Valuing Rural Minority Communities

Inclusive Growth, Broadband, and Leadership

Governance Studies at BROOKINGS

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EXECUTIVE SUMMARY

Candid conversations on structural racism have encouraged social scientists to recast issues of race, place, and inequality by adopting a new racial equity view.

Fortunately, the pivot toward more conscientious research has not been lost on economists committed to improving the human condition. Studies of rural communities have taken center stage in this new interest. At the same time, scholars have added to the volume of empirical studies on rural communities. Many hew to the mainstream path that draws on volumes of static datasets lacking the capacity to model rural America's true complexity and variation.

However, classic empirical analyses often fail to sufficiently describe the breadth of rural America's diversity. Rural minority communities sitting at the intersection of racialized and isolated places are of particular concern within this lacuna. Studies of these communities will expand the framework necessary to accommodate their distinct needs. Yet even when economists pursue this aim, practical research overlooks Indigenous communities of color. We argue that researchers should carefully attend to the experiences of rural minority communities. We explicitly include Indigenous groups, traditional groups such as Native Americans, and those less visible like the Gullah/Geechee because their interests are only partly reflected in today's federal rural policy framework.

Which rural minority communities are growing? What are the strategies behind these growth-oriented communities? Answers to these questions are central to this report; we illuminate inspiring leadership regimes and strategic policy models that are drawing in people and jobs to rural minority communities. While economic turmoil stemming from the COVID-19 pandemic has compromised most urban communities, the prevailing consensus suggests they will recover fully. However, the impact on rural minority communities, which are typically less resilient than others to macroeconomic turbulence, remains in question. The analysis in this report is timely and relevant to policymakers and social actors devoted to securing equitable prosperity for rural America's vulnerable communities.

We capitalize on a wealth of publicly available administrative data to outline these economies and deconstruct trends in employment, business creation, broadband adoption, and the labor force. To ascertain the regenerative strategies underpinning selected growth outliers, we draw on extensive field interviews within each community to highlight stories about shaping these places' capacities and trajectories. We interviewed economic development leaders, mayors, Chamber of Commerce representatives, nonprofit founders, and minority- and women-owned business representatives to unpack their visions for growing secure futures.

Several policy-related conclusions emerge from our analysis:

- **Building Institutional Capacity:** Breaking path-dependent cycles of decline and disinvestment requires creative leaders to be invested in rural minority communities' value and potential. Because leadership matters, it is pivotal that decision-makers across public, private, and philanthropic networks collaboratively invest and direct institutional resources toward building leadership to implement strategies and experiment with new theories of change.

- **Infrastructure:** Reinforcing the economic environment is critical to attracting incumbent businesses willing to relocate to cheaper housing markets or those searching for places with strategic access to e-commerce distribution nodes and global trade gateways. Fostering the establishment of new firms calls for substantial local investment in broadband technology and complementary infrastructure.

- **Understanding Local Competitive Advantage:** These areas must identify and leverage local natural and human capital resources to enhance economic growth and development in a sustainable fashion. Examples of these assets include regional institutions, natural resources, and historical/cultural attractions.

- **Demographics:** To thrive, it will be vital for these areas to retain young, college-educated workers and to attract prime-age working families. These objectives require job opportunities, affordable housing, and quality investments in community-centric placemaking strategies.

- **Federal Rural Development Partnership:** Federal partnership is essential to institutionalizing prosperity in rural America's divested places. However, the conventional top-down approach to rural policymaking vested in a single agency is counterproductive. The needs of rural minority communities call for a new partnership model that establishes a whole-of-government rural development mandate and coordinates federal policy across agencies to support and amplify local community development efforts.

This report sheds light on regenerative strategies inspired by a diverse group of individuals committed to their local communities' vitality. Many approaches are replicable in other contexts and can motivate new ideas or experiments. We encourage readers to critically examine the frameworks we present and to appreciate the tremendous heterogeneity shaping outcomes and trajectories, especially the many ways community leadership manifests in the success stories of rural places.

INTRODUCTION

Urban metros are the locus of most economic activity in our contemporary technology- and service-driven economy.

As is typical of advanced economies, the United States is heavily urbanized. Yet a sizable proportion of U.S. society remains within and deeply connected to rural areas. These places bear substantial economic potential. In addition to providing opportunities based on local natural resources, rural areas often feature lower living costs, cheaper real estate, and a less onerous zoning and regulatory environment that can stifle growth and business establishment. However, as Pipa and Geismer (2021) point out, rural areas often compete with metro regions for access to federally funded programs and are put at a disadvantage: Eligibility requirements may prioritize absolute numbers of people served over percentages of the area population, require local matching funds scarce in rural places, or fail to adjust for the higher fixed costs of delivering services in remote regions.

For federal capital to effectively invest in rural prosperity, the structural and social barriers to success for marginalized Americans in these areas must be addressed (Ajilore and Willingham, 2019). There are sizable populations of people of color, immigrants, LGBTQ people, and disabled people living in rural areas. This report examines these areas' economic prospects through the lens of an understudied and often ignored subset of rural regions: majority-minority rural counties. These are rural areas where the white, non-Hispanic population constitutes a minority. The rural literature has recently tuned into the diversity of rural America and generated crucial insight into the substantial ethnoracial and cultural heterogeneity-shaping life opportunities in these communities. However, few studies pay attention to the nuanced variation within and across rural minority communities. We focus on the structural and economic variation to improve our understanding of the potential for economic development that may go underrecognized because of their demographics or location.

This report presents novel stylized facts about majority-minority rural places. We compare them to their majority-white counterparts along four dimensions of economic growth: demographic trends, broadband adoption, accessibility, and local labor market dynamics. Our analysis draws upon several key data sources, including information on broadband penetration and adoption made available by the Federal Communications Commission (FCC); proprietary monthly electronic job listings collected and made available by Burning Glass Technologies (BGT); and various federal administrative datasets from the Census Bureau, U.S. Bureau of Labor Statistics (BLS), the Bureau of Economic Analysis, and the U.S. Department of Agriculture (USDA). We use these data to map recent trends in economic activity in these areas and to delineate the roles of broadband, the industry mix, and labor force dynamics in enhancing rural communities' economic prospects going forward.

This report highlights several features of rural minority counties. These areas constitute a small share of rural America but are often in economically important regions of the country. Despite the common thread of being rural, there is substantial heterogeneity in places' underlying demographics, geography, and natural resource bases. This variation has consequences for locations' economic prospects. Specifically, Black rural counties are almost exclusively in the Delta region of the Southeast and depend heavily on agriculture and declining industries such as manufacturing. These counties have been hit particularly hard by population loss among prime-age workers.

By contrast, Hispanic-majority counties are more concentrated in the Rio Grande Valley and other parts of the Southwest. While the economies of these counties from agricultural and manufacturing industries populate both sides of the border area, the counties benefit substantially from the essential and somewhat volatile oil and gas industry. This sector injects ample investment and growth potential but leaves some majority-Hispanic areas at the mercy of the boom-bust cycle typical of oil and gas economies. Finally, Indigenous-majority counties are generally in the country's Great Plains, west, and southwest regions. Like Hispanic-majority counties, these counties typically depend on the agriculture and fossil fuel industries, suggesting the need for richer industry investment and diversification.

Our analysis reveals broadband as a central area of infrastructure that works together with other human and capital resources to facilitate development in all rural counties—majority-minority and white. This report posits that broadband has spillover effects on industries once the technology has been sufficiently adopted within a county. Using a new approach that associates the timing and intensity of broadband adoption with economic outcomes, our analysis shows that a natural breakpoint in activity begins beyond the 50% to 60% adoption threshold. The impact of infrastructure investment, including in broadband, tends to coincide with that of other investments such as in road construction or water and sewer infrastructure. Contemporaneous effects make it difficult to isolate precise causal relationships in this respect. We nonetheless provide further evidence that broadband access and adoption are integral for rural areas to stay viable in the modern economy.

Alongside (and possibly related to) broadband are key labor force and demographic factors facing these rural areas. Our analysis suggests that these communities, especially Black-majority ones, suffer from an unfavorable demographic structure and population decline. A relatively small share of the workforce in these areas is considered highly skilled as measured by educational attainment. However, labor demand as indicated by online job postings was found to grow robustly for low- and high-skilled workers over the study period. It thus appears that, with relevant investment (as in training), many of these rural minority areas can support interested middle- and high-skill workers.

Our empirical and qualitative findings collectively highlight the importance of disaggregating these communities to facilitate targeted policy formulation.

To understand the regenerative coping strategies underpinning selected growth outliers, we draw on extensive field interviews within each community to highlight stories about shaping these places' capacities and trajectories. We interviewed economic development leaders, mayors, Chamber of Commerce representatives, nonprofit founders, and minority- and women-owned business representatives who shared their visions for growing thriving rural communities. Our empirical and qualitative findings collectively highlight the importance of disaggregating these communities to facilitate targeted policy formulation given systematic differences between rural majority-minority counties within the broader economic recovery discourse.

This report begins by defining rurality as used in our research. We next provide a descriptive overview of recent employment dynamics and demographics across rural minority counties compared with white-majority rural counties. Then, the report examines the role of broadband in expediting economic growth (Section 5). We present an approach that exploits detailed information on the intensity and timing of broadband adoption to characterize county-level development along these dimensions of infrastructure investment and usage. Section 6 applies the taxonomy from the prior section to study how labor demand and supply dynamics have evolved across counties with varying broadband adoption. The report concludes with a summary discussion and policy-relevant suggestions intended to support economic development in rural minority counties specifically and in rural areas in general.

DEFINING RURAL COMMUNITIES

"Rural America" is an umbrella term encompassing distinct social and economic regions home to unique ethnic populations, environmental settings, and uneven economic development.

Determining which communities should be considered rural has often proven difficult when studying economic development. In many circumstances, the notion of rurality serves as a residual differentiating the stagnant or declining parts of places from growing parts that are absorbed into a metro area (Dam, 2019). It is thus essential to choose a description that covers places fully capturing the lived experiences and opportunities of such communities while allowing for flexibility to accommodate rural areas' economic dynamism. We abide by Mueller et al.'s (2020) guiding principles of choosing definitions of rurality within the context of what is desired or intended to be achieved by policies of interest.

Our decision to extend the ethnoracial taxonomy to include Indigenous-majority communities illuminates the richness embedded in rural communities and the enormous complications accompanying efforts to force an expansive notion of diversity into a monochromatic rural policy framework.

Ajilore and Willingham (2019) note that one limitation of using the metro-nonmetro delineation as a proxy for rurality is that a county's classification may change due to population-based fluctuations. Interpretations of rural areas over the years can therefore become complicated. While we follow standard approaches by using the Office of Management and Budget (OMB) taxonomy that defines rural counties as those that lie outside metropolitan areas, our report focuses on nonmetro areas appearing in OMB's 2003 and 2013 bulletins. By including counties initially defined as rural in 2003 but reclassified as urban in 2013, we capture key features and lived experiences within these areas and across multiple periods. We could therefore evaluate economic development and growth as well as relevant policy decisions.

With respect to defining majority-minority, we depart from conventional approaches that employ a strict arithmetic threshold greater than 50% to demarcate racial identity boundaries. We instead leverage race-identifying methods from academics studying the dynamics of integrated neighborhoods to inform our ethnoracial typology. According to the integrated neighborhood school of thought, racially integrated places emerge around a 20% boundary for each race or ethnic group. For instance, Ellen et al. (2012) finds that in a white-Black integrated neighborhood, an at least 20% share of whites and Blacks captures the salient dynamics of integration and neighborhood change. In our majority-minority classification, we impose a conservative majority-group threshold of 30% for each minority and explicitly limit white representation to less than 50%. Our ethnographic fieldwork confirmed the validity of typing methods. As such, we believe the interplay between our rural and majority-minority typologies accurately describes lived experiences in rural minority communities. Moreover, our decision to extend the ethnoracial taxonomy to include Indigenous-majority communities illuminates the richness embedded in rural communities and the enormous complications accompanying efforts to force an expansive notion of diversity into a monochromatic rural policy framework.

EMPLOYMENT DYNAMICS IN RURAL COUNTIES: 2010–2020

Rural counties have generally failed to keep pace with metro counties in recovering from the Great Recession.

Rural counties have generally failed to keep pace with metro counties in recovering from the Great Recession. According to Cromartie (2018), declining labor force participation due to an aging population has led to slower employment growth rates in rural areas. To contextually clarify differences in employment growth over the recent decade, Table 1 presents three snapshots comparing payroll job growth in metropolitan and rural counties. Urban counties saw roughly 10% growth in jobs between 2010 and 2015. By contrast, rural counties saw 4% growth in employment overall. Likewise, when measured over the decade between 2010 and 2019, metropolitan county

TABLE 1

Payroll Job Growth by County Demographic

	No. of Counties	2010 to 2015		2010 to 2019		2018 to 2019	
		%	#	%	#	%	#
Metropolitan Counties	1,220	9.9	11,053,488	17.3	19,308,272	1.5	1,898,056
Rural Counties	2,056	4.0	687,184	5.9	1,026,590	0.5	96,620
White Rural	1,876	4.2	672,464	6.2	1,006,124	0.5	87,788
Majority-Indigenous	23	-2.6	-3,255	-2.8	-3,618	0.7	861
Majority-Black Rural	85	-2.9	-15,642	-4.6	-24,412	-0.4	-2,230
Majority-Hispanic Rural	72	7.4	33,616	10.7	48,498	2.1	10,204

Source: Quarterly Census of Employment and Wages, Bureau of Labor Statistics.

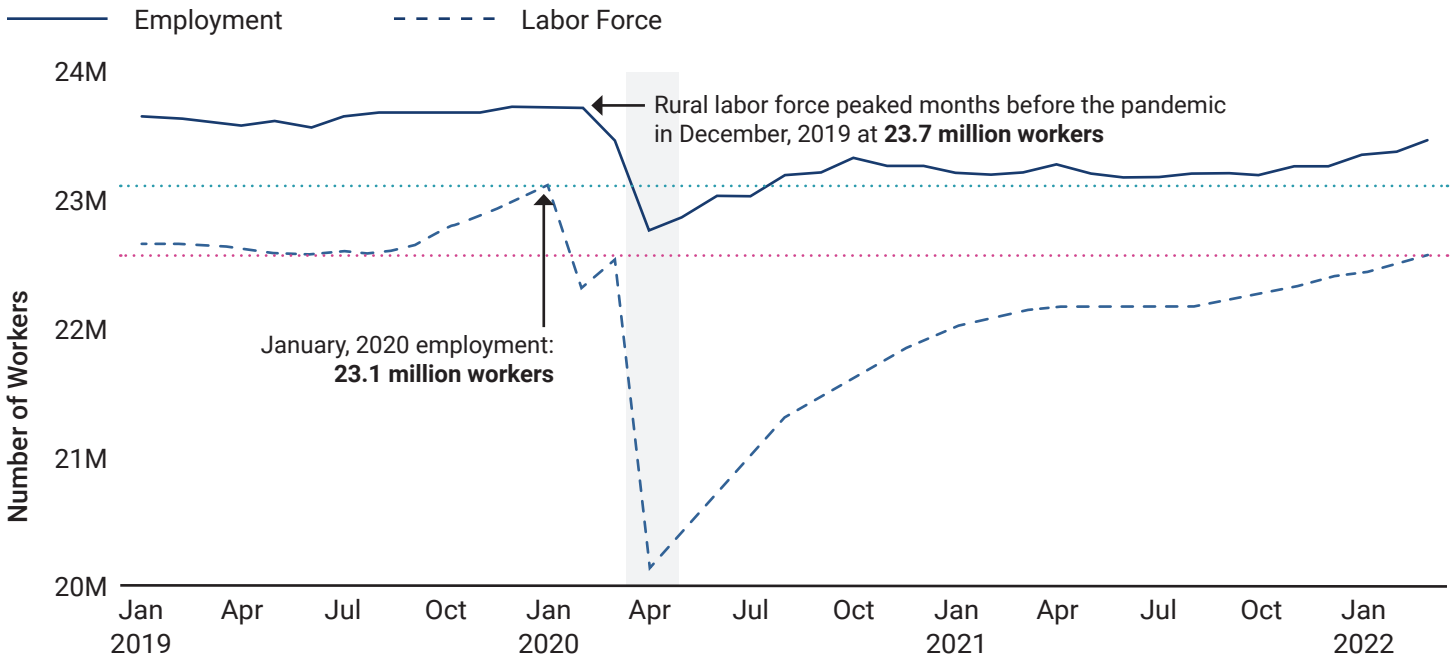
payrolls grew nearly three times faster than their rural county counterparts: An 11-percentage point difference emerged between metro and rural county growth, with metro counties seeing 17.3% job growth while rural counties saw merely 6% over the same period. Finally, just before the COVID-19 pandemic, metro counties saw 1.5% job growth, whereas rural counties saw only 0.5%.

Considerable heterogeneity exists across rural counties in terms of their underlying demographics. White and majority-Hispanic counties saw positive job growth while majority-Black areas experienced a contraction in their workforces. Specifically, between 2010 and 2015, majority-Hispanic rural counties witnessed the most significant job growth at 7.4%. White rural counties saw an increase of 4%, yet majority-Black areas saw a payroll drop of nearly 3%. This trend persisted throughout the decade, where majority-Hispanic counties had nearly 11% payroll growth over the period. White rural counties, on the other hand, saw just over 6% growth. However, the rate of decline in majority-Black areas intensified; they experienced a 4.6% drop in payrolls over this period.

FIGURE 1

Rural Employment by County Demographic Groups, 2019-2022

County leaders' investments in family anchor policies pushed growth in school-aged children living in local communities

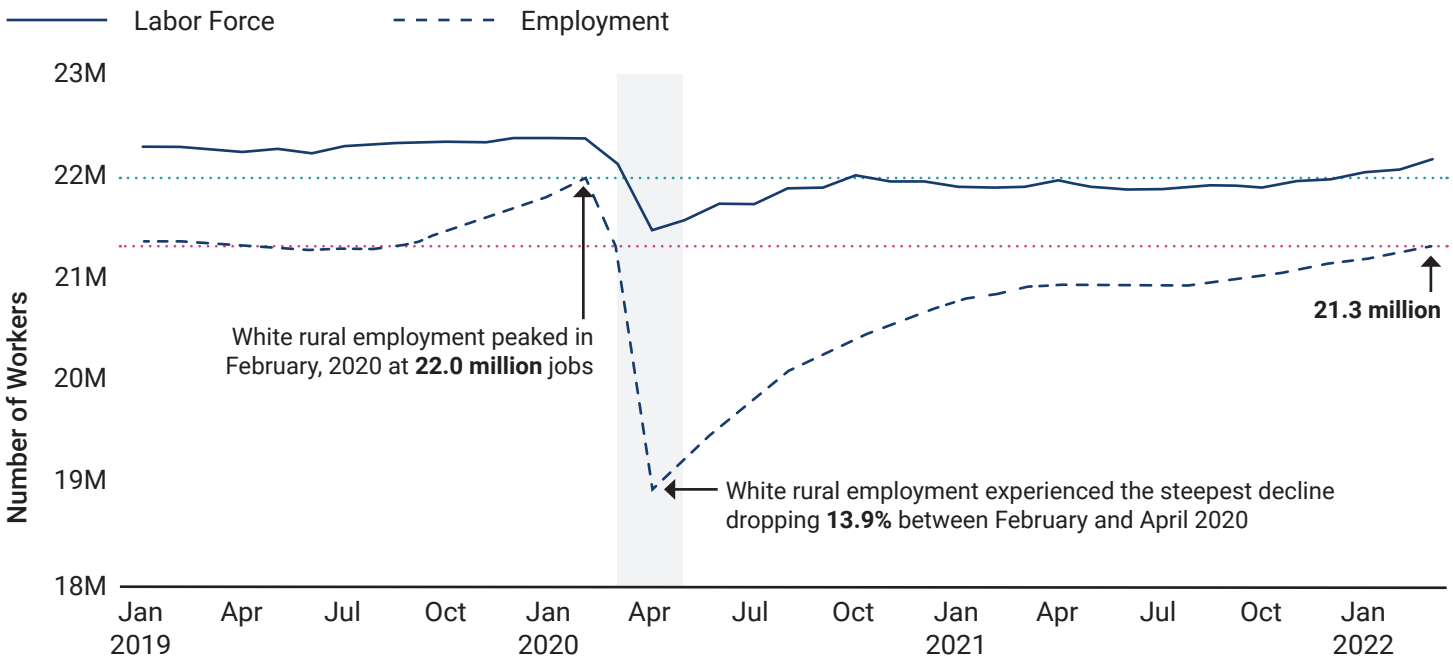


Source: Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS). BLS does not seasonally adjust county-level series, authors seasonally adjusted employment and labor force data using U.S. Census X13-ARIMA-SEATS.

