

# Foundations of Economic Analysis & Explanation

## Lecture 10: The Law of Demand and Applications

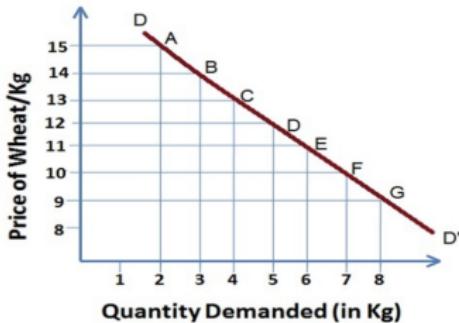
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Department of Economics

# Overview

- 2015 Nobel Laureate
- The Law of Demand
- Demand Curve Shifters
- Individual vs Market Demand



The law of demand is considered as one of the most fundamental principles in economics because of its simplicity and explanatory power: the prediction on human behavior is universal. It encompasses and reflects the law of diminishing marginal use value (utility).

## Questions for Discussion

Think-pair-share: discuss with your peers and write down summary answers.

- ① What is a demand schedule? What is a demand curve?
- ② What is the difference between quantity demanded and demand?
- ③ What is the law of demand? Which direction of causality is implied between price and quantity demanded?
- ④ What is the condition for the law of demand to hold? What would happen to the demand (curve) if the condition changes?
- ⑤ How do changes in price and income affect the demand curve differently?
- ⑥ How does the price of chicken affect the demand curve for beef?
- ⑦ How does oil price affect the demand curve for vehicles (consider private versus public vehicles, respectively)?
- ⑧ How to derive the market demand curve from individual demands?

# 2015 Nobel Prize in Economics

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2015 was awarded to Angus Deaton "for his analysis of consumption, poverty, and welfare."

<https://www.nobelprize.org/prizes/economic-sciences/2015/summary/>

To design economic policy that promotes welfare and reduces poverty, we must first understand individual consumption choices. More than anyone else, Angus Deaton has enhanced this understanding. By linking detailed individual choices and aggregate outcomes, his research has helped transform the fields of microeconomics, macroeconomics, and development economics.



<https://scholar.princeton.edu/deaton>

# Consumption, Great and Small



Deaton receives the 2015 Nobel Prize in Economic Sciences for three related achievements: 1) the system for estimating the demand for different goods that he and John Muellbauer developed around 1980; 2) the studies of the link between consumption and income that he conducted around 1990; and 3) the work he has carried out in later decades on measuring living standards and poverty in developing countries with the help of household surveys.  
<https://www.nobelprize.org/uploads/2018/06/popular-economicsciences2015-2.pdf>

# OUTLINE

- ① The Law of Demand
- ② Demand Curve Movements
- ③ Market Demand Derivation
- ④ Appendix

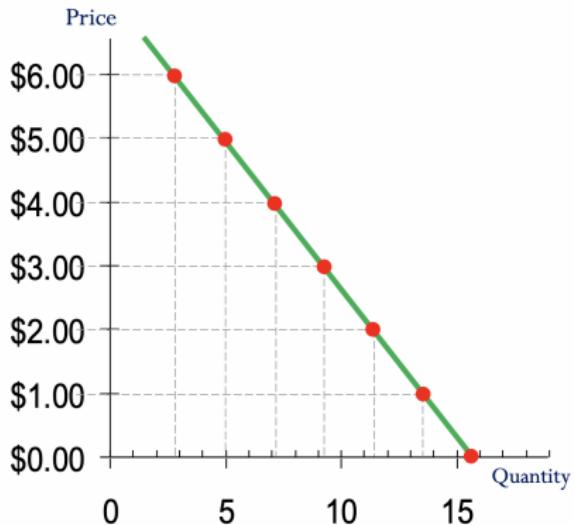
# Market Competition

- Recall that different forms of competition among society members. All serve to resolve conflict of interests.
- Economists focus on one specific type of competition—market competition through which buyers and sellers meet, compete and exchange.
- Thereafter, resource allocation and income distribution are determined via market exchange.
- In this process, what is the most significant factor that determines the buying and selling activities of the market participants?
- To answer this question, recall from lecture 3, what is the competitive criterion in the market place?
- In this lecture, we will identify and model key determinants of individual as well as market demands for consumption of goods and services.
- More essential, we will study the most pivotal law in economic science that dictates all individual and social competition.

