Econ 516 Midterm- Huggett 1993 Replication

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1 Summary

This paper explains the observed low interest rate in economy via a heterogeneous agent in incomplete insurance market model with idiosyncratic shocks to endowment. The model attributes the prevailing low interest rates to prevent households from saving more owing to precautionary saving motives of households to smooth consumption in presence of uncertainty and shocks.

The household problem is to maximize lifetime utility in the infinite horizon framework given as

$$\mathbb{E}\left[\Sigma_{t=0}^{\infty}\beta^t U(c_t)\right] \qquad with\ \beta \in (0,1)$$

and

$$U(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}, \quad \sigma > 1$$

with budget constraint

$$c + a'q \leq a + e, \quad c \geq 0\ \ and\ \ a' \geq \underline{a}$$

The endowment e follows a Markov Process. Agent's choice variable are c_t and a'.

We have tried to replicate the results of the paper using an endogenous grid method in both MATLAB and Julia. To do so we constructed a library in Julia *HA_solver.jl* . For now it just solve the Huggett model, though we plan to expand it during the next projects. All our codes and results for both MATLAB and Julia are available in the git repositiory. The link to the julia package is `https://github.com/janrosa1/HA_solver/blob/master/src/HA_solver.jl`. The MATLAB codes are also in the same repository under the MATLAB folder. The results from Julia are given below:

$\underline{a}$	q	r
-2	1.0126	-7.2%
-4	0.9974	1.5%
-6	0.9949	3.1%
-8	0.9934	4.5%

Table 1: Obtained q and r values for $\sigma = 1.5$

For illustration of the policy function, we plot two consumption function for $\underline{a} = -8$ and $\sigma = 3.0$:

$\underline{a}$	q	r
-2	1.0459	-23%
-4	1.0072	-4%
-6	0.9986	0.8%
-8	0.9952	2.9%

Table 2: Obtained q and r values for $\sigma = 3.0$

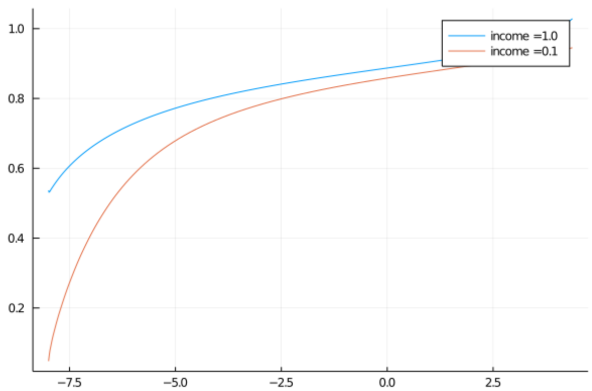


Figure 1: Example of the obtained consumption policy functions

The tables and figures below are the results from MATLAB.

With thee MATLAB program, we have constructed a function which takes as arguments the parameters of the model and provides the interest rates and prices for different credit limits. For convenience, we depict the optimal decision rule and stationary distribution figures only for borrowing limit $= -2$. Other parameters values used are

Parameters	Values
amax	8
grid points	100
β	0.99323

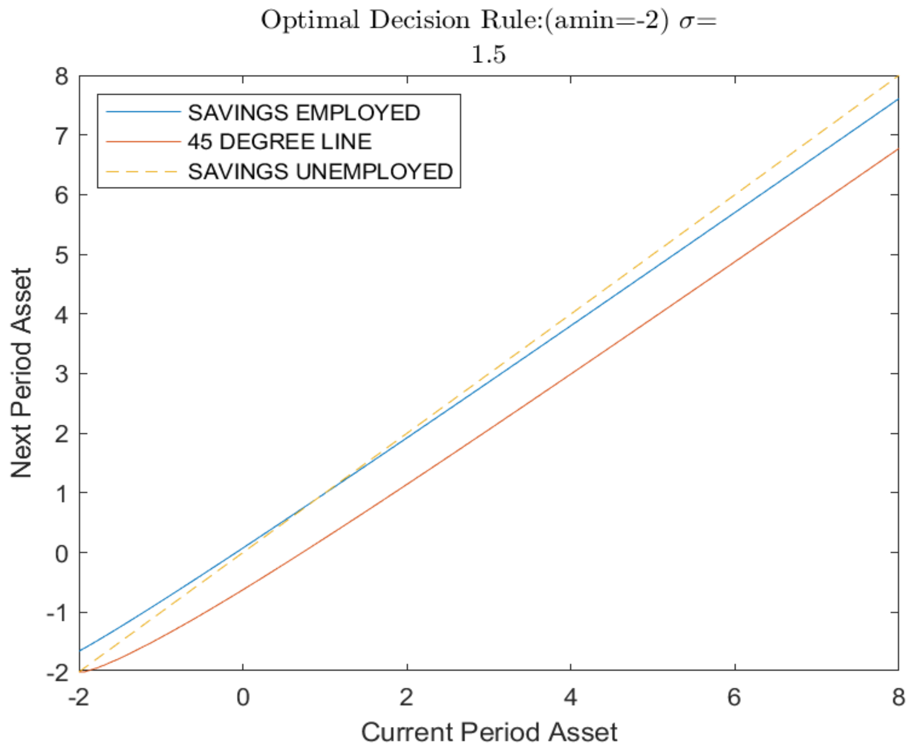
As is evident from the tables our results are very close to the results in the paper, though our interest rates are lower than the ones in the paper.

