Surviving the Great Recession:
Suicides During an Economic Downturn

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PRELIMINARY. PLEASE DO NOT CITE OR REFERENCE WITHOUT PERMISSION.

Abstract

Increasing mortality rates for individuals in the later stages of their careers has been identified as a troubling trend in recent studies, e.g. Case and Deaton (2015). This paper seeks to enhance our understanding of how economic crises affect mortality, specifically suicide rates. With more than 40,000 Americans committing suicide each year, this is a significant cause of lost years of life. The Great Recession of 2007-09 resulted in substantial increases in levels of economic distress, unemployment rates, and suicide rates among certain groups.

Previous theoretical and empirical research finds that challenging economic conditions elevate suicide rates (including Classen and Dunn (2012)), while other causes of mortality typically decline in recessions (Ruhm (2000)) or are unchanged (Ruhm (2013)). In this project, a theoretical model is specified for linkages between increased unemployment, economic distress, and suicide. An empirical model is estimated for annual state-level data on labor markets and suicide in the United States from the period from 1999 to 2015. Given the substantial gradient in levels and growth rates of suicides across racial and ethnic groups, this paper focuses on the effects of the increase in unemployment during the Great Recession on suicides among non-Hispanic whites. This group has experienced enormous increases in suicide rates over the past decade and the role of job loss and labor market distress (as captured by the unemployment rate) in this increase appears strongest for females and those later in their labor lifecycle. However, the relationship between rates of unemployment and suicide does not appear to be statistically significant once year and state-level fixed effects are included in our models. This research enhances our understanding of how economic shocks impact individuals' health choices and highlight an area of growing concern in rising mortality for certain populations.

JEL Codes: I1, I12, J11, J63

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I. Introduction

This research explores the rapid rise in rates of suicide in the United States over the last decade and its potential relationship to the economic distress induced by the Great Recession of 2007-09. There were 42,773 suicides in 2014[1] which made it the 10th leading cause of death in the United States at a rate of 13.4 suicides per 100,000 people. Suicide was the second leading cause of death (behind unintentional injuries such as motor vehicle accidents and drug overdoses) for 10 to 34 year olds and the fourth leading cause of death for 35 to 54 year olds (exceeded only by mortality from unintentional injuries, cancers, and heart disease).[2] Between 2005 and 2014, the suicide rate for females increased by 33 percent to nearly 10,000 deaths while rates for males increased by 18 percent to over 33,000 deaths.[3] Figures 1 & 2 below indicate that non-Hispanic whites had significantly higher rates of suicide relative to other racial and ethnic groups for both genders during the past 15 years. As well, suicide rates increased for non-Hispanic white females by 41 percent between 2005 and 2014 relative to 28 percent for females in other racial and ethnic groups. Similarly, suicide rates for non-Hispanic white males increased by 25 percent relative to 10 percent for other males.[4] Increases in mortality rates for non-Hispanic whites, especially for 45 to 54 year olds, attributed to increased suicides, drug overdoses, and alcohol abuse are discussed in Case and Deaton (2015) which has attracted substantial discussion in the public health arena on this topic.

Two events of primary interest during this period that this research seeks to explore in relation to these increases in rates of suicide are the Great Recession of 2007-09, when

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[1] *Deaths: Final Data for 2014*, National Vital Statistics Report, Center for Disease Control and Prevention. Accessed at http://www.cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_04.pdf

[2] http://www.cdc.gov/injury/images/lc-charts/leading_causes_of_death_age_group_2014_1050w760h.gif

[3] Phillips and Nugent (2014) explore underlying reasons for this variation across genders in the response of suicide rates to increases in unemployment during the Great Recession.

[4] Author's calculations based on data from CDC's Multiple Cause of Death WONDER database, accessed at http://wonder.cdc.gov/mcd-icd10.html

unemployment rates reached 10 percent for the first time since 1983, and the expansion of mental health care access from reforms in the Affordable Care Act of 2010. An especially challenging feature of the Great Recession for the working-age population was long-term unemployment (those in the labor force unemployed for more than six months) rates as high as 4.4 percent which greatly exceeded any level since the Great Depression.