# The Law of Demand: $P \rightarrow Q_D$

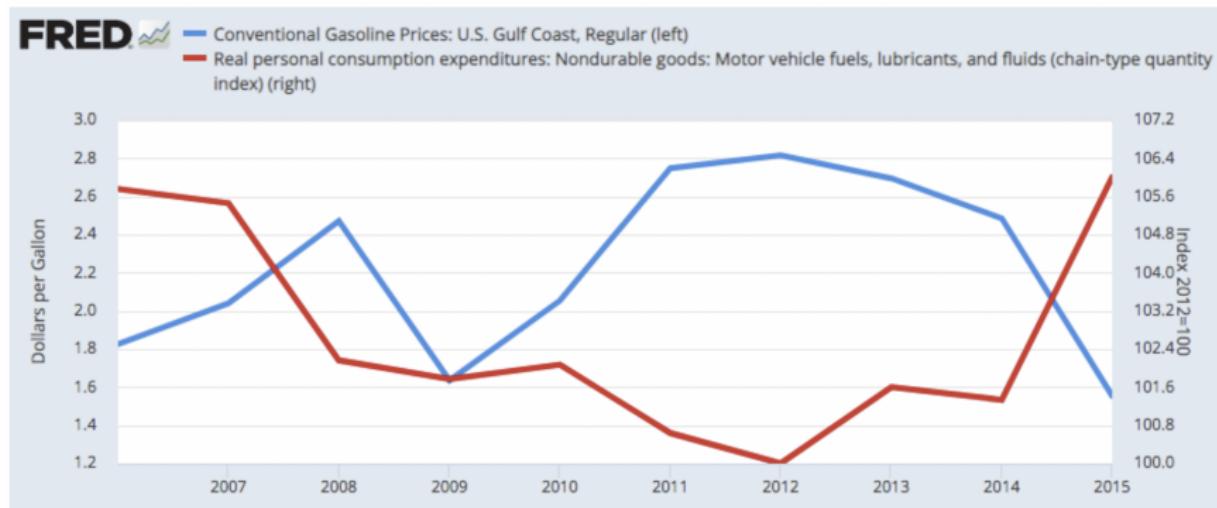
- The law of demand (D): the claim that the quantity demanded of a good will fall when the price of that good rises, other factors being equal (*ceteris paribus*).
- Quantity demanded ( $Q_D$ ): the maximum quantity of the good a buyer is willing and able to purchase at a specific price. Does this concept sound familiar?
- Duality (two sides of the same coin) between the use value and quantity demanded: 1) use value is the maximum value of a given quantity; 2) quantity demanded is the maximum quantity of a good affordable at a given price.
- Mathematical expression for the Law:  $dQ_D/dP < 0$ , *forall D*.

# Demand Schedule and Demand Curve



Prices of lattes	Quantity of lattes demanded
\$0.00	16
\$1.00	14
\$2.00	12
\$3.00	10
\$4.00	8
\$5.00	6
\$6.00	4

# Gasoline Price and Consumer Expenditure



This graph illustrating how changes in prices influence the quantity demanded of a good or service. The inverse relationship between these two variables is a foundational concept in introductory economics courses. However, in a couple of occasions, the law of demand does not seem to hold well. For example, the Great Recession (between 2008 and 2009). How may the Great Recession have affected real personal consumption expenditures on motor vehicle fuels, lubricants, and fluids? Nevertheless, the law of demand always holds.

Source: The FRED Blog (2021): Gasoline prices and consumer expenditures (w)

# How Do Consumers Respond to Price Hikes

Baker, Scott R., Stephanie Johnson, and Lorenz Kueng. 2021. "Shopping for Lower Sales Tax Rates." *American Economic Journal: Macroeconomics*, 13 (3): 209-50. DOI: 10.1257/mac.20190026

- Baker, Johnson, and Kueng examined detailed spending data for more than 150,000 households across 40 states and 3,000 local municipalities to see whether spending changed in response to hikes in sales taxes.
- Evidence in the month before an increase, consumers stocked up on storable goods, like laundry detergent and alcohol, while they were less expensive. Households with a monthly grocery budget of \$500, for example, typically increased spending by up to \$20 before the tax increase, and then cut back spending the month after the higher tax rate went into effect. Consumers also responded to sales tax hikes on more expensive goods like cars.
- Consumers didn't just stockpile taxable goods; they also bought more tax-exempt items (as predicted by the income and substitution effects).

