Economic Determinant of Suicide Rates: A County Level Analysis

By Cynthia Marie Roden
Faculty Advisor: Dr. Eugene Gotwalt

However great a man’s fear of life, suicide remains the courageous act, the clear-headed act of a mathematician. The suicide has judged by the laws of chance – so many odds against one that to live will be more miserable than to die. His sense of mathematics is greater than his sense of survival.

Graham Greene – English Novelist and Critic

I. Introduction

Suicide is most often discussed in psychological terms, but it is certainly not the only way view to such a social phenomenon. Ignoring any judgments regarding the morality of taking one’s life, quantitatively, suicide may be seen as a reasonable act. This study will not argue for, or against, the right to commit suicide, it will simply analyze empirical data regarding suicides in the context of economic theory.

Economists rely on the belief that everyone and everything acts in their best interest, they act to improve their current condition – they act rationally. So it follows that the concept of suicide should be no different. Nineteenth century philosopher Arthur Schopenhauer notes this idea of rational thought as it pertains to suicide, “…as soon as the terrors of life reach the point at which they outweigh the terrors of death, a man will put an end to his life.” The act of suicide is as simple, or as complicated, as that statement. A person chooses to end his or her life when the marginal benefit of another minute, hour, or day alive is less than the marginal cost of staying alive that same amount of time. Or, in another light, one commits suicide when the opportunity cost of life is greater than that of death. One finds it more favorable to forgo all future opportunities and experiences in lieu of ending the situation at hand.

This study looks at the relationship between the number of suicides per county and five independent variables: per capita income, percent of the population over the age of sixty-five, population density, population growth, and transfer payments. Data is collected from the year 2005, the most recent year for which all the required information
is available. Suicide rates should not vary much from year-to-year so even though the model uses data from 2005, it should still have validity in predicting suicide rates for other (close) years. All the data is publicly accessible, and this model will enable counties to predict the suicides in their respective communities, which of course, could serve a variety of purposes aimed at limiting the number of suicides that occur. Finding the variable which has the best ability to predict suicide within the model will also prove useful. With such information, sociologists and economists alike have the ability to expand upon the variable for future research that can only broaden the knowledge our society holds regarding this social phenomenon.

II. Background

The first notable person to look at suicide objectively was sociologist Emilie Durkheim. Whether or not one agrees with the validity of his findings, he remains one of the most famous names in the context of suicide research. Modern researchers use his studies for the basis of many empirical models of suicide (Hamermesh and Soss 1974). His research and ideas are responsible for inspiring sociologists, and more recently economists, to expand, re-examine, and recreate Durkheim’s original concepts regarding suicide and social integration (Chambliss 1966). In regards to Durkheim, this study will only acknowledge the relationship he believed to exist between different levels of social integration and suicide. Suicide is more prevalent in communities or societies with extremely high extremely low levels of integration (Johnson 1965).

One of the most influential studies of economics and suicide was done by Daniel Hamermesh and Neal Soss (1974). The conclusions of their study, An Economic Theory of Suicide, suggest that economic theory is able to help explain, or at least help predict, suicide. Hamermesh and Soss were able to successfully predict the relationships between suicide and age in addition to suicide and income using a mathematical model. Other popular studies, their variables, their sample sizes, and their results will be discussed.

In The Effects of Marital Dissolution on Suicide, Steven Stack (1980) examines adults from all 50 states during the year 1970. Stack uses all 50 states to ensure
randomness and avoid the problem of selectivity that has appeared in previous studies that only examine certain cities. Gregory S. Kowalski, Charles E. Faupel and Paul D. Starr (1987) also attempt to ensure the randomness of their data by examining 3,108 counties in the United States and the District of Columbia (equivalents of counties are used). Steven Stack (1978) uses a different focus group his study entitled *Suicide: A Comparative Analysis*. This time he chooses to examine data from forty-five nations to differ from the many previous studies that only consider one nation. In *Socioeconomic Development, Suicide and Religion: A Test of Durkeim’s Theory of Religion and Suicide*, Miles E. Simpson and George H. Conklin (1989) choose a more expansive cross-national population by including seventy-one different nations in their study. Simpson and Conklin choose to include Islamic nations in their study in order to add variables to their model that have not been used previously. *The Effect of Domestic/Religious Individualism on Suicide*, yet another study by Steven Stack (1985), uses U.S. data from the years 1954-1968.

