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Abstract

I examine the causal impact of oil and gas extraction from new wells on entry and exit of self-employed business owners. I classify self-employed individuals into entrepreneurs and other business owners. I find that fracking induces more wage and salary workers to become entrepreneurs, but does not have any significant effects on the exit rate of entrepreneurs. In addition, fracking lowers the entry rate of other business owners, but has no effect on their exit rate. Extending my analysis to industry-level reveals that the positive impact on the entry to entrepreneurship occurs primarily in the service sector, and the negative effect on entry to unincorporated self-employment in the agricultural sector.

JEL Classification: J24, L26, M13, Q33, Q35

Keywords: Entrepreneurship, Fracking, Self-employment, Entry Rate, Exit Rate

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1 Introduction

Horizontal drilling through hydrofracturing, commonly referred to as fracking, is considered the most significant technological progress in the energy sector during the post World War II period. The process involves injecting water, sand, and chemicals into the rock at high pressure which allows the oil and gas to flow out to the head of well. With this drilling process, the recovery of vast quantities of oil and natural gas from shale deposits has become possible, and thus US production of oil and natural gas has dramatically increased. Fo example, employment in the mining industry grew substantially even during the Great Recession.

Because it has costs and benefits to society, fracking has drawn significant attention from researchers, policy makers, and environmentalists. The fracking process poses serious threats to environmental safety and public health by polluting the environment. Indeed, some states (e.g., New York, Vermont, and Maryland) and countries (Australia, Germany, France, Scotland) have banned this process. However, there is now a growing literature in economics that investigates the implications of hydrofracturing for local and national economies. Feyrer et al. (2017), for example, use the fracking revolution to study how income and employment shocks propagate over time and across geography and industries. They find that new production of oil and gas through fracking in the U.S. produces higher wages and business income, and lowers unemployment. Similarly, Bartik et al. (2017), exploiting geographical variation within shale deposits and timing in fracking, find that allowing fracking leads to improvements in a wide set of economic indicators such as total income, employment, and crime rate.

This paper contributes to this growing literature in economics by studying the impact of hydrofracturing on entrepreneurial activity in the US. In the present context, investigating this issue is important for two important reasons. First, entrepreneurship has long been considered a key determinant of growth and economic prosperity through its effects on technological progress, market competition, and job creation (Decker et al. 2014, Buera et al. 2015). As a result, understanding the determinants of entrepreneurship has been a subject of considerable interest for economists and policy makers alike. Second, literature on fracking has largely ignored its implications for business creation and destruction, focusing instead on labor-market outcomes and the profitability of fracking operations. Exploiting variation across U.S community zones over the 2004–2014 period, this paper investigates the impact of fracking on the entry and exit rates of entrepreneurs. The first step in my analysis is to measure entrepreneurship, and the existing literature typically measures entrepreneurship in one of two ways. Some studies (e.g., Haltiwanger et al. 2013), using the Longitudinal Business Database (LBD) complied by the U.S. Census Bureau, measures entrepreneurial activity by employer establishment birth and death rates. Many other studies (e.g., Fairlie 2014, Levine and Rubinstein 2017, Hurst and Pugsley 2017) measure entrepreneurship at the individual-owner level. In this paper, I follow the second approach for the following reasons. First, measuring entrepreneurship at the individual-owner level is more consistent with theory (Evans and Javanovic 1989, Buera et al. 2015). Second, establishment-based measures represent only a small share of entrepreneurial activity (Fairlie 2014). Finally, individual business owners constitutes about one-tenth of the workforce, while holding about 40 percent of total U.S. wealth (Chatterji et al. 2014).

