what is cba?

- **a tool to aid decision making**

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what is cba?

- a tool used either to **rank** projects

  or

- to **choose** the most **appropriate** option

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what is cba?

- cost-benefit analysis provides an *organizational framework* for **identifying**, **quantifying**, and **comparing** the costs and benefits of a proposed policy action. The final decision is informed (though not necessarily determined) by a comparison of the total costs and benefits.

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what is cba?

- an economic assessment tool that can be used to **quantitatively** rank alternative proposals:

- -between a given proposal and the status quo
- -between competing proposals

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what is cba?

- Cost-benefit methods summarize the *tradeoffs* that people make in giving up time, money, or goods to get something else.
- It provides information that can be used to evaluate the implications of different choices

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WHY USE CBA ?

- CBA provides decision makers a consistent basis for decision-making.
- It imposes discipline, accountability, and transparency on the decision-making process

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WHY USE CBA ?

- Scarcity of resources implies that resources devoted to one end are not available to meet another; hence there is an *opportunity cost* of any action.

✍ example: funds used to create/maintain a marine protected area cannot also be used to build new schools

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WHAT IS CBA?

OUTLINE OF STEPS

As a quick summary:

- initially create a *projection* of cash flows (benefits and costs) over time,
- then *discount* these flows,
- then apply a *decision rule* to provide a ranking

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OUTLINE OF STEPS

- **identify/define the project. Confirm the desired outcomes of the proposal.**
- **determine the assumptions and scope underlying the analysis**
- **determine an appropriate time frame (appraisal period)**
- **identify all significant benefits and costs, and time period of realization**
- **assign monetary values to benefits and costs, whenever possible**

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OUTLINE OF STEPS

- ***(optional)*** **adjust (assign weights to) cost and benefit streams to reflect distributional concerns**
- **discount the cost and benefit streams**
- **assess risk, and uncertainty**
- **apply decision rules based on quantifiable costs and benefits**
- **consider the effects of intangibles that could not be reliably estimated**
- **conduct sensitivity analysis**

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STEPS OF A CBA (in more detail)

- **Identify/define the project.**
  Confirm the desired outcomes of the proposal.

  ✍ **point is: CBA is multi-disciplinary.**

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STEPS OF A CBA (in more detail)

- **determine the assumptions and scope underlying the analysis**

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STEPS OF A CBA (in more detail)
---some default assumptions

- --*apply a general equilibrium viewpoint* (consider inter-relations between sectors)
- example:

Subsidy to beef industry ✍ lower beef price ✍ lower demand for *chicken* as people switch to beef

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STEPS OF A CBA (in more detail)
---some default assumptions

set borders:

typically exclude international impacts
(unless have explicit reason to consider them)

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STEPS OF A CBA (in more detail)
---some default assumptions

- *consider all intangible costs and benefits:*

  -when they can be reliably estimated, do so

  -if not, conduct qualitative assessment

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STEPS OF A CBA (in more detail)

- **<u>determine period of analysis:</u>**

- What will be economic life of underlying proposal or assets?
- often subject to 20 year maximum
  (due to discounting effects).

Lifespan can be expanded where benefits or costs emerge slowly

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STEPS OF A CBA (in more detail)
---identifying costs and benefits

CBA is usually ***ex ante***:

must anticipate benefits and costs

It can be difficult to identify and obtain information necessary to identify and quantify costs and benefits

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Assigning monetary value to costs and benefits

- Costs/benefits often estimated from:

- Market data
- Engineering studies
- Industry surveys

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Assigning monetary value to costs and benefits
---costs---

- Opportunity costs are used.
- Market prices are usually a good approximation of opportunity costs

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Assigning monetary value to costs and benefits

- Rework what follows: allude to when mkt doesn't work and need for shadow prices
- Distorted mkts
- Missing mkts

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Assigning monetary value to costs and benefits
---some more difficult costs

