Section 2
Supply and Demand: How Markets Work

Reference:

N. Gregory Mankiw and Mark P. Taylor (2023), "*Microeconomics*", Cengage Learning, Chapter 3

The slides of this section are mainly based on the 6th edition of the book by Mankiw and Taylor (2023). In some slides we reproduce figures, sentences and definitions given in the book.

Introductory Video: Record Eggs' Prices

https://www.youtube.com/watch?v=UpS7jEy6UqM

Markets
Commodities

Russia's Diesel Ban Threatens to Roil Global Markets—If It Lasts

- The nation shipped more than 1 million barrels a day this year
- Diesel is used in everything from ships to manufacturing

An oil drilling site near Almetyevsk, Russia. *Photographer: Andrey Rudakov/Bloomberg*

By Jack Wittels and Alex Longley
September 21, 2023 at 1:57 PM EDT

Russia's decision to ban exports of diesel — and gasoline — risks disrupting fuel supplies ahead of winter, but how deep the impact will be depends on how long it lasts.

The nation shipped more than one million barrels a day of diesel-type fuel so far this year, narrowly making it the world's biggest seaborne exporter, according to data from Vortexa. That's an enormous chunk of supply for the market to lose at short notice — roughly enough to meet the entire demand of Germany.

Contents

A. What Is a Market?

B. Supply and Demand

C. Comparative Statics

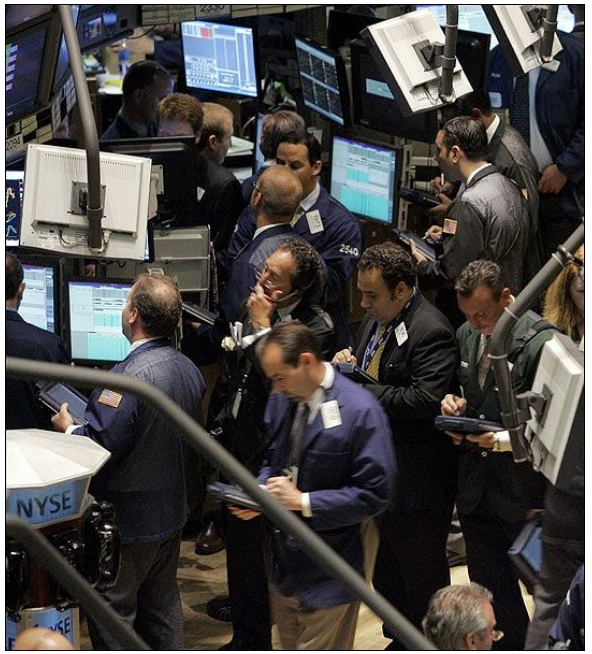
D. Elasticity

E. Appendix

A. What Is a Market?

What Is a Market?

The **market** is a collection of buyers and sellers that, through their actual or potential interactions, determine the price of a good or set of goods.



Types of Goods

- **Search goods**: qualities of the good can be assessed prior to purchase.
- **Experience goods**: qualities of the good are discovered only after purchase.
- **Credence goods:** qualities of the good cannot be evaluated in normal use, even after purchase (e.g. health care, repair services, legal and financial advice, management consulting)

Competitive Market

- A **competitive market** is a market in which there are **many buyers and sellers** so that each has a **negligible impact on the market price**.

- **Buyers and sellers are price takers**

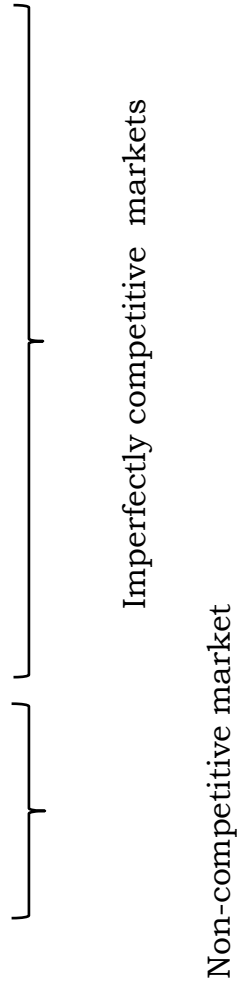
Perfectly competitive Market

A perfectly competitive market should satisfy the following assumptions:

- **Many buyers** and **sellers**;
- Each buyer and seller has **perfect information**;
- Buyers and sellers are '**price-takers**';
- **Freedom to entry and exit** to and from the market;
- Goods and services are **homogeneous**;
- Buyers and sellers act **independently**;
- all costs (private and social costs) and benefits are accounted for

Imperfectly competitive and non-competitive markets

- **Oligopoly**
  - Few sellers
  - Not always aggressive competition
- **Monopolistic Competition**
  - Many sellers
  - Slightly differentiated products (e.g. market for magazines)
  - Each seller may set price for its own product
- **Monopoly (and Natural Monopoly)**
  - One seller that controls the price
  - Barrier to entry the market

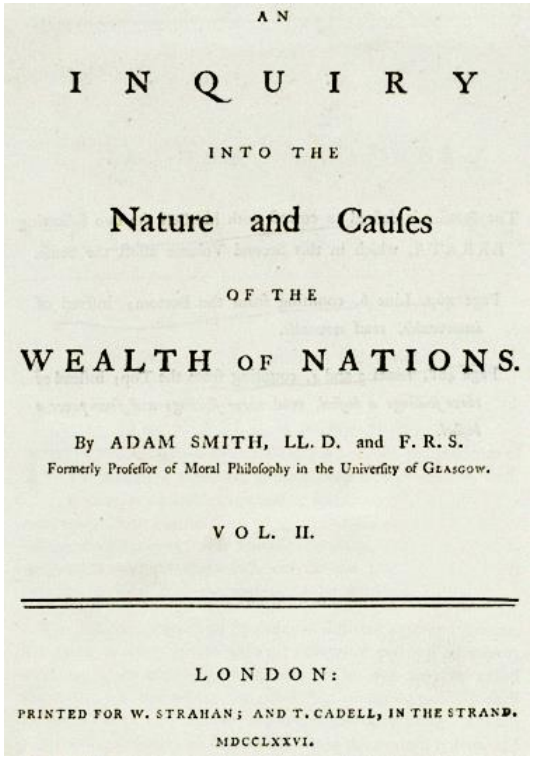


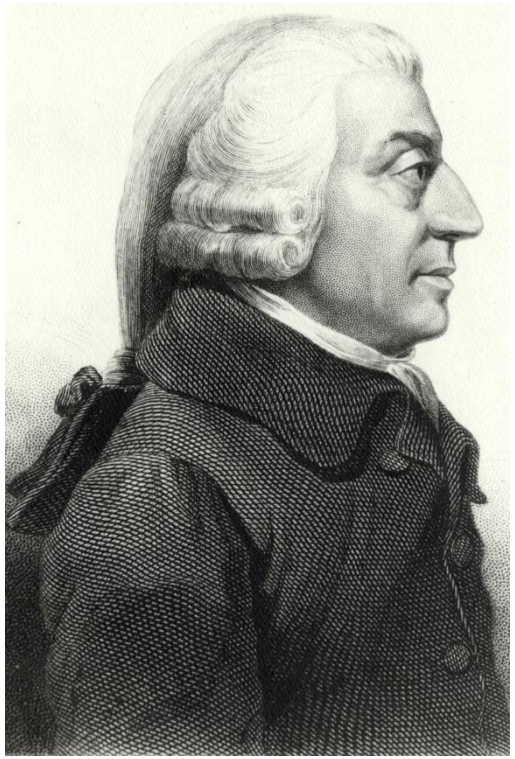
B. Supply and Demand

Supply and Demand

- **Supply and demand** are the forces that make market economies work.
- They determine the quantity of each good produced and the price at which it is sold.
- Economists use the model of supply and demand to analyze **competitive markets**

↳ Perfectly competitive markets
↳ Imperfectly competitive markets (competition at least to a certain degree)


AN
INQUIRY
INTO THE
Nature and Cauſes
OF THE
WEALTH OF NATIONS.
By ADAM SMITH, LL. D. and F. R. S.
Formerly Profeſſor of Moral Philoſophy in the Univerſity of GLASGOW.
VOL. II.
LONDON:
PRINTED FOR W. STRAHAN; AND T. CADELL, IN THE STRAND.
MDCCLXXVI.



Source: https://de.wikipedia.org

Demand

- **Quantity demanded** is the amount of a good that buyers are willing and able to purchase.

- The **law of demand** states that, other things equal, the quantity demanded of a good falls when the price of the good rises.

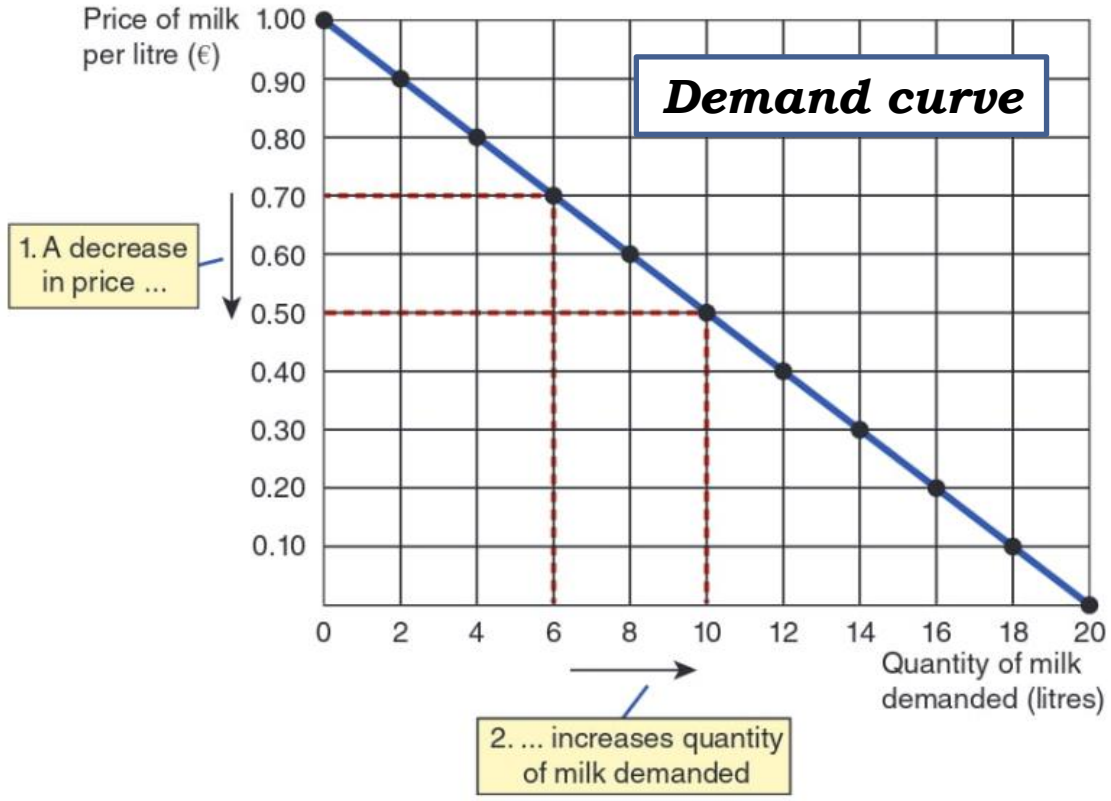
- The **demand schedule** is a table that shows the relationship between the price of the good and the quantity demanded.

Demand

The individual **demand curve** is a graph of the relationship between the price of a good and the quantity demanded.

