



An empirical investigation into the relationship between changes in the business cycle and the incidence of suicide

The business cycle and suicide

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Abstract

Purpose – The purpose of this paper is to explore the relationship between changes in the business cycle (as indicated by the incidence and duration of unemployment) and the incidence of suicide.

Design/methodology/approach – A theoretical utility model with savings and consumption is used, while time series micro-level suicide data and probit analysis is used to empirically test the implications of the model.

Findings – With declining economic activity and the corresponding increase in unemployment the propensity to commit suicide rises among men for numerable reasons. The authors hypothesize that there is a negative impact with respect to the decline in economic activity and as the intensity increases with respect to the declining business cycle, female's suicides will tend to accelerate.

Research limitations/implications – One of the primary limitations of this study is the amount of control variables to which the authors had access. There are many factors that would influence an individual when determining whether or not to take their own life. Religious convictions, the presence of children, income, educational attainment, occupational attainment, pre-unemployment income, and how long one had been married or divorced (or unmarried) are all variables that could influence the likelihood of a suicide. The center of disease control (CDC) public use files, however, do not include these variables; thus, the authors were unable to control for their impact.

Practical implications – The authors believe that these findings merit greater public awareness and increases in various forms of public and private support for recently unemployed individuals, being particularly attentive to the effect of higher than normal rates and durations of unemployment and the differences based on gender. These findings also establish another sound rationale for public policies to encourage the increase of personal savings during times of employment to make weathering periods of unemployment easier.

Social implications – In times of increased incidence and duration of unemployment, the tendency of legislators and other public policy makers presumably would be to establish programs targeted to address the population with the highest rates of unemployment-related suicide – White males. It can be argued, however, that since the increased incidence and duration of unemployment have a greater effect on increasing the rate of suicide in women, public policies and programs targeting the specific needs and issues of those unemployed women with an increased risk of suicide would be more cost-effective, preventing or reducing those incremental suicides and mitigating their negative economic, social, and familial impacts.

Originality/value – Previous studies used descriptive statistics, contingency tables, and the traditional statistical regression techniques in their empirical analysis; this study deviates from the norm by the use of probit analysis. Using the probit technique allowed the authors to focus their analysis on the probabilities of suicide with regard not just to the business cycle itself but also to the intensity of the business cycle.

Keywords Suicide, Business cycles, Unemployment

Paper type Research paper



1. Introduction

According to the popular press, over the last several years, suicides have reached a crisis level with regard to changes in general macro economic activity. This paper explores this allegation by investigating the relationship between changes in the business cycle and the incidence of suicide. There is a literature that focuses on this issue and directly and indirectly looks at the various economic and non-economic determinants of suicides.

While previous empirical studies used aggregate (macro) data in cross-section, time series, and pooled data analysis (Andrés, 2005; Chuang and Huang, 1997; Classen and Dunn, 2009; Kposowa, 2001; Stack and Haas, 1984; Yang, 1992), this is the first attempt using time series micro suicide data in exploring the changes in the business cycle and its impact on the incidence of suicide. Previous studies used descriptive statistics, contingency tables, and the traditional statistical regression techniques in their empirical analysis; this study deviates from the norm by our use of probit analysis. Using the probit technique allowed us to focus our analysis on the probabilities of suicide with regard not just to the business cycle itself but also to the intensity of the business cycle.

The database used in this analysis was a 10 percent random sample extracted from the CDC's database on deaths from 1979 to 2006 in the USA. This provided us approximately 5 million observations, of which approximately 2 percent were classified as suicide. This data were further delineated by age, gender, race, etc.; however, our study focuses strictly on male and male-female suicides with respect to changes in the business cycle with no regard to age or race. We used monthly unemployment rates from the bureau of labor statistics as the proxy for the business cycle even though we understand its shortcomings, especially with regard to understating the "true" unemployment rates. Finally, we explored the lead-lag relationship between suicides and changes in the unemployment rates as well as examined the impact that the intensity of the business cycles has on suicides.

