Intermediate Macroeconomic Theory I (ECON 303) Christian Sigouin

Exam #1 - Fall 2007

Read each question carefully. All answers must be clearly justified. Calculations must be detailed. Unjustified answers are worth zero points.

With a fair understanding of the material seen in class, it is possible to answer each question independently of the others using the information provided in the preceding questions.

You have 75 minutes to answer as many questions as possible. All questions carry equal weight: Do not waste all your time on answering one question.

Consider an economy in which the representative consumer values leisure (l) and consumption (c). This consumer has one unit of time at his disposal ($h = 1$) to allocate to leisure or labour. In addition, given any bundle (c, l), this consumer is willing to give up, at the margin, $5c/2l$ units of the consumption good for an extra unit of leisure. The consumer's budget constraint is $c + wl = w + \pi - T$ in which T are lump sum taxes. The representative firm's production function is $zK^{1/2}N^{1/2}$. Assume that $K = 1$, that $z = 10$ and that the government's goal is to buy two units of the consumption good.

1) **Explain** what the marginal rate of substitution of leisure for consumption (MRS_{lc}) measures. **Explain** why this consumers prefers the allocation $c = 4$ and $l = 0.64$ to the allocation $c = 5$ and $l = 0.51$ if the wage (w) is 10. (both allocations are feasible)
2) **Explain** why this firm does not maximize profits if it chooses $N = 0.64$ when $w = 10$. What should this firm do? **Explain.**
3) **Show** (in details) how to transform the consumer's budget constraint into the production possibility frontier (PPF) $c = 10(1 - l)^{1/2} - 2$. **Explain** why the PPF is useful to determine the social planner's solution of an economy.
4) The social planner's solution must also satisfy the condition $MRS_{lc} = MPN$. **Show** that the social planner's solution is $c = 3$ and $l = 0.75$.
5) Find the equilibrium wage and the firm's profits in a **competitive equilibrium**. Calculate the GDP using the income approach. **Justify** your answer fully.
6) Suppose that following a major earthquake, the capital stock falls to $K = 0.25$. Luckily, the representative consumer is unharmed but, as a result, he increases his labour supply to about 0.3692. How does the wage react to this event? Illustrate with a graph of the labour market. Illustrate with another graph the income effect and the substitution effect associated with this reduction in the capital stock. Which effect dominate in this particular economy? **Explain.**
7) Suppose that higher production lowers the consumer's welfare because producing more goods leads to more pollution. **Explain** in which way this new information is likely to affect the planner's solution found in question 4). Would the planner's solution coincide with the competitive equilibrium in this particular case? **Explain** why or why not.

1) a) MRS_{lc} gives how many units of consumption the consumer is willing to give up to "buy" an extra unit of leisure

∴ it is the value of leisure expressed in terms of consumption

- can be seen as the relative price of leisure according to the consumer

b) $MRS_{lc} = \frac{5c}{2l}$

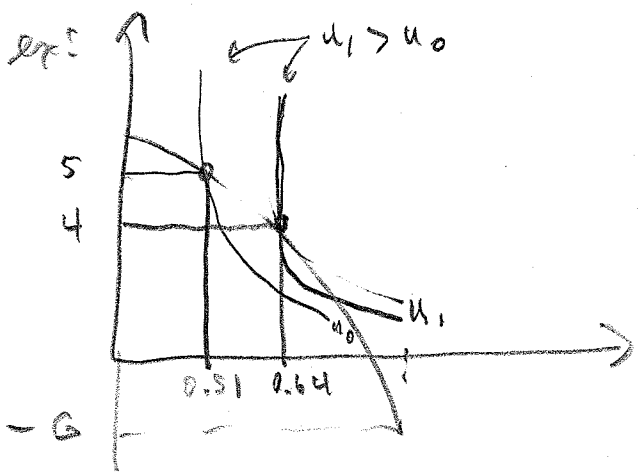
$\therefore MRS_{0.64,4} = \frac{5 \times 4}{2 \times 0.64} = \quad > w = 10$

$MRS_{0.51,5} = \frac{5 \times 5}{2 \times 0.51} = \quad > w = 10$

for both allocations, the consumer should ↑ l

∴ $c = 4$, $l = 0.64$ is preferred because it has more leisure than the other

ex:



2) a) Firms max. profits when $w = MPN$

$$MPN = \frac{\partial Y}{\partial N} = \frac{\partial (10 N^{1/2})}{\partial N} = 5 N^{-1/2} = \frac{5}{0.8} = 6.25$$

$MPN < w = 10$ here

this means that the benefit of hiring an extra worker ($\uparrow$ in Y) is smaller than the cost (w)

b) $\downarrow N \longrightarrow \uparrow MPN$ until $MPN = 10 = w$

(since MPN is $\downarrow$ in N)

