## Ch 2: Budget Line

### The Economic Theory of the Consumer

**Object of study:** **consumer (household)**

**Why this theory:** **satisfaction – given limited resources (our "consumption monkey")**

**Assumptions:** **consumer demands the best bundle of goods he can afford**

**⇒Separating into two questions:**

- **What bundles of goods are affordable to the consumer?**
- **What bundle of goods is the best? (ch. 3: preferences)**



## 2.1 Notation: The Budget Constraint

| | |
|---|---|
| $x_1, x_2$ | **consumption bundle** |
| $p_1, p_2$ | **price vector** |
| $m$ | **budget** |
| $p_1 x_1 + p_2 x_2 \leq m$ | **budget constraint** |
| $\{(x_1, x_2) \mid p_1 x_1 + p_2 x_2 \leq m\}$ | **budget set** |
| $\{(x_1, x_2) \mid p_1 x_1 + p_2 x_2 = m\}$ | **budget line** |

## 2.2 Two Goods Are Often Enough

**Why we may restrict our attention to the 2-good case**

**(We do so because this permits us to use 2-dimensional graphs)**

- **We interpret good #2 as a composite good,**
  **"all the other goods in one", later: "money"**

- **Relative prices is a *real exchange rate* *"of the market":***

$$\frac{p_1}{p_2} = \frac{[\$/\text{units of good 1}]}{[\$/\text{units of good 2}]} = \frac{\text{units of good 2}}{\text{units of good 1}}$$

- **Special case: $p_2 = 1$ (Good 2 is the numéraire)**

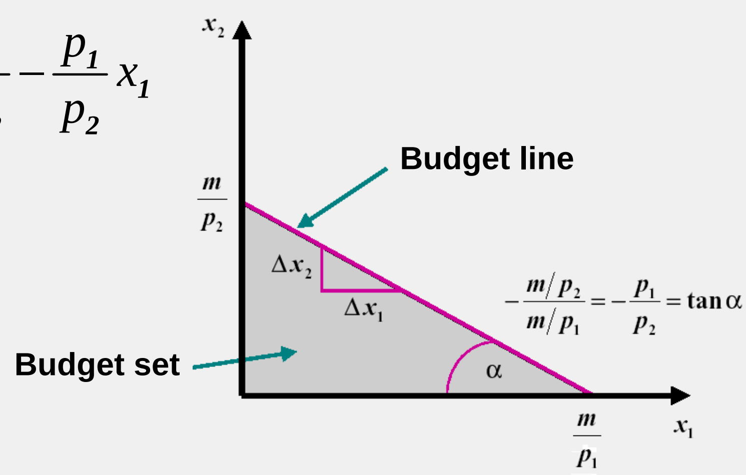
$$\Rightarrow p_1 x_1 + x_2 = m \Leftrightarrow x_2 = m - p_1 x_1$$



## 2.3 Properties of the Budget Set

$$p_1 x_1 + p_2 x_2 = m$$

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



## Interpreting the slope of the budget line

♦ **Slope of the budget line indicates the <u>opportunity costs</u> of good 1:**
**How many units of good 2 is the consumer giving up in order to gain one (marginal) unit of good 1?**

$$p_1 x_1 + p_2 x_2 = m$$

$$p_1(x_1 + \Delta x_1) + p_2(x_2 + \Delta x_2) = m \quad \Big| -()$$

$$p_1 \Delta x_1 + p_2 \Delta x_2 = 0 \Leftrightarrow \frac{\Delta x_2}{\Delta x_1} = -\frac{p_1}{p_2}$$

♦ **Intercepts indicate the maximum quantities that can be bought if the consumer decides to buy only one of the goods.**



