Shale and Family Through the Boom and Bust:

Shale Employment's Impact on Marriage, Divorce, and Cohabitation

Thesis

Presented in Partial Fulfillment of the Requirements for the Degree Master of Science in the Graduate School of The Ohio State University

By

Michael Lynn Shepard, B.S.

Graduate Program in Human Development and Family Science

The Ohio State University

2018

Thesis Committee

Anastasia Snyder, Co-Advisor

Michael Betz, Co-Advisor

Abstract

Shale oil and gas extraction technology has caused a large shift in the United States energy landscape over the last decade. While many studies have focused on the economic and environmental impact of shale development, few have examined social changes brought by resource extraction. I examine the influence of shale oil and gas employment as a share of overall county employment on county marriage, divorce, and cohabitation rates. I find evidence of decreased marriage rates and increased divorced rates from 2009-2014, driven largely by nonmetro counties. Implications are discussed.

Vita

May 2010……………………………….…...Snow Canyon High School

2016……………………….....………..….B.S. Family Studies, Brigham Young University

2016 to 2017……………………………Graduate Teaching Associate, Department of Human Development and Family Science, The Ohio State University

2016 to present…………………….....…..Graduate Research Associate, Department of Human Development and Family Science, The Ohio State University

Fields of Study

Major Field: Human Development and Family Science

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Chapter 1. Introduction

Over the past decade, shale oil and gas extraction has dramatically increased in importance for energy production in the United States. New technology allowed previously untapped communities surrounding shale plays to become mining hubs, affecting new communities and shifting employment for the energy sector. In 2006, the U.S. Energy Information Administration estimated that 5 million barrels of oil were produced per day in the U.S. and only 8% of that came from shale plays (Cook & Perrin, 2016). By 2015, the United States doubled its oil production, virtually all of which came from shale drilling (Bataa & Park, 2017; Cook & Perrin, 2016). A similar shift has happened for natural gas; roughly 25% of natural gas came from shale energy development in 2006, which increased to 67% by 2015 (Perrin & Cook, 2016). Overall natural gas production increased by nearly 35% between 2006 and 2015 in the United States (Perrin & Cook, 2016). The shale boom that occurred from 2007-2014 created 550,000 local jobs in mining and support activities (Maniloff & Mastromonaco, 2017). This shift in production has provided billions of dollars in market benefits through lower energy prices and shifting from coal to natural gas use, but also as billions of dollars in market costs due to health damage through air pollution, greenhouse gas emissions, wildlife habitat fragmentation, and water pollution (see Loomis & Haefele, 2017 for estimates).

Many studies have focused on environmental and economic impacts of shale development (Kelsey, Partridge, & White, 2016; Paredes, Komarek, & Loveridge, 2015, Tsvetkova & Partridge, 2015; White, 2012, Joskow, 2013). Others have examined the health consequences of increasing oil and gas production through fracking (Mitka, 2012; Whitworth, Marshall, & Symanski, 2018; Vengosh et al., 2014; Colborn, Schultz, Herrick, & Kwiatkowski, 2012; McKenzie, Witter, Newman, & Adgate, 2012; Elliott et al., 2017; Bunch et al., 2014; Werner, Vink, Watt, & Jagals, 2015). However, only a small number of studies examine social changes brought on by resource extraction, and fewer still have isolated marriage, divorce, and cohabitation outcomes from resource extraction (see Betz & Snyder, 2017; Kearney & Wilson, 2017).

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 (Cherlin 2010; Manning, Brown, & Payne, 2014; McLaughlin & Coleman-Jensen, 2011; Snyder & McLaughlin, 2004). This trend holds for both metro and nonmetro areas (Snyder, 2006). These shifts in family formation behavior may affect individuals and communities through lower economic welfare for adults and children (Brown & Lichter, 2004; McLaughlin & Coleman-Jensen, 2011; Nelson, 2011). Generally, higher wages and employment are associated with more stable family outcomes (Blau & van der Klaauw, 2013; Charles & Stephens, 2004; Cherlin, Ribar, & Yasutake, 2016; Harknett & Kuperberg, 2011). However, extraction communities may deviate from these findings due to the boom and bust cycles. This study will build on this prior work by answering the following research question: How has shale energy development impacted county-level marriage, divorce, and cohabitation outcomes in both metro and nonmetro areas?

To assess this research question, I draw from the existing literature on the effects of boom and bust cycles effect on the well-being of individuals and communities that experience resource extraction, as well as trends in family behavior in the United States, emphasizing differences between metro and nonmetro counties. By intersecting economic and family literature, I provide estimates of how the rapidly expanding oil and gas industry has affected individuals and families in the United States. Three channels appear prominent in the literature as to how economic development, and more specifically resource extraction, may influence family behavior. First, during the boom phase, mining communities typically experience a shift in sex ratio due to a large influx of young, transient males, which could in turn affect family outcomes. Second, these mining industries bring income and wealth (through royalty payments to land owners), which creates retail and service jobs that provide employment opportunities primarily for women. Last, industries experiencing a boom bring a large, rapid increase to income, which would also impact family formation behavior. I use a stepwise analytic strategy to test the influence of oil and gas employment as a share of overall county employment beyond these three aforementioned channels of sex ratio, female labor force participation, and income. I also estimate equations for both metro and nonmetro areas separately to determine if shale development plays a larger role on marriage, divorce, and cohabitation rates in either of these settings.

I begin by highlighting how shale energy development has shifted the energy landscape both economically and demographically over the last decade, with a focus on my three hypothesized channels of change which are shifting sex ratios, female labor force participation, and income. I highlight family trends over the past few decades for both metro and nonmetro families to provide context of how changing levels of marriage, divorce, and cohabitation may affect oil and gas communities, focusing on my three hypothesized channels of change. Then, I provide hypotheses, explain the data and methods employed, provide detailed results, and end with conclusions and the next steps to understand the social impact of the oil and gas industry.

Shale Energy Development and its Economic and Demographic Impact

Beginning in 2007, shale energy development increased dramatically in the United States due to companies implementing horizontal drilling and hydraulic fracturing, or "fracking". This led to an extended boom period in domestic oil and natural gas production (Rogers, 2011). Beginning the in the Marcellus Shale region of Pennsylvania and portions of Texas, shale energy development has spread throughout the United States over the last decade. While there is great debate over the environmental impact of fracking (see Jackson et. al, 2014 for a review), economists have also begun to explore how closely shale energy development follows the pattern of the "natural resource curse". The natural resource curse is a theory that maintains that places specializing in resource extraction will experience long-term economic outcomes such as lower per capita income, worse socioeconomic outcomes, experience slower growth, and may impact crime rates and education compared to counties that do not specialize (Jacobsen &

Parker, 2016; Weber, 2013; Weinstein, 2014; Haggerty, Gude, Delory, & Rasker, 2014; Measham and Fleming, 2014; Betz, Partrdige, Farren, & Labao, 2015; Sachs & Warner, 1997; James & Aadland, 2011;[1]). This holds even at the county level after controlling for state-specific effects and spatial correlation (James and Aadland, 2011).

