



# Cost-Benefit Analysis

How it works, and when it doesn't work

# Cost-Benefit Analysis

- Economists and logicians have developed a method for making “rational decisions” when we’re uncertain of what consequences will follow each possible action.
- It’s called *cost-benefit analysis*.
- The basic rule is to choose the action that has the greatest “expected utility”.

# Certainty isn't needed for action

- One key feature of CBA is that it can be rational to act on a belief, *even if the belief is uncertain*.
- E.g. the first explicit cost-benefit analysis was “Pascal’s wager”.
  - Pascal argued that people should “bet on” God existing (i.e. go to confession, mass, etc.) if there’s **even a small probability** that God exists.
  - Such a bet will reap an infinite reward if God exists, but cost almost nothing if God doesn’t exist, so the ‘expected’ (average) gain is +infinity.

# Certainty isn't needed for action



# CBA measures trade-offs

- Most policies have potential benefits but also potential costs.
  - Or, they will benefit *some* people in society at the expense of others.
- These costs and benefits have to be compared (“traded off”) against each other, so see whether there is a net gain.
- CBA does this.

“There are no solutions, only trade-offs”



# CBA vs. Appeal to Pity

- In some cases a cost-benefit analysis says that the best option is to do **nothing**, yet it is hard for (e.g.) governments to do nothing.

“Misfortune, tragedy and loss sit at the heart of many risk debates and government can be overwhelmed by the need to respond sympathetically and try to make things better. This frequently clouds the process of choosing the best response and can make the option of “no action” appear both uncaring and irresponsible.”

Better Regulation Commission (2006), p. 11.

# **Safety First?**

**Mike Rowe,  
host of TV show "Dirty Jobs"**



# What does “safety first” even *mean*?

## 1. Safety **overrides** all other goals?

- In that case, a slight safety increase (e.g. a few seconds of life expectancy) would outweigh huge cost increases, huge reductions in productivity, etc.

# “If it saves one life”



# What does “safety first” even *mean*?

## 1. Safety **overrides** all other goals?

- In that case, a slight safety increase (e.g. a few seconds of life expectancy) would outweigh huge cost increases, huge reductions in productivity, etc.

## 2. We maximise a function that combines safety with other objectives, but **safety has the largest weight** in this function?

- Meaningless, as safety isn't measured in the same units as the other objectives.
- (Answer: “Safety first” means **nothing at all.**)

# What does “safety first” even *mean*?

- Even though “Safety is #1” means nothing, we can still assign a high value to human life and health.
- E.g. when making trade-offs between improving safety and saving money, we can assign a high “value of a life year” (VOLY), or the “value of a statistical life” (VSL).

