LOCAL IMPACT AND SPATIAL SPILLOVERS OF THE MARCELLUS SHALE BOOM ON COLLEGE ATTENDANCE

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Overview

Human capital is a key channel in the mechanism of resource curse. In regions where economic growth is driven by the resource sector, higher wages and more employment opportunities with low requirement of skills increase the opportunity cost of education, which in turn impedes the accumulation of human capital and the long-term growth of other sectors that employ a high-skilled labor force. A rich literature has assessed the short-term and long-term impact of the oil boom and the coal boom in the 1970s provides evidence that supports the presence of such mechanism (Douglas and Walker 2017; Kumar 2017; Black et al. 2005). More recently, the shale revolution has inspired a growing literature studying the potentially similar impact of booming unconventional oil and gas sector. Evidence from this literature suggests that the shale boom has contributed to decreasing educational attainment, lower high school enrollments, and wider gender gaps of high school dropout rates (Rickman et al. 2017; Zuo et al. 2019; Casio and Narayan, 2017).

Most studies in the current literature examine either the long-term effects of resource dependence on educational attainment or the short-term effects of a resource boom on high school enrollment. However, only focusing on high school students is unlikely to capture the full story of a resource curse for two main reasons. First, it is often said that college degree is now "the new high school diploma": national high school completion rate among all persons aged 25 and over has increased from 62.5% in 1975 to 88.4% in 2015 (NCES). Thus, the most affected low-skilled group on the margin may as well has changed. Second, the resource curse hypothesis draws on the impact of resource sector on the distribution of skills relative to that of the non-resource sector. It follows that empirically examine a range of skill groups is necessary for testing such hypothesis without making strong assumptions of the distributional effects.

In this paper, I explore the role of postsecondary schooling decisions as a potential channel of resource curse. To address this question, I examine whether enrollment in different types of postsecondary educational institutions respond to local oil and gas development. My empirical analysis focuses on Pennsylvania and New York, a pair of neighboring states with abundant oil and gas resources albeit distinctive approach of regulating unconventional techniques of extraction.

Methods

I examine enrollment outcomes of postsecondary educational institutions to study whether high school graduates' decision of pursing more advanced education respond to local oil and gas development. Following previous studies, I use GIS to construct a spatial wells count to measure shale gas development, and use similar measures of conventional oil and gas which has not been accounted for in existing literature. I use institution-level data from IPEDS and county-level data from BEA and BLS to estimate variations of a spatial autoregressive fixed-effects model of which the general form is specified as:

$$Y_{igct} = \lambda \mathbf{W} Y_{igct} + \sum_{g=1}^{3} \delta_g \, OG_{igct} + \sum_{g=1}^{3} \theta_g \mathbf{W} \, OG_{igct} + \mathbf{X}_{\mathrm{ct}} \boldsymbol{\beta} + Inst_{\boldsymbol{i}} + \mathbf{u}_{igct} \qquad (1)$$

$$\mathbf{u}_{igct} = \rho \mathbf{W} \mathbf{u}_{igct} + \epsilon_{igct}$$

Y_{igct} denotes enrollment at institution *i* of type *g* in county *c* in year *t*, and OG_{igct} denotes the spatial measure of oil and gas development near the institution. $\mathbf{W}Y_{igct}$ and $\mathbf{W}OG_{igct}$ are their respective spatial lags constructed by the inverse-distance weighting matrix. $\mathbf{X}_{\mathrm{ct}}$ is a vector of covariates controlling for time-varying local conditions in county c. $Inst_i$ denotes the panel-level fixed effects controlling for the unobserved characteristics of each institution that are constant over time; time fixed-effects are not explicitly identified but eliminated by the Lee-Yu estimator, effectively allowing the identification of parameters conditional on both panel and time fixed effects. $\mathbf{u}_{ict}$ is the error term that consists of spatially autoregressive error and the remaining idiosyncratic error. When the spatial lags

and the spatial autoregressive error are omitted, this model reduces to the standard fixed-effects model, which serves as a baseline.

Results

County-level data confirms previous findings of positive impact of the shale boom on local employment. Contrast to other regions that experienced population influx during the shale boom, shale gas development in Pennsylvania is associated with moderately decreasing population within the county. With population and other county-level economic condition controlled, baseline results suggest that unconventional drilling is negatively associated with enrollment in four-year colleges, while effects on enrollment in other types of institutions are not statistically significant. Surprisingly, this effect is driven by enrollment of female students, as the share of female students in four-year colleges have also decreased where unconventional drilling is more intensive nearby.

Results from the full model as specified in Equation (1) suggests a somewhat different story. The estimated total effect of unconventional drilling within 25 miles is negative and statistically significant on enrollment of both genders, and the indirect effect is more substantial than the direct effect. However, the statistical significance of these effects diminish when the distance threshold of nearby wells is relaxed to 50 or more miles. Estimated effects are consistently negative for four-year and two-year colleges and positive for non-degree institutions such as vocational and professional schools.

Conclusions

Unconventional oil and gas is seen as a driver of local economy as natural gas production from shale gas and tight oil plays now makes up about half of the entire United States (Annual Energy Outlook 2016). Shale gas development has triggered fierce public debate on the choice between foregoing the economic benefits, such as income and employment, and burdening the environmental costs, such as air emissions and water contamination. Those debates, however, are rarely centered on human capital among other important factors of long-term growth.

This study adds to the resource curse literature by providing the first evidence of postsecondary schooling decisions as a potential channel of resource curse. In the literature of resource boom, this study is the first that take both conventional and unconventional oil and gas into account. I find consistent evidence showing oil and gas development have negative but moderate effect on enrollment in two-year and four-year colleges, but not in other postsecondary non-degree institutions. I find no evidence that these minor effects significantly change over time. These findings support that the resource curse mechanism is more likely in a steady long-run equilibrium.

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