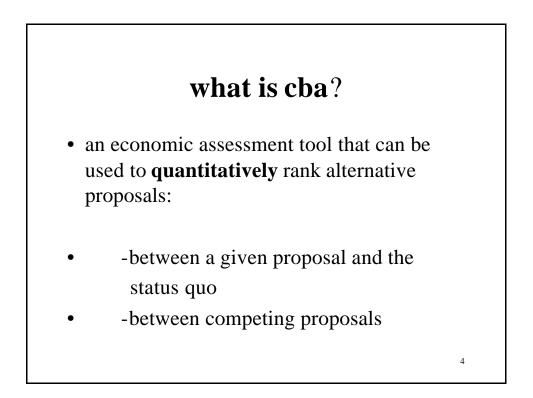


what is cba?

cost-benefit analysis provides an <u>organizational framework</u> 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.



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

5

6

WHY USE CBA ?

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

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

7

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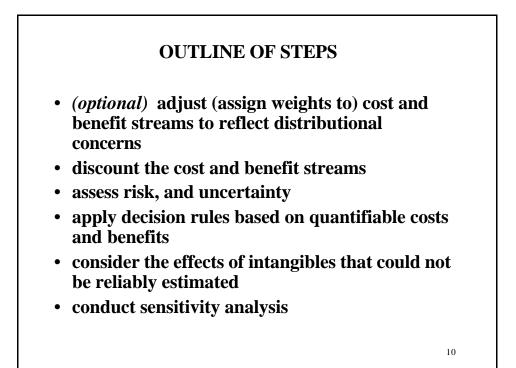
WHAT IS CBA? OUTLINE OF STEPS

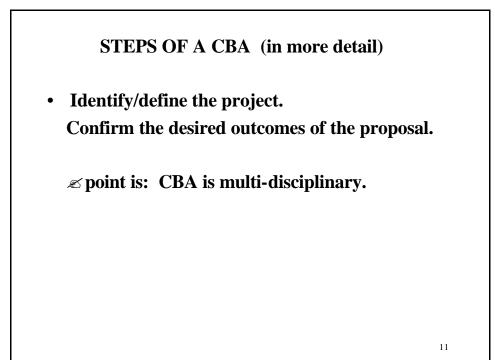
As a quick summary:

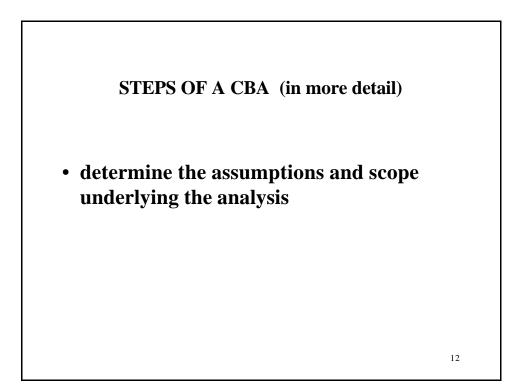
- initially create a *projection* of cash flows (benefits and costs) over time,
- then *discount* these flows,
- then apply a *decision rule* to provide a ranking

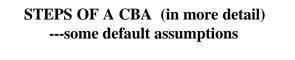
OUTLINE OF STEPS

- 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









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

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

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

set borders:

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

14

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

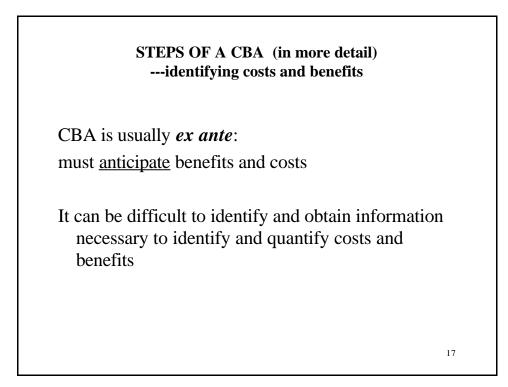
• consider all intangible costs and benefits:

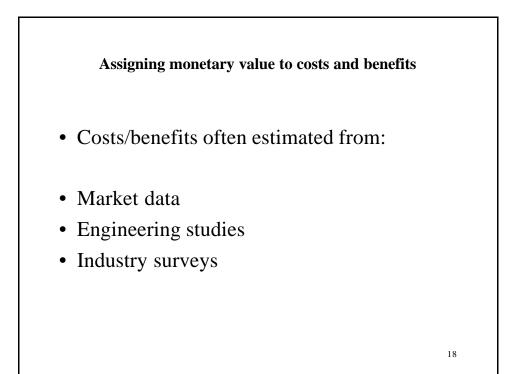
-when they can be reliably estimated, do so

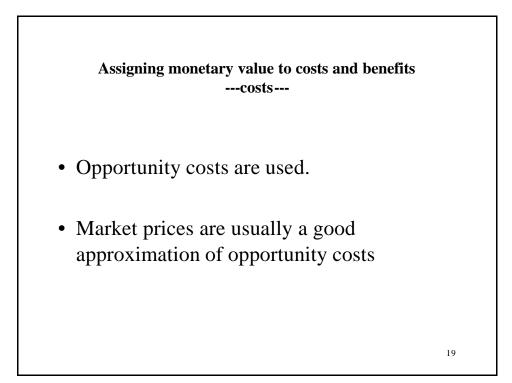
15

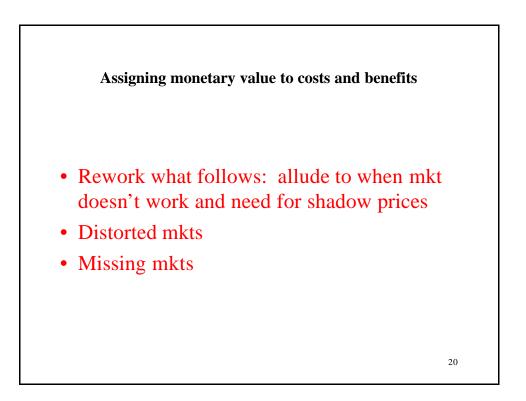
-if not, conduct qualitative assessment

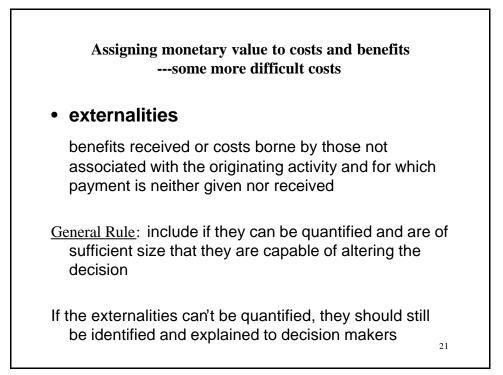
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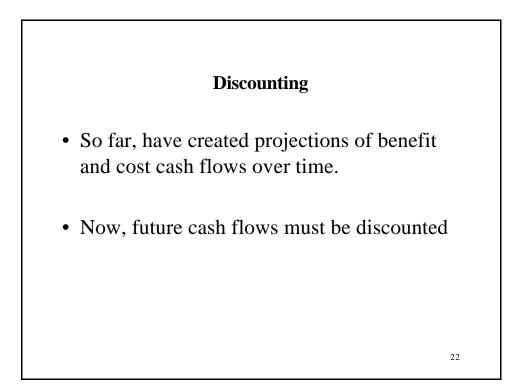