Figure 1 displays recent monthly employment dynamics for the selected rural counties during the immediate pre-COVID-19 era from 2019 to January 2022. As noted earlier, driven by a need to reflect lived experiences in rural places, we classify counties by their baseline rural status in 2003; the decision point to baseline rurality affects all our analyses, including basic labor force counts, populations, and employment estimates. Nevertheless, we expect most of our estimates to align with other credible studies within a reasonable margin. As shown in the first panel of Figure 1, overall rural labor force size and employment peaked around the end of 2019 at more than 23 million workers. Employment declined slightly in the subsequent winter months before the COVID-19 era that began in March 2020. Between January 2020 and April 2020, these rural counties saw a sharp drop-off in the labor force and employment level, with employment effects being much more intense. Expressly, the labor force declined by roughly 5% to nearly 22.5 million workers, whereas employment fell by almost 11% to just over 20 million workers. As in the United States in general, a near V-shaped recovery occurred in both the labor force level and employment beginning in the summer of 2020. Rural counties' labor force and employment levels had returned to pre-pandemic levels as of January 2022.

FIGURE 1A

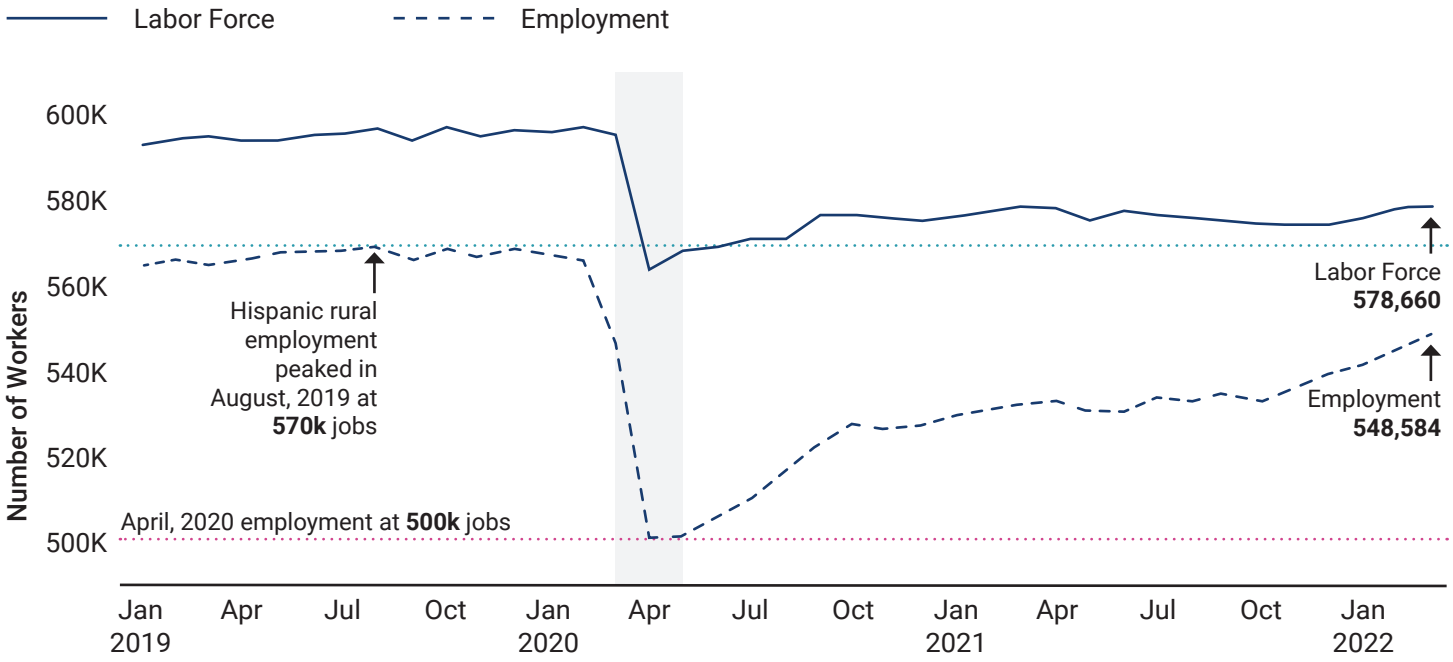
White Rural Employment and Labor Force



Source: Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS). BLS does not seasonally adjust county-level series, authors seasonally adjusted employment and labor force data using U.S. Census X13-ARIMA-SEATS.

FIGURE 1B

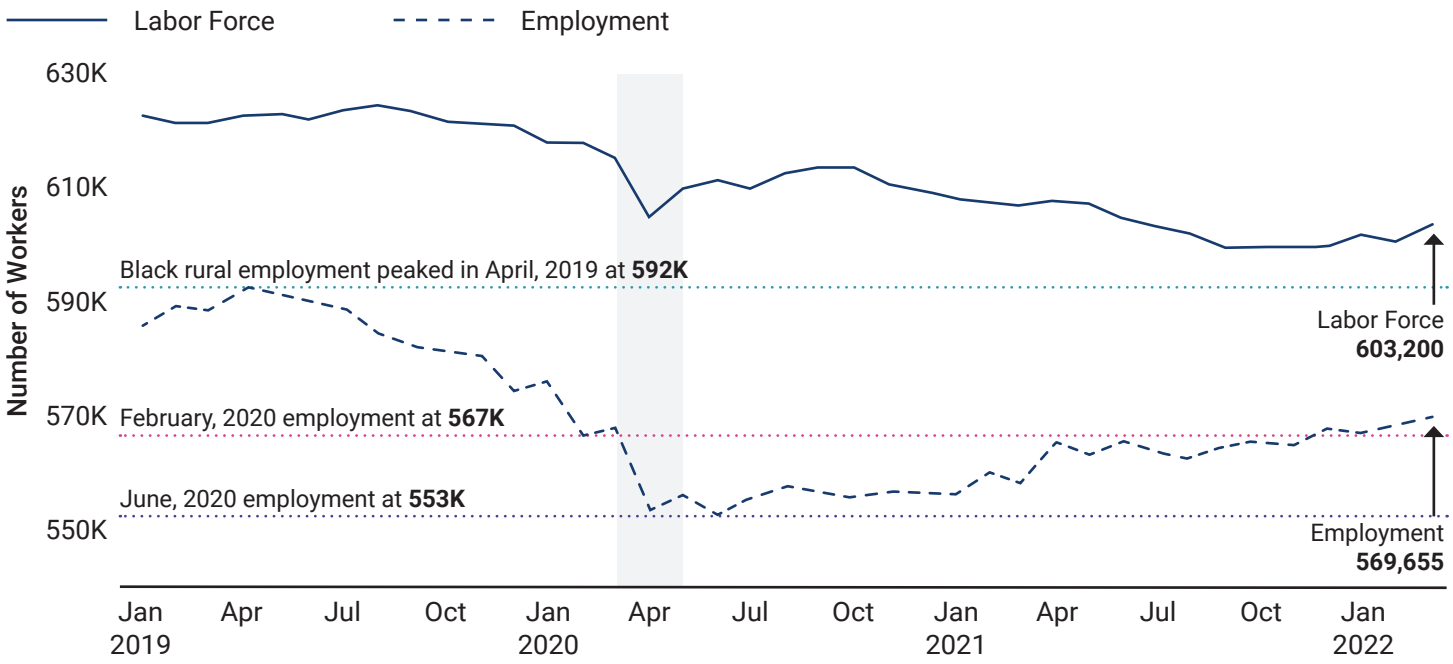
Hispanic Rural Employment and Labor Force



Source: Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS). BLS does not seasonally adjust county-level series, authors seasonally adjusted employment and labor force data using U.S. Census X13-ARIMA-SEATS.

FIGURE 1C

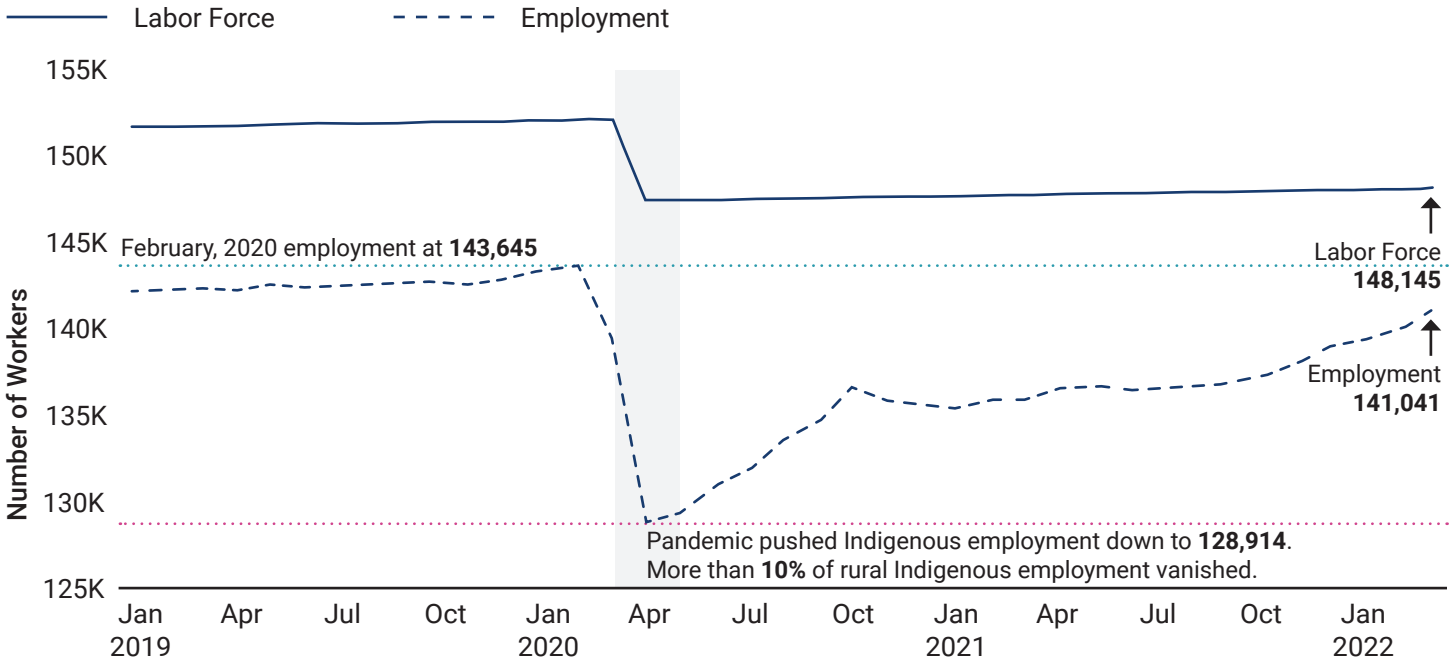
Black Rural Employment and Labor Force



Source: Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS). BLS does not seasonally adjust county-level series, authors seasonally adjusted employment and labor force data using U.S. Census X13-ARIMA-SEATS.

FIGURE 1D

Indigenous Rural Employment and Labor Force



Source: Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS). BLS does not seasonally adjust county-level series, authors seasonally adjusted employment and labor force data using U.S. Census X13-ARIMA-SEATS.

The remaining panels of Figure 1 present these dynamics for predominantly white and rural minority counties. Moving first to Panel 2, consistent with most rural counties being predominantly white, the employment dynamics in these counties largely mirrored overall rural dynamics. Labor force size and employment in these counties peaked at just over 22 million in February 2020 and began to fall rapidly, dropping 13.9% to roughly 18.5 million between January 2020 and April 2020. Employment rebounded in subsequent months to just below pre-pandemic levels.

Interesting differences relative to white rural areas emerge in the final panels comparing employment dynamics over this same period for rural minority areas. Panel 3 shows that in Hispanic-majority areas, the labor force size and employment peaked much earlier than for their white counterparts in the summer of 2019. These levels remained largely steady until early January 2020, when employment started to decline at the beginning of the pandemic. The pandemic was especially deleterious for Hispanic counties: these places saw a 12% drop in employment and a 4% drop in overall labor. Like their white counterparts, these areas underwent significant labor market recovery from the pandemic over the ensuing months. However, figures remained below their pre-pandemic peaks in terms of labor force size and employment.

Most Black-majority rural counties fared somewhat differently concerning the pre- and post-pandemic labor market, seeing a much more muted recovery from the pandemic. These counties' pre-pandemic employment and labor force levels usually peaked much earlier in the spring of 2019. Interestingly, both the labor force and employment began to fall monotonically over the summer and continued to decline through the fall of 2019 and winter of 2020. The COVID-19 pandemic therefore had a much smaller impact on Black-majority rural counties' employment and labor force. In contrast to significant drops in white and Hispanic counties with respect to employment and labor force size, Black-majority counties saw only a 3% dip in employment to around 553,000. Their labor force decline accelerated by an additional 2% to just under 610,000. Additionally, although these counties' employment eventually returned to pre-pandemic levels, figures remained about 10% below those in the spring of 2019. More surprisingly, these counties have largely seen their labor forces continue to decline despite a slight uptick over the summer and fall of 2020.

Employment dynamics illustrate the resiliency and durability of rural counties in general and rural minority areas in particular—despite the challenges these communities regularly confront.

The final panel of Figure 1 explores these dynamics for Indigenous-majority areas. These areas saw largely steady pre-pandemic employment and labor force levels over the months leading up to the pandemic. However, once the pandemic hit, these counties experienced a sharp drop-off in employment levels of roughly 10% and a labor force decline of approximately 3%. Indigenous-majority counties returned to employment levels just below their pre-pandemic high of around 145,000 by January 2022. Labor force levels in these areas saw virtually no recovery.

Taken together, these employment dynamics illustrate the resiliency and durability of rural counties in general and rural minority areas in particular—despite the challenges these communities regularly confront. These findings also highlight the heterogenous nature of the labor market across county types. Black-majority counties stand out as experiencing distinct pre-pandemic aggregate labor market issues relative to other places. In the subsequent sections, we explore this heterogeneity in greater depth to unravel its dynamics and ways to inform policy choices for these areas moving forward.

Rural communities need to attract innovative companies like Atlas Sand to support the county's economic diversification vision. Atlas synthesizes advanced technologies into workforce gains in Ward County. The company partners with local colleges to train, recruit, and hire cybersecurity, network, and process systems engineers.

TRACING THE GEOGRAPHY AND DEMOGRAPHY OF MAJORITY-MINORITY RURAL COUNTIES

Majority-minority counties tend to be in the south, southwest, and western parts of the United States.

As pictured in Figure 2, Black-dominant counties are generally in Mississippi and Alabama or the coastal areas of Georgia and South Carolina. Hispanic-dominant areas are typically concentrated along the Rio Grande Valley area that forms the border between Texas and Mexico as well as in significant portions of New Mexico and Arizona. Lastly, counties that are majority Native American are mostly in the Great Plains.

FIGURE 2

Rural Employment by County Demographic Groups, 2019-2022

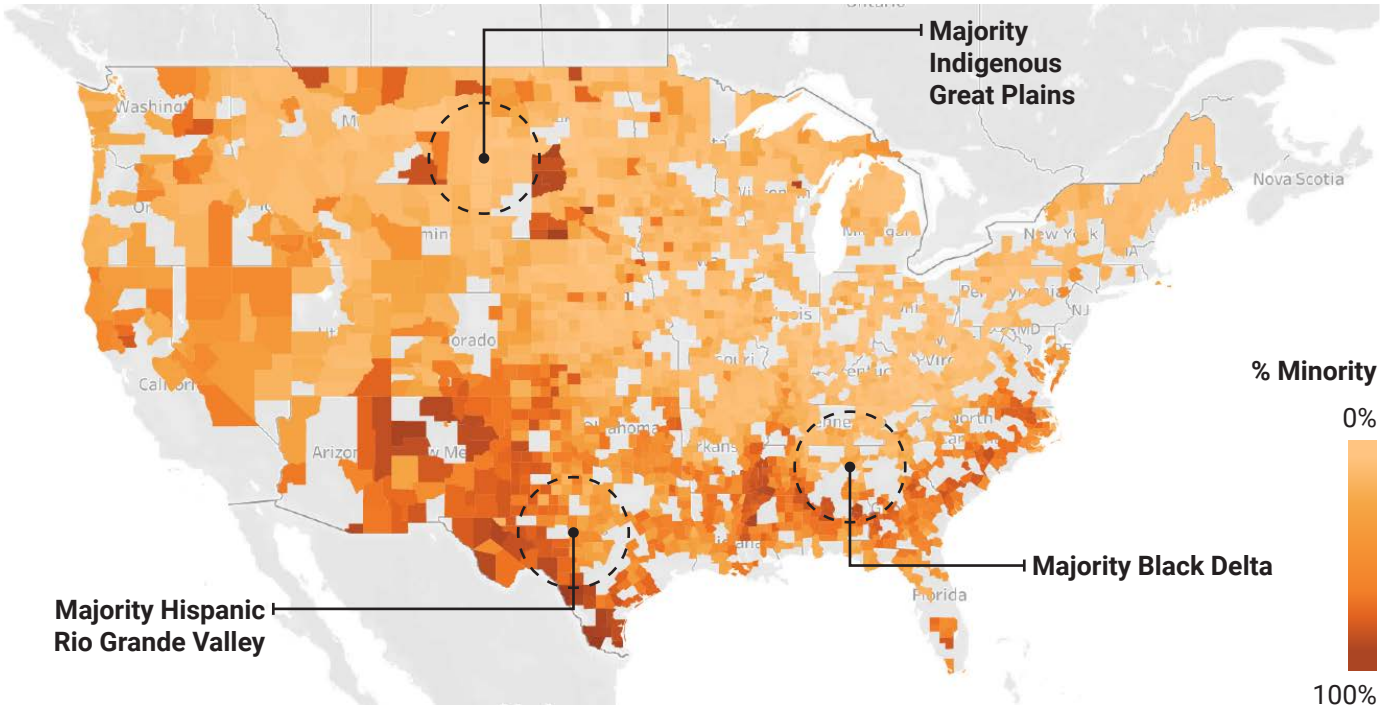
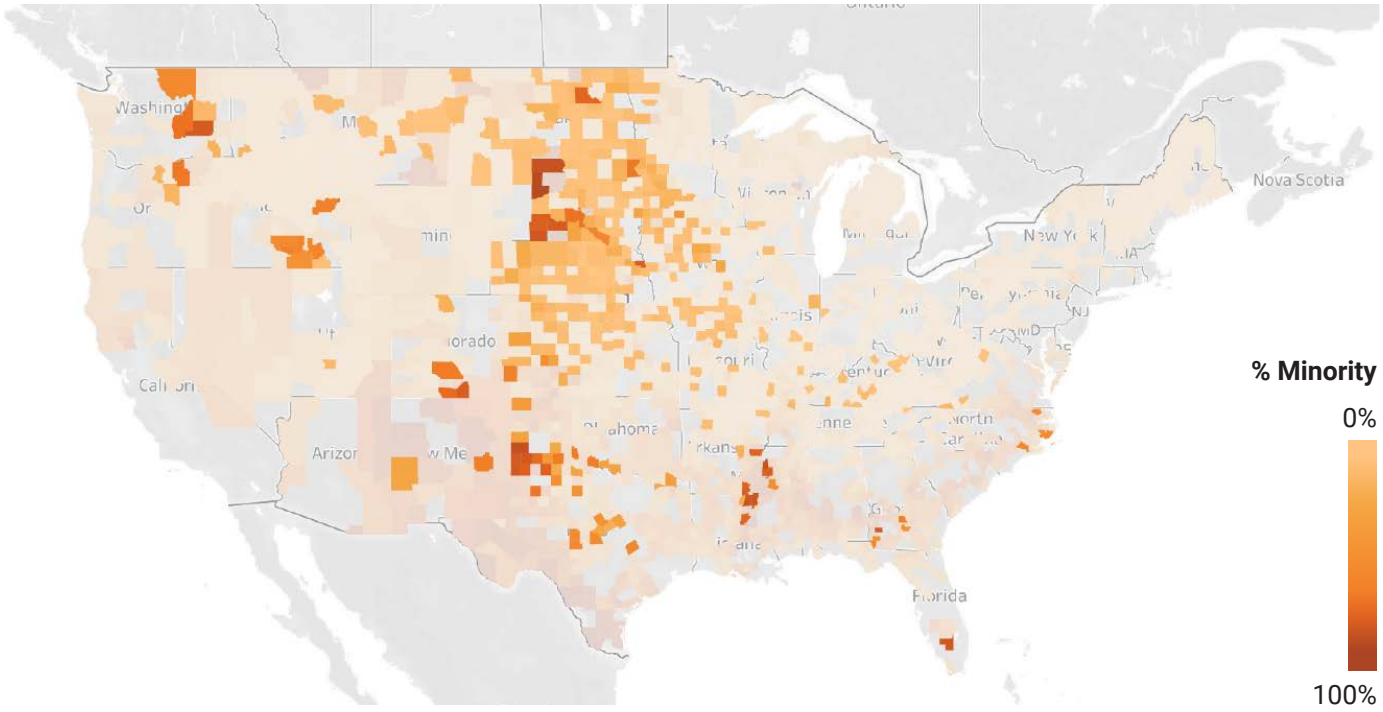


FIGURE 2A

Rural Industry - Farming



Source: American Community Survey, USDA Economic Research Service (ERS) metro-nonmetro county classifications and ERS County Typology Codes.