Extractive industries typically follow boom and bust cycles that keep employment in flux. Due to these cycles, workers are often highly transient and will relocate to maintain full-time employment. Workers in the oil and gas industry tend to be primarily young, single males and as they relocate, booming communities may experience a shifting male-to-female sex ratio within their county. Along with the shifting sex ratio in a county, the boom and bust cycle of natural resource extraction brings both costs and benefits to a community. Benefits include increased employment through support jobs, wealth creation, and higher income. However, there are costs involved as well, especially for the permanent residents in the community who remain during the bust (White, 2012). One cost for long-term residents and communities at large are the taxes levied for infrastructure installed to support a boom cycle. Roads must be built, water pipes connected, and power lines extended to service a swollen population. When a shale reserve runs dry or commodity prices fall, part of the population moves on, leaving a smaller tax base to shoulder maintenance costs (White, 2012; Kelsey, Shields, Ladlee, & Ward, 2011). Along these same lines, some scholars have suggested that policy makers can promote long-term growth through sustainable, reliable employment that promotes residents establishing a long-term home (Weinstein & Partridge, 2011; White, 2012).

[1] See (Brown, 2014) for a notable disagreement.

Permanent relocation for work in the oil and gas industry may alter a county's sex ratio long-term, and it is thus beneficial to understand how an influx of single males impacts social behavior in counties with high oil and gas employment.

The influence of the oil and gas industry on overall employment within a county appears moderate. Evidence from the coal industry suggests that industry support jobs (i.e. construction, service, retail) are added to the local economy during natural resource boom cycles (Black, McKinnish, & Sanders, 2005). Indeed, estimates regarding job creation in oil and gas boom counties range from employment multipliers of 1.3 to 2, indicating that for every one mining job created, there are an additional 1.3 to 2 support jobs created to maintain those working in the mining industry (Weinstein, 2014; Weber, 2013; Tsvetkova & Partridge, 2016). Further studies show that for every 10 energy extraction jobs created during a boom period, three construction, two retail, and 4.5 service jobs are created (Marchand, 2012). The "spillover effects" (i.e. employment multipliers resulting from increased oil and gas mining employment) have shown positive effects, increasing employment and wages for non-mining workers (Munasib & Rickman, 2015; Brown, 2014). These increased opportunities may extend employment to females who otherwise may not be able to find jobs. In particular, the retail and service jobs within a county may be filled by women as men flock to oil and gas work during a boom period.

As is typical in extraction communities during a boom cycle, per capita income increases when a county first begins to specialize in oil and natural gas extraction; however, those positive increases tail off over time (Haggerty, Gude, Delory, & Rasker, 2014; Jacobsen & Parker, 2016; Weinstein, 2014). Additionally, as the oil and natural gas market turns from boom to bust, per capita incomes are even lower than if the boom had never occurred (Jacobsen & Parker, 2016). Due to the recency of the shale energy development revolution and my period of observation capturing the first shale boom, I would expect to see higher median household income in counties with increased oil and gas employment due to opportunities for high wage extraction jobs and larger amounts of retail and service jobs being created.

Another consideration for income and wealth creation is leasing and royalty payments for landowners. Weber, Brown, and Pender (2013) estimate that between energy cost savings and royalty payments, farmers in a nationally representative sample added an average of $104,000 in wealth in 2011. A study of the Marcellus Shale region in Pennsylvania found that in 2009, 55% of total leasing and 66% of total royalty payments to ladowners were saved or invested, which lowered the observed economic impact of shale during that year. However, this illustrates that wealth creation is occurring for landowners in shale counties (Kelsey, Shields, Ladlee, & Ward, 2011).

Prior literature suggests that the long-term economic, environmental, and social costs at the county level should steer developers and politicians to promote other types of employment outside of fracking (Kelsey, Partridge, & White, 2016; Paredes, Komarek, & Loveridge, 2015, Tsvetkova & Partridge, 2015; White, 2012, Joskow, 2013). Despite the findings that point to other sources of employment as more beneficial long-term, both metro and nonmetro counties have experienced the short-term boom in migration, employment, and income from the shale revolution and are now adjusting to the consequences. One aspect of the shale energy boom that has yet to be considered is how the recent oil and gas shift has affected family formation and behaviors. Many of the counties that have experienced the largest shift in employment to the oil and gas industry through shale energy development are nonmetro. With this in mind, this study will focus on metro and nonmetro differences in oil and gas employment and outcomes on family outcomes and behaviors.

Economics and Family Behavior

Beginning in the mid-20th century, American family formation behaviors and attitudes shifted dramatically. Recent trends show a shift away from married two-parent families and increases in the number of single-parent families, nonmarital cohabitation, and nonmarital childbearing (Cherlin, 2010; Manning, Brown, & Payne, 2014; McLaughlin & Coleman-Jensen, 2011; Stevenson & Wolfers, 2007, Snyder & McLaughlin, 2004). This is true for both metro and nonmetro areas (Snyder, 2006). Nonmetro areas are of particular interest when studying the boom and bust cycle of shale extraction and family outcomes, as nonmetro counties have an average of three times the amount of oil and gas employment as a share of overall employment compared to metro counties (author's calculations). Women in nonmetro areas are more likely to marry and have children at earlier ages when compared to metro women (Snyder, Brown, & Condo, 2004). Nonmetro women are also more likely to either separate or marry within 24 months of cohabiting than metro women, which could lead to more relationship transition (Brown & Snyder, 2006). Single mothers in nonmetro areas are "triply disadvantaged"; they experience higher rates of poverty, higher barriers to welfare receipt, and lower economic returns when compared to metro single mothers (Brown & Licther, 2004; Snyder & Mclaughlin, 2004).

These trends have strong implications for the well-being of children, adults, and communities; changes in family structure have lowered welfare for both adults and children, but especially regarding child economic well-being (Brown & Lichter, 2004; McLaughlin & Coleman-Jensen, 2011; Nelson, 2011; Snyder, McLaughlin, & Findeis, 2006; Snyder & McLaughlin, 2006). Lower economic well-being and family outcomes share a bidirectional relationship (Cherlin, 2004), leading to a cycle that may be difficult to break. The Family Stress Model (Conger, Elder, Lorenz, & Simmons, 1994; Conger & Elder, 1994; Conger & Donnellan, 2007; Conger, 2011) explains how economic well-being and family outcomes are tied together; namely, that financial concerns are a major stressor and frequently results in relational and familial conflict that can destabilize both marriages and families. Another confounding factor may be the prevalence of "marriageable men"; a decrease in economic opportunities among males may influence marriage and divorce rates at the county level. Conversely, women with better economic opportunities of their own may choose to forgo marriage altogether (Licther, McLaughlin, Kephart, & Landry, 1992).

The previous section detailed how the oil and gas industry raises income and employment during boom periods. With a rise in wages and lowered unemployment rates, oil and natural gas extraction may impact rates of marriage, divorce, and nonmarital cohabitation. Previous studies have shown that higher employment and earnings are associated with better family outcomes, while lower employment and earnings are tied to worse family outcomes (Blau & van der Klaauw, 2013; Charles & Stephens, 2004; Cherlin, Ribar, & Yasutake, 2016; Harknett & Kuperberg, 2011; Joshi, Quane, & Cherlin, 2009; Kotila, Snyder, & Quian, 2015; Nelson, 2011; Nunley & Seals, 2010; Oppenheimer, 2003; White & Rodgers, 2000). Employment opportunities impact family outcomes differently for men and women. Reduced employment for men destabilizes current marriages and prevents both non- and currently cohabiting couples from transitioning to marriage (Conger, 2011; Edin & Kafalas, 2005; Jensen & Jensen, 2011; Manning, Brown, & Payne, 2014; Nelson, 2011; Oppenheimer, Kalmjin, & Lin, 1997; Oppenheimer, 2003; Rowthorn & Webster, 2008). However, employment opportunities for women can either stabilize or destabilize marriage through the income effect and independence effect (Cherlin, 2004). The income effect serves to stabilize marriage in much the same way as male employment; more stable employment helps women appear more attractive on the marriage market and stabilize marriages that they are already in. The independence effect destabilizes marriage as women with higher income use their resources to abstain from or leave an unequitable or unfulfilling marriage (Nunley & Zeitz, 2012; Sayer & Bianchi, 2000; Schoen, Astone, Rothert, Standish, & Kim, 2002).

