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Opioid Overdose and Unemployment in the UK

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OPIOID OVERDOSE AND UNDEREMPLOYMENT IN THE UK

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ABSTRACT

Opioid overdose in the United Kingdom has risen drastically over the last few years along with the rise in the use of zero-hours contracts. Zero-hours contracts are contracts for employment that guarantee no work but can anchor a person to a job that doesn't pay above minimum wage when they do not receive work. Since opioid use is often associated with poorer economic conditions in the United States, this paper attempts to measure any correlation between poverty and opioid use in the UK. Using zero-hours contracts as a proxy for underemployment we use several regression models to determine the predictability of the proxy on opioid overdose and the extent to which change in underemployment can affect opioid overdose death rates.

Keywords: United Kingdom, Zero-hours Contracts, Underemployment, Opioid, Overdose

I dedicate this to my family, friends, educators, and everyone who has put their belief in me. I pray I never disappoint you all.

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CHAPTER 1

INTRODUCTION

The United Kingdom is an outlier compared to the rest of the European Union in that it has a substantial amount of deaths related to opioids. These can include both illicit drugs such as heroin as well as prescription drugs such as Fentanyl, deaths from which have risen by 29% from 2016 to 2017 according to the Office for National Statistics.[1] This is troubling as this rise has implications for negative externalities of overdose and addiction in the entirety of the country. It is also concerning because this could be an indicator of a much larger epidemic on the horizon, such as the crisis currently unfolding in the United States. This epidemic could begin to exponentially accelerate the rate at which it takes lives, rip families apart, and eventually bring downward pressure on the economy as more and more people become too incapacitated by addiction to be able to work.

With so much at stake many in the United States have been engaged in discussion on how to combat such an issue. Solutions have ranged anywhere from the prosecution of the manufacturers of these drugs to complete decriminalization of all drugs to end the

1. Office for National Statistics. "Deaths related to drug poisoning in England and Wales: 2017 registrations," accessed February 24, 2018, https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsrelatedtodrugpoisoninginenglandandwales/2017registrations.

treatment of addicts as criminals rather than people with a disease that need help. This problem with nary an effective solution enacted is one that has rooted itself in some of the poorest sections of America. It is well known that some of the communities most severely affected by the opioid epidemic are in rust belt states and Appalachia - areas that bring to mind the realities of the economic despair that exists in the First World.

Could the economic anxiety experienced by people in these areas be partly to blame for opioid use? It is hard to say for sure, but we believe that this question requires some attention. With the way emphasis is placed on the unemployment rate as a measure of economic success in spite of its exclusion of discouraged workers, we'd like to look at underemployment instead in order to simultaneously bring light to the opioid epidemic from its economic roots and have serious discussion on the use of underemployment as a measurable metric in economics. The primary problem with attempting to use a metric of underemployment is that no such thing exists within the United States. However, the United Kingdom may have one. The Office for National Statistics in the United Kingdom documents the number of people employed using employment contracts known as "zero-hours contracts," contracts of employment that guarantee but also require no minimum amount of paid work. Workers on zero-hours contracts are entitled to the minimum wage if not worked, but because of the nature of their employment may need to available with little notice if they ever do get summoned for work which limits their ability to search for other employment in the meantime. The number of individuals employed on these contracts exploded from anywhere from 100,000-250,000 individuals being employed with them from 2000-2012 to 585,000 in 2013 and the numbers have not seen a return to

pre-2012 levels since. These contracts cannot represent a one-to-one proxy, but the rise in opioid overdose in recent years has coincided with a bloom in the prevalence of zero-hours contracts across the same amount of time as we will show later in this paper. For this reason, we believe that it will be adequate as a rough measure of the prevalence of underemployment within the United Kingdom as we attempt to discern whether the phenomenon of the increase in opioid overdoses is due in part to an increase in a little observed branch of economic anxiety.