- **externalities**

  benefits received or costs borne by those not associated with the originating activity and for which payment is neither given nor received

General Rule: include if they can be quantified and are of sufficient size that they are capable of altering the decision

If the externalities can't be quantified, they should still be identified and explained to decision makers

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Discounting

- So far, have created projections of benefit and cost cash flows over time.
- Now, future cash flows must be discounted

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Discounting

- in general, future costs and benefits will be discounted by a weighting factor called a **discount factor** ***DF:***

$$DF = \frac{1}{(1 + r)^{t}}$$

with r = **discount rate**

t = time period

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Discounting

First a numerical example of growth:

- ***Receive 100 at end of year 0, earn 10% per year :***

Year 0		*Year 1*	*Year 2*
100	**becomes**	**110**	**121**

So initial 100 has grown to 121 after 2 years

SO: Future value = present value x $(1 + r)^{t}$

$$121 = 100 \times (1.10)^{2}$$

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Discounting

- Discounting simply works backward.

With the base year as year 0, 121 received after 2 years is equivalent to 100 received now:

Present value = (future value) x discount factor

Present value = (future value) x $1/(1 + r)^t$

100 = 121 x $1/(1.10)^2$

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Discounting

- Why discount?

- Time preference: most people prefer receiving a unit of money now rather than later

  --impatience, risk aversion

  --receiving money later reduces options of spending/saving without offering compensating advantages

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Discounting

Why discount?

- Opportunity cost of funds

  --Funds received today can be profitably invested.

  --Interest is a premium paid to compensate for alternative possible uses

  --interest will include a premium to reflect risk

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Discounting

Discounting: a major source of controversy

- 2 major concerns:

  --should discounting future costs/benefits be done at all?

  --if discounting is done, what rate should be used?

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Discounting

- The basic problem

--intergenerational equity:

--Discounting makes future costs and benefits appear smaller in the present

Example: present value of $1.00 received in future (the discount factor $(1 + r)^{-t}$)

Year	5	10	20	25	30	40	50
r = 10 %	0.62	0.39	0.15	0.09	0.06	0.02	0.0085
r = 5 %				0.30			0.09

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Discounting

In general, higher discount rates attach less importance to future

So

- potential future benefits may not be pursued
- potential future costs may be ignored

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Discounting

- What rate should be used?

--zero rate?

-- implies future generations are just as important to us

-- raises problem of reverse infinite regress

--current generations continually impoverish themselves to provide for future generations

✍ No general consensus, generally discount rates vary from ~ 3-8 %

✍ sensitivity analysis should be used

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Discounting

Some considerations

- People tend to discount future benefits more than costs
- society has lower rate of time preference than individuals
- Environmental projects:

--often long-term benefits, short term costs

--biases result that favor current generation

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DECISION RULES

there are a variety of decision rules that may be applied in order to determine:

- ***if a project is acceptable***
- ***in the case of competing projects, which project should be favored***

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DECISION RULES

We will consider the following decision rules:

- *Maximum net present value*
- *Benefit-cost ratio*
- *Internal rate of return*

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DECISION RULES

REMINDER:

Present value = (future value) x $1/(1 + r)^t$

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DECISION RULES
NET PRESENT VALUE

- NPV = PV(B) – PV(C)

Any project satisfying the condition NPV > 0 should be undertaken **IF:**

- projects are <u>independent</u> of one another
- there are <u>no constraints</u> on project implementation (e.g., budget constraints)

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DECISION RULES
NET PRESENT VALUE

WITH CONSTRAINTS

- *how to choose among competing (positive NVP) projects?*

  --choose the subset that **maximizes NPV**

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DECISION RULES
NET PRESENT VALUE

EXAMPLE: ***Budget = 4***

project	cost	NPV
W	1	60
X	3	400
Y	2	150
Z	2	225

Possible combinations:	WX	WY	WZ	YZ
NPV	460	210	285	375

Decision: combination WX maximizes NPV

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DECISION RULES
NET PRESENT VALUE

