

Problem set 4

Importance of Micro Foundations

1. (25 points). Visit the online Encyclopedia, [Wikipedia](#), and search for “Lucas critique”. After reading this article, **briefly** answer the following questions.
 - a. According to Robert Lucas, can we use models consisting of a system of equations (like the Keynesian model discussed in class) for policy advice?

No.

- b. Why, or why not?

Key parameters of the Keynesian model can change due to changes in phiscal or monetary policy.

- c. Give an example of a parameter on the Keynesian model, which is **not policy-invariant**.

MPC - marginal propensity to consume. For example, following a current tax reduction, consumers might anticipate a future tax hikes, and therefore save more now (i.e. $MPC \downarrow$).

- d. Give an example of a parameter in the classical model, which is **policy invariant**.

Preference parameter α is policy invariant. It represents the weight on consumption in the utility function, and should not be affected by government policies.

- e. According to Robert Lucas, if we do want to predict the effect of a policy experiment, what kind of models should we use? In particular, address the importance of Micro Foundations in these models.

Lucas advocates the use of micro-foundations macro models for policy analysis, because the parameters of these models are **policy invariant**.

Keynesian Model

2. (25 points). Consider the Keynesian model discussed in class. Suppose that the economy is characterized by the following behavioral functions:

Consumption: $C = 75 + 0.75(Y - T)$

Investment: $I = 100$

Government spending: $G = 300$

Taxes: $T = 100 + 0.2Y$

Full employment output: $Y_f = 1200$

- a. Solve for the Keynesian equilibrium in the goods market.

$$\begin{aligned}
 Y &= E \\
 Y &= 75 + 0.75(Y - 100 - 0.2Y) + 100 + 300 \\
 Y &= 75 - 0.75 \cdot 100 + 0.75 \cdot (1 - 0.2)Y + 100 + 300 \\
 Y^* &= \frac{100 + 300}{1 - 0.75 \cdot 0.8} = \frac{400}{0.4} = 1000
 \end{aligned}$$

- b. Suppose that investment falls by \$10. Show how the government can restore the previous equilibrium output using its spending.

$$Y^* = \frac{\overbrace{75 + 0.75(Y - 100 - 0.2Y)}^C + \overbrace{100 - 10}^I + \overbrace{300 + 10}^G}{1 - 0.75 \cdot 0.8}$$

The government needs to increase its spending by 10.

- c. Suppose instead that the investment falls by \$10, but the government wants to restore the previous equilibrium using taxes. Find the required change in the autonomous tax that would restore the equilibrium output to its initial level.

The general solution is

$$Y^* = \frac{C_0 - MPC \cdot T_0 + I_0 + G_0}{1 - MPC(1 - t)}$$

Thus, if we want to keep Y^* at its original level, we must change the autonomous tax T_0 such that

$$\begin{aligned}
 -MPC \cdot \Delta T_0 + \Delta I_0 &= 0 \\
 \Rightarrow \Delta T_0 &= \frac{\Delta I_0}{MPC} = \frac{-10}{0.75} = -13\frac{1}{3}
 \end{aligned}$$

In other words, the autonomous tax needs to decline by $13\frac{1}{3}$.

- d. Suppose instead that the investment falls by \$10, but the government wants to restore the previous equilibrium using taxes. Find the required

change in the proportional tax rate that would restore the equilibrium output to its initial level.

Now the only unknown is t , the proportional tax rate.

$$Y^* = \frac{C_0 - MPC \cdot T_0 + I_0 + G_0}{1 - MPC(1 - t)}$$

$$1000 = \frac{100 - 0.75 \cdot 100 + \overbrace{100 - 10}^I + 300}{1 - 0.75(1 - t)}$$

$$1000 = \frac{390}{1 - 0.75 + 0.75t}$$

$$0.25 + 0.75t = \frac{390}{1000}$$

$$t = \frac{\left(\frac{390}{1000} - 0.25\right)}{0.75} = 0.18666\dots$$

- e. Based on the Keynesian model, answer the three basic questions that we asked in the introduction to the topic of business cycles: (1) what causes business cycles? (2) Can the government smooth them? (3) Should it?