FIGURE 2B

Rural Industry - Manufacturing

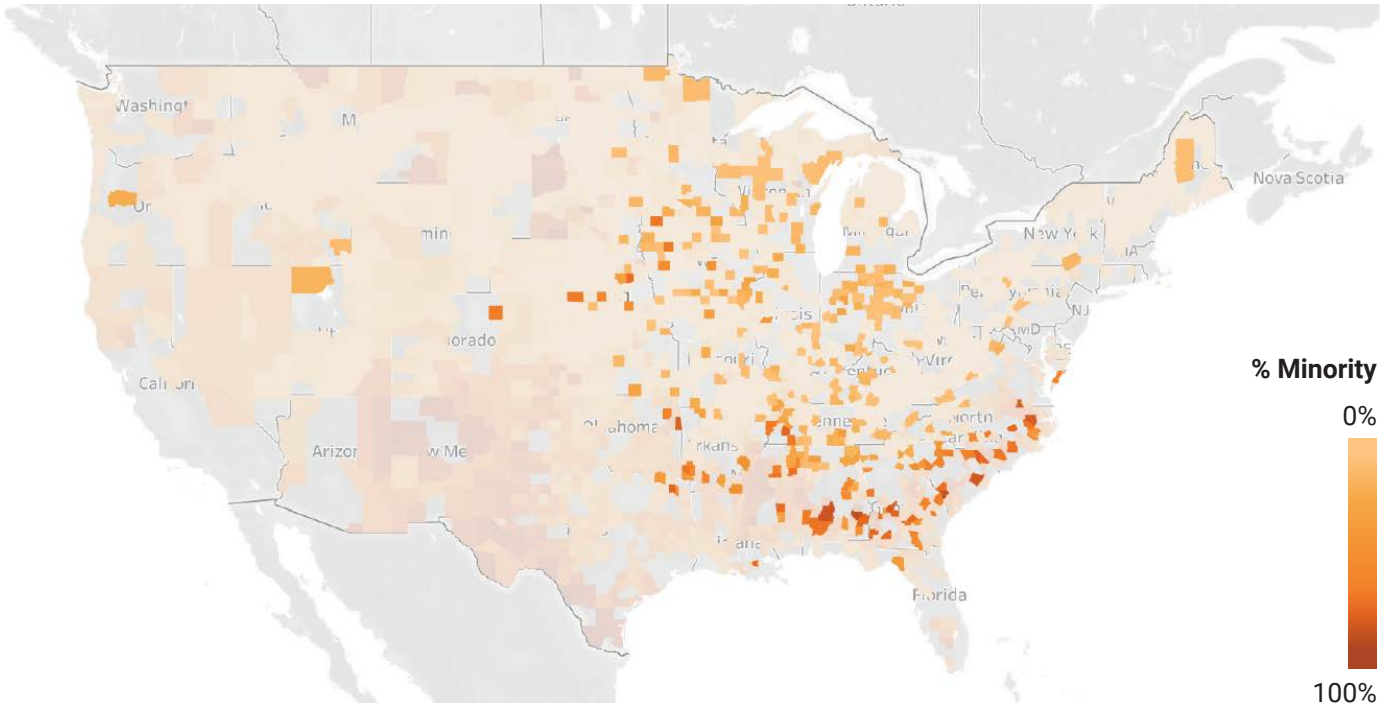
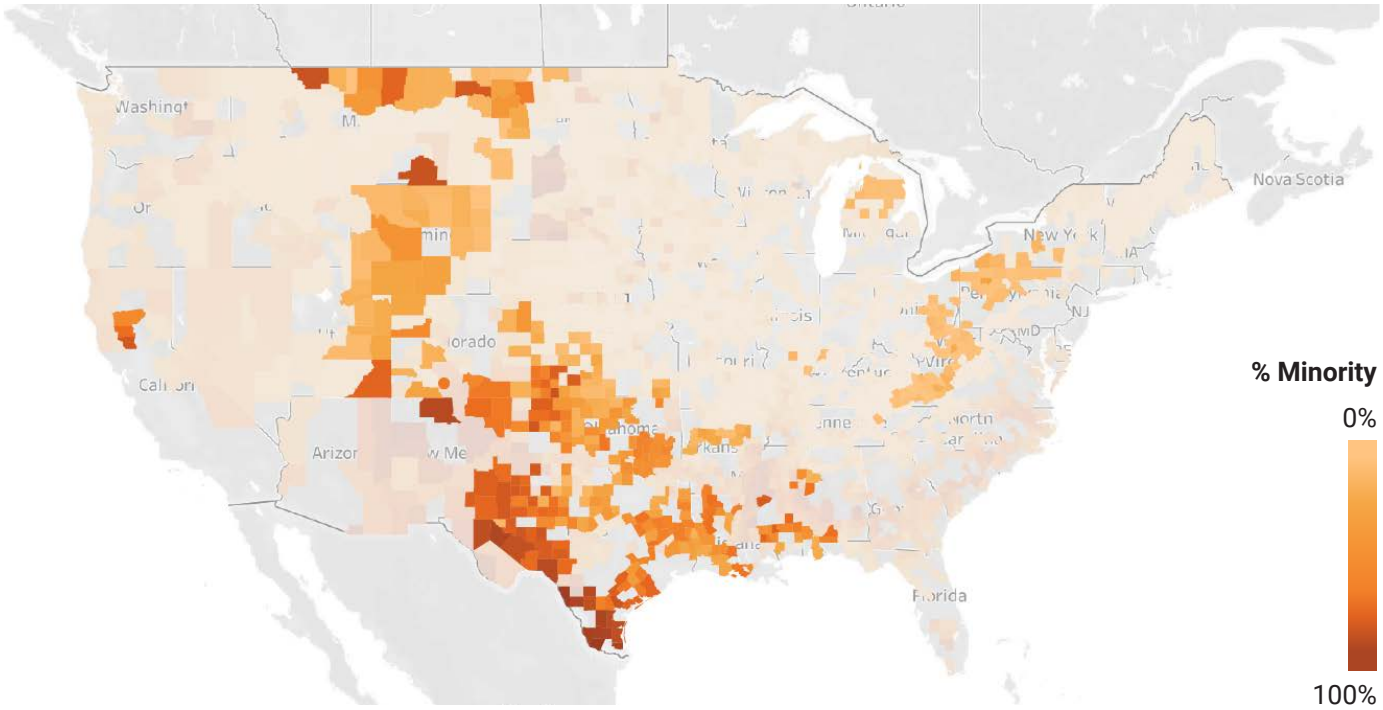


FIGURE 2C

Rural Industry - Oil & Gas



Source: American Community Survey, USDA Economic Research Service (ERS) metro-nonmetro county classifications and ERS County Typology Codes.

TABLE 2

Distribution of Minority Shares by Rural County Demographics

	Black	Hispanic	Indigenous	White
Frequency	85	72	23	1,876
Percent	4.10%	3.50%	1.10%	91.20%
Mean (Group)				
Black	59.40%	2.30%	1.40%	6.00%
Hispanic	3.20%	67.30%	5.10%	7.20%
Indigenous	0.60%	1.30%	64.20%	1.50%
Asian	0.50%	0.80%	0.40%	0.70%
Non-Hispanic White	35.10%	27.90%	27.50%	82.60%

Source: American Community Survey 2016-2020.

Table 2 provides a more descriptive overview of the number of rural areas by majority population. We identify 2,056 rural counties following the OMB 2003 and 2013 definitions.[1] Among them, roughly 4% (85) are Black-dominant, 3.5% are Hispanic-dominant, and about 1% are majority-Indigenous. Among the counties classified as majority Black, roughly 59% of the population was Black. In Hispanic-majority counties, nearly 67% of the population was Hispanic. Likewise, in majority-Indigenous counties, the majority group constituted about 64% of the population. Notably, reflective of these counties' disparate locations, almost no demographic overlap existed with the other minority groups under study. The final column of the table presents a demographic breakdown of the remaining majority-white counties. Unsurprisingly, rural counties tended to be more uniformly white, with less than 10% of the population being Black or Hispanic on average.

The demographic contrast across these counties also suggests ostensibly substantial variation in their population characteristics. We explore these features more deeply in Table 3, which presents a descriptive profile of the overall demographic and labor force of each type of area. In addition to geography, these areas differed in their primary industry mix. The lower panel of Figure 2 maps the dominant industry mix for these areas. In Black-majority areas of the Sun Belt, the industry was still somewhat heavily skewed toward manufacturing; some areas were concentrated in agriculture and, near the Gulf coast, others were involved in oil and gas. By contrast, Hispanic-majority counties, especially those along the Rio Grande Valley, tended to be heavily dominated by oil and gas–related industries. Finally, Indigenous-majority counties were more agricultural, with some areas of high oil and gas intensity.

TABLE 3

Socioeconomic Characteristics in Rural Counties by Dominant Demographic Group

	2010-2011				2018-2019			
	Black	Hispanic	Indig	White	Black	Hispanic	Indig	White
Educational Attainment								
% High Skill	10.8	11.8	12.7	15.3	10.9	11.4	13.3	16.6
% Middle Skill	19.3	19.9	27.4	25.1	20.7	20.8	25.4	25.7
% Low Skill	33.3	38.0	31.7	33.8	29.4	36.5	28.4	30.3
Population Characteristics								
Population	20,832	18,498	18,753	25,526	18,706	18,479	17,549	25,658
Working Age Population	12,159	10,329	10,364	14,806	10,541	10,199	10,081	14,216
Population Density (sqmi)	80.0	12.9	11.9	46.9	80.0	12.9	11.9	46.9
% Homeowners	54.0	56.0	49.0	59.6	50.2	52.8	48.1	56.9
% Renters	26.1	21.9	29.6	20.5	27.4	23.3	29.7	21.1
Racial Composition								
% Black	59.4	2.3	1.2	5.9	58.3	2.1	1.2	5.6
% Hispanic	2.7	63.9	3.3	6.0	3.2	65.9	3.4	7.3
% Indigenous	0.7	1.4	64.3	1.5	0.7	1.5	65.4	1.6
% Non-Hispanic White	36.3	32.0	29.4	84.9	35.3	28.8	26.2	81.2
Institutional Capacity								
4-Year Institutions	1.2	1.0	1.0	1.3	1.2	1.0	1.0	1.3
Community Colleges	1.0	1.1	1.1	1.0	1.0	1.1	1.1	1.0
Economic Context								
Industry Diversity	6.0	5.9	4.5	6.5	5.8	5.7	4.2	6.5
Occupation Diversity	42.2	38.7	39.4	41.7	42.2	38.7	39.4	41.7
Median HH Income	$29,069	$36,611	$31,544	$40,521	$34,805	$45,902	$38,569	$50,434
Avg. Annual Salary	$30,525	$36,607	$31,296	$32,276	$36,400	$45,889	$37,814	$39,343
Avg. Poverty Rate	30.9	22.8	32.7	17.2	28.7	19.9	30.0	15.2
Broadband Context								
% Pop. Access to 25/3Mbps	24.6	23.9	11.9	27.9	61.1	73.4	73.5	78.3

Source: American Community Survey, Integrated Postsecondary Education Data System (IPEDS), USDA ERS non-metro classifications, Business Dynamics Statistics, QCEW , and Small Area Income and Poverty Estimates.

Table 3 is organized into columns presenting information by demographic group in early (2010–2011) and late (2018–2019) segments of the observation period. The rows are organized by skill groups, race and ethnicity, and measures of economic activity. Labor force characteristics are distinguished as follows: high-skill workers, defined as those having a college education or higher; middle-skilled workers, who have some postsecondary education; and workers who completed high school only or who have less than a high school education.

Relative to rural areas that are majority white, majority-minority areas are often home to lower shares of high-skilled workers. Roughly 11% of the workforce in majority-Black areas was high-skill, with virtually no change between the early and late observation periods. Hispanic-majority areas had a slightly larger share of high-skilled workers at around 12%; this share declined somewhat in the later period. Finally, Indigenous-dominant areas had a slightly greater percentage of such workers at 13%. Twenty percent of the workforces in Black- and Hispanic-majority rural areas were classified as middle-skill, whereas 27% of workers in Indigenous counties were classified as such. These shares did not change much over the observation period. Finally, reflective of the increasing formal education levels in U.S. society, we see a decline across rural counties in the share of high school–and less than high school–educated workers over the observation period; approximately 30% of the workforce across these counties was composed of these workers by 2018–¬2019.

Turning to economic indicators, surprising similarities appeared despite these counties' distinct locations within the country. Concerning tenure choice, across all rural county types, roughly half of the population were homeowners. Indigenous-majority counties had the lowest rates at 49% in the initial period, a figure which later declined to 48%. Similar reductions in homeownership over the decade manifested for Black-majority counties (from about 54% to 50%), Hispanic-majority counties (from about 56% to just under 53%), and white-majority counties (from roughly 59% to 57%). Likewise, each type of rural county maintained about one four-year and two-year tertiary educational institution on average.

Rural counties also mirrored each other in their degree of industry and occupational diversity. We adopt an ecological diversity concept, Simpson's Diversity, to describe the degree to which different industries or occupations are present in a county. We scale the diversity indices shown in Table 3, which increase as employment concentrations in various industries or occupations change. The low occupation and industry diversity levels portray historical characteristics; employment is traditionally concentrated within a few dominant sectors which in turn shapes occupational density. Industry concentration has been rural America's proverbial Achilles' heel. It has led to tremendous erosion in the employment base in places over-indexed in manufacturing sector segments and those that have experienced the adverse effects of trade agreements and deregulation. Some argue that strategic company relocations targeting low-wage rural areas have caused monopsony

TABLE 4

Population Change by Age Group in Rural Counties from 2010 to 2020

	Black		Hispanic		Indigenous		White	
Young: 18-24	(24,382)	-15.6%	2,321	1.9%	(4,269)	-9.8%	(132,920)	-3.4%
Prime Working Age: 25-54	(103,757)	-16.2%	(2,952)	-0.6%	(4,664)	-3.0%	(1,447,345)	-8.1%
Older Residents: 55-64	5,926	2.8%	11,410	8.4%	8,964	20.6%	754,354	12.5%
Seniors: 65+	53,076	22.2%	34,003	21.0%	14,998	34.3%	1,976,902	27.2%

Source: American Community Survey 2016-2020.

power to accumulate in these communities: The upshot of dominant companies is weakened labor power and degraded job quality (Willingham and Ajilore, 2019). Emergent automation trends have since added to the deterioration in job quality and threatened the viability of low-productivity manufacturing firms.

However, differences emerge between these places when considering levels and growth of household income, weekly wages, and salaries. Black-majority counties' household incomes and salaries generally lagged behind Hispanic and white rural counties in both levels and growth. Specifically, between our early and late period, household income in Black-majority counties increased by slightly more than $5,000, whereas the corresponding change in household income was roughly $9,000 and $10,000 for Hispanic and white counties. Similar comparisons can be made with Indigenous-majority counties. Of course, some of this difference in growth may be due to variation in the typical household composition across these counties. Although the level differences when comparing average weekly wages and salaries by county type are similar, the growth in wages and salaries over the observation period are roughly identical.

Table 4 provides additional insight into differential labor force dynamics across the majority-minority counties under study. Black-majority rural counties experienced a substantial loss in their prime-age workforce over the decade spanning 2010 and 2020. This loss included a 16% decline in 25- to 54-year-olds and a 19% decline among 15- to 24-year-olds. Hispanic-majority areas saw only slight decreases in the share of the population who were young (1.8%) or prime-age (2.7%) workers over the same period. Indigenous-majority

While all rural areas face challenges from an aging population, the loss in the potential workforce among Black-majority areas is a substantial impediment to economic resurgence.

areas likewise witnessed an 11% share reduction among their youngest potential workers while the share of prime-age workers fell by roughly 6%. In all areas, however, the share of the population that was above 65 grew between 21% and 33%. Together, these dynamics suggest that while all rural areas face challenges from an aging population, the loss in the potential workforce among Black-majority areas is a substantial impediment to economic resurgence.

BROADBAND ADOPTION IN MAJORITY-MINORITY AREAS

The importance of information technology in today's economy is evident.

The internet is central to myriad aspects of services, manufacturing, logistics, and education. Fast internet facilitated by broadband technology is vital to fostering the internet's roles in commerce and economic development. Given the importance of such technologies to modern economic progress, well-known disparities in broadband access may partly exacerbate economic differences. We refer to data from the FCC to more thoroughly comprehend the dynamics of broadband adoption in minority-majority rural areas. Broadband adoption, defined here as the share of households in a county with a broadband subscription, is a robust measure of income growth and economic growth relative to broadband availability as cited in many early studies (Whitacre et al., 2014; de Vos et al., 2020). Numerous observers have commented on the drawbacks and limitations of FCC Form-477 data, and we agree with these critiques. Notably, FCC's data suffer from overestimation

in coverage because the principal survey instrument lacks quality reporting guidelines or appropriate guardrails to prevent internet providers from overstating service (Ford, 2019). Additionally, advocates have strenuously debated the reliability of FCC's speed measurements, arguing that the prevailing 25/3 Mbps benchmark fails to measure up to real-life standards and is incompatible with the bandwidth needs of everyday online transactions. A recent study showed that the FCC's current threshold is insufficient for even a single student's virtual learning needs that were integral during the COVID-19 pandemic that caused an unprecedented shift to online learning (CoSN, 2021).

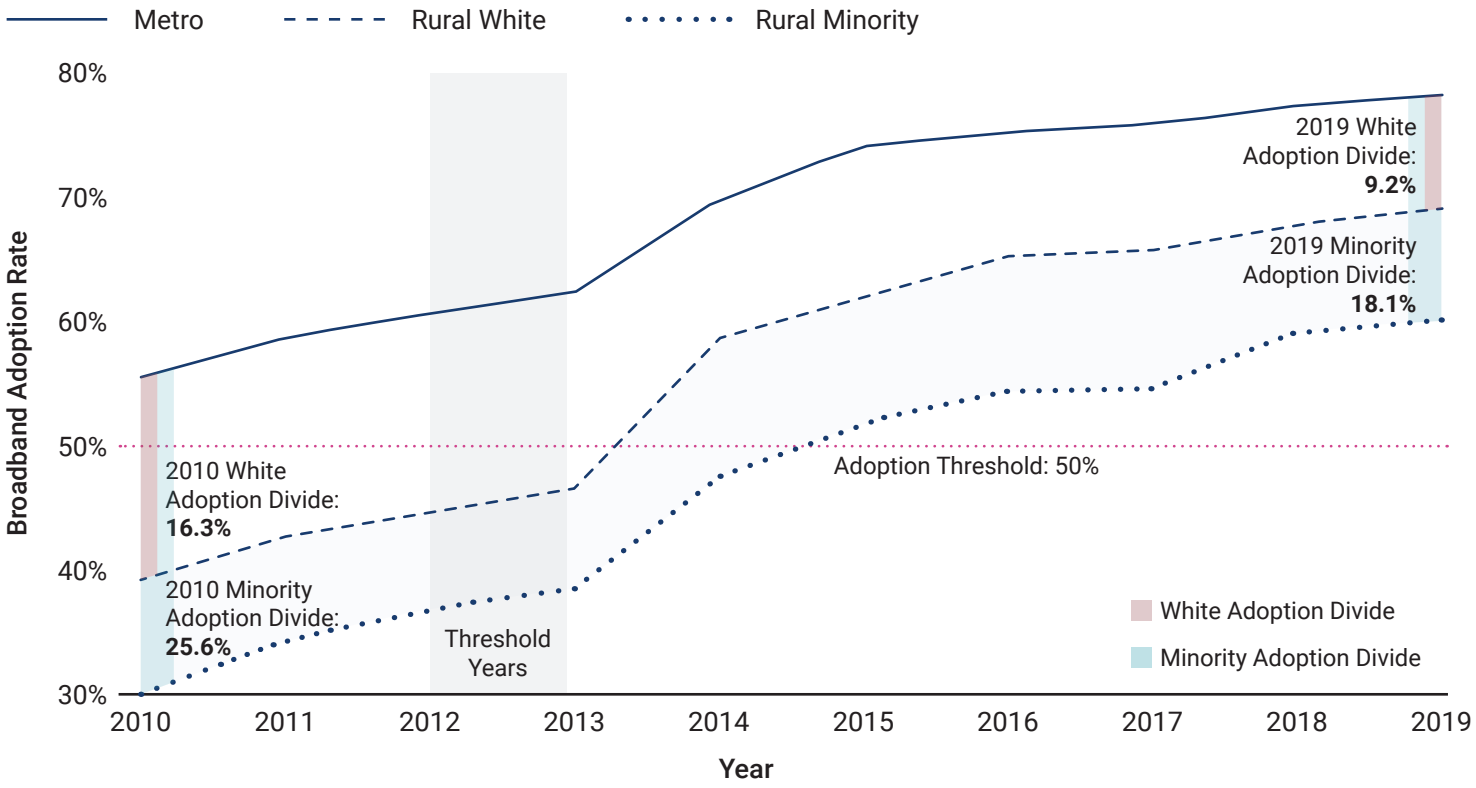
Alternative data sources, such as information from Microsoft, which is freely available on public GitHub repositories, have advanced higher-quality measures of broadband adoption. Even so, these datasets do not provide the longitudinal measures needed to examine trends across periods, as is of interest in this report. Lastly, we use the 200 Kbps threshold to consistently compare rates of change across the decade. The numerous challenges notwithstanding, we believe FCC data can adequately illuminate long-term shifts and trends. County-level data on household subscription rates between 2010 and 2019 were obtained from the FCC's annual Broadband Progress reports.

