→ pulling on demand by price

Sec. 24 Elasticity of demand

Foundation - price and demand are related. But for some commodities price impacts consumer demand and therefore revenue more than for others.

For example, look at the hot dog and TV examples. On first glance you'd think hot dog price increase at a ballpark would impact demand (sales) more than television sales.

But the consumer base for both is probably the top 20% of middle income earners, since leisure time available and expensive TVs and ball games have a lot in common. I think.

Book notes stock example, which does not deal with demand, but just the concept of relative change. So that example is of no use in the analysis of elasticity of demand, but it's point about relative change $\left(\frac{\text{increase in price}}{\text{orig price}}\right)$ is a good one.

Formulation of elasticity of demand:

p = orig price, h = small change in price

$q(p)$ demand as a function of price

price: $(p+h) - p = h$ change in price

demand: $q(p+h) - q(p)$ change in demand

Relative price change: $\frac{p+h-p}{p} = \frac{h}{p}$

Relative demand change: $\frac{q(p+h)-q(p)}{q(p)}$

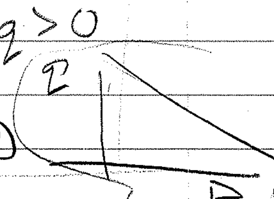
Def Elasticity - The sensitivity of demand to changes in price measured as a ratio of the relative changes of the two.

Ratio $\dfrac{\frac{q(p+h)-q(p)}{q(p)}}{\frac{h}{p}} = \frac{q(p+h)-q(p)}{q(p)} \cdot \frac{p}{h}$

Simplified Rewrite $\boxed{\frac{q(p+h)-q(p)}{h}} \cdot \frac{p}{q(p)}$ mother/father of derivative when limit as $h \to 0$

As $h \to 0$, the ratio $= q'(p) \cdot \frac{p}{q(p)}$

or $\underbrace{\frac{dq}{dp}}_{<0} \cdot \frac{p}{q(p)}$ <0 where $p>0$, $q>0$ and $\frac{dq}{dp} < 0$



Formula: Elasticity $E(p) = -\frac{p}{q} \cdot \frac{dq}{dp}$ put a negative sign ~~before~~ it so it's always (+)

"Elasticity of demand as a fcn. of price"

$$\boxed{E(p) = -\frac{p}{q} \cdot q'(p)}$$

Recall that $R(p) = p \cdot q(p)$, and the derivative tells when revenue is increasing or decreasing

Because we have expressed R as product of 2 variables, the derivative is found by product rule:

$$\frac{dR}{dp} = 1 \cdot q(p) + p \cdot \frac{dq}{dp}$$

by algebra $= q(p)\left(1 + \frac{p}{q(p)} \frac{dq}{dp}\right)$ $\quad \boxed{-E = \frac{p}{q} \cdot \frac{dq}{dp}}$

$$\boxed{\frac{dR}{dp} = q(p)\,(1 - E)}$$

Change in revenue as a fcn. of elasticity.

Notice that $\underbrace{\frac{dR}{dp} < 0}_{\text{revenue drops}}$ when $\underbrace{E > 1}_{\text{elasticity is positive}}$

and $\underbrace{\frac{dR}{dp} > 0}_{\text{revenue rises}}$ when $\underbrace{E < 1}_{\text{elasticity is negative}}$

Def inelastic: Thus, when $E < 1$, demand is inelastic, ~~doesn't react to the "pull" of price~~

Def elastic: When $E > 1$, demand is elastic, revenue is affected by price increase, it is "pulled" by ~~the effect of price~~ rises.

What about $E = 1$?

Writing $\frac{dR}{dp}$ above more simply:

$$\boxed{R'(p) = q(1 - E)}$$

When $E = 1$, $R'(p) = q(1-1) = 0$

Def of unit elasticity

The marginal revenue (revenue realized by raising the price one more unit, i.e., dollar) reaches zero at this value of p.

This says that you cannot increase revenue any more with an increase in price because the decrease in demand will offset it.

Beyond this value of p, demand falls sufficiently for subsequent price increases to see a drop in revenue.

In this price range, demand is elastic (responsive to price)