Demand schedule

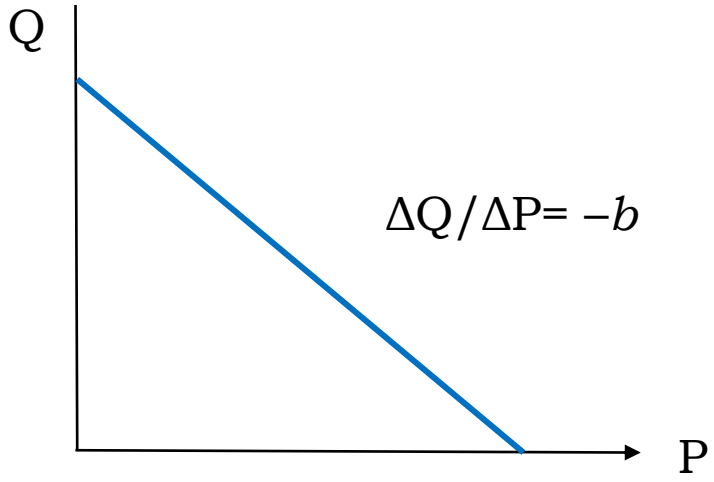
Price of milk per litre (€)	Quantity of milk demanded (litres per month)
0.00	20
0.10	18
0.20	16
0.30	14
0.40	12
0.50	10
0.60	8
0.70	6
0.80	4
0.90	2
1.00	0



Source: Mankiw & Taylor (2023), "Microeconomics"

Demand function

Price of milk per litre (€)	Quantity of milk demanded (litres per month)
0.00	20
0.10	18
0.20	16
0.30	14
0.40	12
0.50	10
0.60	8
0.70	6
0.80	4
0.90	2
1.00	0



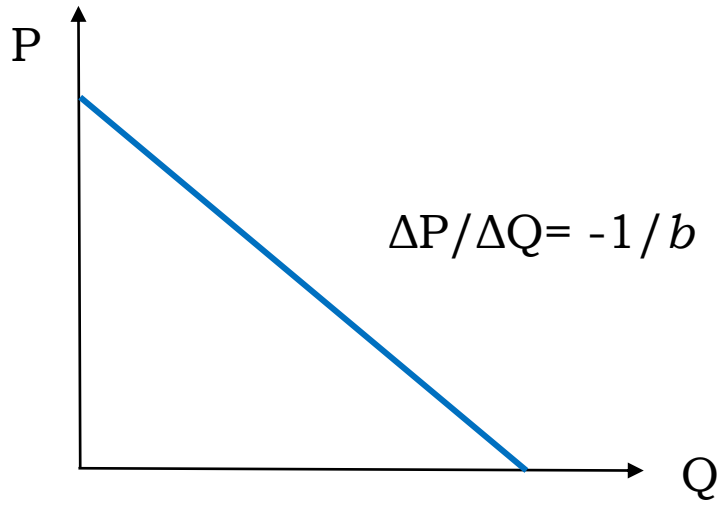
Information included in this table can be represented with a mathematical expression, i.e. a function, for instance a linear function

$$Q = a - bP$$

- Q = demand
- b = slope
- P = price

Inverse demand function

Price of milk per litre (€)	Quantity of milk demanded (litres per month)
0.00	20
0.10	18
0.20	16
0.30	14
0.40	12
0.50	10
0.60	8
0.70	6
0.80	4
0.90	2
1.00	0



In economics, by ***convention*** *we put quantity on the horizontal* (not *vertical*) *axis and price on the vertical axis*

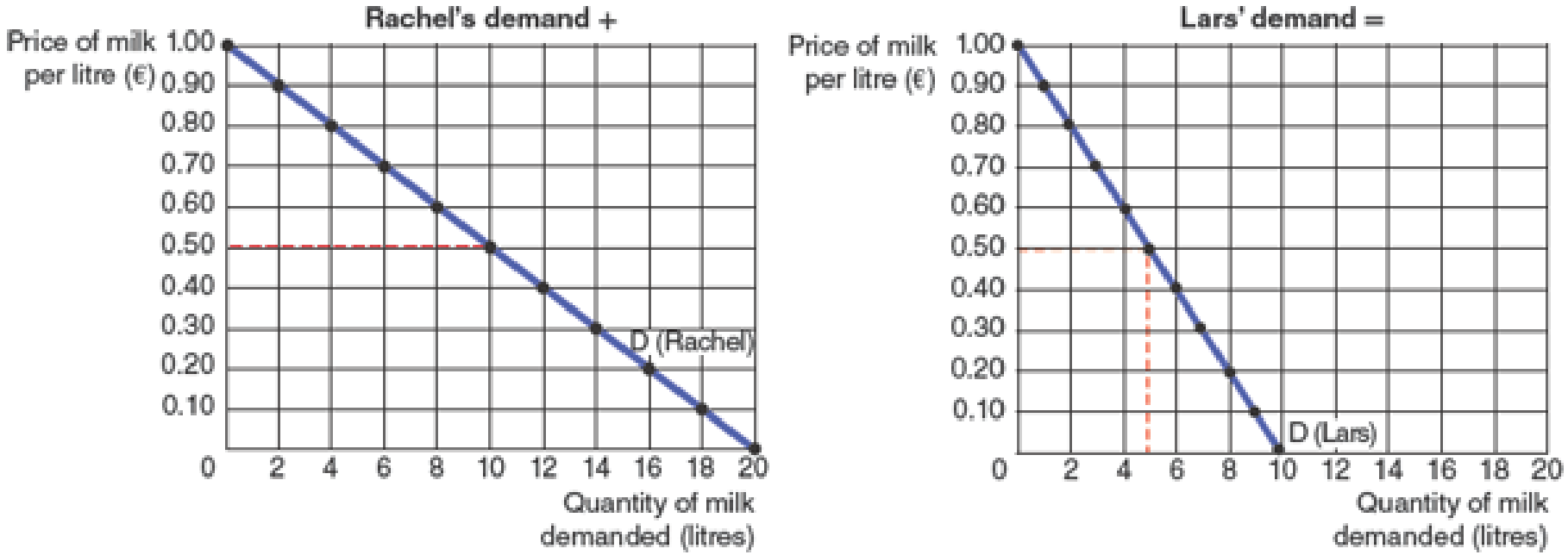
Inverse demand

$$P = \frac{a}{b} - \frac{1}{b} \times Q$$

$$\Delta P / \Delta Q = -1/b$$

Market Demand Versus Individual Demand

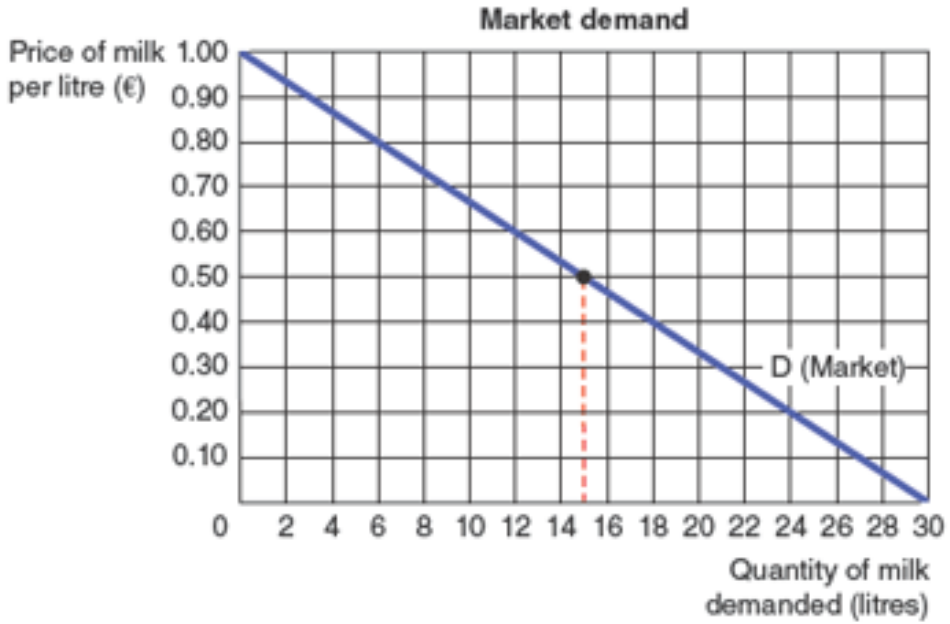
Market demand refers to the sum of all individual demands for a particular good or service.



Source: Mankiw & Taylor (2023), "Microeconomics"

Market Demand Versus Individual Demand

Graphically, individual demand curves for private goods are summed **horizontally** to obtain the market demand curve.



Price of milk per litre (€)	Rachel +	Lars =	Market
0.00	20	10	30
0.10	18	9	27
0.20	16	8	24
0.30	14	7	21
0.40	12	6	18
0.50	10	5	15
0.60	8	4	12
0.70	6	3	9
0.80	4	2	6
0.90	2	1	3
1.00	0	0	0

Source: Mankiw & Taylor (2023), “Microeconomics”

Movements Along the Demand Curve

Assume the price of milk falls:

- More will be demanded because of income and substitution effects.
- **The income effect:** Assume that incomes remain constant then a fall in the price of milk means that consumers can now afford to buy more with their income.
- **The substitution effect**: Milk is lower in price compared to other similar products so some consumers will choose to substitute the more expensive drinks with the now cheaper milk.

Relations of Two Demanded Goods

- **Substitutes**: two goods for which an increase in the price of one leads to an increase in the demand for the other (e.g. pencils and pens, CocaCola and Pepsi)

- **Complements**: two goods for which an increase in the price of one leads to a decrease in the demand for the other (e.g. coffee and sugar, cars and petrol)

Supply

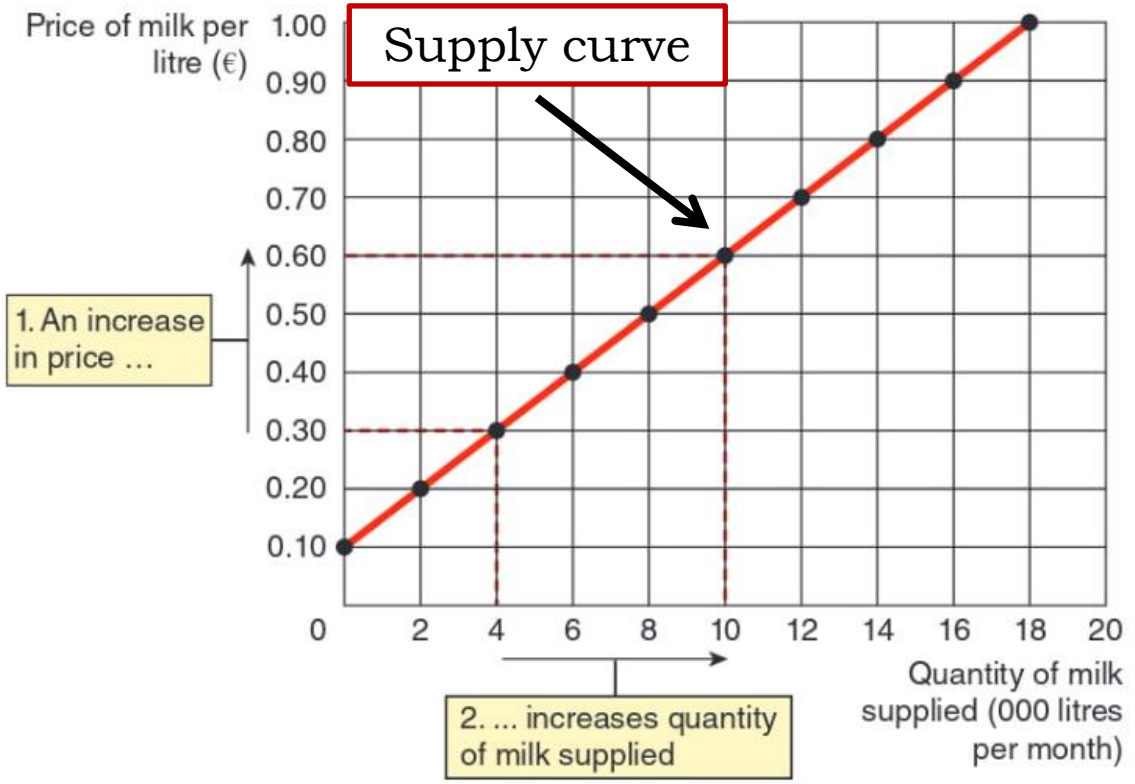
- **Quantity supplied** is the amount of a good that sellers are willing and able to sell.

- The **law of supply** states that, other things equal, the quantity supplied of a good rises when the price of the good rises.

- The **supply schedule** is a table that shows the relationship between the price of the good and the quantity supplied.

Supply

The individual **supply curve** is the graph of the relationship between the price of a good and the quantity supplied.



Price of milk per litre (€)	Quantity of milk supplied (000 litres per month)
0.00	0
0.10	0
0.20	2
0.30	4
0.40	6
0.50	8
0.60	10
0.70	12
0.80	14
0.90	16
1.00	18

Supply schedule

Source: Mankiw & Taylor (2023), "Microeconomics"

Market Supply Versus Individual Supply

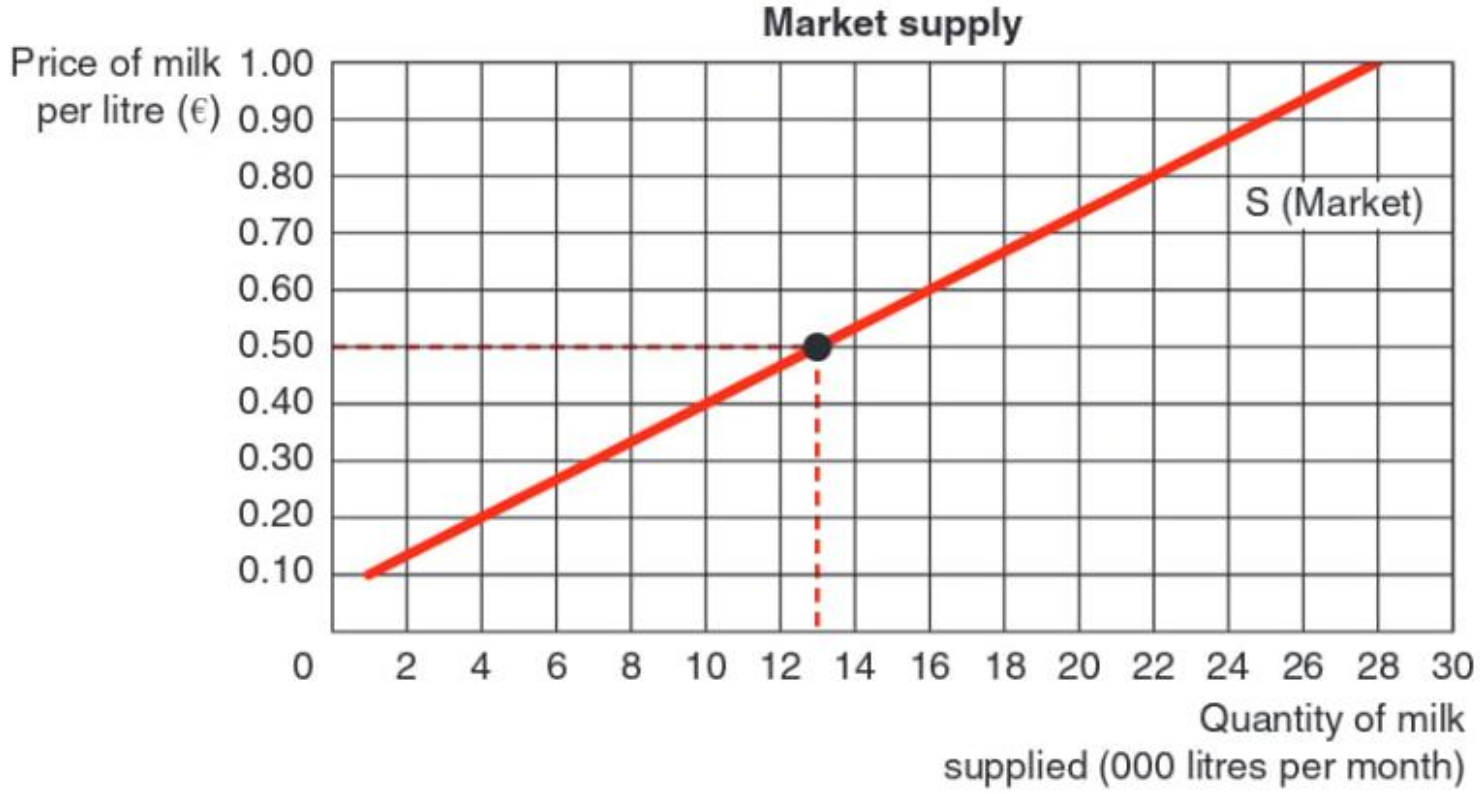
Market supply refers to the sum of all individual supplies for all sellers of a particular good or service.