We contend that with declining economic activity the propensity to commit suicide rises among men for numerable reasons[1]. For example, in economic downturns unemployment rises, increasing stress on both those employed and unemployed. While those still employed experience uncertainty and the fear of possibly losing their jobs as well, those unemployed have an additional problem: loss of income and uncertainty about future employment prospects, making them even more susceptible to suicide. We also contend that the propensity for males to commit suicide tends to increase even further as the economic decline strengthens. As this process continues, stress and depression intensify for those unemployed since it becomes more difficult to find employment; and, once unemployment insurance expires, there are few alternatives for earning income. Finally, we hypothesize that there is a negative impact with respect to the decline in economic activity and, as the intensity increases with respect to the declining business cycle, suicides among females will tend to accelerate.

2. The model

This model develops a simple two-period utility model. We assume that individuals derive utility from consumption, and that this consumption comes from an exogenous, lump sum income Y that is received from working[2]; that is $U = u(c)$, where U is the utility received from consumption and c is the consumption level. We further assume that the consumption levels come from Y and that the individual's utility function

remains constant across periods. For simplicity we assume that the utility function has the following characteristics:

$$\frac{\partial u}{\partial c} > 0 \text{ and } \frac{\partial^2 u}{\partial c^2} < 0.$$

We further assume that each individual has a lowest utility level, $U^s > 0$, that, once their utility drops below this level, the individual will choose to end their life. This level is unique to each individual. Individuals work in the first period and lose their job in the second period. If an individual loses their job, they will also lose their exogenous income Y . If the job is lost and the individual has no savings and receives nothing from the government, consumption will drop to zero, their associated utility level will drop to zero, and the individual will end their life, as:

$$U^s > u(0) = 0.$$

To compensate for this, we allow individuals to save a fraction of their income, δ , to use when they lose their job. Consumption (c) and savings (s) levels in period one are then:

$$c = (1 - \delta)Y \text{ and } s = \delta Y.$$

Call the utility derived from period one consumption when the individual is employed U^e . It then follows that:

$$U^e = u[(1 - \delta)Y].$$

When the individual loses their job, we also allow the government to pay a form of unemployment insurance. When the individual loses their job, the government will pay an exogenous fraction of their income γ so that the total income from the government after losing their job is then γY . We also assume that individuals cannot save more than their income and that the government will not give more than what they were previously earning; that is, we assume $\delta \in [0,1]$ and $\gamma \in [0,1]$.

In the second period, the individual loses their job and their income Y . As a result, individuals must now use their savings and government transfers to obtain their consumption levels. In the second period, the individual's consumption and utility level, call it U^u , after losing their job is then:

$$c = (\delta + \gamma)Y \text{ and } U^u = u[(\delta + \gamma)Y].$$

A quick look at the consumption levels, and thus the utility levels, shows that it is theoretically possible for an individual's utility level to be higher after being fired compared to before; specifically, if $(\delta + \gamma) > 1$. Perhaps, this might occur in reality is if an individual was very unhappy with their current job. This person might save a high amount to consume in the second period. This increased second-period consumption coupled with the relief of leaving the unpleasant job might cause a higher level of utility under unemployment than when the individual is employed. If the individual was unique enough to have this occur, we would then need to compare their utility level before their firing (U^e vs U^s); that is, we implicitly assume that we compare the individual's lowest utility with the base-line utility for suicide. If this was the case and their first-period utility was low enough, the individual would choose to end their life in the first period and would not lose their job in the second. This person would not then

have committed suicide due to changes in unemployment status or rates, but for other reasons. Given that the average American saved between 1.2 and 7.2 percent of their income between the first quarter of 2005 and second quarter of 2010[3] and that the government provides a relatively small amount of unemployment insurance as well, it is unlikely that we would see $(\delta + \gamma) > 1$ in real life. Even if this did occur, the focus of this paper is comparing the individual's likelihood of committing suicide after losing their job. We say that an individual will choose to end their life if $U^s > U^u$ or $U^s > U^e$. Individuals would need to save enough and receive enough from the government in order to keep consumption at high enough levels to prevent suicide.

