Title: Natural Resource Dependence and Rural American Economic Prosperity from 2000 to 2015

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Research suggests dependence upon natural resource development leads to decreases in per capita income, increases in inequality, and elevated poverty. Natural resource development generally takes two forms, extractive (e.g. oil and gas, mining, timber) and non-extractive (e.g. tourism, recreation, real estate). However, research has rarely examined both in-tandem. Drawing on the concept of dependence (i.e. over-specialization), I test the hypothesis that increasing levels of both forms of development was associated with diminishing returns to economic prosperity— operationalized as per capita income, inequality, and poverty—in rural America over the period of 2000 to 2015. Extractive development exhibited the expected relationship in remote rural counties for all outcomes, while non-extractive development had a generally negative relationship with per capita income, a positive relationship with poverty, and no relationship with inequality. Support for the overall hypothesis was limited due to the returns of non-extractive development being more negative than expected.

Key words: Natural resource dependence; Resource curse; Poverty; Dependency; Uneven development; United States; Tourism; Rural tourism; Outdoor recreation

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1. Introduction

Natural resource dependence—meaning the overspecialization of a local economy in the sector of natural resources—is commonly believed to lead to anemic economic growth, increased poverty, and higher levels of inequality (Freudenburg, 1992; Havranek et al., 2016; Krannich et al., 2014; Perdue and Pavela, 2012). Previous longitudinal studies of the relationship between natural resource development and economic production have found both negative (Douglas and Walker, 2017; James and Aadland, 2011; Papyrakis and Gerlagh, 2004, 2007) and positive (Brooks and Kurtz, 2016; Brown, 2014; Deller and Schreiber, 2012; Havranek et al., 2016) impacts. While negative economic impacts, the so-called ‘resource curse’, have received significant attention internationally (Papyrakis, 2017), tests of these relationships within the United States have been more limited.

Within the United States, extractive natural resource development, with perhaps the exception of the recent fracking boom, has been on the decline since the 1920’s, with extraction’s labor market share dropping by 70% from 1920 to 1990 (Freudenburg and Gramling, 1994), and remaining generally flat since 2000 (Thiede and Slack, 2017). Although extraction now plays a smaller role in the national economy of the United States, non-extractive forms of natural resource development such as tourism, outdoor recreation, real estate, and amenity development have continued to grow (English et al., 2000; Green, 2017; Thiede and Slack, 2017). For illustration, drawing on the data I use in the following analysis of non-metropolitan United States counties from 2000 to 2015, the average share of county employment in extractive natural resource development was 1.53% in 2000 and 1.90% in 2015. Meanwhile, the average share of county employment in non-extractive development was 5.35% in 2000 and 5.81% in 2015. Highlighting that, on average, non-extractive development represented at least three times as much of rural employment as extraction from the beginning to the end of the 15-year period.

Rural America finds itself in an era where sustainable economic development is especially needed. The time period of 2000 to 2015, the focus of this study, was one of dramatic economic change for both urban and rural America. The period began with the 2001 recession following the dot-com bubble and was immediately followed by the ‘jobless recovery’, where even though the overall economy recovered, job growth was historically weak (Aaronson et al., 2004). Shortly after this came the Great Recession from 2007 to 2009 which, up to that point in time, represented the most significant financial contraction since the Great Depression. The recovery from the Great

Recession was slow for rural America, and poverty, labor force non-participation, and underemployment remained elevated through 2015 (Brown and Schafft, 2019).

In-tandem with these broader economic upheavals, rural America experienced continued industrial restructuring, originating in the 1970s, from 2000 to 2015 (Brown and Schafft, 2019; Thiede and Slack, 2017). While extractive and non-extractive development increased their employment share in rural America from 2000 to 2015, agriculture continued consolidating in many regions and manufacturing declined significantly. Given the stability and growth of extractive and non-extractive natural resource development over this otherwise tumultuous period, rigorous theoretical and empirical analyses of their relationship with economic prosperity is needed to inform future economic development in rural America. In this paper, I address this need using spatial fixed effects models to evaluate the county-level relationship between both extractive and non-extractive natural resource development and three metrics of economic prosperity—per capita income, income inequality, and poverty—in the rural counties of the contiguous United States of America from 2000 to 2015.

2. Theoretical Framework

This analysis tests hypotheses suggested by the theoretical framework of dual-dependency articulated by Mueller (2020). This integrative theoretical framework of rural natural resource dependence argues the negative impacts of extractive and non-extractive development on economic prosperity should be similar due to the location of the rural resource-rich community in the global capitalist system. In doing so, it draws upon four main research traditions: (1) the resource curse literature from resource economics, (2) the resource dependence literature from rural sociology, (3) the literature on the impacts of rural tourism, (4) and the literature on spatially uneven development, dependency theory, and world systems.

2.1. The Resource Curse

The resource curse, also known as the Dutch disease, is the unexpected finding that areas with rich natural resources have lower and slower economic growth than neoclassical economic theory would suggest (James and Aadland, 2011; Sachs and Warner, 1995). This body of work

is exclusively focused on natural resource extraction, whether that be in the form of mining, oil and gas, or timber. Although far from agreed upon, numerous researchers have found an inverse relationship between natural resource abundance and economic growth, especially when measured at the national level (Douglas and Walker, 2017; Havranek et al., 2016; Gylfason, 2001; Papyrakis and Gerlagh, 2004, 2007; Sachs and Warner, 1995). The pathways through which the resource curse is expected to impact economic growth include the way investment in natural resource extraction crowds out other sectors (Sachs and Warner, 1995; Tsvetkova and Partridge, 2017), the fact that natural resource regions do not incur the same learning-by-doing effects as other economies (Matsuyama, 1992), the low returns to education in a natural resource-dominant economy (Gylfason, 2001; Sachs and Warner, 1995), the booms and busts of the extractive sectors (Frankel, 2012), and the rent-seeking and poor institutions hallmark of the industry (Frankel, 2012; Havranek et al., 2016; Gylfason, 2001).

2.2. Natural Resource Dependence

While economists have generally relied on the resource curse framework, natural resource dependence is the framework commonly used in sociology. Generally using measures such as poverty and unemployment as their outcome variables, natural resource sociologists have consistently demonstrated the negative impact that dependence on natural resource extraction has on rural communities in the United States (Freudenburg and Wilson, 2002; Humphrey et al., 1993; Krannich et al., 2014; Perdue and Pavela, 2012; Peluso et al., 1994). As noted by the terminology, where the resource curse literature has focused on natural resource abundance, rural sociology has generally focused on dependence. The term dependence intimates a threshold at which an economy becomes overspecialized in the natural resource sector, meaning that small degrees of specialization are not expected to have the same adverse effects as large degrees of specialization.

Many reasons for the negative outcomes of resource dependence have been discussed in the literature (see Freudenburg, 1992; Humphrey et al., 1993; Peluso et al., 1994; Krannich et al., 2014; Mueller, 2020 for a full review). Those relevant to the theoretical framework of this paper include the under-investment in human capital at the individual and community level that occurs in resource dependent communities (Humphrey et al., 1993); the role of power, domination, and natural resource bureaucracy in rural communities wherein decisions regarding how a local

resource base is used, and who profits off that use, are made by those who control the resource base at a detriment to local residents (Humphrey et al., 1993; West, 1994); and theories of internal colonialism (Peluso et al., 1994), dependency (Humphrey et al., 1993), and world systems (Bunker, 2003), which are central to the framework of dual-dependency presented by Mueller (2020) and argue rural resource dependent communities in both the United States and abroad exist at the periphery of a global economic system where core, or urban, communities under-develop the rural, or peripheral, communities to facilitate cheap and easy access to goods and natural resources (Bunker, 2003; Franke, 2007:1969; Humphrey et al., 1993; Wallerstein, 2015:1979).

2.3. Impacts of Rural Tourism

Notably absent from the perspectives of either the resource curse or natural resource dependence is the non-extractive development of natural resources (e.g. tourism, recreation, real estate, retirement, amenity development). However, as stated in the introduction, this form of development represented a larger share, on average, of rural employment from 2000 to 2015. Although it should be clear that these two activities are not mutually exclusive—many regions have active extractive and non-extractive sectors—this form of development does represent a competing, and sometimes alternative, use of the same resource base as extraction. Thus, a deeper theoretical and empirical understanding of the differences and similarities between the two is needed.

At present, research on the impacts of rural tourism in the United States remains contested. One body of largely econometric research suggests that rural tourism and amenity development is a possible vehicle for economic growth in rural America (Deller et al., 2001, 2008), or at least not a net harm (Deller, 2010), while other research has suggested that once spatial clustering or cost of living is controlled for, the impact of rural tourism on economic growth is insignificant (Kim et al., 2005; Hunter et al., 2005). Beyond just the economic impacts, a growing body of research has demonstrated the negative and divisive impacts—such as conflict between long-time residents and new-arrivals, as well as between seasonal and long-term residents—that the change wrought by rural amenity development can have on rural communities (Armstrong and Stedman, 2013; Smith and Krannich, 2000; Sherman, 2018; Ulrich-Schad, 2018; Ulrich-Schad and Qin, 2018).

