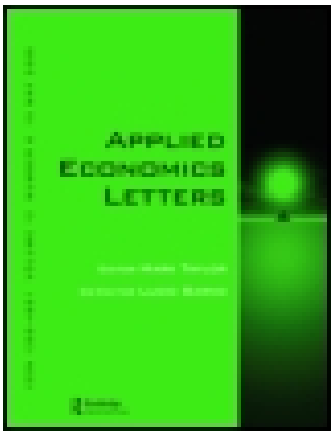

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Conceptualizing suicide in economic models

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This review illustrates how a variety of economic models can be applied to suicidal behaviour, including a cost-benefit analysis, a demand-supply model, a labour force participation analogy, signalling game theory, investment under uncertainty, and economic definitions of irrationality.

I. INTRODUCTION

The similarity between the analysis of some issues in economics and related issues in psychology has often been noted. For example, Lea (1978) has noted that both economics and psychology are concerned with choices, and some of the basic assumptions of theories of choice are common to both disciplines.

In particular, Lea noted that analogies exist between the paradigm of operant conditioning in psychology and demand analysis in economics. Economists call the function that relates the quantity of a commodity that is bought by a consumer to the price of the commodity the demand curve. Lea argued that the number of reinforcements obtained in operant conditioning is equivalent to the 'quantity bought' by a subject. The schedule of reinforcement is equivalent to the 'price'. The schedule of reinforcement may be fixed interval or fixed ratio, and the variation in the size of the schedule (which interval or what ratio) parallels the price.

One trend in economics initiated a few decades ago is to apply economic theory to non-economic problems. This trend was given its greatest impetus by Gary Becker who applied an economic approach to topics not traditionally considered by economists, such as racial discrimination, crime and punishment, fertility and marriage (Becker, 1971, 1973, 1976, 1981), and recently he has applied optimal control theory to addictive behaviour (Becker and Murphy, 1988).

Crime and punishment captured the interest of many economists following Becker's (1968) early paper. Ehrlich (1975) used econometric techniques to explore the deterrent effect of capital punishment, concluding that executions were associated with a reduced murder rate in the USA. Several economists responded, either to support Ehrlich's conclusion or to criticize it (for example Yunker, 1976). Later, a cost–benefit analysis was applied to capital punishment, treating criminal activities as rational and calculated behaviour (Palmer, 1977; Yeh, 1987), while a demand–supply framework was applied to legislative and judiciary decisions in order to predict the execution rate (Yang and Lester, 1988).

This trend continues today as reflected by publications in some economics journals (Yang and Lester, 1995). The range of topics to which economic models are applied is expanding, and a recent issue of *Economic Inquiry* contained analyses of the passage of state abortion legislation (Conway and Butler, 1992), the impact of seat belt use on driving behaviour (Singh and Thayer, 1992), and the regulation of opiates in America in 1912 (Michaels, 1992), all using economic models. Fashion (Coelho and McClure, 1993), altruism (Lord and Rangazas, 1993), and college football (Brown, 1993) were addressed by articles in *Economic Inquiry* in the following year, and a cost–benefit analysis of banning abortion appeared in *Economics and Philosophy* (Nelson, 1993).

The present paper reviews several recent analyses of suicidal behaviour which continue the growing tradition of applying economic models to non-economic behaviour. Section II describes a cost–benefit analysis and a demand-supply analysis of suicidal behaviour, with implications for preventing suicide. Section III shows how a labour force participation perspective can be applied to suicide by treating suicide as a withdrawal from the 'life market'. Section IV explores economic approaches to the issue of whether suicide is rational or irrational, while Section V describes an approach to suicidal behaviour which views it as a signalling game. In Section VI, suicide is construed as an investment under uncertainty, and Section VII draws conclusions from these analyses.

II. AN ECONOMIC MODEL FOR SUICIDE

In most economic models for suicide, committing suicide is considered to be a rational act. An individual is acting 'rationally' if, given a choice between various alternatives, he or she

selects what seems to be the most desirable or least undesirable alternative. Thus, from this perspective, suicide can be a rational act. None the less, economists do not judge whether suicide is wrong, immoral or a deviant act.

Costs and benefits

Applying traditional economic marginal analysis to suicidal behaviour, Yeh and Lester (1987) suggested that the decision to commit suicide depends upon the benefits and costs associated with suicide. An individual will be less likely to commit suicide if the benefits from suicide decrease, the costs of suicide increase, the costs of alternative actions decrease, or the benefits from alternative activities increase.

