Valuing a statistical life

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Valuing a statistical life!

- Q Imagine you are minister for health and you are told that you can implement a new screening programme for a certain type of cancer. The cost of the screening programme is 500 million annually but it will save 25 lives annually. Do you go ahead with the programme?

- Consider a highway upgrade project that is expected to reduce traffic deaths on the corridor from 4 per 100,000 trips to 3 per 100,000 trips. There are an estimated 1 million trips per year, and the estimated cost of the infrastructure project is 50 million per year.

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- How do we decide whether we should go ahead with the screening programme or the highway project?

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  - we need some way to value those lives saved?

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- The long history of government risk policies ranges from the draining of swamps in ancient Rome to suppress Malaria to limits on air pollution in developed countries over the last 40 years

- All such policy choices ultimately involve a balancing of additional risk reduction and incremental costs

- The benefit is the value of the **reduced probability of death** that is experienced by the affected population, **not the value of the lives** that have been saved ex post

Cost benefit analysis

- **Often benefits from environmental interventions relate to lives saved (e.g. air and water pollution)**
- CBA is fundamental to government decision making and can be an effective tool for making informed decisions on the use of society's scarce resources
- Often Cost Benefit analysis involves the evaluation of a wide range of health, transportation and environmental public projects that impose costs on society in exchange for the reduction in fatality risk
- **We will examine how economists can value a statistical life (death averted) in the cost-benefit calculus?**

Valuing a Human life! – Human Capital Approach

Value of life = present value of lifetime earnings

Represents productivity gains from extending life (benefit side)

or

productivity losses from early death (cost side)

For society as a whole, represents a loss in national output due to mortality

Problems with human capital approach?

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- Human capital approach not a good method for obtaining monetary values for lives saved as a result of changes in public policy

- Economists have instead looked at situations where people make choices that involve **a trade-off between money and risk of death**.

  - valuing a statistical life

- The word 'statistical' implies that the valuation of a statistical life is concerned with the valuation of changes in the level of risk exposure rather than valuation of the life of a specific individual!

Valuing a statistical life

- 1. Stated preferences
- 2. Observed behaviour (revealed preferences)

Valuing a statistical life: Stated preferences for reductions in the probability of death

- Posing **hypothetical** interview questions (stated preferences) to ascertain the willingness to pay amount has been a frequent survey technique in the literature on the value of life

  - trade-offs between money and the risk of death

- Scenario presented to respondents can be tailored to specific environmental risks (e.g. pesticide residues or air pollution) and causes of death (e.g. cancer or heart disease).

- Disadvantage is their hypothetical nature.
- Advantage is their flexibility

Valuing a statistical life: Stated preferences for reductions in the risk of death

- Suppose by attending this lecture you have exposed yourself to a rare fatal disease. If you contract the disease you will die a quick and painless death sometime next week. The chance you will get the disease is 1 in 1,000. Good news is we have a single dose of an antidote for this disease that we will sell to the highest bidder. If you take this antidote the risk of dying form the disease goes to zero. What is the most you would be willing to pay for this antidote?

Stated preferences for reductions in the risk of death – see VLE for full paper

FIGURE 1
Example of a Choice Question

If you had to choose, would you prefer Alternative A or Alternative B?

	Alternative A **Constant annual risk reduction**	**Alternative B** **Constant annual risk reduction**
Reduced risk for fatal	Heart attack	Cancer
Risk reduction each year:	reduced each year by:	reduced each year by:
For the next 10 years	1 in 10,000	2 in 10,000
11 years from now and onward	1 in 10,000	2 in 10,000
Your current risks	Click here to view Table 1	
Additional costs you pay each year starting now	$100	$300
Which do you prefer?	A ☐	B ☐

Valuing a statistical life – **Revealed preferences** (hedonic pricing)

- Evidence from actual decisions that people make (observed behavior) is potentially more informative than tradeoffs based on hypothetical situations (e.g. stated preferences) if suitable market data exists.

- The risks to them are real so that they do not have to engage in the thought experiment of imagining that they face a risk.

- Valuing a statistical life is based on estimating a person's willingness to pay for small reductions in the probability of dying through observable market choices

- **Can you think of any examples where you make these income/risk trade offs?**

- A person's willingness to pay is expressed through choices such as wearing or not wearing a seat belt, installing carbon monoxide and/or smoke detectors, **choosing to work in an occupation with a relatively high/low chance of an accident/death** and choosing to engage in unhealthy behaviors such as smoking or excessive drinking

Valuing a statistical life – hedonic pricing

- If for example someone chooses to work in an occupation with a one in hundred chance of death in return for an extra £20,000 in income then this implies a life valuation of 100(£20,000) = £2 million

- Or it someone is willing to spend an extra £500 for car safety features that reduces the chances of a fatal accident by 1 in 10,000 then he or she is setting an implicit value of £500(10,000) = £5 million on his or her life

- **Basic idea is that consumers make choices/trade offs every day where they trade off income for reductions in the probability of dying**

Valuing a statistical life

- Labour data has been the most used approach – e.g. valuing mortality risk by estimating compensating differentials for on the job risk exposure in labor markets

Hedonic wage method

- A job consists of a bundle of attributes, including hours of work, responsibilities, wage, holidays and **risk**

- **All things being equal,** two jobs that require the same skill level but have different occupational risks will pay different wages

- We can thus use labour market data on wages and job characteristics to estimate people's own willingness to accept rs

Valuing a statistical life – hedonic wage approach

- This economic approach requires estimating the rate at which an individual would trade monetary wealth for a small change in the chance of dying

- Basic intuition : Wages rise with risk, other things being equal. → There will be compensating wage differentials for job characteristics that are viewed as undesirable by workers.