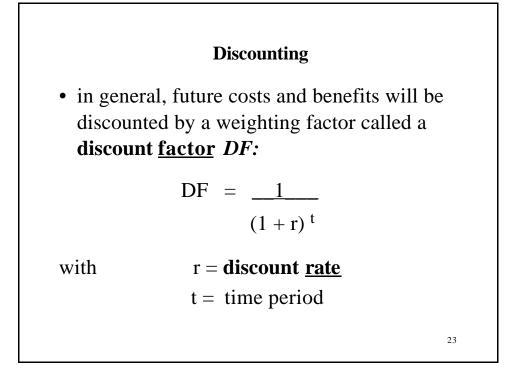




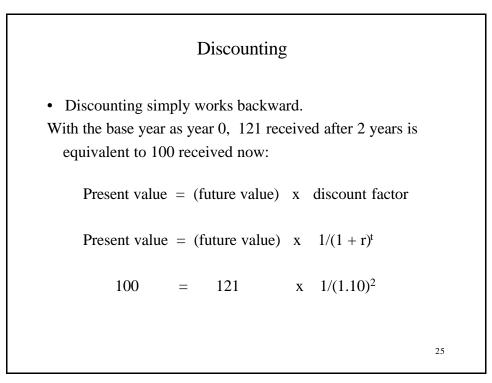


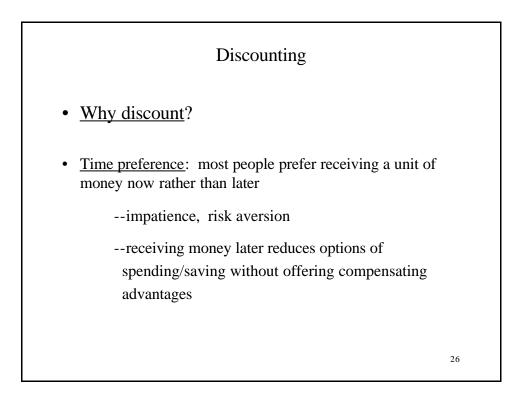


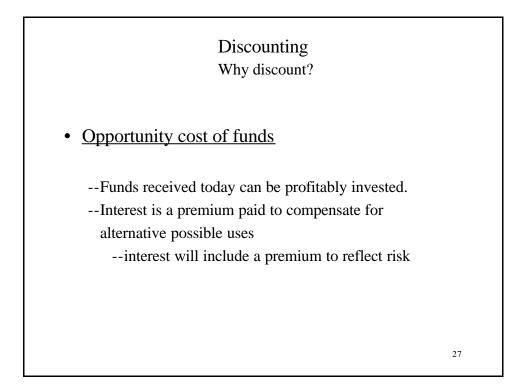


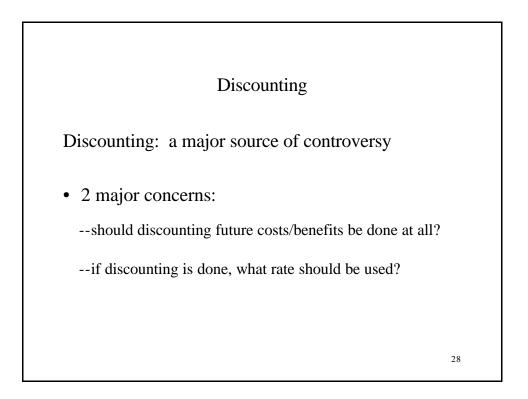


	Disco	ounting		
First a numeric	cal example of	f growth:		
• Receive 100 d	at end of year	• 0, earn 10)% per year :	
Yea	ur O	Year 1	Year 2	
10	0 becomes	110	121	
So initial 100 ho	as grown to 12	21 after 2 y	ears	
SO: Futur	re value = pr	resent valu	ue $x (1+r)^t$	
1	121 =	100	$x (1.10)^2$	
				24