2.4. Dual Dependency

At present, a theoretical integration of the subnational impacts of extractive and non-extractive development on rural communities and regions in United States does not exist. Therefore, Mueller (2020), integrating the theoretical perspectives of the resource curse, natural resource dependence, and critical perspectives of capitalism, developed and presented the integrative theoretical framework of dual dependency. The framework posits that rural natural resource dependence, meaning the over-specialization of the rural economy in the natural resource sector, is characterized by the formation of a dual dependency, first upon the national and global capitalist economy, and second upon the resource rich local environment. This theoretical framework distinguishes between natural resource dependence—meaning the general state of overspecialization in the natural resource sectors—and dual dependency—which refers to the two dependency relationships which develop as a result of over-specialization in natural resource sectors.

Foundational to the first form of dependency is the argument that capitalism within the United States represents a microcosm of free markets, wherein its federalist orientation resembles some degree of a macro-economy, but the constitutional ban on the regulation of interstate commerce by states greatly amplifies the ability of capital to flow across both political boundaries and distance. Thus, the uneven development brought on by capitalism (Harvey, 2018:1982), neo-liberalism (Harvey, 2006), and the rise of the transnational capitalist class (Sklair, 2002), is allowed to accelerate and rural areas have limited power, or legal authority, to determine their own fate. Within this system, rural areas in the United States are geographically and structurally positioned in a peripheral position relative to their urban, or core, counterparts (Wallerstein, 2015:1979). This placement fosters exploitation of the periphery, by the core, for their labor and natural resources. This results in the extra-local interests of the core fostering underdevelopment in rural areas and directing economic growth in a direction outside of local interest.

This exploitative structure, which exists for all of rural America, is exacerbated in the case of natural resources due to the contradiction between the spatially fixed nature of natural resources and the spatially unbound nature of capital. Capital fixed in space is subject to a falling rate of profit due to improving labor conditions, agglomeration effects, and local crises of overaccumulation (Harvey, 2018:1982; Smith, 1984). Thus, in order to maintain a high rate of profit capital must constantly be in motion. Other industrial sectors keep capital in motion by regularly moving their

investment to a more profitable location as the rate of profit falls (Smith, 1984, 2011). This results in the see-saw patterns of development discussed by Smith (1984), where capital leaves one place due to falling rates of profit and does not return until the region degrades to a certain level of underdevelopment. However, capitalists are unable to move the natural resource base in the same way they might move a factory. This results in a contradiction between the need for capital to flow freely across space, and the static nature of natural resources.

This contradiction creates additional friction for the movement of capital invested in natural resources and results in investments remaining in place longer than they would in other industrial sectors. The strategies required to keep the rate of profit high while remaining fixed in these peripheral regions are what create the negative impacts of natural resource dependence. Ultimately, unlike common perspectives of uneven development—which argue capitalists seek out poor regions for high rates of profit (Harvey, 2006; Smith, 1984)—in the case of natural resources capitalists ‘double-down’ on the location, and therefore pursue especially perverse strategies to keep profits high. Importantly, natural resource interests could address the falling rate of profit by fully disinvesting in the region or pursuing technological or regional substitutes to keep profits high (Bunker, 2003). However, the dual dependency framework posits that in the United States it is far easier for capital to pursue the strategies listed above and foster the negative local outcomes hallmark of natural resource dependence.

Under this framework, high levels of both extractive and non-extractive forms of natural resource development are expected to foster similarly negative outcomes, thus highlighting the importance of considering both types of resource use in tandem. These mutually negative outcomes are due to both forms of development sharing the contradiction between generating profit off of a static resource base and the need for capital to be in motion to keep profits high. This alignment creates a mutual interest between the sectors to keep the rural area generally the same—thus limiting diverse and broad-based local economic growth—while using the resource base in exclusively one manner. Both extractive and non-extractive interests have invested in the rural area, at least in part, due to its current level of development. For example, non-extractive development in the form of rural tourism often requires an area to have a specific character. Thus, diverse and broad-based development can run counter to the preservation of the characteristics which make the location ideal for non-extractive development in the first place. In line with this, both extractive and non-extractive interests will pursue strategies antithetical to diverse and broad-based economic growth

to maintain the local characteristics most favorable to their bottom line (Billings and Blee, 2000; Duncan, 2014; Sherman, 2018; Ulrich-Schad, 2018). While the actual use of the resource base may differ, the incentives to exploit and underdevelop the rural area are aligned between extractive and non-extractive interests.

Importantly, this framework does not argue all levels of development in natural resources will result in negative outcomes. The framework of dual dependency draws a distinction between natural resource specialization—where positive economic outcomes occur due to the benefits of regional economic specialization (Kemeny and Storper, 2015)—and natural resource dependence—where negative economic outcomes occur due to over-specialization and the formation of the dual dependencies discussed above. Where this exact level of over-specialization occurs will likely vary due to unique county-level characteristics such as local history and political economy. However, we should be able to expect, on average, that the negative impacts will begin to accrue as specialization in the sector increases. This means that the relationships between natural resource development and economic indicators are expected to be non-linear.

This non-linear view more appropriately grounds the testing of resource dependence within its conceptual footing. What is meant by this is that if theory says natural resource dependence is when over-specialization and negative outcomes occur, it does not make sense to assess the impacts of resource dependence on economic outcomes; this would be tautological. Rather, we should look across the range of development and see when or if this dependence develops. In the following analysis I examine a core tenet of the framework of dual dependency by testing the global hypothesis:

Hypothesis 1: The negative county-level relationship between high levels of natural resource development and economic prosperity, as measured by per capita income, local income inequality, and poverty, as well as the formation of natural resource dependence, will be similar for both extractive and non-extractive natural resource development.

Although the ultimate cause of natural resource dependence suggested by (Mueller, 2020) is the contradiction between static natural resources and free-flowing capital, there are a number of proximate causal mechanisms expected to stem from this contradiction. Mueller (2020) outlined how the formation of dual dependency is expected to negatively impact three indicators of local

economic prosperity: per capita income, local income inequality, and poverty. While the analysis conducted in this paper only tests the direct relationships between natural resource development and economic outcomes—not testing any of these specific mechanisms—they must be discussed to ensure hypotheses regarding direct relationships are properly justified, formulated, and tested.

Beyond the ultimate cause of the spatial contradiction, seven proximate causal mechanisms were identified as reasons why an area with high levels of natural resource development should expect lower economic prosperity: (1) under-investment in human capital, (2) the crowding out of growth in other sectors, (3) the undiverse and oligopsonistic nature of rural natural resource dependent labor markets, wherein the rural economy, already prone to high levels of market concentration, becomes even more concentrated due to the low level of market diversity in the region, (4) the quality of the jobs in natural resources, which tend to be precarious and low-paying in the non-extractive sector (Green, 2017) and highly subject to the ebbs and flows of global commodity markets in the extractive sector (Freudenburg, 1992), (5) the actions of local elites, wherein the power elite in a community will capture what economic growth does exist, resulting in limited overall economic gain, (6) rural gentrification due to natural amenity migrants, (7) and the gendered nature of employment within the natural resource sectors, where extractive labor is masculinized and non-extractive labor is feminized (Sherman, 2009), resulting in limited employment opportunities for half of the population when a community is dependent on just one form of natural resource development.

These seven mechanisms are expected to relate, or not relate, to each of the three indicators of economic prosperity in different ways. High levels of natural resource development are expected to negatively impact per capita income due to the underinvestment in human capital, the crowding out of other sectors, the undiverse and oligopsonistic labor market, the quality of jobs, and the gendered nature of employment. Heightened inequality in the face of high levels of natural resource development is expected due to the undiverse and oligopsonistic labor market, the action of local elites, and rural gentrification effects. Finally, poverty is expected to increase at high levels of natural resource development due to the underinvestment in human capital, the crowding out of other sectors, the quality of the jobs, the actions of local elites, and the gendered nature of employment. As stated, these mechanisms and their negative effects are not expected to develop at low levels of specialization, but will instead emerge as specialization in the natural resource sectors increases. Drawing from these mechanisms, the outcome-specific hypothesis is stated below:

Hypothesis 2: The county-level share of employment in extractive and non-extractive natural resource industries had a non-linear relationship with per capita income, poverty, and inequality in rural counties in the United States from 2000-2015, with higher levels of specialization in either form of development resulting in diminishing, and ultimately negative, returns.

3. Methods

3.1. Data

The data used for this analysis represents all counties in the contiguous United States for the years of 2000, 2010, and 2015—the longest possible time period of analysis that can be conducted while using unsuppressed industry employment data—and comes from five sources: the Decennial United States Census, the American Community Survey (ACS)¹, the Bureau of Economic Analysis (BEA) Local Area Personal Income and Employment data², Wholedata: Unsuppressed County Business Patterns Data from the Upjohn Institute³, and the USDA Economic Research Service Rural-Urban Continuum Codes (RUCC) (Economic Research Service, 2020). Demographic characteristics came from both the Decennial Census as well as the ACS five-year estimates for 2008-2012 and 2013-2017 and were extracted via the National Historic Geographic Information System hosted by the Integrated Public Use Microdata Series (IPUMS-NHGIS; Manson et al., 2017). BEA data were used to calculate both per capita income to residents and overall employment totals. Wholedata was used to calculate industry-specific employment totals. The RUCC codes, discussed in greater detail in Section 3.5, were used to determine metropolitan, non-metropolitan, metropolitan-adjacent, and non-metropolitan remote status. To ensure consistent geographic units, counties that changed boundaries during the study period were collapsed into larger time-consistent geographic areas in both the dataset and within a county-level shapefile from IPUMS-NHGIS (Manson et al., 2017). A description of all county boundary adjustments is provided in the Online Appendix.

