

## Budgets

ECON 370: Microeconomic Theory

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## Spending and Income

- Suppose Cathy consumes two goods 1 and 2.
  - Quantity of good 1 consumed is  $x_1$
  - Quantity of good 2 consumed is  $x_2$
  - Let  $p_1$  and  $p_2$  denote the prices of good 1 and good 2, respectively
  - Let  $m$  be Cathy's (money) income
- The amount she spends is  $p_1x_1 + p_2x_2$
- Ignoring the possibility of borrowing, she cannot spend more than her income
  - That is:  $p_1x_1 + p_2x_2 \leq m$

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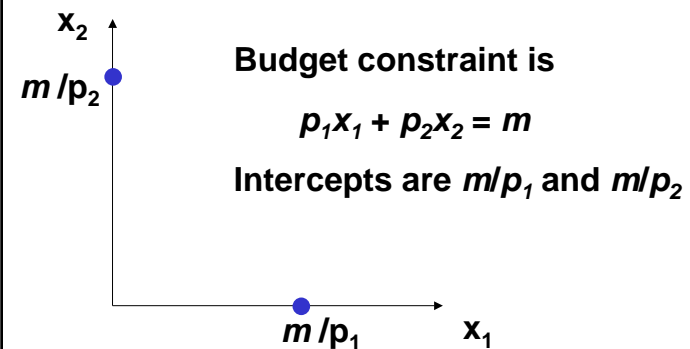
## The Budget Line

- The line  $p_1x_1 + p_2x_2 = m$  is often referred to as the budget line.
  - It shows the maximum possible amounts that can be spent on the two goods.
- The *Feasible Set* is the set of all affordable consumption bundles
  - That is all bundles  $(x_1, x_2)$  such that  $p_1x_1 + p_2x_2 \leq m$
  - And  $x_1 \geq 0$  and  $x_2 \geq 0$ .

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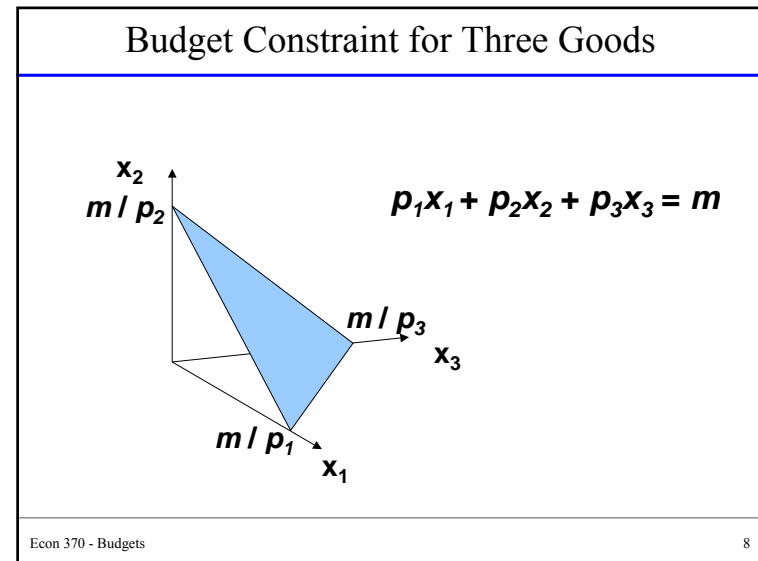
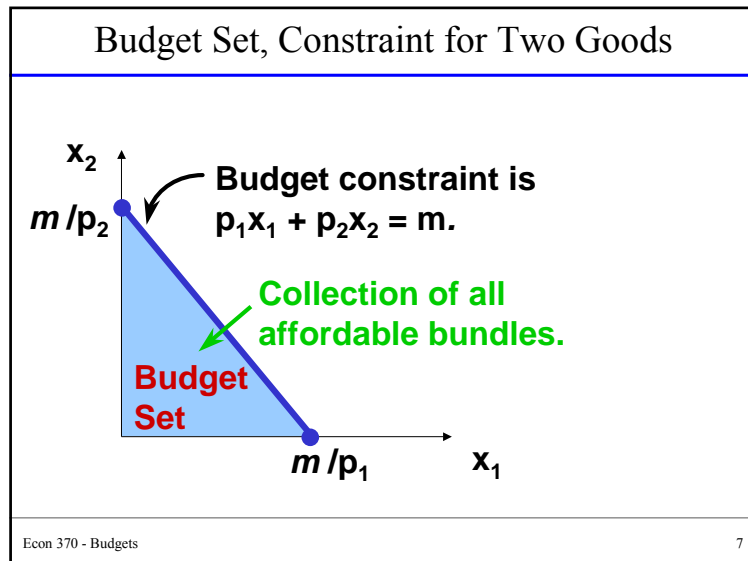
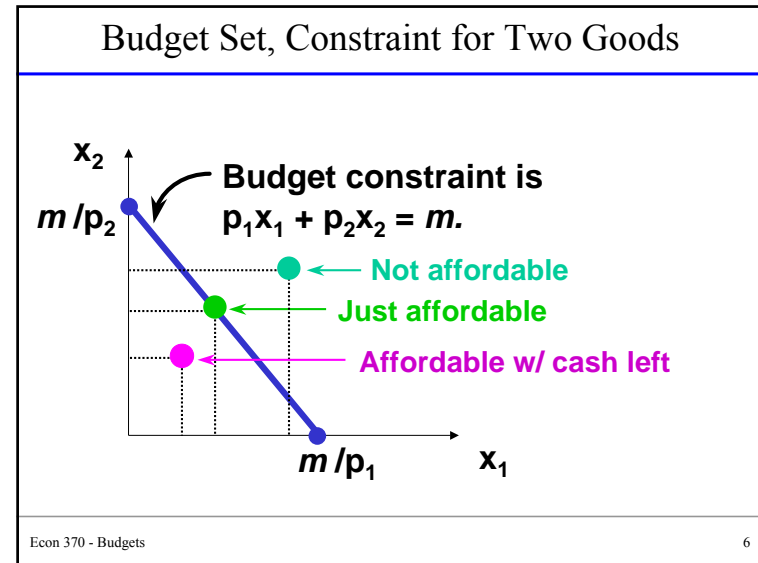
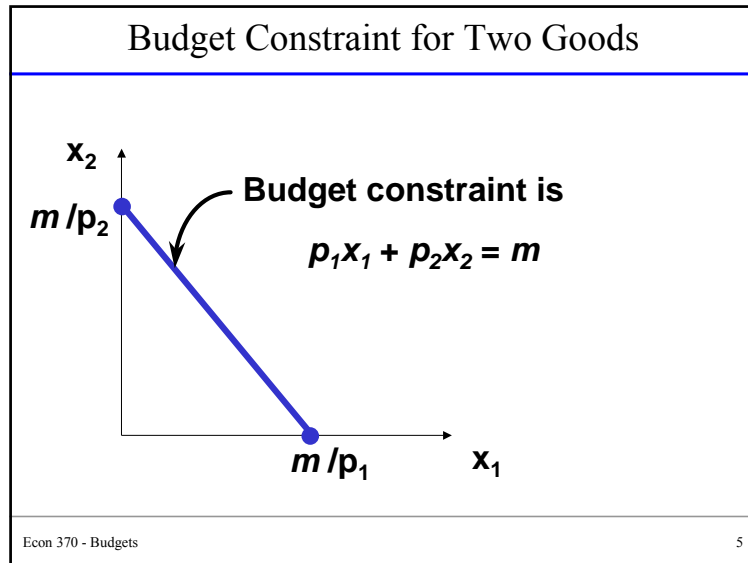
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## Budget Constraint: Intercepts



