Economic Geography 79(4): 365–386, 2003.

Does Place Still Matter? Accounting for Income Variation Across American Indian Tribal Areas

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Abstract: Persistent poverty is frequently identified as a key problem on American Indian tribal lands in the United States. Yet the fact that tribal lands tend to be located in isolated, nonmetropolitan areas suggests that relatively lower levels of per capita income in tribal areas may be due largely to locational factors, such as the lack of access to markets, the absence of agglomeration economies, and an inadequate infrastructure. The study presented here explored the role of location-specific factors and other characteristics in accounting for variation in income levels between tribal and nontribal areas and across different types of tribal areas. The results suggest that location indeed plays a significant role in accounting for variation in income across both tribal and nontribal areas, but that human capital, demographics, and structural factors also matter. In particular, college-educated and retirement-age shares of the population have a positive effect on income levels in all areas, while unemployment rates and shares of the population that are American Indian have a negative effect in all areas. The results further indicate that once locational, structural, and demographic factors are controlled, tribal areas do not have significantly lower levels of income than do other areas. The lower income levels found in tribal areas may thus be understood as a function of location, industrial structure, human capital, and demographics, rather than as a reflection of problems that are inherent only in tribal areas.

Key words: Native American; economic development; regional income; poverty.

Persistent poverty in remote rural areas is an enduring problem in both advanced and developing nations. In the United States, persistent rural poverty is especially evident in areas containing American Indian tribal lands, many of which are also afflicted by poverty-related problems, such as high rates of infant mortality and substance abuse.[1] Yet the fact that tribal lands are primarily located in remote rural regions suggests that the relatively lower per capita incomes in tribal areas may be largely a function of factors, such as the lack of access to markets, an inadequate infrastructure, and a lower cost of living. Although the role of such spatial factors in explaining differential regional

[1] Although the majority of tribal areas suffer from these types of problems, it is important to recognize that there have been a number of tribal "success stories." Tribes like the Mississippi band of Choctow Indians, the Winnebago tribe of Nebraska, and the Salish-Kootenai tribe from Montana have excelled economically in recent years and have become significant employers in their respective regions and elsewhere ("Tribal Pursuit" 2002).

I thank David Listokin, Kris Rengert, Juliet King, Leanna Arrowchis, Ken Goosens, and three anonymous reviewers for their many helpful comments and suggestions on earlier drafts. I also thank Miho Kitaguchi, Julie Silva, and Bernie Jamroz for research assistance and Mike Siegel for cartographic assistance. The views and opinions expressed in this article are mine alone.

development is receiving renewed attention within the geographic and economic literatures (e.g., Glasmeier 2002; Levernier, Partridge, and Rickman 2000; Glasmeier and Wood 2001; Ravillion and Wodon 1999; Henninger 1998), there has been no systematic examination of the role of these types of factors in accounting for differences in income between tribal and nontribal areas or across different types of tribal areas. In light of the continuing problems of persistent poverty in many tribal areas despite—or perhaps as the result of—decades of federal policy initiatives that were intended to alleviate those conditions, additional consideration of these issues is merited.

The mapping and spatial analysis of patterns of regional poverty have long been a hallmark of research in economic geography. Early studies of this type, such as those of Morrill and Wohlenberg (1971) and Smith (1973), provided systematic documentation of spatial patterns of concentrated poverty across regions and within urban areas of the United States. These studies also represent some of the first efforts to incorporate spatial, economic, and social variables into the multivariate analyses of regional poverty. A number of more recent multivariate studies have also considered the determinants of differential levels of income and poverty across U.S. counties and rural areas (e.g., Albrecht, Albrecht, and Albrecht 2000; Glasmeier and Wood 2001; Glasmeier and Fuellhart 1998; Levernier, Partridge, and Rickman 2000; Manson and Groop 1990). This more recent work has suggested that regional patterns of poverty tend to be persistent over time and can be explained by a combination of locational, structural, and demographic factors, including, for example, market size, the presence of natural amenities, industrial composition, and the shares of retirees in the population.

Multivariate analyses of the determinants of income levels and poverty rates across U.S. tribal areas have been more limited and have tended to pay relatively little attention to locational factors. These studies have instead emphasized the importance of human capital and institutional factors, particularly the educational attainment of the population and the structure of tribal governance, in accounting for differences across tribal areas (Cornell and Kalt 1992, 2000; Kingsley et al. 1996). These studies of tribal areas have not attempted to account for differences in income and poverty rates between tribal and nontribal areas.

In addition to statistical analyses, there is also a wealth of case-study research on persistent rural poverty in major regions of the United States including tribal areas. Studies of poverty in regions like Appalachia and the Mississippi Delta have stressed the role of historical and sociocultural factors in accounting for persistent rural poverty. The work of Duncan (1999) and Gaventa (1980) is valuable in this regard, demonstrating that persistent poverty in both Appalachia and the Mississippi Delta is largely a legacy of the coal and plantation economies that existed in these regions during the nineteenth century. The inequitable power structures that emerged historically in these regions have been perpetuated by racial and income-based segregation and by the lack of supportive and inclusive local institutions. Case studies of tribal areas have also emphasized the importance of historical legacy, particularly federal Indian policy, in accounting for present-day tribal poverty. Duffy and Stubben (1998), for example, traced the history of federal Indian policy initiatives since the late nineteenth century, arguing that these initiatives have not only been ineffective in alleviating poverty, but have actually exacerbated problems of underdevelopment in tribal areas. Kodras (1997) further demonstrated that the locational disadvantages experienced by tribal populations are largely the result of deliberate federal-level decisions. Kodras (1997, 87) noted that "the historical choice of remote location has isolated the reservation from urban markets, and the legacy of federal neglect has left an infrastructure base insufficient for development."

Case-study research on tribal areas has also suggested that contemporary tribal economic conditions are associated with social and cultural factors that either support or hinder the acceptance of formal and informal social and economic institutions

(Pickering 2000; Mushinski and Pickering 2000; Duffy and Stubben 1998; Vinje 1996; Trosper 1996; Anderson 1995). Although the cultural independence of American Indians has often been regarded (by non-Indians) as a major obstacle to economic development in tribal areas (see Frantz 1999), recent studies, such as those by Pickering (2000) and Anderson (1995), have found that adherence to cultural traditions and institutions may be an important coping strategy for tribal populations who live in marginalized situations. For example, Pickering noted that the Lakota Indians of South Dakota have limited access to formal wage employment and often face poor working conditions. Lakota cultural ties, manifest through family and community networks, provide a crucial safety net that enables tribal members to cope with the uncertainty of wage work off the reservation and, if necessary, allows them to leave jobs with unacceptable working conditions. Home-based production of cultural artifacts, which are often used for barter with other tribal members, also provides a means of survival outside the formal economy (Pickering 2000).

Taken together, the cross-sectional and case-study research on regional and tribal poverty has yielded important insights into the determinants of variation in income and poverty levels, as well the causes of persistent poverty. As I noted earlier, however, these studies have paid limited attention to the role of locational and other factors in accounting for differences in income between tribal and nontribal areas or across different types of tribal areas. The study presented here addressed those issues asking (1) are there significant differences in per capita income between tribal and nontribal areas after locational and other characteristics are controlled? and (2) among different types of tribal areas, what is the role of locational versus other factors in accounting for variation in per capita income?