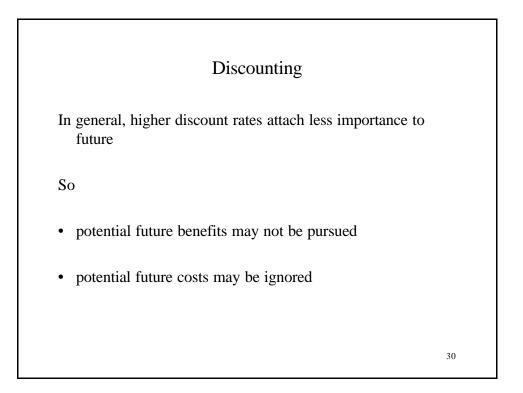


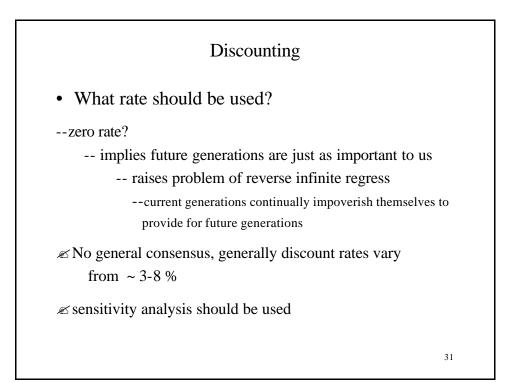


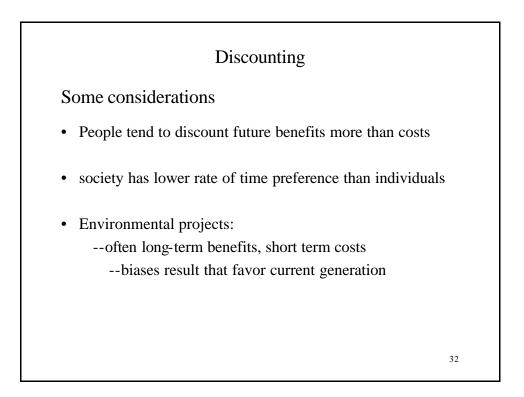


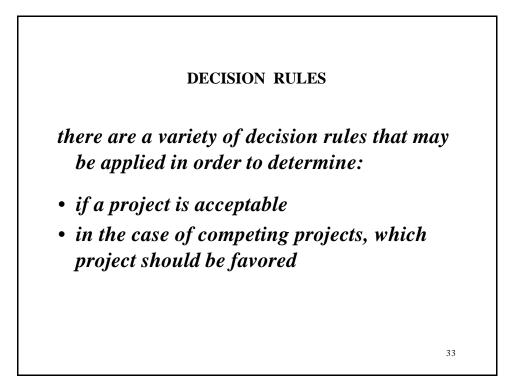


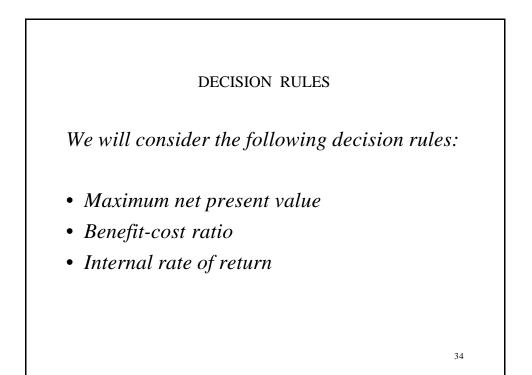
	Discounting						
• The ba	• The basic problem						
Disc	intergenerational equity: Discounting makes future costs and benefits appear smaller in the present						r
Example:	Example: present value of \$1.00 received in future (the discount factor $(1 + r)^{-t}$)						
Year	5	10	20	25	30	40	50
r = 10 %	0.62	0.39	0.15	0.09	0.06	0.02	0.0085
r = 5 %				0.30			0.09
							29











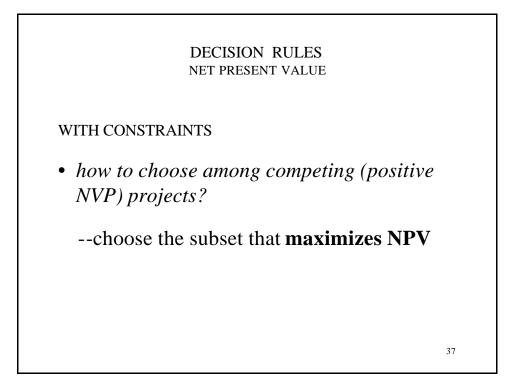
DECISION RULES

REMINDER:

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

35

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7		
7		
i		
Y WZ	YZ	
) 285	375	
PV		
)) 5 Y WZ YZ 0 285 375

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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

DECISION RULES BENEFIT-COST RATIO						
<u>example</u>						
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.						
				41		

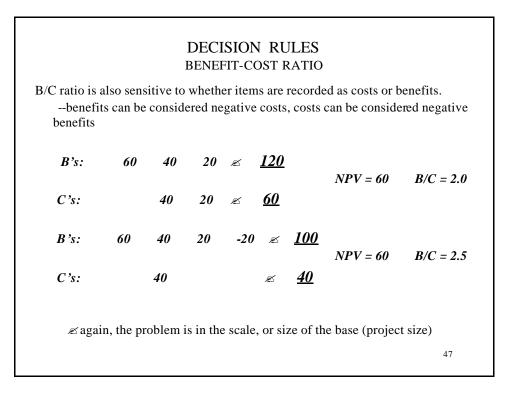
DECISION RULES BENEFIT-COST RATIO						
<u>example</u>						
project	benefits (PV)	costs (PV)	B – C (NPV)	B/C		
Х	200	100	100	2.0		
Y	110	50	60	2.2		
Z	120	50	70	2.4		
with mutual exclusion: Max NPV chooses X, but B/C chooses Z						
	\swarrow by choosing Z, one sacrifices 30 additional units of NET benefits that could have been had from X.					
				42		

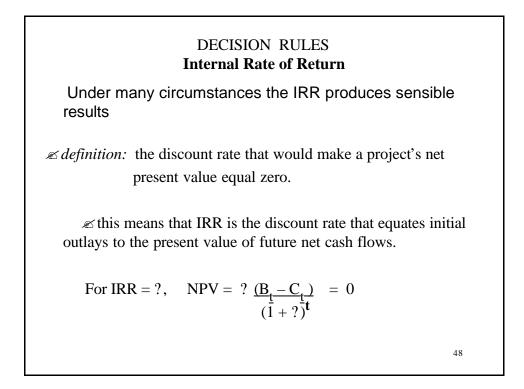
example					
project	benefits	costs	B - C	B/C	
Х	200	100	100	2.0	
Y	110	50	60	2.2	
Ζ	120	50	70	2.4	
	at the problem is ninator; costs) are		e of different size	e, so the bases	

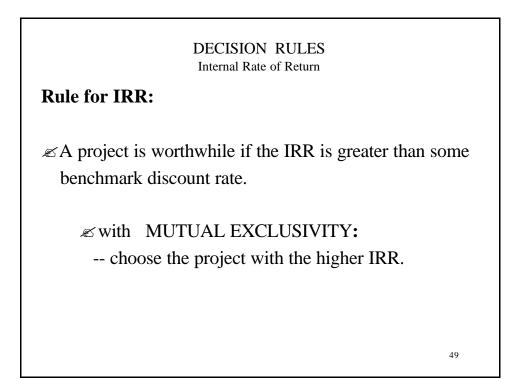
		ECISION RU ENEFIT-COST RA budget constrain	ATIO			
Example: let budget constraint = 100						
	by ranking by B/C and working down the list until the budget is exhausted we get the correct choice of $Z + Y$:					
project	cost	benefits	B – C	B/C		
Z	50	120	70	2.4		
Y	50	110	60	2.2		
Х	100	200	100	2.0		

	В	DECISION RU ENEFIT-COST R oudget constraint =	ATIO			
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		
Х	100	200	100	2.0		
$\mathbf{Y} + \mathbf{Z}$	100	230	130	2.3		

	BEN	CISION RULE NEFIT-COST RAT lget constraint = 1	TIO	
		nple where costs d method fails, as Pr		
,				
project	cost	benefits	B – C	B/C
Х	100	200	100	2.0
Y	60	126	66	2.1
Z	30	63	33	2.1
Y + Z	90	189	99	2.1
				46