The oil and gas industry raises income, wealth, employment, and the population of males during boom periods, but may bring additional long-term costs to communities, individuals, and families. Up to this point, few studies have examined family outcomes in extraction communities, and only two that I am aware of have isolated the associations between employment in one type of extraction industry and family outcomes[2]. Kearney

[2] Betz and Snyder (2017); Kearney and Wilson (2017)

and Wilson (2017) addressed these ideas in a study isolating shale energy development, fertility, and marriage. Using the “marriage marketability” theory that men with low education appear more attractive as potential marriage partners with increased wages, they examined how oil and gas production helped raise wages and the subsequent impact on fertility and marriage behavior. They found a positive impact of wages on fertility but no impact on marital behavior (Kearney & Wilson, 2017). My study is different in a few ways. First, I focus on oil and gas employment as a share of overall employment rather than shale play production. Using proprietary employment data, I am able to separate out oil and gas employment the associated support activities from overall county employment to better understand the impact of shale energy development at the county level. Second, I focus on overall county, rather than PUMA level, marriage, divorce, and cohabitation levels to understand macro trends of shale energy development on the demographics of family behavior. PUMA level measurements encompass several counties in the same measurement; by using county level indicators, I am able to test what is happening at a more community level. I also am able to extend data to 2014, which is when shale employment gains began to level off. With this framework in mind, I propose three hypotheses:

1. I expect higher shares of total employment from the oil and gas industry to be associated with higher marriage rates as income and employment opportunities allow couples with marital aspirations to marry. I expect this effect to outweigh the impact of a large influx of young males moving to a county for O&G employment.

a. I expect that the oil and gas industry may play a larger role in allowing couples to transition to marriage in nonmetro counties due to a higher percentage of overall employment coming from O&G and prior observations of nonmetro counties following more traditional family behavior.

2. I am uncertain how divorce rates will be impacted by higher shares of total employment from the oil and gas industry; increased employment in the oil and gas industry may decrease economic stress, leading to more stable and happier marriages or the independence effect may raise divorce rates as couples gain resources and are better able to leave unhappy marriages. I am unsure of how these effects will interact with the large influx of young males moving to a county for O&G employment.

    a. I expect that divorce rates will show less impact in nonmetro counties as oil and gas employment increases due to prior observations of nonmetro counties following more traditional family behavior.

3. If higher shares of total employment in the oil and gas industry raises the proportion of married adults, I would expect that the proportion of nonmarried cohabiting households and unmarried adults would decrease. I expect this effect to outweigh the impact of an influx of young men moving in to obtain O&G employment.

    a. I expect higher oil and gas industry employment to lower cohabitation rates in nonmetro areas more so than metro areas.

Chapter 2. Methods

I use several data sources to investigate the connection between a county's oil and gas employment as a share of its total employment and county-level marital rates between 2009-2014. The dependent variables are county-level rates of those currently married, divorced/separated, never married, and cohabiting. All dependent variables were constructed using the American Community Survey (ACS) annual 5-year estimates from 2009-2014.

The key explanatory variable is the oil and gas employment share of overall county employment. Data to create this variable were purchased from Economic Modeling Specialists International (EMSI). EMSI uses the Bureau of Economic Analysis' (BEA) Regional Economic Accounts, the US Census Bureau's County Business Patterns form, and the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) to fill in withheld values in publicly available economic data at the 4-digit North American Industry Classification System (NAICS) level. These proprietary data advantage this study by allowing me to distinguish oil and gas employment from all other mining employment (gravel, metal, coal, and other types of mining) that are aggregated in publicly available two-digit NAICS county-level data. The oil and gas share variable is the sum of employment in NAICS industries 2111 (oil and gas mining) and 2131 (oil and gas support activities).

Data for the control variables come from three sources; Demographic variables such as age structure, race, education, percent foreign born, female labor force participation, and population come from the ACS 5-year estimates. Median household income and poverty data come from the Census Bureau's Small Area Income & Poverty Estimates (SAIPE) program and total employment comes from EMSI.

I include county demographic and economic characteristics in each model to control for important factors that may bias the estimated relationship between marriage behaviors and shale energy development. I include county and time fixed effects into the model to minimize potential bias from unobservable time-invariant differences between counties. I weight each county by their population in 2009. The empirical models take the form:

$$OUTCOME_{it} = (OilAndGas_{it})\beta_0 + (X_{it})\beta_1 + \sigma_i + \gamma_t + \varepsilon_{it} \quad (1)$$

The *OUTCOME* variable represents the percentage of the county's population that is married, divorced/separated, never married, or cohabiting, respectively, for each year from 2009-2014. The *OilAndGas* variable is the oil and gas employment share of total county employment variable. X represents a vector of demographic and economic control variables as summarized in Table 1. ε_{it} is the error term, while σ_i represents the county fixed effect. I estimate equation 1 for the four outcome variables from 2009-2014. Robust standard errors are calculated.

I first estimate a parsimonious base model that does not include the variables that represent the hypothesized channels through which O&G employment may influence marital outcomes, namely percent of the population that is male, female labor force participation, and median household income. Of note, the percent population that is male does not capture the transient workers of the O&G industry unless they permanently relocate to a county following employment. I then include each of these variables in a stepwise fashion to examine potential mechanisms through which O&G employment is influencing county marriage outcomes. I then include all of the mechanism and control variables in one model that tests whether there are aspects of O&G employment that influences marriage rates beyond the percent of the population that is male, female labor force participation, and median household income. Finally, I separate the nonmetro and metro counties to test whether there are differences in O&G employment by metro status for all counties in the United States.

Chapter 3. Results

Table 1 includes the descriptive statistics for all variables included in the fixed effects model. Over 53% of the population is married, 26% of the population has never been married while roughly 13% are divorced/separated. Cohabiting couples currently head just over 5% of overall households. The overall share of oil and gas employment within counties nationwide is just under one percent over the entire 2009-2014 period, while the highest county share of O&G employment was 61%. Although oil and gas employment plays a larger role in concentrated nonmetro mining communities, I expect that family outcomes will be influenced by an oil and gas boom period in all counties.

Table 1 also includes the descriptive statistics for nonmetro and metro areas. The currently married population is roughly 1.25% higher in nonmetro areas, while the percentage of never married individuals is just over 2.5% higher in metro areas. Just over 13% of the population is divorced in both nonmetro and metro areas, while cohabiting households are nearly equal in nonmetro and metro counties. These patterns in metro and nonmetro areas are consistent with other data comparing these populations (Lobao et al. 2016; Betz et al. 2015).

