Rural Poverty and Population Change: Insight from Community Capitals

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Rural poverty in the United States is both spatially concentrated and persistent. Yet substantial variation exists in the demographic processes experienced by impoverished rural communities: some experience population growth while others do not. Despite a large body of research on poverty, current models do not explain such distinctions. Most research suggests that poverty concentrations are associated with population loss; poverty can become concentrated within those left behind. Yet, migration into and out of rural communities is influenced by both demographic and socioeconomic factors connected to place and these factors, themselves, may also be connected with poverty. Such factors may include; age structure, educational attainment, the physical environment, access to services, or social and economic structures of rural communities. In other words, the poverty-population connection may be more complex than outmigration by those relatively better off. To further complicate our understanding of rural migration, many of the noted moderating factors intersect. For example, migration to areas with lower costs of living may concentrate rural poverty while the development of new businesses may attract highly qualitied migrants, potentially reducing rural poverty.

This study examines changes in *both* poverty and population across time for rural communities across the U.S. The Community Capitals Framework provides the analytical structure through consideration of various capitals such as cultural, financial, human, natural, physical/built, political and social, which interact to shape rural growth and change. Such capitals may fuel growth (e.g. attraction of natural amenities) or lead to loss (e.g. disaster-related infrastructure loss). Trends are examined from 1980 to 2010 using data from the Integrated Public Use Microdata Series (IPUMS) National Historical Geographic Information System dataset (Manson et al. 2017). Key to this study is the inclusion of Community Capitals, which are conceptualized as influencing trajectories of rural poverty and population change at the baseline, 1980. In doing so, the analyses offer insight into mechanisms underlying connections between place-based poverty and population change.

Background

Poverty has generally declined in the U.S. since high levels of over 20 percent in the 1960s to approximately 12 percent in 2017 (U.S. Census Bureau 2018d). Yet, not all communities have experienced this decline − poverty tends to be higher and more concentrated in remote, rural regions (Lichter and Parisi 2008). In 2017, poverty rates in rural counties averaged 16.9 percent compared to 13.6

percent in urban counties (Economic Research Service 2018b). Additionally, most rural counties with high poverty levels have been impoverished for several decades (Beale and Gibbs 2006). Such persistent poverty is defined as 20 percent of the population having lived below poverty levels for at least 30 years. In 2010, 15.2 percent of rural counties were persistently poor compared to 4.2 percent of urban counties (Economic Research Service 2017b).

Poverty also varies regionally; almost 85 percent of rural counties with persistent poverty are located in the southern United States and/or concentrated in sub-regions such as Appalachia, the Mississippi Delta, Rio Grande River Valley, and on Indian Reservations in the Southwest and Great Plains (Lichter and Parisi 2008). Poverty rates by county (Table 1) highlight this regional and temporal variation.

Table 1. Poverty Rates in Nonmetro Counties by Census Region and Division.

	Average Poverty Rate (%)[a]			
Census Region/Division	1980	1990	2000	2010
Northeast	**12.24**	**11.73**	**11.36**	**13.15**
New England	12.44	10.16	10.01	12.12
Middle Atlantic	12.11	12.72	12.22	13.81
Midwest [b]	**14.05**	**14.84**	**11.76**	**14.07**
East North Central	11.60	13.57	10.41	14.83
West North Central	15.39	15.54	12.51	13.66
South	**21.00**	**22.06**	**18.48**	**20.43**
South Atlantic	19.72	18.89	16.89	20.01
East South Central	23.97	24.84	20.38	22.96
West South Central	20.08	23.32	18.71	18.93
West	**14.25**	**16.27**	**14.72**	**15.76**
Mountain	14.89	16.78	14.75	15.42
Pacific	12.28	14.72	14.68	16.81

[a] Poverty rates estimated from county poverty data provided by NHGIS (Manson et al. 2017).
[b] Prior to 1984, the Midwest region was designated as North Central region.
Rural or nonmetro counties identified based on 1983 rural-urban continuum codes (Economic Research Service 2017c) and do not include Alaska or Hawaii. % = percent.

Rural poverty rates are consistently highest in the South with highest rates observed in the East South Central division (Alabama, Kentucky, Mississippi, and Tennessee). Rural poverty rates in the western U.S. highlight spatial and temporal variation as poverty stayed relatively stable in Mountain states although increasing substantially in Pacific states.

Poverty is shaped by many factors such as rural economic structures, declining infrastructure, and relative isolation. In the early 20th century, farms in rural areas employed approximately 40 percent of the U.S. workforce but by the early 21st century, this number had dropped to less than 2 percent (Dimitri et al. 2005). In response to these declines in farming-related employment, rural economics have diversified through industries such as manufacturing, health services, telemarketing, prisons, retail sales, and recreation (Economic Research Service 2018a). But these industries often have lower paying or less secure employment opportunities than can be found in urban areas (Curtis et al. 2018; Flora and Flora 2008).

Rural Population Trends

General trends in rural population change have been well documented (for example, see Albrecht 2010; Cromartie 2016; Johnson and Lichter 2008, 2019; Porter and Howell 2016). From the 1920s to the 1960s, rural populations generally grew through natural population growth (birth minus deaths) despite outmigration to urban areas (Fuguitt et al. 1998). For example, the Great Plains region grew by more than 2.5 million people between 1930 and 1990 despite almost 2 million residents leaving (Gutmann et al. 2005). In the 1970s, a reversal of rural-urban migration flows resulted in rural population gains during the "rural renaissance period" with growth continuing, albeit at a slower pace, between the 1980s and 2010. Since 2010, population loss has typified rural places as outmigration has exceeded rates of natural population growth (Economic Research Service 2017b). In a recent study of rural depopulation, Johnson and Lichter (2019) explained that rural counties altogether lost population between 2010 and 2016 and that approximately one-third of all nonmetropolitan counties lost at least 25 percent of their peak population between 1950 and 2010.

Notably, population losses and gains are not uniformly distributed spatially. Using similar thresholds as Johnson and Lichter (2019), counties with greater than 25 percent relative population loss between 1980 and 2010 are concentrated in the Midwest (Table 2) where nearly one-quarter of counties in the West North Central division lost over one-quarter of their population.

Table 2. Population Change in Nonmetro Counties by Census Region and Division.

Census Region/Division	% Counties with Population Loss [a] 1980 - 2010
Northeast	**0.00**
New England	0.00
Middle Atlantic	0.00
Midwest	**15.00**
East North Central	1.32
West North Central	22.48
South	**5.20**
South Atlantic	1.73
East South Central	3.07
West South Central	10.58
West	**5.93**
Mountain	7.87
Pacific	0.00

[a] Relative population change calculated between 1980 and 2010. % = percent.