The benefits from suicide include escape from physical or psychological pain (as in the suicide of someone dying from terminal cancer), the anticipation of the impact of the suicide's death on other people (as in someone who hopes to make the survivors feel guilty), or restoring one's public image (as in the suicide of Antigone in Sophocles's play of the same name). In addition, the act itself may be enjoyable. Those who self-injure themselves by cutting their wrists sometimes report that the act of cutting relieves built-up tension and that they feel no pain.

There are several costs in commiting suicide. These include the money and effort spent in obtaining the information and equipment needed for the act of suicide, the pain involved in preparing to kill oneself and in the process of committing suicide, the expected loss as a result of committing suicide such as the expected punishment predicted by most of the major religions of the world, and the opportunity costs (that is, the net gain to be expected if other alternative activities were chosen and life continued).

From this perspective, an individual will engage in suicidal behaviour only if its benefits are greater than all of the costs mentioned above. Therefore, our economic model would suggest that suicide could be prevented by increasing its costs or by decreasing its benefits.

A demand and supply analysis of suicide

Let us assume that suicide is a commodity or service that we purchase. It is obvious that suicide is very different from the typical objects that we purchase. For example, when we buy an object, we pay a specific price to obtain it and then we enjoy it. Suicide results in death, and as a result we have to conceptualize our enjoyment of it quite differently.[1]

Looking at matters from a demand-side perspective, when we purchase a commodity (or a service), the price we pay for the commodity (or service) reflects the benefits we expect to receive from consuming that commodity. From a demand-side perspective, beef costs more than chicken because the public desires beef more, and their stronger desire for beef reflects their expectation of greater satisfaction from eating beef than from eating chicken.

In the demand-side analysis of suicide, the notion of its 'price' is different from the ordinary price of a commodity. The benefit expected by a suicide is the relief of tremendous distress. Accordingly, we must use a scale of distress to measure the benefit expected by the suicidal individual. This benefit expected by the suicidal individual is reflected in the price he must pay for his suicide.

Accordingly, the demand curve is a relationship indicating the probability of committing suicide as a function of the amount of distress felt by the individual. As the amount of distress increases, the probability of committing suicide increases. The demand for suicide is, therefore, an upward sloping curve, which is quite different from the typical downward sloping demand curve found in most economic analyses.

On the supply side, the probability of committing suicide is related to the cost of committing suicide. The cost of committing suicide includes the cost of losing your life, collecting information about how to commit the act, purchasing the means for suicide, etc. While the latter two items have a clear-cut scale of measurement, the cost of losing life is much harder to measure. It includes at least three components, namely, the psychological fear of death, the loss of income over the future which otherwise would have been earned by the suicide, and the loss of any enjoyment that would be experienced during the rest of your 'normal' life.

The higher the cost of committing suicide, the lower the probability that an individual would actually commit suicide. Therefore, the supply curve should be a downward sloping curve.

It is important in such a demand-supply analysis of suicide to convert the psychological variables (level of distress and future pleasure) into measures comparable to monetary units, so that an equilibrium can be obtained through equating the demand and supply for suicide. One way to measure the level of distress is to operationalize it as the cost of the psychological services required to eliminate the distress that the suicidal person is experiencing. Since there is a typical price for psychological services, each level of distress could be converted into a monetary measure representing the cost of psychological services needed to eliminate the distress. This is complicated by the fact that psychological services are not always effective. Some people do not benefit from treatment. This could be taken into account by incorporating the probability of success of the treatment into the calculations, as a multiplier of the cost of treatment. Converting future pleasure from life into monetary units is more difficult. One alternative could be to convert all of the components of the cost into subjective units, based on the ratings given by representative members of society.

1 Suicide is somewhat similar to the purchasing of health care services. In both, we pay a price to get rid of something, life in the case of suicide and sickness in the case of health care. Yet there is a basic difference between suicide and health care in that suicide leads to death while it is hoped that health care leads to further life. Of course, for those who believe that there will be a 'life-after-death', suicide also leads to further life, but of a different kind.

Instability of suicidal behaviour

By definition, the equilibrium of committing suicide is determined by the intersection of the supply and demand curves. Due to the peculiar nature of the demand and supply of suicide, the equilibrium so obtained is not a stable one.