To facilitate description and comparison, we start our discussion by grouping majority-minority areas together. We later disaggregate by dominant demographic group to explore differences in rural minority counties' broadband availability and access. Figure 3 plots the changes in household broadband adoption for metro and rural counties between 2010 and 2019.[2] As shown, household broadband adoption was relatively low for urban and rural counties in 2010, totaling roughly 55.5% for metro counties and 34.5% for rural areas. Household adoption expanded substantially for both regions over the subsequent decade. By the decade's end, broadband adoption (subscription) was 78.2% in metro counties and roughly 64.6% in rural areas. That household internet subscriptions in rural areas have grown substantially over the decade is consistent with more Pew findings that the urban-rural adoption gap has narrowed considerably over the last 10 years. According to the Pew 2021 survey, 72% of rural residents have a fixed broadband connection at home (Vogels, 2021). The level differences between Pew's estimates and those in Figure 3 underscore the longstanding challenges in accurately measuring broadband penetration with FCC data. Figure 3 also

FIGURE 3

Household Broadband Adoption Rates by Rural Groups 2010-2019

Though rural counties have increased broadband subscription rates, considerable gaps remain.



Note: The FCC bins country-level subscription rates into adoption quintiles ranging from 1% to 100% and an additional category to differentiate areas with zero residential fixed high-speed connections. We imputed subscription rates for the years 2010 through 2015. These imputed point estimates are predicted rates derived from individual year interval censored regression models that regress bin endpoints on median household income, the share of the population with a college degree, number of establishments, median home values, road density per housing unit, and the median price for plans with speeds between 24/5Mbps.

plots disaggregated adoption (subscription) rates between 2010 and 2019 for minority rural counties, white rural counties, and urban metro counties.[3] Unsurprisingly, although all areas showed sizable growth in broadband adoption, these counties had significant and persistent level differences. There was a 25.6% difference between urban metros and majority-minority rural areas in 2010. The corresponding gap between metro counties and white-majority rural areas was much smaller at 16.3%. This gap had narrowed somewhat by the end of the observation period to just 18.1% and 9.2% for rural minority counties and rural white areas, respectively.

Understanding the Role of Broadband in the Growth of Rural Minority Areas

To better understand the power of broadband infrastructure and accessibility in facilitating growth in rural areas and how this type of infrastructure may play an essential role in enhancing development within majority-minority rural counties, we develop a taxonomy that exploits the timing and intensity of broadband adoption. Our method varies from the conventional approach of using continuous measures of broadband access and adoption rates, as seen in Kolko (2012), Gallardo et al. (2021), and Mossberger et al. (2022), to identify the significant impacts of broadband on employment, income, and business formation. We identify meaningful thresholds of broadband adoption that matter for economic performance to help guide the infrastructure build-out debate— particularly to aid federal agencies in prioritizing places based on the degree of broadband adoption relative to thresholds through cost subsidies, municipal broadband networks, attracting new internet service providers, and using telephone cooperatives. Based on the timing and intensity of broadband adoption, we divide rural counties into three groups: early adopters, late adopters, and non-thresholds.

Conceptually, broadband is a form of infrastructure that directly assists day-to-day business and recreational activity and has potentially positive externality effects by boosting a location's commercial and residential appeal in the contemporary economy. Marginal changes in broadband availability and usage would not be expected to have large positive effects on economic activity. However, similar to network effects, the size and intensity of use beyond a particular threshold could have nonlinear impacts on the economy, accelerating growth and development. This approach is in line with the literature that has found a non-linear, or an inverted U-shape, relationship between broadband penetration and economic output, suggesting that the impact of broadband is maximized once the infrastructure reaches a critical point (International Telecommunication Union, 2012).

Although no theory predicts the level, we attempt to empirically estimate a breakpoint using data-driven methods.[4] Knots become evident in broadband adoption trends in our imputed series and in the later years once direct FCC measures are available. We first exploit the joints in this broadband adoption series to estimate empirical thresholds in two periods. We then choose a threshold of broadband adoption just above 50% as the relevant cutoff for

TABLE 5

Broadband Adopter Type by Majority Demographic Group

	Black	Hispanic	Indigenous	White	Total
Early Adopters	0	15	0	510	525
Late Adopters	23	38	16	1,013	1,090
Non-Transitioners	62	19	7	353	441
Total Counties	85	72	23	1,876	2,056

Source: Author's calculations of American Community Survey and FCC Internet Access Services County-level 2010-2019.

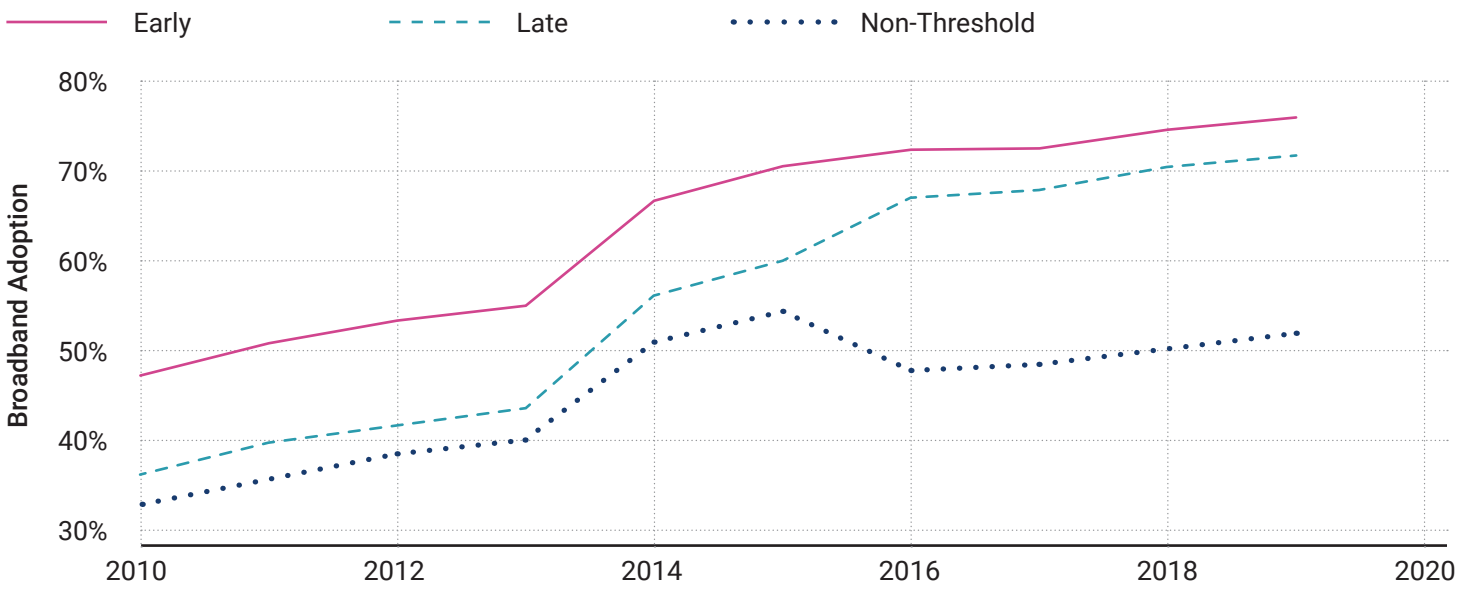
counties that reached the threshold before 2013. We pool rural counties across demographic groups to generate sufficient sample sizes. Restricting the analysis to less than 200 majority-minority counties alone would not yield sufficient statistical power. Pooling the counties allows us to generate adequate variation; however, it forces us to blend minority counties with lower broadband adoption rates with predominantly white communities with higher adoption rates. Ultimately, the 50% threshold combines systematic differences in county growth patterns above and below the threshold, irrespective of a county's demographic grouping. We further use two-year averages in each period to avoid spurious results.

In essence, we compare rural counties that met the threshold between 2012 and 2013 as "early adopters." Among those that did not meet this threshold, the empirical procedure adopts a threshold of roughly 50% for the early period when broadband was less prevalent in rural areas. Broadband availability and household penetration had increased markedly by 2019. These substantial improvements are reflected in our threshold band of 60% for the later period when we average adoption rates between 2018 and 2019. We refer to those counties that met that 60% threshold by 2018–19 as "late adopters." Those that never met the threshold are classified as "non-threshold."

Table 5 summarizes these types across white and rural minority counties. Results indicate 525 early-adopter counties, 1,090 late-adopter counties, and 441 counties that would be considered non-transitioners. Interestingly, we observe no Black or Indigenous early-adopter counties; a mere 15 counties were Hispanic-majority. White-majority rural counties constituted the bulk of early adopters. This is in line with the finding from Figure 3 that while majority-white rural counties face a broadband infrastructure shortage compared to metropolitan areas, majority-minority rural counties face an even more dire infrastructure problem. Among the 1,019 late-

FIGURE 4

Household Broadband Adoption Rates by Adopter Group 2010-2019



Note: The FCC bins country-level subscription rates into adoption quintiles ranging from 1% to 100% and an additional category to differentiate areas with zero residential fixed high-speed connections. We imputed subscription rates for the years 2010 through 2015. These imputed point estimates are predicted rates derived from individual year interval censored regression models that regress bin endpoints on median household income, the share of the population with a college degree, number of establishments, median home values, road density per housing unit, and the median price for plans with speeds between 24/5Mbps.

adopter counties, 23 were Black-majority, 38 were Hispanic-majority, and 16 were Indigenous-majority. The remaining late-adopter counties were predominantly white. Finally, 62 of the 85 total Black-majority counties were non-thresholds. Nineteen Hispanic-majority counties had the same designation.

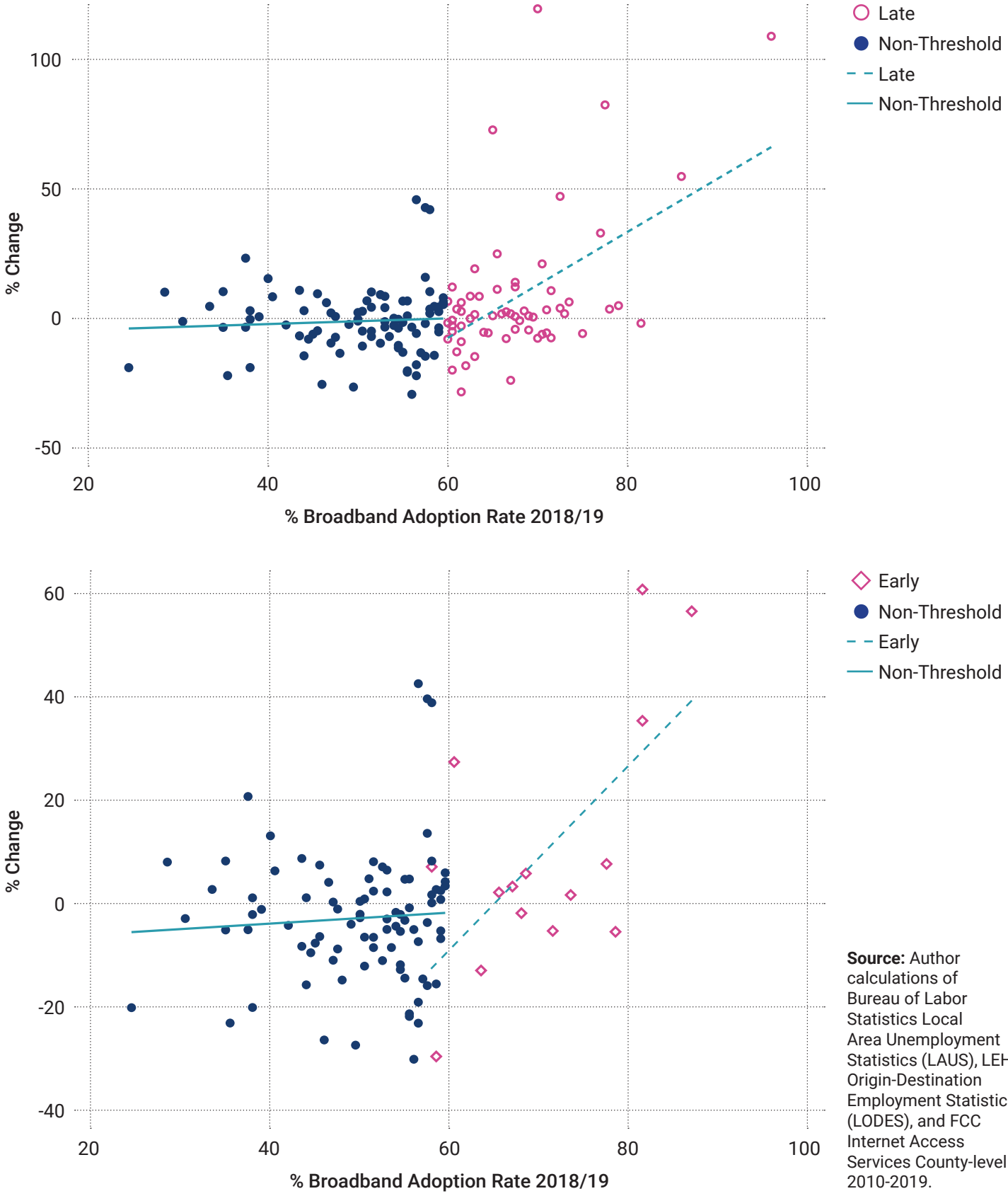
We examine broadband adoption dynamics over time across these three categories in Figure 4, which plots the average household adoption rates by adopter type. Early adopters naturally had much higher adoption levels than late or non-transitioners in the early period of 2010–2012 and continued to increase steadily to just under 80% by 2019. After 2012, broadband adoption in late-adopter counties accelerated between 2013 and 2016; the gap closed substantially between them and early-adopter rural counties from a roughly 15-percentage point gap, on average, to less than five percentage points by 2019. By contrast, non-threshold counties saw non-monotonic adoption rates over the observation period. These counties demonstrated steady increases in adoption until they reached just above 50%, on average, in 2015. This rise was followed by a drop in adoption rates between 2015 and 2016 and only a slight improvement thereafter to just above 50% household adoption by 2019.

We take a different view from most broadband-related research when describing employment in rural counties. Rural communities have experienced tremendous job loss. This aggregate pattern is not uniform—while many counties shed jobs, others enjoyed more employment opportunities thanks to local dynamics that worked to their advantage. Variation in employment growth creates push and pull forces that shape county labor dynamics. For example, a factory closure can compel workers to search for jobs outside their home county. On the contrary, employers in a particular county draw on available labor pools both within their resident county and from neighboring counties to meet workforce needs. The BLS's Local Area Unemployment Statistics (LAUS) series captures employment on a place-of-residence basis but does not pinpoint the jobs created within a rural county that non-residents absorb.[5] While the USDA's Economic Research Service defined commuting zones (CZs) in order to convey the connectivity of economic activity across counties (Fowler and Jensen, 2020), we use the BLS's residence-based job flow data from Census's Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics to create an enhanced measure of job potential in rural counties and to study small-area dynamics that CZs cannot capture. Our interviews revealed the tension around job creation benefits accruing to in-county residents versus workers from regional counties as a salient theme in discussions of economic development outcomes. Our enhanced employment measure therefore reflects a place-based job creation capacity that ties into extant economic development debates and community responses to enable residents to retain a larger share of a county's overall employment potential.

Figure 5 plots the change in employment growth from 2010 to 2019 by adopter type, comparing late adopters to non-thresholds in Panel 1 and early adopters to non-thresholds in Panel 2. Both comparisons feature distinct differences between counties that pass the threshold level of roughly 60% and counties that do not. Employment growth over this decade was largely flat and clustered near zero for non-threshold counties. The normalized average growth rates in non-threshold counties were 0.3% over the decade. Conversely, places that passed the transition threshold tended to have positive growth on average, albeit with some variation. Late-adopter counties had a normalized average growth rate of 4%, while the rate was more than double for early-adopter counties at 8.3%. Employment growth in the early-adopter group also suggests that broadband-driven benefits accumulate over time and generate persistent multiplier effects.

FIGURE 5

Employment Change 2010-2019 by Adopter Type



Source: Author calculations of Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS), LEHD Origin-Destination Employment Statistics (LODES), and FCC Internet Access Services County-level 2010-2019.

Though late-adopter counties exhibited positive growth rates, the difference between them and early adopters implies that timing matters. Advances in internet connectivity technologies such as fiberoptics with gigabit capacity may well have played a role in helping late-adopter counties leapfrog through the development cycle. However, investing in the latest and highest speed may not guarantee better employment outcomes relative to broadband services with capable, workable speeds (Bai, 2016; Ford, 2018). Still, newer technologies such as fiber are comparatively faster than older and baseline technologies. Intrinsic improvements in speed and quality have enabled late adopters with higher household adoption rates to produce employment growth effects (Mayer, 2019). The near-zero growth observed in the non-threshold group aligns with studies in which low levels of broadband adoption led to decreases in the total number of firms and aggregate employment (Whitacre et al., 2014).

These threshold dynamics raise an interesting policy question: Given the recent surge in federal broadband funding, where should non-threshold counties invest their share of monies? Many studies suggest that wider broadband adoption is associated with higher growth, but the variation highlighted here indicates that non-threshold counties should be investing most of their dollars in building out a broadband-enabling infrastructure. While doing so, these counties should be mindful of the types of industries that are enabled because of these investments. Evidence from Canada shows that broadband is especially relevant for IT-intensive service industry businesses. These companies require additional elements, such as a skilled workforce, a thriving business ecosystem, and agglomeration economies, to entice workers to relocate (Ivus and Boland, 2015). For late- and early-adopter counties, perhaps the focus could shift to closing within-county adoption gaps and to addressing adoption barriers such as cost and quality (Whitacre et al., 2014). Although not necessarily causal, this relationship is again suggestive of broadband's role as a potentially integral infrastructure component of growing places in today's economy. However, the inconsistent growth also reveals that broadband alone is likely insufficient to help rural counties thrive.

Furthermore, how do these places differ socioeconomically? Table 6 compares these rural counties on a broad number of sociodemographic characteristics including educational attainment, labor force, racial composition and economic factors during the early (2010–2011) and later (2018–2019) part of our observation period. This comparison offers an intriguing snapshot of how places with high broadband adoption intensity differ from areas where broadband is less accessible.

TABLE 6

Socioeconomic Characteristics in Rural Counties by Adopter Type

	2010-2011			2018-2019		
	Early Adopters	Late Adopters	Non-Threshold	Early Adopters	Late Adopters	Non-Threshold
Educational Attainment						
% High Skill	18.6	14.7	11.3	20.2	15.7	12.2
% Middle Skill	27.4	24.7	21.6	27.8	25.2	22.7
% Low Skill	33.1	33.9	35.1	29.8	30.4	31.3
Population Characteristics						
Population	44,493	18,692	17,433	45,771	18,507	16,453
Working Age Population	25,966	10,783	9,989	25,322	10,236	9,252
Population Density (sqmi)	65.8	44.1	30.3	65.8	44.1	30.3
% Homeowners	62.1	57.7	59.1	59.6	54.9	56.0
% Renters	21.9	20.2	21.1	22.8	20.8	21.8
Racial Composition						
% Black	3.1	5.6	19.1	3.2	5.4	18.5
% Hispanic	7.8	8.2	7.2	9.7	9.3	8.1
% Indigenous	1.2	2.5	2.6	1.3	2.6	2.7
% Non-Hispanic White	85.9	82.1	69.7	81.2	78.7	67.0
Institutional Capacity						
4-Year Institutions	1.4	1.1	1.0	1.4	1.1	1.0
Community Colleges	1.0	1.0	1.0	1.0	1.0	1.0
Economic Context						
Industry Diversity	7.4	6.3	6.0	7.3	6.2	5.8
Occupation Diversity	42.3	41.1	41.9	42.3	41.1	41.9
Median HH Income	$47,471	$38,343	$34,315	$59,094	$47,764	$42,354
Avg. Annual Salary	$36,063	$31,280	$30,548	$44,094	$38,145	$37,072
Avg. Poverty Rate	13.3	18.5	22.8	11.5	16.3	20.6
Broadband Context						
% Pop. Access to 25/3Mbps	32.1	28.0	20.4	88.4	80.0	57.9

Source: American Community Survey, Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS), LEHD Origin-Destination Employment Statistics (LODES), FCC Internet Access Services County-level 2010-2019, Small Area Income and Poverty Estimates, Integrated Postsecondary Education Data, and Business Dynamics Statistics.

Places that had high broadband adoption early are unique. As depicted in the first panel, early-adopter rural counties had higher levels (18.6%) and rates of college attainment growth (1.6 percentage points) than their late-adopter (14.7% and one-percentage point increase) and non-threshold (11.3% and 0.9 percentage point increase) counterparts over the two periods of interest. The share of middle-skilled workers—those with either a high school diploma or an associate degree—also was highest for early adopters (27.4%), followed by late adopters at 24.7%, and non-threshold counties at 21.6%. However,

the growth rates of middle-skilled population growth were reversed with early adopters growing at the slowest rate (0.4 percentage points), followed by late adopters (0.5 points), and non-threshold counties (1.1 points). For the percentage of the population who completed less than high school: Early-adopter counties had the lowest levels (33.1%) and lesser declines (a 3.3-percentage point decrease) in the shares of those with less than a high school education versus the late-adopter (33.9% and 3.5-percentage point decline) and non-threshold places (35.1% and 3.8-percentage point decline). The differences in education between these counties is remarkable in that, as displayed in Panel 4 of Table 6, the counties generally had similar numbers of higher education institutions.

