Demand function and elasticity of demand

Demand

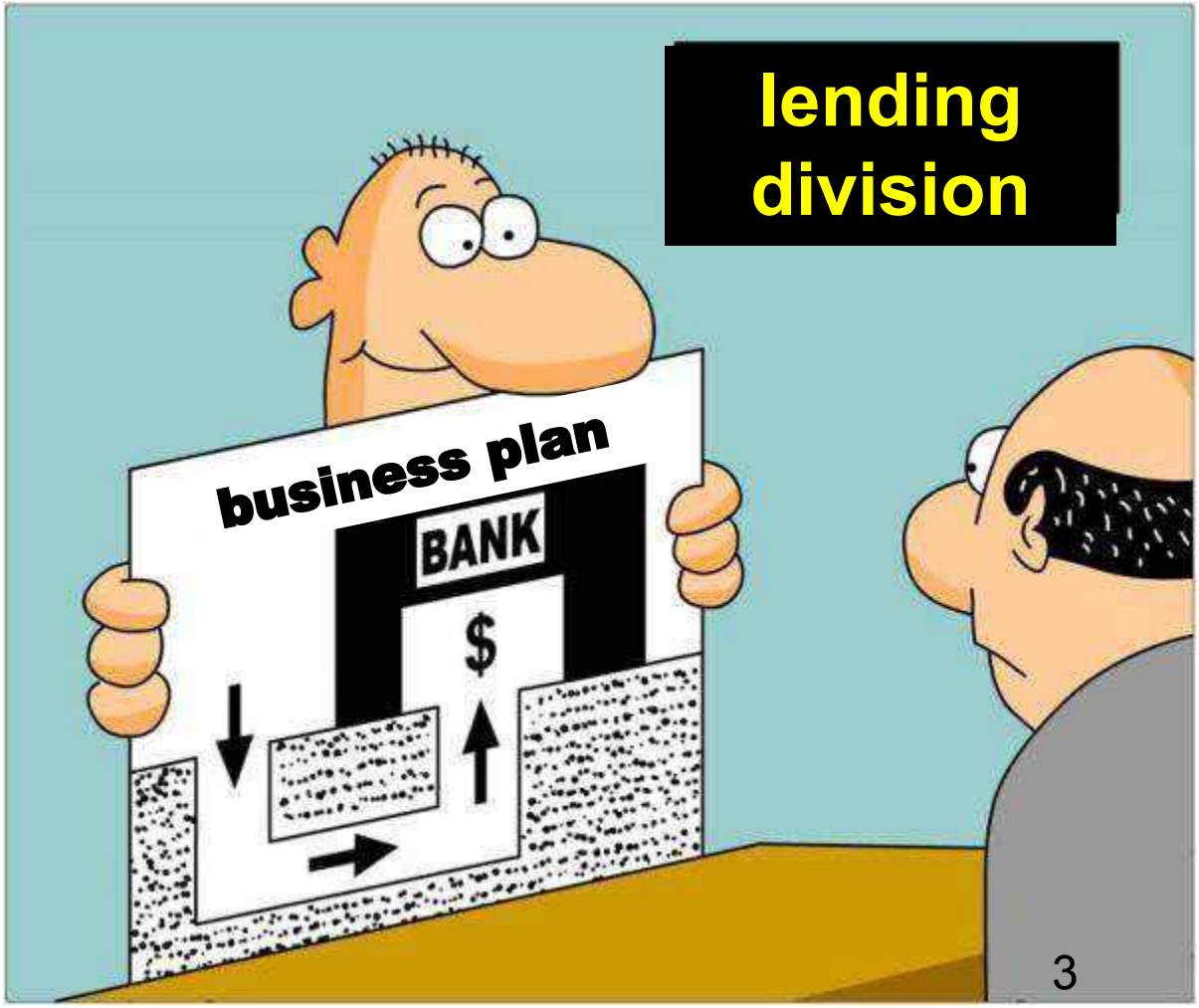
- the number of units of a particular product that consumers are willing and able to buy at clearly defined conditions of time, place, price..

Demand is a function of many independent variables or determinants of demand

Elasticity of demand

– the sensitivity of the required quantity to changes in the determinants of demand

Measuring the elasticity with respect to changes in price, income, or prices of other products can help managers when planning marketing strategies



The basic demand function establishes the relationship between the required number of product units and all variables affecting demand

Price effect

$$Q_d = f(P \mid X_1, X_2, X_3, \ldots\ldots, X_n)$$

The demanded quantity

Price

Other determinants of demand, which remain constant

Function of market demand is the sum of all the individual functions of consumer demand in this market

There is difference between the changes in the required quantity (quantity of demand) and changes in demand:

