Problem Set 2

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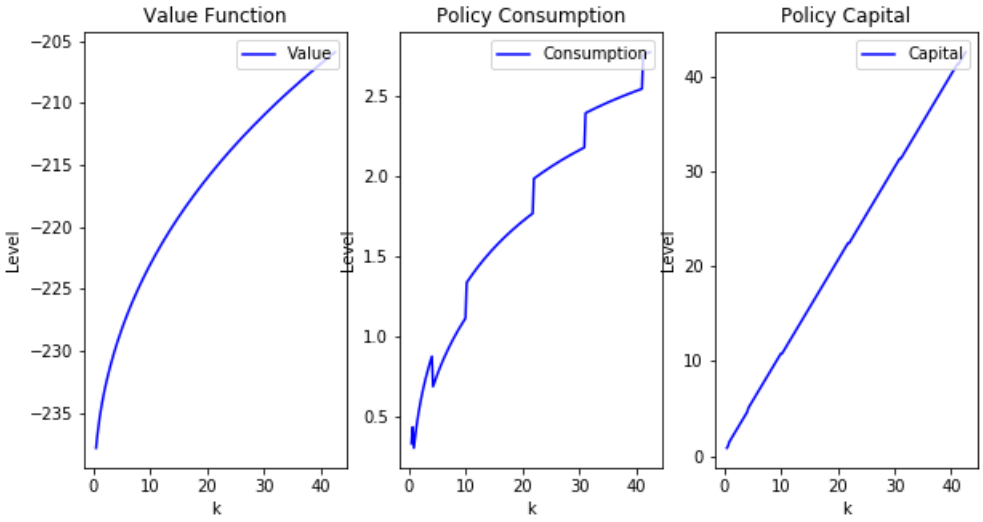
1 Quantitative Macroeconomics

1.1 Problem set 4

Exercise 1

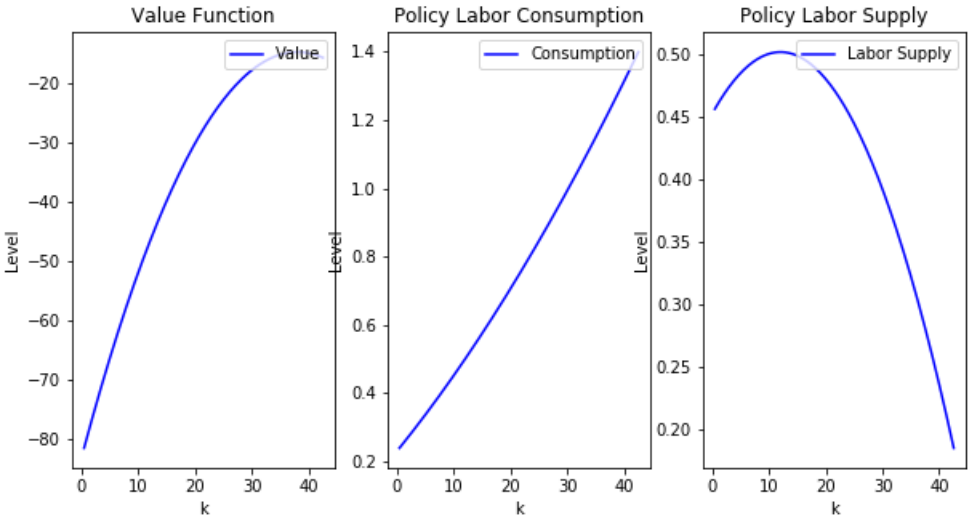
Question 1

The following 2 graphs are the answers to the 3 questions of exercise 1. For question 1, the different methods of estimation for the value function are available in the file Rep-agent.py, which contains a class that does it. You can run the script in Pset4.py and use the different methods of estimation by adding in the options $type\_val =' simple',' mono',' search',' howard', or' conc'$. As you can see the results for question 1 are pretty standard; a concave value function, the policy functions for consumption and capital are increasing.
A few comments need to be done about the part on speeding up the algorithm. In some instances the brute force was faster than the alternative. It can be explained by the fact that the brute force was easily vectorized wheras some of the approaches to make the algorithm faster had to be done with loops which implied a slower code. For the part with the Howard method I noticed that 20 steps was the fastest option and that 50 made actually the algorithm slower.



