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- **or adjust market prices $\rightarrow$ *shadow prices* [C&B Ch. 5; FP Ch. 7.2; S&W Ch8; DoF]**
- **or use the changes in consumer's and producers' surplus when prices change. [C&B Ch. 7; S&W Ch 9,10; FP Ch. 8.4; DoF]**

Other values?

but: value of convenience
value of time saved
value of new road
value of increased quietness ?
value of privacy

But: what if there are no markets?

[C&B Ch. 12; FP Ch. 11; S&W Ch 11; DoF]

Then Use Opportunity-Cost Prices

Q: what is | forgone / sacrificed / given up ?

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A:

- **with over-the-counter prices: Money**
- **with going to hospital (or AGSM):**
  - **— time**
  - **— forgone income**
  - **— fees**
- **with using a road/bridge/tunnel**
  - **— time**
  - **— out-of-pocket money**

eg $2.20 Harbour Bridge v. other

Willingness to pay

Q: **how can we express in $ what is given up?**

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A: use individual's valuation (CS) — "willingness to pay"

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How? –

1. by asking (CV)
2. by revealed choice.

otherwise –

3. by opportunity-cost methods

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8. **The Replacement Cost method: revealed value & costs of replacement (4.7)**

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3. *Cost-based measures*

   — what is the cost of abating the pollution?

Property rights

Coase theorem — bargaining over externality

3. Value of Time Saved

Numerical example: what is the value to Joe of a faster commute home?

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∴ Joe values his reduction in commuting time at $5/hr = $2 – (–$3),

since the value to Joe of a reduction in commuting time
= the benefit to Joe of increased leisure ($2)
– the forgone benefit to Joe of commuting (–$3)

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e.g. (values from surveys and revealed preferences)

w = \$10/hr
$MB_w \equiv$ (forgone) benefits of working = –\$8/hr
$MB_c \equiv$ (forgone) benefits of commuting = –\$3/hr
($\therefore MB_L \equiv$ (forgone) benefits of leisure = 10–8 = \$2/hr)
$\therefore V_c = w + MB_w - MB_c$ = 10 – 8 + 3 = \$5/hr

The Manly Jetcat: Estimate V_c, the value of shorter commuting time.

compare Jet Cat from Manly with ordinary ferry

assume passengers prefer $\left\{\begin{array}{l}\textbf{lower } \textbf{\textit{fares}} \\ \textbf{shorter } \textbf{\textit{trips}}\end{array}\right.$

the Jet Cat is 20 minutes faster at $5.50 more expensive. (check)

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travel costs ∼ individuals different costs

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e.g. consumers' surplus lost if a theatre closes
the opportunity cost of going to the theatre

opportunity cost = price of the

ticket + travel time
and other costs

Observe only 1 point on each group's demand curve: assume a single curve, or estimate each separately.
– National Parks
– method used to estimate value of visiting NPs

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Can be applied to any activity where the quantity consumed varies in response to the (opportunity) cost of travel to undertake it, e.g. recreation.

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6. **Simulate the number of visits with a particular entrance fee.**

Travel Cost Example

TC: Basic Data

Zone of visitor origin	*Average travel cost ($/car)*	*Total car visits*	*Population of zone*	*Total car visits per 1000 pop.*
1	2	150	5	30
2	4	64	4	16
3	6	16	2	8
4	8	8	2	4
5	10	3	1	3
6	12	0	3	0
Total		241		

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TC: simulation of $2/car entry fee

Zone of visitor origin ('000)	Average travel cost ($/car) visits	Entrance fee ($/car)	Total visit cost ($/car)	Pop. of zone	Simulated Total visits per 1000	Total
1	2	2	4	5	16	80
2	4	2	6	4	8	32
3	6	2	8	2	4	8
4	8	2	10	2	3	6
5	10	2	12	1	0	0
6	12	2	14	3	0	0
Total						126

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- Demand schedule:

Simulated entrance fee	*Simulated number of visits/year*
\$0	241
\$2	126
\$4	62
\$6	32
\$8	15
\$10	0

