Elasticity and its Applications

August 18, 2025

August 21, 2025

Introduction (1)

- It is important to know not just the changes in direction but also how much demand and supply respond to changes in prices

- The concept of elasticity helps quantifying the relationship between quantity and price

- Elasticity measures how much the buyers and sellers respond to changes in the market conditions

Introduction (2)

- We shall study
  - Elasticity of demand
  - Various types of the demand elasticities
  - Elasticity of supply
  - Applications
- Types of goods
  - Necessities and luxuries
  - Substitutes and complements
  - Normal and inferior

Price elasticity of demand (1)

- Measures change in quantity demanded when the price of a good changes
  - Defined as the ratio of % change in quantity demanded to % change in price
- Elasticity = % change in Q/ % change in P
- Usually, Q and P move in opposite directions. Hence, the elasticity of demand is negative. Generally, the negative sign is omitted
  - If abs(elasticity) = 1, demand is unit elastic
  - If abs(elasticity) > 1, demand is price elastic
 - If abs(elasticity) < 1, demand is price inelastic

Price elasticity of demand (2)

- Since we are concerned with % changes, a change in the units of measurement does not matter

- Illustration

  – Consider the points A and B, with P = 90, Q = 240 at A and P = 110, Q = 160 at B

  – Calculate the elasticity, as we move from A to B

  – Now, calculate the elasticity as we move from B to A

  – Changes are with respect to the average values

- High price elasticity means elastic demand

  – Low price elasticity: inelastic demand

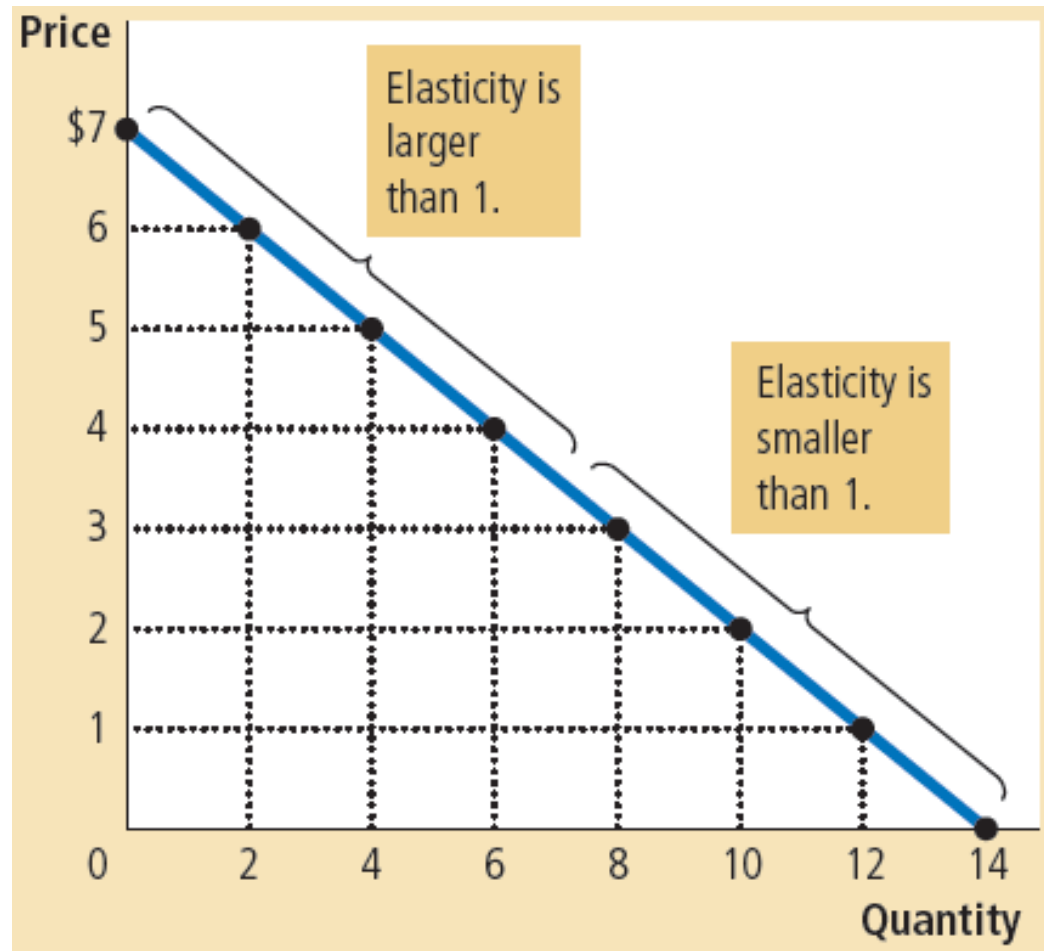# Price elasticity of demand (3)