FOR MUTUALLY EXCLUSIVE PROJECTS:

choose that which **maximizes NPV**

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DECISION RULES
BENEFIT-COST RATIO

B/C ratio = PV(B) / PV(C)

RULE: if B/C ratio > 1, accept

--WITH CONSTRAINTS:

rank projects by B/C, choose projects with highest B/C ratio until budget exhausted

--WITH MUTUAL EXCLUSIVITY:

choose project with maximum B/C

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DECISION RULES
BENEFIT-COST RATIO

example

project	benefits (PV)	costs (PV)	B – C (NPV)	B/C
X	200	100	100	2.0
Y	110	50	60	2.2
Z	120	50	70	2.4

with no rationing constraints, plus no exclusivity :

--both rules (NPV and B/C) show that all projects are desirable.

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DECISION RULES
BENEFIT-COST RATIO

example

project	benefits (PV)	costs (PV)	B – C (NPV)	B/C
X	200	100	100	2.0
Y	110	50	60	2.2
Z	120	50	70	2.4

---***with mutual exclusion:*** Max NPV chooses X, but B/C chooses Z

✍ by choosing Z, one sacrifices 30 additional units of NET benefits that could have been had from X.

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DECISION RULES
BENEFIT-COST RATIO
mutual exclusion

example

project	benefits	costs	B – C	B/C
X	200	100	100	2.0
Y	110	50	60	2.2
Z	120	50	70	2.4

--Note that the problem is that projects are of different size, so the bases (denominator; costs) are different.

SO,

--B/C is sensitive to size of project

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DECISION RULES
BENEFIT-COST RATIO
budget constraint

Example: let budget constraint = 100

--by ranking by B/C and working down the list until the budget is exhausted we get the correct choice of Z + Y :

project	cost	benefits	B – C	B/C
Z	50	120	70	2.4
Y	50	110	60	2.2
X	100	200	100	2.0

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DECISION RULES
BENEFIT-COST RATIO
budget constraint = 100

--this is a very limited example of B/C ratio usefulness, and the same result could be achieved by lumping smaller projects and finding the NPV of the "new, combined" project

project	cost	benefits	B – C	B/C
Z	50	120	70	2.4
Y	50	110	60	2.2
X	100	200	100	2.0
Y + Z	100	**230**	130	2.3

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DECISION RULES
BENEFIT-COST RATIO
budget constraint = 100

With this more realistic example where costs don't perfectly match the budget, it seems the B/C method fails, as Project X should be chosen.

project	cost	benefits	B – C	B/C
X	100	200	100	2.0
Y	60	126	66	2.1
Z	30	63	33	2.1
Y + Z	90	189	99	2.1

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DECISION RULES
BENEFIT-COST RATIO

B/C ratio is also sensitive to whether items are recorded as costs or benefits.

--benefits can be considered negative costs, costs can be considered negative benefits

B's:	***60***	***40***	***20***	✍	***120***		
						NPV = 60	***B/C = 2.0***
C's:		***40***	***20***	✍	***60***		
B's:	***60***	***40***	***20***	***-20***	✍	***100***	
						NPV = 60	***B/C = 2.5***
C's:		***40***			✍	***40***	

✍ again, the problem is in the scale, or size of the base (project size)

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DECISION RULES
Internal Rate of Return

Under many circumstances the IRR produces sensible results

✍ *definition:* the discount rate that would make a project's net present value equal zero.

✍ this means that IRR is the discount rate that equates initial outlays to the present value of future net cash flows.

For IRR = ?, NPV = $\sum \frac{(B_t - C_t)}{(1 + ?)^t} = 0$

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DECISION RULES
Internal Rate of Return

Rule for IRR:

✍ A project is worthwhile if the IRR is greater than some benchmark discount rate.