Hypothesis 1: Changes in the county share of O&G employment positively influences county marriage rates

Table 2 highlights the determinants of the percentage of population currently married from 2009-2014. My initial hypothesis was that increases in oil and gas employment as a share of overall employment would increase the proportion of the population that is currently married due to increased economic outcomes and higher employment. There was a significant shift in observed marriage rates during the oil and gas boom; however, marriage rates *decreased* as oil and gas employment rose. Specifically, as shown in model one, each additional percent increase in oil and gas employment and support activities was associated with a .12% percent decrease in the proportion of the population currently married. Generally, oil and gas employment jobs are taken by young males who may relocate with each successive boom and bust cycle. To control for those who relocate to a county for oil and gas employment and establish residence, I include the population percent that is male as the first stepwise control (Model 2). While increasing the overall percent of males was a significant predictor of lower marriage rates, oil and gas employment remained a significant factor beyond increases in the male population. I am unable to measure the transient male population accurately due to limitations in the ACS sampling frame, but the share of oil and gas employment variable may be serving as a proxy for these young males who move on from a county when the industry busts. These transient workers may be influencing overall marriage behavior within a county.

The third model removed population percentage of males and replaced it with female labor force participation. The economic theory of marriage states that a rise in income for women will provide them with more selectivity in choosing a partner and decreases their reliance on having a partner for economic support (Becker, 1973). Changes in the percent of women in the workforce could affect the marriage rates of the county. As the percentage of females currently employed increased, overall marriage rates decreased, consistent with economic theory. Again, oil and gas employment remained a significant predictor beyond this control. The oil and gas variable includes support activities for mining development, which includes employment that exists to maintain shale energy development in the county, such as workers to install pipelines. These support activities specific to the oil and gas industry may provide higher wages than the alternative, but may follow the boom and bust cycle and could thus prevent or destabilize marriages within the county.

Model four removed female labor force participation and replaced it with median household income. Lower employment and wages are associated with lower marriage rates (Cherlin, 2004). I use household income as a proxy for economic well-being in this model, as poverty status and total employment are part of the baseline controls. Median household income reflects increased wages from O&G employment as well as wealth created from land royalties, which provides a view into how this industry directly influences individuals and families. Income and the squared income term are significant predictors of marriage rates; however, the oil and gas employment share is still significantly associated a decrease in county marriage rates. Oil and gas employment is different from other sectors in that the industry may experience downturn or a company may alter production frequently. This volatility may prevent marriages from occurring that would otherwise take place in a more stable, high-income industry.

Up to this point, I have estimated a parsimonious model and conducted stepwise tests on successive models to determine if the male population percent, female labor force participation, or household income mediated the effect of oil and gas employment. Model five tests all three of these possible confounding variables at once to determine if their combined effect removes the impact of oil and gas employment in these counties. Controlling for these mechanisms, oil and gas employment remains a significant predictor of current percent of population married. As noted in the parsimonious specification (model one), I did not find support for my initial hypothesis that increased O&G employment during the shale boom increased marriage rates. In fact the opposite is true; For a one percent increase in O&G employment as a share of overall county employment resulted in a 0.1% decrease in the proportion of currently married individuals.

The last step was to determine if there are differences of oil and gas employment on marriage rates in nonmetro and metro counties. Using all of the same controls from model five, I found that the decrease in marriage rates was primarily driven by nonmetro counties (See Table 2) Experiencing lower marriage rates in nonmetro counties is noteworthy as previous literature has noted a preference for traditional family behavior in rural areas (Albrecht & Albrecht, 2004; Snyder, 2006; Snyder, 2011).

Shale energy development is correlated with lower marriage rates beyond the impact of income, female employment, and male-to-female ratios. This may be for a few reasons; namely, an influx of transient workers who do not impact changes in the county sex ratios measured by the ACS and young single males who permanently relocate, which would lower the current marriage rate in the county. The cyclical nature of oil and gas development attracts transient young, male workers who are seeking to maintain a high salary with typically lower educational attainment. Although benefits are brought to the county through increased employment in both mining and support activities, the volatile nature and swiftly changing demographic and economic make-up of the county may be different than other industries that develop slowly and have stable long-term projections.

Nonmetro counties accounted for the observed overall difference in marriage rates while the metro counties measure was insignificant. This could be due to the availability of marriageable partners; by definition, metro counties are those which have greater than 100,000 residents within their borders. Typically, as the population grows, there is more diversity in employment sectors, income levels, and educational attainment of those who live there. This differs from the homogeneity that may be found in a nonmetro extraction-based community that exists (or grows) to support activities such as mining. As the energy sector busts, these nonmetro communities may experience large downturns and thus less marriageable partners as incomes decrease and unemployment/underemployment increases.

Hypothesis 2: Divorce rates will change through income or independence effect

Table 3 highlights the determinants of the percentage of population that are divorced or separated. I initially hypothesized that divorce rates could increase through the independence effect or decrease through the income effect and that I was unsure how these effects would interact with a large influx of transient male workers. The first model indicates that as oil and gas employment share increases, the population of those currently divorced increases as well; an increase of one percent in oil and gas employment is associated with a .06% increase in the percent of currently divorced/separated population. Model two tests whether increasing the percent of males in a county mediates the effect of oil and gas employment on divorce. While the male population percent is a significant predictor of divorce, oil and gas employment still has a positive coefficient for divorce.

The third model tests the effect of female labor force participation on divorce rates. Increased employment opportunities for women may serve to insulate marriages from divorce due to higher income, which helps lessen the impact of economic shocks on union stability (Neeman, Newman, & Olivetti, 2008; Cherlin 2004). Conversely, economic theory states that women may be more selective and if their employment opportunities increase, they may choose to leave an unsatisfying marriage (Becker, 1973). Model three appears to support this theory; increases in female labor force participation is associated with a higher percentage of currently divorced/separated individuals. Oil and gas employment share remains significantly associated with divorce beyond the female labor force effect. Model four uses income as another way to test the idea of an income or independence effect. The squared income term is significant; yet again, oil and gas employment share is not mediated out through this specification.

Model five includes all three mechanisms to determine if oil and gas employment share is a significant predictor of divorce rates. After controlling for male population percentage, female labor force participation, and income, a one percent increase in oil and gas employment share as a percentage of overall county employment is associated with a .05% increase in the currently divorced/separated population. Of the two channels initially proposed, it appears that oil and gas employment allows individuals to experience the independence effect and possibly use their increased resources to leave an undesirable marriage. It appears that this effect is stronger in nonmetro counties, although the cumulative effect of metro and nonmetro counties appears stronger (See Table 3).

When metro and nonmetro counties are considered separately, only nonmetro counties have a significant increase in divorce rates. An alternative explanation for observed higher divorce rates may be due to an influx of young, single males who relocate either permanently or temporarily for O&G work and "pick off" married women. As the sex ratio shifts with high numbers of males moving to a county, women have more options to choose from and may form new relationships outside of their marriage with men who moved to these counties for oil and gas employment.

Hypothesis 3: Oil and gas employment decreases never married and cohabiting households

Initially, I hypothesized increases in marriage rates due to the shale boom through increased income and employment prospects. This led to predicting lower numbers of never married and cohabiting households as individuals used their increased resources to convert relationships into marriages. Tables 4 and 5 highlight models that followed the same analytic structure as previously examined for the percent of never married individuals and cohabiting households, respectively. Oil and gas employment share does not appear to have a strong impact on the population of never married individuals when considering both nonmetro and metro counties together. However, when nonmetro counties are tested separately, each additional percent increase in oil and gas employment share is associated with a .04 increase in the population of never married individuals, though this effect is only significant at the 10% level. Oil and gas employment does not appear to be significantly associated with cohabitation in either nonmetro or metro counties, which goes against my hypothesis that cohabiting households would decrease as oil and gas employment share increased.

