Aggregate Uncertainty and Discrete Choice

Computations and Quantitative Models in Macro

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Aggregate Uncertainty and Discrete Choice

- I solved both questions in `Matlab`.
- Some details about the code and algorithms are described in the `README.md` file of each question (in my online repository). See them for more information.
- Questions 2 and 3 from the homework were joined in just one (Q2 in these slides).
- Codes can be found here:

Aggregate Uncertainty: Krusell-Smith Algorithm

Q1: Aggregate uncertainty: Krusell-Smith algorithm

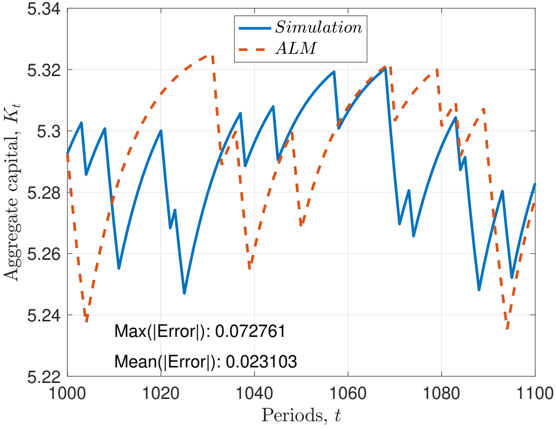
Questions

1. *Use the Krusell-Smith algorithm to solve for the ALM*
   The estimated parameters of the ALM are the following:
   * low-idiosyncratic productivity shock: $\log(K_{t+1}) = 0.1491 + 0.9087 \log(K_t)$
   * high-idiosyncratic productivity shock: $\log(K_{t+1}) = 0.1556 + 0.9071 \log(K_t)$
2. *Calculate the R2 of the ALM*
   * low-idiosyncratic productivity shock: $R^2 = 0.999998803434357$
   * high-idiosyncratic productivity shock: $R^2 = 0.999998802891821$

Q1: Aggregate uncertainty: Krusell-Smith algorithm

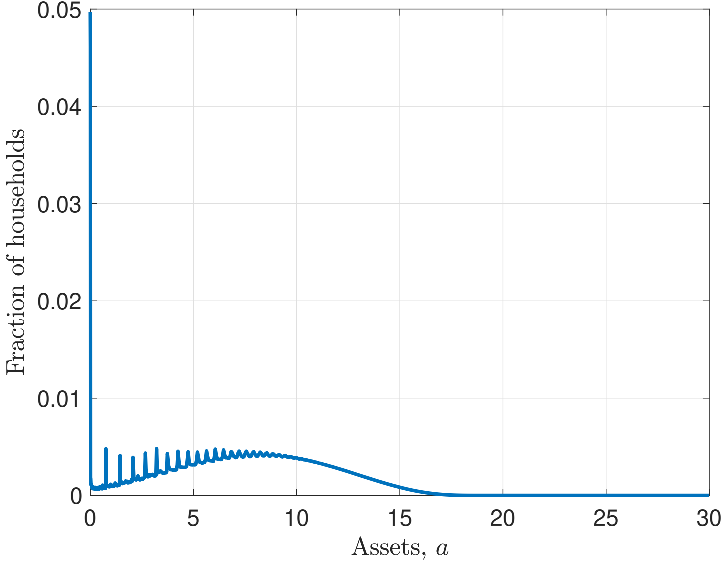
Questions

3. *Calculate the DenHaan measure using the existing time series from period 1000-1100*
   In the next figure, I plot both series of aggregate capital (non-stochastic simulation and ALM forecasting) and point out the maximum and average distance between both series.