3.2. Dependent Variables

Per capita income is a common outcome variable when analyzing natural resource development and is used as one of the indicators of economic prosperity in this analysis (Havranek et al., 2016; James and Aadland, 2011; Sachs and Warner, 1995). The hypotheses under examination pertain to impacts to local residents, therefore, instead of using pure per capita income generated within a county, I use the 'earnings to residents' values from the BEA (Bureau of Economic Analysis, 2019). All income was adjusted for inflation and put into 2017 dollars using the Consumer Price Index inflation calculator provided by the Bureau of Labor Statistics. Per capita income was created by dividing the BEA reported income to residents by the BEA reported total population for that county for that year and is reported in thousands of dollars. Income inequality was operationalized in this study as the local Gini Index, which is the conventional Gini coefficient scaled by multiplying it by 100. This means that 0 represents perfect equality and 100 represents perfect inequality.⁴ The poverty rate used in this analysis is the portion of persons for whom poverty was determined in a county, using the official United States poverty measure. The poverty rate was created by dividing the number of persons for whom poverty was determined, as reported by NHGIS, by the total county population and then multiplied by 100.

3.3. Independent Variables of Interest

Extractive and non-extractive natural resource related development was operationalized as the share of total employees within a county working in either extractive or non-extractive industries. Employment share is used as an indicator for the relative level of natural resource development within a given county. Unlike outcome variables, these measures allow for workers to move across county boundaries for work. This allowance means these measures provide a measure of the level of development in each sector within a county, regardless of where those employees live.

The industries classified as extractive industries included forestry and logging (NAICS=113); fishing, hunting, and trapping (NAICS=114); support activities for forestry (NAICS=1153); and mining, quarrying, and oil and gas (NAICS=21). Only those industries directly involved in the extraction of resources were included in this definition, meaning no processing, manufacturing, or energy production was included. This decision was made to ensure conceptual clarity in the industries considered. Extractive employment share was calculated by dividing the number of

employees in these extractive industries by the total number of employees within a county and multiplying by 100. Non-extractive natural resource related development included accommodation and food services (NAICS=72); arts, entertainment, and recreation (NAICS=71); real estate and rental and leasing (NAICS=531); and scenic sightseeing and transportation (NAICS=487). Non-extractive employment share was calculated by dividing the number of employees in these non-extractive industries by the total number of employees within a county and multiplying by 100.

3.4. Time-variant Control Variables

Although the use of unit and period fixed effects in this study accounts for unobserved county-level and year-specific heterogeneity, relevant variables that are time-variant within units are not controlled for by this model specification. To ensure precise estimates, I adjust for the four confounding variables suggested by the literature to have a causal relationship with both the independent and dependent variables within rural America: population, portion of the population over 65, portion of the population that is Black, and portion of the population that is Latinx (James and Aadland, 2011; Lobao et al., 2016).

The rationale for this set of confounders is as follows: counties increasing in overall population are likely to have lower levels of extractive development and higher levels of economic prosperity (Johnson and Lichter, 2019); counties with an increasing proportion of elderly residents can confound the relationships of interest in two ways—population aging can lead to decreased economic growth resulting in lower natural resource development and lower aggregate economic prosperity (Thiede et al., 2017), and elderly migration into retirement communities can increase non-extractive development and aggregate economic welfare for at least a portion of the population (Poudyal et al., 2008); counties with increasing Black population proportions have historically faced higher levels of resource extraction and environmental injustice, as well as lower economic prosperity due to the deeply embedded racism in American society (Brulle and Pellow, 2006; Harvey, 2017; Duncan, 2014), and counties with increasing Latinx populations, due to the linked migration networks between natural amenity migrants and Latinx immigrants (Nelson et al., 2009), are more likely to have higher levels of non-extractive development, as well as higher levels of inequality and poverty (Lichter, 2012; Monnat and Chandler, 2017).

Notably absent from this list of controls, but which have been included in other studies on this topic, are the dimensions of education, share of employment in manufacturing, cost of living, and unemployment. These variables have been excluded to avoid over-adjusting the model by conditioning on, or controlling for, downstream variables (Schisterman et al., 2009). What this means is that it is not appropriate, or necessary, to control for variables which theory suggests are post ‘treatment.’ As outlined in Section 2.4, the pathways along which natural resource dependence is expected to influence economic prosperity include the under-investment in human capital (e.g. education), the crowding out of manufacturing, rural gentrification effects (increases in cost of living), and increase in overall unemployment. Therefore, including these variables would only serve to suppress the true impact of natural resource development while also potentially opening up the model to additional omitted confounding variables (Schisterman et al., 2009).

That said, additional attention is warranted related to manufacturing employment share, unemployment, and cost of living. It is possible that the exit of manufacturing in a location could lead to higher unemployment and decreased economic prosperity while raising the employment share of natural resources by default due to the changing denominator in employment share. Further, a secular increase in cost of living could occur and reduce the profitability of natural resource development while changing economic welfare of residents. From this, it could be argued that these three variables represent time-varying confounders. However, within the framework of dual dependency guiding this study, these variables are expected to function as downstream mechanisms. Thus, the role of manufacturing, cost of living, and unemployment could be argued to play a dual role as a possible confounder and as a downstream mechanism, and this distinction would occur at a temporal level of precision unavailable in this data. As such, they are not included in the primary models, but are included—along with education—in a robustness check in Section 4.2.

3.5. Rural Indicator

The focus of this analysis is on rural outcomes. As such, the relationship between natural resource development and outcomes is isolated using an interaction technique described in Section 3.6. Given that rurality is not simply a dichotomous trait, but a continuum, relationships were estimated for two kinds of rural counties, those which are adjacent to metropolitan areas, and those that are not. I divide these counties using the Rural-Urban Continuum Codes (RUCC) produced

by the USDA Economic Research Service, which divide the dichotomous OMB metropolitan/non-metropolitan county classification into nine levels based upon both population size and adjacency (Economic Research Service, 2020). For my purposes I combine all non-metropolitan counties which are adjacent to metropolitan areas into one group (RUCC codes 4, 6, and 8), and all non-metropolitan counties not adjacent to metropolitan areas into another (RUCC codes 5, 7, and 9). I use a fixed definition anchored in the year 2000. For the sake of clarity, I will refer to these as non-metropolitan metro-adjacent and non-metropolitan remote counties.

3.6. Analytic Approach

The use of a spatial econometric model was necessary due to the well-documented spatial clustering of social phenomena across the United States (Brooks, 2019; Lobao et al., 2007; Thiede et al., 2018), as well as the ease at which changes in one county can influence its neighbors due to permeable boundaries (Chi and Zhu, 2019; Leicht and Jenkins, 2007). If an aspatial model were used, the assumptions of independence between units built into that model would be violated, producing incorrect estimates of model parameters (Chi and Zhu, 2019). Due to the complexity of the models and the use of polynomial terms, I use a Spatial Lag of X (SLX) model, as opposed to the more complicated model like the Spatial Durbin Model (SDM), to ensure interpretable results (Gibbons and Overman, 2012; Vega and Elhorst, 2015).

The hypothesized non-linear effects were estimated by including both the first and second order (i.e. linear and quadratic) terms of employment shares in the models. A quadratic non-linear relationship was specified due to theory and prior work suggesting an expected threshold where we see diminishing, and possibly negative, returns from increased specialization of either extractive or non-extractive development (Freudenburg and Wilson, 2002; Stedman et al., 2005).

The desired results for this model were direct effect estimates for the two kinds of rural counties, however, the use of spatial regression means that the exclusion of urban neighbors from the overall model would have been inappropriate. Therefore, I estimated the models using a simple spatial regime approach where a three-level categorical indicator, where the reference group was non-metropolitan remote, was interacted with both extractive and non-extractive employment shares.

Ultimately, a spatial lag of X (SLX) fixed effects model with both unit and period fixed effects was used to control for time-invariant unobserved county level heterogeneity, as well as any secular trends occurring over the study period, while also controlling for spatial dependence and spillovers. The full SLX model is presented in Equation 1, where y_{it} is the outcome variable of interest, $metro$ represents the three-level metropolitan-status indicator, ex_{it} represents the share of local employment in the sector of extractive natural resource development, nx_{it} represents the share of local employment in non-extractive natural resource development, β_1 and β_3 capture the first order term of the within-county direct effect of extractive and non-extract employment share on y_{it} , respectively, β_2 and β_4 capture the second order, quadratic within-county direct effect of extractive and non-extract employment share on y_{it} , respectively, W is a row-standardized first-order queen's contiguity matrix, θ represents the spatially lagged coefficient for its corresponding β , X is a vector of time-variant control variables, u_{it} represents the error in the model which has the components μ_i and c_t representing the unit and period fixed effects, and ε_{it} represents stochastic error. The interpretation of this model is straightforward, as β represents the average direct effect of a change in X_{it} on y_{it} and θ represents the average indirect effect of a change in average neighboring levels of X_{it} on y_{it} (Golgher and Voss, 2016; Vega and Elhorst, 2015). All models were estimated using cluster robust standard errors at the county level due to the repeated observation of counties over the study period (Angrist and Pischke, 2008; Cameron and Miller, 2015).