Question 2 and 3

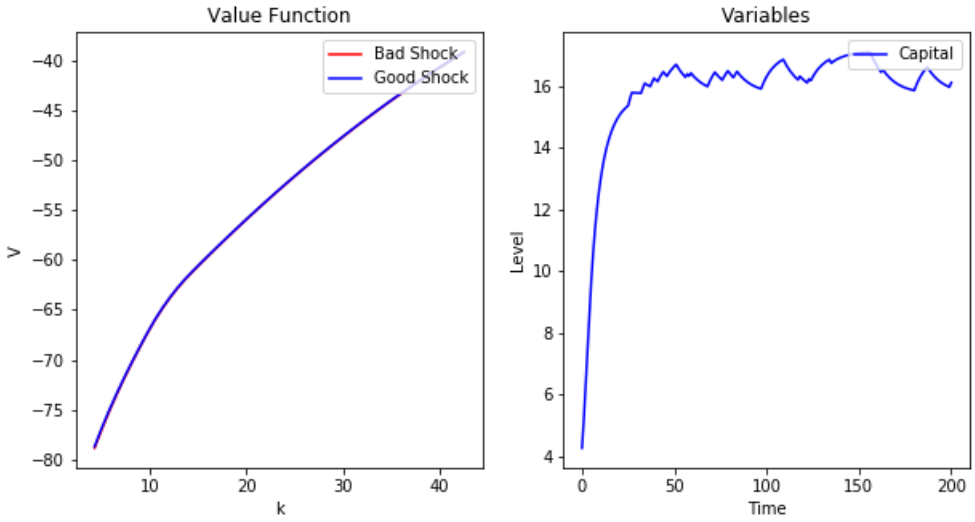
In this section I answered to question 2 and 3. I estimated the value function using a chebychev polinomial but I also wrote the matrix χ that we refered to in class as function of c and h. So I could use a minimization algorithm that could take into acount the gradient of the function; for instance a gradient descent algorithm. This makes the optimization continuous since I am not using a grid to select the control variables. To estimate the value by Chebychev I first guess θ the vector of parameters associated to the functions of the Chebychev familly. Ones the first guess is established, I can solve the model, update V given the old guess for the vector of parameters θ and finally using my last update for V I can reastimate a new vector of parameters. This procedure is performed as long as the distance between my old and new guess for θ are arbitrarly close from one another. I notice that working with Chebychev polinomials, continuous choices for consumption and labor makes the code way faster and more precise than before. It might be slower to run my code from question 1 that has exogenous labour choices than to run the code with continuous choices for the control variables. The 2 files that you should refere to for this part are Pset-cheb.py and Rep-agent-labor2.py that has class constructed representing an agent in this economy.



