

Internet Economics and Financial Technology  
*Computer Science COMSM0019*

## **Lectures 3&4:**

# **Economics of the Internet I & II**

**PART I - Intro**

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# Today's Topics

## Part I – Introduction

- Properties of digital goods versus physical goods
- Back to basics: supply and demand

## Part II – How to price your product and build customers

- Differential pricing methods (how to maximise sales revenue)
- The network effect (a key concept for Internet/Financial Technologies)
  - Building critical mass
  - Lock-in/standards

Learning outcome: **what business models work best for Internet technologies and why – how to succeed**

Next week: Auctions

# “Technology changes, economic laws do not”

(Hal Varian)

- Digital goods and the Internet have substantially changed the business landscape.
- The underlying economic ‘forces’ manifest in new ways.
- But the underlying forces have not fundamentally changed, and if we can understand these forces and how they apply in the Internet age, it can guide our actions in the digital economy.

# Hal Varian



- Emeritus Professor of Economics specialising in the **Information Technology** industry at University of California, Berkeley.
- **Chief Economist at Google** since 2002
  - Design of **advertising auctions** (covered next week)
  - Finance, Corporate strategy, Public Policy

*The Economics of Information Technology – An Introduction*, Varian, Farrell and Shapiro (2007)

- Available in electronic form from the library.
- **Suggested reading: Part I**

# Combinatorial Innovation: The “Internet Surge”

- “A technology whose rich set of components can be combined and recombined to create new products/services”.
  - Initial success breeds more success
  - Development of components, interchangeable parts, standards
- Combinatorial innovation is not new: (e.g., gears, pulleys, chains etc. revolutionised manufacture in the 1800s), but this time it is a lot quicker...
- The Internet Revolution:
  - Ease of access to innovators
  - Cheap to get the kit you need, and to train up.
  - Innovations are rapidly distributed globally, so ideas shared easily.
  - Standardisation (de facto or otherwise) easier and more necessary
  - Many innovations are ‘open source’. HTML is a prime example.
  - Access to Cloud Resources

‘open source software is the primordial soup for combinatorial innovation.’ (Varian)

# Online economic activity

Four different but interconnected activities:

- **Digital goods**
  - can be delivered online, but used locally (e.g., mp3, software)
- **Information goods**
  - the value of the good is in the information it provides. (e.g., news website, stock exchange data feed)
- **Online purchasing of physical goods**
  - (e.g., Amazon books) and moving the B2B supply chain online.
- **Online provision of services**
  - streaming services (e.g., Spotify), SaaS (e.g., Gmail)

# Differences between physical and digital goods (1/2)

The different characteristics of digital technology as compared with physical technology impact its economics:

1. Digital goods are costly to produce, but cheap to reproduce. *Fixed costs* (upfront, capital) are *high*, but *variable costs* (additional cost per unit sale) are *low*.
2. Most of the production costs are *sunk* – they can't be recovered. (Unlike, e.g., a factory)
3. There are *no capacity constraints* limiting the number of times something can be reproduced. (Unlike, e.g., a physical printed-paper newspaper).

# CD (physical) vs MP3 (digital) distribution

## QUESTION: For each:

- What are the sources of fixed costs of distribution?
  - What are the variable costs?
  - What are the capacity constraints? How easy are they to overcome?
- Think about it for one minute – it's fine to discuss



## Differences between physical and digital goods (2/2)

4. Digital goods are often **experience goods** – a customer doesn't know their value without actually using them.
5. **Positive Network Externalities** ('the network effect') are often very strong. Value to you increases as other people also use it.
6. Searching is easy and information is easy to come by, so **search costs** for a consumer are very **low**.

**Question: can you think of examples?**

# What is the effect on competition?

- If two companies are competing with identical digital products, as their *variable costs are near-zero*, competition will *drive the price down to zero*.
- This 'risk' means that a new company won't want to compete with an existing company, because the setup costs are high compared with the possible profits.
- So for commodity digital goods, there will be a *tendency towards monopoly and/or zero pricing*. (As we shall see later, this is further enhanced by 'the network effect')
- Companies must therefore focus on product differentiation, or competing for emerging future *monopolies*.
- Innovation is key, rather than efficiency.

# Disintermediation

- During 1990s dotcom boom, it was predicted that small businesses would no longer need intermediaries to sell their products and services.
- This was predicted because the cost of reaching customers directly online would be dramatically reduced.
- But as the cost of 'reaching' decreased, the cost of getting peoples attention increased.
- So instead a new kind of intermediary emerged – the online marketplace. (Ebay / Amazon)
  - A single site to access and trade with many sellers.
  - Mechanisms to help assess trustworthiness.
    - Ebay – started with auctions, eventually introduced fixed prices
    - Amazon – started with fixed prices, eventually introduced auctions

# Internet Economics

We have seen:

- The **Internet affords combinatorial innovation** producing rapid development of new digital products/services
- Digital products have **low variable costs**
- Therefore competition drives **prices to zero**
- And/or **monopolies** are likely to form

**So: How to make money in a world of free products?**

Let's go back to some economics basics and start by thinking about where prices come from...

# Microeconomics 101: Supply and Demand

- **Microeconomics:**

- behaviour of individuals and firms in making decisions regarding the allocation of scarce resources and the interactions among these individuals and firms

- **Laws of Supply and Demand:**

- determine a “fair” price and “efficient allocation” of a good or service in a competitive market

# Who's hungry?

## QUESTION:

- How much are you willing to pay for a slice of pizza?

## Still hungry?

## QUESTION:

- How much are you willing to pay for a second slice?
- And a third?



Micheal Parkin, *Economics*,  
Pearson

# Demand and Marginal Benefit

## Demand, Willingness to Pay, and Value

- **Value is what we get, price is what we pay.**
- We measure value as the ***maximum price*** that a person is willing to pay. Willingness to pay determines **demand**. A ***demand curve is a marginal benefit curve*** (i.e., the value of each extra unit)

## Individual Demand and Market Demand

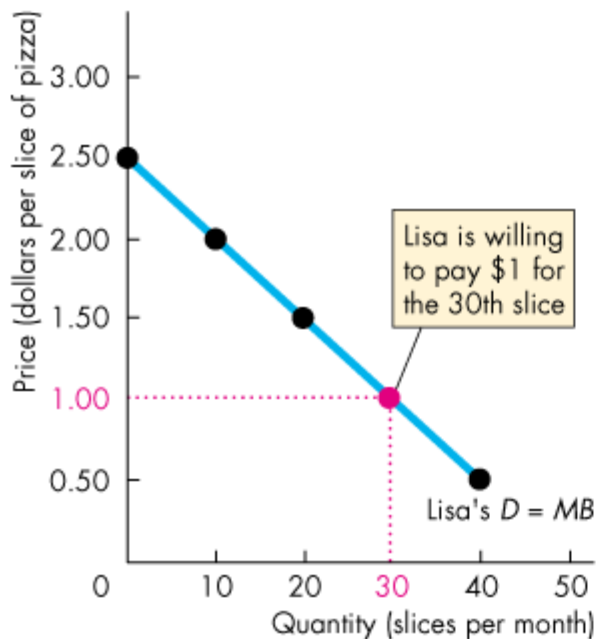
- The relationship between the price of a good and the quantity demanded by one person is called ***individual demand***. The relationship between the price of a good and the quantity demanded by all buyers in the market is called ***market demand***.
- Next Figure shows the connection between individual demand and market demand.

# Demand and Marginal Benefit

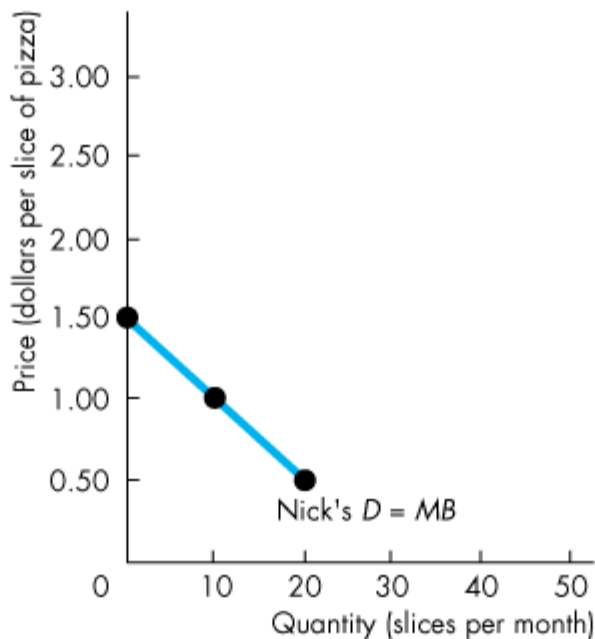


Lisa and Nick are the only buyers in the market for pizza.

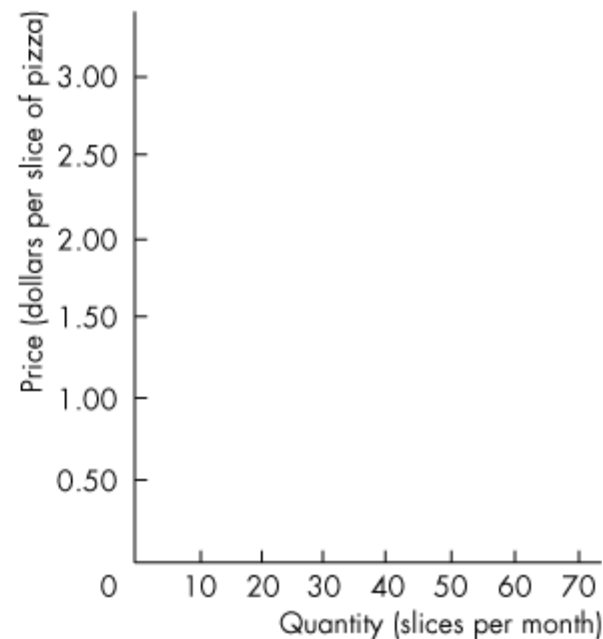
At \$1 a slice, the quantity demanded by Lisa is 30 slices.



