

Problem Set 2

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Problem 1: Macroeconomic Analysis of the 2025 Taiwan Cash Handout

Applied Context: The Policy

In late 2025, the Taiwanese government finalized a plan to distribute a universal cash handout of NTD 10,000 to all eligible citizens and residents. This policy, officially part of the "Special Act for Strengthening Economic and Social Resilience," was designed to share the benefits of strong economic performance and provide relief from global inflationary pressures.

As a junior economist at a local think tank in Hsinchu, you are tasked with analyzing the potential impact of this "helicopter money" on household labor supply. You decide to apply a standard micro-founded macroeconomic model.

Important Note: This is a **partial equilibrium** analysis focusing only on the consumer's decision. It assumes the wage is fixed and does not solve for a general equilibrium where the labor market clears.

The Model

- **Utility Function:** $U(C, l) = \frac{C^{1-\sigma}}{1-\sigma} + b \cdot l$
 - **Budget Constraint:** $C \leq w(h - l) + \pi - T$
 - **Parameters:** $\sigma = 2, b = 5, w = 10, h = 1$
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Part I: Theoretical Foundations

- ① The **Frisch elasticity of labor supply** ($\epsilon_{N,w}^{Frisch}$) measures the percentage change in hours worked (N) in response to a one percent change in the real wage (w), holding the marginal utility of wealth (λ) constant. Mathematically, it is defined as:

$$\epsilon_{N,w}^{Frisch} = \left. \frac{\partial N/N}{\partial w/w} \right|_{\lambda \text{ constant}}$$

Given the utility function in this model, what is the Frisch elasticity of labor supply?

- (A) 0
- (B) 1
- (C) -1
- (D) Infinite (∞)

- ② The MRS represents the rate at which a consumer is willing to trade consumption for leisure while maintaining the same level of utility. What is the correct formula for the $MRS_{l,C}$ for this model? _____

- (A) bC^σ
- (B) C^σ/b
- (C) b/C
- (D) w/b

Part II: The Economy Before the Handout

For this section, assume the baseline scenario where $\pi - T = 0$.

- ③ What is the consumer's optimal consumption (C_0) in this pre-policy environment?

- (A) 2
- (B) 10
- (C) $\sqrt{2}$
- (D) 5

- ④ What is the consumer's optimal choice of leisure (l_0)? _____

- (A) $1 - \frac{\sqrt{2}}{10}$
- (B) 1
- (C) 0.5
- (D) 0

- ⑤ Given the choice of leisure in the previous question, how many hours does the consumer choose to work ($N_0 = h - l_0$)? _____
- (A) $1 - \frac{\sqrt{10}}{2}$
 - (B) $\frac{\sqrt{2}}{10}$
 - (C) 0.5
 - (D) 1

Part III: The Economy After the Handout

The NTD 10,000 handout is now distributed. We normalize this amount so the post-policy value is $\pi - T = 1$.

- ⑥ What is the consumer's new optimal consumption (C_1)? _____
- (A) $1 + \sqrt{2}$
 - (B) 11
 - (C) 1
 - (D) $\sqrt{2}$
- ⑦ What is the consumer's new optimal leisure (l_1)? _____
- (A) It remains unchanged.
 - (B) $1 - \frac{\sqrt{2}-1}{10}$
 - (C) 1
 - (D) $1 - \frac{\sqrt{2}}{10}$
- ⑧ What is the new number of hours worked ($N_1 = h - l_1$)? _____
- (A) $\frac{\sqrt{2}-1}{10}$
 - (B) $\frac{\sqrt{2}}{10}$
 - (C) 0
 - (D) 0.1

- ⑨ What is the approximate percentage change in hours worked as a result of the cash handout? _____
- (A) -29.3%
 - (B) +70.7%
 - (C) -70.7%
 - (D) +29.3%

Part IV: Analysis and Interpretation

- ⑩ The cash handout represents a pure... _____
- (A) Substitution Effect
 - (B) Technology Shock
 - (C) Income Effect
 - (D) Preference Shock
- ⑪ The model's prediction that leisure increases when non-wage income rises implies that leisure is what kind of good? _____
- (A) An inferior good
 - (B) A Giffen good
 - (C) A public good
 - (D) A normal good
- ⑫ This partial equilibrium analysis focuses only on the household labor supply decision. If this were the only effect, what would the model predict is the immediate impact of the cash handout on GDP? _____
- (A) GDP would increase, because consumption rises.
 - (B) GDP would decrease, because total hours worked in the economy fall.
 - (C) GDP would remain unchanged, because the money is just a transfer.
 - (D) The impact cannot be determined.

Part V: Reconciling Theory and Application

- ⑬ Question 1 established that the Frisch elasticity is infinite, implying an "all-or-nothing" labor response to wage changes. Yet, your answer to Question 5 shows an **interior solution** for labor supply. Why does the model predict the average person works *some* of the time? _____
- (A) The income effect from the wage is large enough to offset the infinite substitution effect.
 - (B) The Frisch elasticity is only a theoretical concept and does not apply to this model.
 - (C) In the full optimization, the consumer adjusts their consumption, which in turn adjusts their marginal utility of wealth, allowing them to find an interior balance.
 - (D) The specific parameter values ($b = 5, w = 10$) are uniquely chosen to create an interior solution.
- ⑭ At the benchmark optimum, what is the marginal utility of an additional dollar of income ($\lambda = MU_C$)? _____
- (A) 0.5
 - (B) 2
 - (C) 1
 - (D) 10
- ⑮ Which of the following is a significant limitation of applying this simple model to the real-world policy? _____
- (A) The model incorrectly assumes people like leisure.
 - (B) The model uses a fixed wage, ignoring that a widespread drop in labor supply could cause wages to rise, creating a **general equilibrium effect**.
 - (C) The model's utility function is too complex to be realistic.
 - (D) The model does not account for the government's budget.