I use the monthly Current Population Survey (CPS) data to identify entrepreneurship at the individual-owner level. I identify incorporated self-employed business owners as entrepreneurs and unincorporated self-employed as other business owners. My analysis distinguishes between the incorporated self-employed and unincorporated individuals because recent studies (Levine and Rubinstein 2017) highlight key differences between these two groups. Since households are interviewed four consecutive months in the CPS data, I can identify entry and exit of self-employed business owners between two consecutive months. For each community zone and year, I define the average monthly entry rate as the number of self-employed business owners created between two consecutive months normalized by the number of existing business owners, and the exit rate as the average monthly rate of self-employed business owners becoming wage and salary workers. I then investigate the impact of oil and gas production from new wells on the entry and exit rates of self-employed business owners. The standard regression analysis to estimate the effects may not be appropriate in the present context, because several potential unobserved factors that may affect entrepreneurial activity are also correlated with hydrofracturing. To solve this problem, I estimate the causal effect through using an instrumental variable approach, where time series of productivity in geographical formations is used as an instrument for fracking.

My main findings can be summarized as follows. First, oil and gas production from new wells induce more wage and salary workers to become entrepreneurs; a $1,000/worker increase in oil and gas extraction increases the entry rate by 0.8 percentage points. It does not have any significant effects on the exit rate of entrepreneurs. Second, oil and gas production lowers the entry rate of other business owners, but has no effects on their exit rate. A $1,000/worker increase in oil and gas extraction decreases their entry rate by 0.75 percentage points. One explanation for these findings is as follows. Oil and gas extraction creates new business opportunities, which in turn encourage entrepreneurship. But it also generates new jobs and higher wages (Feyrer et al. 2017). Better job-opportunities may induce individuals to leave unincorporated self-employment for higher paying opportunities as wage and salary workers. Levine and Rubinstein (2017) show that unincorporated self-employed individuals usually earn than the comparable wage and salary workers (see also Hamilton 2000). Finally, extending my analysis to industry-level reveals that the positive impact on the entry to entrepreneurship mainly comes from service sector, and the negative effect on entry to unincorporated self-employment from agricultural sector.

As noted above, this paper relates to an emerging literature that investigates the impact of oil and gas production through hydrofracturing on various economic outcomes, including employment and wage (Jacobsen and Parker 2016, Allcott and Keniston 2017, Feyrer et al. 2017), welfare and amenities (Bartik et al. 2017), consumer behavior (Brown 2018), firm dynamics (Decker et al. 2018), self-employment (Tsvetkova and Partridge 2017), among many others.[1] This paper is more related to Decker et al. (2018) and Tsvetkova and Partridge (2017). Using a differences-in-difference model, the former examines the response of firms to oil and gas extraction, and finds establishment entry accounts for most of the employment growth in shale regions. Decker et al. measure entrepreneurial activity by the number of new

[1] Some other studies are Michaels (2011), Marchand (2012), Deller and Schreiber (2013), Joskow (2013), and Weber (2013).

firms and establishments, and their findings (consistent with my results) imply that oil and gas extraction had a positive effect on entrepreneurship.

Tsvetkova and Partridge (2017) study the impact of *employment* growth in oil and gas extraction industry on self-employment growth in the U.S., and find that the expansion in oil and gas sector mostly lowers self-employment growth. This paper differs from theirs several key aspects. First, they measure expansion in oil and gas sector by employment growth, while this paper measures it by oil and gas production (measured in millions of dollars) from new wells. Since oil and gas industry is less-intensive in labor, measuring its expansion by production is more appropriate. Production from *newly* discovered wells is also exogenous to prevailing economic conditions, while the employment growth in the sector is not. Second, they investigate the impact on the growth rate of self-employment, while this paper focuses on the entry and exit rates of self-employed individuals. I also distinguish between incorporated and unincorporated self-employment, and my analysis shows that the effect of fracking on each ownership is different. Finally, in their IV approach they use lagged values of employment growth in oil and gas industry as an instrument for the employment growth in this sector. However, strong correlation in employment data makes the strength of their instrument questionable. This paper uses time series of productivity in geographical formations as an instrument for fracking.

The rest of this paper is organized as follows. The next section discusses the data used in the paper and describes how key variables are constructed. Section 3 introduces the econometric model and the instrument. Section 4 presents results and provide possible explanations for them. Finally, section 5 concludes the paper.

