

Discount Rates in Risk v. Money and Money v. Money Tradeoffs

Anna Alberini (University of Maryland
and FEEM)
and **Aline Chiabai**

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Monetized Human Health Benefits of Environmental Policies

- Exposure to carcinogens over a long period before onset of symptoms
 - reduce pollution levels now, risk reduction takes place several years from now
 - Future risk reductions important when there is a permanent improvement in environmental quality
- Invest/pay now to obtain a mortality risk reduction later

WTP for future mortality risk reductions

Life cycle model predicts that one should pay for a risk reduction in the future less than he would pay for a risk reduction now

- Future utility is discounted at the subjective rate of time preference
- There is a chance that one may not survive to the age when the risk reduction begins

WTP for future mortality risk reductions – 2


For a marginal risk reduction

$$VSL_{jk} = VSL_{kk} \cdot e^{-\delta(k-j)} \cdot q_{jk}$$

j = current age

k = future age

Conditional probability of surviving
from current age j to age k



WTP for future mortality risk reductions – 3

For a small risk reduction

$$WTP_{jk} = WTP_{kk} \cdot e^{-\delta(k-j)} \cdot q_{jk}$$

Research questions

1. What is the personal discount rate δ , and how does it compare with the discount rate(s) typically used in cost-benefit analyses?
2. When using stated-preference methods, is δ influenced by certain aspects of the hypothetical scenario?
3. How does the discount rate δ from money v. risk tradeoffs compare with the discount rate in money v. money tradeoffs?

Approach

- Stated preferences
 - contingent valuation about mortality risk reduction
 - money (now) v. money (later) choice question
- Risk of dying for cardiovascular and respiratory causes
 - Air pollution (both short- and long-term effects)
 - Heavy metals
 - Heat waves
- Two modes for delivering the risk reduction:
 - Medical test (preventive treatment)
 - Completely abstract risk reduction (“Imagine that it were possible to reduce your risk by ...”)

Administration of the questionnaire

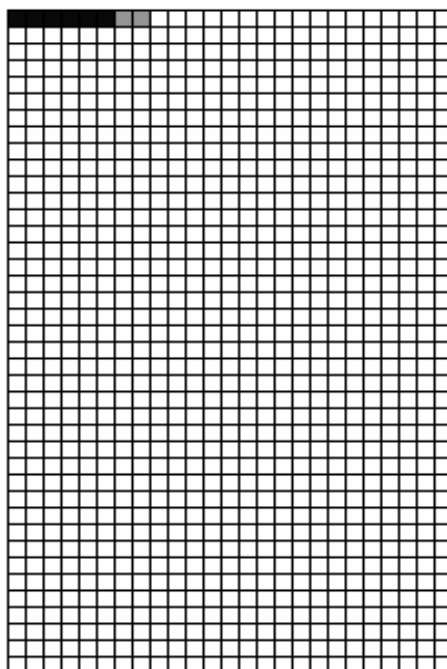
- Self-administered computer questionnaire
- Sample stratified by age, with 3 age groups each with equal number of respondents: 30-40, 45-59, 60-75
 - Future risk reduction question asked only of respondents up to age 59
- 31 May – 9 June 2004
- Rome, Venice, Milan, Genoa and Bari
- N = 801

Contingent valuation questionnaire

- Risk and risk reductions
 - expressed as X in 1000 over 10 years (=X in 10,000 a year)
 - Grid of squares
- 2 WTP questions for a reduction in mortality risks for cardio- and respiratory causes
 - X in 1000 over 10 years starting now
 - Z in 1000 over 10 years starting at future age k
 - Dichotomous-choice with follow-up

- Risk reductions X and Z
 - varied across respondents
 - can test for scope
 - Range from 1 to 22 in 1000 over 10 years
- Future age k varied across respondents, and respondents are of different ages j
 - can identify δ

Per una persona della sua età, sesso e stato di salute, la probabilità di morire per cause cardiovascolari e respiratorie nei prossimi 10 anni è 2 su 1000. Questo è illustrato nel grafico dai 2 quadratini arancioni. Nel calcolare questa probabilità, abbiamo tenuto conto di eventuali azioni preventive o terapie da lei effettuate. (La probabilità di morire per ogni altra causa è 6 su 1000).






Le principali cause di morte fra le persone della sua età e sesso sono:

PRINCIPALI CAUSE DI MORTE TRA LE <u>DONNE</u> NELLA SUA FASCIA D'ETA' (35-39 ANNI)
1. Tumori (al seno)
2. Incidenti (sul lavoro, trasporto, domestici, incendi, ecc)
3. Malattie cardiovascolari
4. AIDS

Cliccando sul seguente link troverà la descrizione per alcune malattie:

descrizione malattie

-  = MORTI (cause cardiovascolari e respiratorie)
-  = MORTI (tutte le altre cause)
-  = VIVI

Per proseguire preme la BARRA SPAZIATRICE oppure clicchi sul pulsante VERDE



Bid amounts (in euro)

Initial bid	If yes	If no
110	250	70
250	500	110
500	950	250
950	1200	500

Money v. Money Tradeoff Questions

Suppose you are entitled to receive a sum of money.
This sum of money may be paid to you in two possible ways:

(A)	(B)
10,000 Euro immediately	An annual payment of FILL Euro for the next 10 years

Which do you prefer, (A) or (B)?