The need for additional attention to poverty in remote rural regions, such as those containing American Indian tribal lands, has become especially apparent in light of recent observations that regional differences in income appear to persist and may actually be growing worse as the result of economic globalization, which tends to channel new investments into areas with high concentrations of advanced service industries and a large number of highly skilled workers (Glasmeier 2002; O'Brien and Leichenko 2003; Kodras 1997). As globalization proceeds, tribal areas may be among those that are the most likely to be left behind because of lower levels of human capital, poor access to markets, poor infrastructure, and other constraints.

The next section describes patterns of income variation across U.S. counties, focusing on differences between those counties that contain tribal areas and those that do not. The third section considers several bodies of theoretical literature on regional variation in income and spatial concentration of poverty. The fourth section develops an empirical model for evaluating income variation between tribal and nontribal areas and across different types of tribal areas. The fifth section describes the results of the empirical analysis, and the final section presents my conclusions and discusses some directions for further research.

Income Patterns Across Tribal and Nontribal Areas

American Indians are often referred to as the United States' most rural minority (Snipp 1995). Recently released data from the 2000 U.S. census suggest that this characterization remains appropriate. In 2000, approximately 2.4 million people defined themselves as members of the American Indian race alone.[2] Of that population, just over 1

[2] I use the category American Indian race alone for comparative purposes because the vast majority—approximately 90 percent, according to the U.S. Bureau of the Census (2002)—of American Indians who were living in tribal areas in 2000 characterized themselves in this manner. Because the analysis also draws on the 1990 census, which did not allow for multiple racial categories, the "race alone" category helps ensure comparability between the 1990 and 2000 data.

million, or 42 percent, lived in nonmetropolitan counties, compared to less than 20 percent of the U.S. population (U.S. Bureau of the Census 2002).

The rural concentration of American Indians appears to be even more pronounced when American Indians who live on and around tribal areas are considered. The definition of *tribal lands* used in the study includes all American Indian areas recognized by the U.S. Bureau of the Census. In 2000, these areas in the continental United States included nationally and state-recognized reservation and trust areas, Oklahoma Tribal Statistical Areas (OTSAs), Tribal Designated Statistical Areas (TDSAs), and State Designated American Indian Statistical Areas (SDAISAs).[3] Approximately 1.5 million American Indians (defined by race alone) live either in a state or nationally recognized tribal area or in an area immediately surrounding a tribal area (i.e., within a county containing a tribal area). Of this population, approximately 57 percent live in nonmetropolitan counties.

In addition to being the most rural minority group in the United States, American Indians are also among the poorest segments of the U.S. population. In 1990, per capita income levels for American Indians were $8,284, less than 60 percent of the U.S. average of $14,420. Problems of lower income levels are especially evident in and around Indian tribal areas, where, as I illustrate later, average per capita income levels are consistently below the U.S. average.

Classifying Tribal and Nontribal Counties

In evaluating and comparing the determinants of income variation across tribal and nontribal areas, I used the county as the basic unit of analysis. The use of county-level data has two major advantages: it allows for a comparison of areas containing tribal lands with similar areas that do not contain tribal lands, and it provides a more inclusive spatial unit of analysis than reservation and trust-area boundaries. The region immediately surrounding a tribal area often contains substantial populations of American Indians who are affiliated with the proximate tribe (Kingsley et al. 1996). The use of county, rather than tribal-area, boundaries captures these proximate-residing American Indians in the comparison of tribal versus other areas. However, it also has some important limitations. First, county-level data limit the focus of the study to the population living in the county and do not separate American Indians living in tribal areas from members of other racial or ethnic groups. Second, county-level data do not allow for intracounty variation between tribal and nontribal areas. The use of county-level indicators for variables such as the quality of the infrastructure may hide variation within counties between tribal and nontribal areas.

To facilitate an exploration of income patterns across tribal and nontribal counties and across different types of tribal counties, I separated counties into several categories (see Table 1). First, I distinguished between counties that contain tribal lands and counties that do not (i.e., tribal counties versus nontribal counties). On the basis of this broad definition, I identified 367 counties in the continental United States that contain tribal lands and 2,743 counties that do not. Next, I made finer distinctions among tribal counties on the basis of whether the tribal county contains a federally or state-recognized reservation and trust area versus another type of tribal statistical area without a land base that includes either an OTSA, a TDSA, or a SDAISA. (The nonreservation and trust tribal areas are referred to as OTSA-TDSA areas.) Among the 367 tribal counties, 263 contain a reservation and trust area and 104 contain an OTSA-TDSA area. Finally, I separated tribal counties according to the American

[3] The analysis is limited to the continental United States to ensure as much comparability among counties as possible. Although both Alaska and Hawaii contain American Indian tribal areas (or Native areas), their economies are relatively separate from that of the continental United States.

Table 1

Distribution of Tribal Counties by Metropolitan or Nonmetropolitan Location

Type of Tribal County	All Types	Reservation and Trust Area	OTSA-TDSA Area
Tribal counties (U.S. counties containing tribal lands)	367	263	104
Located in a metropolitan area	82 (22%)	55 (21%)	27 (26%)
Located in a nonmetropolitan area	285 (78%)	208 (79%)	77 (74%)
Nontribal counties (U.S. counties not containing tribal lands)	2,743	—	—
Located in a metropolitan area	751 (27%)	—	—
Located in a nonmetropolitan area	1,992 (73%)	—	—
Tribal counties in which the AI population accounts for at least 5 percent of the total county population (AI5share)	156	103	53
Located in a metropolitan area	11 (7%)	4 (4%)	7 (13%)
Located in a nonmetropolitan area	145 (93%)	99 (96%)	46 (87%

Indian (AI) share of the total county population. I identified tribal counties in which American Indians account for at least 5 percent of the population (156 total) as "AI5share" counties. These various county groupings are used in the descriptive and mapping exercises that follow and again later in the regression analysis.

The Location and Income Levels of Tribal Counties

As Figure 1 illustrates, tribal counties are generally located in the western half of the United States. This locational pattern is primarily a function of the implementation of forced-relocation polices during the nineteenth century by which American Indians from many areas of the eastern United States were relocated to reservation areas west of the Mississippi River. The distribution of tribal counties by rural location is shown in Table 1. The table indicates that the vast majority (78 percent) of counties that contain tribal areas are rural counties. The definition of *rural* used in the study corresponds to the definition used by the U.S. Bureau of the Census; rural counties are those that are not part of a metropolitan area. (The terms *rural* and *nonmetropolitan* are used interchangeably, as are the terms *urban* and *metropolitan*.) Among the nontribal counties in the continental United States that were included in the study, 1,992 (73 percent) fall into the category of rural, while 751 (27 percent) fall into the category of urban. Table 1 further illustrates that tribal counties with higher AI shares of the total population are overwhelmingly located in nonmetropolitan areas. Among the tribal counties in which AI shares of the total population are at least 5 percent, more than 90 percent are in nonmetropolitan areas.