3) a) Budget constraint:

$$C = w N^s + \pi - T$$

government's budget constraint: $T = G = 2$

$$\therefore \quad C = w N^s + \pi - G$$

Firms' profit: $\pi = Y - w N^d$

$$\therefore \quad C = w N^s + Y - w N^d - G$$

$N^s = N^d$

$$\therefore \quad C = Y - G$$

$$C = 10 N^{1/2} - G \qquad (N = 1 - \ell)$$

$$\therefore \quad \boxed{C = 10(1-\ell)^{1/2} - 2}$$

b) it gives all the combinations of C and ℓ that the economy can efficiently produce

ie: Max C for any given ℓ

4) Planner's solution must satisfy

$MRS_{lc} = MPN$ (optimality)

$c = 10(1-l)^{1/2} - 2$ (feasibility)

with $l = 0.75$, $c = 10(1-0.75)^{1/2} - 2$

$= 10(0.5) - 2$

$= 3$

1) ∴ the allocation $c=3$, $l=0.75$ is feasible

$$MRS_{lc} = \frac{5c}{2l} = \frac{5 \cdot 3}{2 \cdot 3/4} = 10$$

$$MPN = 5(1-l)^{-1/2} = \frac{5}{0.5} = 10$$

2) ∴ $MPN = MRS_{lc}$ ⇒ the allocation is optimal

5) a) in this economy, there are no distortions
no externalities
no market power

in this case, competitive equ. solution is the same as the planner's solution

∴ $w = MPN = 10$

$\pi = 10(0.25)^{1/2} - 10 \cdot 0.25 = 2.5$

b) GDP using the income approach:

