

# Quantitative Macroeconomics - PS V

Tommaso Bighelli

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## 1 Solving the ABHI Model

Problem of the agent is:

$$\max_{c, a'} E_0 \sum \beta^t u(c) \quad (1)$$

given the constraints:

$$\begin{aligned} c + a' &= (1 + r)a + wy \\ a &> -\bar{A} \end{aligned} \quad (2)$$

The Bellman equation is:

$$v(a, y) = \max_{a' > -\bar{A}} u(wy + (1 + r)a - a') + \beta \int v(a', y') d\pi \quad (3)$$

And the Euler equation is:

$$u'(c) \geq \beta(1 + r)E[u'(c')] \quad (4)$$

## 1.1 Infinitely lived households, with certainty, quadratic utility function

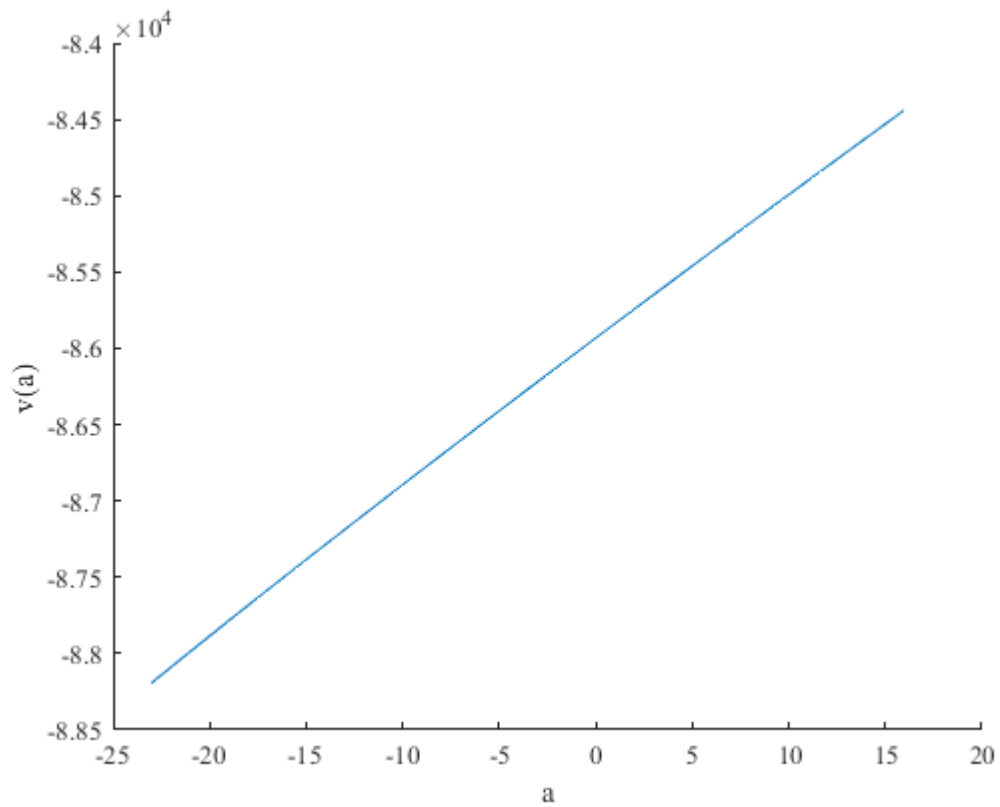


Figure 1: Value function, quadratic utility, certainty, infinitely lived households

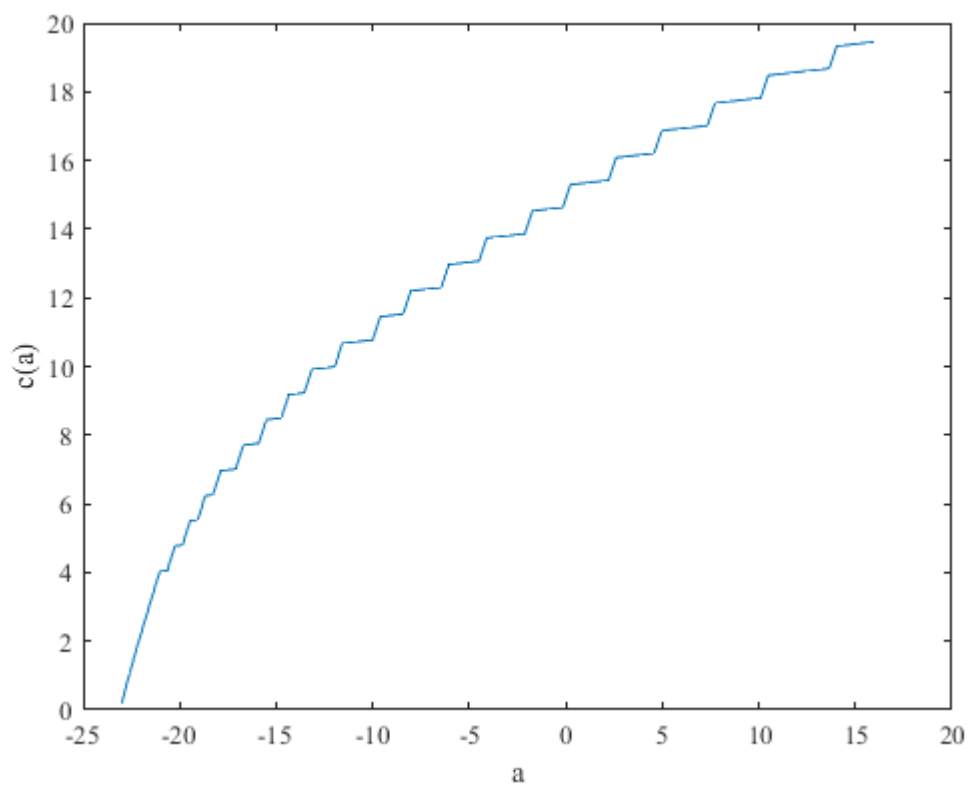


Figure 2: Policy function consumption, quadratic utility, certainty, infinitely lived households

