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Article

Overdose Deaths and Entrepreneurial Activity

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Abstract: Drug overdose deaths, primarily due to opioid addiction, have devastated communities in almost every area of the U.S. The economic impacts of the crisis include additional healthcare resources, unemployment, lost productivity, criminal justice costs, and other indirect impacts that have not yet been researched. This study aims to estimate one potential impact of opioid dependency in communities by estimating the relationship between drug overdose deaths and entrepreneurship. In particular, the empirical models measure how entrepreneurship, as measured by the percentage of self-employed workers, changes in relation to the number of overdose deaths in all U.S. counties, controlling for a number of socioeconomic characteristics. The results suggest that overdose deaths are associated with significant declines in self-employment rates. The coefficients on overdose death rates are generally larger in magnitude for rural counties than for larger metro counties.

Keywords: overdose; opioids; drugs; entrepreneurship determinants; self-employment; labor

JEL Classification: E61; L65; J21

1. Introduction

The U.S. has never faced an addiction crisis as destructive as the current opioid epidemic. The [Center for Behavioral Health Statistics and Quality \(2018\)](#) estimates that approximately 1.7 million Americans were addicted to prescription opioid pain relievers such as morphine, oxycodone, and hydrocodone, and approximately 650,000 were addicted to heroin or illicitly made synthetic drugs fentanyl in 2017. As a result, more Americans died from overdoses involving opioids than the total number of deaths from gun violence, HIV/AIDS, or automobile accidents. In particular, the number of overdose deaths involving opioids has increased at a staggering rate over the past two decades, from 8048 in 1999 to 47,600 in 2017 ([Hedegaard et al. 2018](#)).

Though the opioid crisis is often referred to as a “public health crisis,” the social impacts of the crisis on communities extend far beyond public health. Recent works have shown opioid usage has a significant adverse impact on labor force participation ([Denk 2019](#)), and employment to population and unemployment rates ([Harris et al. 2019](#)), and the school performance of children ([Cotti et al. 2019](#)). This research aims to derive a better understanding of the toll opioids have on communities by examining the relationship between overdose deaths and self-employment rates in all U.S. counties.

Self-employment rates have been shown to be strongly related with local income and employment growth ([Glaeser et al. 2015](#); [Fleming and Goetz 2011](#); [Henderson and Weiler 2010](#)), as well as business creation and innovation in communities ([Faggio and Silva 2012](#); [Acs and Armington 2006](#)). If overdose deaths are associated with lower self-employment rates, then communities struggling with opioid dependency could face additional barriers to long-term local economic development. This is especially true for rural areas which are more dependent on self-employment for job creation than urban areas ([Goetz and Rupasingha 2014](#)).

The empirical models measure how self-employment rates change in relation to overdose death rates in all U.S. counties for the period 2009 to 2017. The models control for numerous socioeconomic

characteristics and include rural–urban classification and yearly fixed effects to control for heterogeneity in neighborhood characteristics over time.

The empirical models reveal a significant adverse relationship between overdose deaths and self-employment rates in counties. The results imply that, other factors constant, a marginal increase in the rate of overdose deaths per 100,000 residents was associated with a 0.12 percent decline in self-employment rates, and a one percent increase in overdose deaths per 100,000 residents was associated with a 1.8 percent decline in self-employment rates. The unit-coefficients on overdose death rates were largest in magnitude in rural counties, while the elasticities of overdose death rates were largest in magnitude in large metro population counties.

The rest of this paper proceeds as follows. Section 2 briefly reviews relevant literature on drug dependency, determinants of self-employment, and discusses the potential ways which drug dependency may influence self-employment. Section 3 describes the data and the empirical methodology used to examine the relationship between drug overdoses and self-employment. Section 4 presents the results and Section 5 concludes.

2. Previous Literature

No previous research to date has examined the relationship between overdose deaths and self-employment. However, this research is related to two disparate streams of literature that have been widely researched: one on the impacts of drug overdoses to communities, and the other on the determinants of self-employment. A brief summary of each follows.