CHAPTER 2

LITERATURE REVIEW

Although we did not find previous literature on this particular topic, there exists a great deal of literature on the nature of employment and opioid use either as intertwined and separate topics. For example, a paper from Currie, Schnell, and Jin[2] assesses the use of legally prescribed opioids on working individuals to see if the drugs allow them to return to work after chronic pain is dealt with. They found that it can help return small numbers of women to work but that no such relationship exists for men. In the other vein is a paper by Slack and Jensen[3] which addresses underemployment in the United States. The paper goes incredibly in-depth about the history and nature of underemployment and, as us, highlight the poor attention given to it within the United States despite the calls for it. From this paper we also receive three definitions of underemployment to clarify its meaning:

> *Underemployed by low hours* (or involuntary parttime employment) parallels the official definition of those who are working "part-time for economic reasons" and includes those who are working less than 35 hs per week because they cannot find fulltime employment; *Underemployed by low income* (or working poor) includes those whose labor market earnings during the previous year, adjusted for weeks

2. Janet Currie, Jonas Y Jin, and Molly Schnell, "U.S. Employment and Opioids: Is There a Connection?," *National Bureau of Economic Research Working Paper Series,* http://www.nber.org/papers/w24440.
3. Leif Jensen and Tim Slack, "Underemployment in America: Measurement and Evidence," *American Journal of Community Psychology*: 21-31

> and hours worked, were less than 125% of the official poverty threshold for an individual living alone; *Underemployed by occupational mismatch* (or overeducated) includes those whose educational level (measured as years of schooling) is greater than one standard deviation above the mean education for workers with the same (three-digit) occupation.[4]

From these we grasp a more concrete meaning of underemployment and are then able to strengthen the idea of underemployment in our hypothesis going forward.

Other literature pertains to the topics at hand and works to support our hypothesis as well such as one paper by Case and Deaton[5] which uses both topics. This paper partially attributes the use of opioids to the recent growth of mid-life mortality in the United States even though this was not the main aim of the study. We take this as reaffirmation of the logic driving our hypothesis especially that of opioid use accompanying stress from economic conditions. Other support comes from a paper entitled "Psychological distress mediated the effects of self-stigma on quality of life in opioid dependent individuals: A cross-sectional study"[6] The researchers found through the methodology they employed that psychological stress acted as a mediator effect between self-stigma and the quality of life experienced. To put it simply, if participants were exposed to psychological stress, they were more likely to have a lower measure of quality of life.[7] We take from this that it would be logical to conclude from these findings

4. Jensen, et al. 2003
5. Anne Case and Angus Deaton, "Rising Morbidity and Mortality in Midlife among White Non-Hispanic Americans in the 21st Century," *Proceedings of the National Academy of Sciences of the United States of America* 112, no. 45 (2015): 15078-15083, doi:https://doi.org/10.1073/pnas.1518393112.
6. Kun-Chia Chang, Chung-Ying Lin, Chih-Cheng Chang, Shuo-Yen Ting, Ching-Ming Cheng, and Jung-Der Wang, "Psychological distress mediated the effects of self-stigma on quality of life in opioiddependent individuals: A cross-sectional study," *Public Library of Science*, Accessed April 8, 2019, doi:https://doi.org/10.1371/journal.pone.0211033.
7. Chang, et al. 2019

that if underemployment were a source of psychological stress in an opioid users' life and that that stress could lead to a decrease in the quality of that users' life, then an overdose would be more likely to occur. Research from Hollingsworth, Ruhm, and Simon supports this as their paper "Macroeconomic conditions and opioid abuse" finds that, according to their data, a 1% increase in unemployment can raise opioid deaths per 100000 by 0.19 or 3.6% and ER visits per 100000 by 0.95 (7%) with both statistics being significant.[8] Although a majority of this data was massed in the United States, many of it regarding opioid use relies on the subjects of the research being human rather than strictly American and we will use this to justify our hypothesis proposed in the introduction as we go forward.

8. Alex Hollingsworth, Christopher J Ruhm, and Kosali Simon, "Macroeconomic Conditions and Opioid Abuse," *National Bureau of Economic Research,* Accessed April 8, 2019, http://www.nber.org/papers/w23192

CHAPTER 3

DATA AND METHODOLOGY

Data obtained was primarily sourced from the United Kingdom Office of National Statistics. The two binary variables included are manually inserted dummy variables, one showing the introduction of the current Conservative Party austerity policy and the years following and one indicating the start Financial Crisis and the years following. These were added to control and/or capture any changes in macroeconomic conditions and their effect on the economic conditions of citizens within the United Kingdom.