Likewise, early-adopter counties tended to be more populous (more than 44,000 residents vs. 19,000), to have higher working-age populations (just under 26,000 vs. under 11,000), to be denser (66 p/mi2 vs. 44 p/mi2), and to have a higher percentage of homeowners in comparison to late-adopter places (62.1% vs. 57.7%) in the early period. These comparisons were fairly similar in the late period. Meanwhile, non-threshold counties had the lowest population (roughly 17,000), working-age population (just under 10,000), and density (30–44 p/mi2) among the three types of counties in the early period. These figures remained similar in the later period. Yet non-threshold counties interestingly had higher rates of homeownership and renter rates in both the early and late periods, but not as high as in the early adopters.

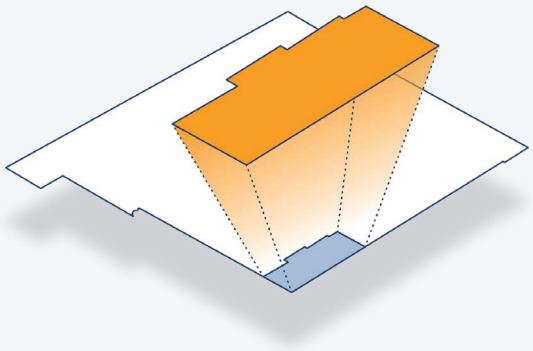
The racial differences across these places are clear. Early-adopter counties tended to be heavily white in both the early (about 86%) and latter part of the decade (about 81%) whereas non-threshold counties often had a substantially larger Black population than early-adopter counties (roughly 19% vs. 3%). Reflective of broader demographic trends, each county type had similar proportions of Hispanic (about seven to 8%) and Indigenous populations (1 to 3%) in the early period. However, both early-adopter places saw a nearly 2-percentage point increase in the Hispanic population; late-adopter and non-threshold counties saw slower growth at just about a one-percentage point increase. The final two panels of Table 6 provide additional insight into differences in the economic context and broadband adoption across these places. Early-adopter counties, reflective of their larger economies, tended to have more industry and occupational diversity in both the early and late periods than late adopters and non-threshold counties. Early-adopter counties also had much higher levels and growth of median household incomes: just over $47,000 in the early period and just over $59,000 by the

late period. Poverty mediates the rural broadband landscape. Early-adopter counties had the lowest rates of poverty in both observation periods. The group also experienced the largest drop (13.5%) in average poverty levels followed by late-adopter counties (11.9%). Non-threshold counties grapple with elevated poverty levels throughout the period, despite a relative decrease in average poverty rates of 9.6%, roughly one in five persons in this group live below the poverty line.

Sorting counties into this intersecting matrix masks place-based dynamics that explain the underlying context—such as the pull factors drawing Hispanic populations to areas that, according to our typology, have high rates of broadband adoption and job growth. Lea County, NM provides some context: Lea is an early-adopter, majority-Hispanic rural county in the Permian Basin region. It has experienced net positive jobs and population growth, with much of the latter being driven by growth in the county's Hispanic population. Interviews with local county leaders revealed the county to be a high-performing oil service economy with a large contingent of locally owned businesses servicing Permian Basin producers. Much of Lea County's population growth can be neatly divided into two distinctive flows. On one hand, oil service companies moving into the county or expanding operations import workers who tend to be skilled and attached to high-paying jobs. The second inflow comprises itinerant workers who usually follow jobs based on information about opportunities gleaned through their social networks. Each flow matters to the county's economic development. Its leaders are keen on building programs and welcoming communities to encourage new residents to stay permanently. The county's oil partners have been longtime anchor institutions that provide stability, well-paying jobs, and community investments that amplify the county's resources. Legacy institutions like oil and gas companies with sophisticated connectivity needs have long contributed to Lea's higher (and earlier) broadband connectivity rates. Over time, rising demand for newer technologies has pushed local internet service providers to deliver fiber and gig-speed service to boost or maintain productivity. Additionally, Lea County invests tremendous resources in building its infrastructure systems, housing, broadband, workforce development, hospitals, and schools to capture a greater share of each newcomer wave (see Case Study 1).

Lea County, NM

Growing through the Pains of Oil and Gas Volatility



Lea County, NM has managed to deftly navigate the interplay between oil depressions and transformative rural placemaking policy to establish an EnergyPlex brand anchored in local community well-being. Capricious oil market forces regulated Lea County's fortunes until the mid-1980s. The 1980s oil shock led to astounding population loss; 15% of the county's populace disappeared. People moved away, leaving their homes behind. In the absence of automatic stabilizers or federal support to mitigate the scale of economic losses, Lea County's leadership harnessed the scars of their wounded experience and the county's assets to invest in safeguarding their future. Lea County emerged from the 1980s crisis with a deep-seated savings mindset and a commitment to enacting smart policies to weather inevitable downturns such as the Great Recession. Coincidentally, while the subprime crisis destabilized the financial sectors and housing-related sectors, oil economies experienced similar disruptive forces. Workers of all ilk were sandwiched between two crippling depressions that pushed the national unemployment rate to double digits by 2009.

The lone bright spot for Lea County was low population churn, according to economic development director Jennifer Grassham: "The oil field busted at the same time the rest of the country did…We were watching for the school system to have an exodus. And it didn't. We'd never seen this happen before. [It] was nice because we kept that population." Lea County wisely anticipated the need to scaffold pliable public institutions that could respond to high-frequency population churn and serve the increasing number of families willing to stay in the county.

Lea County's long-running recovery was grounded in the broader context of a robust nationwide oil production rebound and a coincident shift in drilling technologies. New drilling technologies have made oil production and oil service occupations less labor-intensive while markedly improving the physical safety elements of these jobs. In some ways, drilling technologies have had an equity-enhancing effect on Lea County's energy sector by creating avenues for women to participate in this high-wage sector. The save but make smart investments ideology led county leaders to build a $110 million community hospital and a $50 million state-of-the-art Career and Technical Education Center of Hobbs (CTECH). CTECH is the product of an extraordinary multi-year public-private partnership between the city of Hobbs and a cluster of private stakeholders, including the Permian Strategic Partnership—a contingent of 20 of the largest oil companies based in the Permian Basin that provided a $50 million capital injection. CTECH was explicitly designed to respond to the regional skills gap in high-skill, high-demand jobs and to cultivate an adaptable workforce equipped with growth-oriented skill sets. Workforce preparedness for longer-range economic diversification lies at the heart of the vision for this educational campus. The county is building the pillars of a non-carbon energy value chain featuring hydrogen, nuclear, and carbon sequestration verticals. Many of Lea's incumbent workers can transfer legacy skills to existing oil service horizontals. But they're less prepared for a diverse zero-carbon economy.

The county's sustained investment in affordable housing sets it apart from its peers. Local officials worked to incentivize single-family and multifamily home construction. Likewise, investments in the county's broadband infrastructure has been intentional. Leaco Rural Telephone Cooperative, Inc. (Leaco) is vigorously responding to Lea's broadband needs. The company has prototyped funding strategies, including braiding USDA loans, to overcome extraordinary cost barriers and deliver reliable, high-speed internet to the county's small-scale communities. Leaco has also scaled numerous fiber-to-the-home projects over the last ten years. Lea County is committed to playing a central role in this post-carbon economy with innovative contributions to the energy value chain. The county further believes it can become a leading plastics producer for electric vehicles. Whatever the future holds for Lea County, the federal government should be there to work with the county in developing its plans.

Late-adopter and non-threshold counties had much lower levels of income growth at the median household level: Late adopters had median incomes just above $38,000 in the early period with a later increase to just under $48,000. Non-threshold counties had median household incomes of just over $34,000 and roughly $42,000 for the two periods, respectively. These areas saw substantial growth in broadband adoption over the period as well—roughly 56 percentage points for early adopters, 52 percentage points for late adopters, and just under 38 percentage points for non-threshold counties.

Several takeaways emerge from this descriptive analysis. First, broadband adoption is indeed related to increased economic growth. However, it is not necessarily clear that this relationship is causal rather than emerging in equilibrium. Rural places with larger, more highly educated, and diverse economies in our sample tended to have the fastest and most intense broadband adoption. These trends also speak to the importance of broadband as a component of economic infrastructure in rural counties. For example, Ward County, TX is a late-adopter, majority-Hispanic county that has benefitted from jobs created by the oil and gas industry in the Permian Basin. Ward County ranks among the top 10 oil-producing counties in the country, accounting for both its above-average median income and appeal as a job center. However, like too many extractive economies, Ward County struggled to adeptly plan for the bust cycles associated with oil and gas assets.

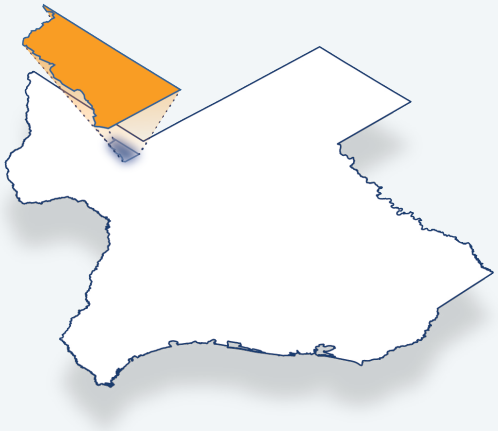
When oil prices dropped precipitously in 2014, much of the country barely noticed, while oil-dominant places—such as those with low levels of economic diversification—experienced a tremendous shock. Ward County lost a large number of workers and businesses—another version of the well-worn story of the resource curse. While booms generate tremendous gains in jobs and people, when the cycle reverses, the bust imposes profound penalties on resource-dependent economies. Workers consequently learn to build these cycles into their expectations and decisions to follow jobs. In places like Ward County, breaking the cycle depends on local leaders' strategic creativity in conceptualizing investments in countercyclical subindustries that can create more stable jobs to attract and retain a highly mobile workforce.

Ward County leaders believe that building out an infrastructure for high-speed broadband is key to retaining workers and their families, diversifying its industries, and attracting new companies interested in leveraging the county's natural resources—sand, land, and solar.

Ward County's Chamber of Commerce and other leadership believe that building out an infrastructure for high-speed broadband is key to retaining workers and their families, diversifying its industries, and attracting new companies interested in leveraging the county's natural resources—sand, land, and solar. The county has seen success in its bid to draw a coterie of innovative firms interested in exploiting its natural resources. For instance, a large hydroponic grow operation opened a manufacturing base in Ward County with plans to expand its footprint. This activity is exactly the kind of growth the county needs to hedge its fortunes during bust cycles. Ward County must attract hundreds of these smaller companies to protect itself. In addition to broadband, county leaders have invested in improving affordable housing options and deepening healthcare services to make its communities appealing so that workers with families choose to live there permanently. Development strategies, timing, and nuanced differences in economic architecture are important attributes separating the experiences of Lea County and Ward County; broadband has played a more prominent economic development role in the latter and has in some ways conditioned the county's relative position in our typology (see Case Study 2).

Ward County, TX

Broadband Opens Doors for a Majority-Hispanic Boomtown



Ward County is a majority-Hispanic (53.7%) rural county with a population of 11,658 situated in western Texas in the Permian Basin, the country's most productive oil and natural gas basin. In 2021, Ward produced 44.8 million barrels of oil, earning a spot as the 9th largest oil-producing county in the Basin. Despite global and national debates on the resource curse that boomtowns face, Ward County has managed to keep its economy strong from the economic opportunities that its dominant industry brings. The economic decline from the 1980s oil glut and the resulting fall of oil prices in 1986 hit oil counties hard. Ward's population previously declined steadily—from a peak of 16,200 in 1982 to a low of 10,100 in 2007—in time with decreasing oil production.

Then, in 2018, the development of hydraulic fracturing and horizontal drilling techniques coupled with a high demand for oil brought the Permian Basin back to business. Ward's population began to climb and has since reached its current total of 11,700. To match the rest of the Permian Basin's production speed during boom cycles and to keep the industry afloat during bust cycles, Ward has begun implementing innovative technologies on the ground such as attracting new startups. New companies like Atlas Sand, a frac sand reserve holding company, moved to Ward County in recent years thanks in part to the county's natural endowment: an abundance of sand with high silica content. Atlas Sand imported new technologies into Ward to exploit the county's sand fracking potential. Company inflows translate into new jobs for local residents and offer the county an opportunity to attract new populations.

Since its arrival, Atlas Sand has created thousands of direct and indirect jobs in the city of Monahans, including for truck drivers and last-mile division teams. The company's recruiters foresee future needs for mechanics and electricians, systems and network engineers, and cybersecurity specialists. New middle-skill jobs create quality wages and more energy-proof skills that workers can transfer to other companies throughout the Permian Basin with similar emergent workforce needs to support energy-diversified jobs in cleantech, solar, and other green economy sectors. Ward's distant location makes it an easier business case for companies to hire locals and provide on-the-job training or invest in other workforce training pathways to skill their workers. Unfortunately, Ward's innovative companies and its small businesses experience first-hand the limitations that a poor broadband infrastructure can bring to a growing industry. Strong broadband infrastructure is an absolute prerequisite for businesses to thrive. According to Teresa Burnett, Executive Director of Monahans Chamber of Commerce: "Broadband is a necessity, not a luxury. Broadband is the number one economic project tool in America. It connects us. It ensures we can develop the technology so we can keep doing what we do."

The Monahans Chamber of Commerce, in partnership with local stakeholders and supported by national advocates such as Broadband Connect, has embarked on an ambitious ethernet ring project to respond to gaps in the county's broadband infrastructure. Local officials have invested millions of dollars from the Biden administration's broadband subsidies into the design and build-out of an ethernet ring project. This project will improve incumbent firms' productivity and position the county as an attractive location for other energy value chain companies. Importantly, the ethernet ring will support the county's larger vision for economic diversification, much of which depends on cutting-edge research contingent on reliable internet connectivity to experiment and scale new non-energy verticals that can capitalize on the county's resource endowments. The federal government should work with recovering boomtowns in rural America, like Ward County, to furnish the resources necessary to diversify their economies. Federal assistance must match the county's vision—one in which every corner of the economy, including the oil and gas industry, agriculture, hospitals, and schools, can harness broadband to develop cutting-edge technology.

LABOR MARKET DYNAMICS AND BROADBAND ACCESS

Rural counties exhibited distinct differences in their aggregate labor market dynamics before and after the COVID-19 pandemic and in broadband access.

Labor markets are a key source of inequality: Local labor markets vary along many dimensions and are characterized by factors such as firm density and connectedness to regional markets that influence job seekers' employment opportunities. In this section, we consider how the rural labor market interacts with broadband and examine how documented differences in the access and intensity of broadband usage relate to prime labor market indicators.

Maintaining the same early, late, and non-thresholds nomenclature for rural counties, Table 7 summarizes our labor market indicators for the three county types in our early and late observation periods. The first panel of Table 7 provides basic labor force information. Early-adopter counties tended to have a much larger labor force than late-adopter and non-threshold counties with an average labor force of just over 22,000 people. Late adopters averaged

TABLE 7

Labor Market Outcomes in Rural Counties by Adopter Type

	2010-2011			2018-2019		
	Early Adopters	Late Adopters	Non-Transitioners	Early Adopters	Late Adopters	Non-Transitioners
Labor Force Outcomes						
Labor Force	22,068	8,450	7,362	22,044	8,189	6,930
Wage Employment	18,183	6,338	5,213	19,400	6,611	5,262
Self Employment	5,800	2,387	2,075	6,249	2,497	2,165
Unemployment Rate (%)	7.7	9.1	10.3	3.5	4.1	4.7
Firms & Establishments						
Establishments	1,015	366	284	1,028	361	273
Establishment Employment	14,012	4,552	3,636	15,173	4,818	3,733
Total Startups and Young Firms	232	83	62	216	74	54
Total Non-Employers	3,004	1,214	1,051	3,211	1,254	1,068
Job Creation & Destruction						
Jobs Created (% of Employment)	11.8	12.0	12.0	11.0	11.4	11.3
Jobs Destroyed (% of Employment)	11.7	12.9	12.9	10.5	10.9	10.9
Net Jobs Created (% of Employment)	0.1	-0.9	-0.9	0.5	0.5	0.4
Job Dynamics						
In-Commute Jobs	767	282	235	990	349	270
Out-Commute Jobs	877	416	414	1,067	493	441
Inflow Earnings	275,096	93,395	95,698	367,427	120,772	120,677
Outflow Earnings	204,482	67,118	58,802	268,216	86,098	74,537
Adjacent Residence Value	70,615	26,277	36,896	99,211	34,674	46,141
BGT Job Postings						
Number of Job Postings	11,216	3,149	2,173	26,450	7,814	4,955
Salary Listed	$46,715	$45,788	$48,703	$55,070	$56,622	$56,899
% Requiring a Bachelor's Degree	16.6	15.0	13.8	17.5	17.0	17.5
% Requiring an Associate's Degree	5.2	4.8	4.7	6.3	6.2	5.5
% Requiring a High School Degree	21.8	19.4	18.6	27.8	28.2	29.7
% Requiring Digital Skills	17.5	14.8	15.5	17.6	14.4	14.2
% Requiring Baseline Skills	58.2	54.5	54.6	65.4	61.9	61.2
% Requiring Certifications	2.7	2.7	2.5	3.3	3.5	3.4

Source: American Community Survey, Bureau of Economic Analysis, Bureau of Labor Statistics Local Area Unemployment Statistics, Business Dynamics Statistics, LEHD Origin-Destination Employment Statistics (LODES), Economic Research Service (ERS) metro-nonmetro county classifications, and Burning Glass Technologies Jobs Postings.

just under 8,500, and non-threshold counties were just above 7,300. Early-adopter counties also featured more than twice the number of self-employed individuals, on average, relative to late-adopter and non-threshold counties. In addition, early-adopter counties generally had lower unemployment rates (7.7%) in the early period that began at the end of the Great Recession than late adopters (9.1%) and non-thresholds (10%). By the late period, due to a much-improved economy, these differences converged: Early adopters had an average unemployment rate of around 3.5% versus 4.1% and 4.7% for late-adoptor and non-threshold counties, respectively. Most of this employment was in establishments. Early adopters tended to have more establishments than both the late-adopter and non-threshold counties. Early adopters further had more startups and young firms in the early period with roughly similar numbers during the late period as well. Lastly, the total nonemployers, a measure of one–person self-employed businesses, was nearly 3 times as high in early-adopter counties than in late-adopter and non-threshold counties in the early period (just over 3,000 vs. just over 1,200 and 1,050, respectively). The growth in these kinds of businesses was also faster in early-adopter counties.

Upon comparing some of the more dynamic factors in these places, all three county types had similar levels of job creation as a percentage of employment in the early and later periods although job creation was roughly 1 percentage point lower in the late period. By contrast, late adopters and non-thresholds had much higher job destruction rates than their early-adopter counterparts, leading to net job losses in the former and net jobs created in the latter in the 2010–2011 period. By 2018–2019, all adopter types had positive net job creation of around 0.5% of employment although both the levels of jobs created and destroyed had fallen. Interestingly, although outflow commuting appeared more likely among the three county types, these places received an inflow of commuters as well. On this point, Jasper County, SC stands out as an example of a late-adopter county with a captivating development and job growth experience.

Jasper County is a majority-Black community, and unlike the other cases we explored, Jasper is not an oil and gas county; its strategic location has recently created tremendous opportunities to increase the relative size of its economy. Jasper County is in South Carolina's Low Country region and rests between two global trade gateways: GA's Savannah Port and SC's Port

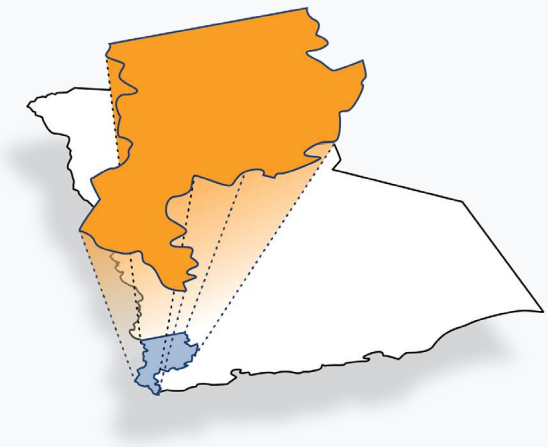
Jasper County's development arc unveils the roles of assets, creative leadership, and the opportunity for land-rich rural counties to gain momentum from the global pivot to e-commerce.

of Charleston. Jasper's leadership initially failed to appreciate the county's location as a potentially valuable asset. In 2007, the GA and SC port authorities anticipated a shift in global commercial trading patterns that would benefit the region's ports. But these ports, each built in the 1700s, did not have the physical capacity to accommodate significant increases in containerized cargo or the larger vessels trafficking international waterways. Trade logistics predicted that each port would exhaust its capacity by 2030. The region needed another hub to service southeast trade routes. With I-95 running through the county and given its proximity to the Savannah Port, Jasper County offered an ideal location to service the spillover. The new port—Jasper Ocean Terminal—would be sited in Jasper County. This decision sparked a revival in the county that has since unfolded into a dynamic economic development strategy built around the area's endowments: location, land, and recreational amenities. The county council began to finance the development of speculative logistical warehousing embedded with state-of-the-art fiber connectivity. County leadership also made other strategic infrastructure investments in water and sewers, roads, and schools.