A number of previous works have estimated the social costs associated with drug overdoses, primarily opioid overdoses, which accounted for 75% of all drug related overdoses in 2017 (Hedegaard et al. 2018). The social costs of opioid dependency include their impact on healthcare costs, premature mortality, social services, education, and criminal justice, and the implicit costs in terms of lost productivity, employment, and tax revenue. Florence et al. (2016) estimates that the total costs of abused legally prescribed opioids were equal to \$78.5 billion in 2013, an estimate which included additional healthcare costs, foregone earnings, addiction treatment, and criminal justice costs. When including the costs of premature fatality in addition to non-fatality costs, the U.S. Council of Economic Advisers (2017) estimated the total cost of the opioid crisis as \$504 billion. Most recently, Davenport et al. (2019) estimated that the total economic burden of non-medical usage only, from 2015 to 2019, was at least \$631 billion, which amounts to more than 3% of total U.S. Gross Domestic Product.

The prevalence of opioid usage has been shown to be strongly related to economic conditions in the surrounding community. Hollingsworth et al. (2017) found that opioid death rates rise by 3.6 percent for every percentage point increase in unemployment in the surrounding county. Similarly, Carpenter et al. (2017) found that economic downturns at the state level were associated with statistically significant increases in the use of prescription opioids such as Percocet and Vicodin. Case and Deaton (2017) found that mortality and morbidity, particularly due to drugs and alcohol, have been increasing at a higher rate among white working-class adults without a college degree than for other groups, which is related to the decline in labor market opportunities and the increasing availability of opioids.

Given the social costs of the opioid crisis and its relationship with adverse economic conditions, it would be reasonable to presume that higher opioid usage is associated with lower rates of entrepreneurship in entrepreneurship. However, previous research has shown that some components of drug activities can have positive impacts on self-employment. For example, Fairlie (2002) found that individuals engaged in drug dealing as youth were significantly more likely to become self-employed as adults. Fairlie posits that drug dealing serves as a proxy for low risk aversion, entrepreneurial ability, and preferences for autonomy, which other research has shown to be positively associated with self-employment (e.g., Rees and Shah 1986; Blanchflower and Oswald 1998; Ahn 2010). In addition, previous literature has shown that higher unemployment can lead to increased entrepreneurship, which has been termed the “refugee” effect (Audretsch et al. 2001; Halicioglu and Yolac 2015). As much

as opioid usage can lead to unemployment and diminish legal employment opportunities of users, areas with a higher prevalence of opioid usage could experience higher rates of self-employment.

Some components of drug activity, particularly drug dealing activities, are associated with the positive impacts of self-employment, and there are several reasons communities with higher rates of drug dependency would have lower rates of self-employment. Previous research has shown that self-employment and other measures of entrepreneurship such as the formation of new businesses are positively associated higher growth rates (Chatterji et al. 2014; Acs and Armington 2006; Blanchflower 2000), more college graduates (Berry and Glaeser 2005; Blanchflower 2000), higher levels of diversity and tolerance (Qian 2013; Audretsch et al. 2010), lower shares of manufacturing employment (Glaeser et al. 2015), and greater access to financial capital and self-employment income (Goetz and Rupasingha 2014; Bates and Robb 2013). Drug prevalence, particularly opioid prevalence, is associated with an adverse effect to each of these characteristics in communities.

The current research primarily contributes to the literature in two ways. First, it is the only research to empirically examine the relationship between drug overdose rates and entrepreneurship in communities. Second, it is the only work to examine the potential impacts of drug overdoses to communities using data from all U.S. counties.

3. Data and Model

Tables 1 and 2 present summary statistics for the key variables in the analysis. Table 1 shows mean estimated overdose death rates per 100,000 residents for all U.S. counties for the years 2009 to 2017. The data are from the National Center for Health Statistics, Centers for Disease Control and Prevention. Of note, U.S. counties have experienced substantial increases in mean overdose death rates in every year from 2009 through 2017. Overdose death rates increased by 65% during the sample period, from 12.8 to 21.1 per 100,000 residents during the same period.

Table 1. Overdose death rate per 100,000 all U.S. counties (N = 3135).

