EE312 Macroeconomics, 2/2019 (Sec. 046402)
Ch9. Numercial Example - Investment

1. (Chapter 9 : Closed Economy, Intertemporal Model with Investment) Tom lives on an island and has 20 coconut trees in the current period, which currently produce 180 coconuts. Tom hates coconuts, but he can trade them with prople on other neighboring island for things he wants. Further, Tom can borrow and lend coconuts with neighboring islands. In the coconut credit market, aloan of 1 coconut in the current period is paid with 2 coconuts in the future period. Each period, Tom's tree produce, and then 10% of them die.

   Hence, at the beginning of the future period if Tom does not plants any coconut in the ground, the would have 18 coconut trees (10% of 20 = 2 coconut tress would die, leaving 18 coconut trees for the begining of the future period).

   If Tom plants a coconut in the ground in the current period, it will grow into a productive coconut ree in the future period. At the end of the future period, Tom can sell any remaining coconut trees for 1 coconut each. When Tom plants coconuts in the current period, he plants them in successively less fertile ground, the less productive is the coconut tree.

   For convenience, we assume here that fractions of coconuts can be produced by trees. Output in the future period, for given numbers of tress in prodution in the future perid, is given in the following table:

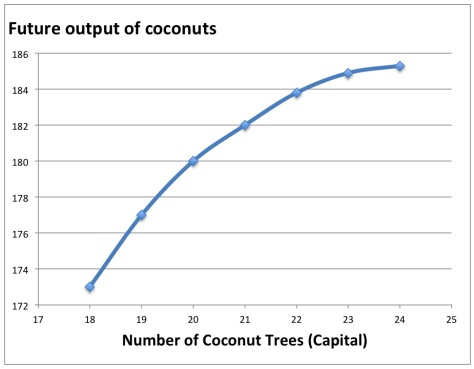
Trees in production in the future	Future output of coconuts
18	173
19	177
20	180
21	182
22	183.8
23	184.9

   (a) Plot the level of output (coconuts) against the quantity of capital (coconut trees) for the future period.

   (b) Calculate marginal product of capital and plot the marginal product of capital against the quantity of capital for the future period.

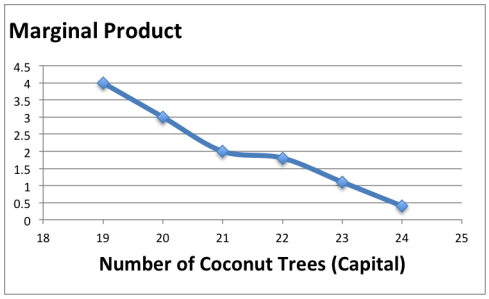
   (c) Calculate Tom's present value of profit given each quantity of future trees .

(a) Plot the level of output (coconuts) against the quantity of capital (coconut trees) for the future period.



(b) Calculate marginal product of capital and plot the marginal product of capital against the quantity of capital for the future period.

Trees in production in the future	Future output of coconuts	Marginal Product of capital
18	173	-
19	177	4
20	180	3
21	182	2
22	183.8	1.8
23	184.9	1.1
24	185.3	0.4



(c) Calculate Tom's present value of profit given each quantity of future trees .
From the textbook (and the lecture note),

$$\begin{aligned} \pi &= Y - wN - I \\ \pi' &= Y' - w'N' + (1-d)K', \\ V &= \pi + \frac{\pi'}{1+r}. \end{aligned}$$

Here, the only input for prodution is capital (the coconut tree), there is no labour. Hence, we can derive the following equations.

$$\begin{aligned} \pi &= Y - I \\ \pi' &= Y' + (1-d)K', \\ V &= \pi + \frac{\pi'}{1+r}. \end{aligned}$$

V is the present value of profit.

Trees in production in the future K'	Future output of coconuts	Investment (I)	Profit in the current period $\pi = Y - I = 180 - I$	Profit in the future period $\pi' = Y' - (1-d)K'$	Present Value of Profit $V = \pi + \frac{\pi'}{1+r}$ $r = 1$
18	173	0	180	189.2	
19	177	1	179	194.1	
20	180	2	178	198.0	277.00
21	182	3	177	200.9	277.45
22	183.8	4	176	203.6	
23	184.9	5	175	205.6	
24	185.3	6	174	206.9	