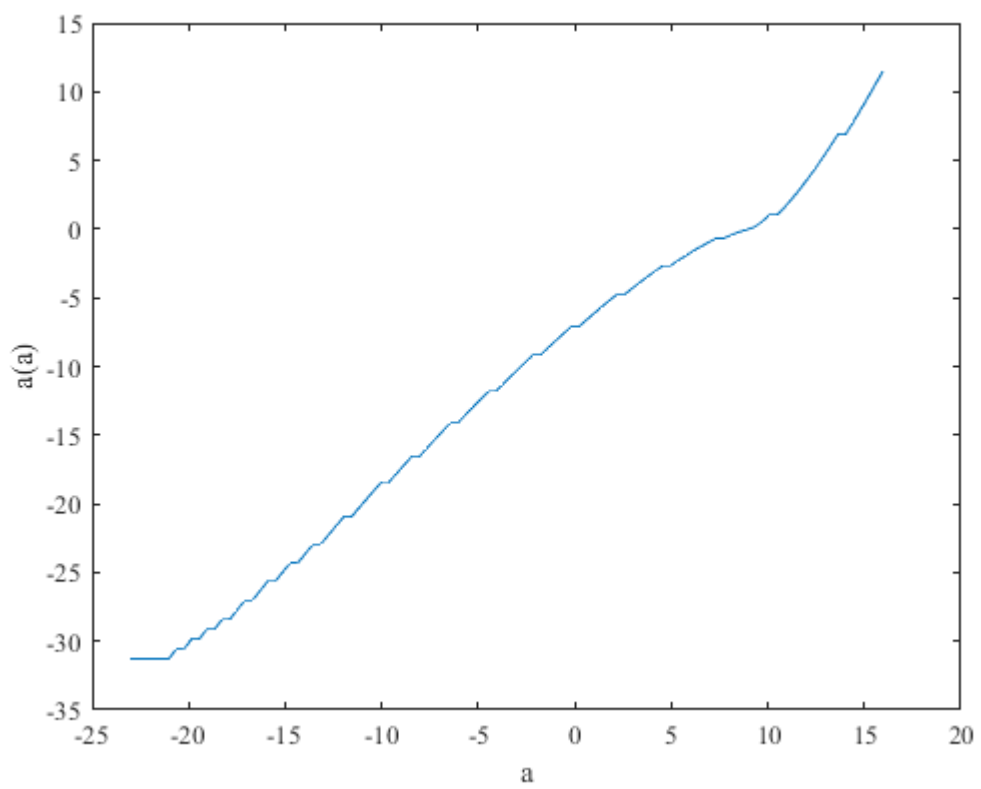


Figure 3: Policy function assets, quadratic utility, certainty, infinitely lived households

## 1.2 Infinitely lived households, with certainty, CRRA utility function

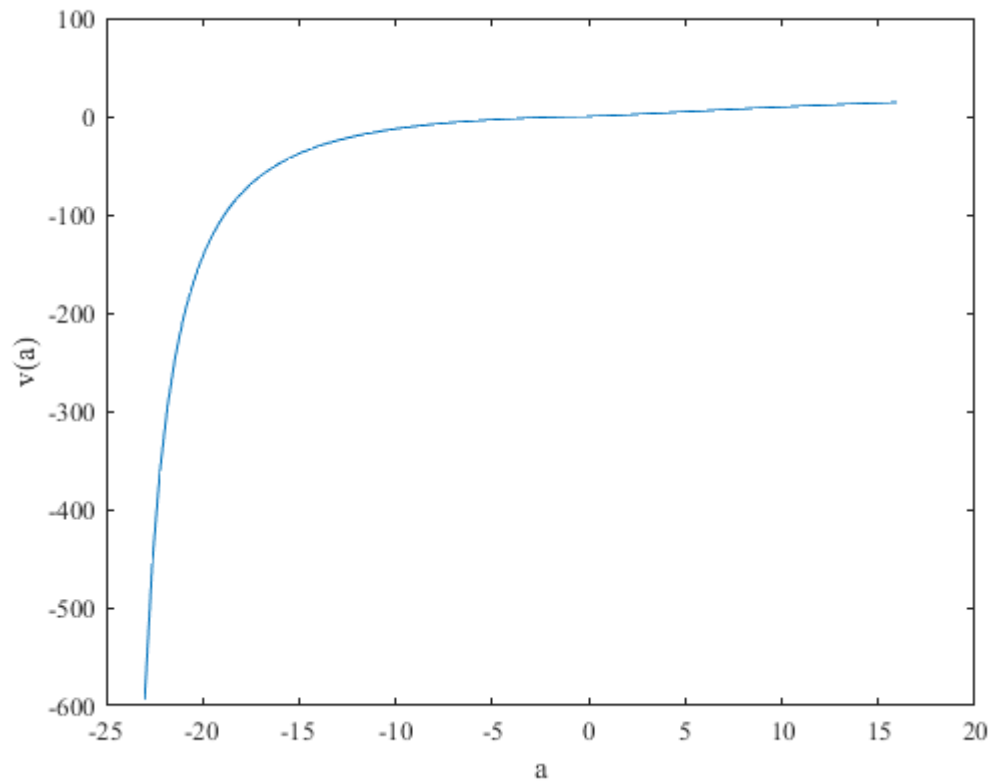


Figure 4: Value function , CRRA, certainty, infinitely lived households

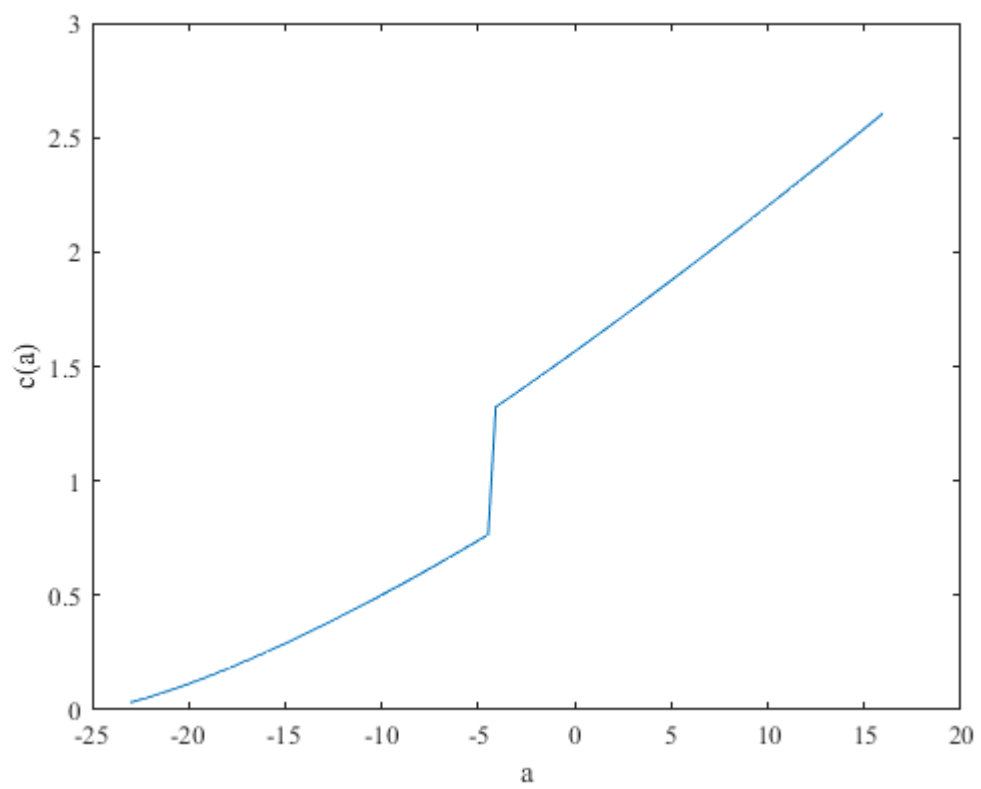


Figure 5: Policy function consumption , CRRA, certainty, infinitely lived households