Year	Mean Overdose Death Rates per 100,000	Std. Dev.	Minimum	Maximum
2009	12.8	4.6	3.3	48.8
2010	13.3	5.4	3.1	72.0
2011	14.2	5.9	3.4	84.8
2012	14.0	5.4	3.2	66.2
2013	14.7	5.5	4.4	69.3
2014	15.5	6.0	3.4	69.0
2015	17.0	6.7	4.0	92.2
2016	19.6	7.9	4.2	87.2
2017	21.1	8.9	4.4	130.2

Unsurprisingly, both the mean overdose death rates per 100,000 and the disparity in overdose deaths across counties increased during the sample period. In particular, the standard deviation in drug overdose deaths increased from 3.3 to 4.4 between 2009 and 2017.

The wide disparity in drug overdose death rates across the U.S. is illustrated in Figure 1 below, which shows the overdose death rates for all U.S. states in 2017. Historically manufacturing-based states in the Northeast and Mid-North Central region generally have higher rates of overdose deaths than states in other regions. The South, as well as Florida, Louisiana, and the Sun Belt states also have relatively high overdose death rates, while Texas, the Dakotas, and Nebraska have the lowest rates.

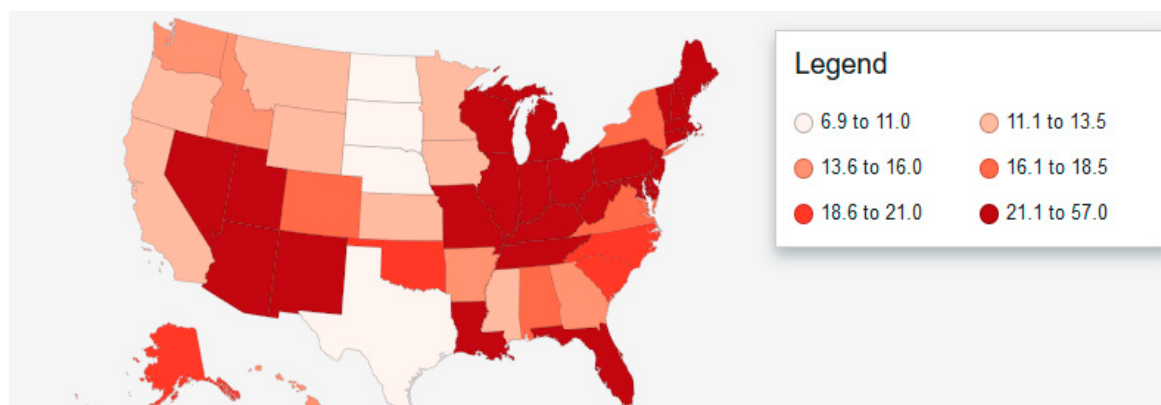


Figure 1. Rate of drug overdose deaths per 100,000 residents by state, 2017. Source: [Centers for Disease Control and Prevention \(2018\)](#).

Table 2 shows the trend in self-employment rates over the sample period. The percentage of self-employed people has steadily declined from 14.6% to 12.3% from 2009 to 2017. Previous research has shown that self-employment tends to be countercyclical to the business cycle ([Parker 2018](#); [Parker et al. 2012](#); [Faria et al. 2009](#)). Considering the sample period begins at the end of the financial crisis and was followed by a decade of robust economic and employment growth, the decline in self-employment is not surprising. How much, if any, of the change in self-employment is attributable to the opioid crisis cannot be determined.

Table 2. Percent self-employed all U.S. counties (N = 3135).

Year	Mean Percent Self-Employed	Std. Dev.	Minimum	Maximum
2009	14.6	6.1	0.0	56.7
2010	14.2	6.2	0.0	52.4
2011	13.8	6.0	1.4	52.0
2012	13.3	5.8	1.2	50.0
2013	13.0	5.7	0.0	47.2
2014	12.7	5.6	0.0	48.8
2015	12.5	5.4	0.0	46.1
2016	12.3	5.3	0.0	44.8
2017	12.3	5.3	0.0	46.5