2 Data

Data on labor are drawn from the Current Population Survey (CPS) monthly files compiled by Flood et al. (2018).[2] The CPS includes information about location of households at the state, metropolitan, and county level. However, due to confidentiality reasons, fips codes

[2]Data are available at https://cps.ipums.org/cps/.

of small counties (which constitutes about 50 percent of the data) are not reported. In my benchmark analysis, the unit of analysis is community zones, each usually including several counties. Considering community zones is more appropriate for the analysis, because an individual living in one county may own a business in another county within her community zone. I match community zones with counties in my sample, and drop all unmatched data from my analysis. Table 1 reports states and the number of community zones in each state used in the final sample. The analysis covers the 2004–2014 period, and this is dictated by the availability of oil and gas data provided by Feyrer et al. (2017).[3]

The CPS provides information on individuals' age, gender, race, marital status, education level, employment status, worker class, and industry worked. I consider all individuals between the ages of 20 and 64, excluding those with allocated employment status and worker class. Entrepreneurial activity is measured by the business creation and closure at individual-owner level, and for this purpose I consider self-employed individuals. The CPS classifies them as incorporated and unincorporated. Previous studies have considered all self-employed individuals as entrepreneurs, but Levine and Rubinstein (2017) show that incorporated self-employed individuals have traits that are more consistent with entrepreneurship. For example, they earn more than comparable unincorporated self-employed individuals and wage workers, tend to score higher on learning aptitude tests, exhibit greater self-esteem, and engage in more aggressive and risky activities. Following their work, I identify incorporated self-employed individuals as entrepreneurs, and unincorporated self-employed individuals as other business owners. My analysis also excludes mining and public administration sectors because self-employment is rare in these sectors. Thus, the results reported below show the impact of fracking on self-employment dynamics in other sectors.

To identify self-employment dynamics, individuals must be tracked over time. However, the CPS does not include individual identifiers. Each household is surveyed on a monthly basis for four consecutive months, resurveyed eight months later for another four consecutive months, and then leaves the sample permanently. Using this rotating feature of the survey,

[3] After dropping unmatched data, the final sample becomes an unbalanced panel dataset. The maximum number of community zones is 172 in 2014, and Table 1 reports the distribution of this number across states. A community zone can be shared by more than one state.

Drew et al. (2014) generate individual identifiers, which are available in the CPS data. I use these identifiers together with information on age, gender, race, and education to match individuals across two consecutive months.[4]

Upon this matching process, entry and exit of individuals into self-employment can easily be determined. Following Davis et al. (1996), I calculate the entry rate ER and exit rate XR of entrepreneurs as follows:

$$ER_{mt} = \frac{E_{mt}^{+}}{NE_{m-1,t}}, \qquad XR_{m,t} = \frac{E_{mt}^{-}}{NE_{m-1,t}}, \tag{1}$$

where m and t denote month and year, respectively. E_{mt}^{+} (E_{mt}^{-}) is the number of entrepreneurs created (destroyed) in month m and NE_{m-1} is the number of entrepreneurs in month $m-1$. For each community zone, taking the average of ER_m (XR_m) across all months in each year yields the average monthly entry (exit) rate of entrepreneurs in that year. Note that new entrepreneurs in each month were either workers or other business owners (i.e., unincorporated self-employed) in the previous month, and in my analysis I distinguish the entry rates of these groups. Similarly, exiting entrepreneurs become either workers or other business owners, and I calculate the exit rate for each group. As discussed above, I also investigate the impact of the fracking revolution on other business owners, and I calculate their entry and exit rates in a similar way.[5]

Table 2.A reports summary statistics on incorporated and unincorporated self-employed individuals. In this table, Young refers to individuals aged less than 40, and Some college includes individuals who have at least some college education. The first two columns shows the average share of incorporated and unincorporated self-employment in the labor force across different groups. According to the first row, incorporated and unincorporated self-employed individuals constitute 3.8% and 6.1% of the labor force, respectively. Similarly, according to the second row, these groups constitutes 5.1% and 6.9% of male labor force. Average rates in column 1 indicate that entrepreneurship is higher among males, whites,

[4] I additionally consider matching along with age, gender, and race, because Drew et al. (2014) argue that considering these additional dimensions increases the precision of linking individuals across months. The success rate of this matching process between two consecutive months is around 95 percent.