## Demand: Marginal Use Value Curve

- Demand is a consumer's monetary vote showing their preference for the goods and services in the market. The price they pay is the cost sacrificed for immediate consumption.
- Indeed, the demand curve is individual marginal use value curve, and the consumer optimize her consumption decision by equalizing MU and MC (market price) of the consumption unit.
- Every voluntary market exchange is mutually beneficial and generates consumer surplus in terms of the gain measured by the difference between the use value and exchange value.
- Furthermore, a buyer can turn into a seller if  $P = EV \geq UV$ . Why?
- Demand creates supply when exchange value is greater than the use value, because it is more beneficial to sell and gain the difference between the two values.

# Demand Creates Supply

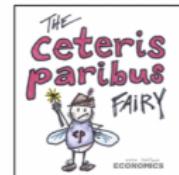
- An economy consists of Alex and Biwei;
- Both demand apples;
- Alex has 6 apples;
- But Biwei has none;
- What is the exchange equilibrium?
- Can you derive Alex's supply curve of apple?

Quantity of Apples	Alex's Marginal Use Value	Biwei's Marginal Use Value
1	\$1.00	\$2.00
2	\$0.90	\$1.60
3	\$0.80	\$1.20
4	\$0.70	\$0.80
5	\$0.60	\$0.80
6	\$0.50	\$0.00

## Highlights on the Law of Demand

- It is a universal law governing all behavior.
- It only focuses on two variables: price and quantity demanded.
- There is a causal relationship between price and quantity.
- Change in price inversely causes change in quantity demanded.
- In reality, price can be observed but not quantity demanded.
- Ceteris paribus: all else equal!  $\Rightarrow$  controlled thought experiment.

In order to correctly apply the law of demand in explanation, we shall always check the list above. More power to you if you can think of the price as the opportunity cost, quantity demanded is the alternative (or marginal) decision.



# The "Ceteris Paribus" Assumption

- "All else equal" is the only assumption imposed before we can apply the law of demand.
- You might wonder what it means and why it is?
- What if "all else NOT equal"? And they do not in fact!
- Answers: it means factors other than price shall remain unchanged. Because in reality, price is not the only factor that can change quantity demanded!
- If the assumption "all else equal" is violated, does the law of demand still hold? What would happen to the demand curve then?



# The "Ceteris Paribus" Assumption

- The answer is yes! Since it is a universal law with no exception, the relationship between price and quantity demanded must always be inversely related.
- However, if other factors besides price also change, say consumer's income, the demand curve will change location ("shift")!
- Economists refer such changes as a movement of the demand curve.

And what exactly are the magical powers of the  
*CETERIS PARIBUS FAIRY?*

Well, no matter  
what the situation,

he keeps **ALL**  
**OTHER THINGS**  
**HELD CONSTANT!**



The point is that his magical powers allow  
for the foundation to be laid for  
BASIC ECONOMIC THOUGHT.

yes.

*CETERIS PARIBUS FAIRY*  
is that powerful.  
No matter what the situation,  
he holds all other variables constant.



<https://stickfigureeconomics.wordpress.com/2012/05/23/cpf/>

# OUTLINE

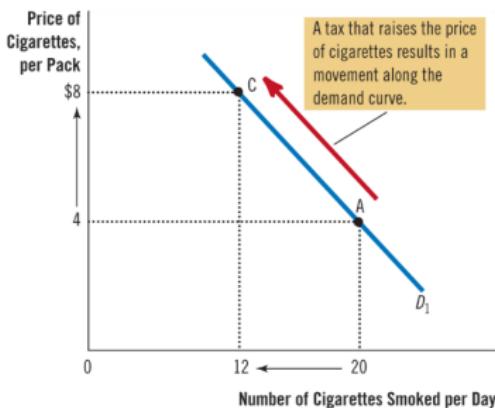
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# Change in the Quantity Demanded ( $Q_D$ )

**FIGURE 4****Shifts in the Demand Curve versus Movements along the Demand Curve**

By contrast, if a tax raises the price of cigarettes, the demand curve does not shift. Instead, we observe a movement to a different point on the demand curve. In panel (b), when the price rises from \$4 to \$8, the quantity demanded falls from 20 to 12 cigarettes per day, as reflected by the movement from point A to point C.