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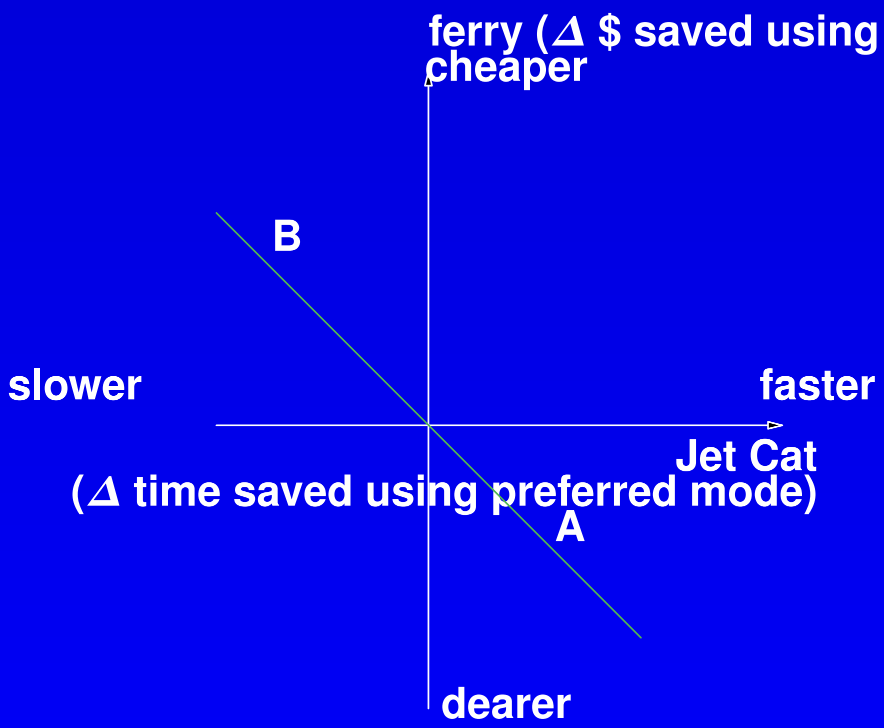
\$2	126
\$4	62
\$6	32
\$8	15
\$10	0

7. Calculate the value.
   The consumer surplus = the area above the price (\$0/visit) below the demand curve plotted from the above table = \$700 total.

Sydney Harbour Travel [S&W pp. 150–156]

Q: “how do you travel?”, “what’s the next best alternative?”
e.g. Manly Jet Cat ($8.00 & 15 min.) v. ferry ($2.50 & 35 min.)



Then the slope of green line → \$??? per minute saved i.e. price, value of time saved. Line of indifference between slow and fast modes. Min. number of wrong responses to the SW. Assumptions: individual rationality, equal values.

Estimating the Relationship — NFX

$$C_i = a_i + bT_i + M_i$$

where C_i total cost of mode i

a_i intrinsic value i

T_i time spent travelling

M_i money cost (fare +)

The probability of using ferry instead of the Jet Cat p_F is (using the logit transform – NOT FOR EXAMS):

$$p_F = \frac{e^{\Delta C}}{1 + e^{\Delta C}} = f(\Delta C)$$

$$\Delta C = C_{JC} - C_F$$

$$\log \frac{p_F}{1 - p_F} = \Delta CR = a_{JC} - a_F + b\Delta T + \Delta M$$

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  - **— improved growth and quality of crops, etc.**

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   - If no, then → stage 3.
     The PPIC is satisfied.

   Negotiating positions depend on the prior allocation of property rights.
3.

A two-stage process:

1. Evaluate the project (which will harm the environment) without environmental effects (costs)

    - If negative NPV, then stop.
    - If positive NPV, then $\rightarrow$ stage 2.

2. Include environmental costs:

    Are these sufficient to reduce NPV to zero?

    - If yes, then stop. (And renegotiate?)
    - If no, then $\rightarrow$ stage 3.
      The PPIC is satisfied.

    Negotiating positions depend on the prior allocation of property rights.

