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THE EFFECT OF NATURAL RESOURCE DEPENDENCE ON ECONOMIC PROSPERITY IN RURAL AMERICA

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Abstract

This dissertation provides a comprehensive theoretical and empirical analysis of rural natural resource dependence in the United States from 2000 to 2015. In the first paper, I ground natural resource dependence within sociological theory surrounding spatially uneven development and dependency by arguing natural resource dependence represents a special case of economic dependency where natural resource development leads to exploitation from both extractive (e.g. coal, timber, mining) and non-extractive (e.g. tourism, amenities) interests. This is due to the contradiction between the spatially fixed nature of natural resources and the need for capital to be in motion.

In the second paper, I test the impact of extractive and non-extractive natural resource development on per capita income, poverty, and inequality from 2000 to 2015. Results support the hypothesis that high levels of both forms of development result in negative impacts to economic prosperity, but not necessarily as expected. Low levels of extractive development were associated with higher per capita income, lower inequality, and lower poverty——with only high levels of development resulting in negative outcomes. This is contrasted by non-extractive development which was associated with lower per capita income across the range of predicted values, as well as no having no effect on inequality or poverty. These findings provide a considerable rebuke of the discourse promoting rural tourism and amenity development as a path for sustainable economic development in rural America.

In the final paper, I begin by formally defining natural resource dependence as over-specialization in the natural resource sectors. From this definition I present an ideal typology and classification scheme for rural counties in the United States. The typology has two dimensions—the level of development and the level of economic prosperity—and six mutually exclusive categories—extractive specialized, extractive dependent, non-extractive specialized, non-extractive dependent, hybrid specialized, and hybrid dependent. I classify counties from 2000 to 2015 and find that extractive dependence decreased over the study period while non-extractive dependence increased. This typology and classification scheme will provide useful insight for identifying where socioeconomic problems may arise, as well as how to best solve them through context-specific economic development policy.

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For Dad.
We Miss you.

“Well the union trumped the unions, now the little guy is frozen. We’re not standing on the street with signs anymore... what the hell for?”
Greensky Bluegrass

Chapter 1 Introduction

Rural America in 2019 finds itself in a time of socioeconomic transition and uncertainty. Since 2000, manufacturing has declined greatly, the service sector has ballooned, and agricultural employment has been reduced to a rounding error (Thiede and Slack, 2017). Further, although per capita income to rural residents has increased since 2000, inequality has remained high and poverty has risen. While these broad trends speak to shared problems, the economic prospects of rural America are highly varied. Rural areas have pursued a variety of strategies for economic development, and it is essential we understand why some rural areas are succeeding, while others continue to fall behind.

In this time of transition, one of the dominant competitive advantages of rural communities has remained constant, that being the resource rich natural environment. Although extractive forms of natural resource development in rural areas such as oil and gas, timber, and mining have decreased since the 1920's and now play a generally small role in the national rural economy (Freudenburg and Gramling, 1994; Mueller, 2019a), in many areas extraction still remains the dominant industry. Further, other non-extractive ways of using the local natural environment such as rural tourism, real estate, outdoor recreation, and amenity development have increased since 2000 and represented three times as much employment, on average, in rural counties as extractive forms of resource use for the entire period of 2000 to 2015. The economic impact of this form of development remains unsettled.

Although the resource rich natural environment represents a distinct competitive advantage for many rural communities, there is a significant body of work arguing the benefits of extractive development are likely more negative than would be expected under neoclassical economic assumptions (Freudenburg, 1992; Havranek et al., 2016; Lobao et al., 2016). Researchers have frequently argued that extractive natural resource development is prone to developing dependence, or over-specialization, in the natural resource sector. This dependence has been frequently associated with lowered economic prosperity. While there is ample research suggesting negative impacts of dependence on extractive natural resource development, there is less understanding and theory regarding the impact of non-extractive forms of development. Some have argued it is a net positive (Deller et al., 2001, 2008), others have argued it is neither good nor bad (Deller, 2010; English et al., 2000), and some have argued it simply represents another form of dependency which produces inequality and community division (Armstrong and Stedman, 2013; Sherman, 2018; Ulrich-Schad, 2018).

Given this lack of agreement in the literature, there remains a notable gap in both theory and analysis regarding the comparative impacts of extractive and non-extractive natural resource-related economic development. As both forms of development rely on the same resource base, are often in competition, and non-extractive development is frequently presented as the path forward for historically extractive regions, a broader perspective is needed. In this dissertation, I develop and test this needed theoretical framework. I first develop an integrative subnational theoretical framework of natural resource dependence in modern rural America. Next, I test one of the core arguments of this framework—that extractive and non-extractive dependence will have similarly negative outcomes for rural economic prosperity. Finally, I draw upon the developed theoretical framework to create an ideal typology and classification scheme for natural resource communities in the rural United States. A detailed summary of each chapter follows.

In the second chapter, I develop a theoretical framework of rural natural resource dependence, addressing both extractive (e.g. mining, timber) and non-extractive (e.g. tourism, real estate) development in the United States. I draw from the literatures on the resource curse, resource dependence, the impacts of rural tourism, and uneven development to argue rural natural resource dependence represents a special case of the core-periphery relationship, wherein rural resource rich areas form a dual-dependency upon both the global capitalist economy and the local natural environment. This results in targeted exploitation from natural resource interests. Due to the contradiction between spatially fixed natural resources and the free movement of capital, external interests and local power elite are incentivized to use their power to pressure rural economies in directions outside their best interest. While historically these interests were predominately focused on natural resource extraction, over the past 50 years non-extractive interests have increasingly replaced extractive forms of development. When viewed this way I argue that non-extractive interests, while pushing a different use of the resource base, do not fundamentally vary in their exploitative relationship with rural communities in the United States.

In the third chapter I test the core argument presented in Chapter 2—that both extractive and non-extractive dependence will result in negative outcomes for rural economic prosperity. I do so by estimating the impacts of both extractive and non-extractive natural resource development—operationalized as county-level employment share—on per capita income, local income inequality, and poverty in the rural counties of the contiguous United States from 2000 to 2015 using spatial fixed effects models. Drawing on the concept of dependence (i.e. over-specialization), I hypothesize the impacts of both forms of development on all three outcome variables will be non-linear, meaning that there will be a point where we see diminishing returns to further specialization in the sector.

I find extractive and non-extractive development both had significant relationships with per capita income, but only extractive development exhibited diminishing returns. Non-extractive development had an overall negative relationship with per capita income from 2000 to 2015; the non-linearity that did exist was in the opposite direction as expected. Only extractive development had a significant relationship with inequality, and the declines in inequality tapered and ultimately reversed direction at high levels of extractive employment share. In the case of poverty, again extractive development had an effect where non-extractive development did not. Extractive development decreased poverty across its range, with the decreases tapering at high levels of development. Taken together, support for the overall hypothesis was mixed. High levels of both forms of natural resource development were associated with negative returns to economic prosperity in rural America from 2000 to 2015. However, the negative impacts for non-extractive development were more apparent than those for extractive. Extraction, while exhibiting diminishing returns at high levels, was associated with absolute increases in per capita income and absolute decreases in inequality and poverty. Non-extractive development had no significant impact on inequality or poverty and had an overall negative relationship with per capita income. These findings suggest non-extractive forms of natural resource development such as rural tourism and amenity development are a particularly troubling form of economic development for residents of rural America.

In the fourth chapter I present a new ideal typology of natural resource dependence grounded in the theoretical framework developed in the second chapter and the concept of ideal types advanced by (Weber, 1949:1904). Natural resource dependence, although commonly invoked in natural resource sociology, has often been ambiguously defined. Communities are frequently described as dependent upon natural resource development, but limited attention has been paid to what that means. Further, the typologies and classifications of natural resource dependence used in the extant literature have generally been one dimensional and have classified counties based upon a threshold of development. For example, if a community is over a certain threshold of employment share (e.g. 20%), they have been classified as dependent on natural resources. However, this approach is limited when considering the conceptual footing of resource dependence. In the literature, resource dependence is often treated as over-specialization in, or over-reliance upon, the natural resource sectors. However, the logic of over-specialization conceptually grounds dependence in poor economic outcomes. Thus, a one-dimensional typology of dependence based upon a threshold of development does not fully capture the concept and risks tautology. If dependence is when high levels of natural resource development result in negative outcomes—meaning over-specialization has occurred—it does not make sense to examine the effect of resource dependence on economic outcomes.

To address this conceptual ambiguity, I formally define natural resource dependence as over-specialization in the natural resource sectors. This definition generates a distinction between places which are specialized in natural resources but faring well (i.e. specialized), and those that are now over-specialized on natural resources and faring poorly (i.e. dependent). Under this definition, a county is only dependent on natural resource development if they have both high levels of development and high levels of economic hardship. I draw on this definition to present a new ideal typology and classification scheme for natural resource communities in rural America. I divide natural resource development into two distinct conceptual groups, extractive forms such as oil, gas, mining, and timber, and non-extractive forms such as tourism, outdoor recreation, real estate, and amenity development.

The typology is comprised of six ideal types of natural resource communities: extractive specialized, extractive dependent, non-extractive specialized, non-extractive dependent, hybrid specialized, and hybrid dependent. I then use this typology to generate a two-dimensional classification scheme for non-metropolitan counties in the United States based upon above average non-metropolitan employment shares in natural resources and poverty rates. A county is classified as specialized if they are above the non-metropolitan annual average for employment share but not poverty, and dependent if they are above average on both. I classify counties from 2000 to 2015 and find that share of counties engaged in extraction classified as dependent (i.e. high poverty) decreased from 2000 to 2015. When considering non-extractive development I find the opposite. The share of counties with high levels of non-extractive development classified as dependent grew from 2000 to 2015.

In the final chapter of this dissertation I present concluding remarks and articulate a future research agenda for natural resource dependence in rural America.

Chapter 2
The Dual Dependency of Resource Rich Areas in Rural America

2.1 Introduction

Research has shown that material hardship and economic stagnation is more common among communities dependent on natural resources than those dependent on manufacturing or other sectors (Freudenburg, 1992; James and Aadland, 2011; James and James, 2011; Matsuyama, 1992). While sociologists and economists have studied the links between natural resource abundance, dependence, and negative socioeconomic outcomes (Freudenburg, 1992; Havranek et al., 2016; James and Aadland, 2011; Lobao et al., 2016; Sachs and Warner, 1995), the field lacks a broader unifying conceptual framework. In this paper I develop a middle range theory of natural resource dependence in the rural United States. I do so by first interrogating three deep pools of extant literature regarding natural resource development and socioeconomic outcomes: (1) the resource curse literature from resource economics, (2) the resource dependence literature from rural sociology, and (3) the literature concerning the impacts of rural tourism. Following this, I turn to critical perspectives surrounding spatially uneven development, dependency, and world systems to articulate a holistic subnational theory of rural natural resource dependence in the modern capitalist system for the United States.

By drawing on theories of dependency (Cardoso, 1982:1972; Franke, 2007:1969; Krannich et al., 2014) and world systems (Wallerstein, 2015:1979), I will argue that rural natural resource dependence in the United States represents a particularly troublesome form of dependency, wherein the rural community develops a dual dependency upon both the national and global capitalist system as well as its resource rich local environment. This dual dependency fosters exploitation by external interests and internal elites, leading to underdevelopment—meaning the heightened levels of material deprivation and economic stagnation faced by peripheral regions due to capitalist exploitation by 'developed' core regions (McMichael, 2017)—of the affected rural community. To avoid ambiguity, throughout this paper I adopt a conventional place-based approach to defining rural (Brown and Schafft, 2019). Thus, I define rural places as those which have both low population density, as well as a low degree of connectivity to urban areas and the amenities and opportunities they provide (Isserman, 2005; Schroeder et al., 2019).

I define natural resource development as any form of economic activity relying on the local natural environment, with the exception of agriculture.[1] Therefore, both extractive development—oil, gas, timber, mining—and non-extractive development—tourism, real estate, outdoor recreation—are forms of natural resource development. As will be argued, given that both of these sectors compete for the use of a resource base and have overlapping, and frequently contradictory, interests, it is necessary to conceptually ground them within the same integrative theoretical framework. Finally, throughout this paper I distinguish between natural resource dependence and dual dependency. I define natural resource dependence as the economic overspecialization in the sector of natural resources frequently discussed by sociologists. Comparatively, dual dependency represents the dependent economic relationships characteristic of natural resource dependence that develop between peripheral and core regions, as well as between peripheral regions and their resource rich local environment.

2.2 The Resource Curse

A touchstone from resource economics, the resource curse is the unexpected finding that many economies with abundant natural resources have lower and slower economic development than those without the same resources, even though neoclassical economic theory would suggest an advantage due to the increased wealth and purchasing power that resource abundance should provide (James and Aadland, 2011; Sachs and Warner, 1995). This unexpected inverse

[1] I do not treat agriculture as a form of natural resource development due to the dissimilar trajectory of agriculture in America relative to the other forms of natural resource extraction via the prominence of family ownership of farms (Mann and Dickinson, 1978), the frequent distinction made by rural communities between agricultural development and other forms of extraction (Freudenburg and Gramling, 1994), the tendency in the literature for rural sociology to treat agriculture and natural resources separately (Freudenburg and Gramling, 1994; Krannich et al., 2014), the different temporal time-frame associated with agricultural yields compared to natural resources, and the domesticated/manufactured nature of agriculture relative to natural timber, fossil fuels, and natural amenities.

relationship between resource abundance and economic growth, while contested, has been found at multiple geographic scales worldwide (Douglas and Walker, 2017; Gylfason, 2001; Papyrakis and Gerlagh, 2004, 2007; Sachs and Warner, 1995). The phenomenon has its roots in the 'Dutch Disease' (James and Aadland, 2011), wherein the Netherlands lagged behind other European countries during and following the industrial revolution despite their rich deposits of natural resources and arable land (Matsuyama, 1992).

One theoretical explanation for this phenomenon argues the problem is one of open versus closed economies (Matsuyama, 1992). In the closed economic system, meaning a country is generally separated from the global economy, agricultural and natural resource productivity has a positive relationship with economic growth. However, in an open economic system—such as exists globally in the modern era—where prices are determined by global markets and external investment is necessary, agricultural and natural resource productivity has a negative relationship with economic growth due to the ability for other sectors to site and invest elsewhere (Matsuyama, 1992). This is argued as resulting from an over-specialization in resource extraction and the subsequent overvaluation of the national currency, which squeezes out investment by other types of development (e.g. Manufacturing). Due to the lack of investment in manufacturing, natural resource dependent economies are outpaced by manufacturing-focused economies as a result of learning-by-doing effects which occur in manufacturing but not resource extraction. Learning-by-doing effects occur when economies increase their productivity and efficiency simply due to a greater amount of time spent performing manufacturing (Matsuyama, 1992).

Sachs and Warner (1995) presented a similar, yet expanded, rationale for the inverse relationship between natural resource abundance and economic growth. They focused on the crowding out effect that a natural resource boom has on manufacturing, and the lack of positive externalities generated by natural resource extraction relative to those generated by manufacturing. Sachs and Warner (1995) described a model with three sectors: tradeable natural resources, tradeable manufacturing, and a non-tradeable sector. As tradeable natural resources increase, demand for non-tradeable goods (e.g. services, local consumables) also increases. However, since the tradeable natural resource sector is large, the demand for the production of manufactured goods for trade is low. Thus, during a resource boom, capital and labor become concentrated in the natural resource sector. It is important to note that from a purely economic perspective this concentration in natural resources is not an inherently problematic phenomenon. However, it may become harmful if the economic linkages and externalities align in certain ways. One example of this negative alignment described by

Sachs and Warner (1995) and Gylfason (2001), is in the case of education. The returns to investment in education are often higher in manufacturing than in natural resources. Gylfason (2001) viewed this as problematic due to education's role as a prerequisite for economic growth worldwide.

Further theoretical explanations for this economically unexpected relationship between resource abundance and anemic economic growth have been provided, I will discuss three: rent-seeking, over-confidence, and institutions (Frankel, 2012; Gylfason, 2001). First, rent-seeking, in which producers attempt to generate additional wealth through manipulation of the social or political environment, is a common behavior by producers in resource abundant economies (e.g. tariff protection, tax breaks). This behavior is often associated with corruption and perverse incentives and can cause stagnation in the economy. Second, the over-confidence thesis posits the abundance of natural resources leads governments and institutions to feel a false sense of security, causing them to lose sight of broader economic and institutional needs, which ultimately leads to a lack of reinvestment and slower overall economic growth (Gylfason, 2001). [2] Third, poor institutions have been presented as both a symptom of the resource curse, as well as an alternative cause of the curse itself (Brunnschweiler and Bulte, 2008; Frankel, 2012; Havranek et al., 2016). Arguing poor institutions are a symptom of resource endowment, Frankel (2012) described rich resource endowments as having freed rulers from the need for tax revenue, thus removing the need for egalitarian and equitable democracy (e.g. Middle Eastern oil exporters). Brunnschweiler and Bulte (2008) argued the opposite, stating instead that, once you differentiate between resource abundance and resource dependence, institutions are what determine both natural resource dependence and poor economic outcomes.

The critique posed by Brunnschweiler and Bulte (2008) points to the contested empirical findings regarding the resource curse. While the resource curse is a popular academic touchstone, its consistency, or even existence, has been frequently questioned (Cust and Poelhekke, 2015; Papyrakis, 2017), with a number of studies finding evidence of the resource curse (Douglas and Walker, 2017; Gylfason, 2001; Papyrakis and Gerlagh, 2004; Sachs and Warner, 1995), and others finding contrary results (Allcott and Keniston, 2017; Brooks and Kurtz, 2016; Brown, 2014; Deller and Schreiber, 2012; Havranek et al., 2016). In their 2016 meta-analysis of econometric analyses of the resource curse, Havranek et al. (2016) found that out of 43 studies, 40% of analyses found negative relationships between natural resource development and economic growth, 40% found no statistically significant effect, and

[2] This explanation is similar to the view "that easy riches lead to sloth (Sachs and Warner, 1995, p. 4)", which Sachs and Warner (1995)—writing over 20 years ago—viewed as outdated.

20% found a positive effect. Havranek et al. (2016) highlighted four important aspects of study design that influence conclusions regarding the resource curse: (1) whether or not the study controlled for institutional quality, (2) the decision to control for the level of saving and investment activity in the economy (3) whether or not studies distinguished between different types of resources, and (4) whether a distinction was made between natural resource abundance and dependence.

The resource curse literature has historically focused on the nation-state as the unit of analysis. While convenient for economic analyses, countries have notable internal heterogeneity in terms of economic prosperity, exploitation, and resource abundance. This heterogeneity may mask regional and local resource curse impacts felt at smaller scales of geography, especially in large and diverse countries. To address this discrepancy, recent studies have investigated the resource curse at the sub-national level in the United States (Allcott and Keniston, 2017; Betz et al., 2015; James and Aadland, 2011; James and James, 2011; Lobao et al., 2016; Papyrakis and Gerlagh, 2007; Weber, 2012). Results regarding the United States have been similar to the nation-state research—meaning the findings have been mixed. Some have found poor growth in counties or states with higher levels of natural resource abundance (James and Aadland, 2011; Papyrakis and Gerlagh, 2007), others have found positive impacts of natural resource development (Allcott and Keniston, 2017; Deller and Schreiber, 2012), and a few have reported their findings as mixed (Betz et al., 2015; Deller, 2014; Lobao et al., 2016; Weber, 2012).

Finally, much of the work on the resource curse has only used income and wages as its dependent variable. As such, this literature has paid limited attention to the distribution of income within study-areas, an omission carrying weight when considering the consistent findings by sociologists regarding natural resource dependence, poverty, and inequality (Freudenburg, 1992). To remedy this, a number of recent studies have addressed this discrepancy by testing impacts on other measures of economic development such as poverty and population change (Betz et al., 2015; Deller and Schreiber, 2012; Lobao et al., 2016; Weber, 2012). That said, this historic neglect of how natural resource dependence is related to income distribution and power dynamics has generally left the resource curse literature tied to linear perspectives of modernization, growth, and development and resulted in an insufficient attention to national and global political economy, relative to theories presented by sociology.

2.3 Natural Resource Dependence

While the resource curse research tradition has largely focused on natural resource abundance, resource dependence is the catchword throughout natural resource sociology (Humphrey et al., 1993; Krannich et al., 2014).[3] Although associated with the resource curse tradition, it has followed a different path. Rather than at the nation-state level, natural resource dependence has often been explored through case studies of communities and regions (Deller and Schreiber, 2012). The relationship between dependence and negative socioeconomic outcomes, while consistent, varies by region and time within the United States (Nord and Luloff, 1993; Lobao et al., 2016).

The focus of the resource dependence literature has historically been on mining and forestry, and less so on other dimensions of natural resource development. In a meta-analysis of mining dependence in 2002, Freudenburg and Wilson found the majority of studies reported mining dependence generated favorable outcomes for income, but adverse outcomes for poverty and unemployment. Their findings add nuance to those of Brunnschweiler and Bulte (2008) who found no relationship between natural resource dependence and growth. Economic growth, while valuable, says little about the distribution of that growth. Although the meta-analysis conducted by Freudenburg and Wilson (2002) focused exclusively on mining dependence, research on forest dependence has found similarly adverse outcomes for poverty and unemployment (Stedman et al., 2005).

The proposed mechanisms by which dependence reproduces poverty have varied. A prominent theoretical frame is that of addictive economies, proposed by Freudenburg (1992). Under this framework, rural economies have become dependent on, or addicted to, extraction due to market volatility (e.g. boom and bust cycles), ambiguity in what constitutes a 'good' or desirable job in the locality, ambiguity in what it means for a remote location to develop, and the low likelihood of actual resource depletion. These 'addicted' communities fail to break the cycle of dependence, and continue to experience negative economic outcomes, due to a limited number of opportunities for realistic economic diversification, geographic isolation, and power imbalances with the extractive industries (Freudenburg, 1992). Further, Freudenburg (1992) argued that whether or not an area was benefiting from resource extraction is likely to hinge on the time frame under examination. In the short run, an economy may experience a brief 'high', but in the long run the consequences will be negative, henceforth the addiction

[3] Various thresholds have been used to signal dependence. Beginning with Elo and Beale (1985) and Bender et al. (1985), the most common definition of dependence has been 20% of the total employment or income, although other definitions of 10% have also been common (Stedman et al., 2005).

metaphor. This variation of highs and lows is especially prevalent for the types of resource extraction associated historically with the often-discussed oil and gas boomtowns (Jacquet and Kay, 2014; Kinchy et al., 2014).

In his 1992 piece on addictive economies, Freudenburg called for more robust longitudinal research on specific forms of resource extraction within regions. While the take-up has been minimal, one such study was conducted by Perdue and Pavela (2012). Perdue and Pavela (2012) explored the relationship between various methods of natural resource extraction and socioeconomic outcomes from 1997-2009 within West Virginia using county-level fixed effects models. Their results suggested the presence of mining, regardless of type, within a county was significantly positively associated with unemployment and poverty. A similar study was conducted by Lobao et al. (2016) on the relationship between poverty, place, and coal employment within Appalachian counties from 1990 to 2010. Lobao et al. (2016) found higher coal development was associated with lower income and higher poverty from 1990 to 2000, but had a positive association with indicators of well-being for the 2000-2010 decade. These decadal changes may speak to the emphasis Freudenburg (1992) placed on the volatility of natural resource sectors, and the intermittent well-being that booms can bring.

Additional perspectives on the causes of rural natural resource dependence, specifically as they relate to persistent poverty, were presented by Humphrey et al. (1993). As a part of the Rural Sociological Society Task Force on Persistent Rural Poverty, Humphrey et al. (1993) outlined what they viewed as the four dominant theoretical perspectives surrounding the phenomenon. The first was that of human capital, and the rational underinvestment in it that may occur in natural resource dependent communities. Under this framework, both rural residents and communities rationally underinvest in human capital. For example, either the individual chooses to drop out of high school or not pursue secondary education, or the community chooses to contribute less tax revenue to schools. These decisions are made due to the lack of return that investments in human capital bring, given the local labor demands and returns to education over an individual's lifetime in the area. This framework is similar to the discussion of over-confidence and underinvestment in education presented by Gylfason (2001). However, the notable difference is that Humphrey et al. (1993) present this underinvestment not as an act of over-confidence, but one of rational decision making when considering community needs and returns to education.

The second framework presented by Humphrey et al. (1993) is that of power, domination, and the natural resource bureaucracy. This framework, further advanced by (West, 1994), positions the relationship between natural resource dependence and poverty as largely a product of who is in control of the resource base. In this case it is either large corporations or government bureaucracies. The focus of this theoretical perspective is how powerful outside groups, either through direct exercise of power or general alignment of interests, come to dominate decisions made pertaining to natural resources in rural areas (West, 1994). These agency decisions, which are subject to external influence, have thus prevented rural areas from developing in a direction that would have reduced poverty.

The third perspective outlined by Humphrey et al. (1993) is the social construction of nature and the process of moral exclusion. This framework argues the environmental movement is at fault for advocating against many forms of rural development which would have reduced poverty in its pursuit of environmental preservation. Thus, providing a 'moral exclusion' for those in rural areas because they are interested in exploiting the local environment for financial gain. This moral exclusion allows the environmental movement to ignore concerns of social injustice related to the poverty faced by those who live in rural areas due to a lack of economic opportunity as the movement pursues environmental preservation. Finally, Humphrey et al. (1993) outlined the fourth dominant framework at the time, the structural perspective and rural restructuring. This framework—similar to the theories discussed by Bunker (2003)—relies on dependency theory (Franke, 2007:1969) and the world system perspective (Wallerstein, 2015:1979) to highlight the position of rural communities within the global capitalist economy. Due to their peripheral position in the world system and their geographic isolation, rural areas are subject to high levels of exploitation and systemic underdevelopment. This perspective is the bedrock of the theory I present in this paper and will receive significant treatment in Section 2.5.

A set of theoretical perspectives surrounding natural resource dependence and economic hardship similar to the theory presented later in this article includes those discussed by Peluso et al. (1994) and Bunker (2003). Peluso et al. (1994) discussed two dominant perspectives regarding the way resource dependence fosters poverty: advanced capitalism and internal colonialism. Although these perspectives are separate frameworks, they work together in many ways to reproduce rural poverty. The concept of advanced capitalism argues that during later stages of capitalism, such as we are in today, capital continues to concentrate in vertically integrated markets and oligopolistic industries. This concentration of capital and markets further removes local control over local economic processes and the role of the state increasingly becomes one of intervention on the behalf of capitalists. This is reflected in the increase of lax anti-trust law and increases in neoliberal policy, which foster further globalization and deregulation. Due to increased competition on the global market, rural industries face cost-price squeezes similar to those discussed by Freudenburg (1992) where the costs of further extraction generally increase or stay the same while the global prices for the extracted commodities either stay the same or fall. This squeeze leads the sectors to look for ways to decrease costs such as automation and the relocation of production. This process fosters poverty due to the lack of local control, the reduction of decent jobs, and the exit of historically dominant industries.

The second, and related, perspective discussed by Peluso et al. (1994) was that of internal colonialism. Under this perspective, regions within nation-states are relegated to the status of an internal colony, wherein external economic interests, in collaboration with local elites, exploit the region for its natural resources while limiting real economic development. This process creates cultural divisions of labor within the country and an unequal exchange between the internal colony and the rest of the nation. This system is perpetuated through interference in local processes by external capitalists, local elites, and government bureaucracies who dictate how land is allowed to be used. A common example of this within the United States is that of Appalachia (Tickamyer and Patel-Campillo, 2016).

In line with some of the theories discussed by both Humphrey et al. (1993) and Peluso et al. (1994), but outside of the context of the United States, Bunker (2003) developed theoretical perspectives regarding dependency and resource extraction in the Brazilian Amazon. Drawing on world systems theory and using a historical approach, Bunker (2003) highlighted the importance that both space and matter play in understanding the dependency that develops between the resource rich region and core industrial regions. Focusing on globalization, Bunker (2003) argued that there is a conflict between the technological and organizational economies of scale present in modern industrial capitalism and the increasing distance materials must be transported for production and consumption as those economies expand. This is known as the contradiction between economies of scale and diseconomies of space (Ciccantell, 2020).

This contradiction results in the development of cheaper and faster technologies for transport of commodities, the pursuit of technological innovation to replace raw materials, and the overall spatial expansion of commodity markets, to the detriment to local people and their economic prosperity due to unequal exchange, local exploitation, and a variety of other mechanisms (Bunker, 2003; Ciccantell, 2020). Additionally, (Bunker, 2003) argued that the specific material being extracted, along with the spatial and temporal considerations of where and how that material will be extracted and then processed, are fundamental to understanding the specific pathway of underdevelopment within a given peripheral region. Key to his framework were the ways that core regions off-load the most capital and energy intensive phases of production to peripheral regions through their exploitation of the global economic structure.

2.4 Impacts of Rural Tourism

While the findings regarding the relationship between natural resource development and economic outcomes remain somewhat mixed, one thing is consistent: the majority of research conducted on natural resource dependence has focused on natural resource extraction as the only form of natural resource dependence. However, extractive natural resource use in rural America has been largely on the decline since 1920 (Freudenburg and Gramling, 1994). Throughout that period, numerous communities in rural America have transitioned to amenity-based economies (English et al., 2000), either in the form of second home and bedroom communities (Winkler et al., 2012; Sherman, 2018), or in the form of rural tourism (English et al., 2000). Results related to the implications of this transition have been mixed. Some have reported rural amenity development as a possible solution for rural economic problems (Deller, 2010), others have found the increased income is cancelled out by increased cost of living (Hunter et al., 2005), and others have positioned amenity development as simply another form of economic dependence (Winkler et al., 2012). This new form of dependence has been argued as likely to provide low-quality jobs (Green, 2017), increases in unaffordable housing (Ghose, 2004; Hines, 2010; Nelson and Hines, 2018), a change in local culture, and conflict between new and old residents (Sherman, 2018; Ulrich-Schad, 2018).

Although direct comparisons between the impacts of extractive and non-extractive development on rural communities and their economies is lacking, a number of studies have been performed on both the economic and social impacts of rural tourism as a form of development. On a global scale, Alam and Paramati (2016) assessed the impact of tourism on income inequality in 49 developing countries from 1991 to 2012. Their results indicated a positive relationship between tourism and inequality, wherein higher levels of tourism were associated with higher levels of national inequality. However, through the use of a curved relationship, they found that if tourism revenue in developing countries were to double, on average, inequality would begin to decrease (Alam and Paramati, 2016). How realistic an increase of that scale is for the countries in question remains to be seen.

In the context of the United States, Deller (2010) reported that, from 1990 to 2000, tourism and recreation played a small, and generally not statistically significant role, in either increasing or decreasing rural poverty. This led Deller (2010) to infer that increasing tourism and recreation in rural areas does not necessarily lead to higher rates of poverty. Similar research using econometric models has heralded rural tourism as a boon for rural communities, citing the strength of natural amenities in spurring economic growth (Deller et al., 2001, 2008). However, Deller et al. (2008) note that natural amenities alone will not foster growth, as resources such as campgrounds and amusement attractions must be built. In contrast, Kim et al. (2005) found that when controlling for spatial auto-correlation, and therefore spillover effects, the relationships between natural amenities and economic growth were generally insignificant, highlighting the importance of spatial relationships.

Although research suggests that non-extractive natural resource development leads to aggregate income growth, others have argued that the economic growth is met with a corresponding increase in cost of living, rendering the economic growth irrelevant (Hunter et al., 2005). Further, recent more in-depth qualitative work by Sherman (2018) and Ulrich-Schad (2018) indicates that aggregate quantitative studies likely miss significant parts of the story concerning the loss of local culture and conflict between new and old residents. This conflict has been described as being in-part due to the increases in unaffordable housing which come with non-extractive development (Sherman, 2018). These changes in housing markets have been documented in the growing literature on the acceleration of rural gentrification processes, particularly within the Inter-Mountain West (Ghose, 2004; Hines, 2010; Nelson and Hines, 2018).

While the evidence regarding the long-run impacts of rural non-extractive natural resource development remains uncertain, the theoretical backing for any expected impacts remains largely absent. Although Peluso et al. (1994) classified three types of natural resource dependence: extractive (e.g. oil and gas), nonconsumptive (e.g. tourism and outdoor recreation), and backdrop (e.g. aesthetic backdrops for bedroom communities); their discussion of dependence only concerned extractive dependence, dismissing poverty in nonconsumptive and backdrop economies as "garden variety poverty (p. 26)" tied to the ebbs and flows of the national economy (Peluso et al., 1994). Given extractive and non-extractive natural resource development compete for the same underlying resource base and labor pool, a more integrative theoretical framework for understanding how rural natural resource dependent communities fit into the broader national and global economy, and the possible negative effects of their position in that economy, is needed.

2.5 A Theory of the Dual Dependence of Resource Rich Areas in Rural America

2.5.1 The Need for a Cohesive and Critical Middle Range Theory

The literature reviewed thus far has served to illustrate the dominant research traditions that exist concerning the relationship between natural resource related economic development, dependence, and economic well-being. There currently exists a need for a more integrated theoretical framework at the subnational scale concerning these topics. A more cohesive theoretical perspective is necessary for three main reasons:

(1) The existing frameworks do not factor in extractive and non-extractive forms of natural resource development side-by-side. Although there exists a significant body of research concerning both forms of natural resource use, both the comparative empirical analyses and theoretical development regarding their relationship remains limited. Those perspectives that do exist, such as the resource curse explanations (Gylfason, 2001), Freudenburg's (1992) addictive economies, Peluso et al.'s (1994) advanced capitalism and internal colonialism, Bunker's (2003) perspective of spatio-material concerns in the world system, or the other perspectives presented by Humphrey et al. (1993), focus on only one side of this—likely false—dichotomy.

(2) Many of the theoretical perspectives only address nation-state or global economies. Resource curse explanations often take a macroeconomic focus, utilizing benchmarks of GDP per capita and explaining effects through national indicators such as overvalued currency and national policies (Matsuyama, 1992). This poses significant problems for understanding the intra-country heterogeneity of resource dependence, a problem articulated by Lobao (2016) in her discussion of the need for sub-national research. This problem is especially severe in federalist countries such as the United States, where many states are the size of other nation-states across the world. However, while states may be large relative to many nation-states, there are not the same restrictions on the inter-state flow of capital within the United States as found between nations, leading to unique problems. These problems are exacerbated by the spatial inequality found between rural and urban regions of the United States.

(3) Many of the theoretical perspectives available on this subject are now dated and were developed before the most recent explosion of neoliberal policy and the transnational capitalist class (Harvey, 2006; Sklair, 2002). The updated theory presented here, which places

a larger emphasis on the spatial linkages that characterize our current phase of capitalism will help guide future empirical investigation.

Given these reasons, it is clear that a critical integrative middle-range theory—meaning an intermediate theory that involves abstractions, but is "close enough to observed data to be incorporated in propositions that permit empirical testing (p. 39)" (Merton, 1949)—of natural resource dependence in the United States is necessary. This integrative framework must account for both extractive and non-extractive natural resource use while nesting the within-country dynamics of the United States within the global system. This theory is needed in response to the call by Lobao (2016) for increased attention to the subnational scale of society. The remainder of this paper will present this integrative middle-range theory of natural resource dependence.