$$\begin{aligned}
y_{it} = & metro * [\beta_1 ex_{it} + \beta_2 ex_{it}^2] + metro * [\beta_3 nx_{it} + \beta_4 nx_{it}^2] \\
& + W\theta_1 ex_{it} + W\theta_2 ex_{it}^2 + W\theta_3 nx_{it} + W\theta_4 nx_{it}^2 \\
& + \beta_7 X_{it} + W\theta_7 X_{it} + u_{it} \\
u_{it} = & \mu_i + c_t + \varepsilon_{it}
\end{aligned} \tag{1}$$

3.7. Evaluation of Hypotheses

The global hypothesis regarding similar relationships between extractive and non-extractive development and economic prosperity (Hypothesis 1) was assessed by considering all the results for all three outcomes variables in-tandem and is discussed at the end of the results. The outcome-specific hypothesis (Hypothesis 2) was evaluated using marginal estimates of changes in the direct

effects for each outcome across a constrained range of each form of natural resource employment share. Marginal effects and predicted means were estimated while holding all other model variables constant at their means. Thus, by calculating and plotting the non-linear predicted marginal means and marginal effects across a constrained range of each form of development, I assessed the shape and significance of the non-linear relationships between extractive and non-extractive employment shares and per capita income, inequality, and poverty. Given the considerable ambiguity regarding what it means to have a ‘significant non-linear effect’, I do not focus on one omnibus test of effects and instead assess the strength and significance of the direct effects as they vary across the selected range of employment share. All tests of statistical significance were evaluated at $p < .05$. Finally, given the complexity of the models due to the use of both interactions, polynomials, and direct and indirect effects, I only present model results visually in the main body of this manuscript. Full tables are available in the online appendix.

4. Results

Summary statistics for all variables included in the primary models by metropolitan status are presented in Table 1. After county boundary adjustments there were a total of 3073 counties, with 961 classified as non-metropolitan remote, 1,049 classified as non-metropolitan metro-adjacent, and 1,063 counties classified as metropolitan. All counties had 3 observations (i.e. 2000, 2010, and 2015) and there was no missing data.

Table 1 here.

4.1. Model Results

Results for both non-metropolitan adjacent and non-adjacent counties are presented in Figures 1 through 3. Each figure presents plots for both types of non-metropolitan counties’ predicted marginal means and direct effects for a constrained range of extractive and non-extractive employment share. Marginal predictions and effects of employment share were estimated for every integer from 0 to 30 for all relationships. The range of 0 to 30 was selected as it contains the vast majority of the observed values for each form of development. Each figure first presents the marginal predicted means for the relevant combination of employment share variable and outcome variable on the left, and then presents the corresponding marginal direct effects on the right.

4.1.1. *Per Capita Income*

In the case of per capita income to residents, extractive development had the expected relationship for non-metropolitan remote counties only (Figure 1). In non-metropolitan remote counties, increases in extractive employment share corresponded to larger increases in per capita income at lower absolute levels of employment share than at higher levels. At high levels of extractive employment share the effect tapered and ultimately became non-significant. In non-metropolitan metro-adjacent counties the relationship was not statistically distinguishable from zero across its range. Taken together, these models show support for the expected non-linear relationship in non-metropolitan remote counties for extraction, but not in non-metropolitan metro-adjacent counties. Although we see the expected non-linear relationships, the effects do not become negative across the range of predicted values, instead, they simply diminish to zero.

The relationship for non-extractive development also varied between remote and metro-adjacent counties. In non-metropolitan remote counties, low levels of non-extractive employment share were associated with decreases in per capita income. As the absolute level of employment share grew, this negative effect tapered toward zero. In metropolitan-adjacent counties the effect was far more consistent, increases in non-extractive employment share were associated with decreases in per capita income across the range of predicted values. Although there does appear to be a non-linear effect, these relationships do not support the hypothesis as the effect either becomes less negative (non-metro remote), or was a strictly negative relationship (non-metro metro-adjacent).

Taking all of this in tandem—the hypothesis regarding per capita income (Hypothesis 2) is partially supported for extractive development and not supported for non-extractive development. The hypothesized negative returns were present for non-extractive development, but counter to the hypothesis, they were present across all predicted levels of employment share.

Figure 1 here.

4.1.2. *Inequality*

In the model of inequality, we again see the expected relationship for extractive development in non-metropolitan remote areas—wherein there are decreases in inequality at low levels of employment share and the effect tapers at high levels (Figure 2). For non-metropolitan metro-adjacent counties, the relationship is more nuanced. The relationship between extractive

employment share and Gini Index is not significantly distinguishable from zero until a relatively high level of extractive employment share, where we then see a positive relationship with increases in extractive employment share corresponding to increases in inequality. Although there is nuance in these findings, they broadly support the outcome-specific hypothesis. High levels of extractive employment share were associated with negligible to negative returns for the reduction of inequality.

In the case of non-extractive development, the relationship between employment share and Gini Index is not statistically distinguishable from zero at any point along the range of predicted values. Thus, the results do not support the hypothesis. Ultimately, the hypothesis regarding inequality (Hypothesis 2) is supported for extractive development and unsupported in the case of non-extractive development.

Figure 2 here.

4.1.3. Poverty

When examining the results for poverty, we again see the expected relationship for extraction in non-metropolitan remote counties. Increases in extractive employment share corresponded to decreases in poverty at low absolute levels of employment share, and this effect tapered to zero as the absolute level of employment share grew. In non-metropolitan metro-adjacent areas, the relationship between extractive employment share and poverty was not statistically distinguishable from zero at any predicted value. Thus, the hypothesis of non-linearity and diminishing returns is supported for non-metropolitan remote counties, but not metro-adjacent counties. Once again, there were not negative returns at high levels of extractive employment share in remote counties, poverty did not increase, but the effect did diminish to zero.

The results for non-extractive development in some ways mirror those for extraction in the case of poverty. In non-metropolitan remote counties, there was no statistically significant effect across the range of predicted values, leaving the hypothesis unsupported. However, in non-metropolitan metro-adjacent counties, there was a significant effect. At low levels, increases in non-extractive employment share resulted in increased poverty in metro-adjacent areas. As the absolute level of non-extractive employment share increased, this effect tapered. While non-linear, this does not support study hypotheses. Instead of the relationship becoming more severe across the range of

development, the relationship tapered—suggesting a ceiling where further increases in non-extractive development did not continue to correspond with increases in poverty.

Similar to per capita income, the hypothesis regarding poverty (Hypothesis 2) is partially supported for extraction and not supported for non-extractive development. Although there is a significant non-linear effect for non-extractive development in non-metropolitan metro-adjacent counties, the relationship gets better, not worse, as absolute levels of employment share rise.

Figure 3 here.

4.1.4. Evaluation of the Global Hypotheses

To assess support for the global hypothesis proposed by the theoretical framework of dual dependency—that the negative county-level relationship between high levels of natural resource development and economic prosperity, as measured by per capita income, local income inequality, and poverty, as well as the formation of natural resource dependence, will be similar for both extractive and non-extractive natural resource development—requires assessing all three models in-tandem. High levels of specialization in both forms of development were associated with adverse outcomes for per capita income and poverty. However, the similarities end there.

Extractive development demonstrated the expected curve of diminishing returns for all three outcome variables in non-metropolitan remote counties, but in metro-adjacent counties the hypothesis was only supported for inequality. Further, only in the case of inequality were actual negative effects observed, as opposed to simply diminishing returns. This indicated significant support for the outcome-specific hypothesis in remote counties, and partial support in metropolitan-adjacent counties. Non-extractive development did not support the outcome-specific hypothesis in any model. The relationships between non-extractive employment share and per capita income and poverty were far more severe than expected and the relationships did not take the expected shape. Additionally, the lack of a significant relationship between non-extractive development and inequality did not support the global hypothesis of similar outcomes and highlights the way these forms of development relate to economic prosperity in different ways.

Taking these findings together, there is little support for the global hypothesis as-written. For extraction, I find the expected curves, but the relationships do not become negative except in the case of inequality. For non-extractive development I do find negative outcomes to per capita income

and poverty at high levels of development, but they are less severe, not more severe, than they would be at lower levels.

4.2. Robustness Checks

To assess model robustness to variables which could be viewed as either downstream mechanisms or time-varying confounders, models were also estimated with the variables of percent without a high school diploma, percent with at least a college degree, median owner-occupied housing value, unemployment rate, and manufacturing employment share included. The findings were consistent between the primary models and the models with these variables included. Figures and tables for this robustness check are included in the online appendix. Additionally, models were estimated using a row-standardized rooks first order contiguity matrix to ensure estimate stability. The conclusions suggested by models were equivalent with the models using the pre-selected queen's contiguity matrix and results are provided in the online appendix.

5. Discussion

This article presents an investigation into the relationship between both extractive and non-extractive development and rural economic prosperity in the United States from 2000 to 2015. This time period was one of significant economic upheaval and industrial restructuring in rural America. As natural resource development, both extractive and non-extractive, showed considerable stability and growth—as measured by employment share—during this otherwise difficult period, it was important to understand how these forms of development related to rural economic outcomes. While I do find support for the hypothesized non-linear relationships of overspecialization for extraction in non-metropolitan remote counties, the results were not as evident in those rural areas adjacent to metropolitan centers. Further, non-extractive development did not conform to the theoretical hypotheses, with the relationships being less straight-forward than hypothesized under the framework of dual dependency articulated by Mueller (2020).