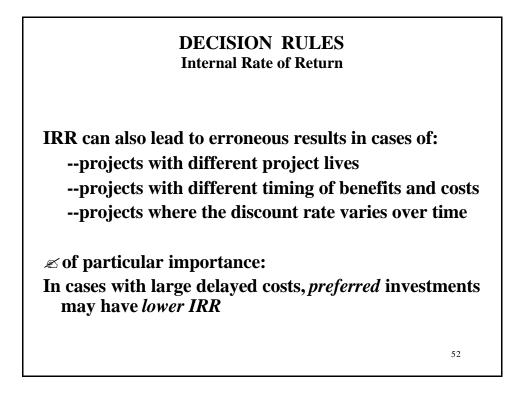


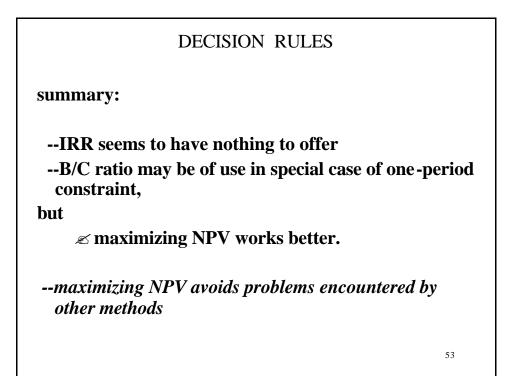




DECISION RULES Internal Rate of Return					
EXAMPLE:					
	YEAR 0	YEAR 1			
Capital cost	100	0			
Benefit	0	130			
Operating cost	0	20			
$NPV = -100 + \{ ($	(130 – 20) / 1.10]	= 0 so IRF	R = 10%		

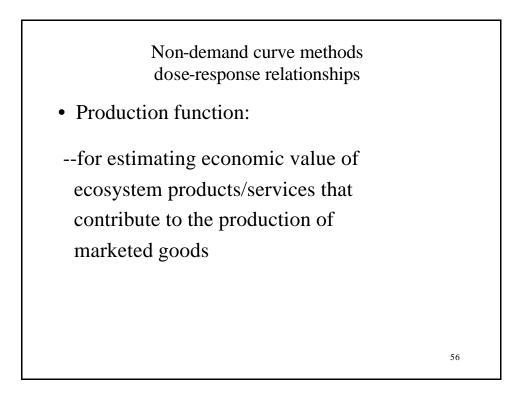
Can give	e wrong res	ults in case of	f mutual excl	usivity
U	0	sized projects:		
		· · ·		y starting Year 2:
Project	Cost	Benefit	IRR	<i>NPV at 10%</i>
X	1000	300	30%	3000
Y	5000	1000	20%	5000
for inde	pendent proje	ects and no cons	traints all woul	d be accepted
for mutu	ally exclusive	e projects, IRR w	vrongly picks pr	oject X

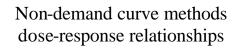




	Categorizing benefits TOTAL ECONOMIC VALUE					
Ŭ	ISE VALUES	NO	DN-USE VALUES			
Direct use values	indirect use values	option values	existence/bequest values			
// -fishing -recreation -transport -navigation	// -flood protection -storm protection -nutrient cycling -waste assimilation -sedimentation	// -insurance value of preserving options for use	// -value derived from knowing a specie/system is preserved -value of passing on assets to future generations			
			54			

Monetary valuation methods		
<u>demand curve approaches</u> <u>approaches</u>		non-demand curve
/	١	11
expressed	revealed	replacement costs
preference	preference	preventative behavior
methods	methods	dose-response methods
//	//	
contingent	travel cost model	
valuation		
	hedonic pricing	
choice		
modeling		
		55



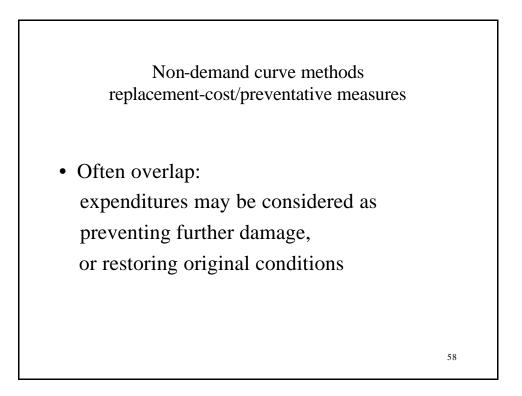


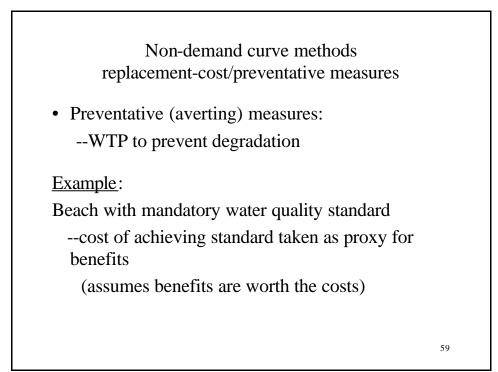
• Production function:

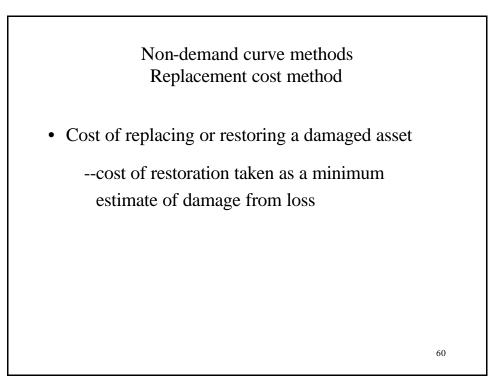
fish yield = f (labor, capital, stock (habitat quality))

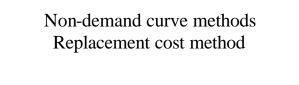
habitat = f (pollution)