Table 2 presents the mean per capita income levels across different categories of counties, including metropolitan and nonmetropolitan, and tribal and nontribal, and different categories of tribal counties in 1999. The largest absolute differences between county groups were between metropolitan and nonmetropolitan counties. In 1999, nonmetropolitan counties had average incomes of $20,616, approximately $6,000 lower than metropolitan counties. Among tribal counties, per capita incomes averaged approximately $21,068, more than $1,200 (5 percent) lower than nontribal counties for that year. Among the tribal counties with greater than a 5-percent AI population (AI5share), per capita incomes were still lower, averaging approximately $18,600, or more than $3,500 (19 percent)

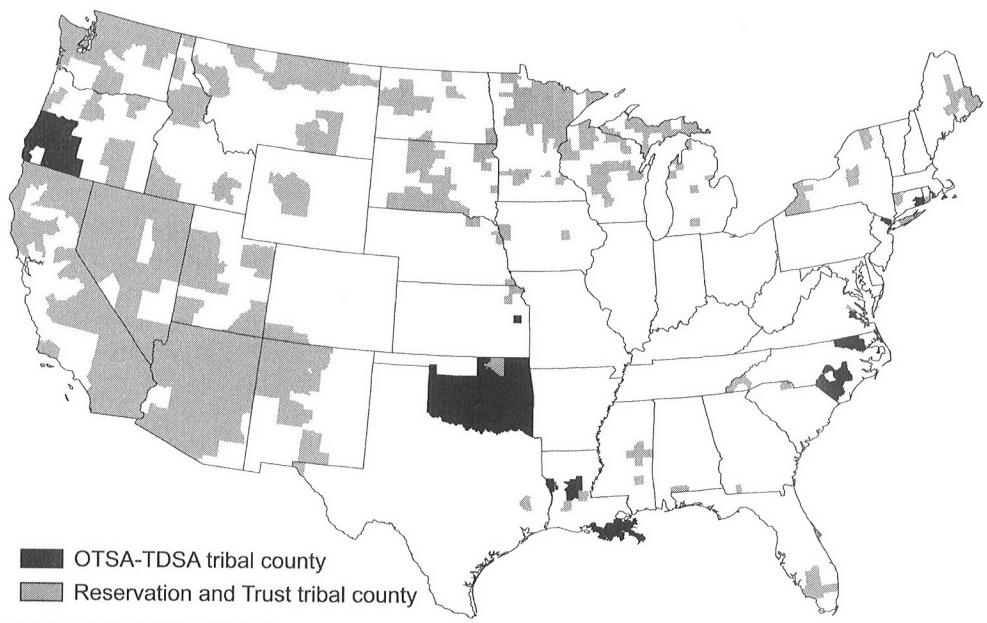

Figure 1. Location of tribal counties in the United States.

below the U.S. county average. Table 2 also distinguishes between tribal counties that contain federally and state-recognized reservation and trust areas and those that contain OTSA-TDSA areas. Per capita incomes tend to be higher in counties with reservation and trust areas than in those with OTSA-TDSA areas.

Table 2

Per Capita Income Across U.S. Counties

	n	Per Capita Income (dollars, 1999)
All counties (continental U.S.)	3,077	22,138
Metropolitan counties	816	26,358
Nonmetropolitan counties	2,261	20,616[a]
Nontribal counties	2,743	22,282
Tribal counties	367	21,068[b]
Reservation and trust areas	263	21,465
OTSA-TDSA area	104	20,071[c]
Tribal counties with 5 percent or more AI population	156	18,649[d]
Reservation and trust area	103	18,902
OTSA-TDSA area	53	18,156

Source: U.S. census (2000); calculations by author.

[a] The difference between the means for nonmetropolitan and metropolitan counties is statistically significant at the .05 level.

[b] The difference between the means for tribal and nontribal counties is statistically significant at the .05 level.

[c] The difference between the means for OTSA-TDSA and reservation and trust counties is statistically significant at the .05 level.

[d] The difference between AI5share counties and all other tribal counties is statistically significant at the .05 level.

Difference-of-means tests among metropolitan and nonmetropolitan, tribal and nontribal, and AI5share tribal counties and other tribal counties indicate that these differences in per capita income are statistically significant in all cases (see Table 2).[4] With regard to reservation and trust and OTSA-TDSA counties, difference-of-means tests indicate that the differences in the per capita incomes of these two groups are statistically significant across all tribal counties, but are not statistically significant across AI5share counties. On the basis of the results of the difference-of-means tests, I estimated regression models for all counties, metropolitan counties, nonmetropolitan counties, tribal counties, AI5share tribal counties, reservation and trust tribal counties, and OTSA-TDSA tribal counties.

Income patterns across all counties are further shown in Figure 2. As suggested by the literature on persistent poverty, concentrations of low-income counties are apparent throughout Appalachia and the Mississippi Delta. Other areas of spatially concentrated low-income counties include the South-Central region, which encompasses much of Missouri and Oklahoma, the Southwest, and the Upper Great Plains. A comparison of Figures 1 and 2 confirms that many of the low-income counties are tribal counties. The most prominent concentrations of low-income tribal counties are in South Dakota, the Four Corners region of the Southwest, and southeastern Oklahoma.

[4] The results of the difference-of-means tests are available from the author upon request.

Theories of Regional Income and Poverty

As I noted earlier, the issue of regional variation in income and poverty has long been a topic of interest in geography and related fields. Within the economic and economic geography literatures, major competing theoretical explanations for differential regional levels of income may be separated into two broad categories. The first category includes equilibrium-based theories, such as neoclassical growth theory,

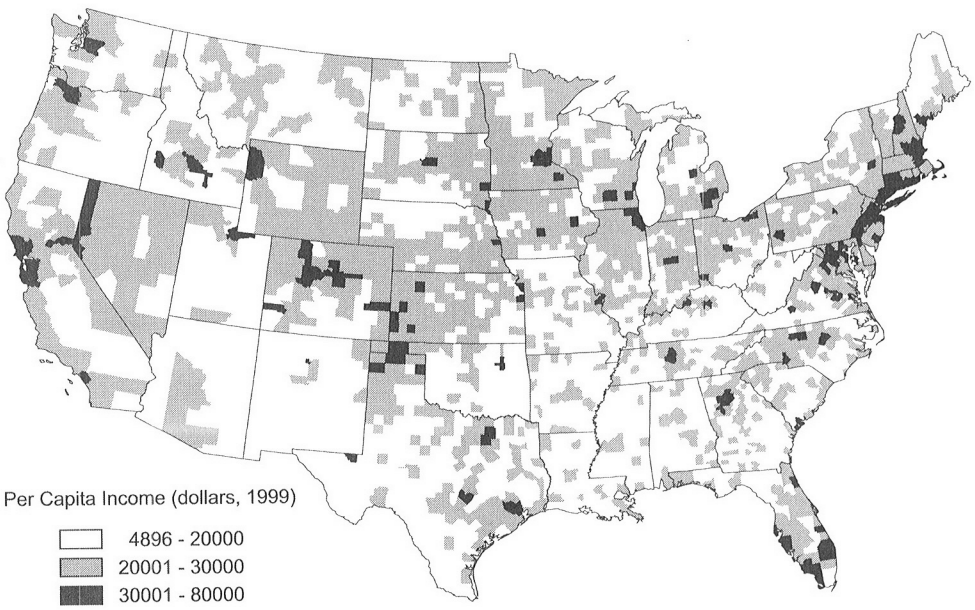

Figure 2. Per capita income in U.S. counties in 1999. *Source:* U.S. Bureau of the Census 2000.

factor endowment theory, and theories of compensating wage differentials. These theories emphasize the role of endowments of technology, physical and human capital, and natural amenities in accounting for differential per capita income and wage levels across regions (Borts and Stein 1964; Barro and Sala-i-Martin 1992; Roback 1982). Equilibrium-based theories suggest that regional differences should gradually disappear as factor mobility narrows differences in wages and returns to capital (Rural Sociological Society Task Force 1993).

The second category includes disequilibrium-based theories, such as theories of cumulative causation, growth poles, and industrial localization, all of which emphasize the role of agglomeration economies in providing some regions with permanent cost advantages over other regions (Myrdal 1957; Kaldor 1970; Krugman 1991; Storper 1997). In contrast to equilibrium theories, disequilibrium theories suggest that income differences among regions are likely to persist and even widen over time. Despite these different predictions about long-term regional income patterns, an important similarity between both approaches is the emphasis on the characteristics of location, including endowments, natural amenities, and agglomeration economies, in accounting for variation in income.

