The Effects of Workforce Creativity on Earnings in U.S. Counties

Todd M. Gabe, Kristen Colby, and Kathleen P. Bell

This paper examines the effects of local workforce creativity on county-level earnings. Descriptive analysis of the data shows that most of the high-creativity counties in the United States are part of metropolitan areas, and that employee earnings are high in these places. Regression results indicate that, other things being equal, workforce creativity enhances county-level labor earnings. However, the returns to creativity that we found can be confirmed only in the urban context. An extension of the analysis suggests that the creative workforce wage premium may be capturing the effects of "technical workforce creativity" on earnings.

Key Words: creative economy, wages, economic development

Many state and local policymakers in the northeastern United States and elsewhere around the country (and world) have a keen interest in enhancing the creative economy. They are searching for ways to attract and retain scientists, writers, engineers, and artists—people who use creativity in their jobs to generate value and wealth. Much of this interest is motivated by Richard Florida's book *The Rise of the Creative Class*, which suggests that creativity is a key driver of regional economic growth and development.

Florida's (2002a) research has defined and documented the growth of the so-called "creative class," made up of a variety of occupations such as architects, scientists, educators, designers, and entertainers. By Florida's account, the size of the creative class has grown from 3 million U.S. workers in 1900 (10 percent of the workforce at that time) to about 38 million individuals in 1999 (30 percent of the workforce at that time). That makes the creative class the second largest occupational group in the United States, behind the service class with its 55 million workers (43 percent of the U.S. workforce in 1999) (Florida 2002a).

Table 1 shows the average annual wages of creative workers compared to other broad occupational categories arranged by Florida (2002a). Members of the creative class earned an average of $20,000 more per year than individuals in Florida's working (e.g., production operations, transportation) and service (e.g., clerical workers) classes. The high earnings associated with creative workers, combined with growth in the proportion of Americans employed in creative occupations, may explain, in part, the increased average earnings received by U.S. workers during the twentieth century. However, earning disparities between the creative and service classes and their parallel growth, with the expansion of service occupations fueled by increasing demand by creative workers, may also lead to an increase in income inequality within regional clusters of high creativity (Florida 2002a, Peck 2005). In addition, regional differences in the proportion of workers employed in creative occupations may explain earning disparities across cities, and between rural and urban areas.

This paper examines the effects of local workforce creativity on county-level earnings. Our analysis focuses on a large sample of U.S. counties, and accounts for the presence of spatial error dependence. The empirical models used in the

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Table 1. Wages and Salaries by Broad Occupational Category (1999)

Category	Total Workers	Average Hourly Wage	Average Annual Salary
Creative class	38,278,110	$23.44	$48,752
Working class	33,238,810	$13.36	$27,799
Service class	55,293,720	$10.61	$22,059
Agriculture	463,360	$8.65	$18,000
Total U.S. workforce	127,274,000	$15.18	$31,571

Source: Florida (2002a).

paper isolate the wage premium associated with workforce creativity, while controlling for the effects on earnings of educational attainment, population density, local amenities, and economic structure. An extension of the analysis, used to reconcile differences in the effects of creativity on earnings between metropolitan and non-metropolitan counties, investigates the earnings premium associated with mathematics skills (i.e., "technical workforce creativity") in the workforce.

Related Literature

Researchers have been studying the economics of artists, a relatively small subset of the creative economy, for several decades (Felton 1978, Filer 1986, Heilbrun 1996, Markusen and King 2003). The growth and geographic distribution of artistic workers is documented by Heilbrun (1996), who found that—after a decade of increased concentration during the 1970s—artists became more geographically dispersed between 1980 and 1990. State-level regression analysis suggests that the amount of tourism activity per capita and the population size of the largest city located within the state have a positive effect on the relative number of performing artists. Alternatively, states with an ethnically diverse and highly educated population have a higher incidence of painters and sculptors (Heilbrun 1996).

Markusen and King (2003) found that artists have become more dispersed across large U.S. metropolitan areas, although certain cities appear to specialize in one or a few types of artists. Artists are characterized as "footloose" because their location decisions are not typically tied to specific place-based resources, as is the case with some types of manufacturing firms. Focus group research found that artists are attracted to areas with high amenities, strong philanthropic and arts organizations, and public sector investments in programs and facilities (e.g., art fairs, parks and recreational spaces, concerts) that support the arts (Markusen and King 2003).

