

LECTURE 4

VOUCHER VS. CASH

INCOME AND SUBSTITUTION EFFECTS

CONSUMER WELFARE



Where are we?

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- Consumer choice
- Individual demand
- Application/Extension of the basic consumer choice model
 - ▣ Revealed preference
 - ▣ Voucher vs. cash
 - ▣ Income and substitution effects
- Consumer welfare
 - ▣ How to measure the benefit/loss to consumers when there is a price change?

Part 1

Application: Voucher vs. Cash

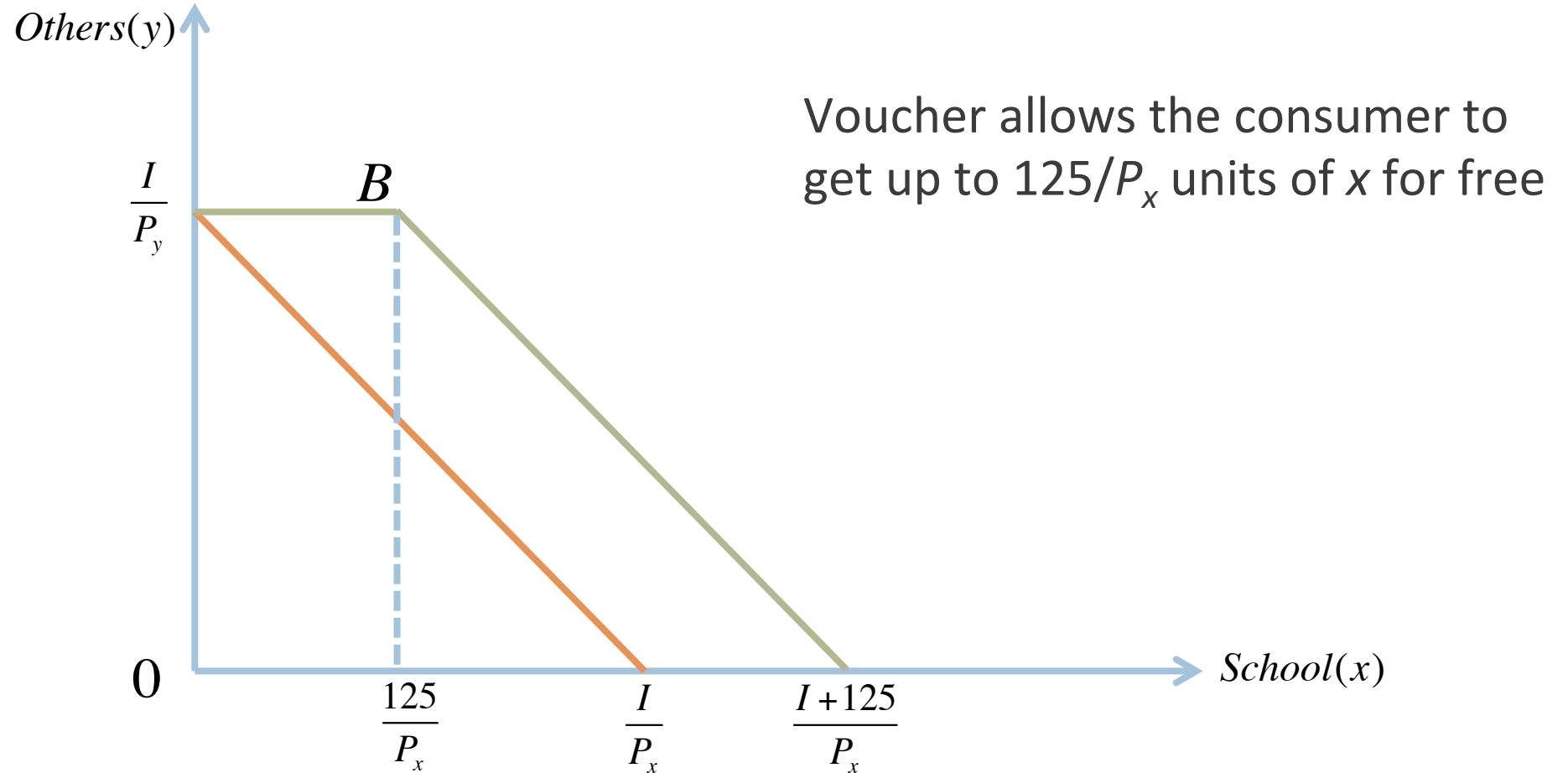
Back-To-School Vouchers

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- NTUC offers back-to-school education vouchers to low-income families
 - ▣ \$125 voucher per school child to be spent on school-related goods
- Similar program
 - ▣ US food stamps
- What is the effect of the voucher on
 - ▣ Consumer's choice
 - ▣ Consumer's utility