The related issue of the persistence of spatially concentrated poverty has also been of long-term interest within the fields of urban geography, sociology, and urban economics. Much of the early literature on the causes of poverty focused on individuals and families and emphasized the role of a "culture of poverty" and lower expectations of status attainment as causes of persistent poverty. This early work, which was conducted primarily by sociologists, suggested that persistent, concentrated poverty is associated with individual-level factors, such as lower expectations of educational achievement for poor children, lower employment aspirations among poor adults, and negative attitudes toward work (Lewis 1966). The second strand of research on poverty emphasizes the role of structural economic factors in accounting for variation in poverty rates across locations. This work includes, for example, theories of dual labor markets, dual economies, and spatial mismatch. Such theories, which have been applied mainly to urban settings, suggest that structural factors, such as occupational segmentation between high-paying primary-sector jobs (industries) and low-paying secondary-sector jobs (industries) and the relocation of manufacturing industries out of urban areas, help to account for the persistence of concentrated poverty (Kodras 1997; Jensen 1994; Massey and Eggers 1990; Kasarda 1985).

The third strand of poverty research relates individual and structural factors. These linkages are epitomized in the work of Wilson (1987), who suggested that structural forces, including the decline and relocation of manufacturing jobs and the growth of low-wage service-sector jobs, have caused a decline in the number of jobs available to men that would allow them to support their families. This situation, in turn, has led to family structures that include a large number of female-headed households, thus promoting patterns of persistent poverty (Albrecht, Albrecht, and Albrecht 2000). Cutler and Glaeser (1997) elaborated on the interaction between structural and individual factors by demonstrating the importance of racial segregation in accounting for poorer economic outcomes of African-American residents in U.S. cities. They found that African Americans who live in more-segregated communities have significantly lower educational attainment and lower incomes than do African Americans who live in less-segregated areas. Cutler and Glaeser attributed these findings to a combination of structural factors, including spatial mismatch; individual factors, such as exposure to less-educated people; and an independent, and less well understood, segregation effect. This apparent convergence across the various urban poverty literatures, noted by Albrecht, Albrecht, and Albrecht (2000), suggests that individual factors, structural factors, and demographic conditions should be taken into

account in modeling regional variation in income.

In addition to these factors, an emerging area of literature is emphasizing the role of social capital in accounting for differential regional incomes (Warren, Thompson, and Saegert 2001). Social capital may be broadly defined as the formal and informal networks that allow individuals to act collectively (Woolcock and Narayan 2000). Empirical studies of the influence of social capital on differential levels of regional income have been performed across countries and across regions in individual countries, including the United States, Canada, and the European Union (Bryden forthcoming; Reimer 2002; Rupasingha, Goetz, and Freshwater 2002; Helliwell and Putnam 2000; Narayan and Pritchett 2000; Knack and Keefer 1997). These studies have generally supported the idea that social capital plays a significant role in accounting for regional variation in economic performance. Although direct tests of the relationship between social capital and income across tribal areas have not yet been performed, the literature on poverty in tribal areas, discussed earlier, has also demonstrated that conditions that may promote or foster social capital in tribal areas, such as tribal sovereignty and strong local governance, play an important role in explaining why some tribal areas are more economically successful than others (Duffy and Stubben 1998; Cornell and Kalt 2000).

Modeling Approach

The various literatures have suggested that a general model to account for variation in regional income should incorporate locational, structural, individual, demographic, and social capital characteristics. Area variation in per capita income may thus be modeled as

$$\text{per capita income} = \begin{array}{l} f(\text{location-specific factors,} \\ \text{structural factors,} \\ \text{individual factors,} \\ \text{demographics, social capital}) \end{array} \quad (1)$$

The dependent variable is the per capita income in the county in 1999, estimated in log form. The explanatory variables are defined in Table 3 and are discussed next.

Location-specific factors, which are emphasized in the regional economic and geographic literatures, include proximity to a metropolitan area, the presence of agglomeration economies, the quality of the transportation infrastructure, the cost of living, and natural amenities, such as a temperate climate.[5] Structural factors, which are stressed in both the regional economic and urban poverty literatures, provide a link between a region's economy and the national and international economies. They include shares of industries in different economic sectors and unemployment rates. Individual-specific characteristics and demographics are emphasized in the urban and tribal-area literatures. Individual-specific factors include human-capital qualities, such as the level of educational attainment, and demographic characteristics include the share of the population that is dependent and racial segregation (in this case, the share of the county population that is American Indian). Social capital is also increasingly recognized as playing an important role in regional variation in income. Although social capital is more difficult to quantify than is locational or other factors, measures of conditions that promote social capital may include control over land resources and the presence of collective economic activities, as will be discussed shortly.

Because the aims of the study were to account for differences between tribal and nontribal areas and differences across tribal

[5] Physical amenities vary widely across the United States. To capture this variation, I used a natural amenity variable that is a composite index developed by the U.S. Department of Agriculture (McGranahan 1999), which is based on criteria related to climate, topography, and area of surface water within the county. Counties with temperate climate, varied topography, and access to either coastal waters or rivers and lakes have higher amenity rankings, whereas counties that lack one or more of these attributes have lower rankings.

Table 3

Definitions of Explanatory Variables

Variable Name	Definition
Locational Factors	
Census region	Indicator of location in one of nine major census regions: Middle Atlantic (base), New England, Southeast, South-Central, Great Lakes, Great Plains, Mountain West, Southwest, and West Coast
Isolation	Indicator of location in a nonmetropolitan area
Agglomeration	Population density (population per square mile)
Adj. to MSA	Indicator of location in a nonmetropolitan county that is adjacent to and functionally linked to a metropolitan area
Natural Am.	Natural amenity index score (see footnote 5)
Interst. Dens.	Density of interstate highways per square mile
Road Dens.	Density of primary roads per square mile
Structural Factors	
Manuf. Sh.	Manufacturing and construction share of employment
Ag-Res. Sh.	Agricultural and natural resources share of employment
Federal Sh.	Federal share of employment
Unemp. Rate	Unemployment rate
Individual Factors	
H.S. Grad	Share of the population that has graduated from high school
College Grad	Share of the population that has graduated from college
Demographic Factors	
Retired	Share of the population that is over age 64
Child	Share of the population that is under age 18
Percentage AI	Share of the population that is American Indian
Tribal Factors	
Tribal	Indicator of the presence of a tribal area in a county
Tribal-AI5sh	Indicator of the presence of a tribal area in a county with an American Indian share of at least 5 percent
OTSA-TDSA	Indicator of the presence of an OTSA-TDSA area in a county
Casino	Indicator of the presence of an American Indian casino in a county
Gaming Revenue	Estimated annual revenue (in millions) from Indian casinos in a county

areas, I modified the general model in two ways. First, to evaluate differences between tribal and nontribal areas, I included indicators of tribal area:

$$\text{per capita income} = f(\text{location-specific factors, structural factors, individual factors, demographics, tribal-area indicators}) \quad (2)$$

The inclusion of indicators of tribal area in equation 2 allowed me to assess whether tribal areas are different from other areas after a broad range of potential determinants of income were controlled. Two alternative tribal-area indicators are included. The first provides a simple indication of whether the county contains a tribal area of any size (via the indicator variable, tribal). The second, AI5share, identifies tribal areas in regions with a larger AI population. It applies to those counties that contain a tribal area and have a population that is at least 5-percent American Indian (see Table 3).

