

# Assignment 6

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1. Numerical Solution (See the attached file “ps6\_q1.m”)

- (a) Discretize the state space
- (b) Denote  $V_1(k)$
- (c) Solve the maximization problem that defines  $V_2(k), g_2(k)$
- (d) Plot  $g_2(k)$

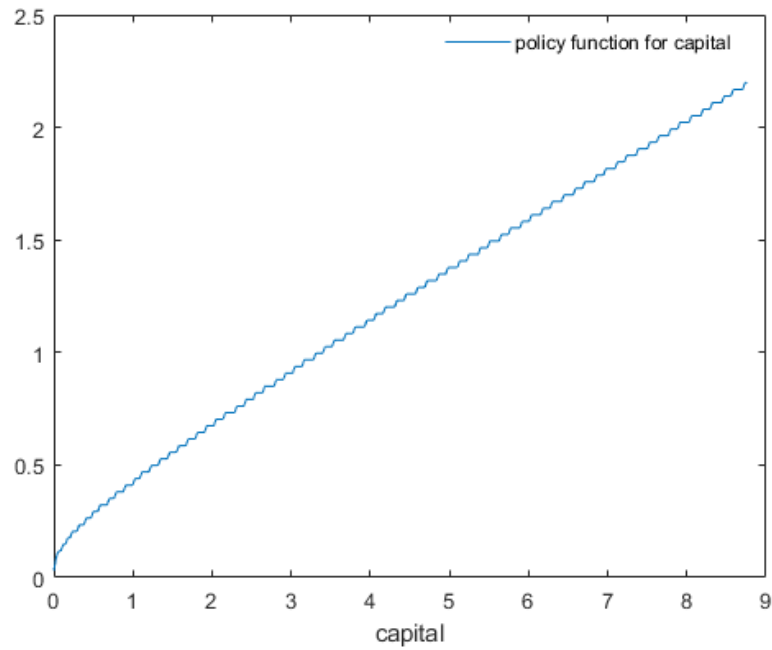


Figure 1:  $g_2(k)$ , with  $N=300$

- (e) Plot  $V_1(k), V_2(k)$

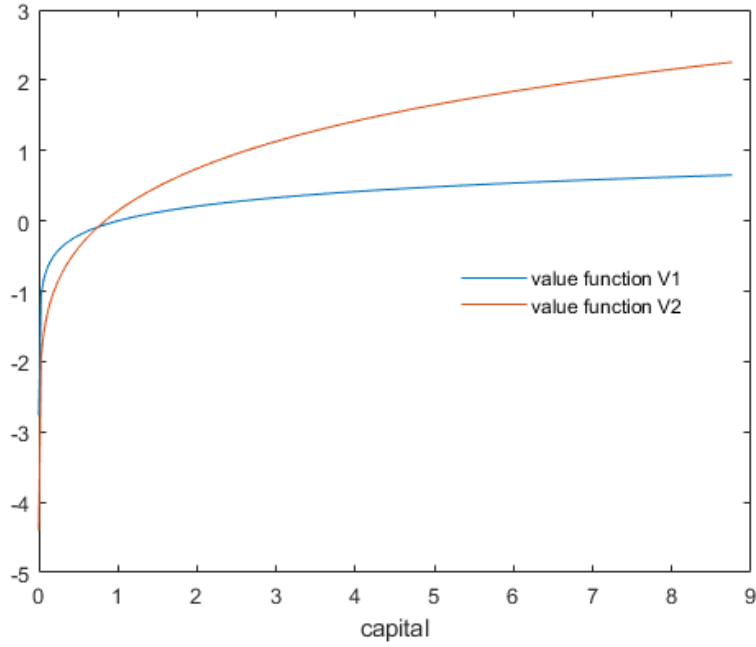
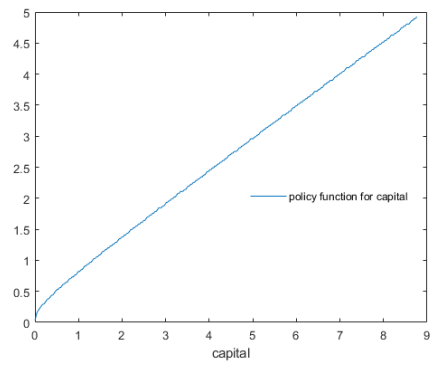


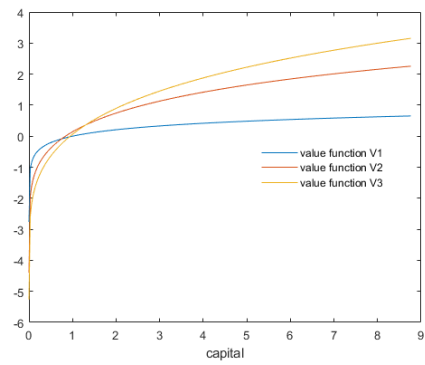
Figure 2:  $V_1(k)$  and  $V_2(k)$ , with  $N=300$

$V_1(k)$  and  $V_2(k)$  are different because the value function  $V_1(k)$  is not true. The two functions would coincide under the right guess.

