Economic Investment Appraisal

R.E. Marks

MID-TERM EXAM

AGSM 202
12 October 2001

Do ONE question from Section *A*, and ONE question from Section *B*. The exam is closed-book, but each student is allowed a single A4 crib sheet. *The exam is 80 minutes long; the first 5 minutes is time for reading: do not write during this time.*

PLEASE RETURN THE QUESTION SHEET AT THE END OF THE EXAM

Section A Attempt ONE of Questions 1 and 2.

1. Attempt all parts.

   a. Discuss all answers.

      i. State the Potential Pareto Improvement Criterion.

      ii. If a project is desirable according to the PPIC and is undertaken by the government, does the PPIC require that compensation occur? Why or why not?

      iii. A positive outcome under the PPIC indicates that *what* would increase if the project were undertaken?

   b. It is often claimed that a particular project in a remote location will be "good for Australia" because of its *multiplier effect*, in which for every dollar spent on the project, a further *y* dollars will be spent in the neighbouring town, or for every new job created by the project, a further *z* jobs will be created in the district.

      i. What is a pecuniary external effect (or PEE)?

      ii. Discuss the merits or otherwise of the use of multipliers in cost–benefit analysis, especially with regard to efficiency measures, such as PPIC.

   c. Because of a recent wave of jewellery shop robberies, police surveillance of jewellery shops is increased, which costs the state an extra $500,000 per year. As a result, however, the amount of jewellery that is stolen falls. Specifically, without the increase in surveillance, jewellery with a retail price of $1 million would have been stolen. This stolen jewellery would have been fenced (sold to receivers of stolen goods) by the thieves for $600,000.

      What is the net *social* benefit resulting from the increased police surveillance? Explain.

OR

2. Attempt all parts.

   a. Discuss all answers.

      i. (Paretian) cost–benefit analysts use the Potential Pareto Improvement Criterion (PPIC) to decide whether to undertake a project. Explain what the PPIC is and how it might be used.

      ii. Explain why, when using the PPIC, it is not necessary that those who stand to gain must compensate those who stand to lose in order for the project to be desirable. Could such compensation nevertheless be desirable? Explain.

   b. When there is capital rationing, net present value (NPV) may not be sufficient for choosing which (non-exclusive) projects to undertake. Which criterion should also be used? How?

   c. Pecuniary External Effects arise when a project's effects in one market (such as train travel from Katoomba down the mountain) affect another market (such as the Katoomba rental market). When, if ever, should the effects on the second market (such as changes in landlord's producers' surplus in response to higher train fares) be explicitly considered in a cost-benefit analysis? Explain.

   d. How would you go about determining the desirability of extending the weeks per year of daylight saving for a region? (Don't try to guess numbers, just write two or three paragraphs explaining how you might determine the costs and benefits.)

Section B Attempt ONE of Questions 3 and 4.

3. Suppose the government is considering an increase in the toll on a certain stretch of highway from 40¢ to 50¢. At present, 50,000 cars per week use that highway stretch; after the toll is imposed, it is projected that only 40,000 cars per week will use the highway stretch.

   a. Assuming that the marginal cost of highway use is constant (i.e., the supply schedule is horizontal) and equal to 40¢ per car, what is the net cost to society attributable to the increase in the toll? (Hint: The toll increase will cause the supply schedule, not the demand schedule, to shift.)

   b. Because of the reduced use of the highway, the government would reduce its purchases of concrete from 20,000 tonnes per year to 19,000 tonnes per year. Thus, if the price of concrete were $25 per tonne, the government's cost savings would be $25,000. The government's reduced demand for concrete, however, causes its market price to fall from $25 per tonne to $24.50 per tonne. Moreover, because of this reduction in price, the purchases of concrete by non-government buyers increase by 300 tonnes

per year. Assuming that the factor market for concrete is competitive, can the government's savings of $25,000 be appropriately used as a measure of the social value of the cost savings that result from the government purchasing less concrete? Or is it important to use shadow pricing? Explain.