To evaluate the determinants of income variation across different types of tribal counties, I next modified the general model (equation 1) as

$$\text{per capita income} = f(\text{location-specific factors, structural factors, individual factors, demographics, tribal-area social capital}) \quad (3)$$

The inclusion of tribal-area social capital in equation 3 allowed me to differentiate

between tribal areas that have traits that are conducive to the formation of social capital and those that do not. I used two types of measures to reflect the capacity of a tribal area to engage in collective action. The first is a measure of the nature of control over land area. As I described earlier, tribal areas may be separated into reservation and trust areas and statistical areas (OTSA-TDSAs). Reservation and trust areas generally have a land base, have some degree of political sovereignty, and have access to various governmental benefits, such as federal aid for education. Consequently, these areas would be expected to have a higher capacity to engage in collective action than would OTSA-TDSA areas and to have higher levels of income. The second type of social-capital indicator measures whether or not a tribal county contains an American Indian casino or casinos and the revenue from the casino or casinos. Gaming has become a major source of revenue for many tribal areas, and the revenues from tribe-owned casinos are shared by the members of a tribe (d'Hauteserre 1998). The existence of a tribe-owned casino is thus one indicator that a tribal area has the capacity to engage in collective economic activity. In using casinos as an indicator of social capital, it is important to recognize that the net economic and social impacts of casinos for tribal areas may not necessarily be positive (Fixico 2001). Nonetheless, the existence of a tribal casino suggests that the tribe possesses the types of formal and informal networks that enable collective activity.

Results

Equation 2 is estimated for all U.S. counties, all urban counties, and all rural counties to assess differences between tribal and nontribal counties in each of these major county groups. Equation 3 is estimated for different types of tribal counties, including all tribal counties, tribal counties with high shares of the American Indian population (AI5share counties), reservation and trust tribal counties, and OTSA-TDSA tribal counties. Before I turn to the modeling results, I briefly consider the descriptive statistics and the results of the model-specification tests.

Descriptive Statistics

Table 4 presents the means and standard deviations for most of the explanatory variables included in equations 2 and 3. A comparison of tribal counties versus all counties suggests that, by many indicators, tribal counties are worse off. For example, tribal counties have higher rates of unemployment, lower densities of infrastructure, and higher shares of the population under age 18. It is interesting, however, that tribal counties tend to fare slightly better than do all counties in their share of the population that is college educated. They also generally have higher natural-amenity rankings.

Among the different subcategories of tribal counties, those with high AI shares tend to fare worse than do other counties. Tribal counties that are at least 5-percent American Indian (AI5share) demonstrate lower rates of educational attainment at the college level, a lower density of infrastructure, and higher unemployment rates than do other counties. These counties also have lower shares of employment in manufacturing and higher shares in natural resources and agriculture. A comparison of tribal counties containing reservation and trust areas with those containing OTSA-TDSA areas suggests that reservation and trust areas fare better than do OTSA-TDSA counties on indicators of educational attainment but fare worse in terms of unemployment, infrastructure, and agglomeration. Concerning industrial structure, reservation and trust counties generally have lower shares of manufacturing and higher shares of both agricultural-natural resource and federal civilian employment than OTSA-TDSA counties. Reservation and trust counties also have substantially higher average AI shares of the population than do OTSA-TDSA counties.

Table 4

Means and Standard Deviations of Selected Explanatory Variables[a]

		N	Mean	*SD*
Locational Factors				
Agglomeration[b]	All counties	3,074	88.923	562.607
	Tribal counties	365	36.157	113.914
	Reservation/trust area	261	28.230	69.679
	OTSA-TDSA area	104	56.204	182.191
	Tribal counties with at least 5 percent AI	156	8.232	9.431
Natural Am.[c]	All counties	3,074	3.493	1.043
	Tribal counties	365	4.038	1.320
	Reservation/trust area	261	4.141	1.475
	OTSA-TDSA area	104	3.779	0.750
	Tribal counties with at least 5 percent AI	156	3.910	1.172
Interst. Dens.[d]	All counties	3,074	0.009	0.019
	Tribal counties	365	0.005	0.008
	Reservation/trust area	261	0.004	0.007
	OTSA-TDSA area	104	0.007	0.010
	Tribal counties with at least 5 percent AI	156	0.003	0.006
Road Dens.[d]	All counties	3,074	0.016	0.013
	Tribal counties	365	0.013	0.011
	Reservation/trust area	261	0.014	0.011
	OTSA-TDSA area	104	0.012	0.011
	Tribal counties with at least 5 percent AI	156	0.012	0.010
Structural Factors				
Manuf. Sh.[b]	All counties	3,074	0.255	0.107
	Tribal counties	365	0.215	0.085
	Reservation/trust area	261	0.204	0.083
	OTSA-TDSA area	104	0.244	0.084
	Tribal counties with at least 5 percent AI	156	0.193	0.085
Ag-Res. Sh.[b]	All counties	3,074	0.104	0.095
	Tribal counties	365	0.113	0.088
	Reservation/trust area	261	0.118	0.095
	OTSA-TDSA area	104	0.100	0.062
	Tribal counties with at least 5 percent AI	156	0.138	0.092
Federal Sh.[b]	All counties	3,074	0.032	0.031
	Tribal counties	365	0.046	0.041
	Reservation/trust area	261	0.050	0.046
	OTSA-TDSA area	104	0.035	0.023
	Tribal counties with at least 5 percent AI	156	0.059	0.047
Unemp. Rate[b]	All counties	3,074	0.066	0.030
	Tribal counties	365	0.081	0.036
	Reservation/trust area	261	0.084	0.040
	OTSA-TDSA area	104	0.075	0.021
	Tribal counties with at least 5 percent AI	156	0.095	0.043
Individual Factors				
H.S. Grad[b]	All counties	3,074	0.342	0.062
	Tribal counties	365	0.333	0.051
	Reservation/trust area	261	0.335	0.055
	OTSA-TDSA area	104	0.329	0.038
	Tribal counties with at least 5 percent AI	156	0.333	0.046

(Continued on next page)

Table 4

Continued

College Grad[b]	All counties	3,074	0.136	0.067
	Tribal counties	365	0.137	0.053
	Reservation/trust area	261	0.141	0.052
	OTSA-TDSA area	104	0.128	0.056
	Tribal counties with at least 5 percent AI	156	0.122	0.040
Demographic Factors				
Retired[b]	All counties	3,074	0.158	0.043
	Tribal counties	365	0.153	0.040
	Reservation/trust area	261	0.150	0.040
	OTSA-TDSA area	104	0.162	0.039
	Tribal counties with at least 5 percent AI	156	0.153	0.044
Child[b]	All counties	3,074	0.260	0.033
	Tribal counties	365	0.274	0.042
	Reservation/trust area	261	0.280	0.046
	OTSA-TDSA area	104	0.257	0.024
	Tribal counties with at least 5 percent AI	156	0.287	0.049
Percentage AI[b]	All counties	3,074	0.015	0.062
	Tribal counties	365	0.097	0.156
	Reservation/trust area	261	0.104	0.177
	OTSA-TDSA area	104	0.078	0.079
	Tribal counties with at least 5 percent AI	156	0.199	0.198
Tribal Social Capital Factors				
Casino[c]	Tribal counties	365	0.368	0.483
	Reservation/trust area	261	0.494	0.501
	OTSA-TDSA area	104	0.048	0.215
	Tribal counties with at least 5 percent AI	156	0.327	0.471
Game Revenue[e]	Tribal counties	365	18.529	51.549
	Reservation/trust area	261	24.196	56.866
	OTSA-TDSA area	104	4.197	30.457
	Tribal counties with at least 5 percent AI	156	9.058	22.247

[a] The table does not include indicator variables for nonmetropolitan location (isolation), adjacency to a metropolitan area (adj to msa), tribal areas (tribal, AI5share, OTSA-TDSA), or census region. Metropolitan and nonmetropolitan figures are also excluded because of space constraints. These figures are available from the author upon request.