- (f) Compute  $V_3(k), g_3(k)$
- (g) Plot  $V_1(k), V_2(k), V_3(k)$



(a)  $g_3(k)$ , with  $N=300$



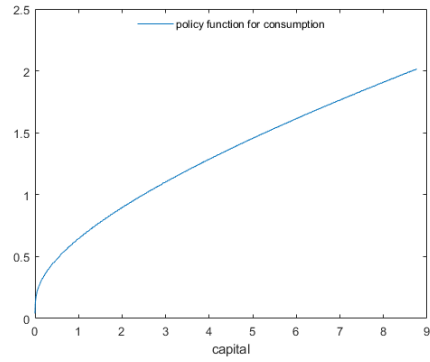
(b)  $V_1(k), V_2(k)$  and  $V_3(k)$ , with  $N=300$

Figure 3: Value and policy functions

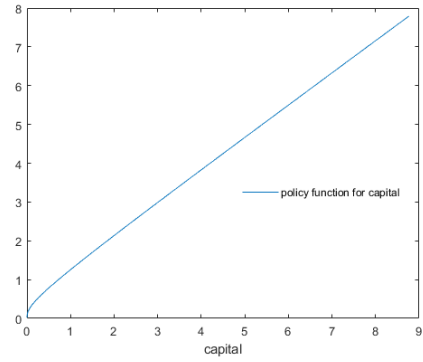
2. Iteration (See the attached file “ps6\_q23.m”)

(a) The Bellman equation

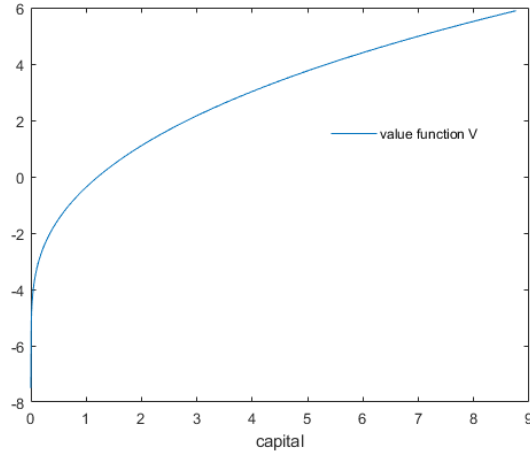
$$\begin{aligned}
 V(k) &= \max_{c, k'} \{ \ln(c) + \beta V(k') \} \\
 \text{s.t. } & c + k' - (1 - \delta)k = k^\alpha \\
 & c \geq 0 \\
 & k' \geq 0 \\
 & k \text{ given}
 \end{aligned}$$



(a)  $g^c(k)$ , with N=1200



(b)  $g^k(k)$ , with N=1200



(c)  $V(k)$ , with N=1200

Figure 4: Value and policy functions

### 3. Simulation

(a) Plot consumption, investment and output

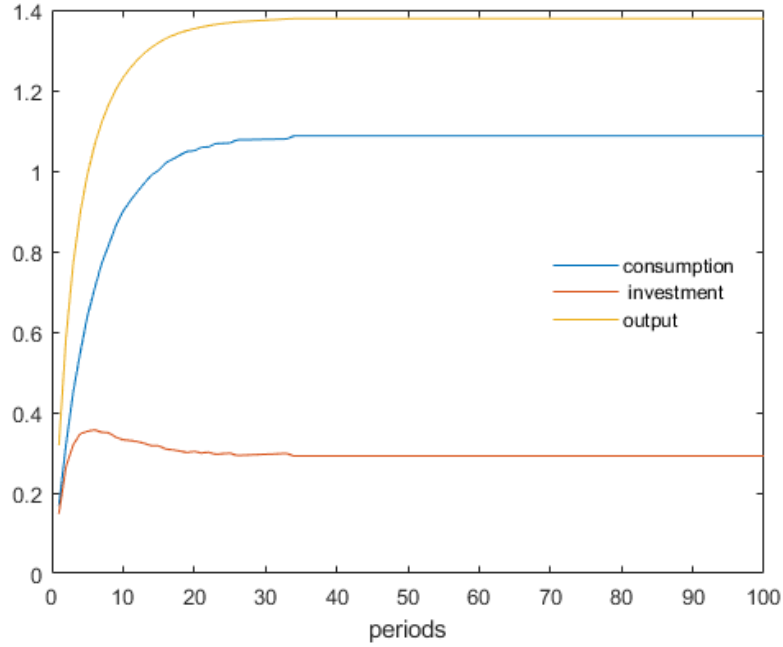


Figure 5: Simulation, with periods=100

(b) Difference between solution and simulation

Solution includes functional approach and numerical one, which can both create simulation and be considered continuous. The latter one is limited by the length of input while the former is not.

Simulation is discrete and belongs to sequence problem, the major elements of which is initial value and how to transit from current state to next state like probability transition matrix. Sometimes, simulation can be converted into functional one.