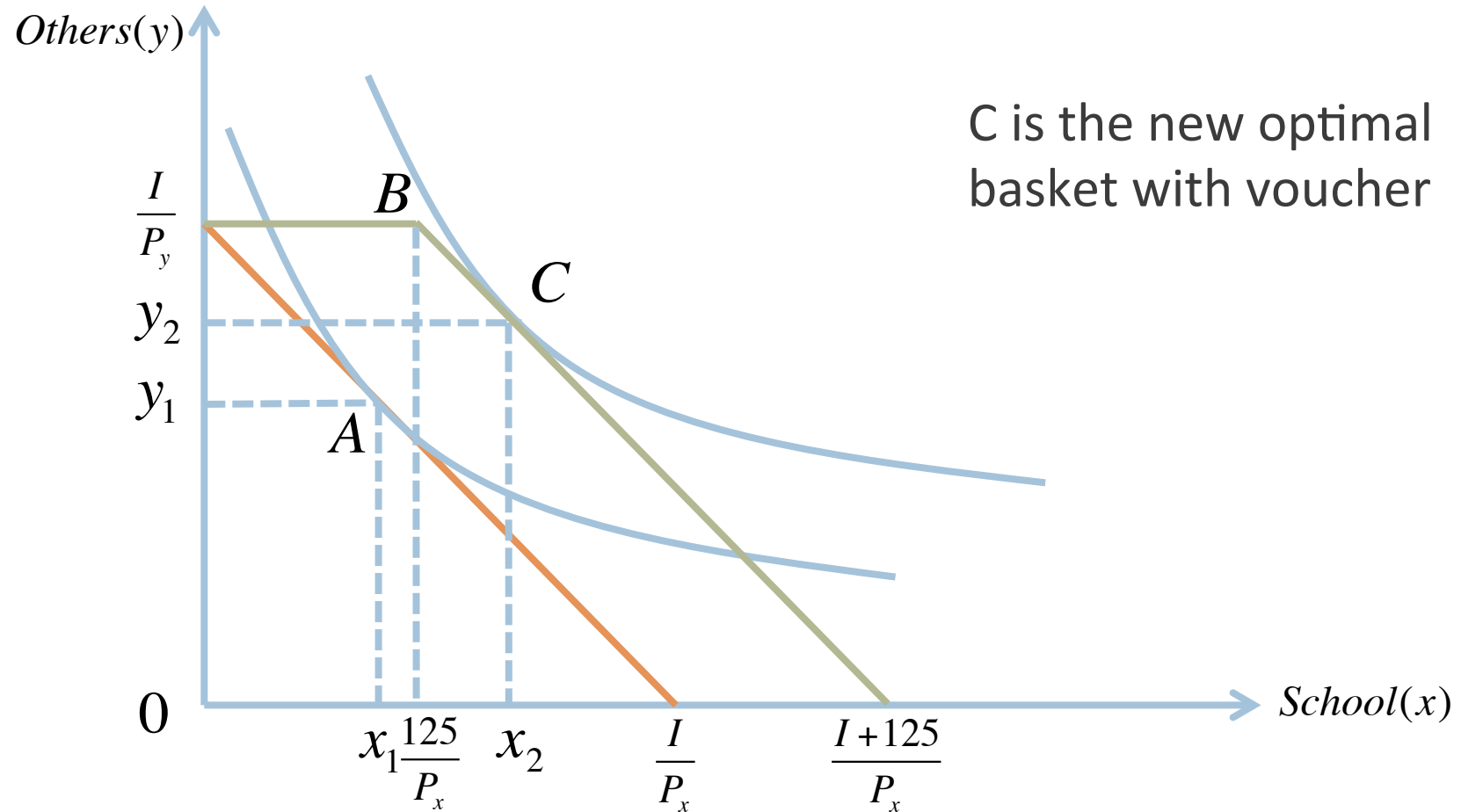
Budget Line with Voucher

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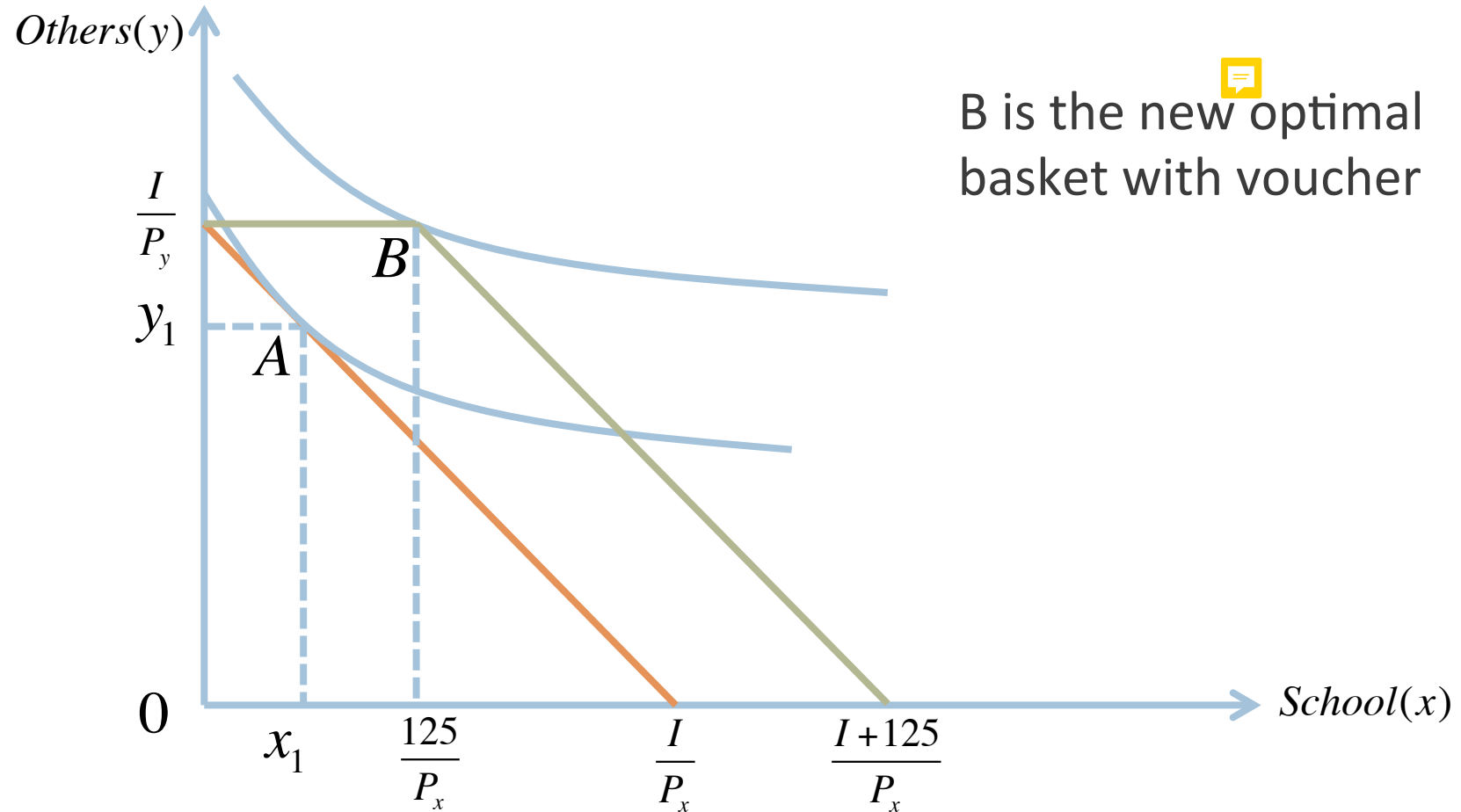
Impact of Voucher on Consumer 1

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Impact of Voucher on Consumer 2

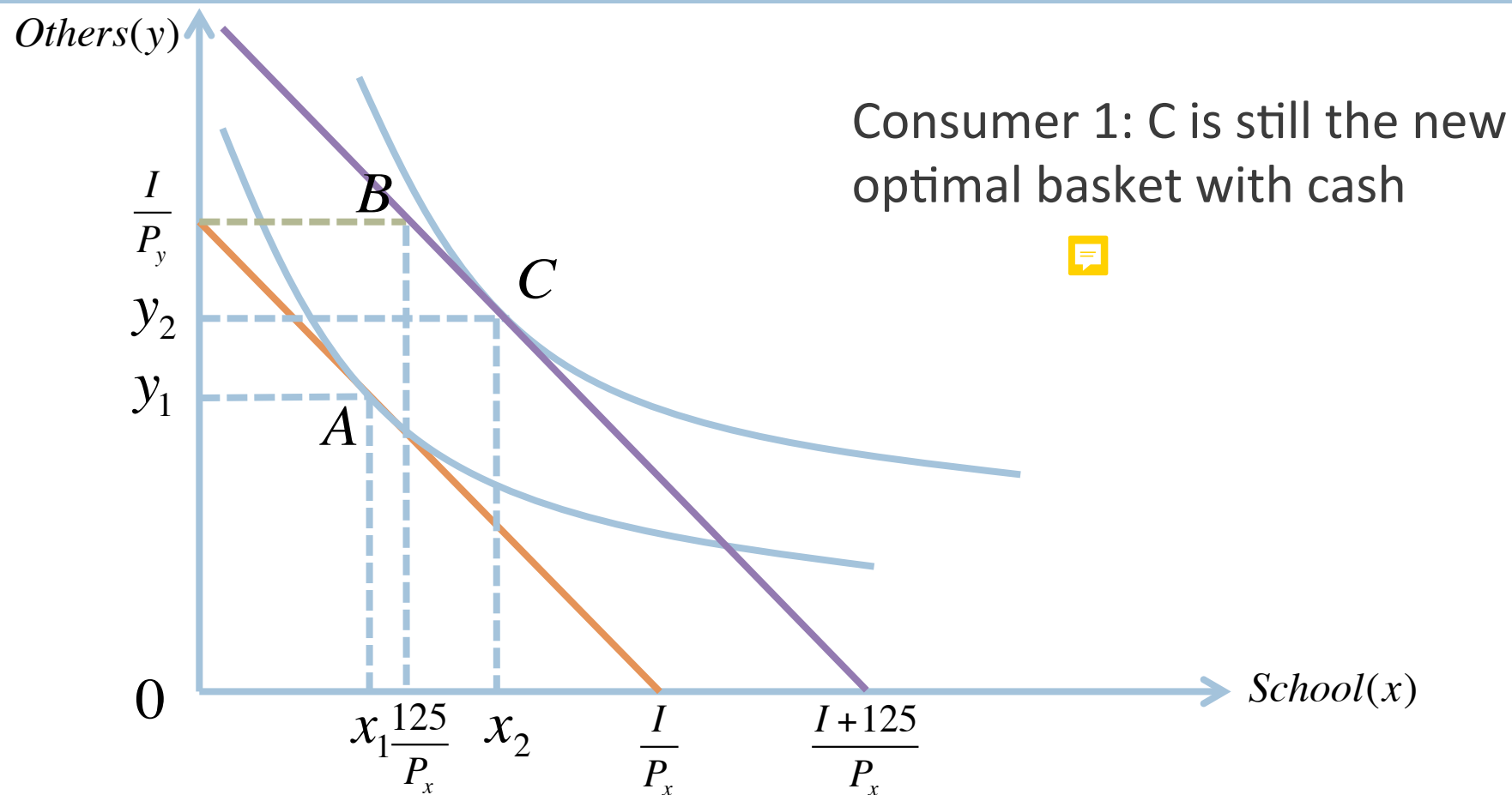
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How about a cash subsidy of \$125?

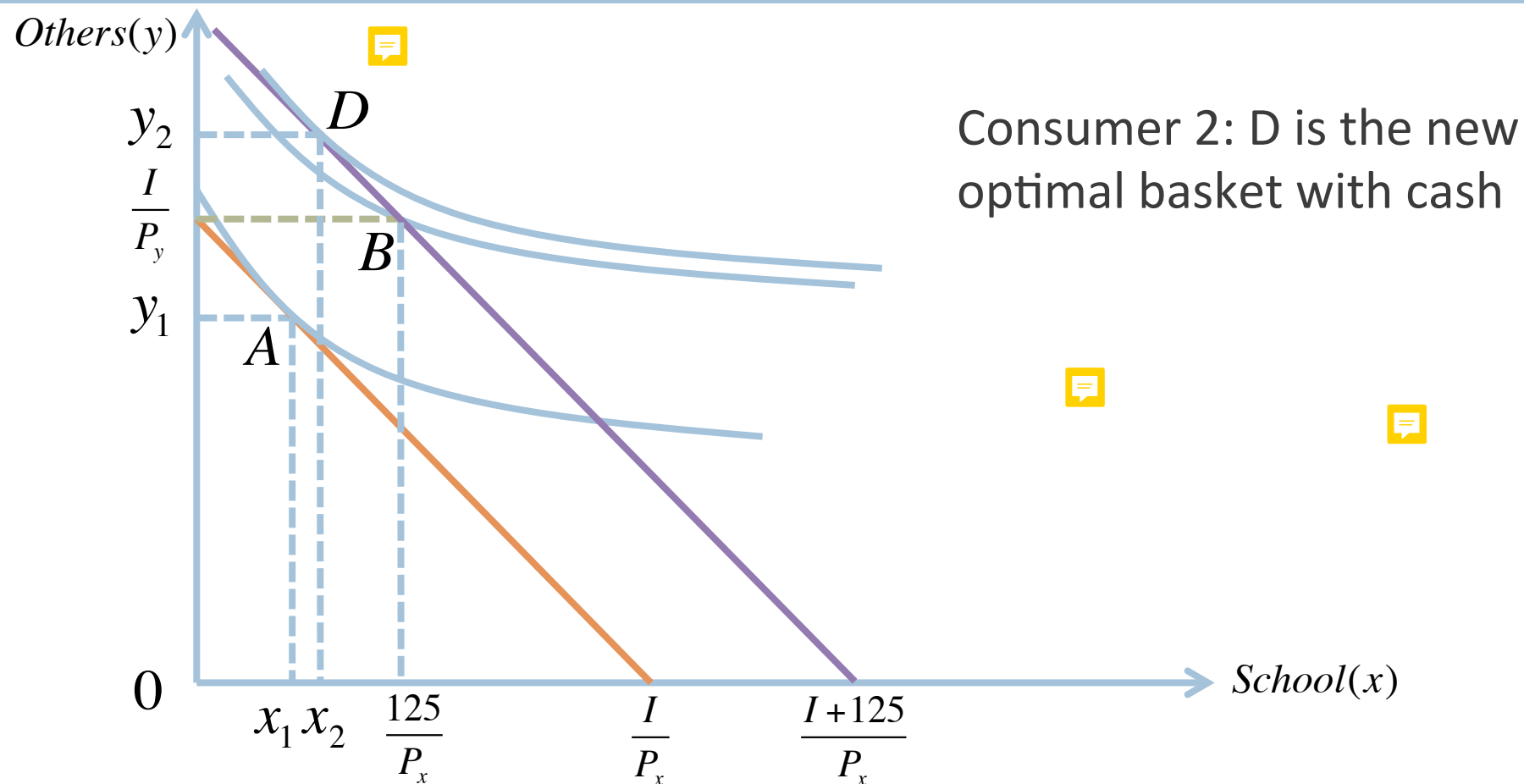
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Cash Gives Consumer 2 Higher Utility!