✍ with MUTUAL EXCLUSIVITY**:**
-- choose the project with the higher IRR.

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DECISION RULES
Internal Rate of Return

EXAMPLE:

	YEAR 0	**YEAR 1**
Capital cost	**100**	**0**
Benefit	**0**	**130**
Operating cost	**0**	**20**

NPV = -100 + {(130 – 20) / 1.10} = 0 so IRR = 10%

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DECISION RULES

Internal Rate of Return

Can give wrong results in case of <u>mutual exclusivity</u>

--example 1: different sized projects:

--costs incurred in Year 1, benefits occur annually starting Year 2:

Project	*Cost*	*Benefit*	*IRR*	*NPV at 10%*
X	*1000*	*300*	*30%*	*3000*
Y	*5000*	*1000*	*20%*	*5000*

--for independent projects and no constraints all would be accepted

--for mutually exclusive projects, IRR wrongly picks project X because IRR discriminates against larger capital outlays

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DECISION RULES

Internal Rate of Return

IRR can also lead to erroneous results in cases of:

--projects with different project lives

--projects with different timing of benefits and costs

--projects where the discount rate varies over time

✍ **of particular importance:**

In cases with large delayed costs, *preferred* investments may have *lower IRR*

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DECISION RULES

summary:

--IRR seems to have nothing to offer

--B/C ratio may be of use in special case of one-period constraint,

but

✍ **maximizing NPV works better.**

--maximizing NPV avoids problems encountered by other methods

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Categorizing benefits

TOTAL ECONOMIC VALUE

USE VALUES			**NON-USE VALUES**
Direct use values	**indirect use values**	**option values**	**existence/bequest values**
-fishing -recreation -transport -navigation	-flood protection -storm protection -nutrient cycling -waste assimilation -sedimentation	-insurance value of preserving options for use	-value derived from knowing a specie/system is preserved -value of passing on assets to future generations

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Monetary valuation methods

<u>demand curve approaches</u> **<u>non-demand curve approaches</u>**

/ \ ||

expressed preference methods ‖ ***--contingent valuation*** ***--choice modeling***

revealed preference methods ‖ ***--travel cost model*** ***--hedonic pricing***

--replacement costs ***--preventative behavior*** ***--dose-response methods***

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Non-demand curve methods dose-response relationships

- Production function:

--for estimating economic value of ecosystem products/services that contribute to the production of marketed goods

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Non-demand curve methods
dose-response relationships

- Production function:

  fish yield = f (labor, capital, stock (habitat quality))

  habitat = f (pollution)

  ? pollution ✍ ? habitat ✍ ? stock ✍ ? harvest

✍ If you can quantify these relationships, you can quantify the benefit of a program that reduces pollution

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Non-demand curve methods
replacement-cost/preventative measures

- Often overlap:
  expenditures may be considered as
  preventing further damage,
  or restoring original conditions

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Non-demand curve methods
replacement-cost/preventative measures

- Preventative (averting) measures:
  --WTP to prevent degradation

Example:

Beach with mandatory water quality standard
  --cost of achieving standard taken as proxy for benefits
    (assumes benefits are worth the costs)

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Non-demand curve methods
Replacement cost method

- Cost of replacing or restoring a damaged asset
  --cost of restoration taken as a minimum estimate of damage from loss

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Non-demand curve methods
Replacement cost method

Examples:

--Valuing storm protection services of coastal wetlands by measuring the cost of building retaining walls

--Valuing fish habitat/nursery services by measuring cost of fish breeding/stocking programs

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Non-demand curve methods
preventative measures method

Method

1) specify the relevant service
2) estimate the potential damage
3) calculate value of potential damage,
   or amount people spend to avoid such damage

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Non-demand curve methods
replacement cost method

Method

1) specify the relevant service
2) identify least costly alternative means of providing the service
3) calculate the cost of the substitute or replacement service

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Non-demand curve methods
replacement cost/preventative measures