Figure 1

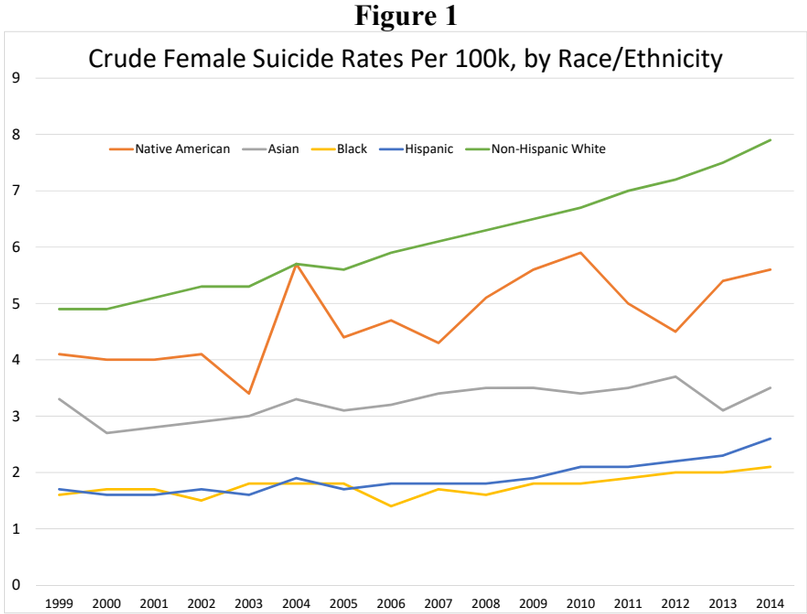
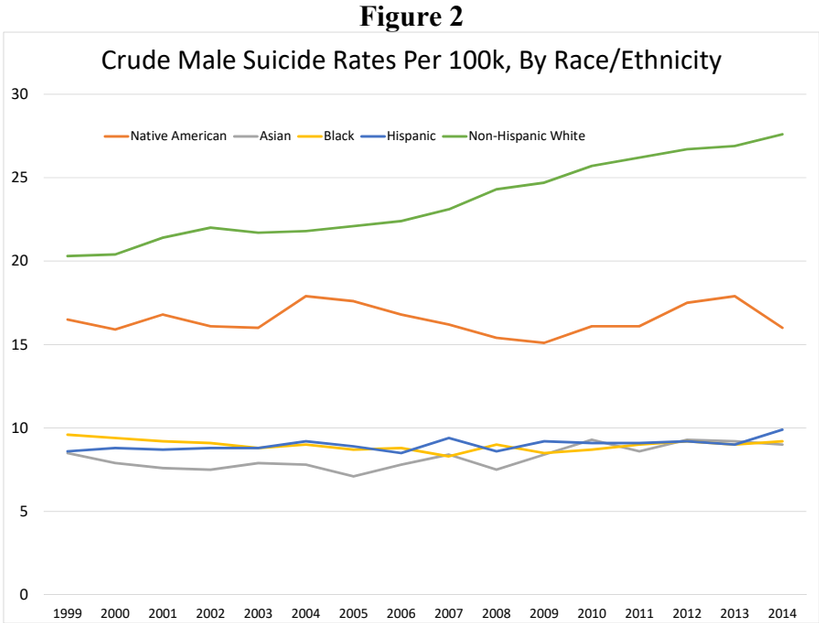