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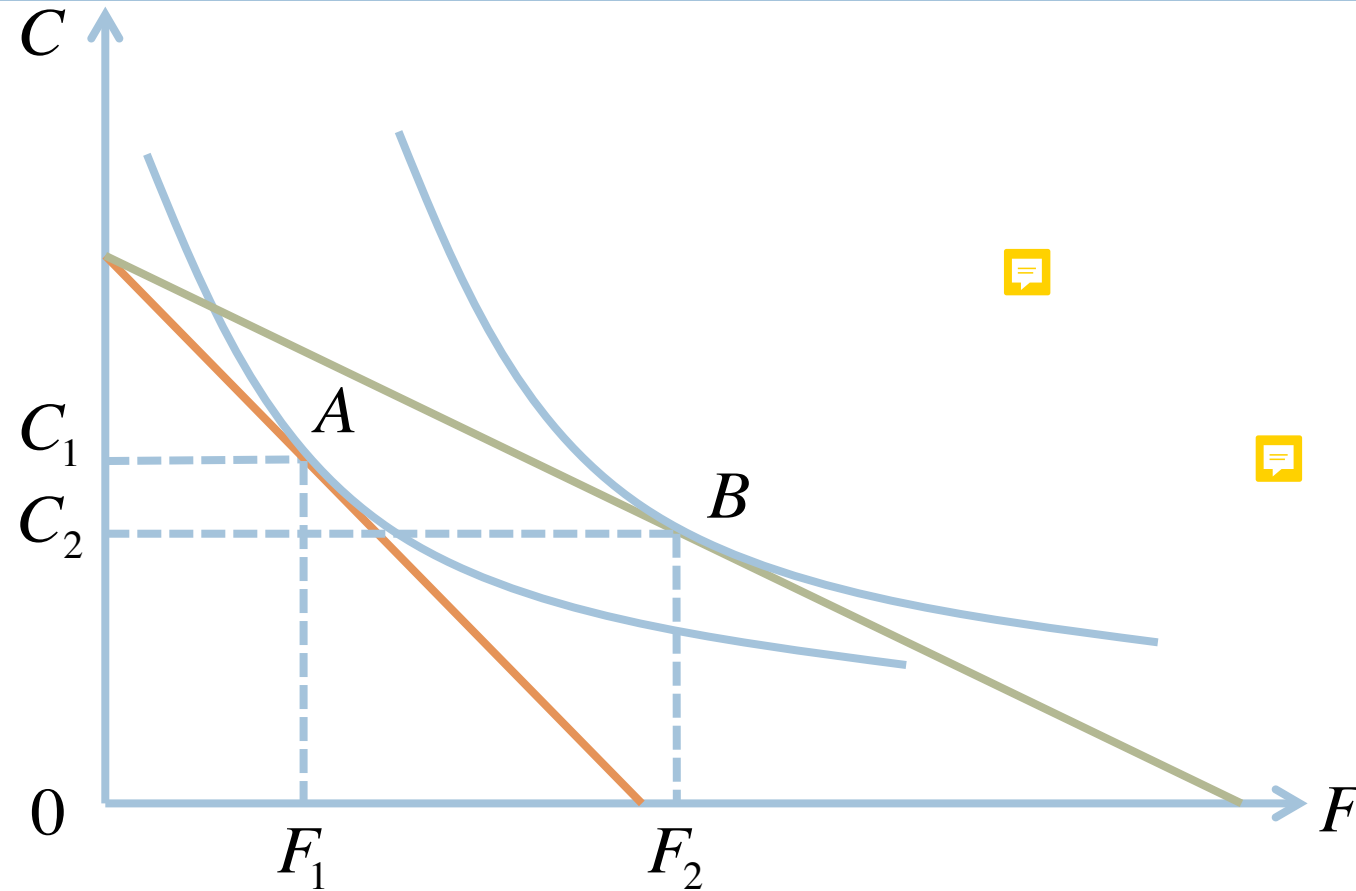


Part 2

Income and Substitution Effects




What happens to the consumption of food when food becomes cheaper?

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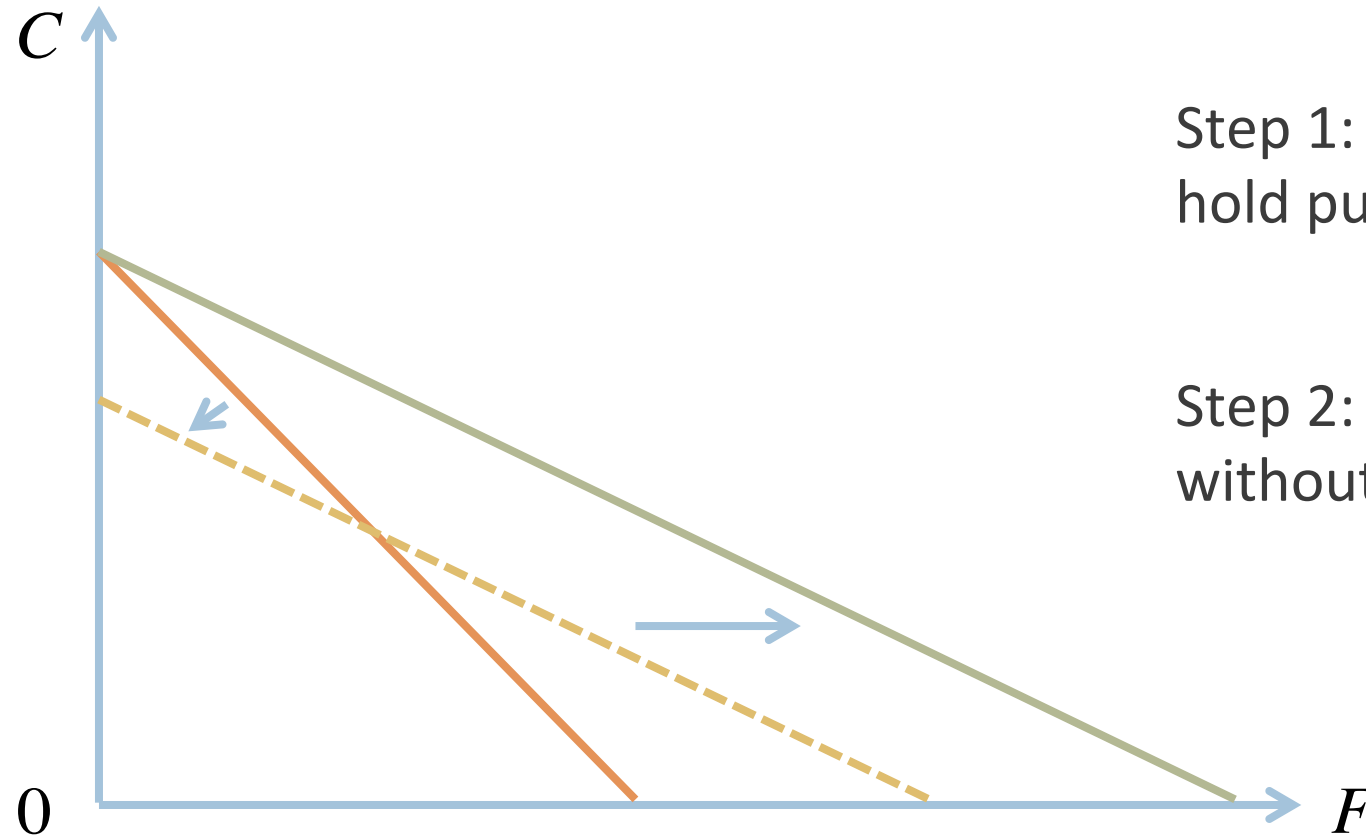
Why does the consumer buy more food?

