Midterm Exam – Econ 2450
6 April 2015
Department of Economics
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Instructions: Unless otherwise explicitly stated, you must show how you arrived at your answer to get full mark. However, where the answer is just one, or a few, words no further motivation is needed. Answers must be given on the answer sheets provided. Ask for extra answer sheets if needed. Do not fold the answer sheets or write on the back.

1. Labor Markets [4 marks]

Consider a model of the labor market under perfect competition. The unemployment benefit, b, is endogenous and financed by taxes on wages, through an Employment Insurance system. The tax rate, τ, is exogenous ($0 < \tau < 1$). The before-tax wage rate is denoted w, so the after-tax wage is $(1-\tau)w$.

The total labor force is $\overline{L}$, and the unemployment rate, u, is given by

$$u = \frac{\overline{L} - L^D}{\overline{L}},$$

where L^D is labor demand, given by

$$L^D = N\left(\frac{\gamma A}{w}\right)^{\frac{1}{1-\gamma}}.$$

As in class, N is the number of firms, and A and γ are parameters from the production function (and $0 < \gamma < 1$).

Recall that an unemployed worker receives a benefit b. No worker wants to work if the after-tax wage is lower than the benefit, so labor supply equals

$$L^S = \begin{cases} \overline{L} & \text{if } (1-\tau)w \geq b, \\ \\ 0 & \text{if } (1-\tau)w < b. \end{cases}$$

Also recall from class that in this model it always holds that $u > 0$ in equilibrium.

(a) Using the information and notation given, write the budget constraint for the Employment Insurance system, and explain it very briefly. (That is, explain what you have on the different sides of the equation you have written.) [1 mark]

(b) Draw the labor supply and labor demand curves in a diagram with w on the vertical axis and L^D and L^S on the horizontal axis. Draw the diagram so that there is less than full employment in equilibrium. [1 mark]

(c) Find the before-tax wage rate, w, in terms of some, or all, of γ, A, N, $\overline{L}$, and τ [2 marks]

NOTE: In Problem 1 (b) you do not need to show how you arrived at your answer, only draw everything correctly.

2. Intertemporal Models [4 marks]

Consider a two-period model. Consumption is C_1 in the first period, and C_2 in the second. The budget constraints can be written

$$C_1 = Y - S,$$

and

$$C_2 = S(1+r) + (1+g)Y,$$

where S is first-period saving, r is the interest rate, Y is first-period income, and $(1+g)Y$ is second-period income. That is, income grows by a factor of $1+g$ from the first period to the second.

Agents choose S to maximize this utility function:

$$U = \ln(C_1) + \beta \ln(C_2),$$

subject to the budget constraints, where $\beta > 0$.

(a) Find an expression for the optimal level of S. Your answer should be something involving some, or all, of β, r, g and Y. [2 marks]

(b) If this model is used to describe a closed economy without production (meaning Y and g are exogenous and r is endogenous), what is the equilibrium level of r? Your answer should be an expression for r in terms of some, or all, of β, g and Y. [2 marks]

3. Dynamic Consistency [4 marks]

Consider a model of dynamic consistency of monetary policy. The central banker minimizes a loss function, which depends on output, y, and inflation, π:

$$L = \frac{1}{2}\left(y - \widetilde{y}\right)^2 + \frac{\alpha}{2}\left(\pi - \widetilde{\pi}\right)^2,$$

where $\alpha > 0$, $\widetilde{y} > 0$, and $\widetilde{\pi} > 0$. As in class, $\widetilde{y}$ and $\widetilde{\pi}$ are the central banker's most desired levels of output and inflation, respectively. The Phillips curve gives a relationship between output, y; actual inflation, π; and expected inflation, π^e:

$$y = y^* + \phi(\pi - \pi^e),$$

where $y^* > 0$ is the equilibrium level of y, and $\phi > 0$ is a parameter. We assume that $y^* < \widetilde{y}$.

(a) Recall that outcomes depend on whether the central banker sets policy under "commitment" or "discretion". We can think of the difference between these in terms of the timing of different events. What event comes first under discretion: the central bankers' choice of inflation, or the public's forming of expectations about inflation? Explain in words how this difference in timing matters for inflation outcomes. [1 mark]

(b) Illustrate the central banker's indifference curves in a suitable diagram. [1 mark]

(c) In the same type of diagram as under (b), or in the same diagram, illustrate the Phillips curve when π^e equals its equilibrium outcome under discretion. Also illustrate the indifference curve passing through that point. [2 marks]

NOTE: In Problem 3 (b)-(c) you do not need to show how you arrived at your answer, only draw everything correctly.

