

Using Impact Analysis As a Measure of Arc Elasticity

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Introduction to Impact Analysis

- When the price is raised, ΔP , there is a decrease in the quantity sold, ΔQ , and a change in the revenue.
- The impact of a higher price, ΔP , increases the revenue, while impact of the decrease in the quantity, ΔQ , reduces the revenue.
- The net effect of the two impacts dictates if the revenue goes up or down

Major Use of Impact Analysis

- To measure the individual impacts that the changes in two variables have on a third variable.
 - Δ Price and Δ Quantity each have an impact on the change in Revenue, ΔR
 - Δ Market Share and Δ Market Size each have an impact on the change in Quantity sold, ΔQ
 - Δ Advertising productivity and Δ Advertising Expense each have an impact on the change in Quantity sold, ΔQ

Impact Analysis is Related to

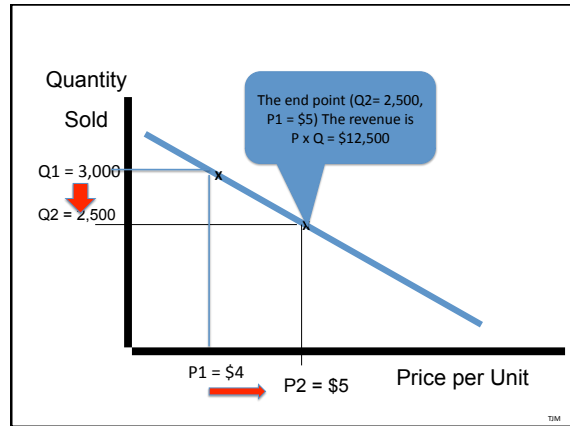
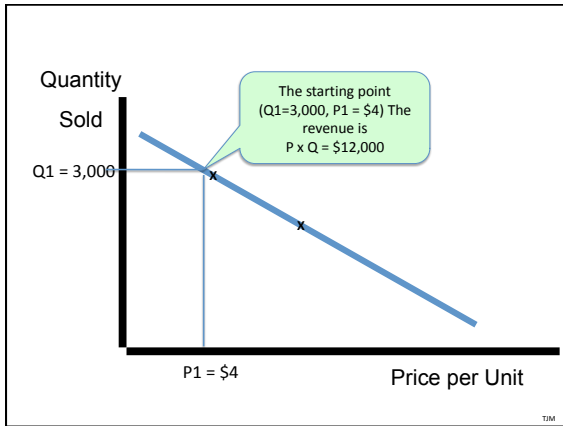
- 1) Variance Analysis in Accounting
- 2) Arc Elasticity in Marketing, Economics

Impact Analysis helps us explain

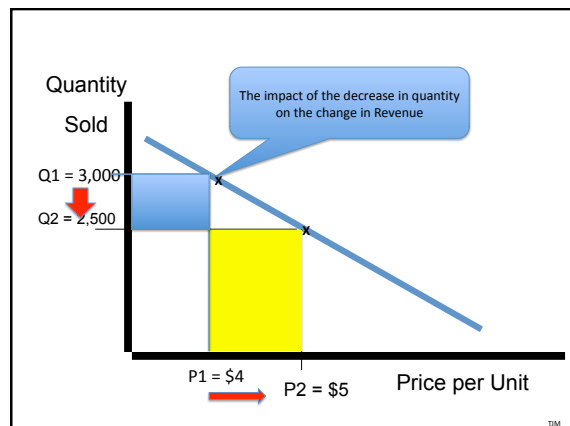
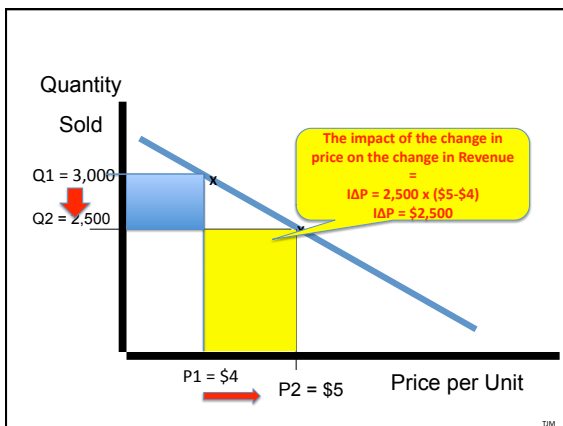
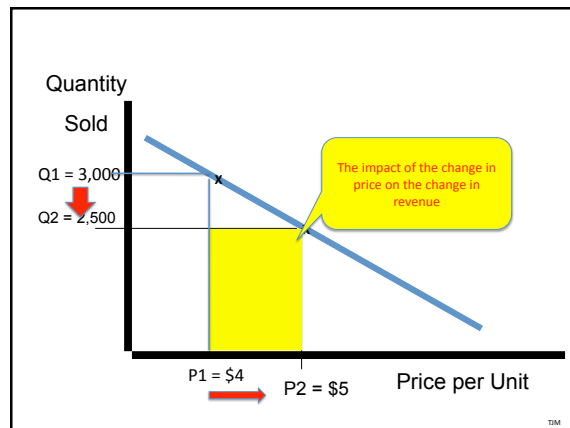
- 1) why revenue is at a maximum, when the price elasticity is equal to -1.0
- 2) why profit is at a maximum, when the elasticity of markup is equal to -1.0
- 3) why profit from promotional efforts, such as advertising, are at a maximum, when the elasticity of the Return on Advertising is equal to -1.0