The financial crisis obviously applies downward pressure on the economy leading more people, especially those who were already low on the socioeconomic ladder, to be worse off prior to the recession. Some also argue that austerity can harm the most vulnerable people within a society as well because the first target of austerity budget cuts are often social service programs. This policy has been linked to an increase in homelessness, increase in childhood poverty, pay caps for nurses, reduced spending in the National Health Service, and increased reliance on food banks. One such critique of austerity was reported by Professor Philip Alston, Special Rapporteur on extreme poverty and human rights to the United Nations as he writes, “British compassion for those who

are suffering has been replaced by a punitive, mean-spirited, and often callous approach apparently designed to instill discipline where it is least useful, to impose a rigid order on the lives of those least capable of coping with today's world, and elevating the goal of enforcing blind compliance over a genuine concern to improve the well-being of those atthe lowest levels of British society."[9] Median income was also added in order to account for a general income effect within the United Kingdom in an attempt to capture any other poverty driven reasons for opioid use. It is measured in Pound Sterling (GBP) at the 2017-2018 value. Using the values obtained from taking the natural logarithm of overdose victims and the number of those employed in zero-hours contracts was used to both make the interpretation of the results easier as well as making the scale of the two comparable.

Two details need to be discussed in both the underemployment variable and in the median income variables. With regards to the variable showing employment on a zero-hours contract, the years for 2014-2017 instead of having values for the entire year they have two ranges of numbers. One for April-June and another October-December. In order to have one value per year, the value for the April-June count and October-December counts were added and divided by 2 in order to obtain a mean which served as the value for their respective year. The value for median income is also shared between two years from 1994 onwards in the format 1994/1995. For this reason, the 1994/1995 is attributed

9. Philip Alston, United Nations Human Rights Office of the High Commissioner, "Statement on Visit to the United Kingdom," published November 16, 2018, https://www.ohchr.org/documents/issues/poverty/eom_gb_16nov2018.pdf.

to 1994 only, 1995/1996 is attributed to 1995 only, and this pattern is repeated until all data up to 2017 is filled. The model used can be expressed by the following equation:

(1) $\ln(\text{Overdose Deaths})_t = \beta_0 + \beta_1 \ln(\text{Underemployment})_t + \beta_2 \text{Median Income}_t + \beta_3 \text{Austerity}_t + \beta_4 \text{Post-Financial Crisis}_t + \varepsilon_t$

Despite having a regression that produced relatively successful results during a first round of testing, two major flaws remain: the sample size and a strong correlation between deaths from opioids and the number of people on zero-hours contracts. There are only 17 observations, which means any results we receive should be taken with a few dashes of salt, but the correlation can be dealt with in order to draw a more causal conclusion because, as of this point, a correlation doesn't imply one causes another. To begin any sort of claim of causality we performed a Granger causality test with the following equations:

(2) $\ln(\text{Overdose Deaths})_t = \alpha + \beta_1 \ln(\text{Overdose Deaths})_{t-1} + \beta_2 \ln(\text{Overdose Deaths})_{t-2} + \gamma_1 \ln(\text{Underemployment})_{t-1} + \gamma_2 \ln(\text{Underemployment})_{t-2} + \varepsilon_t$

(3) $\ln(\text{Underemployment})_t = \delta + \eta_1 \ln(\text{Overdose Deaths})_{t-1} + \eta_2 \ln(\text{Overdose Deaths})_{t-2} + \lambda_1 \ln(\text{Underemployment})_{t-1} + \lambda_2 \ln(\text{Underemployment})_{t-2} + \varepsilon_t$

Testing $\gamma_1 = \gamma_2 = 0$ in equation 2 and $\eta_1 = \eta_2 = 0$ in equation 3.

Although the Granger causality test's name may seem like it implies that we find definite causality, in reality the Granger causality test assesses how well of a predictor one variable is for another. It's done as a hypothesis test with the differing dependent variables while holding the independent, lagged variables constant. Once the regressions are completed, the hypothesis test is initiated with the null hypothesis indicating that the tested variable does not "Granger cause" the other variable. Our beginning test was with

equation 2, testing to see if our underemployment proxy has any predicting power for our model.