	Quantity Supplied (000s litres per month)		
Price of milk per litre (€)	Richard +	Megan =	Market
0.00	0	0	0
0.10	0	1	1
0.20	2	2	4
0.30	4	3	7
0.40	6	4	10
0.50	8	5	13
0.60	10	6	16
0.70	12	7	19
0.80	14	8	22
0.90	16	9	25
1.00	18	10	28

Source: Mankiw & Taylor (2023), "Microeconomics"

Market Supply Versus Individual Supply

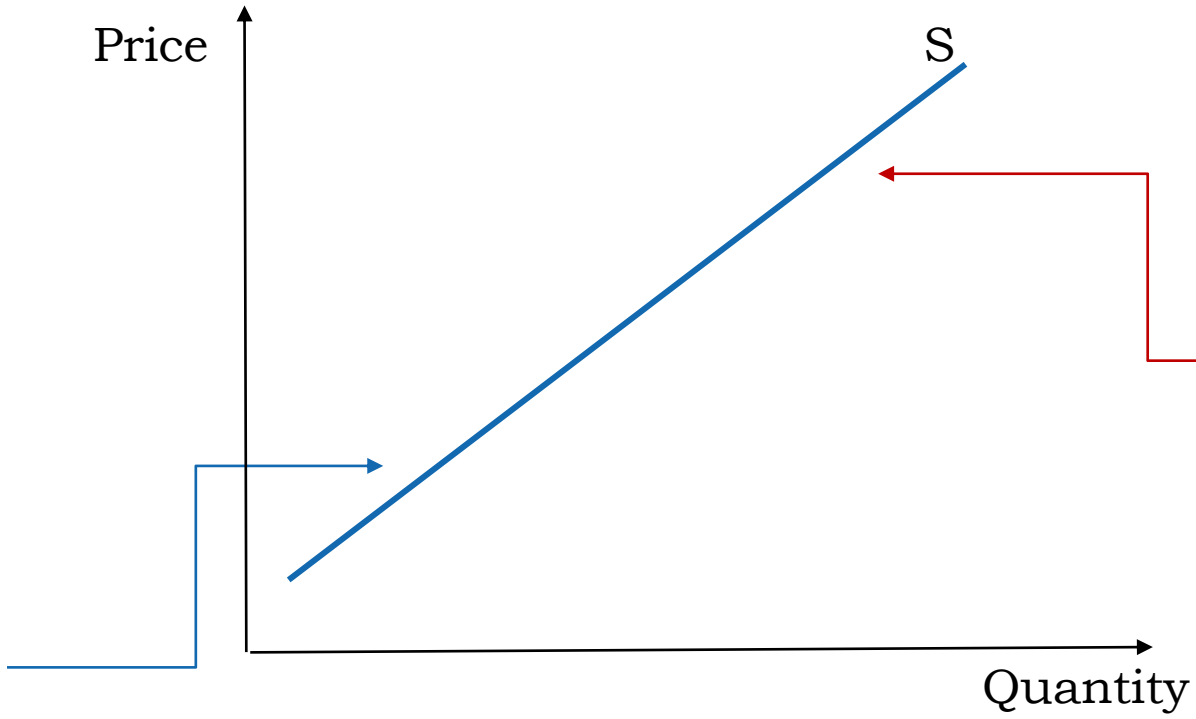
Graphically, individual supply curves are summed **horizontally** to obtain the market supply curve.



Source: Mankiw & Taylor (2023), "Microeconomics"

Market Supply and production cost (just intuition)

the costs of growing grapes in the plains are lower than the cost of growing grapes in the hills. One of the reasons is that in the hills you can't use many machine

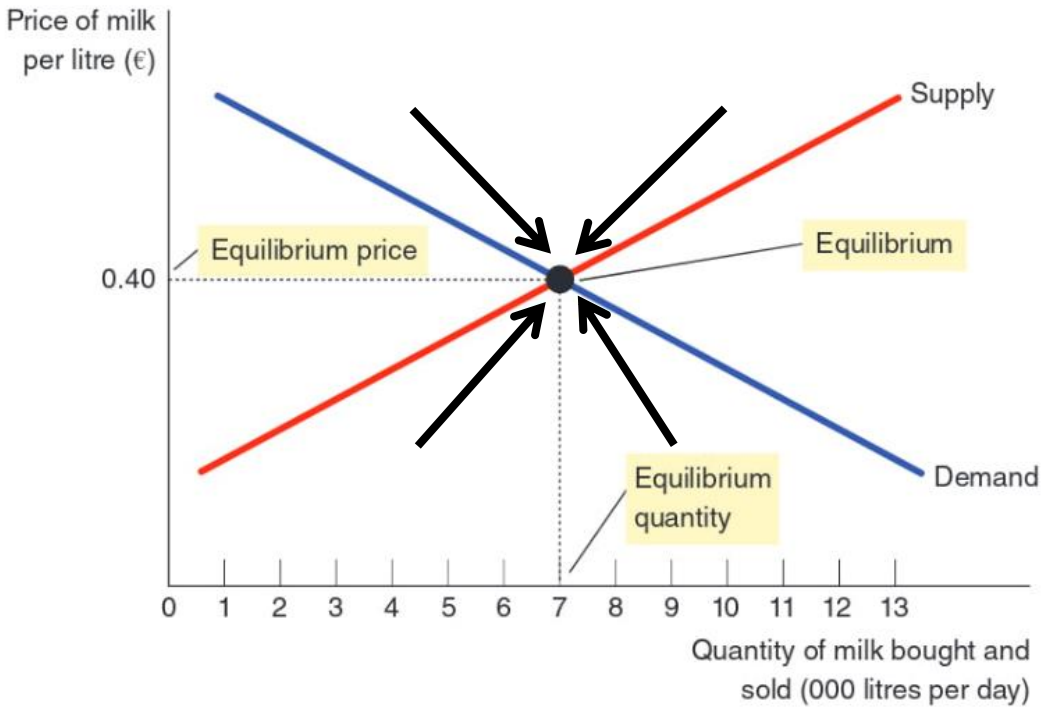


Supply and Demand

- **Equilibrium Price (P_{ME})**

  ↳ The price that balances quantity supplied and quantity demanded

  ↳ On a graph, it is the price at which supply and demand curves intersect.



Source: Mankiw & Taylor (2023), "Microeconomics"

Market prices

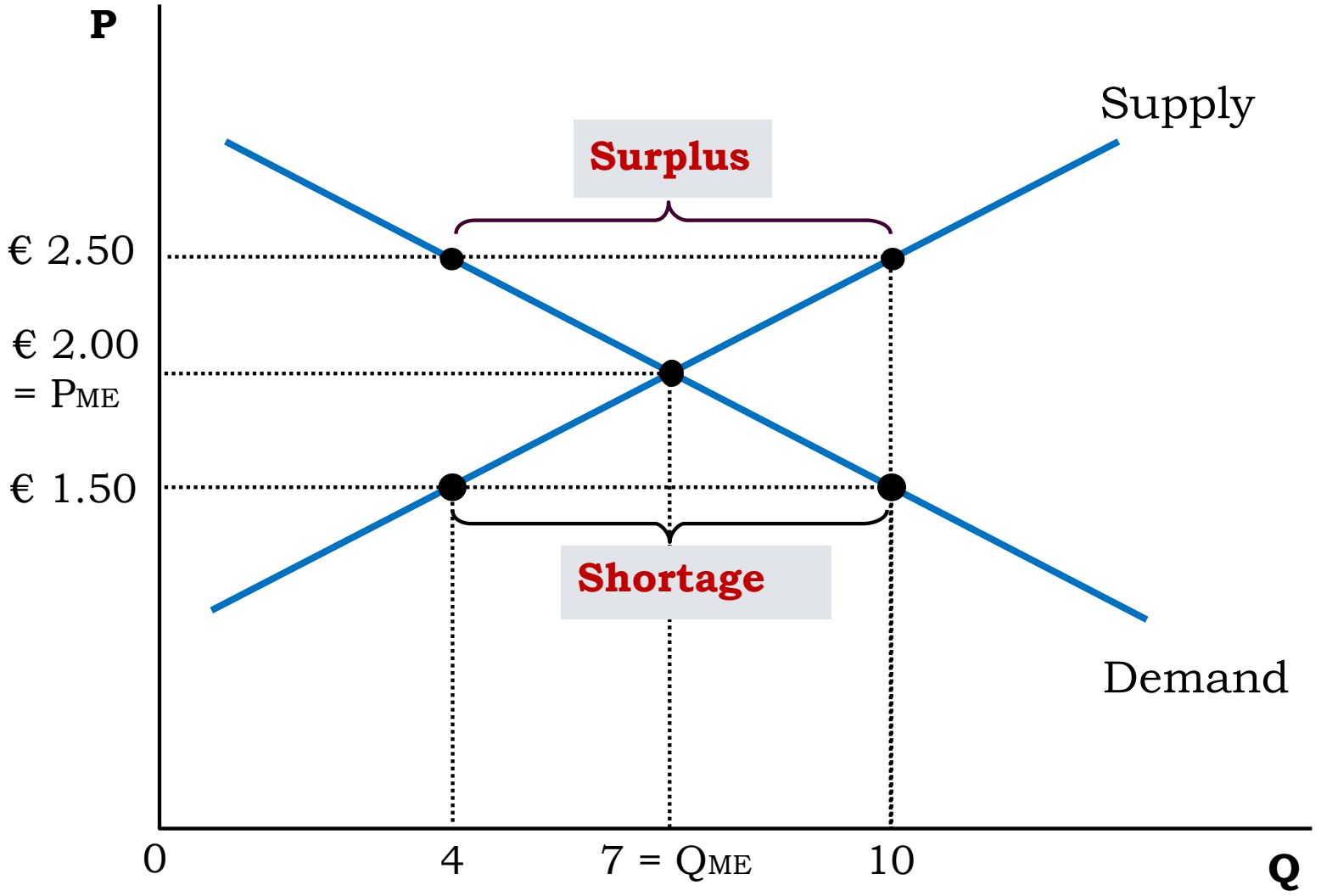
- A market price act as a signal about how scarce resources are

- Prices provides a signal to both producers and consumers
  - Producers: a high price tells that a product is in demand; a low price indicates that a good is being overproduced.
  - Consumers: a high price tells to think about their purchases more carefully; a low price indicates to buy more

- The market price should reflects all opportunity costs

- If the price of a liter of gasoline doesn't include the social cost determined by air pollution, then the price mechanism doesn't provide the right signal to producers and consumers ➔ no sustainable development

Supply and Demand



Supply and Demand

- **Surplus** or **Excess Supply**:
  P > P_{ME} leads to Q supplied > Q demanded
  ↳ Suppliers will lower the price to increase sales, thereby moving toward equilibrium.

- **Shortage** or **Excess Demand**:
  P < P_{ME} leads to Q demanded > Q supplied
  ↳ Suppliers will raise the price due to too many buyers chasing too few goods, thereby moving toward equilibrium.

