

# Elasticity, Taxes, and Welfare: Worked Problems

# Plan For the Day

- Figure out when you can get benefits (CS or PS) with minimal loss to society (DWL) with a price ceiling or floor.
- Build examples and intuition on what makes goods demand and supply elastic.
- Do some elasticity calculations with real numbers.
- Who pays for a tax, i.e., the burden, and how it is different than who writes the check.
- What goods to tax if you only care about excess burden, i.e., DWL
- What about fairness?

# Two Kinds of Supply and Demand

- Odd number groups have a **steep supply and a shallow demand**.
- Even number groups have a **steep demand and a shallow supply**.

# Tasks

- Impose both a price ceiling and a price floor. Two diagrams.
- Questions for each diagram:
  - Did the floor or ceiling have a higher DWL?
  - Did CS or PS increase?

# The Figures

# What matters

- If you have a price ceiling and a steep supply
  - The DWL is small
  - The change in transactions is small
  - CS *likely* increases a lot.
  - Backwards if you have a shallow supply
- If you have a price floor and a steep demand
  - The DWL is small
  - The change in transactions is small
  - PS *likely* increases a lot.
  - Backwards if you have a shallow demand

# A Little on Elasticity

- First we will create some examples of the kinds of goods that are both demand and supply elastic.
- Second we will do some calculations related to elasticity.

# The Tasks

- Give a pair of goods such that one is more demand elastic than the other? Why?
- Give a pair of good such that one is more supply elastic than the other? Why?

The Why is the important part.



# What Did you Find?

# Some Notes On Calculating

- Economists don't really do things the way the book says.
  - We do estimate elasticities but they come out of regression models.
  - Not all Supply or Demand functions have constant elasticity.
- Very nice for back of the envelope, meaning quick degree of magnitude estimation.

# Why Easy?

$$\frac{\% \Delta Effect}{\% \Delta Cause}$$

- Percent change comes without units

$$\% \Delta = \frac{End\$ - Begin\$}{Begin\$} = \frac{End - Begin}{Begin}.$$

- Elasticity is unit free
- Credit to engineers; economics stole it.

# Demand Elasticity

$$\frac{\% \Delta D_q}{\% \Delta P}$$

- Percent change in quantity demanded over percent change in price.
- Is negative for demand function, but some old folks talk as positive.
- Kind of like slope but:
  - A linear demand has different elasticity at every point.
  - A demand with constant elasticity is shaped like a hyperbola  
 $P = \frac{a}{q^{\text{elasticity}}}$
  - No units so can compare feet to gallons.

# Calculation

Elasticities allow back of the envelop calculation – if you know the right elasticity.

- If you know the price change, you can calculate the change in purchases.
- If you know the income change, you can calculate the change in demand, assuming prices remain the same.

## Why? Cancellation

$$\% \Delta P (E_{lp}) = \% \Delta P \frac{\% \Delta D_q}{\% \Delta P} = \% \Delta D_q$$

So, if you see a 10% drop in the price of Mountain Dew with  $E_p = -4.4$  then you should see a  $-10\%(-4.4) = 44\%$  increase in the sales of Mountain Dew.

- Watch the negative signs
- Works with other elasticities too

## Look at some real life

<https://www.ers.usda.gov/data-products/commodity-and-food-elasticities/>

Try Poultry in the US.

# Suppose

The price of poultry increases by 10% what happens to sales?

The price of eggs increases by 10%, what happens to sales of poultry?



## What Did you Find?

$$\% \Delta Cause(El) = \% \Delta Cause \frac{\% \Delta Effect}{\% \Delta Cause} = \% \Delta Effect$$

# On to Taxes

- Odd number groups have a **steep supply and a shallow demand**.
- Even number groups have a **steep demand and a shallow supply**.

# Show

- Tax Revenue
- Excess Burden. That is the name of DWL when we talk taxes.
- The tax burdens for both buyers and sellers.

# What Did You Find?

# Summary

- The more inelastic side, buyers or sellers, has a larger burden of the tax.

Big Take Away: Nothing to do with who writes the check. If you can't change behavior you pay.

# Slight Change

- Odd number groups have **inelastic** supply and demand
- Even number groups have a **elastic** supply and demand.

Show the excess burden

# What Did you Find?

# Key

- The least elastic function determines the decrease in sales.
- Excess burden increases as the least elastic function, supply or demand, increases in elasticity.
- The least elastic function has a larger burden of the tax.



# So Wait

- If I want a low excess burden, I just tax things you need to survive, insulin, or things you are addicted to, cigarettes, and I can minimize social harm?
- If I want to be fair, in the ability to pay sense, I just tax luxury items. Those usually have high elasticity and therefore high excess burden.