Instituto Tecnológico Autónomo de México

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# Dynamic Macroeconomics 1: Lab. 2

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# Contents

# 1. Question 1

Consider the recursive neoclassical growth model seen in class and solved in `MATLAB` where:

$$u(c) = log(c)$$
$$f(k) = \theta k^{\alpha}$$

Assume that $\alpha = 0.35$, $\beta = 0.99$ and $\delta = 0.06$. Further assume that $\theta$ is a technological shock wich follows a markovian discrete process of first order (Usually AR(1)), such that $\theta \in \{0.8, 1, 1, 2\}$, with a transition matrix:

$$PI = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.1 & 0.7 & 0.2 \\ 0.1 & 0.4 & 0.5 \end{bmatrix}$$

## 1.1 (i)

Calculate the invariant distribution of tech. shocks. Is this process asymptotically stationary?

If we calculate the asymptotic distribution of the transition matrix (say for 100,000 periods) we have that

$$PI_{asymp} = \begin{bmatrix} 0.1667 & 0.5476 & 0.2875 \\ 0.1667 & 0.5476 & 0.2875 \\ 0.1667 & 0.5476 & 0.2875 \end{bmatrix}$$

Now, the easiest way to check this distribution is invariant is to compute the product

$$PI_{asymp} \times PI_{asymp}$$

However, it's easy and pretty straight forward that $PI_{asymp}$ is idempotent, therefore we can directly conclude that the distribution of the discrete markov process is asymptotically stationary. Another way to compute this is with the following `MATLAB` code:

Listing 1.1: Asymptotically Stationary Distribution

```
MarkovChain = dtmc(PI);
figure(3);
graphplot(MarkovChain, 'ColorEdges', true)
xFix = asymptotics(MarkovChain)
```

And to visualize the process and its stationarity:

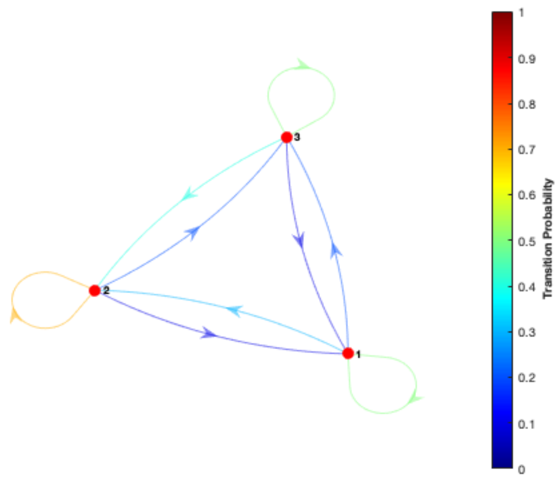


Figure 1.1: Distribution of Discrete Markovian Process with probability transition matric $PI$ in `MATLAB`

## 1.2 (ii)

Now, we have to compute the recursive neoclassical growth model with **uncertainty** and graph the optimal decision path for capital and consumption:

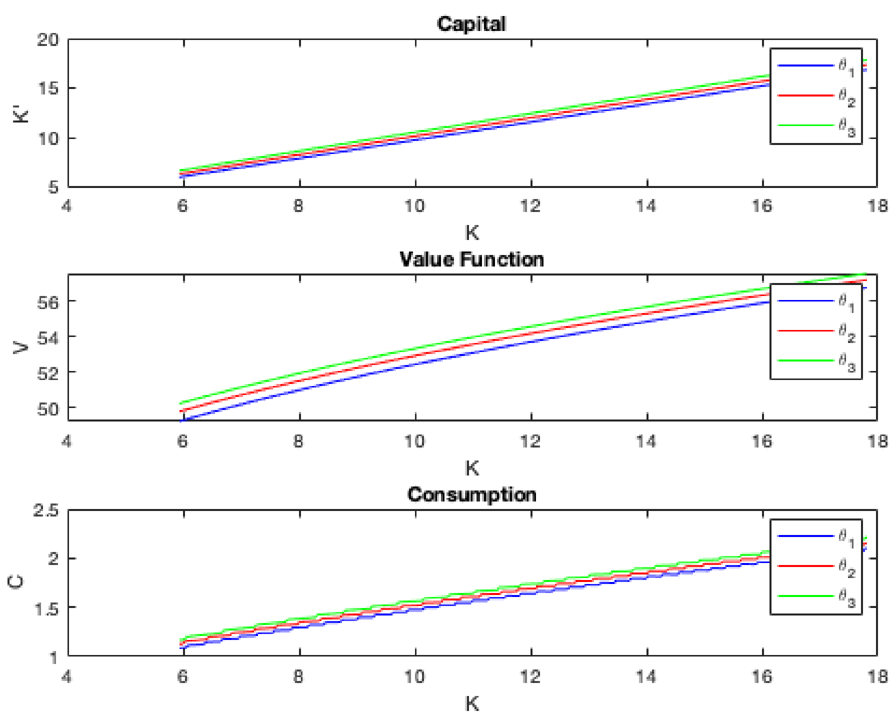


Figure 1.2: Value functions (optimal decision rule) for capital and consumption in `MATLAB`