- Determinants of elasticity
  - Utility
    - luxury or necessity – food, vacations
  - Availability of substitutes
    - tea/coffee, Ola vs Uber
  - Length of time that people have, to respond to the price changes
    - Fuel: initially the demand falls only slightly but over time more substantially
- Elasticity in physics vs in economics
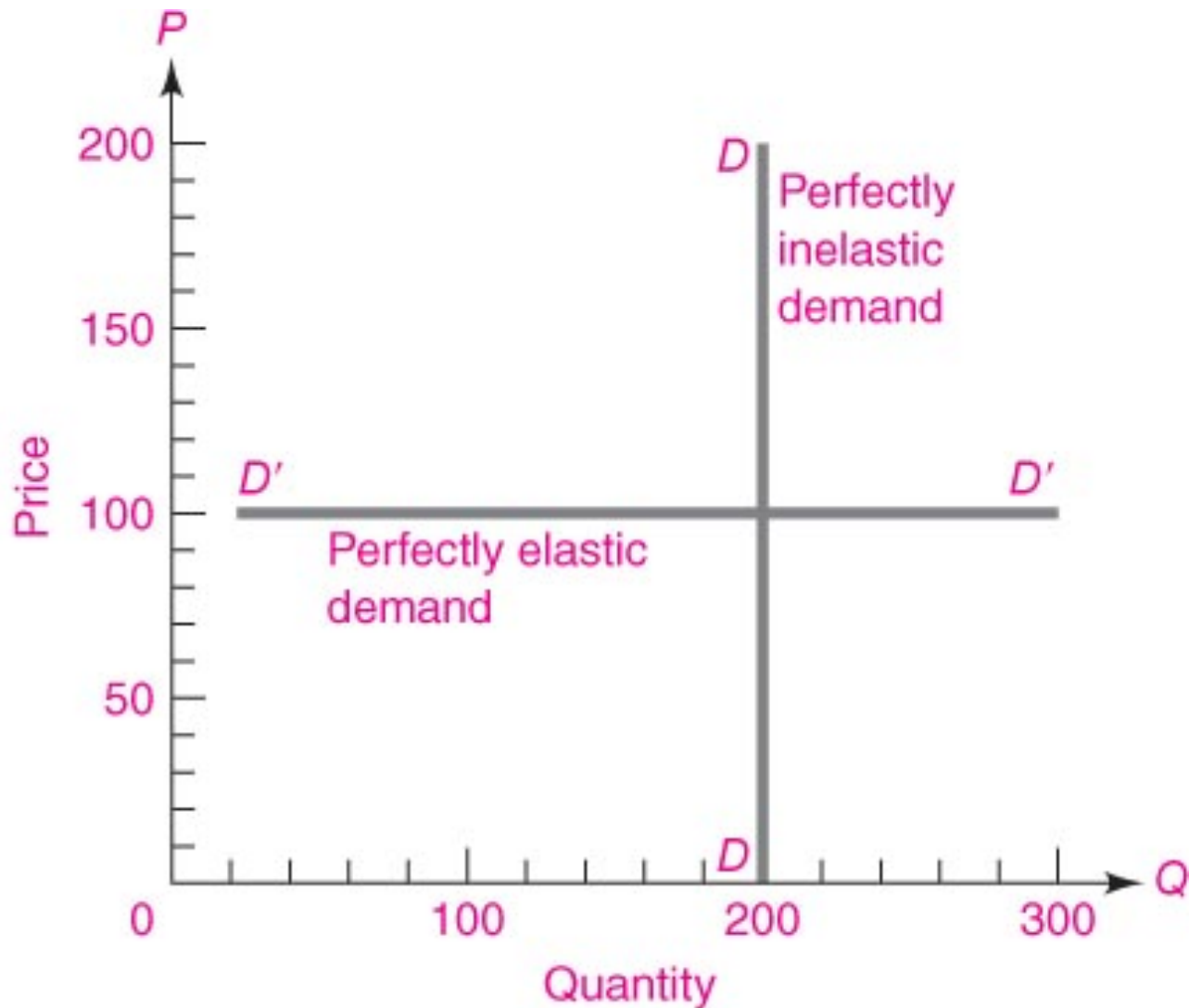
Price elasticity of demand: different cases
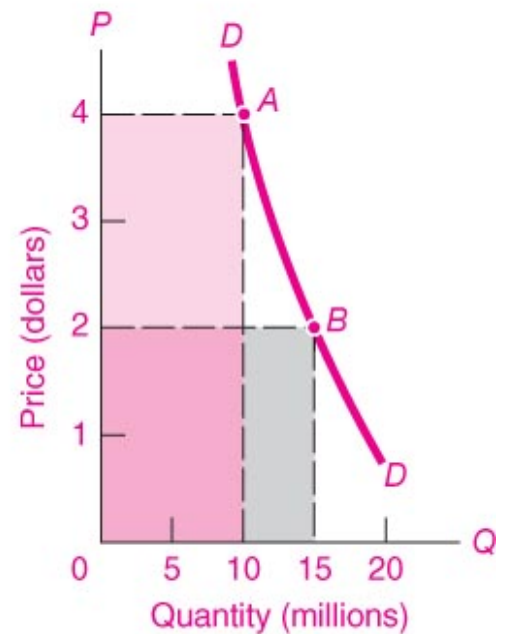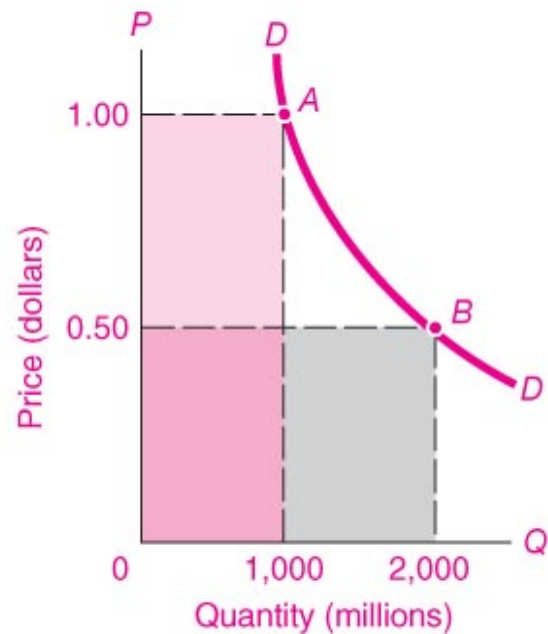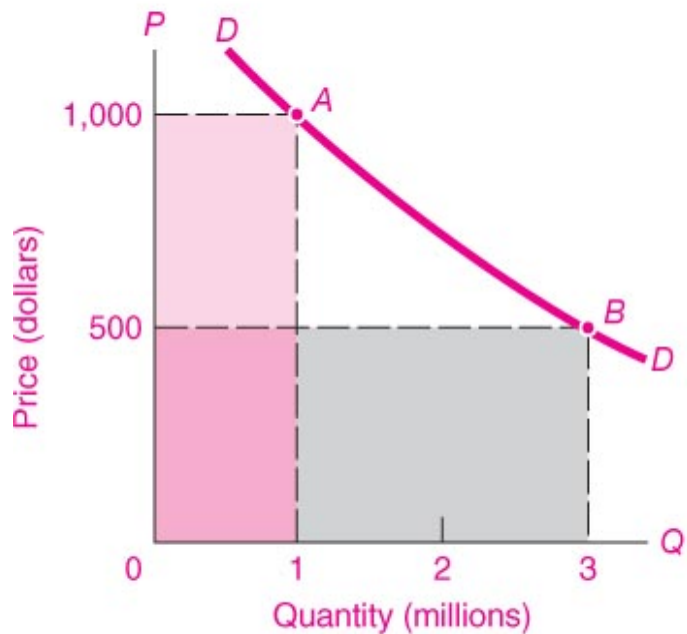
Elasticity of a linear demand curve