## Budget line and comparative statics

**What action / external variable) influences the position the budget line?**

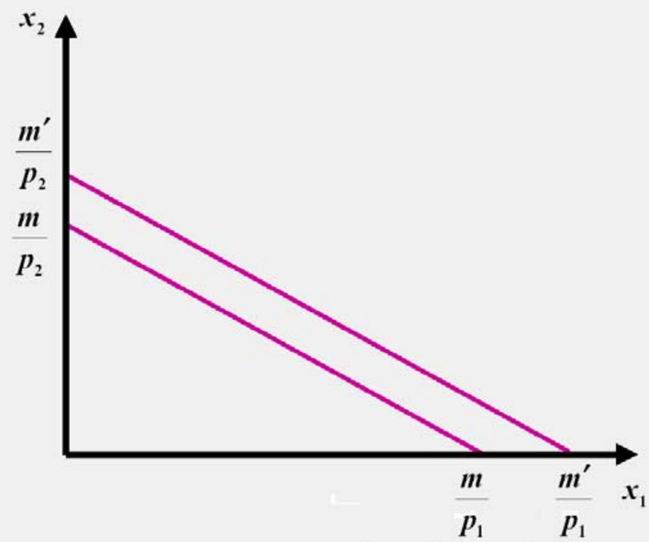
- ♦ **Change in income (budget)**
- ♦ **Change in price**
- ♦ **Tax**
- ♦ **Subsidy**

## Budget line and comparative statics

$$p_1x_1 + p_2x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{p_1}{p_2}x_1$$

$$p_1x_1 + p_2x_2 = m'$$
$$\Leftrightarrow x_2 = \frac{m'}{p_2} - \frac{p_1}{p_2}x_1$$

$$m' > m$$



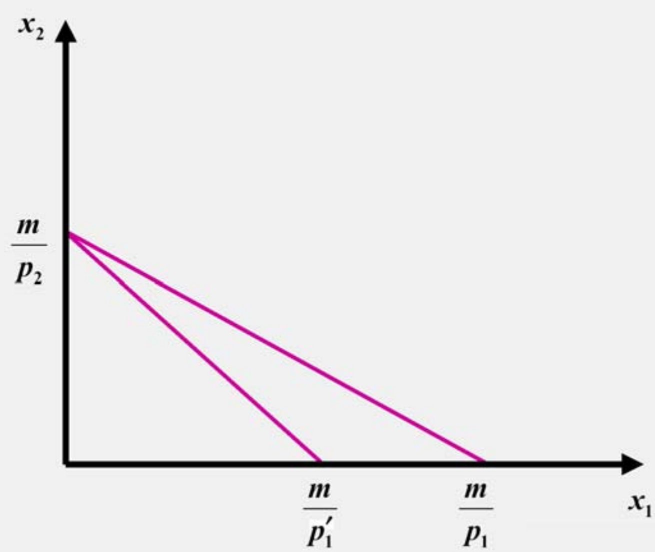



## Budget line and price increase

$$p_1x_1 + p_2x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{p_1}{p_2}x_1$$

$$p_1'x_1 + p_2x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{p_1'}{p_2}x_1$$

$$p' > p$$



## Budget line and other price changes

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

$$p_1 x_1 + p_2' x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2'} - \frac{p_1}{p_2'} x_1$$

$$\lambda p_1 x_1 + \lambda p_2 x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m/\lambda}{p_2} - \frac{p_1}{p_2} x_1$$

$$\lambda p_1 x_1 + \lambda p_2 x_2 = \lambda m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{p_1}{p_2} x_1$$



## Taxes, subsidies and the budget line

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

$$(p_1 + t) x_1 + p_2 x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{p_1 + t}{p_2} x_1$$

**quantity tax**
**(per unit purchased)**

$$(1+\tau) p_1 x_1 + p_2 x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{(1+\tau) p_1}{p_2} x_1$$

**value tax**
**(price, ad valorem)**

## Taxes, subsidies and the budget line II

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

$$(p_1 - s)x_1 + p_2 x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{p_1 - s}{p_2} x_1$$

**quantity subsidy**

$$(1-\sigma)p_1 x_1 + p_2 x_2 = m$$
$$\Leftrightarrow x_2 = \frac{m}{p_2} - \frac{(1-\sigma)p_1}{p_2} x_1$$

