

Jones, Macroeconomics, problems 7.1, 7.2, 7.4-7.8, 7.9, 7.10.

## 1 Basics

1. What are the definitions of labor force, unemployment, unemployment rate?
2. Why is it hard to measure unemployment? Why might unemployment be overstated or understated in the data?

## 2 Walrasian Model

1. What shifts labor supply / labor demand?
2. For the production function  $Y = K^\alpha + L^{1-\alpha}$ , derive the labor demand curve. What is the effect of higher  $K$  on labor demand? Why does it differ from the Cobb-Douglas case  $Y = K^\alpha L^{1-\alpha}$ ?
3. Analyze the effects of shocks on employment and wages:  $A \uparrow$ ,  $K \uparrow$ , wage taxes, expected increase in future productivity.
4. Analyze the effects of a minimum wage. Explain why it is inefficient. Note the general point: it is a bad idea to redistribute income by distorting prices.
5. What is the effect of a stock market rally on equilibrium wages and employment? Assume that stock prices rise without any changes in fundamentals (current or future firm profits or dividends).
6. What is wrong with the following statement: Higher productivity reduces employment because fewer workers are needed to produce the same amount of output.
7. Most economies experience persistent growth in  $A$ , which increases labor demand. Why do we not observe that employment rises over time in those countries?

### 2.1 Answer: Walrasian Model

1. Labor demand is MPL. It is shifted mainly by productivity and capital.
2.  $MPL = (1 - \alpha)L^{-\alpha}$ . No effect of  $K$ .  $K$  does not affect MPL.

- Higher  $A$ : higher labor demand; ambiguous labor supply. Higher  $K$  works the same as higher  $A$ .

Wage taxes: lower labor demand; no clear effect on supply (could argue that income effect raises labor supply).

Expected productivity increase: No effect on demand. Labor supply declines (income and substitution effects).

- The minimum wage excludes the set of persons whose MPL is above the market clearing wage but below the minimum wage from employment. The wage rises, which benefits those who are employed at the expense of those who are not.

It is inefficient because for the marginal worker the opportunity cost of work is below the MPL. If one could tax profits and redistribute the proceeds to the workers, it would be possible to make everyone better off by eliminating the minimum wage.

- Labor supply declines (an income effect).
- The lump of labor fallacy. Employment is limited by the willingness of the marginal worker to work at a wage that equals MPL. It is not limited by lack of demand for labor.
- Income effects reduce labor demand.

### 3 Life-cycle model

[This requires some math.] To really understand labor supply, we should solve the problem of a working household. The household lives for  $T$  periods and chooses how much to consume and how much to work in each period. The objective is to maximize lifetime utility

$$\sum_{t=1}^T \beta^t [u(c_t) + v(l_t)]$$

where  $c$  is consumption,  $l$  is leisure,  $1 - l$  is hours worked, and  $\beta$  is a discount factor which determines how much the household likes current vs. future consumption. The budget constraint equates the present value of consumption with the present value of earnings. Earnings in each period are the product of a wage  $w_t$  and hours worked  $1 - l_t$ :

$$\sum_{t=1}^T \frac{c_t}{(1+r)^t} = \sum_{t=1}^T \frac{w_t(1-l_t)}{(1+r)^t}$$

Now we can proceed in two ways:

- Assume  $T = 2$ , so that the budget constraint becomes

$$c_1 + \frac{c_2}{1+r} = w_1(1-l_1) + \frac{w_2(1-l_2)}{1+r} \tag{1}$$

Next, substitute this into the budget constraint to have

$$\max u \left( w_1(1 - l_1) + \frac{w_2(1 - l_2)}{1 + r} - \frac{c_2}{1 + r} \right) + v(l_1) + \beta [u(c_2) + v(l_2)] \quad (2)$$

2. We can be more ambitious and keep  $T > 2$ . Then we need a Lagrangian:

$$L = \sum_{t=1}^T \beta^t [u(c_t) + v(l_t)] + \quad (3)$$

$$+ \lambda \left[ \sum_{t=1}^T \frac{w_t(1 - l_t)}{(1 + r)^t} - \sum_{t=1}^T \frac{c_t}{(1 + r)^t} \right] \quad (4)$$

In either case we take first-order conditions with respect to  $c_t$  and  $l_t$  to derive the optimal choices. We obtain:

$$\beta^t u'(c_t) = \frac{\lambda}{(1 + r)^t} \quad (5)$$

and

$$\beta^t v'(l_t) = \frac{\lambda w_t}{(1 + r)^t} \quad (6)$$

What then shifts labor supply?

1.  $\lambda$ : This is not obvious, but  $\lambda$  declines when the household gets richer (in a lifetime income sense), for example when wages increase. Lower  $\lambda$  increases consumption and leisure at all ages. This is because  $u'(c)$  and  $v'(l)$  are both decreasing. This is an income effect. When the household gets richer while all prices remain unchanged, he wants to consume more of all goods, including leisure at all dates.
2.  $w_t$ : Higher wages have a direct effect:  $l_t$  declines and hours worked at date  $t$ . The indirect effect is that lifetime income rises ( $\lambda$  falls) so that the household works less at all other dates. Hence, high expected wages in the future reduce labor supply today.
3.  $r_t$ : This is a bit complicated because higher interest rates have both income and substitution effects. Suppose I raise  $r_t$  and hold income ( $\lambda$ ) constant. Then leisure rises, especially later in life. This mirrors what happens to consumption. When  $r$  rises, the household is rewarded for postponing consumption and leisure. So the age profiles of consumption and leisure become steeper.

## 4 Unemployment

1. Explain main reasons why there may be involuntary unemployment: efficiency wages, contracts, search/matching, centralized wage bargaining.
2. Could unemployment be a useful outcome?
3. In a search / matching environment: how do firing costs and unemployment benefits affect the unemployment rate?

## 4.1 Answers: Unemployment

1. See slides.
2. It can be. In search models, the unemployed look for better job matches.
3. Firing cost: fewer vacancies, but also fewer layoffs. Unemployment benefits: less search effort and fewer accepted job matches.

## 5 Europe vs. the U.S.

1. How could downwardly rigid wages explain the European unemployment experience?
2. Explain how higher taxes could account for the fact that Europeans work fewer hours than Americans.