Chapter 4. Discussion

The oil and gas boom period that occurred for much of the last decade has shifted the landscape of extraction-based communities. Shale communities that have experienced the boom cycle are typically different from those counties with long histories of mining other commodities, such as coal. Thus, even with studies surrounding marriage and family behavior in coal counties (Betz & Snyder, 2017), this study helps to fill a gap in the literature about social impacts of resource extraction as shale energy development replaces coal mining as the major mining activity in the United States. These rapidly emerging areas may not have the same history of living through the boom and bust cycle as other extraction communities and merit study to determine how to regulate and promote oil and gas production moving forward.

Despite documented trends of a preference for marriage in nonmetro counties (Albrecht & Albrecht, 2004; Snyder, 2006; Snyder, 2011), the oil and gas boom appears to have dampened these trends in the United States. One explanation for this could be the independence effect, which states that increased resources may allow for dissolution of unsatisfying marriages and selectivity into marriage (Nunley & Zeitz, 2012; Sayer & Bianchi, 2000; Schoen, Astone, Rothert, Standish, & Kim, 2002). The decrease in marriage rates in nonmetro areas is not unprecedented (Snyder & McLaughlin, 2004; Snyder & McLaughlin, 2006), and it appears that counties with larger shares of oil and gas employment may be following these trends. Shale energy development may be destabilizing marriage, especially in nonmetro counties.

One limitation of this study was the inability to measure the transient male population that moves to a county for oil and gas employment. I have used the share of oil and gas employment as a percentage of overall employment as a proxy for this variable with the assumption that counties experiencing shale energy development will draw young males with the allure of high wages. However, this variable does not allow me to delineate what percentage of those employed in the industry are transient, which is one factor that prevents establishing causality in this study. Future studies should aim to find a way to approximate what percentage of employees are transient or do not establish residence after moving to a county for employment.

Another limitation is that 2009 is the first year that nonmetro counties could be included in estimates from the ACS. This limitation prevented me from analyzing data from the beginning of the shale energy boom in 2007. Future studies may find ways to conduct county level analyses from the beginning of the boom with other datasets to capture the entirety of the initial boom in shale oil and gas development.

Another limitation of this study is the inability to differentiate individual marital behavior to determine what role oil and gas employment plays on family behavior. While my findings have established a significant relationship between oil and gas employment and less traditional family behavior, my data limitations have prevented establishing causality. Additionally, these observed findings may be due to the demographic characteristics of those moving in rather than changing original residents' behavior.

Future research should examine individual behavior based on responses to oil and gas industry employment.

Future studies should also focus on oil and gas production leveling off and downturn that has occurred over the past few years. Data limitations have prevented me from examining early trends, but future studies could use the descriptive findings here to determine further the impact of oil and gas employment on marital behavior. Just as this study of the inaugural shale oil and gas boom has been worthwhile, so too will seeing how these communities react to a bust cycle.

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Appendix A. Tables

Table 1. Variable Means and Standard Deviations

	Mean	SD	Nonmetro	SD	Metro	SD
Percent Now Married	53.26	7.24	53.57	7.35	52.34	6.8
Percent Divorced/Separated	13.19	2.77	13.21	2.89	13.15	2.38
Percent Never Married	26.28	6.92	25.64	6.83	28.21	6.85
Percent of Households Cohabiting	5.22	1.81	5.17	1.91	5.38	1.46
Shale Employment Share	0.99	3.52	1.17	3.91	0.43	1.7
Population Percent Male	49.96	2.37	50.13	2.55	49.45	1.6
Female Labor Force Participation	41.79	4.12	41.58	4.4	42.43	3.02
Median Household Income	44,771	11,466	43,043	10,503	50,120	12,612
Percent in Poverty	16.9	6.45	17.36	6.61	15.46	5.69
Percent Employed	40.01	15.63	39.8	14.74	40.64	18.06
Percent Foreign Born	4.44	5.59	3.94	5.12	5.95	6.57
County Population	97,733	312,526	57,341	180,594	219,965	524,134
Percent Under 20	26.17	3.67	25.87	3.78	27.07	3.11
Percent 20-24	6.26	2.61	6.05	2.43	6.89	3.01
Percent Over 64	15.94	4.32	16.74	4.28	13.52	3.45
Percent Hispanic	8.14	13.11	8.04	13.4	8.43	12.22
Percent African American	8.84	14.47	8.15	14.73	10.91	13.45
Percent All Other	6.28	9.81	6.36	10.71	6.02	6.35
Percent Some College	29.18	5.4	29.22	5.6	29.08	4.75
Percent Bachelors or More	19.39	8.75	18.03	7.72	23.5	10.25
N	18,527		13,925		4,602	

Table 2. Determinants of Percentage of Population Currently Married

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	-0.117**	-0.098*	-0.127**	-0.114**	-0.100*	-0.105**	-0.025
	(-2.936)	(-2.463)	(-3.116)	(-2.844)	(-2.473)	(-2.598)	(-0.232)
Population Percent Male		-0.275***			-0.381***	-0.377***	-0.499***
		(-5.131)			(-7.292)	(-5.956)	(-5.087)
Female Labor Force Participation			-0.126***		-0.155***	-0.120***	-0.235***
			(-7.069)		(-8.792)	(-6.686)	(-5.872)
Median Household Income				-0.000*	-0.000*	-0.000*	-0.000
				(-2.487)	(-2.519)	(-2.336)	(-1.356)
Median Household Income Squared				0.000***	0.000***	0.000**	0.000****
				(3.448)	(3.634)	(3.249)	(1.795)
N		18527	18527	18527	18527	18527	13925
R-squared		0.525	0.529	0.532	0.528	0.540	0.450

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients

Controls were included for poverty, employment, foreign born status, county population, age, race/ethnicity, and education

Table 3. Determinants of Percentage of Population Divorce/Separated

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	0.059**	0.051*	0.062**	0.058**	0.052*	0.042†	0.030
	(2.879)	(2.484)	(2.992)	(2.818)	(2.492)	(1.787)	(0.768)
Population Percent Male		0.120***			0.155***	0.133***	0.200***
		(4.231)			(5.477)	(3.555)	(3.803)
Female Labor Force Participation			0.040***		0.051***	0.036***	0.085***
			(4.594)		(6.036)	(3.850)	(4.678)
Median Household Income				0.000	0.000	0.000	0.000
				(1.523)	(1.479)	(1.436)	(1.040)
Median Household Income Squared				-0.000*	-0.000*	-0.000**	-0.000
				(-2.246)	(-2.326)	(-2.744)	(-1.063)
N		18527	18527	18527	18527	18527	13925
R-squared		0.235	0.238	0.238	0.236	0.245	0.222

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients

Controls were included for poverty, employment, foreign born status, county population, age, race/ethnicity, and education