Much of Florida's work on the creative economy, defined to include a much larger group of occupations including artists, focuses on metropolitan areas. He suggests that members of the creative class are attracted to vibrant cities and places that offer a wide range of amenities and experiences. In addition, Florida (2002a) de-emphasizes the importance of job opportunities as a location attractant and—like Markusen and King (2003), who studied only artists—points out that creative people of all sorts select places where they want to live. Florida (2002b) found that a high concentration of "bohemians," another subset of the creative class, is associated with high levels of human capital and high technology activity in large cities. He uses these findings to conclude that "a bohemian presence in an area helps establish an environment that attracts other talented or high human capital individuals" (Florida 2002b, p. 67).

Recent studies that have uncovered strongholds of artists and other creative workers in places outside of big cities offer evidence that some rural areas may provide fertile ground for the creative economy. Wojan (2006) found that between 1990 and 2000 the share of county-level employment in artistic occupations grew faster in non-metropolitan counties than in metropolitan counties. The analysis also classified 189 U.S. non-metropolitan counties as "artistic havens." Logistic regression results suggest that, other things being equal, these counties tend to have a higher proportion of employment in business services, a higher number of entries in the National Register of Historic Places, fewer large retail establishments, a four-year college, an arts organization, and a higher share of employment in recreational industries (Wojan 2006).

McGranahan and Wojan (forthcoming) found that the share and growth of creative workers, broadly defined, raised overall employment growth in rural U.S. counties between 1990 and 2000. The analysis suggests that creative workers are attracted to mountainous areas, and places with a mix of forests and open spaces. In addition, the number of jobs per capita in bicycle and sports stores, the proportion of county-level employment in both business services and recreation, and the proportion of young adults with a college degree enhance the growth of the rural creative economy (McGranahan and Wojan, forthcoming).

The research outlined above provides a good sense of the regional attributes that draw artistic and other creative workers.[1] They tend to favor amenity-rich places and areas with highly educated residents and strong arts organizations. Studies also show that creative workers are becoming more geographically dispersed across large cities, and that some rural areas can support a vibrant creative economy. With this empirical evidence on the regional characteristics that matter to creative workers, the still (mostly) unanswered question that we hope to address in this paper is whether high creativity in the workforce translates into higher local earnings.

Measuring Creativity in U.S. Counties

Previous research has attempted to measure the size and importance of the creative economy at the state and regional levels (New England Council 2000, Florida 2002a, Rosenfeld 2004, Markusen and King 2003, McGranahan and Wojan, forthcoming). The most common approach to this task begins by identifying occupations, or in some cases industries, that are believed to be "creative." For example, Rosenfeld (2004) counted employment in 19 industrial categories (e.g., art glass, design services, pottery) in a study of Montana's "creative enterprise cluster." Once the appropriate occupations or industries are chosen, the next step involves using U.S. government or other pertinent statistics to estimate the proportion of total regional employment accounted for by the creative economy.

These studies differ in focus and, by extension, in the types of workers that are defined as creative. The New England Council (2000) and Markusen and King (2003) emphasize the contributions of the arts and culture, while Florida (2002a) uses a broader definition of the creative economy. He includes, among others, scientists and educators in the "super-creative core," and counts legal occupations and some health care workers as "creative professionals."

McGranahan and Wojan (forthcoming) used information from the Occupational Information Network (O*NET) to refine Florida's classification of the creative class.[2] O*NET is a large-scale database containing information on a wide variety of job-related attributes for an extensive list of detailed occupations. This information is based on employee surveys and input from professional occupational analysts. The specific survey question used to identify creative occupations is: "What level of thinking creatively is needed to perform your current job?" Creativity is measured on a scale of 1 to 7, with examples in the survey indicating that a creativity level of 1.0 is similar to "changing the spacing on a printed report," 4.0 is equivalent to "adapting popular music for a high school band," and 6.0 is comparable to "creating new computer software."

The O*NET ratings provide a systematic way to measure occupational-level creativity requirements. However, Peterson et al. (2001) discuss several potential limitations of the O*NET data. They found that, for many job-related attributes, incumbent employees rated their occupations more highly than professional job analysts. This could be the result of "impression management" or "socially desirable responding" by employees filling out the O*NET survey. Peterson et al. (2001) also uncovered a higher than expected

[1] It should be noted that K-12 educators make up a large percentage of Florida's creative class in some regions. Unlike workers in other creative occupations (e.g., artists and some technical fields) who are considered to be footloose, K-12 educators (and some health care workers, also included in the creative economy) typically "locate" in a region to serve the local population.