GDP = labour income + profits
wN + π

$GDP = 10 \cdot 0.25 + 2.5 = 5$

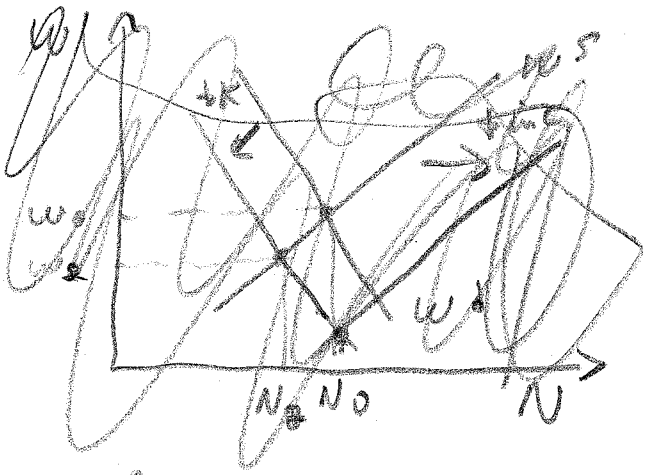
∴ $GDP = 5$

6) a) $N_0 = 0.25 \rightarrow N_1 = 0.3692$

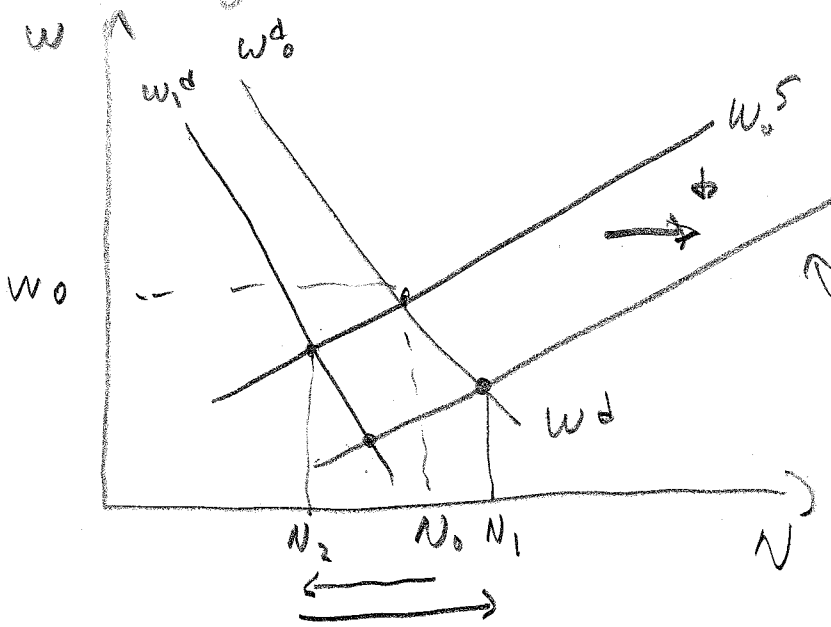
$w = MPN$ and MPN ↓ with N

∴ the wage must go down

essentially, here, a ↓ in K is equivalent to a ↓ in z



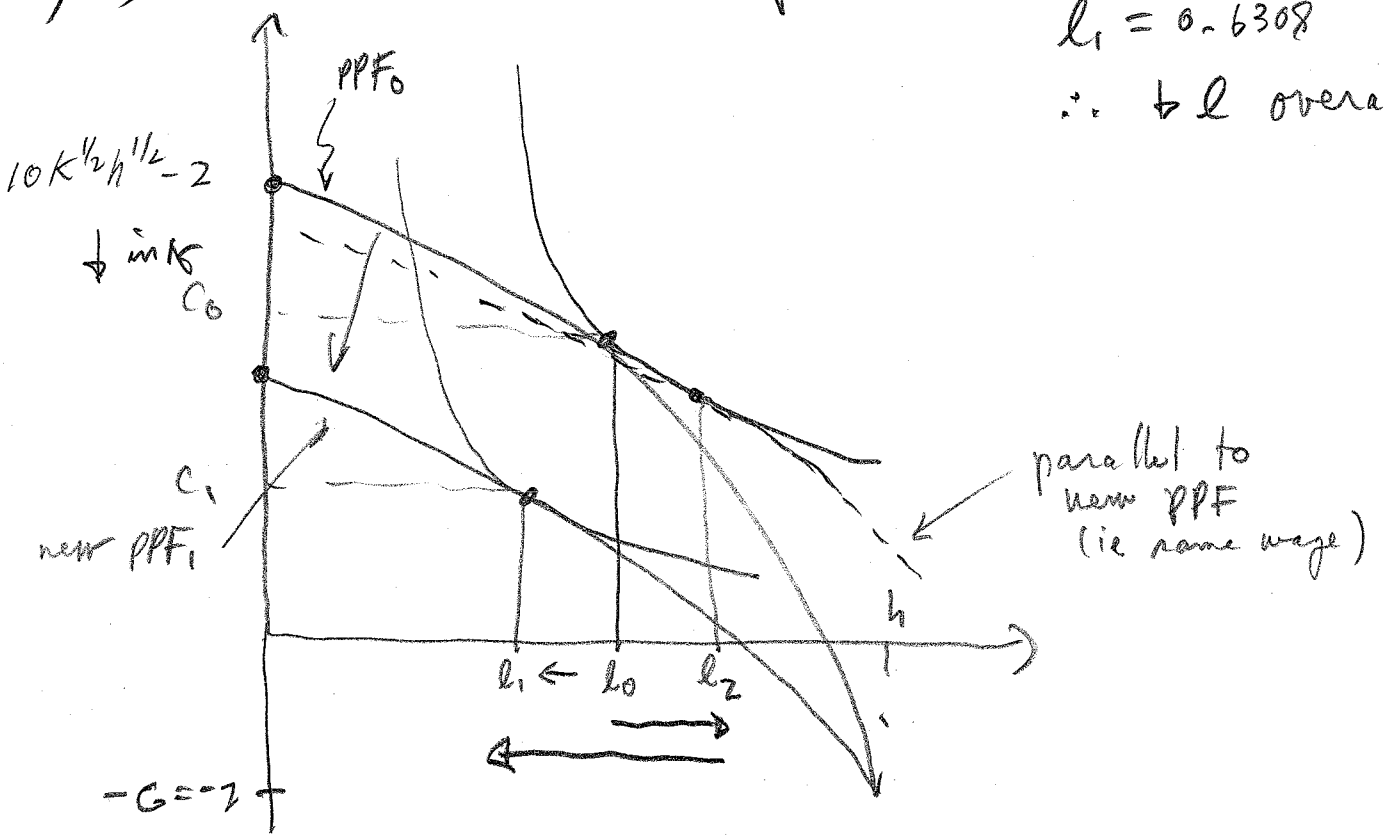
b)



↑ OK if did not draw this one

6) a)

note: given that $l_0 = 0.75$
$l_1 = 0.6308$
$\therefore$ $\downarrow l$ overall



l_0 to l_2 : substitution effect
Δ in w, keeping utility constant
($\downarrow w \rightarrow \downarrow N^S$)

l_2 to l_1 : income effect
$\downarrow C \rightarrow \downarrow l$ because
c and l are normal goods

d) here, given that 1) $\downarrow w$
2) $\downarrow N$
$\therefore$ income effect dominates

the substitution effect would dominate if a $\downarrow w$ would lead to a $\downarrow$ in N

7) This is an externality:

a) • $\uparrow Y \rightarrow \downarrow$ utility but firms do not account for this when they make their decisions [pollution is at his max]

◦ a planner would take this into account because he would choose a pollution level that would max utility

∴ output in the planner's solution should be smaller than in the market solution

∴ the planner's solution would have more leisure and less consumption than in 4) [because output is lower (need to $\downarrow N$)]

b) Planner's solution $\neq$ competitive equ.

see explanation above