ECONOMIC INVESTMENT APPRAISAL

or

Beyond the Bottom Line!

Robert Marks

Week
1. **Introduction; Financial Appraisal v. Cost-Benefit Analysis**
2. **Basics of Project Evaluation**
3. **Shadow Pricing; Effects of Price Changes & Welfare Economics**
4. **Indirect Price Change Effects**
5. **Valuing the Environment & Other Unmarketed Goods**
6. **Risk-Benefit Analysis**
7. **Multi-Attribute Decision Analysis**
8. **Case Studies & the Rôle-Playing Exercise**
9. **Student Presentations**

Package
Assessment
Prerequisites

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How I Teach —

Topics introduced through lectures:

- **— Talk**
- **— Use of PDF slides/ OHP slides**
- **— Use of whyteboard**

Interaction, discussion, rôle-playing exercise, assignments, mid-term exam, term project. No tutes, but worked exercises are available.

IEA is not for everyone — doesn't *directly* help the firm's bottom line. Cost-benefit analysis.

No class on Friday 30th April, makeup on Wednesday May 5th. No classes on 21st and 25th May, makeup TBA.

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This Week: We Cover ...

1. Intro — decision-making issues.

2. Economic efficiency, or the size of the economic pie.

3. A weak ethical criterion: Pareto Improvement. The *efficiency criterion*: The Potential Pareto Improvement Criterion (PPIC), in which the size of the pie is the issue, not the sizes of the slices.

4. Comparing Cost-Benefit Analysis (CBA) with Financial Appraisal (FA).

5. The use of *opportunity cost*, not accounting cost, in CBA.

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1. Introduction

Five Principles

(See Landsburg in the Package.)

1. **Tax revenues are not a net benefit, and a reduction in tax revenues is not a net cost. Tax is a *transfer* = something for nothing.**

2. **A cost is a cost, no matter who bears it.**

3. **A good is a good, no matter who owns it.**

4. **Voluntary consumption is a good thing.**

5. **Don't double count.**

Only Individuals Matter
$$+$$
All Individuals Matter Equally
(A $ is a $)

THE WORLD IS COMPLEX:

$\rightarrow$ **two approaches**

☐ *deductive, reductionist*

• *systems (holistic)*

Analyst/Decision maker **can**

1.   **set priorities $\rightarrow$ weightings**
2.   **generate a set of alternatives**
3.   **choose "best" alternative**
4.   **need a *performance measurement*, however**

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Is this a tall order?

e.g. choosing chemical-processing equipment

e.g. choosing a word-processing system
- **$ cost**
- **performance**
- **servicing**
- **training**
- **documentation**

**(emergence of standards
e.g. MS Word)**

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2. How Can We Compare:

- **the pluses & minuses ?**
- **the advantages & disadvantages ?**
- **the benefits & costs ?**   **?**

The finance boys & girls: **"The $ bottom line!"**

but is that sufficient?

(it's necessary—why?)

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But what if:

- **market prices $\neq$ social values?**
- **the project would alter prices?**
- **there exist unpriced externalities (spillovers)?**

Then use techniques of Cost-Benefit Analysis

(Examples)

$\rightarrow$ **Prescriptive "ought"**

not

Descriptive "is"

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Objectives of the Decision Maker

Let us distinguish first:

"what is" − descriptive from

"what ought to be" − prescriptive

1. **Financial objectives — the bottom line**
2. **Broader objectives of Cost Benefit Analysis (CBA) or: *Beyond the bottom line!***
   - **when the organisation provides non-sold services e.g. defence forces**
   - **when there are external costs/benefits**
   - **when prices change because the project is sufficiently large**
   - **social discount rate $\neq$ private discount rate**
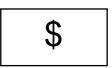
Cost-Benefit Analysis:

CBA: all the effects of a project on society, not just the direct (usually financial) effects.

Q: objective, measurement ?

A: welfare of each individual ideally

CBA: "market" mimicked where it doesn't exist, or is only imperfect in its information

$\rightarrow$ common unit to measure aggregate costs & benefits *shadow prices*

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Shadow Prices

$$\boxed{\$}$$

**market prices $\neq$ necessarily shadow prices
(*social* benefits & costs at the margin)**

how | **to identify
measure
compare** | **changes in
people's welfare ?**

$\rightarrow$ **Pareto Principle**

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2. Potential Pareto Improvement Criterion (PPIC)

[see C&B Ch. 1, FP Ch. 1.5, 4.1; S&W, Ch. 7]

a *Pareto Improvement* = a change that makes at least one person better off & no-one worse off (a measure of increasing economic efficiency, or reducing waste)

a project is OK under PPIC (or Kaldor-Hicks criterion) if *in principle* it is possible to secure an actual Pareto improvement by linking the project to a set of money transfers between the "gainers" and the "losers", in such a way that in principle no-one is worse off, even if these transfers don't actually take place, i.e., a potential improvement.

e.g. the noise cost of airport expansion.