- Is not constant
- Is the ratio of length of the lower segment to that of the upper segment at a point
- Elasticity is not the same as slope

Extreme cases

Relationship between elasticity of demand and revenue

- Can a businessman based on the price elasticity estimates decide whether it is beneficial to increase or reduce the price? Or,

- When can reducing the price would be beneficial for the business?

- Total revenue, R=P*Q

  – Price inelastic demand: price decrease reduces R

  – Price elastic demand: price decrease increases R

  – Unit elastic demand: price decrease does not change R

Elasticity and revenue

- Mathematical representation
- Total revenue and [diagrammatic](#) representation of the relationship between elasticity and revenue

Demand elasticities: summary

Value of demand elasticity	Description	Definition	Impact on revenues
Greater than one ($E_D > 1$)	Elastic demand	Percentage change in quantity demanded *greater* than percentage change in price	Revenues *increase* when price decreases
Equal to one ($E_D = 1$)	Unit-elastic demand	Percentage change in quantity demanded *equal* to percentage change in price	Revenues *unchanged* when price decreases
Less than one ($E_D < 1$)	Inelastic demand	Percentage change in quantity demanded *less* than percentage change in price	Revenues *decrease* when price decreases

Other demand elasticities

- Income elasticity of demand
  - measures how much the quantity demanded changes as consumer income changes
  - is defined as the ratio of percentage change in quantity demanded to the percentage change in income
- Cross-price elasticity of demand
  - measures how the quantity demanded of one good responds to a change in the price of another good
  - Is calculated as the ratio of percentage change in quantity demanded of good 1 to the percentage change in the price of good 2

Will developing country nutrition improve with income?
Income elasticity: rural south India in 1980s
(Source: Behrman and Deolalikar 1987, *JPE*)

| Food type:		
Grains	Levels	.54
	First-difference	1.52
Sugar	Levels	.95
	First-difference	.57
Pulses	Levels	.95
	First-difference	1.00
Vegetables	Levels	.61
	First-difference	.51
Milk	Levels	3.27
	First-difference	− .13
Meat	Levels	1.00
	First-difference	1.05

Types of goods

- Necessities and luxuries
  - price elasticity
- Substitutes and complements
  - cross price elasticity
- Normal and inferior
  - income elasticity

Price elasticity of supply

- Shows responsiveness to the price in production related decisions
  - Is the ratio of % change in quantity supplied to % change in price
- Similar to the price elasticity of demand, but
  - It is usually positive
- Determinants
  - Ease of change in production (textile vs mining; high elasticity in the former case)
  - Time period under consideration (in the long run, the suppliers may be better able to respond to a price change)