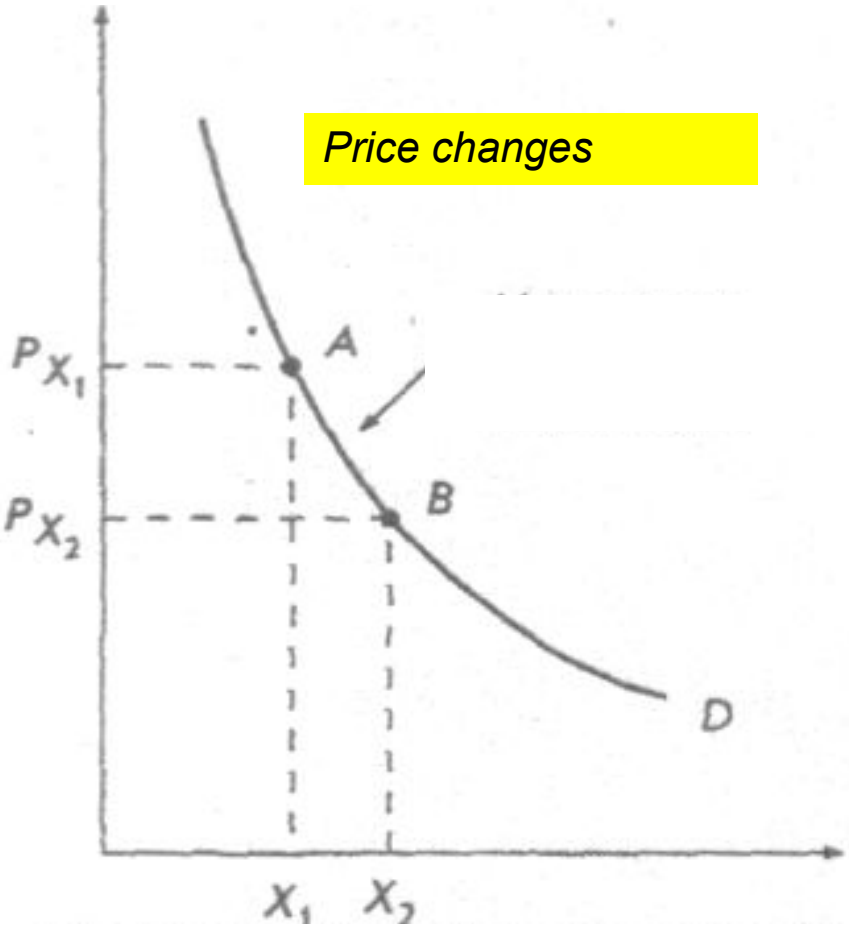
Only price => changes in quantity of demand

Other variables => changes demand function

changes in quantity of demand

Price

Price changes

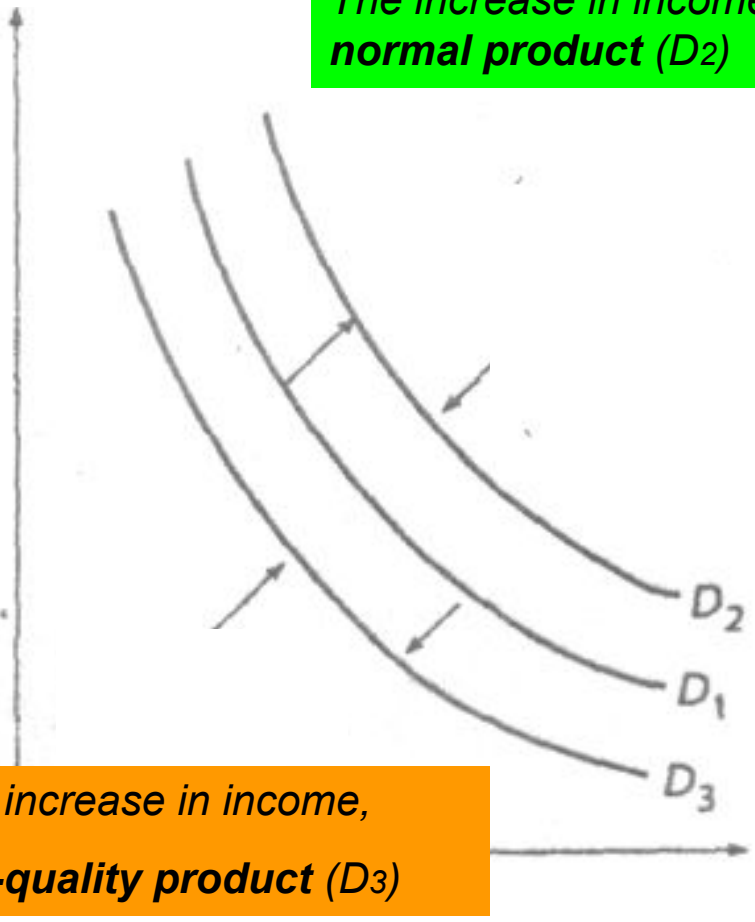


Quantity demanded for period

changes in demand

Price

The increase in income ***normal product*** *(D_2)*



The increase in income,

low-quality product *(D_3)*

Quantity demanded for period

When I talk about market demand or the demand curve, these terms relate to demand only as a function of prices, assuming that other variables are constant