The main objective of the empirical models is to identify the relationship between overdose death rates and the percent of self-employed workers in counties. To do so, the related empirical models take the form of the following equation:

$$\text{SELFEMPLOYMENT}_{ct} = \alpha_0 + \alpha_1 \text{OVERDOSE}_{ct} + \alpha_2 X_{ct} + \alpha_3 Z_c + \lambda_t + \varepsilon_{zct} \quad (1)$$

where $\text{SELFEMPLOYMENT}_{ct}$ is the self-employed percent in county c in year t , OVERDOSE_{ct} refers to the rate of overdose deaths per 100,000 residents in county c in year t , the vector X_{ct} represents any variable that changes across both time and counties such as unemployment, population density, and self-employment income, the vector Z_c represents any variable that changes only across counties such as the percent who voted for the Republican candidate in the most recent Presidential election, or the percentage of residents without health insurance. The vector λ_{qt} represents a time fixed effect unique to year t . The error term ε_{zct} is assumed to be idiosyncratic and randomly distributed. To address potential bias associated with serial correlation across counties, the standard errors are clustered at the county level.

The county-level characteristics include the percentage of the population aged 16 and above that is employed, the population density, poverty rate, per capita income, total self-employed income,

percentage nonwhite residents, percentage of voters who voted for the Republican candidate in the most recent Presidential election, the percentage of residents without health insurance, percentage of residents under age 17, percentage of residents with a bachelor's degree or above, and the rural–urban classification.¹ The complete list of variables and summary statistics are provided in Table 3.

Table 3. Variable definitions and summary statistics.

Variable	Definition	Mean	Std. Dev.
% Self-Employed	Percentage of all employed workers who are self-employed	13.2	5.8
Overdose Death Rate	Number of overdose deaths involving opioids per 100,000	15.8	6.9
% Employed	Percentage of all employed workers who are self-employed	54.9	8.3
Population Density	Population per square mile	266.9	1787.8
Poverty Rate	Percentage of all households with income below poverty line	11.4	5.7
Per Capita Income	Per capita income (2009\$)	32.7	7.9
Self Employed Income	Total income of self-employed workers (\$1000,000s)	142.3	557.8
Unemployment Rate	Unemployment rate	7.8	3.6
% Republican Vote	Percentage of voters who voted for Republican candidate in last presidential election	59.5	14.9
% Under 17	Percentage of population age 16 or under	20.8	3.3
% Uninsured	Percentage of population without health insurance in 2008	17.9	5.9
% Nonwhite	Percentage of county residents who do not identify as Caucasian	16.1	16.5
% Higher Ed	Percentage of county residents with a bachelor's degree or higher	18.7	8.5
Large Metro	=1 if metro area and county have a population of 1 million or more.	0.02	0.14
Metro Fringe	=1 if metro area has population of 1 million or more but county population is less than 1 million	0.08	0.27
Med Metro	=1 if county is in metro area with population between 250,000 to 999,999	0.10	0.30
Micropolitan	=1 if county has population between 10,000 to 50,000 or county is adjacent to metro area of with population less than 1 million	0.15	0.36
Small Metro	=1 county is in metro area with population between 50,000 to 249,999	0.06	0.25
Rural	=1 if county population is less than 49,999 and is not adjacent to metro area, or county population is less than 19,999 and is adjacent to metro area	0.58	0.49

4. Results

The results of the empirical equations for all U.S. counties are shown in Table 4. The coefficients in Specification 1 represent how county self-employment rates changed relative to a marginal increase in the value of each variable. The variables in Specification 2 are equivalent, but include logged

¹ Data on self-employed income are from the Bureau of Economic Analysis. Voting data come from the MIT election lab (<https://electionlab.mit.edu/data>). All other socioeconomic data are from the Census Bureau's American Community Survey.

values for overdose deaths, population, per-capita income, and self-employment. Specification 3 includes a two-year lagged value on the key variable of interest, overdose death rates. The measures of overdose death rates exhibit negative and statistically significant coefficients in all specifications, suggesting that counties with higher levels of drug overdoses exhibit lower rates of self-employment, other factors constant. In particular, an additional overdose death per 100,000 residents was associated with a 0.12 percent decrease in self-employment, while a one percent increase in overdose deaths per 100,000 residents was associated with a 1.83 percent decrease in self-employment. The coefficient on the lagged value of overdose deaths per 100,000 residents in Specification 3 is -1.91 , which may suggest that counties do not feel the full impacts of overdose deaths until years after they occur.

Table 4. Estimation results, all U.S. counties (N = 3082). Dependent variable = percent self-employed.