Within social theory there are a number of existing perspectives surrounding both uneven development and dependency. This theoretical framework draws not only on the extant research regarding the resource curse and resource dependence, but also incorporates existing theoretical perspectives surrounding spatially uneven development (Harvey, 2018:1982; Sklair, 2002; Lobao et al., 2007a; Robinson, 2006; Tickamyer and Patel-Campillo, 2016) and dependency (Cardoso, 1982:1972; Franke, 2007:1969; Freudenburg, 1992; McMichael, 2017; Lovejoy and Krannich, 1982; Wallerstein, 2015:1979). It is important to note from the outset that this perspective does not rely purely on dependency theory, classical Marxism, nor world systems theory, but rather attempts to draw from all three to generate a subnational theoretical framework of natural resource dependence.

When analyzing global capitalism, it is clear that one must analyze the whole world system (Wallerstein, 2015:1979). However, when attempting to understand subnational patterns of exploitation and underdevelopment, this scale of analysis appears too broad. Similarly, when analyzing patterns of exploitation, class relations cannot be ignored (Harvey, 2018:1982; Marx, 1990:1867). Unfortunately, our broader understanding of regional exploitation and uneven development leaves much to be desired when we focus exclusively on the internal class relations suggested by classical Marxism and ignore regional exploitation and the consideration of space. Finally, insights from dependency theory—particularly as they relate to external investment and core-periphery chains—are useful for analyzing subnationally uneven development. However, pure dependency theory does not fully consider the broader world system and has often resulted in policy prescriptions too inwardly focused. Thus, I do not ground this framework within any one of these perspectives. Instead, I adopt the broad viewpoint of the world system, while drawing on dependency theory to look within the world system at the subnational patterns of underdevelopment in the United States. While doing so, I also acknowledge the role of local class relations at the point of production in this broader mosaic of uneven development and natural resource dependence in the modern United States of America. The theory I present argues that natural resource dependence is characterized by a dual dependency, the first form being dependency on the national and global capitalist economy, and the second form being dependency on the local resource rich natural environment.

2.5.2 The First Form: Dependency on the National and Global Capitalist Economy

Importantly, rural economies are not independent of other economies, but are rather nested within a series of generally open and free markets at the national and global level (Franke, 2007:1969; Sklair, 2002; Wallerstein, 2015:1979). It is not appropriate to discuss a rural economy in isolation; a 'dual' society of separate rural and urban domains does not exist. However, while they are not separate economies, they occupy varying positions within this single economic system (Smith, 1984; Sklair, 2002; Wallerstein, 2015:1979). Different communities and regions within society are structurally positioned along a spectrum ranging from the core to the periphery (Wallerstein, 2015:1979), although it should be noted that this structure increasingly does not fall neatly along nation-state lines (Sklair, 2007). The core communities, often urban, exploit the periphery, often rural, for their resources and labor.

Exploitation between the core and periphery, in this context, refers to the exploitative exchange relationships between capitalists and consumers in the core and producers in the periphery. This exploitation simultaneously prevents peripheral communities from developing in the direction of local interest, while fostering the extraction of capital and transporting it back to the core. This extraction of capital results in an unequal exchange between the core and periphery, where the periphery gives up more than it receives. In between these two poles is the semiperiphery, a subsection of communities with less exploitative power than the core, but still with some level of power over the true peripheral communities (Wallerstein, 2015:1979). This middle stratum prevents a fully polarized global system and provides hope for future development to peripheral communities, while decreasing animosity towards exploitative interests. This continuum creates an internal, and ever-shifting, mosaic of underdevelopment both across the world, and within countries (Smith, 1984).

Where a region falls along this continuum of core to periphery is contingent upon numerous region-specific criteria including the specific history, physical characteristics, transport infrastructure available, mobility of labor, and the rate of profit available to capital (Harvey, 2018:1982). Further, the level of development which occurs among peripheral regions often follows a dialectical, see-saw, pattern, wherein development of the periphery by the core necessarily lead to crises of overaccumulation, improves conditions for labor, and decreases surplus value to capital (Harvey, 2018:1982; Smith, 1984). Thus, the rate of profit decreases and capital exits the region for a less-developed peripheral region—what Harvey (2018:1982) calls the spatial fix. After capital exits the region, the region begins to decline. Once the initial peripheral region declines sufficiently, capital, and therefore development, may return (Smith, 1984, 2011a). Importantly, this continuum of exploitation does not develop alongside capitalism, or due to a few bad actors, rather it is built into the very structure of industrial capitalism and the actions capitalists must take to remain successful (Cardoso, 1982:1972; Harvey, 2018:1982; Smith, 1984). Thus, as long as ownership of the means of production is concentrated in core capitalist regions—which it is and will be for the foreseeable future—internal sustainable economic development within peripheral regions is impeded, and in some cases impossible due to capital's necessary flow from the periphery to the core (Cardoso, 1982:1972).

Further, due to the increase in neoliberalism—a view of political economy proposing "human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade (p. 2)" (Harvey, 2007)—and the rise of the transnational capitalist class, the uneven development embedded into capitalism may only be accelerating (Harvey, 2006; Robinson, 2015). The transnational capitalist class represents a global power elite who direct the flow of capital with little regard for national borders (Sklair, 2002). This class is made up of a constellation of four non-mutually exclusive groups: "(1) those who own and control major transnational corporations and their local affiliates (the corporate fraction), (2) the globalizing bureaucrats and politicians (the state fraction), (3) globalizing professionals (the technical fraction), and (4) merchants and media (the consumerist fraction) (p. 145)" (Sklair, 2002). These groups, with deep ties to free markets and neoliberal ideals, work together to control both the economic and the political structures of the world to ensure the accumulation of private profit. The rise of this transnational capitalist class and its actions obscures the role of the state in regulating trade policy and has likely only exacerbated the historic patterns of uneven development.

The world-system of uneven development I have articulated is often discussed at the level of nation-states (Harvey, 2018:1982; Smith, 1984; Wallerstein, 2015:1979) or the global economy (Robinson, 2015; Sklair, 2002). While this is certainly appropriate, this system has, nested within it, myriad smaller, within-country, core-periphery systems of equal importance (Franke, 2007:1969). Thus, unlike the majority of work adopting a world systems theory perspective, my unit of analysis is not the entire world system, but rather the United States system nested within this larger global structure. Lovejoy and Krannich (1982) made early strides in positioning this form of dependency as a phenomenon existing with the United States by interrogating the, now dead, manufacturing boom in rural American during the late 1970's and early 1980's. Drawing from the limited empirical evidence available to them at the time, Lovejoy and Krannich (1982) concluded, "rural industrialization in advanced industrial societies may be expected to result in the maintenance or even exacerbation of 'dependency' relations between the center and periphery with a tendency toward 'underdevelopment' as opposed to 'development' in the periphery (p. 490)." Although the causes of the restructuring of the rural economy since 1980 are complex, given the ultimate collapse of rural manufacturing due in-part to the neoliberal deregulation of the international economy (Harvey, 2006; Thiede and Slack, 2017), as well as the continued relative underdevelopment of rural America, it appears their prediction has been correct.

Subnational patterns of dependency represent a reflection of similar global exploitative networks, with the exception that the movement of capital is even less restrained. Although global deregulation has run rampant in the era of neoliberalism (Harvey, 2006), globalization (Sklair, 2002; Robinson, 2005), and the policies and loan requirements pushed by the International Monetary Fund and the World Bank (McMichael, 2017), there still exist barriers to the flow of money and resources *between* nations. However, these legal and geographic barriers are significantly weaker, and practically non-existent, when considering the movement of capital within and between states in a country such as the United States where interstate trade regulation is constitutionally prohibited.

This unrestricted flow of capital has only accelerated following the rise of the internet and the 1994 Riegel-Neil Act which opened up interstate banking in the United States. Thus, the ability of large national and transnational corporations to steer subnational rural regions into specific forms of economic development is heightened in the modern era. Due to this microcosm of free markets and neoliberal trade within the United States, I argue that the expected uneven patterns of development of industrial capitalism are exacerbated at the subnational scale. In this regard, the ability for wealth and financial capital to flow freely and quickly across great distances in the United States has the effect of exacerbating extra-local control of the local natural resource-based rural economy (insofar that a ‘local’ economy actually exists).

Further, local elites work in-tandem with these external interests to achieve the highest rate of profit possible at the point of production. This structure creates a multi-layered exploitative system, where exploitation exists in both the unequal exchange relationships between regions suggested by dependency theory (Franke, 2007:1969) and within the local creation of surplus value discussed by Marx (1990:1867). In short, both local and external capitalists produce surplus value off of local labor and then a significant portion of that value leaves the region due to unequal exchange relationships. What profit does remain is captured by the local capitalists and is not distributed to labor, ultimately creating a general state of underdevelopment in the region (Billings and Blee, 2000; Duncan, 2014).

Within this framework, the state in the modern era is viewed as playing a role complementary to capitalist interests and I give it limited direct attention in this paper. This is because, following the work of Sklair (2002, 2012), the transnational capitalist class, along with national capitalist interests, dominates the political structure at the local and global levels to maximize their private profit. This view ultimately hinges on Marxist formulations of the state as an agent of the interests of capital (Das, 1996). As the members of the state fraction of the transnational capitalist class generally have aligned interests with the corporate fraction of this class, it will be the interests of the capitalist and private profit that will drive development. Although elements of the state will push against specific capitalist interests and there will always be exceptions (Sklair, 2012), this framework places the ultimate power in modern society with the transnational capitalist class and the interests of capital, not with the state (Sklair, 2002). This view of the state is especially appropriate in the case of natural resource dependence due to the historical way natural resource interests have frequently captured the political apparatus, resulting in detrimental outcomes to both rural economic prosperity and the environment (West, 1994).

In this theoretical framework I focus on the outcomes which accrue to residents in a place, thus representing local labor. Local labor in this instance refers to the those who live and work in a place. As discussed by Harvey (2018:1982), labor under capitalism must be geographically mobile to facilitate the accumulation of capital. However, this results in an inherent contradiction wherein labor must be free to move to where work is offered, but also geographically stable enough to ensure the maintenance of a reserve labor army. As Harvey (2018:1982) discusses, to address this contradiction the “escape routes must be blocked off by legal requirements or other social mechanisms (p. 381).” What this means is that labor in rural America *is* mobile. However, this mobility is not shared by all people. Many residents face significant barriers related to moving for work (Lyson et al., 1993). Although many people, particularly the young and well-educated (Carr and Kefalas, 2009), continue to leave rural America for opportunity, many stay behind. The reason for this lack of mobility is wide-ranging from attachment to a home and community (Harvey, 2018:1982; Lyson et al., 1993), racial discrimination (Duncan, 2014), identity subversion (Bell and York, 2010), and cycles of predatory debt (Billings and Blee, 2000; Duncan, 2014), among others (Lyson et al., 1993). Thus, while labor is mobile in rural America, there remains a particularly vulnerable group of immobile laborers who bear the brunt of the negative impacts wrought by this first form of dependency.

It should be noted that while I have elected to use the language of dependency and world-systems, this framework is similar to the previously discussed view of internal-colonialism, wherein regions within countries—such as Appalachia—are treated as internal colonies, stripped of their resources and denied local capital accumulation in order to exploit cheap labor (Peluso et al., 1994; Tickamyer and Patel-Campillo, 2016). I use the language, and perspective, of dependency because it allows for a more fluid and realistic mosaic of exploitation between the many linked subnational core-periphery chains than the perspective of internal colonialism. Although the theoretical perspective I present here is similar to those often used to understand Appalachia, it is intended to apply generally across the United States. As it is meant to be general, it is important to note there will be some degree of regional variation in the specific ways dependency presents on the landscape. In fact, much of what I argue here may be more relevant to the rural amenity-rich regions outside of Appalachia—such as the Inter-Mountain West—due to the continued extractive development combined with the transition to non-extractive amenity development in those regions. The perspective presented here is grounded in material economic conditions. As Appalachian coal has continued to play a smaller economic, although not ideological (Bell and York, 2010; Lewin, 2017), role in the region, the communities of Appalachia may increasingly not be experiencing the dual dependency characteristic of natural resource dependence discussed here.

This multi-layered exploitative subnational structure of capitalism and dependency I present exists across all of rural America, regardless of natural resource endowment. However, as I argue below, when coupled with a a resource rich local natural environment, this dependence becomes particularly intractable.

2.5.3 The Second Form: Dependency on the Local Resource Rich Natural Environment

Drawing on the research surrounding the negative impacts of natural resource dependence on poverty (Lobao et al., 2016), income growth (James and Aadland, 2011), and other indicators of social well-being. I argue rural natural resource dependence is a *special case* of the core-periphery relationship which produces a dual-dependency: dependency on both the national and global capitalist economy and the resource rich local environment. When a rural community is rich in natural resources, they are likely to become overly dependent on the local environment for their economic production. This dependency will be exacerbated due to their dependency on the national and global economy due to external interests' ease of access in influencing local decision making through capital investment. External interests in this framework refer to those residing outside the peripheral region who either own or invest in the corporations developing natural resources in the periphery. Many of these interests are represented by the transnational capitalist class identified by Sklair (2002). This influence will ultimately result in underdevelopment characterized by higher levels of inequality, poverty, and economic growth relative to both non-natural resource dependent peripheral regions and core regions.

This argument, in many ways, represents an extension of both the resource dependence frameworks presented by Humphrey et al. (1993) regarding power, domination, and rural restructuring, as well as an integration and extension of the advanced capitalism and internal colonialism frameworks discussed by Peluso et al. (1994). This dual-dependency pushes the natural resource dependent community to the furthest edges of the periphery in terms of economic exploitation. When the natural resources surrounding a region are sufficiently rich then the direction of interest among global capitalists becomes obvious, and the consequences more adverse. Thus, the resource rich local environment fosters the dual dependency which allows extra-local control by national and transnational corporations to pressure rural communities to stay in a constant state of relative deprivation, boom and bust cycles, and low-quality jobs.

The ultimate reason extra-local interests promote this constant state of underdevelopment unique to peripheral natural resource rich regions is due to the misalignment of two factors: the spatially fixed nature of the resource base and the spatially unbound nature of capital. Natural resources, unlike a factory, cannot be torn down and rebuilt where labor is cheaper. Thus, external interests face increased friction related to the flow of capital relative to other industrial sectors such as manufacturing; where capital would eventually exit the region due to the falling rate of profit caused by agglomeration, increases in labor power, heightened market diversity, and overaccumulation (Harvey, 2018:1982; Smith, 1984). Further, the extra-local, often transnational, corporations have little interest in the local community and will see no direct benefit from real local economic growth. If the capitalists were located within the region, as they may have been before the rise of the transnational capitalist class, they may have had an interest in broad regional economic development. However, they are spatially unbound and unattached to the locality. Thus, extra-local interests prevent the natural progression of regional economic development to ensure long-term access and profitability of their specific interest in the resource dependent region.

External capital is successful in this partly due to the local exploitative relationships which allow the local elite to profit and maintain power. Due to this contradiction between the necessary free movement of capital and the static nature of the resource base, agglomeration effects—meaning the positive externalities that lead to economic growth generated when firms concentrate in geographic proximity (Melo et al., 2009)—are intentionally inhibited due to the perverse incentives of natural resource interests.

While some agglomeration related to the resource being extracted, such as processing, may be limited due to remoteness of the region and the need for economically feasible supply chains (Bunker, 2003), I argue the majority of agglomeration and market diversity is inhibited as a result of the contradiction between the static nature of resources and the need for capital to move across space. Agglomeration is inhibited to ensure steady rates of profit and continued access to the resource base, at least until it is depleted. Further, drawing on these misaligned factors, forms of economic development that are outside of the natural resource sector will also be pressured out of the region by both cooperating local elites and external interests in order to retain these necessary conditions. It is true that if profit were to fall enough, capital could simply disinvest from the region and the resource. However, in the current political economic system it is far easier to pressure the region in specific directions and buoy the rate of profit for as long as possible. Industrial behavior similar to this was documented by Billings and Blee (2000) in their study of Appalachian poverty and the coal and timber sectors and also discussed by (Duncan, 2014) in her ethnography of poverty in Appalachia. In short, because the capitalist faces significant friction in moving the site of production, they double down on the exploitation of the region to ensure profit.

Although exploitation and the exclusion of other industries from the region are dominant strategies within this framework, other strategies may also pursued to combat the falling rate of profit inherent in a spatially fixed resource base. These include technological innovation to reduce costs which fight against the cost-price squeeze identified by Freudenburg (1992), as well as the pursuit of substitutes for the resource which mold the industry into a more conventional and mobile sector such as in the case of synthetic rubber discussed by Bunker (2003).[4] Importantly, even if technological innovation reduces the absolute number of employees required for resource extraction, the industry may still pursue strategies to dominate the regional economy so as to keep other interests antithetical to their profit out. The decline of coal employment in Appalachia due to technological change, and the persistent effort to create a regional economic identity out of line with the employment realities of the region provides evidence of this strategy (Bell and York, 2010).

Ultimately, the external natural resource interests and their local allies have a vested interest in keeping rural areas underdeveloped to ensure a steady rate of capital accumulation. This vested interest fosters lower levels of market diversity—meaning there are few industries in the region—and increased levels of monopsony and oligopsony—meaning the few industries also have few firms. This means the natural resource sector, and its few firms, end up being the only 'game in town.' These concentrated firms, through both concentrated land-ownership and wage-stagnation due to a lack of competition, direct the local economy and foster underdevelopment in the region (Falkinger and Grossmann, 2013). The suppression of wages in the concentrated labor market prevents the accumulation of wealth among the majority of the population and prohibits diverse local economic development, entrepreneurship, and a transition to a non-dependent economy. Although market concentration is generally higher in rural areas regardless of natural resources (Azar et al., 2017), I argue the problem of oligopsony will be more severe in natural resource dependent economies due to the vested interest of extra-local actors in keeping the conditions of the region largely the same, as well as the economies of scale required to be successful in the sector.

This framework moves social theory further beyond the frameworks of natural resource dependence discussed by Freudenburg and Wilson (2002) and Peluso et al. (1994) by arguing this pattern of exploitation is also likely to occur in the case of non-extractive forms of natural

[4] In his work on the Brazilian Amazon, Bunker (2003) discussed the way capitalists requiring rubber belts for manufacturing pursued both domesticated and synthetic alternatives to combat the conflicts of capital embedded in the reliance upon wild rubber trees. The extraction of wild natural rubber required navigating local political economies with multiple international actors, provisioning a large body of local laborers, the transport of rubber via a difficult network of rivers over great distance, and enduring the temporal dynamics of tree growth. The development of domestic rubber plantations in colonies, followed by synthetic rubber in factories, allowed capitalists in core regions to reduce their reliance on the extraction of natural resources (i.e. wild rubber trees) and instead obtain their rubber via either a more controlled domestic crop structure, or a more mobile manufacturing system (Bunker, 2003).

resource-related development such as tourism, real estate, and outdoor recreation. With the exception of boom and bust cycles—although as tourism is often seasonal one could argue that it simply creates more dependable cycles of boom and bust—the preceding argument holds. This is because those that generate profit from amenity development and tourism have a similarly vested interest in the spatially fixed resource base being used exclusively in one general manner to accumulate capital, while having limited interest in real and diverse local economic growth due to their extra-local nature. Thus, non-extractive capital seeks to keep other economic interests out via manipulation of the political economy, resulting in non-extractive interests fulfilling a function not all that different from extractive interests.

Non-extractive interests, in the same manner as extractive, face constrained mobility relative to other forms of industry. Although the actual use may be different, non-extractive interests also require the locality, and its resource base to remain in a relatively steady state to ensure both a stable rate of profit and access to a cheap reserve labor army. The current level of development in a resource-rich locality is what will have attracted non-extractive interests to begin with, its 'rustic' character is bedrock to profit. Thus, development in any other direction (e.g. manufacturing), contradicts the goals of non-extractive interests, stands as a conflict with future profit, and will be intentionally inhibited.

Given that extra-local national and transnational firms can penetrate local markets regardless of their placement on the extractive to non-extractive continuum, all of the negative aspects associated with extra-local control described for extractive development also hold for non-extractive development. Evidence of the ability of external interests to drive non-extractive development in rural places can be found in several contemporary examples. First, Vail Resorts—a company traded on the New York Stock Exchange which has seen its stock price rise from $38.30 in January of 2012 to $246.29 in January of 2020—has applied economies of scale to the ski and tourism industry and now owns 34 mountain ski resorts across the United States, the majority of which were once locally owned and operated (Yannon, 2019). Second, the property speculation for vacation rentals and second homes in the northern Rocky Mountains has driven rural gentrification and restructured regional economies around the service industry while making housing difficult to afford for long-term residents (Ghose, 2004; Hines, 2010; Nelson and Hines, 2018). Third, Delaware North—a global company which reported a revenue of $3.3 billion in 2018 and is the 140th largest private company in America (Murphy, 2019)—now owns the rights to gift shops within numerous national and state parks, as well as local resorts in many amenity rich areas; once again applying economies of scale to nature based tourism in the rural setting (Fuller, 2016).

These examples highlight the way that modern capitalists external to the rural context can penetrate markets and steer non-extractive natural resource development.

It may be expected that, similar to income growth from mining (Freudenburg and Wilson, 2002), aggregate income growth may continue to increase with some increase in non-extractive specialization. However, equally similar, un(der)employment, poverty, and inequality will be expected to rise—ultimately tipping the region into the state of over-specialization and dependence. It is possible that these negative outcomes will not always occur, but in a generally unregulated national market they are highly likely. When this point is made clear, we can see that a transition to a non-extractive local economy still represents a dual dependency on both the resource rich natural environment and the global capitalist system, with the exception that instead of extracting the physical resources, the core is now extracting experiences and the capital those experiences create. This transition from a historically extractive economy to a non-extractive, often tourism-based economy has been observed by academics in a number of places including Arizona (Davis and Morais, 2004), Wisconsin (Freudenburg et al., 1995), Washington (Sherman, 2018), and Appalachia (Taylor et al., 2017), among others.

It should be noted that this argument concerning non-extractive development is grounded in fewer empirical findings than that of extractive development, largely due to the limited existing body of scholarship. In fact, some researchers have argued that rural tourism can be a savior of resource rich rural communities (Deller et al., 2001, 2008). However, the positive benefits of rural tourism in the empirical data have generally been limited to income growth (Kim et al., 2005), which, as stated, may be expected to grow with increased dependence on the non-extractive sector, similar to the findings of Freudenburg and Wilson (2002). However, this increase may be at the expense of overall employment, poverty, and inequality. To date the findings on this remain mixed, with some findings reporting no positive or negative effect (Deller, 2010), and others reporting negative outcomes—albeit on the international stage (Alam and Paramati, 2016).

Of additional concern is that—unlike many jobs in extraction where although the risk of layoffs is high, the jobs themselves can be of high quality—the quality of jobs provided by non-extractive development such as tourism is often low. The work is often seasonal, provides low wages, offers limited benefits, and presents little room for promotion (Green, 2017). These low-quality jobs, when combined with the rising cost of land and living spurred by this form of development (Hunter et al., 2005), may result in locals being priced out of their own communities. Further, in some cases where tourism has been the most successful in boosting the rural economy, it has been through the use of "ticky-tacky" tourism dominated by external transnational corporations (e.g. Branson, MO, Pigeon-Forge, TN; Deller et al. 2008). The radical change of these places could easily be argued to constitute a loss of local culture and place-change, a type of transition difficult to measure in dollars and cents. Further, while I have discussed literature regarding rural tourism, it is important to note that non-extractive development also includes second home ownership, outdoor recreation development, retirement destinations, and bedroom communities—all topics where the academic understanding of the impacts of this form of development are less well-studied. Future research on the multi-decade impacts of non-extractive natural resource development on rural American well-being is essential for understanding the scope of exploitation associated with this form of development.

Although the extractive and non-extractive sectors have an overlapping interest in the shared resource base, and are mutually aligned at the contradiction between a spatially fixed natural resource base and the need for capital to be in motion, they are not fully equivalent. First, extractive and non-extractive forms of natural resource development do not have the same impacts on physical health of residents, the physical environment, or even the local culture. The externalities associated with each form of development are very different in this regard. Second, price is handled quite differently in the two sectors. The price an extractive industry can charge for a given commodity is pinned to the global commodity markets (Freudenburg, 1992). At the stage of the raw material, a given firm is generally unable to charge more for their specific commodity than any other firm. The extractive commodity market dictates the price they can charge; crude oil is priced as crude oil.

This is not to say there will be no variablity within extraction. The type of resource, whether timber, coal, oil, or any other, will present specific considerations which impact how that form of development navigates the spatial contradiction and the pursuit of profit (Bunker, 2003). However, in the case of non-extractive development we will see more variability in price within the same sector. Depending on the specific natural amenities available, the level of regional development, and the size of the market, among other things, different firms will be able to sell their very similar product (e.g. the tourism experience or real estate) for a different price. This variability makes it likely that the outcomes of this form of development are more subject to the agency of both investors and local residents than in the case of extraction. Ultimately, the goal of this framework is to organize extractive and non-extractive development within an integrated theoretical framework. That said, there will be significant diversity within and between both sectors.

Finally, this theoretical framework presents natural resource dependence as an inherently negative phenomenon, this is due to the approach of defining natural resource dependence as over-specialization in the sector of natural resources. It is at this point over-specialization that dual dependency and its negative outcomes are expected. However, this framework can also be used to assess positive outcomes of natural resource development when they occur. Places with very high levels of natural resource specialization, but without negative socioeconomic outcomes, represent places where the contradiction between the spatially fixed resource base and the need for capital to flow are not being reconciled in the exploitative manner discussed throughout this paper. Thus, these places are best described as specialized in the sectors of natural resources, but not dependent. The reasons this would occur is likely due to a strong state political apparatus detached from the power of capital, as well as unique agent-based factors specific to the context. Exploring these exceptional cases where specialization does not result in dependency through the lens of this framework will be essential for future work.

2.5.4 Natural Resource Dependence as a Process

Natural resource dependence should not be viewed as a steady state that one enters into, but a process characterized by the ebb and flow of dual dependency. Given dual dependency's conceptual footing in a contradiction of capitalism, we should expect it to have a dialectical nature always in a state of flux. Although it is a dynamic process, the theory presented here does suggest some general patterns. As areas increase their economic specialization in the natural resource sectors, they are likely to tip into natural resource dependence and develop dual dependencies. The precise level of specialization where this occurs will vary locally due to many factors such as local political economy, the broader labor market, historical patterns of development, the quality of the resource base, and geography, among others. Thus, it is possible for two areas to have similar levels of development and one be specialized—meaning they are not experiencing negative outcomes from the development—and the other be dependent—meaning they have reached over-specialization and experience the resulting negative outcomes. However, while the level at which this develops will not be constant across all communities, we should expect that, on average, higher levels of specialization will result in diminishing economic benefit. Thus, the pattern suggested here is one where increasing specialization in natural resources from 3% to 5% should, on average, have more positive economic returns than an increase from 23% to 25%, where the returns should be expected to be less positive, if not purely negative.

As it is a process, it is possible for communities and regions to exit, and possibly re-enter, natural resource dependence. It bears repeating that natural resource dependence is the over-specialization of a region in the natural resource sector. Thus, if the natural resource activity continues but no longer contributes significantly to the local economy, then the place is no longer natural resource dependent within this framework. If a region exits natural resource dependence, and therefore dual-dependency, the first form of dependency upon the national and global economy will remain and likely be more severe than if dual dependency had never occurred due to the formation of path dependencies. This is because the peripheral location of the area in the national and global system is unlikely to change and the existing political economy will have been shaped by the former industry. All that will have been severed is the dependency upon the local resource rich environment. Regions and communities which transition out of natural resource dependence may still experience negative effects for generations to come. Much like those who owned timber land have been easily able to convert their interests into real estate (e.g. Plumb Creek Timber), those who gain power over, and within, regions before the economic dependency on the local environment ends will likely still retain their power in the new economy.

This process of dependency formation, dissolution, and transition has been described in prior historical work by sociologists (Billings and Blee, 2000; Freudenburg et al., 1995; Freudenburg and Frickel, 1994; Wilson, 2004). Wilson (2004), in her comparison of two different mining communities, found that the overspecialization and dependence one community had on the copper industry made them far more susceptible to the booms and busts of the global copper markets than their less specialized counterpart. Due to the high share of employment in mining and the lack of alternative forms of employment in this area, when the copper industry experienced declines the community remained economically dependent on coal mining even when the absolute number of available jobs in the industry decreased (Wilson, 2004).

Others have documented communities moving through the process of resource dependency. In their work, Freudenburg et al. (1995) used the case of Iron Mountain—a region along the Michigan-Wisconsin border rich in natural resources—to describe how natural resource dependence progresses over time. Iron mountain was first dependent on the timber industry from the 1830's to the 1870's. The area then transitioned to a dependence on iron ore from the 1870's to the 1940's. In each case the industry continued developing the resource base until it was ultimately unprofitable in the national and global marketplace. Following the iron ore bust, the region transitioned to a dependence on tourism focused on the history of mining in the area which persists to this day.

Although Iron Mountain transitioned from extractive dependence into a form of non-extractive dependence, not all places dependent upon extraction have done so when they are no longer dependent on extractive activities. As documented by Bell and York (2010), Lewin (2017), and Perdue and Pavela (2012), many of the coal mining regions of Appalachia have largely transitioned out of economic dependence upon mining due to both the mechanization and global decline of coal. This transition has not been met with the same large pivot to non-extractive development as found in the West. In fact, the coal industry continues to steer development in the region and exploit the political economy they helped create so they can continue to profit; absent of providing significant employment to the the majority of the region (Bell and York, 2010). This highlights the way the first form of dependency can persist even after the actual local economic dependence on the environment is broken. Even if the dependency upon the local environment is severed, the dependency relationship with national and global capital remains.

Finally, it is important to acknowledge that while the theory I describe appears deterministic and presents a likely path that resource rich rural communities will follow, rural people and communities have agency and there are, and will be, exceptions. However, to paraphrase Marx, people do make their own history, but they do not make it as they please. Thus, within the framework I present, the emergence of natural resource dependence hallmarked by dual dependency—and its host of consequences—should be expected.

2.5.5 The Impact of Dual Dependency

The impacts of this dual dependency on rural well-being are many. While I will not discuss all possible impacts in detail, I believe it is important to clearly state the ways the formation of dual dependency is expected to influence three major indicators of rural economic well-being: income growth, poverty, and inequality. In step with this, a conceptual model of the theory is presented in Figure 2.1. This conceptual model first traces the way a community's peripheral location in the world system, its resource rich local environment, and the level of extra-local control lead to higher levels of natural resource development. It then shows that due to the contradiction between static resources and the need for mobile capital, dual dependency (e.g. overspecialization) develops. From this, the mechanisms of dependence lead to the ultimate underdevelopment of the region.

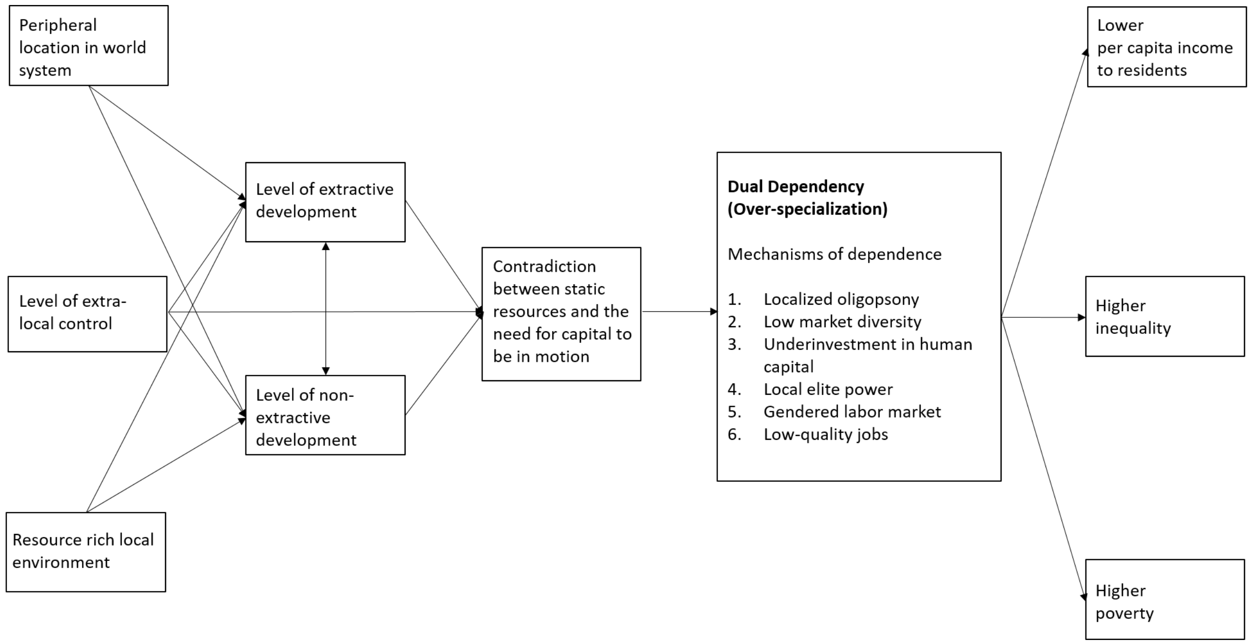

Figure 2.1. Conceptual model of the impacts of dual dependency

Dual dependency is characterized by numerous mechanisms outlined in the following paragraphs. These mechanisms work together to cause lower per capita income, higher local inequality, and elevated poverty. Finally, the relationship between extractive and non-extractive development—represented by a double headed arrow—highlights the way these two forms may interact. Although we may expect high levels of one to preclude the other, as discussed below, the research on this is limited and it remains an empirical question. This model, and the relationships discussed below are general. As discussed by Bunker (2003) and (Freudenburg and Frickel, 1994), these mechanisms and impacts will display variability due to context and the specific type of extractive or non-extractive activity occurring. That said, a general framework such as this will facilitate deeper research into the way this variability presents.

Natural resource dependence, of both the extractive and non-extractive variety, is expected to foster lower and slower income growth than the rest of the non-resource dependent rural economy. This is due to the the spatial contradiction between the static nature of the resource base and the necessary movement of capital. However, it is also due to three more proximate causes: the economically rational under-investment in human capital, the undiverse and oligopsonistic nature of resource dependent rural economies, and the insecure and low-quality jobs provided by both sectors. Education is often viewed as a prerequisite for economic growth (Gylfason, 2001), however in a region where the economic returns to education are low, rural areas are likely to underinvest in human capital (Humphrey et al., 1993; Joshi et al., 2000), leading to stagnant economic growth.

Further, rural economies are small by definition, which tends tends to foster undiverse and oligopsonistic labor markets (Azar et al., 2017). However, in the case of dual dependency, wherein there is often only a single dominant industry which is managed externally through economies of scale, these problems become even more severe. This allows those few employers to keep wages artificially low and leads to decreased labor market power on the part of laborers. Finally, the jobs that are provided by both extractive and non-extractive sectors are notoriously insecure due to the booms and busts of the extractive sector (Freudenburg, 1992) and the service industry orientation of the non-extractive sector (Green, 2017). The insecure and low-quality nature of these jobs makes saving money difficult and prevents the creation of successful local businesses and internal economic growth.

A further pathway by which lower levels of per capita income are expected is the gendered nature of labor in both the extractive—masculinized labor—and non-extractive—feminized labor—sectors (Sherman, 2009a,b; Tallichet, 2000). Although this gendered division of labor may not be desirable, its existence cannot be denied. This labor structure creates a divide between 'men's work' and 'women's work.' Thus, if a county is dependent on extractive development, women will be more likely to stay at home and not draw an income, even if that means increased material deprivation (Sherman, 2009a,b). The same is expected for a non-extractive dependent county, however the situation will be reversed. In this case, the only available work is 'women's work', meaning that men may not see the available jobs as a job they can actually take due to persistent gender norms. While this may mean men take on an increased share of childcare and housework (Sherman, 2009a,b), income will remain suppressed.