3. A decision balancing the net economic benefits against the costs to particular groups.

    (distributional impacts)

Use, Option, and Existence Values

Total Economic Value = Actual Use Value + Option Value + Existence Value

To determine these:

1.

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1. ***Travel Cost Method*** **(see 3.1 above)**
   Uses the value of time spent to visit a park or recreation area, as well as any direct costs, to determine the community demand curve for the amenity.
   Useful when data are available.

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   Uses the changes in land values as a measure of the costs or benefits imputed to changes in environmental amenity due to the project. (e.g. land near the airport)
   Can be useful when similar projects already undertaken, or ex post for damage estimation.

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3. ***Contingent Valuation Method* (see 4.3)**
   Asks people what they are Willing To Pay for the benefit or what they are willing To Accept as compensation.
   It's very general, but may be costly to perform, and has severe qualifications (see below).

Indirect (monetary) benefits, **e.g.,**

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— **reduced air pollution**

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Example: Road through the Grampians

[Sinden & Thampapillai, Box 6.1, p. 93]

Benefits & costs	Alternative A	Alternative B
Benefits from recreation	40	32

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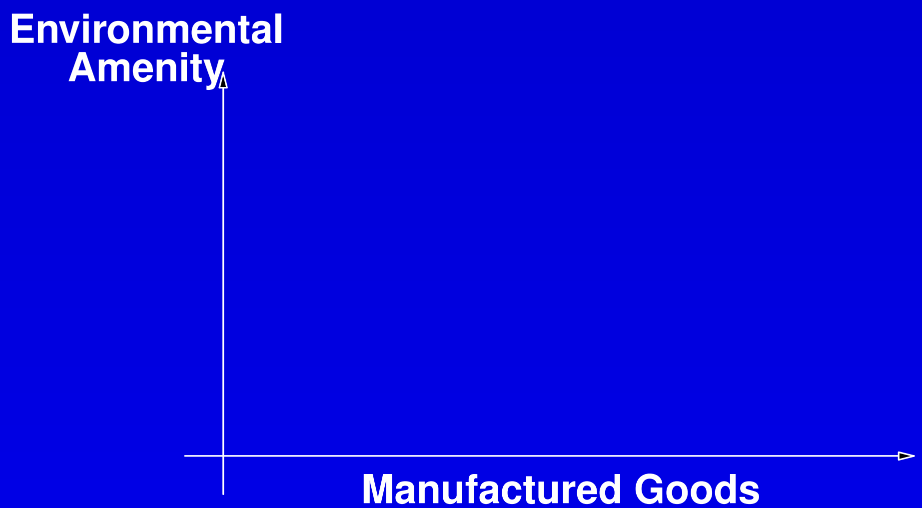
∴ Net benefit	6	8

4.1 Why the Environment Will Always Matter



1.

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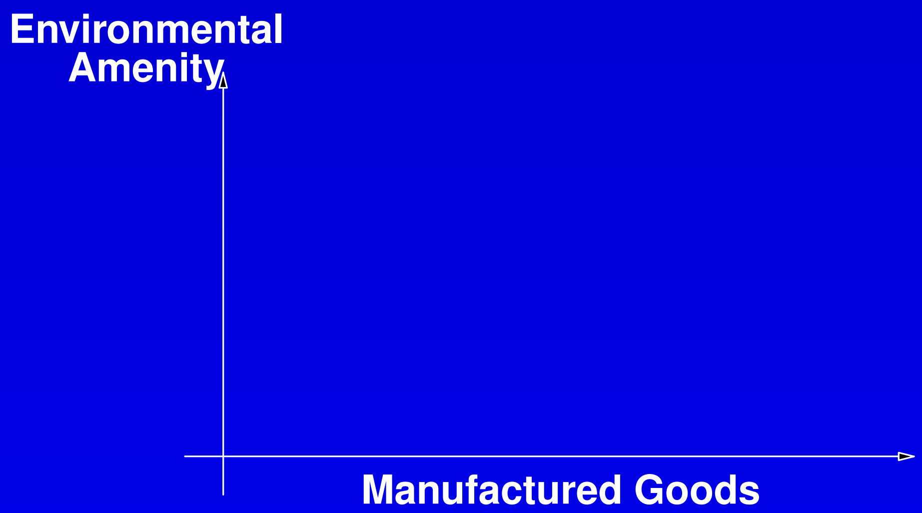

