Elasticity Lab

Elasticity is a measure of how Quantity changes in response to changes in Prices.
To enhance comparisons across products, it has no measurement unit.
It is defined as the Percent Change in Quantity/Percent Change in Price
It can be applied in several contexts (for example, demand, supply, income, and comparisons across products). The difference lies in the quantity and denominator chosen.

$$E_D = \frac{\Delta\%Qd}{\Delta\%P}$$

Another difference lies in how you compute the percent change values, which depends on the data available. Percent change is computed as: $\Delta Q/Q$

If you have two points: Q1, P1 and Q2, P2.
For example (200, 10) and (210, 8)

$$E_D = \frac{(Q2-Q1)/Q1}{(P2-P1)/P1} = \frac{(210-200)/200}{(8-10)/10} = \frac{10/200}{-2/10} = \frac{0.05}{-0.2} = -0.25$$

Which uses the percentage change from point 1 to point 2.
But, you get a different number if you compute the change from point 2 to point 1:

$$\frac{(Q1-Q2)/Q2}{(P1-P2)/P2} = \frac{(200-210)/210}{(10-8)/8} = \frac{10/210}{-2/8} = \frac{-0.4762}{0.25} = -0.19048$$

The problem lies in choosing the Q and P to divide by.
Instead of choosing one of the end points, one solution is to compute the average.
(Q1+Q2)/2, called the arc elasticity, and gives the same value regardless of which point you start with.

$$E_D = \frac{(Q2-Q1)/(Q1+Q2)/2}{(P2-P1)/(P1+P2)/2} = \frac{(210-200)/(200+210)/2}{(8-10)/(10+8)/2} = \frac{0.012195}{-0.5556} = -0.21951$$

If you have an estimate of the demand curve, or the slope of the curve at a point, you can compute the point elasticity:

$$E_D = \frac{dQ/Q}{dP/P} = \frac{dQ}{dP}\frac{P}{Q}$$

Say Q = 250-5P, which uses the slope from the example.
The point elasticity at P1,Q1 (10, 200) is

$$E_D = \frac{dQ}{dP}\frac{P}{Q} = -5\frac{10}{200} = -0.25$$

Because the number is always negative, we often leave off the sign.

Lab Assignments

1. Given two points (P,Q): (15, 120) and (18, 100)
    a. Compute the arc price elasticity of demand
    b. Compute the point elasticity of demand at both points.

2. Given the following demand curve: Qd = 300 – 8 P. Compute the elasticity of demand at three points:
    a. P=30
    b. P=20
    c. P=5
    d. Also, find the point at which Ed= -1

Income elasticity examines the percent change in Qd for a percent change in income.

3. Using the arc (average) formula, compute the elasticity of income for
    a. Q1=110, Y1=10,000; Q2=170, Y2=15,000
    b. Q1=110, Y1=10,000; Q2=150, Y2=15,000
    c. Q1=110, Y1=10,000; Q2=100, Y2=15,000

Cross price elasticity examines the change in the quantity in one product given the change in price of a potentially related product.

4. Compute the cross-price elasticity for the following and identify the relationships
    a. Qa=110, Pb=12; Qa=135, Pb=9
    b. Qa=110, Pb=12; Qa=90, Pb=9
    c. Qa=110, Pb=12; Qa=110, Pb=9