Table 4. Determinants of Percentage of Population Never Married

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	0.044	0.028	0.050†	0.039	0.027	0.043†	-0.020
	(1.475)	(0.947)	(1.670)	(1.332)	(0.932)	(1.689)	(-0.233)
Population Percent Male		0.230***			0.299***	0.322***	0.364***
		(5.572)			(7.476)	(7.426)	(4.606)
Female Labor Force Participation			0.082***		0.104***	0.089***	0.141***
			(6.143)		(7.824)	(6.562)	(4.742)
Median Household Income				0.000**	0.000**	0.000**	0.000
				(3.049)	(2.955)	(3.040)	(1.205)
Median Household Income Squared				-0.000***	-0.000***	-0.000***	-0.000†
				(-3.950)	(-4.053)	(-3.550)	(-1.754)
N	18527	18527	18527	18527	18527	13925	4602
R-squared	0.627	0.631	0.631	0.629	0.639	0.532	0.757

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients

Controls were included for poverty, employment, foreign born status, county population, age, race/ethnicity, and education

Table 5. Determinants of Percentage of Population Cohabiting

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	0.013	0.017	0.014	0.011	0.015	0.004	0.050
	(0.787)	(1.016)	(0.817)	(0.633)	(0.846)	(0.230)	(1.353)
Population Percent Male		-0.057**			-0.056**	-0.036	-0.092*
		(-3.004)			(-2.874)	(-1.607)	(-2.370)
Female Labor Force Participation			0.006		0.003	0.004	0.003
			(0.936)		(0.423)	(0.515)	(0.180)
Median Household Income				0.000*	0.000*	0.000	0.000†
				(2.357)	(2.564)	(1.314)	(1.960)
Median Household Income Squared				-0.000**	-0.000**	-0.000	-0.000*
				(-2.818)	(-2.946)	(-1.501)	(-2.127)
N	18527	18527	18527	18527	18527	13925	4602
R-squared	0.210	0.211	0.210	0.211	0.212	0.133	0.352

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients

Controls were included for poverty, employment, foreign born status, county population, age, race/ethnicity, and education

Table 6. Determinants of Percentage of Population Currently Married

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	-0.117**	-0.098*	-0.127**	-0.114**	-0.100*	-0.105**	-0.025
	(-2.936)	(-2.463)	(-3.116)	(-2.844)	(-2.473)	(-2.598)	(-0.232)
Population Percent Male		-0.275***			-0.381***	-0.377***	-0.499***
		(-5.131)			(-7.292)	(-5.956)	(-5.087)
Female Labor Force Participation			-0.126***		-0.155***	-0.120***	-0.235***
			(-7.069)		(-8.792)	(-6.686)	(-5.872)
Median Household Income				-0.000*	-0.000*	-0.000*	-0.000
				(-2.487)	(-2.519)	(-2.336)	(-1.356)
Median Household Income Squared				0.000***	0.000***	0.000**	0.000†
				(3.448)	(3.634)	(3.249)	(1.795)
Percent in Poverty	-0.036***	-0.038***	-0.036***	-0.034***	-0.035***	-0.038**	-0.029†
	(-3.796)	(-3.998)	(-3.798)	(-3.476)	(-3.627)	(-3.255)	(-1.834)
Percent Employed	0.080***	0.075***	0.076***	0.072***	0.060***	0.030†	0.097***
	(4.963)	(4.661)	(4.906)	(4.345)	(3.845)	(1.805)	(4.485)
Percent Foreign Born	0.249***	0.267***	0.218***	0.229***	0.215***	0.281***	0.097
	(4.975)	(5.380)	(4.377)	(4.639)	(4.455)	(4.990)	(1.143)
County Population	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.171)	(-0.577)	(-0.155)	(-0.358)	(-0.954)	(-0.192)	(-1.120)

Continued

Table 6 Continued

Percent Under 20	-0.001	-0.037	-0.001	-0.016	-0.065	-0.192***	0.122†
	(-0.032)	(-0.813)	(-0.020)	(-0.348)	(-1.495)	(-3.721)	(1.839)
Percent 20-24	-0.294***	-0.303***	-0.289***	-0.284***	-0.290***	-0.313***	-0.285***
	(-5.870)	(-5.983)	(-6.096)	(-5.593)	(-5.986)	(-4.247)	(-4.599)
Percent Over 64	-0.004	-0.058	0.036	-0.018	-0.044	-0.050	-0.072
	(-0.088)	(-1.307)	(0.835)	(-0.396)	(-1.010)	(-1.172)	(-0.795)
Percent Hispanic	-0.125**	-0.139***	-0.107**	-0.126**	-0.124**	-0.154**	-0.051
	(-3.114)	(-3.438)	(-2.653)	(-3.154)	(-3.078)	(-2.979)	(-0.718)
Percent African American	-0.171***	-0.186***	-0.143***	-0.174***	-0.159***	-0.130**	-0.154**
	(-4.515)	(-4.873)	(-3.799)	(-4.654)	(-4.263)	(-2.973)	(-2.927)
Percent All Other	0.098**	0.081*	0.105***	0.081**	0.065*	0.025	0.135*
	(3.126)	(2.563)	(3.428)	(2.696)	(2.224)	(0.789)	(2.527)
Percent Some College	0.119***	0.123***	0.116***	0.135***	0.138***	0.118***	0.184***
	(5.837)	(6.065)	(5.793)	(6.604)	(6.921)	(5.688)	(4.271)
Percent Bachelors or More	0.331***	0.323***	0.333***	0.323***	0.315***	0.285***	0.373***
	(13.357)	(13.111)	(13.560)	(12.989)	(12.895)	(11.259)	(8.061)
year=9	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
year=10	-0.231***	-0.252***	-0.151**	-0.210***	-0.142**	-0.175*	-0.127
	(-4.250)	(-4.845)	(-2.750)	(-3.810)	(-2.652)	(-2.120)	(-1.583)
year=11	-0.812***	-0.816***	-0.688***	-0.799***	-0.655***	-0.670***	-0.657***
	(-10.952)	(-11.286)	(-9.156)	(-10.577)	(-8.697)	(-6.091)	(-5.316)

Continued

Table 6 Continued

year=12	-1.511***	-1.496***	-1.358***	-1.514***	-1.312***	-1.317***	-1.320***
	(-16.070)	(-16.152)	(-14.260)	(-15.657)	(-13.447)	(-9.639)	(-7.868)
year=13	-2.074***	-2.037***	-1.925***	-2.086***	-1.859***	-1.859***	-1.868***
	(-18.396)	(-18.278)	(-16.912)	(-17.862)	(-15.815)	(-11.611)	(-9.048)
year=14	-2.624***	-2.566***	-2.507***	-2.655***	-2.440***	-2.469***	-2.430***
	(-19.434)	(-19.203)	(-18.488)	(-18.934)	(-17.435)	(-13.262)	(-9.717)
Constant	36.992***	53.301***	41.591***	39.422***	67.520***	73.370***	66.088***
	(13.134)	(12.566)	(14.859)	(13.205)	(15.454)	(12.915)	(9.258)
Observations	18527	18527	18527	18527	18527	13925	4602
R-squared	0.525	0.529	0.532	0.528	0.540	0.450	0.659