(b) A Movement along the Demand Curve



Source: Mankiw (2021) CH4 The Market Force of Supply and Demand

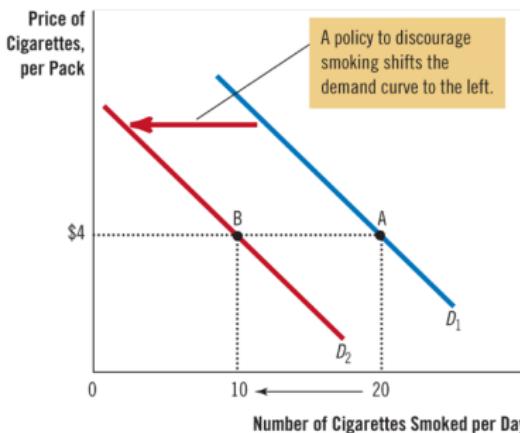
# Change in the Demand (D)

**FIGURE 4**

**Shifts in the Demand Curve versus Movements along the Demand Curve**

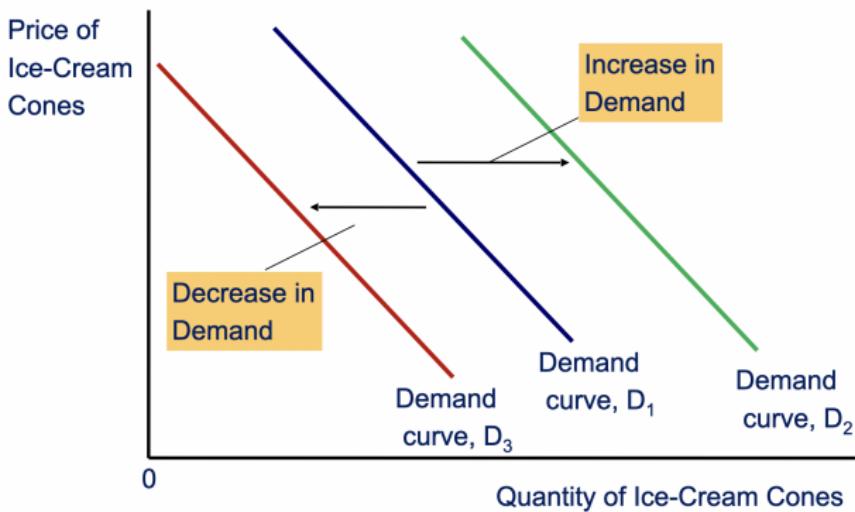
If warnings on cigarette packages convince smokers to smoke less, the demand curve for cigarettes shifts to the left. In panel (a), the demand curve shifts from  $D_1$  to  $D_2$ . At a price of \$4 per pack, the quantity demanded falls from 20 to 10 cigarettes per day, as reflected by the shift from point A to point B.

(a) A Shift in the Demand Curve



Source: Mankiw (2021) CH4 The Market Force of Supply and Demand

# Changes in the Demand Curve



Any change that raises the quantity that buyers wish to purchase at any given price shifts the demand curve to the right. Any change that lowers the quantity that buyers wish to purchase at any given price shifts the demand curve to the left.

## Demand Factors are Curve Shifters

- The factors that can shift the entire demand curve are called the demand curve shifters. They include all possible other-than-price variables that play certain roles in determining market prices.
- We shall study several common factors in detail.
- Variables that can shift the demand curve: Income, Weather, Fashion, Prices of related goods, Tastes, Expectations, New information, Government Policies.
- However, some demand curve shifters such as taste and expectations are not directly observable, which makes it difficult to test any explanations based on these factors.