# Measuring lives in dollars

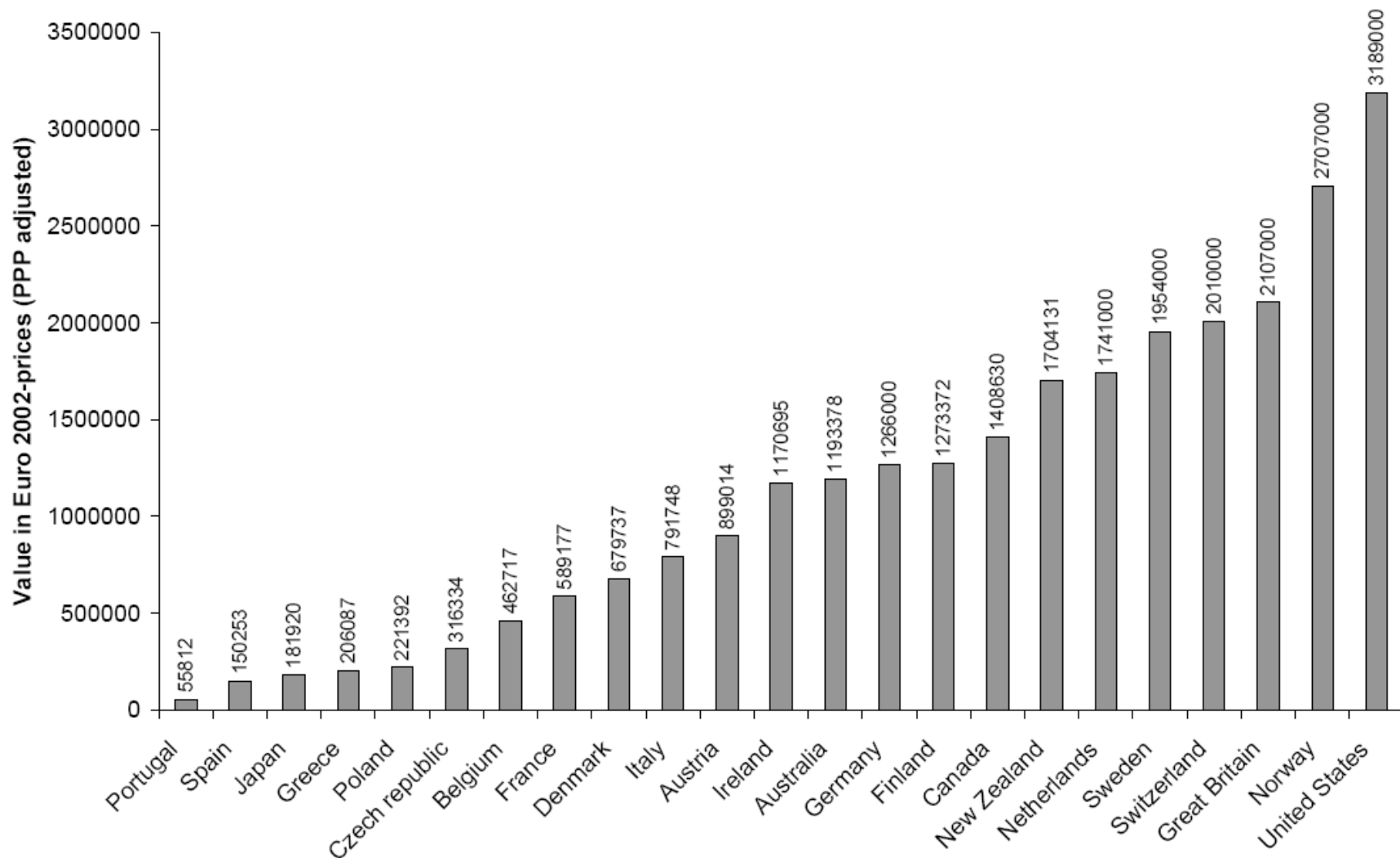
“Some people find the very idea of assigning a monetary value to lifesaving or to quality of life, which is an essential element of cost-benefit analysis, meaningless and ethically wrong. Human life, it is argued, is not a commodity that can be traded against other goods. It should therefore not carry a price tag.”

European Road Safety Observatory (2006) Cost-benefit analysis, retrieved January 18, 2008 from [www.erso.eu](http://www.erso.eu)

# Your life is worth €1,408,630

- However, such measures of the value of human life are *needed*, in order to decide how much money to spend on safety (e.g. road improvements) as opposed to other goods (e.g. education, the arts).
- The ‘value of a statistical life’ (VSL) actually varies enormously from one country to another, even among rich countries.

*Official monetary valuation of a road accident fatality in selected countries. Euro in 2002-prices.*



# Utility values

- Each action under consideration has a number of possible outcomes. (In general, we cannot predict outcomes with certainty.)
- We assign a number to each possible outcome. This is called a *utility*, and it measures how good/bad that outcome is considered to be.
  - Good outcomes have positive utility, bad things have negative utility.
  - If an outcome has both good and bad aspects, then the negative utility is subtracted from the positive.