Of course, the demand can be expressed by function of any other single variable

$$Qx = 5 - 10\,Px + 15\,Py - 25\,Pz + 0{,}001i$$

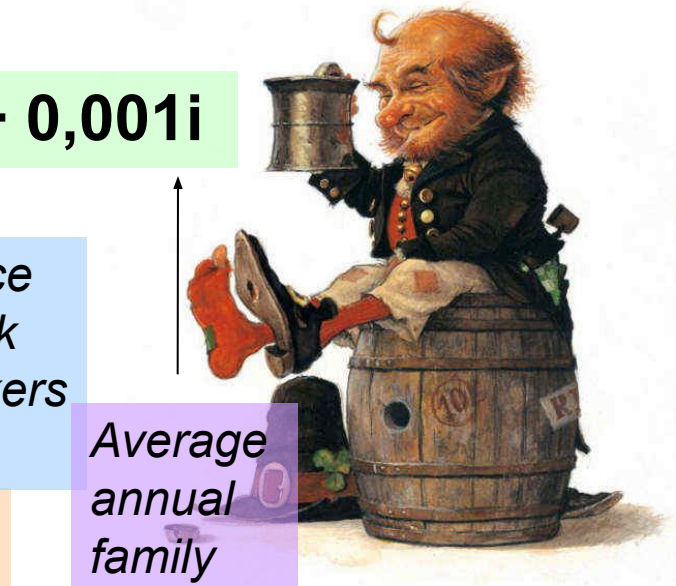
Annual consumption of Swiss cheese brand X (kg) per family

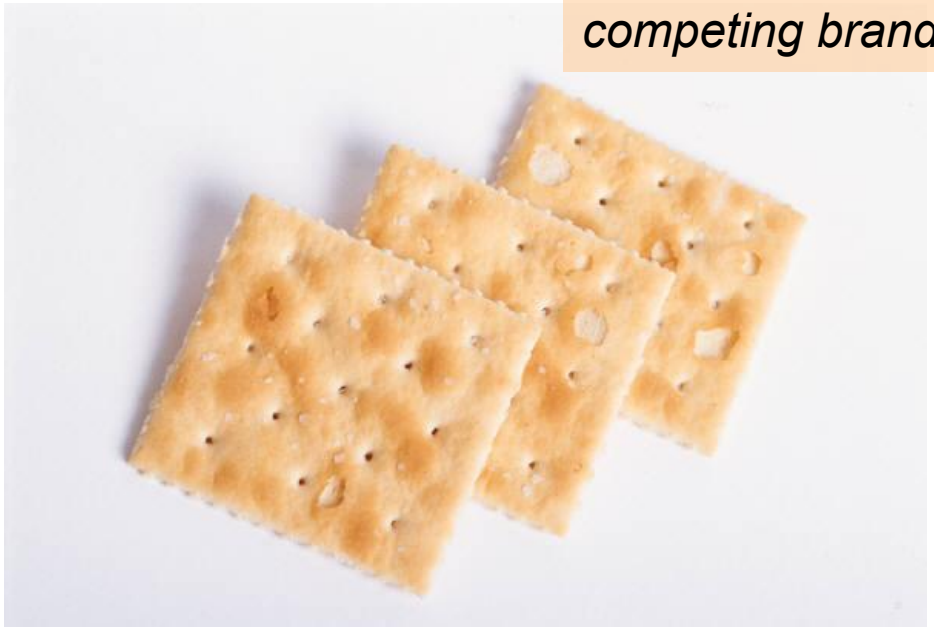
The price for 1 kg of Swiss cheese brand X

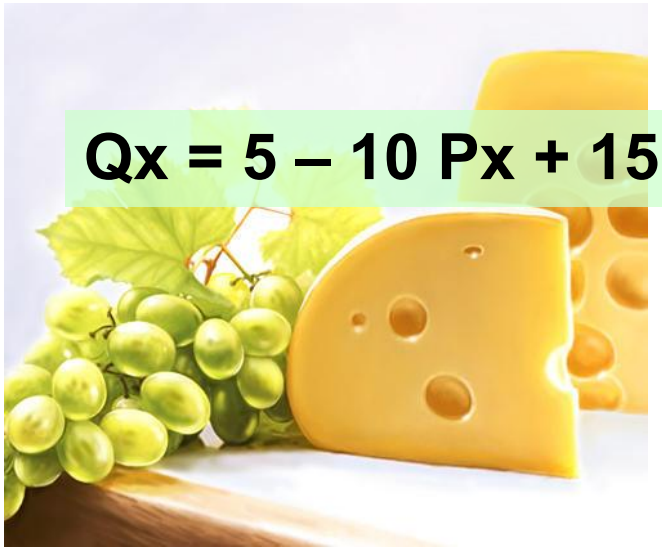
The price for 1 kg of cheese of competing brands