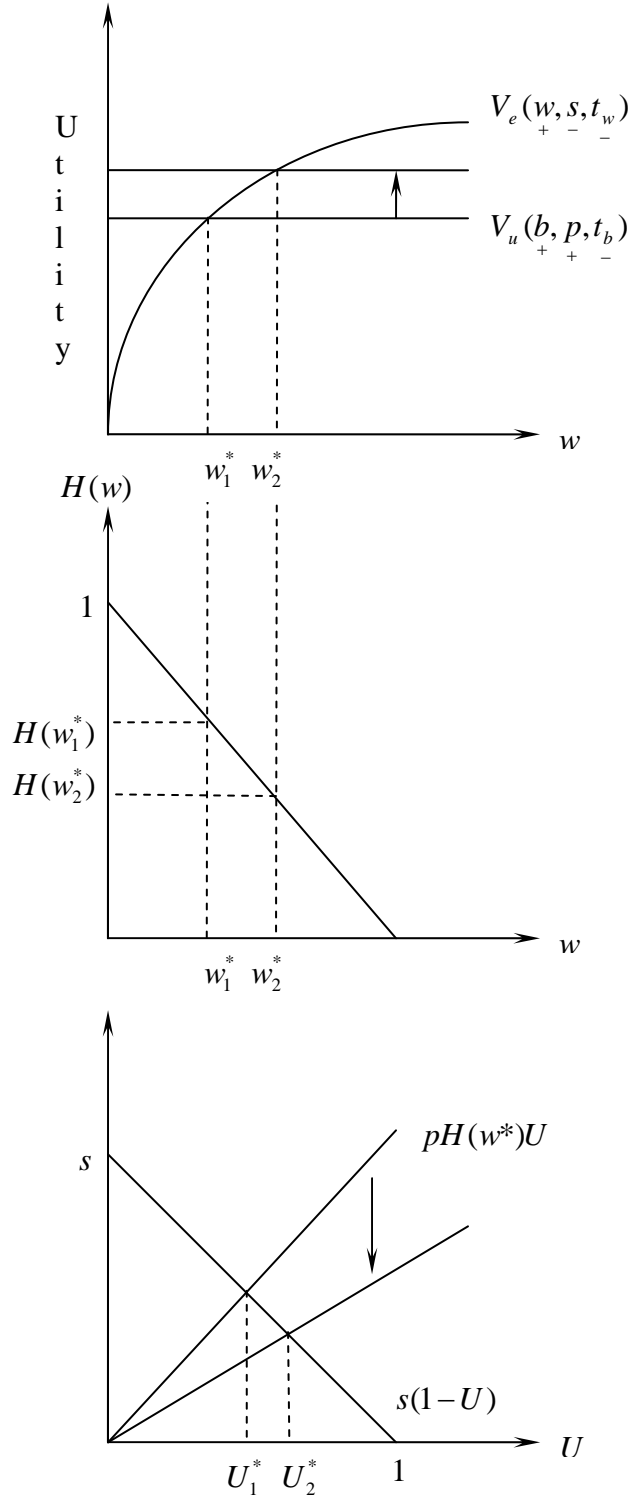
(1) What causes business cycles? Shocks to investment (animal spirit of investors).

(2) Can the government smooth them? Yes, if $Y^* < Y_f$.

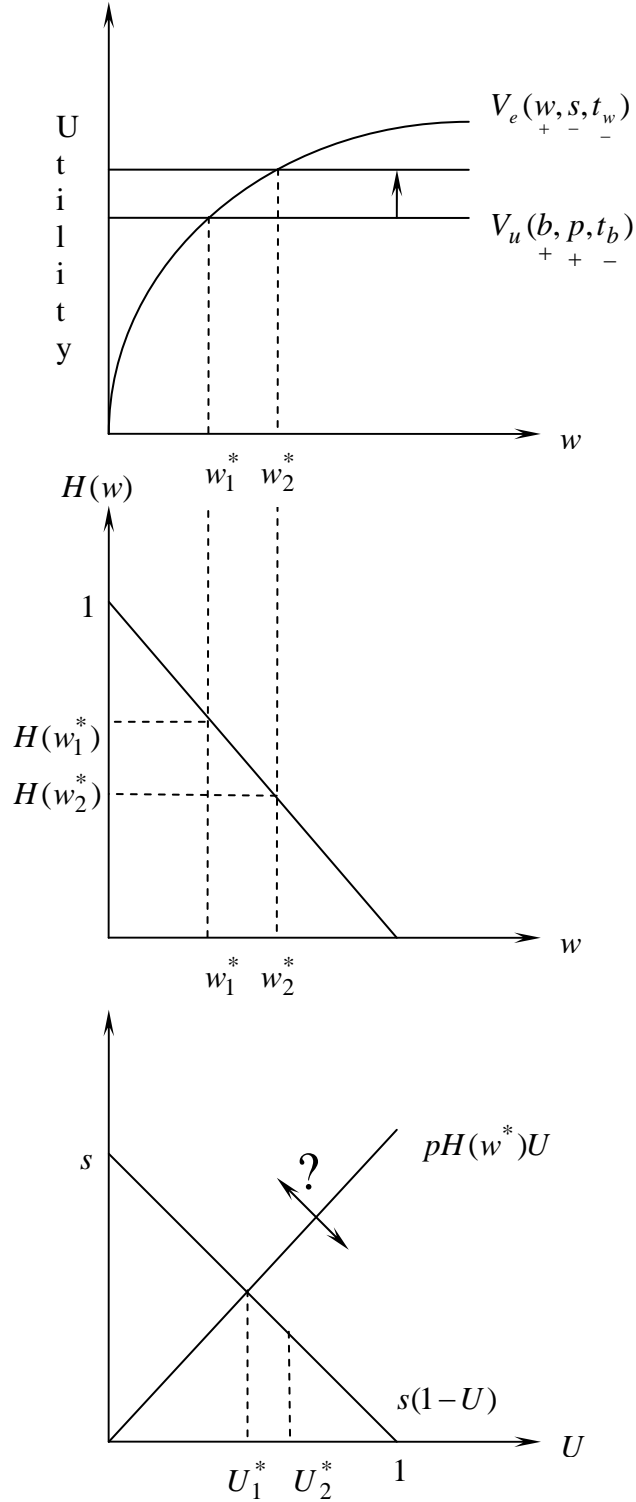
(3) Should it? Yes, if $Y^* < Y_f$.