Figure 2



II. Theoretical Framework

While the decision to commit suicide may result from longer-term mental health issues, such as depression, economic stress from job loss and prolonged unemployment may lead to increased substance abuse, deterioration of interpersonal relationships, and eventually suicide.[5]

a. Labor Market Shocks

Social isolation is considered a proximate cause of many suicides, so the substantial increase in long-term unemployment combined with the housing crisis led to increases in substance abuse (especially alcohol and prescription opiate painkillers) during the Great Recession. Given relatively lower levels of unemployment for non-Hispanic whites relative to blacks and Hispanics, one question this research considers is why suicide rates increased more rapidly for this group. Figures 3 and 4 indicate differentials by state in average unemployment rates for Hispanics and blacks relative to non-Hispanic whites for the period 2007-15 relative to the pre-recession period of 1998 to 2006. In all states (except for Hispanics in Vermont and West Virginia), Hispanics and blacks had higher average unemployment rates during these periods and the differential relative to whites increased in a majority of states in both cases. Given the increasing distress in labor markets for these groups, the lack of increases in rates of suicides for blacks and Hispanics (especially for males, as seen in Figure 2) raises doubt about how labor market shocks may relate to suicide, at least when measured at these aggregate levels. Given that most of the variation over time in suicide rates arises from non-Hispanic whites, the results presented in this paper will focus on this particular sub-group.

[5] The role of alcohol abuse in suicide during the Great Recession is discussed in Kaplan et al (2016)

Figure 3

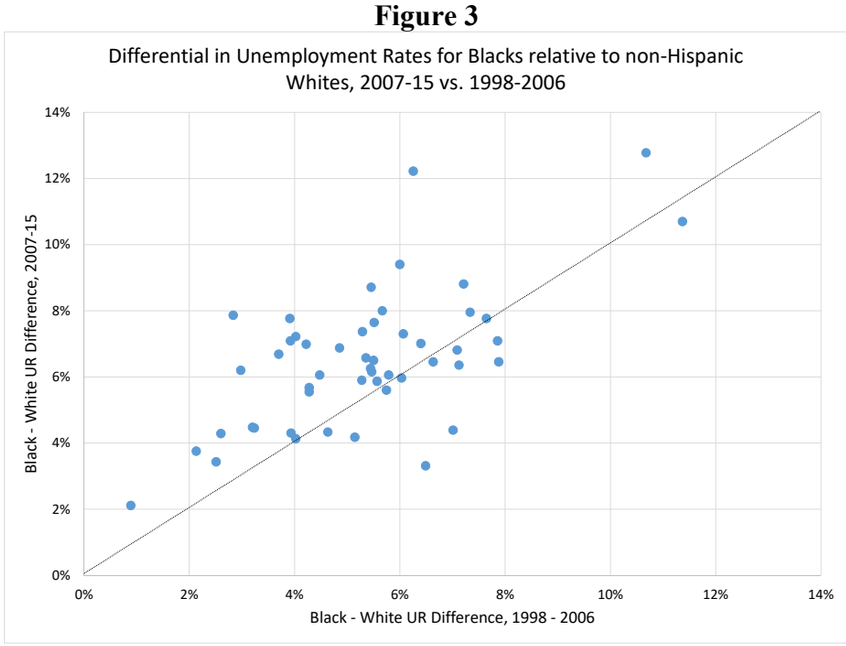
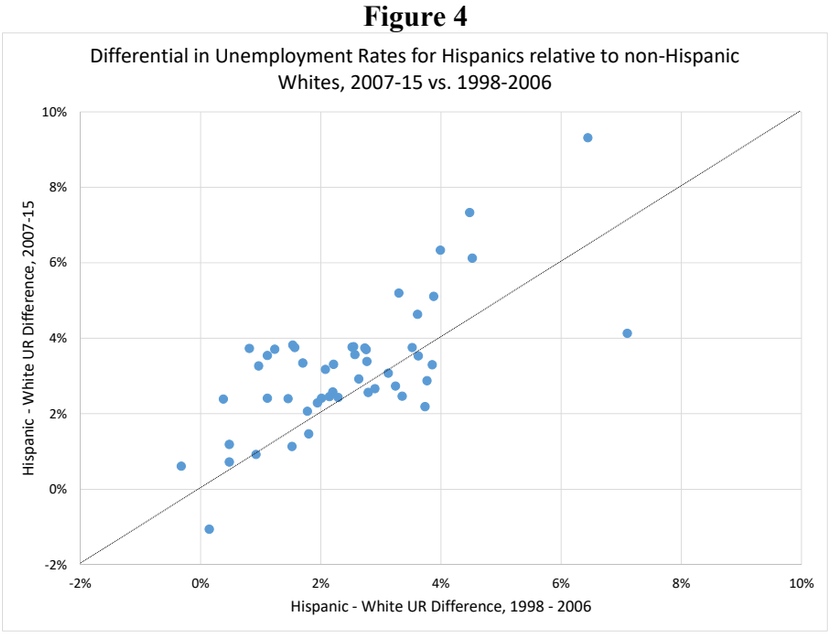