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- Change in relative price 
 - ▣ Food becomes cheaper relative to clothing
 - Budget line becomes flatter
 - ▣ Consumer buys more food and less clothing
- Change in price also leads to a change in purchasing power
 - ▣ Consumer is effectively richer
 - New budget line is “higher” 
 - ▣ Consumer buys more food 

Decomposing the Change in Budget Line

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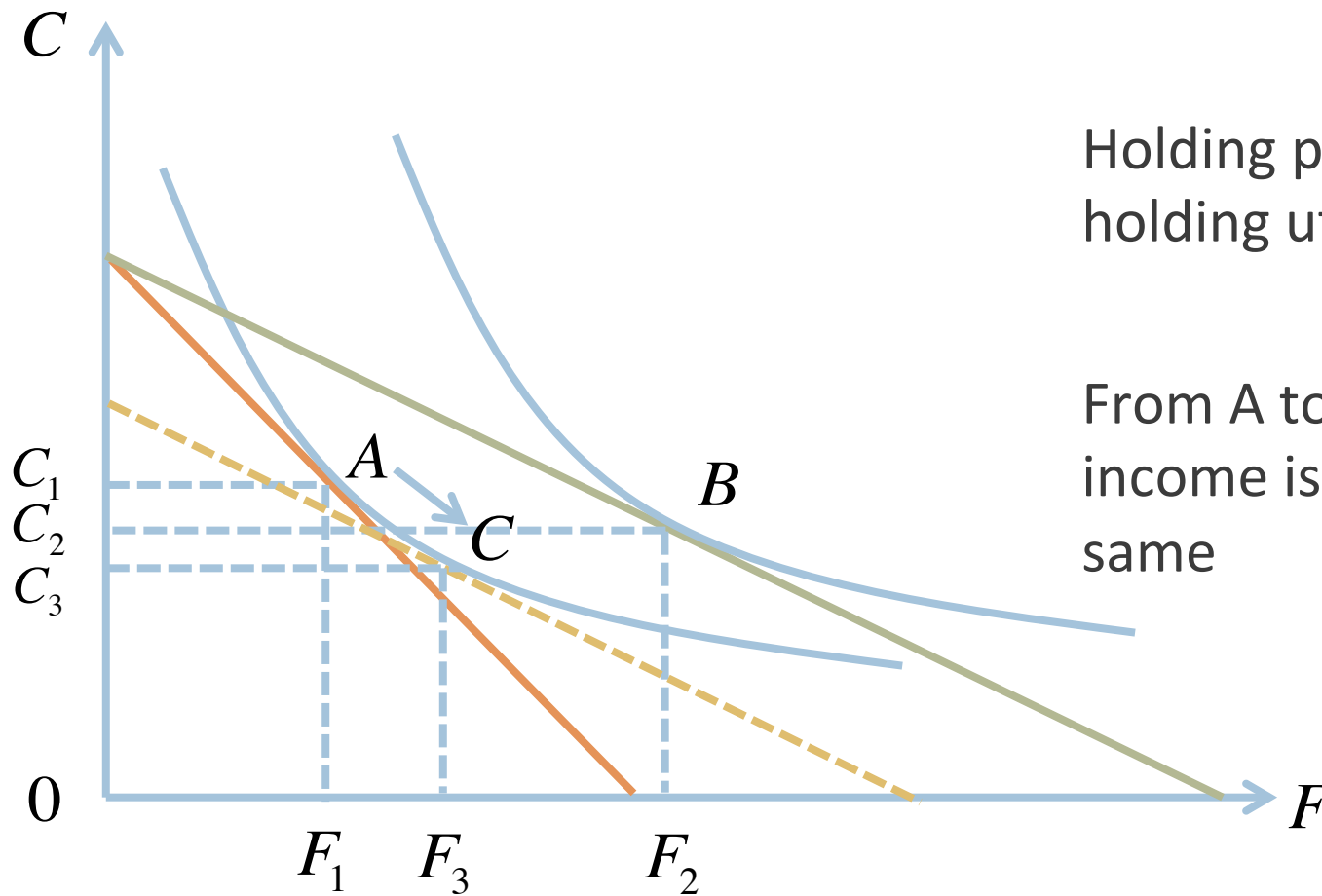


Step 1: Lower the price of food but hold purchasing power constant

Step 2: Increase purchasing power without changing the price of food

From A to C

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Holding purchasing power constant =
holding utility constant

From A to C, price of food is lower,
income is lower, but utility remains the
same

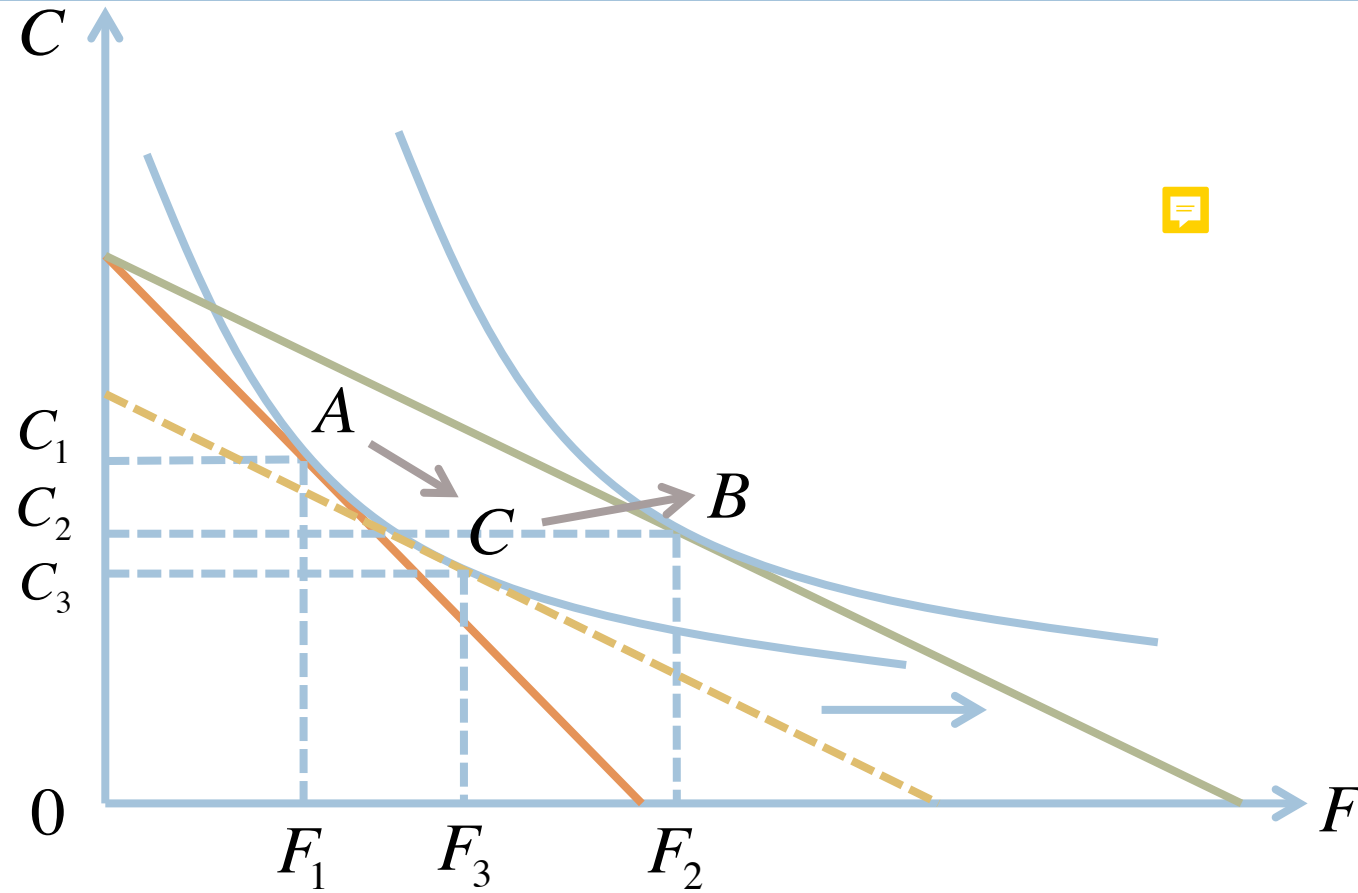
Substitution Effect

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- Definition 4.1 *Substitution effect* is the change in consumption of one good associated with a change in its price, holding the level of utility and other prices constant
- Substitution effect for food is $F_3 - F_1$
 - ▣ Let the price of food drop, and take away some income from the consumer so that the consumer is exactly as well off as before
 - ▣ The consumption of food increases from F_1 to F_3