## Demand Equation and Factors

- The demand equation is the mathematical expression for the demand curve, which follows the law of demand.
- For simplicity, we can model it in a linear equation:  $P = D(Q)$  or  $P = aQ + b$ , where  $a < 0$  is the slope coefficient and  $b > 0$  is the intercept on the P axis. And this intercept "variable"  $b$  is the all possible factors other than price that can shift the demand curve.
- For example, Biwei's demand curve for apple can be written as  $P = -0.5Q_D + 1.5$ . Can you draw this equation in a graph?
- What is Biwei's quantity demanded  $Q_D$  when  $P_1 = \$0.5$  and  $P_2 = \$1$ ?
- If Biwei's income budget for apple consumption increases from \$1.5 per day to \$3, how would it change the demand?

## Demand Factor – Income Level

- Recall from consumer budget constraint that income determines purchasing power and consumption.
- Normal good: Other things constant, an increase in income leads to an increase in demand. ( $I+ \rightarrow D+$ )
- Inferior good: Other things constant, an increase in income leads to a decrease in demand. ( $I+ \rightarrow D-$ )

Luxury chocolates



Exclusive resorts



Own label discounters



Urban bus transport



Business class travel



Fine wines and dining



Cigarettes

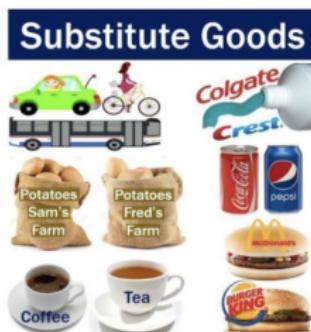


Economy class travel



## Demand Factor – Price of Related Goods

- Price of (closely) related goods consists of two categories.
- Substitutes: two goods whereby an increase in the price of one leads to an increase in the demand for the other. The demand for a good is positively related to the price of its substitutes.
- Complements: two goods whereby an increase in the price of one leads to a decrease in the demand for the other. The demand for a good is negatively related to the price of its complements.



<https://marketbusinessnews.com/financial-glossary/substitute-goods-definition-meaning/>