Given this, we can find a "break-even" level of savings that would keep the individual equally as happy between the two periods. Since we assume that utility functions do not change and that utility is based on consumption, we need not compare utility levels before and after losing a job, but simply at their consumption levels. That is, to keep the utility level the same across time periods ($U^e = U^u$), we would need:

$$(1 - \delta)Y = (\delta + \gamma)Y.$$

A little algebra shows that to keep the individual's utility constant, they would need to save a fraction of their income:

$$\delta = \frac{1 - \gamma}{2};$$

Their break-even consumption level and utility would then be:

$$c = \frac{1 + \gamma}{2} Y \text{ and } U = u\left[\left(\frac{1 + \gamma}{2}\right)Y\right].$$

Call this break-even level U^b . If $U^b > U^s$, the individual will have saved enough and received enough from the government that they will not choose to end their own life. If not, the loss of income that come about through the loss of the job will be too much to overcome.

This model implies that, once an individual loses their job, more than likely, their income and thus consumption levels will drop. This will induce an increase in the probability that this individual chooses to commit suicide through utility loss. We use the unemployment rate to proxy for changes in the likelihood of an individual losing their job. We would anticipate, then, that an increase in the unemployment rate would be accompanied by an increase in the likelihood of suicides occurring.

3. Data and descriptives

The data used here come from the public-use data file[4] of the division of vital statistics of the center for disease control (CDC). The public-use files contain data on the decedent's race, age, gender, date of death, state of residence, state in which the death occurred, marital status, and manner of death, amongst other items. The data cover 39 years starting in 1968 and running annually through 2006. For data between the years of 1999 through 2006, seven options are given for manner of death. Only those deaths that were officially categorized as suicides are counted as suicides. Between the years 1980 and 1998, the five-digit 282 cause recode is used to classify deaths as suicides. For data years between 1968 and 1978, the manner of death cannot be determined with

absolute certainty; thus, these years have been dropped from the analysis and only years after 1978 are used. The year 1979 is also dropped from the data set in order to reduce the size of the final data set.

Most of the manners of death were reported by hospitals or other medical entities on the official US Standard Certificate of Death. Beginning in 1979, the cause of death statistics published by the National Center for Health Statistics have been classified according to the ninth revision of the *International Classification of Diseases (ICD-9)* published by the World Health Organization. In order for the death to be officially certified, only a qualified person (a physician or coroner, for example) can determine the cause of death. The reliability and accuracy of cause of death statistics are then governed by the ability of the certifier to make the proper diagnosis. A bibliography, covering 128 references over a period of 23 years, conducted by Gillelsohn and Royston (1982) indicates that no definitive conclusions have been reached about the quality of medical expertise in the official certification of death. They argue, however, that the proportion of deaths in which the cause was indeterminable implies that great care and consideration was used in determining the causes of death.

Unemployment levels come from the St Louis federal reserve web site[5] and are monthly rates.

Descriptives

Overall, the data contain 49.1 and 50.9 percent males. A total of 86 percentage of the sample is White, while around 10 percent is Black and 3 percent is a race other than White or Black. Around half the individuals (47.1 percent) were aged 74 or younger at the time of their death and 52.9 were over 74. The percentage of individuals divorced at the time of death is 9.3 percent. Overall, suicides account for around 1.4 percent of the total observations. A more detailed description of suicides is given below.

Table I gives the percentage of death by suicides and percent of all suicides by month. Table I shows that the summer months (June, July, and August) were the most likely times in which suicides took place within our sample, with around 1.53 percent of all deaths in these months being suicides, a higher percent of the total suicides than the other months; December and January are the least likely. When we look at the data quarterly, 24.6 percent of the suicides took place in the first quarter (January-March), the second quarter (April-June) accounts for 26 percent of the suicides, the third quarter (July-September) accounts for 25.7 percent, while the fourth quarter (October through December) accounts for 23.6 percent of the total suicides.

Table II gives the percentage of death by suicides by race and gender. Whites were the most likely to commit suicide, with around 1.4 percent of Whites in the sample committing suicide, while around 1.36 percent of deaths from Blacks were by suicide. By gender, males were far more likely to commit suicide than females, with 2.1 percent of all male deaths occurring by suicide, compared with only 0.6 percent of all deaths occurring by suicide for females. White males were most likely to commit suicide, with 2.5 percent of White male deaths occurring from suicide. This is followed by Black males (1.36 percent), White females (0.7 percent), and Black females (0.3 percent).