# Example

- A company wants to build a factory in the city you're the mayor of.
  - The City will earn \$50,000 per year in property taxes from the factory. They will hire 400 local people, for total annual wages of \$12 million.
  - The factory will also reduce air quality in the area, leading to increased asthma and other diseases. There will also be an odour.
- How do you quantify these benefits and costs?

# “Consumer sovereignty” in CBA

- CBA generally uses *people’s preferences* to determine the ‘values’ of things.
  - E.g. if a person pays \$14 to watch a movie, then that’s its ‘value’, to be used in the CBA. Even if the statistician doing the CBA thinks it’s a terrible, worthless movie!

# Probabilities

- In general, we cannot predict the outcome of a given action with certainty.
- Instead, we try to assign a *probability* to each possible outcome, for a given action.
- Usually this is a subjective estimate. We use whatever knowledge we have to estimate the probability of the outcome, given the action.

# Expected utility

- Consider some action A, which has possible outcomes 1 and 2 with utilities  $U_1$  and  $U_2$ , with probabilities  $P_1$  and  $P_2$ . The expected (average) utility of A is then:

$$EU(A) = U_1 \cdot P_1 + U_2 \cdot P_2$$

We calculate the expected utility for each action, and perform the action with the *highest expected utility*.

# Difficulties with CBA

1. It is hard to assign *utilities* in an objective way. They reflect people's subjective preferences. Different people will assign different utilities.
2. It is hard to assign *probabilities* in an objective way. They are often merely subjective assessments, and different people will assign different values.

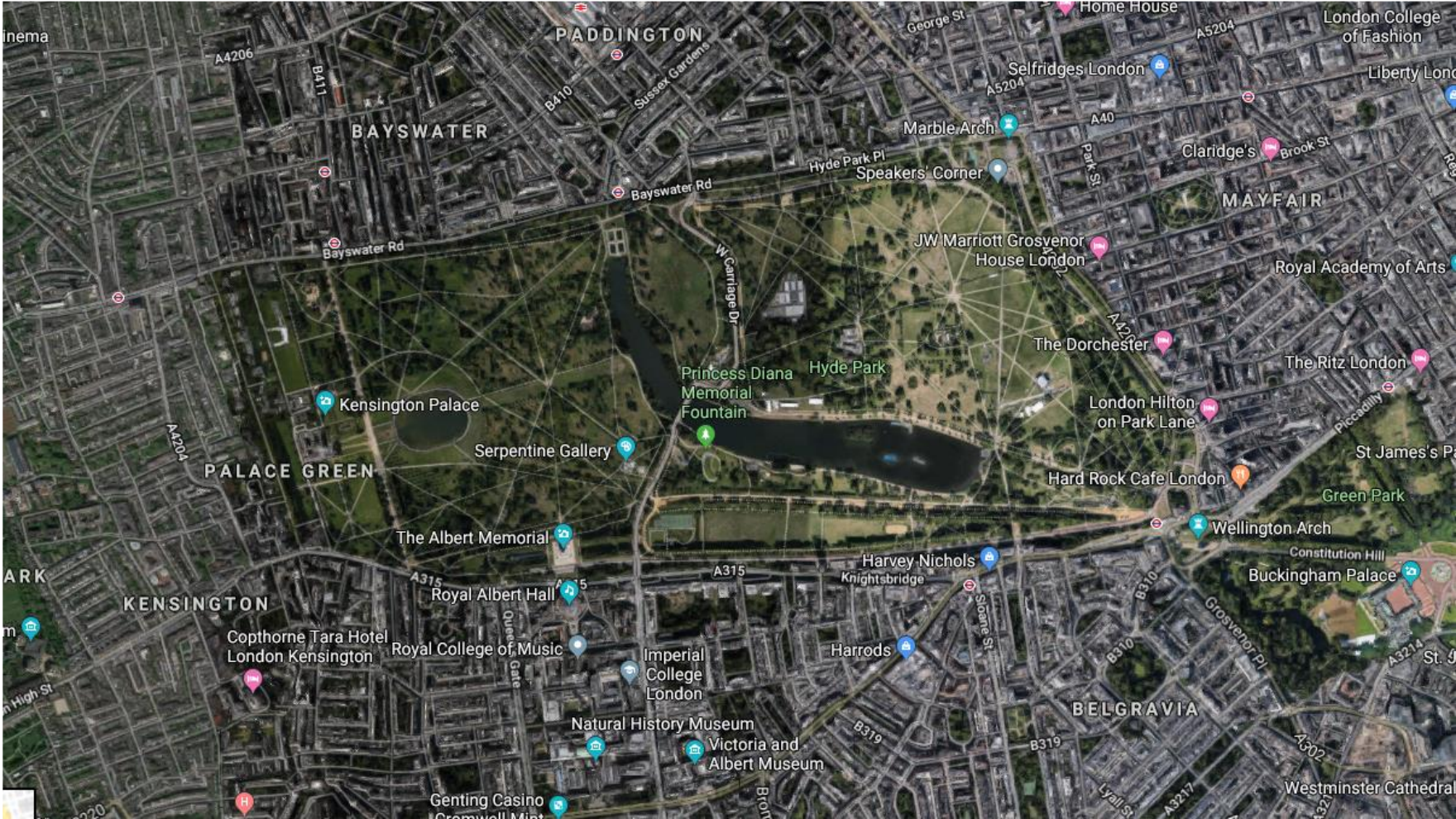
- E.g. in 1970 the Roskill Commission evaluated possible sites for a third London airport. The main considerations were:
  - A. The travel time for Londoners getting to and from the new airport
  - B. The noise, pollution, traffic congestion for residents living near the new airport.
- John Adams noticed that the utilities calculated for B were insignificant compared to A.