The predicted outcome of the compensating wage differential theory of job choice is not that employees working under "bad" conditions receive more than those working in "good" conditions. The prediction is that, **holding worker characteristics constant**, employees in bad jobs receive higher wages than those working under more pleasant conditions.

Valuing a statistical life

- Working as a coal miner is more risky than working as an investment banker, but investment bankers get paid more.

- One must examine the tradeoff between wages and risks, holding constant all other factors that influence pay.

  any ideas how?

Value of a statistical life

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  any ideas how?

- Use statistical models such as regression analysis to disentangle the wage-risk tradeoff from the other factors that affect wages – i.e. control for differences in productivity as well as different quality components of the job

Value of a statistical life

- Imagine a dataset with observations on workers, their annual Earnings, worker characteristics, job characteristics, including the risk of dying on the job in that worker's industry.

$$\text{Earnings}_i = \beta_0 + \beta_1(\text{Education}_i) + \beta_1(\text{Experience}_i) + \beta_2(\text{Management Position}_i) + \beta_3(\text{Fatality Risk}_j) + \ldots\ldots \beta n .. \varepsilon_{ij}$$

- $\beta_3(\text{Fatality Risk}_{j)}$ is a measure of the incremental contribution of the risk characteristics of the job per se to the income obtained, holding constant other factors – in other words how much additional income individuals need to accept a greater risk of injury/death

- Labor market data from the U.S. typically finds a VSL $5m to $11m

- How could we use the same approach but using prices paid for automobiles as an example?

Valuing a statistical life

- In most policy problems, the lives saved (or not saved) as a consequence of a policy decision are not ex ante specific lives; that is, before the fact, the lives saved (or not saved) are anonymous. These are statistical lives.

- For example, consider a highway upgrade project that is expected to reduce traffic deaths on the corridor from 4 per 100,000 trips to 3 per 100,000 trips. If there are 1 million trips per year, then on average the upgrade will save 10 people per year. These are statistical lives in the sense that **the lives saved are not identifiable individuals**.

Value of a statistical life

- Even if CBA is not explicit, any decision, public or private, reveals a cost-benefit calculus consistent with the observed choice

- Raising the maximum speed limit from 55 to 65 increased travel speed by about 2 mph (people often exceed posted speed) ⇗ saving 45 million hours travel time per year, and inducing about 360 deaths per year.

  Our collective decision to drive faster infers that 45 million hours of travel time is worth more that 360 deaths.

  Our decisions lead to changes in benefits and costs regardless of whether we make them explicit.

  Example: Ashenfelter, Orley and Michael Greenstone, "Using Mandated Speed Limits to Measure the Value of a Statistical Life," National Bureau of Economic Research Working Paper w9094, August 2002 (http:www.nber.org/papers/w9094)

Valuing a statistical life

- Clearly these kinds of estimate cannot capture the full value of life as few of us would be prepared to die for say £5 million.

- Rather it indicates the value of what economists call a statistical life based on **demonstrated willingness to pay to avoid risks to life**

- We might object to having the value of our life's expressed in economic terms but what is the alternative?

  - Set the value of life at zero or make in infinite?

- Dilemma cannot be solved by economists alone as it involves political and ethical judgements as well

Valuing a statistical life

The value of human life

- There are enormous ethical difficulties associated with placing a value on a human life.
- Indeed, some would argue that it is "immoral" to place a value on a life even in the abstract, and that no attempt should be made to calculate dollar values.
- This moralist perspective provides no guidance to decision-making since many policy decisions do involve an implicit (and sometimes explicit) trade-off between devoting resources to saving lives and devoting those resources to some other use (such as education).
- How do we assess the benefits of air quality regulations? Main benefit is lives saved but main cost is surrounding economic growth – how do we assess these competing alternatives?
- In other instances (as with the allocation of health care resources) the tradeoff is between one type of life and another. For example, oncology treatments versus AIDS medication.
- To ignore the reality of these tradeoffs due to moral sensitivities is a bad way to make policy. Good policy must recognize these inevitable tradeoffs and attempt to assess relative values. In other words, it is a tough decision, but someone has to make it!

Valuing of a statistical life

- https://www.youtube.com/watch?v=VdyKAIhLdNs

- See VLE for some reading material