The price per pack of crackers

Average annual family income







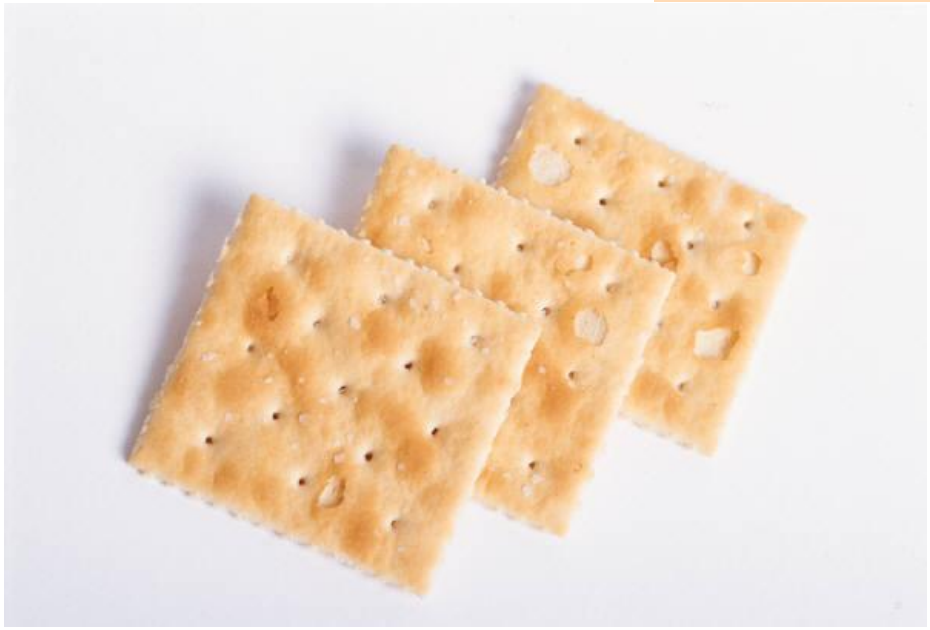
$$Qx = 5 - 10\,Px + 15\,Py - 25\,Pz + 0{,}001i$$

Px = 2,50$

Py = 3$

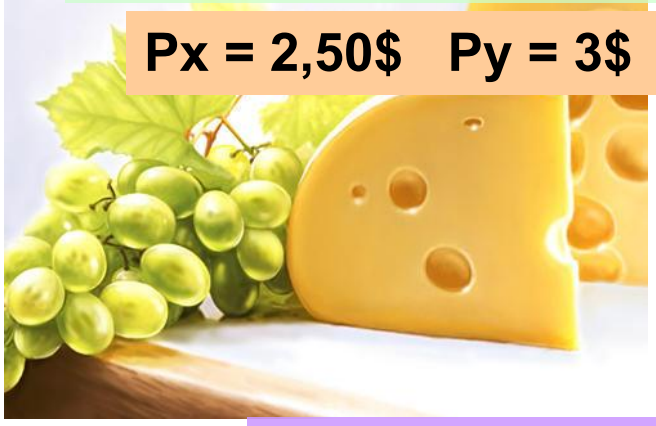
Pz = 1$

I = 30000$



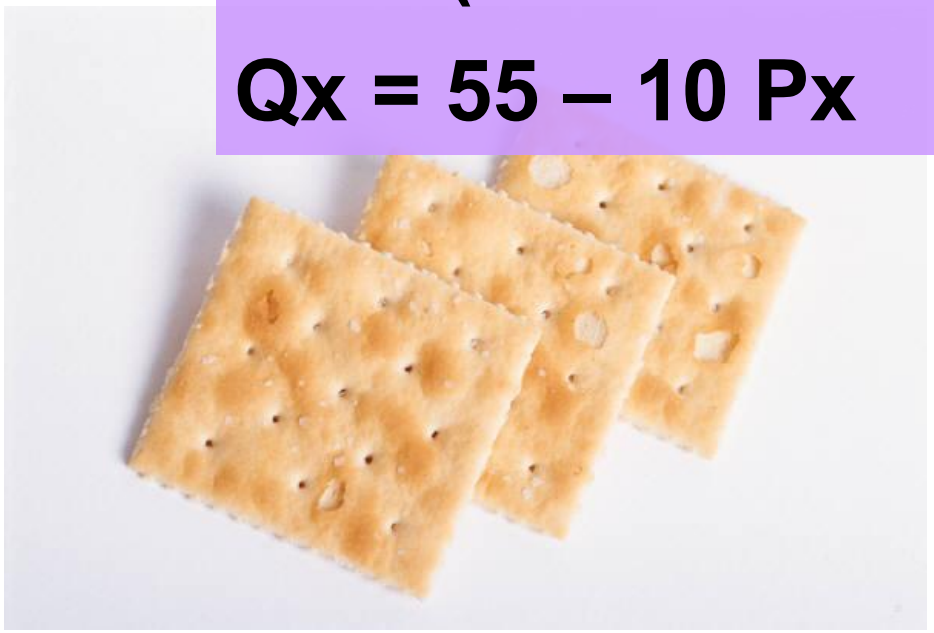
$$Qx = 5 - 10\,Px + 15\,Py - 25\,Pz + 0{,}001i$$

