ASSIGNMENT 1

Question 1(a) – (e) see attached

1(f) Among the "winners" are:

- Lilco shareholders, who voted for the plan, presumably because it benefitted them
- the general population, who might have feared a "Three Mile Island" nuclear accident while Shoreham was operating
- Lilco's customers, who received a "sweetener" from the State
- Lilco's competitors, who would have marginally more market power and sales because of Shoreham's closure.
- possibly the construction companies, who stand to build the new replacement plants, but at competitive rates – beware "multiplier"!

Among the losers are:

- the Federal government, with its deal
- possibly local government — lower local taxes
- possibly local property owners – if their property values fall and don't pick up later
- possibly financiers.

To determine whether a net gain for society exists, we need to consider all benefits and costs, valued using opportunity-cost criteria (no double counting, no transfers) and apply CBA → NPV > 0 ?

1. A. The total loss is $2.5 billion. At the current corporate tax rate of 34 percent this means an undiscounted reduction in tax liability (34 percent times $2.5 billion) of about $850 million.

As you know, time makes a big difference. Tax losses can be claimed only against income, and the article indicates that it will take eight or nine years for Lilco to earn enough income to claim all of the tax loss. To the federal government, revenue lost in the future is worth less than revenue lost today, so the $850 considerably overstates the cost of the tax loss to the federal government.

B. The value of the loss would only be the same to Lilco and the federal government if they both had the *same* discount rate. In fact, Lilco has to pay considerably more than the federal government when it borrows money, so there is good reason to believe that Lilco should use a higher discount rate. In that case, the value to Lilco of the tax loss is less than it is to the federal government.

Yes. There should be some combination of reduced tax loss and quicker write-off time that both the government and Lilco would prefer to the present situation.

C. In opportunity cost terms, the question is, what does the government lose if Shoreham is closed?

Like a loss, deductions for depreciation also reduce the tax revenue to the federal government. Had the plant operated, it would have been depreciated over about seven years. At a 34 percent tax rate, the tax revenue lost because of depreciation would have been about $850 million. Since the depreciation and the tax loss carry forward period are just about the same, the effects on the federal treasury from each of these sources pretty nearly offset each other. From this point of view, the opportunity cost to the government of closing Shoreham is close to zero.

However, if, as the article states, it takes considerably longer than seven years for Lilco to use up the tax loss, the federal government comes out ahead. The present value of the tax loss due to closing the plant is less than the present value of the tax loss that would have occurred because of depreciation! In this case, the opportunity cost to the government of closing the plant is negative. That is, it isn't a cost at all!

D. As the article states, the reduction doesn't start until 1992, and it is spread out over 10 years. Again, time matters. A reduction in tax liability in the future is less valuable than a reduction today. As the article states, at a 10 percent discount rate the $110 million tax reduction is worth only $51 million.

E. In terms of concepts developed in earlier chapters, the author is talking about offsetting shifts in the demand curve for housing.

The fact that Lilco is now going to pay much lower property taxes will mean fewer public services for area residents, higher tax bills, or both. This should shift the demand curve for local property inward, thereby reducing its price (and value).

But, that's only half the story. Not having a nuclear power plant in one's back yard may increase the attractiveness of the area. This would show up as a shift outward in the demand curve for local property.

Since these forces work in opposite directions, it is impossible to say whether the price of housing (hence property values) will rise or fall relative to what they would have been had Shoreham not been shut down.

2 (a)

After describing how to calculate NPV and IRR (given their equations in the crib sheet) appropriate to list their strengths and weaknesses:

IRR's weaknesses

1. IRR is scale-independent: double the project's size (multiply all costs and benefits by two) and its IRR remains unchanged. IRR (like B/C) is a relative measure, not an absolute measure (like NPV).
2. A complicated time series of net positive alternating with net negative cash flows can result in more than one IRR – this potential lack of uniqueness means that in general it is unreliable.
3. Because of 1. above IRR cannot be used to choose between mutually exclusive projects or to choose a portfolio of projects when there are budget constraints.
4. To calculate an IRR there must exist at least <u>one</u> period with net negative benefits (or cash flows).
5. Solving for roots of polynomials is, in principle, difficult, at least before calculators and computers.