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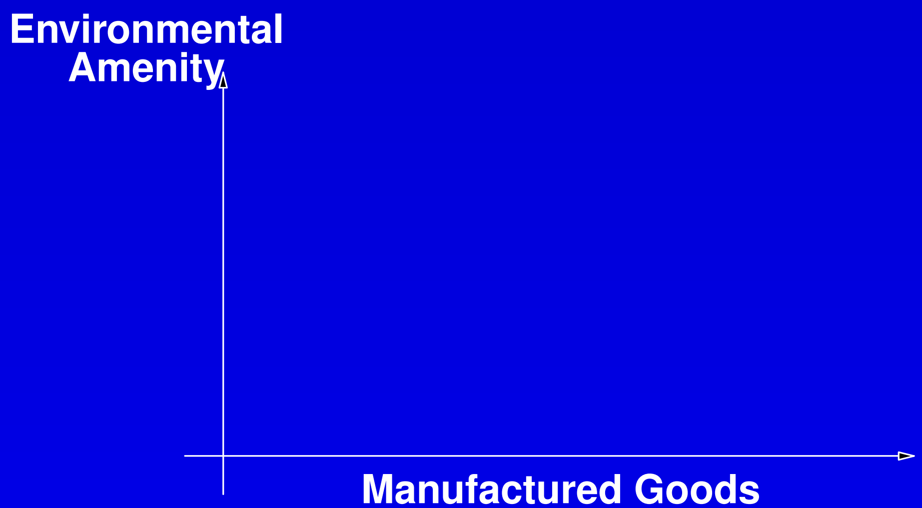

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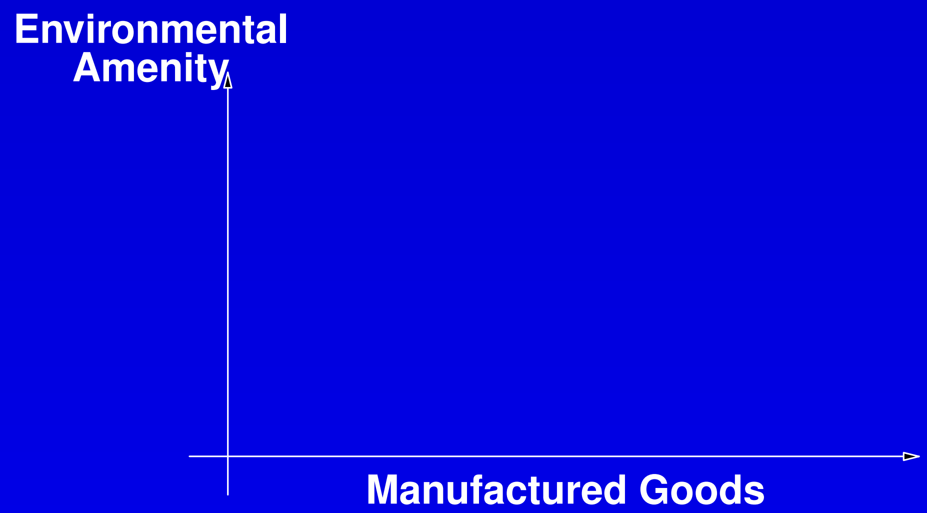

1. technical change, inventions: more Manufactured Goods from the same Environmental Amenity reduction
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The lower slope at point B (new price ratio)

⇒ a higher value of environmental amenity in terms of manufactured goods.

Against this: expectations of a higher level per generation.