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## Slope of the Budget Constraint

Since  $p_1x_1 + p_2x_2 = m$

Then  $x_2 = \frac{m}{p_2} - \frac{p_1}{p_2}x_1$

Or  $\frac{dx_2}{dx_1} = -\frac{p_1}{p_2}$

- We can interpret this as the opportunity cost of a good
- If I want more of good  $x_2$ , I must give up  $(p_1 / p_2)$  units of good  $x_1$  to get it.

## Changes in Budgets

- What happens if:
  - Income increases
  - Income decreases
  - Price of good 1 increases
  - Price of good 2 decreases
  - All prices and income increase by 10%

## Composite Commodities

- We can only conveniently analyze two goods in a budget set diagram.
- In practice people consume a wide variety of goods.
- Often we are interested in describing how some change in price or income affects the amount of one good that can be purchased e.g. loaves of bread.
- To consider this case, it is often convenient to treat all goods other than the good that is of interest as a single *composite commodity* whose quantity is measured in dollars.

## Composite Commodities (cont)

- Let  $x_1$  represent loaves of bread
- Let  $x_2$  represent dollars spent on everything else
- As before, we have  $p_1x_1 + p_2x_2 = m$
- Dividing through by  $p_2$  we get:
  - $(p_1 / p_2)x_1 + x_2 = (m / p_2)$
- One conclusion of this is that we can define prices based on any *numeraire* we want so long as we are consistent about it
- Also note that measuring the amount of other goods in dollars is valid only if the relative prices of these other goods is not changing

## Non-Linear Budget Constraints

- Not all budget constraints are linear
- People may be prohibited from buying all of a good they can afford
- Prices may (and often do) vary depending on quantity purchased
- Example: the Food Stamp Program