16

Supply elasticities
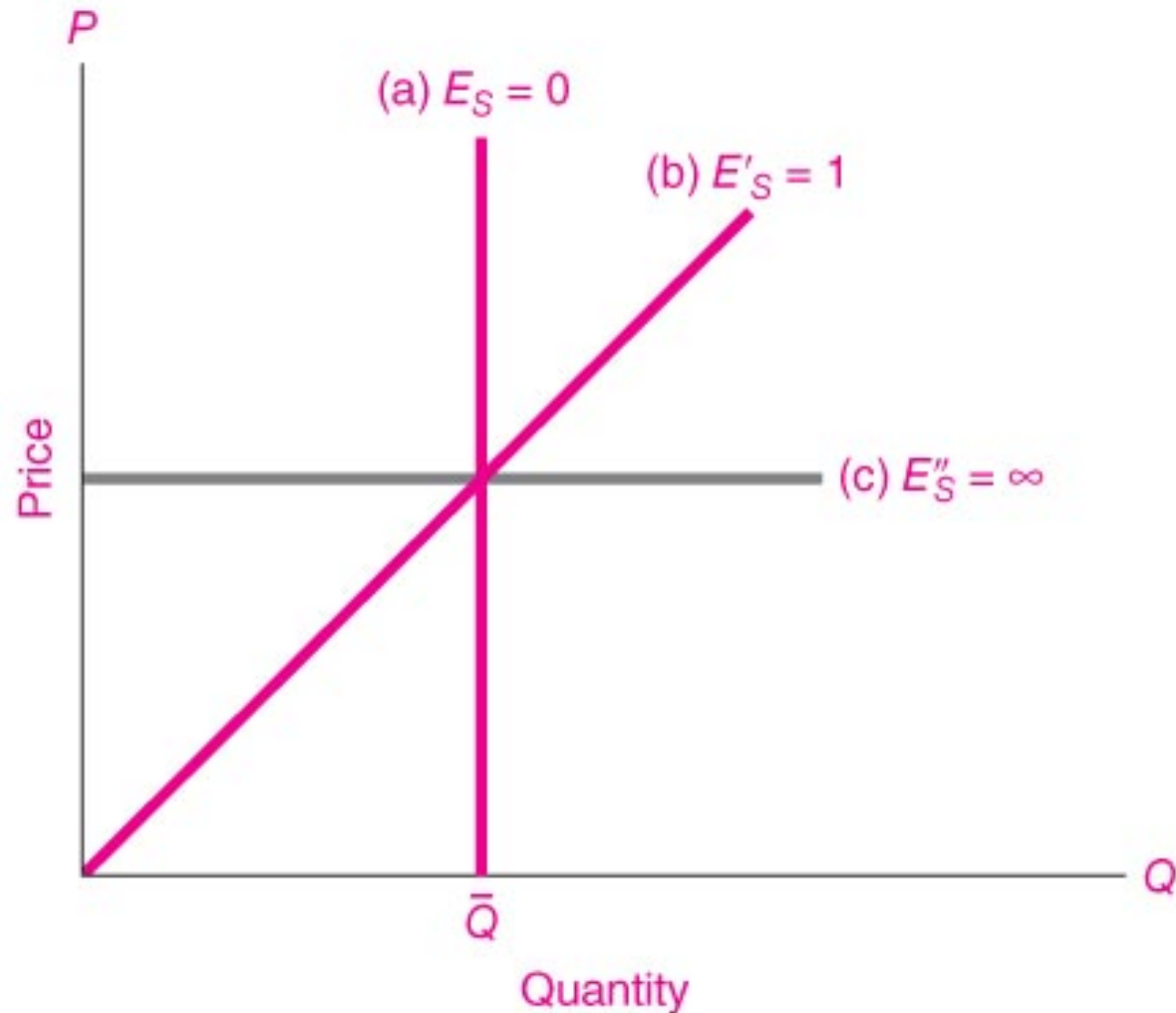
Supply elasticity: features

- Price elasticity of supply may vary
  - with the <u>level of production</u>
  - in the short and the long run
- OPEC case study
  - 1970s: decision to increase the price of oil to raise their incomes; 1973-74 and 1979-81 the price of oil rose sharply
  - 1980s: OPEC found it difficult to maintain the price high. 1982-85 the price of oil steadily declined. This led to dissatisfaction and the cooperation broke down in 1986. In 1990, the oil prices were back to their 1970 level!
  - <u>Why did OPEC fail to keep the oil prices high</u>?

Middle East's $2 Trillion Wealth Could Be Gone by 2034, Says IMF

Global oil demand may start falling sooner than expected, putting a strain on the finances of the six-member Gulf Cooperation Council, which accounts for a fifth of the world's crude production, the IMF said in a report Thursday.

World | (c) 2020 Bloomberg | Anthony DiPaola, Bloomberg | Updated: February 07, 2020 08:51 am IST

- International oil companies and producing states have come to recognize that alternative energy sources, alongside greater efficiency, are already eroding demand

- A further decline in oil prices this year, in the face of geopolitical tensions and threats the coronavirus poses to growth, is making that task even harder

- The world's demand for oil is expected to grow more slowly and eventually begin to decline in the next two decades

- Saudi Arabia, the U.A.E. and Kuwait are the biggest producers in the GCC and are all OPEC members. Risks differ for the GCC states, which also include Qatar, Oman and Bahrain

- Increased use of oil for petrochemicals might help mitigate the slowdown in demand... Even as oil demand peaks, the lower costs of production will allow Gulf states to gain market share over rivals elsewhere

- The countries however face a future of slumping income

- https://www.ndtv.com/world-news/middle-easts-2-trillion-wealth-could-be-gone-by-2034-says-international-monetary-fund-2176306?pfrom=home-topstories

19

Some applications

- Will a higher tax succeed in curbing, say, tobacco consumption?