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Example: The noise cost of airport expansion.

Questions:

- **losers:　minimum amount ($) you'd accept to put up with the project?
(Willingness to accept, WTA.)
(or: your willingness to pay to stop the project)**

- **gainers:　maximum amount ($) you'd pay for the project
(Willingness to pay, WTP.)**

Then:　If $\sum$ gainers $ > \sum$ losers $

then the PPIC is satisfied.

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Assumptions underlying the PPIC:

1. that every taste can be valued in money (everyone has their price) ("pricing out")

2. that changes in people's welfare (measured by their Consumer Surplus) can be measured by their "willingness to pay" (their preferences)

3. that these individual preferences are to be weighted by the individual's *ability to pay* ("a dollar is a dollar")

4. truthfulness (although perhaps there are techniques to reward truthfulness)

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How appropriate is the PPIC as a "social objective"?

Two alternatives suggested by S&W:
1. *d*ecision-*m*aking *a*pproach (DMA)
2. *P*aretian *a*pproach (PA)

1. DMA: The decision maker's objectives are the social objectives, by definition

CBA: process of appraising projects, given the DM's chosen objectives can be private

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The Paretian Approach

2. PA: objectives of the decision maker *should* be distilled from a consensus of the value judgements of the individuals in society

  – **independent of political process**

  – **a "consensus value-judgement", which can be identified using welfare economics
  i.e. using *Consumers' Surplus* (revision)**

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Comparing the DMA with the PA

1. **DMA: "PPIC (i.e. efficiency) is one objective of DM"**

2. **PA: (anyone has a veto in the Pareto Optimal sense e.g. the king)**

    Welfare Economics

    $\rightarrow$ **economic efficiency: size of the cake**

    v.

    distributional justice: relative size of the slices

    PPIC: a change is "good" if $\rightarrow$ greater economic efficiency

    winners v. losers

    [C&B Ch. 5, DoF Ch.2]

    PA: "economic rationalism"

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Efficiency v. Equity

more equal

**Less efficiency,
greater equality.**

**Greater efficiency,
greater equality.**

• *A*

*Smaller cake,
more even slices.*

*Larger cake,
more even slices.*

• *B*

Status Quo Ante   **efficiency**

**Less efficiency,
less equality.**

**Greater efficiency,
less equality.**

*Smaller cake,
less even slices.*

*Larger cake,
less even slices.*

less equal

Efficiency v. *Equity* or *Fairness*

(lexicographic ordering)

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Two questions:

1. **Can an unbiased decision maker exist?**
2. **How should the decision maker choose between:**

$$\left\{ \begin{array}{l} \text{economic growth} \\ \\ \text{environmental protection} \end{array} \right. \textbf{?}$$

assuming there is a conflict?

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4. Comparison of FA & CBA

[C&B Ch. 4, FP Ch. 1, 6]

Often Cost-Benefit Analysis (CBA) $\sim$ Financial Appraisal (FA)

e.g. A large project requires the purchase and use of 1000 t of bricks

FA: know market prices (bricks cheapest)
CBA: welfare of owners of brickworks
employees of brickworks
other users of bricks
etc.

So far, so good ...

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Competitive markets → no problems

but if (IF) there is a competitive market economy, (with no externalities)

brick price = MC of brick production = MV to users
wage   = MV of leisure   = MV of labour
                       to workers   to brickworks
& so long as no prices change, *then*
        there are no welfare effects
           & prices = marginal social benefits
                         = marginal social costs

and FA = CBA

(so long as there is no price change)

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Lack of a competitive market → problems.

But
- **perfect competition is rare**
- **prices may adjust to project (because of its size)**
- **externalities may exist (spillovers +ve or -ve)**
- **taxes exist**

∴ **FA ≠ CBA necessarily**

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Differences between economic and financial analysis

	Economic analysis CBA	Financial analysis FA
Viewpoint	Society as a whole	Individual, firm, or household.
Objective	Increase in welfare	Increase in individual, firm, or household profit or income.
Benefit	Any kind of satisfaction or increase in welfare, including monetary revenue.	Monetary revenue.
Benefit measurement	Willingness to pay or accept compensation	Monetary revenue.
Cost	Any kind of dissatisfaction or fall in welfare, including monetary cost.	Monetary cost.
Cost measurement	Opportunity cost.	Monetary cost.
Value	Net change in welfare.	Net change in monetary revenue.
Measure	dollars	dollars

Source: *Techniques to Value Environmental Resources: An Introductory Handbook*, Canberra: AGPS, 1995.

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Question:

Bill asserts that he could not even "give away" (for literally zero dollars) a building that he owns and uses in his business.

In economic jargon, the building has a zero opportunity cost. True/False? Explain.

(Write down your answer.)