This dual dependency is expected to heighten local inequality. Inequality is expected to increase in cases of extractive and non-extractive dependence due to spatial contradiction, as well as the way the overspecialized regional economy privileges the local power elite. In the case of dual dependency, we can expect local elites will capture what economic growth does exist and perpetuate and exacerbate existing systems of inequality (Billings and Blee, 2000; Duncan, 2014). The local elites, often coming from intergenerational landed families, facilitate rent-seeking by extra-local interests and exploit poorer residents along the lines of race and class. This phenomenon was well-documented in Appalachia and the Mississippi Delta by Duncan (2014) in *Worlds Apart*, wherein severe deprivation persisted among the majority of the population while the local elite remained prosperous through predatory loans, corruption, and discrimination.

Additionally, increased inequality will be expected in the case of non-extractive development for a unique form of local elites, that being the new wealthy residents drawn in to an area for its rich natural amenities (Sherman, 2018). In this situation, rural gentrification processes drive housing prices out of reach for existing residents and lead to increases in local wealth held only among a small subset of the local elite (Ghose, 2004). This occurs in tandem with the proliferation of the low-quality, and often seasonal, work available in non-extractive sectors, making it so that poorer residents cannot realistically improve their situation; increasing local inequality.

Poverty is expected to increase for many of the same reasons per capita income is expected to decrease and inequality is expected to increase. Poverty will increase due to the spatial contradiction, as well as the proximate causes discussed related to per capita income. Poverty increases due to the limited economic opportunity available with less human capital, the lower wages provided by undiverse and oligopsonistic labor markets, the low and insecure wages available from employment in the sectors, and the gendered nature of the natural resource labor markets. All of these work to prevent the generation of savings and make falling into poverty likely. Poverty is also expected to heighten due to the mechanisms discussed for inequality. The local power elite, in maintaining their status, take advantage of poorer residents and reproduce and heighten local cycles of poverty (Duncan, 2014). Additionally, the rural gentrification effects present in the non-extractive setting result in a larger portion of income going to housing and make meeting ends meet more difficult when residents experience temporary hardship (Ghose, 2004).

This distinction I have drawn between extractive and non-extractive development suggests two different but related forms of natural resource dependence. While these distinctions are useful for discussing different impacts of dependence, similar to the distinctions of extractive, nonconsumptive, and backdrop made by Peluso et al. (1994), these are not mutually exclusive. Much of the existing literature has positioned extractive development and non-extractive development as necessarily competing, although the empirical backing for this is limited and some research suggests residents do not necessarily view them as mutually exclusive (Petrzelka et al., 2006). When considering a sufficiently large geographic area, such as a county, it is possible—and even likely—that both extractive and non-extractive dependence may exist side-by-side, creating a form of hybrid natural resource dependence. Thus, once we consider hybrid dependence, meaning dependence on the resource rich local environment for both extractive and non-extractive uses, we arrive at three mutually exclusive forms of natural resource dependence all characterized by the patterns of dual dependency discussed here: extractive-only, non-extractive only, and hybrid.

2.5.6 Relationship with Existing Perspectives on Resource Dependence

I would be remiss if I did not situate this perspective clearly within the existing theories surrounding resource dependence previously discussed. If we consider the reasons for adverse impacts of resource development suggested by both the resource curse and resource dependence literatures, this operating theory is related in numerous ways. First, scholars of the resource curse have attempted to distinguish between natural resource abundance and dependence (Brunnschweiler and Bulte, 2008; Havranek et al., 2016), with some arguing dependence has no impact on income growth and others arguing that it is dependence versus abundance that makes the difference. This differentiation is important in the context of the framework I present here. The use of the term dependence necessarily intimates a threshold where dependence, or overspecialization, occurs. In the framework I have presented, places with natural resource abundance will naturally progress towards dependence in a generally unregulated national economy such as the United States. Therefore, a key goal of policy should be to prevent abundance from becoming dependence.

The other explanations provided by the resource curse warrant discussion in this framework. While the explanation provided by Matsuyama (1992)—that being an overvaluation of local currency leading to lower investment by other sectors—is less relevant when looking within a country, other Dutch Disease explanations present an interesting case. Sachs and Warner (1995) argued in an economy with tradeable natural resource goods, tradeable industrial goods, and non-tradeable goods, the focus on tradeable natural resource goods will expand interest in non-tradeable goods and push out the industrial tradeable goods sector. In the subnational context of dual-dependency this may still be so, with clear consequences. If the natural resource sector expands, this may generate an emphasis on non-tradeable goods, such as services. In a resource rich environment, it is likely that these services will be of a particular bent—non-extractive natural resource related development such as tourism and outdoor recreation. This natural push then facilitates a 'smooth' transition from one form of natural resource dependence to another. Further, as discussed, extractive and non-extractive development are not necessarily at odds, therefore many locations may result in a form of hybrid dependence with pressure from external capital on both sides of the local economy.

In regard to the subject of institutions and rent-seeking prominent in the resource curse discussion (Gylfason, 2001; Havranek et al., 2016), poor institutions and rent-seeking are common in conversations about natural resource development in rural America. Agency capture at both the state and federal level by extractive natural resource interests have been a common thread of concern for many years (Humphrey et al., 1993; Peluso et al., 1994; Singleton, 2000; West, 1994). Backlash against these activities has ultimately resulted in the passing of federal laws dictating conservation and preservation, often to the chagrin of those wishing to exploit the resource base. While these laws have helped stem the tide of ecological degradation and species extinction in many locations, they have provided fodder for rural antipathy towards environmental regulations; as they are perceived as having, and in many cases have, cost many rural Americans their jobs (Foster, 1993). Finally, at the level of the community, many institutions simply do not have the capacity or desire to resist exploitation by natural resource interests, thus facilitating negative socioeconomic outcomes at the subnational scale (James and Aadland, 2011).

I view the theoretical framework proposed here as generally complementary to the addictive economy perspective proposed by Freudenburg (1992). The perspective of addictive economies is grounded in the extraction of natural resources at the scale of the rural community. Therefore, the framework of addictive economies can be thought of as a theory at a lower level than dual dependency. The forces exerted on local economies dependent on natural resource extraction identified by Freudenburg (1992) including the cost-price squeeze, the inability to diversify, the unlikelihood of the resource base actually being depleted, and remoteness of the community all have a role to play in the perspective of dual-dependency. For example, the inability to realistically diversify the rural economy can be seen as a symptom of external pressure, while the remoteness of a given community presents as a likely cause of increased vulnerability.

Further, while non-extractive natural resource-related development may not be as obviously susceptible to the cost-price squeeze as extractive development, if the number of rural resource rich communities pursuing amenity development continues to grow, the supply will likely attenuate demand in such a way that the cost-price squeeze may in fact occur. Finally, non-extractive development generally will, by definition, not deplete the resource base past a certain point, suggesting that amenity development will be viewed as an option for rural economic development for the foreseeable future. In this case, Freudenburg's (1992) point regarding the unlikelihood of resource base depletion is particularly clear. This may result in amenity development ultimately becoming more entrenched than extraction in rural America.

While Freudenburg's (1992) framework of addictive economies can be viewed as complementary to the perspective of dual dependency, there are two notable ways the frameworks differ. First, since 1992 the neoliberal globalization project has progressed apace (Harvey, 2006; McMichael, 2017; Robinson, 2015; Sklair, 2007). Although some of the problems of subnational free markets existed prior to 1992, the opening of interstate banking in 1994 and the capital accumulation of national and transnational corporations in the following years has made these global linkages of increasing concern and detriment (Harvey, 2006). Thus, the framework of addictive economies that paid limited attention to the power of external capital and its contradiction between the free movement of capital but the static nature of the resource base, is insufficient for a holistic understanding of what is driving the socioeconomic conditions of resource-rich communities. In another way, if we consider the conceptual model presented in Figure 2.1, Freudenburg (1992) addressed proximate causes of economic deprivation in the middle of the figure, but not the ultimate cause of the spatial contradiction. This leaves researchers with an incomplete theory of natural resource dependence in the United States, which the perspective I present here begins to complete. Second, the theory put forward by Freudenburg (1992) was partial in regard to the types of resource development considered. Given the increase in non-extractive resource use relative to extractive in recent decades, as well as their overlapping exploitative relationships with rural America, a more comprehensive theory of natural resource dependence was necessary.

This framework of dual dependency is also complementary to the theoretical work advanced by (Bunker, 2003). Similar to addictive economies, the work of Bunker (2003) is at a more specific level than this framework. The focus on the contradiction between economies of scale and diseconomies of space, as well as the material characteristics of the resource being extracted, is essential for fully understanding any single extractive industry. However, this focus does not carry over neatly into the non-extractive sector. Thus, what I have done here is articulate the link within capitalism which can explain the aligned negative outcomes wrought by both non-extractive and extractive forms of development. If researchers are focusing on extraction, the concepts discussed by both Freudenburg (1992) and Bunker (2003) are essential.

Finally, it is important to acknowledge that while the presented theory operates at the level of the community, the negative impacts of dual dependence are not felt equally throughout the population. The United States is a nation full of inequality (Bailey et al., 2017; Bell and Owens-Young, 2020; Chetty et al., 2014; Lobao, 2016; Manduca, 2019; Williams, 2017). While this inequality falls along the spatial lines of rural and urban discussed here, it is more pronounced along lines of race, gender, ethnicity, and class. As discussed by Dunaway (2001), to ignore these persistent inequalities in a discussion of world or national systems is to erase the ways that women and members of traditionally oppressed groups are forced to subsidize the capitalist system in exploitative ways; thus ignoring a primary mechanism by which the exploitative pathways of capitalism are reproduced—the production of people.

As rural economies transition to non-extractive resource dependence, the majority of jobs switch from historically male-dominant physical-labor jobs to historically female-dominated jobs in service sectors. As previous research has shown that this switch does not necessarily correspond to a reduction in work at home and time caring for children (Sherman, 2009a), this dependence will likely have more pronounced effects on women than men. Similarly, although the picture of American rurality is often one of white families, this has never really been true and becomes less so every year (Lichter, 2012). A segment of society of particular concern in the case of natural resource dependence are American Indians, as they have often had to face, and continue to face, the lion's share of the 'development' of the United States. The negative outcomes I have discussed here are likely be felt first, and strongest, by those at the margins of society. In rural areas, this likely means exacerbated inequality as it relates to women, people of color, American Indians, and sexual minorities. Importantly, it is at the intersections of these historically oppressed groups that the negative impacts of natural resource dependence is likely felt the most (Collins, 2015).

2.6 The Path Forward

The theory I have presented is notably pessimistic. Therefore, a brief discussion of the path forward seems prudent. First, while it seems unlikely the first form of dependency, that of the global capitalist economy, will be significantly altered without a radical transformation of global society and the relationship between capital and the state, there are clear steps that could be taken within the existing system. The theory I have presented is rooted in the notion that it is simply too easy for external forces such as transnational corporations to influence rural economies in the United States. Thus, rural communities, however heterogeneous their internal viewpoints may be, need more power in determining their own future. This is not to say that wholesale devolution of the management of natural resources to the local communities would be wise. This is for two reasons. First, it is likely rural communities simply do not have the capacity to effectively manage parcels of land the size of most natural resource holdings in the United States. Second, without a fundamental change in the way capital flows easily across state and local boundaries in the United States, any devolution of power would likely still be captured by external interests and local elites. However, in this case it would be an even worse situation with far less oversight than in the case of the state or federal government. So what is to be done?

Regarding the first form of dependency I will present three ideas that would likely need to be pursued in tandem, of which I am sure there are many more: First, direct and meaningful inclusion of local residents, and not just the elites and landowners, in decision making regarding the direction of rural local economies appears essential. Procedural justice is a fundamental tenet of environmental justice (Brulle and Pellow, 2006), and it must be ensured in the rural setting. Therefore, rural communities need legal mechanisms providing them with the power to say no to certain forms of development, even if the resource use is occurring on private land. One avenue this could occur through is strong zoning policies. The restriction of what can be done with private land is not a new phenomenon, as zoning and city planning are already common in urban, and many rural, areas. Expanding this form of local control in rural America may be necessary if communities are to reduce dependency on extra-local interests.

Second, it is time for the federal government to begin enforcing and strengthening the long-declining antitrust regulations. One of the key outcomes of the articulated theory is undiverse and oligopsonistic labor markets in the dependent region. It is expected there will not only be few industries in a dependent region, but also few firms within those industries due to the necessary economies of scale to compete in the sectors and the increased market concentration which has developed in the broader economy (Azar et al., 2017). Market over-concentration not only prevents competition and leads to market failure, it also exacerbates extra-local control due to the reduction of small locally-based independent companies (Mitchell, 2016). Due to the "Dormant Commerce Clause" in the United States Constitution, states are not allowed to think like nations when it comes to their economies, meaning they are not allowed to prevent the entrance and domination of interstate capitalist interests. However, if capital is being generated within a state in rural resource dependent communities, and that capital is leaving the state across its highly permeable boundaries, this impacts more than just rural residents and ultimately impacts the national economy. While states cannot enact specific policies to prevent this form of behavior, the federal government can do that for them, with the chief option being strong antitrust policies preventing mega-corporations and prioritizing fair and open markets dominated by smaller independent businesses. Further pursuit of market efficiency, as has been the objective in past decades, seems likely to only increase the growing inequality between urban and rural America.

Third, although somewhat limited by the United States Constitution, states need to take action to protect their rural communities where they can. Although the specific policies will likely vary by context, the two clear options involve either an ownership rule, wherein the state requires companies within its boundaries have certain types of ownership—similar to North Dakota's requirement that all pharmacies be owned and operated by a licensed North Dakota pharmacist (Mitchell, 2016)—or progressive taxation of natural resource sectors. Importantly, if taxes are implemented, their revenues need to be reinvested where they are generated, in both rural infrastructure and job creation—which if done well would flow hand in hand. If states engage in this form of taxation, but simply send all revenue to the core cities within the state, then this effort would be pointless for rural America.

The three suggestions I have presented are related to the first form of dependency, but what is to be done about the second form? Alas there is no silver bullet, nor a panacea. Rural resource dependent communities in the United States are in between a rock and a hard place. On the one hand they need to break their dependence on the resource base to allow for more sustainable and diverse economic development, but at the same time I acknowledge that the resource base is generally their only 'comparative advantage' in the national and global economy. Therefore, a delicate balancing act must be reached. The solutions suggested, such as more intentional and just planning, or increased antitrust policy, may make that balancing act possible. What is needed is intentional planning, procedural justice, and attention to the actual interests of rural communities, not the interests assumed by those seeking to foster either extractive or non-extractive natural resource related economic development.

The power of extractive industries in rural communities, as outlined here, has been an issue of concern of social scientists for a long time (Humphrey et al., 1993; Freudenburg, 1992; Krannich et al., 2014). However, the power of the outdoor recreation and tourism industries and other 'environmental interests' in rural communities is of growing concern. The outdoor recreation industry has increasingly advocated for large scale environmental preservation while gaining offices and lobbying power in governors offices throughout the United States (Outdoor Industry Association, 2018). When we consider that these efforts largely serve to increase both the awareness of outdoor recreation among the public, as well as setting aside additional land where Americans may use the products the industry is selling, it is clear that these efforts may not be as purely environmental and magnanimous as often perceived.

The apparent 'good' of environmental protection makes critiquing these initiatives uncomfortable for many scholars and activists. However, as discussed 25 years ago by Humphrey et al. (1993), the moral exclusion of those who live in rural areas by environmental interests only masks and exacerbates issues of rural poverty. We cannot ignore the negative economic costs that environmental protection and non-extractive natural resource related development have on rural communities simply because rural communities have often extracted from, and desire to continue extracting from, their resource rich local environment for economic growth. In fact, as outlined above, it is often the only option with which they have been presented. For external interests—which are often located in core regions—to critique rural natural resource dependent areas for their environmental damage, from which the core regions have expressly benefited and structurally perpetuated, represents a form of victim blaming at a level worthy of critique. As America continues shifting towards an 'experience economy' (Pine et al., 1998), researchers and activists need to continue advocating for the interests of rural people and places if we are to avoid further alienation of the rural segments of American society. Relegating the rural landscapes of America as preserves for outdoor recreation and tourism for the elite will only perpetuate, and likely exacerbate, the problems of dual dependency I have discussed in this article.

I will close with a brief outline for future development and testing of this theory. First, the arguments outlined in this theory, and particularly in Section 2.5.5, allow for empirical examination. Research should use longitudinal data to document the empirical impact of natural resource-related economic development on rural communities in the United States, particularly since the most recent neoliberal turn in the early 1980's (Harvey, 2007). Beyond testing simply the direct relationship between natural resource dependence and economic deprivation, research should also test the proximate causes such as gender, education, local elite power, market concentration, and market diversity outlined in Figure 2.1. The model presented in Figure 2.1, while conceptual in nature, does represent a path diagram with clearly defined relationships. Thus, future research should further develop this model and apply techniques such as structural equation modeling to validate these pathways and mechanisms. An important first step is an investigation into the level of extra-local investment in rural resource dependent communities appears necessary. This will likely require access to restricted data, but will be crucial for determining the primary mechanisms and causes of the negative effects of natural resource dependence.

Moving beyond simple economic deprivation, I have presented this theory with primary outcomes of economic development and prosperity, but it likely has strong carryover to other forms of well-being. Economic deprivation is a strong social determinant of health (Bailey et al., 2017; Marmot, 2005), and future research and theory should extend this work to matters of morbidity and mortality. This notion has been supported by recent work from the resource curse tradition suggesting resource endowment is related to higher rates of child mortality (Wigley, 2017). Additionally, this article provides a middle-range theory of natural resource dependence in the United States, but it likely has carryover to international contexts. In many ways, this theory is a framework of subnational patterns of uneven development as they relate to natural resources. Thus, much of this perspective likely applies to other nations. Researchers familiar with other countries and their subnational contexts should apply this perspective to test its generalizability.

Finally, although this framework addresses economic dependence upon natural resources, it does not address the differential environmental impacts wrought by extractive or non-extractive natural resource dependence. There is a large and growing body of work translating economically unequal exchange between the core and the periphery to the unequal ecological exchange occuring along the same networks (Givens et al., 2019; Jorgenson, 2012, 2016). Future work linking the framework of dual dependency to environmental impacts will be vital for linking the economic and environmental impacts of extractive and non-extractive natural resource dependence.

Chapter 3 The Impact of Natural Resource Dependence on Rural American Economic Prosperity from 2000-2015

3.1 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 this hypothesis within the United States have been more limited. Further, this research has generally focused on impacts to aggregate income growth and ignored the distribution of income throughout society, preventing a broad consideration of economic prosperity.[1]

Research investigating the role of natural resources in economic development has almost exclusively focused on extractive forms of natural resource development such as oil and gas, mining, and timber.[2] This focus has resulted in a lack of attention to non-extractive

[1]For exceptions see Betz et al. (2015), Deller and Schreiber (2012), Lobao et al. (2016), and Weber (2012).

[2]In this analysis I did not treat agriculture as a form of extractive natural resource development. This decision drew from the different temporal time-frame associated with agricultural yields compared to natural

forms of natural resource development such as tourism, outdoor recreation, real estate, and amenity development. Within the United States—the subject of this study—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, tourism and other forms of service-based non-extractive natural resource development have continued to grow (English et al., 2000; Green, 2017; Thiede and Slack, 2017). For illustration, drawing on the data I use for 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 represented at least three times as much of rural employment from the beginning to the end of the 15-year period.

While a significant body of research assessing the various impacts of amenity and natural resource based tourism both globally and within the United States exists (Deller et al., 2001; Deller, 2010; Kim et al., 2005; Sherman, 2018; Winkler et al., 2012), there is a notable lack of research considering both extractive and non-extractive natural resource development in tandem. This limits the comparison of the relative impacts on economic prosperity of these two arguably competing forms of resource use and economic development. This lack of available comparative analysis is increasingly relevant during an era when much of rural America seems to be faced with the choice between re-entrenching traditional forms of extractive industries (i.e., "bringing back coal") and newer forms of natural resource-based development, from renewable energy to amenity-based tourism (Green, 2017; Sherman, 2018).

Rural America finds itself in an era where sustainable economic development is especially needed. At the same time that extractive and non-extractive development increased their employment share in rural America, manufacturing in the rural counties of the United States declined, with the average share of county employment dropping from 11.30% in 2000 to 8.37% in 2015. Thus, rigorous theoretical and empirical analyses of non-manufacturing forms of

resources, the different trajectory of agriculture in America relative to the other forms of resource development due to the prominence of family ownership of farms (Mann and Dickinson, 1978), the distinctions drawn by rural communities between agricultural and other forms of resource development (Freudenburg and Gramling, 1994), the tendency in the academic literature to treat agriculture and natural resources separately (Freudenburg and Gramling, 1994; Krannich et al., 2014), and the domesticated nature of agriculture relative to other natural resources such as fossil fuels, timber, and amenity-rich landscapes.

development, such as extractive and non-extractive natural resource development, are 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 impact of both extractive and non-extractive natural resource development on 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.

3.2 Theoretical Framework

This analysis tests the resource curse hypothesis in the rural counties of the contiguous United States from 2000 to 2015 while also directly testing the hypotheses suggested by the theoretical framework of dual-dependency articulated by Mueller (2019b). 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. Although a comprehensive review of each relevant research tradition is beyond the scope of this paper, summaries of the perspectives, as well as a summary of the theory and relevant hypotheses are provided.

3.2.1 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 vary, and some perspectives—for example the over-valuation of a national currency (Matsuyama, 1992)—are less relevant to subnational considerations.

A dominant perspective relevant to the subnational scale is that investment in natural resource extraction crowds out the manufacturing sector (Sachs and Warner, 1995). This crowding out leads resource rich areas to fall behind regions with higher levels of manufacturing for two main reasons: First, resource rich areas do not incur the same learning-by-doing effects as the manufacturing sector, meaning that areas with manufacturing increase their economic productivity over time by simply participating in manufacturing over a longer period, allowing marginal increases in efficiency to occur (Matsuyama, 1992). Second, both Sachs and Warner (1995) and Gylfason (2001) highlight the role that education plays in this relationship. Returns to education are higher in the manufacturing sector; therefore, within a resource rich economy there is less incentive to pursue education. This results in a less educated population, which inhibits increases in economic growth (Gylfason, 2001).

Two alternative, but related, explanations for the resource curse are rent-seeking and the quality of institutions (Frankel, 2012; Havranek et al., 2016; Gylfason, 2001). Rent-seeking represents the tendency for producers to accumulate increased wealth by manipulating the political and social environment they inhabit through tariff protection, tax breaks, and outright corruption (Gylfason, 2001). The success of rent-seeking relies on the quality of institutions within the resource rich economy, where historically institutions have not been strong. However, poor institutions have been positioned as both a cause and consequence of the resource curse, with the direction of the relationship likely varying by context (Brunnschweiler and Bulte, 2008; Frankel, 2012; Havranek et al., 2016). Two final, and related, explanations for the resource curse include over-confidence in the longevity of the resource base and markets (Gylfason, 2001), as well as the volatility of extractive commodity markets (Frankel, 2012). In this framework, governments become over-confident in the future of the resource markets, and as these markets are frequently prone to booms and busts, the ultimate growth of the local or regional economy is hindered (Gylfason, 2001; Frankel, 2012).

It is important to acknowledge that, at the level of nation-states, findings regarding the existence of the resource curse are mixed. In a recent meta-analysis conducted by Havranek et al. (2016) on 43 econometric studies, 40% of studies supported the resource curse, 40% found no relationship, and 20% refuted the resource curse hypothesis. Within the United States, results have also reported mixed findings, with some studies supporting subnational resource curse effects (James and Aadland, 2011; Papyrakis and Gerlagh, 2007), some refuting subnational resource curse effects (Allcott and Keniston, 2017), and others reporting mixed findings dependent on outcome variable and type of natural resource development (Deller, 2014; Deller and Schreiber, 2012; Lobao et al., 2016; Weber, 2012).

3.2.2 Natural Resource Dependence

While findings regarding the resource curse have been contested, the resource dependence literature from rural sociology has been more consistent in its findings. Generally using measures such as poverty and unemployment as their outcome variables, rural 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). Unlike the nation-state focus common in the resource curse literature, this research has generally focused on specific regions or communities, with fewer large-scale national, or subnational, analyses (Deller and Schreiber, 2012; Lobao et al., 2016). 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. Researchers have often viewed a region as dependent if 20% of local employment or income was associated with the extractive natural resource sector, although 10% has also been used (Beale and Johnson, 1998; Bender et al., 1985; Stedman et al., 2005). However, neither of these thresholds appear to have any empirical backing, suggesting further research is need to determine where dependence actually develops.

Research on resource dependence has historically focused on mining more than other forms of extraction such as timber or oil and gas. In a meta-analysis from 2002, Freudenburg and Wilson explored impacts of mining on economic prosperity and found the majority of research reported negative outcomes for poverty and unemployment, but positive outcomes for income. Their results highlight the importance of considering multiple indicators of economic prosperity when evaluating the impacts extractive natural resource development has on communities. Recent studies on resource dependence and economic outcomes have found mixed evidence for the hypothesized negative effects of resource dependence. Perdue and Pavela (2012) tested the impacts of mining in West Virginia from 1997 and 2012 using a fixed effects framework and found that the presence of all forms of mining were associated with higher county-level poverty and unemployment in West Virginia. Drawing on both the resource curse and resource dependence, Lobao et al. (2016) tested the impact of coal mining at the county level in both Appalachia and across the United States on poverty and employment from 1990 to 2010. When considering the entire United States, they found higher coal development was associated with lower income and higher poverty from 1990 to 2000, but had a positive association with economic prosperity for the 2000 to 2010 decade.

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 (2019b) for a full review), those relevant to the theoretical framework of this paper will be discussed here. First, similar to the resource curse perspective (Gylfason, 2001), Humphrey et al. (1993) discussed the under-investment in human capital, at both the individual and community level, that occurs in resource dependent communities due to limited returns to education. Importantly, Humphrey et al. (1993) viewed this as a rational decision, and not the result of over-confidence. In resource dependent economies, there simply is not a large enough return on the costs of education to warrant the investment due to the lack of employment opportunities for those with an education.

A second pathway from dependence to deprivation is the role of power, domination, and natural resource bureaucracy (Humphrey et al., 1993; West, 1994), which relates to the perspective of rent-seeking and poor institutions discussed in the resource curse literature (Gylfason, 2001; Frankel, 2012). Decisions regarding how a local resource base is used, and who profits off that use, are made by those who control the resource base—often either government bureaucracies, local elites, or large-scale transnational capitalists. Through manipulation of the political system and natural resource bureaucracies by capitalist interests, the resource base is used in a way outside of the best interest of local residents, leading to increased deprivation (West, 1994).

Finally, the perspectives of internal colonialism (Peluso et al., 1994), dependency theory (Humphrey et al., 1993), and world systems (Bunker, 2003), which are central to the framework of dual-dependency presented by Mueller (2019b), help to explain how rural communities continue to be exploited by extra-local interests. Although the language used by the perspectives varies, the core concepts are the same. In the view of internal colonialism, regions such as Appalachia are relegated to the status of an internal colony and kept in an underdeveloped state by both external interests and local elites so as to facilitate both cheaper resources for the rest of the country as well as profits for those in power (Tickamyer and Patel-Campillo, 2016). In the related frame of dependency theory and world systems, rural resource dependent communities 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 resources (Bunker, 2003; Franke, 2007:1969; Humphrey et al., 1993; Wallerstein, 2015:1979).

Bunker (2003) made significant developments to theory surrounding natural resources and the world system by highlighting the importance of space and matter in natural resource dependence. Drawing on years of work in the Brazilian Amazon, Bunker (2003) argued there is inherent conflict in the current economic system between increasing economies of scale and the distance goods must travel for production. Economies of scale are put in place to maximize profit, but the further commodities must be transported the more production costs. This conflict has resulted in the increased technological and spatial expansion of economies in pursuit of more resources, domesticated and synthetic substitutes of natural resources, and cheaper terms of trade. In the process of expansion, both the commodity and the investment in extractive specialization made by the peripheral region are devalued, leading to the underdevelopment of the region and economic hardship. Beyond the importance of space in natural resource markets, Bunker (2003) also argued for the importance of matter, meaning the physical properties of the resource being extracted. Bunker (2003) argued that to understand the pathways and processes of underdevelopment in a region we must take into account the specific physical properties and considerations imposed by the resource being extracted.

3.2.3 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 (e.g. 5.81% in non-extractive and 1.90% in extractive for 2015). As non-extractive development represents a competing, and possibly alternative, use of the resource rich local environment to extraction, 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 underdeveloped and 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).

3.2.4 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 (2019b), 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. A summary of this perspective, followed by the relevant testable hypotheses, is presented here. The theory 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: the first between the periphery and the core, and the second between the periphery and its resource base.

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. It is inappropriate to discuss rural economies as though they are separate from the national economy. The rural economy, insofar as it exists, is fully nested and incorporated within the national and global system (Franke, 2007:1969; Sklair, 2002, 2007).

Within this system, rural areas in the United States are 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 resources. This, in a similar vein as internal colonialism (Tickamyer and Patel-Campillo, 2016), 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. These extra-local interests are comprised of members of the transnational capitalist class (Sklair, 2002)—a global power elite who direct the flow of capital across the world with little concern for national borders (Sklair, 2012)—who work in concert with the cooperating local power elite to reproduce patterns of poverty and uneven development. This phenomenon of uneven development, which is an expected outcome of capitalism generally (Harvey, 2018:1982), is argued by Mueller (2019b) to be exacerbated at the subnational scale due to the ease with which capital moves across the United States.

Importantly, exploitation in this instance occurs from the standpoint of both classical Marxism and unequal exchange. The local capitalists within these peripheral regions, in concert with external investors, generate surplus value off of local labor and thus form the exploitive relationship between labor and the capitalist at the point of production invoked by classical Marxism (Marx, 1990:1867). However, overlaid on top of these localized patterns of exploitation are the exploitive unequal exchange relationships hallmarked by both dependency and world systems theory, wherein the core regions drain capital generated in the periphery through unequal terms of trade (Franke, 2007:1969; Wallerstein, 2015:1979). These patterns of exploitation are expected throughout the entire country, regardless of the presence of natural resources. However, Mueller (2019b) argues these patterns are exacerbated when the peripheral rural region develops dependency not only upon the broader capitalist system, but also upon the local resource base. Mueller (2019b) argues that natural resource dependence represents a special case of the core-periphery relationship, wherein the resource rich local environment fosters specific forms, and higher levels, of exploitation by both local capitalists and extra-local interests than would be expected in localities with fewer natural resources.

The ultimate cause of the compounding negative economic impacts due to the formation of dual dependency is the contradiction between the spatially fixed nature of natural resources and the spatially unbound nature of capital. In other industrial sectors, as the rate of profit falls capitalists move their investment to a more profitable location (Smith, 1984, 2011a). 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 and ultimately results in investment remaining in place and maximizing the rate of profit for the longest possible period of time. The strategies required to keep the rate of profit high in these peripheral regions are what create the negative impacts of resource dependence relative to other sectors. 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. Examples of these include many of the mechanisms discussed in the resource curse and resource dependence literature such as the exclusion of other sectors and the prevention of agglomeration (Billings and Blee, 2000; Duncan, 2014; Sachs and Warner, 1995), rent-seeking and capture of the natural resource bureaucracy (Bunker, 2003; Frankel, 2012; Gylfason, 2001; Humphrey et al., 1993; West, 1994), the recruitment of local elites to maintain power (Bunker, 2003; Duncan, 2014), heightened exploitation of local labor (Bunker, 2003; Humphrey et al., 1993), and identity subversion of local residents (Bell and York, 2010), among others. 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, (Mueller, 2019b) argues that in the United States it is far easier for capital to pursue the strategies listed above and foster the dual dependencies hallmark of natural resource dependence.

Under this framework, Mueller (2019b) argues that high levels of both extractive and non-extractive forms of natural resource development will foster similarly negative outcomes, thus highlighting the importance of considering both types of resource use in tandem. These mutual 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 free-flowing capital. 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. 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. In addition to the desire for a captive and cheap labor force shared by all industrial capitalists (Harvey, 2018:1982), extractive and non-extractive interests require continued access to a static resource base and a steady rate of profit off of the spatially fixed resource.

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 rustic character. Thus, a place with diverse and broad-based development is unlikely to have rural tourism development to begin with. 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).

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 very 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, suggesting a curvilinear relationship between development and economic prosperity.

This non-linearity is expected because dependence intimates a threshold at which impacts will become negative, or where overspecialization will occur. This means that for small levels of natural resource development, the negative impacts on economic prosperity are expected to be small, if not positive. Drawing on this, an increase in the extractive share of employment of 1% to 2% is expected to have a different impact than an increase from 11% to 12%. This expected non-linear relationship is hypothesized to represent a curve where low levels of specialization are associated with increased economic prosperity, but the relationship tapers across the range of specialization and eventually becomes negative. The use of non-linear hypotheses allows for the testing of dependence while avoiding the use of an arbitrary threshold, as has occurred in prior research (Elo and Beale, 1985; Bender et al., 1985; Stedman et al., 2005). These non-linear hypotheses also more appropriately ground the testing of dependency 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 impacts of high levels of natural resource development on 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, 2019b) 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. It is expected that the need to 'double-down' to ensure steady rates of profit by the natural resource sectors leads to local over-specialization in the sector of natural resources (e.g. natural resource dependence) and thus the patterns of dual dependency that are hallmarks of this general state. Due to the activities capital must pursue to keep profits high, this dual dependency leads to the creation of localized oligopsony (i.e. a small number of local employers), prevents successful agglomeration (i.e. the growth of the local economy due to the concentration of firms), limits investment in human capital, and ultimately fosters inequitable, or non-existent, economic growth (Mueller, 2019b). Many of the specific pathways between high levels of specialization in natural resources and economic outcomes are the same pathways discussed by the resource curse and resource dependence literatures, with a notable exception being the emphasis Mueller (2019b) places on market diversity and oligopsony. Regarding market diversity and oligopsony, high levels of market concentration (e.g. few hiring firms in a given market) are known to suppress wages, negatively impact laborers, and foster rent-seeking behavior (Naidu et al., 2018). Rural economies are already prone to high levels of market concentration, resulting in oligopsony (Azar et al., 2017), however, this problem is expected to be even more severe in natural resource dependent areas because of the low levels of market diversity, meaning the number of industries in the labor market, and the misaligned incentives between extra-local capitalist interests and real local economic growth (Mueller, 2019b).

Mueller (2019b) outlined how the formation of dual dependency is expected to negatively impact three indicators of local economic prosperity: income growth, local income inequality, and poverty. Beyond the ultimate cause of the the spatial contradiction, Mueller (2019b) posits four proximate causal mechanisms for why a region dependent on natural resources should expect lower and slower income growth: (1) the rational under-investment in human capital as discussed by Humphrey et al. (1993) and Gylfason (2001), (2) the crowding out of growth in other sectors such as manufacturing, (3) the undiverse and oligopsonistic nature of rural natural resource dependent economies, (4) and 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). As stated, these negative effects are not expected to accrue until over-specialization occurs.