Figure 4



As well, variation across age groups in rates of suicides is measured as economic stress experienced by those towards the end of their career varies substantially from those entering the labor force for the first time as displayed for non-Hispanic whites in Figures 5 and 6 below. Suicide rates increased most rapidly for 45 to 64 year olds of both genders, with a 50 percent

increase among female non-Hispanic whites between 2005 and 2014 (Figure 5). Rates of prescription opiate painkiller misuse also differs substantially across age groups (with overdose rates highest among 45 to 64 year olds as well), so this variation could reflect differences in levels of economic distress or access to insurance for prescription drugs across the working age population.

Figure 5

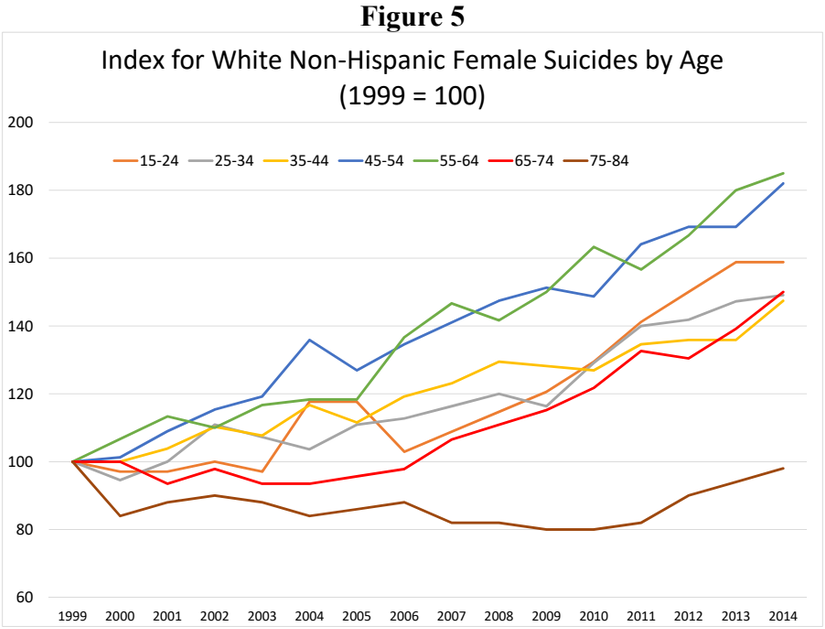
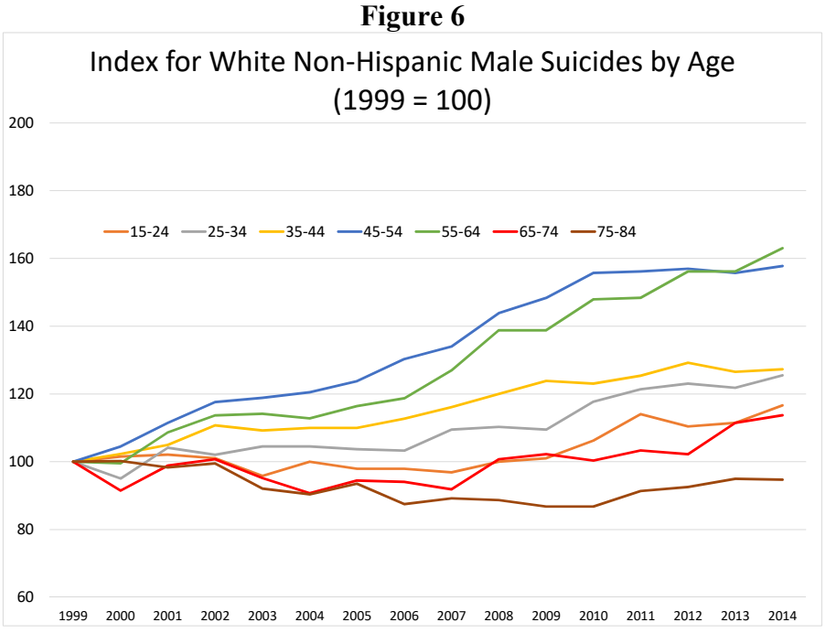