Historically, such long-term loss has occurred in agriculturally-dependent rural counties, with 95 percent of farming communities experiencing population decline, 1950-2010, particularly in the South and Midwest regions (Johnson and Lichter 2019). Economic restructuring in the Midwest has also fueled loss especially in manufacturing-dependent regions (Curtis et al. 2018). Contrasting with these long-term declines, regions offering recreational or natural amenities have been buffered against loss; no counties in the Pacific states of California, Oregon, and Washington experienced greater than 25 percent population loss between 1980 and 2010.

Of course, out-migration is a key driver of rural population loss. In a study of county-level population changes between 1967 and 2002, Johnson and Lichter (2008) identified outmigration of young adults of reproductive ages as one of the main mechanisms of rural population declines. The loss of young adults of childbearing age has long-term demographic impacts, resulting in declining fertility, aging populations, higher mortality rates, and ultimately lower rates of natural population growth (Johnson and Lichter 2008, 2019).

The present study examines how rural population change is shaped not only by poverty, but by other forms of capital at a sub-county scale. The work contributes in two key ways: by offering a 1) national perspective and 2) a focus on places as opposed to counties where much current literature is situated. Analytical structure is provided by the *Community Capitals Framework*.

The Community Capitals Framework

The Community Capitals Framework is useful for examination of community characteristics as related to seven different Community Capitals (Gutierrez-Montes, Emery, and Fernandez-Baca 2009). *Cultural capital* reflects the way that people view the world including language and traditions (Flora and Flora 2008). *Financial capital* provides a measure of the financial resources available for investment in local businesses, infrastructure and to provide basic services (Flora and Bregendahl 2012). As a measure of residents' skills and education, *human capital* is important for community-level economic investment. *Natural capital* includes place-based assets such as favorable climate, geographic location, natural beauty or natural resources such as oil and gas reserves (Emery and Flora 2006). *Physical/built capital* includes infrastructure such as roads, sewers, schools, and businesses (Jacobs 2011). *Political capital* reflects access to power or organizations and the ability of people to engage in actions that contribute to the well-being of their community (Flora et al. 2004). Finally, *social capital* considers the connections among community members and the social ties that connect groups to facilitate community action (Flora and Flora 2008).

Community Capitals are interdependent where the loss of one may negatively affect other capitals creating a "spiraling down" effect and subsequent population loss (Emery and Flora 2006). In a study on the effect of forest fires, for instance, Gutierrez-Montes (2005) identified a spiraling down effect where environmental destruction from fires lead to loss of employment, subsequent increases in poverty and health problems, and the breakdown of community social and cultural capital. Emery and Flora (2006) note this "spiral of decline" present in rural communities in the United States, where the decline of financial capital through the loss of industry results in further losses of human and social capitals. These 'spiraling down' effects can lead to "landscapes of despair" where rural areas become defined by severe economic, social, and health challenges (Monnat and Brown 2017). These areas may be characterized by extremely low levels of financial and human capital. A lack diverse and well-paid employment opportunities can result in low levels of engagement in human capital; adults – especially rural youth – are more likely to leave their rural communities in search of employment opportunities (Domina 2006).

While Community Capitals has been engaged in studies of rural change, prior research has left important knowledge gaps. In particular, many efforts have encompassed small numbers of case studies. For example, in examination of redevelopment in Northwood North Dakota following a devastating EF4 tornado, Stofferahn (2012) finding that cultural, social, human, and political capitals were important in the growth of built, financial, and natural capitals of redevelopment efforts. In this study, political capital was found to be key in mobilizing support and for securing financial capital to assist in recovery efforts. Human capital was also instrumental in redevelopment efforts as residents provided skills and to assist cleanup and rebuilding storm-damaged homes. In another study in western North Carolina, Kline (2017) applied the Community Capitals Framework to shed light on the role of cultural and natural capitals in the local tourism industry. Kline found that increased community engagement in tourism activities increased human, social, and political development in the region. The Community Capitals Framework is proven useful in case-studies because of the interconnections between capitals focusing on community-level outcomes. Here, the emphasis is on using the framework for a national study across 3 decades.

Community Capitals and Trajectories of Rural Change

In all, prior research has documented broad-based rural trends in poverty and population while case studies have examined the influence of various forms of capital on economic and community development. Grounded in these past efforts, the work presented here has two primary goals: 1) to examine associations between poverty and population change simultaneously over time and 2) to shed light on these intersecting trends through inclusion of community capitals.

Data and Measurement

Data

Census-defined "places" represent the units of analysis – such places are population concentrations that are locally recognized and independent of other places. Similar to Flora and Flora's (2008) definition of community as a "location where groups of people interact with each other", Census places represent a collection of people in a city, town or village and with less than 2,500 population. Per the Census Bureau, both "incorporated" and "designated" places are statistical concentrations of people, with incorporated places established with governmental functions (U.S. Census Bureau 2018b). Place-based analyses are important since patterns and trends specific to small towns may be lost when examining county-level data. For example, from 1980 to 2010 in Colfax County New Mexico, Eagle Nest Village saw a 40 percent relative increase in population (from 202 to 290 residents) and Springer Town saw a 37 percent relative decrease in population (from 1,657 to 1,047 residents). Despite these changes at the place level, county population estimates remained relatively stable (13,667 to 13,750 residents).

But for analytical purposes, rural status isn't defined by population size alone. Places are typically also classified as rural if located within counties designated as nonmetropolitan (as compared to metropolitan) by the USDA ERS continuum codes.[1] Counties are grouped according to metro status determined by the Office of Management and Budget. Metro areas are subdivided based on the Metropolitan Statistical Area (MSA) that they are part of while nonmetro counties are classified based on the size of their urban population and proximity to metro areas (Butler 1990). The 1983 continuum codes are subdivided into 10 categories, with four metropolitan and six nonmetropolitan categories (see Table 3).

Table 3. 1983 Rural-Urban Continuum Codes.

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

Rural communities within counties highlighted were selected for this analysis (codes 6-9)

While counties with continuum codes 4 and 5 are also classified as nonmetropolitan, only small rural communities in counties without the presence of larger urban populations (20,000 people or more) are

[1] For the purposes of this study, "metropolitan" and "urban" are used interchangeably as are "nonmetropolitain" and "rural".

considered here (continuum codes 6 to 9) in order to understand the trajectories of these rural communities that are more isolated from larger urban populations. In addition, since the focus of this study is on trajectory of rural communities beginning in 1980, 1983 codes are used here although the several 1980 nonmetro counties are no longer defined as rural under the updated 2013 codes. Analysis is also limited to rural places within continental United States and excludes communities in Alaska and Hawaii.