(a) Lisa's demand



(b) Nick's demand



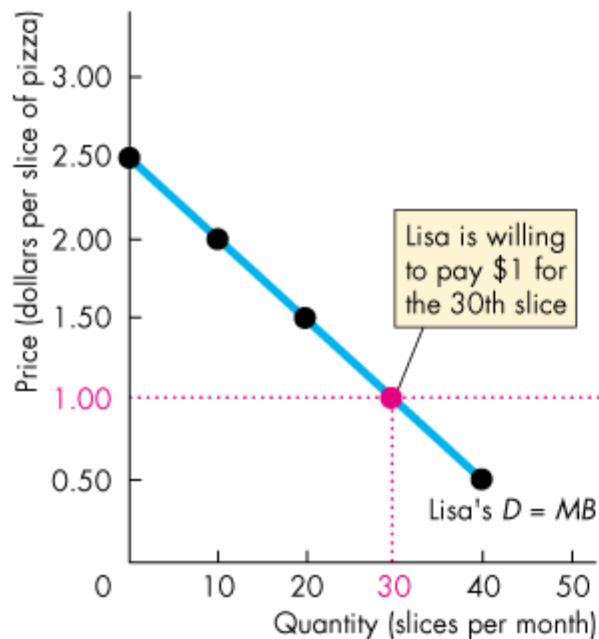
(c) Market demand



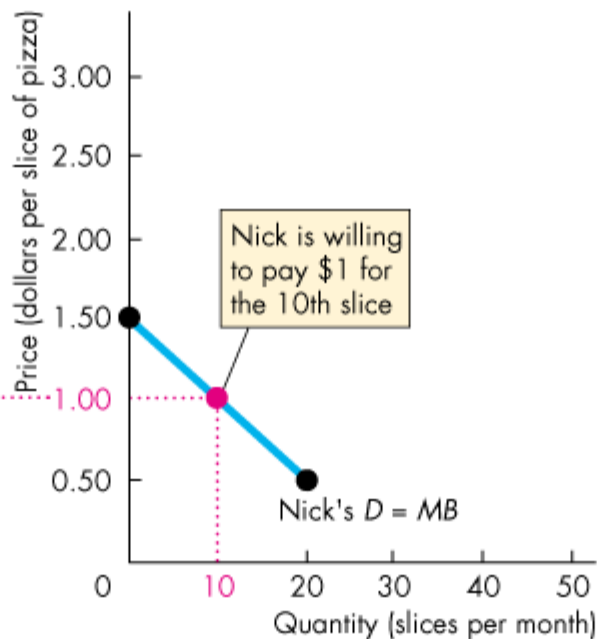
# ► Demand and Marginal Benefit

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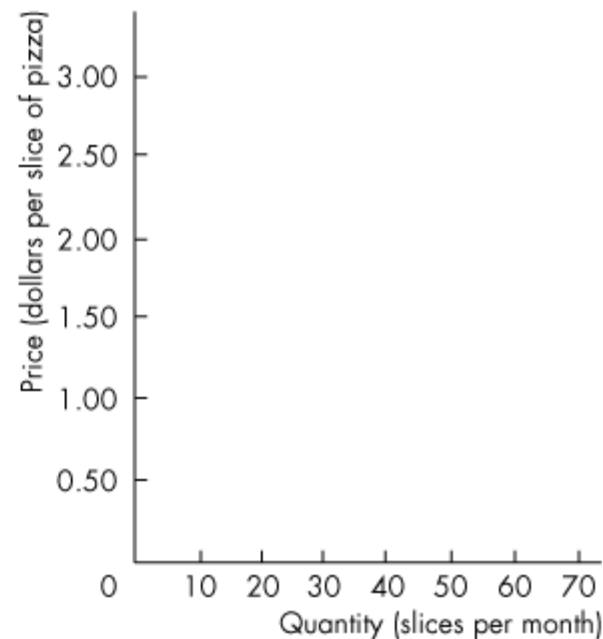
At \$1 a slice, the quantity demanded by Nick is 10 slices.



(a) Lisa's demand



(b) Nick's demand

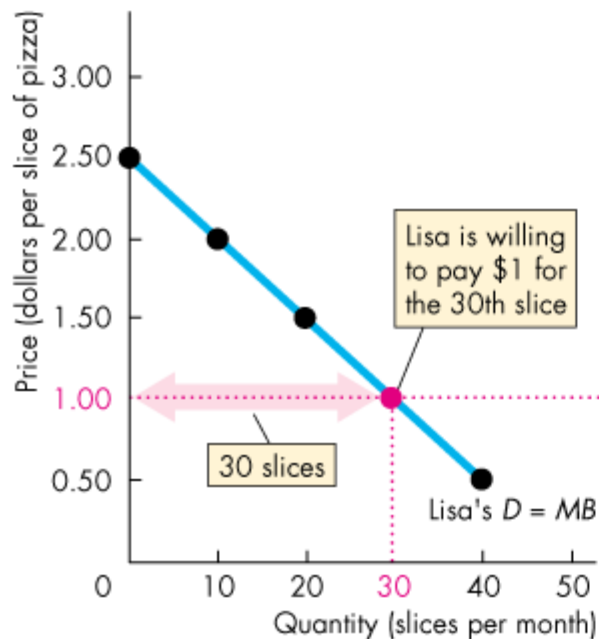


(c) Market demand

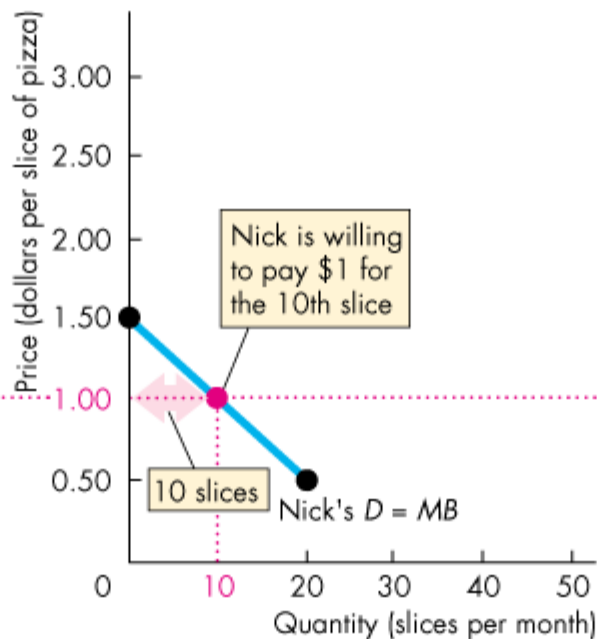
# Demand and Marginal Benefit

At \$1 a slice, the quantity demanded by Lisa is 30 slices and by Nick is 10 slices.

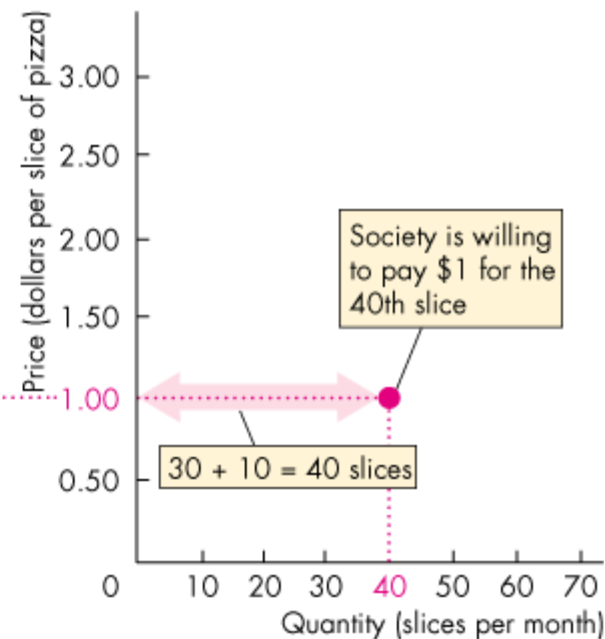
The quantity demanded by all buyers in the market is 40 slices.



(a) Lisa's demand



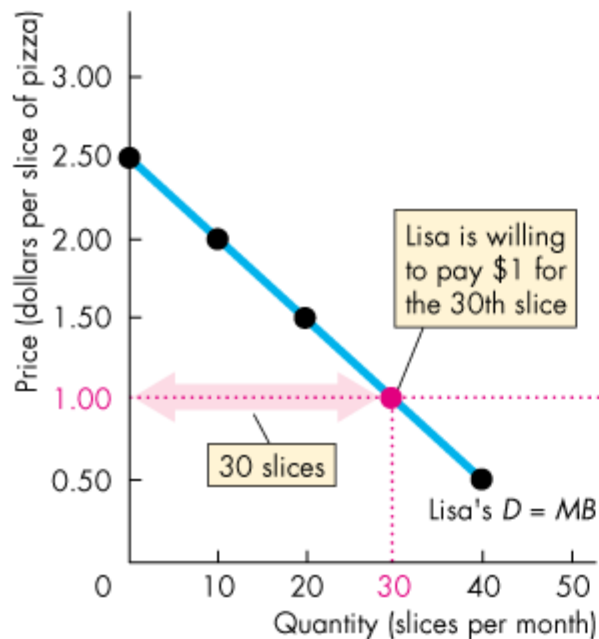
(b) Nick's demand



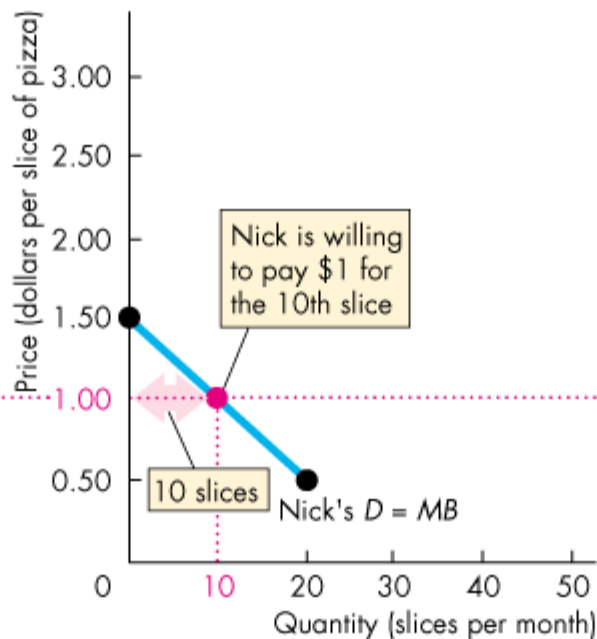
(c) Market demand

# Demand and Marginal Benefit

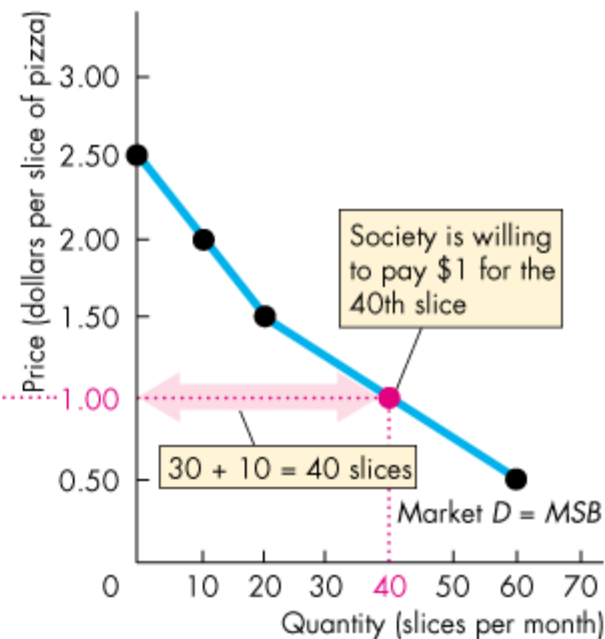
The market demand curve is the horizontal sum of the individual demand curves.



(a) Lisa's demand



(b) Nick's demand



(c) Market demand

# Demand and Marginal Benefit

## Consumer Surplus

**Consumer surplus** is the value of a good minus the price paid for it, summed over the quantity bought.

**It is measured by the area under the demand curve and above the price paid, up to the quantity bought.**

Figure on the next slide shows the consumer surplus from pizza when the market price is \$1 a slice.

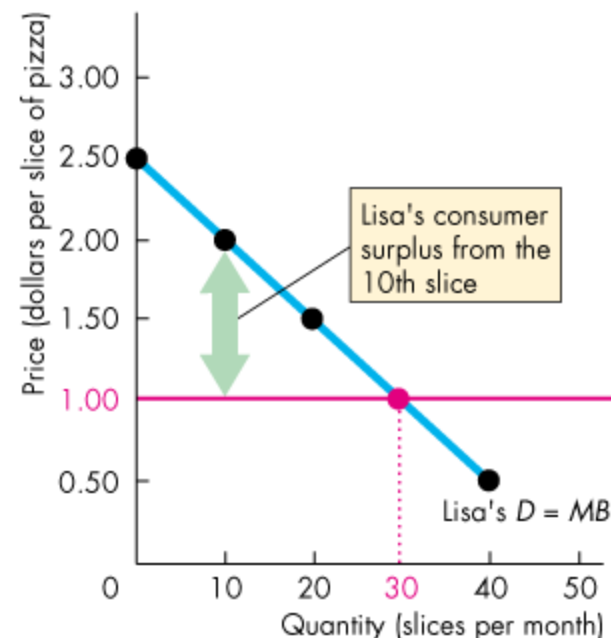
# ► Demand and Marginal Benefit



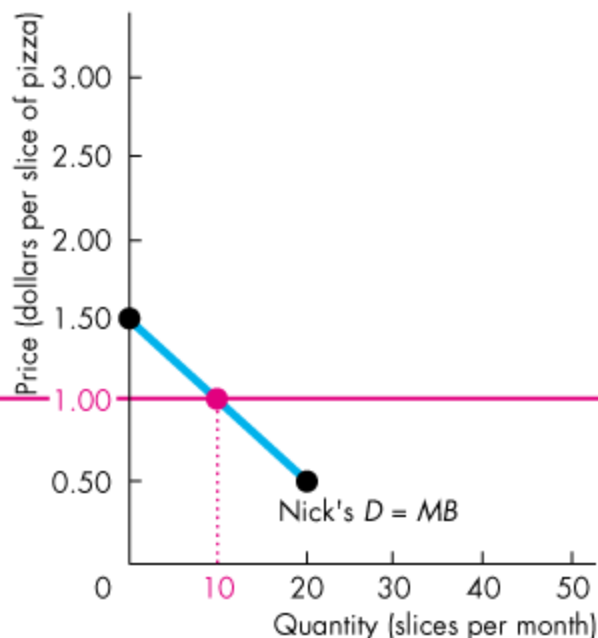
Lisa and Nick pay the market price, which is \$1 a slice.