In addition, per capita income is expected to decrease due to the gendered nature of employment within the natural resource sectors, where extractive labor is masculinized and non-extractive labor is feminized (Sherman, 2009b). While this gendered divide is undesirable, its presence cannot be overlooked. As discussed by Sherman (2009b) in her ethnographic study of former logging towns in the western United States, this gendered structure of employment creates a divide between 'men's work' and 'women's work.' If a county is dependent on extractive forms of natural resource development, women will be more likely to not draw an income and take care of children and do housework, even if finding a job would raise the household standard of living (Sherman, 2009b). Alternatively, a similar situation should be expected for a non-extractive dependent county. In a non-extractive natural resource dependent area, most of the available work is likely to be 'women's work' in the service industry, which men may not view as jobs they can actually take due to restrictive gender norms. While this may cause men to take on increased work at home (Sherman, 2009a), per capita income will still be depressed. From this, the hypothesis for income is:

> 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 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.

Inequality is expected to increase at high levels of natural resource development due to the ultimate cause of the spatial contradiction outlined prior, as well as the proximate cause of the undiverse oligopsonistic labor market. Additionally, it is is largely expected to increase due to the actions of local elites. Within the framework of dual dependency, local elites are expected to capture what local economic growth does exist and foster increased local inequality. Local elites in rural areas facilitate rent-seeking behavior by extra-local interests and encourage the exploitation of poorer residents along lines of class and race (Billings and Blee, 2000; Duncan, 2014). In the case of non-extractive development, increased inequality will also be expected due to the new wealthy residents drawn into an area for natural amenities (Sherman, 2018; Ulrich-Schad and Qin, 2018). Here, we can expect rural gentrification and increases in the low-quality, and often seasonal, work available in the non-extractive sector to make it so poorer residents will struggle to prosper relative to the newer in-migrants; increasing local income inequality. Once again, these negative impacts are expected to accrue once over-specialization occurs. Thus, the hypothesis regarding inequality is:

> Hypothesis 3: The county-level share of employment in extractive and non-extractive natural resource industries had a non-linear direct relationship with local income inequality, measured as the Gini Index, in rural counties in the United States from 2000-2015. While the relationship may have been negative for low levels of employment share, the relationship will be positive at higher levels of employment share.

Finally, we can expect poverty to increase at high levels of natural resource development due to the spatial contradiction, the actions of local elites which will reproduce and heighten existing patterns of material hardship, and the five proximate reasons income growth is expected to stagnate: (1) the rational under-investment in human capital as discussed by Humphrey et al. (1993) and Gylfason (2001), (2) the crowding out of other sectors such as manufacturing, (3) the undiverse and oligopsonistic nature of rural natural resource dependent economies, (4) the insecure and low-quality nature of jobs in the extractive and non-extractive sectors, and (5) the gendered labor markets of natural resources. Additionally, as with the other variables, these negative impacts are expected to develop once over-specialization is reached. The hypothesis concerning poverty is:

> Hypothesis 4: The county-level share of employment in extractive and non-extractive natural resource industries had a non-linear direct relationship with poverty in rural counties in the United States from 2000-2015. While the relationship between employment share and poverty may be negative at low levels of employment share, the relationship will be positive at higher levels.

3.3 Methods

3.3.1 Data

The data used for this analysis represents all counties in the contiguous United States for the years of 2000, 2010, and 2015 and comes from five sources: the Decennial United States Census, the American Community Survey (ACS), the Bureau of Economic Analysis (BEA) Local Area Personal Income and Employment data, Wholedata: Unsupressed County Business Patterns Data from the Upjohn Institute, and the Office of Management and Budget (OMB) metropolitan classifications. 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)). The 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).

The 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). BEA data were used to calculate both per capita income to residents and employment shares. The OMB metro classifications, discussed in greater detail in Section 3.3.6, were used to determine metro and non-metro status.

The period from 2000 to 2015 is the longest possible time period of analysis that can be conducted while using unsuppressed industry employment data. A major limitation of prior 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 a novel data product, called 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 heirarchical nature of the data to identify the smallest possible range of suppressed values and then iteratively estimating the point estimates by satisfying millions of constraints imposed by other values. This results in significantly reduced uncertainty of point estimates (Isserman and Westervelt, 2006). Data are harmonized to the 2012 North American Industry Classification System standard (NAICS) and available to the six-digit NAICS code, allowing for a more detailed analysis than any publicly available data such as the raw County Business Patterns or BEA data allows. Research that does not utilize recovered data, especially on rural areas, is likely to have severe bias, as the census bureau often reports suppressed data as 0, and upwards of two-thirds of employment statistics are often suppressed at the highest level of NAICS detail (Isserman and Westervelt, 2006).[3] As County Business Patterns data only reports total private non-farm employment, overall employment totals used in the denominator of employment shares were extracted from the BEA.

To ensure consistent geographic units, counties that changed boundaries during the study period were collapsed into larger time-consistent geographic areas. Similarly, before releasing estimates the BEA collapsed a number of Virginia cities, for these cases the other datasets were similarly collapsed.[4] To facilitate spatial econometric analysis, the county-level shapefile from IPUMS-NHGIS was used (Manson et al., 2017). Boundaries were also collapsed within the shapefile to ensure appropriate inference. Additionally, data from three island counties were merged into their nearest inland neighbor to allow for the creation of a contiguity spatial-weights matrix. A description of all county boundary adjustments is provided in Appendix A (Table A.1).

[3]As an illustration, the BEA local employment data, which provides information on county-level employment by industry drawing on multiple data sources (Bureau of Economic Analysis, 2019), is heavily suppressed. For the year of 2015, data for 43.5% (1,345) of counties for the sector of Mining, Quarrying, and Oil and Gas Extraction, 21.5% (663) of counties for the sector of Accommodation and Food Services, and 21.5% (665) of counties for the sector of Arts, Entertainment, and Recreation were suppressed. This suppression is at the sector, or two-digit NAICS, level. Data at a higher level of specificity is not available for any county. This is compared to Wholedata, where the dataset is complete and estimates are available down to the six-digit NAICS level.

[4]Virginia, unlike other states, has independent cities which operate outside of the broader county government. Due to data availability and privacy concerns, some of the Virginia cities were collapsed into their encompassing county in the BEA data but others were kept independent. However, data from IPUMS-NHGIS did not follow the exact same scheme. Thus, it was necessary to make all datasets match the most collapsed dataset, which was that of the BEA.

3.3.2 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). This value adjusts reported income so that the reported value reflects income earned to residents of a county, regardless of where that income was earned and does not reflect income within a county earned by non-residents. This value more appropriately captures the income experienced by those living in a locality, and removes the effect of non-residents traveling to earn income in a booming region. 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 coefficient. The Gini coefficient is a value that ranges from 0 to 1 and represents the level of income inequality within a population. Where 0 represents perfect equality, meaning everyone has the same income, and 1 represents perfect inequality, meaning all income goes to only one person (Dorfman, 1979). Ideally the Gini coefficient would be calculated using full information on annual income of residents. However, population income is generally available only 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), which has been shown to produce valid estimates of the Gini coefficient from binned income. To improve regression coefficient interpretation, the Gini coefficient has been scaled into a Gini Index by multiplying it by 100. This means that 0 represents perfect equality and 100 represents perfect inequality.

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 official poverty measure of the United States is an absolute income threshold based upon the estimated cost of the minimum resources needed for a family of a given size to make ends meet (Iceland, 2013). The income threshold for each family size is constant across the entire United States and all pre-tax cash income, including government transfers, is counted when determining poverty status. Non-cash transfers such as SNAP, subsidized housing, or the EITC are not counted as income within this measure (Jensen and Ely, 2017). The official poverty measure is regularly adjusted for inflation, but no other changes are made from year to year. The poverty rate in this analysis was created by dividing the number of persons for whom poverty was determined, as reported by NHGIS, by the total county population multiplied by 100.

3.3.3 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. As the employment share is meant to represent the relative level of development of the natural resource sector within a county, it was important to use an indicator of development which captured the total level of specialization within a county.

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 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). Importantly, this definition implicitly assumes that rural tourism, real estate, and recreation related industries rely on, and utilize, the local resource base for their natural amenities. Using these industries and assuming the natural amenities are playing a role in their development is similar to prior research (English et al., 2000; Johnson and Beale, 2002; Winkler et al., 2012) and highly similar to the methods used to develop the recreation dependence classification of the USDA Economic Research Service (Johnson and Beale, 2002). Thus, while this assumption is common, it must be acknowledged as it assumes all non-metropolitan tourism, recreation, accommodation, or real estate development is at least functionally related to the local environment, even if only as it relates to the landscape. Non-extractive employment share was calculated by dividing the number of employees in extractive industries by the total number of employees within a county and multiplying by 100.

3.3.4 Time-variant Control Variables

Although the use of unit and period fixed effects, as will be discussed in the Section 3.3.7.1, 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. I control for five possible confounding variables utilized in similar studies (James and Aadland, 2011; Lobao et al., 2016) which the literature suggests are likely 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 white, portion of the population that is Black, and portion of the population that is Hispanic.

Although an in-depth discussion of all causal pathways is outside the scope of this paper, in short: counties increasing in overall population are likely to have lower extraction and higher economic prosperity (Johnson and Lichter, 2019); counties with an increasing proportion of elderly residents can either represent population aging leading to decreased economic growth (Thiede et al., 2017), or represent elderly migration into retirement communities—increasing non-extractive development and economic growth (Poudyal et al., 2008); counties with increasing Black, or decreasing white population proportions are likely to see increased exploitation and lower economic prosperity due to structural racism in American society (Harvey, 2017; Duncan, 2014), and counties with increasing Hispanic populations, generally through immigration, are more likely to have extractive and non-extractive development, as well as lower incomes, higher inequality, and higher 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, 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 3.2.4, 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, and the increase of 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).

Additional attention is warranted related to manufacturing employment share and unemployment rates. 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. Thus, it could be argued that these two variables represent time-varying confounders. However, within the framework of dual dependency guiding this study, these variables are also expected to function as downstream mechanisms. Thus, the role of manufacturing and unemployment could be argued to play a dual role as a possible confounder and as a downstream effect, 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 3.4.2.

3.3.5 Geography of Variables

In this analysis the majority of variables use place of residence, as opposed to place of work, as their geographic grounding. This means that the dependent variables—per capita income, inequality, and poverty—and the time-variant controls–total population and portion of population which is white, Black, Hispanic, and over 65–are anchored in the place where people live. This decision was made to ensure that the analysis is in-line with the theory being tested. The framework tested here argues that extractive and non-extractive forms of natural resource development will have a non-linear relationship with the economic prosperity of those residing within a county. If outcome variables were anchored by place of work (e.g. per capita income to workers in a county), I would risk masking the impact of development on outcomes. For example, those traveling into a county for work due to an increase in development would be able to earn income that would be counted as income earned in the county, but that income would leave with the worker and not benefit local residents.

Although the majority of variables are anchored by place of residence, the independent variables of interest are instead anchored by place of work. This means that I capture the total share of all county employment in a sector, regardless of where that worker lives. This choice was made to ensure that the independent variables of interest are valid operationalizations of the level of development within a county. To ensure that the impact of natural resource development on local residents is fully captured, it is essential to account for the full extent of that development in a county. Non-local workers change the labor market of a county in a number of ways related to the mechanisms described in Section 3.2.4 and not accounting for their presence would bias results. Further, the employment share is an indicator of natural resource development, it is not just the employment share *per se* which raises or lowers economic prosperity, but rather what that employment share represents and the mechanisms it flows through identified in Section 3.2.4. Thus, the use of aggregate independent variables anchored by place of work and aggregate outcome variables anchored by place of residence allows me to test the impact of the level of development in a county on the economic prosperity of local residents within that county.

It should be noted that the time-variant control variables are also anchored by place of residence, as opposed to place of work. This decision was made due to the expected pathways of confounding outlined above, which focus on how changes to the population of a county will impact changes in both the level of development and economic prosperity. Further, the spatial econometric approach used in this analysis adjusts for the indirect effect of changes in neighboring populations on economic outcomes within the county. This spatial econometric approach, although a sufficient way to account for the indirect effects of time-variant control variables, would not have been sufficient for the independent variables of interest due to the need to know exactly where employees work for estimating the direct effect of natural resource development on economic outcomes to residents.

3.3.6 Rural Indicator

The focus of this analysis is on rural outcomes. Additionally, the assumptions regarding the accommodation and real estate industries and their reliance upon the local environment are unlikely to hold for metropolitan areas, as there are many more non-natural resource based amenities. As such, the impact of natural resource development on rural communities is isolated using an interaction technique described in Section 3.3.7.3. To determine whether a county was rural or not I use a classification that is common, albeit at times contested in the literature (Isserman, 2005). I rely on the OMB county classifications of metropolitan and non-metropolitan and define rural counties as those classified as non-metropolitan. For the 2000 census the OMB classified a county as metropolitan if it was a county of any population size located within an identified metropolitan statistical area (Office of Management and Budget, 2010). Counties are included in metropolitan statistical areas if they either have a core urban area with at least 50,000 people or are connected to another metropolitan county by at least 25% of commuting. Counties are classified as non-metropolitan if they were anything else. This means that non-metropolitan counties are comprised of different levels of population density ranging from open countryside with urban population of less than 2,500, up to counties with an urban population of 20,000 to 50,000 that is adjacent to a metropolitan area but not included within that metropolitan statistical area (Office of Management and Budget, 2010). I use a dichotomous definition from the year 2000 and consider a county to be rural if they were classified as non-metropolitan in the year 2000.

3.3.7 Analytic Approach

3.3.7.1 Spatial Fixed Effects Modeling Approach

The following section presents a detailed overview of the spatial econometric approach used in this analysis. The use of a spatial econometric model was necessary due to the well-documented spatial clustering of social phenomenon across the United States (Brooks, 2019; Lobao et al., 2007b; 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). Further, recent subnational work on the impacts of natural resource development on economic outcomes accounted for spatial dependence using spatial regression models (Deller, 2010, 2014; James and Aadland, 2011; Lobao et al., 2016), indicating the use of this type of model was necessary.

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.[5] The SLX fixed effects model builds off of the traditional two-way error component fixed effects model presented in Equation 3.1 (Baltagi, 2005).

$$\begin{aligned} y_{it} &= \beta X_{it} + u_{it} \\ u_{it} &= \mu_i + c_t + \epsilon_{it} \end{aligned} \tag{3.1}$$

[5]To calculate these models, spatial lags were generated and included as exogenous independent variables within the conventional fixed effects estimator (i.e. xtreg, fe) in Stata. The unit fixed effects were transformed out of the model in this process, However, due to software requirements the period fixed effects were included as dummy variables. Although the period fixed effects were included via dummy variables, they are presented in the error term of the formulas for simplicity.

Where the outcome variable y and a vector of independent variables X are observed for each unit i over multiple time periods t. The error component of the model, u_{it}, is comprised of the unobservable unit-specific effect μ_i, the unobservable year-specific effect c_t, and a stochastic error term ϵ_{it}. Although the calculation of Equation 1 is equivalent to including dummy variables for each unit and year, the placement of the effect μ_i and c_t in the error component highlights that due to the loss of degrees of freedom, the model is conventionally calculated using a transformation which removes the fixed effects from the model (Baltagi, 2005) and does not directly calculate their effect.

The conventional fixed effects model does not account for spatial autocorrelation and spillover effects. Given the spatial dependence geographic entities have on their neighbors due to spillover effects and clustering (Chi and Zhu, 2019), controlling for these spatial patterns is essential to ensure unbiased estimates of the impact that natural resource development has on economic outcomes within counties. Using spatial regression, one way researchers can explicitly account for spatial dependence is using spatial lags (Chi and Zhu, 2019; LeSage and Pace, 2009). A spatial lag represents the average of a variable for a given unit across all of its neighbors, as defined by a spatial-weights matrix. A spatial weights matrix is a matrix of values which specify the neighbors for each unit within a sample using a given neighborhood structure (Chi and Zhu, 2019). The pre-specified neighborhood structure is often based on either contiguity, distance, or the number of neighbors. Many forms of spatial weights matrices exist. In a row-standardized first-order queen's contiguity matrix, the spatial weight matrix used in this analysis, a unit's neighbors are comprised of all counties touching that unit by either vertex, or border.

Because there is rarely theory suggesting what types of neighbors are likely to influence a county, it is common for researchers to test the robustness of their findings to multiple spatial-weights matrices (Chi and Zhu, 2019; Elhorst, 2010), although it should be noted this practice has received criticism (LeSage and Pace, 2014). For this analysis I assumed spillover effects were likely from all immediate neighbors of a county. For this reason, I chose *a priori* to use the row-standardized first-order queens contiguity matrix. However, to ensure robust findings I also ran the models using a row-standardized first-order rooks contiguity matrix, meaning that a county only qualified as a neighbor if it shared a border and not a vertex. The results were consistent and are reported along with other robustness checks in Section 3.4.2.

There are numerous forms of spatial regression models, Elhorst (2010) identified seven. As in statistics generally, the choice of which spatial model to use, although it has often been driven by data, should be a conceptual decision (LeSage et al., 2014). Thus, although prior researchers using spatial regression have generally used diagnostic tests to determine the appropriate model (Chi and Zhu, 2019), recent work has increasingly advocated for a theory-grounded process of model selection (Gibbons and Overman, 2012; Vega and Elhorst, 2015; LeSage et al., 2014). Further, the majority of diagnostic tests available in the field of spatial econometrics are designed for cross-sectional data, with limited straightforward application to panel data (Chi and Zhu, 2019). To address this, I first validated the importance of space in the analysis by estimating the univariate global Moran's I for each dependent and independent variable of interest for 2000, 2010, and 2015 across all counties in the United States using GeoDa to determine whether spatial clustering existed in the relevant variables. All global Moran's I estimates were significant at $p < .05$ using 999 permutations, suggesting that spatial-autocorrelation was, in fact, a concern and needed to be accounted for. Results of this preliminary analysis are provided in Appendix A in Table A.2. Following this validation, I accounted for space in my models using the SLX model (Vega and Elhorst, 2015).

The SLX assumes that the outcome variable y_{it} is affected by the level of explanatory variables in neighboring counties and contains spatial lags of some, or all, of the independent variables. In this analysis I lagged all outcome variables. The SLX is presented in Equation 3.2 and is an expansion of Equation 3.1 where W represents the row standardized spatial weights matrix and θ represents the estimated coefficients for the vector of spatial lags of independent variables X (Elhorst, 2010; Gibbons and Overman, 2012; Vega and Elhorst, 2015). 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).

$$
\begin{aligned}
y_{it} &= \beta X_{it} + W\theta X_{it} + u_{it} \\
u_{it} &= \mu_i + c_t + \epsilon_{it}
\end{aligned}
\tag{3.2}
$$

The SLX accounts for local spillovers of changes in the independent variables on neighboring counties (LeSage et al., 2014), meaning a change in one county impacts its neighbors, and the spillover ends there. The SLX model does not account for the possibility of global spillovers (LeSage et al., 2014). Global spillovers occur when the spatial effect of a neighbor on a given county will cause a change in the county in question and will then cause a further change in the other neighbors of that given county. Thus, a cascading effect occurs. There are models, notably the Spatial Durbin Model (SDM; Equation 3.3), which can account for these kind of spillovers via the inclusion of a spatial lag of the dependent variable $\rho W y_{it}$ (LeSage et al., 2014). In the case of economic prosperity, the use of a global spillover model may appear attractive due to the plausibility of cascading effects in this context. Unfortunately, using a model such as the SDM would have posed significant barriers for model interpretation and the testing of hypotheses.

$$\begin{aligned} y_{it} &= \rho W y_{it} + \beta X_{it} + W\theta X_{it} + u_{it} \\ u_{it} &= \mu_i + c_t + \epsilon_{it} \end{aligned} \tag{3.3}$$

Due to the endogenous nature of models incorporating global spillovers, regression coefficients such as β and θ cannot be interpreted as direct and indirect effects (LeSage and Pace, 2009). This is due to (1) that each unit has a different spatial weights matrix multiplier and (2) that a change in one unit impacts its neighbors and then that impact feeds back into the same unit, adding to its own direct effect. This means that β is not the true direct effect in these models and θ is not the true indirect effect. Due to the heterogeneity of these effects across units, the SDM produces an N x N matrix of direct and indirect effects for each explanatory variable (Elhorst, 2010; LeSage et al., 2014). As presenting all of these coefficients and interpreting them would be both impractical and misguided (LeSage and Pace, 2009; LeSage et al., 2014), LeSage and Pace (2009) developed an approach for summarizing these effects which averages across the matrix of direct and indirect effects. By design, this averaging approach assumes a linear specification of model relationships (Belotti et al., 2017). As the key relationship of interest in this study is the non-linear relationship between natural resource development and economic prosperity, this made the use of this model impractical.

Due to the significant trouble of interpretation posed by models such as the SDM, recent work by both Gibbons and Overman (2012) and Vega and Elhorst (2015) have advocated for the adoption of the SLX model. This model is especially appropriate when there is not strong prior theory about the spatial process under consideration (Vega and Elhorst, 2015), as is the case in this study. For this analysis, the SLX represented an appropriate balance of theoretical and practical considerations and facilitates the modeling of spillover effects while permitting tests of statistical significance and clear coefficient interpretation.

3.3.7.2 Estimates of Non-linear Relationships

The non-linear effects are modeled 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 is 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). [6]

3.3.7.3 Isolating the Rural Effect

Finally, the desired results for this model are coefficient estimates for rural counties alone, however, the use of spatial regression means that the exclusion of urban neighbors from the overall model would be inappropriate. Therefore, as discussed in Section 3.3.6, I estimate the models using a simple spatial regime approach using a binary indicator for urban where 1 equals metropolitan in 2000 and 0 equals non-metropolitan in 2000. To estimate the unique coefficients for rural counties, the binary urban indicator was interacted with both extractive and non-extractive employment shares, generating two sets of coefficients: those for the effect within rural counties (metro=0), and the deviation from those coefficients for urban counties (metro=1).

3.3.7.4 Fully-specified Model

Building on the models presented previously, the full SLX model is represented by Equation 3.4, where y_{it} is the outcome variable of interest, $metro$ represents the binary metropolitan or non-metropolitan 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 impact of extractive and non-extract employment share on y_{it}, respectively, β_2 and β_4 capture the second order, quadratic within-county impact 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

[6]It should be noted that a body of literature related to climate change has argued non-linear terms in fixed effects models can allow the unit-mean to re-enter the model (McIntosh and Schlenker, 2006; Mérel and Gammans, 2018). Thus, those within this body of literature have argued that the use of the simple first and second order terms is both accounting for short-term (e.g. the within effect) and some degree of long-run (e.g. a global effect) adaptation. Meaning that it may allow places with persistently higher levels of resource development to exhibit a different response to increased development than others and possibly bias coefficients in unknown directions (Mérel and Gammans, 2018). This has led various researchers to suggest the use of a penalty term or other forms of adjustment to further isolate the short-run from the long-run effect (McIntosh and Schlenker, 2006; Mérel and Gammans, 2018). Given the limited uptake of corrections such as this relative to the conventional approach, as well as the lack of clarity regarding its application to spatial models, I do not adopt this approach. Thus, it is possible that the coefficients modeled here may allow for some degree of long-run adaptation.

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.

$$
\begin{aligned}
y_{it} &= metro * [\beta_1 ex_{it} + \beta_2 ex_{it}^2] + metro * [\beta_3 nx_{it} + \beta_4 nx_{it}^2] \\
&\quad + W\theta_1 ex_{it} + W\theta_2 ex_{it}^2 + W\theta_3 nx_{it} + W\theta_4 nx_{it}^2 \\
&\quad + \beta_7 X_{it} + W\theta_7 X_{it} + u_{it} \\
u_{it} &= \mu_i + c_t + \epsilon_{it}
\end{aligned}
\tag{3.4}
$$

As the model presented in Equation 3.4 was the necessary model for appropriately testing the hypotheses laid out in this paper, the SLX models are the only models presented in the main text of this article. However, it is possible the reader would benefit from a more step-wise presentation of models. Thus, models without spatial spillovers and with a linear specification of the relationships between development and outcome variables were estimated and are available, along with a descriptive narrative, in Appendix A. Finally, 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).

3.3.8 Evaluation of Hypotheses

The overall hypothesis regarding similar impacts of extractive and non-extractive development on economic prosperity was assessed by considering all three sub-hypotheses in-tandem and is discussed at the end of the results. Sub-hypotheses for each outcome variable were evaluated in three ways. First, a joint test of significance was performed on the first and second order terms to determine the presence of an overall effect of extractive or non-extractive development on the outcome variable.

Second, to determine whether the shape of the significant relationships within SLX models conformed to sub-hypotheses and supported the the notion of over-specialization, marginal predicted means and direct effects across a range of the independent variables of interest were estimated. All relationships with a significant joint test of the first and second order terms were evaluated, regardless of the specific significance tests of the individual terms. The marginal means and effects were predicted 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 of the non-linear relationships between extractive and non-extractive employment shares and per capita income, inequality, and poverty. Importantly, although the marginal means are scaled to be similar to the average levels observed within the data through an averaged constant term by Stata, the true unit fixed effects are transformed out of the model and not explicitly predicted during model estimation (i.e. the unique individual intercepts are missing). Therefore, I focus on the shape of the relationships and the relative changes across the values of X, and spend limited time on the absolute predicted values.

Finally, the second order term was considered alongside the marginal plots to determine whether or not the inclusion of the quadratic effect was empirically supported. Given the theory driving the analysis, quadratic effects were not removed if the second order t-test was not statistically significant. Instead, the presence of a non-significant second order term was considered alongside the plotted marginal means and direct effects as evidence supporting the consideration of linear effects in future research. All significance tests were evaluated at $p < .05$.

3.4 Results

Summary statistics for all variables included in the primary models are presented in Tables 3.1 and 3.2. After county boundary adjustments there were a total of 3073 counties, with 2,010 counties classified as rural (i.e. non-metropolitan), and 1,063 counties classified as urban (i.e. metropolitan). All counties had 3 observations (i.e. 2000, 2010, and 2015) and there was no missing data. The average per capita income to residents across all counties and all years in 2017 dollars was $22,950. Per capita income was higher in urban counties ($26,980) relative to rural counties ($20,810). The average county Gini Index across all years and counties was 42.8 and was higher for rural (43.2) versus urban counties (42.0). The average poverty rate across all counties and years was 14.9%, and similar to other dependent variables was higher in rural counties (16.0%) than urban counties (12.9%). In rural counties, extractive employment share had an average of 1.7% across all years and non-extractive employment share had an average of 5.6%.

Table 3.1. Summary statistics for model variables across all counties and all years

	Mean	SD	Min	Max
Per Capita Income to Residents (thousands)	22.95	8.13	0.99	115.68
Gini Index	42.76	3.54	30.75	80.67
Poverty Rate	14.94	6.25	0.00	56.69
Extractive Employment Share	1.48	2.76	0.00	55.33
Non-extractive Employment Share	6.11	4.27	0.00	90.13
Population (thousands)	98.33	315.98	0.07	10123.25
Percent Over 65	16.27	4.44	1.80	54.19
Percent White	83.95	16.21	2.92	100.00
Percent Black	8.91	14.50	0.00	86.92
Percent Hispanic	7.90	13.14	0.00	99.19
N/county-years	3073/9219			

Table 3.2. Summary statistics for model variables by metropolitan and non-metropolitan across all years

	Mean	SD	Min	Max
Non-Metropolitan: N/county-years = 2010/6030				
Per Capita Income to Residents (thousands)	20.81	6.94	0.99	115.68
Gini Index	43.18	3.64	30.75	80.67
Poverty Rate	16.01	6.48	0.00	56.69
Extractive Employment Share	1.69	3.12	0.00	55.33
Non-extractive Employment Share	5.63	4.22	0.00	72.27
Population (thousands)	24.70	24.38	0.07	215.19
Percent Over 65	17.51	4.32	3.00	54.19
Percent White	85.37	16.52	2.92	100.00
Percent Black	7.86	14.81	0.00	86.92
Percent Hispanic	7.60	13.65	0.00	99.19
Metropolitan: N/county-years = 1063/3189				
Per Capita Income to Residents (thousands)	26.98	8.67	10.70	95.34
Gini Index	41.96	3.21	32.44	56.96
Poverty Rate	12.91	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	99.44
Percent Black	10.89	13.69	0.00	81.48
Percent Hispanic	8.47	12.11	0.02	95.75

Visualization of the spatial distribution of extractive and non-extractive development for the year of 2015 is presented in Figures 3.1 and 3.2. Extractive and non-extractive development are found across the entire United States, however notable clustering exists. Both extractive and non-extractive natural resource development are, unsurprisingly, high in the western United States. While extractive development is high in the southern Plains and parts of the Southeast, non-extractive development is lower in these regions. Extraction is high throughout Appalachia and in the northern parts of the Northeast. Finally, there are high levels of non-extractive development throughout states bordering the Great Lakes.

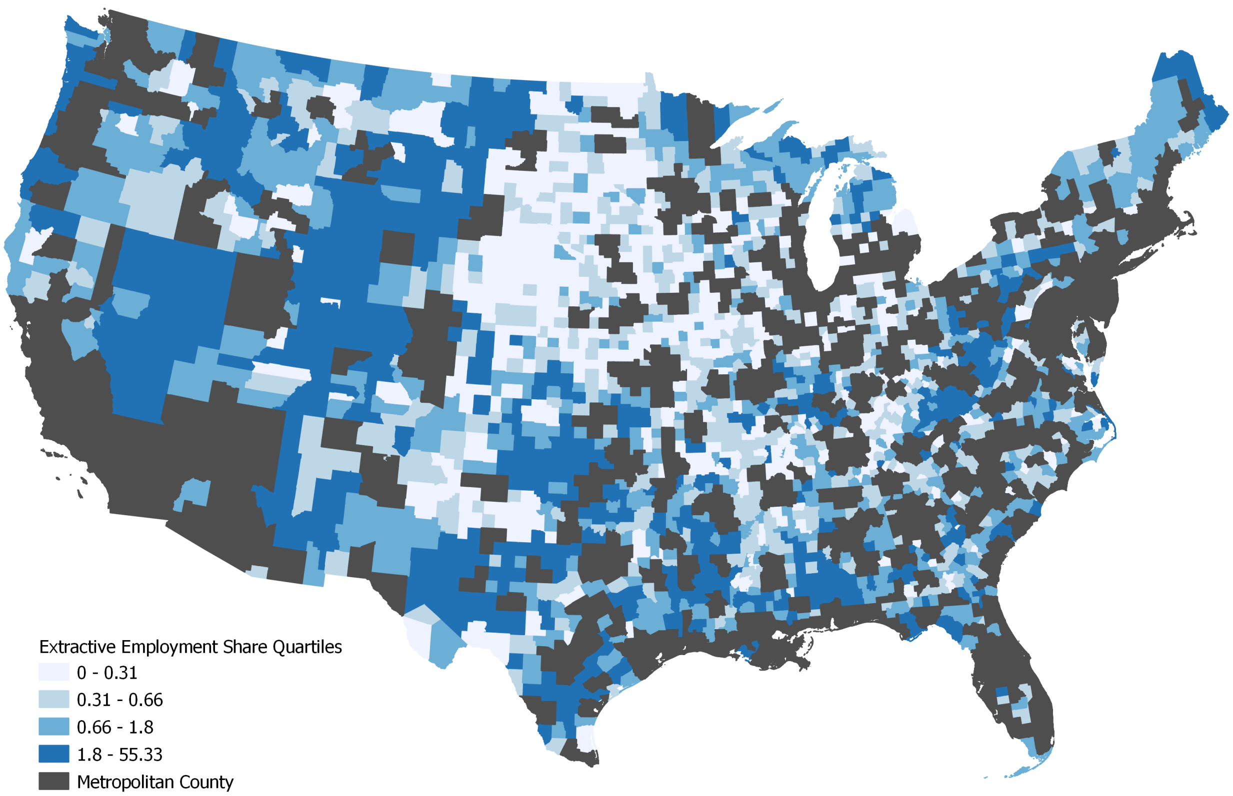

Figure 3.1. Extractive employment share in non-metropolitan counties in 2015.

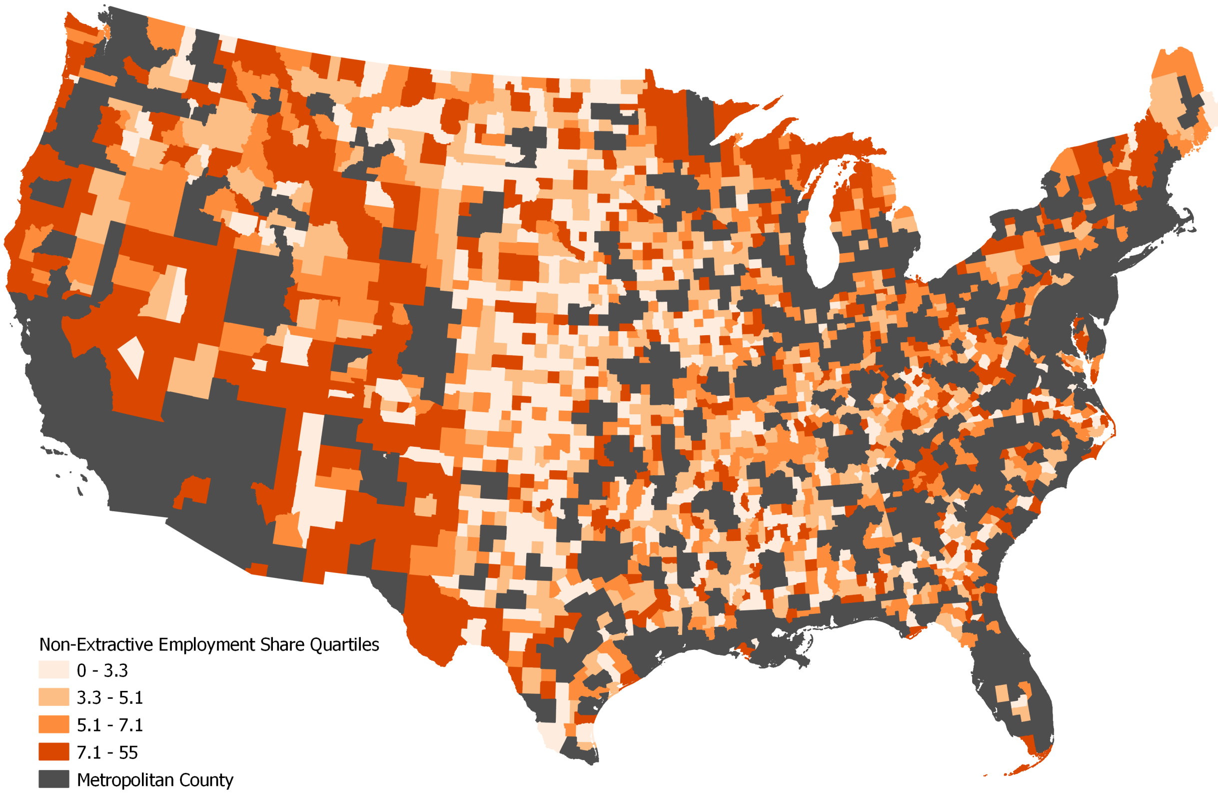

Figure 3.2. Non-extractive employment share in non-metropolitan counties in 2015.

