

Exam 2, Fall 2005

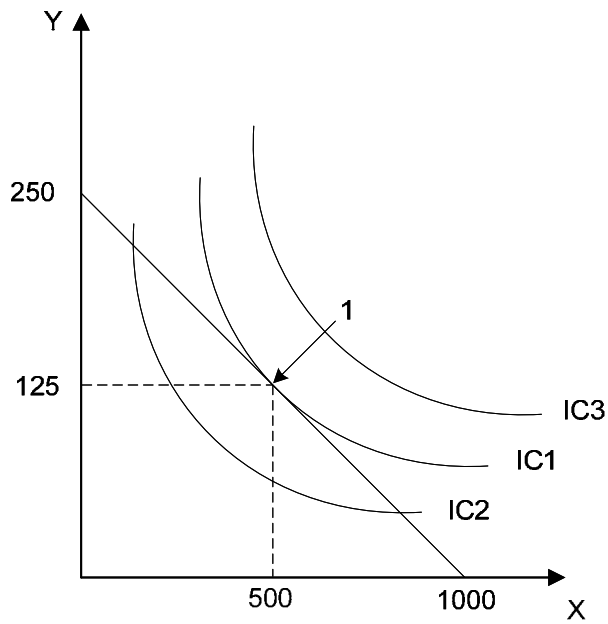
Notes on Solution

Part 1

Utility Function: $U = X^a * Y^{(1-a)}$
Parameter a: 0.5
Demand for X: $X = (0.5 * M) / P_x$
Demand for Y: $Y = (0.5 * M) / P_y$
Expenditure Funct: $M = U * (P_x / 0.5)^{0.5} * (P_y / 0.5)^{0.5}$

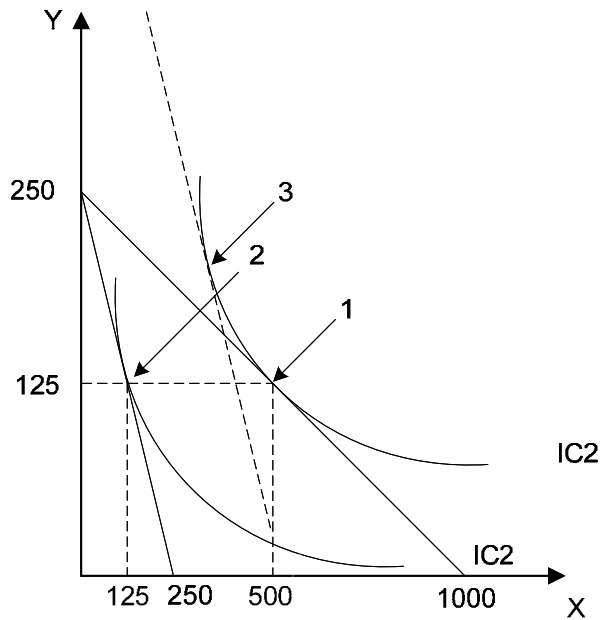
Question 1

M	1000
P _x	1
P _y	4
X	500
Y	125
U	250



Question 1b

Px	4
Py	4
X	125
Y	125
M3	$M = 250.000 * (4/0.5)^{0.5} * (4/0.5)^{0.5}$
M3	2000
CV	1000 <-- 2000 - 1000
Revenue:	375 <-- \$3 * 125



The difference between the CV and the tax revenue arises because of the deadweight loss associated with the tax. That is, the tax costs households more in lost surplus than the revenue it raises. The DWL per unit of revenue is very high for this particular tax:

DWL:	625
Revenue:	375
DWL/Dollar of Revenue:	1.7

Question 1c

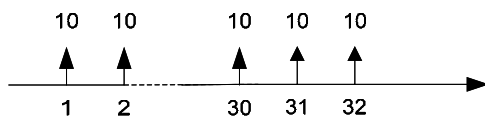
Px	1.6	60% increase
Py	6.4	60% increase
X	312.5	<-- greater X than part B
Y	78.125	<-- lower Y than parts A or B
M3	$M = 250.000 * (1.6/0.5)^{0.5} * (6.4/0.5)^{0.5}$	
M3	1600	
CV	600	
Revenue:	375	

The alternative policy raises the same amount of revenue with much less DWL. As a result, it would be superior to the tax from part B unless there were some additional reason that it was important to reduce consumption of good X.

Question 2a

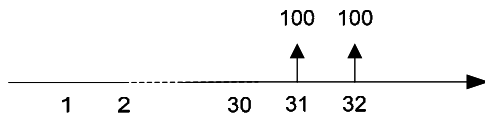
Tax revenue without Destiny	10 million
Tax revenue with Destiny	100 million
Interest rate	5%
Length of tax abatement	30 years

Property taxes without Destiny:



$$PV = 10/0.05 = 200$$

Property taxes with Destiny:



$$PV \text{ in year } 30 = 100/0.05 = 2000$$
$$PV \text{ in year } 0 = 2000/(1.05^{30}) = 463$$

Net present value of proceeding with Destiny is \$263 million (\$463 million less \$200 million). Considering the tax revenue alone, it would be a good idea to proceed with the project (it has a positive NPV).

Question 2b

Tax revenue with Destiny 50 million

Present value of property taxes with Destiny:

PV in year 30 = $50/0.05 =$ 1000

PV in year 0 = $1000/(1.05^{30}) =$ 231

Proceeding with Destiny would still be worthwhile, but the gain is now a lot smaller: \$31 million in net present value.

The minimum annual tax revenue at which the development makes sense is the value of B at which the PV of revenue from Destiny is just equal to the PV of revenue without it:

$$(B/r)/(1+r)^{30} \geq 200$$

Solving for B:

$$B \geq 0.05 * ((1.05)^{30}) * 200$$

$$B \geq \quad \quad \quad 43.2 \text{ million}$$

Check:

PV at 30 864

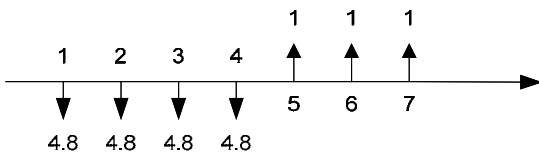
PV at 0 200

Question 3

Interest rate	5%
Construction cost	4 million in years 1-4
Benefits	1 million per year, years 5+

However, the true cost of construction is higher when the DWL of the tax is taken into account. Since the property tax has a DWL of \$0.20 for each dollar of revenue, the cost of the project in years 1-4 in CV is $\$4 \times (1.2) = \4.8 million per year.

Cash flows (including DWL) of the project:



PV of construction, including DWL of the tax:

Year	Payment	PV
0	0	0.00
1	4.8	4.57
2	4.8	4.35
3	4.8	4.15
4	4.8	3.95
<i>Total:</i>		<i>17.02</i>

PV of benefits:

PV in 4	20	<-- B/r
PV at 0	16.45	<-- $(B/r)/(1.05^4)$

Based on the NPV, it would be better not to proceed with the project. The \$1 million of annual benefits could be obtained at lower cost by investing \$16.45 million at the 5% interest rate. Building the project would deliver the same benefits at a higher cost: \$17.02.