The value Lisa places on the 10<sup>th</sup> slice is \$2.

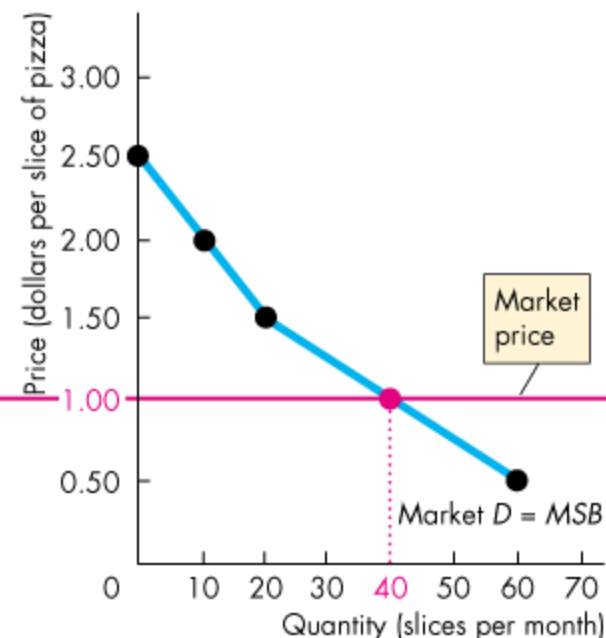
Lisa's consumer surplus from the 10<sup>th</sup> slice is the value minus the price, which is \$1.



(a) Lisa's consumer surplus



(b) Nick's consumer surplus

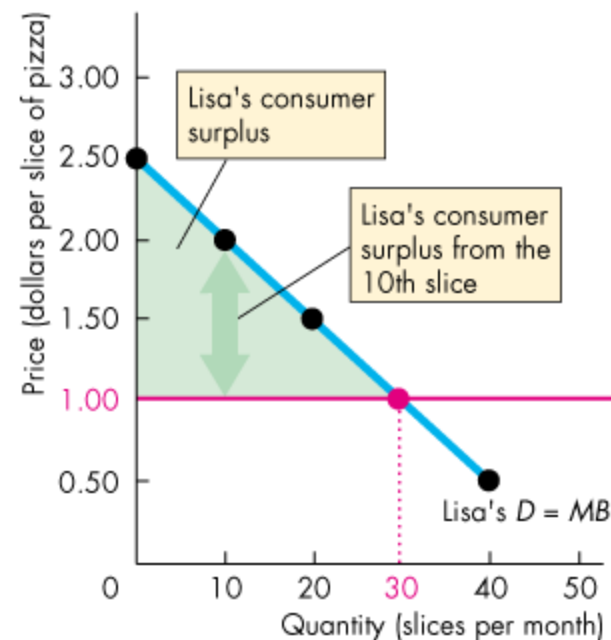


(c) Market consumer surplus

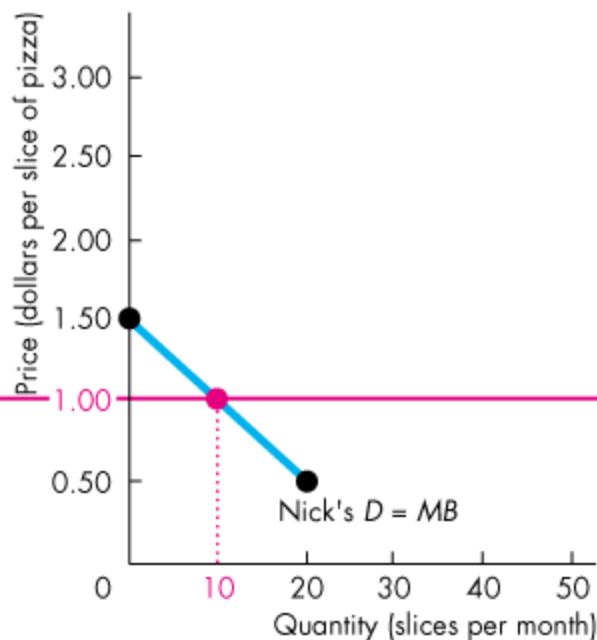
# ► Demand and Marginal Benefit

At \$1 a slice, Lisa buys 30 slices.

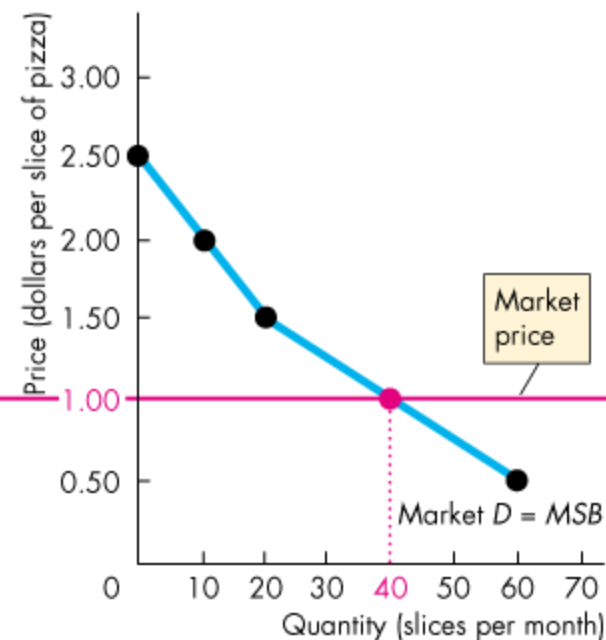
So her consumer surplus is the area of the green triangle.



(a) Lisa's consumer surplus



(b) Nick's consumer surplus

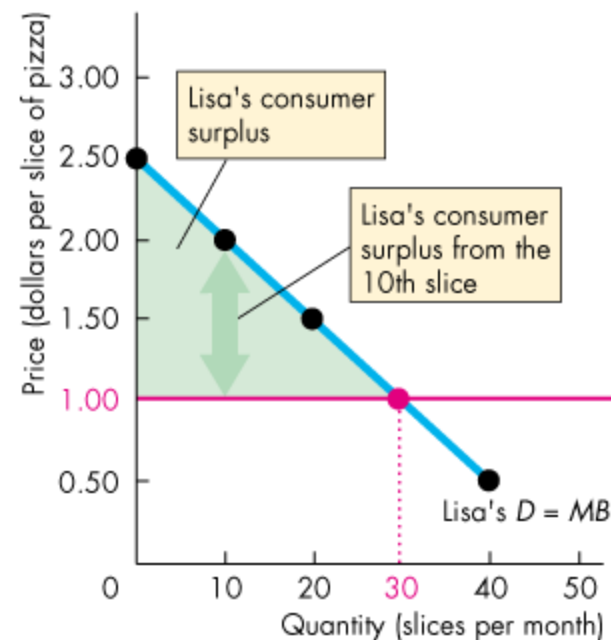


(c) Market consumer surplus

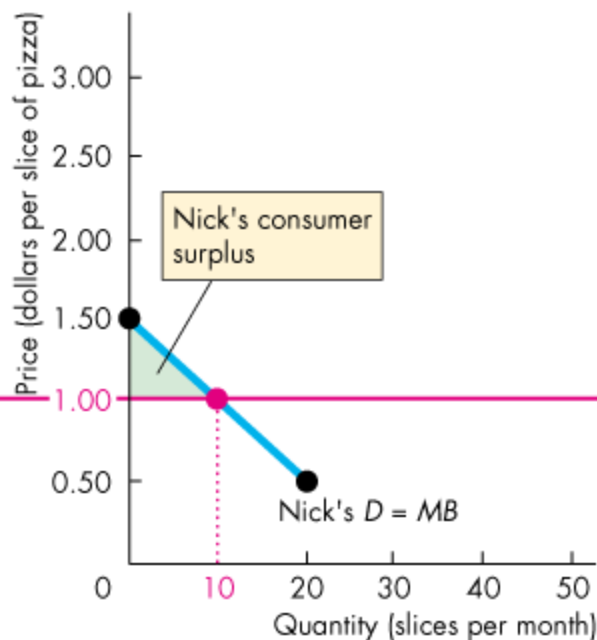
# ► Demand and Marginal Benefit

At \$1 a slice, Nick buys 10 slices.

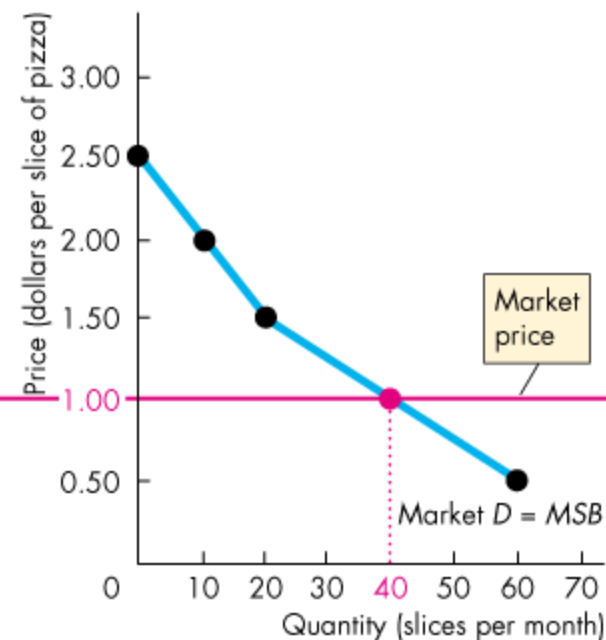
So his consumer surplus is the area of the green triangle.