[2] McGranahan and Wojan (forthcoming) also eliminated from their analysis workers in several creative (non-footloose) occupations such as teachers and doctors because they locate in a region to serve the local population.

correlation among ratings of the occupational attributes. This could be caused by survey "information overload" and the associated tendency to simplify attribute ratings, or the result of "categorization" if analysts based their ratings on summary judgments about an occupation. Despite these issues that might influence the accuracy of job-attribute ratings, Peterson et al. (2001, p. 487) conclude that "the O*NET provides a highly usable and inexpensive methodology for analyzing jobs."

Following McGranahan and Wojan (forthcoming), we use O*NET to assign a creativity rating to 92 occupations included in the Summary File 4 (SF-4) of the 2000 U.S. Census. These ratings are combined with employment information in the 92 occupations to calculate an average creativity score for each county. Figure 1 is a map of the United States that shows these creativity scores. Visual inspection of the map reveals clusters of counties with high creativity scores in the northeast, Rocky Mountains, Research Triangle area of North Carolina, and Silicon Valley area of California.[3]

Table 2 shows the 25 U.S. counties with the highest creativity scores. Eight of these counties belong to the New York City (4 counties) and Washington, D.C. (4 counties) metropolitan areas. The only non-metropolitan county included in the Top 25 list is Tompkins County, New York, which is home to Cornell University. Another finding of note is that workers in high-creativity counties tend to receive high wages. The average payroll per worker in the 25 most creative counties is $44,185, which is over $20,000 higher than the average payroll per worker ($24,116) calculated across 2,467 U.S. counties (see Table 3).[4]

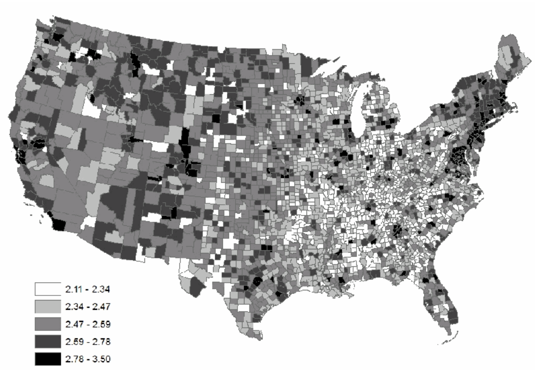

Figure 1. Average Creativity Scores of U.S. Counties

Table 2. Twenty-five Most Creative U.S. Counties

County	Creativity Index	Payroll Per Worker	Urban Influence Code[a]
Los Alamos, NM	3.50	34,292	2
Arlington, VA	3.29	46,267	1
New York, NY	3.27	75,743	1
Howard, MD	3.25	39,817	1
Montgomery, MD	3.22	42,808	1
Fairfax, VA	3.21	53,457	1
Douglas, CO	3.18	30,684	1
Marin, CA	3.17	41,289	1
Loudoun, VA	3.15	40,090	1
Collin, TX	3.15	42,997	1
Tompkins, NY	3.11	25,716	7
Boulder, CO	3.10	48,063	1
Somerset, NJ	3.09	52,528	1
Hamilton, IN	3.09	36,690	1
Hunterdon, NJ	3.07	44,664	1
Middlesex, MA	3.07	51,757	1
Albemarle, VA	3.06	25,694	2
Orange, NC	3.06	28,255	2
Morris, NJ	3.05	57,953	1
San Francisco, CA	3.05	55,901	1
Johnson, KS	3.04	34,968	1
Washtenaw, MI	3.03	41,669	1
Norfolk, MA	3.03	42,293	1
Santa Clara, CA	3.03	76,820	1
Wake, NC	3.01	34,204	2

[a] "1" signifies central and fringe counties of metro areas of 1 million population or more. "2" signifies counties in metro areas of fewer than 1 million population. "7" signifies not adjacent to a metro area and with a city of 10,000 or more.

[3] The map also shows some counties with high creativity scores in rural areas of the Great Plains. In some cases, a high creativity score may be the result of a small workforce with a relatively large number of K-12 educators present in the region to serve the local population.

[4] These two general results—that high-creativity counties are part of big cities and that earnings are high in places of high creativity—are consistent with Florida's (2002a) ideas about the creative economy.