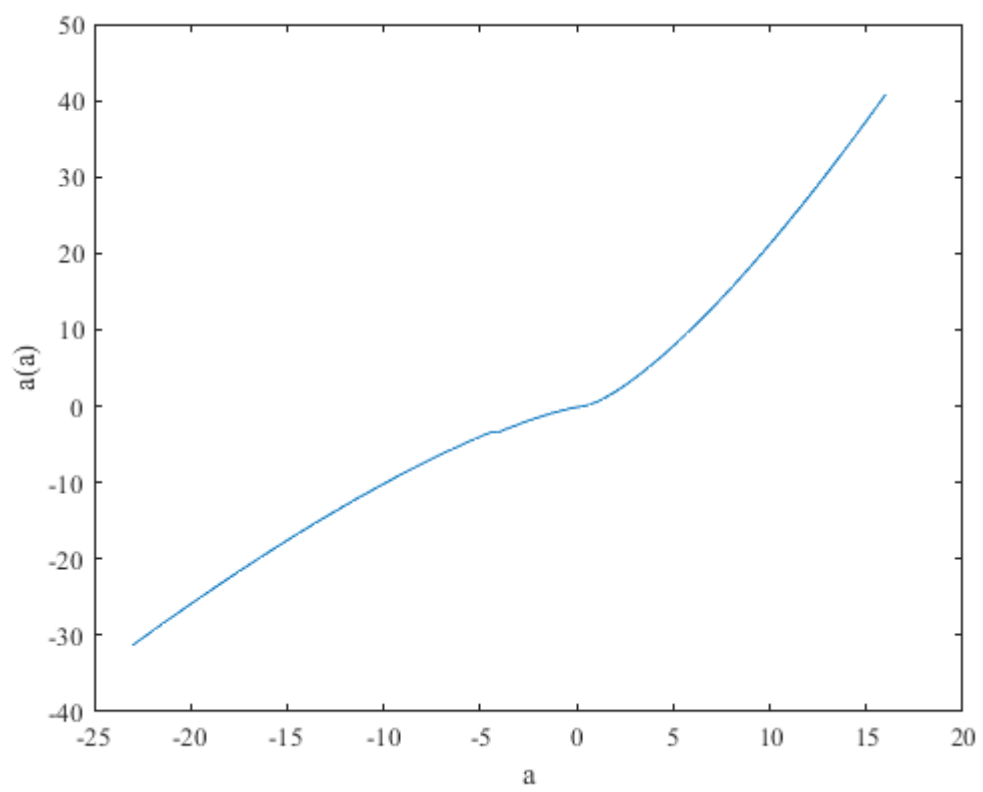


Figure 6: Policy function assets , CRRA, certainty, infinitely lived households

### 1.3 Infinitely lived households, with uncertainty, quadratic utility function

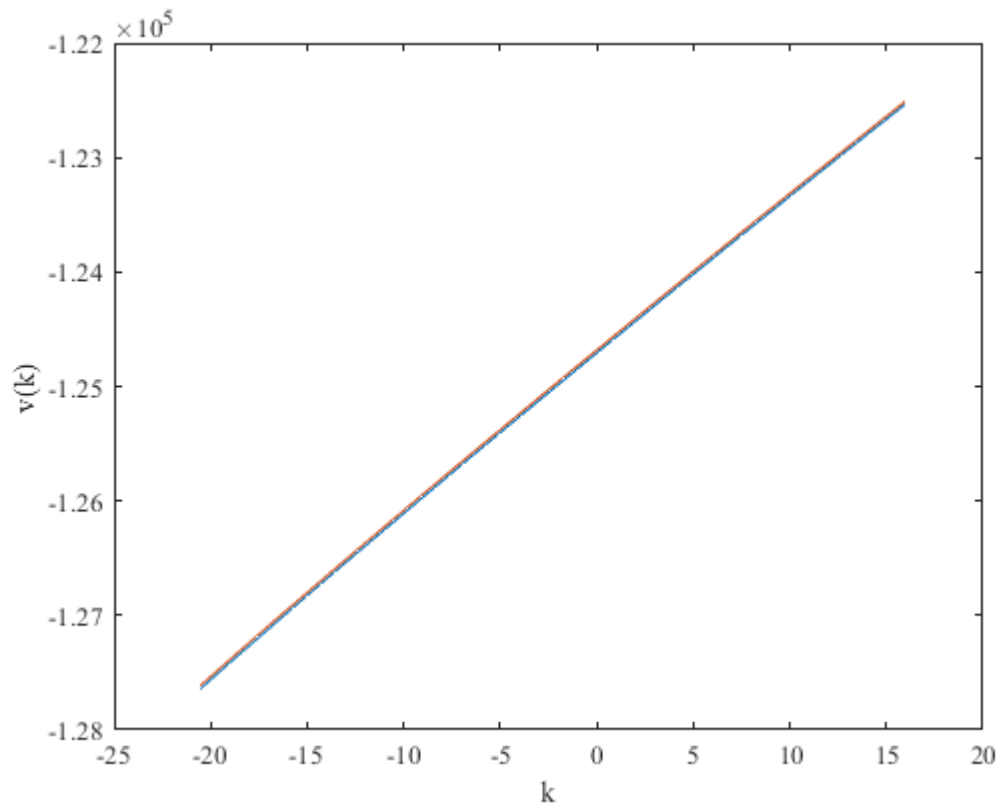


Figure 7: Value function , quadratic, uncertainty, infinitely lived households



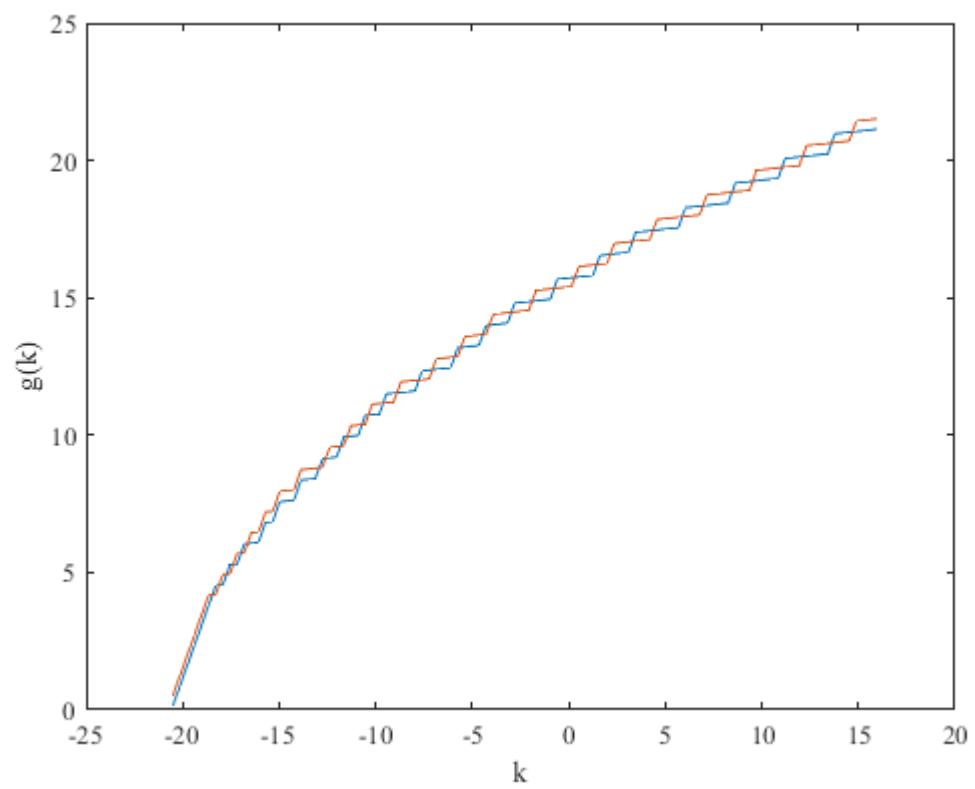


Figure 8: Policy function for consumption , quadratic, uncertainty, infinitely lived households