(a) Lisa's consumer surplus



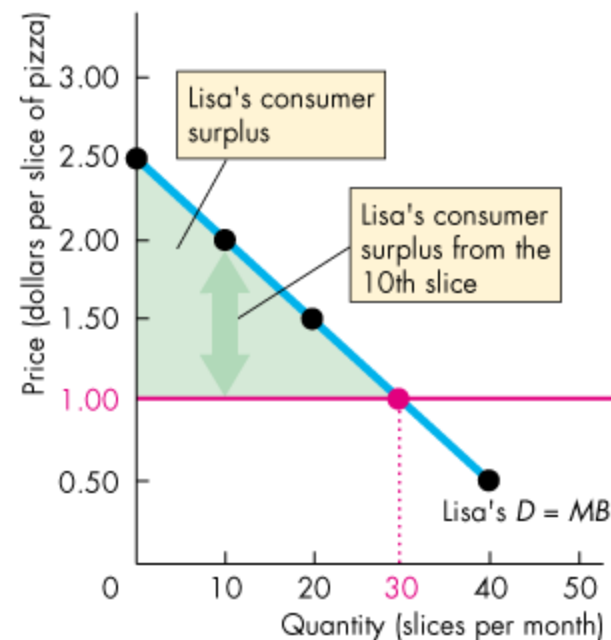
(b) Nick's consumer surplus



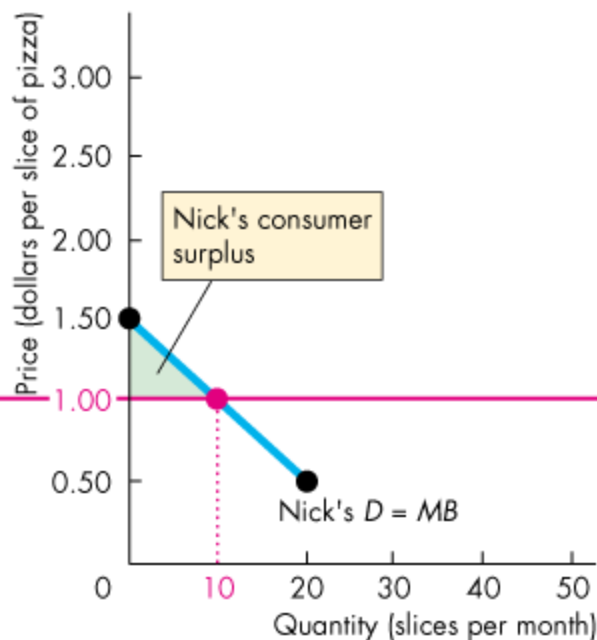
(c) Market consumer surplus

## Demand and Marginal Benefit

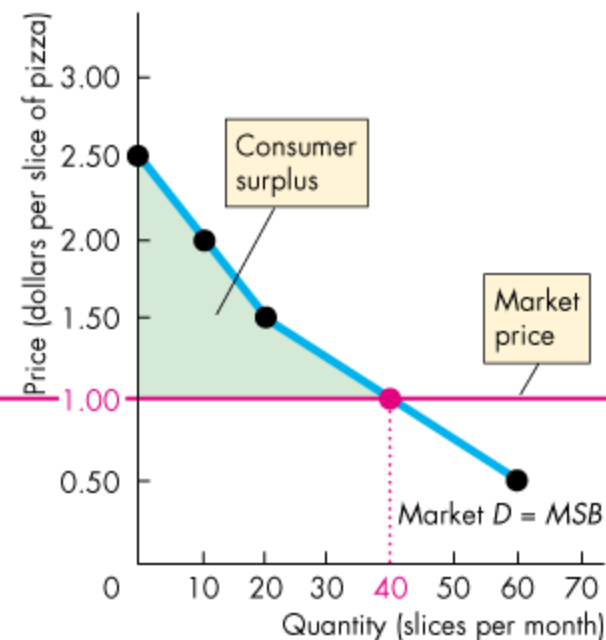
At \$1 a slice, the consumer surplus for the economy is the area under the market demand curve above the market price, summed over the 40 slices bought.



(a) Lisa's consumer surplus



(b) Nick's consumer surplus



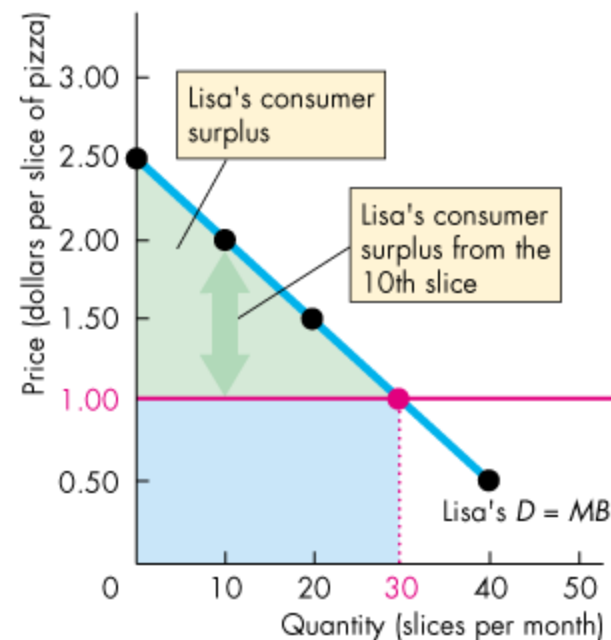
(c) Market consumer surplus



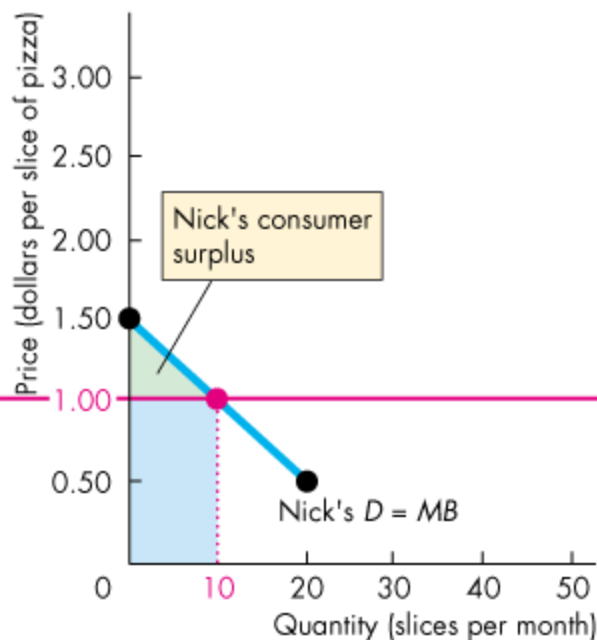
## Demand and Marginal Benefit

At \$1 a slice, Lisa spends \$30, Nick spends \$10, and together they spend \$40 on pizza.

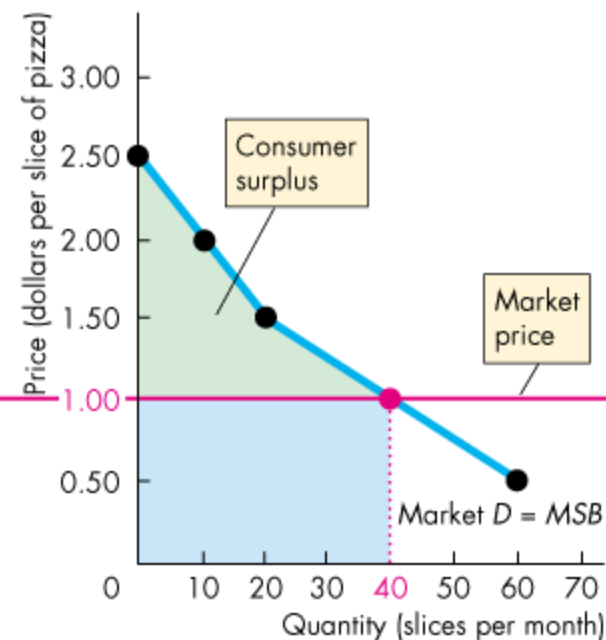
The consumer surplus is the value from pizza in excess of the expenditure on it.



(a) Lisa's consumer surplus



(b) Nick's consumer surplus



(c) Market consumer surplus

# What about the sellers?

## QUESTION:

- What price are sellers willing to accept for a slice of pizza?

## ANSWER:

- It depends how much it costs them to produce

# Supply and Marginal Cost

## Supply, Cost, and Minimum Supply-Price

- Marginal cost is the ***minimum price*** that a firm is willing to accept. The minimum supply-price determines supply. A ***supply curve is a marginal cost curve***. (i.e., the cost to produce each extra unit)

## Individual Supply and Market Supply

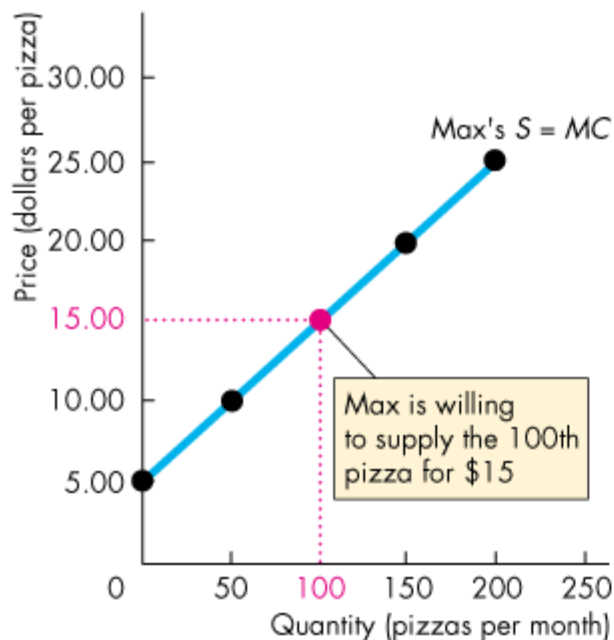
- The relationship between the price of a good and the quantity supplied by one producer is called ***individual supply***. The relationship between the price of a good and the quantity supplied by all producers in the market is called ***market supply***.
- Figure on the next slide shows the connection between individual supply and market supply.

# Supply and Marginal Cost

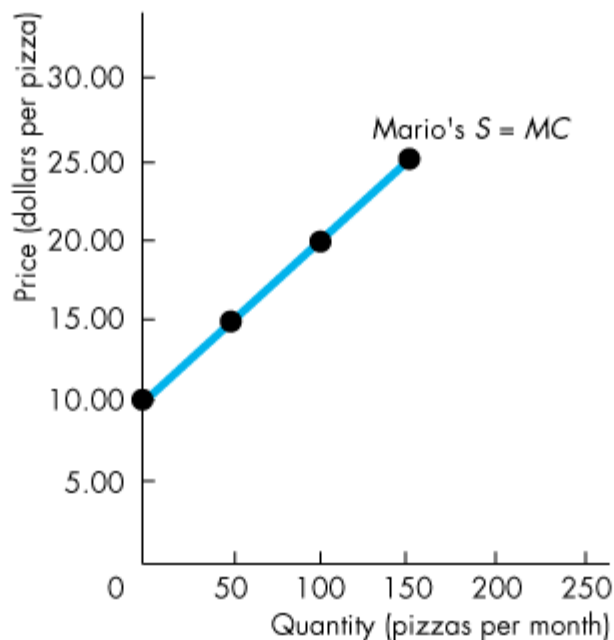


Max and Mario are the only producers of pizza.

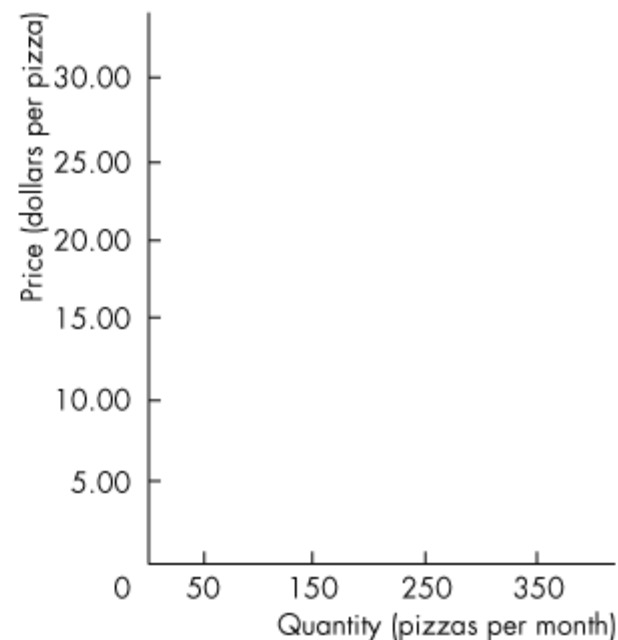
At \$15 a pizza, the quantity supplied by Max is 100 pizzas.