? pollution \ll ? habitat \ll ? stock \ll ? harvest



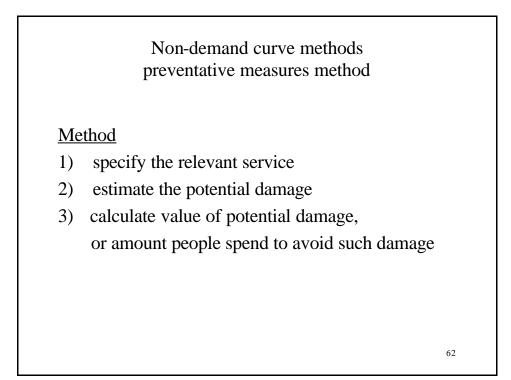


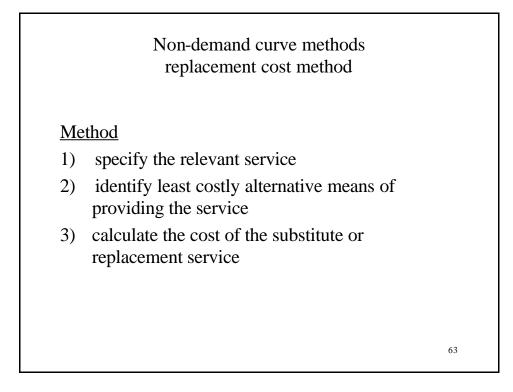


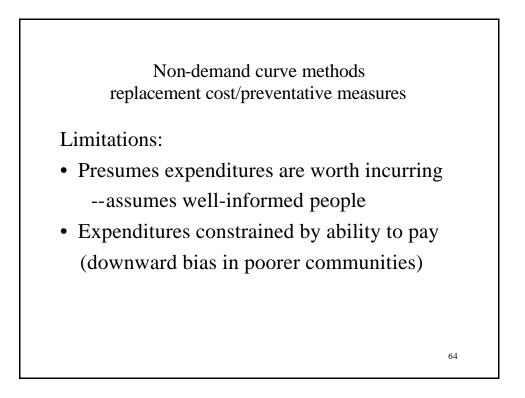


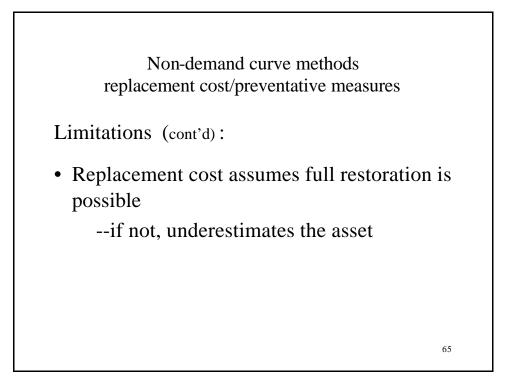
Examples:

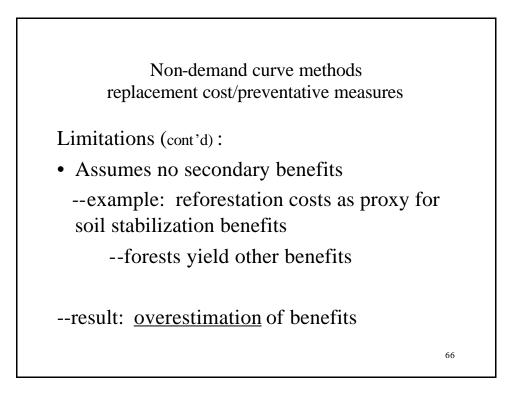
- --Valuing storm protection services of coastal wetlands by measuring the cost of building retaining walls
- --Valuing fish habitat/nursery services by measuring cost of fish breeding/stocking programs









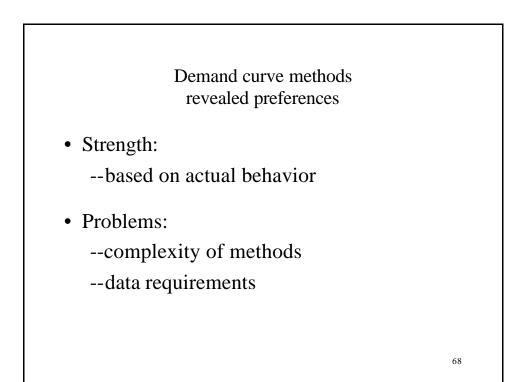


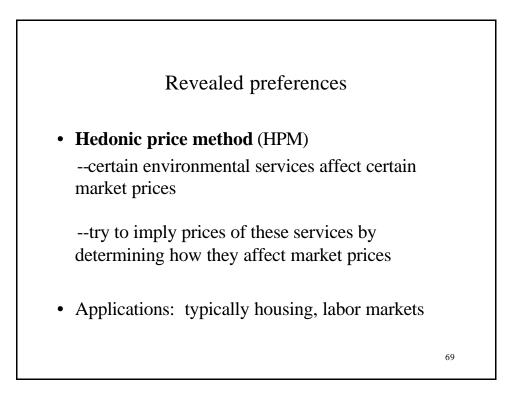
Demand curve methods

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

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

--behavior in one market <u>reveals</u> an implicit price of a related non-market good





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
70

Revealed preferences hedonic prices

Methodology:

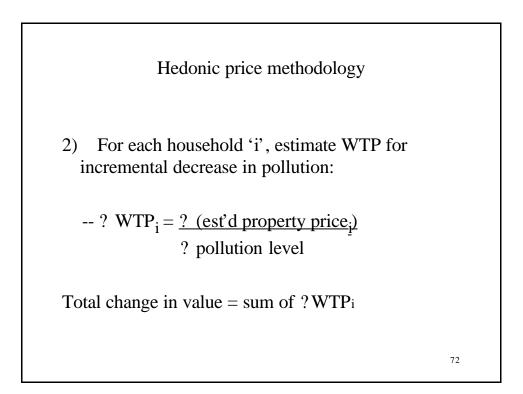
1) Estimate a price function:

Property price = function of:

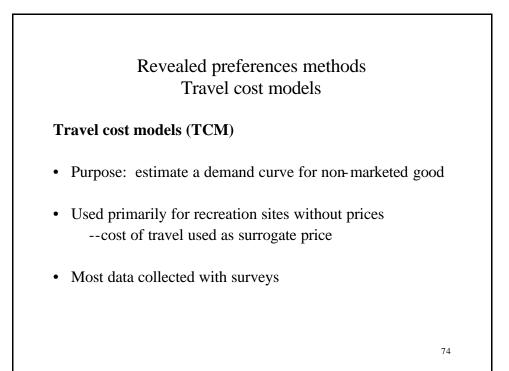
--physical characteristics (house size, no. of rooms, etc)

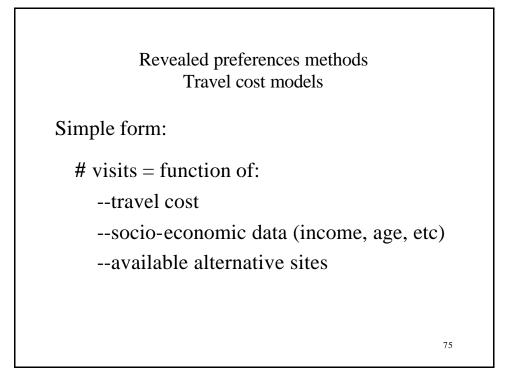
--location characteristics (proximity to work, amenities)