From C to B

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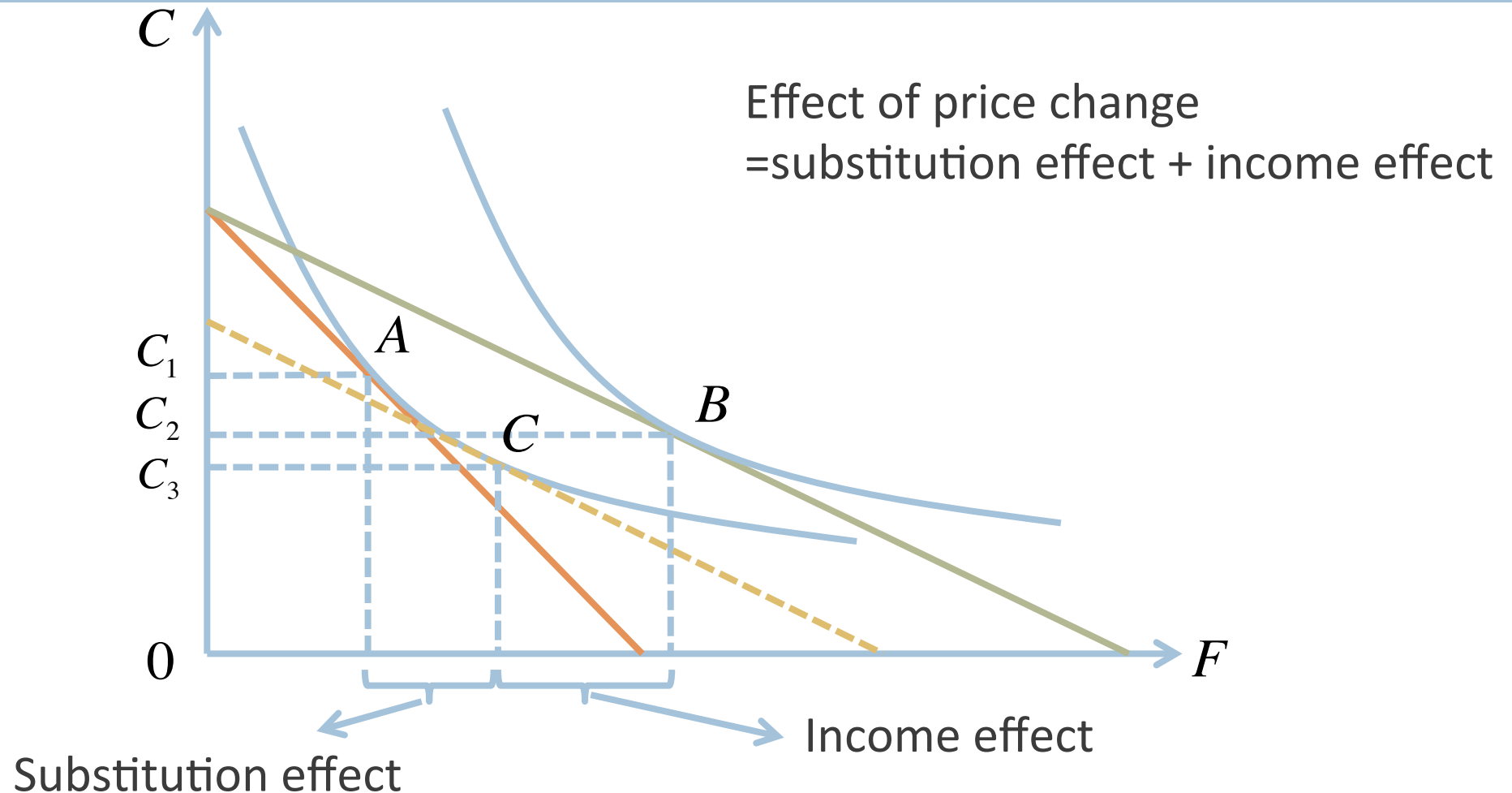
Income Effect

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- Definition 4.2 *Income effect* is the change in consumption of a good associated with a change in purchasing power, holding all prices constant
- Income effect for food is $F_2 - F_3$
 - ▣ Keep the prices fixed, and give back the consumer the income we took away
 - ▣ The consumption of food increases from F_3 to F_2

Decomposing the Effect of Price Change

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Example: Computing Substitution and Income Effects

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- Suppose the consumer has utility function

$$U(F,C) = FC$$

- Suppose price of food is 2, price of clothing is 2, income is 10
- Optimal basket is $F=2.5$, $C=2.5$, consumer's utility is 6.25
- Suppose price of food decreases to 1
- Then new optimal basket is $F=5$, $C=2.5$
- Total change in food is $5-2.5=2.5$

Example: Computing Substitution and Income Effects Cont'

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- The intermediate basket (basket C) must satisfy

$$FC = 6.25$$



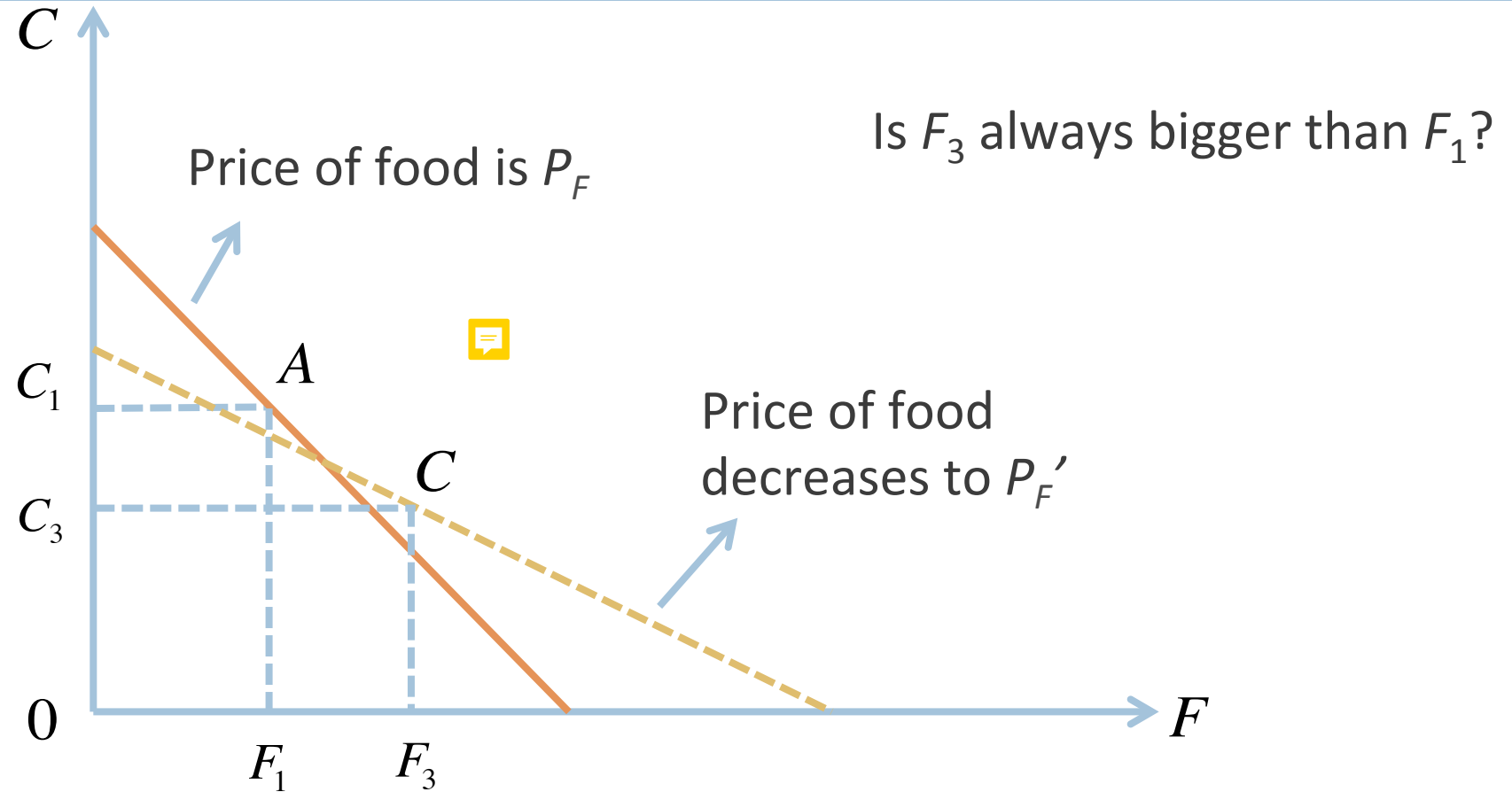
$$\frac{C}{F} = \frac{1}{2}$$

- The intermediate basket is $F=3.54$, $C=1.77$
- Substitution effect is
- Income effect is



Direction of Substitution Effect in Graph

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Direction of Substitution Effect

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- If price of food decreases, substitution effect is always non-negative
- Suppose from A (F_1, C_1) to C (F_3, C_3), the price of F dropped from P_F to P_F'
- We know the consumer is indifferent between A and C, A is optimal given the initial budget line, C is optimal given the intermediate budget line
- By revealed preference, we have

$$P_F F_3 + P_C C_3 \geq P_F F_1 + P_C C_1$$



Direction of Substitution Effect Cont'