$Px = 2{,}50\$ \quad Py = 3\$ \quad Pz = 1\$ \quad I = 30000\$$

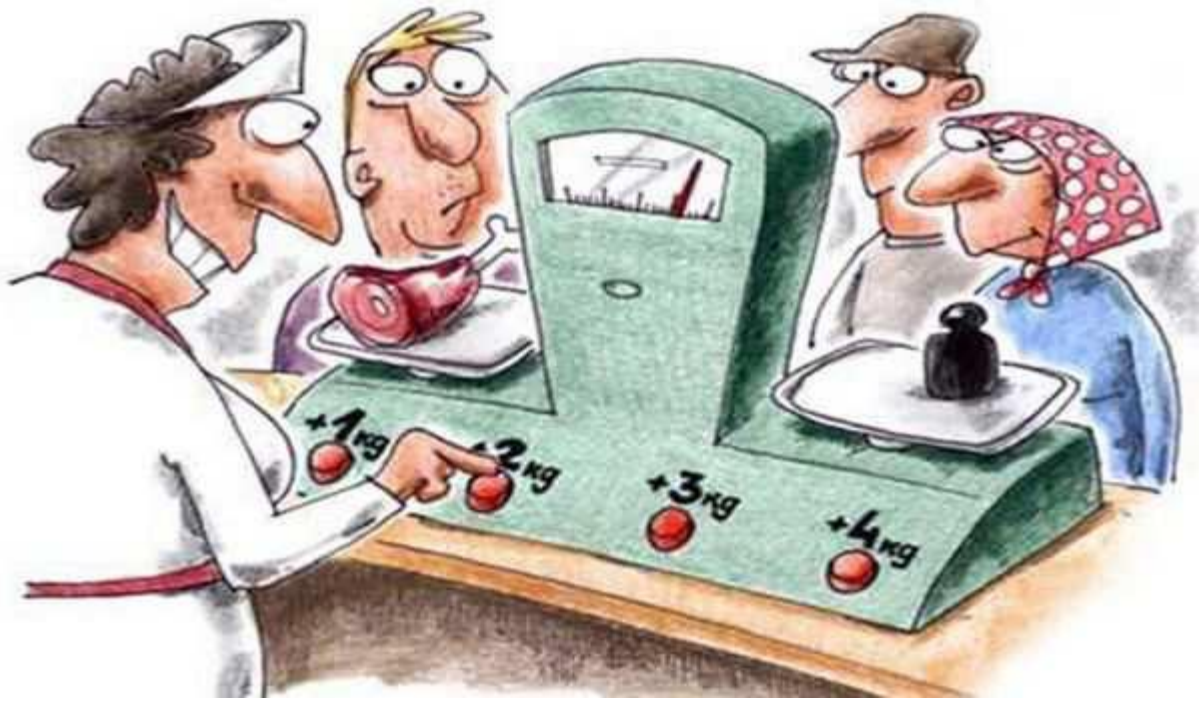


$$Qx = (5 + 45 - 25 + 30) - 10\,Px$$

$$Qx = 55 - 10\,Px$$



Elasticity of demand



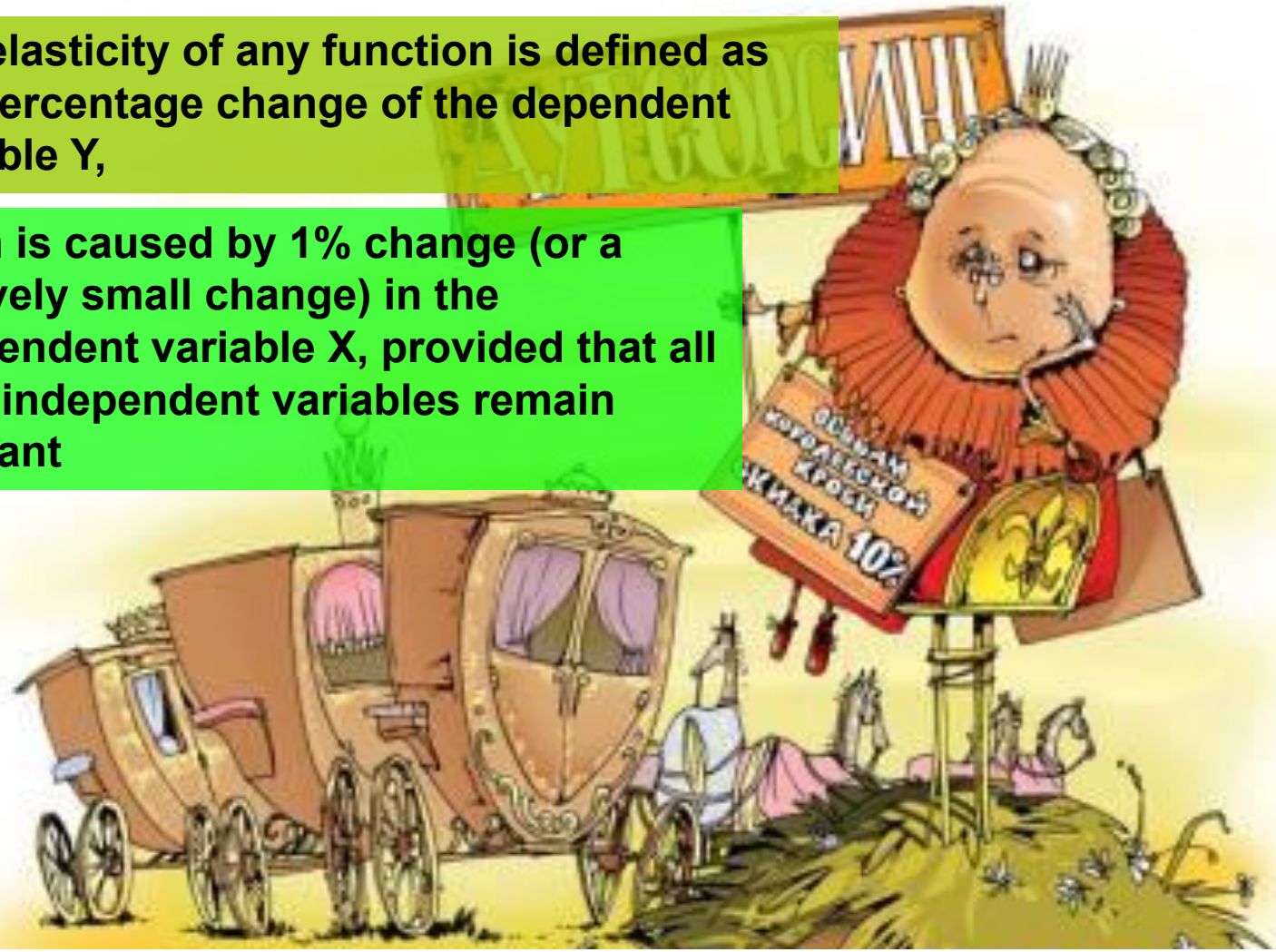