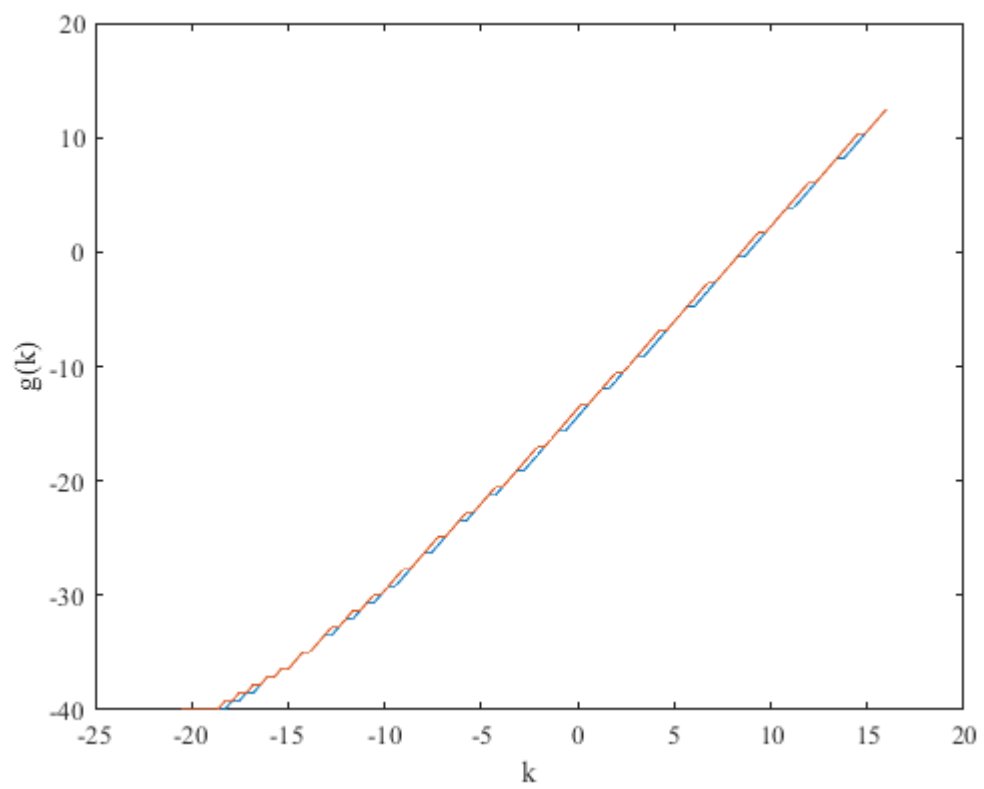


Figure 9: Policy function for capital , quadratic, uncertainty, infinitely lived households

#### 1.4 Infinitely lived households, with uncertainty, CRRA utility function

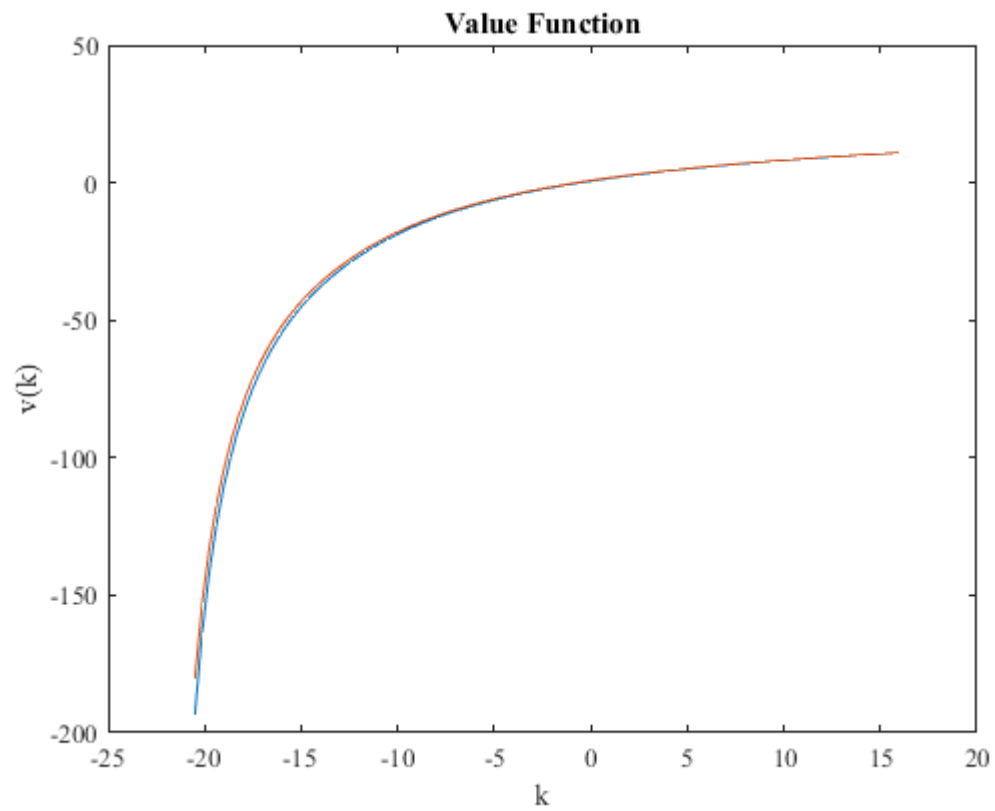


Figure 10: Value function , CRRA, uncertainty, infinitely lived households

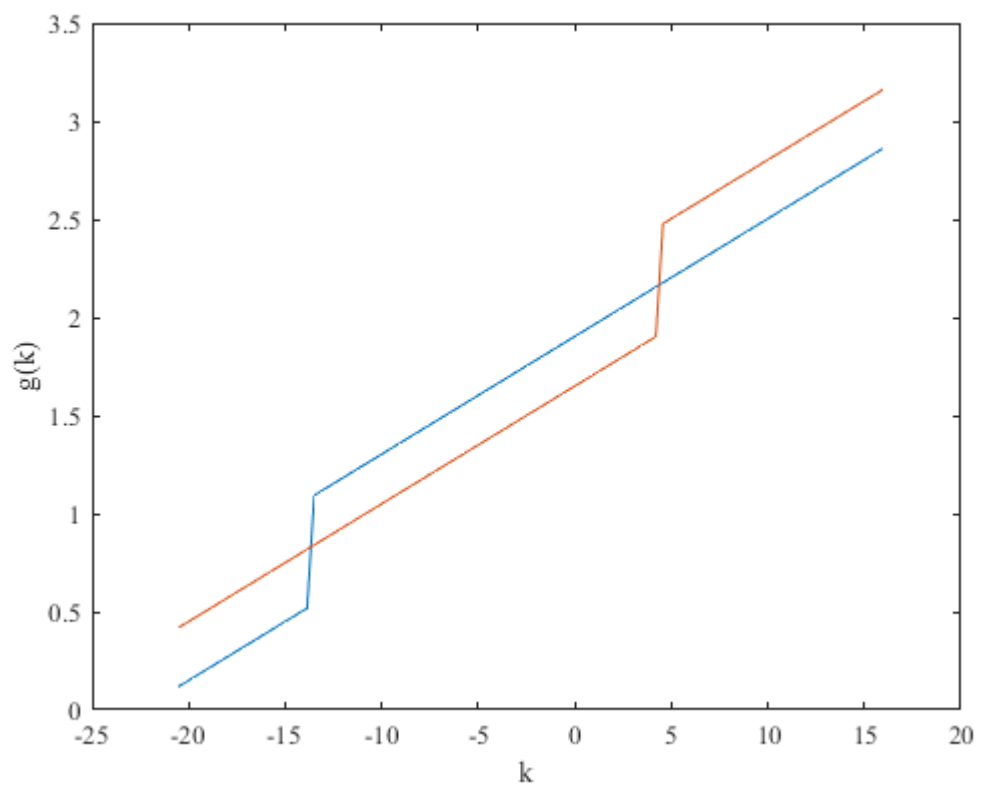


Figure 11: Policy function for consumption , CRRA, uncertainty, infinitely lived households