Table 3. Summary Statistics (n = 2,467)

Variable Name	Definition	Source	Mean	Std. Dev.
Payroll per worker	Annual compensation per full- and part-time employee in county, 2000	*County Business Patterns*, U.S. Census Bureau	24,116	
Creativity	County-level creativity score, defined in text.	Author's calculations using county-level occupational employment data from the U.S. Census Bureau (SF 4), and occupational creativity levels from the Occupational Network (O*NET)	2.503	0.166
Population density	County population per square mile, 2000	U.S. Census Bureau	207.5	995.8
Education	= 1 if average educational attainment of county residents (aged 25 and older) is more than one standard deviation above the mean calculated across all U.S. counties, zero otherwise	U.S. Census Bureau, 2000	0.140	NA
January temperature	Mean temperature for January, 1941–1970	McGranahan (1999)	33.19	12.54
January sunlight	Mean Hours of Sunlight for January, 1941–1970	McGranahan (1999)	150.4	33.86
July humidity	Mean Relative Humidity for July, 1941–1970	McGranahan (1999)	56.48	14.99
Water coverage	Percent water area	McGranahan (1999)	5.243	12.10
Museums per capita	Number of "arts, entertainment and recreation" (NAICS 71--) establishments per 1,000 county residents, 2000	*County Business Patterns*, U.S. Census Bureau	0.397	0.356
Crime rate	Number of serious crimes reported to police per county resident, 1999	U.S. Federal Bureau of Investigation	0.026	0.017
Manufacturing base	Proportion of county establishments in the manufacturing sector (NAICS 31--), 2000	*County Business Patterns*, U.S. Census Bureau	0.051	0.023
Tourism base	Proportion of county establishments in accommodation and food services (NAICS 72--), 2000	*County Business Patterns*, U.S. Census Bureau	0.084	0.023

Workforce Creativity and County-Level Earnings

We use the following regression equation to estimate the effects of workforce creativity on county-level earnings:

(1) Payroll per worker = $\beta_0 + \beta_1$ creativity + β_2 population density + β_3 education + β_4 January temperature + β_5 January sunlight + β_6 July humidity + β_7 water coverage + β_8 museums per capita + β_9 crime rate + β_{10} manufacturing base + β_{11} tourism base

In Table 3, we define the variables used in equation 1 and present summary statistics. The dependent variable, constructed using *County Business Patterns* data, is the average annual compensation per employee working in the county. A limitation of this dataset is that it does not capture sole proprietorships, which may account for a large number of individuals in some creative occupations (e.g., self-employed consultants, service providers, artists, and musicians).[5]

Our analysis of county-level data allows us to measure the "social returns" to creativity that capture earnings received by members of the creative class, as well as earnings received by other workers in areas of high creativity.[6] Markusen (2004) notes that occupations such as performing artists, a relatively small category in Florida's creative class, may increase productivity in other non-artistic sectors (e.g., actors and directors making instructional videos for manufacturing businesses). More generally, a highly creative workforce may generate "positive externalities" where interaction (i.e., knowledge spillovers) among creative workers and between creative and non-creative workers leads to enhanced innovation, productivity, and wages.

Results shown in Table 2, which reveal a \$20,000 wage premium in high-creativity counties, are suggestive of a positive association between earnings and workforce creativity. However, in light of Glaeser's (2004) comments about Florida's book, one should not rush to this conclusion. Glaeser (p. 2) remarks: "While Florida acts as if there is a difference between the human capital theory of city growth and the 'creative capital' theory of city growth, this is news to me. I have always argued that human capital predicts urban success because 'high skilled people in high skilled industries may come up with more new ideas….' "

Thus, a plausible explanation for the wage premium in high-creativity counties is that the local workforce in these places exhibits high levels of human capital (i.e., education). The average educational attainment of county residents is a key control variable that will allow us to make the important distinction between the "human capital" and "creative capital" theories of regional growth. As one might expect, a high correlation ($r = 0.76$) exists between the county-level creativity score and the average educational attainment of county residents. Thus, instead of the average education level, we use a dummy variable that equals one if the average educational attainment of county residents is more than one standard deviation above the mean average educational attainment across all U.S. counties.

Population density is included in the model to control for the effects of urbanization on earnings. Numerous studies have examined the relationships among city size, worker productivity, and wages (Segal 1976, Moomaw 1981, Yankow 2006). Some explanations for the urban wage premium are that workers must be compensated to live in big cities, or that information flows easier in areas with a high density of economic activity (Glaeser and Mare 2001, Jacobs 1969, Hoch 1972). Whatever the reason, we expect to find a positive relationship between county-level earnings and population density.

The next six variables shown in equation 1 (*January temperature, January sunlight, July humidity, water coverage, museums per capita,* and *crime rate*) control for a variety of amenities that may influence labor earnings. If a local attribute is viewed as an amenity, people may accept lower wages to work in the area. Alternatively, individuals may have to be compensated to work near attributes viewed as disamenities. McGranahan

[5] This limitation may be especially severe in some high-amenity rural areas that are home to export-oriented sole proprietors, termed "Lone Eagles" by Beyers and Lindahl (1996). They found that about 5 percent of the 240 rural producer service firms surveyed in 1994 fell into this category. Lone Eagles, which generated substantially more sales revenue per worker than other types of rural producer service firms, frequently cited "high quality of life" as a key location factor.