**ad valorem subsidy**

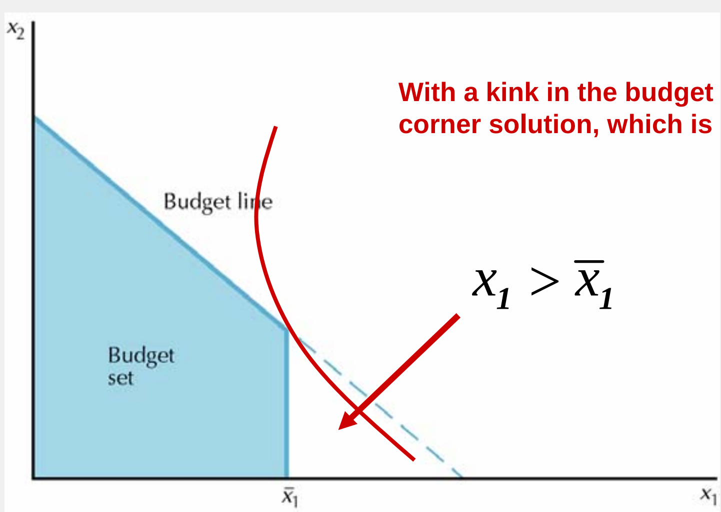
$$p_1 x_1 + p_2 x_2 = m - t$$
$$\Leftrightarrow x_2 = \frac{m-t}{p_2} - \frac{p_1}{p_2} x_1$$

**lump-sum tax**



## Rationing constraints

**With a kink in the budget line you get a corner solution, which is never optimal.**




$$x_1 > \bar{x}_1$$

Figure 2.4 Budget set with rationing

**good 1 is rationed**

## Combining rationing with taxes/subsidies

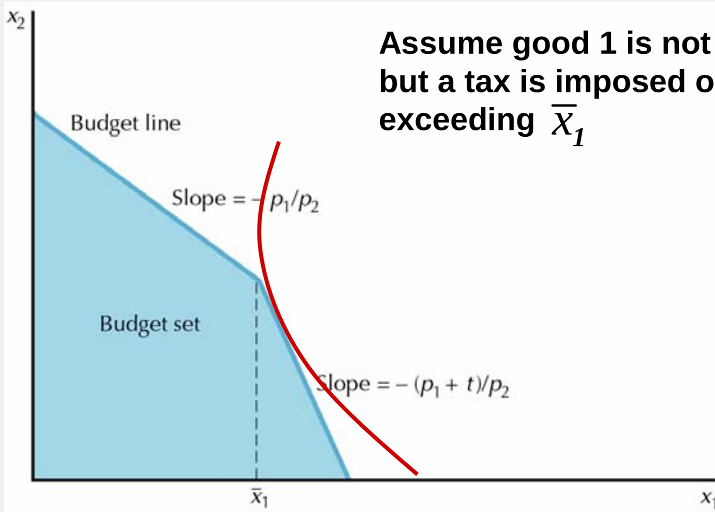
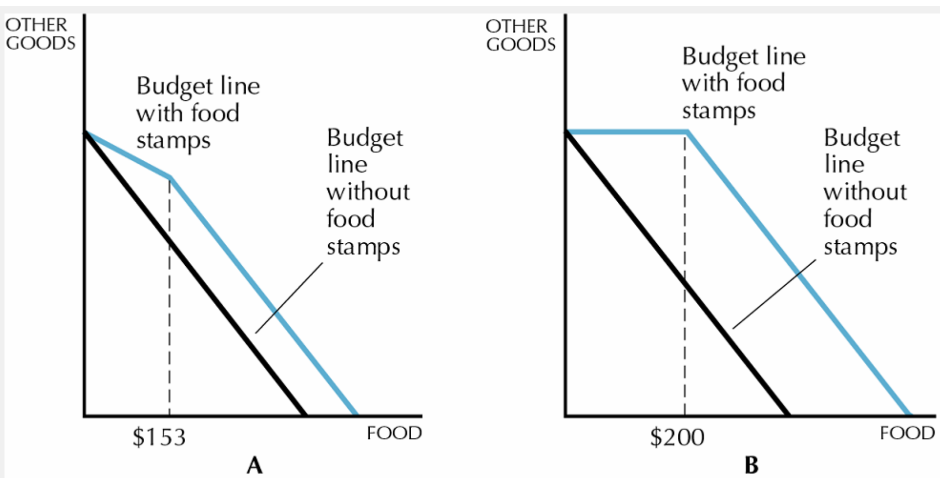



**Figure 2.5** Taxing consumption greater than $\bar{x}_1$

**Assume good 1 is not rationed, but a tax is imposed on all quantities exceeding $\overline{X}_1$**



## Example: Food Stamp Act




*A: ad valorem subsidy of 1-25/153=84 percent (qualified households can buy food stamps worth $153 for $25*
*B: qualified households get $200 worth of food for free.*

## Food Stamp Act: Case A (before 1979)