Place-based demographic data come from the decennial Census,1980 – 2010, with supplementary data from the 2018-2012 American Community Survey (ACS) five-year estimates. Core demographic variables such as population counts and race/ethnicity are based on the national full count Census collected through the "short form". Additional data such as educational attainment and poverty status were obtained from the more detailed "long form" circulated to a sub-sample of the population. Sparsely populated areas were oversampled for the 2018-2012 ACS to provide statistically reliable estimates for smaller communities (U.S. Census Bureau 2015). In order to minimize bias of population change in communities with smaller population counts, analysis was limited to communities with at least 25 residents, resulting in 61 communities removed from the study data set. There are approximately 3,500 rural communities reporting missing data during at least one Census period, with the majority of communities reporting data for only 2010 (approximately 3,200 communities). Given the goals of the study to understand change at the baseline (1980), communities with missing population data were removed from the analysis. As such, 8,053 rural communities are examined representing approximately 5.8 million residents in 1980.

Measurement

For each decadal time point, population, poverty and Community Capitals are considered at the baseline.

Population. Census-derived population counts are used to estimate the population trajectories of rural communities, and changes in total population reflect both natural change (births minus deaths) and net migration (inmigration versus outmigration). At the place level, data on births, deaths, and migration is not publicly available. However, given that natural change is expected to be negligible in rural communities - fertility rates have remained stable at 2.1 births per woman since 1990 (Population Reference Bureau 2003) – changes in population estimates are assumed to primarily reflect losses and gains through migration. This is consistent with research identifying outmigration as one the main mechanisms of rural population losses over the last century (Johnson and Lichter 2019; Economic Research Service 2017b). For this study, rural communities in 1980 ranged from 30 to 2,498 residents, averaging 717 residents (see Table 4).

Poverty. Poverty rates are calculated from Census-derived counts of people living below the poverty line relative to the number of people for whom poverty status was determined. Poverty is also a measure of *financial capital* as it reflects community financial resources based on taxation (Flora and Flora 2008) [2]. Poverty rates in 1980 ranged from 0 to 84.5 percent, averaging 15.9 percent.

Cultural capital. Cultural capital includes the values and symbols held by individuals and reflected in objects such as art, language, and books (Emery and Flora 2006). Cultural capital is challenging to operationalize, and researchers have used measures reflecting community traditions, festivals, or local efforts to preserve cultural and historical artifacts (Fey, Bregendahl, and Flora 2006). In this study, cultural capital is reflected by the number of registered National Historic Places, which are properties deemed worthy of preservation that have historical and cultural significance. (U.S. National Park Service 2018). This register includes over 93,000 such properties and the presence of these historic places may usefully represent cultural capital because registration requires efforts by community members to preserve structures. In this study, 32 percent of rural places have at least one registered National Historic Place.

Human capital. Human capital is measured by Census-derived indicators of educational attainment, calculated as the percentage of residents 25 years or older with a college degree. Education is understood to be an important aspect of human capital; the level of educational attainment of a community influences the ability of communities to attract economic development and the type of jobs available (Flora and Flora 2008). Rural communities tend to have lower levels of educational attainment than their urban counterparts because rural college graduates are less likely to return to their homes after completing college degrees (Flora and Flora 2008). In 1980, the percentage of college graduates ranged from 0 to 83.9 percent, averaging 8.5 percent.

Natural capital. The environmental resources that shape demographic and socioeconomic development is a measure of natural capital. The USDA Economic Research Service has developed a useful county-scale measure incorporating six measures of climate (warm winter, winter sun, temperate summer, low summer humidity), topographic variation, and percent water area (Economic Research Service 2017a). Standardized scores of temperature, humidity, topographic variation and water area are combined to construct a natural amenity scale for counties within the continental United States. This "natural amenities scale" does not include other forms of natural capital such as natural resources that can be used for extraction (Flora and Flora 2008). However, a dependence on extractive forms of capital (i.e. mining) can be problematic for community growth as economic benefits tend to flow to outside corporations rather than community members (Flora and Flora 2008). For this study, rural communities are assigned a value of natural capital based on the county they were located within. For the rural places

[2] Measures of median household income and unemployment were initially included in this analysis but later omitted due to multicollinearity issues between these variables and poverty rates.

examined here, measures of natural capital range from -6.4 (low amenities) to 8.5 (high amenities) with an average of -0.7.

Physical/built capital. Roads, bridges, and buildings are examples of built capital and well-developed foundations of built capital have been linked to prosperity of rural communities (Flora and Flora 2008). To reflect such capital, prior research has used measures such as the number of building permits issued for businesses or housing (Fey et al. 2006). As another option, Geographic Information Systems (GIS) data has been used to provide reflect infrastructure over large areas (Brownson et al. 2009). Similar to approaches highlighted by Brownson and others, built capital in this study reflects road length in feet divided by community area (square-feet) using GIS data from the U.S. Census Bureau (U.S. Census Bureau 2018a), since roads can reflect public infrastruture such as sewer systems. This measure reflects the relative density of infrastructure (road length divided by road area) within a community, and ranges between 0.1 and 2.7 foot per square-feet, averaging 1.0 feet per square-feet for this study. Limitations exist with this measure. Using roads to estimate physical features may be an overestimation as houses incorporated within a community may not have access to public utilities.

Political capital. Political capital refers to the ability of community members to access public resources and is often mediated through public officials. Since power is often distributed unequally, measures of political capital have involved conducting network analysis or interviews to quantify access to political power within case studies (Stofferahn 2012). Measuring political capital in communities across the nation is perhaps more challenging. In this study, political capital is measured by calculating the percentage of residents compared to the number of residents within the same state. Only voting-aged residents are considered to reflect the number of potential voters. Measures of political capital in 1980 ranged from 0.0003 to 0.5 percent, averaging 0.03 percent. Not all members of the voting-age public participate in voting activities. As such, this measure may overestimate political capital. Additionally, since power is often not distributed evenly (Flora and Flora 2008), other measures could include political affiliation, voter participation, or campaign contributions but such information is challenging to retrieve at the place-scale.

Social capital. Efforts to measure social capital nationally have focused on developing indices through surveys. For example, Putnam's (2000) "social capital index" has five components; community organizational life, engagement in public affairs, community volunteerism, informal sociability, and social trust. Again however, quantifying this concept is difficult at the place-scale. Leaning to prior research, prior studies have found negative associations between racial/ethnic diversity and measures of social capital. For example, Hero (2003) found a negative association between ethnic diversity – measured as percent black, Latino, and Asian – and Putnam's (2000) social capital index in that states with relatively less diversity tended to have higher social capital scores (Hero 2003). Given that social capital indices are developed from questions not included on the Census and thus not available at the place level, this preliminary analysis uses racial/ethnic diversity as a measure of social capital. Using Census-based estimates of race (white, black or African American, American Indian or Alaska Native, Asian and Pacific Islander or Other Race, Two or More Races), measures of diversity are developed using Simpson's Diversity Index. This index calculates the probability that two randomly selected residents will be from the same race based on the following equation:

$$\boldsymbol{D} = \mathbf{1} - \sum \boldsymbol{pi}^{\mathbf{2}} \tag{1}$$

Where *pi* represents the proportion of each racial category *i* (Simpson 1949). A high value represents greater heterogeneity and thus lower social capital. Diversity estimates in 1980 range from 0 (high social capital/low diversity) to 0.95 (low social capital/high diversity) with an average of 0.10, with mean estimates reflecting a relatively homogeneous rural population. Clearly this measure is not without limitations, bonds within smaller rural communities may reflect higher levels of social capital despite higher levels of diversity and the association identified by Hero may not be as strong at the local level. Although nationally representative surveys such as the Social Community Benchmark Survey (Cornell University 2019) could provide additional insight sample size issues disallow characterizaton of small places.