[6] Our methods do not allow us to distinguish between higher earnings due to an in-migration of high wage creative workers to a region and higher earnings due to processes (e.g., knowledge spillovers among local workers) occurring within a high-creativity region.

(1999) used the climate and water coverage variables, along with other measures, to construct a natural amenity rating that he found encouraged population growth in rural counties.[7]

We use the number of museums per capita (measured in the paper as the number of arts, entertainment, and recreation establishments per 1,000 county residents) and the county-level crime rate to capture attributes that may be particularly important wage determinants across urban counties. Roback (1982) found that crime had a positive effect on wages in large cities, consistent with people viewing it as a disamenity. Glaeser, Kolko, and Saiz (2001) found that the number of live performance venues per capita encouraged population growth, but that the number of art museums per capita did not have a significant effect on population growth across U.S. cities.

As noted above, amenities are particularly important to creative workers in their location decisions. Our exclusion in equation 1 of some of the factors found to attract members of the creative economy (e.g., presence of philanthropic and arts organizations, number of jobs per capita in bicycle and sports stores) may lead to possible omitted variable bias. Another potential limitation of our econometric analysis is that we do not account for relationships among county-level earnings, amenities, and the growth of creative workers. A fruitful area for future research may be to estimate a structural model that can capture the effects of amenities on local earnings and the growth of the creative economy (Deller et al. 2001).

Finally, the empirical model used in our analysis includes variables (*manufacturing base, tourism base*) to represent the local economic structure. We focus on the proportions of county-level employment in manufacturing and tourism industries because of the traditional and emerging roles that these sectors, respectively, have played in local economic development. In addition, researchers have noted the connection between the creative economy and tourism: tourists are drawn by arts and cultural activities, and the amenities valued by creative workers are also often desired by tourists (Heilbrun 1996, Markusen and King 2003).

[7] McGranahan (1999) also considered landscape variables such as mountain topography and forest cover.

Empirical Results

Table 4 presents empirical results on the relationship between county-level earnings and the creativity level of the local workforce. Estimates shown in the left-hand column of results are from a regression model that uses all of the variables included in equation 1. In order to account for these factors expected to influence county-level earnings, we had to omit from the analysis a sizable number of counties with missing values for one or more of the explanatory variables. The other two columns of results show estimates from regression models that omit two variables (*museums per capita* and *manufacturing base*) included in equation 1. This is done to minimize the number of counties that are dropped from the analysis. A (nearly) complete coverage of the United States is preferred in our empirical analysis, presented in the right-hand column, which controls for spatial dependence.

We conducted several diagnostic tests on the ordinary least-squares regression model, shown in the center column of results, to investigate the potential for spatial dependence (see Anselin 2005, 2002, 1998). A variety of spatial weight matrices were considered, and test results supported the use of a row-standardized, first-order queen contiguity matrix. This spatial weight matrix allows for dependence among neighboring counties. The test statistics revealed the presence of spatial error dependence, leading to our use of the spatial error model.

Spatial error dependence, which may be caused by spatial correlation of omitted variables or spatial mismatch in data measurement, violates the standard assumptions of the linear regression model (e.g., the assumption of independent, homoskedastic residuals). In our empirical work, the spatial error dependence is likely to be influenced by both data measurement (i.e., county-level observations) and omitted variable problems. Spatially correlated residuals cause ordinary least-squares estimates to be unbiased but inefficient. Our spatial error model incorporates spatial error dependence using the conventional spatial autoregressive structure (Anselin 1988, 2002).

Results from all three models show that workforce creativity has a positive effect on county-level earnings. Other things being equal, a one-unit increase in the county-level creativity score

Table 4. Regression Results: Effects of Creativity on Labor Earnings in U.S. Counties