Non-extractive forms of natural resource development have been suggested as a boon for struggling rural economies (Deller et al., 2008; Deller, 2010). However, these results call into question how effective these forms of development really are for rural America. These results provide support for the qualitative findings of both Sherman (2018) and Ulrich-Schad (2018) showing negative outcomes in the face of increased non-extractive development in rural areas, as

well as the quantitative findings of Deller (2010) showing a limited impact of non-extractive development on poverty reduction. When controlling for relevant county characteristics, the share of employment in non-extractive natural resource industries such as tourism, recreation, accommodation, and real estate, generally decreased per capita income to residents, either had no effect or raised poverty, and had no relationship with inequality. The reasons for this finding remains an empirical question, and may stem from the generally low quality of jobs in the sector. Regardless of reason, when considering these findings, it appears that rural natural amenity development may not only be a poor panacea for rural America, but may be a direction to be seriously avoided.

While the effects found for extractive forms of development were not as severe as those found for non-extractive development, extractive natural resource employment was not strictly positive for rural economic prosperity. These results support the notion that natural resource dependency develops at high levels of extraction where we see diminishing returns to per capita income, inequality, and poverty. However, given the lack of actual negative returns—generally the effects simply tapered toward zero—it appears remote rural counties are better off with some extraction than none. Thus, while these results both support prior literature demonstrating the resource curse within the United States (James and Aadland, 2011; Perdue and Pavela, 2012) and highlight the possible negative socioeconomic outcomes of natural resource dependence, the use of non-linear effects highlights the complexity of these relationships and the positive absolute outcomes extraction can have for remote rural counties.

I find the relationship between natural resource development and economic prosperity varies between non-metropolitan remote and non-metropolitan metro-adjacent counties. The framework of dual dependency argues one of the primary reasons over-specialization develops is the peripheral nature of rural communities. That I only find consistent support for study hypotheses for extraction in the remote rural counties supports this element of the framework. The fact that non-extractive development did not show a clear trend between the two types of rural counties highlights the work left to do before we will fully understand the trajectory of non-extractive resource development in the United States. Although Mueller (2020) may be correct in the prediction that both forms of development ultimately result in negative dependent relationships for rural communities, it does not appear as simple as simply assuming a similar trajectory between extractive and non-extractive natural resource development.

5.1. Limitations

There remain two limitations to acknowledge. The use of the county as the spatial unit, although common and ideal for subnational research (Hooks et al., 2004; Lobao and Kraybill, 2005), poses limitations for this study due to the variability in size and structure of counties throughout the United States. Counties have a large degree of internal heterogeneity. Treating them as a single unit of analysis necessarily removes nuance from findings and assumes impacts will be shared equally. For example, within a county which appears dependent on extraction you may have communities which are, in fact, dominated by the sector and other communities with little or nothing to do with extractive activities. Future work using restricted data will be needed to understand these effects at a community level.

Finally, I elected to group industrial activities into either extractive or non-extractive categories. This approach, while necessary for the analysis at hand, is rather coarse when considering the intricacies of context and the varying trajectories of the component sectors over the time period. It will be crucial for future work to explore each kind of extractive or non-extractive development separately, while also looking at varying contextual and regional effects, if we are to fully understand the benefits and drawbacks of these forms of economic development.

Notes

¹The ACS is a regularly occurring survey from the US Census Bureau which replaced the long-form version of the decennial census after 2000 (United States Census Bureau, 2014). The ACS sampling structure covers every address in the United States in five-year intervals. From these five-year samples the data is generalized into estimates of county level variables over the five-year period (United States Census Bureau, 2014).

²The BEA Local Area Personal Income and Employment data is produced at the county level by the BEA by collating data from multiple federal agencies. The data provides accurate estimates of overall and sector-specific income and employment at the county-level for the United States (Bureau of Economic Analysis, 2019).

³A major limitation faced by sub-national research on rural development in the United States is the extent to which industry-specific employment and income data are suppressed at the county level by the federal government. Publicly available unsuppressed data at the county level is often aggregated at a very large scale (e.g. all types of service industries aggregated into ‘services’), rendering appropriate inference impossible. I overcome this limitation using Wholedata, developed and maintained by the Upjohn Institute. Wholedata utilizes the Isserman-Westervelt algorithm to recover tight bounds and point estimates of suppressed employment statistics at the county level from the Census Bureau’s County Business Patterns Data (Isserman and Westervelt, 2006).

The algorithm accomplishes this by exploiting the hierarchical nature of the data to identify the smallest possible range of suppressed values and then iteratively estimating the point estimates by satisfying constraints imposed by other values. Thus, although these are still estimates whose exact level of precision remains unknown, this results in significantly reduced uncertainty (Isserman and Westervelt, 2006). Although these estimates are of a high precision and represented the best available data the time of the study, future work should replicate this analysis using restricted data to validate these findings and the Wholedata product. Further, many jobs in both extractive and non-extractive natural resource development are seasonal. The use of annual estimates obviously misses this seasonality. Data which can speak to this seasonality will be essential for future work in this area.

⁴Population income for this study was only publicly available in categories, or ‘bins’. For the study period in question, household income was reported in 16 income bins with a maximum of \$200,000 or greater. I calculate the local Gini coefficients from binned income using the Robust Pareto Midpoint Estimator developed by Von Hippel et al. (2016).

References

- Aaronson, D., Rissman, E. R., Sullivan, D. G., et al. (2004). Assessing the jobless recovery. *Economic Perspectives*-Federal Reserve Bank of Chicago, 28:2–20
- Angrist, J. D. and Pischke, J.-S. (2008). *Mostly harmless econometrics: An empiricist’s companion*. Princeton, NJ: Princeton University Press.
- Armstrong, A. and Stedman, R. C. (2013). Culture clash and second home ownership in the us northern forest. *Rural Sociology*, 78(3):318–345.

- Billings, D. B. and Blee, K. M. (2000). *The road to poverty: The making of wealth and hardship in Appalachia*. Cambridge University Press.
- Brooks, M. M. (2019). The advantages of comparative LISA techniques in spatial inequality research: Evidence from poverty change in the United States. *Spatial Demography*, 7(2-3):167–193.
- Brooks, S. M. and Kurtz, M. J. (2016). Oil and democracy: Endogenous natural resources and the political “resource curse”. *International Organization*, 70(2):279–311.
- Brown, D. L. and Schafft, K. A. (2019). *Rural people and communities in the 21st century: Resilience and transformation: Second Edition*. Medford, MA: Polity.
- Brown, J. P. (2014). Production of natural gas from shale in local economies: a resource blessing or curse? *Economic Review-Federal Reserve Bank of Kansas City*, Q1:5–33.
- Brulle, R. J. and Pellow, D. N. (2006). Environmental justice: human health and environmental inequalities. *Annual Review of Public Health*, 27:103–124.
- Bunker, S. G. (2003). Matter, space, energy, and political economy: The Amazon in the world-system. *Journal of World-Systems Research*, 9(2):219–258.
- Bureau of Economic Analysis (2019). Local area personal income methodology. Technical report.
- Cameron, A. C. and Miller, D. L. (2015). A practitioner’s guide to cluster-robust inference. *Journal of Human Resources*, 50(2):317–372.
- Chi, G. and Zhu, J. (2019). *Spatial regression models for the social sciences*. Thousand Oaks, CA: Sage.
- Deller, S. (2010). Rural poverty, tourism and spatial heterogeneity. *Annals of Tourism Research*, 37(1):180–205.
- Deller, S. C., Lledo, V., and Marcouiller, D. W. (2008). Modeling regional economic growth with a focus on amenities. *Review of Urban & Regional Development Studies: Journal of the Applied Regional Science Conference*, 20(1):1–21.
- Deller, S. C. and Schreiber, A. (2012). Mining and community economic growth. *Review of Regional Studies*, 42(2).

- Deller, S. C., Tsai, T.-H., Marcouiller, D. W., and English, D. B. (2001). The role of amenities and quality of life in rural economic growth. *American Journal of Agricultural Economics*, 83(2):352–365.
- Douglas, S. and Walker, A. (2017). Coal mining and the resource curse in the eastern United States. *Journal of Regional Science*, 57(4):568–590.
- Duncan, C. M. (2014). *Worlds apart: Poverty and politics in rural America, Second Edition*. New Haven: Yale University Press.
- Economic Research Service (2020). Documentation of rural urban continuum codes. Technical report, United States Department of Agriculture.
- English, D. B., Marcouiller, D. W., and Cordell, H. K. (2000). Tourism dependence in rural America: Estimates and effects. *Society & Natural Resources*, 13(3):185–202.
- Franke, A. G. (2007:1969). The development of underdevelopment. In Roberts, J. T. and Hite, A. B., editors, *The Globalization and Development Reader: Perspectives on Development and Global Change*, pages 76–85. Malden, MA: Basil Blackwell.
- Frankel, J. A. (2012). The natural resource curse: A survey of diagnoses and some prescriptions. *NBER Working Paper No. 15836*.
- Freudenburg, W. R. (1992). Addictive economies: Extractive industries and vulnerable localities in a changing world economy. *Rural Sociology*, 57(3):305–332.
- Freudenburg, W. R. and Gramling, R. (1994). Natural resources and rural poverty: A closer look. *Society & Natural Resources*, 7(1):5–22.
- Freudenburg, W. R. and Wilson, L. J. (2002). Mining the data: Analyzing the economic implications of mining for nonmetropolitan regions. *Sociological Inquiry*, 72(4):549–575.
- Gibbons, S. and Overman, H. G. (2012). Mostly pointless spatial econometrics? *Journal of Regional Science*, 52(2):172–191.
- Golgher, A. B. and Voss, P. R. (2016). How to interpret the coefficients of spatial models: Spillovers, direct and indirect effects. *Spatial Demography*, 4(3):175–205.