*The Effects of Martial Dissolution on Suicide* (Stack 1980) uses multiple regression to test the predictive value of its variables. The rate of suicide (dependent variable) is obtained from the U.S. Public Health Service and is measured by the total suicides per 100,000 population. The incidence of divorce (independent variable) in a state is measured by the ratio of males fourteen years of age and older who are currently divorced. Long distance migration to a state if measured by the number of immigrants to a state between the years of 1965-1970 divided by the 1970 population of that particular state. Divorce and migration data are found in the U.S. Bureau of the Census 1973. Other independent variables used in this study include: age composition, state population above the age of sixty-five, cultural differences and income level.

*Urbanism and Suicide* (Kowalski, Faupel, & Starr 1987) names the incidence of suicide as its dependent variable and measures it by suicide deaths in 1974-76 divided by three and equated into suicides per 100,000 people. Suicide statistics are obtained from the National Center for Health Statistics. The U.S. Bureau of the Census 1978 provides the divorce rate (independent variable) per 100 people. The U.S. Bureau of the Census
also provides statistics for the percent of women in the labor force per 1,000 population. Religion, birth rate, percent of population living alone, net migration change, median age, sex ratio, median family income, income inequality (GINI), percent unemployment, occupational diversity, median education, education diversity, percent black, population size and percent living in urban area are also used as independent variables. Multiple regression is used to test these relationships.

The suicide rate is also the dependent variable in *Suicide: A Comparative Analysis* (Stack 1978) and it is measured by suicide per 100,000 population and is obtained from United Nations data. The female population in the labor force, the first independent variable, is measured by the female workers (defined by wage and salary workers) as a percent of all workers (defined by wage and salary workers. This data is obtained through a prior private study Russet et al. (1964). The rate of economic growth and level of industrialization are also part of this model as independent variables. Multiple regression is used to test these relationships.

In *Socioeconomic Development, Suicide and Religion* (Simpson & Conklin 1989), suicide is the first variable considered and its data is obtained from the World Bank and *Demographic Yearbook*. The rates of suicide have been substituted by estimates in some nations and this data is obtained through a collection of studies. The divorce rate is measured as the legal rate of divorce per 1,000 population and this information can be found in United Nations Data. Female employment is measured as the percent of females who are economically active, but the study does not list from where this data is obtained. Agricultural employment, affluence, schooling, urbanization, sex ratio, older population, Sub-Saharan Africa, Eastern Block and religious adherents compromise the remaining independent variables. Factor Analysis is used to test these relationships.

In *The Effect of Domestic/Religious Individualism on Suicide* (Stack 1985), suicide rate is used as the first variable in this Cochrane-Orcutt analysis (serial correlation). It is measured by the number of suicides per 100,000 population. These numbers are taken from Diggory (1972) and from the U.S. National Center for Health
Statistics. Mothers’ participation in the workforce is calculated by the ratio of mothers with children under six to all other workers and such data obtained through the U.S. Bureau of the Census. Divorce rate is measured by the number of divorces per 1,000 married females is also obtained through the U.S. Bureau of the Census. Religious individualism, economic anomie, presidential election years, and suggestion/imitation of *New York Times* suicide stories are the remaining variables.

*The Effects of Marital Dissolution on Suicide* (Stack 1980), *Urbanism and Suicide* (Kowalski, Faupel & Starr 1987), *Socioeconomic Development* (Simpson & Conklin 1989), *and The Effects of Domestic/Religious Individualism on Suicide* (Stack 1985) all find the divorce rate to be positively correlated with suicide. *Urbanism and Suicide* (Kowalski, Faupel & Starr 1987), *Suicide: A Comparative Analysis* (Stack 1978), and *Socioeconomic Development* (Simpson & Conklin 1989) also found the percent of females in the labor force to have a positive relationship with suicide. Statistics for the divorce rate were not available at a county level or a state level as many states do not have public records of their divorce rate. With the other variables used in this study being mainly economic and demographic, the absence of divorce rate statistics should not result in an issue of an underlying variable. Although used in older studies, this research will also omit the variable of percent women in the workforce. Many of the studies using these variables were done in previous decades, and gender equality and its implications are no longer issues.