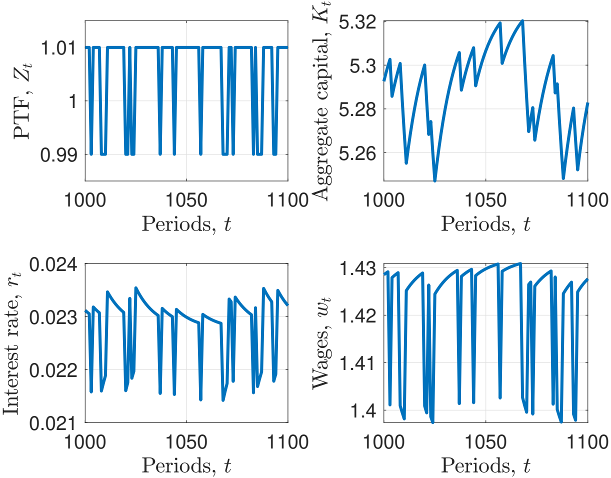
Q1: Aggregate uncertainty: Krusell-Smith algorithm
Questions

4.1 *Plot the distribution of aggregate capital*



Q1: Aggregate uncertainty: Krusell-Smith algorithm
Questions

4.2 *Plot the timeseries of aggregate capital, interest rate, wages and TFP*
In order to ease the visualization, I plot these timeseries only for the period 1000-1100 (as in the DenHaan's test).

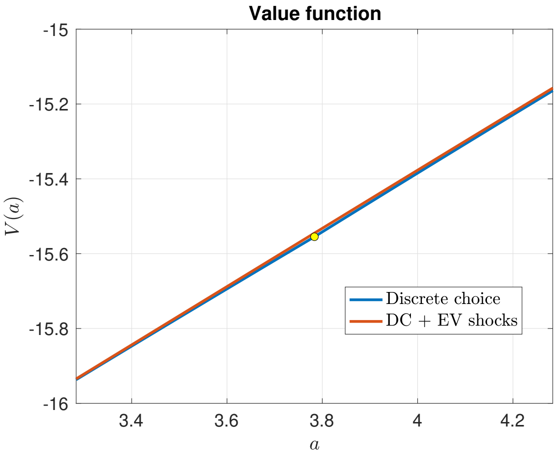


SIM with Discrete Choice - Adding Extreme Value Taste shocks

Q2: SIM with Discrete Choice and EV shocks

Questions

1.1 *Plot the value function*

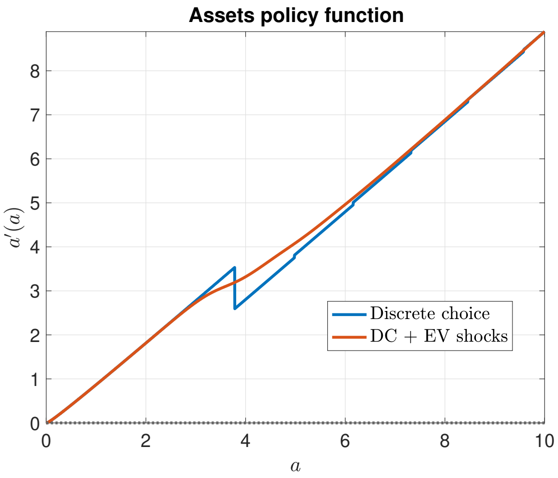


- I show value functions of the standard model with discrete choice (`Discrete choice`) and with extreme value shocks (`DC + EV shocks`).
- I graph both functions around the point where the value function changes (the round marker, although the difference in the curve's shape is not noticeable).
- At that point consumer decides to go out from the labor market.
- Adding extreme value shocks allows to "smooth" the value function.