4.2 Hedonic Prices [C&B pp. 279, S&Th pp. 93]

(Johansson Ch 7)

-

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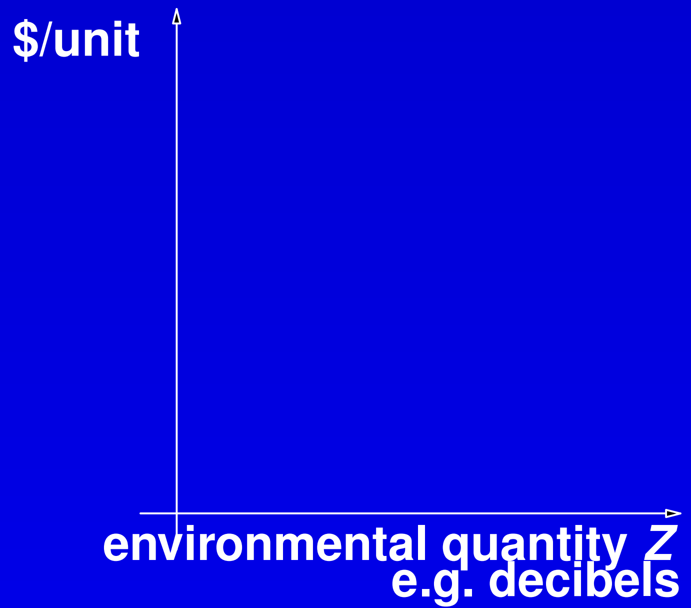
- **regress housing prices against L, N, and Z**
- **compute incremental effect of Z on price P_h**

But beware of double counting!

Graphically:



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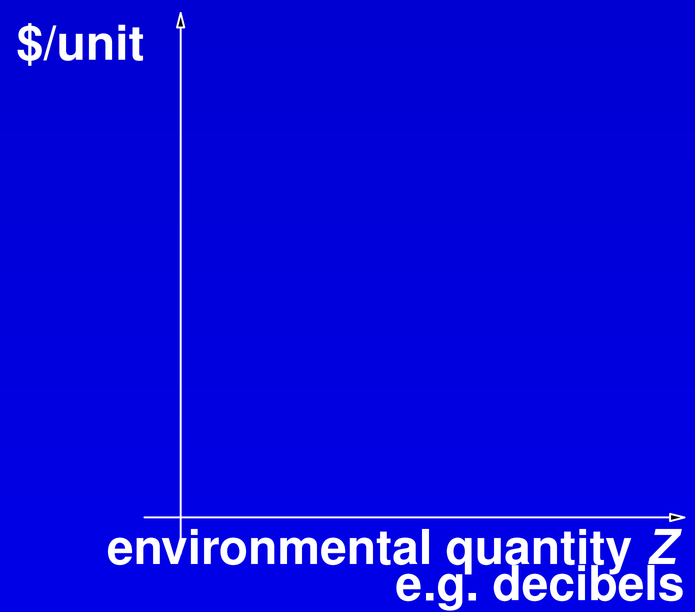

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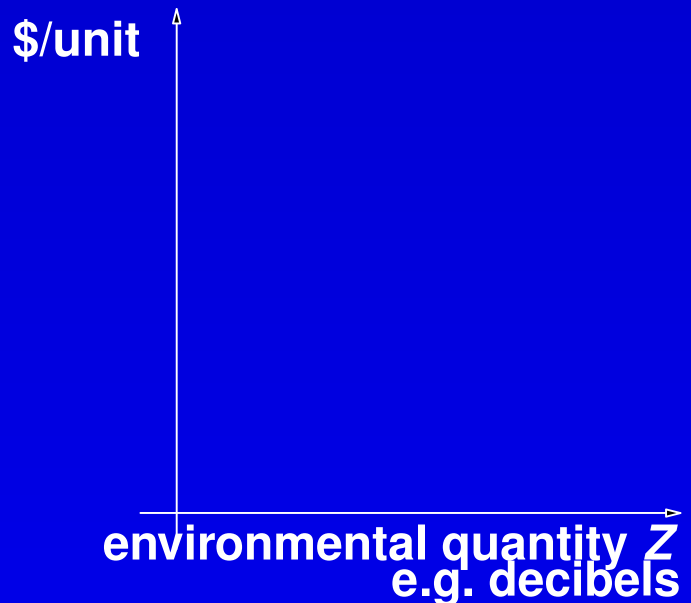