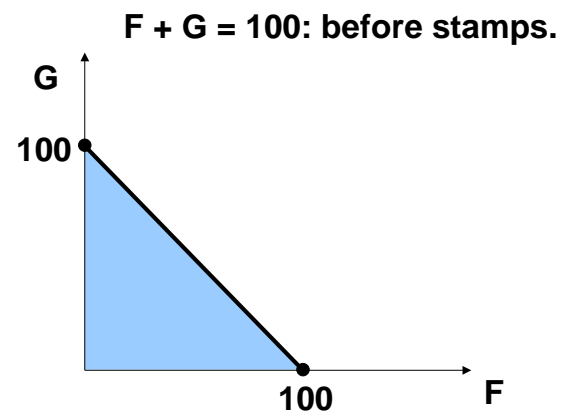
## The Food Stamp Program

- Popular income support program
- Coupons given to poor (used to be sold)
- Can be legally exchanged only for food
- Popular with some donors
- Popular with agricultural interests

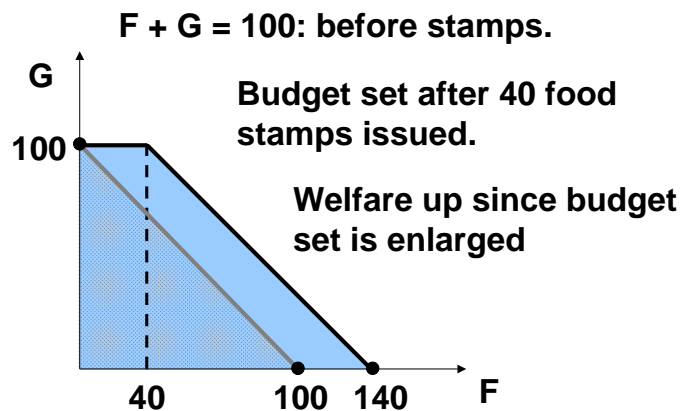
## The Food Stamp Program

- What is effect on budget constraint?
  - Suppose  $m = \$100$
  - Price of food:  $p_F = \$1$
  - Price of “all other goods”:  $p_G = \$1$
  - Other goods is “numeraire” good
  - Budget constraint is  $F + G = 100$
  - Key factor: Income available for “other goods” does not change with receipt of food stamps
  - Suppose receive food stamps for \$40 worth of food

## The Food Stamp Program



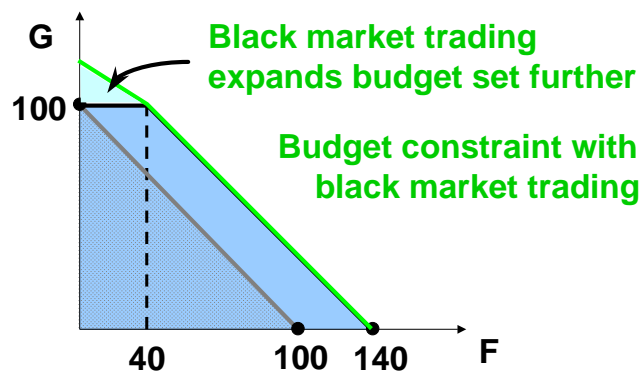
### The Food Stamp Program



### The Food Stamp Program

- If food stamp program is generous, families may be at “kink” of budget set
- What if food stamps can be traded on a black market for \$0.50 each?

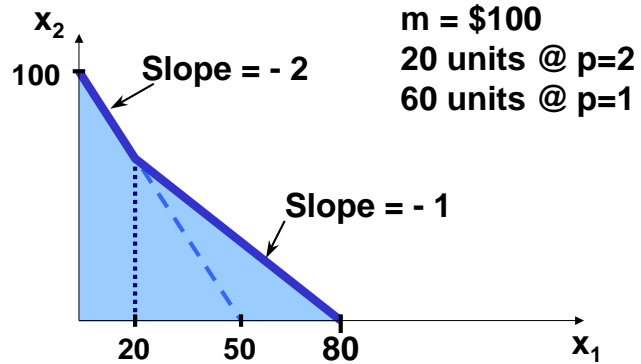
### The Food Stamp Program



### Quantity-Based Prices

- Price may be a function of quantity
  - Quantity discounts for large buyers
  - Penalties for buying “too much”
- Budget constraints “kinked” where  $p$  changes
- Suppose quantity discount:
  - $p_2$  constant at \$1 and  $m = 100$
  - $p_1 = \$2$  for  $0 \leq x_1 \leq 20$ ;  $-p_1 / p_2 = -2$
  - $p_1 = \$1$  for  $x_1 > 20$ ;  $-p_1 / p_2 = -1$
  - What does the budget set look like?

## Budget Constraints w/ Quantity Discount



## Quantity Restrictions

- Suppose as follows:
  - $p_1 = \$2$
  - $p_2 = \$1$
  - $m = 100$
  - But not allowed to buy more than \$25 of good 1
- What does the budget set look like?

## More General Choice Sets

- Other constraints on choices
  - Time constraints (labor choice)
  - Other resource constraints
- “Available” bundle must meet all relevant constraints simultaneously
- Budget set is intersection of each set formed by each separate constraint

## Example

- Instead of budgeting Money, let's budget time
  - Erika is choosing how much time to work per week
  - If she works, she earns a wage of \$25 / hour
  - In addition, she has \$250 in non-wage income
- What would this budget set look like?