**III. Data and Empirical Tests**

This study will examine suicides per county in relation to demographic and economic variables to construct a multiple regression model (Ordinary Least Squares). This regression model will predict the suicide rate using data from the year 2005. All counties did not provide the necessary information, so 1,095 U.S. Counties, independent cities, or county equivalents will be used in this study.

Dependent Variable – *Number of Suicides per County*
The number of suicides per county will be used as the dependent variable and not the suicide rate per county. This will help to limit slight errors that may result from converting real numbers into a potentially less accurate percentage.

Independent Variables
All variables come from publicly accessible data and are included for the reasons provided.

*Per capita income*
Per capita income is an important variable to this model. Many studies state the effect of economic prosperity (or lack thereof) on depression and suicide. In *The Effects of Marital Dissolution on Suicide*, Steven Stack (1980) notes that a higher per capita income is a sign that most people are able to meet all their financial demands. Studies also show that many signs of social pathology and low economic status are related (Horwitz 1984). From an economic standpoint one must also consider the concept of opportunity cost. Opportunity cost can be defined as all the future opportunities one gives up by making any type of choice. A poor person has less to lose (from a financial standpoint) then one that lives more comfortably. The person of lower means gives up less future income than a person of a more substantial financial situation. A person who makes less money has incentive to work fewer hours than one who makes more money due to the lower opportunity cost of leisure. Therefore, it is not inaccurate to predict that a poorer person may never have the incentive to increase hours and therefore binding oneself into a life of poverty – a depressing situation in itself. Thus, a negative relationship between per capita income and the number of suicides per county is expected. This dollar value of per capita income per county will be obtained from the *Bureau of Economic Analysis*. Data will be used for the year 2005.

*Percent of Population Over the Age of Sixty-Five*
The elderly population in general, can be characterized as a portion of the population more prone to depression than others. Factors such as deteriorating health, loss of friends and spouse, loneliness, loss of self-reliability, and a lack of social integration may increase chances of unhappiness. Prolific suicide researcher Steven Stack writes that
“The population aged over sixty-five is more apt to be marked by depression and higher rates of suicide—” (Stack 1980). In comparison to other age groups with good health, an abundance of friends, and a full family, the opportunity cost of death for an elderly person may be low. If one is dying and lonely he or she may not consider to be giving up much by forfeiting life. *Socioeconomic Development, Suicide and Religion: A Test of Durkheim’s Theory of Religion and Suicide* (Simpson & Conklin 1989) uses the percent of population over the age of sixty-five to “control for the known correlation of suicide with old age in Western nations.” To be congruent when the information obtained, the relationship between the percentage of the populated over the age of sixty-five and the number of suicides per county is predicted to be positive. As the elderly population increases in a county, so should the suicide rate. The 2005 population information will be obtained from the *Bureau of Economic Analysis* and the number of people per county over the age of sixty-five will be estimated by the Wonder database of the *Center for Disease Control*. The estimate of the population sixty-five and older for 2005 will be divided into the 2005 population for the percentage.

*Population Density*

Studies show that population density and suicide rates are correlated. Percent urban [population] was found to be a moderate, and significant, predictor of suicide in the study *Urbanism and Suicide* (Kowalski, Faupel & Starr 1987). High population densities may also result in negative externalities. Close living inevitably causes one’s actions to have an indirect effect on those around them. Many people in urban environments are exposed to pollution and high noise levels caused by others. High population densities are a natural part of urban environments—environments in which many people do not have the privacy or personal space they may desire. Therefore, the relationship between population density and suicide is predicted to be positive. As population density increases, so should the number of suicides. The study (Kowalski, Faupel & Starr 1987) also suggests that standard explanations of suicide are not relevant to rural areas. Rural communities have an undeniably different social network than other areas of the country. To make the most accurate model, only counties with population densities above ten people per square mile will be used in this study. The population per county for the year
2005 was found through the Bureau of Economic Analysis. The National Association of Counties was the source of each county’s square-mileage. Density was calculated by dividing population into square-miles.