“In any study such as this the final outcome of the calculations will be greatly influenced by the simplifying assumptions on which they’re based. When the outcome indicates that factors that are apparently of greatest public concern weigh so little in the balance, we can expect to find the explanation not only in the calculations but also, and perhaps predominantly, in the initial assumptions.”

[“Westminster: The Fourth London Airport?” pp. 2-3]

Adams found that, using the utility assumptions of the Roskill Commission, the best site would actually be Hyde Park, in Westminster!

# Hyde Park





# Fallacies with CBA

## **1. Omit costs and benefits that are hard to measure objectively**

In some cases, some utilities will be objective, e.g. dollar values of costs and revenues. Other utilities are more subjective, e.g. costs and benefits to the environment, human health. The hard-to-measure costs and benefits are often left out of the analysis, effectively assigning a false value of *zero*.

## 2. Ignore the Costs

- If one is lobbying for an action, it is tempting to do a “benefit-benefit analysis”.
- This analysis carefully counts the benefits of the action, but ignores the costs, or even claims that there are no costs.

This type of analysis might be called *cheerleading*, since the role of a cheerleader is to celebrate (and draw attention to) positive outcomes and ignore negative ones.



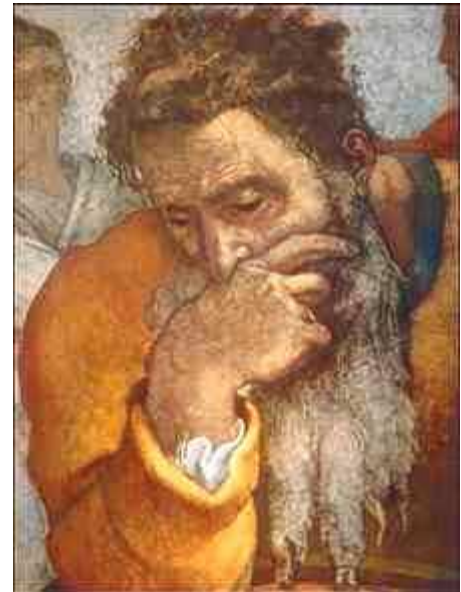
“It’ll be just *GREAT!*”

# 3. Ignore the Benefits

- The exact reverse is also possible, and equally fallacious.
- If you oppose an action, then make your case with a “cost-cost analysis”.