2 Table 1

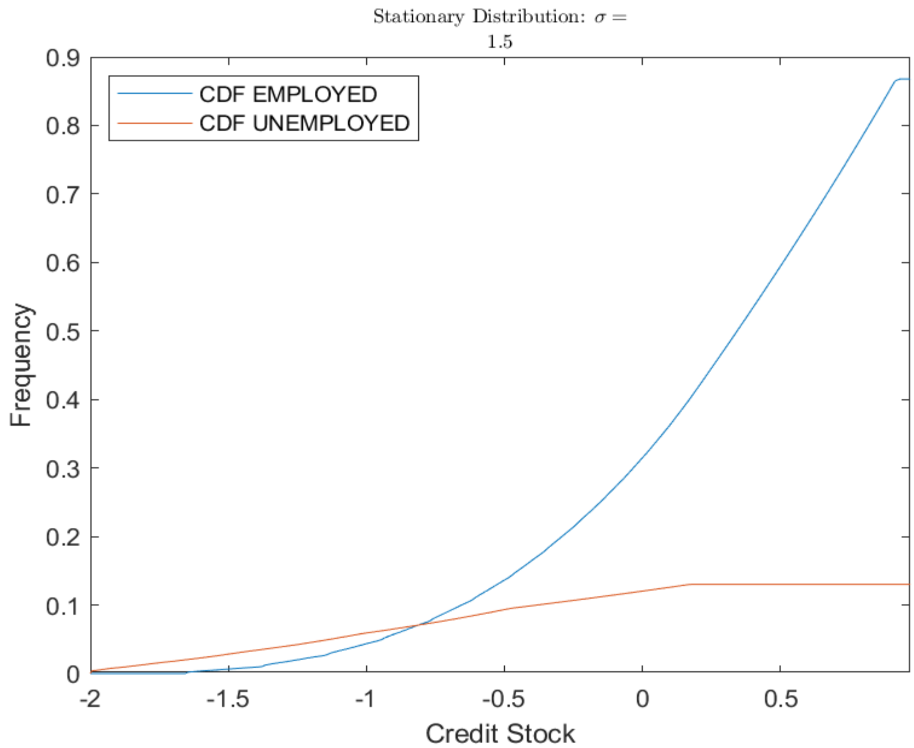
Table 3: Coefficient of relative risk aversion $\sigma = 1.5$

Credit Limit	Interest Rate	Price
-2	-7.55	1.0133
-4	1.14	0.9981
-6	2.89	0.9953
-8	3.50	0.9943

3 Decision Rule



4 Stationary Distribution

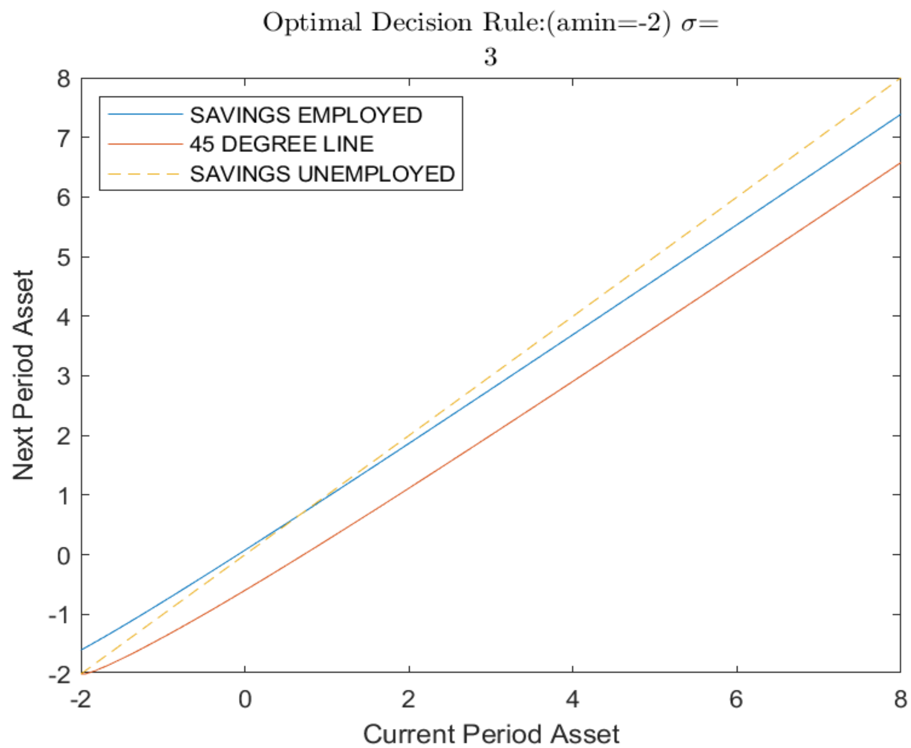


5 Table 2

Table 4: Coefficient of relative risk aversion $\sigma = 3.0$

Credit Limit	Interest Rate	Price
-2	-23.95	1.0469
-4	-4.51	1.0077
-6	1.70	0.9972
-8	2.890	0.9953

6 Decision Rule



7 Stationary Distribution