4. Methodology

As stated above, the manner of death for data years between 1968 and 1978 cannot be determined with certainty, so only the years between 1980 and 2006 are used. For the

Table I.
Percentage of suicides
by month

	January	February	March	April	May	June	July	August	September	October	November	December
Percentage of deaths	1.20	1.26	1.34	1.41	1.49	1.55	1.51	1.53	1.48	1.36	1.29	1.16
Percentage of suicides	8.2	7.7	8.7	8.4	8.9	8.7	8.8	8.7	8.3	8.2	7.7	7.7

purposes of this paper, individuals are categorized as White, Black, or other, with Hispanics counted as White in the data (this was not the choice of the authors, but was simply how the original data were coded). In this paper, in order for any individual to be categorized as divorced, they must be listed as divorced; individuals listed as separated are not counted as divorced. The age variable is a categorical variable; exact ages for individuals are not known. Instead, the data classifies individuals into groups of five-year increments; that is, for example, individuals who were aged 20-24 are in one category while individuals aged 25-29 are in a separate category.

We also limit our dataset to include only individuals aged 15 or older. Suicides in individuals aged younger than 15 are exceedingly rare and thus are not included in the analysis. Only complete observations are used in the analysis. Once these data selections are put into place, we were left with over 50 million observations. To reduce computing times, we randomly selected a ten percent sample from the original dataset. This left us with a final sample of 5,909,462 individual observations. The breakdown of this data is discussed in the previous section.

One of the key differences between this paper and others that similarly examine the role of macroeconomic fluctuations and suicide is that other papers use suicide rates as a dependant variable. We chose to take a different approach and use probit analysis to examine the roles of macroeconomic fluctuations on the likelihood of any death being ruled a suicide.

Unlike many countries with statutorily mandated employment guarantees, restrictions against lay-offs, and requirements of severance pay for many months for those whose employment is terminated, most jobs in the USA are not protected by such guarantees, making the unemployment rate a suitable indicator of business cycle fluctuations. We use the natural rate of unemployment as a macroeconomic alternative proxy for economy-wide fluctuations. This will be discussed in greater depth later in the paper.

In order to determine the effects of unemployment rates on the probability of suicide, we control for whether or not an individual is Black or male. We also include a control for whether the individual was divorced at the time of death. We also anticipate that males and females as well as Blacks versus non-blacks will be differentially affected by unemployment rates. We therefore, include interaction variables allowing for these differences.

We are also interested in how the length of unemployment affects suicide probabilities; that is, does the unemployment rate two to six months ago affect the likelihood of suicide. Put another way, how long does it take someone to react to the state of the employment market in terms of the unemployment rate? While it may be assumed that people would react to the generalized news of unemployment, we contend, rather, that they react to the realization of unemployment in their own individual lives and react

Percentage of deaths by suicides

White	1.44
Black	1.36
White males	2.5
White females	0.7
Black males	1.3
Black females	0.3

Table II.
Percentage of deaths
by suicide by race
and gender

to the expectation and realization of the duration, both actual and anticipated, of their own unemployment. To control for this, we include several months of lagged unemployment rates as well as their race and gender interacted controls. The unemployment rates we use are also lagged for another reason. Unemployment rates are not released until the next month; therefore, someone who died in March, for example, would not know the unemployment rate for that month but would know the unemployment rate for February. We then use at least a one-month lag in all regressions. The basic equation we estimated was then:

$$\text{suicide}_i = X_i\beta_i + \sum U_t\gamma_t + \sum (X_i*U_t)\lambda_{i,t} + \varepsilon$$

where X_i is a matrix of demographic variables for the individual, U_t is the unemployment rate for each month included in the study, (X_i*U_t) is the interaction between the demographic controls and the unemployment rates, and ε is an error matrix. β , γ , and λ are then the probit estimates for the individual controls. These estimates and their associated changes in probabilities are reported in the following section.