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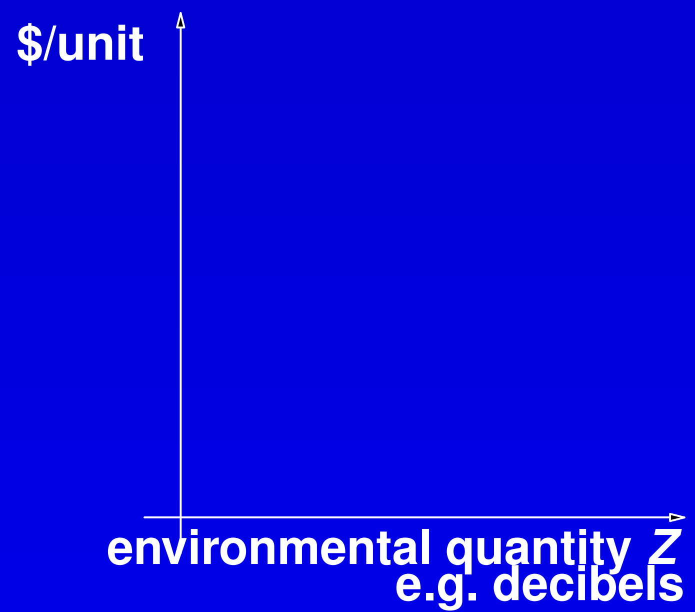

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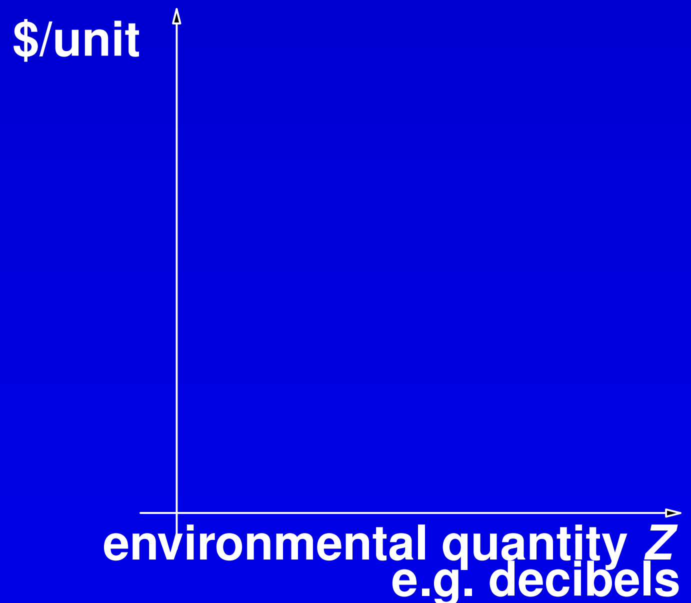

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- Comparison of survey and hedonic approaches

4.3 Contingent Valuation Survey Data [C&B pp. 281, S&Th pp. 96]

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The true measure should be in between.

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  - — starting bids are also important

•

- **Hyland and Strand study of Grenland area of Norway**
  - —

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  - **visibility the issue**
  -

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    path-dependent:

A to B to C	1.3%
A to C	0.9%

Example: CV converts environmental ratings to $

[Sinden & Thampapillai, Box 6.2, p.97]

CV: value of recreational visit per group —
ranged from $7 to $30, they said

Then:

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CV: value of recreational visit per group —
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Then: agency scored each on 10 environmental factors
and found a correlation:
Δ 1 unit in rating $\rightarrow$ increase of $8 per visit

4.4 Defensive Expenditure [C&B p. 272, S&Th p. 99]

Agents sometimes willing to sacrifice to defend their existing position.

When the action exactly maintains their utility, the expenditure measures the avoided loss in CS.

