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Local economic impact of boom and bust in mineral resource extraction in the United States: A spatial econometrics analysis

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ABSTRACT

This paper examines how shocks in the U.S. mineral resource extraction (MRE) industry impact MRE-dependent counties using county level data between 1970- and 2012. A difference-in-difference fixed effects model and a spatial modeling to incorporate spatial heterogeneity and dependence among U.S. local areas that are in close geographical proximity are employed in this study. The results show that MRE industry employment grew faster during boom periods and slower during the bust period in MRE dependent counties. MRE earnings and earnings per worker grew slower during boom periods and faster during the bust period. The findings give evidence of negative spatial indirect spillover effects between neighboring counties' MRE sector labor markets. An analysis of the effect of shocks in the MRE sector on the non-MRE sectors shows that in MRE dependent counties non-MRE sector employment grew slower during boom periods and faster during the bust period. Positive shocks in the MRE sector had no effect on the manufacturing sector labor market; however, negative shocks had a positively effect. Booms in the MRE sector positively impacted the construction sector, while negatively affecting the service and retail trade sectors' labor markets in MRE dependent counties. Finally, this study finds that male population grew faster, while female population grew slower in the MRE dependent counties.

1. Introduction

It is a general agreement among historians, political scientists, and economists that the presence of abundant natural resources in the U.S. has played an important role in its history since the 1700's by contributing to economic development, growth and technological innovations. Activities related to Mineral Resource Extraction (MRE) generate employment, income, and contribute to the local economy and the fiscal system. Mineral resources provide the energy resources and raw materials that are essential to a growing economy. According to the Mine Safety and Health Administration (2011), there are more than 14,000 operations that mine for coal, metal ores and non-metallic minerals in the United States. A report of the National Mining Association (2011) shows that U.S. mining has a broad impact on the national economy, providing high-wage jobs averaging $71,075 annually and generating value across all economic sectors in all 50 states. Mineral resource operations impact local economies directly through the economic activity in those sectors. Those operations also indirectly impact local economies through economic activity of related sectors and through induced effects from spending (National Mining Association, 2011).

In spite of the important role that MRE has on the U.S. economy, and its relative positive spillovers on other economic sectors, there is still no consensus in the literature about the real impact of MRE on local economic growth. Some of these previous investigations found that resource intensive areas grow slower than non-resource areas, which is referred to as the "Dutch disease" or "resource curse" phenomenon (Matsuyama, 1992; Sachs and Warner, 1995, 1997, Kuwimb, 2010; Davis, 1995; Pegg, 2006; Black et al., 2005; Gaetano (2015)). Other studies found that resource abundance is positively correlated with economic growth (Sarmidi et al., 2013; Boyce and Emery, 2011; Aubynn (2009); Brunnschweiler, 2008; Aroca, 2001; Hajkowicz et al., 2011). However, little is still known about its impact more broadly on U.S. local economic development and about its indirect spillover effects on other sectors and contiguous regions. None of these studies on the U.S. MRE industries employed spatial models to incorporate spatial heterogeneity and dependence among U.S. local areas that are in close geographical proximity. Thus, this paper fills a gap in the literature by examining spatially the local economic impact from MRE industries in the entire United States. It also measures the impact of mineral shocks on other non-MRE economic sectors such as manufacturing, construction, services, and retail trade.

The remainder of the paper is structured as follows: the next section

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reviews the related literature, and Section 3 describes the boom and bust in the MRE sector and related shocks in the U.S economy that can affect the local economy. Section 4 describes the distinction between treatment and comparison counties. Section 5 provides a brief discussion of data, and presents the data analysis and the empirical models employed in the study. The results and findings are presented in Section 6. Section 7 shows a brief discussion, and Section 8 provides a general conclusion.