## 1.3 (iii)

In this section we will simulate and graph the optimal trajectories for a series of interest variables for **50** periods.

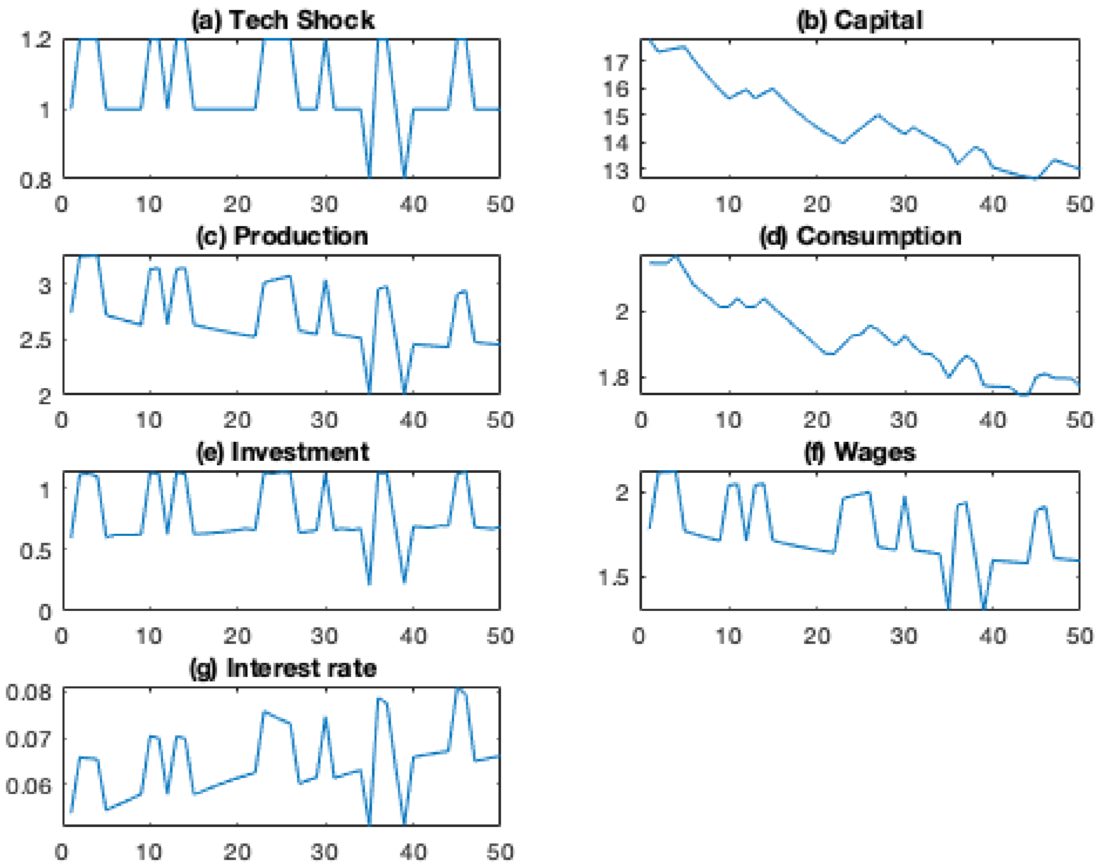


Figure 1.3: Optimal Trajectories or Paths for Interest Variables affected by technological shocks in `MATLAB`

## 1.4 (iv)

We are asked to use an average of 500 simulations (without taking the first 100 observations into account) to calculate the standard deviation of the logarithm of each of the previously computed series, as their correlation with production.

Listing 1.2: Volatilities (Std. Dev's) of series and Correlations with respect to production

```
Volatilities or Std. Dev's:

- Production     = 0.14468
- Consumption    = 0.054166
- Inverstment    = 0.49649
- Wages          = 0.14468
- Interest Rates = 0.14435

Correlation of production with respect to:

- Consumption       = 0.60868
- Inverstment       = 0.95252
- Wages             = 1
- Interest rates    = 0.83308
```