- Who bears the burden of the tax?

- Crop production and farmers' revenue

- Price distortions in the economy

  - Price control and free market price

Price controls

- Price ceiling: a legal maximum on the selling price

- Price floor: a legal minimum on the selling price

- The impact of [price ceilings](#)
  - Shortage and scarcity; rationing mechanisms

- The impact of [price floors](#)
  - surplus

Minimum wages

- Prof P: Minimum-wage laws cause unemployment (scientist)
- Prof N: The government should raise the minimum wage (policy-maker)
- [Minimum wages and labor market](#)
- Economy comprises of many labor markets for different types of workers
- For jobs requiring skilled (and experienced) labor this may not be true
  - Equilibrium wages are well above the minimum
  - The minimum wage is not binding

Taxes

- Incidence of tax:
  - refers to the way in which the burden of a tax is shared by the buyers and the sellers
- Taxes on sellers
  - Illustration
- Taxes on buyers
  - Illustration
- Taxes levied on sellers and buyers are different, but also equivalent
  - In both the cases, tax places a wedge between the prices that the buyers pay and the sellers charge

Taxes and elasticity

- It pays to be flexible ☺
  - The burden of a tax falls more heavily on the side of the market that is less elastic
  - Illustration

Taxes and Policy

- In 1990, the US Congress adopted a new luxury tax on items such as yachts, private airplanes, expensive cars with the objective of raising tax revenue (from the rich). However, the middle class ended up bearing a higher burden of the tax!

- Consider the market for yachts
  - Demand: quite elastic, the rich may not spend on yachts and buy house, spend on vacations
  - Supply: relatively inelastic, at least in short run. Yacht factories may not have alternative uses and it may not be easy for the workers to shift careers
  - Given elastic demand and inelastic demand, which side of the market will bear a higher burden of the tax?
  - The tax placed a higher burden on the firms and workers, who are not wealthy. The burden of this luxury tax fell more on the middle class than the rich

- The suppliers made representations to the Congress and and the Congress repealed most of the luxury tax by 1993

Sin taxes

- Sin taxes are a type of excise taxes imposed on goods that society deems harmful (e.g., alcohol, certain substances, tobacco, gambling)
  - The objective is to curb consumption as well as raise revenue
  - Also referred to as the Pigouvian taxes
- How much do such taxes contribute to the market price?
  - "For many of these products, taxes represent a large share of the overall price. In New York City, a 1.75L bottle of vodka might sell for as little as $11.99 of which $7.97 is tax; and a $13.00 pack of cigarettes includes $6.86 in taxes... taxes on sin goods have grown... In 2009 the federal excise tax on a pack of cigarettes increased from $0.39 to $1.01." There are demands to increase such taxes further.
- What about revenue?
  - "... tax revenues from alcoholic beverages have grown, due to both rising consumption and state tax rate increases. In all, combined federal and state taxes on alcohol and tobacco raise nearly $40 billion annually – an amount comparable to the total federal income tax paid by the bottom half of the income distribution... Over the last decade several localities have also levied new taxes on sugar-sweetened beverages"
- Sin taxes are believed to be regressive
  - The low-income households end up bearing a disproportionately higher burden of these taxes
  - This is because of consumption patterns – such households allocate a larger share of their income to sin goods vis-à-vis the rest

Sin taxes (contd.)

- Consumption patterns
  - Alcohol: In the US, a mere "10% of households account for more than 80% of alcoholic beverage purchases by volume"
  - Cigarettes: "8% of households are responsible for virtually all purchases"
  - "Heavy purchasers of one sin good (those in the top decile) are likely to purchase larger amounts of other goods... This phenomenon is particularly strong among households with smokers"
  - Overall regressive: "These patterns imply that the combined burden tends to be even more concentrated than sin taxes on individual categories, leading the top 20% of households to pay more than 90% of all sin taxes"

- Though the composition varies
  - While "cigarette taxes are highly regressive, and fall disproportionately on lower-income households... taxes on wine and spirits appear to be quite progressive"

- Clustering
  - "We identify a tiny group of households (2.5% of the population)... who consume extremely large amounts of nearly all sin goods"
  - "The two most taxed clusters comprise 8% of households, pay 68% of sin taxes"