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients

Table 7. Determinants of Percentage of Population Divorced/Separated

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	0.059**	0.051*	0.062**	0.058**	0.052*	0.042†	0.030
	(2.879)	(2.484)	(2.992)	(2.818)	(2.492)	(1.787)	(0.768)
Population Percent Male		0.120***			0.155***	0.133***	0.200***
		(4.231)			(5.477)	(3.555)	(3.803)
Female Labor Force Participation			0.040***		0.051***	0.036***	0.085***
			(4.594)		(6.036)	(3.850)	(4.678)
Median Household Income				0.000	0.000	0.000	0.000
				(1.523)	(1.479)	(1.436)	(1.040)
Median Household Income Squared				-0.000*	-0.000*	-0.000**	-0.000
				(-2.246)	(-2.326)	(-2.744)	(-1.063)
Percent in Poverty	0.005	0.006	0.005	0.004	0.005	-0.000	0.013
	(1.056)	(1.246)	(1.037)	(0.866)	(0.939)	(-0.074)	(1.618)
Percent Employed	-0.024***	-0.022***	-0.023***	-0.022**	-0.017**	0.002	-0.034***
	(-3.581)	(-3.345)	(-3.437)	(-3.108)	(-2.588)	(0.291)	(-3.926)
Percent Foreign Born	-0.075**	-0.082***	-0.065*	-0.068**	-0.065**	-0.095**	-0.011
	(-2.868)	(-3.345)	(-2.497)	(-2.637)	(-2.660)	(-2.890)	(-0.271)
County Population	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000**	-0.000**
	(-4.297)	(-3.975)	(-4.389)	(-4.221)	(-3.922)	(-2.614)	(-3.168)
Percent Under 20	-0.059**	-0.044*	-0.059**	-0.055**	-0.035	-0.049*	-0.026
	(-2.824)	(-2.039)	(-2.874)	(-2.620)	(-1.640)	(-1.970)	(-0.762)

Continued

Table 7 Continued

Percent 20-24	-0.204***	-0.199***	-0.205***	-0.206***	-0.204***	-0.197***	-0.206***
	(-11.473)	(-11.272)	(-11.654)	(-11.698)	(-11.678)	(-7.401)	(-7.912)
Percent Over 64	0.034	0.057*	0.021	0.038	0.052*	-0.001	0.127**
	(1.410)	(2.293)	(0.904)	(1.581)	(2.095)	(-0.033)	(2.735)
Percent Hispanic	-0.027	-0.020	-0.032	-0.026	-0.025	-0.035	-0.034
	(-1.187)	(-0.912)	(-1.424)	(-1.149)	(-1.130)	(-1.192)	(-0.975)
Percent African American	0.040	0.047†	0.031	0.041	0.038	-0.008	0.049
	(1.606)	(1.926)	(1.244)	(1.645)	(1.564)	(-0.264)	(1.529)
Percent All Other	-0.046**	-0.038*	-0.048**	-0.040**	-0.033*	-0.013	-0.060*
	(-3.034)	(-2.564)	(-3.210)	(-2.689)	(-2.284)	(-0.849)	(-2.286)
Percent Some College	0.000	-0.002	0.001	-0.005	-0.006	0.006	-0.050*
	(0.024)	(-0.142)	(0.114)	(-0.455)	(-0.577)	(0.483)	(E6-2.388)
Percent Bachelors or More	-0.130***	-0.127***	-0.131***	-0.127***	-0.124***	-0.110***	-0.149***
	(-10.536)	(-10.323)	(-10.607)	(-10.336)	(-10.136)	(-7.209)	(-7.073)
year=9	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
year=10	0.116***	0.125***	0.091**	0.109***	0.089**	0.130**	0.067
	(3.792)	(4.415)	(2.973)	(3.513)	(3.060)	(2.593)	(1.599)
year=11	0.268***	0.270***	0.229***	0.264***	0.217***	0.278***	0.185**
	(6.429)	(6.729)	(5.481)	(6.129)	(5.188)	(4.350)	(2.855)
year=12	0.500***	0.493***	0.452***	0.501***	0.433***	0.521***	0.389***
	(9.362)	(9.416)	(8.455)	(8.902)	(7.794)	(6.207)	(4.464)

Continued

Table 7 Continued

year=13	0.683***	0.667***	0.636***	0.687***	0.610***	0.725***	0.543***
	(10.806)	(10.579)	(10.046)	(10.159)	(9.016)	(7.419)	(5.055)
year=14	0.823***	0.798***	0.786***	0.833***	0.758***	0.908***	0.670***
	(11.129)	(10.719)	(10.620)	(10.455)	(9.488)	(8.047)	(5.244)
Constant	22.971***	15.874***	21.524***	22.199***	11.231***	12.551***	8.460*
	(17.197)	(7.070)	(15.845)	(15.431)	(4.670)	(3.730)	(2.213)
Observations	18527	18527	18527	18527	18527	13925	4602
R-squared	0.235	0.238	0.238	0.236	0.245	0.222	0.319

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients

Table 8. Determinants of Percentage of Population Never Married

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	0.044	0.028	0.050†	0.039	0.027	0.043†	-0.020
	(1.475)	(0.947)	(1.670)	(1.332)	(0.932)	(1.689)	(-0.233)
Population Percent Male		0.230***			0.299***	0.322***	0.364***
		(5.572)			(7.476)	(7.426)	(4.606)
Female Labor Force Participation			0.082***		0.104***	0.089***	0.141***
			(6.143)		(7.824)	(6.562)	(4.742)
Median Household Income				0.000**	0.000**	0.000**	0.000
				(3.049)	(2.955)	(3.040)	(1.205)
Median Household Income Squared				-0.000***	-0.000***	-0.000***	-0.000†
				(-3.950)	(-4.053)	(-3.550)	(-1.754)
Percent in Poverty	0.034***	0.035***	0.034***	0.034***	0.035***	0.039***	0.025*
	(4.557)	(4.717)	(4.554)	(4.673)	(4.768)	(4.460)	(2.085)
Percent Employed	-0.050***	-0.045***	-0.047***	-0.044***	-0.035**	-0.033**	-0.047**
	(-4.246)	(-3.852)	(-4.189)	(-3.681)	(-3.064)	(-2.707)	(-2.717)
Percent Foreign Born	-0.149***	-0.164***	-0.130***	-0.136***	-0.129***	-0.168***	-0.074
	(-4.283)	(-4.560)	(-3.782)	(-3.995)	(-3.765)	(-4.421)	(-1.217)
County Population	0.000**	0.000***	0.000**	0.000**	0.000***	0.000	0.000***
	(2.903)	(3.306)	(2.886)	(3.238)	(3.751)	(1.526)	(3.886)
Percent Under 20	0.028	0.058	0.028	0.037	0.076†	0.242***	-0.156**
	(0.627)	(1.270)	(0.623)	(0.850)	(1.728)	(4.855)	(-2.900)

