ASSIGNMENT 1

1. (i) (a) NPV of A @ 10% = \$137.24
NPV of B @ 10% = \$216.94

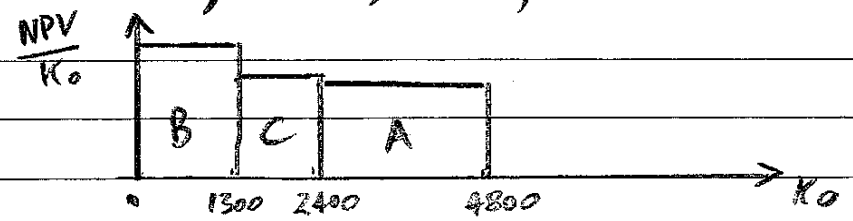
(b) IRR of A = 15.24% p.a.
IRR of B = 14.65% p.a.

(c) Undertake project B: both projects have the same K_0 = \$1000, and at 10% p.a. project B has the larger NPV, even though its IRR is lower. Moreover, both projects have the same life and are mutually exclusive.

(ii) (a) The NPVs of the three projects are \$600, \$450, and \$300, respectively. If only one project is chosen, it should be project A, leaving nothing in the budget, with an NPV of \$600

(b) But if more than one project can be undertaken (not mutually exclusive), then projects B and C should be, also exhausting the budget, but with a combined NPV of \$750.

In general, NPV / K_0 gives 0.25, 0.35, 0.27, as is seen below.



NPV is the area under the curves, maximised with B & C for ΣK_0 = \$2400.

2(a) 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 thus a weighted average of the two

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

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

(b) From the handout on the solution to the first spreadsheet exercise,

$$NBIR = \frac{\Sigma (B_t - OC_t)/(1+i)^t}{\Sigma IC_t/(1+i)^t}$$

the ratio of the p.v. of a project's benefits minus its operating costs OC to the present value of its investment cost.

It calculates the net operating benefits per unit of investment. But it is unreliable for choosing mutually exclusive projects.

⊕ but it separates operating costs from investment costs — operating costs might be financed from operating revenues.

⊕ NBIR is better than B/C because it ranks projects by return per unit investment, and so can be used with capital budgeting to obtain the mix of (non-exclusive) projects which maximizes NPV.

(c) The table from p. 30 of the DoF Handbook shows how to allow for taxes and subsidies on project inputs and outputs (see Q3, 4b). In particular, there is a distinction between incremental or displaced inputs and outputs.

Take labour as an input (Q4b): 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 forgone, 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).

(d) The \$500k is clearly a cost: the value of the increased resources of the police etc. Since it cannot be used elsewhere now, it is an opportunity cost.

What of the \$1m of stolen goods? This is a transfer (yes, an involuntary, illegal transfer, but still something for nothing). Who loses with the increased policing? (The owners of the goods win, since their goods are not stolen.)

Well, after selling to the fences, the thieves would have received \$600k, so they lose. And the fences' newly bought "hot" goods have a net value of \$400k, which they lose with the increased policing.

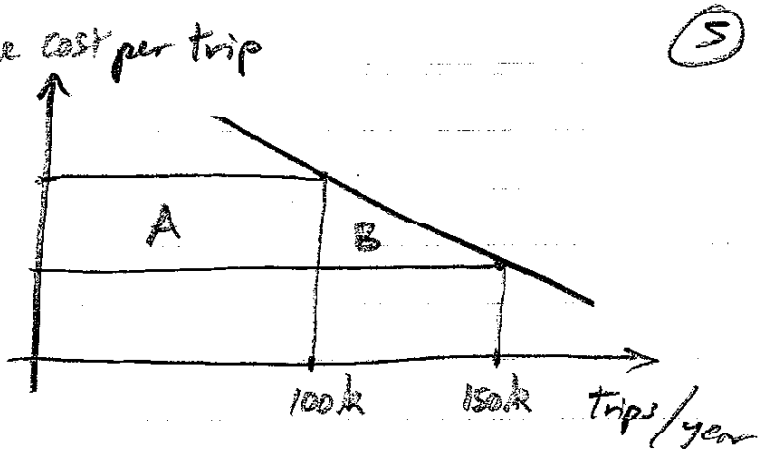
Ignore these transfers!

So far: one cost = \$500k.

