Self Test

Allocating Fossil Fuel Production Over Time and Oil Leasing

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Click on True or False to test your knowledge of the chapter.

1. **True** **False** All economic decisions can be analyzed with static modeling accurately.

2. **True** **False** The R/P (reserve over production) ratio gives a measure of how long current proved reserves will last if current production continues.

3. **True** **False** If an oil R/P ratio = 15, it indicates that the country will certainly run out of oil in 15 years.

4. **True** **False** The countries with largest oil and gas reserves are Saudi Arabia, Iraq and Kuwait.

5. **True** **False** Maximizing the value of production of nonrenewable reserves in a competitive two-time period world with no costs can be solved using a Lagrange multiplier method. The solution will show that in a competitive model with no cost, price will go up at the interest rate, $P_1 = (1+r)P_0$.

6. **True** **False** Let demand, P(Q), represents social benefits, R be total reserves of a fixed energy source, r be the interest rate, and marginal costs are zero. Then price going up at the interest rate maximizes social welfare.

7. **True** **False** If demand is $Q_d = 120 - 1/3\ P + Y$,

reserves (R) = 100,

income (Y) = 70 and does not grow,

interest rate (r) = 10%,

and MC = 0,

then optimal use of resources over two time periods will be $Q_0 = 56.67$ and $Q_1 = 43.33$ and net present value of reserves = 40,000.

8. **True** **False** In a two period model with fixed reserves, if the interest rate increases, production will be delayed to the second period.

9. **True** **False** In the two period model from above,

$Q_d = 120 - 1/3\ P + Y$,

reserves (R) = 100,

income (Y) = 70 and does not grow,

interest rate (r) = 10%,

MC = 0, and

optimal output in each period was $Q_1 = 43.33$ and $Q_0 = 56.67$.

If reserves, **R**, change from 100 to 150 for the model, then production will in increase in both period and $Q_0 = 80.48$ and $Q_1 = 69.52$.

10. **True** **False** If income increases the same amount in both periods for a two period model with fixed reserves, production will be increased in both periods, but by a greater amount in the second period.

11. **True** **False** In a two period model from above,

$Q_d = 120 - 1/3\ P + Y$,

R = 100,

income (Y) = 70 and does not grow,

interest rate (r) = 10%,

and MC = 0, and

optimal output in each period was $Q_1 = 43.33$ and $Q_0 = 56.67$.

Now let total costs TC = 50Q. Since marginal costs are constant, optimal output will not change.

12. **True** **False** In a two period model from above,

$Q_d = 120 - 1/3\ P + Y$,

R = 100,

income (Y) = 70 and does not grow,

interest rate (r) = 10%,

and TC = 50Q, and

optimal output in each period was $Q_0 = 55.87$ and $Q_1 = 44.13$.

Now if the market is monopolistic instead of competitive, then production will be delayed to the second period and $Q_0 = 52.14$ and $Q_1 = 47.85$.

13. **True** **False** When the interest rate goes to infinity, you should behave as you would in a static market.

14. **True** **False** New technologies in several areas of the oil and gas industry are likely to have a great impact on production costs in the near future.

15. **True** **False** The 'rule of capture' encourages efficient use of oil resources and is a good example of well-defined property rights, leading to welfare maximization.

16. **True** **False** A dynamically optimizing competitive private market, with no externalities and well defined property rights, will produce where social welfare is maximized.

17. **True** **False** The first order conditions for competitive and monopoly markets with fixed resources are different in the static and dynamic scenarios.

18. **True** **False** Bonus bidding is favored by economists because it does not distort the production profile.

19. **True** **False** Work bidding is used by governments that want to develop their resources at a very slow pace.

20. **True** **False** The winner's curse describes the paradox of some resource rich countries that under perform in comparison with some resource poor countries.

21. **True** **False** Concessions and production sharing are two different types of economic agreement between governments and companies that have very different economic impacts.

22. **True** **False** A tax that is 8% of profits leaves the optimal use of a resource the same over two-time periods.

23. **True** **False** An ad valorem tax on a nonrenewable resource will not change the production profile.

24. **True** **False** In 2003, Iraq had the highest proven oil and gas Reserve/Production ratio in the world because they value the future more ($P_1 > P_o(1+r)$) than the current period. (i.e. their current production rate is low because they think that the oil in the ground is worth more than money in the bank.)

25. **True** **False** Governments can unitize an oil field as a way of alleviating a monopolistic market imperfection.

26. **True** **False** In a two period model from above,

$Q_d = 120 - (1/3)P + Y$,

R = 100,

income (Y) = 70 and does not grow,

interest rate (r) = 10%,

and MC = 0, and

optimal output in each period was $Q_1 = 43.33$ and $Q_0 = 56.67$.

Now if a backstop is introduced with a backstop price of $350, then production will be $Q_0 = 83$ and $Q_1 = 73.33$ and the amount of backstop consumed in the second period is 56.33.

27. **True** **False** In a dynamic multiperiod model,

$Q_d = 120 - 1/3\ P + Y$,

R = 100,

income (Y) = 70 and does not grow,

interest rate (r) = 10%,

and MC = 0

Reserves will last 5 periods before they were exhausted.

28. **True** **False** Assume that producers dynamically optimize in a two-period model from above,

$Q_d = 120 - (1/3)P + Y$,

R = 100,

income (Y) = 70 and does not grow,

interest rate (r) = 10%,

and MC = 0, and

optimal output in each period was $Q_1 = 43.33$ and $Q_0 = 56.67$ at price $P_o = \$400$ and $P_1 = \$440$.