Variable	Estimated Coefficients		
Constant	-9,597*** (-4.044)	-11,032*** (-4.947)	-4,010* (-1.717)
Creativity	13,379*** (15.79)	13,876*** (17.39)	11,715*** (14.73)
Population density	1.051*** (10.36)	0.723*** (13.03)	0.687*** (12.83)
Education	1,923*** (5.258)	2,059*** (5.934)	1,107*** (3.434)
January temperature	-2.202 (-0.230)	37.157*** (4.292)	29.154** (2.051)
January sunlight	-21.95*** (-7.021)	-24.08*** (-8.123)	-21.43*** (-4.490)
July humidity	22.089*** (3.071)	24.08*** (3.330)	23.14** (2.027)
Water coverage	25.312*** (2.955)	34.83*** (4.020)	33.11*** (9.191)
Museums per capita	-953.0*** (-2.921)	NA	NA
Crime rate	49,358*** (7.698)	NA	NA
Manufacturing base	46,520*** (9.951)	43,950*** (10.36)	21,828*** (4.974)
Tourism base	-18,631*** (-4.807)	-18,805*** (-5.688)	-24,195*** (-7.371)
Lambda	NA	NA	0.511*** (23.27)
R-squared	.365	.321	.441
Number of observations	2,467	2,981	2,980

Notes: Figures shown in parentheses are t-statistics. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

(i.e., a 40 percent increase relative to the mean) is associated with an $11,715 to $13,876 increase in average earnings. Using results from the model that controls for spatial dependence, we find that a 10 percent increase in the creativity score leads to 12 percent higher average earnings.

The educational attainment and population density variables have a positive effect on county-level earnings. As expected, these results suggest that human capital and urbanization contribute to county-level earnings. Looking at the results presented in the left-hand column of Table 4, we find that the crime rate has a positive effect on earnings and that a negative relationship exists between earnings and the number of museums (and entertainment and recreational establishments) per capita. This suggests that, other things being equal, individuals have to be compensated to work in locales with high crime, but people will accept lower earnings to be in areas with a relative abundance of museums and other fun places to visit.

Our results show that January temperature (in two of the three models), July humidity, and the percentage of county area covered by water have a positive effect on earnings. Two of these results are surprising. As expected, we find that individuals require additional compensation to work in areas with high summer humidity. However, our estimates show that people also view mild winters and lakes (and other bodies of water) as disamenities. On the other hand, the empirical results suggest that individuals are willing to accept lower wages to work in areas with abundant January sunshine.

Finally, we find that the industrial structure of the local economy affects county-level earnings. The proportion of local businesses in manufacturing industries has a positive effect on earnings, while earnings are negatively related to the relative importance of tourism to the local economy. Lambda, an additional parameter estimated in the spatial error model, is positive and significant, indicating positively spatially correlated residuals among neighboring counties.

Effects of Creativity in Metropolitan and Non-Metropolitan Counties

Table 5 shows results on the effects of workforce creativity on earnings in metropolitan and non-metropolitan counties. The regressions use the same explanatory variables as the model shown in the left-hand column of results in Table 4. However, the "high education" dummy variable is defined relative to other counties of the same metropolitan status. Spatial dependence may be present in these models, but the form would likely be quite different than in the analysis of all U.S. counties. The sets of metropolitan and non-metropolitan counties provide an incomplete coverage of the United States, which would require a different spatial weight matrix than used in the earlier analysis. In addition, the average earnings per worker in cities may have an effect on earnings in surrounding non-metropolitan counties (and vice versa).[8]

A comparison of the descriptive statistics reveals some differences between metropolitan and non-metropolitan counties, but no real surprises. As expected in light of the information shown in Table 2, the average creativity score is higher in metropolitan counties than in non-metropolitan counties. In addition, the population density and crime rate variables are substantially higher in cities than in non-metropolitan areas.

Our regression results show that workforce creativity enhances earnings in metropolitan counties, but has a negative effect on earnings in non-metropolitan counties. Consistent with our findings from the earlier analysis, educational attainment and population density have a positive effect on earnings in metropolitan and non-metropolitan counties. Other results that are similar across metropolitan and non-metropolitan counties are that the crime rate and proportion of local establishments in manufacturing industries have a positive effect on earnings, while county-level earnings are negatively related to the amount of sunlight an area receives in January.

One explanation (more are discussed in the next section) for why workforce creativity, as measured in the study, does not enhance earnings outside of cities is that the composition of the creative economy differs substantially between metropolitan and non-metropolitan counties (McGranahan and Wojan, forthcoming). We illustrate this point by focusing on the proportions of employment in segments of Florida's "super-creative core." These are the occupations that, by Florida's standards, require the highest levels of creativity. In Table 6, we show that the proportions of employment in technical occupations within the creative core (e.g., computer and mathematical, architecture and engineering) are much higher in metropolitan counties than in non-metropolitan areas. On the other hand, the proportion of educators and related occupations is higher in non-metropolitan counties than in cities.