Figure 6



b. Health Insurance Coverage Expansions

Two primary expansions in insurance coverage resulting from the ACA affected access to mental health care during the period of this study. The ACA allowed individuals under the age of 26 to remain on their parents' health insurance plans and greatly expanded health insurance coverage via Medicaid and (often subsidized) private health insurance purchased from exchanges. The first expansion was the provision for 19 to 25 year olds to remain on their parents' insurance coverage beginning in late 2010. This resulted in a substantial decline in rates of uninsurance for this group from 34 percent in 2010 to 20 percent by 2014. Variation in uninsured rates across age groups is displayed in Figure 7 below. The second mechanism by which health insurance coverage increased was the 2014 increase in Medicaid eligibility for low-income individuals in the 24 states that used funds from the federal government to expand their programs.[6] State-level health insurance exchanges were also made available in 2014 to purchase private health insurance plans with subsidies for individuals below 400 percent of the Federal Poverty Line. The effect of this expansion is shown in Figure 5 with the decline in uninsured rates for 25 to 64 year olds between 2013 and 2014 (and even further by 2015).

Figure 7

Percentage of adults aged 18–64 who were uninsured at the time of interview, by age group: United States, 2010–2015

From *Health Insurance Coverage: Early Release of Estimates From the National Health Interview Survey, 2015* available at http://www.cdc.gov/nchs/data/nhis/earlyrelease/insur201605.pdf

[6] As of September 2016, 31 states and Washington D.C. have now expanded Medicaid eligibility under the federal funding provided in the ACA.

Expanding access to health care reduces costs for mental health therapy and prescription drugs so people with depression can more readily afford treatments including talk therapy and SSRI anti-depressants. In a randomized study of individuals receiving Medicaid in Oregon discussed in Baicker et al (2013), rates of diagnosed depression increased significantly while rates of treatment for such depression also increased relative to a similar group of low-income individuals not receiving Medicaid in that state.

III. Data and Empirical Approach

This research uses state-level mortality data from the Centers for Disease Control and Prevention for the period from 1999 to 2015 compiled in the Multiple Cause of Death data.[7] With the ICD-10 classifications provided, suicide rates (termed intentional self-harm) are collected at the state level at an annual frequency for non-Hispanic whites as well as by gender or age groups.[8] The age range of most interest is 18 to 65 year olds to understand how labor market distress may affect suicide rates among this working age population. Measures of economic distress include fluctuations in state-level unemployment rates available from the Bureau of Labor Statistics and the Economic Policy Institute.[9] The national effects of changes in insurance markets induced by the ACA expansions for individuals up to age 26 in 2010 as well as the availability of Medicaid and private insurance exchanges in 2014 will be captured using year fixed effects.

To estimate the effect of variation across states in economic stress and changes in rates of uninsured on state-level suicide rates, I estimate panel-data models with both state and year fixed

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[7] Described in detail at http://wonder.cdc.gov/wonder/help/mcd.html Mortality classification data reporting changed significantly between 1998 and 1999, so the time series will begin in 1999.
[8] Suicides are identified as Intentional Self-Harm in UCD-ICD-10 codes X60 – X84 in the CDC database. When there are less than 10 suicides in a given cell (state/year/gender, for instance), the CDC supresses
[9] Annual state-level unemployment rates by race/ethnicity are available at http://www.epi.org/data/#/?subject=unempstate&r=*