Since the demand for suicide is an upward sloping line, the higher the distress level, the higher the probability of committing suicide. Since the supply curve is downward sloping, the higher the cost of committing suicide, the lower the probability of committing suicide. Let us label the equilibrium level of distress and the cost of committing suicide S_E and the corresponding equilibrium probability P_E.

Let us examine the implications of these supply and demand curves. If the probability of committing suicide is initially at P_1, which is lower than the equilibrium probability P_E, this corresponds to a low level of distress from the demand-side perspective and a high cost of committing suicide from the supply-side perspective. As a result, the situation will lead to an even lower probability of committing suicide, and the individual will eventually withdraw from the suicidal situation.

On the other hand, if the probability of committing suicide initially is higher than the equilibrium probability P_E, say at P_2, this corresponds to a high level of distress from the demand-side perspective and a low cost of committing suicide from a supply-side perspective. Thus, this situation will lead to an even higher probability of committing suicide.

Both situations, whether the initial probability of committing suicide is higher or lower than the equilibrium, result in movement away from the equilibrium. If the initial probability of committing suicide is lower than the equilibrium, then the individual becomes less likely to commit suicide; while if the initial probability of committing suicide is higher than the equilibrium the individual becomes more likely to commit suicide. In short, this economic model of suicide implies that suicidal behaviour is an unstable behaviour.

An unstable equilibrium necessitates outside intervention. This implies that suicidal behaviour also requires outside intervention. Therefore, this economic interpretation of suicidal behaviour provides justification for outside intervention, such as suicide prevention and crisis intervention services, especially when available at an early stage in the development of the suicidal crisis when the probability of suicide is lower than the equilibrium level.

Factors behind the supply and demand for suicide

Yeh and Lester (1987) examined some of the factors which contributed to the decision to commit suicide based on a review of the literature of suicide by Lester (1983). They noted that most of the factors, such as psychiatric disturbance, gender and age, and dysfunctional families of origin, are reasonably stable characteristics. Thus, once the demand curve is formed, it will remain quite stable over time. Sudden shifts in the demand curve might be caused by events such as sudden deaths of significant others, illness or work difficulties, but the extent of the shifts in the demand curve as a result of these factors may be quite limited.

III. LABOUR-FORCE ANALOGIES

Huang (1991) applied economic analyses of the decision to enter and leave the labour market to suicidal behaviour conceptualized as a decision to enter or leave the 'life market'. The decision to leave the life market will be based on maximizing utility. The utility, according to Huang, will encompass more than income, including as well as dimensions of the worth or value of life, such as love, health, fame, beauty, fun, adventure, prestige, respect, security, etc. This life income has to be earned, and it is a struggle to gain some of these rewards. Obtaining them requires a great deal of hard 'labour' (L).

The opposite of work is leisure, rest and relaxation (R). Leisure entails letting go of pressure and responsibility. The maximum manifestation of leisure is complete and permanent rest – death. Labour measures the extent of effort and resolve to live while leisure measures its lack. The expected wage of market rate (W) is the perceived opportunity of ability to earn life income for a unit of life effort.

Two solutions are possible. Most people will choose an interior solution, choosing to live with a varying amount of effort. Some will be unable to find an interior solution, and they may choose to drop out of the life market, that is, commit suicide, analogously to discouraged workers dropping out of the labour market.

People will decide to drop out of the life market if the perceived obtainable wage in the life market falls short of some minimally acceptable level, perhaps as a result of a terminal disease, recurring depressions, business fiascos, public humiliation, etc. Less probably, the decision to committ suicide can also be caused by an increase in the reservation wage. For an individual wealthy in the sense of life, he or she may need more to keep life interesting and challenging. Having so much of everything, his utility from life diminishes and he may become tired of life. Given a much higher reservation wage than the average person, and without a matched increase in perceived wage, the individual may find the corner solution desirable and choose to commit suicide.

Huang noted that, in this perspective, suicide is not irrational. However, suicide may not be the correct solution, especially because of the uncertainty of the future. Life market information is always incomplete and imperfect. In the model W was the *perceived* expected wage from living, and the individual's perception may be erroneous.

IV. ECONOMIC DEFINITIONS OF IRRATIONALITY

Economists define rational behaviour as maximizing some variable such as utility of profit. Becker (1962) defined two types of irrational behaviour: (1) random, erratic and whimsical choices and (2) perseverative choices in which the person chooses what he or she has always chosen in the past. Lester and Yang (1991) argued that these two types of irrational behaviour paralleled the major typology of suicidal behaviour

in which suicidal behaviour is seen as a time-limited impulsive crisis or as a chronic maladaptive pattern.