These differences in the creative economy across metropolitan and non-metropolitan counties may influence both aspects of the "social returns" to creativity captured in our empirical analysis. The technical (creative) occupations in greater abundance in cities tend to pay high wages, which could result in a larger impact of creativity on earnings in metropolitan counties. In addition, knowledge spillovers among workers may be more likely to spur productivity and enhance earnings in "technical creative places" than in creative places with a higher concentration of non-technical occupations.

To investigate this possibility, we calculate a "mathematics score" to distinguish between "technical" and "non-technical" creative places. This variable is based on a question from the O*NET survey that reads: "What level of mathematics is needed to perform your current job?" Like the O*NET question that we used to calculate the county-level creativity scores, this survey

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[8] We hope to address the issue of spatial dependence in the metropolitan versus non-metropolitan context in future research.

Table 5. Effects of Creativity on Labor Earnings in U.S. Metropolitan and Non-Metropolitan Counties

Variable	Descriptive Statistics and Estimated Coefficients			
	Metro Counties		Non-Metro Counties	
Constant	NA	-27,595*** (-5.915)	NA	31,443*** (10.41)
Creativity	2.618 [0.183]	19,724*** (13.05)	2.452 [0.128]	-2,264** (-2.041)
Population density	578.4 [1,744]	0.786*** (6.998)	44.21 [48.12]	23.65*** (9.543)
Education	0.147 NA	2,031*** (3.044)	0.124 NA	974.9*** (2.649)
January temperature	35.71 [11.76]	-7.017 (-0.353)	32.08 [12.72]	-26.57*** (-2.671)
January sunlight	148.1 [33.56]	-16.80*** (-2.758)	151.4 [33.95]	-16.62*** (-5.049)
July humidity	60.00 [12.89]	19.66 (1.333)	54.93 [15.6]	-30.24*** (-3.741)
Water coverage	7.649 [14.11]	11.11 (0.803)	4.184 [10.95]	21.85** (2.170)
Museums per capita	0.335 [0.157]	643.1 (0.471)	0.424 [0.411]	31.33 (0.103)
Crime rate	0.034 [0.019]	32,862*** (3.098)	0.023 [0.014]	34,309*** (4.343)
Manufacturing base	0.052 [0.021]	82,480*** (8.088)	0.051 [0.025]	8,255* (1.670)
Tourism base	0.077 [0.018]	-8,766 (-0.769)	0.087 [0.032]	-11,807*** (-3.198)
R-squared	NA	.466	NA	.137
Number of observations	754	754	1,713	1,713

Notes: Descriptive statistics are shown to the left of the regression coefficients. In the column of descriptive statistics, standard deviations are shown in brackets below mean values. Figures shown in parentheses under the estimated coefficients are t-statistics. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

question asks respondents to rate the level of mathematics required on a scale of 1 to 7.[9] We used this information along with county-level employment data in 92 occupations to calculate an average mathematics score for each U.S. county.

We found a much higher correlation between the creativity and mathematics scores in metropolitan counties (r = 0.91) than in non-metropolitan counties (r = 0.70). Along with the information shown in Table 6, this provides additional evidence that the composition of the creative economy differs between metropolitan and non-metropolitan areas. Further, the very high correlation uncovered between the creativity and mathematics scores in metropolitan counties suggests that, in cities, "creative places" and "technical creative places" are largely one and the same.

In Table 7, we present empirical results on the relationship between county-level labor earnings and mathematics skills in the workforce, a proxy

[9] The mathematics variable is a "basic skill," whereas the creativity variable is a "generalized work activity" in the O*NET model.

Table 6. Proportion of Employment in Florida's "Super-Creative Core"

	Average % of Total Workforce	
Segment of Florida's "Super-Creative Core"	Metropolitan Counties	Non-Metro Counties
Computer and mathematical occupations	2.046	0.583
Architecture and engineering occupations	2.015	1.056
Life, physical, and social science occupations	0.855	0.603
Education, training, and library occupations	5.607	5.963
Arts, design, entertainment, sports, and media occupations	1.533	0.980
Total "Super-Creative Core"	12.056	9.185