The Algebra of Market Equilibrium

- Demand: $Q_d = 34 - 3P$
- Supply: $Q_s = 20 + 4P$

- At market equilibrium: Demand = Supply ($Q_d = Q_s$)
  → solve for **P**rice and **Q**uantity by substitution

Equilibrium price:

$34 - 3P = 20 + 4P$

$7P = 14$

$P = 14/7 = 2$

Equilibrium quantity:

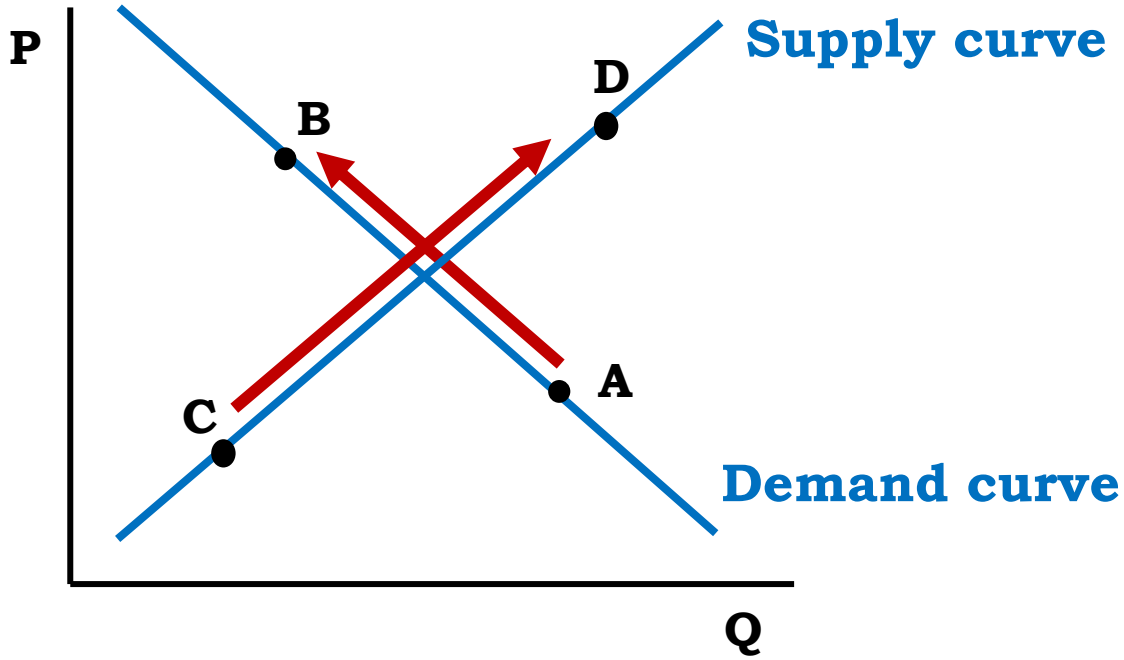
$Q_d = 34 - 3p = 34 - 3*2 = 28$

$Q_s = 20 + 4p = 20 + 4*2 = 28$

Supply and Demand

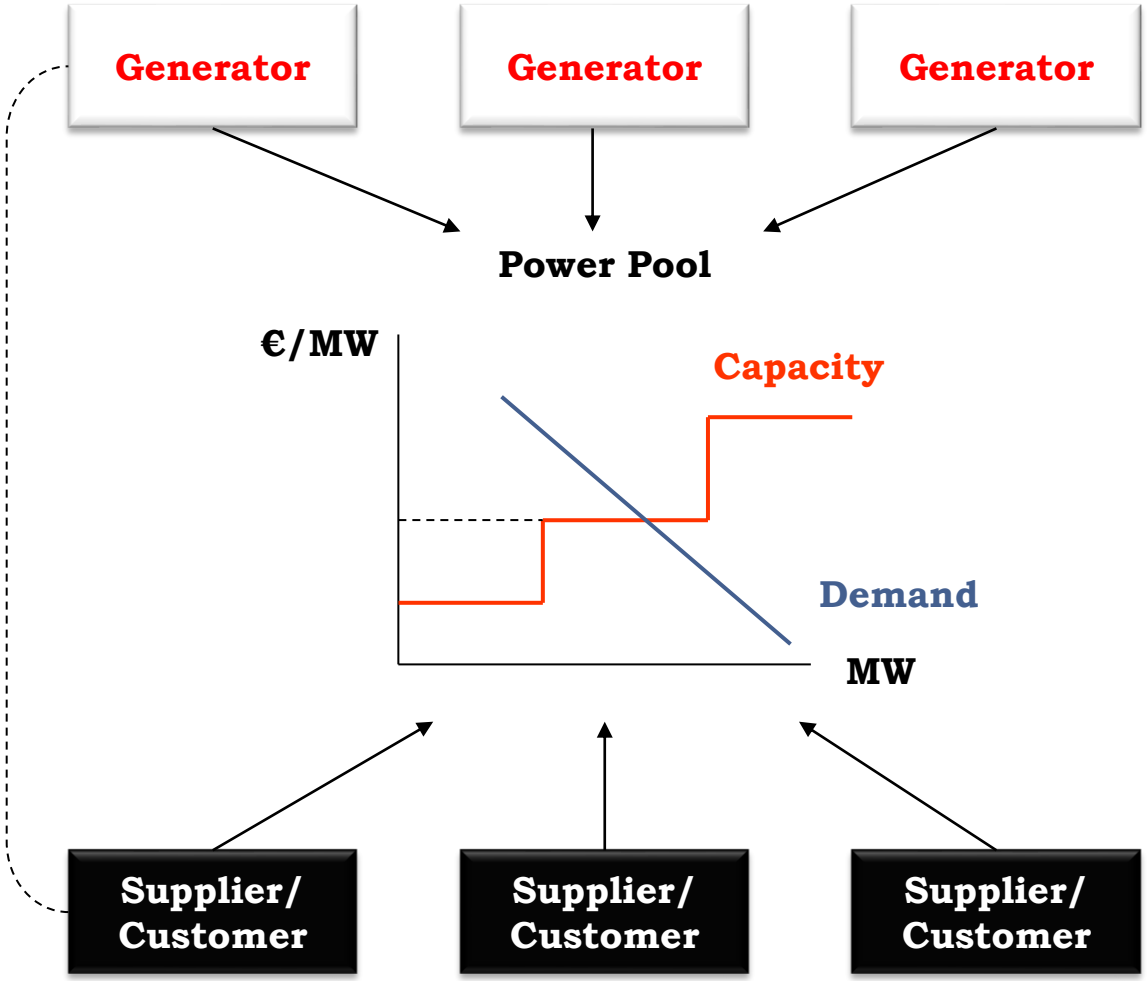
Change in Quantity Demanded/Supplied

↳ Movement along the demand/supply curve ➔ caused by a change in the price of the product.



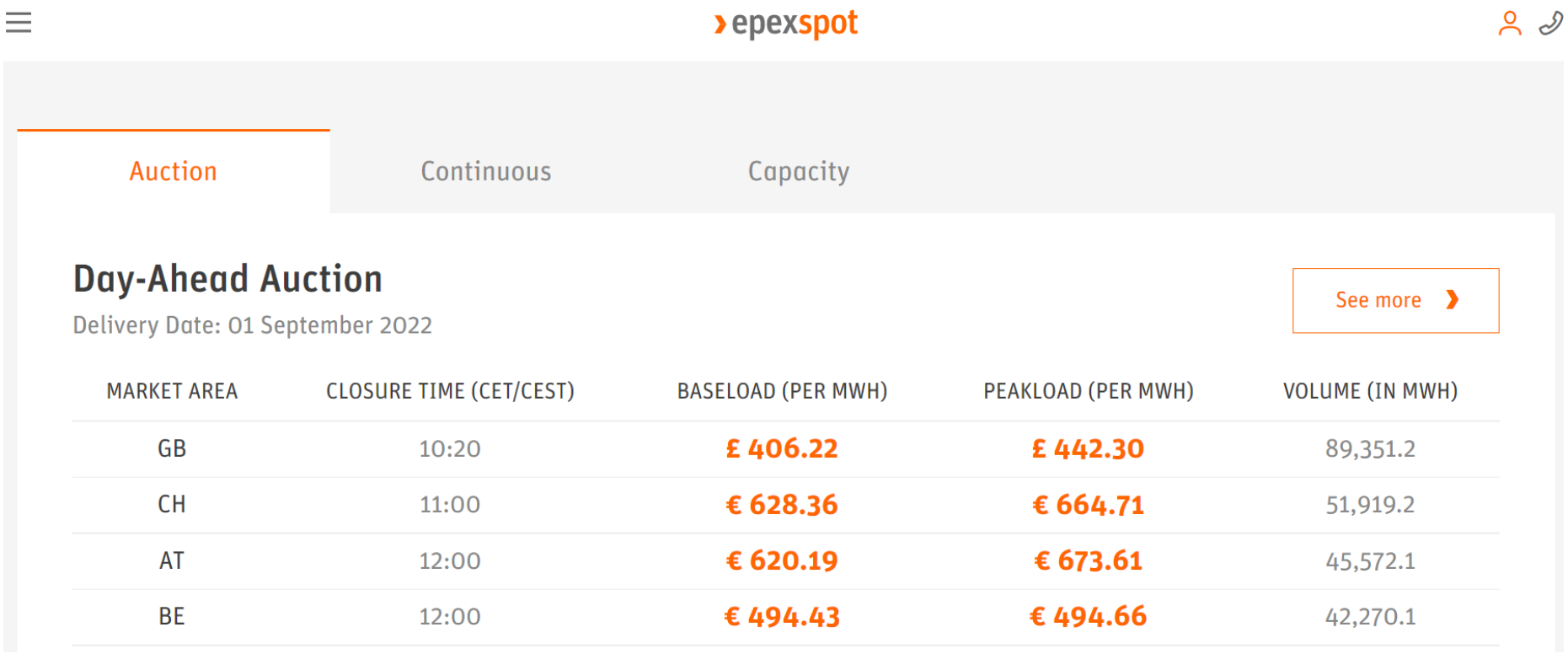
Example: Electricity spot market

- Spot market: on this market electricity is traded on a daily basis for physical delivery the following day (a day-ahead-market)
- Generators (and demand-side) bid prices and quantities
- TSO creates demand and supply curve and sets the price in each 'hour'



What Is a Market?

https://www.epexspot.com/en/market-data/dayaheadauction



MARKET AREA	CLOSURE TIME (CET/CEST)	BASELOAD (PER MWH)	PEAKLOAD (PER MWH)	VOLUME (IN MWH)
GB	10:20	£ 406.22	£ 442.30	89,351.2
CH	11:00	€ 628.36	€ 664.71	51,919.2
AT	12:00	€ 620.19	€ 673.61	45,572.1
BE	12:00	€ 494.43	€ 494.66	42,270.1

C. Comparative Statics

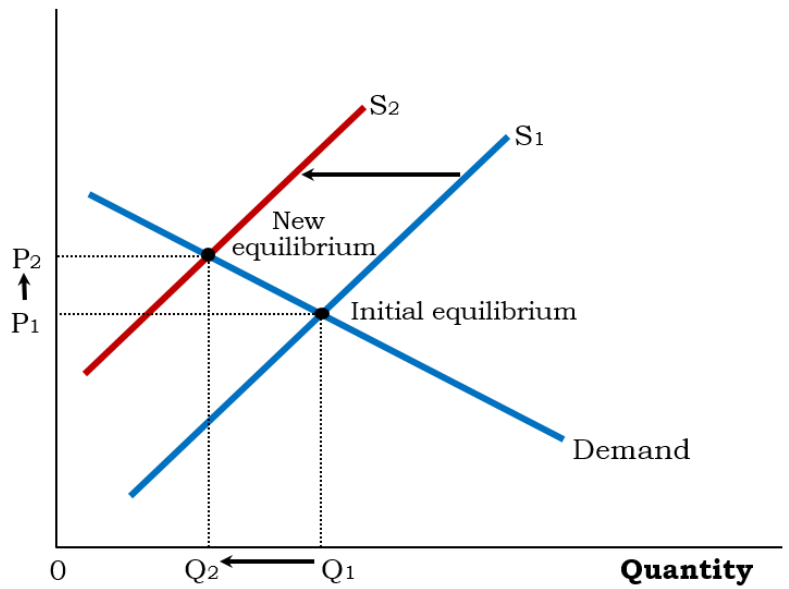
Comparative Statics

Three steps to analyzing changes in equilibrium:

1. Decide whether an event (e.g. change of the income or of the weather) shifts the demand curve, the supply curve or both of the curves.