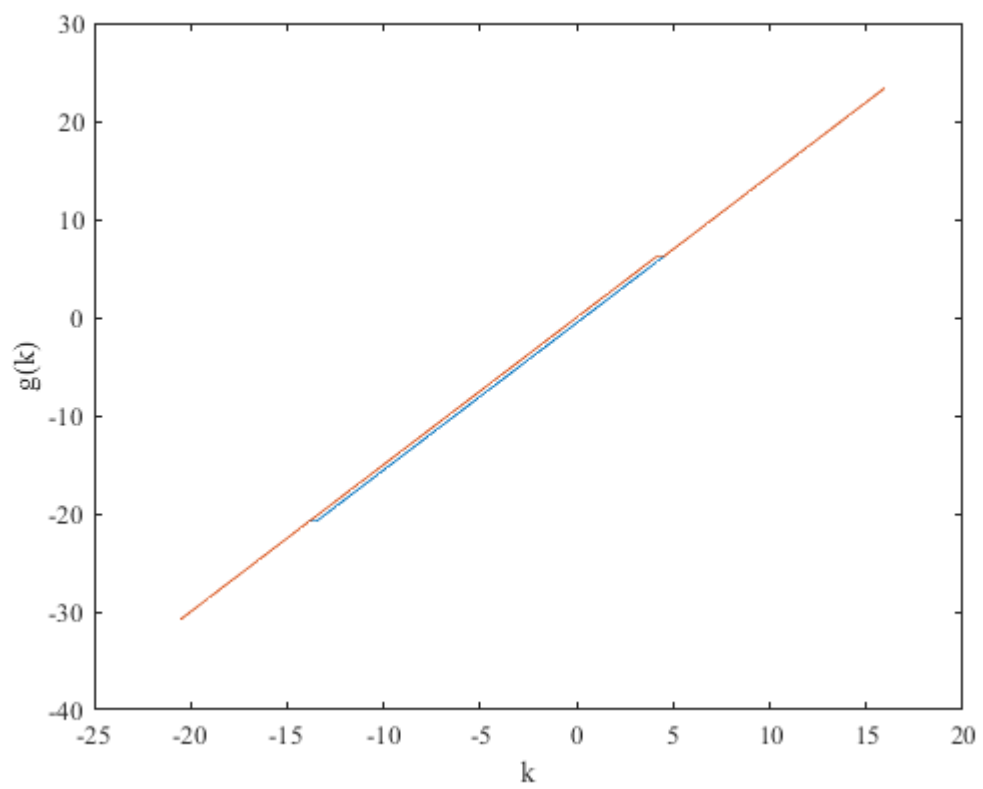


Figure 12: Policy function for capital , CRRA, uncertainty, infinitely lived households

### 1.5 Finitely lived households, with uncertainty, CRRA utility function

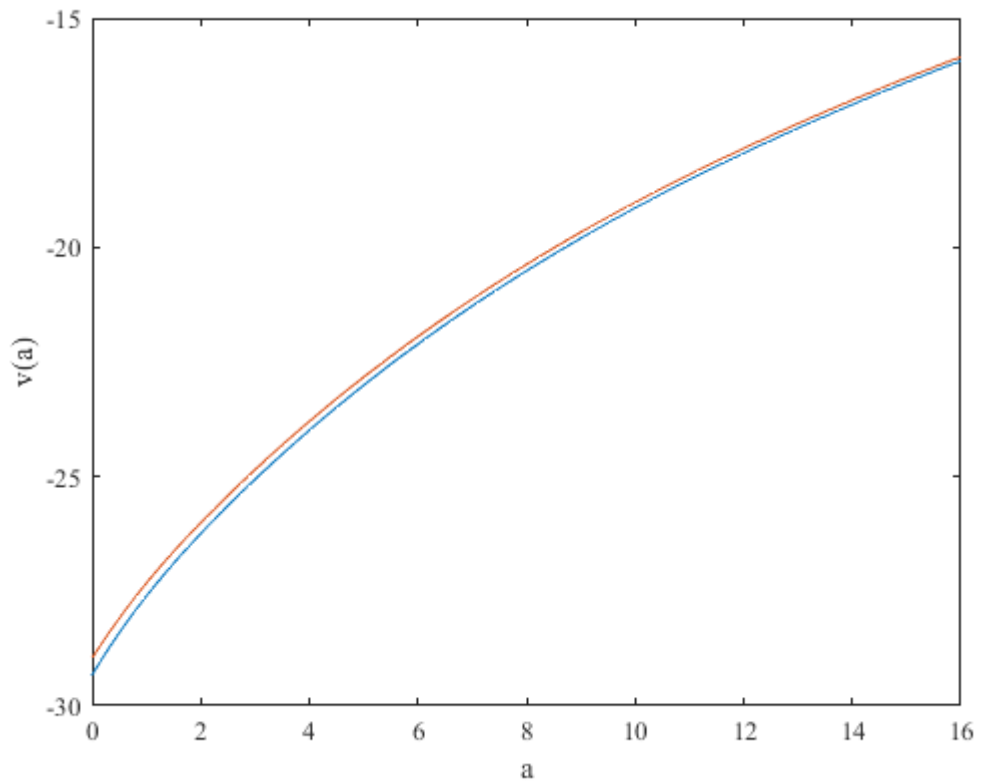


Figure 13: Value function , CRRA, uncertainty, finitely lived households

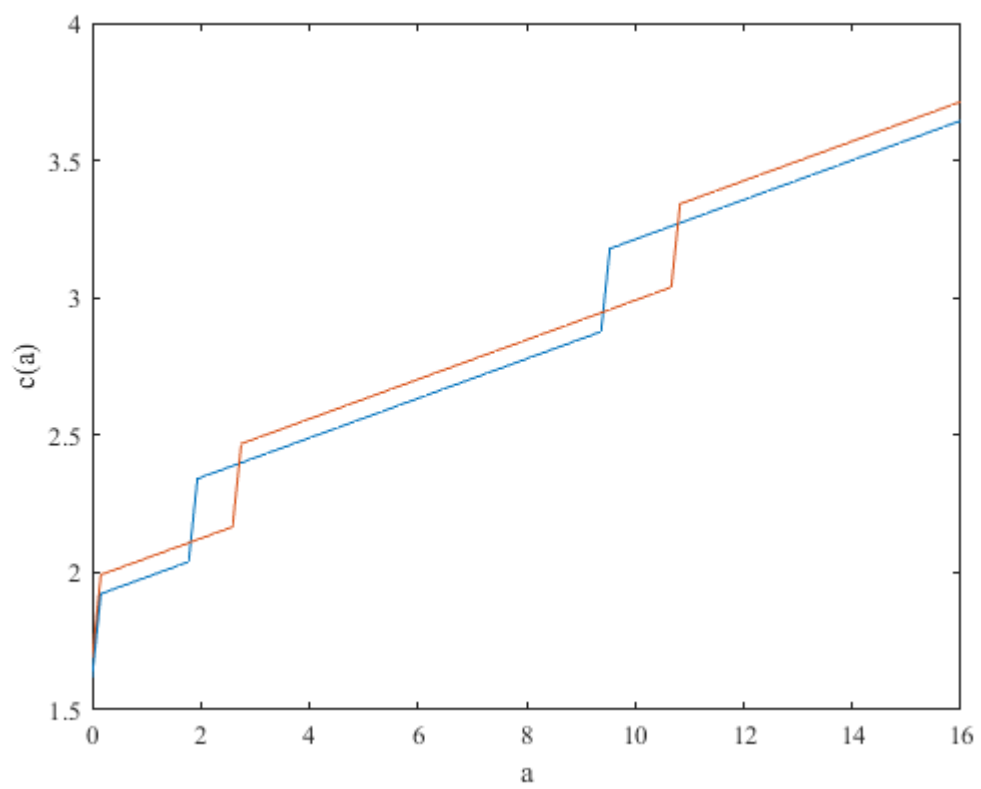


Figure 14: Policy function for consumption , CRRA, uncertainty, finitely lived households