We might also call this *doomsaying*.

“I foresee a disaster”



# (Or ignore *some* benefits of increased transit)

<b>Included</b>	<b>Overlooked</b>
<p>Transit passenger travel time savings</p> <p>Transit passenger reduced vehicle operating costs</p> <p>Transit passenger reduced accident cost</p> <p>Transit passenger avoided vehicle parking fees</p> <p>Reduced congestion, air pollution and road wear from reduced vehicle travel</p>	<p>Improved mobility for non-drivers</p> <p>Transit passenger comfort benefits (e.g., from reduced crowding)</p> <p>Vehicle ownership cost savings (?)</p> <p>Parking subsidy cost savings to businesses</p> <p>Reduced per capita crash risk (particularly from transit-oriented development)</p> <p>Reduced impervious surface and stormwater management costs from reduced parking and more compact development</p>

# 4. Worst Case Thinking

- Technically this isn't a fallacy committed by people doing CBA. It's rather a **failure to do CBA in the first place**, by considering only the worst possible outcome for each action, no matter how improbable it is.
- Economists call this (fallacious) alternative to CBA "maximin" reasoning. Maximin advises us to minimise our possible losses, i.e.

*Choose the action which has the best worst-possible outcome.*

# Maximin fallacy ('worst case thinking')

- E.g. Should you fly to Hawaii for a vacation?

	Plane crashes	Plane doesn't crash
Fly to Hawaii	Death	Fun times!
Stay home	Feel sad but relieved	Feel regret

- With maximin reasoning, only the worst possible outcome for each action counts. The worst possible outcome is *death* (for going to Hawaii) and *feel regret* for staying home. So staying home is the “rational” choice (!)
- Maximin reasoning is notoriously risk-averse.

# Maximin fallacy

- Maximin is driven by fear, making it an absolute imperative to avoid catastrophe.
- Maximin fails to consider the *probability* that this potential bad thing will happen.
- Also, it fails to weigh this cost against the *benefits* that might result from the action.

## (Similar to an appeal to fear)

“Frequently, worst-case thinking displaces any genuine risk-assessment process. Risk assessment is based on an attempt to calculate the probability of different outcomes. Worst-case thinking—these days known as precautionary thinking—is based on an act of imagination. It imagines the worst-case scenario and demands that we take action on that basis.”

Frank Furedi, “Fear is key to irresponsibility”, *The Australian*, Oct 9 2010.



# 5. Narrow Focus on One Problem

- A cost-benefit analysis is often used to evaluate a possible measure to address *one specific problem*.

The analysis is then likely to focus exclusively on how well the measure works as a solution to *that* problem. Other effects (whether beneficial or harmful) occurring elsewhere are often not considered.



# NIH Director Francis Collins



Narrow focus?

**Martin Kulldorf**

**Prof. of medicine at Harvard medical school,  
2003-2024**

## E.g. a “Cane Toad Solution”



- In 1935, the Bureau of Sugar Experiment Stations was worried by the effect of the native cane beetle on Australian sugar cane crops.
- They introduced 102 cane toads, imported from Hawaii, into parts of Northern Queensland in the hope that they would eat the beetles. Unfortunately they had no noticeable effect on the beetles.
- And now 200 million cane toads call eastern Australia home, damaging the ecosystem.

# E.g. Road Safety vs. Health



- Road infrastructure is often “improved” or “upgraded” to reduce congestion, or reduce the number of injuries and deaths on the roads.
- In some cases these measures have focused exclusively on motor vehicle users, and the “improvements” have made neighbourhoods less walkable.
- People living in walkable neighbourhoods are substantially healthier, so such changes can cause a net loss of public health.



*"Yes, the planet got destroyed. But for a beautiful moment in time we created a lot of value for shareholders."*

# 6. Ignoring human adaptation

“The grand delusion of contemporary liberals is that they have both the right and the ability to move their fellow creatures around like blocks of wood ....”