Becker and Murphy (1988) have recently proposed a rational model for addictive behaviours in which they view addicts as rational optimizers, exhibiting consistent, forward-looking and individually optimal behaviour. They have accurate perceptions of the trade off between present benefits and future costs, and they are capable of making rational decisions based on these perceptions. A model for suicide might be based on such principles.

More recently, Fehr and Zych (1994) have proposed a theory of addictive behaviour which they have called irrationally myopic, in which people are assumed to base their decisions on the benefits which accrue immediately rather than on the costs which accrue over a longer period of time.

V. SUICIDE ATTEMPTS AS SIGNALLING GAMES

Rosenthal (1993) focused on suicide attempts which have chances of either success or failure (that is, suicide attempts of moderate to severe severity, where the individual is 'gambling' with the outcome). He suggested that the suicide attempt can be seen as a signal intended to manipulate the receiver's behaviour in a way favourable to the sender. In this respect, it resembles a game.

In this perspective, the sender may be either depressed or normal, and it is assumed that the players know the respective probabilities of these two possibilities. The sender knows his type while the receiver does not. The sender chooses an attempt (signal) strength (which determines whether he or she survives). The receiver then chooses a sympathetic or unsympathetic response. The receiver would prefer to respond sympathetically to a depressed sender and unsympathetically to a normal sender. Both types of sender would prefer a sympathetic response, but the preference is stronger in the depressed sender.

Rosenthal then examined Nash-equilibrium solutions, with the Cho–Kreps refinement and the Grossman–Perry refinement. His analysis suggested two hypotheses. First, gambling-type suicidal behaviour would be less common if the suicidal individual strongly demanded a sympathetic response. Second, if the receiver is very likely to give a sympathetic response, then depressed senders are less likely to engage in gambling-type suicidal behaviour.

VI. SUICIDE AS INVESTMENT UNDER UNCERTAINTY

Dixit and Pindyck (1994) examined the nature of investment under conditions of uncertainty. Although their book focused on the investment decisions of firms, they noted that other decisions are made with the same conditions as investments: the decision is irreversible, there is uncertainty over the future rewards of the decision, and there is some leeway over the timing of the decision.

Dixit and Pindyck noted that suicide fits these criteria. They noted that Hamermesh and Soss (1974) had argued that an individual will commit suicide when the expected value of the utility of the rest of his or her life falls short of some benchmark (or down to zero). Dixit and Pindyck argued that Hamermesh and Soss failed to consider the option of staying alive. Suicide is irreversible, and the future is quite uncertain. Therefore, the option of waiting to see if the situation improves should be a likely choice. Even if the expected direction of life is downward, there may still be some non-zero positive probability that it will improve.

Dixit and Pindyck speculated that suicides project the bleak present into an equally bleak future. They ignore the uncertainty of the future and the option value of life. In this respect, Dixit and Pindyck saw suicides as irrational.

They argued that religious and moral proscriptions against suicide compensate to some extent for this failure of rationality. These proscriptions raise the perceived cost of suicide and lower the threshold of the quality of life that precipitates suicide.

VII. DISCUSSION

Our aim here has been to show that economic models can be applied to suicidal behaviour and, sometimes, lead to interesting conclusions about the nature of suicide. In particular, economic models have much to say about the rationality or irrationality of suicide, proposing a variety of criteria on which to make such judgements.

These perspectives also have implications for the prevention of suicide. For example, it was noted that a simple application of an economic demand and supply model to suicidal behaviour provided a justification for particular strategies for suicide prevention, such as the establishment of suicide prevention services. Rosenthal's signalling game analogy also has implications for suicide prevention. If the receiver is likely to give a sympathetic response, then depressed senders are less likely to engage in gambling-type suicidal behaviour. Thus, friends and relatives of potentially suicidal individuals should be encouraged to give sympathetic responses, and many suicide education programs given to high school students train the students to respond in sympathetic ways to their suicidal peers (Leenaars and Wenckstern, 1991).

In the investment under uncertainty perspective, suicidal people extrapolate from a grim present to the future, and ignore the uncertainty of the future. Thus, counselling techniques which challenge this pessimistic point of view and reduce the hopelessness of the individual should prove effective (Lester, 1991).

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