In the meantime, Jasper County's population grew by 25.1%, driven by two principal flows: affluent retirees moving to the county for its recreational amenities and lower-income workers from neighboring counties where affordable housing or jobs are in low supply. Jasper's development arc unveils the roles of assets, creative leadership, and the opportunity for land-rich rural counties to gain momentum from the global pivot to e-commerce. Like Ward County, broadband is an economic development tool that has enabled Jasper County to build a new economy with better-quality jobs. Jasper County's experience underlines the significance of market forces in effecting promising outcomes (see Case Study 3).

Jasper County, SC

An Asset-Based Story of Development



With a population of roughly 30,000, Jasper is nestled deep in South Carolina's Low Country region. The county has long been mired in economic deprivation and persistently high poverty levels that seemed impervious to change—almost forgotten or perhaps forsaken. But a closer look at Jasper reveals a story of resilience and transformation rooted in both structural forces and bold leadership choices.

The economic odds were stacked against places like Jasper County with weak industrial bases. Between 1995 and 2005, the county lost 10.1% of its small commercial base annually. The Great Recession exacerbated Jasper's economic challenges. Manufacturing and construction firms (already small sectors) exited the county, taking output and jobs while leaving behind a service-dependent economy reliant on low-wage retail and food service sectors. This industrial mix had severe implications for the county's ability to improve its public institutions or invest in building a thriving, entrepreneurial workforce—a key factor of economic progress.

However, a crucial inflection point in the county's development arc emerged among the layers of economic turmoil. In 2007, Georgia and South Carolina governors signed an agreement to construct a new marine cargo terminal. The momentous decision to site the Jasper Ocean Terminal (JOT) in Jasper County was an acknowledgment of the importance of the Ports of Charleston and Savannah as critical geo-economical trade assets that served as gateways to Asian and European trade markets. For Jasper, this choice reflected a shift in the appraisal of the county as a valuable geographic resource, with trade-facilitating amenities not available in Savannah, GA, or upriver

in the Port of Charleston. The potential for the new port was the genesis for a critical re-appraisal of Jasper's locational assets, which include proximity to the Port of Savannah, I-95 running through the middle of the county, railroads, and an airport. In other words, without JOT, Jasper still controls an underdeveloped intermodal distribution system that, with sufficient and well-timed investments, could capitalize on economic spillover benefits from the fast-growing Savannah port.

Acting on this re-appraisal is fundamental to changes underway in Jasper—including the development of industrial parks with warehouse buildouts and new companies that have internalized Jasper's location as a balance sheet asset. Jasper experienced remarkable population growth in the last decennium—between 2010 and 2020, the county's population expanded by 25.1%. Three distinct groups are largely responsible for this rapid influx: relocating retirees moving away from distant metros, workers from peripheral counties, and new companies. New companies often note that Jasper's location supports better supply chain integration because of access to interstate highways and two major gateway trade ports. Migrating retirees, who tend to be affluent, are drawn to the county's recreational assets such as a world-class golf course and attractive retirement neighborhoods. Less affluent groups moving to Jasper are primarily workers spilling over from neighboring counties, where access to unaffordable housing is extremely limited or where fewer job opportunities exist.

County-financed speculative development of logistics and manufacturing warehouses is a key pillar of Jasper's economic development strategy. The county's speculative industrial parks offer potential companies a ready-made platform for relocation. Building a broadband framework has been a cornerstone of Jasper's prospective economic growth. Vested stakeholders such as the Palmetto Electrical Cooperative and Palmetto Rural Telephone Company created a critical partnership to extend broadband connectivity, particularly high-speed fiberoptic service. Meanwhile, the county's industrial parks are fully wired with bleeding-edge fiberoptic capability. These anchor institutions play an integral force-multiplying role via their broadband networks, namely in scaling high-quality broadband to less developed areas of the county. Jasper County leadership has successfully executed its strategic vision to construct a concrete foundation on which sustainable growth can take root.

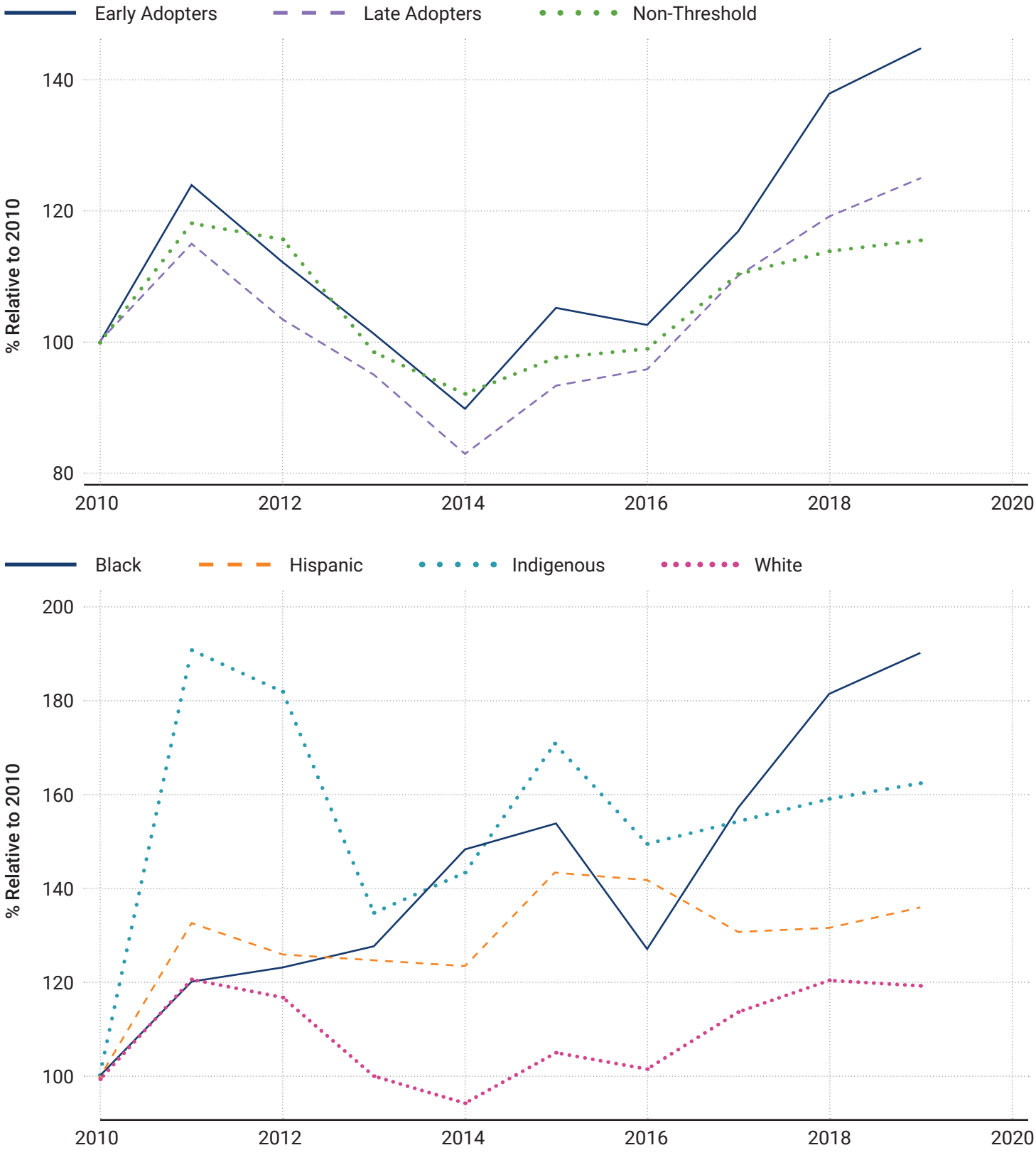
Lastly, to get a better sense of labor demand across rural counties by broadband adopter type, we draw upon real-time online job postings data from Burning Glass Technologies (BGT). In line with the relative sizes of their labor forces, early-adopter counties received many more job postings than their counterparts in both earlier and later parts of our observation period. These differences increased in the later period, with monthly job postings in early-adopter places expanding from a little over 11,000 monthly in the earlier period to more than 26,000 in the later period. Late adopters and non-threshold counties also saw postings slightly more than double, albeit on a much smaller scale. It should be noted that BGT data increased coverage over time, so comparisons of the number of job postings across time periods should be done with caution (Cammeraat and Squicciarini, 2021).

What types of skills were employers searching for? Figures 6 and 7 provide some graphical evidence about skill demand, as reflected in online job postings, between 2010 and 2019. The first panel of Figure 6 plots the share of jobs requiring a bachelor's degree relative to a 2010 baseline. The number of posts for jobs requiring a bachelor's degree declined in early-adopter, late-adopter, and non-threshold counties following the Great Recession, dipping below 2010 levels until 2014. After 2014, however, this trend changed sharply: The number of jobs requiring a bachelor's degree climbed drastically relative to 2010 across all county adopter types. By 2019, early- and late-adopter counties saw just under 20% and just over 20% growth in postings requiring a bachelor's degree relative to 2010. Remarkably, the number of job postings requiring this degree expanded even more dramatically in non-threshold counties—totaling 40% growth over 2010 levels. Employers who posted jobs online in these rural areas were clearly seeking more skilled workers.

The second panel of Figure 6 investigates these dynamics based on county-level racial composition. Given the relatively small share of majority-minority rural counties, white counties were expected to track more closely with aggregate trends in rural counties. Indeed, these counties saw a dip in the number of job postings requiring a bachelor's degree in the years leading up to 2014 and relative growth in subsequent years. By contrast, job postings continually surpassed 2010 levels in majority-minority rural areas. Black rural counties, aside from a two-year period between 2014 and 2016, saw near monotonic growth relative to 2010 in the number of job postings requiring a bachelor's degree. By 2019, the number of job postings requiring this degree was roughly 90% higher in Black-majority rural counties compared to 2010. Similar dynamics, although on a lower scale, manifested for Hispanic-

FIGURE 6

Growth of Job Postings Requiring Bachelor's Degrees by Adopter Type and Demographic Group, 2010-2019



Source: Authors' calculations of Burning Glass Technologies Jobs Postings. FCC Internet Access Services County-level 2010-2019, and American Community Survey.

majority rural counties: These places generally saw higher levels of job postings relative to 2010 throughout 2011–2019, peaking at 40% higher in 2015. Finally, Indigenous areas saw a large uptick in these job postings—nearly doubling between 2010 and 2011—with a generally higher level of job postings calling for bachelor's degrees relative to 2010 for the remaining part of the decade.

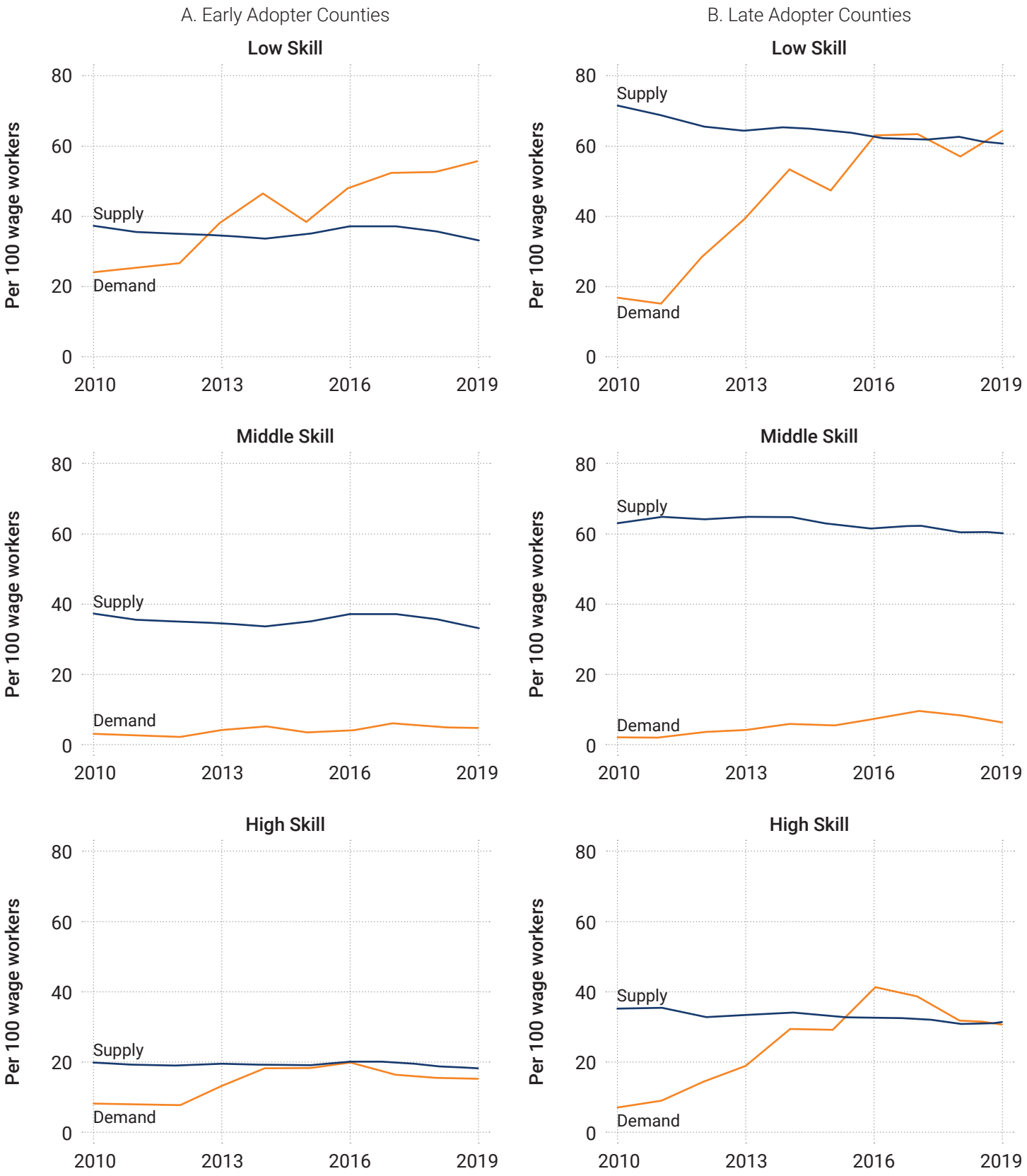
Given this surge in demand for skilled workers in rural areas, it is important to understand the extent to which these rural counties could satisfy such needs. Figure 7 compares labor demand across skill types as measured by BGT job postings to the average number of workers by skill group (defined as educational attainment using American Community Survey (ACS) data). The BGT job postings data were weighted using the ACS data at the county and occupation levels to be made comparable to the job supply, or the county level number of workers from the ACS.[6]

The top panel of Figure 7 presents supply and demand data for early-adopter counties. These counties had roughly just below 40 low-skill workers per 100 wage workers in 2010 on average, with this proportion declining only slightly over the intervening decade. Likely reflective of the Great Recession, demand for lower-skill workers was relatively low at merely 20 job posts per 100 workers in 2010. Demand trumped supply by 2013; by 2019, the supply-demand gap had grown to roughly 20 workers per 100 wage workers. Conversely, the supply of middle-skill workers far outstripped demand for such workers throughout our observation period. There were fewer than 5 job postings per 100 workers at the beginning of the period, which increased negligibly until 2019. The supply was just below 40 per 100 wage workers early in the period and remained fairly stable throughout our study timeframe. High-skilled workers represented the smallest share of workers in early-adopter counties at around 20 per 100 wage workers. The number of job postings seeking such workers was initially low, just under 10 per 100 wage workers but increased by the end of the period to about 20 per 100 wage workers.

The dynamics in late-adopter counties echoed those in early-adopter counties. In this case, the supply of low-skill workers initially far outstripped demand at just over 70 per 100 wage workers while there were just under 20 job postings per 100 wage workers. Even though supply remained generally stable over the study period, declining only slightly, the number of job postings among this skill group grew substantially to just over 60 per

FIGURE 7

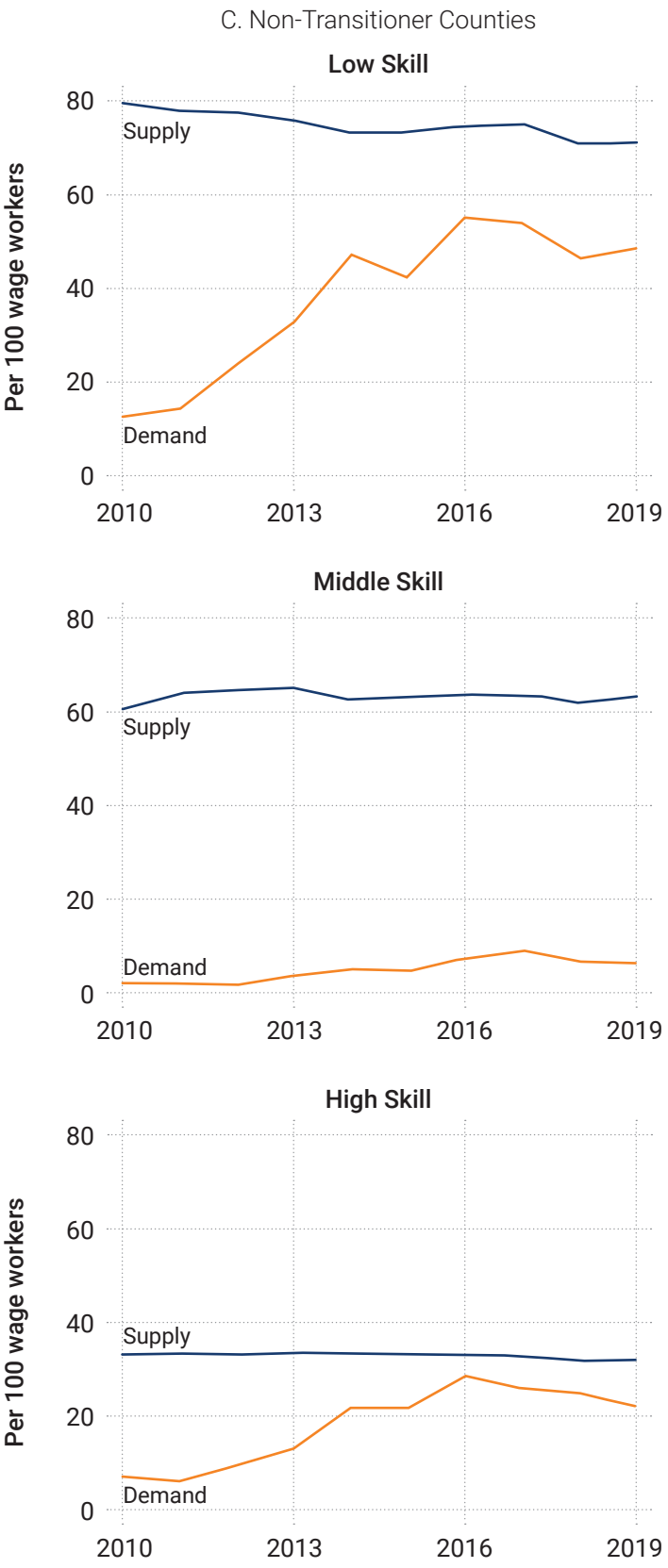
Supply and Demand of Jobs by Skill Levels Across Adopter Types, 2010-2019



Demand = Average number of job postings by county (Source: BGT); Supply = Average number of workers by county (Source: ACS).

FIGURE 7 (CONTINUED)

Supply and Demand of Jobs by Skill Levels Across Adopter Types, 2010-2019



100 wage workers by the end of the time horizon. Similar to early-adopter counties, the supply of middle-skill workers (just over 60 per 100 wage workers) was much higher than the corresponding number of job postings (around 1 per 100 wage workers) in 2010. This gap only closed slightly as postings grew to about 5 per 100 by the end of the period. Lastly, the supply of high-skilled workers was again roughly stable over the period at around 35 per 100 wage workers. The demand for workers in these skill groups was relatively low at the beginning of the decade (around 5 per 100 wage workers). By the end of the period, demand had risen sharply to around 30 posts per 100 wage workers, meeting the supply of such workers in late-adopter counties.

Lastly, we examine these labor supply and demand dynamics for non-threshold counties. Looking first at the low-skill market, counties began the observation period with a substantial difference between the supply of low-skill workers (roughly 80 per 100 wage workers). Demand for workers, as measured by BGT job postings, was just over 10. The number of postings grew substantially over time: The volume was just under 50 per 100 wage workers by the end of the period. Remarkably, the supply of low-skill workers fell slowly but monotonically over this timeframe as well. Like the other two adopter types, middle-skill workers far exceeded the demand for such workers as measured by job posts at 60 and roughly 5 per 100 wage workers, respectively. Lastly, the gap between supply and demand for

high-skill workers was large in 2010, with supply being just over 30 per 100 wage workers and the number of job postings being just under 10 per 100 wage workers. By the end of the period, the number of such postings had roughly tripled whereas the worker supply remained similar.