[b] *Source:* Claritas (2000).

[c] *Source:* McGranahan (1999).

[d] *Source:* Center for Urban Policy Research (2002).

[e] *Source:* National Indian Gaming Commission.

Specification Tests

Before I estimated the regression models, I performed tests for multicollinearity among the explanatory variables via a calculation of multicollinearity condition numbers. The tests indicated that multicollinearity among the explanatory variables is generally not a problem, with condition numbers under 20 in all cases.[6] An examination of the

[6] The multicollinearity condition numbers were calculated with adjustment for the intercept. Such adjustment is appropriate because the intercept term (which represents the omitted Middle Atlantic region) tends to be correlated with other regional dummy variables. One additional variable, transfer payment shares of the total income per county, was also considered for use in the regression models. Correlation tests revealed, however, that this variable was highly correlated with retirement-age shares of the population in most model groups. The results of the multicollinearity and correlation tests are available from the author upon request.

bivariate correlations among the explanatory variables across all counties reinforced this finding. Among all the explanatory variables, only percentage AI and AI5share were found to have a relatively high zero-order bivariate correlation of .685. This high correlation is not surprising, since percentage AI is a measure of the county's population that is AI, and AI5share singles out those tribal counties with a high percentage of the AI population. Because both variables measure similar phenomena, percentage AI was excluded from those models that include the AI5share variable. In the tribal area models, percentage AI was also found to have a high bivariate correlation with child (approximately .75 across all tribal counties). This correlation is a reflection of the relatively younger populations of tribal areas. The child variable was thus dropped from the tribal county models.

Tests for heteroskedasticity and spatial autocorrelation were also performed for each model.[7] The results indicated that heteroskedasticity and spatial autocorrelation were present in all the county groups except the OTSA-TDSA group. The spatial autocorrelation tests also indicated that a spatial-error model was the appropriate correction for spatial autocorrelation: the values for the spatial-error test statistics were larger and more significant in all the cases than were those for the spatial-lag test statistics (which were frequently not significant). To control for spatial autocorrelation and ensure robust estimates in the presence of heteroskedasticity, I estimated all the models (except OTSA-TDSA) as a spatial-error model via generalized method of moments. The OTSA-TDSA model was estimated via ordinary least-squares.

[7] These tests were performed using the Spacestat econometrics package. The heteroskedasticity tests included calculation of the Breusch-Pagan statistic and the Koenker-Bassett statistic. The spatial autocorrelation tests included, among others, Moran's I, the Lagrange multiplier for spatial error, the Kelejian-Robinson for spatial error, and Lagrange and Robust Lagrange Multiplier for spatial lag. The results are available from the author upon request.

Results for All Counties, Rural Counties, and Urban Counties

Model 2 was estimated for all counties, rural counties, and urban counties (Table 5). The results indicate that many of the explanatory variables are significant determinants of county variation in per capita income and that most have the expected sign.

Locational Factors. Locational factors are significant in all three county groupings. In each case, relatively higher costs of living in New England and on the West Coast have a consistently significant positive effect on income levels, as do economies of agglomeration associated with market size. The agglomeration result is consistent with the expectation that areas with larger population concentrations have more job opportunities and hence higher income levels. Concerning the transportation infrastructure, the density of roads and interstate highways has a positive and significant effect across all counties and rural counties, but is not significant in urban counties (likely because the density of the transportation infrastructure is less varied across urban counties). Finally, location in a nonmetropolitan area, a variable that applies only to the all-county model, has a significant and negative effect on income levels.

Structural Factors. Structural variables also play a significant role across all three county groupings. Unemployment rates, which reflect the lack of job opportunities in a county, have a consistently significant negative effect in all the models. The results for the industrial-structure variables are more mixed. Manufacturing and construction shares of employment have a negative and significant effect in nonmetropolitan counties but a positive and significant effect in metropolitan counties. Because manufacturing and construction are perceived to pay higher wages than other sectors, a higher

Table 5

Results for All Counties, Rural Counties, and Urban Counties[a]

County Group Variable	All Log of PCI		All Log of PCI		Nonmetropolitan Log of PCI		Nonmetropolitan Log of PCI		Metropolitan Log of PCI		Metropolitan Log of PCI	
	Parameter	*z*-value	Parameter	*z*-value	Parameter	*z*-value	Parameter	*z*-value	Parameter	*z*-value	Parameter	*z*-value
Intercept	9.468	143.1°°	9.478	143.9°°	9.605	119.4°°	9.618	119.9°°	9.325	77.0°°	9.333	77.2°°
New England	0.060	2.0°°	0.061	2.0°°	0.078	1.9°	0.079	2.0°°	0.053	2.0°°	0.054	2.0°°
Southeast	–0.019	–1.0	–0.019	–1.0	–0.008	–0.3	0.007	–0.2	–0.022	–1.2	–0.022	–1.2
South-Central	–0.025	–1.3	–0.024	–1.2	–0.023	–0.8	–0.020	–0.7	0.011	0.6	0.011	0.5
Great Lakes	0.009	0.5	0.009	0.5	0.008	0.3	0.009	0.3	0.036	2.1°°	0.034	2.0°°
Great Plains	–0.022	–1.1	–0.022	–1.1	–0.007	–0.2	–0.007	–0.3	–0.003	–0.1	–0.007	–0.3
Mountain West	0.009	0.4	0.011	0.4	0.017	0.5	0.020	0.6	0.024	0.7	0.020	0.6
Southwest	–0.016	–0.8	–0.014	–0.6	0.003	0.1	0.006	0.2	–0.019	–0.8	–0.016	–0.7
West Coast	0.075	2.9°°	0.078	3.0°°	0.086	2.4°°	0.091	2.6°°	0.060	2.0°°	0.061	2.1°°
Isolation	–0.022	–2.4°°	–0.022	–2.4°°								
Agglomeration	0.030	8.1°°	0.031	8.1°°	0.019	3.9°°	0.019	4.0°°	0.056	9.3°°	0.056	9.4°°
Adj. to MSA	–0.008	–1.2	–0.008	–1.2	–0.009	–1.3	–0.009	–1.3				
Natural Am.	0.001	0.1	0.001	0.1	–0.002	–0.5	–0.002	–0.5	0.003	0.4	0.002	0.4
Interst. Dens.	0.413	2.1°°	0.411	2.0°°	0.833	2.1°°	0.825	2.1°°	0.141	0.6	0.132	0.6
Road Dens.	0.357	1.8°	0.355	1.8°	0.617	2.6°°	0.612	2.5°°	–0.107	–0.3	–0.136	–0.4
Manuf. Sh.	–0.039	–0.9	–0.041	–0.9	–0.113	–2.2°°	–0.116	–2.2°°	0.170	2.3°°	0.167	2.3°°
Ag-Res. Sh.	–0.285	–5.4°°	–0.286	–5.4°°	–0.402	–6.5°°	–0.402	–6.5°°	0.544	2.9°°	0.561	3.0°°
Federal Sh.	–0.243	–2.6°°	–0.274	–2.9°°	–0.268	–2.1°°	–0.334	–2.7°°	–0.054	–0.4	–0.063	–0.5
Unemp. Rate	–2.032	–17.1°°	–2.077	–18.1°°	–2.024	–15.1°°	–2.094	–16.2°°	–2.952	–10.8°°	–2.970	–10.9°°
H.S. grad	0.436	6.1°°	0.442	6.2°°	0.449	5.5°°	0.458	5.6°°	0.341	2.5°°	0.347	2.6°°
College grad	1.671	23.2°°	1.665	23.1°°	1.435	14.4°°	1.427	14.3°°	1.762	14.8°°	1.755	14.8°°
Retired	0.858	9.0°°	0.856	9.0°°	0.547	4.8°°	0.548	4.8°°	1.342	7.1°°	1.340	7.1°°
Child	0.443	3.7°°	0.415	3.5°°	0.315	2.3°°	0.270	2.0°°	0.239	1.0	0.220	0.3
Percentage AI	–0.105	–2.0°°			–0.142	–2.5°°			–0.584	–1.9°		
Tribal	0.004	0.5			0.007	0.6			0.015	0.9		
Tribal—AI5share			–0.020	–1.6			–0.020	–1.5			–0.091	–2.7°°
Lambda	0.459		0.459		0.423		0.422		0.202		0.204	
n	3,067		3,067		2,258		2,258		809		809	
R-squared	0.60		0.60		0.45		0.45		0.74		0.74	