[5] In calculating their entry (exit) rate, I only consider entry from (exit to) workers, since switching from unincorporated to incorporated (or vice versa) is already considered above. In my analysis, workers include unemployed people as well.

older people, and educated individuals. It is higher in construction sector and lower in manufacturing. According to column 2, unincorporated self-employment is more common among males, whites, and older people. Note that they constitute 14% of the work force in construction sector.

The last two columns in Table 2.A report statistics for the incorporated and unincorporated self-employed populations. According to column 3, 72% of incorporated self-employed individuals are male, about 86% white, 25% between 40 and 64 years-old, and 76% with some college education. Similarly, the majority of unincorporated self-employed people are male, white, old, and educated. Note that majority of both types of self-employed people work in service sector. Consistent with Levine and Rubinstein (2017), incorporated self-employed individuals are more educated.

Table 2.B presents the average monthly entry and exit rates of incorporated and unincorporated self-employed individuals in each group. According to the first row, the average entry rate of entrepreneurs among workers (unincorporated self-employed) is about 2% (1.1%), and average exit rate of entrepreneurs becoming workers (unincorporated self-employed) is 2% (0.9%). Compared to these rates, the average entry and exit rates of other business owners are very high. The other rows report these rates for each group. Note that the entry and exit rates of entrepreneurs and other business owners ar significantly higher among Young. These rates are also higher in construction and manufacturing sectors than those in service sector. These high rates are not surprising given that majority of self-employed individuals are older and work in service sector as shown in Table 2.A. Summary statistics in Tables 2.A and 2.B show substantial variation across different groups, and their shares should be controlled in the analysis.

Data on oil and natural gas production are taken from Feyrer et al. (2017), who compiled the data from Drillinginfo Inc. The data include only the amount of oil and gas produced from *new* wells in a given year, and their dollar values are calculated using fuel prices from the U.S. Energy Information Administration (EIA). The data are available at county, community zone, and state levels, and as I discussed above, my main analysis use the data at the community zone level. The instrument that I use in my analysis is also from Feyrer et al. (2017), who construct it using data on the presence of shale in a region from the EIA.

3 Econometric Framework

To estimate the effect of hydrofracturing on entrepreneurial activity, I use the following model:

$$Y_{ct} = \beta \mathrm{OG}_{ct} + X_{ct} + \eta_c + \eta_t + \varepsilon_{ct} \quad (2)$$

where Y_{ct} represents the average monthly entry or exit rate of a certain type of business owner in community zone c and year t. The independent variable OG denotes the total value of oil and natural gas extracted from wells that started producing in year t measured in million of dollars per worker. The total new value is normalized by one year lagged employment to control for cross-region differences in size.

Variable X_{ct} denotes the set of time-varying observed characteristics such as proportion of the zone population who are male, black, other races, skilled, etc. Community-zone fixed effects (η_c) are included to control for fixed factors that can affect entrepreneurial activity across zones, and time fixed effects (η_t) to control for common economic shocks and trends that affects business dynamics. Finally, ϵ_{ct} is the error term. I use heteroskedasticity robust standard errors clustered at the community zone level.

Estimation of equation (2) using the Ordinary Least Square (OLS) approach can provide an unbiased coefficient estimates of β_1 and β_2 if the value of fracturing activity in the region is exogenously determined. However, there are many potential unobserved factors that affect entrepreneurial activity are also correlated with hydraulic fracturing activity in the region. For example, a county having a better infrastructure may have higher entrepreneurial activity, but it can also attract fracking businesses if it is close to reserves. Ignoring these factors in the estimation of equation (2) most likely yields a biased coefficient estimate of the impact of oil and natural gas production on entrepreneurship.