**Population Growth**

Rapid growth may result in some level of social disorganization (Wechsler 1961) due to the disruption of the “norm” caused by new people and enterprises entering an area. High levels of growth assume a small population to begin with since it is quite difficult for a highly urban area to double its population in a few years (Wechsler 1961). Thus high population growth may indicate a change from moderately rural to urban causing culture changes that affect everything from friendships to the job market. Community growth is stressful on the current population as their habitat is changing, and to the new people who must build new lives in an environment foreign to them. Population growth caused by an increase of births will also have inevitable effects on the social dynamics of any given area. Population growth is obtained by calculating the growth of the population from the year 2000 to the year 2005 in every county. The relationship between population growth and suicide is predicted to be positive as higher growth rates indicate a more significant change in the area. Population information is obtained from the Bureau of Economic Analysis. The growth rate is calculated as the population (per county) 2005 minus the population (per county) 2000, with that sum being divided by the population (per county) 2000.

**Transfer Payments**

An easy way to predict suicide would be to assign each county a level of happiness. Unfortunately, happiness is an extremely subjective matter and is nearly impossible to measure on a individual basis, let alone on a community-wide level. It is well-known that financial problems are a general cause of depression, anxiety, and stress. A journal article entitled, The Economy and Social Pathology (Horwitz 1984), echoes this viewpoint. “The most common view of how the economy influences social pathology emphasizes the consequences of economic deprivation. This study will use transfer payments as a measure of hardship within counties. Transfer payments include: social security, food
stamps, disability, unemployment compensation, retirement benefits, veterans benefits, and Medicare/Medicaid. Thus one can say that the majority of transfer payments are given those that are assumed to have financial problems. (The word assumed is used to acknowledge that there are people who receive social security, and other transfer payments, that are not in need of financial assistance. It is near impossible however to weed out the amounts given to people who do not need the help). When using transfer payments as a measurement of hardship, or potential for depression and unhappiness, the relationship between suicide and transfer payments should be positive. A high level of adversity within a community should lead to high level of transfer payments given to the respective county. Dollar amount is the way in which the variable will be measured, and the data was obtained from the Bureau of Economic Analysis.

IV. Results

The data was run using the standard Ordinary Least Squares method of multiple regression. It was done on SPSS statistical software. The multiple regression results give the following equation using unstandardized betas:

\[ Y = 1.191 + .000\text{percap} + .000\text{transfer} - 33.734\text{percent65} - .002\text{density} + 38.663\text{population} \]

The standardized results show the independent variable transfer payments has the biggest effect at .913, meaning it predicts the majority of suicides that the model can account for. However, all five independent variables are significant so the remaining four variables are still important parts of the model. Four of the five independent variables have p-scores below .01 (99% confidence) and the independent variable percent65 has a p-score below .05 (95% confidence). The confidence level of 95% is standard in the field, meaning all the variables in this model are of statistical importance.

The R-square value represents the predictability of the model, or how much of the dependent variable, in this case, suicides per county, can be accounted for by the model. Thus, the R-square value of .835 means that the model can predict 83.5% of suicides in any given county. One should note that not all counties could be used and the majority of the missing counties come from the mid-west and western side of the county.
Variables
Per capita income $in thousands 
Beta / t-score

Transfer payments
Percent Population 65+
Population Density
Population Growth

*significant at 95%
**significant at 99%

Multiple Regression Results

R²  .835
N  1095
F-Score  1103.159
Durbin Watson Statistic  2.042

Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>suicides</td>
<td>1095</td>
<td>3.00000</td>
<td>698.00000</td>
<td>25.1954338</td>
<td>42.64084284</td>
</tr>
<tr>
<td>percap</td>
<td>1095</td>
<td>1755.00000</td>
<td>80580.00000</td>
<td>3.0333967E4</td>
<td>7.46449687E3</td>
</tr>
<tr>
<td>transfer</td>
<td>1095</td>
<td>67400.00000</td>
<td>5.03378E7</td>
<td>1.1396931E6</td>
<td>2.39182760E6</td>
</tr>
<tr>
<td>percentsixtyfive</td>
<td>1095</td>
<td>.03131</td>
<td>.32734</td>
<td>.1331680</td>
<td>.03483050</td>
</tr>
<tr>
<td>density</td>
<td>1095</td>
<td>10.67093</td>
<td>15988.53191</td>
<td>454.2236000</td>
<td>1.12246395E3</td>
</tr>
<tr>
<td>popgrowth</td>
<td>1095</td>
<td>-.08983</td>
<td>.49190</td>
<td>.0516705</td>
<td>.07421667</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>1095</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Thus the randomness of the sample size is less than ideal and the R-square cannot be completely accurate. The Durbin-Watson Statistic poses no problems as the number is extremely close to two (the number that indicates no serial correlation within a model). The F-score is well above 1,000 meaning the confidence in the entire equation is quite high. Descriptive statistics are also given.