2. Decide whether an event shifts the curve to the right or left.

3. Use the supply and demand diagram to compare the initial with the new equilibrium.



Shifts Versus Movements Along the Demand Curve

The factors affecting demand could be presented as a function written as:

$$D = f(P_n, P_1, P_2 \dots P_{n-1}, Y, T, \dots\dots)$$

Where:

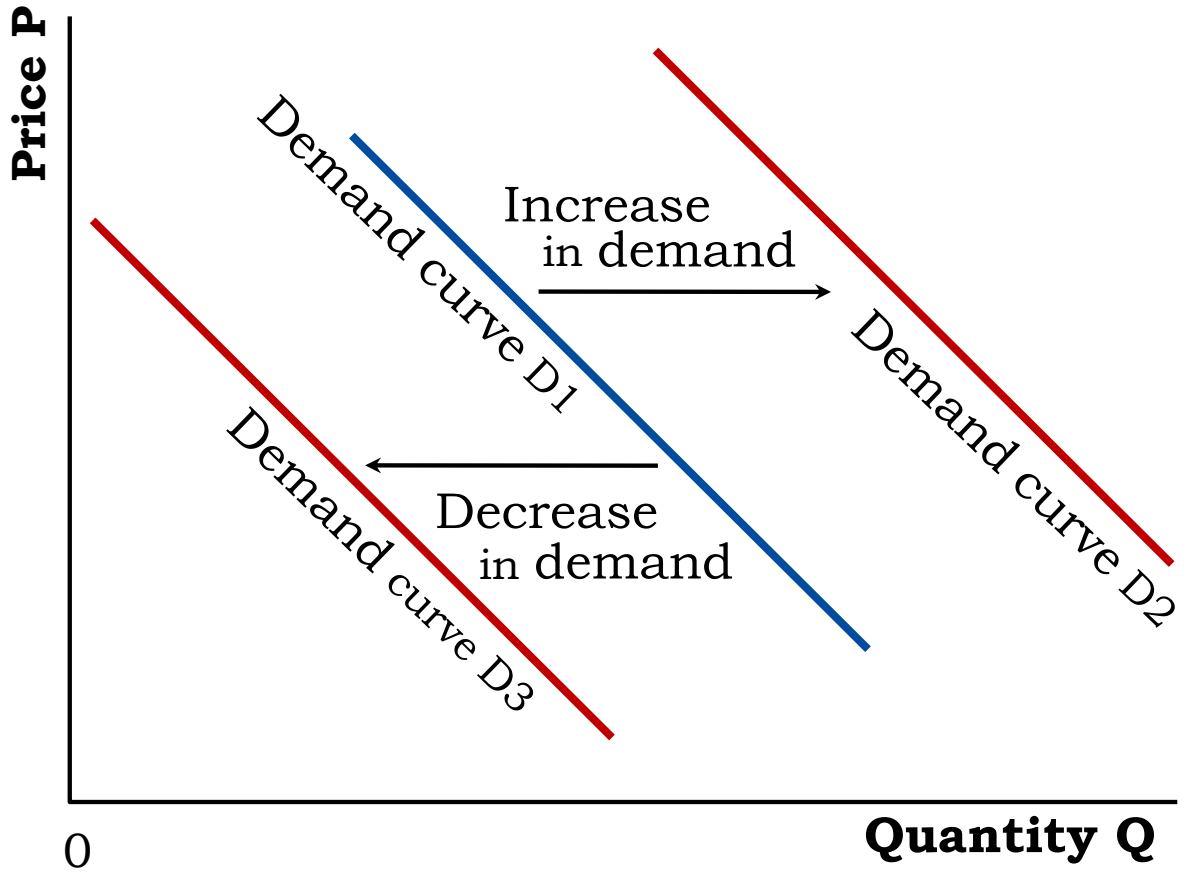
- P_n = price
- $P_1, P_2 \dots P_{n-1}$ = Prices of other goods – Substitutes and complements
- Y = Incomes
- T = Tastes and fashions

A shift in the demand curve is caused by a factor affecting demand **other than a change in price**.

Shifts in the Demand Curve

Demand shifts due to:

- Consumer income
- Prices of related goods
- Tastes
- Expectations
- Number of buyers



Shifts in the Demand Curve

Which of the following does not shift the demand curve for automobile tires?

A. The price of gasoline.
B. Consumer incomes.
C. Gasoline rationing.
D. The price of tires.

Shifts in the Demand Curve

Which of the following does not shift the demand curve for automobile tires?

A. The price of gasoline.
B. Consumer incomes.
C. Gasoline rationing.
D. The price of tires.

Shifts in the Demand Curve

Shift due to Consumer Income

- As income increases the demand for a **normal good** will increase.
- As income increases the demand for a **luxury good** will increase a lot.
- As income increases the demand for an **inferior good** will decrease, e.g. bus rides.

Shift due to Prices of Related Goods

- When a fall in the price of one good reduces the demand for another good, the two goods are called **substitutes**.
- When a fall in the price of one good increases the demand for another good, the two goods are called **complements**.

Shifts in the Supply Curve

The factors affecting supply could be represented as a function:

$$S_n = f(P_n, P_1, P_2 \dots P_{m-1}, P_m, W, S_q, \dots)$$

Where:

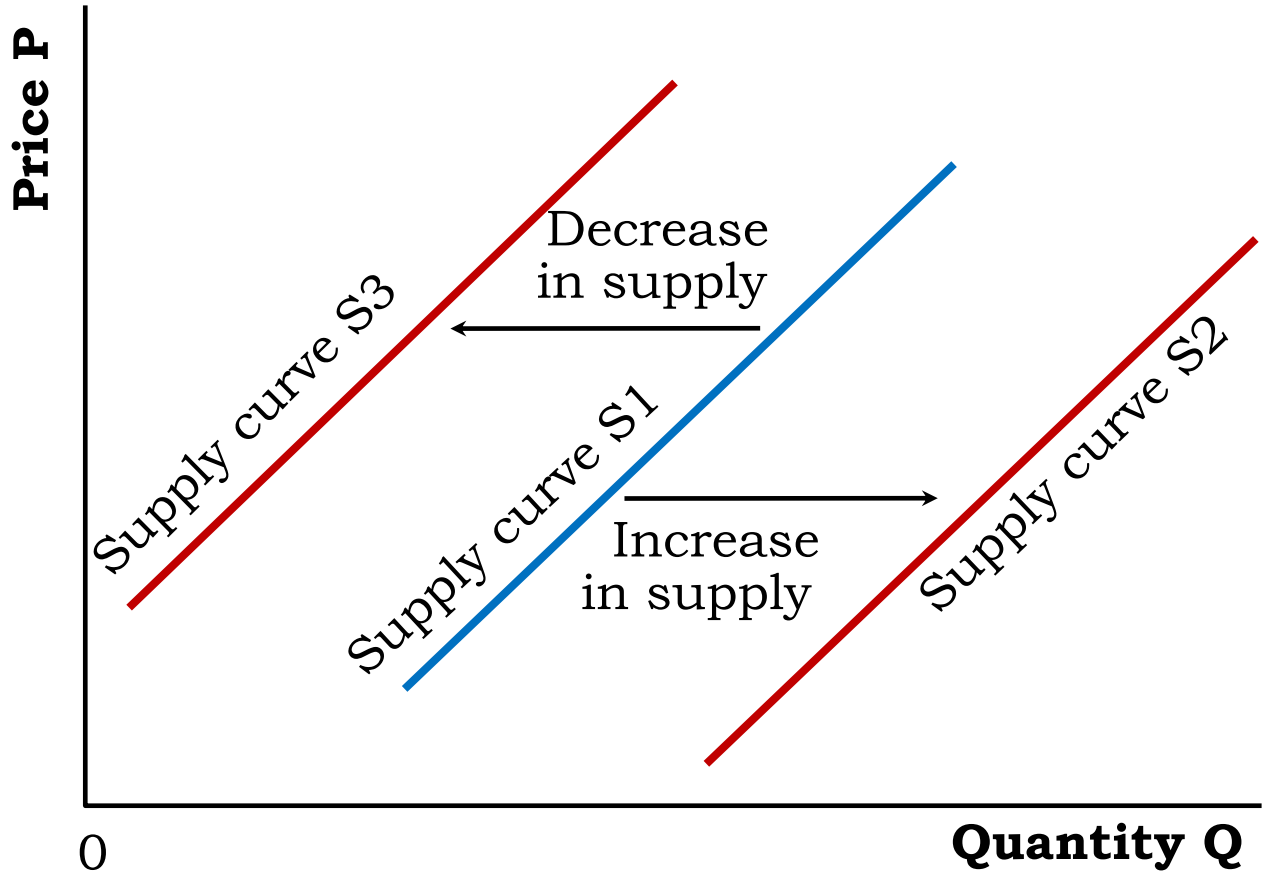
- P_n = price
- $P_m \dots P_{m-1} = price\ of\ the\ production\ factors$
- W = Weather conditions
- S_q = Number of sellers
- …….

A shift in the supply curve is caused by one or more factors affecting supply **other than price**.

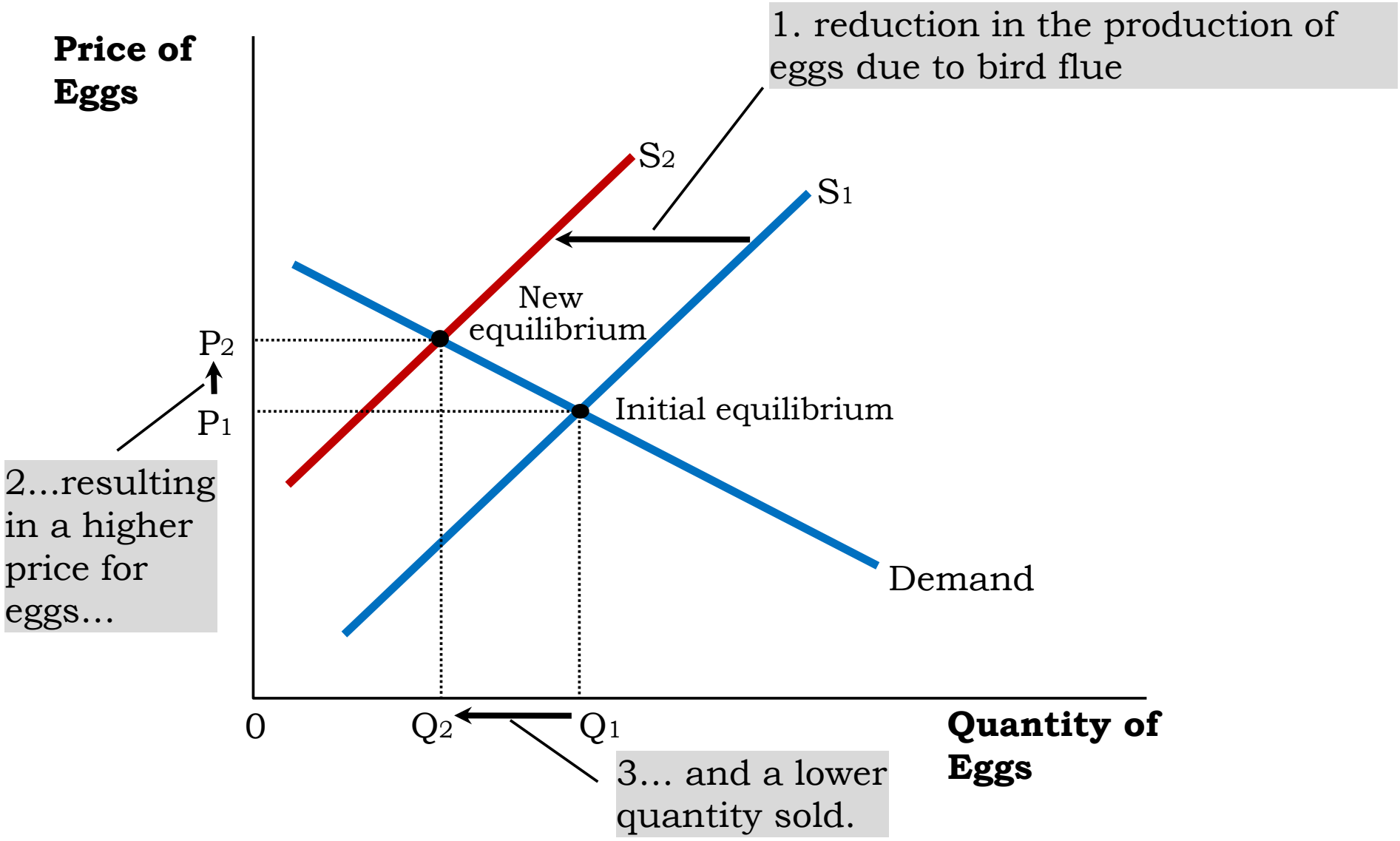
Shifts in the Supply Curve

Supply shifts due to:

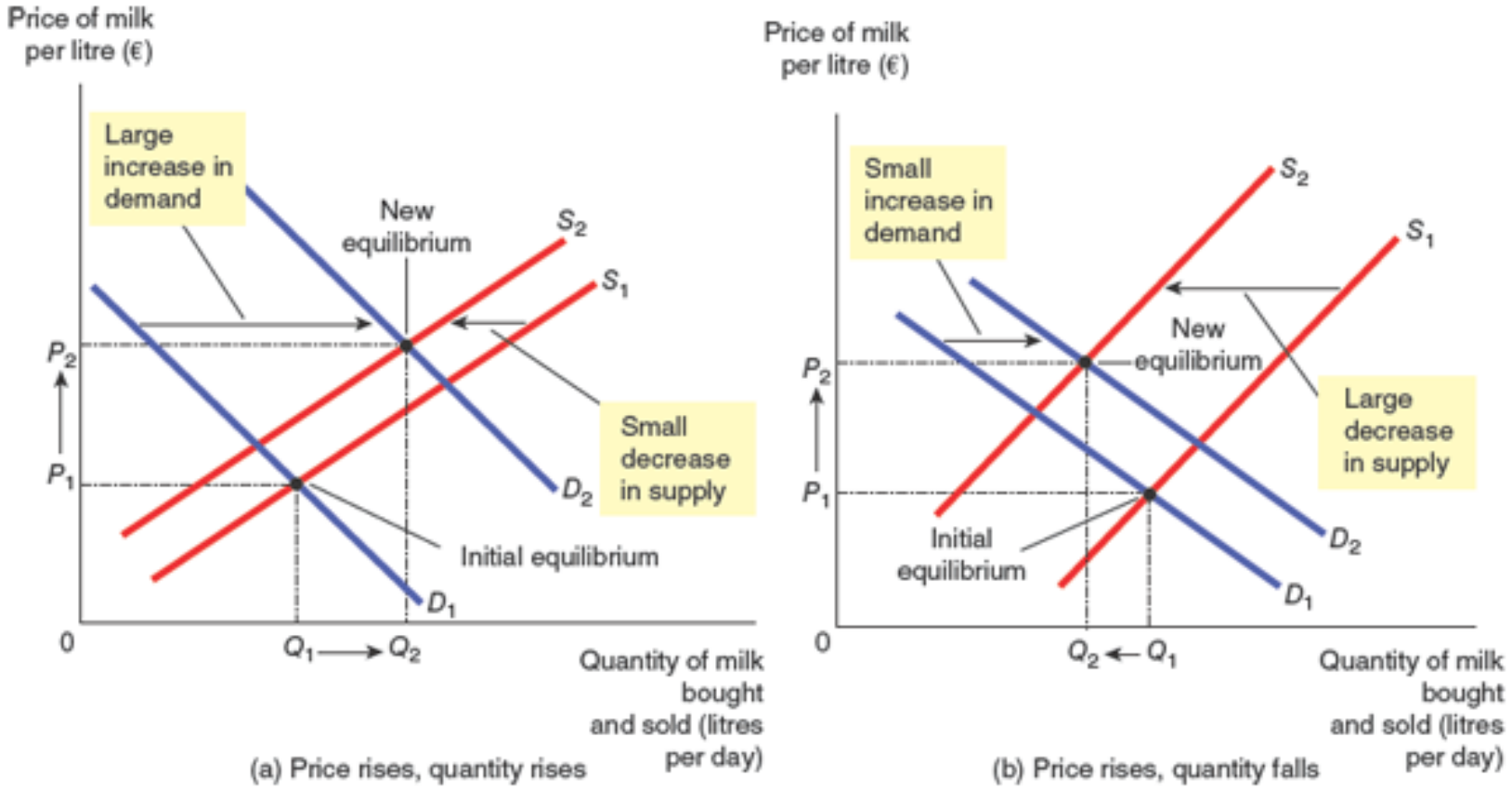
- Input prices
- Technology
- Weather conditions
- Number of sellers