effects with standard errors adjusted to allow for autocorrelation in error terms within states. Including state fixed effects allows the empirical model to capture any features of the state that did not vary substantially during the period from 1999 to 2015, such as geography, religiosity, and other time invariant characteristics. Year fixed effects capture national level shocks, such as the 9/11 terrorist attacks in 2001 and expansion of insurance to those under age 26 in 2011, that might affect suicide rates in all states in a similar fashion. Controlling for both state and year fixed effects captures much of the variation across states in levels of suicide (such as variation in state gun laws or population density that do not change during the study period), so any statistically significant relationships found between variation in levels of economic distress to suicide rates can more plausibly be inferred to be causal given such a specification. Thus, the following model for the natural logarithm of suicide rates in state s in year t is estimated using state fixed effect (α_s) and year fixed effect (λ_t) as well as variation over time within a state's labor market measured by the unemployment rate for non-Hispanic whites (UR_{st}):

$$\text{Ln}(SuicideRate)_{st} = \alpha_s + \lambda_t + \beta * UR_{st} + e_{st}$$

IV. Results

Given the relatively larger increases in suicide rates for non-Hispanic whites since 2000 (displayed in Figures 1 & 2), the estimates in this paper focus on how variation over time within state-level unemployment rates affect suicide rates. Given the logarithmic specification of the dependent variable (state-level suicide rates) and the measure of unemployment rates in decimal form (so a 2 percent unemployment rate is indicated by UR = .02), the coefficient of interest β indicates the percent change in suicide rates for a one percentage point increase in the unemployment rate. Summary statistics for suicide (overall and by sub-group) and unemployment rates are provided in Table 1.

Table 1 - Summary Statistics for non-Hispanic Whites, 1999 - 2015 (n = 850)

	Sample Mean	Std. Deviation	Min	Max
Suicide Rate - All	19.84	5.35	8.7	42.1
Males	30.86	7.77	13.2	63.4
Females	8.77	3.21	1.7	25.9
18 - 40 year olds	18.12	4.93	5.3	41.0
41 - 65 year olds	21.25	6.31	8.0	45.3
Unemployment Rate	0.048	0.018	0.016	0.123

There exists substantial variation across states in suicide rates with New York and Massachusetts both having annual rates below 10 per 100,000 people in the pre-recession period (1999 to 2006) while New Mexico and Nevada both had more than 34 suicides per 100,000 people per year in the post-recession period of 2009-15. Within-state variation over time (pre-recession relative to the post-recession) in suicide rates[10] also ranges from a 10 percent increase in Nebraska to more than 45 percent increases in North Dakota and Hawaii. This contrasts with North Dakota having a lower unemployment rate for non-Hispanic whites in the 2009-15 period than in 1999 to 2006. While Nevada experienced a nearly 5 percentage point increase in its unemployment rate after the Great Recession relative to the period prior to 2007, their increase in suicide rates was among the lowest at only 16 percent (but they started with the highest suicide rate in the country at 30 per 100,000 annually for 1999 to 2006).

Given these relationships in rates of change within states and variation across states in levels of suicide and unemployment, we estimate the specified model for all non-Hispanic whites between 18 to 65 years old, males only, females only, 18 to 40 year olds and 41 to 65 year olds. This allows us to consider how the effects of job loss and increased unemployment may affect suicide rates differently by gender or for those at different stages of their lifecycle. Table 2 displays that estimated β coefficients from four specifications for each group. The first column

[10] Measured as changes in average rates in 2009-15 relative to 1999-2006.

simply measures the estimated relationship of unemployment rates to suicide rates with no other controls (or fixed effects). Subsequent columns add state-level, year, and both state and year fixed effects. The final column displays the preferred specifications given the strong trends in increased suicide rates over time (justifying year FEs) and important unobserved differences across states (such as gun laws or mental health access) that are captured in state fixed effects.