To address potentially confounding effects, I use the instrumental variable approached proposed by Feyrer et al. (2017). Specifically, for each county i and shale play s, they estimate the following equation:

$$\ln(\mathrm{OG}_{it} + 1) = \alpha_i + \lambda_{st} + \nu_{it} \quad (3)$$

where α_i denotes county fixed effects, λ_{st} represents shale play-by-year fixed effects, and ν_{ct} is an error term. Note that predictions from this equation ($\widehat{\text{OG}}_{it}$) incorporates timing of new production from shale-plays and control for idiosyncratic shocks to level of production in the county. It is reasonable to assume that no county can account for a large share of the total production obtained from a shale play. In this case, predicted values for new production in the county based on the timing of new production for all counties in a given shale become exogenous, and can be used as an instrument for the oil and gas production OG in equation (2). Feyrer et al. (2017) construct and report this instrument at county, community zone, and state levels. I use their data in my analysis.

4 Results

This section presents results based on the econometric model presented by equations (2) and (3). The next section discusses the impact of oil and gas extraction on entrepreneurial activity at the community zone level. In Section 3.2, I investigate the impact of fracking on entrepreneurial at the industrial-level to uncover where the impact stems from.

4.1 Benchmark Results

Table 3.A reports the impact of oil and gas extraction on the entry and exit rates of different types of business owners using the simple OLS approach. Columns 1–4 show the impact on entrepreneurs (i.e., incorporated self-employed), and the last two columns on other business owners (i.e., unincorporated self-employed). All regressions include community zone and year fixed effects, and the standard errors are clustered at the community zone level. According to these results, Oil and Gas extraction has positive and significant effect on the entry rate of entrepreneurs among workers. Since OG is measured in millions of dollars per worker, the estimated coefficient in column 1 implies that a \$1,000/worker increase in oil and gas extraction increases the entry rate about 0.31 percentage points. Estimated coefficients on Oil & Gas (OG) in columns 2–4 are positive, but highly insignificant. According to columns 5 and 6, fracking has a negative and insignificant effects on the entry and exit of other business owners.

As discussed above, the OLS estimates most likely suffer from omitted-variable bias. Table 3.B reports results using the instrumental variable (IV) approach, where I instrument OG with $\widehat{OG}$ obtained from equation (3). Note that estimated coefficients are now different both in magnitude and significance from those reported in Table 3.A. Note also that estimated coefficients on controls remained mostly the same. According to column 1, oil and gas fracking has a positive and significant effect on the entry to entrepreneurship from workers: a $1,000/worker increase in oil and gas extraction increases the entry rate by 0.8 percentage points. However, the impact of oil and gas extraction on the entry rate stemming from unincorporated self-employed individuals is negative and significant at the 10% level. It is interesting that the total effect is positive, but insignificant, which underlines the importance of distinguishing the source of entry. Columns 3-4 show the impact of fracking on the exit rate of entrepreneurs. The estimated coefficients are negative, but insignificant.

The last two columns in Table 3.B show the impact of oil and gas extraction on the entry and exit rates of other business owners (i.e., unincorporated self-employed individuals). As discussed in Section 2, those who enter are previously wage & salary workers, and those who exit become wage and salary workers. The impact on entry rate is negative and significant at the 5% level, and the estimated coefficient implies that a $1,000/worker increase in oil and gas extraction decreases the entry rate by 0.75 percentage points. The impact on the exit rate is positive, but statistically insignificant.

To explain these findings, one needs to understand the difference between incorporated and unincorporated business owners. As mentioned earlier, incorporated self-employed individuals have human capital traits that are more consistent with entrepreneurship, while unincorporated self-employed individuals are similar to wage and salary workers. For example, the median self-employed worker has lower initial earnings and slower earning growth than wage and salary workers (Hamilton 2000). In addition, some individuals become self-employed out of necessity to avoid unemployment. Oil and gas extraction creates new business opportunities in other industries through linkage effects, which in turn encourage entrepreneurship. But it also generates new jobs and higher wages. For example, Feyrer et al. (2017) show that each million dollars of new oil and gas production generates $80,000 wage income within a county, and increased aggregate employment by 650,000 during the Great Recession. Better job-opportunities may induce individuals to become wage and salary workers instead of becoming an unincorporated self-employed business owner.

