

Precept 2

Demand & Supply, pt. 2

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Problem 1: Weed

The US federal government is thinking of implementing a tax on the nascent recreational marijuana market, dubbed the “Mary Jane Tax” (Bernie calls it the MJ Tax, for short). You are tasked with estimating the price elasticity of demand and supply, which are key inputs to the design of the policy, as they would allow you to forecast the estimated tax revenue for different tax levels. Since there’s not enough data in the US, you collect data from Uruguay, which legalized marijuana in December 2013. The information is presented below.²

Price (USD)	Demand (millions)	Supply (millions)
60	22	14
80	20	16
100★	18★	18★
120	16	20

²The standard unit is half an ounce, for some reason. Ask Americans.

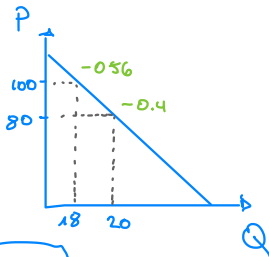
- a. Compute the price elasticity of demand when the price is \$80 and when the price is \$100. Interpret your results.

$$E^P \equiv \frac{\% \Delta Q}{\% \Delta P} = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \left[\frac{\Delta Q}{\Delta P} \right] \frac{P}{Q}$$

$$\frac{\Delta Q}{\Delta P} = \frac{-2}{20} = -0.1$$

$$i) P = \$80: E_d = -0.1 \cdot \frac{80}{20} = -0.4$$

$$ii) P = \$100: E_d = -0.1 \cdot \frac{100}{18} = -0.56$$



- b. Compute the price elasticity of supply when the price is \$80 and when the price is \$100. Interpret your results.

$$E_s = \frac{\frac{\Delta Q_s}{Q_s}}{\frac{\Delta P}{P}} = \underbrace{\frac{\Delta Q}{\Delta P}}_{0.1} \cdot \frac{P}{Q}$$

i) $P = \$80 : E_s = 0.5$

ii) $P = \$100 : E_s = 0.56$

- c. What are the equilibrium price and quantity? Now suppose the US government is planning on setting a price ceiling of \$80. What consequences will this have on the local market? Clearly state any assumptions you make.

$$Q_s = Q_d \Rightarrow P^* = 100 \Rightarrow Q^* = 18$$

Problem 2: Cigarettes

In 1998, Americans smoked 23.5 billion packs of cigarettes, which had an average retail price of \$2. Studies have shown that the price elasticity of demand for cigarettes is -0.4 , and the price elasticity of supply is 0.5 . Using this information, *and any other assumptions you deem necessary*, derive the demand and supply curves for the cigarette market.

Demand $Q_d = a - b \cdot P$ $E_d^P \equiv \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$
 $Q_s = c + d \cdot P$

Assuming a linear demand, supply, with Q in billions.

$$\Rightarrow -0.4 = \frac{2}{23.5} \cdot \underbrace{\frac{\Delta Q}{\Delta P}}_b \quad \text{Noticing that the slope of the demand is}$$

$$\Rightarrow \boxed{b = 4.7}$$

$$\frac{\Delta Q}{\Delta P} \equiv b.$$

Substituting b, P, Q in demand $\Rightarrow 23.5 = a - 4.7 \cdot 2$
 $\Rightarrow \boxed{a = 32.9}$

Demand is

$$Q_d(P) = 32.9 - 4.7 \cdot P$$

Supply

$$0.5 = \frac{\Delta Q}{\Delta P} \cdot \frac{2}{23.5}$$

$$\frac{\Delta Q}{\Delta P} = d$$

$$\Rightarrow d = 5.875$$

$$\Rightarrow 23.5 = c + 5.875 \cdot 2 \Rightarrow c = 11.75$$

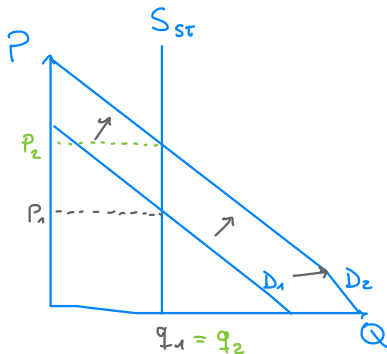
Supply is

$$Q_s(P) = 11.75 + 5.875 P$$

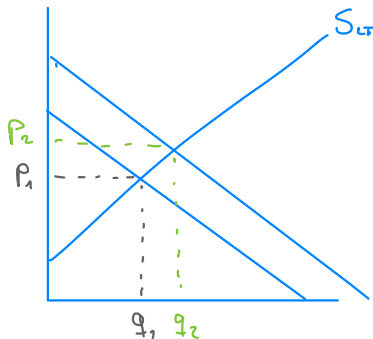
Comments

1. Suppose that an unusually contagious virus causes the demand curve for face masks to shift. What do you predict will happen in the short and long run to prices and quantity?

Short term:



Long term:



Comments

2. If a 3-percent increase in the price of corn flakes causes a 6-percent decline in the quantity demanded, what is the elasticity of demand?

$$E_d = \frac{\% \Delta Q}{\% \Delta P} = \frac{-6}{3} = -2$$

Comments

3. Explain the difference between a shift in the supply curve and a movement along the supply curve.

A movement along the supply curve occurs when the price of the good changes. A shift of the supply curve is caused by a change in something other than the good's price that results in a change in the quantity supplied at the current price. Some examples are a change in the price of an input, a change in technology that reduces the cost of production and an increase in the number of firms supplying the product.

Comments

4. Explain why for many goods, the long-run price elasticity of supply is larger than the short-run elasticity.

The price elasticity of supply is the percentage change in the quantity supplied divided by the percentage change in price. In the short run, an increase in price induces firms to produce more by using their facilities more hours per week, paying workers to work overtime and hiring new workers. Nevertheless, there is a limit to how much firms can produce because they face capacity constraints in the short run. In the long run, however, firms can expand capacity by building new plants and hiring new permanent workers. Also, new firms can enter the market and add their output to total supply. Therefore, the price elasticity of supply is larger in the long run than in the short run.

Bonus Problem: Netherlands agriculture

Much of the demand for Dutch agricultural output comes from other countries. In 2019, the total demand for potatoes was estimated to be

$$Q_{td} = 3244 - 283P.$$

Of this, total domestic demand was

$$Q_{dd} = 1700 - 107P,$$

and domestic supply was

$$Q_{ds} = 1944 + 207P.$$

Suppose that after the 2020 recession the demand for potatoes falls by 40%.

- a. Dutch farmers are concerned about this drop in export demand. What happens to the free-market price of potatoes in The Netherlands? Do farmers need to worry?

- b. Now suppose the Dutch government is planning to buy enough potatoes to raise the price to \$3.5 per sack. With the drop in export demand, how much potatoes would the government have to buy to achieve this target, and how much would it cost it?