2(b) With capital rationing:

(1) ~~through~~ throw out projects with $NPV \leq 0$

(2) rank remaining projects with B/C (or better NBIR – see the Finance Dept. Handbook

(3) choose the projects in descending ranking of B/C until the capital budget is exhausted. This procedure will maximise the NPV of the portfolio of projects.

Might also check for dependencies between projects – there might exist synergies or "congestions".

2(c) By asking how long a projects net benefits will equal its up-front costs, the PB method ignores what happens later.

In effect there is zero time rate of discount until PB has occurred, and then 100% discount. That is, PB ignores the opportunity cost of capital, as reflected in the discount rate or interest rate by weighting equally costs and benefits before PB, and ignoring them after PB.

In addition PB is scale independent. Size doesn't matter.

2(d) Projects A and B are mutually exclusive. Assuming that they are of the same life time, then choose that with the higher NPV, Project A (Assuming that the risk of B is higher than that A, as reflected in their discount rates.)

If their lifetimes are not the same, can compare using an annualised basis.

3 (a) Labour is an input to a project, and so the cost of labour is a cost in the NPV calculations. To the extent that workers were previously unemployed or underemployed (perhaps because of a legal minimum wage), however, the market wage will overstate the true opportunity cost of hiring these workers: the shadow wage will be less than the market wage paid (which is what a Financial Appraisal uses).

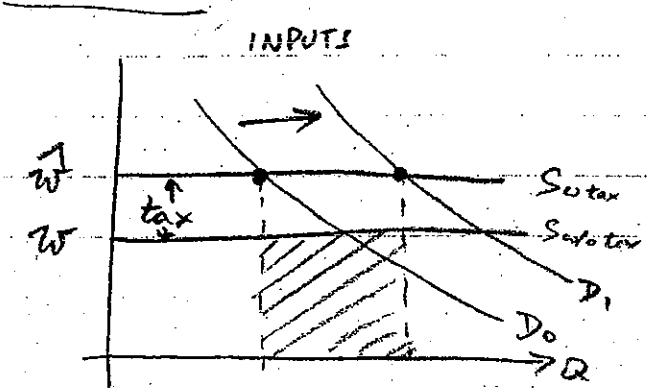
$$w_{sp} < w_{market}$$

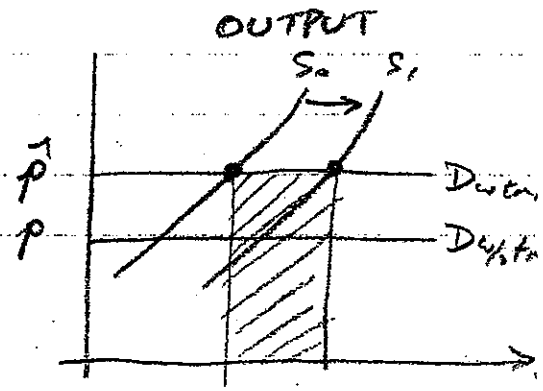
$$\therefore \quad C_{CBA} < C_{FA}$$

$$\therefore \quad NPV_{CBA} > NPV_{FA} \quad \text{cet. par.}$$

It is not necessary that unemployment fall significantly.

