Intermediate Microeconomics Exercise Class 4

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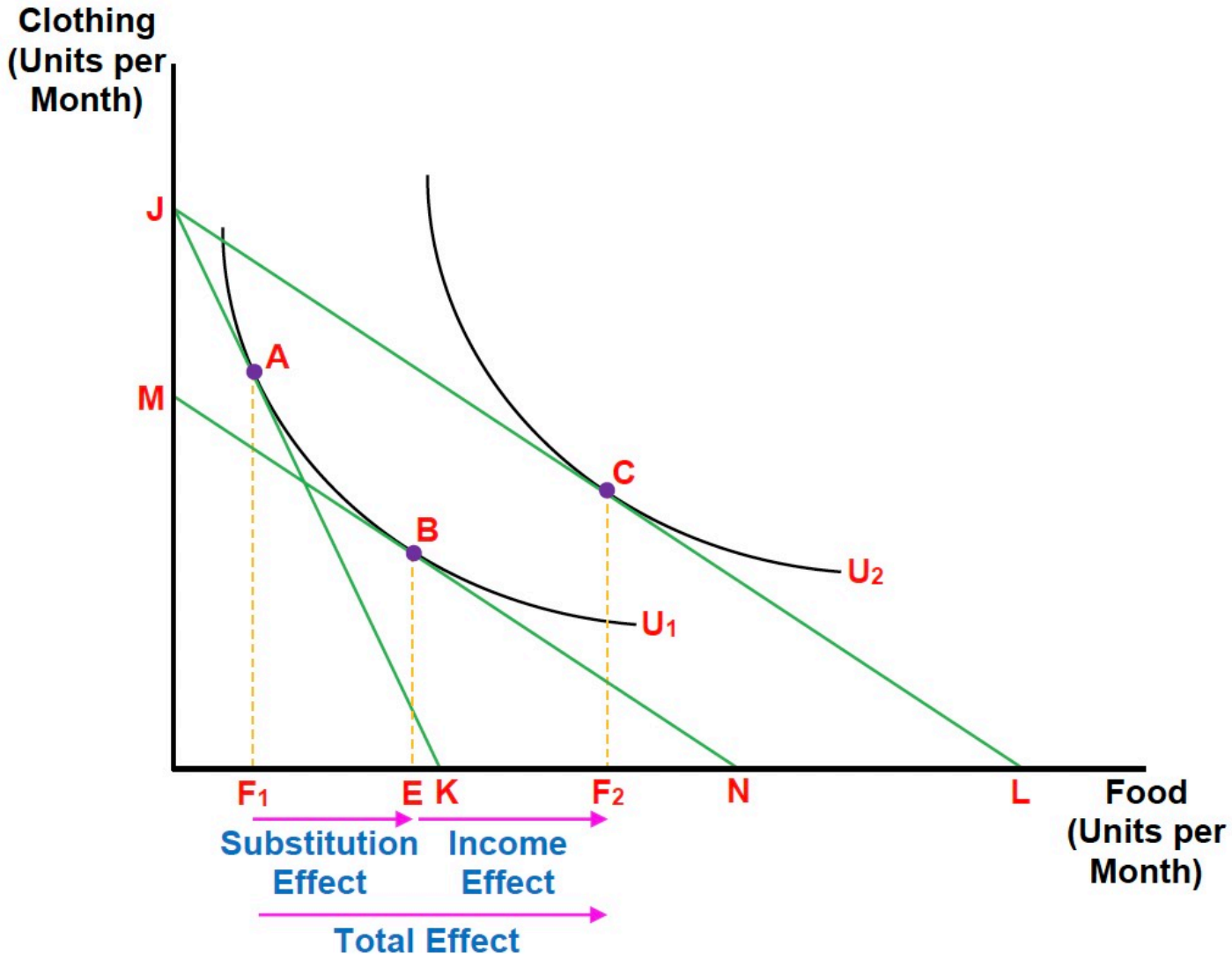
Content

Income and Substitution Effects

- Relative Price: $\frac{P_x}{P_y}$
- Substitution Effect
  - Hicks Substitution Effect
  - Slutsky Substitution Effect
- Income Effect
- Total Effect = Substitution Effect + Income Effect