(a) Max's supply



(b) Mario's supply

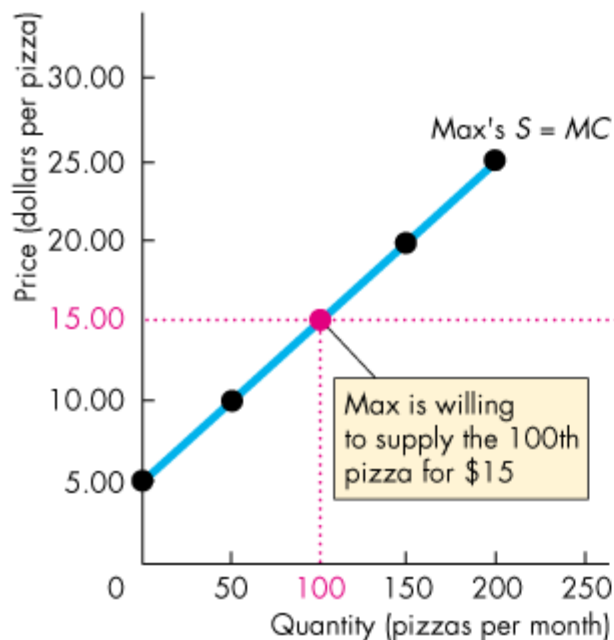


(b) Market supply

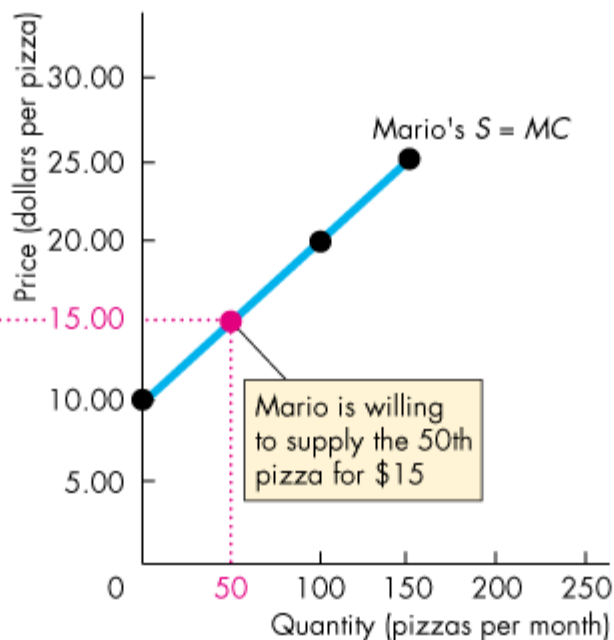
# Supply and Marginal Cost

Max and Mario are the only producers of pizza.

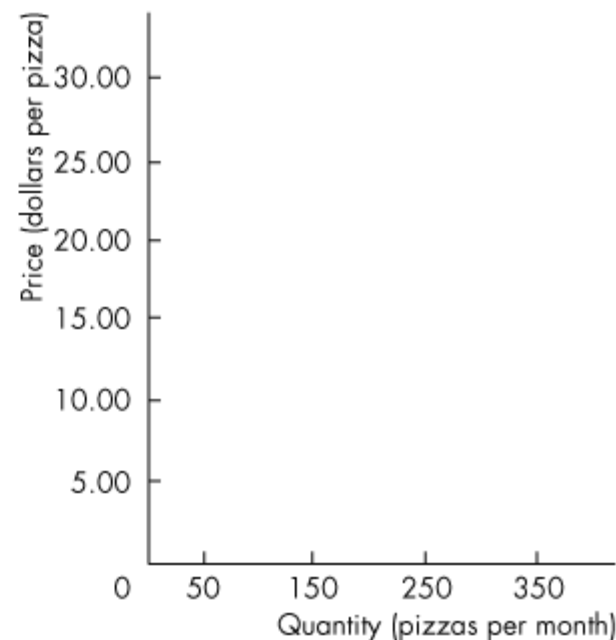
At \$15 a pizza, the quantity supplied by Mario is 50 pizzas.



(a) Max's supply



(b) Mario's supply

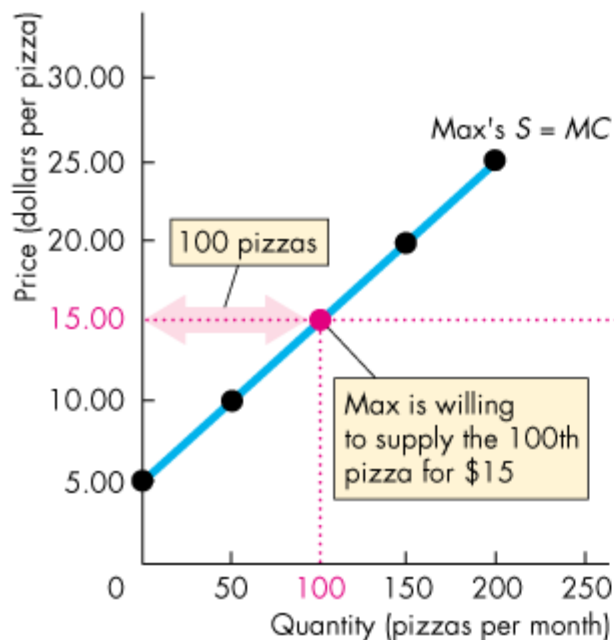


(b) Market supply

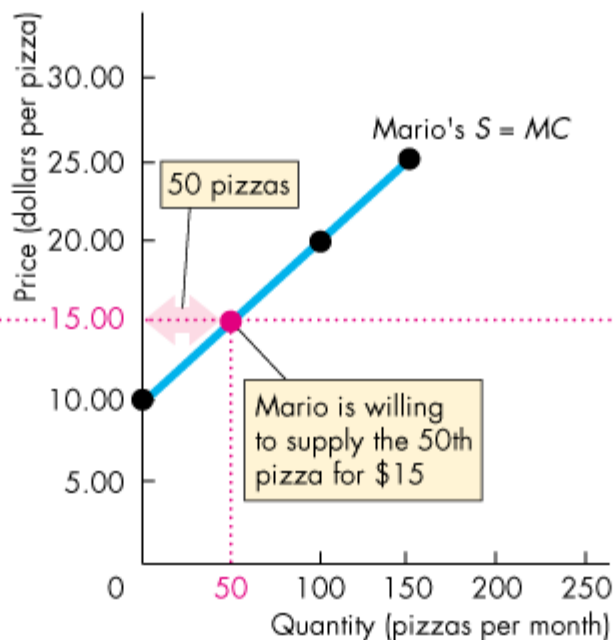
## Supply and Marginal Cost

At \$15 a pizza, the quantity supplied by Max is 100 pizzas and by Mario is 50 pizzas.

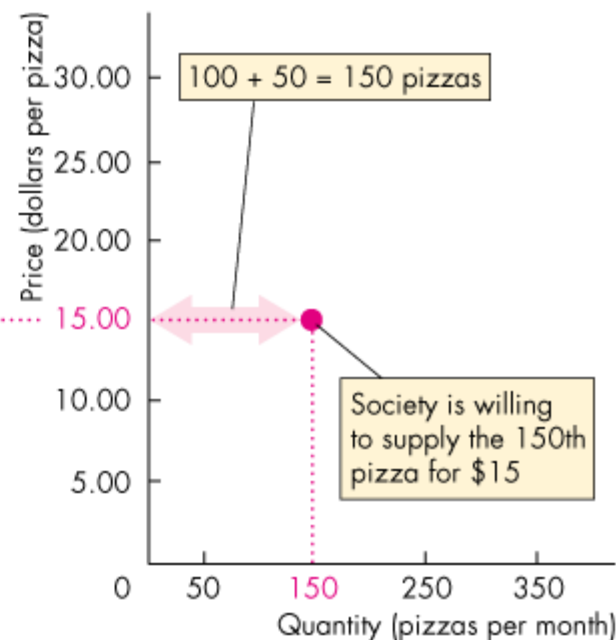
The quantity supplied by all producers is 150 pizzas.



(a) Max's supply



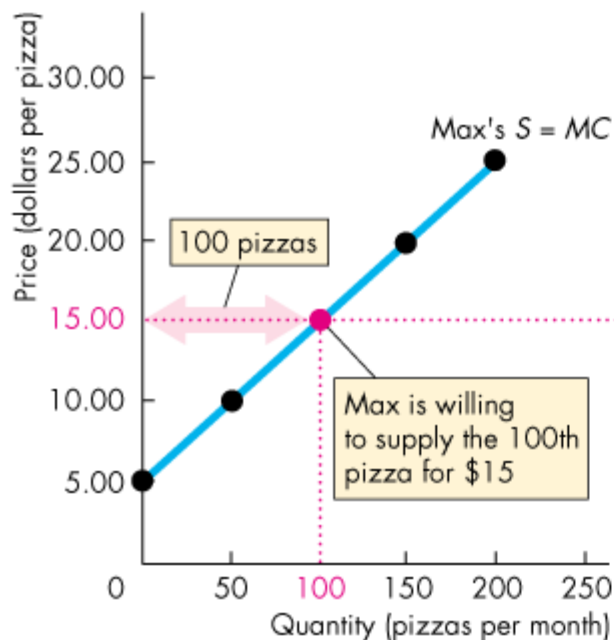
(b) Mario's supply



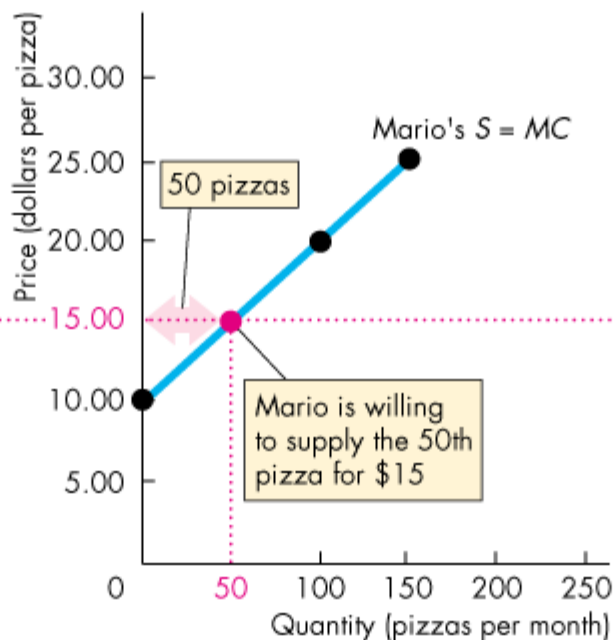
(b) Market supply

# Supply and Marginal Cost

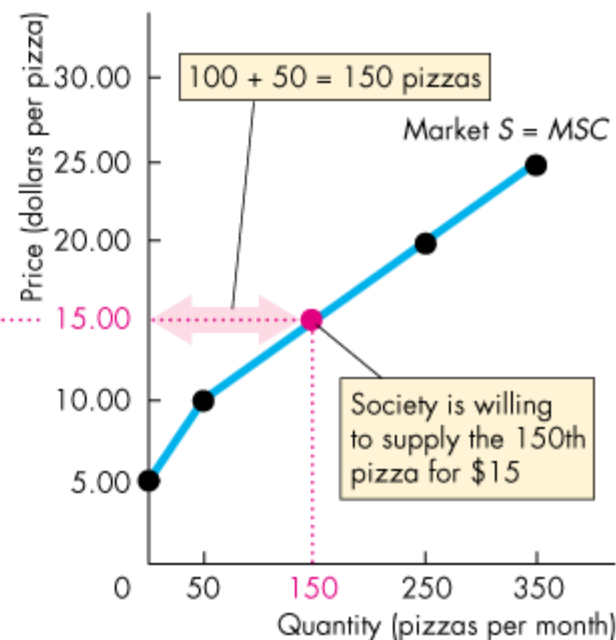
The market supply curve is the horizontal sum of the individual supply curves.