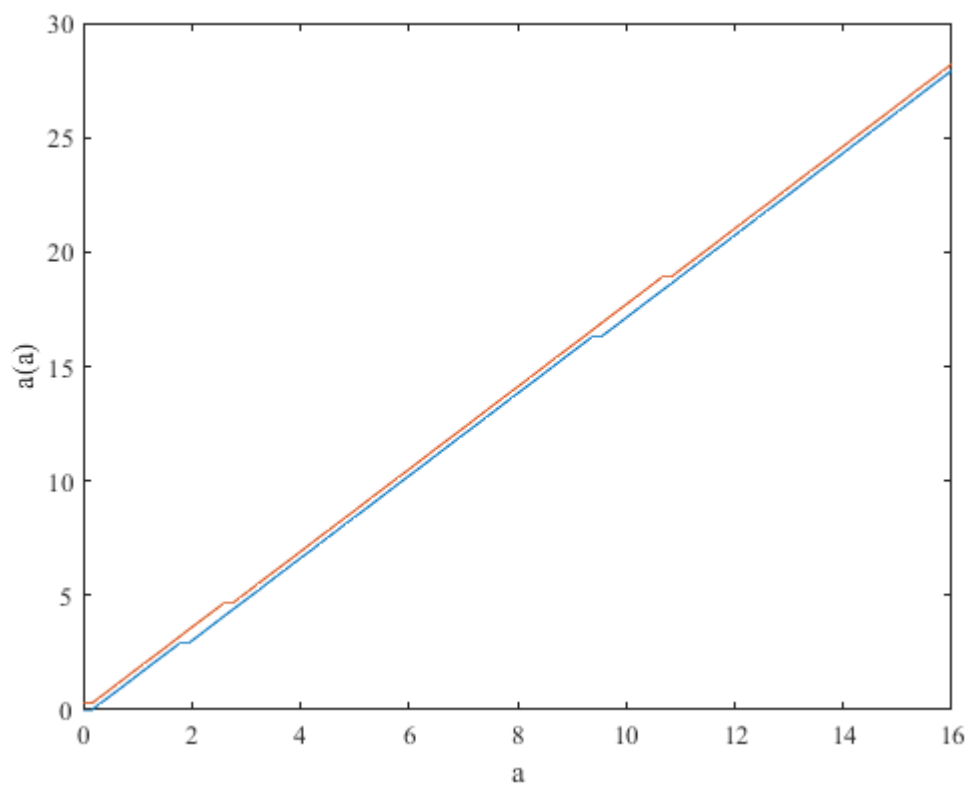


Figure 15: Policy function for capital , CRRA, uncertainty, finitely lived households



### 1.6 Infinitely lived households, with uncertainty, CRRA utility function, Prudence (sigma=5)

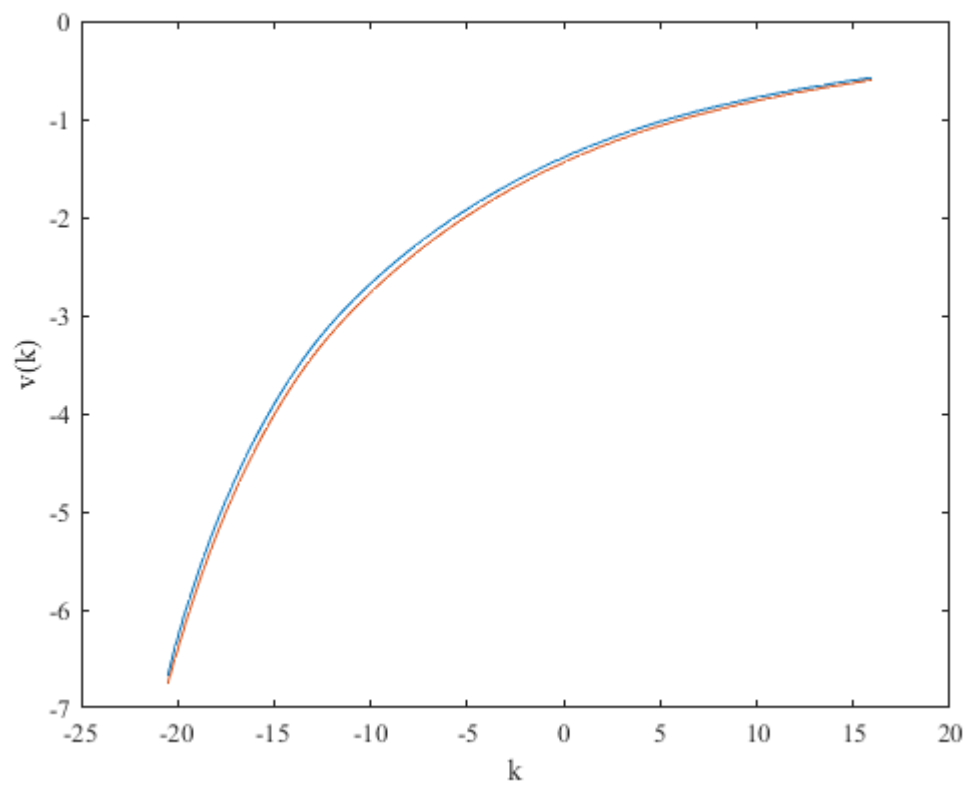


Figure 16: Value function , CRRA, uncertainty, infinitely lived households, prudence