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Cost at present – Cost with useful change = Cost saved

Example: tollway benefits > cost of toll for those who pay it

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The value of a project which supplies more soil conservation can be derived from changes in the value of an associated output, such as agricultural produce.

e.g. Lower erosion or salinity should also improve the market value of the land, as in Hedonic Pricing.

So: the benefit is propoertional to the Δ output value

4.7 The Replacement-Cost Method [C&B p. 273, S&Th pp. 104]

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e.g. lack of replacement of a burnt-out bridge implies that the value of the bridge is less than its replacement cost.

A range:

Minimum replacement cost	**<**	**Value of benefit**	**<**	**Maximum replacement cost**

Example: Benefits of fishing on the Ovens

[Sinden & Thampapillai, Box 6.3, p.105]

Anglers visit the Ovens River:
they spend ~ $43 and catch 1–5 trout per visit

Next best alternative would cost ~ $151/visit, they said.

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- special interest groups
- emission permits, e.g. CFCs in Australia

Example: Proposed Gold Mine: NSW South Coast.

Environmental Impact Statement:

detail of the mine proposal
Financial Appraisal
economic appraisal
abatement undertaken
social effects—*local*
economic effects
“public” goods
water supply/pollution *
landscape
wildlife
noise
dust
prostitution/. . .

———

employment
infrastructure

———

closing down ?
    moving away
    rehabilitation

Summary tables:

Methods of estimating values.

Method	*What can be valued?*	*What data are required?*
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Defensive expenditure	Net benefit, total benefit	Change in expenditure to maintain existing level of welfare

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Change in output	**Total benefit**	**Money revenue, before and after change**
Replacement cost	**Range for a benefit**	**Actual and likely costs of replacement**

(Source: Sinden & Thampapillai, pp. 88–89)

e.g. airport noise

5. Criticisms of Contingent Valuation

Introduction

(Report of the NOAA Panel on Contingent Valuation, as a response to the litigation over damages from the 1989 *Exxon Valdez* disaster in King William Sound, Alaska.)

Estimation of fall in values of damaged environmental amenity.

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information revealed in market transactions — out-of-pocket expenses

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How to evaluate passive-use values?

No direct market transactions to observe.
No indirect methods → clues to lost values?
Answer: *Contingent Valuation*.

Contingent Valuation

— the direct elicitation of these values from individuals through carefully designed and administered sample surveys.

Typically:

Contingent Valuation

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Typically:
provide responents with information about hypothetical government programs that would reduce the likelihood of a future adverse environmental event.

Respondents given some specific information about the exact nature of the damages to be prevented.

Respondents confronted with questions that provide information about the economic sacrifice (their WTP) they would have to make to support the environmental program.

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— **respondents may not take the questions seriously, since they're not binding (talk is cheap[1])**

Criticisms of the Contingent Valuation Method

(See Hausman & Diamond in Package)

First: The impossibility of *external validation* of CV results.

Experiments may provide an artificial opportunity to pay for environmental goods, including passive use.

Then compare CV WTP with “real” results.

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eg. Seip & Strand:

> **CV WTP for membership in a Norwegian environmental organisation was very much greater than the actual responses when the real opportunity was offered to a similar group: only 6 of 64.**

Examples of CV WTP

eg. Duffield & Patterson:

The environment amenity was maintenance of flow of Montana rivers, with spawning grounds for two rare species of fish. Two groups of passive-use respondents polled by mail:

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Compare expressed WTP with actual.
CV WTP > actual by up to 50%
(although casual design)
Still possible to conclude that CV WTP reflects actual market demand, although significantly higher.

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- **WTP should be an increasing function of the scale of the program**
- **Falling marginal WTP (as scale of project increases) shouldn't result in very abrupt falls.**

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WTP for cleaning up all lakes in Ontario only slightly > WTP for one region's lakes' cleanup.

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Average WTP for measures to prevent 2000 migratory birds (not endangered species) from dying in oil-filled ponds ≈ AWTP for 20,000 or 200,000 birds from dying.
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- **How to reason about values without rationality?**
- **Give a lack of external validation → want internal consistency.**

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With, say, 7–8m households, get hundreds of million $ as aggregate WTP (see Kakadu CV by the Resources Assessment Commission).