Specification 1	Coefficient	Std. Error	Specification 2	Coefficient	Std. Error	Specification 3	Coefficient	Std. Error
Overdose Death Rate	-0.12 ***	0.01	Log Overdose Death Rate	-1.83 ***	0.18	Log Overdose Death Rate _(t-2)	-1.91 ***	0.18
% Employed	0.31 ***	0.02	% Employed	0.23 ***	0.02	% Employed	0.23 ***	0.02
Pop Density	-0.0001 **	0.00003	Log Pop Density	-2.12 ***	0.09	Log Pop Density	-2.12 ***	0.09
Poverty Rate	0.10 ***	0.02	Poverty Rate	0.07 ***	0.02	Poverty Rate	0.07 ***	0.02
Per Capita Income	0.06 ***	0.02	Log Per Capita Income	1.27 ***	0.12	Log Per Capita Income	1.27 ***	0.12
Self Emp Income	0.0001	0.00001	Log Self Emp Income	1.07 ***	0.09	Log Self Emp Income	1.07 ***	0.09
Unemp Rate	-0.21 ***	0.03	Unemp Rate	-0.11 ***	0.03	Unemp Rate	-0.11 ***	0.03
% Repub Vote	0.02 **	0.01	% Repub Vote	0.01 **	0.01	% Repub Vote	0.01 **	0.01
% Under 17	-0.29 ***	0.04	% Under 17	-0.23 ***	.03	% Under 17	-0.23 ***	.03
% Uninsured	0.17 ***	0.02	% Uninsured	0.03 *	0.02	% Uninsured	0.03 *	0.02
% Nonwhite	-0.06 ***	0.01	% Nonwhite	-0.04 ***	0.01	% Nonwhite	-0.04 ***	0.01
% Higher Ed	0.02	0.01	% Higher Ed	0.04 ***	0.01	% Higher Ed	0.04 ***	0.01
Large Metro	-4.44 ***	0.40	Large Metro	0.87	0.51	Large Metro	0.87	0.51
Large Fringe	-4.56 ***	0.26	Large Fringe	-1.11 ***	0.28	Large Fringe	-1.11 ***	0.28
Med Metro	-4.25 ***	0.19	Med Metro	-1.57 ***	0.22	Med Metro	-1.57 ***	0.22
Micropolitan	-3.26 ***	0.17	Micropolitan	-2.16 ***	0.16	Micropolitan	-2.16 ***	0.16
Small Metro	-4.54 ***	0.25	Small Metro	-2.40 ***	0.26	Small Metro	-2.40 ***	0.26
QIC	27,790		QIC	27,812		QIC	27,812	

Standard errors clustered at the county level. Year fixed effects included. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The coefficients on most other variables exhibit the expected signs. Self-employment was positively associated with the percentage of employed workers, the percentage of highly educated workers, per-capita income, and self-employed income levels, which suggests that residents are more likely to become employed in areas with higher returns to entrepreneurship. The percentage of residents without health insurance and poverty rates both take on unexpected positive coefficients. The percentage of voters who voted for a Republican candidate in the most recent Presidential election, which is a proxy for the counties' political climate, also takes on a positive coefficient. The coefficients on population density, the percentage of the population under age 17, and the percentage of nonwhite resident also take on negative and significant coefficients. Counter to the "refugee" effect hypothesis, the coefficients on unemployment rates are negative and significant.

The coefficients on the rural-urban classification, for which rural counties are the benchmark, suggest that all metro counties have significantly lower rates of self-employment compared to rural counties, a result which was also found by [Goetz and Rupasingha \(2014\)](#). The coefficients suggest small metro counties, which are those in a metro area with population between 50,000 to 249,999, have lowest rates of self-employment, other factors constant.

Tables 5 and 6 show how the results vary according to county rural-urban classifications. Table 5 shows the coefficients on the absolute values of each variable, while Table 6 shows the coefficients on logged values of overdose death rates, population density, per capita income, and self-employed income. The results on overdose death rates are negative and statistically significant for all rural-urban classifications except small metro counties, and the coefficient on overdose death rates are largest in magnitude in rural counties. The coefficients in Table 5 suggest that a marginal increase in the overdose death rate was associated with a 0.18 percent decline in the rate of self-employment in rural counties, while the coefficient on the logged value in overdose death rate in Table 6 suggests a one percent increase in overdose death rates was associated with 2.74 percent decrease in self-employment. The second largest coefficients on overdose death rates are in metro fringe counties, but the magnitude of the coefficients is less than half the magnitude of the coefficients of rural counties.

