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Multiple Year Cost Calculations

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Section A

Present Value

Issues with Multiple Year Calculations

Inflation

- ★ *Make sure all dollars are worth the same amount in terms of what they can purchase*

Discounting

- ★ *Make sure that the dollar value is expressed in terms of the money that is needed at the present time rather than the total cash flow*

Main Idea of Discounting

Costs and benefits

- ★ *Accrue currently and in the future*

Examples

- ★ *Think corrective cosmetic surgery (cleft palate)*
  - Benefit from surgery over your entire life
  - Costs are incurred at a single point in time
- ★ *Dysfunctional uterine bleeding surgery*
- ★ *Elimination of trachoma*
- ★ *Investment in averting low birth weight*
- ★ *Others?*

Continued

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Important Assumption

Simplifying assumption that relevant group doesn't change over time

- ★ *Accounting for the time horizon*
- ★ *This is not true but we can relax it later*
- ★ *Perspective does not change*

For reference: Flow of costs and benefits

- ★ *Immediate (t=0)*
- ★ *End of first year/beginning of second (t=1)*
- ★ *End of second year/beginning of third (t=2)*

Idea of Present Value (PV)

What's the value of $1 received today?

- ★ *$1*

If $1 will not be received until next year, is the value higher or lower?

- ★ *Lower because you have to wait*
  - Interest rate
  - General impatience

Example for Present Value

Want to know present value now for $1 received every year for 5 years?

Could ask what is value for $1 in year 1 (t=0), year 2 (t=1), year 3 (t=2), year 4 (t=3), year 5 (t=4)?

- ★ *Value(0)>Value(1)>Value(2)>Value(3)> Value(4)*
- ★ *Each report is in present dollars*
  - Dollars measured at time zero

Take Away Message Regarding Present Value

The sum of concurrent payments for the plan is not the value over time

- ★ *Key*
  - The value for $1 received this year is not equal to the value for $1 received next year

Reasons for Non-Equality

Basic impatience

- ★ *People don't want to wait for benefits and are willing to pay in order to get benefits sooner rather than later*

Behavior reflected in money markets

- ★ *Cost to borrowing and a reward for lending*
- ★ *People have uses for money now*
- ★ *For money markets the degree of impatience is quantified by the interest rate, r*

Present Value: Concept and Example

The concept of present value is the concept of value at time 0

Return to PV of $1 received each year for five years with a constant r?

- ★ $1 + 1/(1+r) + 1/(1+r)^2 + 1/(1+r)^3 + 1/(1+r)^4$
- ★ *Use notation of t for each year and get to equation in which have sum over T periods*

Still have rule a decision rule that says adopt programs with a positive net benefit based on present value

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Section B

Details on the Discount Rate

What Is the Discount Rate?

Rate on money lent now in exchange for payment at the end of a pre-specified period of time

- ★ *Often an annual rate*

Arguments and Counters Regarding Prevention

Prevention is different

- ★ *No reason to say they should be valued more or less but, if you feel a need to make an adjustment, change the value*

Inflation

- ★ *Adjust for inflation and discount*

Continued

Arguments and Counters Regarding Prevention

Adjust discounting for uncertainty

- ★ *Use expected discount rate*

Keeler-Cretin is irrelevant

- ★ *Rarely have to spend money in limited time and would like to avoid issues anyway*

Arguments and Counters (2)

Proportional discounting (b/(b+t))

- ★ *Time preferences change as time advances*

Real value of health benefits may not be constant

- ★ *Change threshold but leave discounting alone*

Continued

Arguments and Counters (2)

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Continued

Arguments and Counters (2)

Real cost of producing health changes over time

- ★ *Adjust cost stream*

Individual discount rates

- ★ *Use market rate because CEA's purpose is prescriptive rather than descriptive*

Problems with Not Discounting

Policy deferral

- ★ *If you get the same costs and results in a given year, then invest smaller amount now if you are not discounting*

Affluence

- ★ *Always wait for effects as these will be more highly valued by those with more money in the future*

Continued

Problems with Not Discounting

Technological change

- ★ *Always makes sense to wait for it if you are not discounting*

Infinite stream has infinite value

Look at what people receive for differential mortality risk at work

- ★ *Discounting at rates of 1–14.2 percent*
- ★ *This includes rate of return in financial markets*

Continued

Evidence on Discounting

Look at what people receive for differential mortality risk at work

- ★ *One method*
  - Observe people's choices of jobs
  - Know probability of mortality and wage
  - Assume functional form for utility
  - Solve for implicit discount rate (people don't necessarily think this way, but behavior is consistent)

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Section C

Discounting and Inflation

Discounting and General Price Inflation

General price inflation means an equal percentage increase of all prices in an economy (including wages)

- ★ *No real effect*
- ★ *Multiplying all prices by the same factor does not change the budget constraints*

Nominal rate of interest is the actual rate received for money lent

Nominal rate of interest adjusted for the rate of price inflation

Equation relating the real rate to the nominal rate

- *(1+real)=(1+nominal)/(1+inflation)*
- *Equation useful because with info on nominal rate and rate of inflation we can calculate the real rate*
- *Approximation:* $r=(i-\pi)/(1+\pi)\approx i-\pi$

Inflation and Cost-Outcome Analysis

Real dollars and real effects should be more intuitive

- ★ *Easier to think of a constant value effect*
- ★ *Easier to assess changes in effects*

Shock trauma unit in a public hospital

Cost of the unit $700,000 per year in constant dollars

WTP for the benefits (in lives saved) by the public authority is $1,200,000 per year in constant dollars

If the nominal rate is 6% and the rate of inflation is 3% what is the PV of net benefits of running the trauma unit for three years?

Calculation of Present Value

($1.2 m - $0.7 m) + [$0.5 m / (1.06/1.03)] + [$0.5 m /(1.06/1.03)^2]

- ★ *Work in constant dollars with real rate of discount*

Could also adjust dollars to current year's dollars and then discount

- ★ *Changes calculation but not result*

Timing Matters: Adjusting for Inflation and Discounting

Following through with last example with all benefits at the start of the year

- ★ *1457948*

Suppose all benefits occur at end of year

(– \$0.7 m) + [\$0.5 m /(1.06/1.03)] + [\$0.5 m /$(1.06/1.03)^2$]+\$1.2m/$(1.06/1.03)^3$

- ★ *1345494*

Changes in Relative Prices Are Not the Same as Inflation

Suppose we have a sudden run on community health nurses and the cost of hiring a community health nurse increases to 110% of its current value

Changes the results of the cost outcome analyses substantially

Data for Making Inflation Adjustments

www.bls.gov