Taken together, these labor dynamics suggest several issues of interest. First, early gaps in supply may have been aggravated by the persistent effects of the Great Recession. These gaps also speak to area demographics. Over the course of a decade, the supply of such workers was roughly similar or even declined across all three county types. These places, on average, therefore may not have been growing much demographically. Job postings for low- and high-skill workers seemed to increase much more rapidly than those for middle-skill workers in all three county types despite the supply of such workers being relatively high. This phenomenon may be reflective of local job polarization as discussed in Acemoglu and Autor (2011) where there is much more interest in lower- and higher-skill workers.

The fact that labor supply remained flat despite a noticeable increase in online job postings suggests that the economic context varied markedly between early and late adopters. As an initial observation, our coarse typology captures a heterogeneous group of counties with similar growth trajectories and broadband conditions. Their varied economic circumstances were determined by forces much larger than broadband. Broadband can enable critical economic forces if used appropriately, but other critical factors must be present for this tool to function optimally. The economic challenges facing non-threshold counties were a function of multiple systemic obstacles. Although broadband is a priority, some communities continue to grapple with pressing concerns that may not align with a singular broadband policy agenda. This circumstance creates tension in the digital divide dialogue that is difficult to resolve. In the cases of rural Indigenous communities like the Gullah/Geechee, broadband is important but does not rank above the coastalcommunity's concerns about climate change. Oceanic acidity, warming seas, and intense heat waves have stressed that community's food environment to a dangerous point. Its survival depends on leaders' ability to marshal resources to help local farmers and fishermen build geo-defenses against climate threats that are jeopardizing community members' livelihoods, drinking water, and food environment (See Case Study 5).

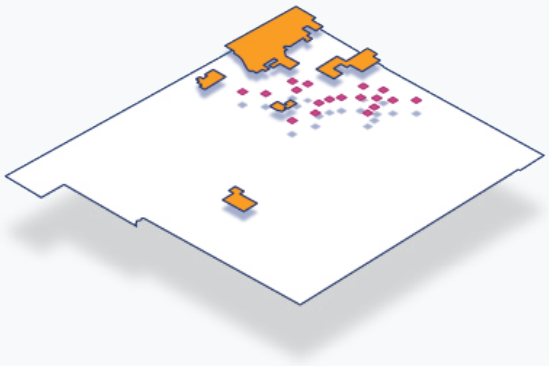
Broadband can enable critical economic forces if used appropriately, but other critical factors must be present for this tool to function optimally. The economic challenges facing non-threshold counties were a result of multiple systemic obstacles.

In rural Native American communities that have been divested and exploited, formal jobs as described in this report are scarce and hard to create in high-poverty settings that have been unfairly devalued by racist stereotypes. The question in such places then becomes: What regenerative strategies can these communities draw on to create economic security? Entrepreneurship immediately emerges as an expansive economic development tool for economic and social safety, particularly for Native women. Innovative community-embedded organizations, like Native Women Lead and Roanhorse Consulting, work outside bureaucratic channels of rigid policies to devise strategies that support entrepreneurship for Native women. These women experience more violence than any other racialized group in the country. These collaboratives, led by a new theory of change model, have reengineered elements of the community finance system to equitably serve the unique needs of Native women-led businesses (see Case Study 4). Technocratic frames about rural communities are severely limited in their ability to encompass diverse challenges facing rural communities or out-of-box tactics that can open small but valuable pathways to resilience.

Case Study 4

Native Women-Led Entrepreneurship

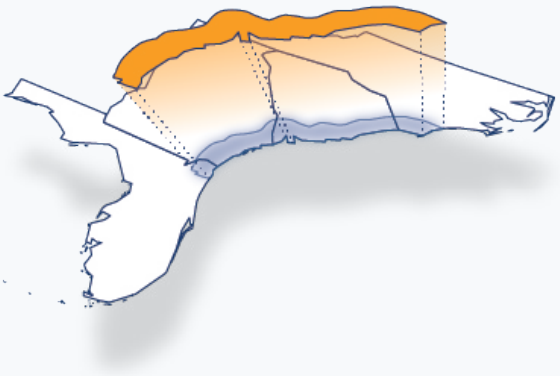
Alternative Pathways to Economic Security



Recognizing the disempowerment of indigenous groups marginalized in mainstream policy is a crucial equity-building step. Yet policymakers have failed to include the distinct needs of rural Native American communities in their economic agendas. Entrepreneurship is a valuable pathway to economic security for Native American communities, particularly those steeped in poverty and economic decline. For far too many Native women, poverty, violence, and invisibility are regular bookends in the chapters of their lives. These same women are essential to the economic vitality of their families and, by extension, their communities. Roughly 2 out of 3 Native women, the majority of whom are single mothers, are breadwinners for the households they anchor. Providing for the economic safety of Native women is critical to securing their physical, emotional, financial, and spiritual well-being. Entrepreneurship offers a vital safety net for these women. However, the rural policy toolbox is silent on this connection and continually misses opportunities to create alternative pathways to security for vulnerable groups.

Native Women Lead (NWL) is a collaborative founded by eight indigenous women focused on forcing systemic changes in community development finance. NWL created a suite of innovative financial services and loan programs to support the growth and viability of Native women-led businesses. The collaborative's Matriarch Fund is an innovative wraparound capital strategy serving the distinctive needs of nascent and thriving founders. Importantly, each NWL loan, grant, or service reflects the community's core values of empathy and community connectedness. Guided by equity and caring, NWL customizes repayment terms to support women's ability to repay borrowed funds that protect credit scores and improve these women's visibility in mainstream financial systems. NWL's model exemplifies the power of entrepreneurship as an alternative pathway to economic resilience.

The Other Rural Agenda: Climate Change in Coastal Gullah/Geechee Communities



The Gullah/Geechee people live on the coastal plains and islands of North and South Carolina, Georgia, and Florida. They are the direct descendants of Africans who were enslaved and who created a unique culture with ties to West African culture and a distinctive dialect. For rural Gullah/Geechee communities, broadband is a second-order priority to climate change and weakening land ownership. Compounding these struggles is the reality that rural indigenous communities are often overlooked because policymakers have a very narrow picture of what "rural America" looks like.

Agriculture and marine assets have shaped the primary occupations and core economic activities in Gullah communities. Unregulated access to coastal waters created a fishery industry that supported business ownership and robust forms of self-employment. However, this fragile ecological system faces existential threats from climate change. Warming seas, a rising sea level, eroding marshlands, and other anthropogenic global warming effects have compromised various aspects of Gullah's marine economy and biosphere. Queen Quet, chieftess of the Gullah/Geechee Nation, and advocacy organizations like the Gullah/Geechee Cultural Heritage Corridor Commission have developed solutions to address systemic issues such as climate change and coastal gentrification that have jeopardized their ability to retain ownership of their land. These institutions need urgent substantial political and financial resources to protect Gullah/Geechee homesteads. The Biden administration's Justice40 Initiative could provide much-needed funds to support critical efforts such as the South Atlantic Salt Marsh Initiative, which is vital to the Gullah/Geechee's preservation.

Regression Evidence

To get a better sense of how the factors we have studied separately contribute to economic outcomes in tandem, we estimate a series of regressions that relate economic outcomes to a number of relevant aspects. Our regressions focus on two outcomes: (1) the normalized change in enhanced employment—that is, local county employment plus inflow-outflow measures provided by the Bureau of Economic Analysis, normalized by the labor force at baseline—between 2010 and 2019 and (2) the normalized change in nonemployers, which serves as a proxy for entrepreneurial activity in the county. Each regression consists of a set of indicators: whether a county met the appropriate broadband thresholds (50% by 2012 to be an early adopter vs. 60% after 2012 to be a late adopter); the timing of adoption; an interaction between indicators for meeting the threshold and whether the county was an early adopter; and a set of baseline sociodemographic measures on population characteristics, labor force, and local industry. This specification, while not claiming causality, allows us to better understand the dynamic relationships between broadband expansion and economic development measures for places that were sociodemographically similar at baseline.

Table 8 lists these estimates for the change in enhanced employment over the decade. Column 1 begins with a core set of controls, and the remaining columns include oil and gas-specific measures that capture the nature of that industry and its effect on employment growth. The regression results in Columns 1–5 suggest that, conditional on baseline characteristics, there is no strong predictive relationship between meeting the broadband expansion (whether early or late) and the change in employment. Several thought-provoking associations nevertheless emerge. Unsurprisingly, demographics are strongly associated with employment growth: Population growth and expansion in the share of workers with postsecondary education were predictive of strong employment growth across all specifications. In addition, places that were majority Hispanic at baseline saw strong job growth relative to majority-white places. However, Black-majority counties stood in stark contrast to Hispanic-majority areas; their concentration in regions that have struggled to maintain and grow legacy manufacturing bases limited growth prospects in many ways. Wealthier places, as measured by median house value at baseline, saw stronger employment growth as well. This finding again implies that places where people wanted to move also tended to be places where employment growth was strong.

TABLE 8

Regression Outputs on Normalized Change of Enhanced Employment 2010-2019

	(1)	(2)	(3)	(4)	(5)
Meet Broadband Threshold	0.38	0.20	0.35	0.37	0.23
	(0.81)	(0.82)	(0.80)	(0.81)	(0.76)
Threshold*Early	1.82	1.51	1.73	1.85	1.58
	(1.17)	(1.11)	(1.10)	(1.17)	(1.19)
Adjacent to large metro area	2.21**	2.24**	2.16**	2.25**	1.69*
	(0.72)	(0.72)	(0.71)	(0.73)	(0.71)
Log Population Density in 2010	1.44	1.62	2.07	1.35	1.35
	(1.14)	(1.14)	(1.08)	(1.07)	(1.12)
Log Population Density in 2010 Squared	-0.13	-0.17	-0.21	-0.12	-0.13
	(0.15)	(0.15)	(0.14)	(0.14)	(0.15)
Log Pop. Growth (2005-2010)	44.18**	43.43**	45.49**	40.68***	42.80**
	(15.05)	(14.25)	(14.31)	(8.39)	(14.91)
% workers with post-sec edu increased between 2000-2010	2.27***	1.06	2.26***	2.27***	2.48***
	(0.68)	(0.63)	(0.66)	(0.68)	(0.65)
Majority Black	-3.00*	-2.96*	-2.80*	-3.21*	-3.16*
	(1.38)	(1.39)	(1.38)	(1.28)	(1.38)
Majority Hispanic	8.31*	8.69**	8.30*	8.12*	0.75
	(3.38)	(3.37)	(3.26)	(3.32)	(2.68)
Log median household income	1.67	2.06	0.95	1.34	0.63
	(3.21)	(3.24)	(3.28)	(3.32)	(3.18)
Log Median House Value	12.88***	12.69***	12.64***	12.96***	13.69***
	(1.98)	(1.93)	(1.89)	(1.95)	(1.91)
Log Total Firms	0.10	0.28	0.76	0.13	0.17
	(0.85)	(0.79)	(0.77)	(0.86)	(0.86)
Growth of >= $20M oil&gas production (2000-11)	8.66**	3.19	54.81**	7.51*	5.59
	(2.90)	(1.86)	(18.73)	(3.46)	(2.98)
Industry Diversity	-0.28	-0.28	-0.24	-0.31	-0.27
	(0.37)	(0.37)	(0.37)	(0.34)	(0.37)
Interaction of oil&gas growth and postsec LF growth		16.06*			
		(7.71)			
Interaction of oil&gas growth and log number of firms			-8.15**		
			(3.04)		
Interaction of oil&gas growth and pop growth				31.29	
				(85.16)	
Interaction of oil&gas growth and majority Hispanic					33.55**
					(10.84)
Constant	-159.63***	-162.07***	-154.83***	-156.82***	-157.86***
	(29.42)	(29.41)	(28.97)	(31.15)	(28.56)
Adj. R-Square	0.238	0.252	0.255	0.239	0.259
N	2044	2044	2044	2044	2044

Source: Bureau of Labor Statistics Local Area Unemployment Statistics (LAUS), LEHD Origin-Destination Employment Statistics (LODES), American Community Survey, FCC Internet Access Services County-level 2010-2019, USDA County-level Gas Production 2000-11, USDA ERS metro-nonmetro classifications.

Finally, the regression results in Table 8 underscore the importance of industries being built on local resources. While industry diversity is not statistically predictive of employment growth, an industry built on gas and oil seems to be strongly related. In Column 1, including an indicator for greater than $20M of growth in oil and gas is associated with growth that is roughly eight percentage points higher. The model in Column 2 contains an interaction between this term and a measure of Labor Force growth; this term is positive and statistically significant. Column 3 presents a model that replaces this interaction with an interaction between the oil and gas growth indicator and a measure of the log number of firms at baseline. While the main oil and gas growth indicator remains positive and statistically significant, the sign and magnitude of this interaction suggests that having a larger number of firms at baseline is associated with less employment growth. The final two columns of Table 8 show an additional specification. Column 4 presents a model that includes an interaction of oil and gas growth and population growth that is noisily estimated and insignificant. The final column allows for an interaction between the oil and gas growth measure and whether the county was majority-Hispanic. This interaction is positive and statistically significant, implying that belonging to a dominant oil and gas economy drives employment growth in Hispanic-majority counties.

Table 9 presents results from a set of similar regression specifications looking at the normalized change in nonemployers, a proxy for entrepreneurship, between 2010 and 2018.[7] This table is organized similarly to Table 8, where Columns 1–5 mirror the parametric specification to predict the outcome variable of interest. In contrast to results for the overall change in employment, reaching the threshold early had a statistically significant 0.29 percentage point increase in the number of nonemployers relative to late-adopters, and a 0.36 percentage point increase relative to non-thresholds. This effect is stable across all but one specification. Increased broadband adoption, despite data quality issues, has a positive effect on entrepreneurial growth in rural areas. Early broadband adoption, despite data quality issues, had a positive effect on entrepreneurial growth in rural areas. This finding has significant implications for marginalized groups such as minority, women, and indigenous-owned micro-businesses in rural areas faced with shrinking formal job opportunities. Relatedly, work by Conroy and Low on establishment birth in rural areas confirms that broadband infrastructure is a fundamental precursor to entrepreneurial growth in rural

TABLE 9

Dependent Variable: Change of Nonemployers (Normalized 2010-2018)

	(1)	(2)	(3)	(4)	(5)
Meet Broadband Threshold	0.07	0.05	0.07	0.07	0.06
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Threshold*Early	0.29*	0.26	0.28*	0.29*	0.28*
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Adjacent to large metro area	0.12	0.12	0.12	0.12	0.11
	(0.12)	(0.11)	(0.12)	(0.12)	(0.12)
Log Population Density in 2010	-0.12	-0.12	-0.12	-0.12	-0.12
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Log Pop. Growth (2005-2010)	4.44***	4.38***	4.46***	4.36***	4.41***
	(1.33)	(1.31)	(1.33)	(1.29)	(1.33)
% workers with post-sec edu increased between 2000-2010	0.12	0.03	0.12	0.12	0.13
	(0.09)	(0.10)	(0.09)	(0.09)	(0.09)
Majority Black	0.44	0.44	0.44	0.43	0.43
	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)
Majority Hispanic	0.56	0.58	0.56	0.56	0.38
	(0.34)	(0.34)	(0.34)	(0.34)	(0.38)
Log median household income	1.86***	1.89***	1.84***	1.85***	1.83***
	(0.50)	(0.50)	(0.50)	(0.50)	(0.51)
Log Median House Value	2.04***	2.03***	2.04***	2.04***	2.06***
	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)
Log Total Firms	0.00	0.02	0.02	0.00	0.01
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Growth of >= $20M oil&gas production (2000-11)	0.12	-0.28	1.04	0.09	0.04
	(0.22)	(0.24)	(1.42)	(0.22)	(0.24)
Industry Diversity	-0.04	-0.04	-0.04	-0.04	-0.04
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Interaction of oil&gas growth and postsec LF growth		1.15*			
		(0.50)			
Interaction of oil&gas growth and log number of firms			-0.16		
			(0.23)		
Interaction of oil&gas growth and pop growth				0.71	
				(4.92)	
Interaction of oil&gas growth and majority Hispanic					0.78
					(0.76)
Constant	-42.66***	-42.85***	-42.58***	-42.59***	-42.62***
	(4.36)	(4.36)	(4.35)	(4.37)	(4.37)
Adj. R-Square	0.325	0.329	0.325	0.325	0.325
N	2044	2044	2044	2044	2044

Source: Census Nonemployer Statistics, American Community Survey, FCC Internet Access Services County-level 2010-2019, USDA County-level Gas Production 2000-11, USDA ERS metro-nonmetro classifications.

TABLE 10

Characteristics by Majority Oil&Gas Industry Status

	2010-2011		2018-2019	
	Majority Oil&Gas	Non-Dominant	Majority Oil&Gas	Non-Dominant
Median Household Income	$40,533	$31,090	$51,262	$37,864
% Black	4.1	33.1	4.4	33.1
% Hispanic	58.0	22.3	62.3	23.7
Log Decennial Population Growth	4.5	-2.8	0.8	-10.3
Firm Density	4.9	3.9	5.2	4.2

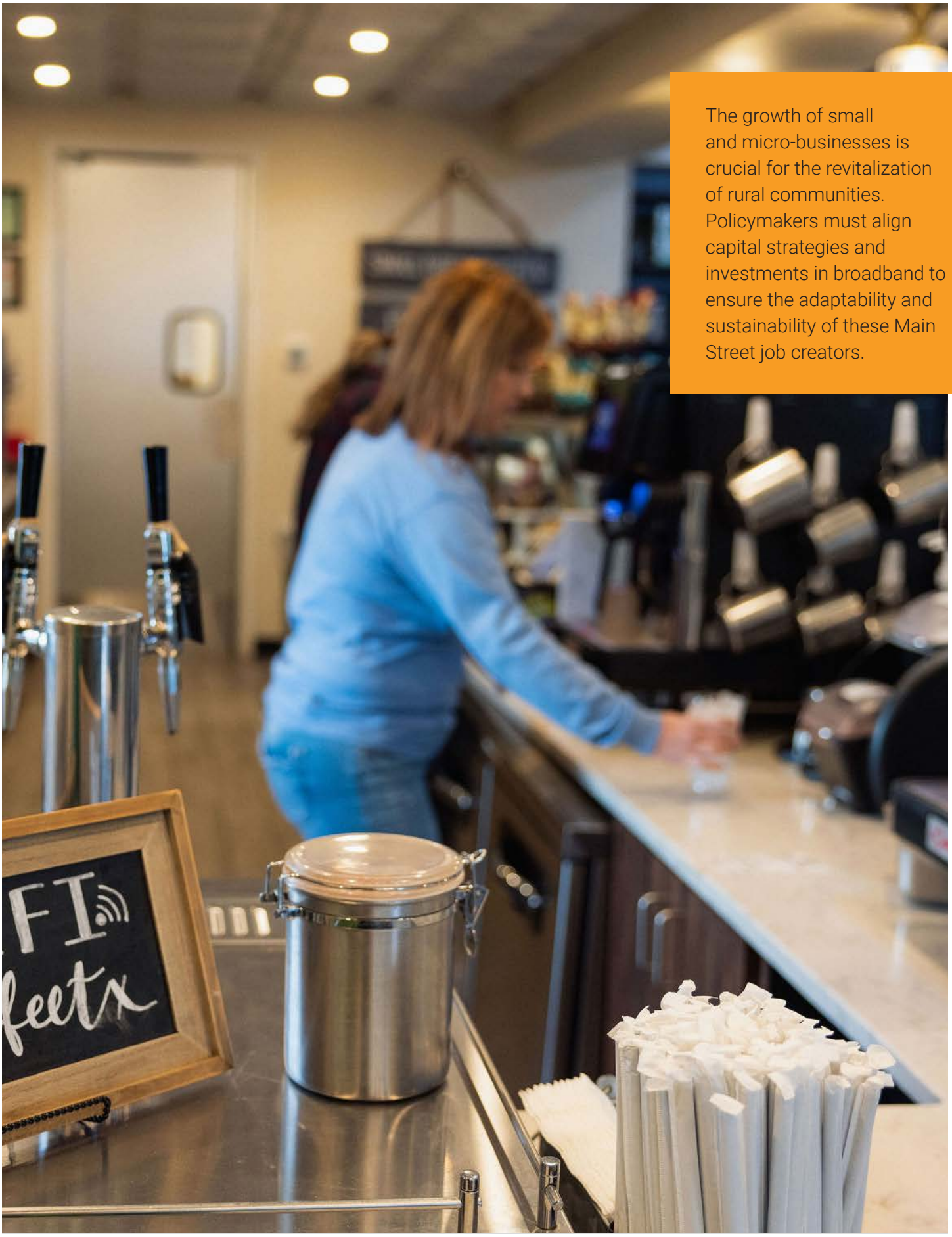
Source: Authors' calculations of American Community Survey, USDA County-level Gas Production 2000-11, USDA ERS metro-nonmetro classifications, and Business Dynamics Statistics.

areas, but its effects are strongest for remote rural counties and women-led startups (Conroy and Low, 2022). Moreover, studies have substantiated the job creation potential of startups and young firms that tend to be net job creators relative to older firms regardless of size (Haltiwanger et al., 2013). Attention to the policy environment is critically important to promote the full range of entrepreneurship possibilities and engage community assets to support the diverse needs of rural micro-businesses. While broadband plays an enabling role in driving entrepreneurial outcomes, its interaction with other infrastructure tools is far more important. Broadband complements entrepreneurship and induces new firms to locate to rural areas, but this complementarity attenuates in areas with critically low levels of educational attainment (McCoy, 2017). Consistent with the literature, Table 9 shows that effects of demographics and wealth exert greater influence on nonemployer outcomes than broadband adoption. Unsurprisingly, we find that a county's wealth, ability to attract and retain population, and income at baseline were predictive of greater entrepreneurship, more so than broadband. Finally, unlike the overall change in employment, being in a county with a substantial oil and gas industry was not highly predictive of entrepreneurial activity although such places with strong labor force growth saw an increase in nonemployers.