An interesting extension would be to examine the changes in the unemployment rates month to month and their effects on the likelihood of suicides. In separate estimates, we also determine the effects of these changes. In sum, we also estimate the following equation:

$$\text{suicide}_i = X_i\beta_i + \sum (U_t - U_{t-j})\gamma + \sum (X_i*(U_t - U_{t-j}))\lambda + \varepsilon$$

where j represents the specific lag.

5. Results and discussion

Unemployment levels

The numbers presented in Tables III and thereafter are the probit estimates for the regression equations presented above, while the numbers in parenthesis are the associated changes in the probabilities. Asteriks represent different levels of significance.

Table III presents probit estimates for lagged unemployment rates estimated independently. As can be seen from the tables, the coefficients on the unemployment rates for the first two lags are positive and significant. This implies that as the unemployment rate increases, the likelihood of a suicide also rises. The coefficient for the first lag is 0.004, which corresponds to an increase in the probability of a suicide of 0.01, while the coefficient for the second lag is 0.003, which implies an increase in the predicted probability of 0.01. These are small changes, but remember that suicides account for a very small percentage of the total number of deaths; any change, regardless of size, will imply a higher number of suicides occurring. There are a number of variables to consider when examining suicide; for example, the state of employment in the economy would most likely play a small role relative to the presence of children or religious conviction. It does, however, indicate that individuals do react to changes in unemployment. Unfortunately, this reaction is sometimes suicide.

There are a number of reasons why one individual chooses suicide while another does not, but the numbers presented here imply that as the unemployment rate increases, so does the probability of a suicide occurring. The stresses that accompany a job loss are typically large and the longer the duration of the unemployment spell, the greater are these costs, not just in financial terms, but also in terms of psychological

Variable	Probit estimates, lag = 1	Probit estimates, lag = 2	Probit estimates, lag = 3	Probit estimates, lag = 4
Unemployment rate, lag = 1	0.004 ** (0.01)			
Unemployment rate, lag = 2		0.003 * (0.01)		
Unemployment rate, lag = 3			0.003 (0.001)	
Unemployment rate, lag = 4				0.002 (0.002)
Person was divorced	0.341 *** (0.90)	0.341 *** (0.90)	0.341 *** (0.90)	0.341 *** (0.90)
Person was Black	-0.265 *** (0.20)	-0.263 *** (0.20)	-0.263 *** (0.20)	-0.266 *** (0.20)
Person was male	0.661 *** (2.50)	0.6589 *** (2.50)	0.66 *** (2.50)	0.658 *** (2.50)
Unemployment/Black interaction, lag = 1	-0.001 (0.004)			
Unemployment/male interaction, lag = 1	-0.026 *** (0.002)			
Unemployment/Black interaction, lag = 2	-0.001 (0.004)			
Unemployment/male interaction, lag = 2		-0.026 *** (0.002)		
Unemployment/Black interaction, lag = 3			-0.001 (0.004)	
Unemployment/male interaction, lag = 3			-0.021 *** (0.002)	
Unemployment/Black interaction, lag = 4				-0.000 (0.004)
Unemployment/male interaction, lag = 4				-0.026 *** (0.002)

Notes: Significance at: *90, **95, and ***99 percent confidence; numbers in parentheses are marginal changes in probability

Table III.
Each lag run
independently

and emotional well-being, self-esteem, and familial and social prestige. As costs increase, stress within a family or society increases. Unfortunately, it makes intuitive sense when looking at the connection between unemployment and the costs of stress that as the unemployment rate increases, more people will choose suicide.

But this is not the only statement that we can make with regards to the effects of unemployment. Table III shows that the coefficients for the unemployment rate three and four months before the death cease to be significant, implying that only recent activity in the employment market affects individuals who commit suicide. Individuals considering suicide may be more reactionary and will make their decision based on the most recent data. It may also be the case that, as argued above, the longer the unemployment spell, the greater the costs. If the spell is long enough, an individual who was able to endure for a few months may not be able to do so after four months.

The significance of the coefficients for the unemployment rate in Table III initially is marginal; however, when examining a more robust framework as represented in the context of Table IV, which considers all lags together, we see consistency not only in the probit estimate but also in their significance levels. Moreover, in Table IV, the estimates and significance remain consistent as we include more variables and lags.