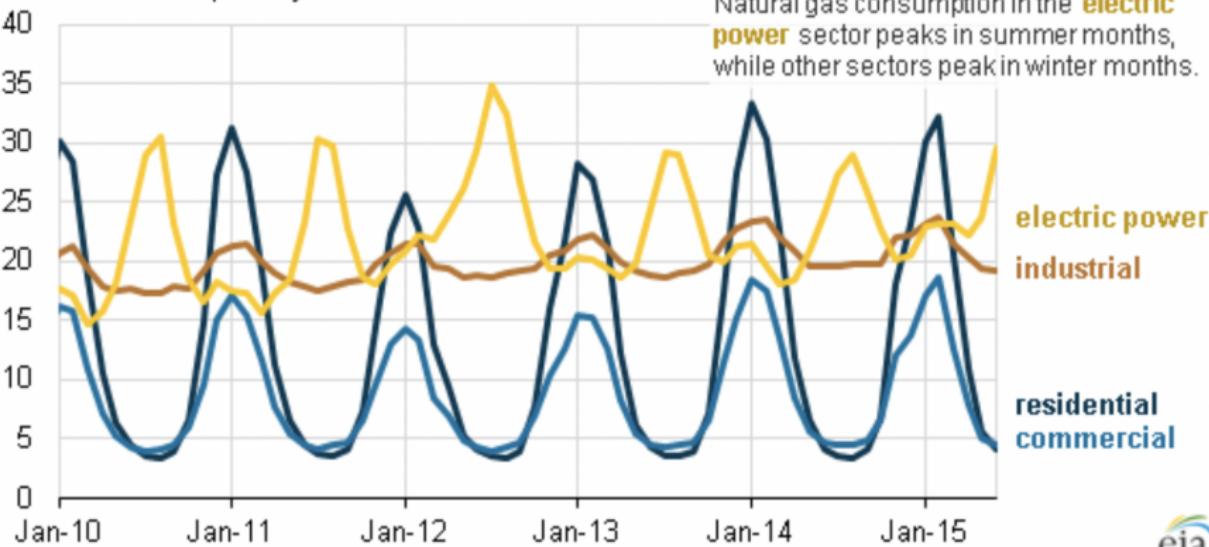
## Factors that Shift the Demand Curve

- Weather and climate: Consumer will increase demand for ice-cream and cold drinks in summer, for example.
- Tastes and fashion: change in tastes changes the demand. What exactly is taste? How do we explain a change in taste?
- Expectations about the future:
  - Expected rising income leads to an increase in current demand;
  - Expected higher prices leads to an increase in current demand.
  - Expectation plays a vital role in financial market asset pricing.
  - Expectation play a central role in public policy decisions.
- Government policies: tax, subsidies, price control, quantity restriction, regulation, standards, ...
- Natural disasters, concerning social and political events are the most often the dominant risk factors in global financial markets.

# Demand Factor: Weather & Seasons

## Natural gas deliveries to customers by end use, Jan 2010 - Jun 2015

billion cubic feet per day



<https://www.eia.gov/todayinenergy/detail.php?id=22892>

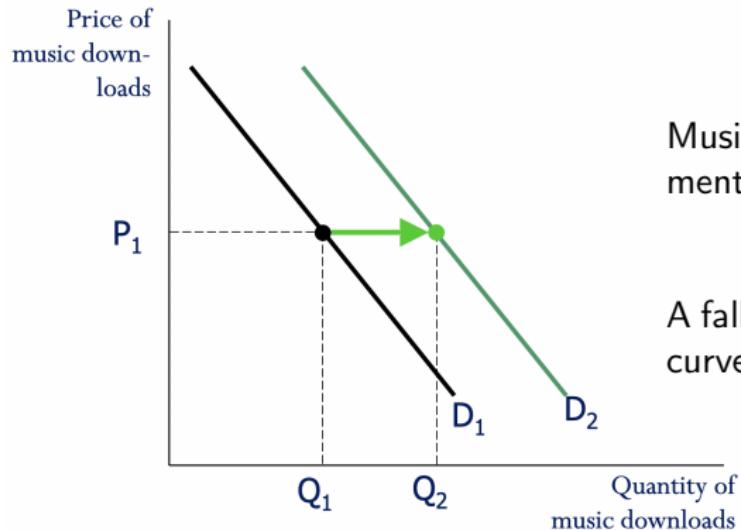
## ACTIVE LEARNING 1 Demand Curve

Draw a demand curve for music downloads. What happens to it in each of the following scenarios?

- ① The price of iPods falls
- ② The price of music downloads falls
- ③ The price of CDs falls



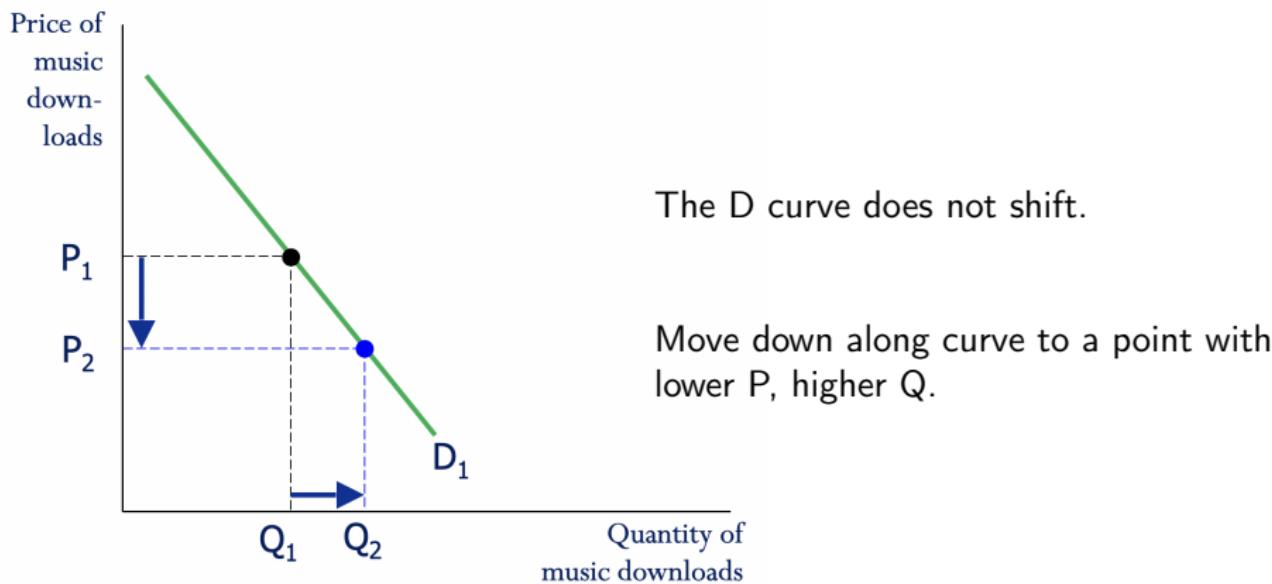
## ACTIVE LEARNING 1 A. Price of iPods falls