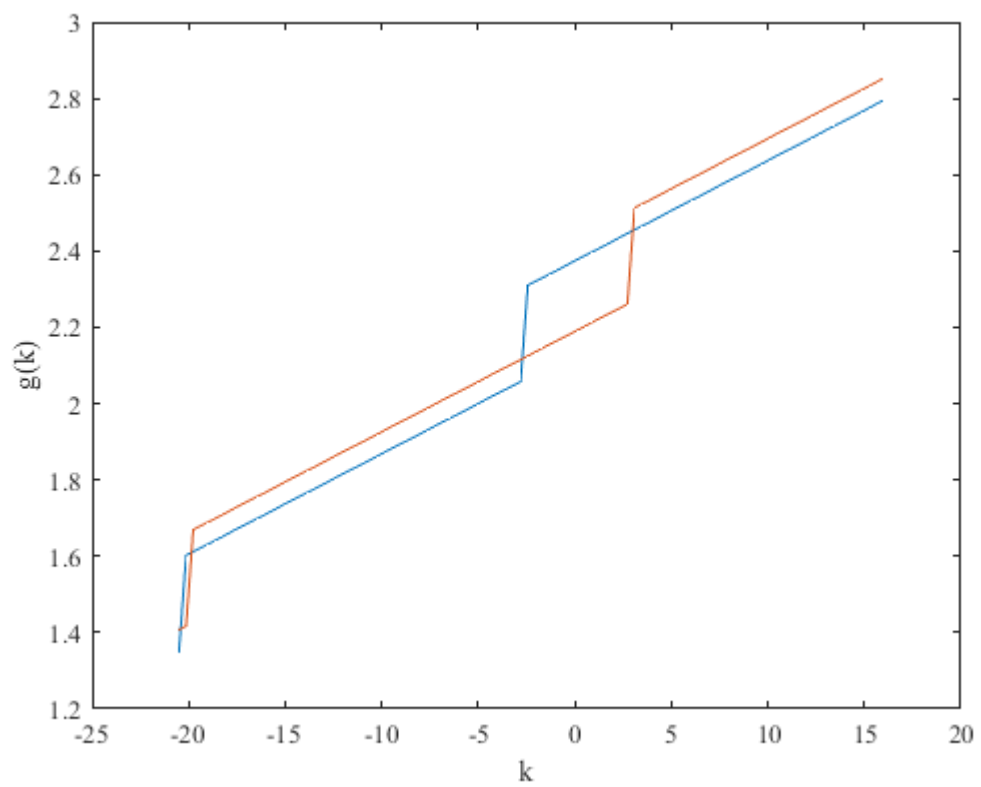


Figure 17: Policy function for consumption , CRRA, uncertainty, infinitely lived households, prudence

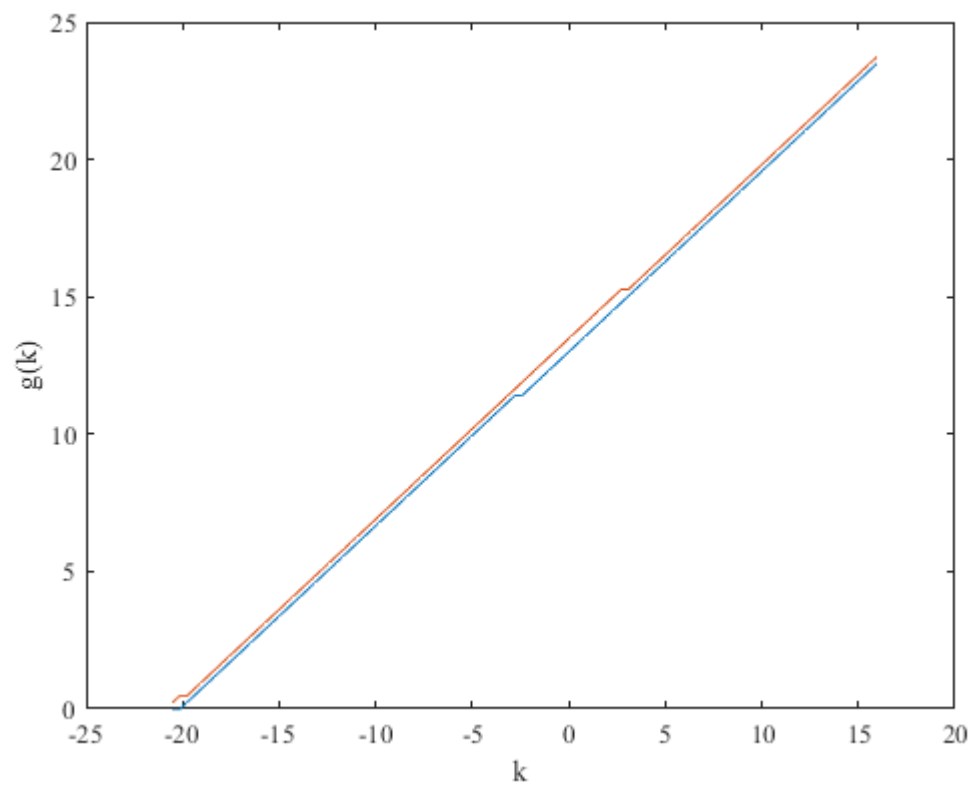


Figure 18: Policy function for capital , CRRA, uncertainty, infinitely lived households,prudence

## 2 General Equilibrium

### 2.1 The simple ABHI model

In this exercise, given a guess for the interest rate I got  $K(r)$  and  $w(r)$  using the FOC. Households have a positive or a negative shock on wage equal to 0.4. Utility function of households is a CRRA with sigma equal 2. Households face borrowing constraints as in the previous exercise.