Table 7. Effects of Mathematics Skills on Labor Earnings in U.S. Counties

	Estimated Coefficients			
Variable	Entire U.S.	Entire U.S.	Metro	Non-Metro
Constant	-51,118*** (-16.04)	-39,848*** (-11.86)	-63,567*** (-9.019)	-741.0 (-0.163)
Mathematics skills	24,706*** (24.64)	21,409*** (20.68)	27,967*** (13.59)	8,455*** (5.838)
Population density	0.783*** (14.95)	0.755*** (14.67)	0.685*** (11.78)	24.63*** (10.01)
Education	1,308*** (4.116)	735.0** (2.446)	2,564*** (3.977)	105.8 (0.334)
January temperature	57.25*** (6.843)	44.89*** (3.448)	19.05 (0.994)	16.47* (1.740)
January sunlight	-20.97*** (-7.211)	-18.39*** (-4.195)	-10.21* (-1.645)	-17.17*** (-5.511)
July humidity	4.745 (0.689)	7.235 (0.692)	-5.627 (-0.375)	-28.35*** (-3.678)
Water coverage	32.51*** (3.930)	31.43*** (3.558)	19.51 (1.437)	26.59*** (2.621)
Manufacturing base	24,429*** (6.398)	12,042*** (2.958)	53,135*** (5.560)	11,935*** (3.039)
Tourism base	-7,205** (-2.244)	-15,537*** (-4.824)	18,084 (1.537)	-7,117** (-2.259)
Lambda	NA	0.467*** (20.26)	NA	NA
R-squared	.378	.469	.463	.133
Number of observations	2,981	2,980	803	2,177

Notes: Figures shown in parentheses are t-statistics. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

for "technical creative places." The control variables included in the regressions are similar to those from the model (right-hand column of Table 4) used in our earlier analysis to account for spatial error dependence. The first two regressions shown in Table 7 use data for (almost) all

U.S. counties, but they differ in the treatment of spatial dependence. Results shown in the next two columns apply to metropolitan and non-metropolitan counties.

Empirical results from all four regressions reveal a positive relationship between labor earnings and the average level of mathematics in the labor force. The positive effect of mathematics skills on earnings in metropolitan counties is not surprising given our previous results and the high correlation between the creativity and mathematics scores in cities. However, unlike our regression analysis focusing on workforce creativity, we also found that mathematics skills in the workforce enhance earnings in non-metropolitan counties. This suggests that "technical workforce creativity" enhances earnings in metropolitan and non-metropolitan counties.

Summary and Conclusions

The empirical analysis presented in this paper reveals several key findings related to the creative economy and earnings in U.S. counties. First, most of the counties with the highest creativity scores are part of cities. Almost one-third of the counties included in the Top 25 list (Table 2) belong to the New York City and Washington, D.C., metropolitan areas. On the other hand, only one non-metropolitan county makes the list of the top 25 counties with the highest creativity scores. Second, our descriptive analysis of the data shows that the average payroll per worker in the 25 most creative counties is more than $20,000 higher than the average across all U.S. counties.

Our regression results suggest that, other things being equal, workforce creativity has a positive effect on county-level earnings. For example, one of our regression models shows that a 10 percent increase in a county's creativity score is associated with 12 percent higher earnings. However, in our initial analysis, the effects of workforce creativity on county-level earnings appear to be primarily an urban phenomenon. We found a positive relationship between earnings and workforce creativity in metropolitan areas, but that creativity has a negative effect on earnings in non-metropolitan counties.

We offer a few explanations for why, in our initial analysis, workforce creativity does not enhance earnings outside of cities. First, as discussed in the previous section, the composition of the creative economy differs between cities and non-metropolitan areas. In cities, we found that "creative places" are largely indistinguishable from "technical creative places." Unlike our initial analysis that did not uncover a high-creativity wage premium in non-metropolitan areas, a different set of regressions found that "technical workforce creativity" has a positive effect on earnings in metropolitan and non-metropolitan areas. As noted earlier in the paper, this may be capturing the earnings received by members of the (technical) creative class, as well as earnings received by non-creative workers in "technical creative places."

Second, it is possible that the high density of economic activity present in big cities is necessary to facilitate the flow of ideas among creative individuals, and between creative and non-creative workers (Jacobs 1969). This notion is consistent with theories of urbanization and knowledge spillovers that have been used to explain other aspects of the urban-rural wage gap (Glaeser and Mare 2001, Glaeser 1999). Third, limitations of the dataset used in the analysis, such as the omission of self-employed individuals (e.g., "Lone Eagles"), may have resulted in the unexpected finding that workforce creativity has a negative effect on county-level earnings in non-metropolitan areas.

To conclude, our results generally show a positive relationship between county-level earnings and workforce creativity. This finding is likely capturing the effects of "technical workforce creativity" on earnings. Future work on this topic could attempt to separate the social returns to workforce creativity found in this paper into the earnings received by creative and non-creative workers. Another promising topic for future study would be to investigate, in more depth, differences between "technical" and "non-technical" creative places in metropolitan and non-metropolitan areas.

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