4.2 Industrial-Level Analysis

Table 4 reports the results for different industries based on equations (2) and (3). Each regression include community-zone fixed effects, year fixed effects, and the set of controls X; and for brevity, I do not report estimates on these variables. Panel A shows the estimation results for the agricultural sector. First-stage F-statistics for the validity of the instrument are high. Oil and gas production from new wells does not have any significant effects on the entry and exit of entrepreneurs (see columns 1–4), but has significant effects on the entry and exit of other business owners (columns 5 and 6). It both decreased the entry to and increased the exit from unincorporated self-employment, and thus reduced unincorporated self-employment in the sector. According to estimates in columns 5 and 6, a $1,000/worker increase in oil and gas extraction decreases the entry rate about 8.7 percentage points and increases the exit rate by 4.9 percentage points. One possible explanation is new job opportunities created by oil and gas production induce unincorporated self-employed individuals in the agricultural sector to become wage and salary workers in other sectors.

Panel B reports results for the construction sector, and note that the first-stage F-statistics for the IV estimates are high. Point estimates are negative, but mostly insignificant. Oil and gas production from new wells has not had any significant impact on entrepreneurial activity (columns 1–4). It only has a negative and (barely) significant effect on the exit rate of other business owners (column 6). The lower exit rate among other business owners in the construction sector suggests that oil & gas production has probably created a strong demand for goods and service produced by them so that they preferred to keep their own businesses.

Panel C shows the results for manufacturing sector. Observe that oil and gas production does not have any significant impact on the entrepreneurial activity as shown in column 1–4. However, one should take this observation with caution because the F-statistics associated with the first-stage estimates are very low, which makes the strength of instrument questionable. Its impact on entry and exit rates of other business owners is negative, but the effect is significant only for the exit rate. The estimated coefficient in the last column of Panel C implies that a \$1,000/worker increase in oil and gas extraction decreases the exit rate about 1.8 percentage points.

Finally, the impact of oil and gas production on self-employment dynamics in the service sector is given in Panel D. The first-stage F-statistics are high, indicating the strength of the instrument. Note that it has a significant impact on the entry to entrepreneurship among workers, but its impact on the exit of entrepreneurs is insignificant. The estimated coefficient in column 1 indicates that a \$1,000/worker increase in oil and gas extraction increases the entry rate about 0.73 percentage points. The effects of fracking on entry and exit of other business owners are small and insignificant as shown in the last two columns. Small point estimates with large standard errors suggest considerably amount of heterogeneity among observations, which is not entirely surprising given that the composition of service sector varies substantially across regions.

In sum, estimates in Table 4 imply that the effects of oil and gas extraction through hydrofracturing on self-employment dynamics show considerable variation across sectors. The positive effect of fracking on the entry rate of entrepreneurs observed in Table 3.B mainly comes from the service sector, and the negative effect on the entry to unincorporated self-employment mostly comes from agricultural sector. The positive effect on entrepreneurship indicates that fracking generated demand for new business opportunities in service sector. The negative effect on entry to other businesses suggests that high-paid jobs generated by oil and gas extraction in the economy induce unincorporated self-employed individuals to become wage and salary workers. Finally, the impact of fracking on the exit rate of other business owners is more subtle –positive in the agricultural sector, but negative in construction and manufacturing sectors.

5 Conclusion

Extraction of oil and gas through hydrofracturing has become a quite popular technique in the energy sector. The process has both benefits and costs, and thus has created a considerable controversy among public and policy makers. There is now an emerging literature that investigates the impact of this process on local economies and environment. Previous studies have explored how fracking affects local economic outcomes, including employment, wages, crime, etc. This paper contributes to this literature by studying the effects of oil and gas extraction from new wells on the average business creation and destruction rates in U.S. community zones over the 2004-2014 period. Business ownership is identified by self-employed individuals using the monthly CPS data. My analysis distinguishes between incorporated and unincorporated self-employment, and I call the former entrepreneur and the latter other business owner.

