

**Title: The Effect of Oil and Gas Employment on Fertility Outcomes in Metro and Nonmetro Counties in the United States**

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**Extended Abstract**

The shale oil and gas boom has transformed communities across the nation with the influx of jobs, people and money. This transformation has been especially profound for smaller rural communities. Communities that developed their shale resources experienced population changes that included an influx of mostly younger male oil and gas workers. Many communities also experienced employment growth and economic opportunities for their residents, although concerns about environmental and health consequences also exist. Thus far, research on the effects of the shale oil and gas boom on people and places has focused on environmental (Paredes et al., 2015; White, 2012, Joskow, 2013), economic (Munasib and Rickman, 2015; Paredes et al., 2014; Weber, 2014; Brown, 2014; Kelsey, 2011) and human health (Mitka, 2012; Whitworth et al., 2018; Vengosh et al., 2014; Colborn et al., 2012; McKenzie et al., 2012; Elliott et al., 2017; Bunch et al., 2014;) outcomes. Few have studied how the changes experienced by these communities have affected their demographic composition and family outcomes such as marriage, divorce, and fertility.

Trends in family formation behavior over the past several decades show lower overall marriage rates, a high and steady overall divorce rate, and rising rates of nonmarital cohabitation and childbearing (Cherlin 2010; Manning, Brown, & Payne, 2014; McLaughlin & Coleman-Jensen, 2011; Snyder & McLaughlin, 2004). This trend holds for both metro and nonmetro areas (Snyder, 2006). However, family formation behavior in shale extraction communities may deviate from other rural communities due to the stabilizing influences of an improved local economy, or destabilizing influence of a community in demographic flux. Generally, higher wages and employment are associated with more stable family outcomes (Blau & van der Klaauw, 2013; Charles & Stephens, 2004; Cherlin, et al, 2016; Harknett & Kuperberg, 2011). However, extraction communities may deviate from these findings due to the boom and bust cycles. The limited research on family outcomes in mining and extraction communities suggests that families in these mostly rural places are better able to weather the ups and downs of a boom and bust economy compared to those in other places (Betz & Snyder, 2017). This study will build on this prior work by answering the following research question: How has shale energy development impacted county-level fertility outcomes in both metro and nonmetro areas?

Although much work has been done to investigate how changing economic conditions affect family outcomes (Blau & van der Klaauw, 2013; Cherlin, 2015; Joshi, Quane, & Cherlin, 2009; McLaughlin & Coleman-Jensen, 2011; Smith & Tickamyer, 2011), only two studies have examined these relationships in the context of natural resource extraction (Betz & Snyder, 2017; Kearney & Wilson, 2017). Only one of these has specifically focused on employment in shale

oil and gas extraction industry (Kearney & Wilson, 2017). They find that that shale employment is associated with a rise in both marital and nonmarital births, using data at the PUMA level. Building on this prior research, we expect that an increase in oil and gas employment is associated with higher county-level fertility rates, and that this association will be weaker in nonmetro counties. Previous work has shown that significant changes in fertility trends typically occur over long periods of time and are due to a complex combination of micro and macro forces (Lesthaeghe, 2010). In some communities, shale development may not have progressed long enough to have a measurable impact on overall fertility rates. However, changes in non-marital and teen fertility are more closely associated with short-term individual-level economic conditions (Aassve, 2003; Cherlin et al, 2016; Kearney & Levine, 2012; Ryan, Manlove & Hofferth, 2006), so we also expect to find a stronger association between oil and gas employment and these two fertility outcomes than overall fertility rates.

This research examines how shale oil and gas employment is associated with fertility outcomes using the 2009-2014 county level data from the American Community Survey (ACS) merged with proprietary employment data from Economic Modeling Specialists International (EMSI). The EMSI data allows us to separate oil and gas employment from all other types of employment in each U.S. county. The analyses include county demographic, social and economic characteristics in each model to control for important factors that may bias the estimated relationship between fertility outcomes and oil and gas employment. County and time fixed effects are included in the models to minimize potential bias from unobservable time-invariant differences between counties. Each county is weighted by their population in 2009.

### **Preliminary Results**

All tables control for the following county-level variables: percent poverty, percent employed, percent foreign born, population, age lt 20, 20-24, 65+, race, percent some college, percent BA or higher, year dummies. Table 1 reports that counties with growth in oil and gas employment from 2009 and 2014 had higher total fertility rates, controlling for economic, social and demographic factors. Oil and gas employment in a county is associated with an increase in the total fertility rate beyond the influence of the male population and female labor force participation, but once controls for median household income are included the association becomes nonsignificant. Separate analyses of the full model for metro and nonmetro counties, however, find that oil and gas employment is associated with an increase in the total fertility rate in metropolitan counties, but non nonmetro counties.

Table 2 provides the results considering only marital fertility as the outcome. A growth in oil and gas employment is associated with an increase in marital fertility, controlling for economic, social and demographic factors. In addition, the significant positive association remains significant when male population, female labor force participation and median household income are added in the stepwise models, and in the full model (model 5). Separate analyses of the full

model for metro and nonmetro counties reveal that this association exists only for metro counties.

Table 3 provides the results considering teen fertility. Here we find that an increase in oil and gas employment is negatively associated with teen fertility in the base model and throughout the stepwise regression models. When analyses of the full model is conducted separately by metro and nonmetro counties we find that this association only occurs in nonmetro counties. This is the largest effect in our findings.

### Additional Analyses

We have received permission to use the restricted PUMS data from the ACS at the University of Kentucky Data Center. We are in the middle of the background check process and when that is complete we will be able to add to these analyses by examining the association between oil and gas employment in shale counties and individual-level fertility behavior. We plan to present these findings in addition to the ones included in this extended abstract.

**Table 1. Oil and Gas Employment and Total Fertility**

Variable	Model 1	Model 5	Nonmetro	Metro
Oil and gas employment	0.067****	0.063	0.025	0.171*
Percent male	-	-0.024	-.039	-.004
Female LFP	-	-0.032***	-0.024*	-0.042**
Median HH income	-	0.000****	0.000	0.000
Median HH income2	-	-0.000	-0.000	-0.000
Constant	2.000****	4.348*	6.308*	1.013
Observations	13902	13902	10083	3819
R-squared	0.088	0.092	0.043	0.203

**Table 2. Oil and Gas Employment and Total Marital Fertility**

Variable	Model 1	Model 5	Nonmetro	Metro
Oil and gas employment	0.057*	0.051*	0.027	0.096****
Percent male	-	0.002	-0.012	0.019
Female LFP	-	-0.023***	-0.014****	-0.035***
Median HH income	-	0.000*	0.000	0.000
Median HH income2	-	-0.000	-0.000	-0.000
Constant	1.294	1.761	2.861	-0.428
Observations	13902	13902	10083	3819
R-squared	0.146	0.149	0.083	0.285

**Table 3. Oil and Gas Employment and Total Teen Fertility 15-19**

<b>Variable</b>	<b>Model 1</b>	<b>Model 5</b>	<b>Nonmetro</b>	<b>Metro</b>
<b>Oil and gas employment</b>	-0.149*	-0.152*	-0.228**	0.049
<b>Percent male</b>	-	-0.005	0.029	-0.110
<b>Female LFP</b>	-	0.011	0.010	0.007
<b>Median HH income</b>	-	0.000	-0.000	0.000
<b>Median HH income2</b>	-	-0.000	0.000****	0.000
<b>Constant</b>	-0.965	-1.413	-4.901	6.716
<b>Observations</b>	13902	13902	10083	3819
<b>R-squared</b>	0.081	0.081	0.049	0.172