(b) With no change in price, all inputs used by the project, and all output sold by the project is incremental:

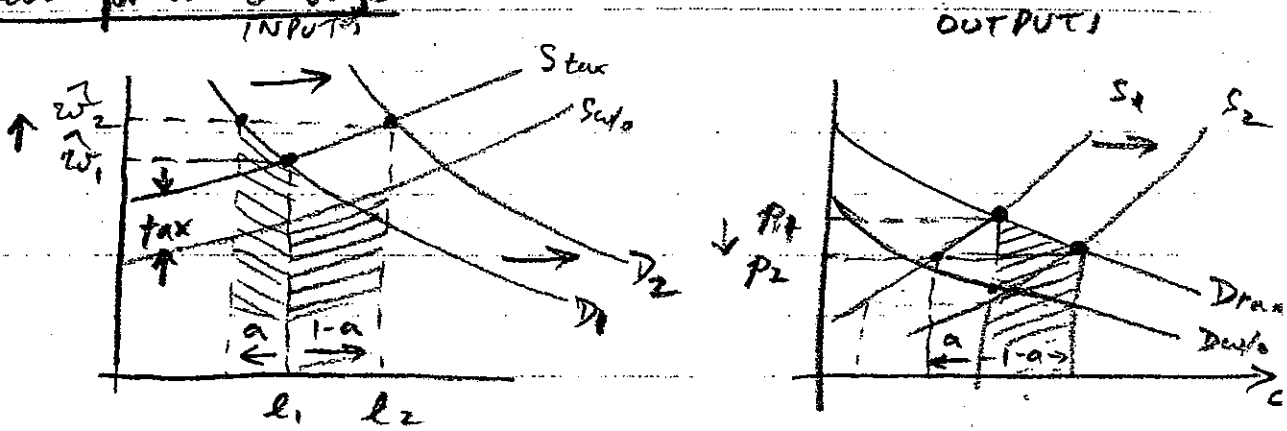




FA: use $\hat{w}$ including tax
CBA: use w ex-tax because that reflects the opp. cost, the return to sellers necessary for production

FA: use $\hat{p}$ including tax
CBA: " " " " because that reflects the market's willingness to pay for the project's output.

When prices change.



1-a : incremental (no tax)

a : displaced – valued at the higher (including tax) price because that's what the other buyers were prepared to pay – the value to them of the inputs before they were lured away.

See below

1-a : incremental output.

a : displaced producers

from F. Perkins, p. 131

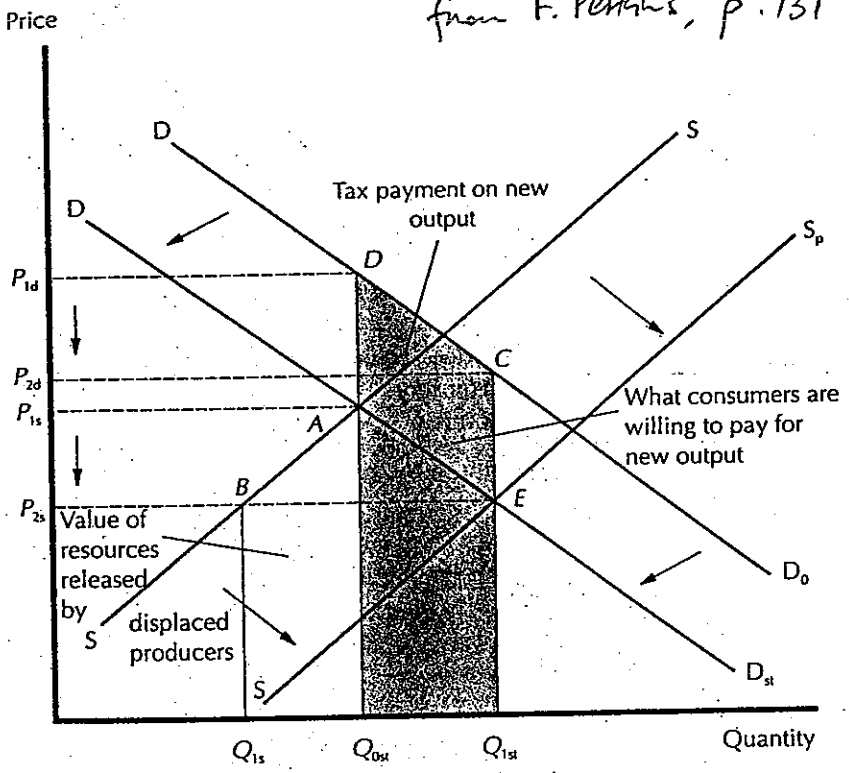


Figure 7.11 *Measuring the economic benefits of a project whose output is subject to sales tax*

The table from p. 30 of the DoF Handbook shows how to allow for taxes and subsidies on project inputs and outputs.
In particular, there is a distinction between incremental or displaced inputs and outputs.