Table 2 - Percent Change in Suicide Rates Among Non-Hispanic Whites for One Percentage Point Increase in Unemployment Rates, 1999 - 2015

	18 - 65 year old non-Hispanic Whites			
Coefficient	3.95***	4.47***	1.73	0.58
S.E.	(0.66)	(0.31)	(1.75)	(0.57)
State FE		X		X
Year FE			X	X
	Males			
Coefficient	3.60***	4.23***	1.25	0.37
S.E.	(0.59)	(0.34)	(1.60)	(0.69)
State FE		X		X
Year FE			X	X
	Females			
Coefficient	5.71***	5.36***	4.48*	0.87
S.E.	(1.12)	(0.33)	(2.58)	(0.67)
State FE		X		X
Year FE			X	X
	18 - 40 years old			
Coefficient	1.90***	2.56***	-0.23	-0.57
S.E.	(0.69)	(0.33)	(1.71)	(0.53)
State FE		X		X
Year FE			X	X
	41 - 65 years old			
Coefficient	5.38***	5.69***	3.15	1.05
S.E.	(0.73)	(0.36)	(1.89)	(0.82)
State FE		X		X
Year FE			X	X

Notes: Standard errors clustered at the state level. *** indicates p-value < .01, ** p-value <.05, and * p-value <.1. Data for 17 years (1999 to 2015) for 50 states with 1999 and Alabama as the reference year and state, respectively.

The estimated relationships between unemployment and suicide rates are largest for females and the older working age population, but none of the coefficients when both state and year fixed effects are statistically significant at the usual levels. To provide interpretation of their magnitude, the 1.05 in the final column of results for 41 to 65 year olds indicates that a one percentage point increase in the unemployment rate (from its sample of average of 4.8 percent to 5.8 percent for instance) would be associated with an increase in the suicide rate of 1.05 percent. Given the average rate of 21.25 suicides per 100,000 people for this group, that would imply an additional suicide per 100,000 people for an increase in the unemployment rate of 4.5 percentage points. However, given the sizeable standard error on this and the other coefficients in the final column, it appears that the relationship between unemployment and suicide cannot be distinguished from no effect when state and year fixed effects are included.

The trends in the coefficients on the year fixed effects indicate the sizeable changes in annual effects that the empirical model allows to affect all states contemporaneously. Since the ACA expansion in health insurance to those under age 26 occurred in 2010, the year fixed effects around that time for the model of 18 to 40 year olds would capture this national effect for a subset of this population. The fixed effect coefficients for this model are displayed with the 95 percent confidence bounds in Figure 8 below. Interestingly, the year fixed effects first differ from zero at the start of the Great Recession in 2007 (measured relative to the base year of 1999). They increase substantially up to 2010 and then level off between 2010 and 2013 before rising again in 2014. While this is obviously not a test of the policy effects of the ACA expansion of insurance to younger people, the patterns of these fixed effects are suggestive of increased suicide rates at the beginning of the recession and flattening out around the time of the insurance expansion. These year fixed effects for the 18 to 40 year old model contrast with the annual fixed effects in the model estimated for 41 to 65 year olds that displayed significant

increases in suicide rates relative to 1999 in the period prior to the recession (an estimated 20 percent increase already by 2006). This is displayed in Figure 9 below.