Table 1: Results of Equation 2 Regression

VARIABLES	(1) ln(Opioid Deaths)
ln(Opioid Deaths) = L1	0.685*
	(0.343)
ln(Opioid Deaths) = L2	-0.457
	(0.296)
ln(Underemployment) = L1	0.138
	(0.112)
ln(Underemployment) = L2	0.0218
	(0.0960)
Constant	4.745***
	(1.054)
Observations	15
R-squared	0.842

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Results of Equation 2 Granger Causality Test

Test	p-value
$\gamma_1 = \gamma_2 = 0$	0.0162

Table 3: Results of Equation 3 Regression

VARIABLES	(1) ln(Underemployment)
ln(Opioid Deaths) = L1	-0.431
	(1.411)
ln(Opioid Deaths) = L2	0.174
	(0.951)
ln(Underemployment) = L1	1.286**
	(0.413)
ln(Underemployment) = L2	-0.233
	(0.382)
Constant	1.674
	(5.087)
Observations	15
R-squared	0.905

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Results of Equation 3 Granger Causality Test

Test	p-value
$\eta_1 = \eta_2 = 0$	0.9499

The results revealed a p-value of 0.0162, meaning that we can reject our null hypothesis with more than 95% confidence that underemployment doesn't Granger cause opioid overdose deaths. This brings us to the conclusion that underemployment *does* Granger cause opioid overdose deaths, which is in line with our hypothesis. Out second test involves equation 3. This test attempts to see if opioid overdose deaths Granger cause underemployment. This test yielded a resulting p-value of 0.9499, meaning that the null hypothesis that opioid overdose deaths do not Granger cause underemployment is not rejected under all traditional tolerances.

Thanks to these results we believe to have established a statistical case that our dependent variable, opioid overdose, is the result of our primary independent variable, underemployment, rather than the other way around or both having influence on each other. We understand that the search for true causality may still be in question, but we also hope that the inclusion of these Granger causality tests may be enough to begin to make a case for both our hypothesis and validity of our results.

CHAPTER 4

RESULTS

The results of the regression model seem to be in line with our expectations for our topic variable. Underemployment using zero-hours contracts as a proxy indicates that a 1% change in the number of those underemployed leads to an increase in opioid overdoses of 0.216% through over 99% confidence. Although we did expect a significant, positive outcome, we weren't expecting the size of this result. However, this could be, and more than likely is, due to the small sample size available to us.

Although we were confident in the result of our independent variable of interest, the other variables we have included have produced some interesting results. For example, median income has an almost negligible effect on how many people overdose and has no significance. However, this is likely due to the small number of observations available. Even so, the fact that this metric is positive is also concerning since this would imply that increases in median income would cause increases in the amount of people dying from overdose.

Austerity also yields an interesting result. Despite some of the ways in which austerity could be described as economic cruelty against those who rely on state benefits

in the United Kingdom, the result from our testing implies that austerity led to a decrease of 16% in the amount of opioid death, albeit with only about 90% confidence. Given our current line of thinking, we aren't entirely sure why this result might have occurred.

The dummy variable marking the financial crisis and the years following, however, falls more in line with our expectations given our hypothesis. The financial crisis and its aftermath appear to increase the rate at which people die to opioid overdose by 15.8% with over 99% confidence. The global economic hardship that's been thrown upon the lower and middle class by the great recession is almost unfathomable, and it's hardly comparable to anything that isn't the great depression. We expected this variable to carry some weight and the result seems consistent with what we expected given the nature of the event it was meant to capture.

Table 5: Results of Equation 1 Regression

VARIABLES	(1) ln(Opioid Deaths)
ln(Underemployment)	0.216***
	(0.0519)
Median Income (2018-2017 GBP)	1.20e-05
	(2.84e-05)
Austerity	-0.160*
	(0.0774)
Post Financial Crisis	0.158***
	(0.0395)
Constant	5.676***
	(0.789)
Observations	17
R-squared	0.838

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

CHAPTER 5

CONCLUSION

Although the results of this paper have supported the hypothesis we began with there are some serious limitations that harm the validity of our conclusion. Primarily, there is the size of the sample we have available to us. Although we believe our results would hold given a larger sample size, unless we obtain that larger sample size we may be the only believers in these results. If possible, we suggest anyone looking to perform this in the future to attempt to expand the data set to the four nations of the United Kingdom. Although the sample size would be relatively small, it would exceed the traditionally acceptable minimum of 30 and increase the validity of any results obtained.

That being said, we feel we must reiterate that we didn't expect our results to be groundbreaking given the data available. What we *did* want to do, however, was begin to look at some of the ways economists can begin to look closely at the economic factors driving the opioid epidemic, and start a conversation within the world of economics on how we can observe underemployment and how underemployment can cause dangerous anxieties within people that can't be attributed to outdated factors such as unemployment. Unemployment has long been touted as one of the greatest indicators of economic health available to us and we hope that one day we'll be able to look at it in tandem with the

underemployment rate to assess our economy to see in what direction we are truly growing as a society.

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