Music downloads and iPods are complements.

A fall in price of iPods shifts the demand curve for music downloads to the right.

## ACTIVE LEARNING 1 B. Price of music falls



## Demand Factor: Psychological Tricks

- Visual Pricing Tricks: These tricks aim to intentionally minimize the appearance of the price, so it's more palatable to consumers. For instance, a store will price something at \$9.99 instead of \$10.00, or label a product as "buy-one-get-one" rather than 50% off.
- Intentional Language Tricks: It's not what you say, but how you say it. Making products seem costly to manufacture, offering exclusivity, and using words associated with small amounts fall under this category. These tricks use semantics to position a product in an appealing way.
- Brick-and-Mortar Tricks: A store's layout is less arbitrary than you may realize. Having a bright and colorful entrance, playing calm and slow music, and putting the essential items at the back of the store are a few tactics that fall into this section. These tricks use displays and product placement to influence consumer behavior.
- Urgency Tricks: A false sense of urgency and phase-out discounts are included in this category. If a consumer believes they might miss out on a deal, they're more likely to buy.

<https://www.visualcapitalist.com/29-psychological-tricks-to-make-you-buy-more/>

## Demand Factor: Market Expectation



"Once you get spooked by something, you start being very sensitive to other bumps in the night."  
<https://www.vox.com/policy-and-politics/2018/12/18/18146722/why-is-the-stock-market-down>

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## From Individual to Market Demand

- Individual is the basic unit in all economic analysis.
- Society consists of individuals. Individuals trade in the marketplace.
- Therefore, the market demand must consist of individual demands.
- The question becomes: How do we derive the market demand curve from the individual demand curve?
- First, recall that individual has a demand schedule. Different individuals have different demand schedules.
- Second, for simplicity, economists can assume the market is composed of only two individuals.
- Third, by definition, the demand curve is derived from the relationship between market price and quantity demanded.
- Therefore, we can trace out the demand curve by focusing on the pair of the quantity demanded in the market and its corresponding price.

# From Individuals to the Market Demand: Table

The quantity demanded in a market is the sum of the quantities demanded by all the buyers at each price. Thus, the market demand curve is found by adding horizontally the individual demand curves. At a price of \$4, Catherine demands 4 ice-cream cones and Nicholas demands 3 ice-cream cones. The quantity demanded in the market at this price is 7 cones.

**FIGURE 2**

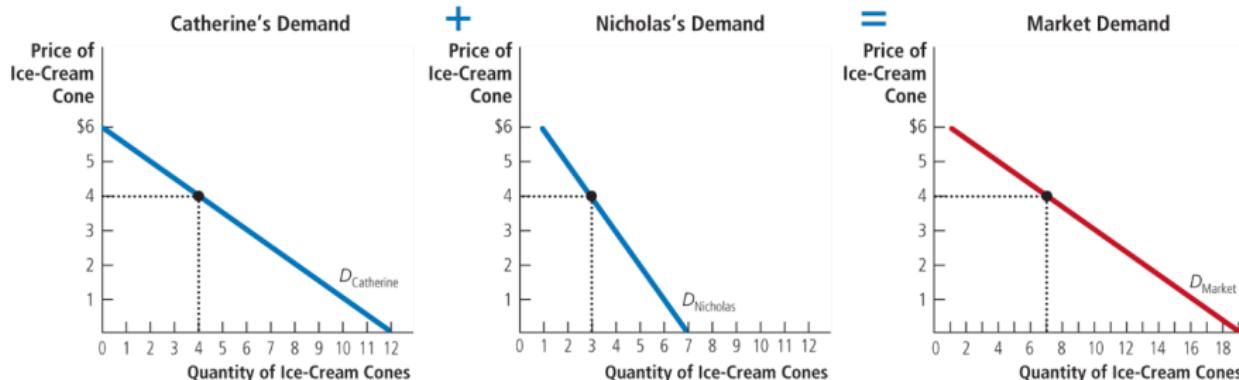
**Market Demand as the Sum of Individual Demands**