(Thomas Sowell)

- In reality, **people adapt** (intelligently or otherwise) with changed behaviour, when a situation changes.
  - Such behavioural changes are an example of “unintended consequences”

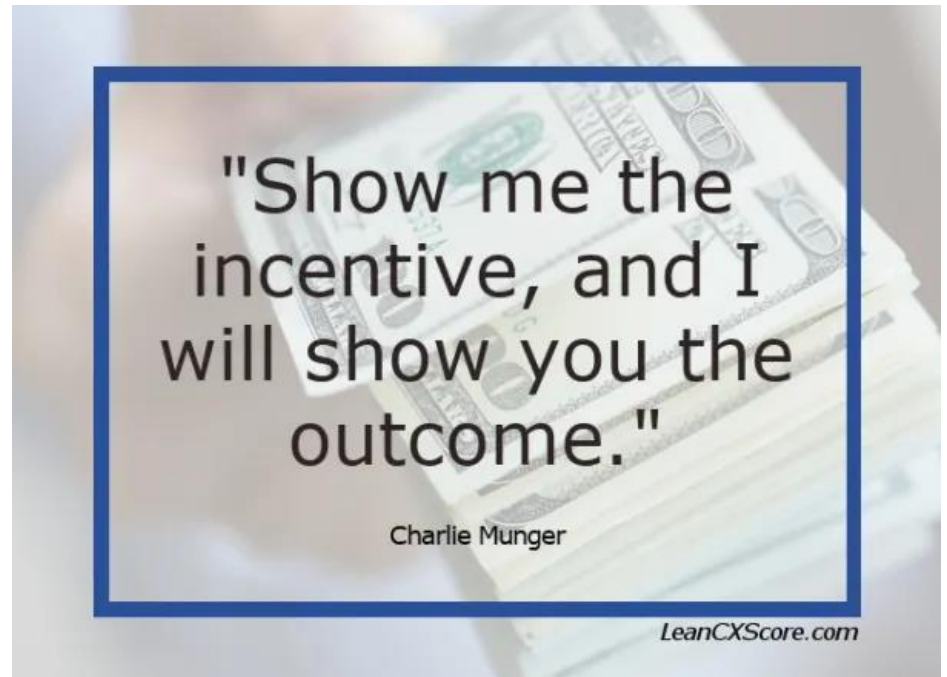
# Unintended consequences

**What we expect to  
happen**



# Unintended consequences

- Are such “unintended consequences” generally predictable?
- Yes!
  - Human nature
  - Incentives



# Unintended consequences

**THE YEAR**

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**(MIGHT NOT ACTUALLY BE TRUE)**

**WHO KNOWS?**



# Part 2

Past quiz questions, and philosophical criticisms of CBA

1. The following passages each argue for some policy on the basis of its costs and/or benefits. Identify any problems or weaknesses with the analysis given, or questions you have about it.

(i) People who do skydiving are obviously crazy. I mean, what's the benefit? Just a few minutes of exhilaration. Compare that to the potential cost, where your parachute fails somehow and you end up as flat as a pancake! Every year it happens to about 50 people. Real people, with families, not just statistics. Is it really worth dying just to get a few minutes of pleasure?

- Failure to consider probability. (Worst case thinking)
- N.B. The loss of life expectancy is about **4 hours**, which is equivalent to driving about 1000km. It's probably worth it.

(ii) Cyclists ought to be regulated, just like motorists. It's really a no-brainer. By making cyclists take a road test, and get a licence, we won't have these idiots riding on the wrong side of the road, running red lights, and so on. They'll know that if they do that then they'll lose their cyclist's licence and their licence plate with it! Lives will be saved.

- Ignoring the costs (cheerleading)

(iii) Local residents are opposed to building the new airport in south Greenwich, citing concerns about noise. A thorough cost-benefit analysis clearly shows, however, that the economic benefits of the airport far outweigh the economic costs. Proximity to an airport is very convenient, and property values will rise rather than fall. The airport will provide jobs for local people as well as tax revenue, to be spent on local amenities.