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5. Use *Opportunity Costs*, not Accounting Costs:

Example [S&W, pp.35–36]: *Service A or B?*

A private bus company:

1. *Running Costs*

    Suppose the differences in running costs reported by different bus fleets can be explained quite well by the equation (in $'000):

$$C = 250.0 + 1.5b + 0.0038h + 0.00006k$$

    per year　　　　　　　　buses　　　hours　　kilometres

    b = 300 buses (typical fleet)
    k = 48,000 km/year/bus (both services)
    h = 3,000 hr/year/bus (typical)

    $\rightarrow C$ = **$4,984,000/y excluding costs of buying**
    　　　　　　　　　　　　　$4,984,000/year

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2. *Capital Costs*

$24,000/bus for 15 years (lifetime)

$\rightarrow$ $2,804/year/bus @ 8% p.a. (accounting depreciation)

300 buses $\rightarrow$ $841,000/year

$$\text{\$841,000/year}$$

3. $\therefore$ *Total Accounting Costs*

$\rightarrow$ accounting cost of $5,825,000/year

$$\text{\$5,825,000/year}$$

4. $\therefore$ *Average Accounting Cost*

$5,825,000 $\div$ (48,000 $\times$ 300)

$\rightarrow$ $0.40/bus-kilometre (accounting cost).

$$\text{\$0.40/bus-km}$$

Table 3.1

Characteristics of the two bus services

	Bus-km per week	Hours of service per week	Average speed (km per hour)	Additional buses required
Service A	4,000	20	12.5	16
Service B	4,000	96	20.8	2

Table 3.2

Accounting and opportunity costs of the two bus services

	Cost incurred in year(s) 0	Cost incurred in year(s) 1–15	Present cost in year 0
$0.40/bus-km → *Accounting costs*			**$ thousands**
Service A	–	83.2 per year	712.2
Service B	–	83.2 per year	712.2
***Opportunity costs* (using equation)**			
Service A	384.0	92.9 per year	1,179.5
Service B	48.0	47.1 per year	451.1

All costs in $'000. Present value calculated by using a discount rate of 8 per cent.

So: Using the accounting cost of $0.40/bus-kilometre understates the opportunity cost of Service A and overstates the cost of Service B.

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Why CBA?　[C&B Ch. 1, DoF 2.6]

- **To identify *efficient* alternatives.**

  Allocative efficiency: the level of output of any good or service cannot be increased without reducing the output of some more valuable good or service.

- **Allocative efficiency is maximised when the**
  benefit an individual derives from the last unit of consumption
  = the cost of producing that unit.

  Thus a producer in competitive markets who's pricing at marginal cost is operating efficiently.

- **Marginal-cost pricing implies that costs and benefits are valued at their *opportunity costs.***

Opportunity costs $\neq$ accounting costs.

Opportunity costs are operationalised through the *Willingness To Pay* (WTP) criterion.

— Outputs (except where they displace existing production) are valued according to the willingness of consumers to pay for them, which includes the consumer surplus (the difference between the price actually paid and maximum that would have been paid). (Later.)

— Opportunity costs look forward:
"What would I forgo?"
Accounting costs look back:
"What did I pay?"

— Inputs are valued on the basis of the maximum that others would have paid for them (except when there are no other users, in which case they are valued on the basis of the relevant constituent costs). (Later.)

Accept some projects, reject others.

So: accept projects whose net social benefits are positive, subject to budget constraints.

This rule is consistent with allocative efficiency, provided that:

- **— prices are set equal to marginal cost**
- **— marginal-cost pricing applies in related sectors**
- **— the distribution of income is equitable, fair**

Distinguish allocative efficiency from:

- **— productive efficiency**
- **— financial efficiency**
- **— social equity, fairness,**

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Why Would You Undertake a CBA?

- **CBA helps meaningful comparisons between different courses of action.**

- **CBA can provide a clear focus on net benefits without regard to who wins and who loses.**

- **CBA encourages clear thinking about the true "value added" from a proposal.**

- **CBA adds a useful "hard edge" to an evaluation strategy.**

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When To Use CBA?

- **Undertaking a new or replacement capital project.**
- **Using or disposing of an existing asset.**
- **Leasing or buying an asset.**
- **Analysing a policy option.**
- **Post-evaluation of a project or program.**
- **To value or not?**

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Summary of Week 1

These lectures introduced:

- **Economic efficiency, or the size of the economic pie for the region (city, state, country, or — rarely — the world)**

- **A weak ethical criterion: Pareto Improvement, which gives anyone a veto.**

- **The efficiency criterion: The Potential Pareto Improvement Criterion (PPIC), in which the overall size of the pie is the issue, not the sizes of the slices — redistribution is seen as a political responsibility**

- **Comparing CBA with Financial Appraisal.**

- **The use of *opportunity cost*, not accounting cost, as a general rule.**