(a) Max's supply



(b) Mario's supply



(b) Market supply

# Supply and Marginal Cost

## Producer Surplus

**Producer surplus** is the price received for a good minus the minimum-supply price (marginal cost), summed over the quantity sold.

It is measured by the area below the market price and above the supply curve, summed over the quantity sold.

Figure on the next slide shows the producer surplus from pizza when the market price is \$15 a pizza.

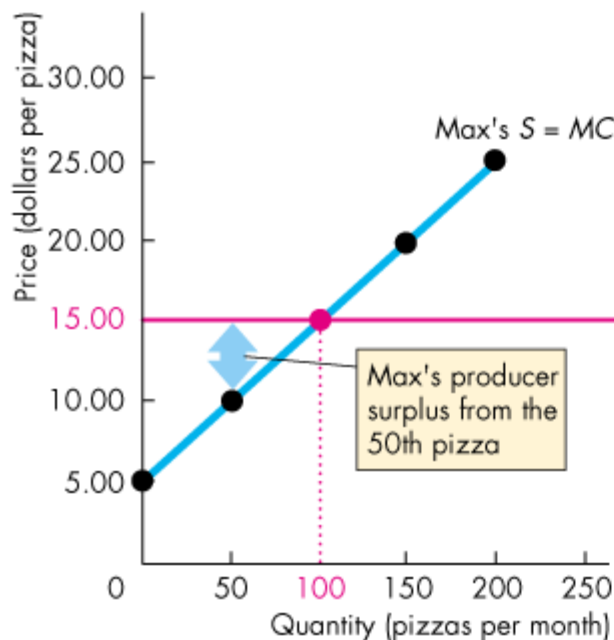


# Supply and Marginal Cost

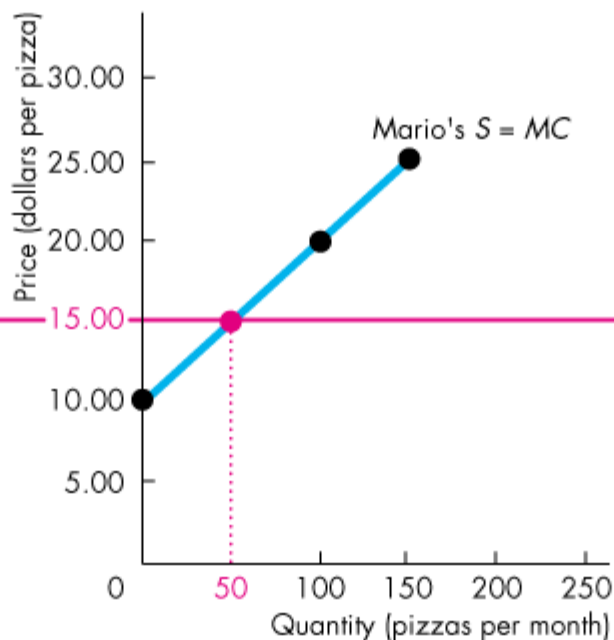


Max is willing to produce the 50<sup>th</sup> pizza for \$10.

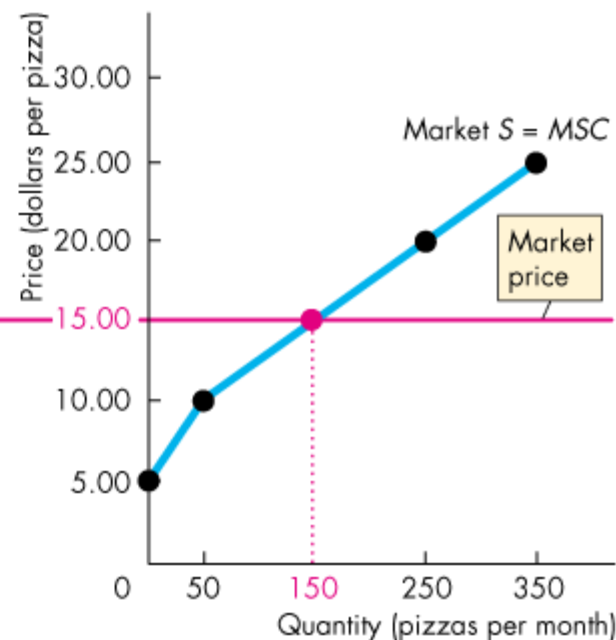
Max's producer surplus from the 50<sup>th</sup> pizza is the price minus the marginal cost, which is \$5.



(a) Max's producer surplus



(b) Mario's producer surplus

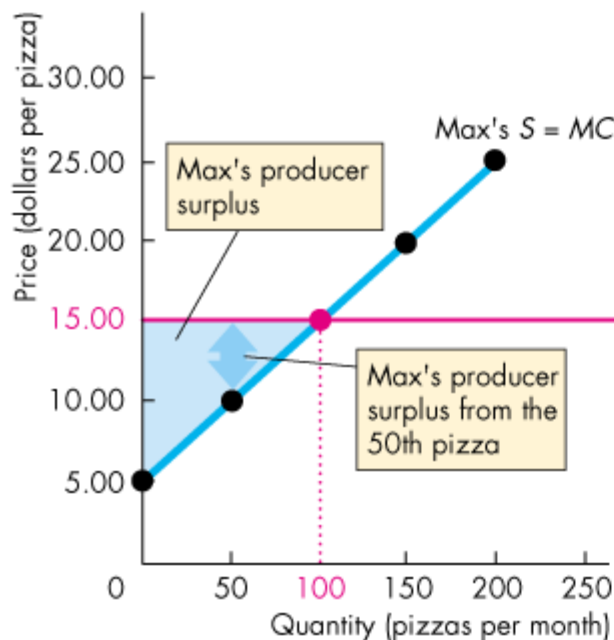


(c) Economy producer surplus

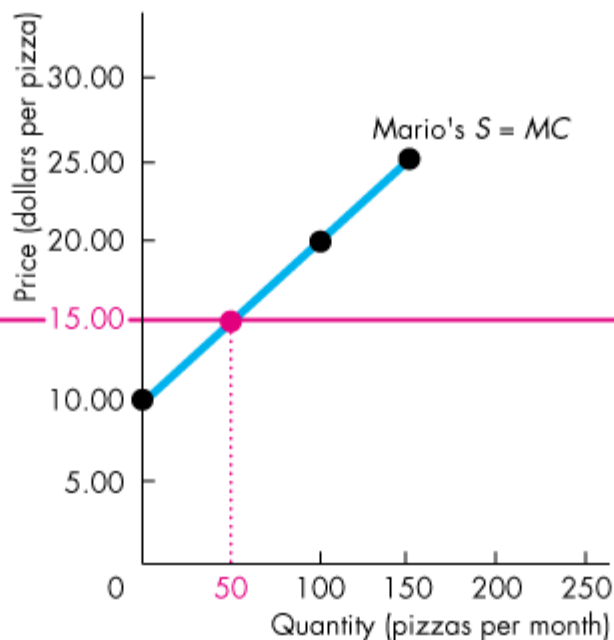
# Supply and Marginal Cost

At \$15 a pizza, Max sell 100 pizzas.

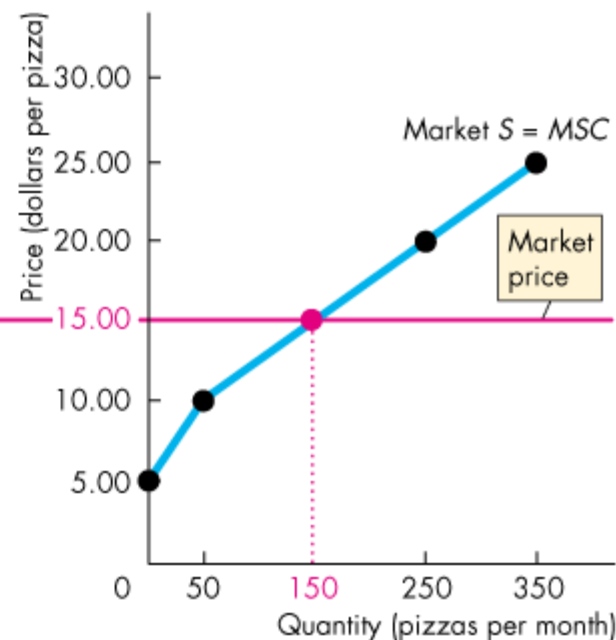
So his producer surplus is the area of the blue triangle.



(a) Max's producer surplus



(b) Mario's producer surplus

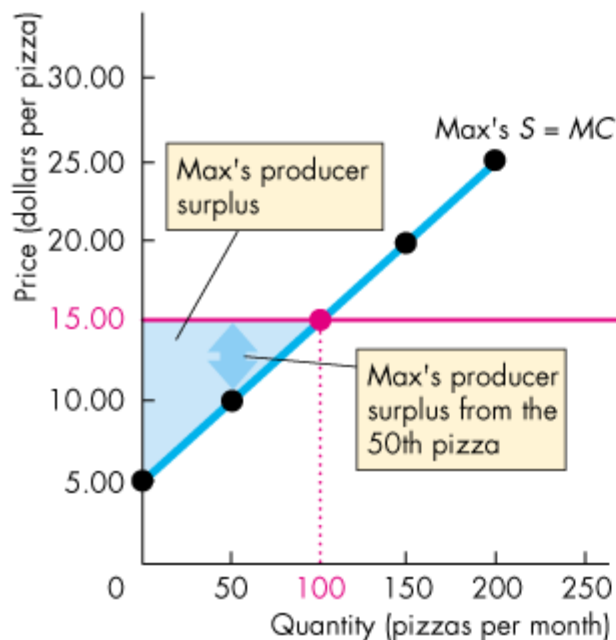


(c) Economy producer surplus

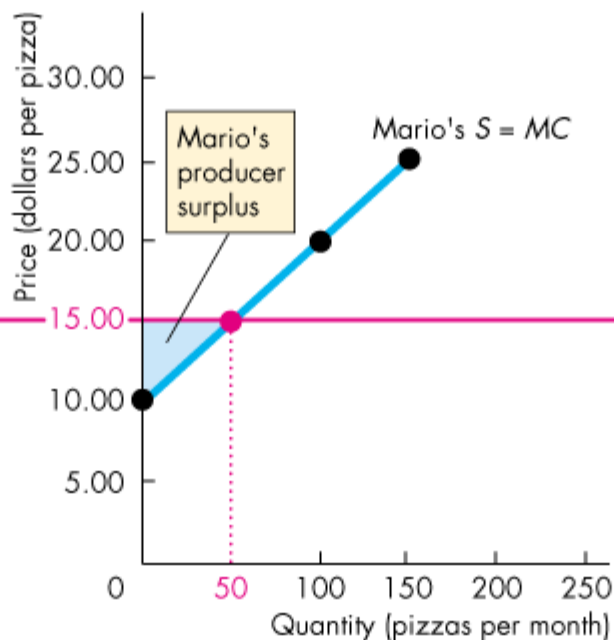
# Supply and Marginal Cost

At \$15 a pizza, Mario sells 50 pizzas.

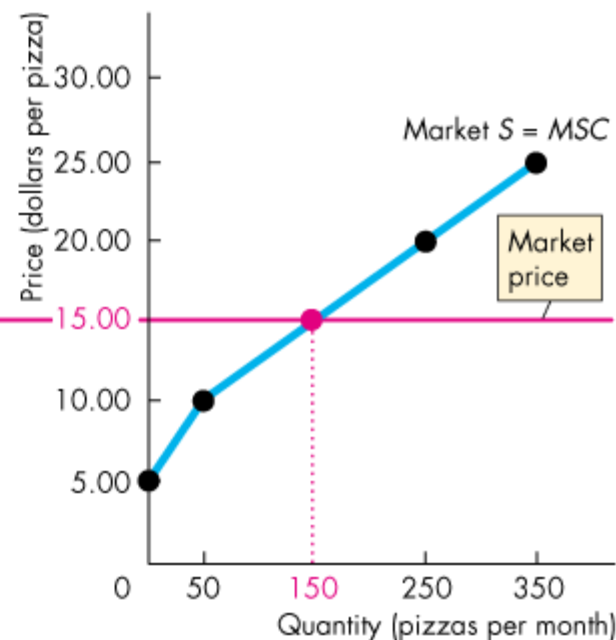
So his producer surplus is the area of the blue triangle.



