# Problem Set #1

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## 1

- The sequential problem can be written as follows:

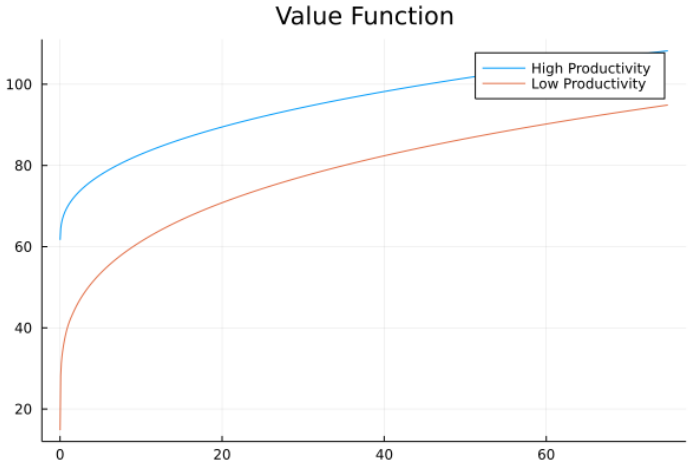
$$\max_{(k_{t+1},c_t)} E[\sum_{t=0}^{\infty} \beta^t \log(c_t)]$$
$$\text{s.t. } c_t + k_{t+1} - (1-\delta)k_t \leq z_t k_t^{\theta}$$

  Thus the Bellman equation is:

$$V(k,z) = \max_{k'}(\log(zk^{\theta} + (1-\delta)k - k')) + \beta E[v(k',z')]$$

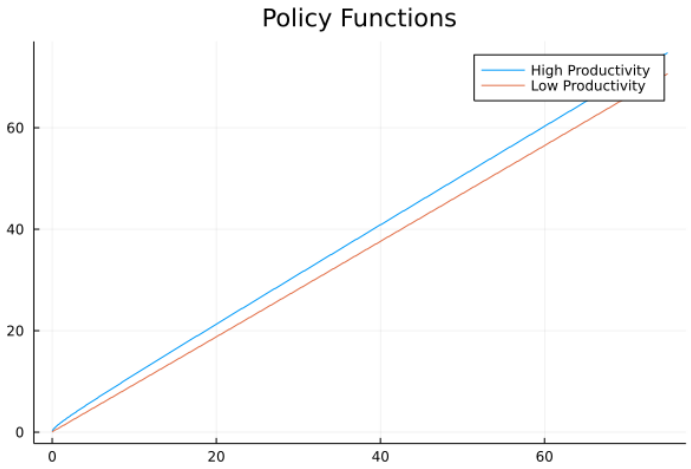
## 2

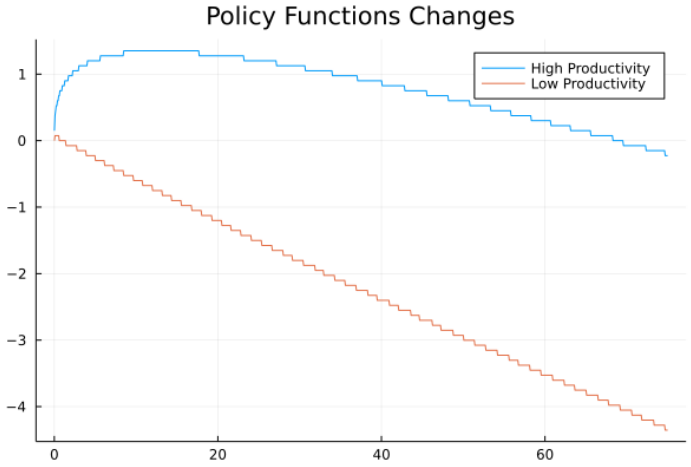
- As shown in the figure below, the value function over $k$ for each state $z$ is increasing and concave (i.e., $V(k_{i+1},z) \geq V(K_i,z)$ for $k_{i+1} \geq k_i$ and $V(k_{i+1},z) - V(K_i,z)$ is decreasing).



## 3

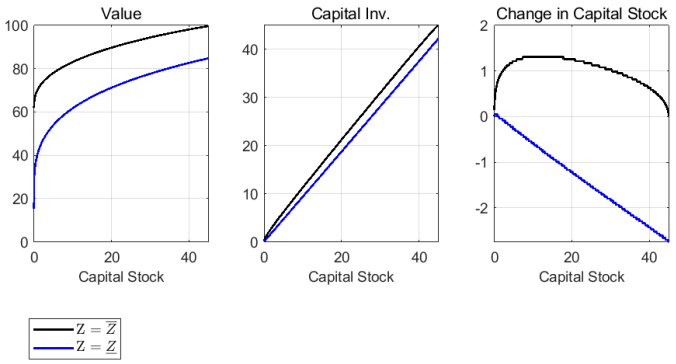
- The decision rule is increasing in $k$ and $z$ (i.e., $K'(k_{i+1}, z) \geq K'(K_i, z)$). Also, saving is increasing in $z$ (i.e., $k'(k, z) - k$ is increasing in $z$). With regard to $k$, in $z_g$ saving is first increasing but turns to be decreasing, whereas in $z_b$ saving is always decreasing. My argument is presented in the below two figures.



- Also, figures drawn from Fortran and Matlab are presented below.

1. **Fortran**




2. **Matlab**