- Green, G. (2017). The opportunities and limits of economic growth. In Tickamyer, A. R., Sherman, J., and Warlick, J., editors, *Rural Poverty in the United States*, pages 416–438. Columbia University Press: New York, NY.
- Gylfason, T. (2001). Natural resources, education, and economic development. *European Economic Review*, 45(4-6):847–859.
- Harvey, D. (2006). *Spaces of Global Capitalism*. New York, NY: Verso.
- Harvey, D. (2018:1982). *The Limits to Capital*. New York, NY: Verso books.
- Harvey, M. H. (2017). Racial inequalities and poverty in rural America. In Tickamyer, A. R., Sherman, J., and Warlick, J., editors, *Rural Poverty in the United States*, pages 141–167. Columbia University Press: New York, NY.
- Havranek, T., Horvath, R., and Zeynalov, A. (2016). Natural resources and economic growth: A meta-analysis. *World Development*, 88:134–151.
- Hooks, G., Mosher, C., Rotolo, T., and Lobao, L. (2004). The prison industry: Carceral expansion and employment in US counties, 1969–1994. *Social Science Quarterly*, 85(1):37–57.
- Humphrey, C. R., Berardi, G., Carroll, M. S., Fairfax, S., Fortmann, L., Geisler, C., Johnson, T. G., Kusel, J., Lee, R. G., Macinko, S., et al. (1993). Theories in the study of natural resource-dependent communities and persistent rural poverty in the United States. In Summers, G., editor, *Persistent Poverty in Rural America*, pages 136–172. Boulder, CO: Westview Press.
- Hunter, L. M., Boardman, J. D., and Onge, J. M. S. (2005). The association between natural amenities, rural population growth, and long-term residents' economic well-being. *Rural Sociology*, 70(4):452–469.
- Isserman, A. M. and Westervelt, J. (2006). 1.5 million missing numbers: Overcoming employment suppression in county business patterns data. *International Regional Science Review*, 29(3):311–335.
- James, A. and Aadland, D. (2011). The curse of natural resources: An empirical investigation of us counties. *Resource and Energy Economics*, 33(2):440–453.

- Johnson, K. M. and Lichter, D. T. (2019). Rural depopulation: Growth and decline processes over the past century. *Rural Sociology*, 84(1):3–27.
- Kemeny, T. and Storper, M. (2015). Is specialization good for regional economic development? *Regional Studies*, 49(6):1003–1018.
- Kim, K.-k., Marcouiller, D. W., and Deller, S. C. (2005). Natural amenities and rural development: understanding spatial and distributional attributes. *Growth and Change*, 36(2):273–297.
- Krannich, R. S., Gentry, B., Luloff, A., and Robertson, P. (2014). Resource dependency in rural america: Continuities and change. In Bailey, C., Jensen, L., and Ransom, E., editors, *Rural America in a Globalizing World*, pages 208–225. West Virginia University Press.
- Leicht, K. T. and Jenkins, J. C. (2007). New and unexplored opportunities: Developing a spatial perspective for political sociology. In Lobao, L. M., Hooks, G., and Tickamyer, A. R., editors, *The Sociology of Spatial Inequality*, pages 63–84. Albany, NY: State University of New York Press.
- Lichter, D. T. (2012). Immigration and the new racial diversity in rural America. *Rural Sociology*, 77(1):3–35.
- Lobao, L. and Kraybill, D. S. (2005). The emerging roles of county governments in metropolitan and nonmetropolitan areas: Findings from a national survey. *Economic Development Quarterly*, 19(3):245–259.
- Lobao, L., Zhou, M., Partridge, M., and Betz, M. (2016). Poverty, place, and coal employment across Appalachia and the United States in a new economic era. *Rural Sociology*, 81(3):343–386.
- Lobao, L. M., Hooks, G., and Tickamyer, A. R. (2007). *The sociology of spatial inequality*. Albany, NY: SUNY Press.
- Manson, S., Schroeder, J., Van Riper, D., and Ruggles, S. (2017). IPUMS national historical geographic information system: Version 12.0.
- Matsuyama, K. (1992). Agricultural productivity, comparative advantage, and economic growth. *Journal of Economic Theory*, 58(2):317–334.

- Monnat, S. M. and Chandler, R. F. (2017). Immigration trends and immigrant poverty in rural America. In Tickamyer, A. R., Sherman, J., and Warlick, J., editors, *Rural Poverty in the United States*, pages 167–201. New York, NY: Columbia University Press.
- Mueller, J. T. (2020). The Effect of Natural Resource Dependence on Economic Prosperity. PhD Dissertation, Department of Agricultural Economics, Sociology, and Education, The Pennsylvania State University, University Park, PA.
- Nelson, P. B., Lee, A. W., and Nelson, L. (2009). Linking baby boomer and hispanic migration streams into rural america—a multi-scaled approach. *Population, Space and Place*, 15(3):277–293.
- Papyrakis, E. (2017). The resource curse-what have we learned from two decades of intensive research: Introduction to the special issue. *The Journal of Development Studies*, 53(2):175–185.
- Papyrakis, E. and Gerlagh, R. (2004). The resource curse hypothesis and its transmission channels. *Journal of Comparative Economics*, 32(1):181–193.
- Papyrakis, E. and Gerlagh, R. (2007). Resource abundance and economic growth in the united states. *European Economic Review*, 51(4):1011–1039.
- Peluso, N. L., Humphrey, C. R., and Fortmann, L. P. (1994). The rock, the beach, and the tidal pool: People and poverty in natural resource-dependent areas. *Society & Natural Resources*, 7(1):23–38.
- Perdue, R. T. and Pavela, G. (2012). Addictive economies and coal dependency: methods of extraction and socioeconomic outcomes in West Virginia, 1997-2009. *Organization & Environment*, 25(4):368–384.
- Poudyal, N. C., Hodges, D. G., and Cordell, H. K. (2008). The role of natural resource amenities in attracting retirees: Implications for economic growth policy. *Ecological Economics*, 68(1-2):240–248.
- Sachs, J. D. and Warner, A. M. (1995). Natural resource abundance and economic growth. Technical report, National Bureau of Economic Research.
- Schisterman, E. F., Cole, S. R., and Platt, R. W. (2009). Overadjustment bias and unnecessary adjustment in epidemiologic studies. *Epidemiology*, 20(4):488–495.

- Sherman, J. (2009). *Those who work, those who don't: Poverty, morality, and family in rural America*. Minneapolis, MN: University of Minnesota Press.
- Sherman, J. (2018). Not allowed to inherit my kingdom: Amenity development and social inequality in the rural West. *Rural Sociology*, 83(1):174–207.
- Sklair, L. (2002). Democracy and the transnational capitalist class. *The Annals of the American Academy of Political and Social Science*, 581(1):144–157.
- Smith, M. D. and Krannich, R. S. (2000). “Culture clash” revisited: Newcomer and longer-term residents’ attitudes toward land use, development, and environmental issues in rural communities in the Rocky Mountain West. *Rural Sociology*, 65(3):396–421.
- Smith, N. (1984). *Uneven development: Nature, capital, and the production of space*. New York, NY: Basil Blackwell.
- Smith, N. (2011). Uneven development redux. *New Political Economy*, 16(2):261–265.
- Stedman, R. C., Parkins, J. R., and Beckley, T. M. (2005). Forest dependence and community well-being in rural Canada: Variation by forest sector and region. *Canadian Journal of Forest Research*, 35(1):215–220.
- Thiede, B., Kim, H., and Valasik, M. (2018). The spatial concentration of America’s rural poor population: A postrecession update. *Rural Sociology*, 83(1):109–144.
- Thiede, B. and Slack, T. (2017). The old versus the new economies and their impacts. In Tickamyer, A. R., Sherman, J., and Warlick, J., editors, *Rural Poverty in the United States*, pages 231–256. New York, NY: Columbia University Press.
- Thiede, B. C., Brown, D. L., Sanders, S. R., Glasgow, N., and Kulcsar, L. J. (2017). A demographic deficit? Local population aging and access to services in rural America, 1990–2010. *Rural sociology*, 82(1):44–74.
- Tsvetkova, A., & Partridge, M. (2017). The shale revolution and entrepreneurship: an assessment of the relationship between energy sector expansion and small business entrepreneurship in US counties. *Energy*, 141, 423–434.