Analytic Strategy

The current analytic strategy provides a direct test of the temporal association between place-based poverty and population by estimating both fixed and random effects of each repeated measure while also examining the covariation of measures across repeated measures representing four different time points (1980, 1990, 2000, and 2010). Latent growth models are used here in that they provide insight into group-level change, individual variability in change, and time trends in the differences in change of variables as a function of other variables of interest (Bollen and Curran 2006). These models are more appropriate to this study than methods that provide inferences about group level change only. With latent growth models, underlying trajectories are identified, and temporal change is defined in terms of unobserved latent variables (Bollen and Curran 2006). Conditional latent growth models incorporate measures of covariates as predictors of the repeated measures of outcomes while accounting for the growth processes of these outcomes (Bollen and Curran 2006).

The general form of the bivariate latent growth model level 1 equations for two repeated measures (*y* and *w*) are as follows (Bollen and Curran 2006):

$$y_{it} = \alpha_{iy} + \beta_{iy}\lambda_t + \epsilon_{yit} \quad (2)$$

$$w_{it} = \alpha_{iw} + \beta_{iw}\lambda_t + \epsilon_{wit}$$

Where y_{it} are the observed values for each community *i* at time *t*. α_{iy} is the latent intercept and β_i is the latent slope factor. To assess individual initial values of growth, the factor loadings of the latent intercept term α_i constrained to 1 while λ_t - the factor loadings for the latent slope factor β_i – are set to values of 0, 1, 2, and 3 which specifies linear growth. ϵ_{it} is the random error, which is assumed to have a mean of zero and is uncorrelated with exogenous variables. Level 2 equations include the presence of exogenous variables as predictors. For Q predictors, the level 2 equations for *y* and *w* are as follows (Bollen and Curran 2006):

$$\alpha_{iy} = \mu_{\alpha y} + \sum_{q=1}^{Q} \gamma_{q\alpha y} x_{iq} + \zeta_{\alpha yi}$$

$$(3)$$

$$\beta_{iy} = \mu_{\beta y} + \sum_{q=1}^{Q} \gamma_{q\beta y} x_{iq} + \zeta_{\beta yi}$$

and:

$$\alpha_{iw} = \mu_{\alpha w} + \sum_{q=1}^{Q} \gamma_{q\alpha w} x_{iq} + \zeta_{\alpha wi}$$

$$\beta_{iw} = \mu_{\beta w} + \sum_{q=1}^{Q} \gamma_{q\beta w} x_{iq} + \zeta_{\beta wi}$$

Here, α_i and β_i represent the latent intercept and slope factors while μ_α and μ_β represent the means for the latent factors. $\zeta_{\alpha i}$ and $\zeta_{\beta i}$ represent the variability of the means. Interpretation of the conditional latent growth models are similar to unconditional multivariate latent growth models, with the key difference that the model incorporates fixed regressions of the latent factors on the set of covariates. For this study, analyses were completed using Mplus Version 8.1 (Muthén and Muthén 2010).

Results

Results are presented in three sections. First, descriptive statistics, followed by results from univariate growth modeling and finally, results from conditional bivariate growth modeling.

Table 4 presents descriptive statistics that demonstrate that, in the aggregate, small rural places experienced low levels of growth, 1980-2010, while poverty rates do not show a clear pattern.

Table 4. Population and Measures of Community Capitals Descriptive Data.

Variables	Population				Poverty [a]				Cultural		Human	Natural	Physical	Political	Social
Measures	Population count				% Poverty				NHP count	NHP binary	% College grad.	Natural amenities. scale	% roads	% State pop.	Diversit index
Year	1980	1990	2000	2010	1980	1990	2000	2010	--	--	1980	--	--	1980	1980
Mean	717	692	741	765	15.89	18.24	15.16	18.03	0.76	0.32	8.50	-0.69	0.80	0.03	0.10
SD	604	630	748	874	9.68	4.27	9.53	11.64	2.47	0.47	6.05	2.11	0.40	0.04	0.15
Skewness	1.12	1.55	3.23	4.56	1.38	1.18	1.18	1.02	17.63	0.76	2.33	0.74	0.75	4.53	1.79
Kurtosis	0.34	3.59	29.44	49.01	2.98	2.19	2.08	1.49	558.04	-1.42	13.93	1.10	3.28	30.98	5.39
Transformed data															--
Skewness	-0.25	-0.26	-0.24	-0.21	--	--	--	--	--	--	-0.48	--	--	0.16	--
Kurtosis	-0.69	-0.65	-0.58	-0.53	--	--	--	--	--	--	1.74	--	--	2.87	--
Transformation	natural log				--	--	--	--	--	--	square-root	--	--	natural log	--

[a] Poverty is also a measure of financial capital.
NA = Natural amenities. SD = Standard deviation. % = percent. NHP = Natural historic places.

As shown on Table 4 and in the regional trends of popualtion and poverty presented in Table 5, mean trends in population show increases from 1980 to 2010, but overall declines are apparent in the Northeast and Midwest. It is notable that population trends of log-transformed data show overall declines between 1980 and 2010. Poverty estimates follow similar regional patterns to county-level poverty estimates. The highest average poverty rates were in the South for all time periods. Povery rates tend to follow national patterns, with povery increases recorded during the 1990 and 2010 Census both nationally and at the place-level. Poverty rates are higher in the communities included in this study than the national average at all times with the exception of povery rates in the Northeast in 1980. Povery increases in the 1990s and 2010 relative to previous decades (1980 and 2000) do appear to be assocated with poplation declines in both the Northeast and Midwest. However, communities in the South and West experienced population increases between 2000 and 2010 despite povery increases during this same time period suggesting that the population-poverty assocation is complex.

Table 5. Regional Trends in Population and Poverty Data.