3.4.1 SLX Fixed Effects Models

Results for models of per capita income to residents, local inequality, and poverty are presented in Table 3.3. In Table 3.3, the metro coefficients are not reported due to their lack of relevance to research questions. However, they are reported with a narrative in Appendix A alongside both aspatial and linear models of each outcome variable.[7] In addition to tables, Figures 3.3 through 3.6 present the plots of the predicted marginal means of, and effects on, each dependent variable for a constrained set of observed levels of extractive and non-extractive employment share. Marginal predictions and effects of employment share were estimated for

[7]The use of the metropolitan dummy-variable interaction was theoretically necessary to isolate the effect for rural areas and was significant—tested via a joint test of significance for the first and second order terms—in the case of non-extractive development and per capita income ($F(2{,}3072){=}5.96^{**}$), extractive and non-extractive development and Gini Index (Extractive $F(2{,}3072){=}6.19^{**}$; Non-extractive $F(2{,}3072){=}15.30^{***}$), and extractive and non-extractive development and poverty rate (Extractive $F(2{,}3072){=}30.03^{*}$; Non-extractive $F(2{,}3072){=}9.33^{***}$).

every integer from 0 to 30 for all relationships where the joint test of significance for the first and second order terms was significant at $p < .05$. The range of 0 to 30 was selected as it contains the vast majority of the observed values for each form of development.

3.4.1.1 Per Capita Income

In the case of per capita income to residents, the joint test of significance for the non-linear terms was significant for both extractive and non-extractive development (Table 3.3), indicating a significant effect of both types of development on per capita income. In the case of extraction, low levels of employment share had a positive relationship with per capita income, however, as employment share increased the curve flattened, indicating diminishing returns and supporting hypotheses (Figure 3.3). When looking at the point estimates of marginal effects from Figure 3.3, a one percentage point increase in extractive employment share at 5% was associated with a direct effect of 0.27, or $270 in per capita income. This decreased at higher levels where a one percentage point increase at 15% was only associated with a direct effect of 0.19, or $190. The curve began to flatten at the highest estimates, with a one percentage point increase at 25% having a direct effect of only 0.11, or $110.

Non-extractive development had a significant overall effect, but the shape of the relationship did not support the non-linear hypothesis regarding overspecialization. As seen in Figure 3.4, higher levels of non-extractive employment share were associated with lower per capita income, supporting the notion of negative impacts, but there was no evidence of the expected non-linear over-specialization effects. As non-extractive development increased the negative returns slightly diminished, but the relationship was generally linear and negative. When examining the point estimates of marginal effects in Figure 3.4, we see that the marginal effect estimates were far more consistent for non-extractive development than extractive. A one percentage point increase was associated with a direct effect of -0.18, or -$180, at 5%, -0.16, or -$160, at 15%, and -0.14, or -$140, at 25%.

This smaller change in difference across the range of employment share for non-extractive relative to extractive employment share highlights the limited support of the non-linear hypothesis for non-extractive development in this model. Further, the way the effect changes across the range of non-extractive employment share is in the opposite direction as hypothesized, with the impacts being less negative at higher levels of specialization. Finally, as can be seen in Table 3.3, the *t*-test of the second order term for non-extractive development was not significant. This result, combined with the plotted effects and predicted means,

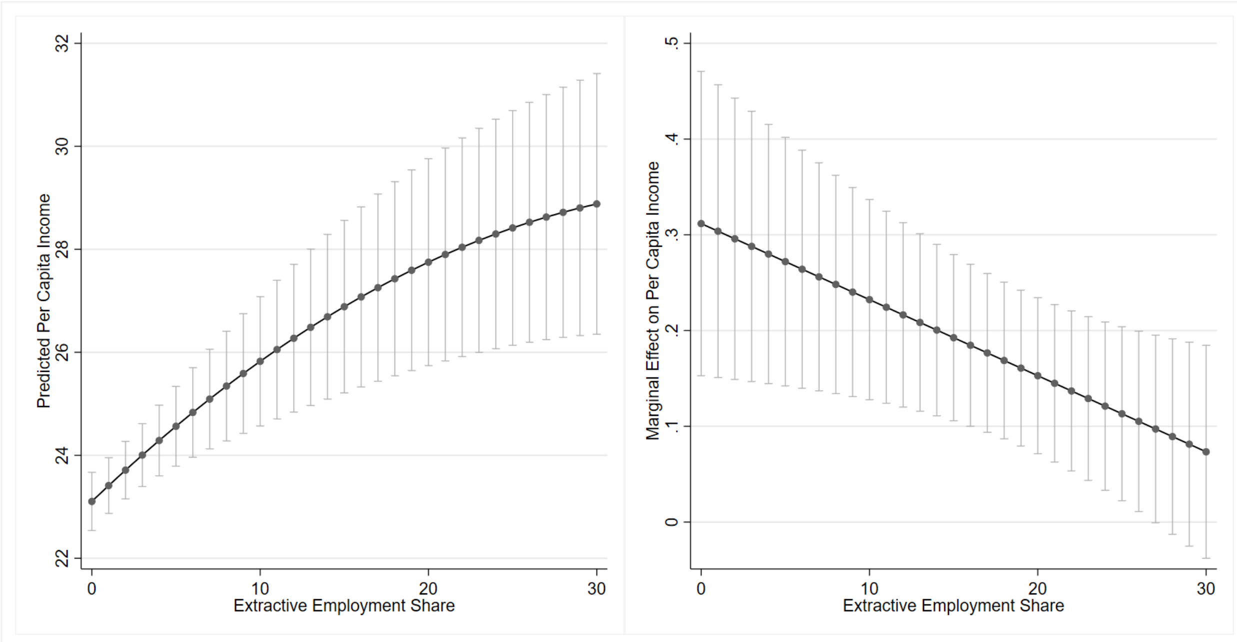

Figure 3.3. Predicted means and marginal direct effects for per capita income to residents across constrained ranged of extractive employment share. Other variables held constant at means. Vertical bars represent 95% CI

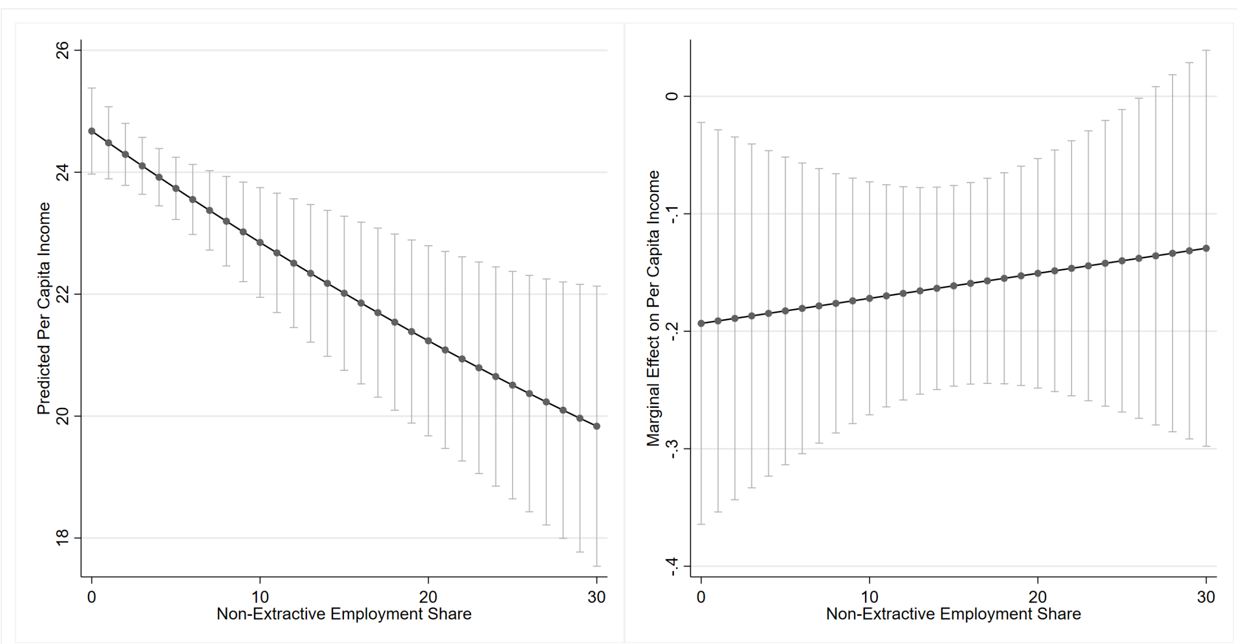

Figure 3.4. Predicted means and marginal direct effects for per capita income to residents across constrained ranged of non-extractive employment share. Other variables held constant at means. Vertical bars represent 95% CI

highlights the lack of empirical support for a non-linear specification of the relationship between non-extractive employment share and per capita income.

Table 3.3. Impact of Natural Resource Development on Non-metropolitan Economic Prosperity from 2000-2015

	Per Capita Income		Gini Index		Poverty Rate	
Direct Effects	Coef.	SE	Coef.	SE	Coef.	SE
Extractive Employment Share	0.3117***	0.0811	-0.1377**	0.0492	-0.1656**	0.0582
Extractive Employment Squared	-0.0040*	0.0018	0.0040**	0.0014	0.0017	0.0016
Non-extractive Employment Share	-0.1933*	0.0873	-0.0219	0.0621	0.0505	0.0566
Non-extractive Employment Squared	0.0011	0.0025	-0.0009	0.0010	-0.0006	0.0009
Population (thousands)	-0.0033*	0.0014	0.0018**	0.0006	-0.0004	0.0007
Percent Over 65	-0.1512*	0.0759	-0.0177	0.0346	-0.0610	0.0399
Percent White	0.0553	0.0312	-0.0398	0.0233	-0.0769**	0.0236
Percent Black	-0.1453**	0.0509	0.0365	0.0397	0.0280	0.0465
Percent Hispanic	-0.0595	0.0546	-0.0406	0.0310	0.0696*	0.0333
Year [2000 ref]						
2010	2.5823***	0.1918	-0.0908	0.1072	1.3218***	0.1323
2015	6.3287***	0.3538	0.1714	0.1808	0.5905**	0.2220
Indirect Effects						
Extractive Employment Share	0.7016***	0.2004	-0.1036	0.0813	-0.5652***	0.1250
Extractive Employment Squared	-0.0279	0.0189	0.0050	0.0059	0.0167	0.0117
Non-extractive Employment Share	-1.5457***	0.2164	-0.0784	0.0954	0.4765***	0.1076
Non-extractive Employment Squared	0.0547***	0.0095	0.0024	0.0046	-0.0163***	0.0046
Population (thousands)	-0.0086**	0.0030	0.0020	0.0014	0.0026	0.0015
Percent Over 65	-0.7753***	0.1000	0.0641	0.0505	0.3092***	0.0555
Percent White	0.0940*	0.0453	-0.0291	0.0305	-0.0784*	0.0323
Percent Black	0.1308	0.0887	0.1157*	0.0534	0.0057	0.0600
Percent Hispanic	0.1631*	0.0802	0.0450	0.0424	-0.0467	0.0437
Constant	30.1129***	3.4475	46.6764***	2.2075	20.9074***	2.5748
AIC	45743.6812		34898.3168		38141.5383	
Joint test of non-linear terms ($F(2,3072)$						
Extractive	9.72***		4.38*		6.91***	
Non-extractive	6.92**		2.02		0.55	

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.

Due to their lack of relevance to research questions, metropolitan county direct effect interaction coefficients are not reported here, but are available in Appendix A.

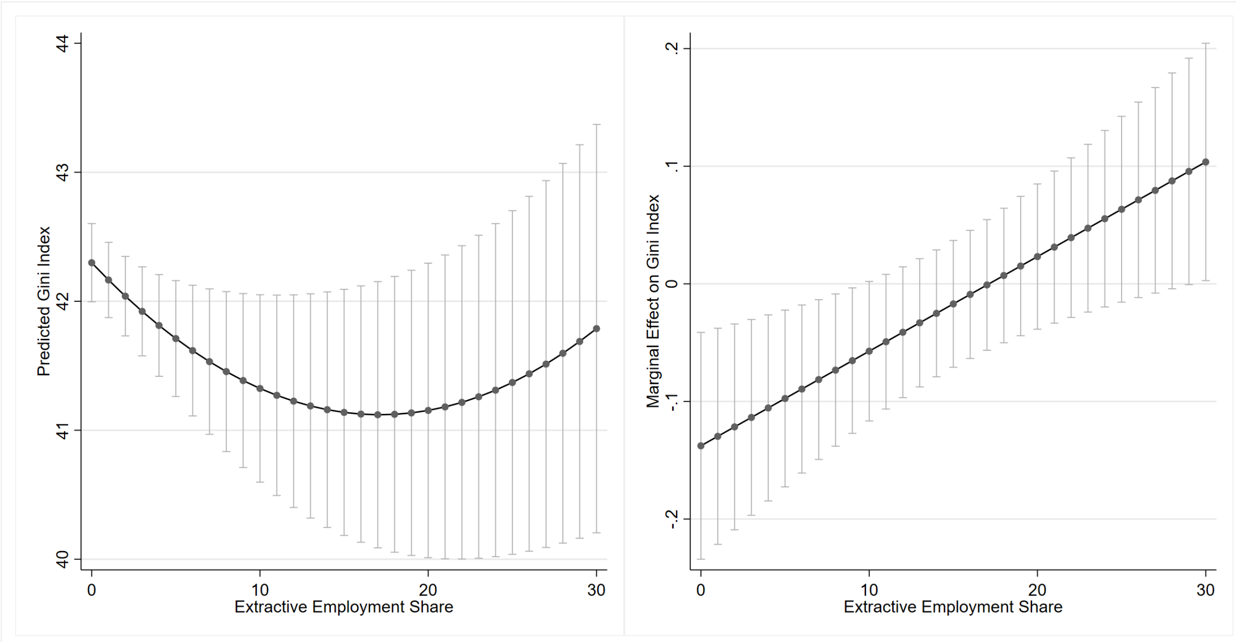

Figure 3.5. Predicted means and marginal direct effects for Gini Index across constrained ranged of extractive employment share. Other variables held constant at means. Vertical bars represent 95% CI

3.4.1.2 Inequality

In the model of inequality, the joint test of significance for extractive employment share, as well as the *t*-test of the second order term, were significant and supported hypotheses. The shape of the relationship, as shown in Figure 3.5, indicates that low levels of extractive employment share were associated with decreasing inequality, but those decreases tapered as extractive employment share increased and ultimately led to increases in inequality. When looking at point estimates of the marginal effects from Figure 3.5, we see that a one percentage point increase in extractive employment share at 5% was associated with a direct effect of -0.09. This effect diminished in the middle of the predicted range with a one percentage point increase at 15% being associated with a direct effect of -0.02, and ultimately reversed direction, with a one percentage point increase at 25% corresponding to a direct effect of 0.06. This finding supports hypotheses regarding extractive development and inequality.

Results were less supportive for non-extractive development. Results from the model of Gini Index indicated that non-extractive development did not have a significant relationship with income inequality from 2000 to 2015 in rural counties (Table 3.3). This result, which does not support hypotheses, indicates that higher levels of non-extractive development were not associated with either increased or decreased inequality.

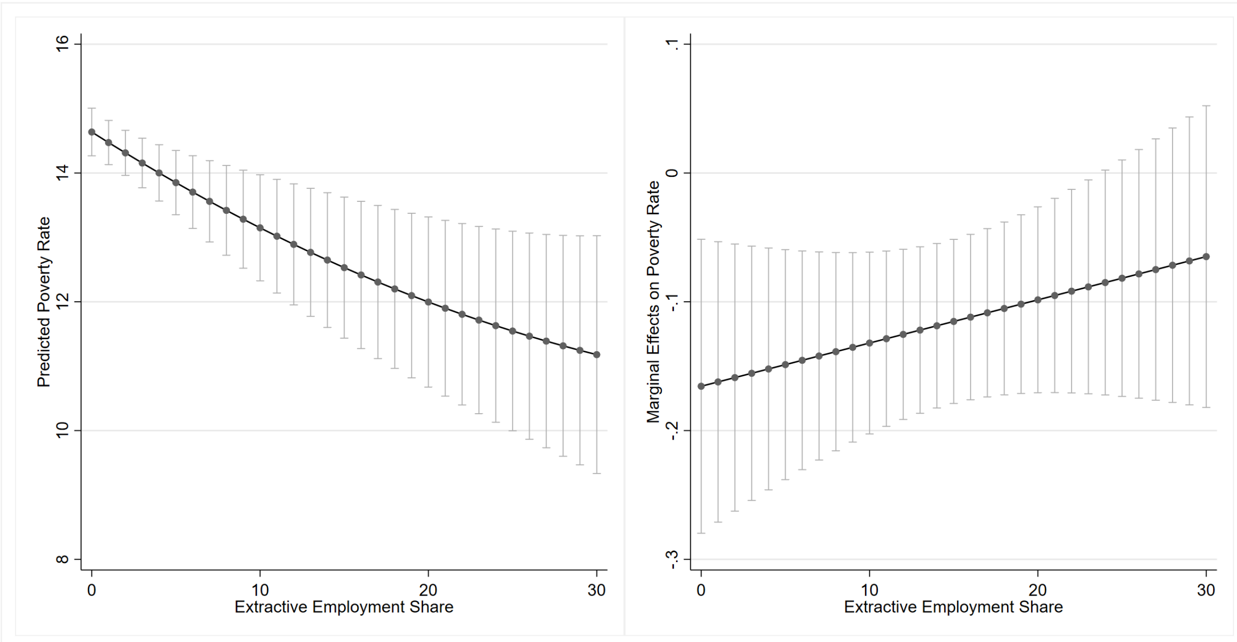

Figure 3.6. Predicted means and marginal direct effects for poverty rate across constrained ranged of extractive employment share. Other variables held constant at means. Vertical bars represent 95% CI

3.4.1.3 Poverty

When examining the results for poverty, the joint test of terms for non-extractive development did not support model hypotheses as non-extractive employment share did not have a significant relationship with poverty (Table 3.3). Thus, although income was influenced by the level of non-extractive employment share, these impacts did not correspond with changes in the poverty rate.

Extractive development did exhibit a significant joint test of terms and a significant second order term, supporting the hypothesis of non-linear relationship with diminishing returns. As seen in Figure 3.6, extractive employment share had a curvilinear negative relationship with poverty. Increases at low levels of extractive employment were associated with lower poverty. This relationship diminished at higher levels of extractive employment share. Although diminishing effects were evident, the change was slight. A one percentage point increase in extractive development was associated with a direct effect of -0.15 at 5%, -0.12 at 15%, and -0.08 at 25%. Further, the second order term for extraction was not significant in the model (Table 3.3). Thus, although the findings for extractive development and poverty support hypotheses, there is evidence that future research should consider treating the relationship as linear.

3.4.1.4 Evaluation of Hypotheses

Results from all three models showed statistically significant relationships between natural resource development and economic prosperity. However, the relationships were not in the shape or direction expected for non-extractive development. I will first evaluate Hypotheses 2 through 4 and then discuss the global hypothesis (Hypothesis 1). Hypothesis 2, related to per capita income, was partially supported. Extractive development had the expected non-linear relationship with per capita income, but non-extractive development did not. Unlike extraction, the expected non-linear relationship showing diminishing returns was not present in the case of non-extractive development, where I instead found a slightly tapering negative relationship. Thus, the portion of the hypothesis theorizing negative outcomes at high levels of development in both sectors was supported, but the portion suggesting similar curves of overspecialization was not.

The hypothesis concerning inequality (Hypothesis 3), was not supported by my findings. The hypothesized non-linear relationship of overspecialization was evident for extraction, but there was no significant relationship between non-extractive development and inequality in my data. As non-extractive development did not decrease inequality, the hypothesis was not refuted, but the notion of similar outcomes for both forms of development was not supported.

Hypothesis 4, related to poverty, received a similar lack of support as the inequality hypothesis. Although extractive development had a significant non-linear relationship with poverty, non-extractive development did not. Further, although the relationship in Figure 3.6 did taper as expected, the relationship was slight and the second order term was not significant, suggesting a linear specification may capture the relationship best. Similar to the findings regarding inequality, non-extractive development neither supported nor refuted the hypothesis, it did not lead to lower poverty, but it did not support the hypothesis either.

To assess support for the global hypothesis proposed by the theoretical framework of dual dependency—that the negative county-level impacts of high levels of natural resource development on 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 negative outcomes for per capita income. However, the similarity of the outcomes ends there.

Extractive development demonstrated the expected curve of diminishing returns for all three outcome variables, but non-extractive development did not. The negative impacts of non-extractive development were far stronger for per capita income than expected and the relationship did not take the expected shape. Further, the lack of a significant effect of non-extractive development on inequality and poverty did not support the global hypothesis of similar outcomes and highlights the way these forms of development impact the economy in different ways. Taking these findings together, there is mixed support for the global hypothesis. Both forms of development resulted in at least one form of negative economic return at high levels of specialization, but not in the same ways and diminishing returns were only evident in the case of extraction.

3.4.2 Robustness Checks

Because the mechanisms outlined by the framework of dual dependency posit natural resource dependence is expected to impact economic prosperity by influencing the investment in human capital, overall employment, and the crowding out of manufacturing, the downstream time-variant variables of education, unemployment, and manufacturing were not included in the primary models to avoid over-adjustment of the effect of natural resource development on economic prosperity (Schisterman et al., 2009). However, it could be argued that these variables represent confounders, particularly for unemployment and manufacturing. Thus, to test model robustness, models were also estimated with the variables of education, unemployment, and manufacturing employment share included. The relationships significant in the primary models remained significant and the direction of relationships was consistent in the models with downstream variables included. Thus, the significant results from the primary models appear robust to the inclusion of these downstream variables. Although not presented in the main text, marginal means and effects which support the robustness of these findings were estimated and plotted and are available in Appendix A.

Although we cannot interpret them independently and this was not a direct test of these three variables as mechanisms of dependence, some additional interpretation of the difference between these models (Table 3.4a & 3.4b) and the primary models (Table 3.3) is warranted. In general, support for the theorized role of these variables as downstream effects was mixed. If these variables, taken together, were strong downstream mechanisms, we would expect coefficients to be reduced towards zero (Schisterman et al., 2009). The inclusion of these variables resulted in the first and second order coefficients, as well as the F-values, to decrease for all significant relationships except for extractive development and poverty where the F-value, but not the coefficients, increased. Although the coefficients did shrink, the change was generally small and no effects were completely suppressed. Thus, there is support that education, unemployment, and manufacturing jointly act as downstream variables between natural resource development and per capita income inequality, but mixed evidence for poverty. Future research on the individual effects of each of these variables in the relationship between natural resource development and economic prosperity appears warranted to better understand their role as either confounders or downstream mechanisms.

Table 3.4a. Robustness test of impact of natural resource development on 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 [(Metro=0)*X]						
Extractive Employment Share	0.2867***	0.0765	-0.1319**	0.0490	-0.1528**	0.0524
Extractive Employment Squared	-0.0034	0.0018	0.0040**	0.0015	0.0014	0.0015
Non-extractive Employment Share	-0.1300	0.0778	-0.0163	0.0627	0.0190	0.0537
Non-extractive Employment Squared	0.0000	0.0021	-0.0011	0.0011	0.0000	0.0008
Metropolitan [(Metro=1)*X]						
Extractive Employment Share	0.0214	0.0965	-0.0741	0.0566	0.0563	0.0736
Extractive Employment Squared	0.0012	0.0023	-0.0013	0.0016	-0.0034	0.0023
Non-extractive Employment Share	-0.1715*	0.0683	-0.0490	0.0361	-0.0093	0.0421
Non-extractive Employment Squared	0.0005	0.0007	0.0025***	0.0005	0.0013**	0.0005
Population (thousands)	-0.0042***	0.0013	0.0009	0.0005	-0.0007	0.0007
Percent Over 65	-0.1289	0.0738	-0.0384	0.0346	-0.1048**	0.0375
Percent White	0.0565	0.0305	-0.0325	0.0229	-0.0660**	0.0224
Percent Black	-0.1400**	0.0450	0.0283	0.0392	-0.0048	0.0449
Percent Hispanic	-0.0379	0.0533	-0.0697*	0.0318	-0.0211	0.0345
Percent without High School Diploma	0.0145	0.0474	0.1270***	0.0288	0.2193***	0.0323
Percent with at Least a College Degree	0.1581***	0.0421	0.0514*	0.0217	-0.1223***	0.0248
Manufacturing Employment Share	0.0705***	0.0200	-0.0237*	0.0094	-0.0755***	0.0112
Unemployment Rate	-0.0879*	0.0348	0.0383	0.0219	0.1825***	0.0267
Year [2000 ref]						
2010	3.8857***	0.3123	0.0820	0.1928	1.4887***	0.2144
2015	5.2260***	0.5036	0.6249*	0.2926	2.5689***	0.3244

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

Table continued on next page

Table 3.4b. Robustness test of impact of natural resource development on rural prosperity from 2000-2015 including downstream variables (Continued)

	Per Capita Income		Gini Index		Poverty Rate	
Indirect Effects	Coef.	SE	Coef.	SE	Coef.	SE
Extractive Employment Share	0.5645**	0.1881	-0.0643	0.0816	-0.4525***	0.1091
Extractive Employment Squared	-0.0226	0.0178	0.0044	0.0058	0.0146	0.0101
Non-extractive Employment Share	-0.9645***	0.1932	-0.0835	0.0978	0.1575	0.0979
Non-extractive Employment Squared	0.0319***	0.0081	0.0017	0.0047	-0.0049	0.0041
Population (thousands)	-0.0096***	0.0028	-0.0001	0.0013	0.0005	0.0014
Percent Over 65	-0.6316***	0.0959	0.0223	0.0499	0.1457**	0.0505
Percent White	0.0432	0.0448	0.0151	0.0305	0.0079	0.0306
Percent Black	0.0813	0.0786	0.1238*	0.0521	0.0435	0.0557
Percent Hispanic	0.1686*	0.0780	0.0100	0.0418	-0.0990*	0.0438
Percent without High School Diploma	-0.0307	0.0644	0.0719*	0.0349	0.1631***	0.0401
Percent with at Least a College Degree	0.1993**	0.0717	0.0733*	0.0361	0.0551	0.0387
Manufacturing Employment Share	0.2741***	0.0279	-0.0422*	0.0181	-0.2296***	0.0211
Unemployment Rate	-0.4785***	0.0468	0.0041	0.0294	0.1104***	0.0330
Constant	23.2618***	3.6040	40.6687***	2.3740	17.7280***	2.7538
AIC	44727.0167		34665.1441		36676.9530	
Joint test of non-linear terms ($F(2,3072)$)						
Extractive	9.60***		3.98*		7.63***	
Non-extractive	5.31**		2.12		0.57	

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

As stated in Section 3.3.7.1, models were also tested using a row-standardized rooks first order contiguity matrix—meaning a county was considered a neighbor if it directly shared a border with the county in question, but was not counted as a neighbor if it only shared a vertex. The conclusions suggested by models using this alternative spatial weights matrix were equivalent with the models using the pre-selected queens contiguity matrix. As the only variation between model coefficients of interest was generally within rounding error, the results are are not reported here. However, they are provided in Appendix A (Table A.9).

3.5 Discussion

This article presents an investigation into the impact that both extractive and non-extractive development had on rural economic prosperity in the United States from 2000 to 2015. While I find some support for both the global hypothesis suggested by Mueller (2019b)—that the negative impacts of high levels of natural resource development will be similar for both extractive and non-extractive development—and find support for the expected non-linear relationships for extraction, the results for non-extractive development did not conform to the theoretical hypotheses. I find the results for non-extractive forms of natural resource development were less straight-forward than hypothesized under the framework of dual dependency articulated by (Mueller, 2019b), with the impacts being generally negative across the range of development for per capita income and there being neither a positive nor negative effect for inequality and poverty. Further, when the relationship between non-extractive development and per capita was evaluated, the shape of the relationship was in the opposite of the hypothesized direction.

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 both the qualitative findings by 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 limited impact of non-extractive development on poverty. When controlling for relevant county characteristics, the share of employment in non-extractive natural resource industries such as tourism, recreation, accommodation, and real estate, only served to decrease per capita income to residents and did not lower poverty nor inequality. Considering the lack of a positive effect for inequality and poverty and the notable negative effects on per capita income, it appears that rural amenity development may not only be a poor panacea for rural America, but may be a direction to be seriously avoided.

This analysis provides mixed support for the theoretical framework of dual dependency discussed by (Mueller, 2019b) via the global hypothesis of similar negative impacts and overspecialization. The support of the notion of diminishing returns due to overspecialization was only present for extractive development, where the relationship took the expected curvilinear shape for all three indicators. Non-extractive development, although partially supporting hypotheses regarding negative impacts for per capita income, did not conform to the notion of diminishing returns advanced by Mueller (2019b). Higher employment shares in non-extractive development did not demonstrate diminishing positive returns, but if anything diminishing negative returns. The relationship between non-extractive development and economic prosperity appears best described as flat to negative. While the reason for this requires further research, I will advance one likely cause—the different types of jobs in each sector.

The jobs in extractive development, although tenuous due to market fluctuations, are often regarded as decent jobs by those in rural communities (Freudenburg and Gramling, 1994). They generally supply a living wage and stable income as long as extraction is ongoing (Krannich et al., 2014; Sherman, 2009b). This is contrasted by the jobs in the non-extractive sector which are usually service oriented, supply unstable hours, and have often been regarded as 'bad' jobs (Green, 2017). It is only at high degrees of extractive specialization that we see the negative impacts theorized by Freudenburg (1992), Humphrey et al. (1993), Mueller (2019b), and others start to creep in. This finding suggests that the quality of the jobs may counteract any negative economic effects at low to medium amounts of specialization. As the jobs in non-extractive natural resource development are generally of a lower quality, it is possible that the initial benefit at lower levels of specialization in the sector do not accrue, causing the relationship between non-extractive development and per capita income to be negative across the entire range of specialization. This finding requires further investigation.

These findings cast doubt on rhetoric pushed by the Outdoor Industry Association, which suggests that outdoor recreation, and its associated tourism, are vital to local, often rural, economies. The Outdoor Industry Association reported $887 billion in annual consumer spending associated with outdoor recreation in 2017, as well as reporting that the outdoor recreation industry generated 7.6 million jobs, of which many can be presumed to be rural (Outdoor Industry Association, 2017). However, these results raise the questions; to whom is this vast amount of consumer spending accruing, who is getting these jobs, and how good are they?

Although the outdoor recreation industry is often viewed in a more magnanimous light relative to the traditional extractive industries of coal, oil, and timber, their political influence may be growing just as strong. Between 2013 and 2018, ten state offices or task forces on outdoor recreation were established (Outdoor Industry Association, 2018). These offices are generally located within governor's offices and give the outdoor industry remarkable access to those with political influence. Given the detrimental impact non-extractive development had on per capita income, and the negligible benefit it had on poverty and inequality from 2000 to 2015—a period of significant growth for this industry—it may be time for a more critical appraisal of this sector than prior research has undertaken. Both the outdoor recreation industry and natural resource based tourism have a history of pressuring for increased protection of public lands and limiting extractive development. When considering that this protection essentially provides more land for consumers to utilize products produced by the outdoor recreation industry and to increase the scope of outdoor recreation offerings, the environmental rationale oft-provided for increased preservation begins to ring hollow. According to this analysis, higher shares of employment in non-extractive development in an area, and therefore the expansion of those industries in that area, decreased local incomes from 2000 to 2015 and did not alleviate poverty. Given this finding, research should increase scrutiny on this sector if future rural economic development is to be effective.

While the impacts 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 to residents, inequality, and poverty. However, although there are diminishing returns, it appears rural counties are better off with some extraction than none. For example, although inequality did increase at high levels of extractive development, the predicted levels of inequality at that level of development were still lower than if there was no development at all (i.e. 0%). 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 rural counties.

In this analysis I found evidence of the direct impact of natural resource development and economic prosperity. However, I did not test the specific pathways by which this impact occurred. Although the hypothesized pathways between natural resource dependence, deprivation, and inequality have been discussed by Mueller (2019b), in Section 3.2.4 of this article, and within the broader literature (Freudenburg, 1992; Havranek et al., 2016; Humphrey et al., 1993; Peluso et al., 1994; Sachs and Warner, 1995), limited research has explored these pathways explicitly at the subnational level within the United States. Future research to determine the exact pathways and their significance is essential for future policy development. This is particularly important for the issues of market diversity and oligopsony. A dominant pathway suggested by Mueller (2019b) is the effect natural resource dependence likely has on labor market diversity and concentration, which is expected to lead to increased inequality, stagnant income growth, and higher levels of poverty. Research using unrestricted Census and Internal Revenue Service data on market concentration and oliopgosny in rural America, specifically as it relates to the natural resource sector, is needed to determine how serious the problem is, and what might be done to resolve it. Oligopsony at a national level not only hinders local economic growth, but fosters extra-local control of local economies due to market concentration at the national, and global level (Mitchell, 2016; Naidu et al., 2018). As extra-local control is posited to be a key driver of these negative impacts, future research should assess this issue.

In terms of methods, the use of spatial fixed effects models, as well as the explicit inclusion of non-linear effects, sets this analysis apart from prior research. Research on natural resource dependence has generally not investigated the non-linear impact of natural resource development on economic prosperity. Given that much of this research derives from an implicit theoretical viewpoint of overspecialization wherein a threshold is crossed, this is surprising. Future research should continue to investigate these non-linear relationships in other contexts and across other time-periods. It is possible that studies finding the resource curse was unsupported reported by Havranek et al. (2016) did not find an effect due to specifying the relationship between natural resource development and income as linear. In fact, when the models presented in this analysis were specified with linear relationships, as presented in Appendix A, the relationships between extraction and both inequality and poverty were non-sigificant.

Additionally, this study, similar to others (Deller and Schreiber, 2012; James and Aadland, 2011; Lobao et al., 2016), employed spatial statistics to properly estimate effects. Future research should continue to use this approach. While the purpose of this paper was not to investigate the spillover effects of natural resource development and dependence on neighboring counties, and therefore limited attention was paid to the estimated spillover effects, this is an important research question in its own right. The results in Table 3.3 suggest both extractive and non-extractive development had significant indirect effects on per capita income and poverty. Although these indirect effects were not separated into rural and urban effects in the same way as the direct effects, and should thus be interpreted with caution, it appears the indirect effects of natural resource development on economic prosperity may be quite notable. Future research focusing on these indirect effects should be performed to assess the ways the effects of natural resource development permeate beyond county boundaries.

3.5.1 Limitations

There are a number of limitations that need to be addressed for this study. First, 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 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. However, the impacts found in this analysis are not shared equally and will be mapped onto the existing patterns of inequality found within these rural counties (Duncan, 2014; Sherman, 2018, 2009a). Future, likely qualitative, work at the community level will be needed to assess the way these impacts vary within counties.

Second, I elected to use metropolitan status as my definition of rurality. This approach has faced criticism due to the way it assumes a county is either urban or rural and does not allow for a continuum of rurality (Isserman, 2005). This approach was necessary given both the county level nature of the analysis and the need for a simple urban/rural indicator in a complex spatial model. That said, future work should explore alternative specification such as Rural Urban Continuum Codes or distance to nearest metro, as done by (Lobao, 2016).

Third, as stated in Section 3.3.7.1, the use of the SLX model did not account for the possibility of global spillovers but was the appropriate model due to its interpretability. Future work should explore alternative estimation methods such as Bayesian approaches to include non-linear relationships and global spillovers in an interpretable manner.