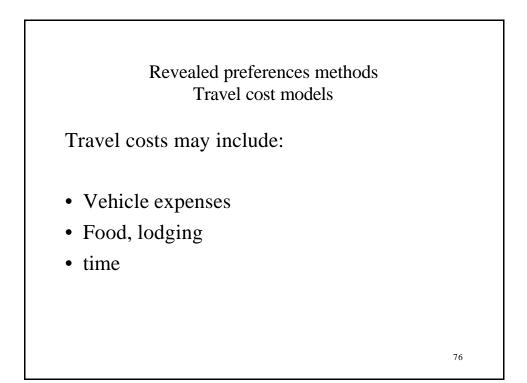
--environmental quality variables (ex.: pollution level)

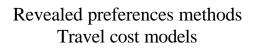


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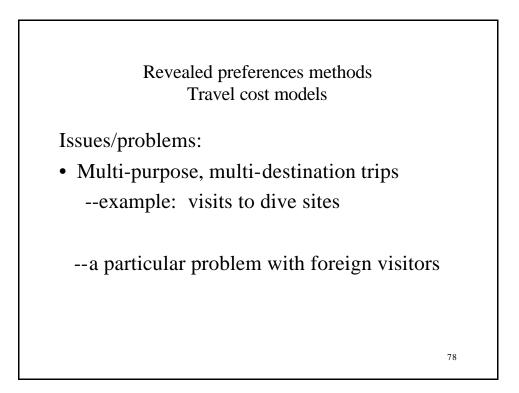


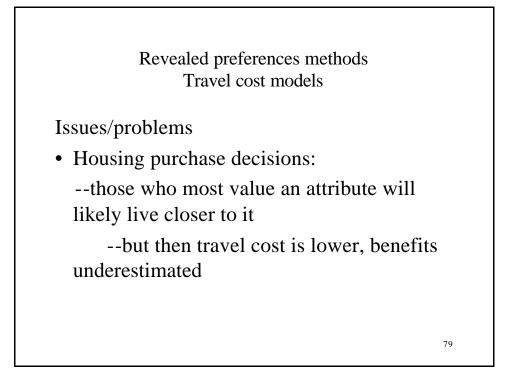
Issues/problems

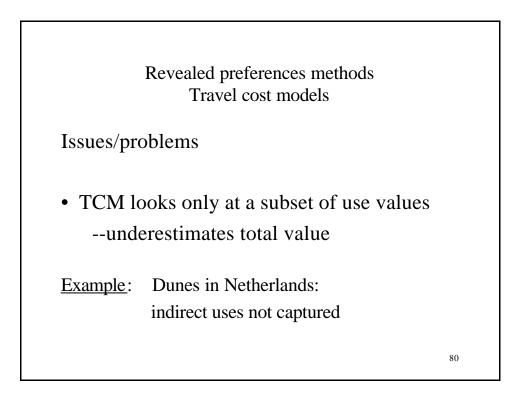
--<u>time costs</u>:

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







Demand curve methods Expressed (stated) preferences methods

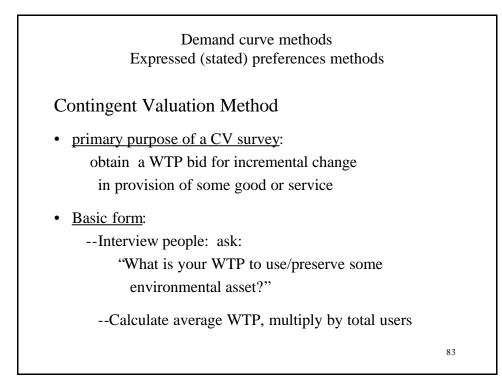
- Not based on actual behavior
- Survey based; hypothetical context
- Capable of capturing both use and non-use values

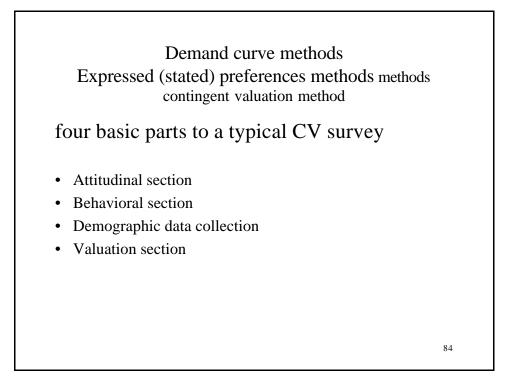
Demand curve methods Expressed (stated) preferences methods

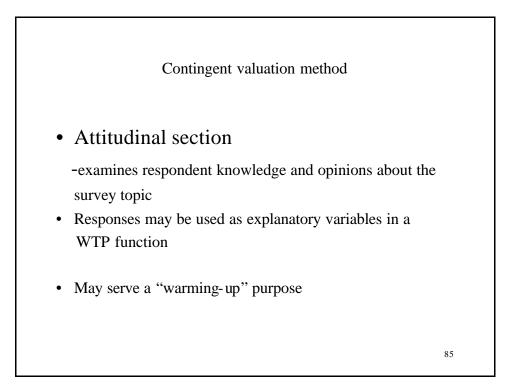
Two main categories:

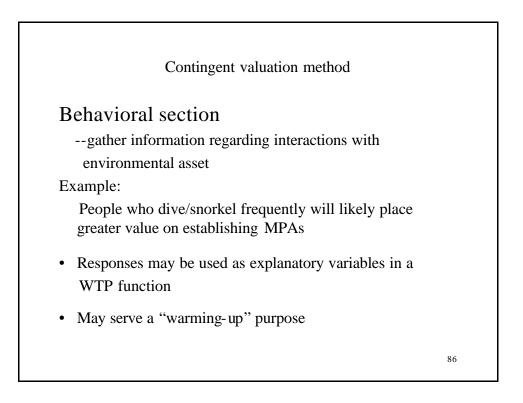
- Contingent valuation method (CVM) --widely used for environmental impacts
- Choice modeling (CM)
 - --gaining acceptance for multi-attribute environmental goods