Limitations:

- Presumes expenditures are worth incurring
  --assumes well-informed people
- Expenditures constrained by ability to pay
  (downward bias in poorer communities)

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Non-demand curve methods
replacement cost/preventative measures

Limitations (cont'd):

- Replacement cost assumes full restoration is possible

  --if not, underestimates the asset

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Non-demand curve methods
replacement cost/preventative measures

Limitations (cont'd):

- Assumes no secondary benefits

  --example: reforestation costs as proxy for soil stabilization benefits

  --forests yield other benefits

--result: <u>overestimation</u> of benefits

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Demand curve methods

- Revealed preference methods
  - --Hedonic pricing
  - --Travel cost models

--valuation of non-market impacts by observing actual market behavior

--behavior in one market reveals an implicit price of a related non-market good

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Demand curve methods
revealed preferences

- Strength:
  - --based on actual behavior
- Problems:
  - --complexity of methods
  - --data requirements

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Revealed preferences

- **Hedonic price method** (HPM)

  --certain environmental services affect certain market prices

  --try to imply prices of these services by determining how they affect market prices

- Applications: typically housing, labor markets

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demand curve methods
hedonic price method

basic process:

--Observe systematic differences in values of property between locations,

--Isolate the effect of ambient environmental quality on those values

Examples: --exposure to pollution
--proximity to amenities

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Revealed preferences
hedonic prices

Methodology:

1) Estimate a price function:

Property price = function of:

--physical characteristics (house size, no. of rooms, etc)
--location characteristics (proximity to work, amenities)
--environmental quality variables (ex.**:** pollution level)

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Hedonic price methodology

2) For each household 'i', estimate WTP for incremental decrease in pollution:

-- ? WTP_i = $\frac{? \text{ (est'd property price}_i)}{? \text{ pollution level}}$

Total change in value = sum of ? WTP_i

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Hedonic price methodology

Problems

- ***Significant*** data requirements
- Complex statistical analysis
- Requires individuals properly understand relation between pollution and welfare
- Not usually applicable when housing markets constrained
  --rent controls, housing shortages,
  government ownership
- ? pollution ⇙ ? 's in other prices also, so hedonic method underestimates value of ? pollution

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Revealed preferences methods
Travel cost models

Travel cost models (TCM)

- Purpose: estimate a demand curve for non-marketed good
- Used primarily for recreation sites without prices
  --cost of travel used as surrogate price
- Most data collected with surveys

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Revealed preferences methods
Travel cost models

Simple form:

visits = function of:

--travel cost

--socio-economic data (income, age, etc)

--available alternative sites

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Revealed preferences methods
Travel cost models

Travel costs may include:

- Vehicle expenses
- Food, lodging
- time

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Revealed preferences methods
Travel cost models

Issues/problems

--**time costs**:

general belief: ignoring value of travel time will underestimate total travel costs, and so also recreational value

- But how to value time?

- Opportunity cost of time usually taken as working wage
  --1/3 to ½ of wage rate is usually used

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Revealed preferences methods
Travel cost models

Issues/problems:

- Multi-purpose, multi-destination trips
  --example: visits to dive sites

--a particular problem with foreign visitors

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Revealed preferences methods
Travel cost models

Issues/problems

- Housing purchase decisions:

  --those who most value an attribute will likely live closer to it

  --but then travel cost is lower, benefits underestimated

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Revealed preferences methods
Travel cost models

Issues/problems

- TCM looks only at a subset of use values

  --underestimates total value

Example: Dunes in Netherlands:
indirect uses not captured

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Demand curve methods
Expressed (stated) preferences methods

- Not based on actual behavior
- Survey based; hypothetical context
- Capable of capturing both use and non-use values

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Demand curve methods
Expressed (stated) preferences methods

Two main categories:

- Contingent valuation method (CVM)
  --widely used for environmental impacts
- Choice modeling (CM)
  --gaining acceptance for multi-attribute environmental goods

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Demand curve methods
Expressed (stated) preferences methods

Contingent Valuation Method

- primary purpose of a CV survey:
  obtain a WTP bid for incremental change
  in provision of some good or service
- Basic form:
  --Interview people: ask:
  "What is your WTP to use/preserve some
  environmental asset?"