Problem 2

Credit: Sungmin Park

Suppose that the only consumption good in the state of Ohio is soybeans, and suppose that Ohio's output Y of number of soybeans is determined by the following production function

$$F(K, L) = zK^{\frac{1}{3}}L^{\frac{2}{3}}, \quad (1)$$

where z is TFP, K is its current stock of capital, and L is the size of its current labor force. Suppose also that the current technological level is $z = 1$, the current stock of capital is 1,000, and the current labor force is 8,000.

(a) At the current technological level, capital stock, and labor force, what is the total output of soybeans? What is the marginal product of capital? What is the marginal product of labor?

$$MPK = \underline{\text{Q16}}$$

$$MPN = \underline{\text{Q17}}$$

①6 _____

- (A) 0.333 (B) 1.333 (C) 2.333 (D) 3.333

①7 _____

- (A) 0.333 (B) 1.333 (C) 2.333 (D) 3.333

Suppose that the markets for capital and labor are competitive—that is, there are many firms (soybean farms) in Ohio, so that they are price-takers.

(b) What is the real rental rate of capital? What is the real wage? How many soybeans go to the capitalists? (i.e. what is the capital income?) How many soybeans go to the workers? (i.e. what is the labor income?) What is the total income?

$$\text{rental rate } R = \underline{\text{Q18}}$$

$$\text{wage } w = \underline{\text{Q19}}$$

$$\begin{aligned} \text{Capital income } R \times K & \quad \underline{\text{Q20}} \\ \text{Labor income } w \times L & \quad \underline{\text{Q21}} \\ \text{Total income } R \times K + w \times L & \quad \underline{\text{Q22}} \end{aligned}$$

18 _____

- (A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{3}{3}$ (D) $\frac{4}{3}$

19 _____

- (A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{3}{3}$ (D) $\frac{4}{3}$

20 _____

- (A) $\frac{2000}{3}$ (B) $\frac{4000}{3}$ (C) $\frac{6000}{3}$ (D) $\frac{8000}{3}$

21 _____

- (A) $\frac{2000}{3}$ (B) $\frac{4000}{3}$ (C) $\frac{6000}{3}$ (D) $\frac{8000}{3}$

22 _____

- (A) 2000 (B) 4000 (C) 6000 (D) 8000

Now suppose that the demand for soybeans in Ohio are as follows. First, the demand for the consumption of soybeans is given as

$$C = 0.5(Y - T) + 500, \quad (2)$$

where $T = 400$ is the number of soybeans taxed by the Ohio state government. Second, the demand for investing soybeans for future production is given as

$$I = 1500 - 100r, \quad (3)$$

where r is the real interest rate in percent. Finally, the demand for soybeans from the Ohio state government is as the government collect the same amount as taxes T and spend it on running the Ohio State University.

(c) What are the equilibrium interest rate, investment, and consumption?

$$r = \underline{\text{Q23}}$$

$$I = \underline{\text{Q24}}$$

$$C = \underline{\text{Q25}}$$

23) _____

(A) 2

(B) 3

(C) 4

(D) 5

24) _____

(A) 1500

(B) 1400

(C) 1300

(D) 1200

25) _____

(A) 2100

(B) 2200

(C) 2300

(D) 2400

(d) Suppose the Ohio state government reduces the taxation to $T = 200$ while maintaining the same spending of $G = 400$, as a part of COVID-19 stimulus package. What is the government surplus/deficit? What is the equilibrium interest rate, investment, and consumption after this government policy?

$$\text{government surplus/deficit: } T - G = \underline{\text{Q26}}$$

$$r = \underline{\text{Q27}}$$

$$I = \underline{\text{Q28}}$$

$$C = \underline{\text{Q29}}$$

26) _____

- (A) 200 (B) 400 (C) -200 (D) -400

27) _____

- (A) 2 (B) 3 (C) 4 (D) 5

28) _____

- (A) 1500 (B) 1400 (C) 1300 (D) 1200

29) _____

- (A) 2100 (B) 2200 (C) 2300 (D) 2400

Suppose instead that Ohio state residents' consumption demand also depends on the real interest rate:

$$C = 0.5(Y - T) + 600 - 50r. \quad (4)$$

That is, for every percentage point increase in the interest rate, the Ohio state resident would rather not consume 50 soybeans and save them instead.

(e) Analyze again the effects of reduced taxation to $T = 200$, using the new consumption demand but using everything else the same as (d)

government surplus/deficit: $T - G =$ Q30

$$r =$$
 Q31

$$I =$$
 Q32

$$C =$$
 Q33

30) _____

- (A) 200 (B) 400 (C) -200 (D) -400

31 _____

(A) 1.667

(B) 2.667

(C) 1.333

(D) 2.333

32 _____

(A) 1537

(B) 3212

(C) 1233

(D) 2367

33 _____

(A) 1537

(B) 3212

(C) 1233

(D) 2367