Take labour as an input (Q3c): when there is no displacement from existing employers (no change in price, because the supply elasticity of labour is infinite and the labour supply curve horizontal), then the shadow wage should be = market wage − tax (tax exclusive) because this take-home pay is what the workers receive = their value of other opportunities foregone, at the margin.

When there is displacement (the project bids up the wage rate, since labour supply is not perfectly elastic or horizontal) then the cost is the value of these displaced workers to their previous employer = the unit cost = the wage paid (including the tax).

3(c) For the 50 skilled workers diverted from elsewhere, the shadow cost is their value to their previous employer (viz. \$500/week. It is a social cost, because their previous employers must now find replacements (either labour or machines, etc.)

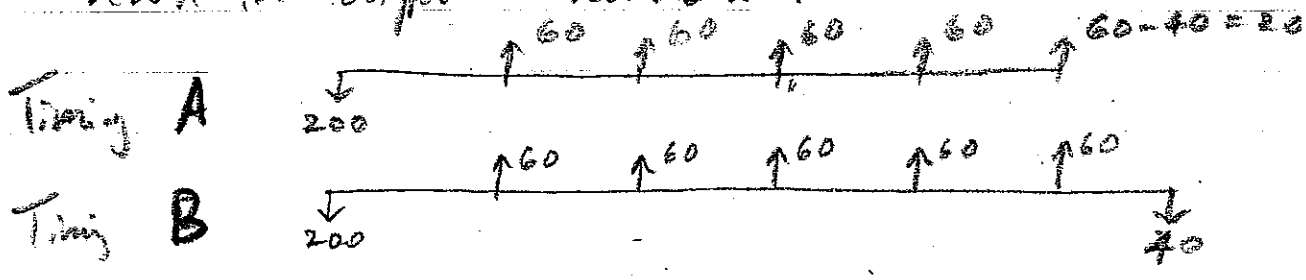
For the 150 who have been employed driving cabs (a second-best choice for them) etc., ~~it's~~ the cost is the value to them (their take-home pay). At the margin, this is \$500/1.20 = \$416/w, but for some workers it's even lower.

The shadow wage is then a weighted average of the two

$$\simeq 0.25 * 500 + 0.75 * 416$$
$$\simeq \$437/\text{week}$$

To be more accurate, we'd need to know the previous (take-home, after-tax) wages of the 150 workers.

4. In my email, I tried to suggest timing A below, but in the wording of the question there is ambiguity in the timing, which will result in different numbers.



(a) NPV @ 0% = \$60 k (A, B the same)

(b) NPV @ 10% = \$2.61 k (A)
OR \$4.87 k (B)

(c) NPV @ 15% = − \$18.74 k (A)
OR − \$16.16 k (B)

Choose NPV > 0 to improve efficiency or economic welfare.

(a) YES

(b) YES, but do a sensitivity analysis to see how robust the decision is.

(c) NO

Now we need only consider the incremental project, since NPVs are linear additive.

(d) NPV of increment @ 0% = \$10 k (A, B same)
so choose the larger project.

(e) NPV of increment @ 10% = − \$3.53 k (A)
so stay with the smaller project.

(f) If the NPV of increment was < 0 @ 10%, then it will be even more < 0 @ 15%.
(It is: − \$5.23 k)
Choose neither project @ 15%, since both will reduce efficiency (NPV < 0)