Comparative Statics – Example 1

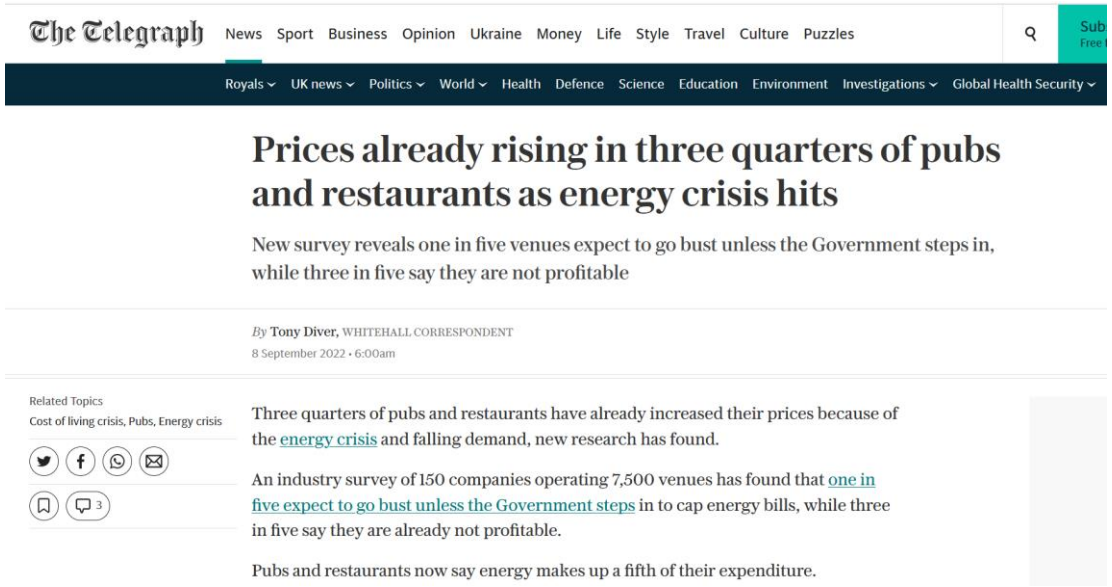


Comparative Statics – Example 2



Source: Mankiw & Taylor (2023), "Microeconomics"

D. Elasticity



The Telegraph News Sport Business Opinion Ukraine Money Life Style Travel Culture Puzzles

Royals UK news Politics World Health Defence Science Education Environment Investigations Global Health Security

Prices already rising in three quarters of pubs and restaurants as energy crisis hits

New survey reveals one in five venues expect to go bust unless the Government steps in, while three in five say they are not profitable

By Tony Diver, WHITEHALL CORRESPONDENT
8 September 2022 • 6:00am

Related Topics
Cost of living crisis, Pubs, Energy crisis

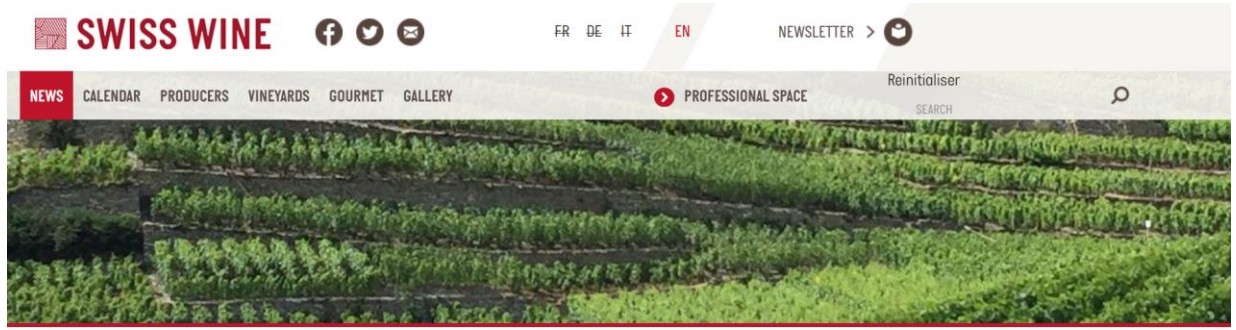
Three quarters of pubs and restaurants have already increased their prices because of the energy crisis and falling demand, new research has found.

An industry survey of 150 companies operating 7,500 venues has found that one in five expect to go bust unless the Government steps in to cap energy bills, while three in five say they are already not profitable.

Pubs and restaurants now say energy makes up a fifth of their expenditure.

Elasticity

- **Elasticity:**
  - is a measure of how much buyers and sellers respond to changes in market conditions
  - allows us to analyze supply and demand with greater precision
- **Elasticity of Demand:**
  - Price elasticity of demand
  - Income elasticity of demand
  - Cross-price elasticity of demand
- **Elasticity of Supply:**
  - Price elasticity of supply



NEWS

Reinitialiser

SEARCH

RÉGIONS

CATÉGORIES

ANNÉES

OVERVIEW OF PRICE ELASTICITY ON THE MARKET FOR SWISS WINES

ANALYSIS FRIDAY 03 MARCH 2017

SOURCE / ALEXANDRE MONDOUX - KOF ETHZ

T 1: Price Elasticity of Swiss AOC Wines in Major Retailers Over the Period 2012–2016

	Red	White	Rosé	Total (by region)
Valais	-1.21***	-1.35***	-3.56***	-2.67***
Vaud	-1.09***	-0.86**	-1.97***	-1.53***
German-speaking Switzerland	-1.76***	0.28	-6.01***	-3.82
Geneva	-1.14***	-1.51***	-2.56***	-1.70**
Ticino	-0.54	-4.16***	0.53	-0.72
3 lakes	-2.11***	-1.84***	-2.40***	-2.49***
Total (by colour)	-1.65***	-2.23***	-2.39***	-2.01***

*** p < 0.01, ** p < 0.05, * p < 0.1

LOCARNO

CARATTERISTICHE AGRONOMICHE
Varietà: 85% Merlot, 15% Cabernet franc

CARATTERISTICHE ENOLOGICHE
Tipologia: Rosso del Ticino doc
Gradazione alcolica: 13.5% vol.

CARATTERISTICHE ORGANOLETTICHE
Visive: Rosso rubino
Olfattive: Fine elegante di bacche rosse e more
Gustative: Morbido, buona struttura con tannini ben fusi
Temperatura di servizio: 18 - 20°

Prezzo 50.00 Frs.

MIRO

CARATTERISTICHE AGRONOMICHE
Varietà: 100% Merlot

CARATTERISTICHE ENOLOGICHE
Tipologia: Merlot Ticino doc
Gradazione alcolica: 12.8% vol.

CARATTERISTICHE ORGANOLETTICHE
Visive: Rosso rubino con riflessi violacei
Olfattive: Intenso di bacche rosse con sfumature
Gustative: Morbido, buona struttura con tannini ben presenti giovani
Temperatura di servizio: 16 - 18°

Prezzo 38.00 Frs.

SAN GIORGIO

CARATTERISTICHE AGRONOMICHE
Varietà: 100% Merlot

CARATTERISTICHE ENOLOGICHE
Tipologia: Merlot Ticino doc
Gradazione alcolica: 14.0% vol.

CARATTERISTICHE ORGANOLETTICHE
Visive: Rosso rubino intenso
Olfattive: Intenso, frutta matura, note speziate e vaniglia
Gustative: Morbido, ottima struttura, tannini presenti e ben fusi
Temperatura di servizio: 18 - 20°

Prezzo 58.00 Frs.

RESLINA

CARATTERISTICHE AGRONOMICHE
Varietà: 100% Chardonnay

CARATTERISTICHE ENOLOGICHE
Tipologia: Chardonnay Ticino doc
Gradazione alcolica: 12.5% vol.

CARATTERISTICHE ORGANOLETTICHE
Visive: Giallo con riflessi verdacei
Olfattive: Fine di frutta esotica con note floreali
Gustative: Struttura morbida, finale con retrogusto fruttato
Temperatura di servizio: 13 - 15°

Prezzo 38.00 Frs.

https://swisswine.ch/en

Elasticity of Demand

- **Price elasticity of demand** is a measure of the percentage change in quantity demanded given a percent change in the price of a good.

$$E_p = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

- **Inelastic Demand:**
  Price elasticity of demand is less than one (no strong response to price changes).
- **Elastic Demand:**
  Price elasticity of demand is greater than one (strong response to price changes).
- **Perfectly Inelastic:**
  Quantity demanded does not respond to price changes.
- **Perfectly Elastic:**
  Quantity demanded changes infinitely with any change in price.
- **Unit Elastic:**
  Quantity demanded changes by the same percentage as the price.

Point Versus Arc Elasticity

Point elasticity measures elasticity at a point on the demand curve (small changes)

The formula is:

$$E_p = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Arc elasticity: Price elasticity of demand over a range of prices

The formula is (midpoint formula):

$$E_p = \frac{\Delta Q}{\Delta P} \cdot \frac{\bar{P}}{\bar{Q}}$$

Point Versus Arc Elasticity

Point Elasticity:

Example: For a demand given by Q = 50 – 3P, the price elasticity for demand when price = 10 is calculate using calculus as:

dQ/dP = – 3 and Q = 20 (at P = 10), $E_p = \frac{dQ}{dP}\frac{P}{Q} = -3\left(\frac{10}{20}\right) = -1.5$

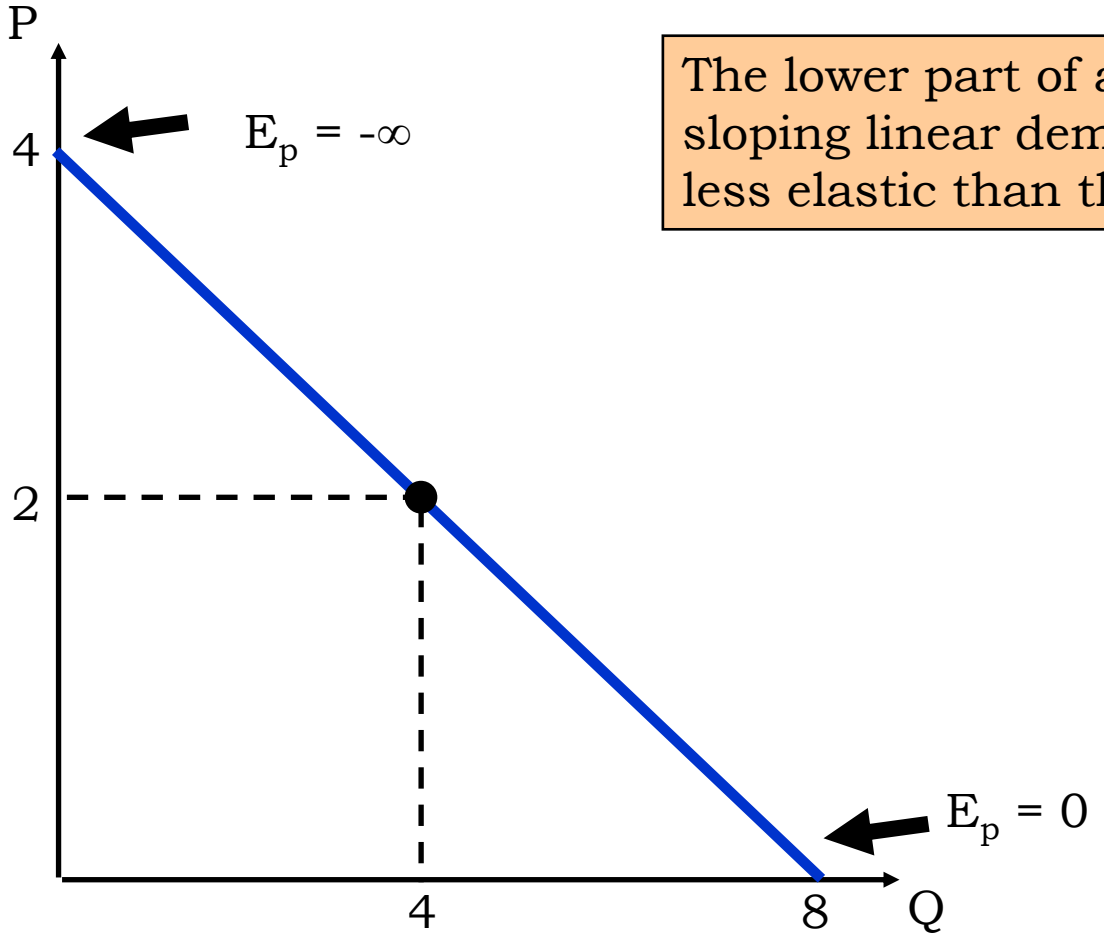
Arc Elasticity:

Example: If the price of an ice cream cone increases from €2.00 to €2.20 and the amount you buy falls from 10 to 8 cones, then your elasticity of demand, using the midpoint formula, would be calculated as:

$$E_p = \frac{\frac{(10-8)}{(10+8)/2}}{\frac{(2.20-2.00)}{(2.00+2.20)/2}} = \frac{22\%}{9.5\%} = 2.32$$

Price Elasticity of Demand

$$E_p = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$



The lower part of a downward sloping linear demand curve is less elastic than the upper part.