Figure 8

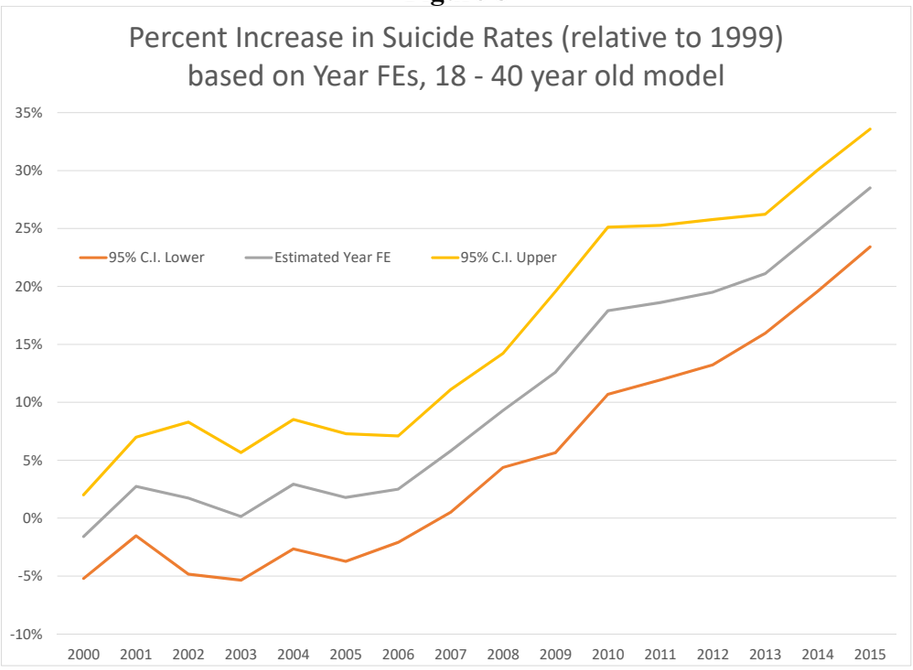
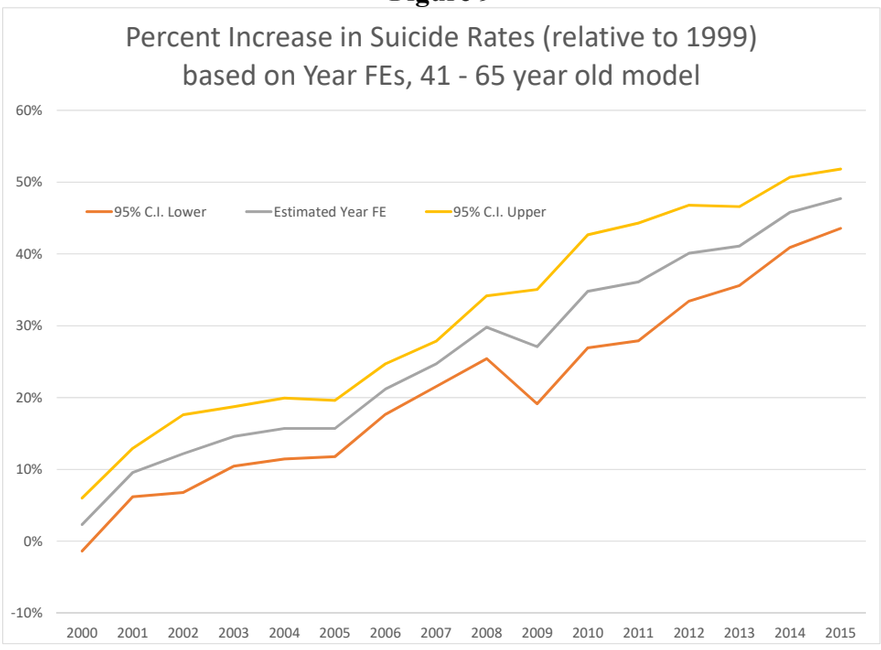


Figure 9



V. Conclusions and Directions for Future Research

This paper has considered the potential for increases in unemployment rates that occurred during the Great Recession (and persisted in many states) to explain the substantial rise in suicide rates among non-Hispanic whites during the period from 1999 to 2015. While unemployment rates have declined back to pre-recession levels in most states, suicide rates have continued to rise following the end of the Great Recession. The unemployment rate is one measure of labor market volatility, but obviously suffers limitations in capturing the distress suffered during the Great Recession. When equal numbers of people gain and lose employment in a given period, the unemployment remains unchanged even as many may have lost their job. Hence, this may be one reason why we fail to find significant relationships between fluctuations in state-level unemployment rates and variation over time in suicide rates.

But this also suggests that challenge of identifying the causal factors of individual choices using aggregate data. The trends in suicide rate increases are certainly alarming and efforts must be made to better understand the underlying causes to develop policies to counteract these trends. Whether it is due to labor market shocks, other forms of economic distress (such as the collapse of the housing market), increased substance abuse (evidenced by increasing rates of overdose from prescription opiates), or other measures of dissatisfaction with life (as expressed in the surprising results of the 2016 Presidential election), this is an important topic to continue studying to better understand and reverse these trends.

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