But there are many types of possible environmental damage:

$\rightarrow$ much for each household to pay

$\rightarrow$ overestimates for large numbers of environmental problems, especially when exist substitutes too.

5.3 CV: Information Provision and Acceptance

Often programs and impacts only sketchily outlined.

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i.e. What if respondents rely on a set of heuristics, such as

- **"These environmental accidents are seldom as bad as we're led to believe."**
- **"Authorities almost always put too good a face on these things."**

— then they're answering a different set of questions.

5.4 CV: “Warm Glow” Effects

Open-ended CV questions $\rightarrow$ many “zeroes” (those who would pay nothing for the program) and a number of sizable reports.

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Do such responses to CV questions also reflect a *warm glow* from expressed support of environmental protection, rather than actual WTP?

If so, that would explain the lack of scale effects mentioned in 5.1 above.

5.5 CV: Absence of a Meaningful Budget Constraint

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5.6 CV: Extent of the Market

Undersampling and zero sampling of a subgroup of the relevant population only justified if the subgroup has a predictably low WTP for protecting the resource.

Design of CV Instruments

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The latter is *the Panel’s preferred form*: realistic, no strategic reason not to answer truthfully, possible to validate with property tax referendums.

CV: Addressing the Embedding Problem

CV: Time Dimension of the Passive Use Losses

6. Irreversibility, or Forgoing Options

(From Pearce on the Gordon-below-Franklin — see Package.)

Suppose: direct costs: \$1,
benefits: \$$D$ forever (a perpetuity)

$\therefore$ $NPV(D) = -1 + \dfrac{D}{r}$, **where r is the discount rate.**

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But P and D will not be constant: $P_t = P_0 e^{gt}$, and $D_t = D_0 e^{kt}$,
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If $P = 0.2$, $k + g = 0.01$, then $\sqrt{D} > 0.547$, $\therefore\ D = 0.299$

and $D/P > 0.299/0.2 = 1.497$: $\therefore$ for NPV > 0, $D > 150\%\ P$.

Let's put numbers in for the Gordon-below-Franklin:

The N.P.V. of the dam is given by

$$NPV(D) = -1 + \frac{D}{r+k} - \frac{P}{r-g}$$

where *D* is the benefit perpetuity discounted at *r* p.a., with technological decay of *k* p.a.

and *P* is the forgone, lost benefits, with a real rate of growth of *g* p.a.

Let *r* = 5% p.a., and *g* = 4% p.a.

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So that if the initial year's preservation benefit > $750,000

then NPV(D) < 0, so STOP!

7. What Is the Value of Human Life?

Life: Nature of the Valuation **[C&B pp. 284]**

Two senses:

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& from 2. *knowledge that person obtains utility while alive*

e.g. rescue strangers

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but higher-risk job $\rightarrow$ higher pay (& self selection)

Value of life depends on probability of remaining alive

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c. quality of life: e.g. ?

Ethical issue — utilitarian perspective. Dread factor.

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b. possibility of causing loss of life

compare value of desired end
v. probability of causing death

Life: Rationality

Moral issues; but *not* making a decision is a decision itself

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a. *Preventing loss of life*

costs usually clear $\rightarrow$ threshold problem
benefits?

voluntary donations $\Rightarrow$ individual choices?

e.g. dialysis machines prolong life — clear
CAT scanners, MRI $\rightarrow$ better diagnosis $\rightarrow$ lives saved – whose?

longer-run decisions to prevent death

e.g. kidney dialysis machines, CAT scanners, NMR machines
— often need *representatives* to decide

e.g. value of additional lives saved by another doctor (marginal value of a doctor)

or group-insurance approach

– e.g. willingness to pay for *option* of having an ICU $\rightarrow$ voluntary HMOs
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b. *causing possible deaths*

e.g. fire department hazardous to firemen

probabilities are crucial when there are risks.

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