2. Literature review

Mineral endowment plays an important role in local economic, social, cultural, educational, political, and environmental conditions. Prior to the 1980's, studies examined how local and regional labor markets responded to demand shocks and found a negative correlation between high natural resource endowment and economic growth (Baldwin, 1966; Nankani, 1979). Since the early 1990s, there has been a growing literature which supported and reinforced this idea that a large natural resource sector slows economic growth (Matsuyama, 1992; Sachs and Warner, 1995, 1997; Black et al., 2005). Although many studies investigated the impact of mining operations in developing countries, only a few studies have attempted to understand how MRE operations impact local and regional communities in the United States. (Bender et al., 1985) investigated the impact of mining operations on community economic development and found that mining dependent counties had higher population growth rates, higher incomes, and fewer people receiving social security compared to non-mining dependent counties. Black et al. (2005) examined the impact of the coal boom in the 1970's and the subsequent coal bust in the 1980's on local labor markets in Kentucky, Ohio, Pennsylvania, and West Virginia, and found evidence of modest employment spillovers into sectors with locally traded goods but not into sectors with nationally traded goods. Their results showed evidence that boom in the mining sector crowded-out employment in non-mining traded sectors (Black et al., 2005). Papyrakis and Gerlagh (2007) studied variations within the U.S. and found that natural resource abundance is a significant negative determinant of growth. They results gave evidence that natural resource abundance decreases investment, schooling, openness, and R & D expenditure and increases corruption (Papyrakis and Gerlagh, 2007). James and Aadland (2011) used U.S. county level data and found that resource-dependent counties tend to cultivate anemic growth relative to non-resource dependent counties. Deller and Schreiber (2012) explored the relationship between non-oil and gas extractions and economic growth for non-metropolitan U.S. counties for the period 2000–2007. They found robust results suggesting that non-oil and gas extraction is associated with lower population growth and a positive impact on per capita income, but it is negatively correlated to employment growth (Deller and Schreiber, 2012). Many empirical studies, however, gave evidence of a positive correlation between resource abundance and economic growth (Aroca, 2001; Brunnschweiler (2008); Aubynn (2009); Boyce and Emery, 2011; Hajkowicz et al., 2011; Sarmidi et al., 2013). In the intent to explain the effects of natural resource abundance on economic growth through various channels of transmission, Boyce and Emery (2011) found that resource abundance is negatively correlated with growth rates but positively correlated with income levels, thus, concluding that resource endowment is a blessing, not a curse. Brunnschweiler (2008) re-examined the effect of natural resource abundance on economic growth using new measures of resource endowment and considering the role of institutional quality. He found a positive direct correlation between natural resource abundance and economic growth (Brunnschweiler, 2008). Using annual data on drilling to identify western boom-and-bust counties, Jacobsen and Parker (2014) found substantial positive local employment and income effects during the boom. However, they found that during bust periods, incomes per capita decreased and unemployment compensation payments increased relative to what they would have been if the boom had not occurred (Jacobsen and Parker, 2014). Allcott and Keniston (2014) found that Oil and gas booms increased growth rates in producer counties by 60–80% relative to non-producer counties, and local wages increased by 0.3–0.5% points per year during a boom. Dissimilar to the finding of Black et al. (2005), they found that manufacturing growth is positively associated with natural resource booms (Allcott and Keniston, 2014).

Shocks in the MRE industry also have a significant impact on migration patterns and population growth. Thus, while estimating how shocks in the U.S. mineral resource extraction (MRE) industry impact MRE-dependent counties, it is important to take migration into consideration since it influences local labor markets. As showed by Saks and Wozniak (2011), U.S. internal migration rates are strongly pro-cyclical, and Moretti (2012) documented that Americans have historically been an unusually mobile people, constantly seeking better economic conditions. During the Great Recession, geographic relocation took place as a response to particularly strong negative local economic shocks (Mian and Sufi, 2013). Yagan (2014) showed that fewer workers moved into the locations most affected by the Great Recession. Monras (2015) showed that differences in population growth rates across locations are mainly explained by differences in in-migration rates rather than in out-migration rates.

Many studies have also been done to understand the correlation between MRE and economic growth in developing countries. Matsuyama (1992) and Sachs and Warner (1995, 1997) found a negative correlation between mining abundance and economic growth, suggesting that most of mining dependent developing countries are experiencing a “Resource Curse” or “Dutch Disease” phenomenon. Caselli and Michaels (2011) used variation in oil output among Brazilian municipalities to investigate the effects of resource windfalls on government behavior. They found that oil-rich municipalities experienced increases in revenue, and increases in spending on public goods and services; however, they did not find any increase in economic and social outcomes (Caselli and Michaels, 2011). Ross (2014) showed that petroleum tends to produce a “political resource curse.” He showed that petroleum has at least three harmful effects: it makes authoritarian regimes more durable, increases certain types of corruption, and helps generate violent conflict in low and middle income countries. Contrary to conventional theories, recent studies documented a positive correlation between MRE and economic growth in developing countries (Ross, 2014). Focusing on the Norwegian economy, Mideksa (2013) examined the impact of petroleum endowment and found that the impact varies from year to year and remains positive and very large. According to Mideksa (2013), on average, about 20% of the annual GDP per capita increase is due to the endowment of petroleum resources such as oil, natural gas, natural gas liquids, and condensate. Aragon and Rud (2013) examined the local economic impact of Yanacocha, a large gold mine in Northern Peru using annual household data from 1997 to 2006 and found evidence of a positive effect of the mine’s demand for local inputs on real income. Using a panel fixed-effects estimation and resource discoveries since 1950 in countries that were not previously resource-rich as a plausibly exogenous source of variation, Brock (2015) found a positive effect on GDP per capita levels following resource exploitation that persists in the long term. His results vary significantly between OECD and non-OECD treatment countries, with effects concentrated within the non-OECD group (Brock, 2015). Mamo et al. (2016) investigated how mining impacts on local, regional and national level living standards measured by night-time lights and found that both mineral extraction and discovery improved local living standards in a panel of 3,635 districts from 42 Sub-Saharan African countries observed between 1992 and 2012.

However, it is not clear that the “Resource Curse” or “Dutch Disease” applies to U.S local economies. Many factors such as the type of mining, the time-period, and the measure of economic impact play important roles in determining the real impact of mining operations on