The elasticity of demand does not only depend on the slope of the demand curve, but also on the prices and quantities.

Empirical Estimation of the Price Elasticity of Demand

TABLE 4.1 Estimates of the Price Elasticity of Demand for a Selection of Goods

Product	Price Elasticity of Demand
Tobacco	0.4
Milk	0.3
Wine	0.6
Shoes	0.7
Cars	1.9
Particular brand of car	4.0
Movies	0.9
Entertainment	1.4
Furniture	3.04
Fuel	0.4
Bread	0.25

Source: Mankiw & Taylor (2017), "Microeconomics", Chapter 4, p. 63

The Price Elasticity of Demand and its Determinants

- **Availability of close substitutes:**

  Butter and margarine are easily substitutable…

  No close substitutes to eggs
- **Definition of the market:**

  Narrowly defined market (vanilla ice-cream) have more elastic demand than broadly defined markets (food)
- **Time horizon:**

  Short-run vs. long-run
- **Regions, culture, habits**

Contents lists available at ScienceDirect

Energy Strategy Reviews

journal homepage: www.ees.elsevier.com/esr

Dynamic models of residential electricity demand: Evidence from Switzerland

Nina Boogen [a], Souvik Datta [b,*], Massimo Filippini [a,c]

[a] Center of Economic Research (CER-ETH), ETH Zürich, Zürichbergstrasse 18, 8032 Zürich, Switzerland
[b] Adam Smith Business School, University of Glasgow, University Avenue, Glasgow G12 8QQ, United Kingdom
[c] Università della Svizzera italiana, Ex Laboratorio, Office 205 (Level 2), Via Buffi 13, 6904 Lugano, Switzerland

ARTICLE INFO

Article history:
Received 16 January 2017
Received in revised form
20 June 2017
Accepted 12 September 2017
Available online 21 September 2017

JEL classification:
C23
Q41
Q48
Q58

Keywords:
Residential electricity demand
Price elasticity
Partial adjustment model
Dynamic demand model
Panel data

ABSTRACT

We estimate the short- and long-run elasticities of electricity demand in Switzerland using a dynamic model of residential electricity consumption incorporating a correction introduced by Kiviet. We find that the short-run elasticity of residential demand for electricity in Switzerland is around −0.3 while the long-run elasticity is around −0.6. Our estimates indicate that pricing policy as a plan for energy strategy may have a moderate impact on residential customers in the short run but will have a stronger influence in the long-run. In view of the recent proposal in Switzerland to introduce a tax on electricity as part of its energy strategy plan, an increase in the price of electricity may result in a moderate decrease in electricity consumption.

Energy Policy 158 (2021) 112561

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Estimating residential electricity demand: New empirical evidence

Nina Boogen [a,c], Souvik Datta [b,c,*], Massimo Filippini [c,d]

[a] ZHAW School of Management and Law, Center for Energy and the Environment, Zurich University of Applied Sciences, Bahnhofplatz 12, 8400, Winterthur, Switzerland
[b] Institute for Competitiveness and Communication, Hochschule für Wirtschaft, Fachhochschule Nordwestschweiz, Riggenbachstrasse 16, 4600, Olten, Switzerland
[c] Center of Economic Research (CER-ETH), ETH Zürich, Zürichbergstrasse 18, 8032, Zürich, Switzerland
[d] Institute of Economics, Università della Svizzera italiana, Ex Laboratorio, Office 205 (Level 2) Via Buffi 13, 6904, Lugano, Switzerland

ARTICLE INFO

Keywords:
Residential electricity
Energy services
Instrumental variables
Correlated random effects
Switzerland

ABSTRACT

In this paper, we estimate the price elasticity of residential electricity consumption in Switzerland using a unique longitudinal household survey of around 5000 households. The survey contains information on a household's stock of appliances, use of appliances, and various socio-demographic characteristics. Our empirical model is derived from a variant of household production theory that posits electricity demand as being a derived demand for energy services. Based on this, we extend our basic model by using information on energy services, e.g. the amount of washing and the amount of cooking. We also use an instrumental variables approach to obtain consistent estimates of the price elasticity to account for potential endogeneity concerns with the average price. Our results indicate that the short-to medium-run price elasticity is around −0.7. This implies that policy makers concerned about reducing electricity consumption can use pricing policy, with a combination of other policies, to effectively reduce or, at least, stabilise electricity consumption in Switzerland.

APPLIED ECONOMICS LETTERS
2021, VOL. 28, NO. 5, 359–364
https://doi.org/10.1080/13504851.2020.1753875

Routledge
Taylor & Francis Group

ARTICLE

Gas demand in the Swiss household sector

Massimo Filippini[a,b] and Nilkanth Kumar[a]

[a]Center of Economic Research (CER-ETH), ETH Zürich, Zürich, Switzerland; [b]Università Della Svizzera Italiana, Lugano, Switzerland

ABSTRACT

In this article, we analyse the gas demand of Swiss households and provide an estimate of the own price elasticity. We use household-level panel data from 2010 to 2014 for 958 Swiss households while controlling for several socioeconomic characteristics and dwelling attributes. The results report the own price elasticity of gas demand to be around – 0.73. An inelastic demand is expected as the gas demand among Swiss households originates primarily for space heating and water heating purposes. Policy implications are discussed.

KEYWORDS

Natural gas; energy demand; panel data; households; Switzerland

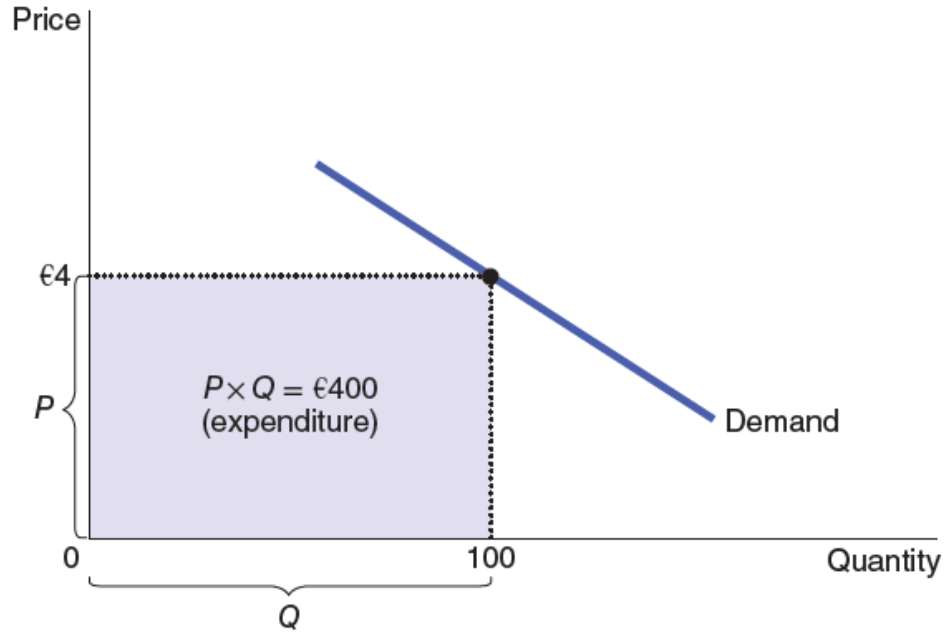
JEL CLASSIFICATION

D12; D13; Q41; Q48

Relation between Total Expenditure, Total Revenue and the Price Elasticity of Demand

Total expenditure is the total amount paid by buyers and received by sellers (total revenue) of a good.

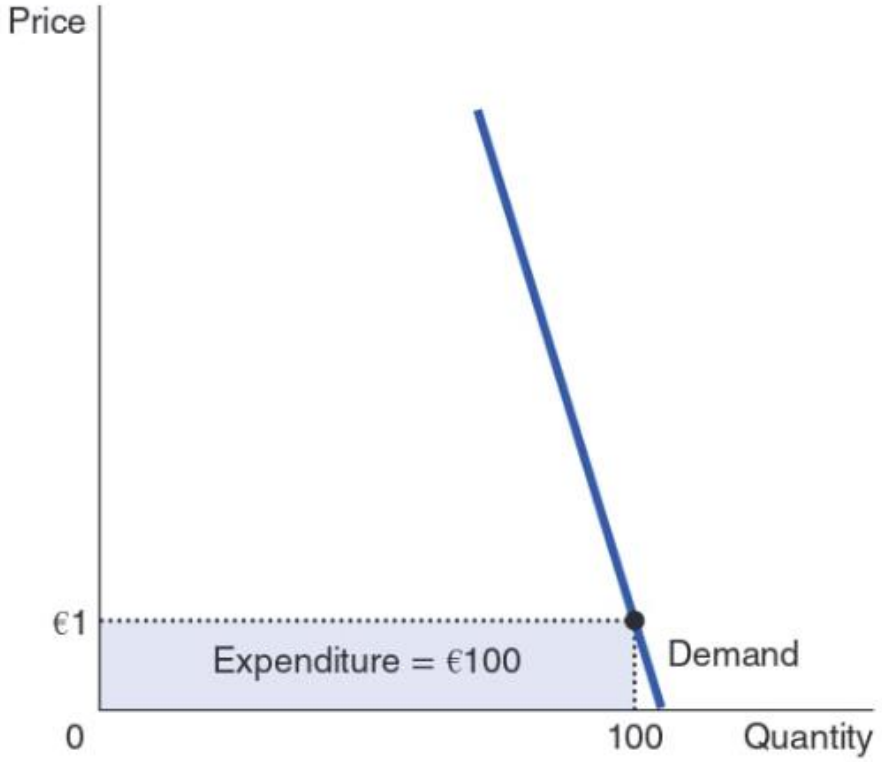
TR = P x Q

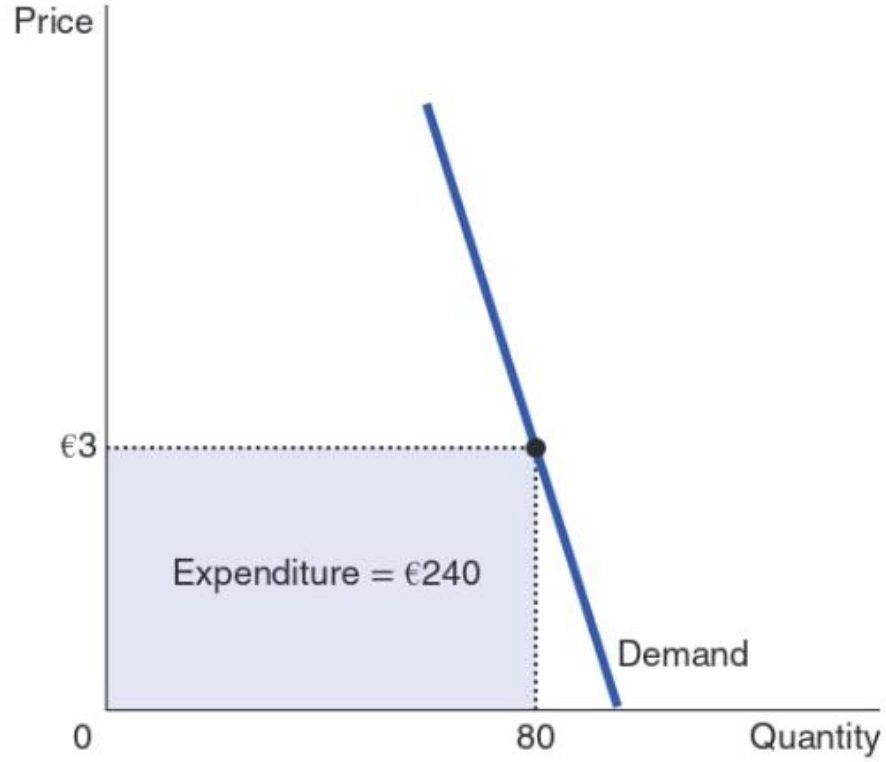


Source: Mankiw & Taylor (2023), "Microeconomics"

Relation Between Total Expenditure, Total Revenue and the Price Elasticity of Demand

Source: Mankiw & Taylor (2023), "Microeconomics"





When demand is **price inelastic** (a price elasticity less than 1), price and total expenditure move in the same direction.