Q2: SIM with Discrete Choice and EV shocks

Questions

1.2 *Plot the policy function for assets*

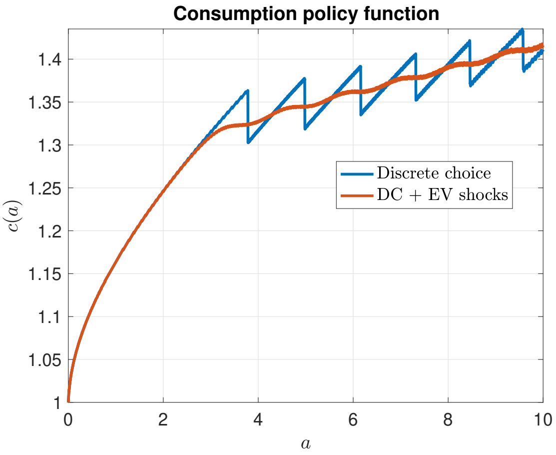


- In the standard model with discrete choice, we observe a sort of "regime change" at the point where the consumer decides not working. That point is $a = 3.7835$.
- If consumers don't supply labor, then they save less in order to finance consumption.
- Adding extreme value shocks makes the optimal choice of assets for the next period be smooth between both "regimes".

Q2: SIM with Discrete Choice and EV shocks

Questions

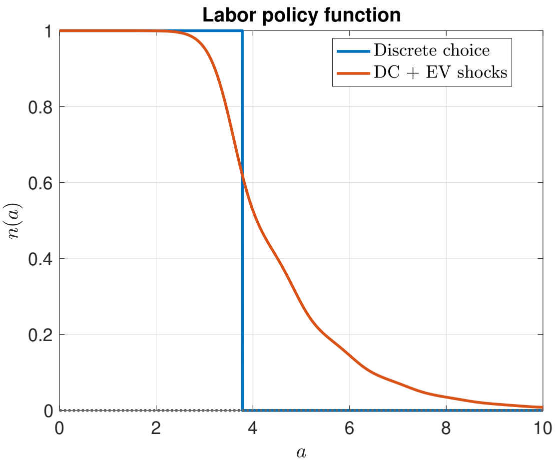
1.3 *Plot the policy function for consumption*



- In the standard model with discrete choice, we observe a change in its behavior for assets $a > 3.7835$ (not work), with ups and downs around a increasing trend.
- Consumption and assets policy functions are non-monotonic in assets and have discontinuities given by the participation in the labor market and the consumption smoothing behavior.
- As before, including extreme value shocks makes consumption policy function be smooth after that point.

Q2: SIM with Discrete Choice and EV shocks
Questions

1.4 *Plot the policy function for labor*



- The policy function for labor is totally different between both models. In the standard discrete choice model we observe a drastic change before (work) and after (not work) of $a = 3.7835$.
- The presence of extreme value shocks makes to obtain probabilities for the values in the assets grid instead of a discrete "regime change".

Q2: SIM with Discrete Choice and EV shocks

Questions

2. *Could you use EGM for either of the problems? Why / why not?*

No, we can't. For implementing the EGM we should obtain, as a first step, the FOC from the (recursive) consumer's problem:

$$V(a,n,z) = \max_{a',n} U(nwz + (1+r)a - a') - \phi n + \beta \mathbb{E} V'(a',n',z')$$

The FOC is:

$$U_{a'}(\cdot) = \beta \mathbb{E} V'_{a'}(\cdot)$$

For a log utility form:

$$nwz + (1+r)a - a' = \left(\beta \mathbb{E} V'_{a'}(\cdot)\right)^{-\frac{1}{\sigma}}$$

Q2: SIM with Discrete Choice and EV shocks

Questions

2. *Could you use EGM for either of the problems? Why / why not? (...continued)*
The EGM implies that:

$$a = \left[\frac{1}{1+r}\right]\left\{\left(\beta \mathbb{E} V'_{a'}(\cdot)\right)^{-\frac{1}{\sigma}} + a' - nwz\right\}$$

However, as we seen before, a' is non-monotonic in a and non-differentiable at $a = 3.7835$, then we cannot apply the Envelope theorem. Moreover, $V'(\cdot)$ is not concave so $V'_a(\cdot)$ is non-monotonic as well (in terms of Carroll (2006), $V'(\cdot)$ should be "well-behaved").
Therefore we cannot apply the EGM for either of the problems. A solution could be to implement the EGM method with an Upper Envelope algorithm, such that the two (or more) a' solutions that we obtain applying the EGM by itself, are reduced to just one by the selection of the a' that maximizes the value function.