Variable	Probit estimates, <i>n</i> lags = 1	Probit estimates, <i>n</i> lags = 2	Probit estimates, <i>n</i> lags = 3	Probit estimates, <i>n</i> lags = 4
Unemployment rate, lag = 1	0.004 ** (0.01)	0.034 ** (0.13)	0.032 ** (0.13)	0.029 * (0.12)
Unemployment rate, lag = 2		− 0.031 * (0.10)	− 0.006 (0.025)	− 0.004 (0.025)
Unemployment rate, lag = 3			− 0.023 (0.017)	− 0.004 (0.025)
Unemployment rate, lag = 4				− 0.017 (0.017)
Person was divorced	0.341 *** (0.90)	0.341 *** (0.90)	0.341 *** (0.90)	0.341 *** (0.90)
Person was Black	− 0.265 *** (0.20)	− 0.264 *** (0.20)	− 0.265 *** (0.20)	− 0.226 *** (0.19)
Person was male	0.661 *** (2.50)	0.66 *** (2.50)	0.661 *** (2.50)	0.661 *** (2.50)
Unemployment/Black interaction, lag = 1	− 0.001 (0.004)	0.023 (0.034)	0.024 (0.034)	0.027 (0.034)
Unemployment/Black interaction, lag = 2		− 0.024 (0.034)	− 0.034 (0.05)	− 0.036 (0.05)
Unemployment/Black interaction, lag = 3			0.01 (0.034)	− 0.017 (0.05)
Unemployment/Black interaction, lag = 4				0.025 (0.035)
Unemployment/male interaction, lag = 1	− 0.026 *** (0.002)	− 0.045 ** (0.019)	− 0.047 ** (0.019)	− 0.047 ** (0.02)
Unemployment/male interaction, lag = 2		0.02 (0.02)	0.043 (0.029)	0.043 (0.029)
Unemployment/male interaction, lag = 3			− 0.022 (0.02)	− 0.023 (0.029)
Unemployment/male interaction, lag = 4				0.001 (0.02)

Table IV.
All lags run together

Notes: Significance at: *90, **95, and ***99 percent confidence; numbers in parentheses are marginal changes in probability

The coefficients for the unemployment rate in Table IV are greater than those in Table III, but the sign is the same as is the significance. Comparing Table III with Table IV, we find similar results. The farther back in time we go, the less is the effect and the significance.

Note also the coefficient for the male/unemployment rate interaction. In each specification, the coefficient is negative and significant. This is an interesting result in that it indicates that men react less to the unemployment rate than do women. Given that women are the comparison group, this also implies that women, while having lower suicide rates overall and being less likely to commit suicide, are more likely to commit suicide due to changes in the employment sector than are men. This effect is seen throughout the results and is negative and significant in all specifications. This is an interesting result that is not necessarily without precedent. A recent study published in the *Spanish Journal of Psychology* (Etxebarria *et al.*, 2009) finds that women tend to feel changes more intensely and also tend to harbor those feelings much longer than do men.

The other variables also yield interesting results. From Tables III-V, we see that the coefficient for whether the individual was male is significant and positive in all

Variable	Probit estimates	Probit estimates	Probit estimates
$U_t - U_{t-1}$	0.033 ** (0.13)		
$U_t - U_{t-2}$		0.02 ** (0.10)	
$U_t - U_{t-3}$			0.024 *** (0.10)
Person was divorced	0.344 *** (0.90)	0.344 *** (0.90)	0.344 *** (0.90)
Person was Black	- 0.274 *** (0.20)	- 0.274 *** (0.20)	- 0.274 *** (0.20)
Person was male	0.499 *** (2.25)	0.499 *** (2.25)	0.499 *** (2.25)
Unemployment/Black interaction, $U_t - U_{t-1}$	0.025 (0.033)		
Unemployment/male interaction, $U_t - U_{t-1}$	- 0.034 * (0.019)		
Unemployment/Black Interaction, $U_t - U_{t-2}$		0.009 (0.022)	
Unemployment/male interaction, $U_t - U_{t-2}$		- 0.015 (0.015)	
Unemployment/Black interaction, $U_t - U_{t-3}$			0.000 (0.017)
Unemployment/male interaction, $U_t - U_{t-3}$			- 0.016 (0.01)

Notes: Significance at: *90, **95, and ***99 percent confidence; numbers in parentheses are marginal changes in probability

Table V.
Changes in monthly
unemployment rates

specifications, indicating that men are more likely to commit suicide than are women. The coefficients vary slightly from Tables III and IV relative to Table V, with a coefficient of around 0.66 in Tables III and IV and around 0.5 in Table V. This corresponds to an increase in probability of about 2.5, or triple the likelihood of women committing suicide.