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- Rearranging,

$$P_F(F_3 - F_1) + P_C(C_3 - C_1) \geq 0$$

$$P_F'(F_1 - F_3) + P_C(C_1 - C_3) \geq 0$$

- Adding up the two equations,

$$(P_F - P_F')(F_3 - F_1) \geq 0$$

- Thus

$$F_3 \geq F_1$$



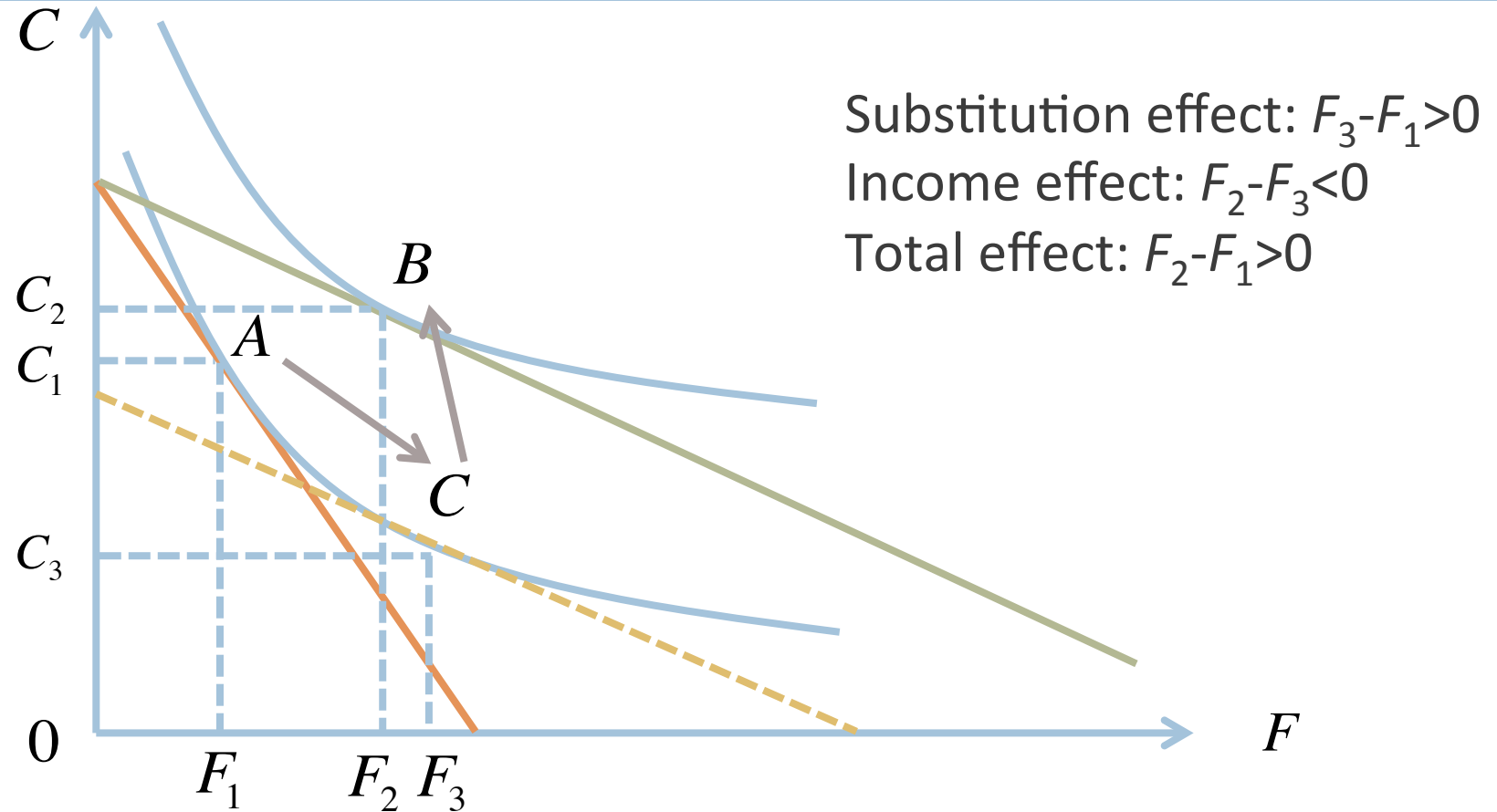
Direction of Income Effect

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- If food is normal
 - ▣ If price of food decreases, purchasing power increases, consumer buys more food
 - ▣ If price of food increases, purchasing power decreases, consumer buys less food
 - ▣ Income effect same direction as substitution effect
- What if food is inferior?
 - ▣ Income effect opposes substitution effect

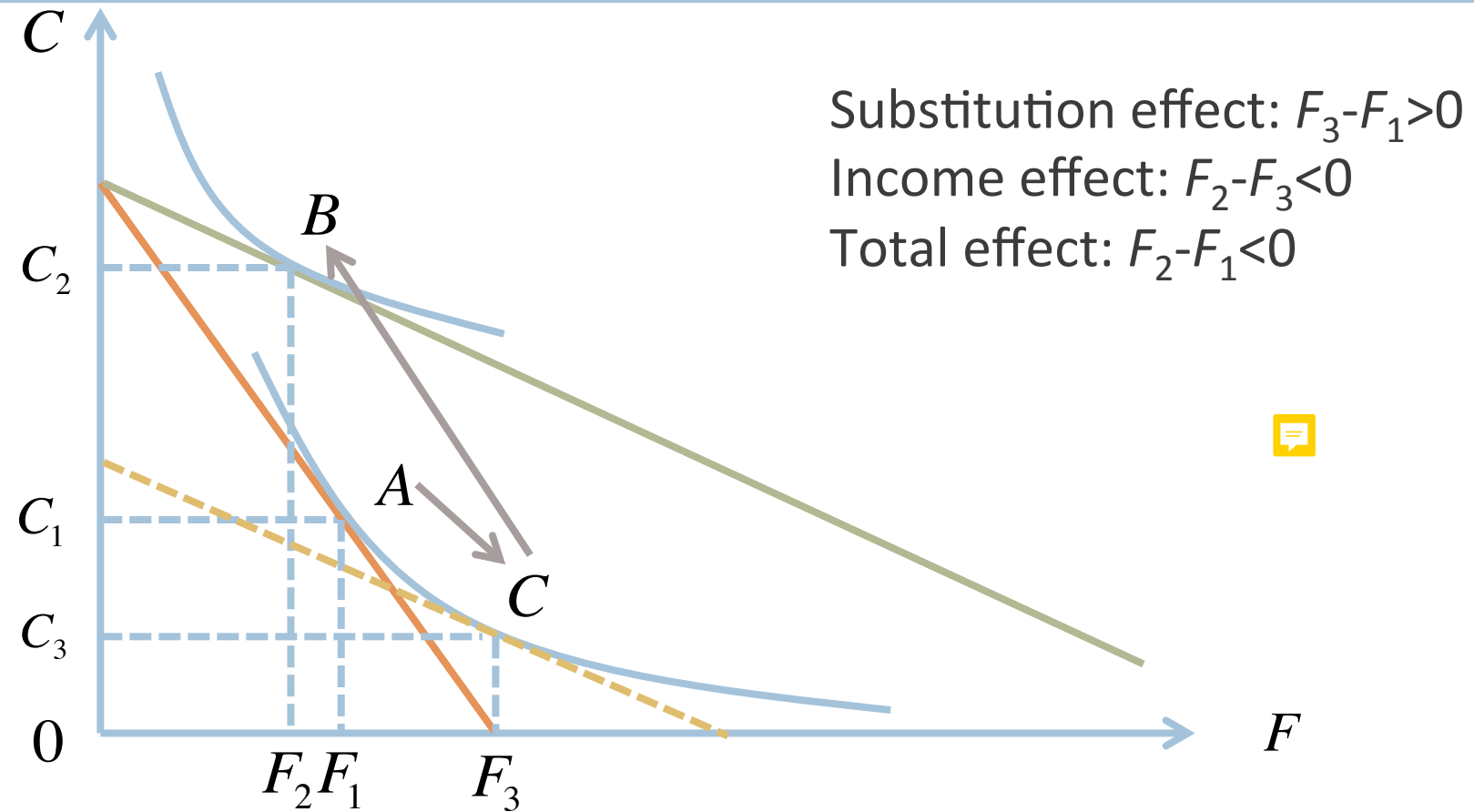
Income Effect for an Inferior Good

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What if income effect dominates substitution effect?

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Giffen Good

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- Definition 4.3 A good is a *Giffen good* if 
 - ▣ As price decreases, quantity demanded for the good drops
 - ▣ As price increases, quantity demanded for the good goes up
 - ▣ Holding other factors fixed
- Law of demand revisited
 - ▣ Is demand curve always downward sloping?
 - ▣ Not for Giffen good!
 - ▣ Demand curve is upward sloping for Giffen good

Example: Rice as Giffen Good



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- Jensen and Miller conducted field experiments on poor urban households in China
 - ▣ Hunan province: provides subsidy on rice
 - ▣ Gansu province: provides subsidy on wheat 
- What do they find?
 - ▣ 1% decrease in the price of rice causes 0.22% decrease in rice consumption

Source: Jensen and Miller, *“Giffen Behavior and Subsistence Consumption”*, 2008

Giffen Goods vs. Inferior Goods

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- Giffen goods
 - ▣ Positive correlation between price and quantity demanded
- Inferior goods
 - ▣ Negative correlation between income and quantity demanded
- Are all Giffen goods inferior goods? 
- Are all inferior goods Giffen goods? 

Part 3

Consumer Welfare

How to measure the change in utility when price changes?

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- When the price of a good decreases
 - ▣ Consumer is usually better off (higher utility)
- When the price of a good increases
 - ▣ Consumer is usually worse off (lower utility)
- How to quantify the benefit or loss due to a change in price?
 - ▣ Consumer surplus
 - ▣ Compensating variation
 - ▣ Equivalent variation

Why is measuring consumer welfare important?