Finally, this analysis was limited by the availability of longitudinal county-level data on employment structure. Due to suppression, the publicly available data products from the Census or the BEA are unusable. This issue resulted in the use of the Wholedata product from the Upjohn Institute for my independent variables of interest. However, Wholedata is comprised of estimates. Although these estimates are of a high precision and represented the best available data the the time of the study, future work should replicate this analysis using unrestricted data to validate these findings and the Wholedata product. Further, Wholedata was only available after the United States switched from the Standard Industrial Classification System to the North American Industrial Classification System in 1998. This availability meant that my analysis could only go back to 2000. Given the decline of extractive development and the increase in non-extractive development over the past 50 years, future work should extend analyses back further in time and explore the possibility of time-varying effects.

3.5.2 Conclusion

Given these results, it is hard not to be pessimistic about the future for rural America. In many parts of the rural United States, the resource rich local environment can easily be argued to be the only comparative advantage in an increasingly global economy. As discussed in Section 3.1, manufacturing has declined in rural America and is not likely to be a viable alternative to natural resource development. As other traditionally rural sectors such as agriculture become increasingly mechanized and transnational, the local natural resource base may be all that rural places have to turn to. In this analysis, extraction did produce benefits for rural economies. However, overspecialization was evident and many extractive sectors will need to be limited and restructured if we are to reduce the carbon footprint of the United States in the face of global climatic change. One solution often proposed is to invest in non-extractive activities such as tourism and natural amenity development. Drawing on these results, using the natural resource base for non-extractive alternatives appears to only have decreased per capita income and not improved—nor exacerbated—poverty and inequality. If increasing specialization in non-extractive natural resource sectors has negligible economic benefit, and causes some degree of harm, then what is to be done? Unfortunately, the problem is complicated, and there is no silver bullet. Future research needs to investigate policy solutions which will help diversify rural economies, or create jobs which provide security and pay a living wage.

Although many policy prescriptions could flow from this research, I will suggest two. First, the return on investment for non-extractive development is simply too low for those living in rural America. The solution to this is unlikely to be region-, or even rural-, specific, rather, it seems state and federal labor laws need to be improved. Increasing minimum wages and creating labor markets where jobs with reliable hours and benefits are the standard would go a long way in improving the economic benefit of non-extractive development. Second, drawing on the mechanisms discussed in the theory underlying this paper, it is simply too easy for external interests to influence rural economies and foster natural resource dependence. One method to combat this would be to re-establish anti-trust enforcement in the United States (Mitchell, 2016). The current state of anti-trust enforcement in the United States has led to an economy with very high levels of market concentration and decreased competition (Mitchell, 2016; Shapiro, 2018). This concentration has corresponded with the disappearance of many small firms and the weakening of regional economies (Mitchell, 2016). Thus, although reinvigorating anti-trust enforcement is a national solution, it would likely have serious local effects for natural resource rich regions of rural America. Ultimately, the research presented here suggests that high levels of specialization in either form of natural resource development is unlikely to be a pathway for sustainable economic development in the future. Thus, increased research and policy is needed if we are to break this cycle of dual dependency and foster equitable development in rural America.

Chapter 4
Issues of definition and scope: An ideal typology and classification scheme for natural resource communities in rural America

4.1 Introduction

Natural resource dependence has frequently been found to be associated with negative socioeconomic outcomes, both in the United States (Deller and Schreiber, 2012; Freudenburg and Wilson, 2002; James and Aadland, 2011; Lobao, 2016; Papyrakis, 2017; Weber, 2012) and internationally (Douglas and Walker, 2017; Gylfason, 2001; Havranek et al., 2016; Shahbaz et al., 2019; Sachs and Warner, 1995). While a plethora of research on the effects of natural resource dependence exists, a clear definition, or typology, of natural resource dependence remains absent. Within the extant literature, the term natural resource dependence has often gone undefined, its conceptual meaning presumed clear. And while there has been significant theoretical work on the impacts and mechanisms of natural resource dependence (Freudenburg, 1992; Humphrey et al., 1993; Krannich et al., 2014; Peluso et al., 1994), there has been limited attention to what the concept represents (Machlis and Force, 1988). This inattention has left conceptual holes in the usage of natural resource dependence in the literature, limiting understanding of the economic outcomes of natural resource-involved rural communities.

In addition to definitional issues, traditional typologies and frameworks of natural resource dependence are limited in scope. The majority of natural resource dependence research has focused on natural resource extraction. However, much of rural America has increasingly been using natural resources for non-extractive activities such as tourism, recreation, and amenity development. As evidenced by the work of English et al. (2000) on tourism dependence nearly 20 years ago, this is not a recent development. Given that tourism and natural amenity development now represent a larger absolute share of employment in rural America than extraction, a framework and typology of dependence which allows for non-extractive natural resource use is warranted. Prior work has classified counties into various typologies of amenity (Winkler et al., 2012) or recreation (Economic Research Service, 2019) dependence, but these classifications have been similarly limited in scope in that they do not incorporate extractive and non-extractive natural resource dependence within an integrated framework. As both forms of development compete for the same underlying resource base, have been argued to have similarly exploitative relationships with rural economies (Mueller, 2019b), and are often perceived as being in conflict (Petrzelka et al., 2006), a more comprehensive approach from which future research and policy can proceed is needed.

To address these issues of definition and scope, the purpose of this paper is threefold. First, I interrogate the conceptualization and operationalization of natural resource dependence to highlight the definitional issues inherent in prior approaches; from this I draw on the recent theoretical work of Mueller (2019b) to present a definition of resource dependence grounded in over-specialization. Second, drawing on the concept of ideal types discussed by Weber (1949:1904) and the framework of dual dependency presented by Mueller (2019b), I present an ideal typology of natural resource communities in the United States. This ideal typology uses the dimensions of natural resource development and economic prosperity to distinguish between natural resource specialized communities and natural resource dependent communities. Third, drawing on this ideal typology, I present a two-dimensional classification scheme for natural resource communities in the United States. I then classify counties and explore changes in classification across the period of 2000 to 2015.

4.2 Background

4.2.1 Natural Resource Dependence

The framework of natural resource dependence argues that reliance upon the sector of natural resources results in over-specialization and leads to higher levels of inequality and poverty, as well as stagnant economic growth (Freudenburg, 1992; Krannich et al., 2014; Perdue and

Pavela, 2012).[1] Research on resource dependence has generally focused on rural communities, and a significant portion of this research tradition has focused on the effects of resource dependence within the United States, although work in other countries does exist (Stedman et al., 2005). Research has found that natural resource dependence, while often increasing short-run income, has negative impacts to employment and poverty (Freudenburg and Wilson, 2002). Further, in line with the scholarship of boomtowns (Jacquet and Kay, 2014; Kinchy et al., 2014), theoretical work on the topic suggests that even the short-run positive impacts to income will degrade over time (Freudenburg, 1992). These negative impacts have been shown to vary across both time and space, with different sectors and regions experiencing dependency differently at different times (Lobao et al., 2016; Norton et al., 2003; Stedman et al., 2005). Although the impacts of natural resource dependence display variability, the finding of negative socioeconomic outcomes persists (Krannich et al., 2014; Lobao et al., 2016; Mueller, 2019a; Perdue and Pavela, 2012).

The vast majority of prior work on natural resource dependence has exclusively focused on extractive forms of natural resource use, meaning oil, gas, mining, and timber. However, as rural America is increasingly transitioning away from these uses and towards non-extractive uses such as tourism and amenity development, research has begun to emphasize this newer form of resource use (Winkler et al., 2012; English et al., 2000). The impact of non-extractive development on rural American economic prosperity remains unsettled. Some work has argued tourism development is a boon for struggling rural economies and results in limited negative outcomes (Deller et al., 2001, 2008; Deller, 2010). However, others have argued that when controlling for spatial autocorrelation (Kim et al., 2005) or cost of living increases (Hunter et al., 2005), the economic benefits disappear. Further, Mueller (2019a) found non-extractive development had a generally negative impact on per capita income and no positive or negative impact on poverty or inequality. From a qualitative perspective, recent work has suggested that non-extractive development, including second-home ownership, amenity migration, and rural tourism, provides limited real economic opportunity for locals while creating significant culture clash and strife between new and old residents (Sherman, 2018; Ulrich-Schad, 2018). These negative outcomes from economic specialization have led some researchers, beginning

[1] It is important to acknowledge that resource dependence is intimately related to the perspective of the resource curse from resource economics. The resource curse is the name given to the phenomenon where economies with rich natural resource endowments have lower and slower economic growth than would be expected under neoclassical economic theory (James and Aadland, 2011; Sachs and Warner, 1995). The perspective of the resource curse, although important to note, has historically focused on nation-state level analyses and aggregate income growth or GDP. As the focus of this typology is on subnational variation and impacts, I instead use the terminology of natural resource dependence. However, I do draw on the theoretical insights and findings of the resource curse literature where relevant.

with English et al. (2000) to characterize non-extractive development as another form of economic dependence, with its own suite of ramifications (Mueller, 2019b; Winkler et al., 2012).

4.2.2 Definitional Issues

As stated prior, natural resource dependence has often been ambiguously defined. In their decadal review of resource dependency, Krannich et al. (2014) argued resource dependency is most often "...conceptualized as involving high levels of employment and/or income derived from resource extraction and processing industries" (p.208). Similarly, in their summary of theories of natural resource dependence and poverty, Humphrey et al. (1993) state that natural resource dependent places, "...have or traditionally had a significant part of their local economy based upon resource extraction activities such as farming, mining, timber harvesting, commercial fishing, or grazing" (p. 136.). Finally, Peluso et al. (1994) described natural resource dependent areas as, "...places where a natural resource either accounts for a substantial part of the local economy or attracts population" (p. 24). However, these conceptualizations do not make it clear how researchers should determine what high or significant levels of natural resource activities are, making assessing the outcomes of dependence highly subjective.

Drawing on these conceptualizations, the vast majority of work has grounded natural resource dependence within a one-dimensional economic framework (Krannich et al., 2014). In this common approach, a geographic area, usually a county, is presumed to be dependent upon natural resources if they are above a certain threshold of either the share of income or employment in the natural resource sectors. Various thresholds of dependence, such as 20% (Elo and Beale, 1985; Bender et al., 1985), 10% (Stedman et al., 2005), or 8% (Economic Research Service, 2019) have been used. Unfortunately, the reliance upon these one-dimensional approaches has left dependence with significant definitional issues.

This reliance upon one-dimensional thresholds has had the unfortunate impact of conflating the operationalization of natural resource dependence with the theoretical conceptualization of natural resource dependence. The definition for what natural resource dependence *is* has become how it is *measured*. This conflation has resulted in the definition of dependence remaining opaque and ambiguous. Even if not directly stated, a close reading of the literature reveals that many of the scholars working on the topic have implicitly defined dependence not as simply a *high* level specialization within natural resources, but as *over*-specialization in the natural resource sectors. For example, the use of thresholds by the vast majority of the work on mining and timber dependence intimates that there is a point of specialization where we expect negative outcomes to begin to occur or change (Elo and Beale, 1985; Freudenburg and Wilson, 2002; Nord and Luloff, 1993; Stedman et al., 2005). Further, in his work on addictive economies and natural resource dependency, Freudenburg (1992) frames the issue as one of communities "becoming too heavily dependent (p. 305)" on the natural resource sector. In short, we expect negative economic outcomes in the case of natural resource dependence because the locality has reached a level of specialization now providing diminishing returns or negative outcomes.

Once it is clarified that natural resource dependence can, and should, be defined as the over-specialization in, or over-reliance upon, the sectors of natural resources, the definitional issues baked into its frequent operationalization become clear. The term over-specialization introduces two dimensions: the level of specialization and economic outcomes. We cannot argue an economy is over-specialized if we are not evaluating the level at which outcomes begin to become negative. Thus, the methodological approach of anchoring dependence in a subjectively chosen dichotomous threshold of the total share of employment or income risks tautology. If dependence conceptually represents the point of specialization where negative outcomes begin to occur, it does not make sense to test the impact of dependence on economic outcomes. Rather, researchers should treat specialization as a spectrum and model the non-linear relationship between specialization and economic outcomes to see at what average level of specialization diminishing returns occur (For an example see Mueller (2019a)).

Further, prior work anchoring natural resource dependence in one-dimension—the level of natural resource development—has inhibited analyses on why some natural resource communities become dependent, or over-specialized, and some do not—even at similar levels of specialization. There are many places with high levels of development with positive economic outcomes, and these outcomes have been shown to vary by both time, region, and a variety of other factors (Lobao et al., 2016; Nord and Luloff, 1993). Once we conceptually acknowledge the need to ground natural resource dependence in both the level of specialization and economic outcomes, a richer typology can be developed. Ultimately, these definitional issues, combined with the lack of scope present in existing typologies of natural resource dependence, make it clear that a new typology and classification schemes for natural resource communities in the rural United States is needed. In the following sections I present this typology and classification scheme. This typology is one of ideal types and stems from recent theoretical work on resource dependency by Mueller (2019b). Mueller's (2019) framework, called the framework of dual dependency, is an integrative middle-range theory of natural resource dependence in the rural United States and defines natural resource dependence as the over-specialization of rural economies in extractive or non-extractive sectors of natural resources.

4.2.3 Theoretical Orientation

This paper relies on the theoretical framework of dual dependency articulated by Mueller (2019b) and partially tested by Mueller (2019a). The framework integrates both extractive and non-extractive uses in the modern United States under one theoretical umbrella and argues natural resource dependence is characterized by the formation of a dual dependency, the first between the rural community and the national and global capitalist system, and the second between the rural community and its resource-rich local environment.

The framework of dual dependency argues rural areas first become dependent on the global capitalist economy due to their peripheral location within the capitalist world system and the ease at which capital moves across space in the modern era (Sklair, 2002; Smith, 2011b). This peripheral location creates patterns of exploitation from transnational corporations and global elites, which leads to underdevelopment and an inability to generate real local economic development as profit consistently exits the region. These patterns of exploitation exist for all of rural America, but this framework argues that when a region is rich in natural resources the patterns of exploitation become increasingly intense.

This is due to the contradiction between the need for capital to be in constant motion and the static nature of natural resources. Relative to other sectors, capital in natural resources has difficulty shifting production away from a region as the rate of profit falls, which is naturally expected in a locale over time due to crises of overaccumulation, labor organization, agglomeration, and heightened market diversity (Harvey, 2018:1982; Smith, 1984). As you cannot move oil, timber, or landscapes in the same way you might a factory, if capital is interested in the resource base they are compelled to stay in the region. This difficulty in effectively moving production creates misaligned incentives between local residents and capitalists. Thus, the capitalists seek to limit real economic growth in the region to keep the rate of profit in their sector as high as possible. Additionally, given the increasing turn towards neoliberalism, the rise of the transnational capitalist class, and the advent of interstate banking in the mid-1990's, these capitalists are unlikely to have regional ties to the area and thus limited interest in fostering real economic growth in the locality (Harvey, 2006; Sklair, 2002; Smith, 2011b). This results in capital doubling down in the region to keep a specific form of profit high and inhibiting other forms of development outside their business interests.

This leads to the over-specialization in the sector of natural resources and the formation of the second form of dependency—that between the region and its resource base—in-part because other industries are prevented from entering the region. These exploitive exchange relationships across space are furthered by local elites who are able to capture the economic development that does occur at the point of production through the traditional patterns of exploitation via surplus value identified by Marx (1990:1867), as well as the oft-corrupt political economy of these regions (Billings and Blee, 2000; Duncan, 2014). This contradiction between the movement of capital and the static nature of resources serves as the ultimate cause of the lowered economic prosperity wrought by natural resource dependence. However, a number of more proximate causes stemming from the formation of dual dependency exist including localized oligopsony, low market diversity, underinvestment in human capital, local elite power, gendered labor markets, and the often low quality jobs found in the sectors.

The framework of dual dependency is comprehensive in that it argues these negative patterns of exploitation should be expected for both extractive and non-extractive sectors, highlighting the importance of considering them in-tandem. This expectation stems from both sectors mutual interest in the spatially fixed resource base being used in exclusively one manner while keeping the region's level of development generally the same. Both sectors wish to preserve access to the resource base while keeping profits high in light of their difficulty in feasibly relocating production. Further, both extractive and non-extractive interests became interested in the region for its underdeveloped qualities, although likely for different reasons. In particular, non-extractive interests value the region for its status at the initial point of development, or 'character.' Thus, diverse economic growth that is not explicitly aligned with the goals of either sector are antithetical to business interests. In sum, within this theoretical framework both extractive and non-extractive development have an inherently exploitative relationship with rural communities, which results in over-specialization, the formation of dual dependencies, and lower economic prosperity.

4.2.3.1 Mechanisms of Dependence

As stated prior, although the ultimate cause of the formation of dual dependency is the contradiction between static resources and the need for capital to be in motion, it is the proximate causes that flow from this which are directly responsible for the diminished economic prosperity in resource dependent communities. Figure 4.1 presents a conceptual model of the framework of dual dependency. In it we see that the peripheral location of a region, the level of extra-local control by capital, and the richness of natural resources lead to higher levels of extractive and non-extractive development. As this happens, the spatial contradiction fosters exploitation and incentivizes economic activities by capital which are in conflict with local economic prosperity, leading to natural resource dependence (i.e. over-specialization). In the conceptual model, I identify eight primary mechanisms by which dual dependency fosters diminished local economic prosperity. These mechanisms reflect the causes of negative economic outcomes frequently discussed in the resource curse (Havranek et al., 2016) and resource dependence literatures (Humphrey et al., 1993).

The first mechanism is the formation of local oligopsonies, meaning concentrated labor markets with few employers (Rogers and Sexton, 1994). Rural economies have a tendency to face a higher degree of market concentration by their nature, there are simply fewer people to support more businesses (Azar et al., 2017). However, in the case of natural resources it is expected that this problem will be more severe. This is due to the difficulties of investing in the sector by smaller regional companies. The economies of scale currently pursued to make both extractive (Bunker, 2003) and non-extractive (Mueller, 2019b) development profitable make it difficult for smaller players to enter the market. When this is considered alongside the way rural labor markets are smaller in absolute size, it is likely the rural natural resource sectors will be highly oligopsonistic. As with all oligopsonies, these concentrated sectors are likely to produce wage-stagnation due to a lack of competition, engage in rent seeking behavior, and ultimately foster diminished economic prosperity among the working population (Falkinger and Grossmann, 2013).

In the rural context, these negative impacts of oligopsony are expected to be amplified due to the second mechanism identified in Figure 4.1, low market diversity. In the natural resource sector, these few dominant firms are incentivized to keep other industries out of the regional economy. Due to the need to maintain the character of a location to ensure access to cheap labor, continued access to the resource base, and that the rustic nature of a location persists for natural amenity development, natural resource interests will attempt to exclude other sectors. This works against the agglomeration effects necessary for successful regional economic development and provides limited opportunity for other forms of employment in the region. This exclusionary behavior by rural natural resource sectors has been documented by both Billings and Blee (2000) and Duncan (2014) in their work on Appalachia. Ultimately, this low level of market diversity is emblematic of the overspecialization hallmark of natural resource dependence and directly leads to diminished economic prosperity.

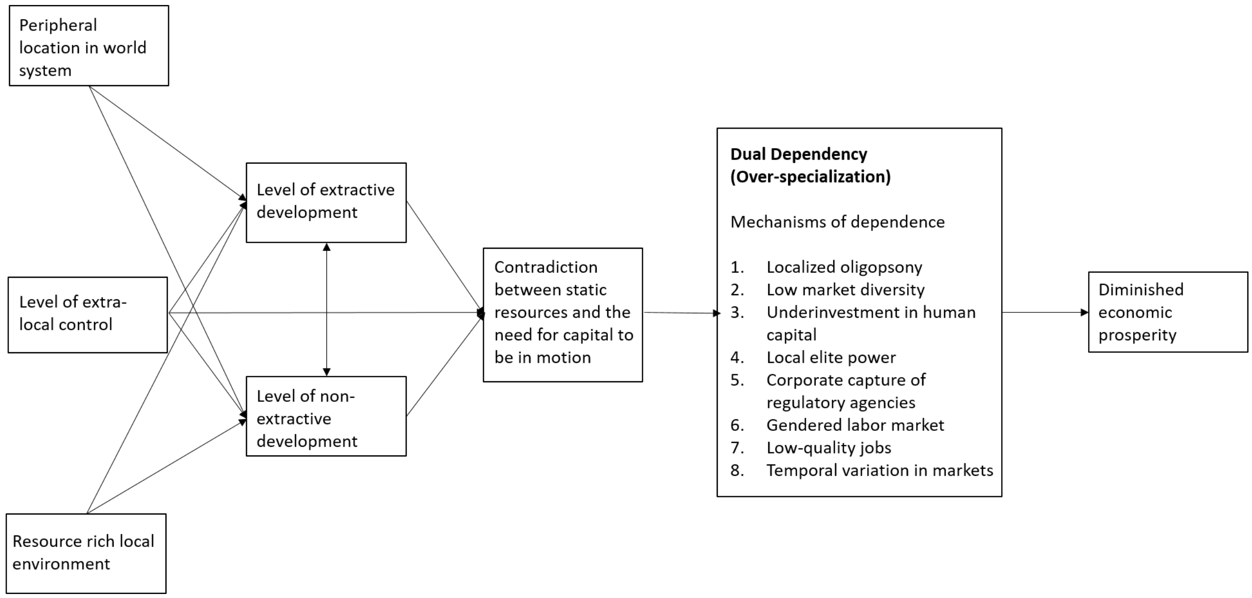

Figure 4.1. Conceptual model of the impacts of dual dependency

A commonly cited cause for negative outcomes due to natural resource dependence, and the third mechanism identified in Figure 4.1, is underinvestment in human capital (Gylfason, 2001; Humphrey et al., 1993; Joshi et al., 2000). In a rural area where the returns to education are low, such as one with a dominant extractive or non-extractive service sector, rural areas are likely to underinvest in education (Humphrey et al., 1993; Joshi et al., 2000). As education is a key factor for economic growth, this leads to worse economic outcomes for natural resource involved regions than non-natural resource involved counterparts (Gylfason, 2001). This lack of investment can be at either the community or individual level. At the community level, less tax revenue will be sent to schools as they are viewed as less important than other government services. At the individual level, people within the community will self-evaluate future job prospects and ultimately decide that continued education is unlikely to pay off (Humphrey et al., 1993).

The fourth mechanism relevant to over-specialization in the natural resource sectors is the power of the local elites in a community. In the case of natural resource dependency, it is expected that local elites in a region will operate as the foot-soldier of the transnational capitalist class and capture what local economic growth does exist. In doing so, the local elites create and reinforce patterns of inequality while facilitating rent-seeking behavior by the external investors (Billings and Blee, 2000; Duncan, 2014). Further, in the case of non-extractive development, a new elite class is expected to move into a region due to its natural amenities (Sherman, 2018). This new influx of wealthy residents is likely to lead to the concentration of wealth among the elite while fostering rural gentrification processes (Ghose, 2004).

Further, the local elites in the rural natural resource community work with the external interests to foster the fifth mechanism of natural resource dependence, corporate capture of regulatory agencies (Humphrey et al., 1993; West, 1994). This capture, characterized by rent-seeking behavior where industries attempt to manipulate the political system to serve their capitalist interest, has been historically well-documented throughout natural resource bureaucracies in rural America (West, 1994). As previously argued, the external natural resource interests have limited interest in the success of the broad regional economy. From this, they attempt to capture the regulatory mechanisms surrounding their development to ensure they make the greatest possible profit, to the detriment of local people.

The sixth mechanism of natural resource dependence expected to lead to negative economic outcomes is gendered labor markets. Both the extractive and non-extractive sectors are historically gender-segregated. The extractive sectors are masculinized, while the non-extractive sectors are feminized (Sherman, 2009a,b; Tallichet, 2000). This creates a gendered division of labor in places where only one form of natural resource development is present. This division means that even when work may be available, if it is not appropriately gendered the individual will choose to stay home and do work around the house instead (Sherman, 2005). This division results in fewer members of the household earning income than would be possible in a non-gendered labor market, which leads to lower economic prosperity overall.

This gendered labor market is in-part reflective of the seventh mechanism identified, the low quality work available in each sector. Although often providing decent wages, benefits, and full-time employment, jobs provided in the extractive sector are notoriously insecure due to the booms and busts of the global commodity markets (Freudenburg, 1992). This makes saving in the long-term difficult and ultimately leads to exacerbated economic hardship (Freudenburg, 1992). On the non-extractive side, the jobs are generally even worse, with employment in non-extractive natural resource sectors often being seasonal, part-time, and low paying (Green, 2017; Sherman, 2018).

The final mechanism identified here is the temporal variation in markets. Extraction, in particular, has a long history of wide temporal variation (Freudenburg, 1992; Jacquet and Kay, 2014). This has been typically described as the boomtown effect, where communities and regions dependent on extraction face rapid peaks of economic prosperity followed by deep troughs of hardship and economic decline (Kinchy et al., 2014). However, the non-extractive sector has its own issues of temporal variation. Although more reliable, the seasonal nature of the sector makes it difficult to find year round employment and makes it difficult for rural residents to make ends meet (Sherman, 2018). Residents find it difficult to piece together work and generate savings, and for many, buying a house is out of the question (Sherman, 2018).

These mechanisms, although surely not an exhaustive list of every proximate cause for negative economic outcomes under natural resource dependence, provide a cohesive list of the ways we may expect to see the contradiction between the static nature of natural resources and the need for capital to be in motion expressed in the rural natural resource economy. It is these mechanisms that will be drawn upon in the creation of the ideal typology of natural resource communities that follows.

4.3 An Ideal Typology of Natural Resource Communities

4.3.1 Ideal Types

Ideal types, an analytic tool common to sociology, were first popularized by Max Weber (Ritzer and Stepnisky, 2017). An ideal type is a description of a phenomenon designed to elucidate the most important aspects of that phenomenon for comparison with the real world. The ideal type is a heuristic, it is not meant to perfectly describe things as they are, but rather to capture a phenomenon as we might expect it to be. From this, we can compare the ideal type with actual observations to see where reality deviates from theory and why that may occur (Ritzer and Stepnisky, 2017). Watkins (1952) presented a useful analogy of ideal types when writing, "one might improve one's appreciation of the shape of a roughly circular object by placing over it an accurate tracing of a circle (p. 25)". As this analogy highlights, we are unlikely to find a truly circular object in nature, but by comparing it with one that is, we can see how it deviates from its ideal form.

Importantly, just because something is an ideal type does not mean it is 'ideal'. The term ideal is used by Weber (1949:1904) to indicate that the type is rarely found in the observed world, as indicated in his definition:

> "An ideal type is formed by the one-sided *accentuation* of one or more points of view and by the synthesis of a great many diffuse, discrete, more or less present and occasionally absent *concrete* individual phenomena, which are arranged according to those one-sidedly emphasized viewpoints into a unified *analytical* construct. In

> its conceptual purity, this mental construct cannot be found empirically anywhere in reality. It is a *utopia*." (Weber, 1949, p.90)

From this quote we can also see ideal types are not meant to be constructed in a haphazard fashion. Rather, they are to be generated by bringing together multiple theoretical and empirical viewpoints in such a way as to produce an analytical tool which emphasizes the most essential components of a phenomenon. To do this, the ideal typology of natural resource communities presented below draws on the theoretical and empirical insights of the resource curse literature, the resource dependence literature, the scholarship on the impacts of rural tourism, the framework of dual dependency developed by Mueller (2019b), and the proximate mechanisms of natural resource dependence outlined in Section 4.2.3.1. In-line with Weber (1949:1904), the ideal type presents accentuated types from which comparisons with the real world may be conducted.

4.3.2 The Ideal Typology

The ideal typology of natural resource communities contains six ideal types. As is common to ideal types, no natural resource community is expected to fit any of the types exactly (Ritzer and Stepnisky, 2017). However, by comparing communities against this theory-grounded ideal typology future research will be able to develop a richer understanding of natural resource dependence in the United States. The scale of the ideal-typology is that of the natural resource community. Meaning communities where a significant portion of their local economy is reliant upon the natural environment. In this ideal type, what constitutes a community has been left intentionally vague. This decision was made due to the history of natural resource dependence scholarship using a wide-range of scales and the considerable debate in academic scholarship as to what constitutes a 'community' (Flint et al., 2008; Machlis and Force, 1988). As such, future researchers may wish to apply this typology at the scale of the town, the county, or some other scale. As we may expect, as the scale increases in size the direct applicability of these types will likely vary.

Relying on the framework of dual dependency, which defines natural resource dependence as the over-specialization of a community in the natural resource sectors, the typology has two dimensions: the type of development and economic prosperity. As this typology is focused on natural resource involved communities, ideal types for communities with low levels of natural resource development have not been created. Although both the level of development and economic prosperity are ultimately continuous dimensions, they have been dichotomized

	High Economic Prosperity	Low Economic Prosperity
High level of extractive development	**Extractive Specialized**	**Extractive Dependent**
High level of non-extractive development	**Non-extractive Specialized**	**Non-extractive Dependent**
High level of both forms of natural resource development	**Hybrid Specialized**	**Hybrid Dependent**

Figure 4.2. An ideal typology of natural resource communities

into 'high' and 'low' for the purposes of the ideal typology. The dichotomization facilitates the "one-sided accentuation of one or more points of view (p. 90)" described by Weber (1949:1904).

A community is considered 'dependent' on the natural resource sector if they have a high level of development in that sector and low economic prosperity. If a community has a high level of development, but high economic prosperity, then they are considered specialized. It is possible, and argued as likely by Mueller (2019b), that a specialized natural resource community will trend towards dependence. However, this distinction allows for a more precise consideration of places where natural resource development does not result in underdevelopment (For a rich example see the rural northeastern community discussed by Duncan (2014)).

The typology applies the distinction between extractive and non-extractive development made throughout this paper. Extractive development includes activities which remove a natural resource from a site for future production or consumption such as oil, gas, mining, timber, hunting, and fishing. Non-extractive development includes activities which rely on the natural resource base functionally but do not remove that resource such as tourism, real estate, outdoor recreation, amusement, and other forms of natural amenity development. Additionally, a third category of hybrid development allows for places where extractive and non-extractive natural resource development are occurring in-tandem. Although often viewed as competing uses of the same resource base, extractive and non-extractive forms of development can occur in-tandem and are not always viewed as in-conflict by residents (Petrzelka et al., 2006).

The simplified version of the typology is presented in Figure 4.2. At the intersection of the level of development and economic prosperity we have six ideal types of natural resource communities: extractive specialized, extractive dependent, non-extractive specialized, non-extractive dependent, hybrid specialized, and hybrid dependent. Figures 4.3 through 4.5 present each pair of ideal types, along with a summary of their attributes. I have chosen to

	Extractive Specialized (High Extractive Development & High Economic Prosperity)	Extractive Dependent (High Extractive Development & Low Economic Prosperity)
Labor Market Diversity	High	Low
Income Inequality	Low	High
Economic Agglomeration	Yes	No
Investment in Human Capital	High	Low
Ownership & Investment Location	Majority Local	Majority External
Political Economy	Honest and Fair	Corrupt
Local Elite Behavior	Egalitarian and Community Focused	Individualistic and Profit Driven
Labor Market Concentration	High (Competitive)	Low (Oligopsonistic)
Gendered Labor Market	No	Yes
Job Quality & Distribution	Good and Equitable	Good and Inequitable
Regulatory Status	Fair and just regulation of extractive industry by the state	Regulatory agencies captured by extractive interests
Rent Seeking Behavior	Absent	By both local elites and external extractive interests
Temporal Variation	Sustainable levels of extraction allow economy to weather downturns in commodity markets	Frequent booms and busts in local well-being due to high attachment to commodity markets

Figure 4.3. Ideal types of extractive natural resource communities

present these characteristics within the figures, and do not belabor them in this narrative to simplify communication of the characteristics of each type. The listed attributes flow directly from the eight mechanisms identified in Section 4.2.3.1 and represent the way these mechanisms are manifested in these ideal types of natural resource communities.

Each figure presents the ideal types of specialized and dependent communities for that form of natural resource development. As can be seen, the characteristics of specialized communities are in many ways opposite of those in dependent communities. They represent exaggerated mirror images of one another. In general, the specialized community represents the positive utopia and the dependent community the negative utopia. For example, while we can expect diverse labor markets in specialized communities, we should expect homogenous labor markets in dependent communities. Similarly, the ideal type of dependent community has a corrupt local political economy and the ideal type of specialized community has a local political economy that is honest and fair.

The reasons for why one location is specialized and another dependent will vary from place to place and is an important question for comparative case-study research. From a theoretical standpoint, a community will be specialized instead of dependent where the

	Non-Extractive Specialized (High Non-Extractive Development & High Economic Prosperity)	Non-Extractive Dependent (High Non-Extractive Development & Low Economic Prosperity)
Labor Market Diversity	High	Low
Income Inequality	Low	High
Economic Agglomeration	Yes	No
Investment in Human Capital	High	Low
Ownership & Investment Location	Majority Local	Majority External
Political Economy	Honest and Fair	Corrupt
Local Elite Behavior	Egalitarian and Community Focused	Individualistic and Profit Driven
Labor Market Concentration	High (Competitive)	Low (Oligopsonistic)
Gendered Labor Market	No	Yes
Job Quality & Distribution	Good and Equitable	Low-quality and Inequitable
Regulatory Status	Fair and just regulation of non-extractive industry by the state	Regulatory agencies captured by non-extractive interests
Rent Seeking Behavior	Absent	By both local elites and external extractive interests
Temporal Variation	Seasonal ebbs and flows are offset by the availability of year-round employment	Seasonal job availability makes saving difficult and results in limited off-season opportunity
Housing Market	Housing affordable at all income levels	Unequal and unaffordable housing market due to wealthy in-migrants and rural gentrification processes
Sense of Community	Mutual understanding and aligned goals between amenity migrants and historic residents	Culture clash and class conflict between amenity migrants and historic residents

Figure 4.4. Ideal types of non-extractive natural resource communities

context of the location and its history altered either the incentives or power of capital such that the negative results of the spatial contradiction did not occur. Examples of these may include state intervention, resource constraints, linkages with nearby labor markets, or the specific history of capital investment. For example, Duncan (2014) describes a community in the Northeast where the original capitalists lived in town with the working class, which led to broader trust, shared values, and lower levels of exploitation. After the original capitalists relocated, the positive outcomes persisted due to the path-dependencies created through this process.

Although extractive and non-extractive sectors are mutually aligned in the conflict between spatially fixed natural resources and mobile capital, and thus their ideal type communities share many characteristics, they do differ in key ways. For example, the ideal non-extractive dependent community is characterized by highly unequal housing markets

	Hybrid Specialized (High Extractive Development & High Non-Extractive Development & High Economic Prosperity)	Hybrid Dependent (High Extractive Development, High Non-Extractive Development & Low Economic Prosperity)
Labor Market Diversity	High	Low
Income Inequality	Low	High
Economic Agglomeration	Yes	No
Investment in Human Capital	High	Low
Ownership & Investment Location	Majority Local	Majority External
Political Economy	Honest and Fair	Corrupt
Local Elite Behavior	Egalitarian and Community Focused	Individualistic and Profit Driven
Labor Market Concentration	High (Competitive)	Low (Oligopsonistic)
Gendered Labor Market	No	Yes
Job Quality & Distribution	Good and Equitable	Low-quality and Inequitable
Regulatory Status	Fair and just regulation of non-extractive industry by the state	Regulatory agencies captured by non-extractive interests
Rent Seeking Behavior	Absent	By both local elites and external extractive interests
Temporal Variation	Seasonal ebbs and flows are offset by the availability of year-round employment	Seasonal job availability makes saving difficult and results in limited off-season opportunity
Housing Market	Housing affordable at all income levels	Unequal and unaffordable housing market due to wealthy in-migrants and rural gentrification processes
Sense of Community	Mutual understanding and aligned goals between amenity migrants and historic residents	Culture clash and class conflict between amenity migrants and historic residents
Sector Cooperation	Cooperation between extractive and non-extractive sectors	Conflict between extractive and non-extractive sectors

Figure 4.5. Ideal types of hybrid natural resource communities

due to rural gentrification processes (Figure 4.4), but this is not an expected characteristic of extractive dependent communities (Figure 4.3). Similarly, the jobs in non-extractive dependent communities are expected to be low-quality, seasonal, and distributed inequitably, whereas the jobs in extractive dependent communities will likely be of decent quality in terms of wages and benefits, but will still have an inequitable distribution.