If we lower the product's price, then we know that sales will increase, but for how much?

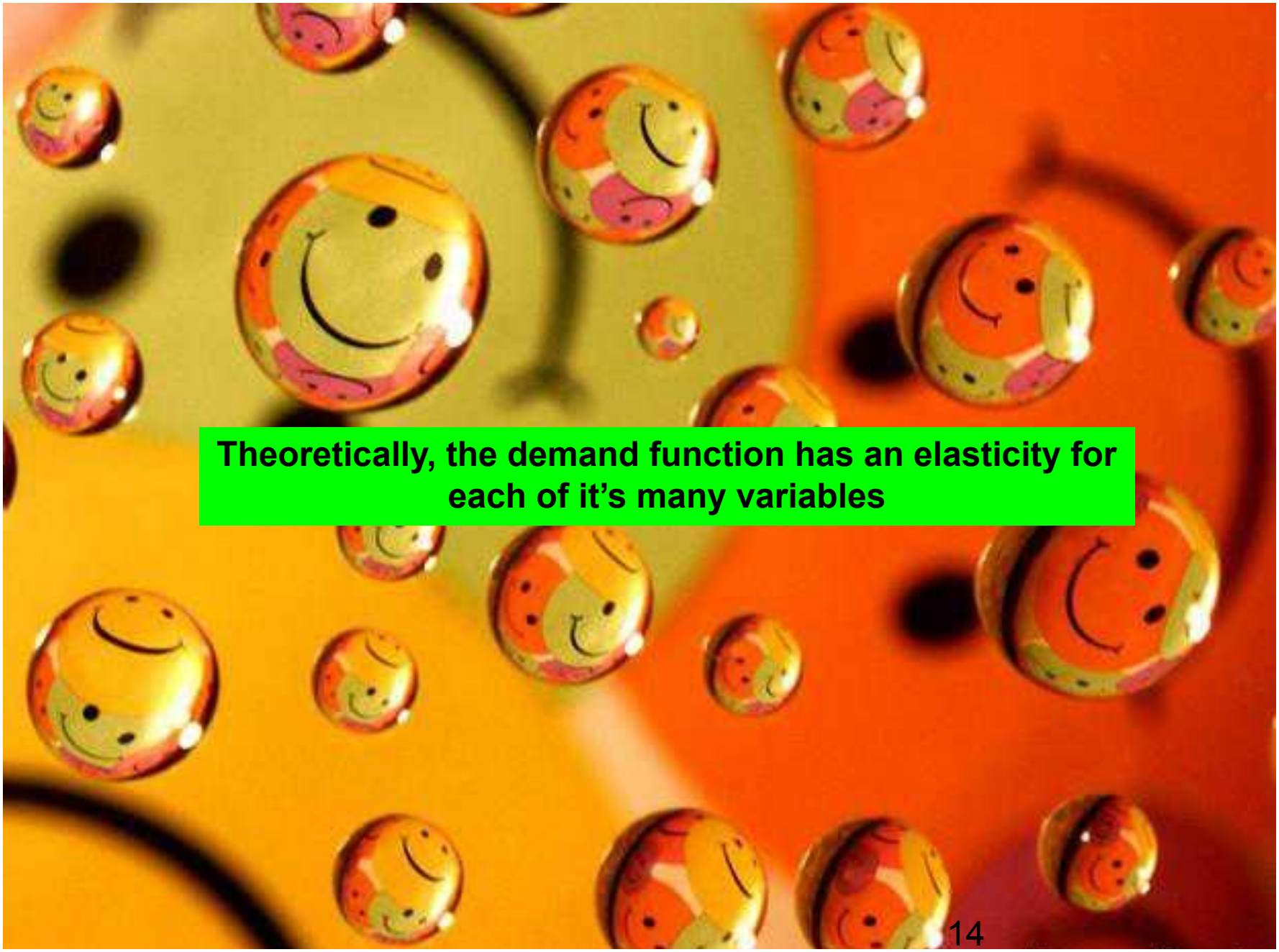
What will be the dynamics of sales, if you increase the income of the consumer?