Answer sheet for Problem ___ Econ 2450 Midterm Exam 6 April 2015

Student Name: SID Number:

Write your answers below. Do not fold the answer sheets or write on the back.

Sketches of solutions

1.

(a) The budget constraint for the Employment Insurance system can be written:

$$L^D \tau w = \left(\overline{L} - L^D\right) b. \tag{1}$$

The interpretation is that total expenditures on benefits, $\left(\overline{L} - L^D\right) b$, must equal total taxes collected from the employed, $L^D \tau w$.

(b) See attached.

(c) Dividing (1) by $\overline{L}$ gives

$$\left(\frac{L^D}{\overline{L}}\right) \tau w = \left(\frac{\overline{L} - L^D}{\overline{L}}\right) b,$$

or:

$$(1-u)\tau w = ub. \tag{2}$$

From the diagram we saw that $w = b/(1-\tau)$ in equilibrium (where L^D intersects the horizontal segment of L^S). Using $w = b/(1-\tau)$ and (2) we get

$$(1-u)\tau \left(\frac{b}{1-\tau}\right) = ub,$$

which gives $u = \tau$. Using this and the expressions for u and L^D in the question, we see that

$$1 - u = \frac{L^D}{\overline{L}} = \frac{N}{\overline{L}} \left(\frac{\gamma A}{w}\right)^{\frac{1}{1-\gamma}} = 1 - \tau,$$

which can be solved for w to give:

$$w = \gamma A \left[\frac{N}{\overline{L}(1-\tau)}\right]^{1-\gamma}.$$

2.

(a) Setting up the utility maximization problem, the first-order condition should give:

$$S = \frac{\left[\beta(1+r) - (1+g)\right] Y}{(1+\beta)(1+r)}$$

(b) In closed economy without production, saving is zero. Setting $S = 0$ in (a) should give

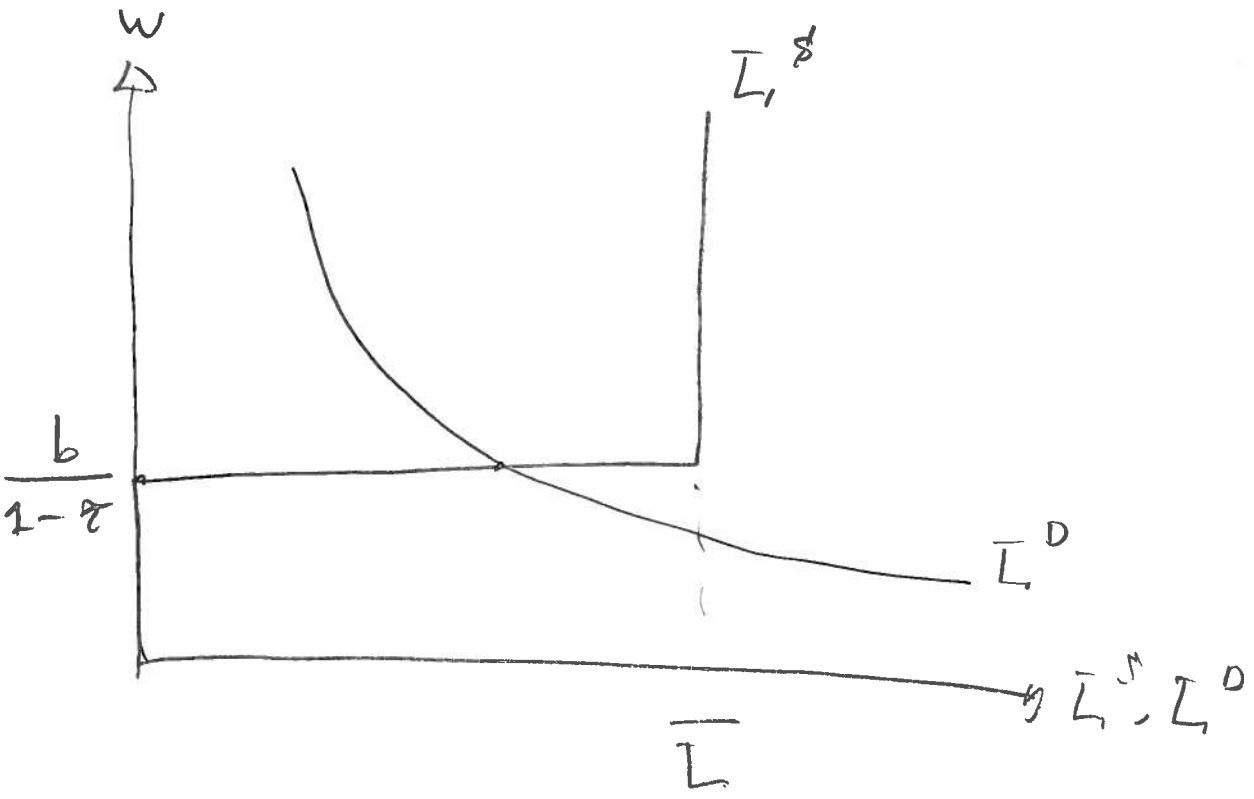
$$r = \frac{1+g}{\beta} - 1$$

3.