Relation between Total Expenditure, Total Revenue and the Price Elasticity of Demand

Source: Mankiw & Taylor (2023), "Microeconomics"

When demand is **price elastic** (a price elasticity greater than 1), price and total expenditure move in opposite directions.

Income Elasticity IE_{Q_b}

$$IE_{Q_b} = \frac{\Delta Q_b}{\Delta I} \cdot \frac{I}{Q_b}$$

(Q_b = quantity of good b; I = Income)

Interpreting the signs of IE_{Q_b}

- **normal good** ➔ income elasticity > 0
- **luxury good** ➔ income elasticity > 1
- **inferior good** ➔ income elasticity < 0

Empirical Estimation of the Income Elasticity

TABLE 4.2 Estimates of the Income Elasticity of Demand for a Selection of Goods and Services

Good/Service	Income Elasticity of Demand
Education	–6.9
Alcoholic drinks, tobacco and narcotics	–6.6
Transport	–2.8
Food and non-alcoholic drinks	–1.0
Household goods and services	–0.5
Restaurants and hotels	0.4
Health	1.7
Housing, fuel and power	2.7
Recreation and culture	5.0
Communication	6.4
Clothing and footwear	9.8

Source: Mankiw & Taylor (2017), "Microeconomics", Chapter 4, p. 64

Cross Price Elasticity $E_{Q_b P_m}$

- Cross price elasticity considers, in contrast to income elasticity and price elasticity, **two goods:**

$$E_{Q_b P_m} = \frac{\Delta Q_b}{\Delta P_m} \cdot \frac{P_m}{Q_b}$$

(Q_b = quantity of good b; P_m = price of good m)

- Describes the change in the demand of one good "b" in response to a change in the price of another good "m".

- Interpreting the signs of E_{QbPm}
  - **complements** ➔ negative sign
  - **substitutes** ➔ positive sign
  - **no effects** ➔ "zero" value

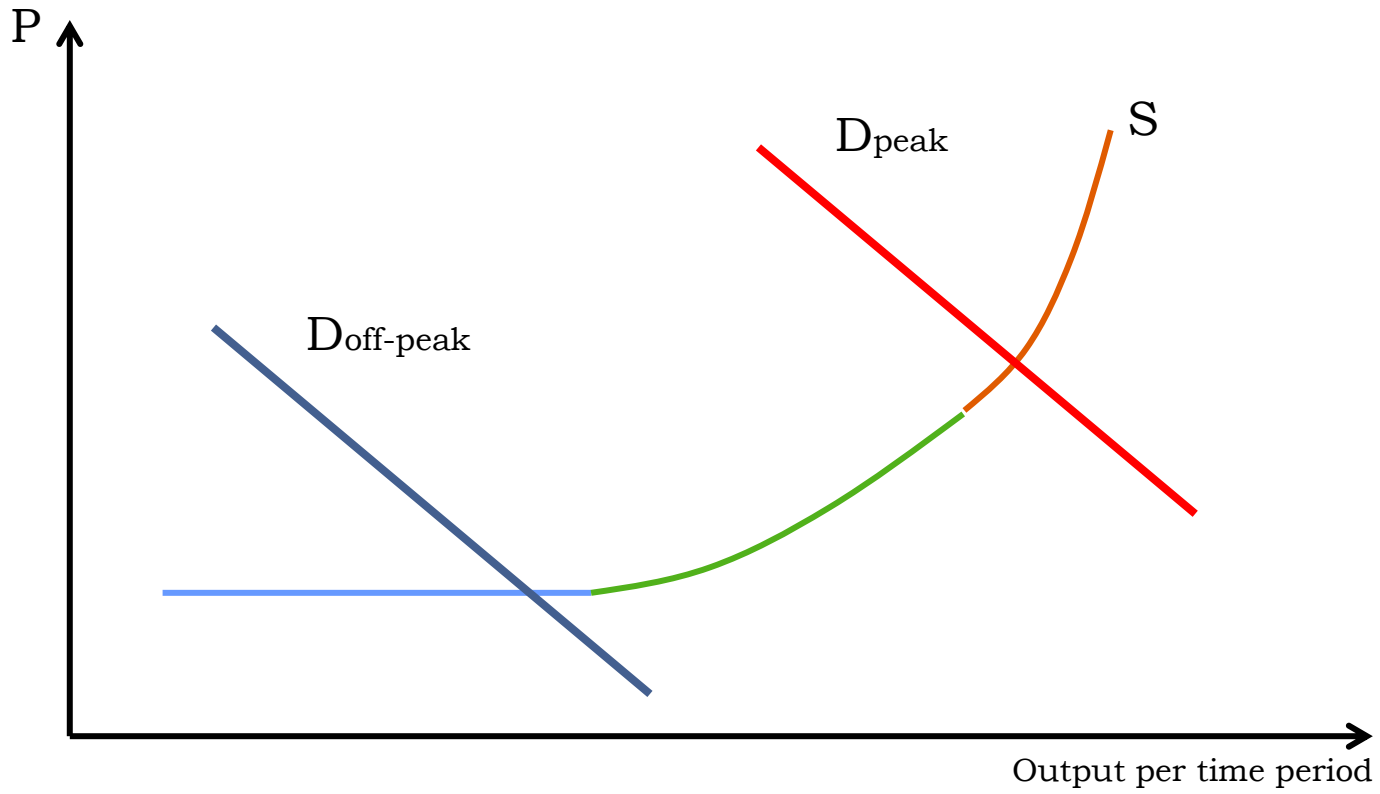
Cross Price Elasticity

Which of the following pairs of goods are most likely to have a negative cross price elasticity of demand?

A. Hotdogs and hotdog buns (small rounded bread)
B. Coke and Pepsi
C. Rail tickets and plane tickets
D. A Luciano Pavarotti CD and a Placido Domingo CD (both are opera stars)

Example: Peak and Off-Peak Electricity Demand

$$E_{Q_{off\text{-}peak}P_{peak}} = \frac{\Delta Q_{off\text{-}peak}}{\Delta P_{peak}} \cdot \frac{P_{peak}}{Q_{off\text{-}peak}}$$



Energy Policy 39 (2011) 5811–5817

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Short- and long-run time-of-use price elasticities in Swiss residential electricity demand

Massimo Filippini *

ETH Zurich and University of Lugano, Switzerland

ARTICLE INFO

Article history:
Received 2 February 2011
Accepted 1 June 2011
Available online 23 July 2011

Keywords:
Residential electricity demand
by time-of-use
Panel data
Partial adjustment model

ABSTRACT

This paper presents an empirical analysis on the residential demand for electricity by time-of-day. This analysis has been performed using aggregate data at the city level for 22 Swiss cities for the period 2000–2006. For this purpose, we estimated two log–log demand equations for peak and off-peak electricity consumption using static and dynamic partial adjustment approaches. These demand functions were estimated using several econometric approaches for panel data, for example LSDV and RE for static models, and LSDV and corrected LSDV estimators for dynamic models. The attempt of this empirical analysis has been to highlight some of the characteristics of the Swiss residential electricity demand. The estimated short-run own price elasticities are lower than 1, whereas in the long-run these values are higher than 1. The estimated short-run and long-run cross-price elasticities are positive. This result shows that peak and off-peak electricity are substitutes. In this context, time differentiated prices should provide an economic incentive to customers so that they can modify consumption patterns by reducing peak demand and shifting electricity consumption from peak to off-peak periods.

Elasticity of Supply

Price elasticity of supply measures by how much the supplied quantity of a good responds to a price change for this good.

$$\textbf{Price elasticity of supply} = \frac{\%\text{ change in quantity supplied}}{\%\text{ change in price}}$$

Elasticity of Supply

Estimates of Price Elasticity of Supply

Good	Price Elasticity of Supply Estimate
Public transport in Sweden	0.44 to 0.64
Labour in South Africa	0.35 to 1.75
Beef	
• Zimbabwe	2.0
• Brazil	0.11 to 0.56
• Argentina	0.67 to 0.96
Corn (short run in US)	0.96
Housing, long-run in selected US cities	Dallas: 38.6 San Francisco: 2.4 New Orleans: 0.9 St. Louis: 8.1
Uranium	2.3 to 3.3
Recycled aluminium	0.5
Oysters	1.64 to 2.00
Retail store space	3.2
Natural gas (short-run)	0.5

Source: Mankiw & Taylor (2017), "Microeconomics", Chapter 4, p. 67

E. Appendix

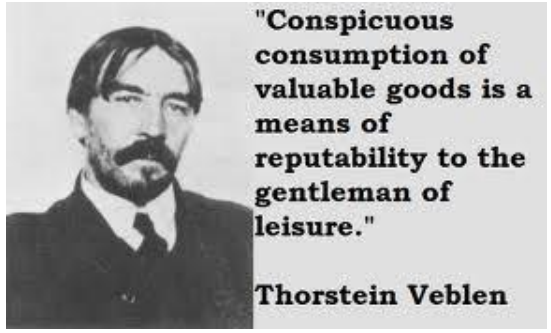
Type of goods

Giffen good

- Increase in price increases demand because of the income effect: if the price of bread rises, poor workers have less income available for meat and need to substitute with more bread.

Veblen/Snob good

- People purchase things not because they need them but because they want to impress others with their purchasing power. ➔ Price increases ➔ demand increases
- Rich people buy certain good because it gives some social prestige.



Price Elasticity of Demand

Three aspects have to be considered in calculating the elasticity:

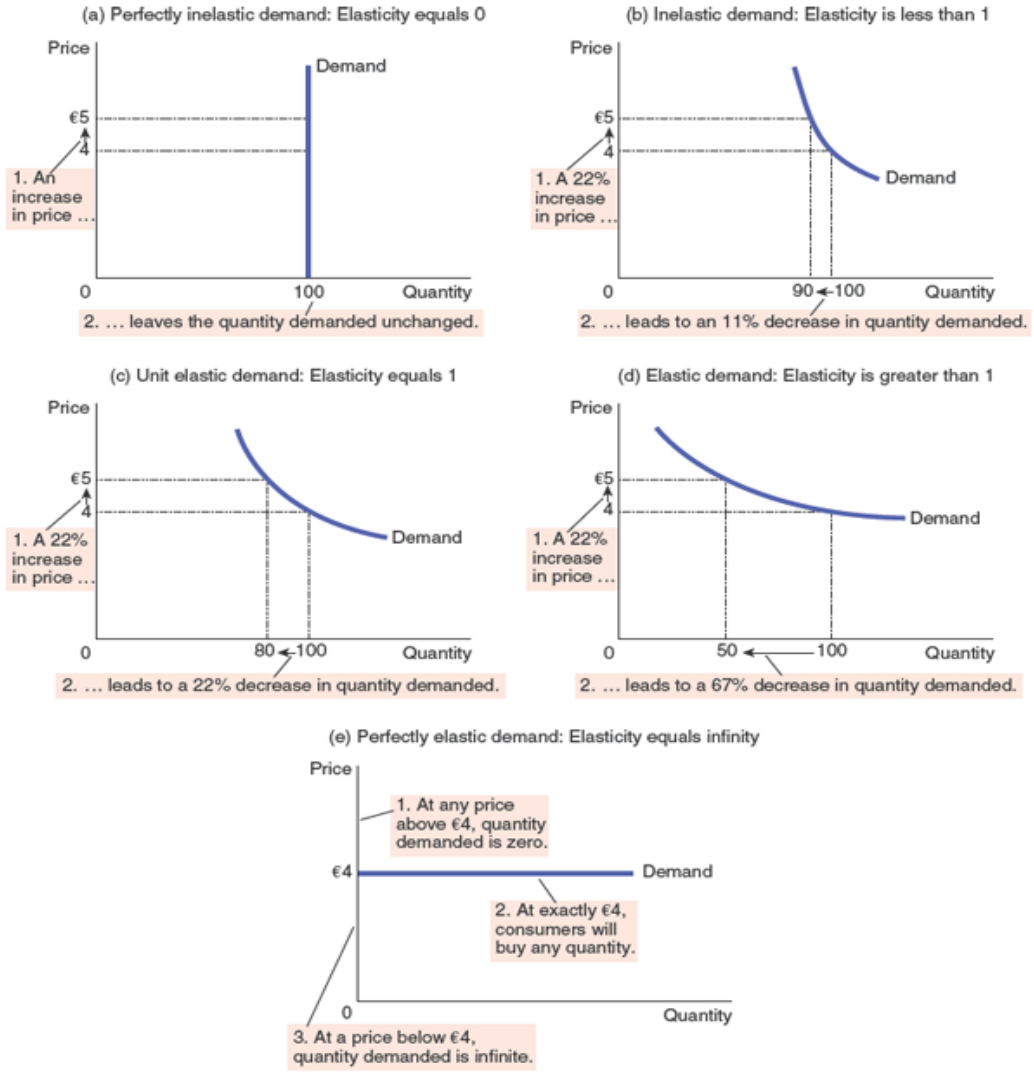
- The price and the quantity demanded almost always **move in opposite directions** (there are a few exceptions such as Veblen goods).

- Price elasticity of demand are sometimes reported as negative numbers (e.g., in calculations).

  It is also a **common practice** to simply **drop the minus** sign and report just the absolute value, where a large elasticity value implies greater responsiveness of quantity demanded to price.

- Elasticity has **no dimension** as it is related to a percentage change and will not be affected by changing the units of measure.

The Variety of Demand Curves



Note: All percentage changes here are calculated using the midpoint method

Source: Mankiw & Taylor (2023), "Microeconomics"