Census Region/ Division	Average Population				Average Poverty Rate (%)			
	1980	1990	2000	2010	1980	1990	2000	2010
Northeast	969 (6.6)	930 (6.55)	903 (6.52)	876 (6.48)	11.95	13.61	12.66	16.03
Midwest	624 (6.02)	589 (5.92)	612 (5.93)	604 (5.87)	13.34	15.75	12.21	15.72
South	814 (6.37)	789 (6.3)	856 (6.35)	915 (6.37)	20.99	23.43	20.22	22.49
West	787 (6.3)	822 (6.27)	990 (6.41)	1,093 (6.44)	14.13	16.14	15.03	16.32
All Regions	717 (6.19)	692 (6.1)	741 (6.14)	765 (6.12)	15.89	18.24	15.15	18.03
				National Poverty Rates	13.00	13.50	11.30	15.10

Data in parenthesis are natural log of population estimates. %=percent. National poverty rates obtained from U.S. Census Bureau.

Variation in Community Capitals is also evident regionally (Table 6). Notably, avearge levels of cultural, human, natural, physical, and political capital were highest in the western region of the United States. Measures of social capital were lowest in the Northeast – where low levels of Simpson's Diversity Index represent high levels of social capital. On average, measures of cultural capital, human capital, natural capital and political capital were lowest in the Midwest.

Table 6. Regional Trends in Community Capitals.

Census Region/ Division	Cultural	Human	Natural	Physical	Political	Social
	NHP binary	% College grad.	Natural amenities scale	% Roads	% State pop.	Simpson's Diversity index
Northeast	0.45	11.03	-0.21	0.70	0.04	0.02
Midwest	0.26	7.60	-1.96	0.91	0.02	0.04
South	0.37	8.47	0.22	0.68	0.02	0.20
West	0.48	12.48	3.03	0.90	0.06	0.09
All Regions	0.32	8.50	-0.69	0.80	0.03	0.10

NHP = National historic places. % = percent.

A review of correlations between measures indicate significant correlations between measures of poverty and population, with the exception of physical capital (Table 7).

Table 7. Correlations of Population and Measures of Community Capitals

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Population 1980	--													
2. Population 1990	.978*	--												
3. Population 2000	.958*	.979*	--											
4. Population 2010	.935*	.962*	.982*	--										
5. Poverty 1980	-.047*	-.067*	-.072*	-.076*	--									
6. Poverty 1990	-.008	-.039*	-.042*	-.055*	.586*	--								
7. Poverty 2000	.086*	.059*	.055*	.038*	.548*	.598*	--							
8. Poverty 2010	.117*	.105*	.106*	.096*	.399*	.439*	.486*	--						
9. Cultural capital	-.329*	-.328*	-.325*	-.321*	.001	.030*	-.018	-.020	--					
10. Human capital	.346*	.362*	.366*	.369*	-.177*	-.178*	-.111*	-.105*	-.267*	--				
11. Natural capital	.143*	.167*	.202*	.225*	.172*	.154*	.218*	.148*	-.133*	.163*	--			
12. Physical capital	.021	-.008	-.027*	-.053*	-.117*	-.069*	-.072*	-.073*	.007	.048*	-.079*	--		
13. Political capital	.680*	.657*	.638*	.615*	-.063*	-.042*	.028*	.007	-.361*	.380*	.089*	.153*	--	
14. Social capital	.118*	.108*	.103*	.105*	.414*	.361*	.388*	.277*	-.059*	.028*	.228*	-.150*	.027*	--

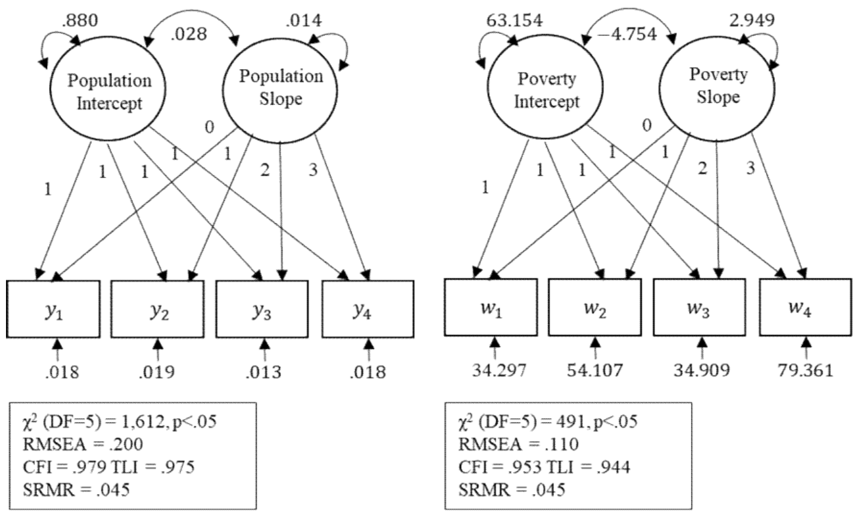
*p<.05, two tailed.

Poverty is both negatively and positively associated with population from 1980 to 2010. Natural capital, political capital, and social capital are positively associated with population and poverty changes over time, while natural capital was positively associated with population but negatively associated with poverty changes over time. These associations suggest that measures of community capitals are predictive of trajectories of population and/or poverty change in these small rural communities. Built capital is not well correlated with population or poverty measures. This measure was removed from the analysis due to weak correlations between with both poverty and population measures.[3]

Univariate latent growth models

Latent growth models provide yet more insight into temporal trends. Initially, modeling efforts were focused on the construction of univariate latent growth models for population and poverty growth separately. Models were assessed based on model fit indices and the distribution and magnitude of residuals between the observed and estimated means and covariances with final results presented on Figure 1.

Figure 1 – Results of Univariate Growth Models for Population and Poverty.



Estimates and loadings are unstandardized.
DF = Degrees of freedom. RMSEA = Root mean squared error. CFI = comparative fit index; TLI = Tucker Lewis index; SRMR = Standardized root mean square residual

Results of the univariate population models indicate individual differences in both initial values and rates of change for rural communities, as indicated by significant variances for both slope and intercept. For the univariate population growth model, results indicate that populations were declining on average with a mean negative slope of -.018 (standard error [s.e.] = .002) and a mean intercept of 6.164 (s.e. = .011) in 1980. Figure 1 also reveals a positive association between intercept and slope factors (.028) suggesting that communities with larger populations in 1980 tended to experience slower

[3] Results of exploratory factor analysis using measures of Community Capitals reported a large negative residual variance for physical/built capital, indicating that the inclusion of this measure for physical/built capital was not appropriate for the current model.

population declines over time relative to initially smaller communities. Essentially, greater size is protective of population decline.