[a] All models are estimated as a spatial autoregression (GMM).
°Significant at the .10 level.
°°Significant at the .05 level.

employment share in these industries was expected to have a positive effect on income levels across all types of counties. The unexpected negative sign in nonmetropolitan counties may be explained by the fact that low-wage, low-skill manufacturing employment has decentralized away from urban and suburban areas to nonmetropolitan areas in recent years (Glasmeier and Leichenko 1999). By contrast, the positive sign in metropolitan counties suggests that the higher-skill manufacturing employment that remains in urban areas continues to be associated with higher wages.

Agricultural and natural-resource shares of employment also have a mixed effect. This variable was expected to have a negative effect across all types of counties because these sectors employ a large number of low-skilled workers and typically pay lower wages. The negative effect found across all counties and nonmetropolitan counties is consistent with this hypothesis, but the positive sign in metropolitan areas is surprising. On average, employment in agriculture and natural resources accounts for only 3 percent of the total employment in metropolitan counties. An examination of the minimum and maximum values of this variable in metropolitan counties, however, indicated that agricultural and resource shares of employment range from .02 percent to 22 percent, suggesting that this sector continues to play a substantial role in some metropolitan counties. Furthermore, whereas in nonmetropolitan counties, agricultural and resource domination may reflect the lack of alternative, higher-wage activities, it is likely that in metropolitan counties, given other types of development and land-use pressures, the remaining agricultural and resource activities are relatively high value added.

Federal employment shares have a significant and negative effect across all counties and nonmetropolitan counties but are not significant in urban counties. This result is consistent with the expectation that having relatively high shares of federal civilian employment is an indicator of the lack of other economic opportunities, particularly in isolated nonmetropolitan areas.

Individual and Demographic Factors. Individual and demographic factors are also consistently significant across all the models. Both types of educational attainment, high school graduate and college graduate, have the expected, positive effect on income levels in all types of counties. The positive and significant effect of shares of the retirement-age population across all types of counties indicates that counties that are attractive to older residents tend to have higher income levels. This finding contrasts with Manson and Groop's (1990) finding that areas with high levels of "nonemployment income," which is typically associated with populations of retirees, tend to have lower overall income levels. The positive effect of the retirement-age share found in the present analysis may reflect the impact of the stock market run-up of the late 1990s, which dramatically increased nonemployment income from stock dividends. The positive and significant effect of the variable child in the all-county and nonmetropolitan models was also unexpected, since counties with higher shares of children were expected to have lower per capita incomes because children are typically not part of the labor pool.

AI population share has a negative and significant effect on income levels across all types of counties. This result, which indicates that counties with a relatively high population share of American Indians tend to have lower income levels, is consistent with the idea of Cutler and Glaeser (1997) that the spatial segregation of minority groups leads to worse economic outcomes.

Tribal Indicators. The tribal-area indicators are generally not significant. The presence of a tribal area (tribal) is not significant in any of the models, while the presence of a tribal area with high AI shares (AI5share) is significant (negative) only in the metropolitan model. These results imply that the simple presence of a tribal area in a county has no significant effect on income levels,

once locational and other factors are controlled. However, across urban areas, counties that contain tribal areas with higher AI population shares tend to fare worse than do other counties.

Results for Tribal Counties

The second set of regression models focus on different types of tribal counties (see Table 6). In general, the tribal models contain fewer statistically significant variables than do the models presented in Table 5. While lower levels of statistical significance may partially reflect smaller sample sizes, which imply higher standard errors, lack of significance may also reflect the fact that there is less variation among the tribal counties across many of the selected indicators.

Locational Factors. Locational factors play a relatively limited role across the different categories of tribal counties.

Table 6

Results for Tribal Counties[a]

County Group	All Tribal Counties Log of PCI		Tribal–AI5 share Log of PCI		Res. and Trust Log of PCI		OTSA-TDSA Log of PCI	
Variable	Parameter	*z*-value	Parameter	*z*-value	Parameter	*z*-value	Parameter	*t*-value
Intercept	9.579	79.0°°	9.516	59.6°°	9.576	66.9°°	9.948	32.3°°
Southeast	–0.014	–0.3			0.055	1.0	–0.223	–2.5°°
South-Central	–0.028	–0.6			–0.005	–0.1	–0.178	–2.1°°
Great Lakes	0.004	0.1	0.024	0.4	0.030	0.7		
Great Plains	0.014	0.4	0.055	0.9	0.049	1.1	–0.209	–1.7°°
Mountain West	–0.113	–2.8°°	–0.017	–0.3	–0.079	–1.7°		
Southwest	–0.115	–3.0°°	–0.050	–1.1	–0.073	–1.4	–0.276	–3.5°°
West Coast	0.038	1.0	0.151	2.8°°	0.085	1.8°	–0.187	–2.1°°
Isolation	–0.018	–0.8	–0.001	–0.1	–0.011	–0.4	–0.102	–2.3°°
Agglomeration	0.018	2.1°°	–0.002	–0.1	0.017	1.8°	0.022	1.2
Adj. to MSA	–0.016	–1.1	0.006	0.3	–0.016	–0.9	0.019	0.8
Natural Am.	0.003	0.4	–0.003	–0.2	–0.002	–0.2	–0.006	–0.3
Interst. Dens.	0.495	0.6	1.563	1.0	–0.651	–0.5	1.474	1.2
Road Dens.	–0.753	–1.3	0.164	0.2	–0.932	–1.2	0.293	0.3
Manuf. Sh.	–0.075	–0.7	–0.072	–0.4	–0.075	–0.6	–0.004	0.0
Ag-Res. Sh.	–0.183	–1.6	–0.491	–3.1°°	–0.268	–2.0°°	0.199	0.7
Federal Sh.	–0.217	–1.2	–0.314	–1.0	–0.265	–1.3	0.028	0.1
Unemp. Rate	–1.218	–4.5°°	–1.019	–2.8°°	–1.269	–4.2°°	–1.567	–2.2°°
H.S. grad	0.571	3.2°°	0.641	2.5°°	0.644	3.0°°	–0.118	–0.3
College grad	1.941	10.6°°	1.845	6.5°°	1.965	8.6°°	1.519	4.0°°
Retired	0.505	2.7°°	0.769	2.6°°	0.378	1.7°	0.983	2.2°°
Percentage AI	–0.220	–3.5°°	–0.208	–2.5°°	–0.214	–2.9°°	–0.364	–2.3°°
OTSA-TDSA	–0.017	–0.8	–0.036	–0.9				
Casino	–0.020	–1.3	–0.044	–1.6°	–0.026	–1.6	0.134	1.7°
Gaming Revenue	0.001	1.5	0.001	1.5	0.001	1.1	–0.001	–1.3
Lambda	0.222	0.0	0.162	0.0	0.239			
n	364		154		260		104	
R-squared	0.74		0.74		0.74			
Adjusted *R*-squared							0.82	

[a] All models are estimated as a spatial autoregression (GMM), except OTSA-TDSA model which is estimated via ordinary least-squares (OLS).