(A) (B) (A) and (B) are equally attractive

FILL = 1150 (which corresponds to a discount rate of 2%)
= 1500 (which corresponds to a discount rate of 7%)
= 1650 (which corresponds to a discount rate of 10%)

Descriptive Statistics of the Sample

Variable	Mean or percent of the sample
Male (dummy)	48.0%
Household income/number of family members (euro per year)	8,808.6
Has chronic cardio or respiratory illness, high blood pressure, or diabetes (AT RISK)	40.0%
Abstract mode of delivery of the risk reduction (ABSTRACT)	51.0%
Respondent is risk averse with respect to financial risk (RISK AVERSE)	52.6%
Baseline risk (in 1000 over 10 years)	7.96
Risk reduction (in 1000 over 10 years)	2.75

Responses to the (immediate) WTP questions (N=508)

Yes-yes: 29.92%

Yes-no: 17.91%

No-yes: 11.42%

No-no: 40.75%

Responses to the Money v. Money tradeoff questions

Annual payment (euro per year)	D* (discount rate that makes annual payments equivalent to 10,000 euro immediately)	Percent that chose the 10,000 euro immediately
1150	2.86%	55.55
1500	8.74%	50.59
1650	11.02%	44.90

A Model of WTP

$$WTP_{ij}^* = \exp(\mathbf{x}_i \beta_1) \cdot (\Delta R_{ij})^{\beta_2} \cdot \exp(\varepsilon_i) \quad (\text{now})$$

$$WTP_{ik}^* = [\exp(\mathbf{x}_i \beta_1) \cdot (\Delta R_{ik})^{\beta_2}] \cdot e^{-\delta(k-j)} \cdot q_{jk} \cdot \exp(\eta_i) \quad (\text{later})$$

Individual characteristics
affecting WTP, e.g., income,
health status, risk aversion, etc.

Risk
reduction

Discount
factor

From official
life tables, but
results robust
to using
subjective
estimates

A Model of WTP – 2

$$\log WTP_{ij}^* = \mathbf{x}_i \beta_1 + \beta_2 \log \Delta R_{ij} + \varepsilon_i \quad (\text{now})$$

$$\log WTP_{ik}^* = \mathbf{x}_i \beta_1 + \beta_2 \log \Delta R_{ik} + \delta(j - k) + \log q_{jk} + \eta_i \quad (\text{later})$$

Interpretation of coefficients:

β_2 = elasticity of WTP with respect to risk reduction. If equal to 1, WTP is proportional to the size of the risk reduction.

δ = discount factor

A Model of WTP – 3

- Error terms are assumed to be jointly normally distributed
- WTP is joint lognormal
- Interval-data contribution to the likelihood based on bivariate lognormal WTP

WTP model results

N=508

Variable	Coeff.	T stat.
Intercept	4.5970**	15.28
DELTARISK	0.5172**	14.28
Household income per family member (thou. Euro)	0.0119	0.67
Missing income dummy	0.1074	0.33
Respondent has chronic cardiovascular or respiratory illness, high blood pressure, or diabetes (ATRISK)	0.4234**	2.32
Abstract mode of delivery of the risk reduction (ABSTRACT)	0.4648**	2.63
Respondent is risk averse (RISKAVER)	-0.3068	-1.59
Discount rate δ	0.0218**	3.32
σ_ε and σ_η (scale of the error terms)	1.8178**	19.24
Correlation coefficient (RHO)	0.9168**	78.22

Remarks and Implications for Q1

- Scope test: WTP increases significantly—but less than proportionately—with the size of the risk reduction
- Discount rate = 2%, less than discount rates recommended by European Commission
- VSL*
 - For immediate risk reduction, mean VSL is €4.686 million
 - For risk reduction in 20 years, mean VSL is €3.030 million—36% less.

* = For person of average income resident in Rome, in good health and risk averse, risk reduction=2 in 1000 a year

Q2. Does the discount rate depend on scenario specifics?

- Separate the data into the subsamples that received the medical and abstract risk reductions
- Discount rates
 - medical 1.63%
 - abstract 2.64%
 - Not statistically different from one another (wald statistic 0.46)

Q2 continued

- If anything, the medical/abstract scenario seem to influence the WTP for an immediate risk reduction
- No effect on variance of WTP
- Empirical results do not seem to confirm the evidence and insights from focus groups during survey development work

Q3. What is the discount rate in money v. money tradeoffs?

- Median discount rate is 0.0807 (8.07%)
 - Heterogeneity among respondents captured into standard deviation of the distribution of the discount rate (0.0784)
 - Males have lower discount rates (2.50% lower)
- Discount rate in money v. money tradeoff higher than in the money v. risk tradeoff, but lower than found in much of the previous literature

Conclusions

- Contingent valuation survey about immediate and future risk reduction implies discount rate of about 2%--lower than official discount rate recommended by EC, lower than own studies in US and Canada
- Scenario aspects influenced immediate WTP, but not discount rate
- Discount rate in money v. money tradeoff 8%--lower than in many other studies

The end

Structure of the Questionnaire

- Age and gender → input for calculating baseline risks and risk reductions
- Health status of the respondent
- Probability tutorial
- Show respondent's own risk of dying for all causes and for cardio and respiratory causes
- Explain that it *is* possible to reduce the risk of dying for these causes (e.g., high blood pressure medication)
- All risks and risk reductions are X in 1000 over 10 years; risk reductions are varied to the respondents
- Elicit WTP for risk reductions
- Money now v. Money later questions
- Demographics