Need to consider other benefits of the increased policing: lower private security payments, lower levels of anxiety, less loss of sentimental goods (of no value to the thieves, but often irreplaceable for their owners). These benefits are not captured in the \$1m book value.

3.

Save $\left\{ \begin{array}{l} 6 \text{ min} @ \$4/\text{hr} \\ 2\,\ell @ \$1/\ell \end{array} \right\}$ (including 80¢/ℓ tax)



(a) Including fuel taxes:

Savings to existing drivers (area A)

time $= \$100{,}000 \times \frac{1}{10} \times 4 = \$40{,}000$ /year

fuel $= \$100{,}000 \times 2 = \$200{,}000$ /year

Savings to new drivers (area B)

time $= \frac{1}{2} \times 50{,}000 \times \frac{1}{10} \times 4 = \$10{,}000$ /year

fuel $= \frac{1}{2} \times 50{,}000 \times 2 = \$50{,}000$ /year.

But for existing drivers, 80% of the fuel savings is a transfer: subtract \$160,000 /year.

∴ Annual savings = \$140,000 /year = ΔCS

At 10% p.a. → capital value of \$1.4m

Cost of construction = \$1.2m ∴ NPV > 0 GO!

(b) What is the lifetime of the road?

What are the maintenance and operating costs?

What is the level of unemployment among truckers?

What is the tax level for truckers? (payroll)

What is the reduction in accidents?

What is the level of externalities – drivers?

" " " " " – construction?

etc.

4. (a) IRR ≡ discount rate → NPV = 0

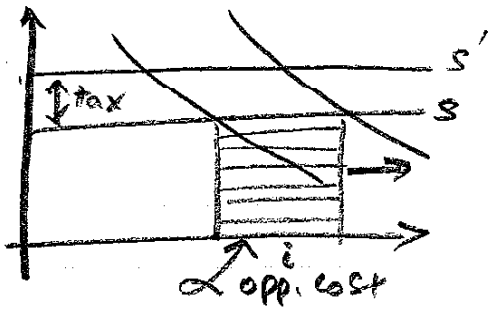
NPV is scale-dependent ∴ additive
unique, used for capital budgeting
simple to calculate

IRR is scale-independent, non-unique
requires −ve and +ve net cash flows

(b) When K (the supply elasticity of labour) is infinite then the supply curve S is horizontal, and no diverted labour, only incremental

∴ sh. w = market wage − tax

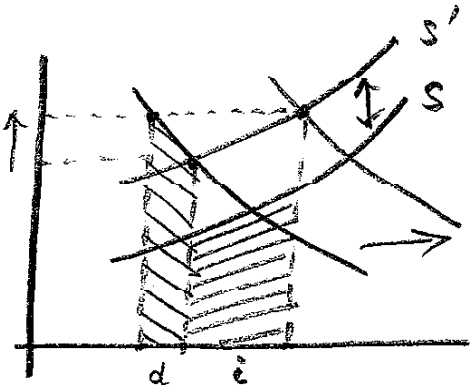
∴ social cost as shown:



When K is less than infinite, the S curve is upwards sloping, and there is diverted labour as the market wage rises

incr: sh. w = m. w. − tax

div: sh. w = m. w.
(including tax)



The lower the price elasticity of labour supply, the greater the proportion of displaced workers & so the greater the opportunity cost of labour.

(c) For involuntarily unemployed workers the (wage − tax) overstates the value of leisure: they would work, but can't find jobs.

∴ the shadow wage < market wage − tax.

(d) Beware double counting (multipliers, P.E.E.).

The purpose of Interlingua is to become profitable for its shareholders (see FA). From a social point of view (CBA), we are concerned with increased efficiency, especially from the uses to which its graduates put their new language skills, to increase Australia's value added.

To the extent that these benefits accrue to the graduates via higher salaries, Interlingua could raise its fees.

If the (positive) externalities are beyond Interlingua and its graduates look at the activity and profitability of the firms who employ the graduates, and the levels of inbound tourism from the countries whose languages are taught. (See later.)

(e) If FA < 0 but NPV > 0, then from PIC Interlingua is a good thing, but it won't operate at a loss.

The government could assist (through subsidies or tax breaks), but any such taxes will distort the markets in raising money → a Dead Weight Loss or inefficiency. OK, so long as DWL < NPV.