OR

4. The government is considering building a freeway (for trucks only) between two cities. This would cut journey time by 6 minutes and save 2 litres of fuel per journey. The number of journeys that will be diverted from other routes onto the freeway is 100,000 a year, and 50,000 new journeys will be made. The wage of truck drivers (one per vehicle) is $4 per hour, and the price of fuel $1.00 per litre (including 80¢/litre tax). The interest rate on long-term government bonds is 10% p.a., and the cost of building the freeway $1,200,000.

   a. Using only this information, would you recommend building the freeway? Explain.

   b. If you could ask for additional information, what else would you wish to know? (Assume everyone has the same income.) Explain.

Equations

Net Present Value

$$NPV = \sum_{t=0}^{T} \frac{b(t) - c(t)}{(1+r)^t} - K,$$

where NPV = net present value from project
$b(t)$ = benefits ($) received from project in year t
$c(t)$ = costs ($) of project in year t
$\frac{1}{1+r}$ = discount factor at interest rate r p.a.
T = lifetime of project
K = initial (capital) outlay at $t = 0$

Internal Rate of Return

$$NPV = \sum_{t} \frac{x_t}{(1+i^*)^t} = 0 \rightarrow i^* = \text{IRR}.$$

$$\text{IRR} = r^* : \sum_{t=0}^{T} \frac{b_t}{(1+r^*)^t} = \sum_{t=0}^{T} \frac{c_t}{(1+r^*)^t} + K$$

Perpetuity

Where FV is the *future value* of an amount F_0 and r is the discount rate over n periods; where F is an *annuity* of over t periods. When n is infinite, we have a *perpetuity*. In present value terms:

$$PV = \frac{F_n}{(1+r)^n}$$

$$PV = F\,\frac{1-(1+r)^{-t}}{r} \quad \text{annuity}$$

$$PV = \frac{F}{r} \quad \text{perpetuity}$$

Value on Completion

If a project involves cash investment outlays $-x_t$ without receipts over the first T years of the project, followed by net operating revenues y_t over the operating life of the project represented by L, then the Value On Completion (VOC):

$$VOC_T = x_0(1+r)^T + x_1(1+r)^{T-1} + \cdots + x_T$$

Benefit/Cost Ratio

$$\text{The ratio of } \frac{\text{p.v. of benefits}}{\text{p.v. of costs}} = \frac{B}{C} \text{ or } \quad \frac{\sum_{t=0}^{T} \frac{b_t}{(1+r_m)^t}}{\sum_{t=0}^{T} \frac{c_t}{(1+r_m)^t} + K} \quad = \quad \frac{B}{C}$$

Harberger Equation

$$\text{Social cost (1) + (2)} \quad = P_s \bullet \Delta G$$

$$= \Delta P \ (\eta \bar{Q}_D + \kappa \bar{Q}_s)$$

$$\therefore P_s = \frac{\Delta P \ (\eta \bar{Q}_D + \kappa \bar{Q}_S)}{\Delta G} \quad \text{shadow price}$$

$$= \frac{\Delta P \ \left[\eta \left(\frac{Q_1 + Q_D}{2} \right) + \kappa \left(\frac{Q_1 + Q_S}{2} \right) \right]}{\Delta G}$$

(if $\eta = \kappa$)

$$= \frac{\Delta P \eta \left[Q_1 + \frac{Q_D}{2} + \frac{Q_S}{2} \right]}{\Delta G}$$

Payback Period $= \frac{K}{b_t}$

Net Benefit Investment Ratio, NBIR

$$NBIR = \frac{\sum_{t=0}^{T} \frac{B_t - OC_t}{(1+i)^t}}{\sum_{t=0}^{T} \frac{IC_t}{(1+i)^t}}$$

where OC_t are the project's operating costs in period t,
IC_t are the project's investment costs in period t,
B_t are the benefits in period t,
i is the appropriate discount rate.