The hybrid ideal types presented in Figure 4.5 are a logical amalgamation of the characteristics of the extractive and non-extractive ideal types. This means that hybrid dependent communities will have the largest number of negative characteristics, and hybrid specialized the largest number of positives. Hybrid dependent communities have the culture clash of new and old residents common to non-extractive dependent communities, as well as the frequent booms and busts in local well-being due to a strong attachment to the volatile natural resource commodity markets. They will have a highly unequal housing market due to gentrification processes, and the rent-seeking efforts from both extractive and non-extractive sectors. Although the labor market will have both feminized (non-extractive) and masculinized (extractive) labor opportunities, the overall labor market is still expected to be gender segregated in the hybrid dependent community. In addition to the additive characteristics of the extractive and non-extractive communities, hybrid communities will also be characterized by the way the two sectors interact. In the specialized community we can expect cooperation between the extractive and non-extractive sectors, but in the dependent community we can expect conflict between the two.

These ideal types expand the initial theoretical work of Mueller (2019b) into a clear analytic typology from which future comparative work can proceed. To facilitate this future work, I next propose a classification scheme for rural counties in the United States. This classification scheme relies on the logic of this ideal typology to classify each rural county into one of these six types. By comparing the observed characteristics of the classified counties with those described here, we can continue developing a robust theoretical understanding of natural resource development and dependence in the United States. Although the county is not a perfect analog of the community (Machlis and Force, 1988), for classifying the entire nation it is the smallest practical scale available. Future case-study work using this typology may benefit from selecting towns within these classified counties to more appropriately compare the ideal types to the real world.

4.4 A Classification Scheme of Natural Resource Communities

4.4.1 Prior Classifications of Dependence

There exist a number of prior classification schemes of natural resource dependence. Although the majority of these differ fundamentally from the framework used here and suffer from issues of definition and scope discussed prior—meaning natural resource dependence was operationalized from a one-dimensional economic standpoint for either extractive or non-extractive development in isolation—it is important to outline these existing efforts before going forward. The majority of these measures have used a share of either income or employment as their underlying statistic. In this framework, researchers establish a threshold and all counties above that threshold are classified as dependent.

The most common threshold was developed by Bender et al. (1985) and also used by Elo and Beale (1985). This dependence threshold was created specifically for mining dependence and classified a county as mining dependent if 20% or more of total labor and proprietor income came from mining. In their meta-analysis of mining dependence, Freudenburg and Wilson (2002) found this classification was, by far, the most frequently used. This 20% threshold has been extended to other sectors, particularly in the timber industry (Norton et al., 2003). Although 20% is common, lower thresholds have been used. Notably, Stedman et al. (2005) used a more relaxed threshold of 10% for Canadian timber dependence. In this approach, a county was timber dependent if the proportion of employment in forest industries was at least 10%.

Although research has often benchmarked mining dependence at 20% of employment or income, the USDA Economic Research Service (ERS) uses a more relaxed classification. According to the ERS, a non-metropolitan county was considered dependent on mining in 2015 if mining comprised at least 13% or more of total county earnings, or 8% of total county employment (Economic Research Service, 2019). Unlike the other classifications, the ERS classification is a part of a broader typology. The ERS publishes a mutually exclusive economic dependence typology with six categories: farming, mining, manufacturing, federal/state government, recreation, and non-specialized. If a county met the criteria for multiple types, it was put into the category representing a larger share of total earnings. Regarding the benchmarking of each threshold of dependence, the ERS says, "Most thresholds were roughly set at the non-metropolitan mean plus one standard deviation (2019)." Of particular interest to this analysis is the classification of recreation dependence. Unlike other groupings, recreation dependence was not classified using a percent of labor or income. A county was classified as recreation dependent by three thresholds: (1) if they scored above a 0.67 on a weighted index created from three variables: employment, income, and seasonal housing; (2) if they scored above average on the weighted index and had at least $400 of per capita hotel/motel receipts; and (3) if the they scored above average on the weighted index and at least 25% of housing was seasonal (Johnson and Beale, 2002).

There have been other attempts at classifying dependence on non-extractive forms of natural resource use. In a complex paper using cluster analysis, principal components analysis, and numerous regressions, English et al. (2000) ultimately classified rural counties as dependent on tourism if they had more than double the national average of tourism-based jobs and income. Coming from a different angle, Winkler et al. (2012) classified non-metropolitan counties as amenity destination counties if they scored one standard deviation above the mean on an amenity development scale. This scale, developed by Winkler (2010), is a log-transformed unweighted index of the percent of metropolitan in-migrants in the last five years, the share of housing for seasonal or recreational use, and the share of owner-occupied homes worth at least $200,000.

The classification schemes discussed all have strengths and weaknesses. Much of this derives from their two general forms, either a simple threshold of employment and income share or a multi-item index. Typologies using simple thresholds of employment and income share have the benefit of simple interpretation and easy replication, but risk over-simplification or less-than-meaningful groupings. On the counter-point, multi-item indices, weighted or not, have conceptual appeal and are time-varying. This may allow for more meaningful groupings and a more realistic threshold which moves with the changing landscape of development. Unfortunately, they often require access to very specific and often difficult to obtain data—reducing simplicity and replicability—and are subject to many cut-point decisions and branching paths; determining the correct indicators to include or exclude, and their respective weights is difficult to theoretically justify.

Further, the existing schemes have generally only classified either extractive or non-extractive dependence, limiting comparison of the two under one umbrella. The only typology that does account for both extractive and non-extractive resource use—the ERS dependence typology—only accounts for the extractive use of mining, ignoring timber, oil, and gas development. Further the recreation dependence category used by the ERS, while considering recreation broadly and counting real estate, tourism, and recreation-based income and employment, lacks simplicity and is difficult to replicate by non-government researchers. The following classification scheme of the ideal typology overcomes many of these issues in prior schemes by using a simple and replicable typology including both extractive and non-extractive forms of natural resource development grounded in the two-dimensional ideal typology outlined above.

4.4.2 Detailing the Approach

To create a classification scheme of counties for the ideal typology, two factors had to be considered: operationalization and thresholds. The first step was determining how to operationalize the two dimensions of development and economic prosperity. Many variables could be used as indicators for the level of development such as share of employment, income, or firms, among others. While an index of multiple indicators would be possible, it would suffer from the same issues of interpretation, hard to justify cut-point decisions, and possible replication issues depending on the data used. Instead, a single indicator was desired. As much of the work in this area has used employment shares in classification schemes (Elo and Beale, 1985; Stedman et al., 2005) or empirical analyses (Deller, 2014; Lobao et al., 2016; Perdue and Pavela, 2012; Mueller, 2019a), I elected to operationalize the level of development as the share of total county-level employment in the natural resource sector (Elo and Beale, 1985; Economic Research Service, 2019; Stedman et al., 2005). This means the share of the total jobs in the county in each sector, regardless of where the employees lived.

Extractive natural resource employment was comprised of 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 industries focused on extraction were included, meaning that none of these codes include processing, manufacturing, or energy production. Although prior work on extractive natural resource dependence has included some degree of processing (Krannich et al., 2014), this approach allowed for a clear conceptual focus on the just the extraction of resources.

Non-extractive industries 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). The use of these codes for non-extractive industries embeds an assumption into this classification scheme—that tourism, recreation, and real estate development in non-metropolitan counties is tied to the local natural resources and natural amenities. This assumption is similar to the work of English et al. (2000) and Johnson and Beale (2002) where employment in these sectors, although not directly tied to natural resources in the definition, is assumed to be implicitly related to them in function.

Operationalizing economic prosperity presented an equally large number of options as development; indicators such as per capita income, inequality, poverty rate, or labor force participation would all have been reasonable choices. Similar to the level of development, although a multi-item index could have been created, it was not desired to ensure a interpretable and justifiable measure. Thus, a single indicator—poverty rate—was used. The selection of poverty as the indicator for economic prosperity stems from the historic focus in the natural resource dependence literature on poverty impacts, where studies have consistently found higher levels of natural resource development were associated with higher levels of poverty (Krannich et al., 2014). Using poverty as the indicator of economic prosperity in the classification scheme directs the focus of the scheme on the bottom of the income distribution where negative economic outcomes are likely to be most severe. If an indicator such as per capita income had been used, higher levels of material hardship could have been masked by high inequality. Finally, given the persistently higher poverty in rural parts of the United States relative to urban areas, the use of poverty rate as the indicator of economic prosperity nests the classification within this ongoing issue (Tickamyer et al., 2017).

Following operationalization, the next factor to consider was thresholds. Although the use of the two-dimensional, six-category ideal typology alleviates many of the definitional issues of prior work, it does not ameliorate the difficulties in deciding what constitutes a 'high' level of development. As a goal of this scheme was application by future research, a clear and replicable threshold was desired. The prior schemes have used various thresholds, and although 20% of employment has been the most common (Freudenburg and Wilson, 2002), it does not have any substantive meaning on its own. As noted, the ERS conventionally uses a benchmark of one-standard deviation above the mean for their one-dimensional economic thresholds of dependence (Economic Research Service, 2019). However, it is possible that this could under-classify counties if dependence develops before this somewhat arbitrary threshold. To ensure broad classification under the two-dimensional approach, a lower threshold was adopted.

A county was classified as having a high level of development if they were above the annual average employment share in the sector for non-metropolitan counties. This is in-line with earlier work on natural resource dependence which assumed a county was dependent if they had excess employment in that sector (Machlis and Force, 1988); excess employment was defined by Machlis and Force (1988) as county-level employment in a given sector being above the national average. In order to keep measurement clear and consistent, the same approach was used for determine if a county had high (i.e. above the non-metropolitan average) or low (i.e. below the non-metropolitan average) poverty. Annual averages were used to allow for temporal changes to have less of an impact on classifications. For example, by using the annual non-metropolitan average of poverty, the bias introduced by broad increases in poverty on the resulting classification—such as the increases which occurred during the great recession—were minimized.

Following the adoption of the approach, non-metropolitan counties were classified for the years of 2000, 2010, and 2015. I focus on non-metropolitan counties due to the rural nature of natural resource dependence, the similar focus of prior classification schemes (Economic Research Service, 2019; Johnson and Beale, 2002), and the assumptions built into the categories of employment used for non-extractive development which would become less appropriate if metropolitan counties were also included.[2] If a county was above the non-metropolitan average for extractive employment share and poverty rate they were classified as extractive dependent, if they were above average on extractive development but below average on poverty they were classified as extractive specialized. If a county was above the non-metropolitan average for non-extractive employment share and poverty rate they were classified as non-extractive dependent, if they were above average for non-extractive development but below average on poverty they were classified as non-extractive specialized. Counties were classified as hybrid specialized if they were above average on both forms of employment share and below average on poverty and hybrid dependent if they were above average on both forms of employment share and above average on poverty.

4.4.2.1 Data and Variables

Data for classification came from five sources: the American Community Survey (ACS), the Decennial United States Census, the Bureau of Economic Analysis (BEA) Local Area Personal Income and Employment data, the Office of Management and Budget (OMB) metropolitan classifications, and Wholedata: Unsupressed County Business Patterns Data from the Upjohn Institute. These databases were merged into one long-form time-consistent database for the years of 2000, 2010, and 2015 and cover all counties within the contiguous United States. The study interval of 2000 to 2015 is the longest interval for which all necessary data was available in an unsuppressed format. To ensure time-consistent geographic boundaries, any counties which changed boundaries during the interval were collapsed into larger geographic clusters.[3] A table detailing all of these changes is presented in Appendix B (Table B.1). The non-metropolitan classification was allowed to vary for each year, meaning that there were a different number of non-metropolitan counties in 2000 than 2010 and 2015 due to reclassification by the OMB following the 2010 census. Employment shares in each sector were created by dividing the number of employees for the sectors reported in Wholedata by the total number of employees in the county. Poverty rate was calculated by dividing

[2] A county is classified by the Office of Management and Budget as metropolitan if they have a core urban area with a population of at least 50,000 or are linked to another metropolitan county by at least 25% of commuters. A non-metropolitan county is one that does not meet this criteria. (Office of Management and Budget, 2010)

[3] Similarly, each database used its own rules for handling Virginia cities and their corresponding counties, if one database collapsed a city into a county, then this was done across the entire dataset. Additionally, the three island counties in the contiguous United States were merged into their nearest continental neighbor to facilitate spatial regression.

the number of persons below the poverty line reported by the census by the total county population for the same year.

4.4.3 Classification Results

The results of the classification for 2000, 2010, and 2015 are presented in Table 4.1. The classification of every county over the study period is available on the author's personal website and upon request.[4] A total of 2010 counties were classified in 2000, and 1936 were classified for 2010 and 2015, reflecting the reclassification of non-metropolitan counties following the 2010 census. As may be expected by the use of averages as thresholds, the absolute number of counties on any single dimension was generally stable. There were between 1059 and 1175 non-metropolitan counties with above average poverty from 2000 to 2015. Similarly, there were between 275 and 300 counties with above average extractive employment shares and between 587 and 595 counties with above average non-extractive employment shares. Given this consistency built into the scheme through the use of averages, it is not the number of counties in a single dimension that is valuable, but rather the number, and proportion, of counties in the groups at the intersection of the two dimensions, and how those proportions change over time.

[4]visit JTomMueller.com to download the full typology.

Table 4.1. Classifications of Natural Resource Counties from 2000 to 2015

	Above Average Poverty[a]	Below Average Poverty	Total (100%)
Above average extractive	Extractive Specialized	Extractive Dependent	
2000 (> 1.53%)	98 (32.7%)	202 (67.3%)	300
2010 (> 1.66%)	145 (48.3%)	155 (51.7%)	300
2015 (> 1.91%)	135 (49.1%)	140 (50.9%)	275
Above average non-extractive	Non-extractive Specialized	Non-extractive Dependent	
2000 (> 5.4%)	408 (69.3%)	181 (30.7%)	589
2010 (> 5.7%)	307 (52.3%)	280 (47.7%)	587
2015 (> 5.8%)	328 (55.1%)	267 (44.9%)	595
Above average in both	Hybrid Specialized	Hybrid Dependent	
2000	133 (69.3%)	88 (39.8%)	221
2010	108 (60.7%)	70 (39.3%)	178
2015	110 (59.1%)	76 (40.9%)	186
Other non-metro			
2000	536 (59.6%)	364 (40.4%)	900
2010	499 (57.3%)	372 (42.7%)	871
2015	503 (57.2%)	377 (42.8%)	880
Total			
2000	1175 (58.5%)	835 (41.5%)	2010
2010	1059 (54.7%)	877 (45.3%)	1936
2015	1076 (55.6%)	860 (44.4%)	1936

[a] Non-metropolitan poverty rate annual averages: 2000 = 15.0, 2010 = 16.7, 2015 = 16.4

Note: Averages for extractive and non-extractive development calculated from non-metropolitan employment shares; averages for poverty calculated from non-metropolitan poverty rates.

When looking at the extractive counties in Table 4.1, we see that the proportion of counties with above average employment share classified as extractive dependent in 2000 decreased over the study period. In 2000, 67.3% of extractive counties were dependent. However, by 2015 that proportion had decreased to 50.9%. The pattern for non-extractive dependence mirrored that of extractive. The proportion of counties with above average non-extractive employment share increased from 30.7% in 2000 to 44.9% in 2015. Unlike the changes evident in extractive and non-extractive counties, the breakdown of hybrid counties was more stable. Among hybrid counties, the proportion classified as dependent ranged from 39.3% to 40.9%.

Although the absolute number of counties along each dimension was generally stable, this does not mean counties did not transition between groups during the 15-year study period. Further, it is unclear if the changing proportion of counties classified as dependent versus specialized for extractive and non-extractive counties was due to counties moving between the specialized and dependent groups for the sectors (e.g. transitioning from extractive specialized to extractive dependent), or some other change. To investigate this further, Tables 4.2 and 4.3 present information on counties transitioning out of, or into, dependence during the study period.

Table 4.2. Transitions out of Dependence Between 2000 and 2015

	Form of Dependence in 2000		
Classification in 2015	Extractive	Non-Extractive	Hybrid
Extractive Specialized	28 (25%)	1 (1.5%)	2 (3.6%)
Extractive Dependent	N.A.	3 (4.6%)	7 (12.5%)
Non-Extractive Specialized	1 (0.9%)	13 (19.7%)	2 (3.6%)
Non-Extractive Dependent	5 (1.8%)	N.A.	19 (33.9%)
Hybrid Specialized	2 (1.8%)	2 (3.0%)	18 (32.1%)
Hybrid Dependent	12 (10.7%)	9 (13.6%)	N.A.
Other Non-Metro Low Poverty	9 (8.0%)	2 (3.0%)	0 (0.0%)
Other Non-Metro High Poverty	43 (38.4%)	29 (43.9%)	4 (7.1%)
Metropolitan	12 (10.7%)	7 (10.6%)	4 (7.1%)
Total	112 (100.0%)	66 (100.0%)	56 (100.0%)

Note: Percentages may not sum to exactly 100% due to rounding.

Table 4.2 presents counties that were classified in a form of natural resource dependence in 2000 but not in 2015. A total of 234 non-metropolitan counties transitioned out of one form of natural resource dependence over the 15-year period. When looking at extraction we see that counties predominately moved into two groups: a quarter (25%) of the extractive dependent counties had below average poverty by 2015 and were reclassified as extractive specialized and a plurality of counties (46.4%) were no-longer natural resource involved by 2015 and were instead classified as other non-metropolitan. Of these 52 counties which were reclassifed as other non-metropolitan, 43 were classified as high poverty. This indicates that extraction decreased but poverty remained elevated for the vast majority of these counties. Counties moving out of non-extractive dependence had a very similar story, with 46.9% of the reclassified counties ending up as other non-metropolitan and 29 of those 31 counties continuing to have above average poverty. The hybrid transitions were more variable, with similar proportions moving into non-extractive dependent (33.9%) and hybrid specialized (32.1%).

Table 4.3. Transitions into Dependence Between 2000 and 2015

	Form of Dependence in 2015		
Classification in 2000	Extractive	Non-Extractive	Hybrid
Extractive Specialized	8 (16.0%)	1 (0.7%)	1 (2.3%)
Extractive Dependent	N.A.	5 (3.3%)	12 (27.3%)
Non-Extractive Specialized	0 (0.0%)	55 (36.2%)	2 (4.6%)
Non-Extractive Dependent	3 (6.0%)	N.A.	9 (20.5%)
Hybrid Specialized	4 (8.0%)	6 (4.0%)	15 (34.1%)
Hybrid Dependent	7 (14.0%)	19 (12.5%)	N.A.
Other Non-Metro Low Poverty	6 (12.0%)	22 (14.5%)	0 (0.0%)
Other Non-Metro High Poverty	20 (40.0%)	40 (26.3%)	5 (11.4%)
Metropolitan	12 (10.7%)	4 (2.6%)	0 (0.0%)
Total	50 (100.0%)	152 (100.0%)	44 (100.0%)

Note: Percentages may not sum to exactly 100% due to rounding.

Over the period of 2000 to 2015, a total of 246 of counties transitioned into one of the three forms of natural resource dependence (Table 4.3). Of those counties transitioning into extractive dependence, the largest share came from other non-metropolitan high poverty (40.0%). A further 16.0% came from extractive specialized and the rest came from a fairly even mix of the other groups. The majority of the counties that transitioned into non-extractive dependence over the study period came from either non-extractive specialized (36.2%) or other non-metropolitan high poverty (26.3%). Indicating there were some places which saw increases in non-extractive development, and others which saw increases in poverty. The majority of counties which transitioned into hybrid dependence unsurprisingly came from either extractive dependence (27.3%), non-extractive dependence (20.5%), and hybrid specialized (34.1%).

Although the tables presented demonstrate the transitions in and out, and proportions of, natural resource dependence, it does not show where dependence occurs. To do so, the maps presented in Figure 4.6 show the geographic distribution of the classification scheme for the years of 2000 and 2015. When reviewing the typology spatially we see that the distribution of dependence and specialization varies by region and changed over the study period. Across both time periods, extractive natural resource dependence was most evident in the high poverty regions of the South, while extractive specialization was more common in the center of the country and the Inter-mountain West. The decrease in extractive dependence, and growth in extractive specialization was visible when comparing the two maps, with notable changes throughout the South and Northwest.

Counter to extractive dependence, non-extractive dependence experienced significant growth over the study period. Although notable clusters existed in the Southeast, the Southwest, and the Northwest in both 2000 and 2015, there was a notable increase in the Southeast, Northwest, and Midwest between 2000 and 2015. Non-extractive specialization was common in the Midwest, Northeast, Great Lakes, and Inter-mountain West. Hybrid counties were generally dispersed throughout the country and displayed less temporal variability. Hybrid dependence was more common in the southern latitudes of the United States, while hybrid specialization was more evident in the Inter-mountain West.

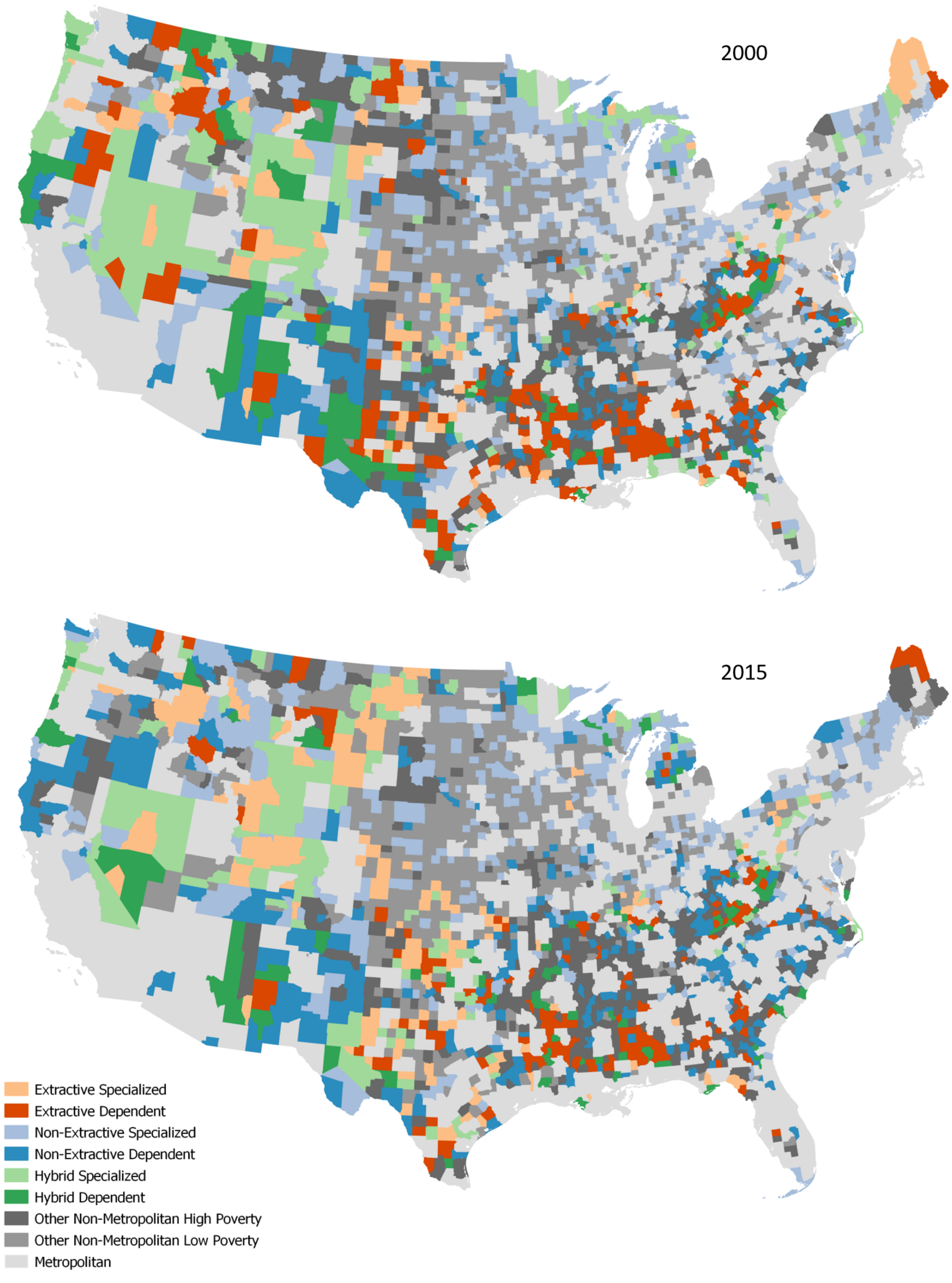

Figure 4.6. The spatial distribution of natural resource counties in 2000 and 2015

4.5 Discussion and Conclusion

This paper has presented an ideal typology and classification scheme for natural resource communities in the United States. This approach, which draws on the work of Mueller (2019b) to formally define natural resource dependence as over-specialization in the natural resource sectors, has the potential to generate a richer understanding of the causes and consequences of natural resource dependence. By exploring the conditions experienced on the ground in the classified counties, and comparing them with the theoretically suggested characteristics in the corresponding ideal types, future research will be able to explore the deviations between the two. As recommended by Weber (1949:1904), through exploration of these deviations and their causes, a more accurate understanding of the phenomenon will be generated.

By aligning the typology and classification scheme on the dimensions of development and economic prosperity, this typology overcomes the definitional issues embedded in prior work on natural resource dependence. Using this classification scheme, it is clear that assessing the impact of dependence on economic outcomes is not a useful exercise. Natural resource dependence, in this framework, is clearly defined by its negative outcomes. Thus, this approach allows us advance our understanding of the phenomenon by asking why dependence has developed, what are the associated outcomes, and what can be done to resolve it.

It should be made clear that natural resource dependence, and the formation of dual dependency hallmark of the phenomenon, is not a steady state, but rather an ongoing dialetical process (Mueller, 2019b). This ebb and flow is clear in the transitions seen between 2000 and 2015 documented in Tables 4.2 and 4.3, and Figure 4.6. Communities will move back and forth between specialization and dependence as their economies, and the global economy, experience shocks and changes. Importantly, when a community decreases its reliance upon natural resources, or increases their economic prosperity, its history is not erased. As highlighted by the number of counties remaining high poverty after extraction decreased, counties which leave natural resource dependence are likely to still remain underdeveloped due to the creation of path dependencies over time. It is possible they will return to natural resource dependence when market conditions allow, but it is certainly not a guarantee. Thus, although the communities with high levels of natural resource development are important for research and policy consideration, these counties which have transitioned out of natural resource development but remain high in poverty are equally important for future rural economic development efforts.

Beyond research, this approach has the potential to help policy makers begin to develop and prepare policy solutions. If a county is classified as dependent on natural resources, it is clear that the development occurring in the county is not helping residents stay out of poverty. However, if a county is classified as specialized, it is clear that something is working in the locality to keep residents out of poverty. Future work should assess the different characteristics of specialized versus dependent counties to inform policies which can help dependent counties transition towards a state of specialization and away from their current state of dependence.

In conclusion, this paper has presented a formal definition, ideal typology, and classification scheme of natural resource communities in the rural United States. There remains much theoretical and empirical work to be done on this topic. Hopefully, this ideal typology and classification scheme will help researchers identify counties of concern while helping policy-makers design solutions considerate of existing dependencies. Extractive and non-extractive natural resource dependence continues to represent the dominant economic structure for a significant share of non-metropolitan counties in the United States (Figure 4.6). It will be important to monitor the trajectory of these counties over time if we intend to ensure sustainable economic development for rural America.

Chapter 5 Conclusion

In this body of work I theorized, tested, and classified natural resource dependence in rural America. Unlike prior work, I approached natural resources broadly, allowing for both extractive and non-extractive forms of natural resource development. I have found that non-extractive forms of development have a more negative relationship with rural economic prosperity than I argued in my theoretical framework. As theory is a dialogue, future research will need to develop an understanding of these inconsistencies. In this brief conclusion I present directions for future research on natural resource dependence.

First, the theoretical framework of dual dependency, while firmly grounded in existing scholarship, requires further testing. Although my findings do suggest high levels of both forms of development ultimately resulted in negative socioeconomic returns from 2000 to 2015, the mechanisms have yet to be explored. Key among these mechanisms are disinvestment in education, the gendered nature of extractive and non-extractive labor markets, and market diversity and concentration. To appropriately test these mechanisms, restricted data will likely be required. However, pursuing this will be vital to understanding the pathways between high levels of specialization in the natural resource sectors and negative impacts on economic prosperity.

Further, well-being is not just comprised of material economic conditions, but also physical well-being and health. In the interest of considering the relationship between natural resource dependence and well-being holistically, future work should theorize and test the impact of resource dependence on health outcomes. Recent work by Wigley (2017) has found that the resource curse not only impacts economics but also has resulted in increased child mortality. Further, researchers have long-documented the negative impacts of working in, and living near, extractive forms of development (Arnold, 2016; Bonauto et al., 2019; Graber et al., 2017; Hendryx and Ahern, 2008; Liebman et al., 2013; Mueller, Forthcoming; Patel et al., 2017). While these negative health impacts of extractive development are well known, the health impacts of non-extractive development and dependence remain opaque. Research on the social determinants of health finds lower levels of income are associated with negative health outcomes (Franks et al., 2003; Galea et al., 2011). If non-extractive development is impacting income, then population health may be indirectly impacted by these mechanisms. This is an area of importance for future work.

Third, the goal of this work was to provide a general theoretical framework and empirical analysis of the entire contiguous United States. However, regional variation exists (Lobao et al., 2016; Nord and Luloff, 1993). Important next steps include regional models and region-specific effects, as well as qualitative work comparing regions. The way resource dependence operates likely varies between regions. For example, both the Inter-mountain West and the Gulf Coast have extractive and non-extractive activity, but the impacts and mechanisms of dependence are likely to look very different. Applying the ideal types presented in Chapter 4 to varying regions will be crucial for understanding how the characteristics of dependent and specialized communities vary across regions.

Finally, from a policy perspective this research does not present a clear solution. If the United States is to slow its pace of carbon emissions, as is needed to deal with global climatic change, extractive activities will need to decrease. However, as found in Chapter 3, non-extractive development had a negative impact on per capita income from 2000 to 2015 and provided no benefit to inequality and poverty. Further, as found in Chapter 4, non-extractive dependence has grown since 2000, with more rural counties having high levels of both non-extractive development and poverty. Thus, what is the solution for rural America? It is clear that further work is needed to understand what sustainable economic development in rural America actually looks like. This dissertation and the broader literature seriously question whether or not rural America can survive long-term without stronger social policy. If we continue to let the market drive development and define development as urbanization, it is unclear how much longer there will be a rural America, as we know it, to develop. As it currently stands, non-extractive uses of the natural resource base are, on average, a net loss for rural communities. Until we can make work in these sectors provide a living wage, non-extractive forms of natural resource-related economic development should likely be avoided as a policy prescription.

Ultimately, the theoretical framework presented in this dissertation does not suggest local economic development efforts will provide a sustainable solution for resource dependent counties in rural America. Local efforts are certainly essential. But they are ultimately insufficient. Issues such as the strength of labor, market concentration, and the ease of extra-local control will not be solved at the community level. Broader, and increasingly imaginative, policy reforms are likely needed. In step with this, future work should find creative ways to assess the possible impacts of different types of policy reforms on rural America.

Appendix A
Chapter 3 Supplement

County Boundary Adjustments

A number of counties were collapsed to ensure time-consistent units across the study period. Additionally, each dataset handled the independent cities of Virginia differently. This required merging the vast majority of the Virginia independent cities into their larger county for analysis. The specific adjustments are detailed in Table A.1.

Table A.1. 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)

Spatial Diagnostics

Although the vast majority of spatial diagnostics are not available for panel data, a modified approach was used to validate the necessity of spatial considerations. Table A.2 presents the resents of Univariate Moran's I tests of each independent and dependent variable of interest for each study year. Estimates were performed using GeoDa using 999 permutations. All tests demonstrated significant spatial autocorrelation at $p \leq .001$, validating the necessity of controlling for spatial effects (Chi and Zhu, 2019).

Table A.2. Univariate Moran's I Statistics for Independent and Dependent Variables

	2000		2010		2015	
	Moran's I	Z-statistic	Moran's I	Z-statistic	Moran's I	Z-statistic
Extractive Employment Share	0.300	28.775***	0.377	35.826***	0.358	33.897***
Non-extractive Employment Share	0.195	18.075***	0.191	17.595***	0.212	19.482***
Per Capita Income to Residents	0.571	54.2954***	0.544	48.373***	0.520	46.808***
Gini Index	0.507	46.757***	0.381	35.103***	0.348	31.241***
Poverty Rate	0.616	57.300***	0.522	48.397***	0.518	47.082***
N	3073		3073		3073	

Moran's I calculated in GeoDa; Z-statistic calculated using 999 permutations

Row standardized queens first order contiguity spatial weights matrix used for Moran's I calculation

* $p < 0.05$, ** $p < 0.01$, *** $p \leq 0.001$

Summary of Results of Alternative Aspatial and Linear Models

The tables below present aspatial conventional fixed effects models alongside the main SLX models of this paper. To allow comparison each model with quadratic effects is presented alongside a model with the relationships between extractive and non-extractive employment shares and outcomes variables specified as linear. The SLX models with the quadratic specification are the same models as presented in the main body of the manuscript. AICs are estimated and presented for each model to facilitate comparison of overall model fit.

Per Capita Income

The aspatial models of per capita income yielded similar results to the spatial models (Tables A.3 and A.4). In the models with the linear specification, we see that extractive and non-extractive employment shares had a significant relationship with per capita income in the aspatial and spatial models. When turning to the models with the quadratic specification, we see similar results for both forms of development in both the aspatial and spatial models. Across both the linear and quadratic specification the coefficients were smaller in the spatial models than the aspatial. When comparing AIC levels between models, the model with the lowest AIC value was the spatial model with the quadratic specification. The quadratic specification was lowest for both the aspatial and spatial models. This indicates that the spatial model with the quadratic specification had the best model fit.