- Ulrich-Schad, J. D. (2018). “We didn’t move here to move to Aspen”: Community making and community development in an emerging rural amenity destination. *Journal of Rural and Community Development*, 13(4).
- Ulrich-Schad, J. D. and Qin, H. (2018). Culture clash? predictors of views on amenity-led development and community involvement in rural recreation counties. *Rural Sociology*, 83(1):81–108.
- United States Census Bureau (2014). American community survey design and methodology. Technical report.
- Vega, S. H. and Elhorst, J. P. (2015). The SLX model. *Journal of Regional Science*, 55(3):339–363.
- Von Hippel, P. T., Scarpino, S. V., and Holas, I. (2016). Robust estimation of inequality from binned incomes. *Sociological Methodology*, 46(1):212–251.
- Wallerstein, I. (2015:1979). The rise and future demise of the world capitalist system: Concepts for comparative analysis. In Roberts, J. T., Hite, A. B., and Chorev, N., editors, *The Globalization and Development Reader: Perspectives on Development and Global Change, Second Edition*, pages 126–146. Hoboken, NJ: John Wiley & Sons, Ltd.
- West, P. C. (1994). Natural resources and the persistence of rural poverty in America: A Weberian perspective on the role of power, domination, and natural resource bureaucracy. *Society & Natural Resources*, 7(5):415–427.

6. Tables

Table 1: Summary statistics for model variables by metropolitan and non-metropolitan across all years

	Mean	SD	Min	Max
Non-Metropolitan Non-Adjacent: N/county-years = 961/2883				
Per Capita Income to Residents (thousands)	21.47	8.29	0.99	115.68
Local Gini Coefficient	43.32	3.78	30.75	80.67
Poverty Rate	15.85	6.93	0.00	56.69
Extractive Employment Share	1.80	3.35	0.00	55.33
Non-extractive Employment Share	5.46	4.40	0.00	54.97
Population (thousands)	17.17	17.71	0.07	179.90
Percent Over 65	18.16	4.68	3.00	39.16
Percent White	86.93	16.05	2.92	100.00
Percent Black	6.07	13.81	0.00	86.49
Percent Hispanic	7.57	13.66	0.00	95.68
Non-Metropolitan Adjacent: N/county-years = 1049/3147				
Per Capita Income to Residents (thousands)	20.21	5.33	7.70	84.36
Local Gini Coefficient	43.05	3.50	32.91	70.33
Poverty Rate	16.16	6.03	2.91	50.45
Extractive Employment Share	1.60	2.88	0.00	36.47
Non-extractive Employment Share	5.79	4.03	0.00	72.27
Population (thousands)	31.59	27.42	0.69	215.19
Percent Over 65	16.90	3.87	5.21	54.18
Percent White	83.93	16.80	9.34	99.52
Percent Black	9.50	15.48	0.00	86.92
Percent Hispanic	7.64	13.64	0.00	99.18
Metropolitan: N/county-years = 1063/3189				
Per Capita Income to Residents (thousands)	26.98	8.67	10.70	95.34
Local Gini Coefficient	41.95	3.21	32.44	56.96
Poverty Rate	12.90	5.21	2.11	38.59
Extractive Employment Share	1.09	1.84	0.00	44.45
Non-extractive Employment Share	7.00	4.22	0.00	90.13
Population (thousands)	237.54	507.87	1.54	10123.25
Percent Over 65	13.94	3.64	1.80	38.30
Percent White	81.28	15.26	17.10	99.43
Percent Black	10.89	13.69	0.00	81.48
Percent Hispanic	8.47	12.11	0.02	95.74

7. Figures

Figure 1: Predicted means and marginal direct effects for per capita income to residents across constrained ranged of natural resource employment share. Other variables held constant at means. Vertical bars represent 95% CI

Extractive Development and Gini Index

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Gini Index

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure 2: Predicted means and marginal direct effects for Gini Index across constrained ranged of natural resource employment share. Other variables held constant at means. Vertical bars represent 95% CI

Extractive Development and Poverty

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Poverty

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure 3: Predicted means and marginal direct effects for poverty rate across constrained ranged of natural resource employment share. Other variables held constant at means. Vertical bars represent 95% CI

Online Appendix

County Boundary Adjustments

Table A1: Counties Collapsed to Ensure Time-Consistent Geographic Units

State	Counties
Colorado	Broomfield (8014) + Adams (8001) + Boulder (8013) + Weld (8123) + Jefferson (8059)
Connecticut	Barnstable (25001) + Dukes (25007) + Nantucket (25019)
Florida	Miami-Dade (12086) + Dade (12025)
South Dakota	Oglala (46102) + Shannon (46113)
Virginia	Albermarle (51003) + Charlottesville City (51540) Alleghany (51005) + Covington City (51580) Augusta (51015) + Staunton City (51790) + Waynesboro City (51820) Bedford (51019) + Bedford City (51515) Campbell (51031) + Lynchburg City (51680) Carrol (51035) + Galax City (51640) Dinwiddie (51053) + Colonial Heights City (51570) + Petersburg (51730) Fairfax (51059) + Fairfax City (51600) + Falls Church (51610) Frederick (51069) + Winchester City (51840) Greensville (51081) + Emporia City (51595) Henry (51089) + Martinsville City (51690) James City (51095) + Williamsburg City (51830) Montgomery (51121) + Radford City (51750) Pittsylvania (51143) + Danville City (51590) Prince George (51149) + Hopewell City (51670) Prince William (51153) + Manassas City (51683) + Manassas Park City (51685) Roanoke (51161) + Salem (51775) Rockbridge (51163) + Buena Vista City (51530) + Lexington City (51678) Rockingham (51165) + Harrisonburg (51660) Southampton (51175) + Franklin City (51620) Spotsylvania (51177) + Fredericksburg City (51630) Washington (51191) + Bristol City (51520) Wise (51195) + Norton City (51720) York (51199) + Poquoson (51735)
Washington	San Juan (53055) + Skagit (53057)

Primary Model Results

Table A2: Relationship between Natural Resource Development and Non-metropolitan Economic Prosperity from 2000-2015

	Per Capita Income		Gini Index		Poverty Rate	
Direct Effects	Coef.	SE	Coef.	SE	Coef.	SE
Non-Metropolitan Remote						
Extractive Employment Share	0.4520***	0.1222	-0.2467***	0.0656	-0.2106*	0.0857
Extractive Employment Squared	-0.0063**	0.0023	0.0050***	0.0014	0.0023	0.0019
Non-extractive Employment Share	-0.3293*	0.1494	0.0161	0.1162	-0.0959	0.1164
Non-extractive Employment Squared	0.0060	0.0032	-0.0035	0.0021	0.0016	0.0021
Non-Metropolitan Metro-Adjacent						
Extractive Employment Share	-0.3500*	0.1704	0.1855	0.0999	0.1159	0.1415
Extractive Employment Squared	0.0085	0.0061	-0.0000	0.0029	-0.0030	0.0061
Non-extractive Employment Share	0.1818	0.1627	-0.0308	0.1220	0.2685*	0.1270
Non-extractive Employment Squared	-0.0066	0.0036	0.0032	0.0021	-0.0038	0.0023
Metropolitan						
Extractive Employment Share	-0.3744*	0.1651	0.1469	0.0864	0.2094	0.1161
Extractive Employment Squared	0.0084**	0.0032	-0.0058**	0.0021	-0.0056*	0.0028
Non-extractive Employment Share	0.0642	0.1611	0.0027	0.1200	0.2066	0.1256
Non-extractive Employment Squared	-0.0044	0.0033	0.0055*	0.0022	-0.0010	0.0022
Population (thousands)	-0.0037**	0.0014	0.0021***	0.0006	0.0002	0.0007
Percent Over 65	-0.1510*	0.0764	-0.0185	0.0349	-0.0644	0.0408
Percent Black	-0.2027***	0.0407	0.0770**	0.0278	0.1043**	0.0395
Percent Hispanic	-0.0628	0.0553	-0.0344	0.0309	0.0760*	0.0345
Year [2000 ref]						
2010	2.2625***	0.1865	0.0573	0.0968	1.6739***	0.1213
2015	5.9541***	0.3471	0.3526*	0.1741	1.0094***	0.2139
Indirect Effects						
Extractive Employment Share	0.7427***	0.1967	-0.1130	0.0794	-0.6123***	0.1229
Extractive Employment Squared	-0.0284	0.0191	0.0034	0.0055	0.0178	0.0112
Non-extractive Employment Share	-1.6272***	0.2168	-0.0459	0.0958	0.5336***	0.1067
Non-extractive Employment Squared	0.0577***	0.0096	0.0013	0.0046	-0.0179***	0.0046
Population (thousands)	-0.0083**	0.0031	0.0017	0.0014	0.0026	0.0016
Percent Over 65	-0.7295***	0.0980	0.0401	0.0502	0.2622***	0.0551
Percent Black	0.0322	0.0731	0.1499***	0.0398	0.0929	0.0510
Percent Hispanic	0.2037*	0.0806	0.0231	0.0407	-0.1052*	0.0441
Constant	43.6971***	1.7502	40.4603***	0.8393	7.0663***	1.0437

Coef.= unstandardized regression coefficient; SE= cluster robust standard error; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: SLX unit and period fixed effects model using row standardized queens first order contiguity spatial weights matrix.