Overall, the results from these models, while not supporting a causal interpretation, continue to indicate that demographics matter. Given the change in the demographic structure of these rural areas, places that could successfully attract population were more likely to have higher employment and entrepreneurial activity. Likewise, even though reaching the broadband threshold did not forecast greater growth in employment potential overall, this milestone was predictive of greater entrepreneurial activity. Access to fast, reliable internet may facilitate entry into the modern information economy. More work needs to be done regarding this aspect of broadband. To this point, though, our findings may speak to the role of increased broadband investment and adoption for economic development in these rural areas.

Finally, the results in Table 10 on the role of oil and gas industry growth highlight the importance of leveraging local growth industries to maintain rural areas. The ongoing expansion of this industry and its primary location in areas that include Hispanic-majority counties—and, to a lesser extent, Indigenous counties—helped boost employment and population growth in these places relative to Black-majority rural counties which are mostly in the Southeast. Oil and gas-dominant economies captured a growing share of a geographically mobile workforce that includes immigrants as well as firms eager to innovate in new markets. Table 10 depicts the contrast between counties with a dominant oil and gas industry and counties in which this industry is not dominant.[8] Counties with a major oil and gas industry, defined as those where at least 10% of all employment comes from the mining industry, had significantly higher median household income, population growth, and firm density compared with counties where oil and gas was not dominant. By 2019, counties with a dominant oil and gas industry were 62.3% Hispanic on average, explaining the higher economic outcomes observed in Hispanic rural counties.

The wide-ranging variation in rural minority areas' economic experiences warrants nuanced research on the factors driving population growth in these areas. These new empirical truths must be grounded in a flexible policy frame with poverty-eradication policies and stakeholders who enhance the renewal of these places. Abstract policies aimed at growing rural populations that ignore specialized economic dynamics will not stimulate growth of any kind. As this report makes clear, energy economies are markedly different from the manufacturing base that long anchored but now fails the Black rural South. Policies intended to maintain and expand economic development in these areas will need to be aimed at identifying local competitive advantages and using these assets to attract workers and their families as well as complementary industries.



The growth of small and micro-businesses is crucial for the revitalization of rural communities. Policymakers must align capital strategies and investments in broadband to ensure the adaptability and sustainability of these Main Street job creators.

DISCUSSION AND POLICY IMPLICATIONS

This descriptive analysis of rural areas points to three core takeaways.

First, demographics matter. Places that generally had larger populations, especially of prime-age workers, tended to fare better economically. The second takeaway is that rural places, particularly those with minority-majority populations, are heterogeneous in their locations, economic prospects, and policy needs. Finally, it is important that local economies modernize and provide the necessary infrastructure to retain and attract new workers, migrating retirees, and a broad cross-section of companies.

Federal rural policy is not situated in a context that serves rural America's diverse communities. In an analysis of federal rural programs, Pipa and Geismar (2021) called for sweeping modernizations in USDA policy to address substantial funding inefficiencies and critical policy disconnects. Our colleagues Hannah Love and Teresa Garcia contend that shifts in the policy arc should be tethered to a community-centered economic inclusion framework that creates growth momentum and tangible benefits in disinvested communities (Love and Garcia, 2022). Proceeding with this recommendation requires a holistic representation of all rural constituencies, regardless of size or economic circumstances, to shape an equitable rural policy framework. Although broadband accessibility is an important provision, broadband policy alone will not build resilience in rural communities. The key policy implications are therefore multifold:

- **Building the institutional capacity to break path-dependent cycles of decline and disinvestment requires creative leaders vested in the value and potential of rural minority communities.** Decision makers across public, private, and philanthropic networks must acknowledge their distinctive roles in supporting equitable growth models in rural minority communities. Braiding national partners' intellectual knowledge and financial resources with local expertise is an underappreciated but essential part of the institutional building process. National stakeholders have worked alongside many community leaders to inspire economic regeneration, but these efforts need more partners to grow and sustain these encouraging starts. Collaborative investments can steer greater resources toward building leadership capacity to implement strategies and experiment with new theories of change.

- **Broadband is no longer an economic development nice-to-have.** Broadband infrastructure is the 21st century's key production factor. Places with underdeveloped broadband systems find it difficult to create new jobs, retain population, or grow their economic base. Local leaders must look to new models to bridge this infrastructure divide. The Biden administration has provided unprecedented levels of federal funding through multiple channels to subsidize construction costs. However, smart investments are required to ensure these funds support future growth. This report has provided suggestive evidence that broadband infrastructure investments should differ based on a county's relative position to the growth threshold. Broadband was one of many structural factors contributing to the economic decline of non-threshold counties. Building out a state-of-the-art ethernet ring will not engender much growth in the face of a poorly skilled workforce or inadequately built infrastructure. Early and late adopters are better positioned to realize growth from further investments in broadband infrastructure. However, they should endeavor to lower cost barriers and improve speed; these differentiators are integral for household production and business productivity.

- **Community leaders must critically appraise their amenities and local resources to identify untapped growth potential.** Globally, e-commerce has opened new growth pathways for rural economies with access to interstate highways that articulate into high-value distribution chains. In this context, land and waterways in rural communities assume new value with the potential to support emergent industries. However, without regional coordination, reappraisal strategies will lead to poor outcomes.

- **The federal government must broaden its rural policy lens.** Assigning the enormous responsibility for rural America's economic prosperity to a single federal agency does a tremendous disservice to the communities USDA serves. The federal government needs a new partnership model that directs resources across the federal ecosystem into rural regional institutions and directly into local communities. The diverse needs of rural minority communities call for a new partnership model that establishes a whole-of-government rural development mandate and coordinates federal policy across agencies to support and amplify local community development efforts.

- **Entrepreneurship is a critical economic development tool in rural minority communities.** It is especially crucial for vulnerable groups in non-threshold counties, such as Indigenous communities where the economic landscape is especially harsh for women. Community-vested financial institutions such as credit unions and community development financial institutions play integral roles in unlocking access to capital to invest in rural micro-enterprises and small businesses. However, without innovative financial services that meet the varied needs of these business owners, many Indigenous-led and women-owned businesses will fail to realize their potential. Inspirational platforms such as Native Women Lead, in coordination with its community finance partners, have designed a transformative Character-Based Lending framework that enables vulnerable, non-traditional, and low-income groups to access inclusive capital (i.e., grants and loans). Scaling and replicating these models are vital to unlocking rural minority communities' entrepreneurial potential.

- **Climate change threatens to erase rural coastal communities and the Indigenous communities who have built hard-won homesteads and subsistence-based ecologies for centuries.** Warming seas, eroding shorelines, and severe heatwaves have had disastrous effects on these rural communities in real time. Framing climate change as an issue for future generations masks the urgent issues coastal rural communities are facing now, including rising food insecurity and public health concerns stemming from oceanic acidity. The Biden administration's Justice40 Initiative should prioritize the environmental needs of these rural communities. The administration should also allocate infrastructure funds and technical support to develop resilience hubs and help farmers build geo-engineering defenses, such as hydroponic farms, equipped with new technologies to protect critical food sources.

The pandemic has offered a moment of enlightenment for policymakers to recreate the rural policymaking apparatus. Appreciating the economic diversity and growth potential of rural minority communities is pivotal to developing a more sophisticated, nuanced rural policy framework. This frame demands presence, resources, and intentionality across all elements of federal agency policymaking and administrative governance. It builds from strength to strength across the political-ideological spectrum and can transcend partisan politics. Supporting the equitable future of rural communities places demands on policymakers to prioritize these communities' varied needs and requires public officials to make their concerns visible in economic policymaking agendas.

APPENDIX A
DATA AND VARIABLE CONSTRUCTION

Broadband Threshold

1. Construct adoption ratios at the county level for years 2012–2019 from Form 477 County Data on Internet Access Services (https://www.fcc.gov/form-477-county-data-internet-access-services). Adoption ratios are defined as ratio of households with residential fixed high-speed connections over 200 Kbps in at least one direction.

2. Construct two-year average adoption ratios for early period (2012–2013) and late period (2018–2019).

3. Conduct threshold regressions using normalized change in enhanced employment as the dependent variable and the adoption ratios for early period and late period (for all rural counties and for rural minority counties only).

4. Based on the threshold regressions, we choose 50% and 60% as adoption thresholds in the early period and late period, respectively. See Section 5.1 for the threshold selection justification.

5. Classify county as "early adopter" if reached 50% threshold in early period (2012–2013); classify as "late adopter" if county did not reach the 50% threshold in the early period but reached the 60% threshold in the late period (2018–2019); classify county as "non-threshold" if county did not reach either threshold in either period.

Labor Demand and Supply

To construct the measures of supply and demand in Figure 7, we modify Cammeraat et al.'s (2014) approach.

1. Use ACS 5-year data (2010–19) for county-level occupation employment data. Additionally, we use the two-digit SOC occupation level as our preferred aggregation choice. It avoids cross-walking SOC codes across the years when SOC classification schemes change as they did in 2007, 2012, and 2017. Furthermore, we retain the Farming, fishing, and forestry occupational group because of its relative importance for rural areas.

2. We apply similar two-digit SOC aggregation to the BGT data and aggregate posting counts within each county. Each job posting has a unique ID and includes several profile variables such as experience, education, specialized skills, baseline skills, digital skills, salary, full-time status, employer name, 6-digit SOC, and FIPS codes. We use SOC, county FIPS, and education requirements to create our skill-level classification and merge to our adopter type typology. For labor supply, we use the ACS 5-year (2010–19) counts of the population with a bachelor's degree or higher (high-skill), some college and associate degree (middle-skill), and high school or GED equivalent (low-skill).

3. By county and year, the BGT and ACS occupational shares are weighted by BGT/ACS occupational shares:

$$Occ\ Employment\ BGT = \frac{Occ\ employment^{i}_{it}}{Total\ Occ\ employment^{i}_{it}}$$

   where i indexes BGT/ACS

4. Using the adopter type taxonomy (see main report), postings are weighed by year using the following methodology:

$$\sum_{it} totaljobs\ requiring\ degree * posting\ weights$$

Note: The weighting scheme does not fully account for the complete set of unobservable considerations that shape occupational distribution. Still, we are confident that this approach sufficiently accounts for the influential systematic factors described in Cammeraat et al. work. Moreover, we are only interested in tracing the contours of the dynamics between labor supply and demand over time. This approach allows us to assess the responsiveness of labor supply to employers' skill demand signals (Modestino, 2019).

ENDNOTES

1 See section 2 "Defining Rural Communities" for an explanation of how we define rural counties.

2 FCC began reporting data on direct household subscription rates in 2016. For the years 2010–2015, only internet subscription quintiles and an additional zero-adoption group were available. We use interval regressions to impute subscription estimates between 2010 and 2015. We use the six bucket endpoints to create dependent variables that are then regressed on a set of controls: median household income, share of population with a college degree, median home values, road density per housing unit, and state-level median price for plans at the 25/3 Mbps speed threshold. The predicted subscription estimates are adopted in Figure 3.

3 The figure plots data smoothed using two-year averages due to year-to-year variation in these data.

4 We implement a threshold regression model that identifies empirical breakpoints in the relationship between broadband adoption and several economic outcomes used in our analysis, including employment growth and growth in self-employment (Gadiraju, 2018).

5 The LAUS program measures employed people and unemployed people on a place-of-residence basis, https://www.bls.gov/news.release/laus.tn.htm.

6 See Data and Variable Construction Appendix for more information about how these measures are constructed.

7 We study nonemployer growth for the period 2010-2018, because data on nonemployers (U.S. Census Bureau, Annual Business Survey, Nonemployer Statistics by Demographic Series (NES-D) are only available until 2018.

8 We use Business Dynamics Statistics (BDS) data to identify counties where at least 10% of jobs were created in the mining sector (NAICS code 21) in the baseline year 2010.

REFERENCES

Acemoglu, Daron, and David Autor. "Skills, Tasks and Technologies: Implications for Employment and Earnings." Handbook of Labor Economics, vol. 4, Elsevier, 2011, pp. 1043–171. DOI.org (Crossref), https://doi.org/10.1016/S0169-7218(11)02410-5.

Ajilore, Olugbenga, and Caius Willingham. Redefining Rural America. Center for American Progress, 2019.

Cromartie, John. Rural America at a Glance, 2018 Edition. United States Department of Agriculture Economic Research Service, 2018, p. 6.

Akerman, Anders, et al. "The Skill Complementarity of Broadband Internet *." *The Quarterly Journal of Economics*, vol. 130, no. 4, Nov. 2015, pp. 1781–824. DOI.org (Crossref), https://doi.org/10.1093/qje/qjv028.

Bai, Yang. "The Faster, the Better? The Impact of Internet Speed on Employment." *Information Economics and Policy*, vol. 40, Sept. 2017, pp. 21–25. DOI.org (Crossref), https://doi.org/10.1016/j.infoecopol.2017.06.004.

Cammeraat, Emile & Squicciarini, Mariagrazia. (2021). Burning Glass Technologies' data use in policy-relevant analysis: An occupation-level assessment. 10.1787/cd75c3e7-en.

Carthy, Philip, and Sean Lyons. "Is Employment Growth Affected by the Introduction of Broadband Services? Evidence from Firms in Ireland." *Economics and Business Letters*, vol. 8, no. 1, Feb. 2019, p. 41. DOI.org (Crossref), https://doi.org/10.17811/ebl.8.1.2019.41-52.

Conroy, Tessa, and Sarah A. Low. "Entrepreneurship, Broadband, and Gender: Evidence from Establishment Births in Rural America." *International Regional Science Review*, vol. 45, no. 1, Jan. 2022, pp. 3–35, doi:10.1177/01600176211018749.

CoSN, Student Home Connectivity Study. 2021. https://emma-assets.s3.amazonaws.com/paqab/37cf06d0de533f59eb780f4ec065d766/Home_Connectivity_Study_Report_5.3.21_FINAL.pdf

Czernich, Nina, et al. "Broadband Infrastructure and Economic Growth." *The Economic Journal*, vol. 121, no. 552, May 2011, pp. 505–32. DOI.org (Crossref), https://doi.org/10.1111/j.1468-0297.2011.02420.x.

Dam, Andrew van. "The Real (Surprisingly Comforting) Reason Rural America Is Doomed to Decline." *Washington Post*, 24 May 2019, https://www.washingtonpost.com/business/2019/05/24/real-surprisingly-comforting-reason-rural-america-is-doomed-decline/.

de Vos, Duco, et al. "Does Broadband Internet Allow Cities to 'Borrow Size'? Evidence from the Swedish Labour Market." *Regional Studies*, vol. 54, no. 9, Sept. 2020, pp. 1175–86.

Ellen, Ingrid Gould, et al. "Pathways to Integration: Examining Changes in the Prevalence of Racially Integrated Neighborhoods." *Cityscape*, vol. 14, no. 3, 2012, pp. 33–53.

Ford, George S., Quantifying the Overstatement in Broadband Availability from the Form 477 Data: An Econometric Approach (July 11, 2019). Available at SSRN: https://ssrn.com/abstract=3608442

Ford, George S., Is Faster Better? Quantifying the Relationship between Broadband Speed and Economic Growth (February 2018). Phoenix Center Policy Bulletin No. 44, February 2018, Available at SSRN: https://ssrn.com/abstract=3138739

Fowler, Christopher S., and Leif Jensen. "Bridging the Gap between Geographic Concept and the Data We Have: The Case of Labor Markets in the USA." Environment and Planning A: Economy and Space, vol. 52, no. 7, Oct. 2020, pp. 1395–414. DOI.org (Crossref), https://doi.org/10.1177/0308518X20906154.

Gadiraju, Vamsi, et al. "Who Gets Broadband When? A Panel Data Analysis of Demographic, Economic and Technological Factors Explaining U.S. Broadband Deployment." *SSRN Electronic Journal*, 2018. DOI.org (Crossref), https://doi.org/10.2139/ssrn.3142479.

Gallardo, Roberto, et al. "Broadband Metrics and Job Productivity: A Look at County-Level Data." The Annals of Regional Science, vol. 66, no. 1, Feb. 2021, pp. 161–84. DOI.org (Crossref), https://doi.org/10.1007/s00168-020-01015-0.

Haltiwanger, John, Ron S. Jarmin, Javier Miranda; Who Creates Jobs? Small versus Large versus Young. *The Review of Economics and Statistics* 2013; 95 (2): 347–361. doi: https://doi.org/10.1162/REST_a_00288

International Telecommunication Union. The Impact of Broadband on the Economy: Research to Date and Policy Issues. 2012. https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf

Ivus, Olena, and Matthew Boland. "The Employment and Wage Impact of Broadband Deployment in Canada." *Canadian Journal of Economics/Revue Canadienne d'économique*, vol. 48, no. 5, Dec. 2015, pp. 1803–30. DOI.org (Crossref), https://doi.org/10.1111/caje.12180.

Love, Hanna, and Teresa Garcia. "Centering Neighborhood Priorities for Economic Inclusion: Early Outcomes from Five Cities." *Brookings*, 6 Apr. 2022, https://www.brookings.edu/essay/centering-neighborhood-priorities-for-economic-inclusion-early-outcomes-from-five-cities.

Kim, Younjun, and Peter F. Orazem. "Broadband Internet and New Firm Location Decisions in Rural Areas." *American Journal of Agricultural Economics*, vol. 99, no. 1, Jan. 2017, pp. 1–18. DOI.org (Crossref), https://doi.org/10.1093/ajae/aaw082.

Kolko, Jed. "Broadband and Local Growth." *Journal of Urban Economics*, vol. 71, no. 1, Jan. 2012, pp. 100–13. DOI.org (Crossref), https://doi.org/10.1016/j.jue.2011.07.004.

Mayer, Walter, et al. "Broadband and Economic Growth: A Reassessment." *Information Technology for Development*, vol. 26, no. 1, 2019, pp. 128–45. Crossref, https://doi.org/10.1080/02681102.2019.1586631.

McCoy, Daire, et al. "The Impact of Broadband and Other Infrastructure on the Location of New Business Establishments." *Journal of Regional Science*, vol. 58, no. 3, June 2018, pp. 509–34. DOI.org (Crossref), https://doi.org/10.1111/jors.12376.

Meijers, E., and Martijn Burger. "Stretching the Concept of 'Borrowed Size.'" Urban Studies (Edinburgh, Scotland), vol. 54, no. 1, Sage Publications, Ltd, 2017, pp. 269–91, https://doi.org/10.1177/0042098015597642.

Modestino Alicia Sasser, Daniel Shoag, and Joshua Ballance. 2019. "Upskilling: Do Employers Demand Greater Skill When Workers are Plentiful?" Forthcoming, Review of Economics and Statistics.

Mossberger, Karen, et al. "A New Measure of Digital Economic Activity and Its Impact on Local Opportunity." Telecommunications Policy, Sept. 2021, p. 102231. DOI.org (Crossref), https://doi.org/10.1016/j.telpol.2021.102231.

Mueller, Keith J., et al. Considerations for Defining Rural Places in Health Policies and Programs. Rural Policy Research Institute, 2020.

Pipa, Tony, and Natalie Geismar. Modernizing Federal Investments for Rural Prosperity. Aspen Institute Community Strategies Group, 2021, p. 24.

Pipa, Anthony F., and Max Bouchet. *Partnership among Cities, States, and the Federal Government: Creating an Office of Subnational Diplomacy at the US Department of State*. p. 14.

Vogels, Emily a. "Some Digital Divides Persist between Rural, Urban and Suburban America." Pew Research Center, 2021, https://www.pewresearch.org/fact-tank/2021/08/19/some-digital-divides-persist-between-rural-urban-and-suburban-america/.

Willingham, Caius Z., and Olugbenga Ajilore. *The Modern Company Town*. Center for American Progress, 2019, https://www.americanprogress.org/article/modern-company-town/. Whitacre, Brian, et al. "Broadband's Contribution to Economic Growth in Rural Areas: Moving towards a Causal Relationship." Telecommunications Policy, vol. 38, no. 11, Dec. 2014, pp. 1011–23. DOI.org (Crossref), https://doi.org/10.1016/j.telpol.2014.05.005.

"Does Rural Broadband Impact Jobs and Income? Evidence from Spatial and First-Differenced Regressions." *The Annals of Regional Science*, vol. 53, no. 3, Nov. 2014, pp. 649–70. DOI.org (Crossref), https://doi.org/10.1007/s00168-014-0637-x.

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