Economics 33530: Assignment 3 Key

Professor Jensen Fall 2007

1. Current GDP in your country is 100 trillion (or 100,000 billion). Your economy is expected to grow at an annual rate of 3% over the next 10 years. Scientific experts predict that a policy designed to reduce greenhouse gases in your country to 2000 levels over the next 10 years will cause a reduction in the annual rate of growth to 2%.

a. Compute the loss of GDP for each of the next 10 years from this policy.

b. If the discount rate is 5%, what is the present value of the loss of GDP from this policy?

c. Suppose your current population is 5 billion, and it is expected to grow at a rate of 2% over the next 10 years.
(1) Compute the loss of GDP per capita for each of the next 10 years from this policy.
(2) If the discount rate is 5%, what is the present value of the loss of GDP per capita from this policy?

year	GDP with no policy	GDP with policy	GDP Loss	PV of GDP loss	population	GDP loss per capita	PV of loss per capita
current	100,000	100,000			5.000		
1	103,000	102,000	1,000	952.38	5.100	196.0784	186.74
2	106,090	104,040	2,050	1859.41	5.202	394.0792	357.4415
3	109,273	106,121	3,152	2722.73	5.306	594.0212	513.1378
4	112,551	108,243	4,308	3543.927	5.412	795.9233	654.8081
5	115,927	110,408	5,519	4324.537	5.520	999.8049	783.3733
6	119,405	112,616	6,789	5066.047	5.631	1205.685	899.701
7	122,987	114,869	8,119	5769.894	5.743	1413.584	1004.608
8	126,677	117,166	9,511	6437.467	5.858	1623.521	1098.863
9	130,477	119,509	10,968	7070.11	5.975	1835.517	1183.19
10	134,392	121,899	12,492	7669.125	6.095	2049.59	1258.271
total				45,415.63			7,940.14

2. Consider an isolated community in which electricity is provided by a firm that uses a coal-fired generator. The total community demand (in dollars) for megawatt hours M of electricity is given by the marginal private benefit of electricity,

$$MPB_e = 1000 - 20M.$$

The marginal private cost of electricity MPC_e is a constant \$5 per megawatt hour.

Downwind from the power plant is the agricultural region that provides food for the community. Emissions from the plant affect the PH level of the soil and reduce the crop yield. The total community demand (in dollars) for tons of food F is given by the marginal private benefit of food,

$$MPB_f = 3000 - 5F.$$

The marginal private cost of food MPC_f is a constant \$50 per ton.

a. What are the total net social benefits in this situation?

$MPB_e = 1000 - 20M = 5$ implies $M = (1000–5)/20 = 49.75$
$NSB_e = (½)(1000-5)(49.75) = 24,750.625$

$MPB_f = 3000 - 5F = 50$ imples $F = (3000–50)/5 = 590$
$NSB_f = (½)(3000–50)(590) = 870,250$

Total NSB = 872,720.625

b. Suppose the agricultural community suggests legislation that would force the power plant to install a scrubber that would increase the MPC of producing electricity to a constant of \$10 per megawatt hour. However, it would also reduce acid deposition and the acidic content of the soil, thereby increasing crop yield and thus reducing the cost of producing food to \$40 per pound.
(1) What would installation of this scrubber do to net social benefits?
(2) Would you expect the citizens of this community to support this legislation? Explain.

$MPB_e = 1000 - 20M = 10$ implies $M = (1000–10)/20 = 49.5$
$NSB_e = (½)(1000-10)(49.5) = 24,502.50$

$MPB_f = 3000 - 5F = 40$ imples $F = (3000–40)/5 = 592$
$NSB_f = (½)(3000–40)(592) = 876,160$

Total NSB = 900,662.50

Total NSB increase, so one would expect support for this legislation (assuming the citizens had access to this information.