°Significant at the .10 level.

°°Significant at the .05 level.

Differences in regional cost of living are significant determinants of income levels across all types of tribal counties, but the signs and significance levels of the regional variables vary among the different tribal-county groups. The presence of agglomeration economies associated with market size has a positive and significant effect in two of the tribal models—all tribal counties and reservation and trust tribal counties—suggesting that in these two cases, the presence of larger markets has a significant and positive effect on income levels. Location in a nonmetropolitan area has a significant and negative effect on income only in the OTSA-TDSA tribal-county model.

Structural Factors. Among the structural variables, unemployment rates have a negative and significant effect on income levels in all the tribal models. This result, which was also found in the first set of models (see Table 5), indicates that labor market conditions are a key driver of income levels in tribal areas. Among the industry-share variables, agricultural and natural resources shares of employment have a significant and negative effect in AI5share tribal counties and in reservation and trust tribal counties. This finding suggests that in these types of tribal counties, higher shares of employment in these sectors are associated with lower levels of income.

Individual and Demographic Factors. As was the case for all counties, metropolitan counties, and nonmetropolitan counties, individual and demographic factors are significant across all types of tribal counties. Educational attainment at the college level is positive and significant across all groups of tribal counties, while high school graduate shares have a positive and significant effect across all tribal groups except OTSA-TDSA counties. Retirement-age shares of the population have a positive and significant effect across all types of tribal counties, suggesting that tribal counties that are attractive to retirees also tend to have higher income levels. American Indian shares of the population also have a consistently significant negative effect on income levels across all types of tribal counties.

Tribal Social Capital. The tribal social capital variables have limited and mixed effects. The presence of a casino has a negative and significant effect in AI5share tribal counties but a positive and significant effect in OTSA-TDSA counties. This mixed casino effect is somewhat unexpected, but rather than suggesting that casinos "cause" changes in income, it is possible that the result may reflect different motivations for the location of casinos in the different types of tribal counties. In AI5share counties, the most economically disadvantaged tribal counties, casinos may be a development option of last resort and thus are likely to be located in areas with the lowest levels of per capita income. In contrast, in relatively better-off OTSA-TDSA areas where other avenues for economic development are likely to exist, casinos may tend to be located in higher-income areas where they have a higher probability of success. The other tribal social-capital variables, including nature of control over the land (OTSA-TDSA) and gaming revenue, are not significant in any of the tribal models.

Conclusions

Persistent rural poverty is a problem in countries throughout the world. In the United States, persistent poverty is especially evident in remote areas that contain American Indian tribal lands. A review of the theoretical and empirical literatures on regional variation in income and the spatial concentration of poverty suggested that locational, structural, individual, demographic, and social capital factors may each play a role in accounting for variation in income and poverty levels across regions. The relative importance of these factors was evaluated via regression analyses of tribal versus nontribal counties and through analyses of several categories of tribal counties.

The results of the analysis of tribal and nontribal counties suggested that loca-

tional factors, such as agglomeration economies and a transportation infrastructure, indeed play a significant role in accounting for variation in income across counties, but that individual, demographic, and structural factors also matter. Specifically, college-educated and retirement-age shares of the population have a positive effect on income levels across all types of counties. Unemployment rates and shares of the population that are American Indian have a negative effect across all types of counties. The results further suggest that once locational and other factors are controlled, tribal counties do not have significantly lower levels of income than do nontribal counties. The relatively lower income levels found in tribal counties may thus be understood as a function of locational and other factors, rather than as a reflection of problems that are inherent in tribal areas. This conclusion notwithstanding, the fact that counties with higher AI shares have significantly lower levels of income than do other counties, even after other factors are controlled, suggests that these counties merit special attention to alleviate the problems of persistent poverty.

Among different types of tribal counties, locational factors play a more limited role in accounting for variation in income. Instead, structural, human-capital, and demographic factors predominate, especially unemployment rates, college-educated shares of the population, retirement-age shares of the population, and American Indian shares of the population. These findings are generally consistent with the case-study work on tribal-area poverty that has also emphasized human-capital and demographic factors. The positive role of human capital was also borne out in separate research, including interviews and focus-group meetings with American Indians from tribal areas across the United States; in most cases, the lack of a skilled workforce was cited as a key constraint on economic development in tribal areas (Center for Urban Policy Research 2002).

The results also suggest a number of directions for additional research. One important issue that this study only began to touch upon is the role of social capital in accounting for variation in income and spatial concentration of tribal poverty. Case-study research on rural poverty, both within and outside tribal areas, has found that social capital plays a decisive role in accounting for the persistence of concentrated poverty in remote rural regions. In the present study, however, social capital in tribal areas, measured via the presence of an Indian casino, was found to play a mixed role, having a positive effect in OTSA-TDSA areas but a negative effect in high AI-share areas. These mixed findings suggest that the broader economic effects of social capital in tribal areas require further investigation. Additional research on the impact of tribal casinos is especially relevant, given the growing reliance on gaming as an economic development strategy in remote tribal areas.

The second issue for further study entails exploring the options for development that overcome or compensate for locational disadvantages. The results of this study demonstrate that locational factors present a constraint on economic development across all types of counties but also suggest that nonspatial factors are important, especially across tribal areas. These findings raise the possibility that locational disadvantages may be overcome via such measures as enhancement of an area's human capital base and the attraction of new services and other industries to diversify remote economies and lessen their reliance on agriculture and natural resources.

A final issue for further research concerns the mechanisms by which higher AI population shares are associated with lower regional income levels. This finding lends support to the idea, suggested by Cutler and Glaeser (1997) in the context of U.S. urban areas, that segregation, in itself, has negative consequences for the economic outcomes of minority populations. Yet the mechanisms leading to these outcomes remain poorly understood. Furthermore, although the present study emphasized

traditional measures of economic development (i.e., per capita income), the recent case-study literature on tribal areas has pointed to the fact that such measures may miss a substantial portion of the economic activity that occurs in tribal areas. Pickering (2000), in particular, noted that traditional economic measures do not take into account the importance of bartering or the presence of a gift economy in allowing members of a tribal community to maintain an acceptable quality of life even under circumstances of a relatively low per capita income. Similar observations have been made by geographers, such as Gibson-Graham (2002), with respect to the importance of nonmarket activities in allowing marginalized communities to maintain living standards outside formal market economies. In exploring the reasons behind the apparently lower income levels in high AI-share counties, as well as possible alternatives for improving economic conditions in tribal areas, a fuller accounting of tribal cultural economies would therefore seem crucial.

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