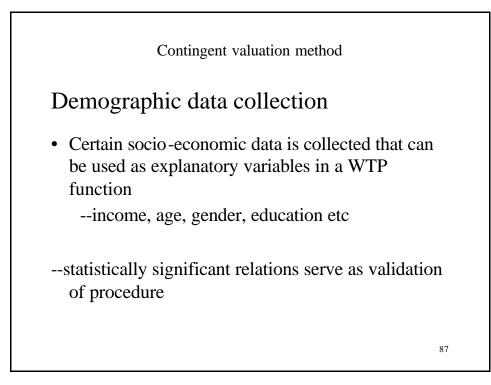
82

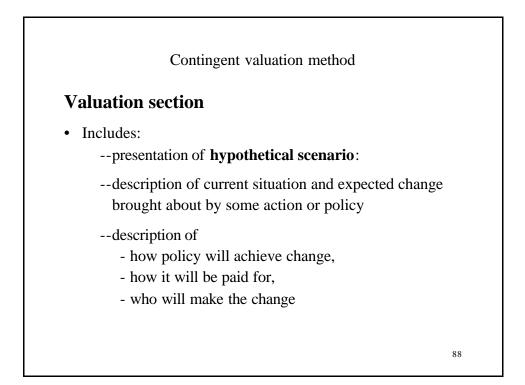


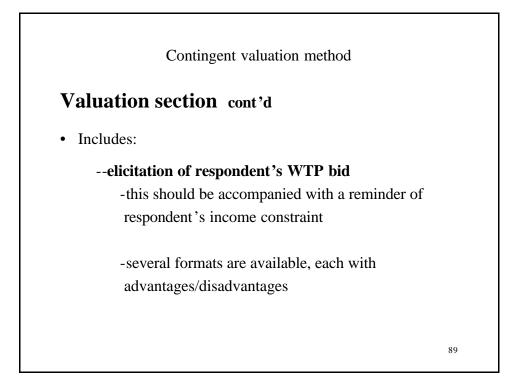


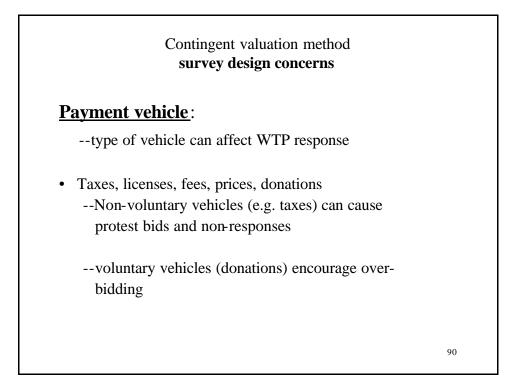


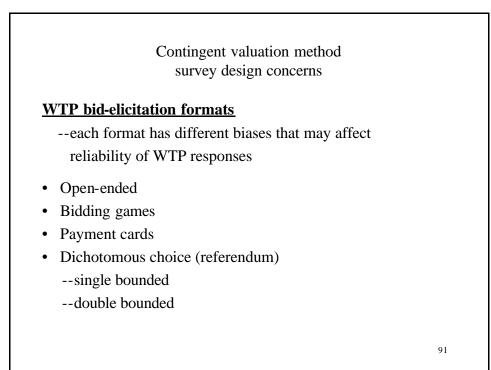


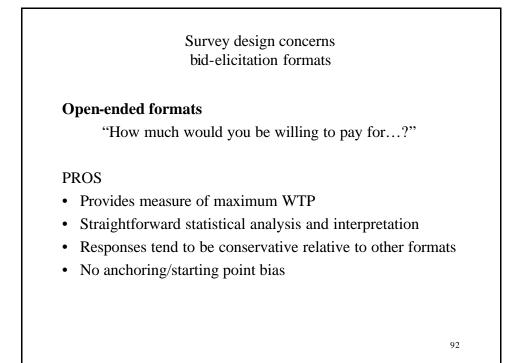


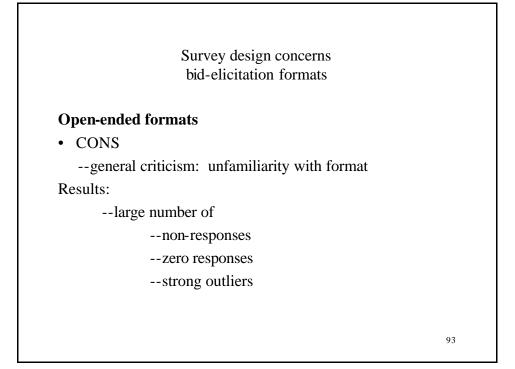


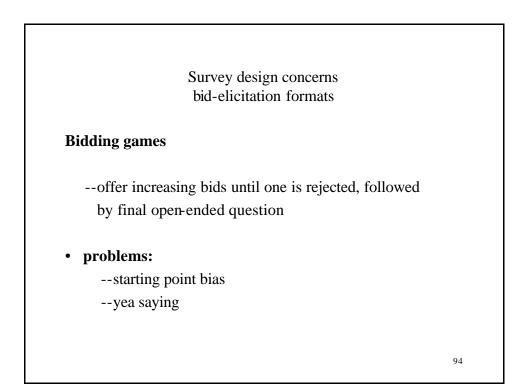


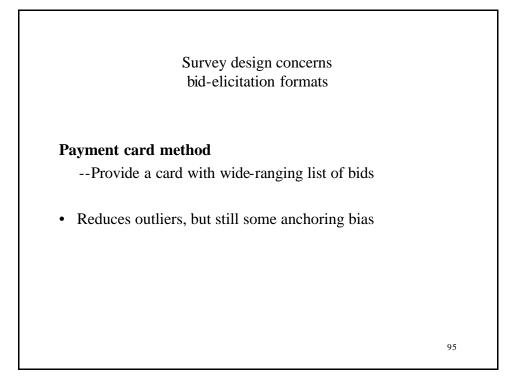


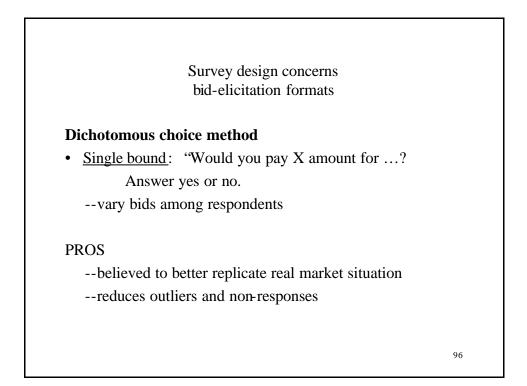










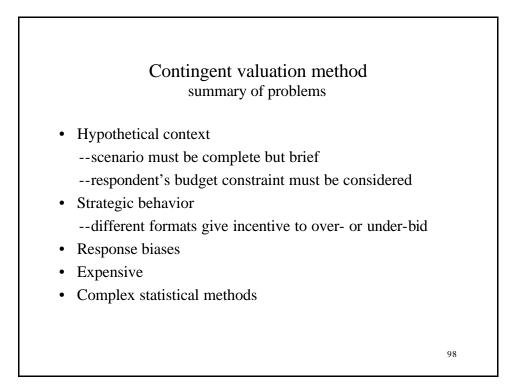


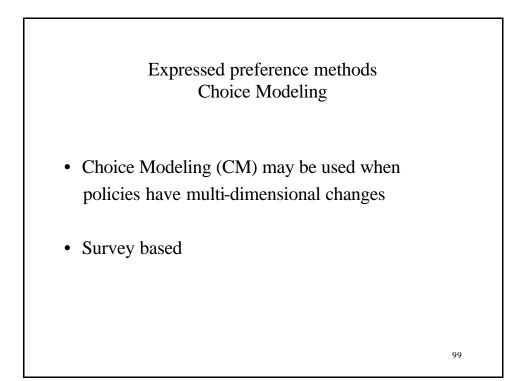
Survey design concerns bid-elicitation formats

