

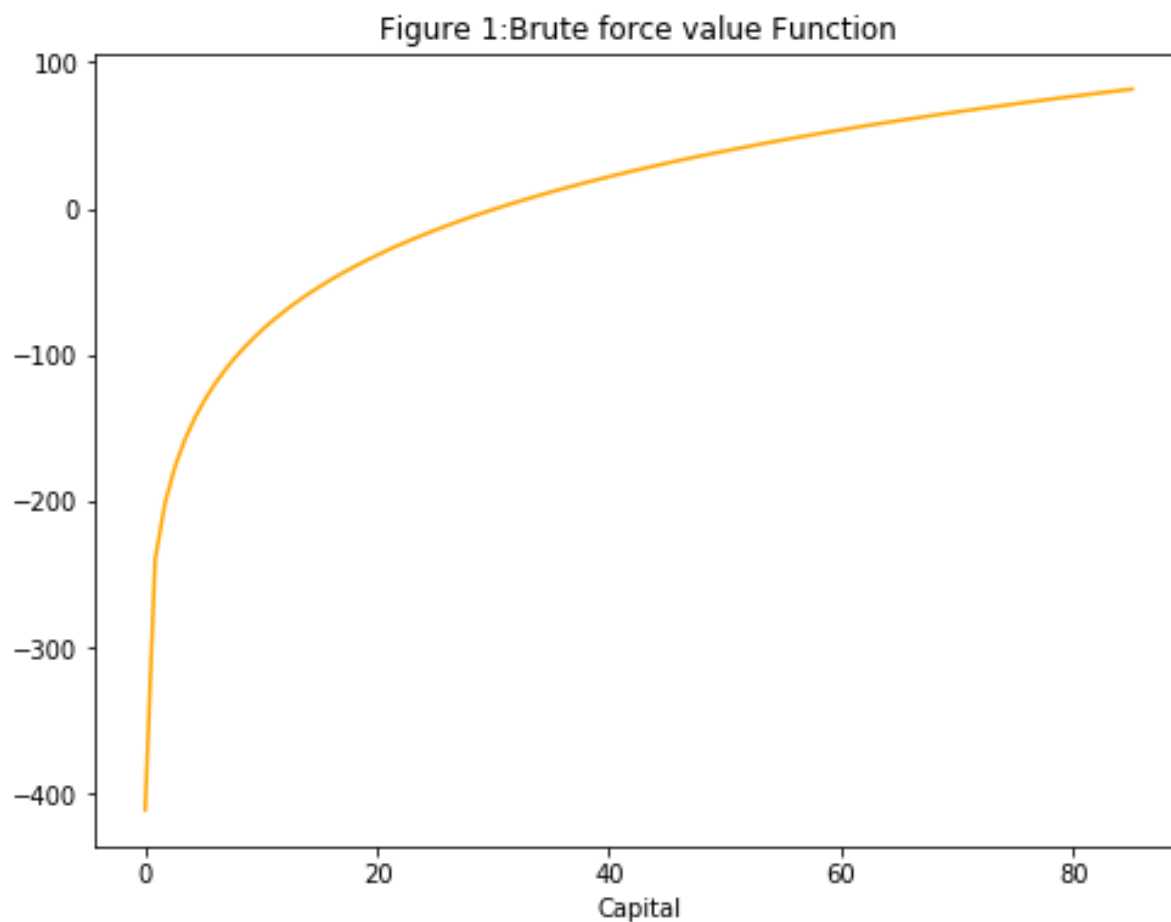
Macroeconomics Homework 4

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Question 1.1

All the value functions were evaluated with an initial $v=0$.

Brute force Value function graph:



