to $\sigma^2 I$ and W was a symmetric binary matrix representing queen-type neighbor contiguity, except for the 13 counties with zero neighbors, for which we created links to the nearest neighbor.

[3] The 3-Wests predictor was categorical, and it entered the model dummy-coded such that the Isolated level served as the baseline. Therefore, the two Wald tests of interest from this model tested differences between Isolated and Connected and Isolated and Metro.

- The mean change in UNR increased across the quartiles of the square root of UNR 2007.
- Counties in the lower two quartiles of population had lower mean change in UNR.
- Counties in the lower quartile of manufacturing had lower mean change in UNR.
- The mean change in UNR increased steadily across the quartiles of the log of percent timber jobs.
- Counties in the lowest quartile of construction had higher mean change in UNR, and counties in the highest quartile of construction had lower mean change in UNR.
- Counties in the lowest quartile of non-labor income had lower mean change in UNR.
- There was a consistent decrease in mean change in UNR across the quartiles of the percent of the population over age 25 with a college degree.
- Observed mean change in UNR increased slightly with increasing amenities.
- There was relatively little variation in the observed change in UNR within the quartiles of the Farming, Government, Services, Protected, 3-Wests, and Airport variables.

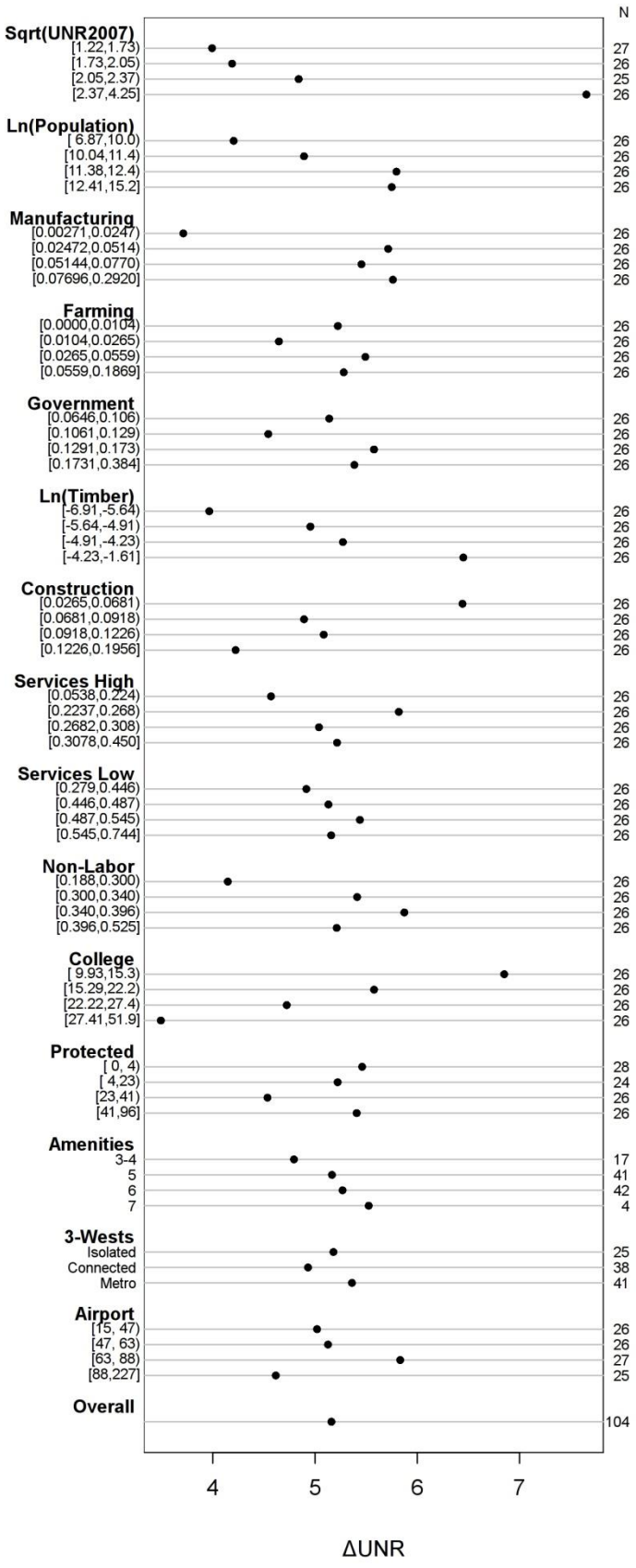

FIGURE 2. Observed mean change in UNR by quartiles of the observed predictor values within the fast growing counties.