  --Calculate average WTP, multiply by total users

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Demand curve methods
Expressed (stated) preferences methods methods
contingent valuation method

four basic parts to a typical CV survey

- Attitudinal section
- Behavioral section
- Demographic data collection
- Valuation section

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Contingent valuation method

- Attitudinal section

  -examines respondent knowledge and opinions about the survey topic
- Responses may be used as explanatory variables in a WTP function
- May serve a "warming-up" purpose

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Contingent valuation method

Behavioral section

--gather information regarding interactions with environmental asset

Example:

People who dive/snorkel frequently will likely place greater value on establishing MPAs

- Responses may be used as explanatory variables in a WTP function
- May serve a "warming-up" purpose

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Contingent valuation method

Demographic data collection

- Certain socio-economic data is collected that can be used as explanatory variables in a WTP function
  --income, age, gender, education etc

--statistically significant relations serve as validation of procedure

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Contingent valuation method

Valuation section

- Includes:
  --presentation of **hypothetical scenario**:
  --description of current situation and expected change brought about by some action or policy
  --description of
  - how policy will achieve change,
  - how it will be paid for,
  - who will make the change

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Contingent valuation method

Valuation section cont'd

- Includes:

  --**elicitation of respondent's WTP bid**

  -this should be accompanied with a reminder of respondent's income constraint

  -several formats are available, each with advantages/disadvantages

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Contingent valuation method
survey design concerns

Payment vehicle:

--type of vehicle can affect WTP response

- Taxes, licenses, fees, prices, donations
  --Non-voluntary vehicles (e.g. taxes) can cause protest bids and non-responses

  --voluntary vehicles (donations) encourage over-bidding

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Contingent valuation method
survey design concerns

WTP bid-elicitation formats

--each format has different biases that may affect reliability of WTP responses

- Open-ended
- Bidding games
- Payment cards
- Dichotomous choice (referendum)
  --single bounded
  --double bounded

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Survey design concerns
bid-elicitation formats

Open-ended formats

"How much would you be willing to pay for…?"

PROS

- Provides measure of maximum WTP
- Straightforward statistical analysis and interpretation
- Responses tend to be conservative relative to other formats
- No anchoring/starting point bias

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Survey design concerns
bid-elicitation formats

Open-ended formats

- CONS

  --general criticism: unfamiliarity with format

Results:

--large number of

--non-responses

--zero responses

--strong outliers

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Survey design concerns
bid-elicitation formats

Bidding games

--offer increasing bids until one is rejected, followed by final open-ended question

- **problems:**

  --starting point bias

  --yea saying

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Survey design concerns
bid-elicitation formats

Payment card method

--Provide a card with wide-ranging list of bids

- Reduces outliers, but still some anchoring bias

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Survey design concerns
bid-elicitation formats

Dichotomous choice method

- Single bound: "Would you pay X amount for …?
  Answer yes or no.

  --vary bids among respondents

PROS

--believed to better replicate real market situation

--reduces outliers and non-responses

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Survey design concerns
bid-elicitation formats

Dichotomous choice method

- Problems
  --need large samples (expensive)
  --complex statistical analysis/interpretation
  --results seem significantly larger than other methods

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Contingent valuation method
summary of problems

- Hypothetical context
  --scenario must be complete but brief
  --respondent's budget constraint must be considered
- Strategic behavior
  --different formats give incentive to over- or under-bid
- Response biases
- Expensive
- Complex statistical methods

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Expressed preference methods
Choice Modeling

- Choice Modeling (CM) may be used when policies have multi-dimensional changes
- Survey based