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- Consider the merger between Grab and Uber
- CCCS concluded the merger was anti-competitive
- There may be some benefits
 - ▣ E.g., merger may reduce the cost of production
- There may be some costs
 - ▣ E.g., the new firm may be able to set higher prices
 - ▣ Need to estimate the potential damage to consumers due to higher prices

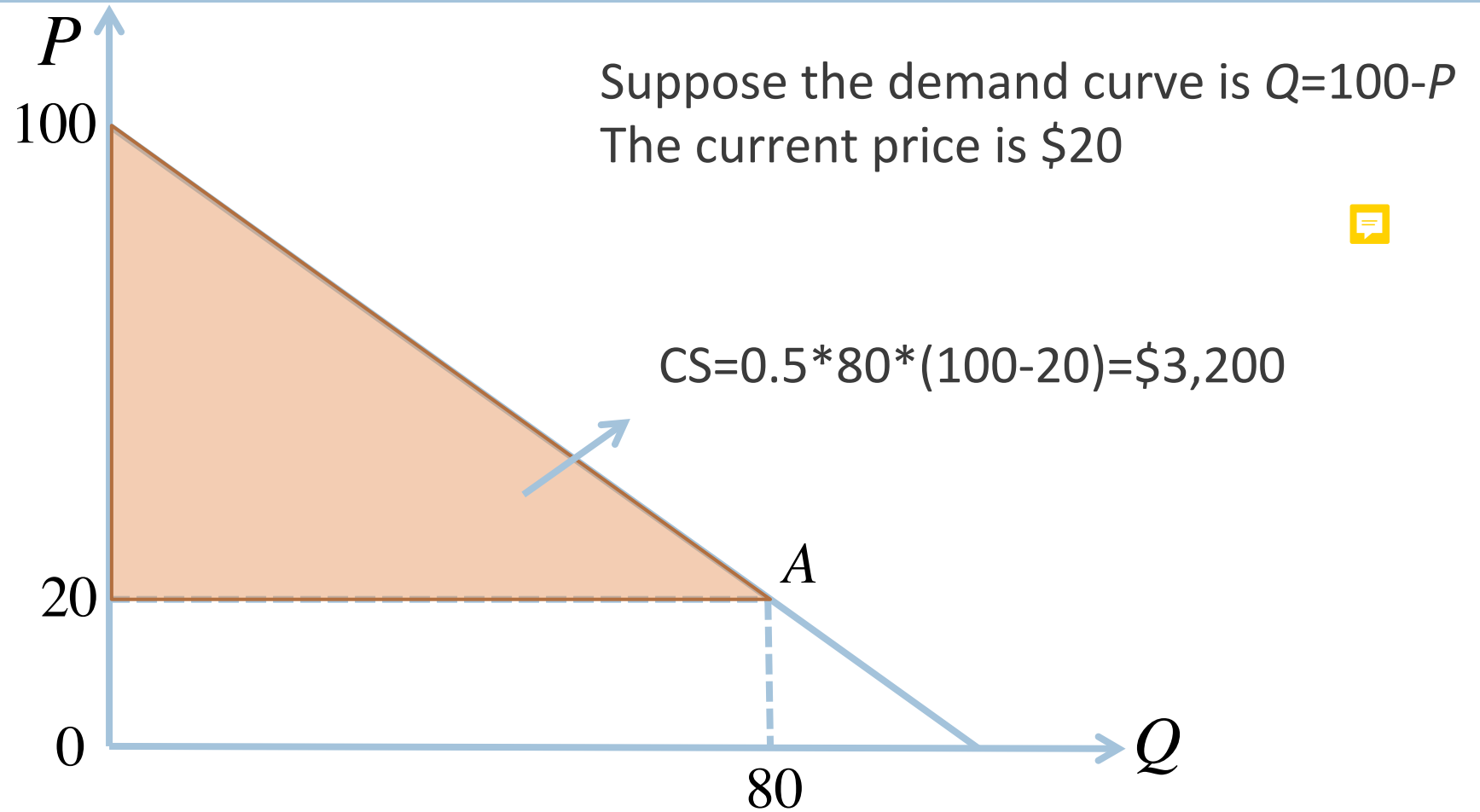
Consumer Surplus

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- Definition 4.4 *Consumer surplus* (CS) for an individual consumer is the difference between the consumer's willingness to pay for a good and the cost of purchasing the good
 - ▣ E.g., the consumer is willing to pay 1 million to buy a house
 - ▣ The consumer actually paid 0.8 million
 - ▣ CS is 0.2 million
- CS is the area below the demand curve and above the price

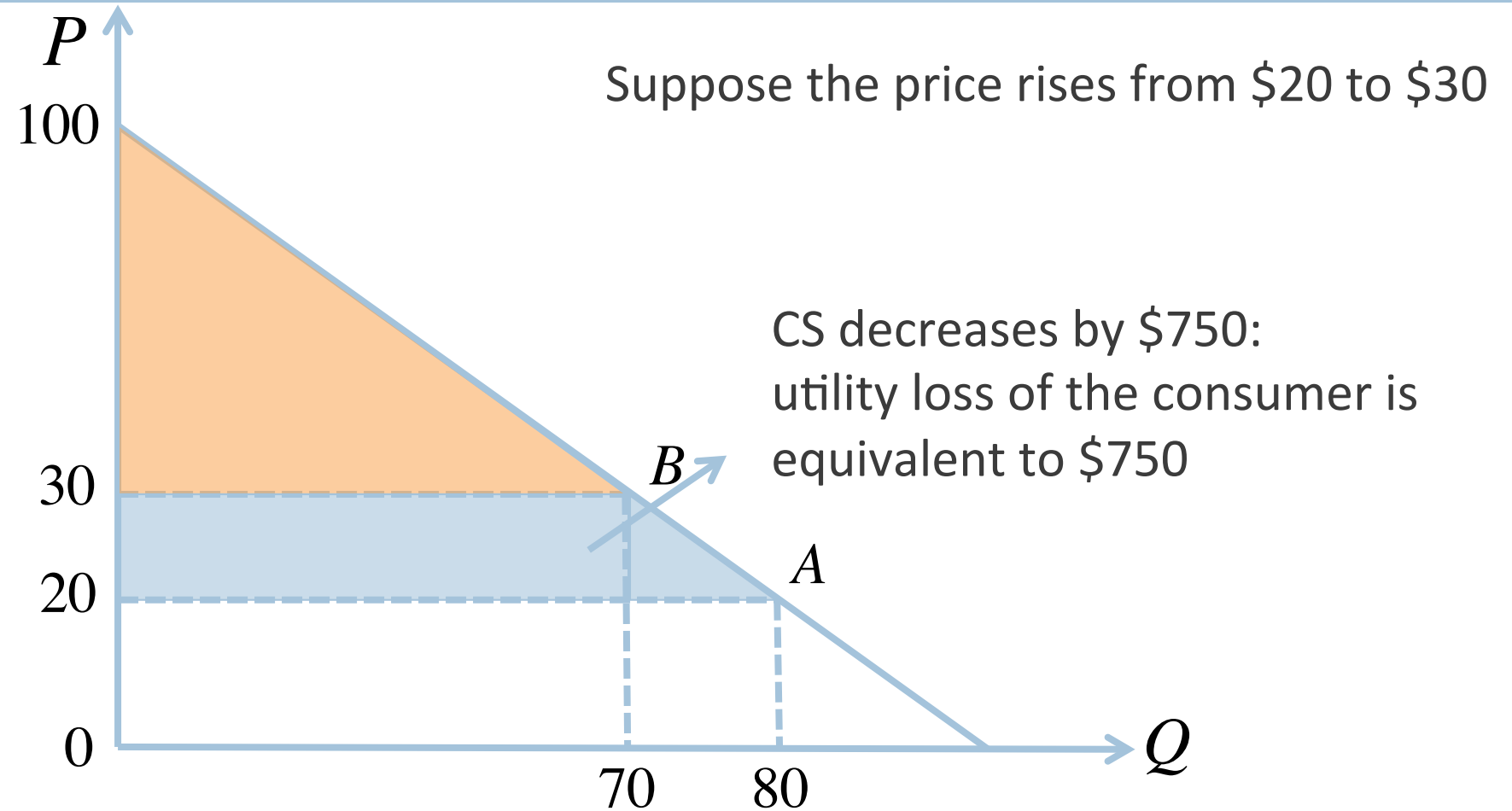
Consumer Surplus in Graph

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Change in Consumer Surplus

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Compensating Variation: An Example

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- Suppose the consumer buys food and clothing and has an income of \$100
 - ▣ At the initial optimal basket, his utility is 20
- Suppose food becomes cheaper
- After the price drop, to still get a utility of 20, the consumer only needs to spend \$90
- The compensating variation is $\$100 - \$90 = \$10$
 - ▣ After the price drop, the consumer can spend \$10 less and still get the same utility as before, thus the benefit of the price drop is equivalent to \$10