Search Model of Unemployment

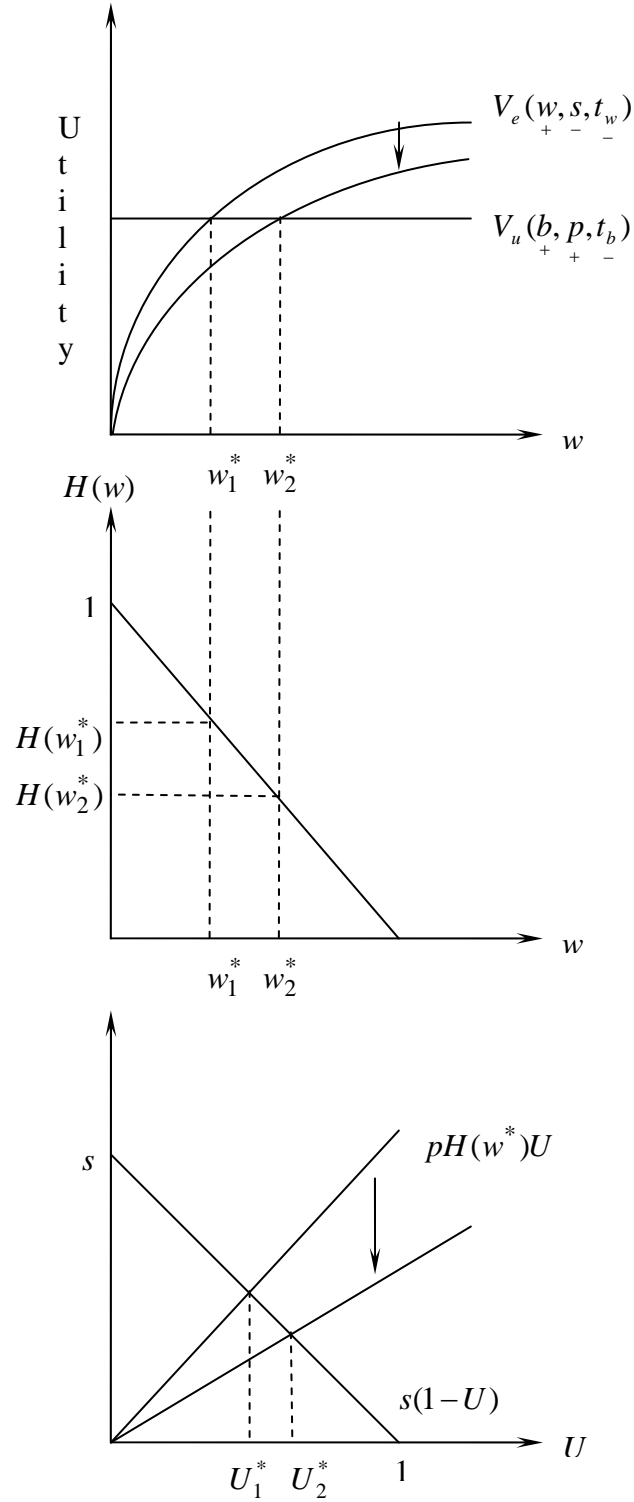
3. (10 points). Consider the search model of unemployment studies in class. Illustrate with 3 fully labeled graph the impact of an increase in unemployment insurance benefits ($b \uparrow$) on: (1) reservation wage w^* , (2) probability of acceptance of job offers $H(w^*)$, and (3) steady-state unemployment rate U^* .



