

Problem Set 1

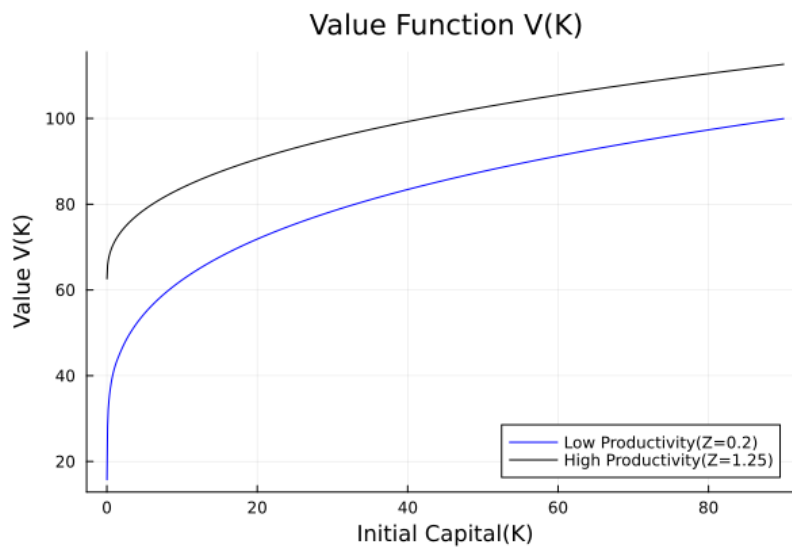
Nicolas Moreno, Kushal Patel, Olivia Wilkinson
ECON: 880

September 11, 2024

1 Problem 1

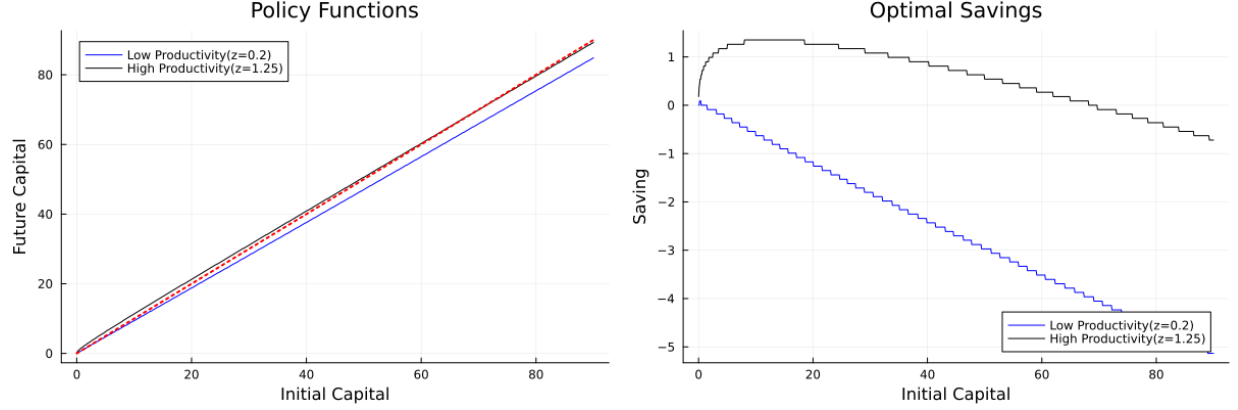
The execution time for the un-parallelized implementation takes about 63 seconds while the parallelized implementation finishes in about 20 seconds.

2 Problem 2



The value function is plotted for both states $z = 1.25$ and $z = 0.2$. The value function is clearly increasing and concave.

3 Problem 3



The policy function is clearly increasing in K . Since $K'(K, Z_h)$ lies above $K'(K, Z_l)$, it is also increasing in Z . Savings is increasing in Z . When productivity is high, savings is increasing in K for low values of K but then decreasing. When productivity is low, savings is monotonically decreasing.

The euler equation is given by

$$\underbrace{\frac{1}{c_t}}_{\text{marginal utility of consumption}} = \underbrace{\beta \mathbf{E}_t \left[\frac{\alpha z_{t+1} k_{t+1}^{\alpha-1} + 1 - \delta}{c_{t+1}} \right]}_{\text{marginal cost of saving}}.$$

The LHS captures the marginal utility of consuming more while the RHS is the marginal cost of foregoing consumption today for consumption in the future. When K is low, households might save more in response to a positive productivity shock since they can capture higher future returns. When K is high, a positive productivity shock leads to increased consumption since they have a lot of wealth and the MPK is low at high K . This explains the non-monotonic shape of the savings curve above for high TFP. On the other hand, a negative productivity shock decreases the MPK of capital and disincentivizes savings. Another relevant aspect of the role of productivity in the Saving decision of households is the persistence of the productivity shocks, which in our case is very high as the states are pretty absorbent. As a consequence, when consumers start with a low productivity their expected value of future MPK will be very low, whereas it will be higher when they start at a high productivity level. In the latter case, more capital at very low initial capital holdings will decrease MPK but this effect will be mitigated by the higher returns that are expected to persist due to productivity.