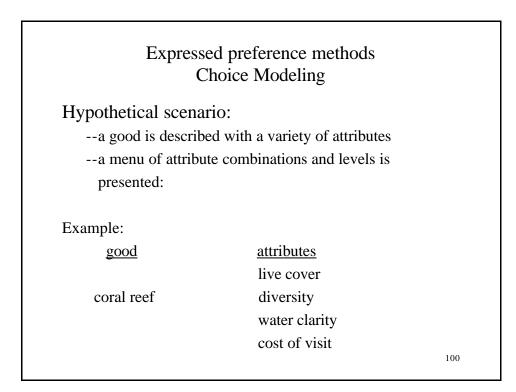
Dichotomous choice method

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

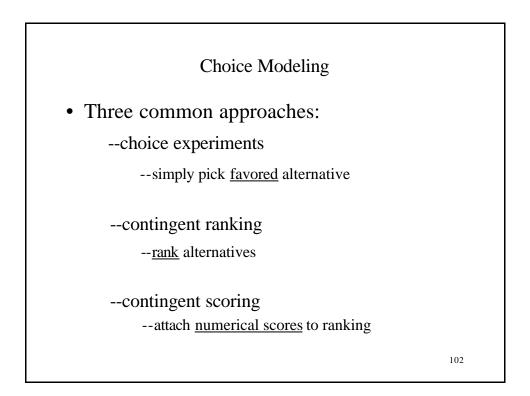


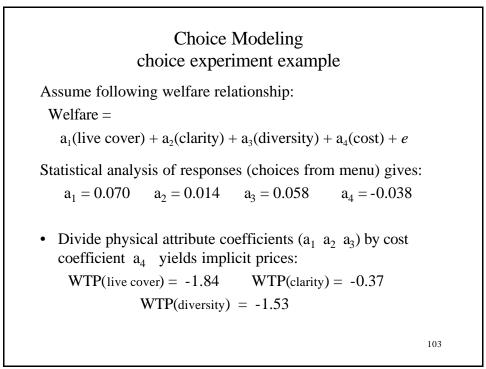


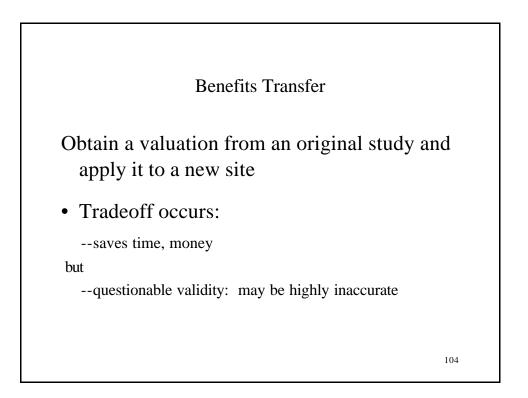


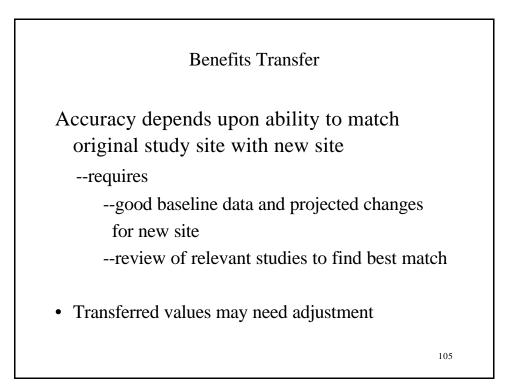


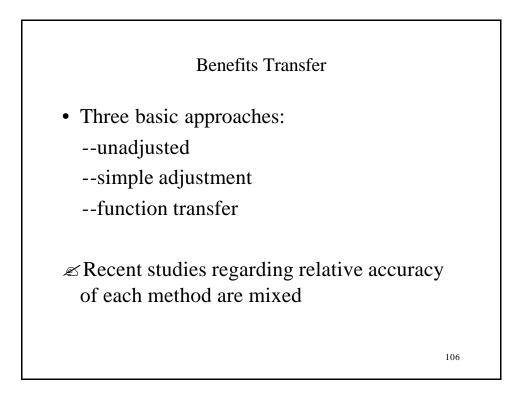
	Hypothet	Modeling tical scenario ample		
Menu:				
attribute	<u>status quo</u>	policy 1	policy 2	
Live cover Diversity Water clarity Cost	low medium low zero	medium high medium medium	high medium high high	
				101









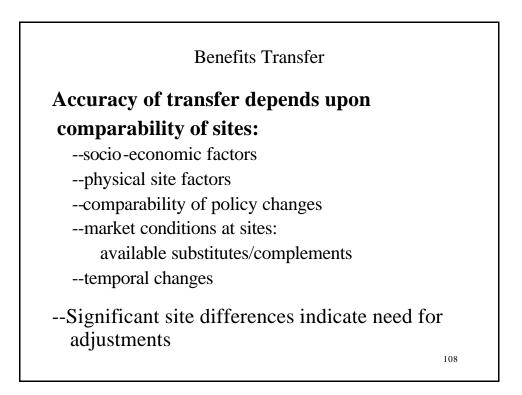


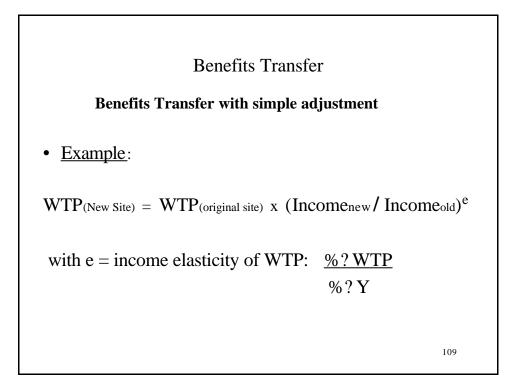


• Unadjusted method

--WTP(original site) = WTP(new site)

--mean WTP x relevant new population = aggregate benefits





Benefits Transfer			
Benefits Transfer with <u>function transfer</u>			
• 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)			
stransfer involves use of same coefficients for variables			
An immediate problem: access to data needed for function			
110			