Using time series of productivity in geographical formations as an instrument for fracking, I examined the causal impact of oil and gas extraction from new wells on self-employment dynamics. I find that fracking has a significant impact on business dynamics, and its impact varies considerably across different ownership structures. More precisely, oil and gas production from new wells induce more wage and salary workers to become entrepreneurs, but does not have any significant effects on the exit rate of entrepreneurs. In addition, fracking lowers the entry rate of other business owners, but has no effects on their exit rate. Finally, extending my analysis to industry-level reveals that the positive impact on the entry to entrepreneurship mainly comes from service sector, and the negative effect on entry to unincorporated self-employment from agricultural sector. I argue that new business opportunities combined with new jobs and higher wage wages are the primary drivers behind these occupational choices.

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Table 1. States and the Number of Community Zones

State	No of CZ	State	No of CZ
Alabama	4	Minnesota	2
Arizona	5	Missouri	2
Arkansas	1	Montana	1
California	13	Nebraska	1
Colorado	3	Nevada	1
Connecticut	1	New Jersey	3
Delaware	2	New Mexico	4
D.C.	1	New York	7
Florida	14	North Carolina	9
Georgia	5	North Dakota	1
Hawaii	2	Ohio	7
Idaho	1	Oklahoma	1
Illinois	7	Oregon	3
Indiana	7	Pennsylvania	0
Iowa	4	South Carolina	5
Kansas	3	Tennessee	3
Kentucky	3	Texas	7
Louisiana	4	Utah	2
Maine	2	Virginia	5
Maryland	4	Washington	5
Massachusetts	3	West Virginia	1
Michigan	7	Wisconsin	4

Table 2.A. Summary Statistics on Self-Employment (%), 2004–2014

Variable	Incorp. (1)	Unincorp. (2)	Incorp (3)	Unincorp. (4)
All	3.97	6.29	100.00	100.00
Male	5.35	7.25	72.31	61.95
White	4.31	6.62	85.54	83.15
Young	2.12	4.15	24.70	30.60
Some college	4.70	6.07	76.15	62.17
Construction	8.09	13.95	16.12	17.46
Manufacturing	2.20	1.90	5.99	3.28
Service	3.75	5.74	74.58	72.32

Notes: The data draw on the monthly CPS files compiled by Flood et al. (2018), and the CPS weights are used in all calculations.

Table 2.B. Average Monthly Entry and Exit Rates of Business Owners (%), 2004–2014

	Entry to Incorporated		Exit from Incorporated		Unincorporated	
Variable	Workers (1)	Unincorp. (2)	Workers (3)	Unincorp. (4)	Entry (5)	Exit (6)
All	1.97	1.11	1.99	0.90	4.52	3.18
Male	2.04	1.18	1.95	0.96	4.51	3.42
White	1.90	1.10	1.97	0.87	4.20	3.21
Young	3.49	1.27	3.09	1.43	7.21	4.90
Some college	1.95	0.95	1.93	0.87	4.25	3.11
Construction	2.65	1.42	2.30	1.14	6.15	4.00
Manufacturing	2.20	1.34	2.91	1.69	4.05	3.58
Service	1.77	1.21	2.16	0.92	3.95	3.18

Notes: The data draw on the monthly CPS files compiled by Flood et al. (2018), and the CPS weights are used in all calculations.

Table 3.A. Impact of Oil and Gas Extraction on Self-employment Dynamics (2004-2014), OLS Estimates

	Entry to Entrepreneurship		Exit from Entrepreneurship		Other Business	
	Workers	Unincorp.	Workers	Unincorp.	Entry	Exit
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Oil & Gas	3.125**	0.693	5.228	3.543	−0.276	−0.852
	(1.512)	(1.233)	(5.280)	(2.768)	(2.221)	(1.091)
Male	−0.150	−0.070	−0.114	−0.142**	0.009	−0.002
	(0.106)	(0.064)	(0.098)	(0.069)	(0.187)	(0.073)
Young	0.020	0.034	−0.044	0.015	−0.203	0.039
	(0.049)	(0.033)	(0.063)	(0.046)	(0.136)	(0.031)
Black	0.028	0.022	0.041	0.002	−0.041	−0.061
	(0.072)	(0.071)	(0.076)	(0.038)	(0.174)	(0.070)
Others	−0.155**	0.059	0.055	−0.038	0.128	−0.107
	(0.071)	(0.065)	(0.100)	(0.052)	(0.147)	(0.082)
Some College	0.046	0.034	0.021	0.010	−0.022	−0.036
	(0.048)	(0.051)	(0.044)	(0.040)	(0.149)	(0.046)
Observations	1,373	1,373	1,374	1,370	1,428	1,428