Table 5. Estimation results by urban–rural classification—Specification 1. Dependent variable = percent self-employed.

Variable	Rural Only (N = 1818)		Large Metro (N = 63)		Metro Fringe (N = 248)	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Overdose Death Rate	−0.180 ***	0.016	−0.007	0.010	−0.085 ***	0.013
% Employed	0.313 ***	0.024	0.048	0.051	0.170 ***	0.039
Population Density	−0.002	0.002	−0.0002 *	0.0001	−0.001 ***	0.0002
Poverty Rate	0.145 ***	0.029	−0.212 **	0.068	0.082	0.055
Per Capita Income	0.053 *	0.031	−0.029	0.028	0.114 ***	0.031
Self Employed Income	−0.014 ***	0.003	0.0003 ***	0.0001	0.0005	0.0003
Unemployment Rate	−0.292 ***	0.032	0.185	0.106	−0.122	0.154
% Republican Vote	0.034 ***	0.009	−0.023	0.026	−0.040	0.025
% Under 17	−0.291 ***	0.054	0.143	0.125	−0.089	0.071
% Uninsured	0.110 ***	0.024	0.140 ***	0.033	0.261 ***	0.056
% Nonwhite	−0.062 ***	0.009	−0.031	0.020	−0.088 ***	0.019
% Higher Ed	0.132 ***	0.029	0.166 ***	0.046	0.009	0.045
QIC	27,790		711		2391	
Variable	Medium Metro (N = 312)		Micropolitan (N = 483)		Small Metro (N = 282)	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Overdose Death Rate	−0.050 ***	0.011	−0.061 ***	0.015	−0.004	0.025
% Employed	0.106 ***	0.024	0.182 ***	0.030	0.219 ***	0.046
Population Density	−0.0002	0.0003	−0.011 ***	0.003	−0.003 **	0.001
Poverty Rate	−0.013	0.038	−0.013	0.042	−0.382 ***	0.082
Per Capita Income	−0.018	0.024	0.007 ***	0.030	−0.028	0.039
Self Employed Income	0.001 *	0.0005	0.012 ***	0.003	0.001	0.002
Unemployment Rate	−0.019	0.051	0.170 *	0.089	0.059	0.066
% Republican Vote	0.022 *	0.011	0.001	0.011	−0.029 *	0.017
% Under 17	0.3774	0.5910	−0.072	0.065	−0.033	0.123
% Uninsured	0.148 ***	0.035	0.090 ***	0.031	0.290 ***	0.059
% Nonwhite	−0.063 ***	0.014	−0.041 ***	0.013	−0.017	0.020
% Higher Ed	0.101 ***	0.022	0.067 ***	0.025	0.024	0.031
QIC	3071		4569		1964	

Standard errors clustered at the county level. Year fixed effects included. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 6. Estimation results by urban–rural classification—Specification 2. Dependent variable = percent self-employed.