Robustness Check Results

Table A3a: Robustness Test of Relationship between Natural Resource Development and Rural Prosperity from 2000-2015 including Downstream Variables

	Per Capita Income		Gini Index		Poverty Rate	
Direct Effects	Coef.	SE	Coef.	SE	Coef.	SE
Non-Metropolitan Remote						
Extractive Employment Share	0.3921***	0.1116	-0.2396***	0.0648	-0.1767*	0.0764
Extractive Employment Squared	-0.0054*	0.0022	0.0049***	0.0015	0.0017	0.0018
Non-extractive Employment Share	-0.3109*	0.1408	0.0403	0.1168	-0.0710	0.1097
Non-extractive Employment Squared	0.0057	0.0030	-0.0040	0.0021	0.0010	0.0020
Non-Metropolitan Metro-Adjacent						
Extractive Employment Share	-0.3127*	0.1560	0.1793	0.0982	0.0758	0.1219
Extractive Employment Squared	0.0080	0.0056	0.0007	0.0028	-0.0011	0.0051
Non-extractive Employment Share	0.2561	0.1514	-0.0638	0.1233	0.1711	0.1206
Non-extractive Employment Squared	-0.0076*	0.0032	0.0039	0.0022	-0.0020	0.0021
Metropolitan						
Extractive Employment Share	-0.3541*	0.1486	0.1584	0.0833	0.2127*	0.1036
Extractive Employment Squared	0.0063*	0.0030	-0.0061**	0.0021	-0.0049	0.0027
Non-extractive Employment Share	0.1470	0.1484	-0.0894	0.1215	0.0636	0.1147
Non-extractive Employment Squared	-0.0053	0.0030	0.0065**	0.0022	0.0004	0.0020
Population (thousands)	-0.0057***	0.0014	0.0012*	0.0005	0.0001	0.0006
Percent Over 65	-0.1346	0.0735	-0.0377	0.0347	-0.1045**	0.0378
Percent Black	-0.1815***	0.0333	0.0582*	0.0273	0.0503	0.0371
Percent Hispanic	-0.0433	0.0528	-0.0619*	0.0314	-0.0106	0.0351
Percent without High School Diploma	0.0071	0.0476	0.1292***	0.0289	0.2248***	0.0331
Percent with at Least a College Degree	0.1115*	0.0438	0.0580*	0.0225	-0.0959***	0.0252
Manufacturing Employment Share	0.0639**	0.0199	-0.0227*	0.0094	-0.0699***	0.0111
Unemployment Rate	-0.0894*	0.0360	0.0400	0.0222	0.1864***	0.0273
Median Housing Value (thousands)	0.0000***	0.0000	-0.0000	0.0000	-0.0000**	0.0000
Year [2000 ref]						
2010	3.7183***	0.3071	0.1215	0.1896	1.6377***	0.2120
2015	5.3597***	0.4969	0.5997*	0.2936	2.4602***	0.3249

Coef.= unstandardized regression coefficient; SE= cluster robust standard error; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table continued on next page

Table A3b: Robustness Test of Relationship between Natural Resource Development and Rural Prosperity from 2000-2015 including Downstream Variables (Continued)

Indirect Effects	Per Capita Income		Gini Index		Poverty Rate	
	Coef.	SE	Coef.	SE	Coef.	SE
Extractive Employment Share	0.5617**	0.1831	-0.0497	0.0800	-0.4456***	0.1084
Extractive Employment Squared	-0.0229	0.0179	0.0025	0.0055	0.0150	0.0101
Non-extractive Employment Share	-1.0409***	0.1930	-0.0720	0.0986	0.1758	0.0974
Non-extractive Employment Squared	0.0351***	0.0080	0.0011	0.0047	-0.0054	0.0041
Population (thousands)	-0.0108***	0.0029	0.0001	0.0013	0.0025	0.0015
Percent Over 65	-0.5979***	0.0927	0.0127	0.0495	0.1288**	0.0491
Percent Black	0.0470	0.0586	0.1088**	0.0391	0.0295	0.0447
Percent Hispanic	0.1591*	0.0777	0.0103	0.0406	-0.0983*	0.0442
Percent without High School Diploma	-0.0467	0.0649	0.0768*	0.0350	0.1681***	0.0409
Percent with at least a College Degree	0.0729	0.0710	0.1052**	0.0380	0.1590***	0.0396
Manufacturing Employment Share	0.2482***	0.0277	-0.0366*	0.0183	-0.2056***	0.0208
Unemployment Rate	-0.4935***	0.0476	0.0029	0.0291	0.1138***	0.0327
Median Housing Value	0.0000	0.0000	-0.0000	0.0000	-0.0000***	0.0000
Constant	34.3179***	1.7115	38.6764***	1.1407	11.3453***	1.1251

Coef.= unstandardized regression coefficient; SE = cluster robust standard error; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: SLX unit and period fixed effects model using row standardized queens first order contiguity spatial weights matrix

Extractive Development and Per Capita Income

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Per Capita Income

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure A1: Predicted means and marginal direct effects for per capita income to residents across constrained ranged of natural resource employment share. Downstream variables included. Other variables held constant at means. Vertical bars represent 95% CI

Extractive Development and Gini Index

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Gini Index

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure A2: Predicted means and marginal direct effects for Gini Index across constrained ranged of natural resource employment share. Downstream variables included. Other variables held constant at means. Vertical bars represent 95% CI

Extractive Development and Poverty

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Poverty

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure A3: Predicted means and marginal direct effects for Gini Index across constrained ranged of natural resource employment share. Downstream variables included. Other variables held constant at means. Vertical bars represent 95% CI

Table A4: Models Using Alternative Spatial Weights Matrix: Row-standardized Rooks First Order Contiguity Matrix

	Per Capita Income		Gini Index		Poverty Rate	
Direct Effects	Coef.	SE	Coef.	SE	Coef.	SE
Non-Metropolitan Remote						
Extractive Employment Share	0.4553***	0.1235	-0.2468***	0.0655	-0.2089*	0.0858
Extractive Employment Squared	-0.0064**	0.0024	0.0050***	0.0014	0.0022	0.0019
Non-extractive Employment Share	-0.3379*	0.1497	0.0149	0.1163	-0.0924	0.1168
Non-extractive Employment Squared	0.0061	0.0032	-0.0034	0.0021	0.0015	0.0021
Non-Metropolitan Metro-Adjacent						
Extractive Employment Share	-0.3419*	0.1709	0.1850	0.0995	0.1085	0.1392
Extractive Employment Squared	0.0082	0.0061	-0.0000	0.0028	-0.0025	0.0059
Non-extractive Employment Share	0.1824	0.1632	-0.0298	0.1221	0.2685*	0.1275
Non-extractive Employment Squared	-0.0067	0.0037	0.0032	0.0021	-0.0037	0.0023
Metropolitan						
Extractive Employment Share	-0.3752*	0.1658	0.1468	0.0865	0.2095	0.1159
Extractive Employment Squared	0.0084**	0.0032	-0.0058**	0.0020	-0.0055*	0.0028
Non-extractive Employment Share	0.0731	0.1615	0.0042	0.1202	0.2039	0.1259
Non-extractive Employment Squared	-0.0045	0.0033	0.0055*	0.0022	-0.0009	0.0022
Population (thousands)	-0.0035*	0.0014	0.0020***	0.0006	0.0001	0.0007
Percent Over 65	-0.1566*	0.0765	-0.0212	0.0349	-0.0618	0.0409
Percent Black	-0.2028***	0.0406	0.0780**	0.0279	0.1052**	0.0397
Percent Hispanic	-0.0617	0.0556	-0.0329	0.0310	0.0769*	0.0341
Year [2000 ref]						
2010	2.2425***	0.1878	0.0667	0.0960	1.6796***	0.1216
2015	5.9124***	0.3499	0.3586*	0.1726	1.0216***	0.2144
Indirect Effects						
Extractive Employment Share	0.7397***	0.1859	-0.1116	0.0790	-0.5929***	0.1186
Extractive Employment Squared	-0.0286	0.0176	0.0037	0.0053	0.0150	0.0104
Non-extractive Employment Share	-1.5953***	0.2149	-0.0621	0.0951	0.5204***	0.1042
Non-extractive Employment Squared	0.0569***	0.0095	0.0016	0.0046	-0.0175***	0.0045
Population (thousands)	-0.0091**	0.0031	0.0021	0.0014	0.0028	0.0016
Percent Over 65	-0.7135***	0.0987	0.0470	0.0494	0.2568***	0.0557
Percent Black	0.0335	0.0738	0.1412***	0.0395	0.0891	0.0510
Percent Hispanic	0.2055**	0.0796	0.0165	0.0406	-0.1061*	0.0435
Constant	43.4483***	1.7701	40.5478***	0.8336	7.1483***	1.0499

Coef.= unstandardized regression coefficient; SE= standard error; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

SLX unit and period fixed effects model using row standardized rooks first order contiguity spatial weights matrix

Extractive Development and Per Capita Income

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Per Capita Income

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure A4: Predicted means and marginal direct effects for per capita income to residents across constrained ranged of natural resource employment share. Alternative spatial weights matrix (Rook). Other variables held constant at means. Vertical bars represent 95% CI

Extractive Development and Gini Index

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Gini Index

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure A5: Predicted means and marginal direct effects for Gini Index across constrained ranged of natural resource employment share. Alternative spatial weights matrix (Rook). Other variables held constant at means. Vertical bars represent 95% CI

Extractive Development and Poverty

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Non-Extractive Development and Poverty

Non-Metropolitan Remote

Non-Metropolitan Metro-Adjacent

Figure A6: Predicted means and marginal direct effects for poverty rate across constrained ranged of natural resource employment share. Alternative spatial weights matrix (Rook). Other variables held constant at means. Vertical bars represent 95% CI