The coefficient for whether the individual was Black is negative and significant in all specifications in all tables. The coefficients are around - 0.265, which correspond to a decrease in probability of around 0.2, or between half to a third less likely than are non-blacks. From the Black/unemployment rate interaction, however, we are able to see that blacks are no more affected by the unemployment rate than are non-blacks. This is consistent across all tables and specifications.

The coefficient for whether the individual was divorced at the time of their death is also positive and significant in all tables and specifications. The coefficient is around 0.34 in all tables and specifications. This corresponds to an increase of about 0.9 in the probability, or triple the likelihood of non-divorced individuals. There are a number of reasons why this may be the case. Marriage can lead to income pooling, which may serve as a buffer against macroeconomic fluctuations; one partner may lose their job while the other does not. Marriage may provide emotional and social support to weather the consequential complications of unemployment. It may also simply be the case that divorce is a fairly large shock with correspondingly large costs, both financially and emotionally.

Fluctuations in unemployment levels

Table V presents the coefficients for changes in the unemployment rate along with the demographic and interaction controls used above. The coefficients for the three differences are all positive and significant, indicating that the greater the increase

in the unemployment rate, the greater is the likelihood of suicide. This implies that the greater the increase, or the greater the shock in the employment sector, the greater and more surprising is the associated cost. The coefficients range between 0.02 and 0.03, or an increase in the probability of suicide by 0.04-0.06. The coefficients and implications for the demographic and interaction variables are the same as above.

Earlier, we made the argument that the coefficients imply that individuals may be able to stave off suicide during a short unemployment increase but perhaps not a longer one; when we compare the results of the regressions using levels and the regressions using the differences, we can start to develop some supporting evidence. The estimate for the first difference is greater than the estimates for the second and third differences. When we combine this with the results from the regressions using levels, specifically their significance, this implies that longer unemployment spells have a greater effect than shorter spells.

To check the robustness of the results, we also ran regressions that included the differences between the actual unemployment rate and the natural unemployment rate. The idea behind this is to measure the effect of deviations from the “expected value” of unemployment from the actual unemployment rate. While not shown in tabular form here, the coefficients from these regressions were not significantly different to those discussed above. The coefficients for the first and second lagged unemployment variables were still significant (at least a 90 percent confidence) and were around 0.003; the coefficients for the third and fourth lags were insignificant. The coefficients for the individual being Black, male, or divorced were all significant at a 95 percent confidence with similar levels to those above. Also, the coefficient for the Black/unemployment interaction remained insignificant, while the male/unemployment interaction was significant with similar levels to those discussed above.

6. Limitations, conclusions, and policy implications

Limitations

One of the primary limitations of this study is the amount of control variables that to which we had access. Clearly, there are many factors that would influence an individual when determining whether or not to take their own life. Religious convictions, the presence of children, income, educational attainment, occupational attainment, pre-unemployment income, and how long one had been married or divorced (or unmarried) are all variables that we could anticipate influencing the likelihood of a suicide. The CDC public-use files, however, do not include these variables; thus, we are unable to control for their impact. We are also not able to control for all races, as Hispanics are lumped together with Whites in the original data.