Table 3 contains results of fitting the different multivariable SAR models (all models include both control variables). The Ln(Population) control variable was not statistically significant in any of the models but was kept as a control. The other control, square root of 2007 unemployment, was highly significant in all models and therefore had the most potential to impact inferences. With both controls included, trends associated with the Government, Ln(Timber), and College variables remained statistically significant. Government and College were negatively associated with ΔUNR and Ln(Timber) was positively associated with ΔUNR. For all 13 models, residual diagnostic plots showed residuals were well behaved, with no clear evidence of violations of the normality or homoscedasticity assumptions.

Table 3. Inference statistics for the predictor of interest from each of 13 SAR models containing the predictor and 2 control variables: the log of the population and the square root of the baseline unemployment rate. ΔR^2 represents the marginal improvement in Nagelkerke's R^2 over the model containing only the two control variables (pseudo-R^2 = 0.41)

	$\hat{\beta}$	SE	z	p	ΔR^2
Manufacturing	4.389	4.113	1.067	0.286	0.006
Farming	−5.379	5.389	−0.998	0.318	0.005
Government	−5.908	2.878	−2.053	0.040	0.023
Ln(Timber)	0.462	0.148	3.121	0.002	0.050
Construction	8.683	5.439	1.596	0.110	0.012
Services High	−3.202	2.824	−1.134	0.257	0.007
Services Low	−3.042	2.187	−1.391	0.164	0.011
Non-Labor	1.056	2.743	0.384	0.700	0.001
College	−0.064	0.022	−2.962	0.003	0.045
Protected	0.003	0.005	0.577	0.564	0.001
Amenities	−0.146	0.227	−0.642	0.521	0.003
Airport	0.003	0.005	0.577	0.564	0.002
3-Wests					0.006
Connected	0.525	0.514	1.020	0.308	
Metro	0.327	0.576	0.567	0.571	

Figure 3 provides another look at the relationships between ΔUNR, the two control variables, and the two most highly significant explanatory variables from the multivariable SAR models: Ln(Timber) and College. The statistics in this figure are from SAR models fit without the control variables, and are shown as a supplement to the results in Table 3. Displayed *p*-values indicate that for the simple linear SAR fits, all four variables had statistically significant mean expected change in ΔUNR with each unit change in the predictor. The strength of the predictors, as judged by Nagelkerke's R^2, were from strongest to weakest: square root of pre-recession unemployment rate, percent of the population over 25 with a college degree, log of percent timber employment, and log of county population. Of these four predictors, College was the only variable negatively associated with ΔUNR. Although for reasons described

previously we chose not to base inferences on a single model containing all predictors, we note as a measure of sensitivity that in both the OLS and SAR full models the directions (signs) of the effects and their statistical significance (at $\alpha = 0.05$ level) did not change.