Table A.3. Impact of Natural Resource Development on Per Capita Income from 2000-2015 - Aspatial

	Aspatial Fixed Effects Models			
	Linear		Quadratic	
Variables	Coef.	SE	Coef.	SE
Non-Metropolitan [(Metro=0)*X]				
Extractive Employment Share	0.2621***	0.0640	0.4511***	0.0949
Extractive Employment Squared			-0.0069**	0.0024
Non-extractive Employment Share	-0.1727***	0.0475	-0.2269*	0.0971
Non-extractive Employment Squared			0.0014	0.0029
Metropolitan [(Metro=1)*X]				
Extractive Employment Share	0.1874*	0.0878	0.1956	0.1067
Extractive Employment Squared			0.0001	0.0022
Non-extractive Employment Share	-0.2279***	0.0680	-0.3718***	0.0765
Non-extractive Employment Squared			0.0028***	0.0007
Population (thousands)	-0.0075***	0.0015	-0.0071***	0.0015
Percent Over 65	-0.4725***	0.0598	-0.4630***	0.0596
Percent White	0.1209***	0.0241	0.1209***	0.0239
Percent Black	-0.0835	0.0463	-0.0782	0.0466
Percent Hispanic	0.0449	0.0440	0.0401	0.0439
Year [2000 ref]				
2010	1.7647***	0.1575	1.7781***	0.1605
2015	4.6041***	0.2832	4.6067***	0.2868
Constant	20.3127***	2.5065	20.3915***	2.4972
AIC	46359.9044		46339.0521	
Joint test of non-linear terms				
Extractive			$F(2,3072)=14.19^{***}$	
Non-extractive			$F(2,3072)=8.27^{***}$	

Coef. = unstandardized regression coefficient; SE = cluster robust standard error

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Unit and period fixed effects model

Table A.4. Impact of Natural Resource Development on Per Capita Income from 2000-2015 - Spatial

	SLX Spatial Fixed Effects Models			
	Linear		Quadratic	
Direct Effects	Coef.	SE	Coef.	SE
Non-Metropolitan [(Metro=0)*X]				
Extractive Employment Share	0.1968***	0.0513	0.3117***	0.0811
Extractive Employment Squared			-0.0040*	0.0018
Non-extractive Employment Share	-0.1645***	0.0453	-0.1933*	0.0873
Non-extractive Employment Squared			0.0011	0.0025
Metropolitan [(Metro=1)*X]				
Extractive Employment Share	0.1018	0.0828	0.0574	0.1062
Extractive Employment Squared			0.0024	0.0023
Non-extractive Employment Share	-0.1620**	0.0582	-0.2462***	0.0741
Non-extractive Employment Squared			0.0015	0.0009
Population (thousands)	-0.0035**	0.0013	-0.0033*	0.0014
Percent Over 65	-0.1518	0.0779	-0.1512*	0.0759
Percent White	0.0570	0.0322	0.0553	0.0312
Percent Black	-0.1461**	0.0506	-0.1453**	0.0509
Percent Hispanic	-0.0502	0.0545	-0.0595	0.0546
Year [2000 ref]				
2010	2.4602***	0.1868	2.5823***	0.1918
2015	6.2445***	0.3512	6.3287***	0.3538
Indirect Effects				
Extractive Employment Share	0.3681***	0.1081	0.7016***	0.2004
Extractive Employment Squared			-0.0279	0.0189
Non-extractive Employment Share	-0.4980***	0.0875	-1.5457***	0.2164
Non-extractive Employment Squared			0.0547***	0.0095
Population (thousands)	-0.0090**	0.0030	-0.0086**	0.0030
Percent Over 65	-0.8106***	0.0993	-0.7753***	0.1000
Percent White	0.1069*	0.0464	0.0940*	0.0453
Percent Black	0.1372	0.0901	0.1308	0.0887
Percent Hispanic	0.1563	0.0809	0.1631*	0.0802
Constant	25.6736***	3.3847	30.1129***	3.4475
AIC	45854.3932		45743.6812	
Joint test of non-linear terms				
Extractive			$F(2,3072)=9.72^{***}$	
Non-extractive			$F(2,3072)=6.92^{**}$	

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 estimated with row standardized queens first order contiguity spatial weights matrix

Inequality

The aspatial models of the Gini Index yielded similar results to the spatial models (Tables A.5 and A.6). In the linear specification of both the spatial and aspatial models, neither form of development had a significant relationship with Gini Index. When looking at the quadratic specification, extractive employment share had a significant non-linear relationship with similarly sized coefficients for both the aspatial and spatial models. Non-extractive employment share did not have a significant relationship with Gini Index in either the aspatial or spatial model with the quadratic specification. As with per capita income, the model with the lowest AIC value was the spatial model with the quadratic specification, indicating the spatial model with the quadratic specification fit the data the best out of the four models.

Table A.5. Impact of Natural Resource Development on Gini Index from 2000-2015 - Aspatial

	Aspatial Fixed Effects Models			
	Linear		Quadratic	
Variables	Coef.	SE	Coef.	SE
Non-Metropolitan [(Metro=0)*X]				
Extractive Employment Share	-0.0329	0.0282	-0.1482**	0.0468
Extractive Employment Squared			0.0042**	0.0013
Non-extractive Employment Share	-0.0574	0.0385	-0.0263	0.0624
Non-extractive Employment Squared			-0.0009	0.0011
Metropolitan [(Metro=1)*X]				
Extractive Employment Share	-0.1378***	0.0378	-0.1140	0.0599
Extractive Employment Squared			-0.0007	0.0016
Non-extractive Employment Share	0.1270**	0.0486	0.0246	0.0374
Non-extractive Employment Squared			0.0020***	0.0006
Population (thousands)	0.0026***	0.0006	0.0027***	0.0006
Percent Over 65	0.0184	0.0269	0.0087	0.0271
Percent White	-0.0484**	0.0170	-0.0491**	0.0170
Percent Black	0.0570	0.0325	0.0576	0.0324
Percent Hispanic	-0.0266	0.0229	-0.0261	0.0229
Year [2000 ref]				
2010	0.0163	0.0877	0.0435	0.0867
2015	0.3460*	0.1350	0.4030**	0.1339
Constant	45.8372***	1.6880	46.2068***	1.6720
AIC	34951.5354		34920.4447	
Joint test of non-linear terms				
Extractive			$F(2,3072)=5.52^{**}$	
Non-extractive			$F(2,3072)=2.06$	

Coef. = unstandardized regression coefficient; SE = standard error

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Unit and period fixed effects model

Table A.6. Impact of Natural Resource Development on Gini Index from 2000-2015 - Spatial

	SLX Spatial Fixed Effects Models			
	Linear		Quadratic	
Direct Effects	Coef.	SE	Coef.	SE
Non-Metropolitan [(Metro=0)*X]				
Extractive Employment Share	-0.0242	0.0286	-0.1377**	0.0492
Extractive Employment Squared			0.0040**	0.0014
Non-extractive Employment Share	-0.0554	0.0387	-0.0219	0.0621
Non-extractive Employment Squared			-0.0009	0.0010
Metropolitan [(Metro=1)*X]				
Extractive Employment Share	-0.1166**	0.0374	-0.0895	0.0596
Extractive Employment Squared			-0.0010	0.0015
Non-extractive Employment Share	0.1198*	0.0517	0.0090	0.0374
Non-extractive Employment Squared			0.0021***	0.0006
Population (thousands)	0.0017**	0.0006	0.0018**	0.0006
Percent Over 65	-0.0070	0.0347	-0.0177	0.0346
Percent White	-0.0393	0.0233	-0.0398	0.0233
Percent Black	0.0364	0.0398	0.0365	0.0397
Percent Hispanic	-0.0387	0.0310	-0.0406	0.0310
Year [2000 ref]				
2010	-0.1243	0.1081	-0.0908	0.1072
2015	0.1026	0.1805	0.1714	0.1808
Indirect Effects				
Extractive Employment Share	-0.0582	0.0441	-0.1036	0.0813
Extractive Employment Squared			0.0050	0.0059
Non-extractive Employment Share	-0.0294	0.0406	-0.0784	0.0954
Non-extractive Employment Squared			0.0024	0.0046
Population (thousands)	0.0018	0.0014	0.0020	0.0014
Percent Over 65	0.0646	0.0507	0.0641	0.0505
Percent White	-0.0268	0.0307	-0.0291	0.0305
Percent Black	0.1150*	0.0536	0.1157*	0.0534
Percent Hispanic	0.0421	0.0423	0.0450	0.0424
Constant	45.8897***	2.2020	46.6764***	2.2075
AIC	34928.3418		34898.3168	
Joint test of non-linear terms				
Extractive			$F(2,3072)=4.38^*$	
Non-extractive			$F(2,3072)=2.02$	

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 estimated with row standardized queens first order contiguity spatial weights matrix

Poverty

The aspatial models of poverty also yielded generally similar results to the spatial models (Tables A.7 and A.8). In the linear specification of both the spatial and aspatial models, extractive employment share had a significant negative relationship with poverty. When looking at the quadratic specification, extractive employment share had a significant relationship in both the aspatial and spatial models. Although the second order term for extractive employment share was statistically significant in the aspatial model, in the spatial model with the quadratic specification it was not. As with both per capita income and gini coefficient, the model with the lowest AIC value was the spatial model with the quadratic specification. This indicates that the spatial model with the quadratic specification again had the best model fit.

Table A.7. Impact of Natural Resource Development on Poverty from 2000-2015 - Aspatial

	Aspatial Fixed Effects Models			
	Linear		Quadratic	
Variables	Coef.	SE	Coef.	SE
Non-Metropolitan [(Metro=0)*X]				
Extractive Employment Share	-0.1662***	0.0390	-0.2638***	0.0585
Extractive Employment Squared			0.0036*	0.0015
Non-extractive Employment Share	0.0312	0.0275	0.0568	0.0586
Non-extractive Employment Squared			-0.0007	0.0010
Metropolitan [(Metro=1)*X]				
Extractive Employment Share	-0.1457**	0.0524	-0.0824	0.0801
Extractive Employment Squared			-0.0026	0.0018
Non-extractive Employment Share	0.1499***	0.0366	0.1424**	0.0507
Non-extractive Employment Squared			0.0001	0.0007
Population (thousands)	0.0011	0.0007	0.0011	0.0007
Percent Over 65	0.0795*	0.0339	0.0730*	0.0341
Percent White	-0.1238***	0.0188	-0.1243***	0.0189
Percent Black	0.0059	0.0417	0.0047	0.0416
Percent Hispanic	0.0189	0.0257	0.0201	0.0256
Year [2000 ref]				
2010	1.6630***	0.1026	1.6721***	0.1026
2015	1.2392***	0.1665	1.2630***	0.1672
Constant	22.5159***	1.9239	22.6623***	1.9489
AIC	38455.4935		38449.3511	
Joint test of non-linear terms				
Extractive			$F(2,3072)=12.03^{***}$	
Non-extractive			$F(2,3072)=0.66$	

Coef. = unstandardized regression coefficient; SE = cluster robust standard error

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Unit and period fixed effects model

Table A.8. Impact of Natural Resource Development on Poverty from 2000-2015 - Spatial

	Spatial Fixed Effects Models			
	Linear		Quadratic	
Direct Effect	Coef.	SE	Coef.	SE
Non-Metropolitan [(Metro=0)*X]				
Extractive Employment Share	-0.1156***	0.0316	-0.1656**	0.0582
Extractive Employment Squared			0.0017	0.0016
Non-extractive Employment Share	0.0316	0.0274	0.0505	0.0566
Non-extractive Employment Squared			-0.0006	0.0009
Metropolitan [(Metro=1)*X]				
Extractive Employment Share	-0.0672	0.0536	0.0214	0.0799
Extractive Employment Squared			-0.0037	0.0021
Non-extractive Employment Share	0.1238**	0.0400	0.0867	0.0484
Non-extractive Employment Squared			0.0007	0.0006
Population (thousands)	-0.0004	0.0007	-0.0004	0.0007
Percent Over 65	-0.0559	0.0406	-0.0610	0.0399
Percent White	-0.0775**	0.0236	-0.0769**	0.0236
Percent Black	0.0277	0.0466	0.0280	0.0465
Percent Hispanic	0.0675*	0.0331	0.0696*	0.0333
Year [2000 ref]				
2010	1.3371***	0.1308	1.3218***	0.1323
2015	0.5706**	0.2198	0.5905**	0.2220
Indirect Effect				
Extractive Employment Share	-0.3654***	0.0778	-0.5652***	0.1250
Extractive Employment Squared			0.0167	0.0117
Non-extractive Employment Share	0.1630***	0.0486	0.4765***	0.1076
Non-extractive Employment Squared			-0.0163***	0.0046
Population (thousands)	0.0026	0.0015	0.0026	0.0015
Percent Over 65	0.3221***	0.0552	0.3092***	0.0555
Percent White	-0.0814*	0.0325	-0.0784*	0.0323
Percent Black	0.0045	0.0606	0.0057	0.0600
Percent Hispanic	-0.0436	0.0438	-0.0467	0.0437
Constant	21.8971***	2.5365	20.9074***	2.5748
AIC	38167.0553		38141.5383	
Joint test of non-linear terms				
Extractive			F(2,3072)=6.91**	
Non-extractive			F(2,3072)=0.55	

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 estimated with row standardized queens first order contiguity spatial weights matrix

Alternative Spatial Weights Matrix

For further validation of results, the primary models were estimated using an alternative spatial weights matrix—the row standardized rooks first order contiguity matrix. This matrix allows a unit to count as a neighbor if it is touching a given unit by a border, but not by a vertex as allowed in the queen's contiguity matrix used in the primary analysis. The results with the alternative spatial weights matrix were equivalent to those of primary models, with the differences between coefficients being within rounding error.

Table A.9. 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 [(Metro=0)*X]						
Extractive Employment Share	0.3185***	0.0815	-0.1389**	0.0494	-0.1648**	0.0582
Extractive Employment Squared	-0.0041*	0.0018	0.0040**	0.0014	0.0017	0.0016
Non-extractive Employment Share	-0.2007*	0.0877	-0.0229	0.0622	0.0534	0.0567
Non-extractive Employment Squared	0.0012	0.0025	-0.0009	0.0010	-0.0007	0.0009
Metropolitan [(Metro=1)*X]						
Extractive Employment Share	0.0595	0.1060	-0.0897	0.0596	0.0233	0.0795
Extractive Employment Squared	0.0024	0.0022	-0.0010	0.0015	-0.0036	0.0021
Non-extractive Employment Share	-0.2446***	0.0742	0.0088	0.0374	0.0867	0.0484
Non-extractive Employment Squared	0.0015	0.0008	0.0021***	0.0006	0.0007	0.0006
Population (thousands)	-0.0032*	0.0014	0.0018**	0.0006	-0.0004	0.0007
Percent Over 65	-0.1562*	0.0760	-0.0207	0.0346	-0.0589	0.0399
Percent White	0.0530	0.0315	-0.0382	0.0231	-0.0752**	0.0232
Percent Black	-0.1474**	0.0514	0.0390	0.0396	0.0303	0.0464
Percent Hispanic	-0.0593	0.0552	-0.0385	0.0312	0.0709*	0.0331
Year [2000 ref]		.		.		
2010	2.5716***	0.1933	-0.0840	0.1065	1.3260***	0.1323
2015	6.2966***	0.3569	0.1753	0.1790	0.6018**	0.2215
Indirect Effect						
Extractive Employment Share	0.7095***	0.1894	-0.1104	0.0812	-0.5550***	0.1206
Extractive Employment Squared	-0.0292	0.0173	0.0061	0.0057	0.0149	0.0107
Non-extractive Employment Share	-1.5109***	0.2145	-0.0947	0.0943	0.4637***	0.1050
Non-extractive Employment Squared	0.0538***	0.0095	0.0027	0.0046	-0.0159***	0.0045
Population (thousands)	-0.0094**	0.0030	0.0024	0.0014	0.0028	0.0015
Percent Over 65	-0.7617***	0.1007	0.0716	0.0496	0.3050***	0.0558
Percent White	0.1028*	0.0463	-0.0330	0.0300	-0.0824*	0.0326
Percent Black	0.1413	0.0906	0.1031	0.0528	-0.0025	0.0599
Percent Hispanic	0.1659*	0.0792	0.0376	0.0423	-0.0491	0.0432
Constant	29.2495***	3.5012	46.9804***	2.1874	21.2159***	2.6249
AIC	45751.7780		34896.8575		38133.9899	
Joint test of non-linear terms ($F(2,3072)$)						
Extractive	9.90***		4.42*		6.89**	
Non-extractive	7.26***		2.04		0.61	

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

Marginal Means and Direct Effects with Downstream Variables Included

Included here are the marginal predictions and direct effects for the models with downstream variables included presented in Section 3.4.2. The graphs do not noticeably change from those in the primary models. The slight exception to this is for non-extractive development and per capita income where the marginal effect becomes remarkably consistent across the range of employment share (Figure A.2).

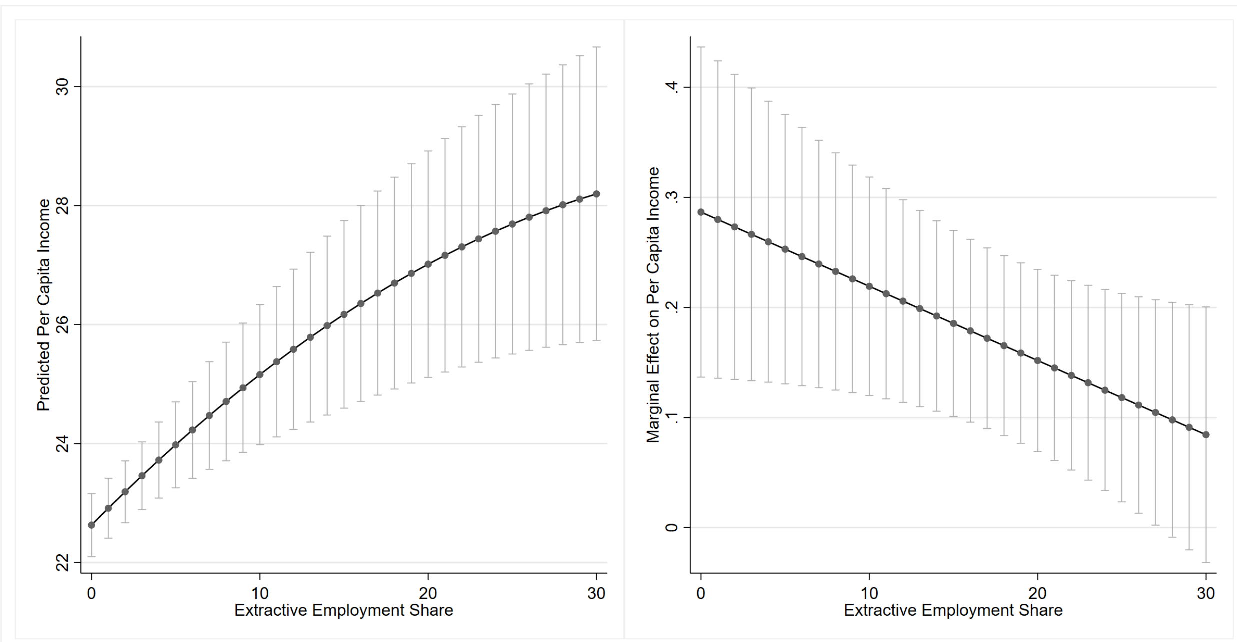

Figure A.1. Predicted means and marginal direct effects for per capita income to residents across constrained ranged of extractive employment share. Downstream variables included. Other variables held constant at means. Vertical bars represent 95% CI

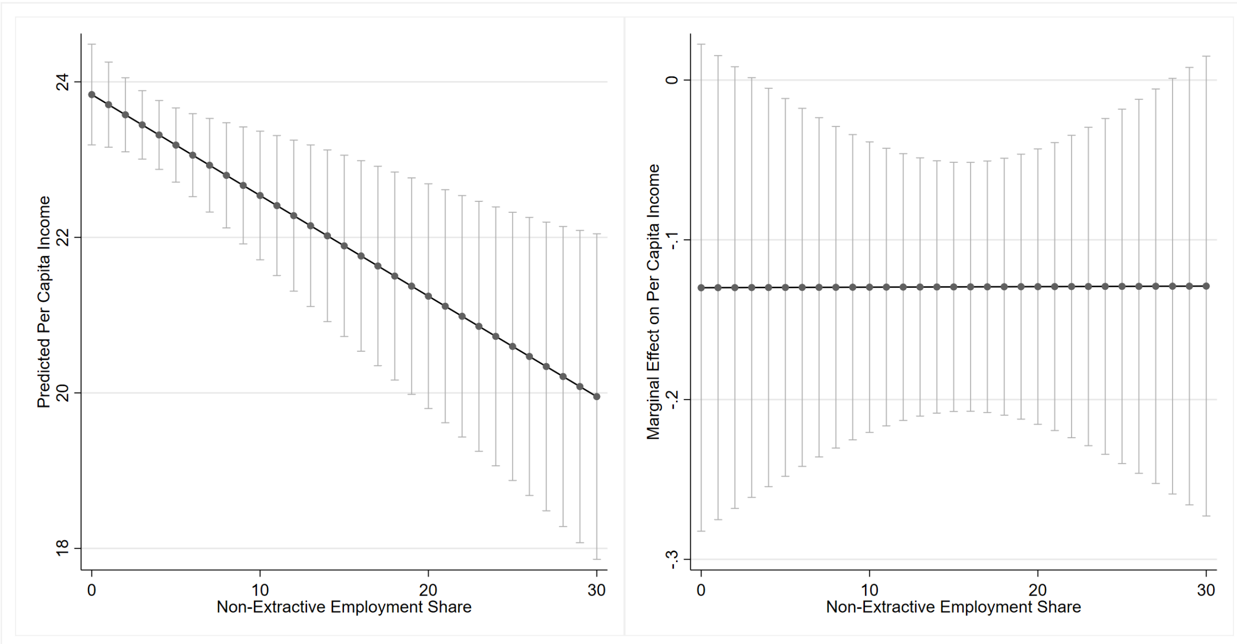

Figure A.2. Predicted means and marginal direct effects for per capita income to residents across constrained ranged of non-extractive employment share. Downstream variables included. Other variables held constant at means. Vertical bars represent 95% CI

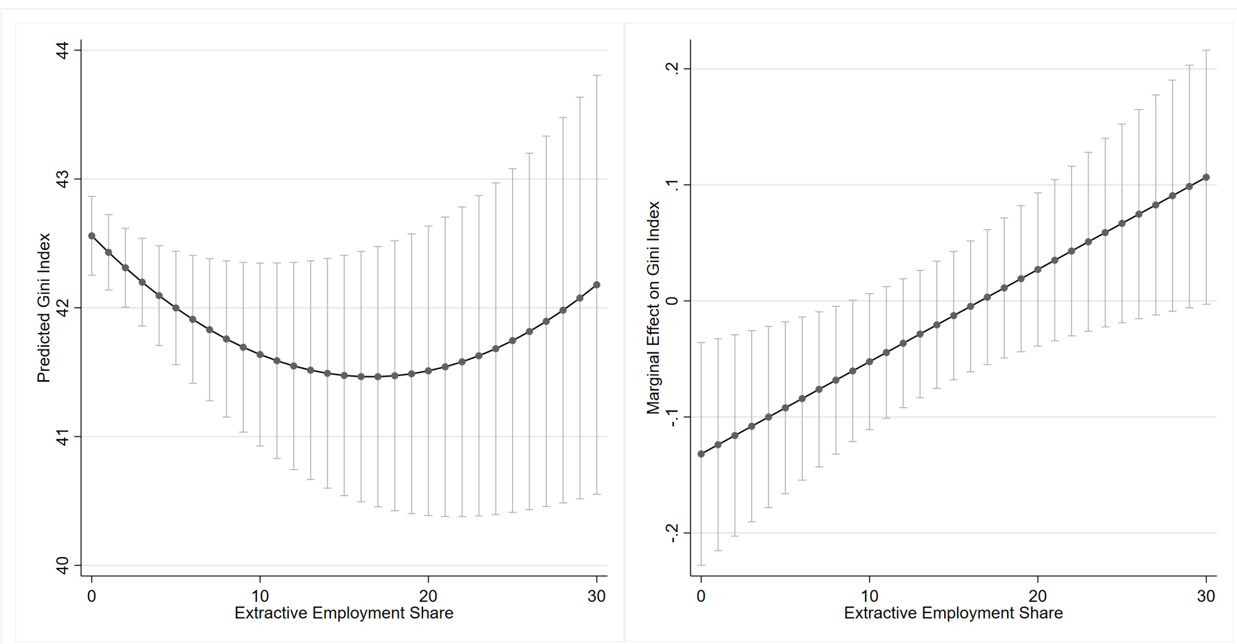

Figure A.3. Predicted means and marginal direct effects for Gini Index across constrained ranged of extractive employment share. Downstream variables included. Other variables held constant at means. Vertical bars represent 95% CI

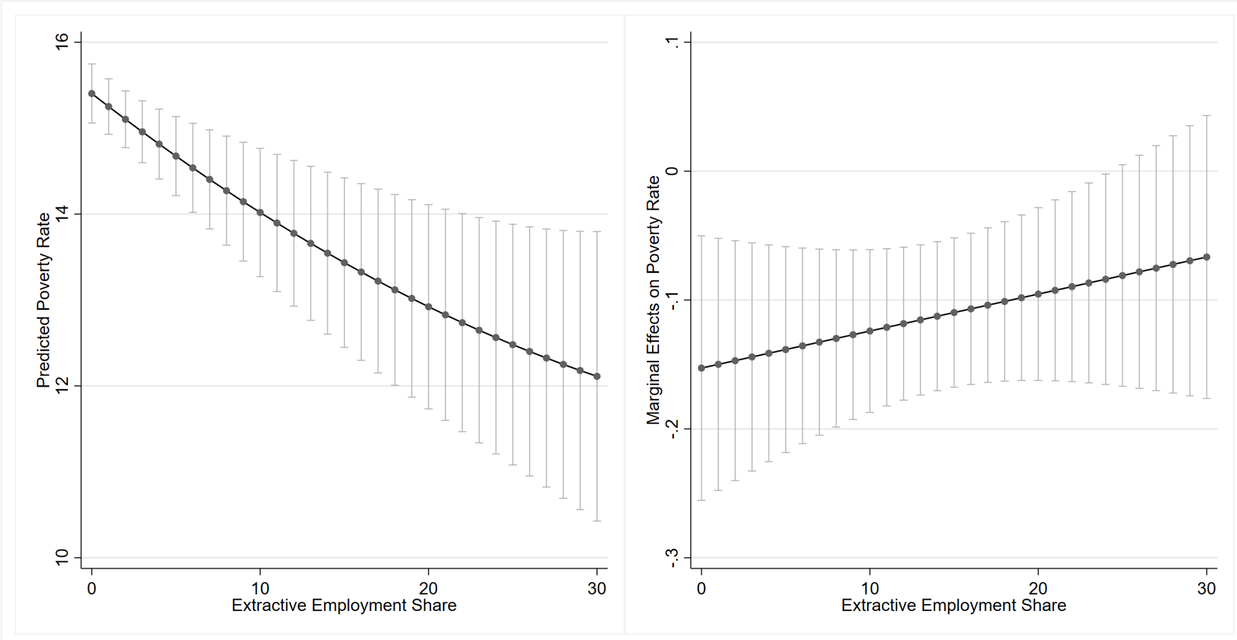

Figure A.4. Predicted means and marginal direct effects for poverty rate across constrained ranged of extractive employment share. Downstream variables included. Other variables held constant at means. Vertical bars represent 95% CI

Reflection on Modeling Difficulties and Decisions Made

A number of methodological difficulties and questions arose during the process of producing Chapter 3. In this section I will discuss what they were and how I dealt with them.

In the initial proposal of this paper I planned to conduct my analysis using an aspatial fixed effects model with unit and period fixed effects. I planned to do this for the years of 1970, 1980, 1990, 2000, 2010, and 2017. My first issue arose surrounding the years of available data. Although you can get data for county-level employment going back to 1970 from the Bureau of Economic Analysis, when starting analysis I realized the data was heavily suppressed. The vast majority of rural counties—the interest of this study—had very little data available. Due to this I was forced to use Wholedata, a product from the Upjohn Institute which uses an algorithm developed by Isserman and Westervelt (2006) to recover missing numbers from the County Business Patterns data. Unfortunately this data only went from 1998 to 2017. Thus, my analysis scope was narrowed to 2000 to 2015.

Next, as was rightly pointed out to me by my reviewers at the National Science Foundation, my conventional fixed effects approach would not have factored into account the interdependence of counties in the United States. Counties have permeable boundaries and can influence one another in many ways. To address this problem, and therefore account for issues of spatial autocorrelation and spillover effects, I decided to use spatial fixed effects models.

I first planned to do this using a data driven approach common to what has been used in traditional spatial econometrics literature (Chi and Zhu, 2019). This would mean that I would test my model using various diagnostics to learn whether I should estimate a spatial lag, spatial error, or spatial lag and error model. However, I quickly learned that these diagnostics are not generally available for longitudinal data. Upon realizing this I dug into the literature and decided to use an approach advocated by both LeSage and Pace (2009) and Belotti et al. (2017). Under this approach I estimated two models, the spatial Durbin model (SDM) and the spatial autocorrelation model (SAC). The SDM contains within it two more parsimonious models which can be tested using postestimation commands in Stata. Thus, the approach involved estimating the SDM and running the post-tests. From this you would know which model was best in the SDM family. You would then estimate the SAC and compare AIC values between the SDM family of models and the SAC. Whichever had the lowest value was the 'correct' model. It was this approach I used in the first draft of my paper.

I did not like this approach much because it felt too data driven. These various spatial models have different assumptions built into them and I felt like a theoretical approach to model selection was more desirable. Thankfully, I found a paper documenting a far more theoretical approach by LeSage et al. (2014) which has been increasingly picked up in the literature. This paper argued that there are only two models to worry about if you theoretically expect spillovers, the SDM and its sibling the spatial Durbin error model (SDEM). In short, if you are worried about global spillovers where a change in one county creates a feedback loop and ripple effects across the whole country then you should use the SDM. If you are worried about local spillovers where a change in one county impacts its neighbor and the effect ends there, you should use an SDEM. Drawing on this, I decided to use spatial Durbin fixed effects models because I thought global spillovers were more appropriate—although it should be noted that there isn't much evidence for this in the literature and authors have argued global effects are hard to justify (Vega and Elhorst, 2015). That said, it seemed plausible to me that a change in economic prosperity in one county would influence economic prosperity it its neighbor and this would lead to further impacts to neighboring counties.

Given the arguments of LeSage et al. (2014), the existing literature on this topic using spatial approaches, the well-documented spillovers and relationships between counties in the United States, and my preference for theory driven analysis, it appeared to me that we could decide *a priori* that a spatial model was required for answering the research question. This means I did not, and do not, think exploratory spatial data analysis and diagnostics to 'prove' spatial effects were needed. However, because people expect to see some form of diagnostics, I estimated univariate Moran's I statistics for each independent and dependent variable of interest for each study year. They were all highly significant.

After deciding on the SDM and estimating the univariate Moran's I's, I had to deal with more difficulties. A key piece of this analysis was testing for non-linear relationships. This posed problems from both the fixed effects and SDM standpoint. Related to fixed effects, the conventional transformation to generate the 'within' estimator raises questions when using polynomials. This is because the normal transformation jointly de-means (i.e. unit-mean centers) all variables. This is done because this transformation is equivalent to adding in a dummy variable for each unit without the loss of degrees of freedom. Unfortunately, this makes it unclear if the variable is squared and then demeaned or demeaned and then squared. The climate literature has discussed this because if the variable is squared and then demeaned it can allow the unit-mean to reenter the model (McIntosh and Schlenker, 2006; Mérel and Gammans, 2018). This means that the coefficients can be biased in unknown ways while also allowing coefficients to capture long-run adaptation in a short-run model. Climate research is interested in this because they wish to separate climate impacts from weather impacts.

I initially tried to explicitly deal with this by adopting the transformation proposed by McIntosh and Schlenker (2006) which tries to separate the long-run from the short-run impact via manual demeaning of the independent variable of interest. However, as I was using spatial fixed effects models which have rarely been discussed in this literature, was using both unit and period fixed effects, and the vast majority of the literature has not adopted, or even acknowledged, this approach, I moved away from this. I instead used a conventional non-linear approach and simply included a first and second order term, as the majority of the literature has done. Thus, it is possible some long-run adaptation is being captured, but it is unlikely to be very influential.

The difficulty posed from the standpoint of the SDM was less ignorable. The coefficients in SDMs are not directly interpretable because of the recursive nature of the models (see Golgher and Voss (2016)). This meant that a post-estimation approach was needed to interpret the effects. Further, given the lack of interpretability it was not even clear if I could trust the significance tests of the model coefficients or joint tests of significance of the first and second order terms. If I was interested in linear hypotheses it would not be an issue because LeSage and Pace (2009) developed a now widely used approach for summarizing the true direct and indirect effects of variables in the SDM. Unfortunately, their approach assumes linear relationships, making it useless for my purposes. I first tried to estimate marginal predicted means (marginal effects are not available in this form of spatial fixed effects model) so I could properly interpret the relationships. This did indeed allow for the appropriate interpretation of the relationships in the model, unfortunately that was not enough.

Estimating marginal predicted means from spatial fixed effects models takes an exceedingly long time. I was unable to get the standard errors of any estimated means due to the models running for as much as five days with no solution. I was able to get point estimates of the means, but those alone took about 6 hours to run for each variable. An additional problem posed by this approach was that it did not allow for the assessment of statistical significance for the overall effect or the second order terms. Although the idea of statistical significance is fraught (Amrhein et al., 2019), it is still necessary and expected in applied research.

After increasing frustration with the difficulties posed by non-linear estimates in spatial Durbin fixed effects models, I came to the conclusion that the costs of this approach were now greater than the benefits. Although this approach may be best from a purely theoretical perspective, it simply is not at a place where its application was useful here. Due to this, I returned to the literature and began pursuing the spatial lag of X model (SLX). This model allows for local instead of global spillovers through spatial lags of independent variables. The benefit of this approach is the model coefficients are directly interpretable as direct and indirect effects (Vega and Elhorst, 2015). Further, other authors have expressed similar frustrations with the interpretation of SDMs and have instead recommended the use of the SLX in the absence of strong theory for global spillovers (Gibbons and Overman, 2012; Vega and Elhorst, 2015). As there is little theory for *global* spillovers in the context of my study, and the lack of interpretability for the SDM posed an insurmountable barrier, the SLX was the best approach.

The SLX model allowed for the direct interpretation of the significance of model coefficients, as well as the joint-testing of the first and second order terms to determine an overall significant effect. As the SLX was a much simpler model, I was able to estimate the desired marginal means plots with standard errors as well as marginal effects plots. Thus, after assessing all constraints and difficulties, the SLX fixed effects model was the best balance of theoretical and practical considerations for testing the hypotheses of this study.

Unfortunately, the one issue I still dealt with was how to determine the 'significance' of a non-linear effect. There was very little good literature I could find out there on this as it is rarely a theoretical goal and many people rely on rules of thumb. Upon reflection, it does not make much sense to test for the significance of non-linearity. Non-linear relationships take many shapes and it is the shape of the relationship that matters. In general, most statistical advice recommends you do not try and interpret the t-tests from individual terms when terms of multiple orders are included. However, I still wanted to know if the inclusion of the quadratic was empirically supported. Ultimately, I decided to assess significance using three steps. First I conducted joint tests to detect an overall effect. Second, I estimated marginal means and marginal direct effects for all relationships which were jointly significant and evaluated their shapes to see if they conformed to hypotheses. Third, I evaluated the second order t-tests as supporting evidence to determine whether or not the inclusion of the non-linear relationship was empirically supported. Thus, I did not use the t-test to say 'there is no significant non-linearity', but rather to say that it is evidence, when combined with a generally linear set of margins plots, that future research should consider using a linear effect instead.

Appendix B
Chapter 4 Supplement

County Boundary Adjustments

Table B.1. 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)

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Selected Publications

Mueller, J.T. (Forthcoming) Decomposing the differences in self-rate health between those who work in agriculture and natural resources and those who don't. *Journal of Agromedicine.*

Mueller, J.T. (Forthcoming) A more complete picture: Rural residents' relative support for seven forms of natural resource related economic development. *Rural Sociology.*

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