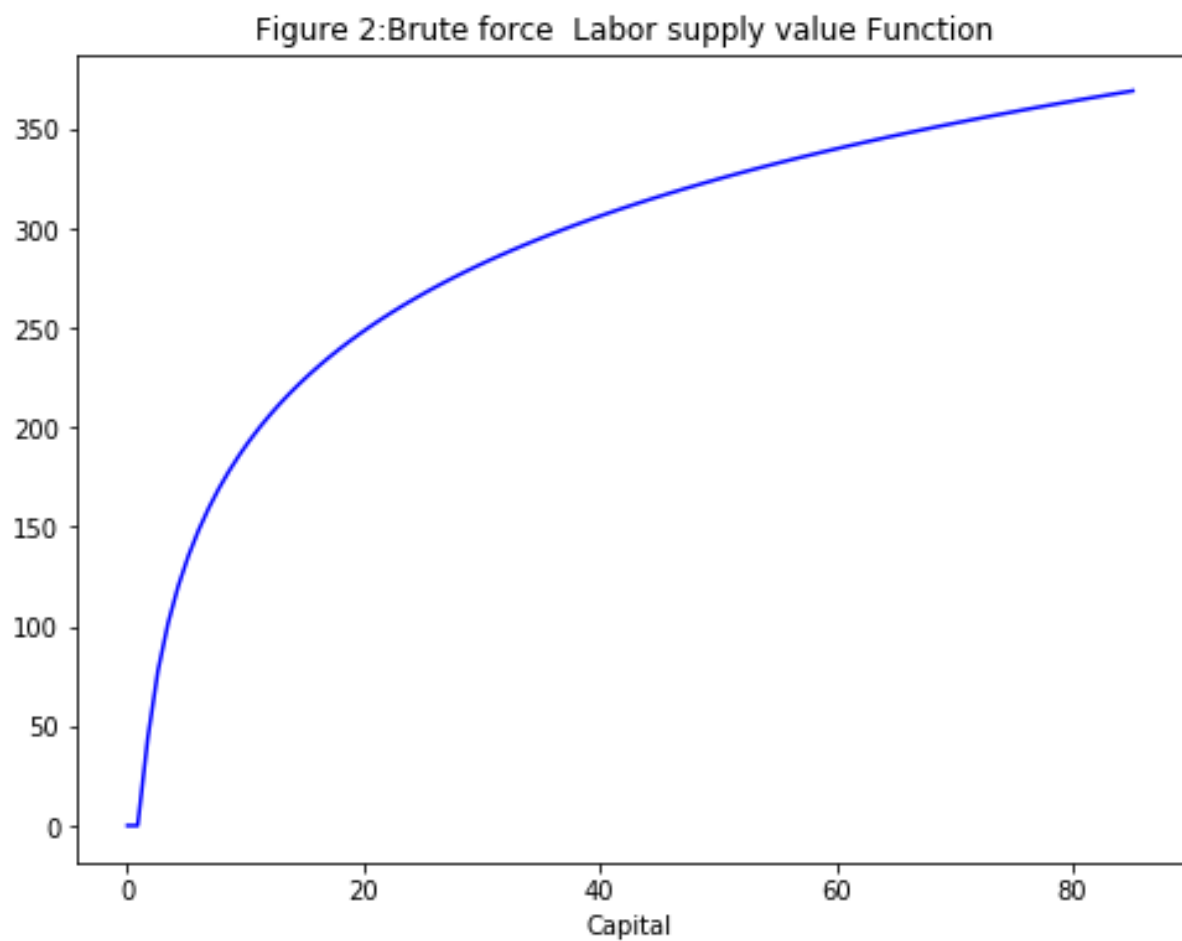
Part	Value function conditions	Time	Time Improvements
a	Brute force	7.592	
b	Monotonicity	9.387	Including monotonicity increases the time of iteration.
c	Concavity	4.899	Including concavity the value iteration has a strong improvement.
d	Local Search	4.140	Local search also shows a massive improvement from both brute force and monotonicity. Compared to concavity there is only a slight improvement.
e	Monotonicity and Concavity	3.64	Including both monotonicity and concavity improves the time drastically compared to all the other conditions.

Part	Value function conditions	Iterations
a	Brute force	28668
b	Monotonicity	40000
c	Concavity	40000
d	Local Search	40000
e	Monotonicity and Concavity	39999

Except Brute force all the other conditions take the same number of iterations. The iterations are so high due to the shape of our grid. We have tried different grid sizes and reducing the size greatly reduces the number of iterations.

Question 1.2

Brute force Value function with labor supply graph:



Part	Value function conditions	Time	Time Improvements
a	Brute force	25.260	
b	Monotonicity	57.542	Including monotonicity increases the time of iteration drastically.
c	Concavity	17.157	Including concavity the value iteration has a strong improvement.
d	Local Search	17.704	Local search also shows a massive improvement from both brute force and monotonicity. Compared to concavity there is only a slight improvement.
e	Monotonicity and Concavity	26.308	Including monotonicity and concavity improves the time compared to monotonicity but takes longer than all other conditions.

When compared to Ex 1.1, for all conditions the value function with labor supply takes longer. This is mainly due to the fact that now there is an extra parameter to be evaluated. We can also see a similar trend for most conditions except when both monotonicity and concavity is included in comparison to the first value function.

Part	Value function conditions	Iterations
a	Brute force	40000
b	Monotonicity	40000
c	Concavity	40000
d	Local Search	2000
e	Monotonicity and Concavity	405965

We can again observe the number of iterations is high due to the shape of the grid. We kept the same grid size in order to compare with the value functions without labor supply. Local search is the only conditions which reduces the number of iterations drastically.