Conclusions

Despite these limitations, we are able to obtain some interesting results. First, we do find a positive association between the unemployment rate and the likelihood of a death being a suicide, implying that an increase in the unemployment rate increases the likelihood of a suicide. This effect was found for a lag of one month in each specification run. The effect varied for lags greater than one month. That men are more likely than women to commit suicide is well-documented (Murphy, 1998; Rich *et al.*, 1988) and supported by the CDC data. Conventional wisdom and anecdotal experience would suggest that women in general are more likely to have more diverse social networks,

more ties to both nuclear and extended family, and more experience with time out of the workforce because of pregnancy, childbirth, and child-rearing; thus, the assumption would be that women are more adaptable to periods of unemployment and would be more resilient than men, more resistant to the tendencies to commit suicide. Yet our data indicate that while males were more likely to commit suicide overall, those females who did commit suicide were more likely to be affected by the unemployment rate than were males[6]. This effect was seen in every specification run. We argue that while it has been long established that men tend to compartmentalize reason and “feelings”, women are far more likely to integrate emotional and rational thinking[7], causing women to consider suicide a more logical response to unemployment than do men. Also, Blacks were less likely to commit suicide and they are also no more affected by the unemployment rate than were Whites in terms of the likelihood of a death being a suicide. We also find that males and divorcees are more likely to commit suicide while Blacks are less likely. Again, these results were consistent across all specifications and met the predictions of the theoretical model developed in Section 2.

Policy implications

The authors believe that these findings merit greater public awareness and increases in various forms of public and private support for recently unemployed individuals, being particularly attentive to the effect of higher than normal rates and durations of unemployment and the differences based on gender. These findings also establish another sound rationale for public policies to encourage the increase of personal savings during times of employment to make weathering periods of unemployment easier. In times of increased incidence and duration of unemployment, the tendency of legislators and other public policy makers presumably would be to establish programs targeted to address the population with the highest rates of unemployment-related suicide – White males. It can be argued, however, that since the increased incidence and duration of unemployment has a greater effect on increasing the rate of suicide in women, public policies and programs targeting the specific needs and issues of those unemployed women with an increased risk of suicide would be more cost-effective, preventing or reducing those incremental suicides and mitigating their negative economic, social, and familial impacts.

One interesting extension of this paper would be to examine the effects of the recent extension of unemployment insurance, particularly since there have been state-by-state differences in the lengths of those extensions determined by the unemployment rate in the respective states. Now that these benefits have been extended, we argue that the likelihood of suicide would decrease at least in the short term since individuals would then have the ability to stabilize their consumption, and thus utility over time; furthermore, there may be other factors in addition to income that cause the upsurge in suicides during times of increased incidence and duration of unemployment that may not be offset by the extension of unemployment benefits alone. Another extension, with regard to the impact of factors influencing unemployment-related suicide, would be to examine the effects of the dominant culture, social support networks, public assistance programs, mean per capita income levels, and average education levels as they vary among the various states and/or standard metropolitan statistical areas. Still another extension would be to conduct a cost-benefit analysis comparing

the economic impact of the increase in such suicides and the public investment in various programs aimed at preventing or reducing them and/or mitigating their impact.

All we have measured are the “successful” suicides – not the attempts, and not the increased incidence of depression and desperation that our observed increase in suicide would suggest. Studying the effect of the business cycle on suicide informs us of its even more pervasive impact on the social and psychological well-being of society at large. As we learn more about the true extent of the economic and social costs of suicide (and of suicide attempts), it becomes increasingly important to identify those factors that increase its incidence and to devise public policies and programs to mitigate its negative effect on the economy.

Notes

1. Kposowa (2001), for example, found that unemployed men are more than twice as likely to commit suicide as employed, and among men, the lower the socio-economic status, the higher is the risk of suicide.
2. We do not model the labor/leisure choice here; this model concerns itself with utility levels derived from consumption after the income is received.
3. <http://bea.gov/briefrm/saving.htm>. These are the lowest and highest levels during this time period and not rates for the first quarter of 2005 and second of 2010, respectively.
4. www.cdc.gov/nchs/data_access/VitalStatsOnline.htm
5. www.research.stlouisfed.org/fred2/data/UNRATE.txt
6. This confirms earlier findings by Kposowa (2001) that, among women, the unemployed experience a suicide risk more than three times higher than those employed.
7. Cahill (2006), Clarke *et al.* (2002), Cosgrove *et al.* (2007), Petersen (1982), Etxebarria *et al.* (2009), and Baron-Cohen (2003), “The female brain is predominately hard-wired for empathy. The male brain is predominately hard-wired for understanding and building systems” (p. 1).

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