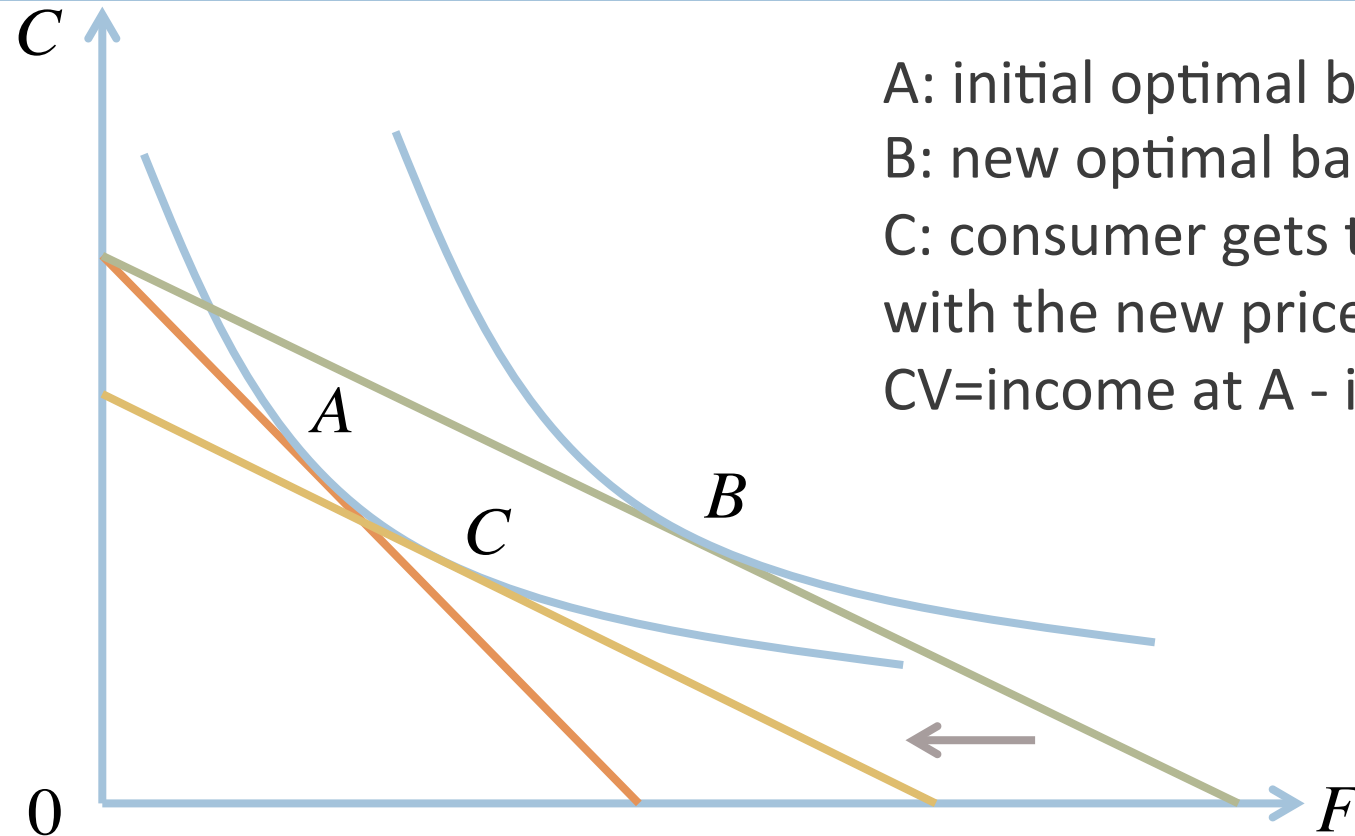
Compensating Variation: Definition

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- Definition 4.5 *Compensating variation* (CV) measures the amount of money (income) the consumer is willing to give up after the price drop to be just as well off as before the price drop 
- The initial optimal basket is A
- Suppose the price of food drops
- Given the new price, the optimal basket that generates the same level of utility as basket A is basket C 
- $CV = \text{income at A} - \text{income at C}$ 

Compensating Variation in Graph

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A: initial optimal basket
B: new optimal basket
C: consumer gets the old utility
with the new price
 $CV = \text{income at A} - \text{income at C}$

Equivalent Variation: An Example

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- Suppose the consumer buys food and clothing and has an income of \$100
 - ▣ At the initial optimal basket, his utility is 20
- Suppose food becomes cheaper
 - ▣ At the new optimal basket, his utility is 30
- Before the price drop, if the consumer wants to get a utility of 30, the consumer needs an income of \$120
- The equivalent variation is $\$120 - \$100 = \$20$
 - ▣ Before the price drop, if the consumer wants to get the same level of utility as after the price drop, he needs an additional income of \$20, thus the benefit of the price drop is equivalent to \$20



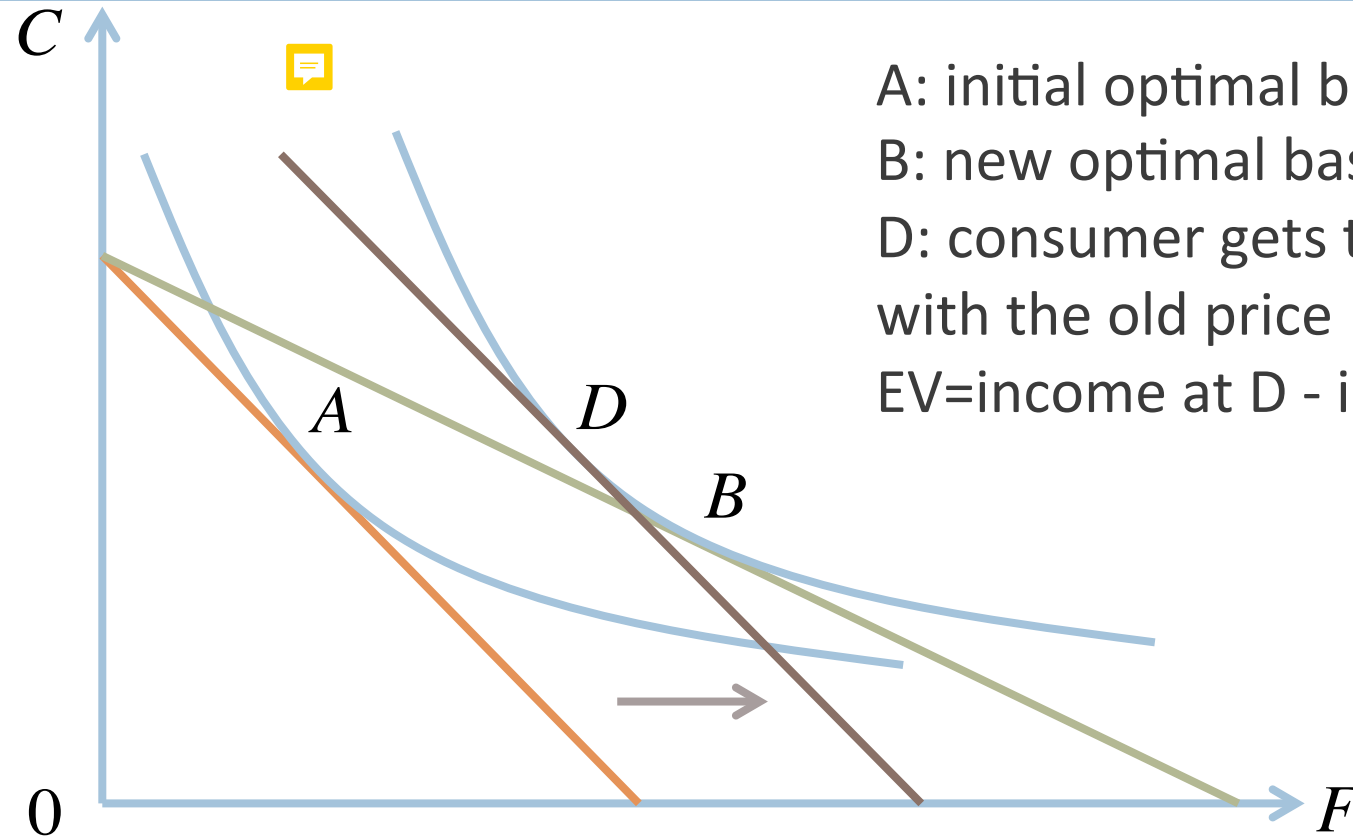
Equivalent Variation: Definition

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- Definition 4.6 *Equivalent variation* (EV) measures the additional amount of money (income) the consumer needs before the price drop to be as well off as after the price drop
- The initial optimal basket is A
- Suppose the price of food drops
- The new optimal basket is B
- Given the initial price, the optimal basket that generates the same level of utility as basket B is basket D
- $EV = \text{income at D} - \text{income at A}$

Equivalent Variation in Graph

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A: initial optimal basket
B: new optimal basket
D: consumer gets the new utility
with the old price
 $EV = \text{income at D} - \text{income at A}$



Example: Calculating CV and EV

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- Suppose the consumer has utility function

$$U(F, C) = FC$$

- Suppose price of food is \$2, price of clothing is \$2, income is \$10
- Optimal basket (A) is $F=2.5$, $C=2.5$, consumer's utility is 6.25
- Suppose price of food decreases to \$1
- Then new optimal basket (B) is $F=5$, $C=2.5$, consumer's utility is 12.5

Example: Calculating CV and EV Cont'

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- Basket C must satisfy

$$FC = 6.25$$

$$\frac{C}{F} = \frac{1}{2}$$

- Basket C is $F=3.54$, $C=1.77$
- To afford C, the consumer needs an income of

$$P_F F + P_C C = 1 \times 3.54 + 2 \times 1.77 = 7.08$$

- Thus $CV=10-7.08=\$2.92$
 - ▣ The utility gain from the price decrease is equivalent to \$2.92

Example: Calculating CV and EV Cont'

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- Basket D must satisfy



- Basket D is $F=3.54$, $C=3.54$
- To afford D, the consumer needs an income of
$$P_F F + P_C C = 2 \times 3.54 + 2 \times 3.54 = 14.16$$

- Thus $EV=14.16-10=\$4.16$
 - ▣ The utility gain from the price decrease is equivalent to \$4.16