What will happen with sales if you increase the advertising budget?

The elasticity of any function is defined as the percentage change of the dependent variable Y,

which is caused by 1% change (or a relatively small change) in the independent variable X, provided that all other independent variables remain constant




Theoretically, the demand function has an elasticity for each of it's many variables

4 main types of elasticity of demand:

- ✔**Price elasticity of demand - measures the responsiveness of sales to changes in prices**

- ✔**Income elasticity of demand - measures the responsiveness of sales to changes in income of the consumer**

- ✔**Cross-elasticity of demand - measures the responsiveness of the sales of one product to changes in the price of another product**

- ✔**The elasticity of demand for advertising - measures the responsiveness of sales to changes in the amount of money spent on advertising and promotion of goods on the market**

✔**Price elasticity of demand is defined as the percentage change in the required quantity, which is caused by change of 1% in price, while all other variables remain constant**

The amount of product X ↓

X product price ↓

$$\varepsilon_{\mathrm{d}} = \frac{\Delta Q_x / Q_x}{\Delta P_x / P_x} = \frac{\Delta Q_x}{Q_x} \cdot \frac{P_x}{\Delta P_x} = \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{P_x}{Q_x}$$

2 types of elasticity measurement :

Direct measurement at a specific point using the formula for point elasticity

A measurement of the average elasticity in an arc or segment of the demand curve using the formula for arc elasticity

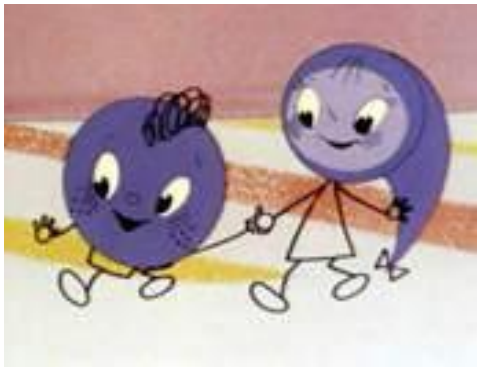
Point elasticity

If we want to have the exact slope at a particular point on the demand curve, we assume that ΔPx tends to zero

$$\lim_{\Delta P_x \to 0} (\Delta Q_x / \Delta P_x)$$

Hence the condition that serves as a definition of the derivative

$$\varepsilon_d = \frac{dQ_x}{dP_x} \cdot \frac{P_x}{Q_x}$$



In the case of point elasticity demand function must be known.

$Q_X = 30 - 2\,P_X$

The price elasticity at the point Px = 6?