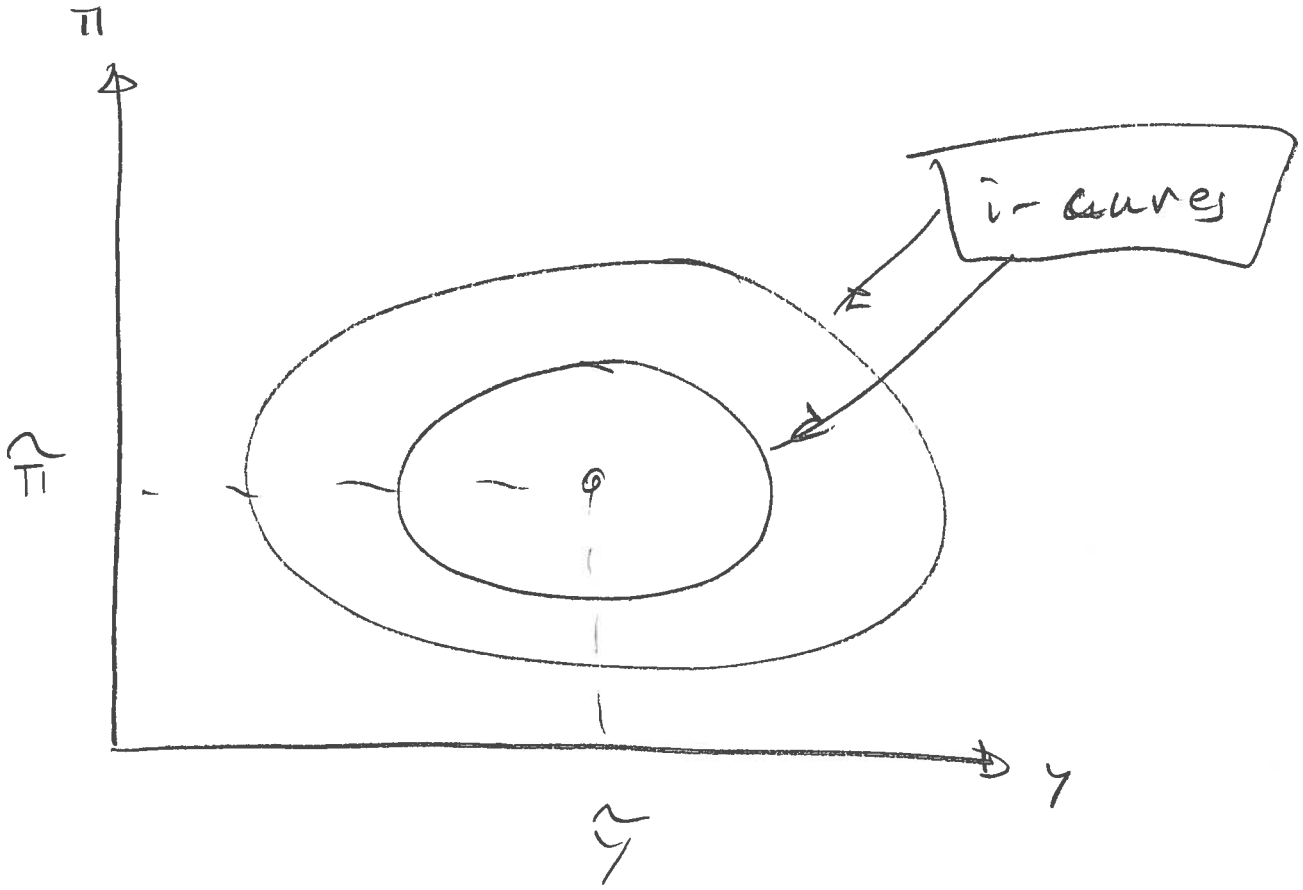
(a) Under discretion, the public forms inflation expectations *before* the central banker sets inflation. This means the central banker faces a temptation to exploit the Phillips curve by raising inflation to increase output. Because the public anticipates this, the result is higher inflation in equilibrium, compared to the commitment case, where the central banker does not face any such temptation.

(b)-(c) See attached.

(1) (b)



(3) (b)



(3) (c)