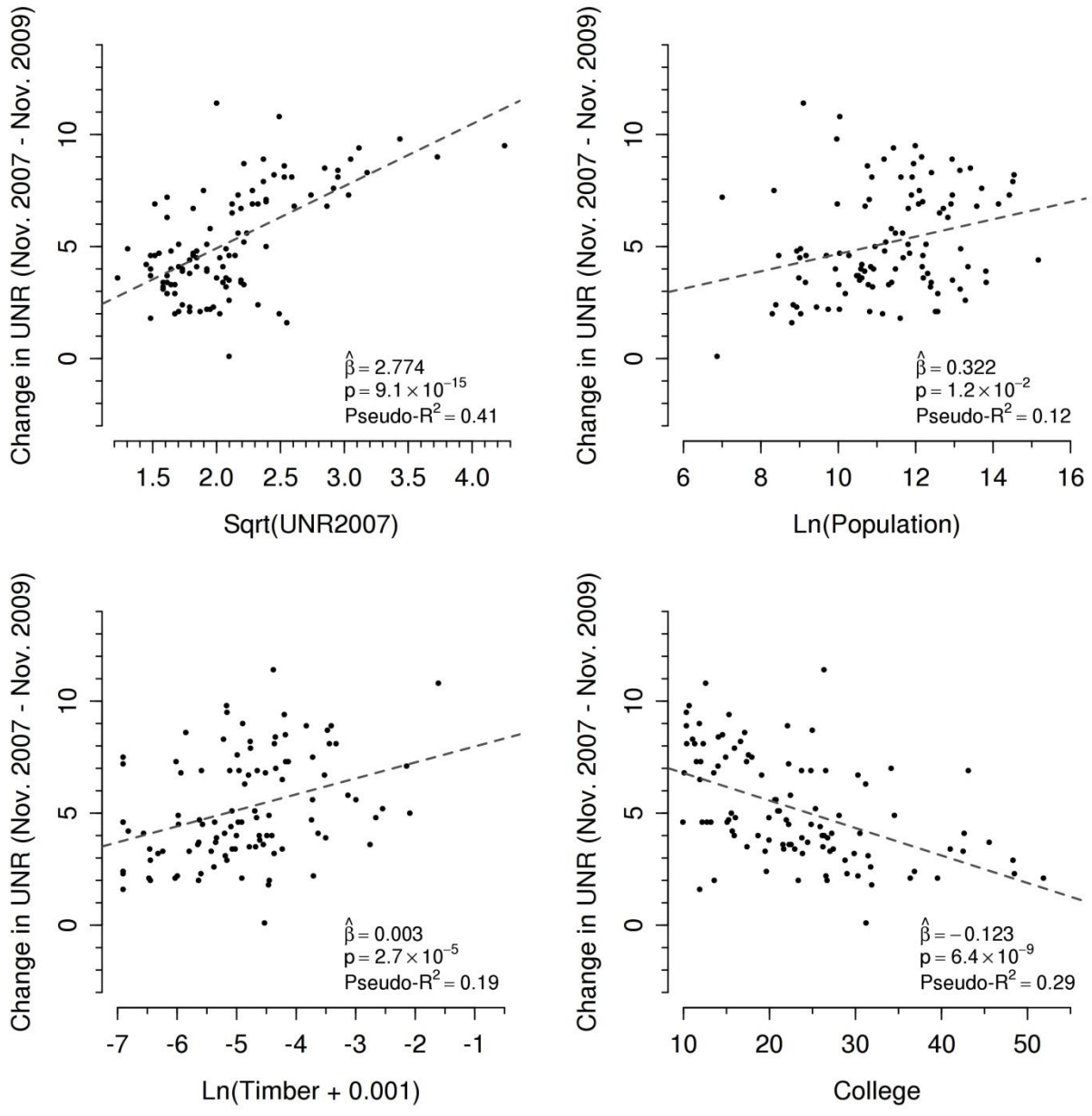

FIGURE 3. Change in UNR plotted against the two control variables and the two most significant explanatory variables. Statistics shown are from simple linear SAR fits.].

4. Discussion

4.1 Summary of Results

Within the West's fastest-growing counties, several variables were statistically significant in their relationship to change in unemployment rate. After accounting for the fact that counties went into the recession with widely differing unemployment and population levels, we confirmed that mean ΔUNR increased with increases in the portion of the jobs that were timber-related, and decreased with increases in the portion of the population with a college degree and the portion of jobs in government. Other variables that appeared to have relationships with ΔUNR, such as the portion of jobs in construction and measures of natural amenities, did not explain variation in ΔUNR after controlling for pre-recession unemployment and population levels.

4.2 Lessons Learned

Recessions expose economic vulnerabilities. The U.S. West has gone through many periods of rapid growth followed by rapid decline, most of which were associated with recessions and the rise and fall in prices for natural resource, like minerals and fossil fuels. This paper helps explain whether the latest period of growth and decline is any different. Did the factors that contributed to growth also contribute to economic contraction?

By examining what happened during the most recent recession to the fastest growing counties, several dynamics emerge that suggest possible lessons, organized into three sets. The first set of findings has to do with those variables that have been shown to influence economic growth during the boom, but did not emerge as significant influences on rates of job loss during the recession. Although the statistical tests performed in this research do not test for the absence of effects, these are factors that convey advantages in periods of growth, but do not appear to convey significant benefits or disadvantages in the context of the past severe recession. The second set of findings concerns those characteristics of boom-time economic performance that do appear to convey risk or disadvantages to local economies in terms of a link to job losses during the recession. The third describes two variables that were beneficial both prior to and during the recession.

4.2.1 Nonsignificant Pre-Recession Characteristics

The analysis failed to find evidence of a clear relationship between several pre-recession growth factors and unemployment rates in fast growing counties. The potential explanatory variables that did *not* demonstrate a statistically significant influence on the change in rate of unemployment during the recession include:

(1) Dependence on farming, high-wage services, and low-wage services as measured by share of total employment of each of these sectors,
(2) Percent of personal income from non-labor sources (dividends, interest, rent and transfer payments),
(3) Access to markets, as measured by the travel time to the nearest airport or by a classification that described counties as "Metro", "Connected", or "Isolated", and
(4) Natural amenities, as measured by the percent of public land in the county in protected status or by McGranahan's (1999) county index.

The lack of evidence of effects of these variables is consistent with the concept that many of the factors (declines in farming, gains in service-related jobs, growth in non-labor income, access to markets, and natural amenities) that contributed to the changing structure of the West's fastest growing counties, did not contribute to higher rates of job loss during the recession.

This study did explore the influences of the share of employment in other sectors, including manufacturing and construction, that media outlets and policy makers have portrayed as especially vulnerable to the recession. Although a statistically significant linear relationship between levels of employment in manufacturing and performance during the recession within the fastest-growing counties was not found, the exploratory analysis clearly showed a lower mean change in the unemployment rate for counties in the lower quartile of manufacturing. On average, those fast growing counties with less than 2.5% of employment in manufacturing suffered fewer job losses. This study also found that after controlling for pre-recession unemployment and population levels, employment in construction did not explain variation in performance among fast growing counties.

