ECON 210: Section 4

Marcelo Sena

Plan for today

- Approximating the value function with basis functions
- Endogenous grid method

Approximating the value function with basis functions

- So far we have represented the value function with a finite set of points in a vector
- How to find the value at a non-sampled point?
  - so far, we find closest point in the grid
  - good enough when grid is very fine
  - but requires more points
- alternatively, could interpolate
  - softwares typically does this automatically when plotting (linear interpolation)
- given one set of points, we can find the best fitting polynomials to value function
- you will experiment with this in the next problem set

Endogenous-Grid Method (EGM)

- Method proposed in Carroll (2006)
- Idea: instead of fixing grid for state we will fix a grid for optimal choices
- Back engineer what the state grid has to be such that the proposed optimal choice grid is indeed optimal
- What does the algorithm achieve? No need to interpolate or perform complicated root-finding for optimization

Endogenous-Grid Method (EGM)

EGM in Consumption-Savings

- recall the maximization step of consumption-savings: first-order condition implies

$$u'(a - R^{-1}a')R^{-1} = \beta V'(a') \tag{1}$$

- given a value function, could solve for a'
- instead, fix some "exogenous" grid for a' and find what the state must be to yield the desired optimal choice

$$a^{\text{endo}} = u'^{-1}\left(R\beta V'(a')\right) + R^{-1}a' \tag{2}$$

- much simpler inversion! no root-finding/finding point in the grid that solves the equation
- repeat this for every point in the grid of a' and we obtain the endogenous state grid
- update value function at each point in endogenous grid

Carroll, Christopher D, "The method of endogenous gridpoints for solving dynamic stochastic optimization problems," *Economics letters*, 2006, *91* (3), 312–320.