Variable	Rural Only (N = 1818)		Large Metro (N = 63)		Metro Fringe (N = 248)	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Log Overdose Death Rate	−2.735 ***	0.313	−0.682 **	0.323	−1.048 ***	0.266
% Employed	0.219 ***	0.023	−0.009	0.060	0.061	0.040
Log Population Density	−2.457 ***	0.115	−0.338 *	0.175	−1.486 ***	0.189
Poverty Rate	0.110 ***	0.025	−0.162 **	0.069	−0.061	0.051
Log Per Capita Income	1.614 ***	0.165	0.992 **	0.451	1.601 ***	0.331
Log Self Employed Income	1.297 ***	0.141	0.653 **	0.257	0.394 **	0.185
Unemployment Rate	−0.144 ***	0.031	−0.081	0.119	−0.161	0.179
% Republican Vote	0.029 ***	0.009	−0.054 *	0.030	−0.054 *	0.028
% Under 17	−0.232 ***	0.045	0.039	0.127	−0.004	0.067
% Uninsured	−0.031	0.022	0.136 **	0.038	0.222 ***	0.052
% Nonwhite	−0.059 ***	0.009	−0.025	0.023	−0.069 ***	0.019
% Higher Ed	0.034	0.025	0.068	0.048	0.083 **	0.036
QIC	16,189		2734		2872	
Variable	Medium Metro (N = 312)		Micropolitan (N = 483)		Small Metro (N = 282)	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Log Overdose Death Rate	−0.709 **	0.308	−1.209 ***	0.347	0.036	0.461
% Employed	0.118 ***	0.035	0.169 ***	0.039	0.197 ***	0.049
Log Population Density	−0.758 ***	0.155	−1.526 ***	0.216	−1.451 ***	0.291
Poverty Rate	0.011	0.043	−0.005	0.044	−0.326 ***	0.070
Log Per Capita Income	0.262	0.253	0.592 **	0.292	0.549	0.436
Log Self Employed Income	0.287 *	0.157	0.906 ***	0.223	−0.180	0.312
Unemployment Rate	0.010	0.075	0.211 **	0.096	0.151	0.101
% Republican Vote	0.012	0.012	0.008	0.012	−0.027 *	0.015
% Under 17	0.036	0.056	−0.101 *	0.060	−0.033	0.106
% Uninsured	0.126 ***	0.035	0.050	0.032	0.271 ***	0.047
% Nonwhite	−0.057 ***	0.014	−0.040 ***	0.014	−0.018	0.017
% Higher Ed	0.112 ***	0.025	0.069 ***	0.026	0.071 **	0.031
QIC	2978		4456		1906	

Standard errors clustered at the county level. Year fixed effects included. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Turning our attention to the coefficients of other explanatory variables, Table 6 shows that total annual self-employed income in the county takes on positive and significant coefficients for all county classifications, and they were largest in magnitude for rural and micropolitan counties, perhaps suggesting that potential returns to self-employment play a bigger role in the choice of self-employment in smaller population areas, which are likely to have relatively fewer highly compensated salary or wage opportunities. The coefficient on population density is negative and significant in all classifications but is largest in magnitude in rural counties. This result is in contrast to the results found by [Goetz and Rupasingha \(2014\)](#), which suggested that population density captured the presence of agglomeration economies. Higher poverty rates were associated with higher rates of self-employment in rural and small metro counties, which may reflect a lack of wage or salary positions available to low-income residents in rural or smaller metro areas. More Republican rural counties were associated with higher rates of self-employment, but more Republican large metro and metro fringe counties were associated with lower rates of self-employment. Finally, the percentage of youth in the county had a negative and significant relationship with self-employment in rural counties, but the coefficient of youth was not statistically significant in any metro classification.

5. Conclusions

Over the past two decades, the opioid crisis has devastated millions of families and thousands of communities across the U.S., yet few academic studies to date have attempted to measure the potential economic impacts that the opioid crisis has had on communities. This study aims to partially fill this void by estimating the relationship that drug overdose deaths have with one important measure of economic development and entrepreneurship: self-employment.

The main findings are that the percentage of self-employed workers is significantly lower in counties with higher rates of drugs overdose deaths, other factors constant. The magnitude of the coefficients on the overdose death rate is highest in rural and lower population counties. Self-employment income and population density also play an important role in self-employment rates, particularly in rural counties.

To the extent that self-employment has positive impacts on local economic development, innovation, and employment growth (e.g., [Fleming and Goetz 2011](#); [Henderson and Weiler 2010](#)), the potential negative impact that drug overdoses have on self-employment represents another economic cost of the opioid crisis to communities, one that to date has not been estimated by researchers or considered by policymakers.

Though this paper provides clear evidence of the negative association between drug overdose deaths and self-employment rates, the empirical models cannot infer the direction of causality between drug overdose deaths and self-employment, nor can this research identify the mechanism by which drug overdose deaths may impact self-employment rates. Whether the relationship is driven by drug overdose deaths specifically or by general drug usage, for which overdose deaths serve as a proxy, is an important policy question for future research. In addition, whether other measures of entrepreneurship, such as new proprietorships, or measures of innovation such as new patent formation, are related to drug overdose deaths is left for future researchers to consider.

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