Federal Aviation Administration

Cost Effective Analysis:
The role of discounting in government investing

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Cost effective analysis

- A program is considered cost effective if it is determined to have the lowest cost in PV terms for a given amount of benefits
  - Applicable when it is unnecessary to consider the dollar value of the benefits under each alternative

Cost effective analysis (cont'd)

- All cost effective investments are discounted back to today's dollars using a PV formula
  - One method : Cash flow x Discount Factor
- Appropriately setting up the discount factor is critical in valuing a cost effective investment
  - Discount factor $1 / (1+R)^t$
    - Time is Maturity
    - Nominal or Real Treasury rate
- Over or under valuation can result when misappropriate inputs are applied
- Items to consider when computing an appropriate discount factor :
  1. Discount rates
  2. Timing of expenditures
  3. Inflation

Discount Rates

- Government discount rates are guided by OMB in Circular A-94 Appendix C
  - United States government cost of capital (treasury borrowing rate)
  - Treasury rates are given on a nominal and real basis for the 3, 5, 7, 10, 20 and 30 year

- Circular A-94 guides us to match the life cycle cost to the maturity of the treasury rate
  - A 20 year cost estimate would use a 20 year treasury rate
  - If the lifecycle extends beyond 30 years a 30 year treasury rate is applied

Discount Rates(cont'd)

- Linear interpolation shall be used when the life cycle falls between the given Treasury rates
  - Inter-period rate is computed by using a linear equation
  - Linear interpolation - X3 + (R5 – R3) / (X5 – X3)

- Linear interpolation is vital in coming up with an appropriate discount rate
  - If using a different rate than what should be applied your PV
    - Use higher rate then underestimate cost
    - Use lower rate then overestimate cost

- 15 year investment using OMB's 2004 10 and 20 year real treasury rates :

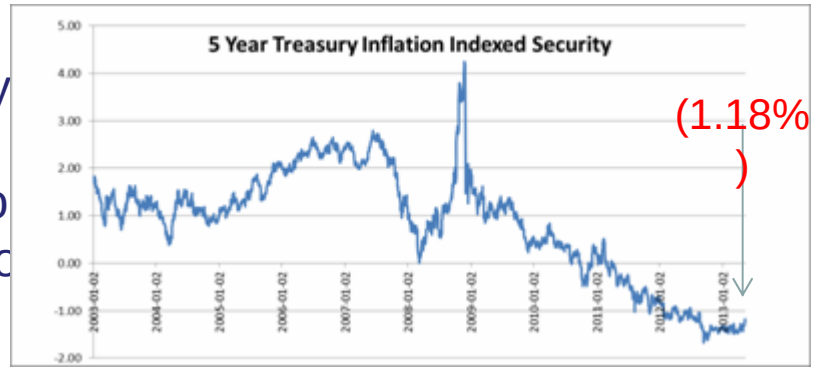
		1	2	3	4	5	6	7	8	9	FY 10-15	∑ (Sum)	Δ Delta
T-Note	15yr - 3.1%	485	470	456	443	429	416	404	392	380	$2,051	$5,926	0
	10yr - 2.8%	486	473	460	448	436	424	412	401	390	$2,127	$6,056	2%
	20yr - 3.4%	484	468	452	437	423	409	396	383	370	$1,978	$5,800	-2%

Note[1]: Constant dollar base of $500

Discount Rates(cont'd)

- Negative real rates
  - In periods of low nominal rates real rates can be negative - expected inflation exceeds the nominal rate
  - At negative real rates on treasury debt discounting on a cost effective investment will lead to a higher cost than your initial amount

- 5 year investment using OMB's 5 year treasury
  - 2013 OMB real rate negative at (.8%)
  - Discounted cost will higher than base amo
  - Cost effective investment deemed more co



	1	2	3	4	5	∑ (Sum)	Δ Delta
5yr - (.8%)	504	508	512	516	520	$2,561	2.45%

Note[1]: Constant dollar base of $500

Timing of Expenditures

- The timing of your cash flow is important and will have an impact on your present value
  - Three scenarios to consider:
    - Beginning of the year payment
    - Mid year payment
    - End of the year payment

- Depending on when your agency or project expends its cash:
  - If the expenditure occurs at the beginning of the year → beg. of year discount
  - If the expenditure occurs in the middle of the year → mid year discount factor
  - If the expenditure occurs at the end of the year → end of year discount factor

Timing of Expenditures (cont'd)

- Beginning of the year cash flows are treated as the previous end of the year expenditure
  - Year 1 beginning cash flow will not be discounted (t-1 = 1 - 1 = 0 N^0 = 1)
  - Raise to the power of t-1 $CF/(1+R)^{t-1}$
- Mid year payments are applied when a constant stream of expenditures are made throughout the year or a single expenditure is made mid-year
  - Raise to the power of t - .5 $CF/(1+R)^{t-.5}$
- End of the year payments are applied when expenditures is made at the end of the year
  - Raise to the power of t $CF/ (1+R)^{t}$

Inflation

- Circular A-94 guides us to use nominal or real discount rates
  - Nominal rates – expected inflation is included in the discount rate
  - Real rates - expected inflation is excluded in the discount rate

- Nominal rates should be used with Then Year cost (current dollars) and Real rates should be used with base year cost (constant dollars)

- It is imperative to match nominal rates with current dollars because the higher nominal rate will adjust for inflation
  - If current dollars are discounted by a real rate it will lead to overestimation

- It is imperative to match real rates with constant dollars
  - If constant dollars are discounted by a nominal rate it will lead to underestimation

Model Inputs and Model Run Through

- Walkthrough of VBA model that performs discounting procedure

Sources

Office of Management and Budget (2012). Circular A-94 Appendix C. Retrieved November 10, 2012, from <http://www.whitehouse.gov/omb/circulars_a094/a94_appx-C>