Exercise 2

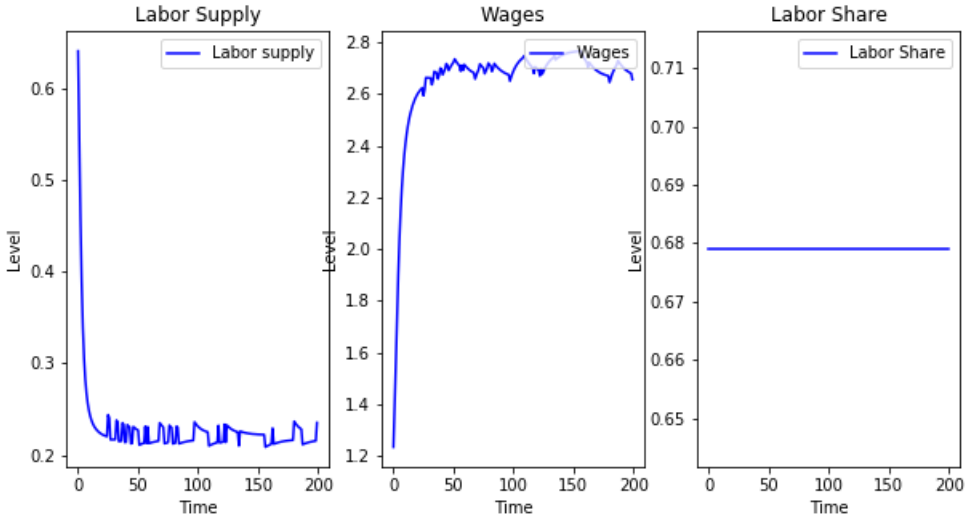
Question 1

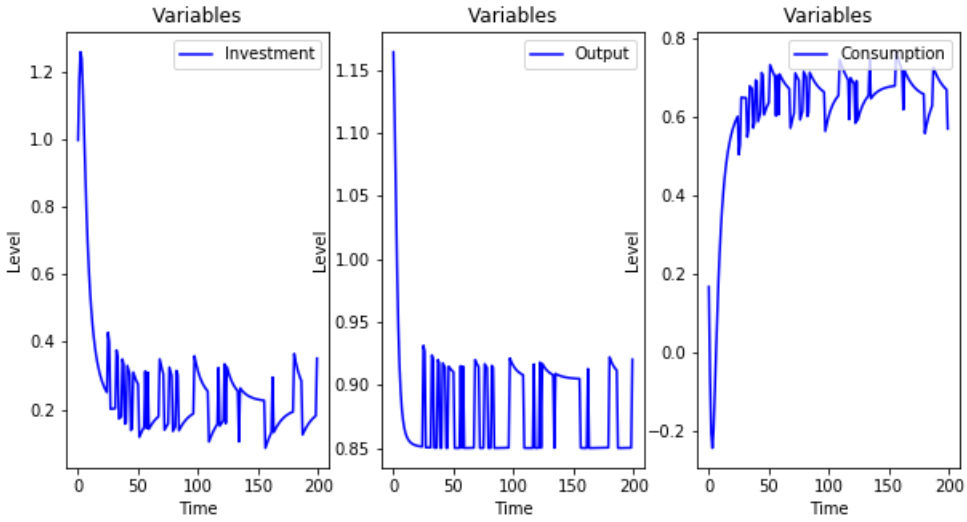
For this part you should refere to two scripts Pset-shock-labor-VFI.py and rep-VFI-shock-labor.py. I also worked on another script that I will include where I tried to use continuous methods in order to approximate the value function. In particular, I used a two dimensinal Chebychev. I encountered a few problems with that approach due to the lack of nodes for the shock state space, that resulted to a non invertible matrix which havent let me update the parameter θ. So instead, I decide to go discrete and use the brute force approach.
In the following graph you can see the two value functions; under the good and the bad shock. There is not much difference between them because of how small the variance of the shock Z is. However, you can see the effect of the shocks in the simuation.