Arc elasticity

The demand function may be unknown.
We are interested in a larger segment of the demand curve

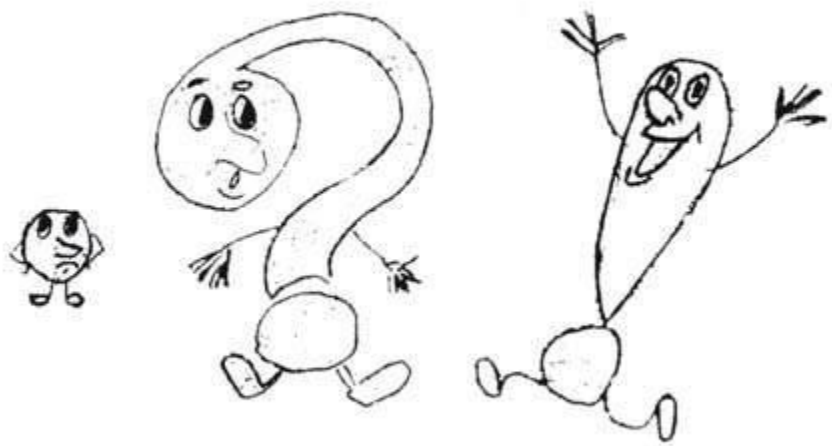
$$E_d = \frac{\Delta Q_x / Q_x}{\Delta P_x / P_x} = \frac{Q_2 - Q_1}{(Q_2 + Q_1)/2} \div \frac{P_2 - P_1}{(P_2 + P_1)/2} = \frac{(Q_2 - Q_1)(P_2 + P_1)}{(Q_2 + Q_1)(P_2 - P_1)}$$

$$E_d = \frac{(Q_2 - Q_1)(P_2 + P_1)}{(Q_2 + Q_1)(P_2 - P_1)}$$

$$E_d = \frac{(450 - 300)(38 + 50)}{(450 + 300)(38 - 50)} = -1{,}47$$

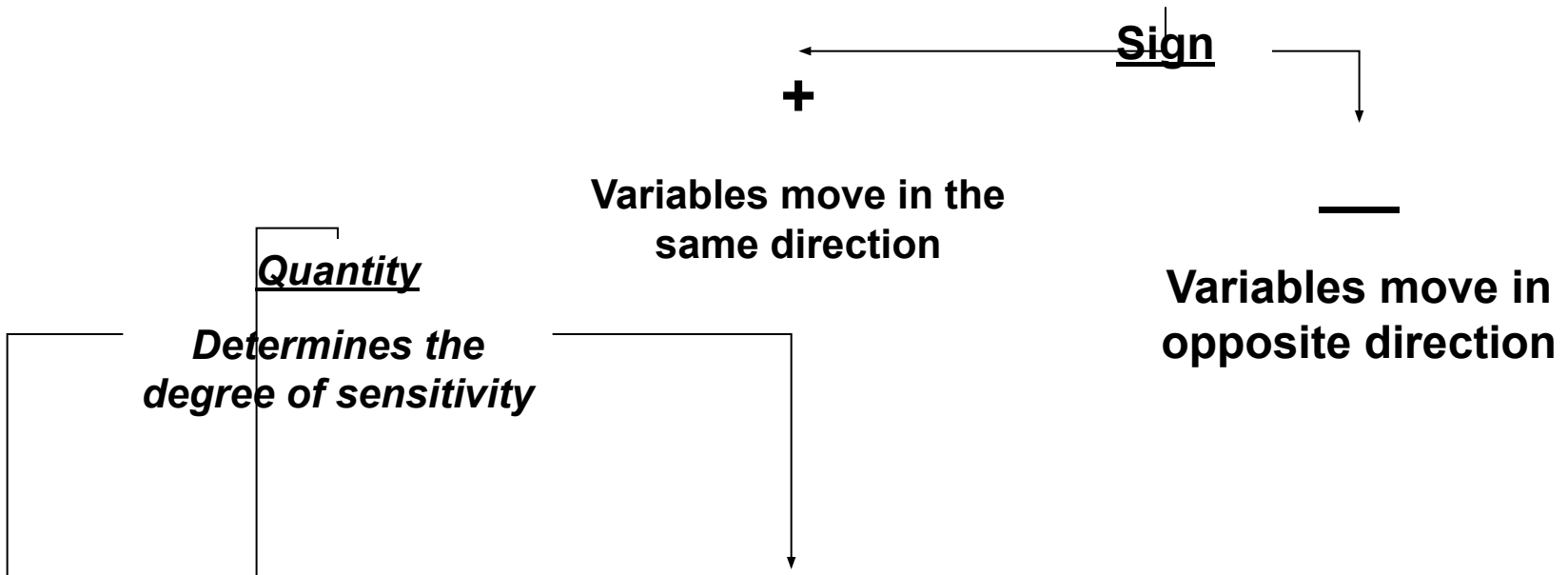
Point elasticity is the limit concept, because it measures the elasticity at a specific point on the demand curve. Can be used to analyse the effect of very small changes in price

Arc elasticity is a broader concept that allows to measure the average elasticity over a wide range of changes in the price



EX:

The coefficient of price elasticity



|ε| = 1 –the function of specific elastic: change in price by 1% can cause a change in the required amount by 1%

|ε| > 1 –the elastic function: the change in price by 1% can cause a change in the required number by more than 1%

|ε| < 1 –inelastic function: the change in price by 1% can cause a change in the required number by less than 1%