MIT 14.41 – Problem Set 4

Due November 4, 2022
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QUESTION 1: Social Security [36 points]

Tegan makes decisions about two periods in her life: In her working period, she earns a wage w and can save an amount s at interest rate r (with $s \geq 0$). In her retirement period, she doesn't earn anything but consumes her savings (plus interest), and she cares some fraction $\delta \in [0, 1]$ about her retirement period consumption relative to her working period consumption. She knows that she won't have children and doesn't want to leave any money behind. So, she chooses c_w, an amount to consume during her working period, and c_r, an amount to consume during her retirement period, to maximize her lifetime utility:

$$U = ln(c_w) + \delta ln(c_r)$$

subject to the constraints that:

$$w = c_w + s$$

$$c_r = s(1 + r)$$

1. (5 points) How much does Tegan optimally save? What is Tegan's optimal consumption in each period?
2. (3 points) Why might the government be concerned that Tegan isn't saving enough?
3. For the reason(s) you described above, the government decides to help Tegan save for retirement. They require her to put some amount b in a retirement account during her working period, and they return back $b(1 + r)$ during her retirement period. She can still choose to put some amount s into a personal savings account, which still returns $s(1 + r)$ in the retirement period.
   (a) (2 points) Write down the problem that Tegan will solve now
   (b) (5 points) How does this government policy affect Tegan's chosen consumption and **private** savings levels, relative to the case without government intervention? What about her **total** savings? Why?
   (c) (2 points) What is this type of social security called, and why is it a good idea for countries just setting up a social security system?
4. Now, assume that there are 2 otherwise identical people alive at any time, except one is in their working period and the other is in their retirement period. Instead of forcing individuals to save for the own retirement, the government has instituted the following: in their working years, an individual faces a social security tax at rate x, the proceeds of which is paid out to the individual currently in their retirement years. When that person retires, they receive the social security tax proceeds collected from the subsequent generation. Assume that wages are growing at the same rate as savings, so the workers who work when Tegan is retired are earning $w(1 + r)$, and Tegan knows this will be true when she makes her initial consumption and savings decisions.
   (a) (2 points) Write down the problem that Tegan will solve now

(b) (4 points) Is this policy economically different from the previous part? Why? What is the effect of this policy on Tegan's savings and consumption rates?

(c) (5 points) Now imagine that wage growth was slower than the rate of returns on financial investments (though both are strictly greater than 0). In particular, wages are growing at a rate $\tilde{r} < r$. How would this affect Tegan's saving levels and consumption levels, relative to part (b)?

Now let's consider another decision affected by social security – the decision to retire. Sara lives in the Netherlands, and is deciding when to retire. Each year, she can earn a wage w if she works, of which she pays t in social security taxes, or, if she retires, she can receive αw in social security benefits for each year going forward. In year 0, she chooses whether or not to retire by maximizing her remaining lifetime income for the next N years:

$$U = \sum_{t=0}^{N} \delta^t ln(c_t)$$

5. (1 point) What is α called?

6. Write down an expression for Sara's lifetime utility if she retires in...

   (a) (1 point) ... year 0?

   (b) (1 point) ... year 1?

   (c) (1 point) ... year 2?

7. (4 points) Sara is deciding whether to retire in year 0. What inequality should she solve to make this decision? Solve this inequality for an expression in terms of α,w, t, and/or δ, and explain the intuition behind the condition you get.

QUESTION 2: Unemployment Insurance [36 points]

This question will ask you to think about issues in the design of unemployment insurance. To do this, we'll assume a model with two time periods and people who can be employed or unemployed. Employed people earn a wage of $w > 0$, and unemployed people receive an unemployment insurance payment of $b \geq 0$ from the government.

In the first period, a fraction $e_1 \in [0,1]$ of people are employed and $1 - e_1$ are unemployed. In the second period, employed workers lose their jobs with probability π, which is fixed. Unemployed workers find a new job with probability

$$p = \bar{p} + \gamma x$$

where $\bar{p} \in [0,1]$ and γ are constants. The workers can choose $x \in \left[0, \frac{1-\bar{p}}{\gamma}\right]$ by choosing how much effort they put into finding a job, but to do this they must pay a utility cost of x^2.