Continued

Table 8 Continued

Percent 20-24	0.556***	0.564***	0.553***	0.551***	0.556***	0.578***	0.549***
	(12.004)	(12.050)	(12.371)	(11.779)	(12.272)	(9.689)	(8.523)
Percent Over 64	-0.306***	-0.261***	-0.332***	-0.295***	-0.269***	-0.182***	-0.374***
	(-6.682)	(-5.778)	(-7.220)	(-6.566)	(-6.164)	(-3.741)	(-5.918)
Percent Hispanic	0.143***	0.155***	0.131***	0.145***	0.146***	0.180***	0.095†
	(4.690)	(4.929)	(4.336)	(4.841)	(4.740)	(5.387)	(1.752)
Percent African American	0.102**	0.115***	0.084**	0.105***	0.097**	0.121*	0.084*
	(3.280)	(3.478)	(2.718)	(3.425)	(3.010)	(2.211)	(2.171)
Percent All Other	-0.060*	-0.046†	-0.065**	-0.048*	-0.035	-0.012	-0.077†
	(-2.480)	(-1.864)	(-2.697)	(-2.018)	(-1.464)	(-0.491)	(-1.710)
Percent Some College	-0.097***	-0.100***	-0.095***	-0.108***	-0.111***	-0.100***	-0.122***
	(-6.329)	(-6.580)	(-6.295)	(-7.083)	(-7.402)	(-6.314)	(-4.000)
Percent Bachelors or More	-0.158***	-0.152***	-0.160***	-0.153***	-0.146***	-0.125***	-0.187***
	(-8.179)	(-7.868)	(-8.303)	(-7.929)	(-7.679)	(-6.094)	(-5.556)
year=9	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
year=10	0.280***	0.298***	0.229***	0.264***	0.222***	0.212***	0.232***
	(6.501)	(6.849)	(5.224)	(6.110)	(4.968)	(4.564)	(3.681)
year=11	0.792***	0.796***	0.712***	0.778***	0.682***	0.637***	0.723***
	(13.154)	(13.152)	(11.573)	(12.742)	(10.749)	(9.427)	(7.533)
year=12	1.336***	1.324***	1.238***	1.328***	1.192***	1.110***	1.256***
	(17.444)	(17.253)	(15.851)	(17.003)	(14.722)	(12.619)	(9.924)

Continued

Table 8 Continued

year=13	1.821***	1.790***	1.725***	1.814***	1.658***	1.548***	1.745***
	(19.522)	(19.268)	(18.232)	(18.968)	(16.963)	(14.592)	(11.372)
year=14	2.323***	2.274***	2.247***	2.324***	2.173***	2.050***	2.272***
	(20.583)	(20.404)	(19.749)	(20.094)	(18.743)	(16.059)	(12.578)
Constant	36.266***	22.675***	33.291***	34.214***	12.815***	4.554	19.450***
	(14.816)	(6.133)	(13.646)	(13.178)	(3.407)	(1.103)	(3.310)
Observations	18527	18527	18527	18527	18527	13925	4602
R-squared	0.627	0.631	0.631	0.629	0.639	0.532	0.757

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients

Table 9. Determinants of Percentage of Population Cohabiting

	Model 1	Model 2	Model 3	Model 4	Model 5	Nonmetro	Metro
Shale Employment Share	0.013	0.017	0.014	0.011	0.015	0.004	0.050
	(0.787)	(1.016)	(0.817)	(0.633)	(0.846)	(0.230)	(1.353)
Population Percent Male		-0.057**			-0.056**	-0.036	-0.092*
		(-3.004)			(-2.874)	(-1.607)	(-2.370)
Female Labor Force Participation			0.006		0.003	0.004	0.003
			(0.936)		(0.423)	(0.515)	(0.180)
Median Household Income				0.000*	0.000*	0.000	0.000†
				(2.357)	(2.564)	(1.314)	(1.960)
Median Household Income Squared				-0.000**	-0.000**	-0.000	-0.000*
				(-2.818)	(-2.946)	(-1.501)	(-2.127)
Percent in Poverty	0.013**	0.012**	0.013**	0.014**	0.014***	0.018**	0.011†
	(2.976)	(2.904)	(2.975)	(3.283)	(3.317)	(3.220)	(1.741)
Percent Employed	0.021***	0.020***	0.021***	0.023***	0.022***	0.021***	0.023***
	(4.991)	(4.751)	(5.050)	(5.367)	(5.138)	(3.700)	(3.680)
Percent Foreign Born	-0.059**	-0.055**	-0.057**	-0.055**	-0.051**	-0.036†	-0.074*
	(-3.250)	(-3.052)	(-3.179)	(-3.032)	(-2.815)	(-1.677)	(-2.506)
County Population	0.000**	0.000*	0.000**	0.000**	0.000**	0.000	0.000*
	(2.765)	(2.419)	(2.747)	(3.050)	(2.677)	(0.607)	(2.541)
Percent Under 20	-0.058***	-0.065***	-0.058***	-0.055***	-0.062***	-0.051**	-0.065**
	(-3.854)	(-4.372)	(-3.859)	(-3.666)	(-4.172)	(-2.830)	(-2.639)

Continued

Table 9 Continued

Percent 20-24	0.065***	0.063***	0.065***	0.064***	0.063***	0.094***	0.035†
	(4.766)	(4.676)	(4.756)	(4.725)	(4.653)	(5.221)	(1.814)
Percent Over 64	-0.156***	-0.168***	-0.158***	-0.151***	-0.163***	-0.138***	-0.199***
	(-9.957)	(-10.580)	(-9.960)	(-9.619)	(-10.210)	(-6.962)	(-6.213)
Percent Hispanic	-0.001	-0.004	-0.002	0.001	-0.002	-0.001	0.001
	(-0.045)	(-0.235)	(-0.103)	(0.051)	(-0.146)	(-0.032)	(0.055)
Percent African American	-0.043**	-0.046**	-0.044**	-0.042**	-0.045**	-0.026	-0.057**
	(-2.982)	(-3.206)	(-3.060)	(-2.879)	(-3.113)	(-1.048)	(-3.178)
Percent All Other	0.013	0.009	0.012	0.017†	0.014	0.008	0.027
	(1.254)	(0.902)	(1.219)	(1.709)	(1.358)	(0.677)	(1.457)
Percent Some College	-0.006	-0.005	-0.005	-0.010	-0.009	-0.015	0.006
	(-0.659)	(-0.559)	(-0.640)	(-1.145)	(-1.042)	(-1.525)	(0.405)
Percent Bachelors or More	-0.030**	-0.032**	-0.030**	-0.029**	-0.030**	-0.029*	-0.036*
	(-2.973)	(-3.118)	(-2.983)	(-2.822)	(-2.982)	(-2.258)	(-2.113)
year=9	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)	(.)
year=10	0.162***	0.158***	0.158***	0.156***	0.149***	0.116***	0.177***
	(9.141)	(8.997)	(8.621)	(8.815)	(8.291)	(5.301)	(5.621)
year=11	0.263***	0.262***	0.256***	0.255***	0.250***	0.231***	0.268***
	(9.690)	(9.784)	(9.178)	(9.416)	(9.068)	(6.847)	(5.543)
year=12	0.363***	0.366***	0.355***	0.354***	0.352***	0.327***	0.371***
	(10.300)	(10.481)	(9.864)	(9.916)	(9.705)	(7.471)	(5.814)

Continued

Table 9 Continued

year=13	0.496***	0.504***	0.489***	0.486***	0.486***	0.458***	0.512***
	(11.656)	(11.909)	(11.347)	(11.140)	(11.097)	(8.444)	(6.621)
year=14	0.623***	0.635***	0.617***	0.612***	0.617***	0.575***	0.659***
	(12.245)	(12.519)	(12.086)	(11.669)	(11.771)	(8.891)	(7.053)
Constant	8.942***	12.294***	8.707***	8.045***	11.150***	9.839***	13.326***
	(10.608)	(9.020)	(9.994)	(8.943)	(7.570)	(5.529)	(4.982)
Observations	18527	18527	18527	18527	18527	13925	4602
R-squared	0.210	0.211	0.210	0.211	0.212	0.133	0.352

*** p<.001; ** p<.01; * p<.05; †p<.10

T-statistics are in parentheses under the coefficients