(a) Max's producer surplus



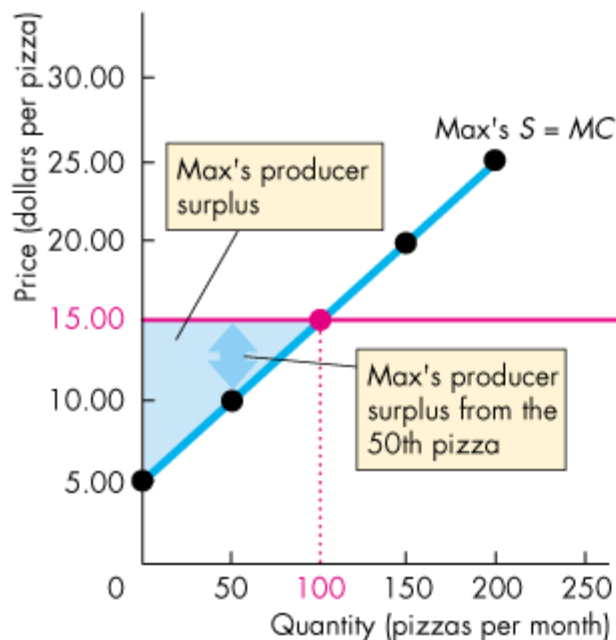
(b) Mario's producer surplus



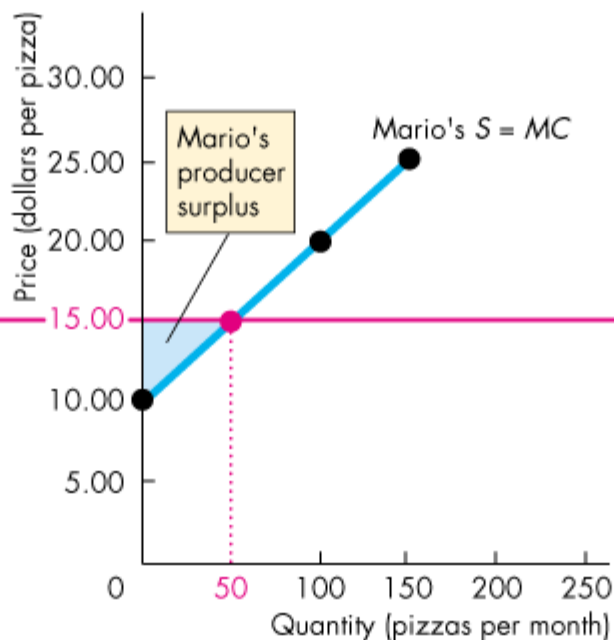
(c) Economy producer surplus

# Supply and Marginal Cost

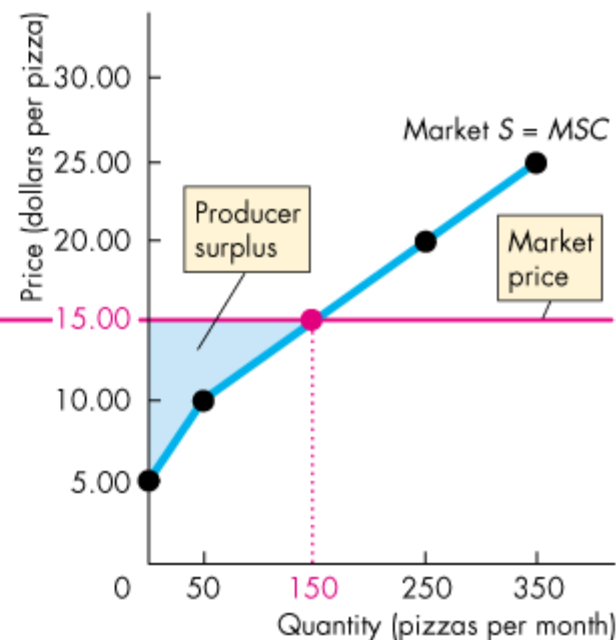
At \$15 a pizza, the producer surplus for the economy is the area under the market price above the market supply curve, summed over the 150 pizzas sold.



(a) Max's producer surplus



(b) Mario's producer surplus

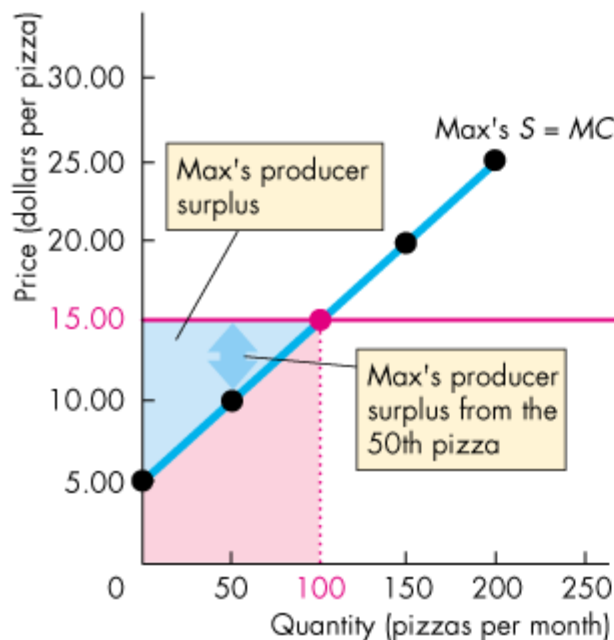


(c) Economy producer surplus

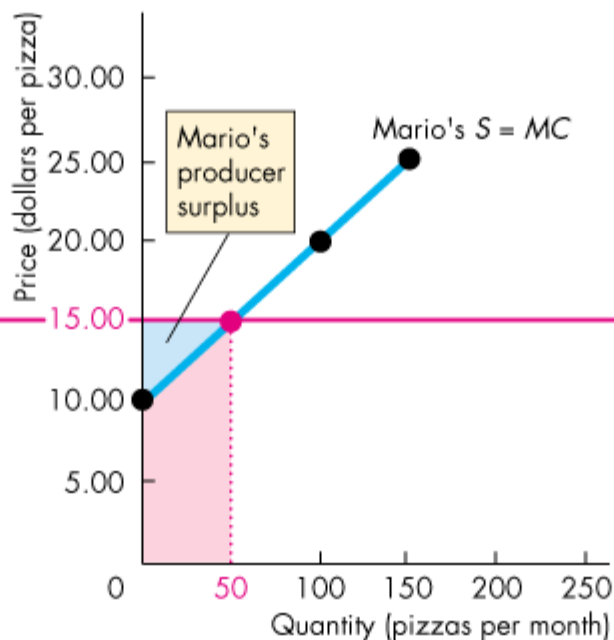
## Supply and Marginal Cost

The red areas show the cost of producing the pizzas sold.

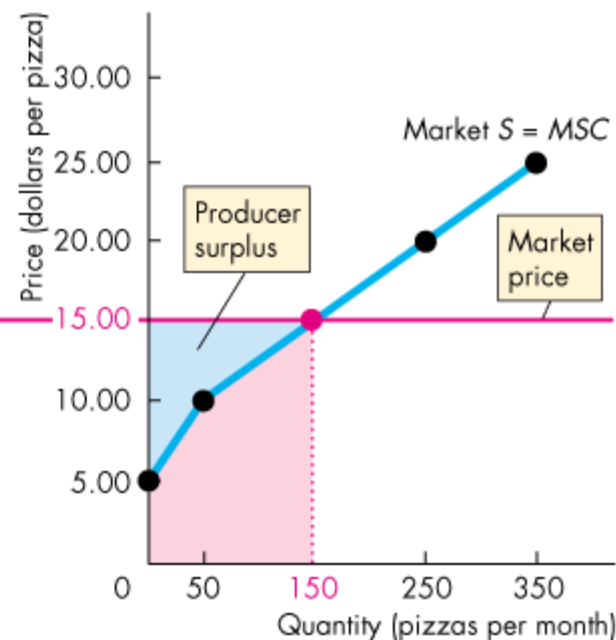
The producer surplus is the value of the pizza sold in excess of the cost of producing it.



(a) Max's producer surplus



(b) Mario's producer surplus



(c) Economy producer surplus

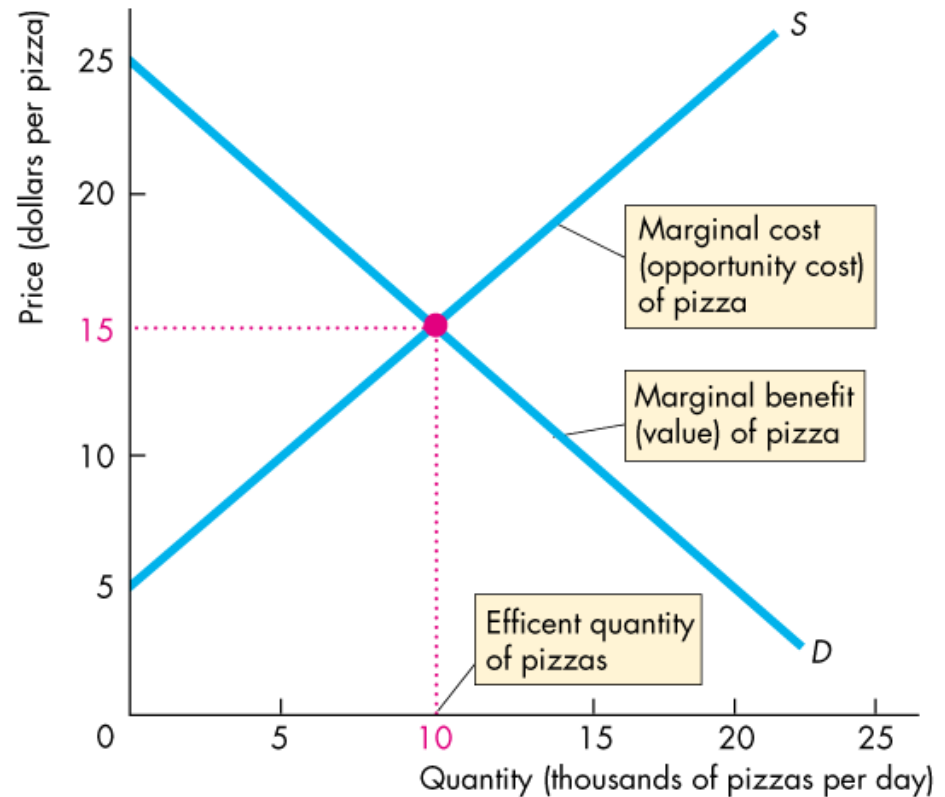
# Is the Competitive Market Efficient?



## Efficiency of Competitive Equilibrium

A competitive market creates an efficient allocation of resources at equilibrium.