Notes: All regressions include community zone and year fixed effects. Numbers in parentheses are the robust standard errors clustered at the community zone level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

Table 3.B. Impact of Oil and Gas Extraction on Self-employment Dynamics (2004-2014), IV Estimates

	Entry to Incorporated		Exit from Incorporated		Unincorporated	
	Workers	Unincorp.	Workers	Unincorp.	Entry	Exit
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Oil & Gas	8.026**	−2.149*	−15.430	−2.403	−7.749**	1.526
	(3.492)	(1.192)	(19.458)	(1.665)	(3.001)	(2.915)
Male	−0.150	−0.070	−0.115	−0.141**	0.009	−0.002
	(0.106)	(0.064)	(0.102)	(0.069)	(0.187)	(0.072)
Young	0.021	0.033	−0.050	0.014	−0.203	0.039
	(0.049)	(0.033)	(0.066)	(0.047)	(0.136)	(0.031)
Black	0.030	0.021	0.033	0.001	−0.043	−0.060
	(0.072)	(0.071)	(0.079)	(0.038)	(0.174)	(0.070)
Others	−0.148**	0.055	0.027	−0.045	0.112	−0.102
	(0.070)	(0.066)	(0.094)	(0.052)	(0.147)	(0.083)
Some College	0.048	0.033	0.012	0.008	−0.021	−0.037
	(0.048)	(0.051)	(0.053)	(0.040)	(0.149)	(0.046)
F-Statistics	28.76	28.76	28.81	57.51	19.08	19.08
Observations	1,373	1,373	1,374	1,370	1,428	1,428

Notes: All regressions include community zone and year fixed effects. Numbers in parentheses are the robust standard errors clustered at the community zone level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4. Impact of Oil and Gas Extraction on Self-employment Dynamics Across Sectors, IV Estimates

	Entry to Incorporated		Exit from Incorporated		Unincorporated	
	Workers	Unincorp.	Workers	Unincorp.	Entry	Exit
	(1)	(2)	(3)	(4)	(5)	(6)
A. Agriculture						
Oil & Gas	9.328	1.722	−3.870	−16.092	−87.080***	48.910***
	(12.998)	(6.175)	(10.558)	(29.500)	(32.468)	(15.710)
F-Statistics	51.42	51.42	46.99	57.06	21.93	25.94
Observations	521	521	515	515	997	1,005
B. Construction						
Oil & Gas	−2.188	−13.988	−6.560	−15.128	−19.503	−7.341*
	(3.267)	(11.731)	(5.654)	(12.710)	(13.241)	(3.967)
F-Statistics	55.63	55.63	55.30	54.47	21.05	20.953
Observations	1,034	1,034	1,035	1,024	1,256	1,262
C. Manufacturing						
Oil & Gas	−2.559	4.307	−167.880	−164.069	−20.137	−17.600***
	(12.832)	(5.105)	(414.526)	(137.517)	(13.318)	(4.230)
F-Statistics	4.37	4.37	0.19	4.38	17.52	17.54
Observations	628	628	625	616	655	657
D. Service						
Oil & Gas	7.325**	0.526	−12.371	1.901	0.186	0.071
	(3.076)	(1.948)	(17.273)	(1.434)	(3.594)	(1.870)
F-Statistics	26.96	26.96	27.02	55.30	19.09	19.10
Observations	1,334	1,334	1,335	1,330	1,407	1,406

Notes: All regressions include community zone and year fixed effects. Numbers in parentheses are the robust standard errors clustered at the community zone level, and ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.