Problem Set 1

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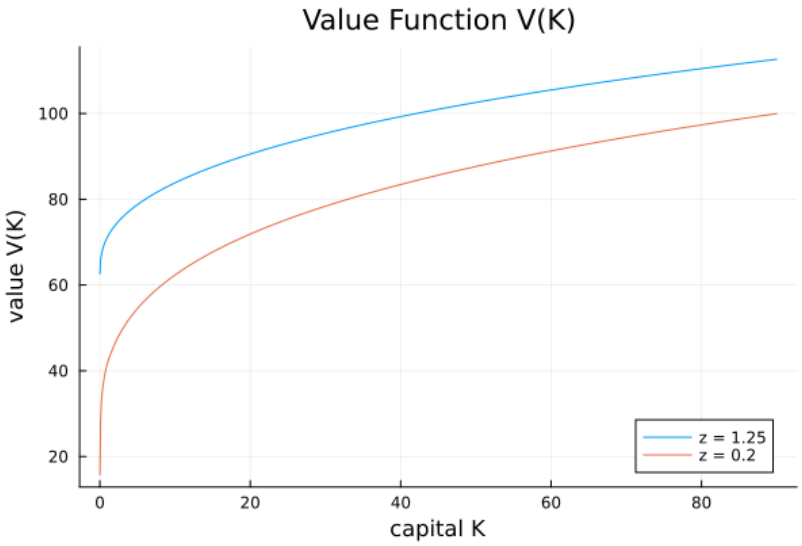
1 Problem 1

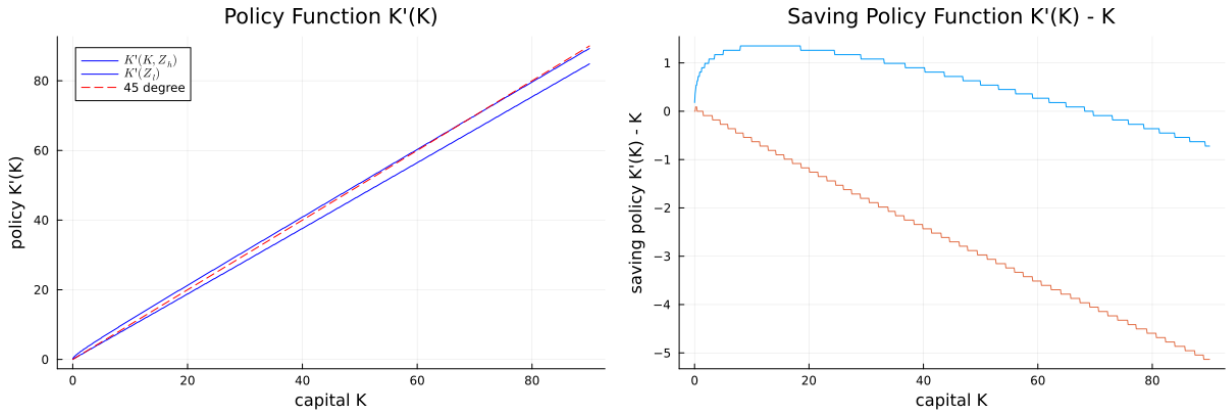
The execution time for the un-parallelized implementation takes about 63 seconds while the parallelized implementation finishes in about 20 seconds.

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

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

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.