Workers have access to a consumption good c with price 1. Assume they cannot borrow or save, so in each period they spend all their income for that period – either their wage w or their benefit b – on c (this means we are assuming there is no self-insurance). Their utility from consuming c in a period is $u(c)$, where u is an increasing and concave function: $u'(c) > 0, u''(c) < 0$ for all c. Assume that workers do not discount the future. Then they care about their utility today as well as their expected utility in the next period. They will make choices to maximise the following function:

$$EU_u = u(b) + (\bar{p} + \gamma x)\, u(w) + (1 - (\bar{p} + \gamma x))\, u(b) - x^2$$

Throughout this question, you should assume that workers want to choose an interior solution for x (that is, their optimal choice of x satisfies $0 < x < \frac{1-\bar{p}}{\gamma}$)

1. (3 points) Derive an expression for an unemployed worker's optimal choice of x if the worker chooses an interior solution.

2. (a) (2 points) What level of b would provide full insurance against unemployment for workers? What would effort be if the government set b at this level?

   (b) (4 points) Differentiate $p = \bar{p} + \gamma x$ with respect to b (your answer can be in terms of u', the derivative of u), and interpret in words what this means for how increases in benefits change the probability of unemployed people finding a job. How does this effect depend on γ?

   (c) (2 points) What do we call the effect you demonstrated in part (b)?

3. (a) (3 points) What fraction of people will be employed in period 2, in terms of $\bar{p}, \pi, x, \gamma$, and e_1? Label this value e_2.

   (b) (3 points) Differentiate e_2 with respect to b. In words, what does this imply about how unemployment benefits affect the employment rate in period 2?

Now suppose that the government has the following loss function:

$$L = \alpha(1 - e_2)^2 + (1 - \alpha)(u(w) - u(b))^2$$

This means that the government cares about both getting the employment rate closer to 1 and about providing more insurance for workers by providing benefits closer to w. α is a parameter that measures how much the government cares about high employment relative to full insurance. The government's objective is to *minimise* this function.

4. (a) (2 points) What benefit level should the government choose when $\alpha = 0$, so that it only cares about providing full insurance to workers?

   (b) (2 points) What benefit level should the government choose when $\alpha = 1$, so that it only cares about getting the employment rate in period 2 as close to 1 as possible?

   (c) (3 points) Intuitively (no math required), will increasing α (in the range between 0 and 1) increase or decrease the optimal level of b, and why?

5. (a) (3 points) What benefit level should the government choose when $\gamma = 0$ (if $0 < \alpha < 1$), and why?

   (b) (3 points) Intuitively (no math required), when $0 < \alpha < 1$, will increasing γ increase or decrease the optimal level of b, and why?

6. (6 points) During the peak of the COVID-19 pandemic, the federal government substantially increased unemployment insurance payments as part of the Coronavirus Aid, Relief and Economic Security (CARES) Act, in many cases paying people as much as they earned in their previous jobs (so that $w = b$). Before the pandemic, unemployment insurance payments were much lower so that usually $w > b$ and $w - b$ was reasonably large. Based on your answers to the previous parts of this question, suggest and explain *two* possible reasons why the US government might have temporarily increased the size of its unemployment insurance payments during the pandemic.

QUESTION 3: Social Insurance Potpourri (T/F/U) [28 points]

State whether each of the following claims is true, false, or uncertain and explain why in 2-5 sentences. No credit will be awarded without an explanation.

1. (7 points) **Social Security.** Social security helps individuals smooth consumption over time.

2. (7 points) **Unemployment Insurance.** One proposed reform to the unemployment insurance system is *worker self-insurance*, where workers contribute their own money to a savings account that is reserved for unemployment insurance, and can draw on this account if they lose their job.

   Claim 1: a worker self-insurance system would reduce the length of time that unemployed people spend looking for jobs on average.

   Claim 2: a worker self-insurance system would be more economically efficient than the current system.

3. (7 points) **Disability Insurance.**

   Research discussed in lecture and section 14.3 of the textbook, such as French and Song (2014), suggests that there is some evidence of moral hazard responses to disability insurance: some people who receive disability insurance are capable of working in jobs that suit their skills.

   Claim: this evidence proves that the current system of assessing people for disability insurance is not strict enough, and that evaluators should require stronger evidence of disability before declaring someone eligible for DI.

4. (7 points) **Workers Compensation.** Two components of the current design of workers' compensation programs likely lead to more efficient outcomes than the status quo before states mandated that employers buy insurance against on-the-job accidents: (1) the fact that these are *no-fault* insurance policies and (2) the use of partial experience rating in determining firms' insurance premiums. Please respond T/F/U separately for each component (1) and (2).

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