If a price control of $308 is passed, $P_o = \$308$ and $P_1 = \$308$ and producers will wait until the second year to exploit their resources.

29. **True** **False** Resources which are almost fully depleted are called backstops. (Contributed by Oksana Chernenko)

30. **True** **False** According to technical reports, an oil field in the Middle East has an initial production of 1,500,000 barrels of oil per year. The reservoir engineers have determined that oil production will probably follows an exponential pattern. Oil production in year 't', *q(t)*, is approximately determined by the following function:

$$q(t) = q(0)e^{-rt}$$

where *q(0)* in the initial oil production, and *r* is the annual rate of extraction which is equal to 4%. The amount of reserve that the field has is about 31,000,000 barrels of crude oil. (Contributed by Arturo Vasquez Cordano)

31. **True** **False** An African government has imposed a unit tax on oil production in order to obtain revenues to afford social projects in its country. Oil is totally exported abroad by a foreign private. African economists have estimated the following oil export demand: Qd = 100 - (1/4)*P. The oil reserve of the African country is about 50. The marginal extraction cost of oil is equal to 2. The total cost function is TC(Q) = 2Q (the investment and development cost are sunk). Because the African economy is small with respect to the world oil market, this country is a price taker. To simply the analysis, suppose time has two periods: today (s=0) and the future (s=1). In addition, suppose the discount rate is equal to r = 10%, the marginal cost does not change over time, the parameters of the demand function remain stable over time, and the unit tax (t) is equal to 80. The unit tax generates a distortion on the resource allocation. The results are: Q_o = 27.59, Q_1 = 22.41, P_o = 289.64, and P_1 = 310.36. (Contributed by Arturo Vasquez Cordano)

32. **True** **False** If demand is $Q = 140 - 2.5P + 1Y$, given that R = 120, Y = 90, r = 40%, r' = 10%, where r' is the anticipated lower interest rate. The optimal conditions if interest rate are lowered are Q_o = 68.095, Q_1 51.905, P_o = 64.762 and P_1 = 71.238. (Contributed by Ali Albinali)

32. Correct. The answer is true. The solution can be found by first inverting the demand function:

$$Q_o = 140 - 2.5P_o + 1(90) = 230 - 2.5P_o \rightarrow P_o = 92 - 0.4Q_o$$

When the interest rate change (r' = 10%)

92-0.4Q_o = (92-0.4Q_1)/1.1

and

$$Q_o + Q_1 = 120$$

Q_o = 68.095 and Q_1 = 120 - 68.095 = 51.905

P_o = 64.762 and P_1 = 71.238

If the interest rate does not change (r = 40%)

92-0.4Q_o = (92-0.4Q_1)/1.4

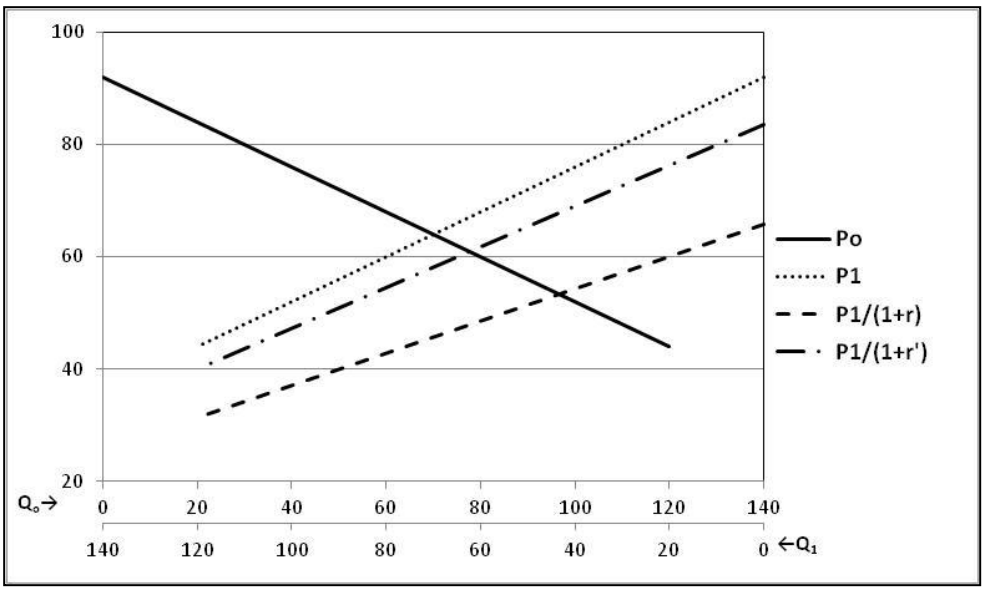
and

$$Q_o + Q_1 = 120$$

Q_o = 88.33 and Q_1 = 31.67

P_o = 92-0.4*88.33 = 56.67

P_1 = 92-0.4*31.67= 79.33



33. **True** **False** To maximize your present worth given that:

$Q_o = 140 - 2.5\,P_o + Y$

$TC(Q_o) = 50 - 20Q_o$

with R = 120, Y = 90, r = 20% and ad valorem rent tax of t_a = 10%.

The optimal prices and quantities are $\{Q_o = 76.71, P_o = \$61.31\}$ and $\{Q_1 = 43.28, P_1 = \$74.69\}$.