Question 2

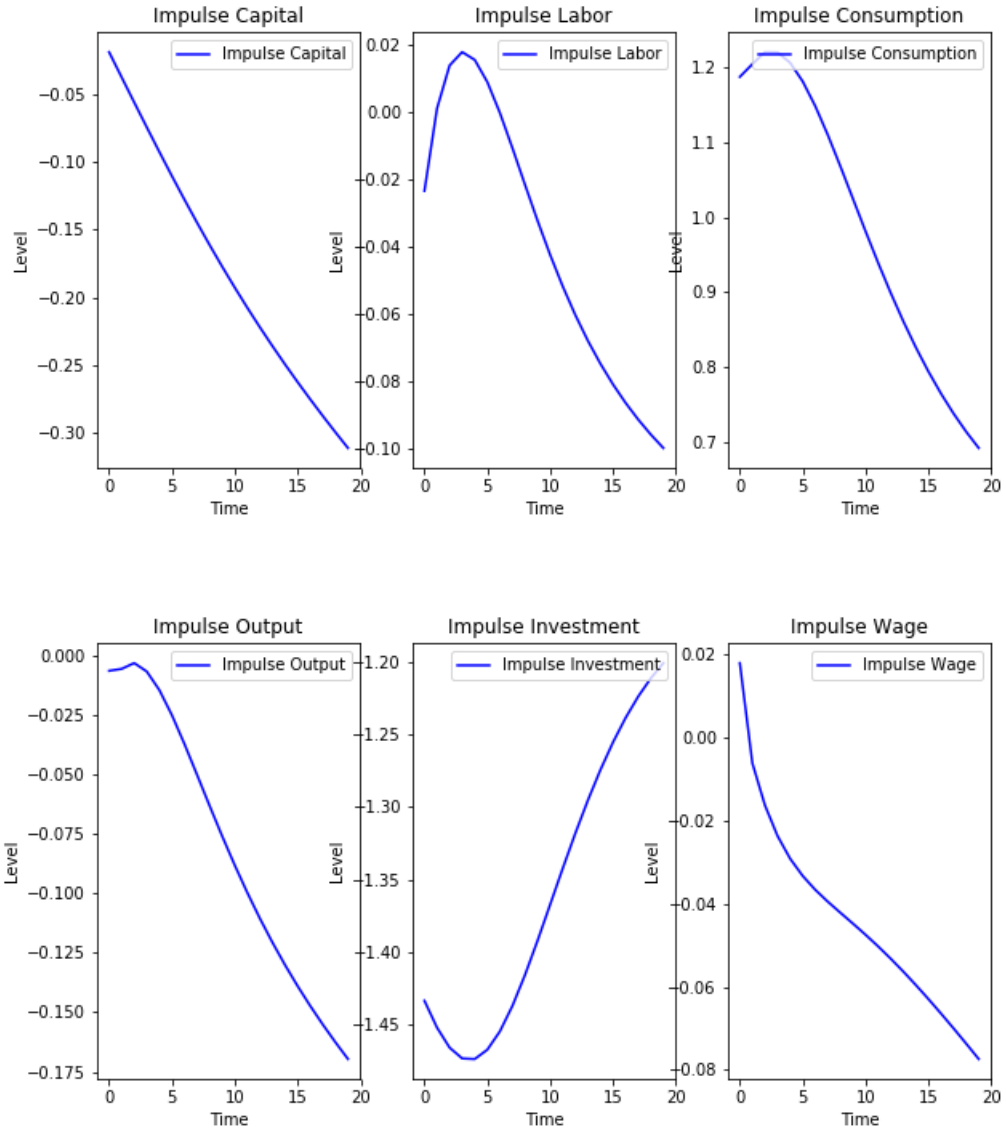
In the simulation everything seem to go as expected. I started the economy at the lowest level of capital and you can observe a quick increase of that capital level, followed by a drop in labor supply explained by the fact that the rent from capital accumulation contributes to consumption funding. Since the labor supply droped wages increase output decrease.





Question 3

The impulse responses are also as expected, the graphs should be interpreted as deviations from the steady state generated by a transitory increase of 1 percent of Z. The impulse responses are clearly not correct the effects are too high, however the signs of the effects seem to be right. There is a decrease in capital and labor due to the fact that we can produce the same quantity with less inputs. Consumption increases then slowly goes back to normal.



Conclusion

The model matches a lot of aspects of the data for instance labor supply is around 0.3 which matches the data. The labor share is 0.68 the level is correct since we observed that in the US the mean value was around 0.71. The issue is that the labor share doesn't repond to the TFP shock in the model and second we saw in the data that the labor share had a slightly downward trend. The

impulse response functions seem to show the right mecanisms, however, it is important to find what part is not done correctly in the code in order to get effects of the right scale.