$$EA(r) = \int a'(a, y) d\Phi_r = 3.4421$$

$$\text{And with } r=0.04, d(r) = K(r) - EA(r) \approx 0$$

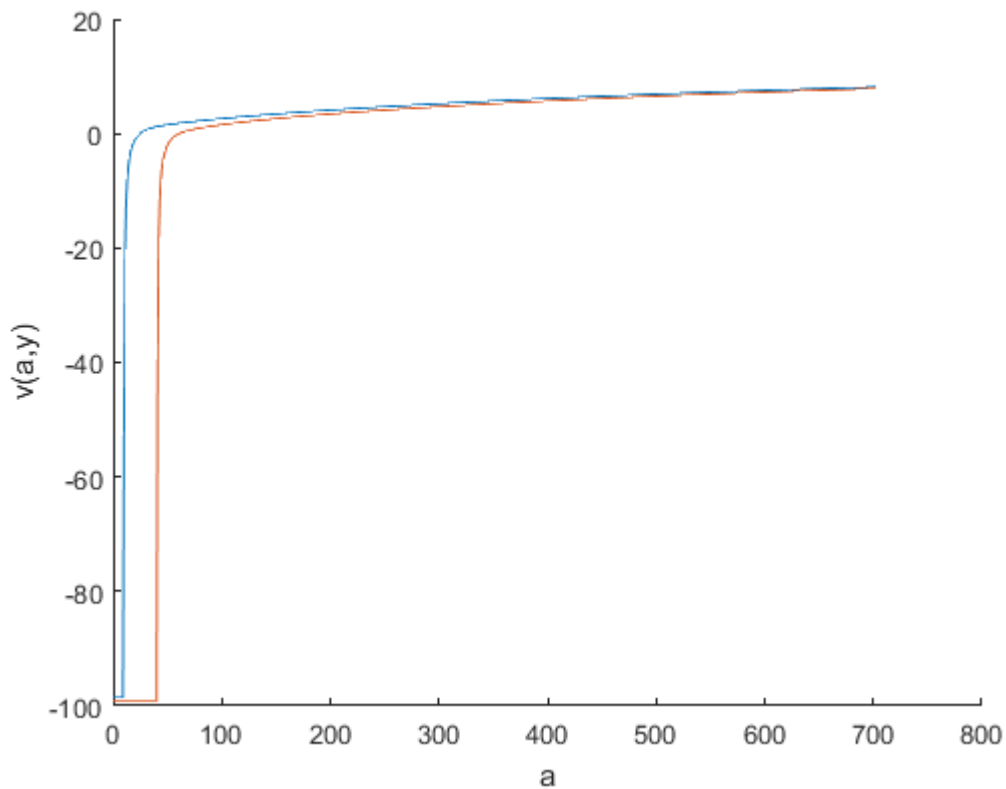


Figure 19: Value function of Households

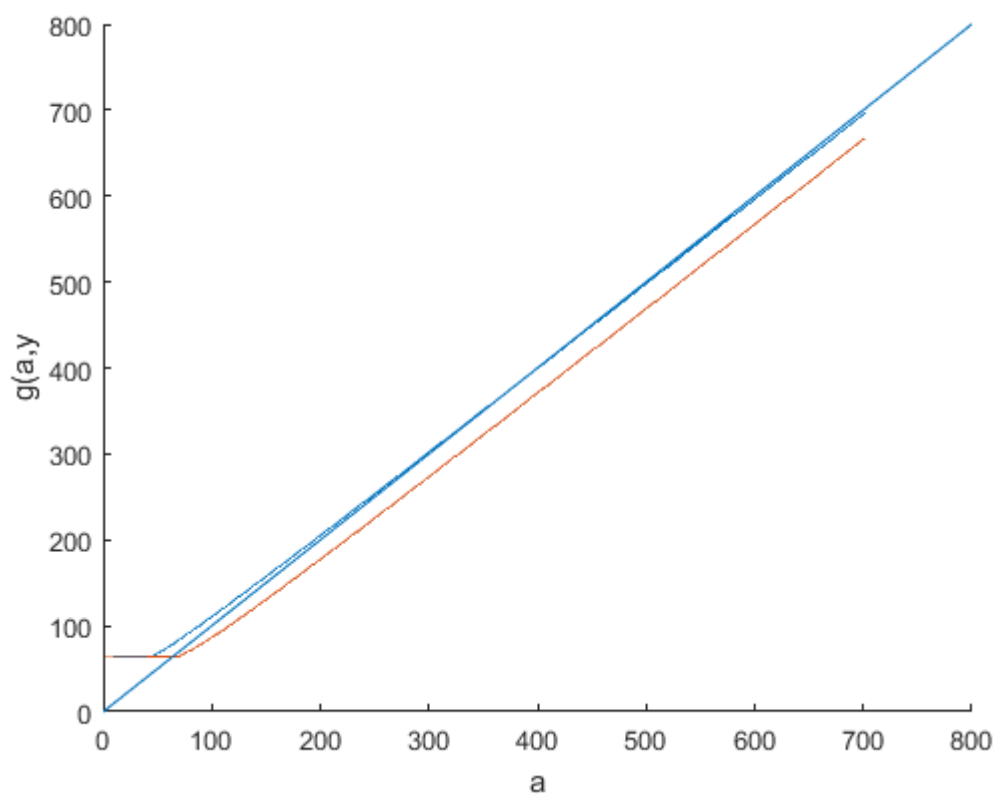


Figure 20: Households decision rules

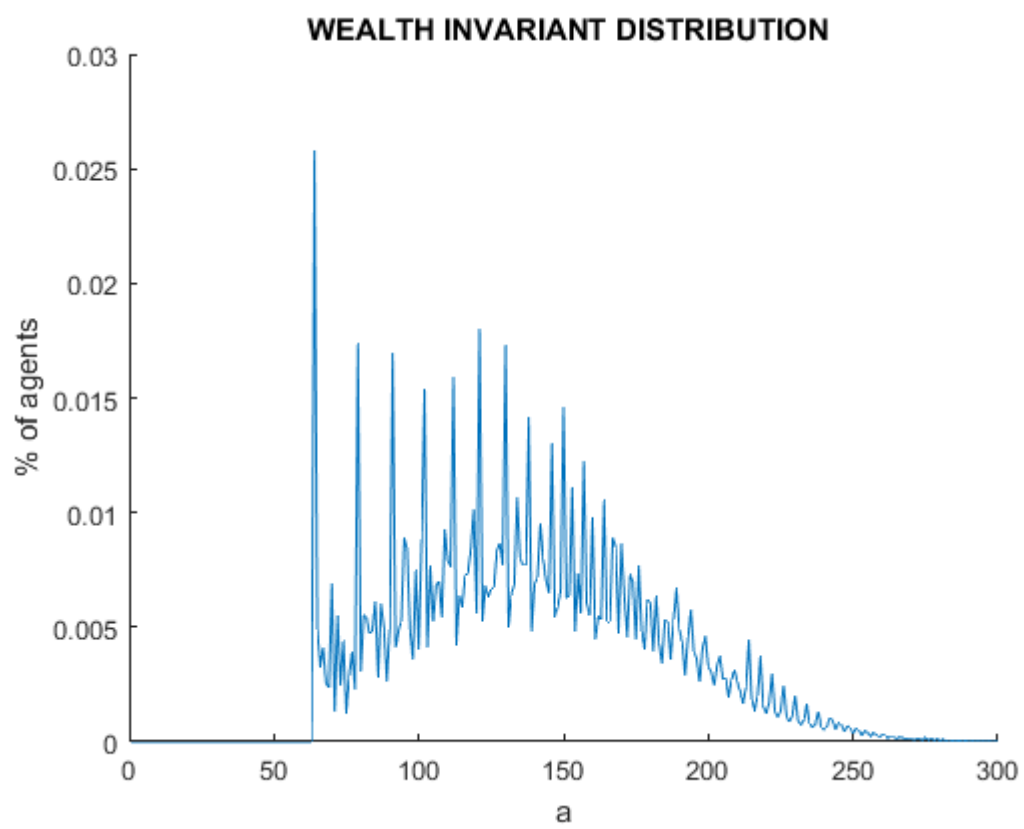


Figure 21: Assets invariant distribution

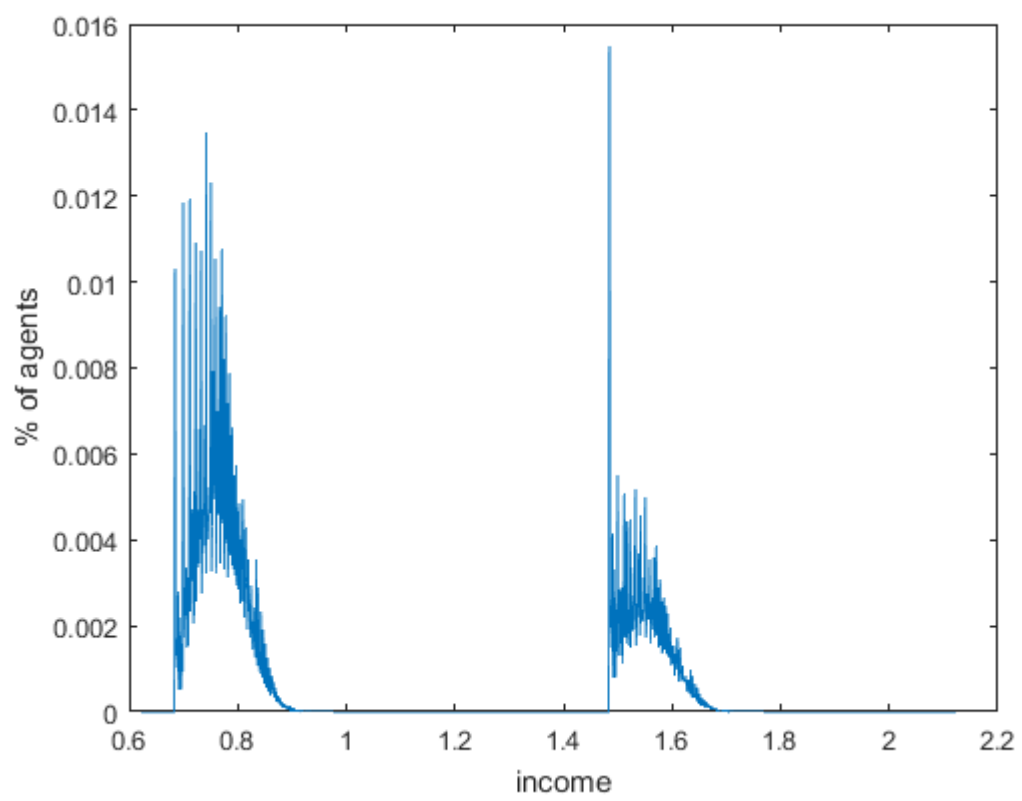


Figure 22: Income invariant distribution