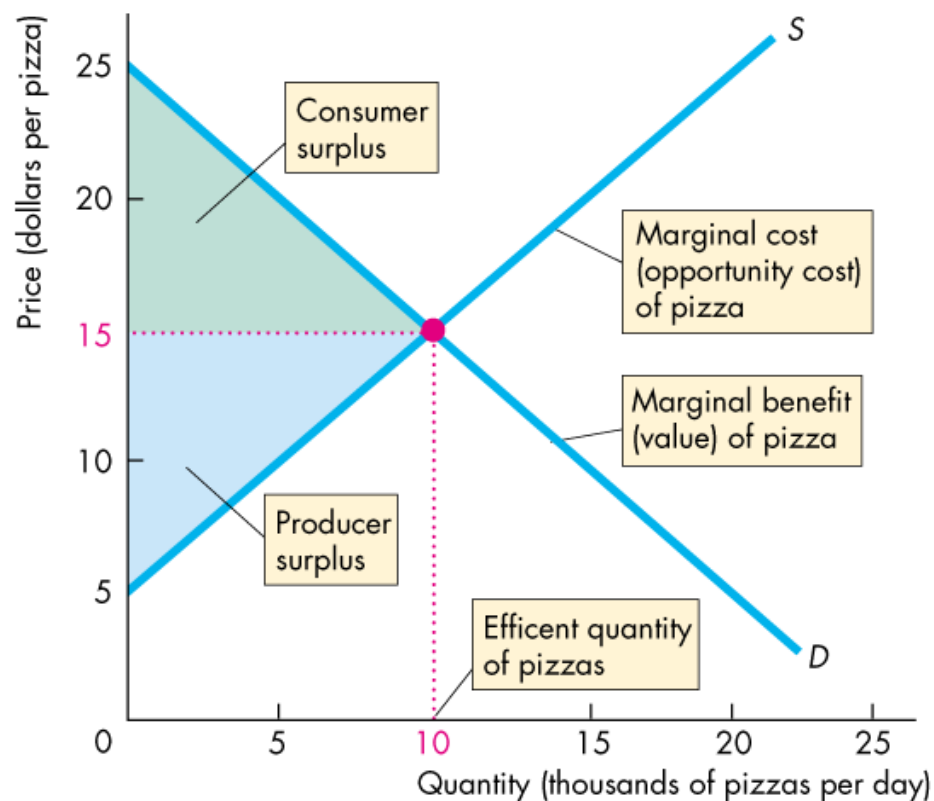
In equilibrium, the quantity demanded equals the quantity supplied.



# Is the Competitive Market Efficient?

At the equilibrium quantity, marginal benefit equals marginal cost, so the quantity is the efficient quantity.

When the efficient quantity is produced, total surplus (the sum of consumer surplus and producer surplus) is maximized.

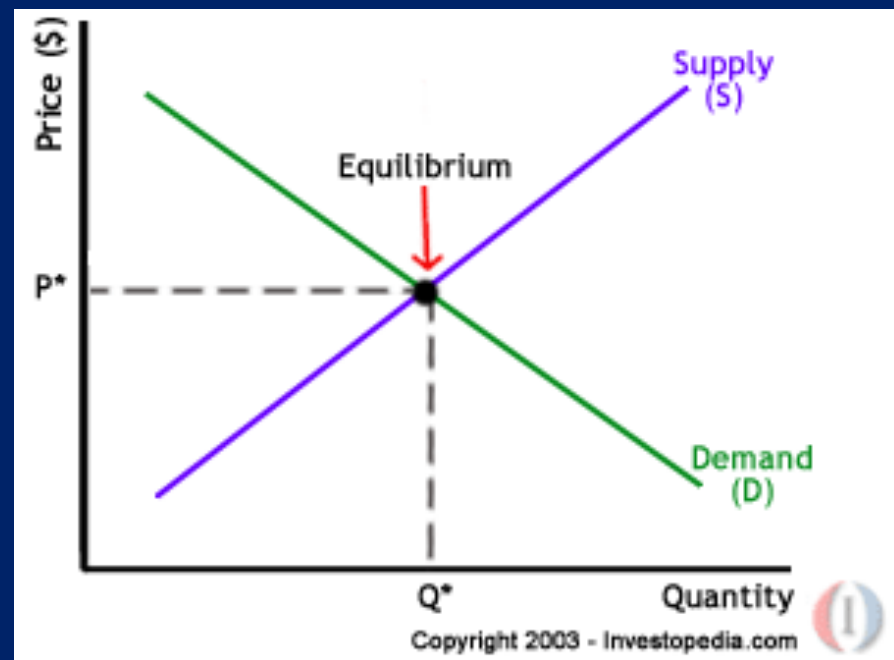


# Equilibrium Price

The point at where demand and supply cross is the market **equilibrium**

- At this point, quantity demanded equals quantity supplied,  $Q^*$ .
- The equilibrium price is  $P^*$

We expect  $Q^*$  items to be sold at a price  $P^*$ .

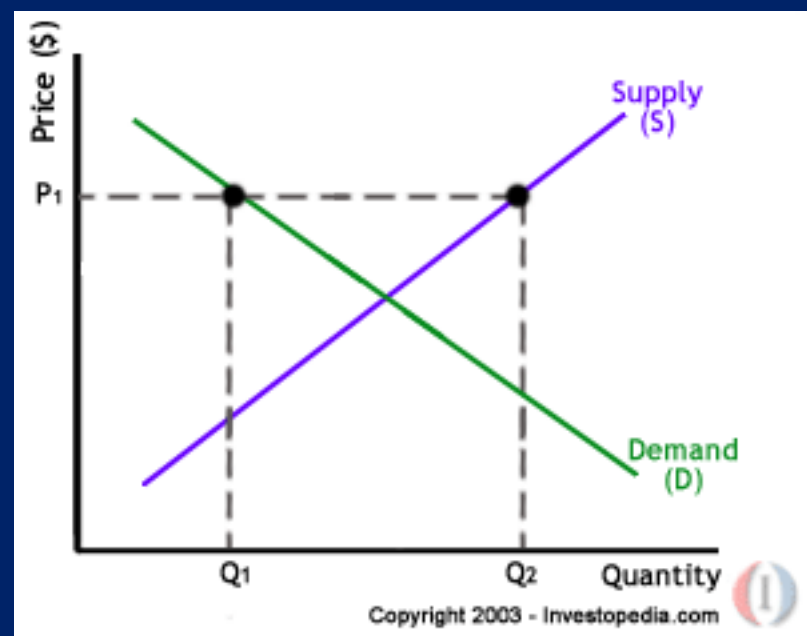




# Excess Supply: Prices will fall

At price  $P_1$  supply  $>$  demand:  
we have **excess supply**

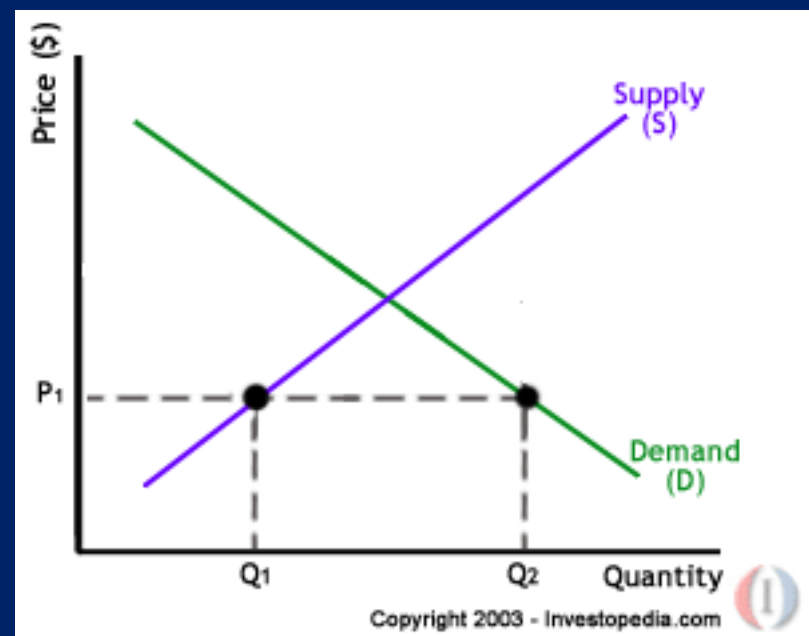
- There is a product **surplus**
- $Q_2 - Q_1$  goods will be supplied, but not purchased
- Sellers will **lower prices**
- Eventually settling to equilibrium price  $P^*$ , where quantity supplied = quantity demanded



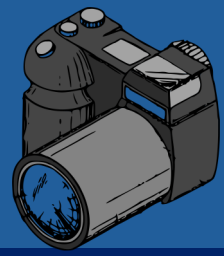
# Excess Demand: Prices will rise

At price  $P_1$  demand  $>$  supply:  
we have **excess demand**

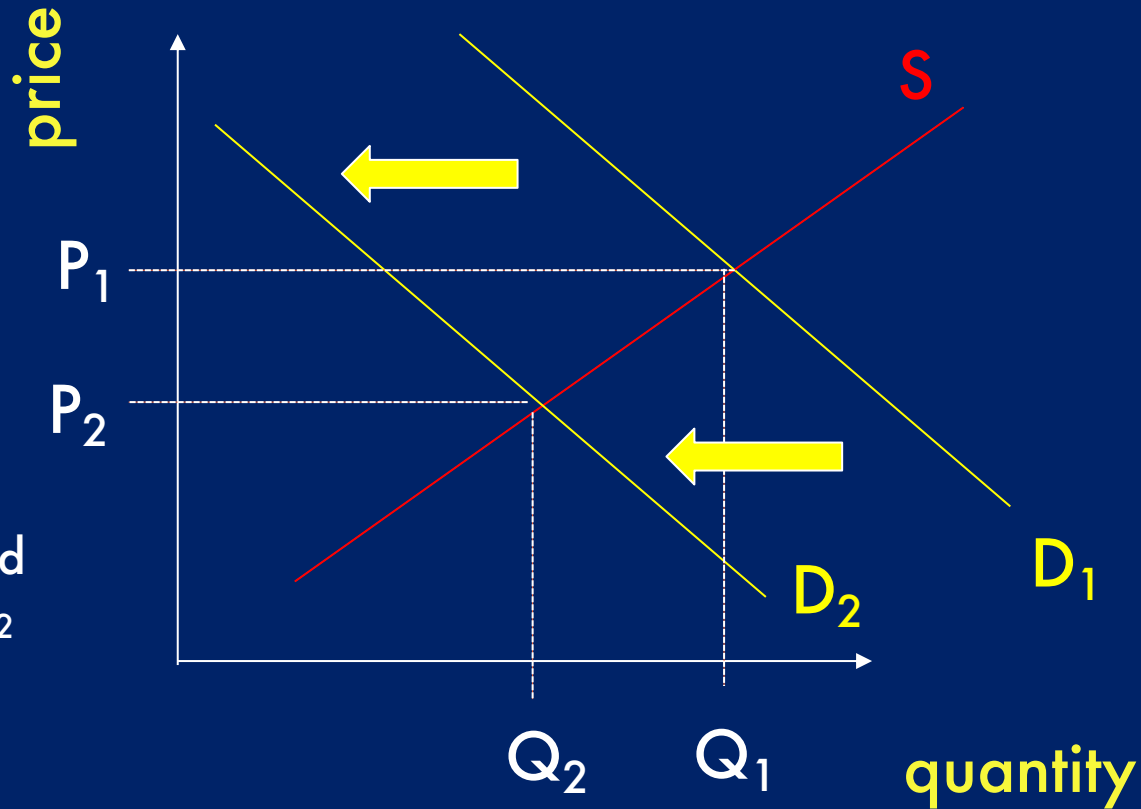
- There is a product **shortage**
- $Q_2 - Q_1$  goods will be demanded, but will not be supplied
- Sellers will **raise prices**
- Eventually settling to equilibrium price  $P^*$ , where quantity supplied = quantity demanded



# Shifts in Demand/Supply: Market “shock”



- A shift in demand (or supply) will affect equilibrium price and quantity
- Here is a negative shift in demand from  $D_1$  to  $D_2$
- Equilibrium price falls to  $P_2$  and equilibrium quantity falls to  $Q_2$



- Example: Could be a result of a **technology disruption**
- S&D of analogue cameras/photographic film.  $D_1$  before digital camera disruption,  $D_2$  afterwards. Price and quantity of analogue photography falls.