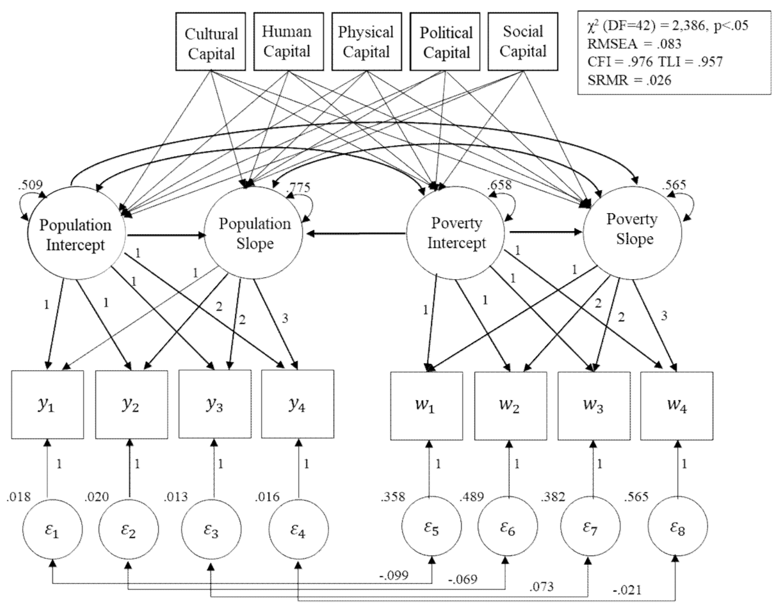
Modeling poverty changes over time uses adjusted poverty rates, calculated as the difference between community-level poverty rates and national poverty rates obtained from the U.S. Census Bureau (U.S. Census Bureau 2018d). In this way, this approach provides insight regarding poverty rates of rural communities relative to national trends and each other. Results indicate that on average, poverty rates were 2.5 percent higher than the national rate of 13.0 percent in 1980 (mean intercept of 3.5, s.e. = .108). Relative to national poverty rates, poverty also increased over time (significant mean slope of is .111, s.e. = .041). These findings are consistent with current research suggesting that rural communities have higher rates of poverty than urban areas and have been slow to recover from economic recessions (Danziger, Chavez, and Cumberworth 2012). In addition, lower initial rates of poverty predict more substantial and rapid poverty increases.

Bivariate conditional latent growth model

Building on the univariate growth models, conditional bivariate growth models consider changes in poverty and population simultaneously. Additionally, including measures for community capitals are as exogenous predictors of both intercepts and slopes provides insight on the differing trajectories of population and poverty based on these community assets. Prior to analysis, all measures were scaled with exogenous predictors mean-centered to allow for estimation of these predictors on the intercepts and slopes of population and poverty. Table 8 and Figure 2 present the final bivariate conditional growth model with significance levels for intercept and slope estimates as well as the relations between exogenous predictors and intercept and slope estimates as the level of significance.

Of key interest is the prediction of changes in population as a result of initial status of poverty. is the results suggest that initial poverty levels significantly and negatively predict subsequent changes in population (poverty intercept/population slope = -.254 s.e. = .041). In other words, communities with relatively high poverty levels in 1980 tended to experience relatively more population loss; poverty inhibits population growth – or accelerates population loss – over time. This finding of the importance of financial capital is consistent with prior work finding positive associations between economic development and population growth (e.g. Johansen and Fuguitt 1984). On the reciprocal associon, population size in 1980 is also positively predictive of subsequent changes in poverty over time; larger communities at the baseline had relatively greater increases in poverty. These results suggest that poverty tends to grow in larger communities.

Figure 2. Conditional Bivariate Latent Growth Model



Estimates standardized with the exception of factor loadings.
DF = Degrees of freedom. RMSEA = Root mean squared error. CFI = comparative fit index;
TLI = Tucker-Lewis index; SRMR = Standardized root mean square residual

Table 8. Parameter Estimates for Conditional Bivariate Growth Model

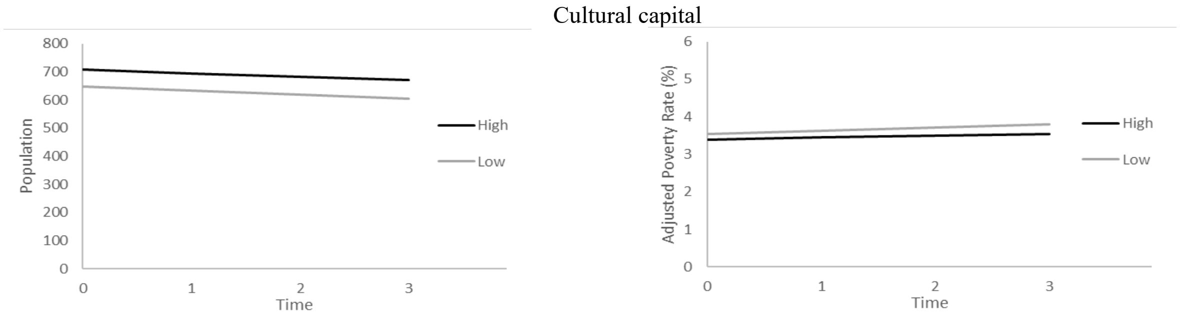
Parameter				Estimate
Poverty population paths/covariances				
Poverty intercept/population slope				-.254 (.041)*
Population intercept/poverty slope				.442 (.037)*
Population slope/poverty slope				.005 (.035)
Population intercept/poverty intercept				-.085 (.015)*
Exogenous Predictors	Population Intercept	Population Slope	Poverty Intercept	Poverty Slope
Cultural capital	.075 (.009)*	.016 (.013)	.009 (.013)	-.045 (.023)†
Human capital	.083 (.008)*	.064 (.014)*	-.265 (.013)*	-.039 (.026)
Natural capital	.044 (.008)*	.323 (.012)*	.143 (.012)*	.094 (.023)*
Political capital	.616 (.008)*	-.203 (.017)*	-.005 (.013)	-.116 (.031)*
Social capital	.083 (.008)*	.027 (.016)†	.488 (.011)*	-.024 (.034)

Numbers in parenthesis are standard errors of parameter estimates. *p<.05. † p<.1

To understand the role of Community Capitals as related to poverty and population trajectories, baseline characteristics are used to predict changes over time. The following figures show model-implied growth trajectories as a function of each predictor at one standard deviation (SD) above and below their means.

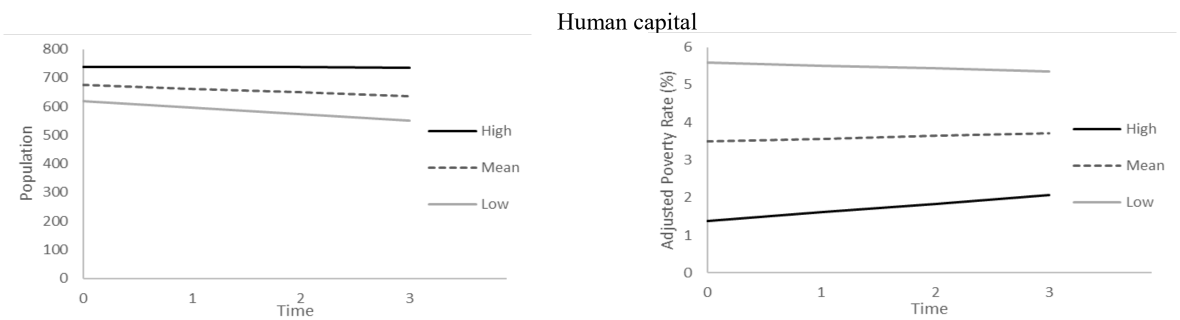
Communities with *cultural capital* are larger at the baseline (Figure 3a). However, the presence of cultural capital is not predictive of population changes over time. Communities with cultural capital still demonstrate poverty gains, but at a slower pace than communities lack such capital (at p<.1). Here, the presence of historical sites or properties may provide a means of generating financial capital that reduces poverty levels in these rural communities.