Income and Substitution Effects Cont'd

Hicks Substitution Effect



Income and Substitution Effects Cont'd

Hicks Substitution Effect

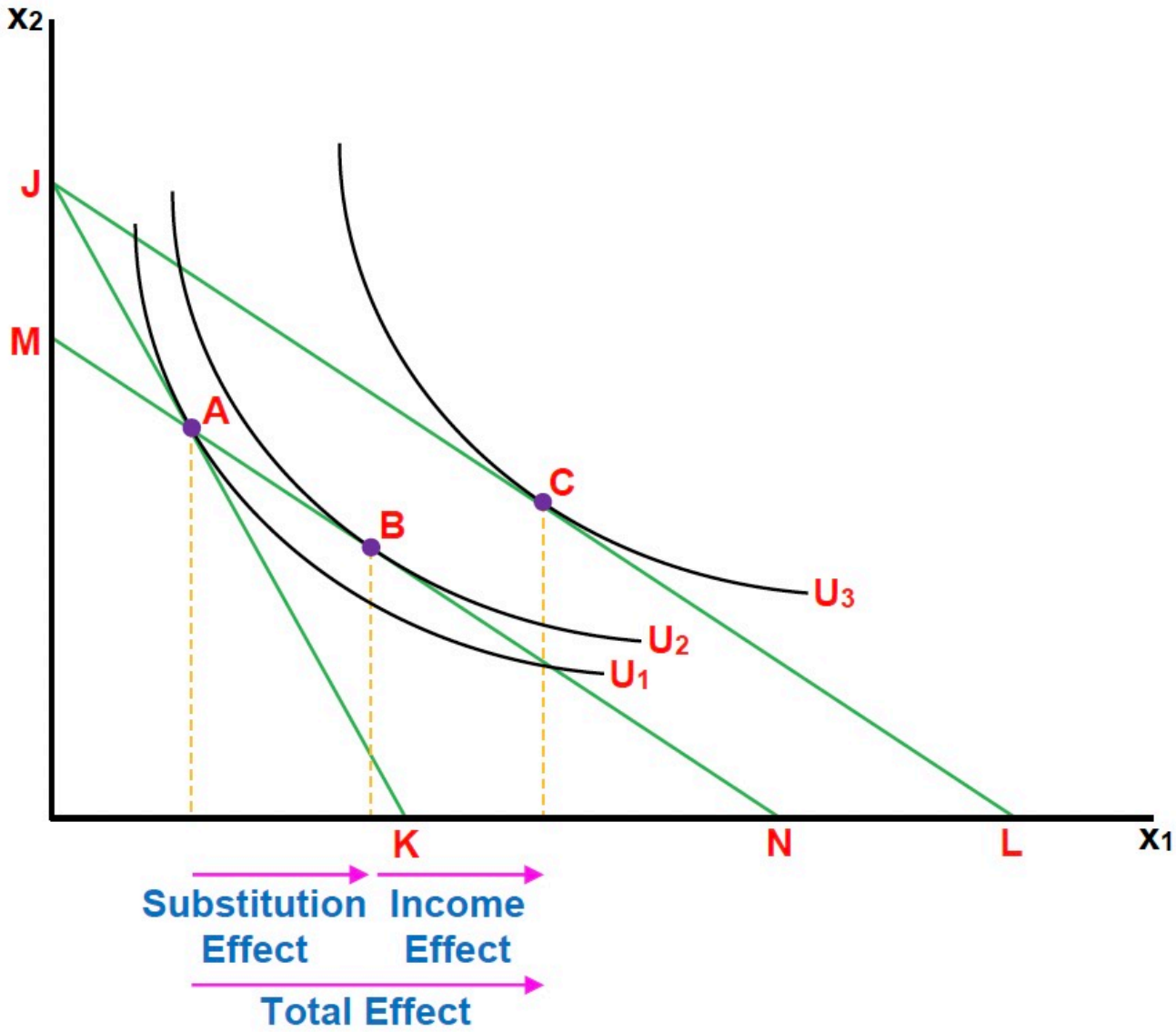
- Normal Goods
  - Substitution Effect: Positive
  - Income Effect: Positive
  - Total Effect: Positive
- Inferior Goods
  - Substitution Effect: Positive
  - Income Effect: Negative
  - Total Effect: ?
- Giffen Goods
  - Substitution Effect: Positive
  - Income Effect: Negative
  - Total Effect: Negative

Theorem

Giffen goods must be inferior goods.

Income and Substitution Effects Cont'd

Slutsky Substitution Effect



Income and Substitution Effects Cont'd

Slutsky Substitution Effect

- Pivoted Budget
- Original Choice
- Final Choice

Income and Substitution Effects Cont'd

- Compensating Variation
- Equivalent Variation

Production

- Microeconomics
  - Consumer Theory
  - Producer Theory

Production Cont'd

- Inputs
  - Labor
  - Capital
  - Land
  - Raw Materials
- Output
- Technology
- Production Function: $Q = F(K, L)$

Production Cont'd

- Fixed Factors
- Quasi-Fixed Factors
- Variable Factors
- Short-Run
- Long-Run

Production Cont'd

- Total Product
- Average Product
- Marginal Product
- Marginal Rate of Technical Substitution: $\frac{dK}{dL} = -\frac{MP_L}{MP_K} = MRT_{LK}$

Production Cont'd

- Isoquant
  - Capital-Intensive
  - Labor-Intensive
- The Slope of IQ – The MRTS
- The Shape of IQ – Convex: Law of diminishing marginal returns
- Isoquant Map