4.2.2 Risky Pre-Recession Characteristics

Characteristics that were statistically related to higher rates of job loss within fast growing counties were:

(1) High unemployment rates prior to the beginning of the recession,
(2) Larger populations prior to the recession, and
(3) Relatively high dependence on timber related jobs.

These findings indicate several trends. First, past performance was influential in the recession. Those counties already doing poorly were more likely to continue to do poorly, and lose jobs at a relatively faster rate. In addition, the recession affected larger populations disproportionately: counties with larger populations lost jobs at a faster rate than others. Finally, counties that were more timber dependent lost relatively more jobs during the recession.

4.3 Advantageous Characteristics

One variable that emerged as being beneficial during the recession was the education rate, measured as the percent of the adult population with a college degree. The education rate was positively associated with lower rates of job loss. This is a simple yet important finding. A better-educated workforce appears to offer a degree of buffer against the effects of economic downturns. Furthermore, education will be critical if the West is to successfully compete with the rest of the world for their share of the higher-wage components of the growing service industries.

Government employment was also found to be beneficial in that, after controlling for pre-recession unemployment and population levels, higher government employment, including military, federal, state and local government, was associated with lower rates of job loss. This result supports the concept that government employment tends to be more stable than private sector employment in times of recession. In addition to the role of government employment during economic contraction, it is also a source of relatively high-wage jobs in many small communities in the West. However, it is possible that the two-year study period did not capture lagged contraction of government in response to decreased tax revenues.

4.4 Limitations

This study measured economic performance during the recession using one fundamental variable: the change in unemployment rate. It would be interesting to ask the same questions addressed in this paper using alternative measures such as changes in the distribution of income and poverty levels. Further study would also be useful to understand what factors explain variability in the characteristics of unemployment such as length of joblessness and age structure. Another factor that should be kept in mind when interpreting the results of this study is that the focal period was defined as the last month before the recession began (November 2007) to the official end of the recession (November 2009). Given that the period of economic contraction extended beyond the official end of the recession, it would be interesting to investigate trends in economic performance over a longer period.

Many interesting and informative differences exist between individual fast growing counties that could be discussed further in case studies. While some instances of heightened job loss seem easily explained by the fate of a particular industry,[4] a goal of this research was to test for and understand broader patterns. The disadvantage of the quantitative methods used in this study is that stories of individual communities, particularly outliers, were deemphasized. However, the methods allowed for unbiased evaluation of characteristics that were generally consistent across counties. Importantly, the study was observational and causality therefore cannot be implied.

4.5 Conclusions

The research reported here evaluated whether the factors that served as accelerants to growth in the 1990s and early part of the 2000s shaped county-level economic performance during the most recent recession. The results of this study underscore important tenets of economic development theory: the importance of education in the emerging global economy, the stabilizing effect of government employment during economic contraction, and the dangers of over-reliance on single sectors, in particular those that fluctuate with commodity markets. Both educational attainment and government employment stood out as factors that offered measurable resilience to job losses during the recession.

Furthermore, the results of this study help to refine our understanding of the new economy of the U.S. West. This study failed to find evidence that several factors (declines in farming, gains in service-related jobs, growth in non-labor income, access to markets via air travel, and the presence of natural amenities) that contributed to the changing structure of the West's fastest growing counties, also contributed to higher rates of job loss. This suggests that economic development efforts that target transportation infrastructure, the service economy, and natural amenities are not putting an area at particular risk for economic contraction when a recession arrives. In the context of the recession that began in 2007, these appear to be "safe" strategies for development activities. The lack of evidence of effects (either positive or negative) on job loss for manufacturing and construction is also an important observation that suggests that explanations of recession performance that focus exclusively on these sectors may be overly simplistic.

[4] Some of the highest rates of job loss outside of California were in Greenlee County, Arizona (declining prices led to layoffs in one of the country's biggest copper mines); central and northern Idaho (loss in timber-related jobs), and central Oregon (rapid declines in the housing market).

The boom of the 1990s and early part of the 2000s was unique in that it was driven more by human capital (in-migration, growth in services, and growth in knowledge-based jobs) and less by commodity markets. Despite this difference, the familiar boom and bust cycle occurred. A key lesson to be learned from the places that grew most rapidly is this: in today's economy, the quality of human resources is strongly linked to resilience during economic downturns. An educated workforce provides economic stability. Both national and regional development policies aiming to guard against the effects of recessions should strive to increase access to education, and attract and retain educated individuals locally.

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