Calculus

Rob Hayward

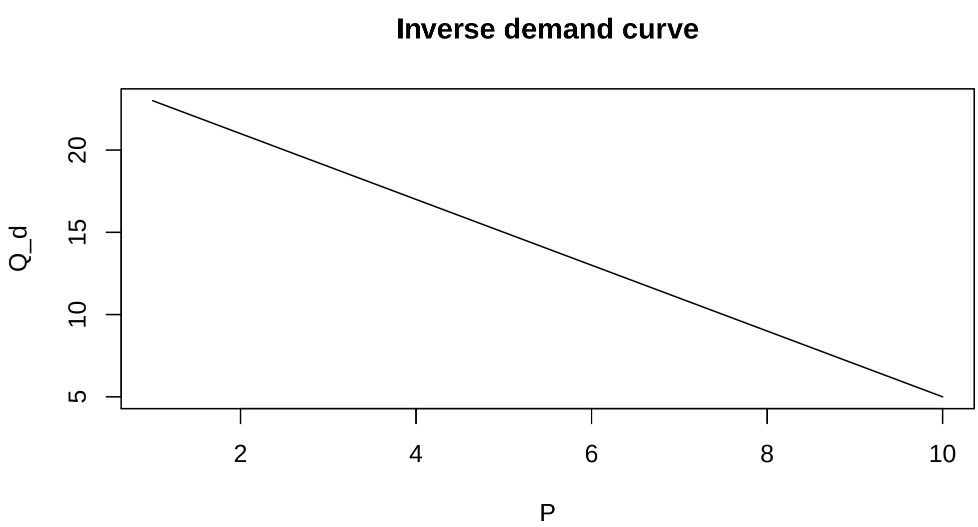
November 20, 2014

Introduction

- Economics is all about relationships
  - tax - spend
  - education - income
  - R and D - Sales
- We would like to measure these relationships

Take the following equation

$$Q_d = 25 - 2P$$



Remember that the elasticity is calculated as

$$\begin{aligned}\varepsilon_d =& \frac{Q_2 - Q_1}{Q1} / \frac{P_2 - P_1}{P_1} \\ =& \frac{Q_2 - Q_1}{Q_1} \times \frac{P_1}{P_2 - P_1} \\ =& \frac{\Delta(Q) P_1}{\Delta(P) Q_1}\end{aligned}$$

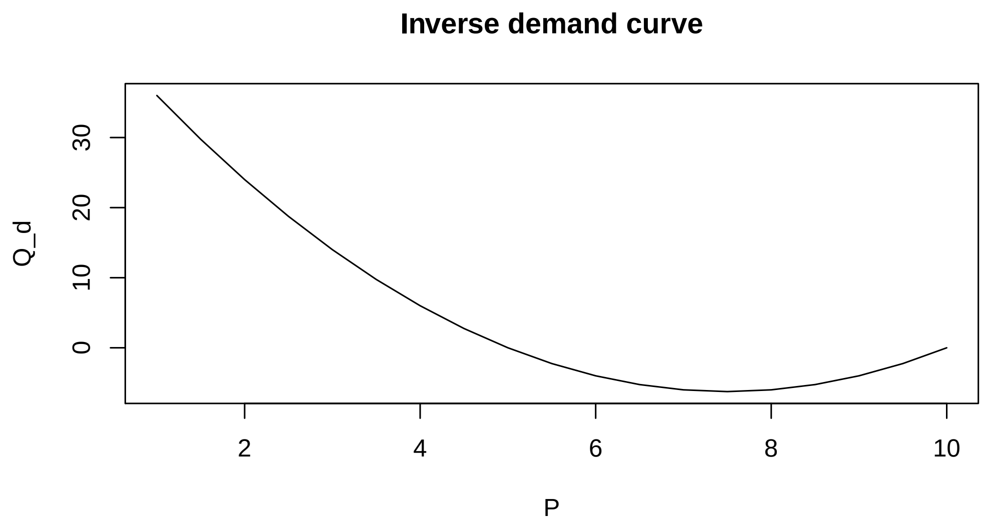
Knowing that $\Delta(Q)/\Delta(P) = -5$, this rule can be applied to any point on the graph.

For example, when $P = 6, Q = 13$ and the elasticity of demand at that point is

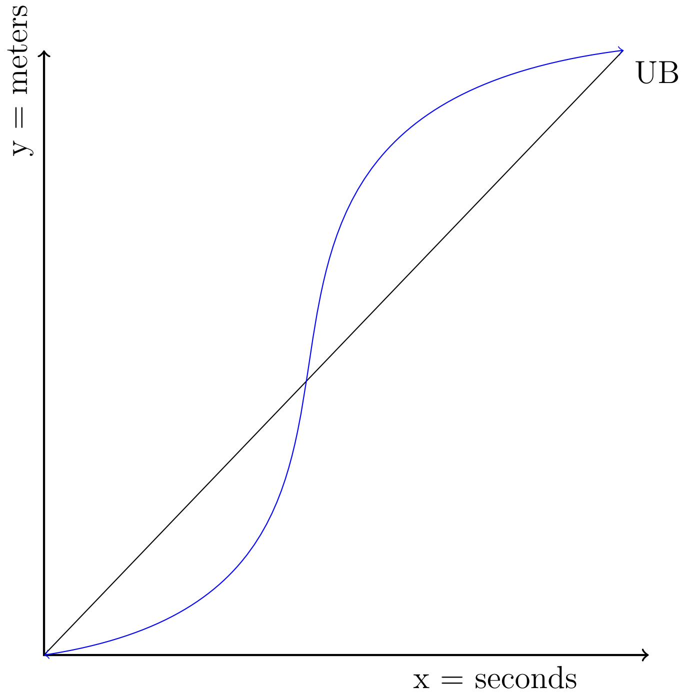
$$\begin{aligned}\varepsilon_d =& -5 \times \frac{6}{13} \\ =& -2.3077\end{aligned}$$

That is all very well, but what happens when there are non-linear relationships? The last elasticity examples that we looked at had a non-linear demand curve.

$$Q_d = 50 - 15P + P^2 \tag{1}$$



0.1 Usain Bolt



The average speed can be calculated as the total distance divided by the time

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

In this case, that is

$$\text{average speed} = \frac{100 \text{ meters}}{9.58 \text{ seconds}}$$

This is $10.43\frac{m}{s}$ However, if you want the instantaneous speed, it is necessary to draw the line at a tangent to the curve.