Problem Set 6

1 Huggett (1993) ctd

Consider the Huggett economy from problem set 5.

1. Produce a contour plot with the joint distribution of (a,s). What is the correlation between income and savings? (Hint: You can apply the formulas for the Covariance and Variance directly to the joint distribution using the value and mass of each grid point.)

2. How does the correlation change when you change the borrowing constraint ϕ to 1) the natural borrowing limit (NBC) and 2) -0.1? How do you interpret this? (Hint for the NBC case: notice that the NBC depends on the interest rate, so you need to update it (and the asset grid) with every guess of r. For the bisection procedure to work smoothly, set an ad-hoc large negative number Φ (e.g., -100) as the borrowing constraint for the case where $r < 0$, and set the borrowing constraint to be $BC = \max(\Phi, -\frac{ws(1)}{r})$ for the case where $r > 0$.).

   Let's compare welfare between economies with different borrowing constraint $\phi \in \{NBC, -2, -0.1\}$.

3. Calculate welfare ex-ante, behind a veil of ignorance, using a utilitarian welfare criterion with equal weights. Which economy provides the highest welfare and how do you interpret this result?
   Note: Utilitarian social welfare is defined as:

$$U = \int E_t V(\{c_s\}_{s=t}^{\infty}) d\theta_t(a, s)$$

4. Now, compare welfare of individual households with states (a,s). Calculate the consumption equivalent that the average household would be willing to pay to live in an economy with $\phi = NBC$ instead of $\phi = -0.1$. Compare differences in individual willingness to pay. How do you interpret this?
   Note: The consumption-equivalent welfare change is defined as the percentage change in consumption that the average household must incur in the old situation in order to be indifferent between staying in the old situation and being in a

new stationary equilibrium with different borrowing constraint. Let the new situation be denoted by the subscript new and characterized by the new borrowing constraint, $\phi = NBC$, and resulting density θ_{new}. The consumption-equivalent change for the average household, x, is defined as follows:

$$\int V_{old}(a, s; x) d\theta_{old}(a, s) = \int V_{new}(a, s) d\theta_{new}(a, s)$$

$$\int E_0 \sum_{t=0}^{\infty} \beta^t \frac{(c_{old}(a, s)(1+x))^{1-\gamma} - 1}{1-\gamma} d\theta_{old}(a, s) = \int E_0 \sum_{t=0}^{\infty} \beta^t \frac{c_{new}(a, s)^{1-\gamma} - 1}{1-\gamma} d\theta_{new}(a, s)$$

This can be solved for x.

Let's further decompose welfare into uncertainty and inequality effects as suggested by Martin Floden in the JME (2001). The idea is to isolate uncertainty effects from inequality effects by calculating certainty-equivalent consumption levels for each individual $\bar{c}$. Inequality is then measured from the distribution of certainty-equivalent consumption while uncertainty is measured by comparing the differences in actual and certainty-equivalent consumption levels. Certainty equivalent consumption satisfies:

$$V(\{\bar{c}\}_{s=t}^{\infty}) = E_t V(\{c_s\}_{s=t}^{\infty})$$

5. Calculate the cost of uncertainty p_{unc}:

$$V(\{(1 - p_{unc})C\}_{s=t}^{\infty}) = V(\{\bar{C}\}_{s=t}^{\infty}),$$

   where C is average consumption and $\bar{C}$ is average certainty equivalent consumption.

6. Calculate the cost of inequality p_{ine}:

$$V(\{(1 - p_{ine})\bar{C}\}_{s=t}^{\infty}) = \int V(\{\bar{c}\}_{s=t}^{\infty}) d\theta(a, s),$$