Price of Ice-Cream Cone	Catherine	+	Nicholas	=	Market
\$0	12		7		19 cones
1	10		6		16
2	8		5		13
3	6		4		10
4	4		3		7
5	2		2		4
6	0		1		1

Source: Mankiw (2021) CH4 The Market Force of Supply and Demand

# From Individuals to the Market Demand: Graph

The quantity demanded in a market is the sum of the quantities demanded by all the buyers at each price. Thus, the market demand curve is found by adding horizontally the individual demand curves. At a price of \$4, Catherine demands 4 ice-cream cones and Nicholas demands 3 ice-cream cones. The quantity demanded in the market at this price is 7 cones.

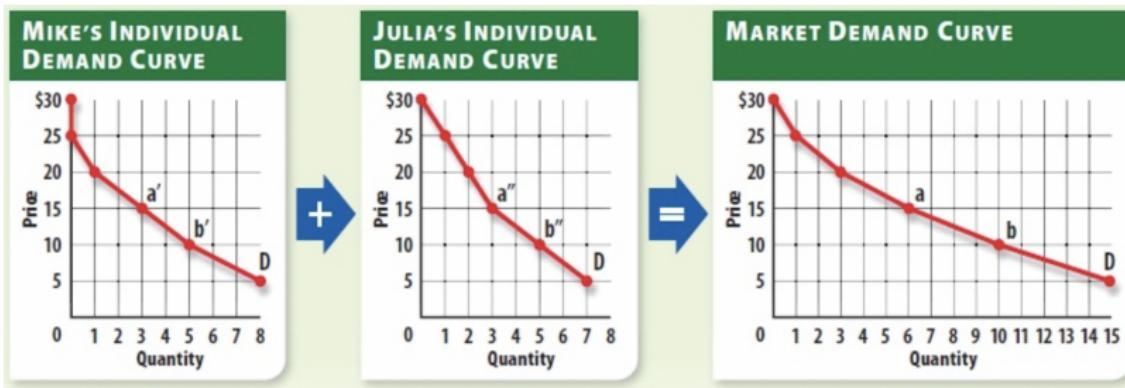


Source: Mankiw (2021) CH4 The Market Force of Supply and Demand

**FIGURE 2**

Market Demand as the Sum of Individual Demands

# Market Demand: Aggregate Individuals



To get the market demand curve, all we do is add together the number of quantity that Mike and Julia would purchase at every possible price. Then, we simply plot the prices and quantities on a separate graph. The market demand curve above is very similar to the individual demand curve in we looked at earlier. Both show a range of possible prices that might prevail in the market at a given time, and both curves are downward sloping. The main difference between the two is that the market demand curve shows the demand for everyone in the market.

<https://relivingmbadays.wordpress.com/2012/08/09/law-of-demand/>

# OUTLINE

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## References

N. Mankiw (2021) Principles of Microeconomics, 9e, Cengage

Pindyck & Rubinfeld, Microeconomics, 8th edition. Prentice Hall

201511 Natural gas use features two seasonal peaks per year

<https://www.eia.gov/todayinenergy/detail.php?id=22892>

Wikipedia: 2020 stock market crash (coronavirus)

[https://en.wikipedia.org/wiki/2020\\_stock\\_market\\_crash](https://en.wikipedia.org/wiki/2020_stock_market_crash)

Short Video: The importance of studying consumer behavior 1:46

<https://www.youtube.com/watch?v=v1q1nnPCcKw>

MRU Microeconomics: Consumer choice 4:41 (w)

MRU Microeconomics: The demand curve 3:31 (w)