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Expressed preference methods
Choice Modeling

Hypothetical scenario:

--a good is described with a variety of attributes

--a menu of attribute combinations and levels is presented:

Example:

good	attributes
	live cover
coral reef	diversity
	water clarity
	cost of visit

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Choice Modeling
Hypothetical scenario
example

Menu:

attribute	status quo	policy 1	policy 2
Live cover	low	medium	high
Diversity	medium	high	medium
Water clarity	low	medium	high
Cost	zero	medium	high

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Choice Modeling

- Three common approaches:
  - --choice experiments
    - --simply pick favored alternative
  - --contingent ranking
    - --rank alternatives
  - --contingent scoring
    - --attach numerical scores to ranking

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Choice Modeling
choice experiment example

Assume following welfare relationship:

Welfare =

a_1(live cover) + a_2(clarity) + a_3(diversity) + a_4(cost) + *e*

Statistical analysis of responses (choices from menu) gives:

$a_1 = 0.070$ $a_2 = 0.014$ $a_3 = 0.058$ $a_4 = -0.038$

- Divide physical attribute coefficients (a_1 a_2 a_3) by cost coefficient a_4 yields implicit prices:

WTP(live cover) = -1.84 WTP(clarity) = -0.37

WTP(diversity) = -1.53

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Benefits Transfer

Obtain a valuation from an original study and apply it to a new site

- Tradeoff occurs:

--saves time, money

but

--questionable validity: may be highly inaccurate

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Benefits Transfer

Accuracy depends upon ability to match original study site with new site

--requires

--good baseline data and projected changes for new site

--review of relevant studies to find best match

- Transferred values may need adjustment

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Benefits Transfer

- Three basic approaches:
  --unadjusted
  --simple adjustment
  --function transfer

✍ Recent studies regarding relative accuracy of each method are mixed

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Benefits Transfer

- Unadjusted method

$$\text{--WTP}_{\text{(original site)}} = \text{WTP}_{\text{(new site)}}$$

--mean WTP x relevant new population = aggregate benefits

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Benefits Transfer

Accuracy of transfer depends upon comparability of sites:

--socio-economic factors
--physical site factors
--comparability of policy changes
--market conditions at sites:
    available substitutes/complements
--temporal changes

--Significant site differences indicate need for adjustments

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Benefits Transfer

Benefits Transfer with simple adjustment

- Example:

$$WTP_{(New\ Site)} = WTP_{(original\ site)} \times (Income_{new} / Income_{old})^{e}$$

with e = income elasticity of WTP: $\frac{\%? WTP}{\%? Y}$

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Benefits Transfer

Benefits Transfer with function transfer

- Original study should provide some WTP function:

WTP = function of:

-income

-other socio-economic data

WTP for an increase in biodiversity =

constant + a_1 (income) + a_2 (age) + a_3 (education)

✍ transfer involves use of same coefficients for variables

✍ An immediate problem: access to data needed for function

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Benefits Transfer with function transfer

Meta-analysis

--based on a large sample of original studies

--explanatory variables common across sites

--not specifically from any particular site

Example:

$WTP_{site\ i} = c + a_1(\text{per capital income}) + a_2(\text{site characteristics}) + a_3(\text{policy characteristics}) + a_4(\text{study format})$

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Benefits Transfer

Benefits Transfer: Does it work?

- Validity of transfer depends in part on similarity of sites, policies, and context
- Are international transfers valid?

  --this would be useful for developing countries
- Are temporal transfers useful?

  --do original studies quickly lose their usefulness?

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Benefits Transfer

Temporal transfers

- Pearce (2006) cites studies showing:
  --over two year period, WTP is stable
  --over five year period, WTP increases significantly

✍ implications are poor for Meta-analysis

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Benefits Transfer

International transfers

--how to test validity?
  --perform an original study and a Benefit Transfer and compare

--mixed results at best

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