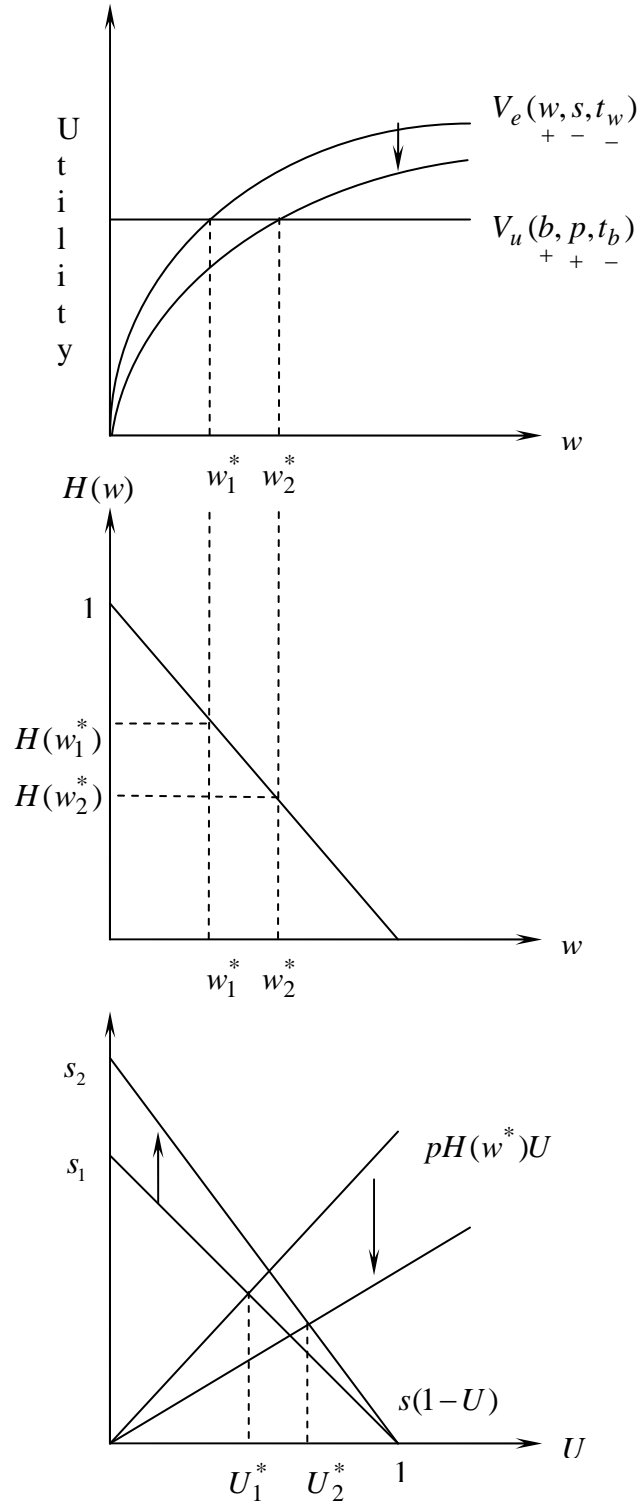
4. (10 points). Consider the search model of unemployment studies in class. Illustrate with 3 fully labeled graph the impact of an increase in probability of getting a job offer ($p \uparrow$) on: (1) reservation wage w^* , (2) probability of acceptance of job offers $H(w^*)$, and (3) steady-state unemployment rate U^* .



5. (10 points). Consider the search model of unemployment studies in class. Illustrate with 3 fully labeled graph the impact of an increase labor income tax ($t_w \uparrow$) on: (1) reservation wage w^* , (2) probability of acceptance of job offers $H(w^*)$, and (3) steady-state unemployment rate U^* .



6. (10 points). Consider the search model of unemployment studies in class. Illustrate with 3 fully labeled graph the impact of an increase in separation rate ($s \uparrow$) on: (1) reservation wage w^* , (2) probability of acceptance of job offers $H(w^*)$, and (3) steady-state unemployment rate U^* .



7. (20 points). **Bonus question.** Using the mortgage calculator from the following page <http://bss.sfsu.edu/mbar/ESA.htm>, answer the following questions.

- a. Suppose you take a mortgage of \$700,000 for 30 years (360 monthly payments) at 5% annual interest rate. What is the sum of all the interest payments on this mortgage?

$$\$652,790.49$$

- b. Suppose that the above interest payments are tax deductible, and you are in the 35% income tax bracket. What is the total amount of tax deductions that you get as a subsidy of your mortgage?

$$Sub = 35\% \cdot 652,790.49 = \$228,476.67$$

- c. Suppose that you took the same mortgage, but your income tax bracket is only 25%. What is the total tax subsidy you get on the mortgage?

$$Sub = 25\% \cdot 652,790.49 = \$163,197.62$$

- d. Suppose that the above mortgage has adjustable rate, so that for the first two years the interest rate is only 1%, and it jumps to 8% after that. Calculate the monthly payment during the first two years and the monthly payment after that.

First two years: **\$2,251.48**

After the first two years: **\$4,925.46**