Production Cont'd

- Short-Run Production: At least one variable is fixed
- Law of diminishing marginal returns
- Long-Run Production: Alter all inputs
  - Linear: $Q = F(K, L) = aK + bL$
  - Leontief: $Q = F(K, L) = \min\{aK, bL\}$
  - Cobb-Douglas: $Q = F(K, L) = aK^bL^c$

Production Cont'd

- Returns to Scale
  - Increasing Returns to Scale: $f(tx_1, tx_2) > tf(x_1, x_2)$, for all $t > 1$
  - Constant Returns to Scale: $f(tx_1, tx_2) = tf(x_1, x_2)$, for all $t > 0$
  - Decreasing Returns to Scale: $f(tx_1, tx_2) < tf(x_1, x_2)$, for all $t > 1$
- For industries that are relatively stable, expect firms to show constant returns to scale
- Firms have strong incentives to increase returns to scale
- Markets will punish firms with decreasing returns to scale

Production Cont'd

- $Q = aK^bL^c$: determined by $b + c$
- Why does increasing returns to scale exist?
  - Higher output allows higher labor specialization
  - Sometimes the technology simply requires large output runs to use the technology efficiently
- Why does decreasing returns to scale exist?
  - Higher costs of information flow coordinating
  - Higher costs of decision-making and managing

Question 1

Our old friend, John Snow, has a utility function given by $U(x_1, x_2) = \min\{2x_1, x_2\}$, where x_1 and x_2 are the quantities of the two commodities he consumed. His income is 40, and the prices are $(p_1, p_2) = (2, 1)$.

a) Calculate the utility-maximizing bundle for John.

b) Suppose now the price of good 2 rises to $p_2' = 3$. What are the Hicks and Slutsky substitution effects of this change on the demand for good 1 and good 2?

c) Recall that the price of good 2 has risen from $p_2 = 1$ to $p_2' = 3$. Calculate the compensating variation (CV) and equivalent variation (EV) of this change.

Question 2

John has a utility function $U(X, Y) = XY$, and an income of 4. If the prices of X and Y change from $(p_x = 1, p_y = 1)$ to $(p'_x = 2, p'_y = 1)$, what are the Compensating Variation and the Equivalent Variation?

Question 3

There are two types of food in the canteen, rice noodles (x) and stewed beef (y). Suppose John's utility function is given by $U(x, y) = x^{0.7}y^{0.3}$ and his optimal consumption bundle is $(0.7, 0.3)$. The relative price p_x/p_y is equal to what?

Question 4

A firm uses two inputs: labor (L) and capital (K). The wage rate $w > 0$ and rental rate $r > 0$. For each of the production function, go through the following four steps:

Step 1 : With L on the horizontal axis and K on the vertical axis, sketch a typical isoquant and indicate at least two points.

Step 2 : Discuss returns to scale.

Step 3 : In the short run, capital is fixed at $K = \bar{K}$. Solve the firm's short-run cost minimization problem to get conditional labor demand $L_s^*(w, r, y|\bar{K})$ and cost function $c_s(w, r, y|\bar{K})$.

Step 4 : In the long run, both labor and capital are variable. Solve the the firm's long-run cost minimization problem to get conditional input demands $(L^*(w, r, y), K^*(w, r, y))$ and cost function $c(w, r, y)$.

a) $f(L, K) = L^2 + K^2$

b) $f(L, K) = \begin{cases} 2L & \text{if } L \leq K \\ L + K & \text{if } L > K \end{cases}$

Question 5

It is known that a consumer's demand function for milk is

$$x = 10 + \frac{y}{10p}.$$

Here x is the amount of milk consumed in a week, $y = 120$ dollars is income, and $p = 3$ dollars (per barrel). Now let's say the price of milk goes from 3 dollars to $p = 2$ dollars.

a) What is the total effect of the price change on the consumer's demand? (How much will his milk consumption change?)

b) Please calculate the Slutsky substitution effect of price change. (Hint: How much money will the consumer save if he maintains his consumption level? How much money does he now use for the original utility?)

c) Please calculate the Slutsky income effect of price change.

Question 6

The utility function of a consumer is $u(x_1, x_2) = x_1^2 x_2$. Let p_1, p_2, and m denote the price of good 1, the price of good 2 and the income, respectively.

a) If m is 24, p_1 is 1, p_2 is 1, and now p_1 rises to 2, find the Slutsky substitution effect and income effect of this consumer with respect to good 1.

b) Find the corresponding Hicks substitution effect and income effect.

Question 7

Suppose a consumer consumes only two kinds of goods. He buys $x_1 = 5$, $x_2 = 10$ when $p_1 = 10$ and $p_2 = 5$. Now, p_1 is down to 8 and p_2 is up to 6.
a) Does the consumer's standard of living increase or decrease after the price change?
b) Why is that?

Thanks!