Figure 3a. Population and Adjusted Mean Poverty Trends, 1980 to 2010 – Cultural Capital



For *human capital,* communities with higher levels of human capital tended to show stable populations over time while communities with lower levels of human capital experienced population loss (Figure 3b). For poverty trends, communities with higher levels of human capital were significantly and negatively predictive of initial levels poverty but not significantly predictive of rates of poverty change over time. Consistent with Flora and Flora (2008), results suggest that communities with higher levels of human capital are associated with higher levels of financial capital – or lower poverty rates – and tend to experience less population loss relative to communities with lower levels of human capital.

Figure 3b. Population and Adjusted Mean Poverty Trends, 1980 to 2010 – Human Capital



As shown on Figure 3c, communities with higher levels of *natural capital* have significantly higher initial populations and *population growth* over time. These results are consistent with prior analyses that have found natural amenities to be a driver of rural population growth (Beale and Johnson 1998; Nord and Cromartie 1997). Interestingly, communities with higher levels of natural capital tend to report significantly higher levels of initial poverty *and* greater increases in poverty over time relative to low-natural capital communities. Suggesting that rural communities with high levels of natural amenities have increasing rates of poverty.

Figure 3c. Population and Adjusted Mean Poverty Trends, 1980 to 2010 - Natural Capital

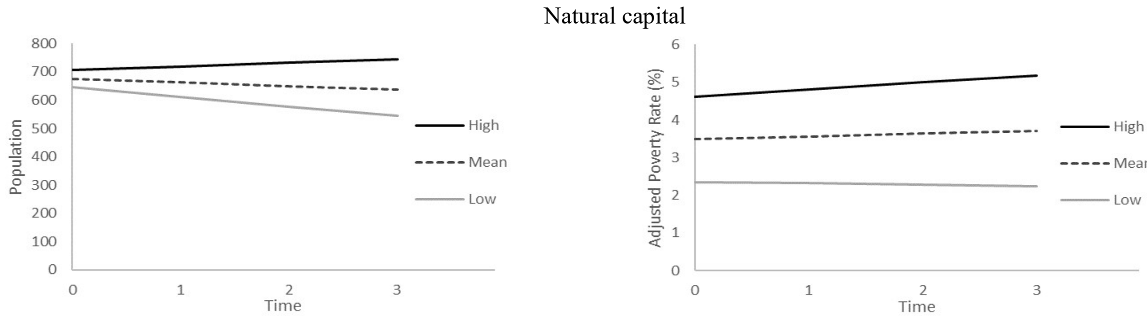
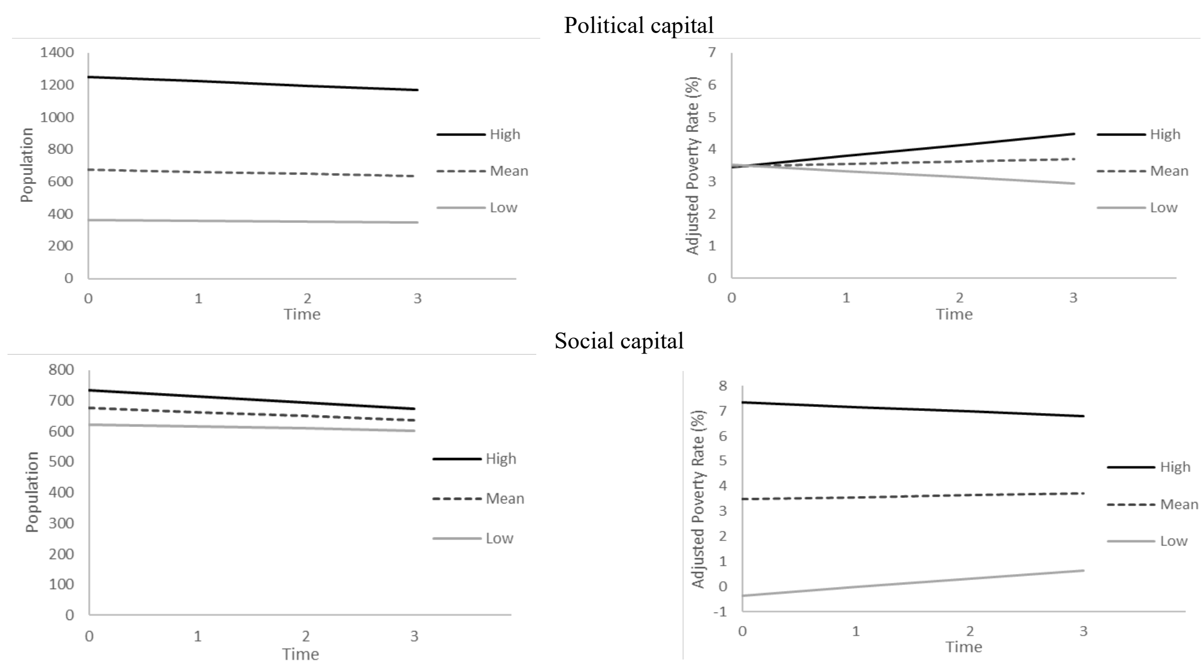


Figure 3d presents results for political and social capital. Results indicate that communities with high levels of *political capital* tend to have significantly higher initial populations, but similar rates of population decline over time relative to communities with low levels of political capital. High levels of political capital are also predictive of increased poverty rates over time. Finally, the measure for social capital is significantly and positively associated with initial population and population declines. Similar to the Community Capitals Framework, communities with higher levels of social capital (i.e. low levels of the study-level measure of diversity) are associated with slower rates of population declines over time. The presence of social bonds (high social capital) may help protect communities from population declines.