Some of the results obtained from the multiple regression were unexpected. When considering the positive sign of the relationship between per capita income and suicide, the reasoning behind the original argument must be reconsidered. Instead of considering the difference in opportunity cost between a wealthy and poor person, perhaps the concept of marginal benefit versus marginal cost should be used. The marginal benefit of committing suicide when you earn more income may be higher than the marginal cost because the remaining family members (if in existence) have the benefit of the assets and life insurance associated with the death of a wealthier citizen. In terms of marginal benefit and cost, one should also consider the stress involved in some of the country’s highest paying jobs. In a study entitled *Occupation, Status and Suicide*, Elwin Powell (1958) finds that pharmacists, physicians, and lawyers all have higher than average suicide rates.

The positive relationship between the sixty-five and older population and suicide is another surprising one. When looking at an elderly person on an individual level compared to a person of younger age, the elderly person probably faces greater potential for depression. Through the results of this model, however, it is clear that the relationship does not hold when considering elderly population in whole. Communities with a high percent of persons aged sixty-five and older may have one or more nursing homes or housing communities for retired persons. In such cases, perhaps the abundance of other elderly people in the area is a positive externality for other elderly people. Friendship and social integration is more likely to occur amongst people of similar ages. Neighbors in such communities may serve as inspiration for others who struggle.
The most unexpected relationship is the negative one between suicide and population density. The concept of positive externalities must again be considered. In opposition to an earlier hypothesis, it appears that population density provides positive, not negative externalities. The lack of excessive personal space and privacy may benefit those struggling as it may be difficult for their unhappiness to go unnoticed in a dense community. People living in urban communities may have easy access to mental health services, hospitalization, and social services.

V. Summary

This study confirms that per capita income, transfer payments, population growth, population density, and the percent of the population over the age of sixty-five are all related to the suicide rate at a county level. Although the amount of transfer payments per county has a large effect size, all the variables are important inclusions in the model since they are all significant. The positive relationship between community growth and suicide was confirmed, as was the positive relationship between transfer payments and suicide. The other three independent variables had surprising results which may inspire others to do more specific research determining why the relationships may exist.

This research can be applied to a number of different factions. This study is yet another example of how economics can be used to explain social phenomena. If suicide rates can be rationalized (at least in some ways) by economic thought, think of all the other applications for economic thought within the social sciences. Fresh perspective on ideas from the sociology, anthropology, and psychology fields may help better the understanding we have on the individual and the community. This research may also have a direct effect on suicide prevention programs. If suicide rates can be easily, and rather accurately, estimated using publicly accessible data, counties may be able to determine if their community is a high-risk area. The high-effect size of transfer payments on the suicide may also be useful information. If future research can determine which transfer payment have the highest relationship with suicide, mental health services can be made available to those receiving those transfer payments.
There are a number of different ways in which the data found in this study can be explored. The first and most obvious use of this data, as mentioned above, is to determine which transfer payments, or which type of transfer payments, are causing the effect on the suicide rate. Transfer payments given to the elderly do not appear to be the variables causing the effect since the percent sixty-five and older variables has a negative relationship with suicide. This leaves transfer payments for the disabled, unemployed, and the poor open for continued research. A mathematical model using certain types of transfer payment may be another interesting way to analyze suicide data. Other options for future research include comparisons of different areas of the United States or comparisons between the female and male suicide rates using the same variables.

*There is but one truly serious philosophical problem and that is suicide. Judging whether life is or is not worth living amounts to answering the fundamental question of philosophy.*

-Albert Camus
Works Cited


Horwitz, Allan V. “The Economy and Social Pathology.” Annual Review of Sociology Vol. 10 1984:95-119 JSTOR