- Ignoring non-economic costs

# Cost-benefit analysis and justice

- Cost-benefit analysis assumes the moral theory known as *consequentialism*, which say that the morally right action is the one with the best (estimated) consequences.
- Consequentialism is often criticised for ignoring justice, and indeed for finding unjust actions to be morally right.



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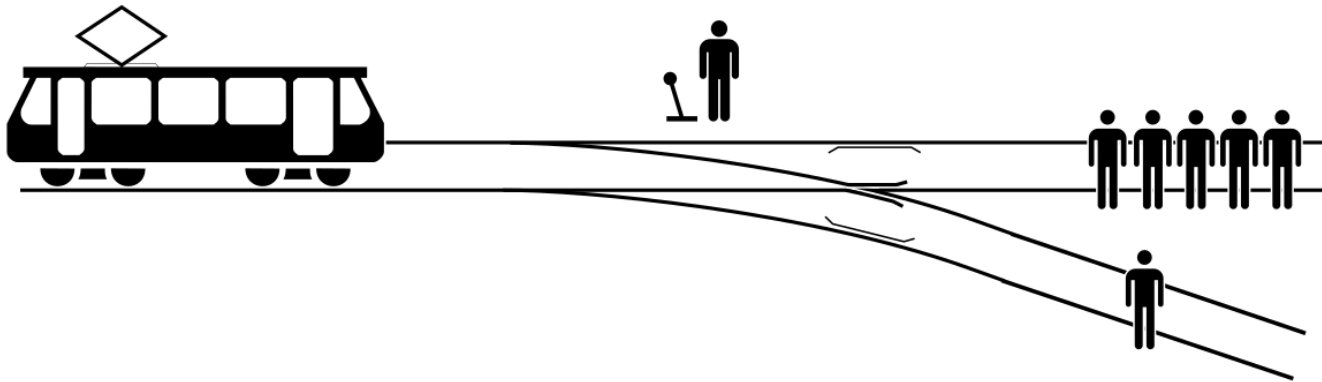
“Face it, you’ve changed. The man I married would never subject his family to an annual cost-benefit analysis.”

# Cost-benefit analysis and justice

- E.g. suppose in the American South, in 1890, a white woman has been raped. A lynch mob of white men has captured a black youth and dragged him to the sheriff, claiming that he is the rapist, and demanding that he be hanged.
- The sheriff knows that it would be unjust to hang the (probably innocent) youth without a fair trial. But he does a quick cost-benefit analysis, predicting riots and mayhem if he refuses to hang the boy. So he does the “right” thing and hangs him.

# Harvest organs from a healthy person?

- A healthy man is having a routine surgery to remove his impacted wisdom teeth.
- His surgeon realises that he is a perfect donor match for 5 people that need organ transplants right away in order to survive.
- So the surgeon does a cost-benefit analysis ...



# The effect of the UK seatbelt law

- On the basis of estimated effects of the law shown in the table below, Allsop et. al. argued that the seatbelt law should remain. (*Significance*, June 2008.)
- The law is justified by the fact that it prevents more deaths than it causes.

<i>Road user group</i>	<i>Change in deaths</i>	
	<i>Percent</i>	<i>Number</i>
Car drivers	-18	-267
Front seat passengers	-25	-165
Rear seat passengers	+27	+80
Pedestrians	+8	+150
Pedal cyclists	+13	+38
Total	-3.6	-164

- John Adams criticised this argument in a letter to *Significance* (December 2008 issue).
- Let us for the moment grant them their dubious contention of “many more deaths” saved than caused. Who are the saved and who are those sacrificed for their benefit? The saved are people in cars; the lives sacrificed are those of pedestrians and cyclists. The best protected (and usually the economically best off) are provided further protection at the expense of the most vulnerable.
- Adams regards this as “unfair”, since the law protects those who are *causing* the harm, at the expense of those who are *suffering* it.