Figure 3d. Adjusted Mean Poverty and Population Trends, 1980 to 2010 – Political and Social Capital

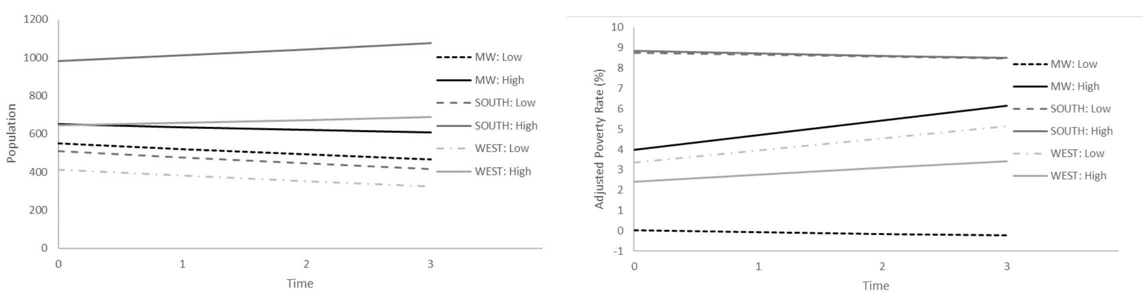


Evaluating these associations regionally shows significant variation. The Midwest, South, and Western states present intriguing associations although the small sample size for Northeast rural communities (N=342) prevents model estimation. As expected, population decline is evidenced in the South, stable populations in the Midwest, and population growth in the West. Relative to other regions, communities in the South show high, but slightly declining trends of poverty over time (approximately 8 percent above the national average), while communities in the Midwest and West indicate lower (approximately 1 percent and 2.5 percent respectively) but increasing rates of poverty relative to the national average.

When looking at the role of community capitals, modeling results also show regional variation. For example, Figure 4 shows the trajectories grouped regionally (excluding Northeast) with low and high levels of *natural capital*. Results indicate that communities with high levels of natural capital in the South and West regions tend to have growing populations while rural communities in the Midwest tend to decline despite higher levels of natural capital. The associations with poverty are interesting; in the South, the presence of natural capital is not significantly associated with poverty trends, but communities in the Midwest and West with higher levels of natural capital tend to have increasing levels of poverty compared to communities with lower levels of natural capital. Notably, in the Midwest, poverty rates were declining relative to the national average in communities with lower levels of natural capital.

Figure 4. Adjusted Mean Poverty and Population Trends, 1980 to 2010 – Regional Variation

Natural Capital



Discussion

Drawing on data from the U.S. decennial Census, the aims of this study twofold: 1) to understand the associations between population and poverty changes simultaneously over time, and 2) to examine different trajectories of population and poverty over time drawing on measures of Community Capitals.

Findings indicate that the rural communities in this study have generally declined in population from 1980 to 2010, with latent growth modeling indicating that communities with larger initial populations had relatively slower population loss. Additionally, rural communities tend to have higher levels of poverty than the national average (approximately 3.5 percent higher), and this gap continued to increase over time. In all, results speak to the economic challenges of increasing rural poverty faced by these rural communities.

Results of this study reveal that *high levels of poverty in 1980 were associated with population declines over time.* As suggested by the Community Capitals framework, high-poverty communities may experience higher rates of population loss due to outmigration, likely as residents leave in search of economic opportunities (Flora and Flora 2008). Consistent with previous studies examining the link between economic well-being and population change in nonmetropolitan counties (e.g. Johnson and Fuguitt 1985), lower levels of poverty in 1980 are associated with less population loss over time.

This study finds that *Community Capitals yield variation in the population-poverty association*. Of particular interest, results suggest that high levels of natural capital are associated with both population growth *and* increasing poverty over the study period (Figure 3c). Here, natural capital helps explain variation in poverty-population association, where communities with increasing poverty rates also experience population growth. Prior research suggests that rural population growth due to natural amenities results from a desire to improve overall quality of life rather than economic "pull" factors (Deller et al. 2001). Higher poverty rates may be explained by the movement of lower wage earners into these communities, resulting in overall increasing levels of poverty.

Other community capitals matter too. Cultural capital shapes the trajectories of poverty over time but not population change; cultural capital-rich communities experienced increasing rates of poverty, but at a slower pace than communities lacking such capital (Figure 3a). The presence of cultural capital may reduce poverty by the generation of financial capital through tourism or grants (Flora and Flora 2008). Interestingly, human capital shapes the trajectories of population change over time but not poverty. Communities with higher levels of human capital – measured as the percentage of college graduates – experienced almost no measurable population loss on average while communities with lower levels of human capital experienced population declines. Flora and Flora (2008) suggest that human capital is important for community-level population and economic growth. Additionally, higher levels of social capital, or low levels of diversity, were associated with lower rates of population decline over time compared to communities with lower levels of social capital. Results highlight the importance of social bonds within a community, protecting communities from population loss (Flora and Flora 2008).

The current study is not without limitations. First, community capitals are difficult to measure quantitatively (Flora and Flora 2008; Pigg et al. 2013), with prior work focused on measuring data using survey instruments or detailed data that is not presently available at the place-scale. Future analyses should consider additional. For instance, given that Hero (2003) noted that social capital tends to be high within social classes, measures could be extended to include income inequality. For political capital, measures such as voter participation or political affiliation could be incorporated into this analysis but is again challenging to retrieve at on the national and place scale.

This study fundamentally asks whether initial conditions influence later trajectories of growth and change. Yet capitals are included here only at the baseline; additional longitudinal measures would instead illustrate the ups and downs of particular community assets. For example, economic declines in the late 2000s due to the Great Recession impacted rural communities more so than earlier economic declines; nonmetropolitan areas struggled to return to pre-recession levels of income and employment even many years after metropolitan areas had recovered (Danziger, Chavez, and Cumberworth 2012). During the recession, human capital levels likely shifted as individuals migrated in search of employment (Flora and Flora 2008; Stockdale 2006). Similarly, social capital as reflected by racial and ethnic diversity has drastically changed over the past 30 years with some rural communities becoming new destinations for immigrants (Lichter and Johnson 2009). These temporal shifts in capital may allow for even better explanation of population and poverty patterns but are not included here.

Finally, there are accuracy concerns with place-based data. Although the U.S. Census notes a 90 percent confidence interval for data reported using 5-year ACS estimates, these errors might be magnified when considering smaller rural communities.

Such limitations notwithstanding, this study offers an innovative approach to exploration of fundamental trends in rural America, and an approach that can serve as a jumping off point for further investigation. Population and poverty trends are indeed associated, sometimes in surprising ways, and Community Capitals offer useful predictors of observed trends. Amenity communities, in particular, appear challenged by both population growth and increases in poverty. This combined challenge of growth and economic hardship deserves further scholarly and policy attention.

The results of this project have important policy implications. Rural communities have experienced long-term population loss and since 2010, the majority have experienced declines (Economic Research Service 2017b). Population losses have been linked to challenges faced by rural communities such as chronic poverty, greater morbidity and lower life expectancies (Lichter and Ziliak 2017; Monnat and Brown 2017). Understanding the role of community resources and their influence on demographic and economic trajectories of these small rural communities is vital to the development of policies that sustain rural communities.

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