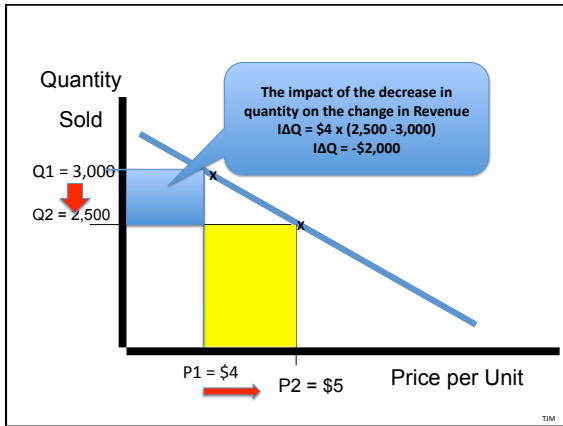
Revenue as an Example

- Impact of Changing Price and Changing Quantity on the Change in Revenue
- Learning Why the Revenue is at a maximum when the two impacts are equal and the ratios of the two impacts is equal to -1
- Learning Why the Revenue is at maximum when the price elasticity is equal to -1.0



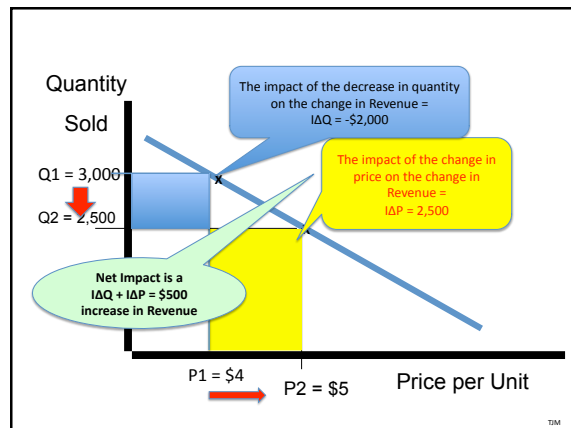
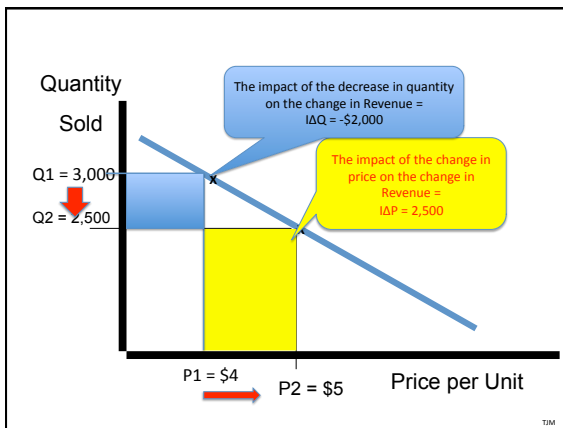
- The \$500 change in Revenue has to be equal to the impact of the change in price and the impact of the change in quantity
- $\Delta R = R2 - R1 = \$12,500 - \$12,000 = \$500$
- $\$500 = \Delta Q + \Delta P$
- $\$500 = \Delta Q + \Delta P$
- $\$500 = P_{\min}(Q2-Q1) + Q_{\min}(P2-P1)$



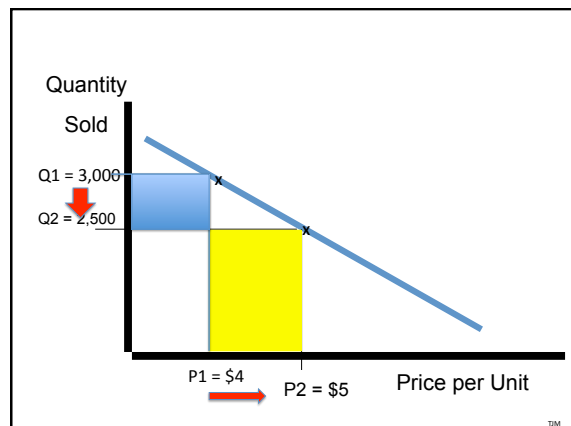


$\Delta R = \Delta Q + \Delta P$

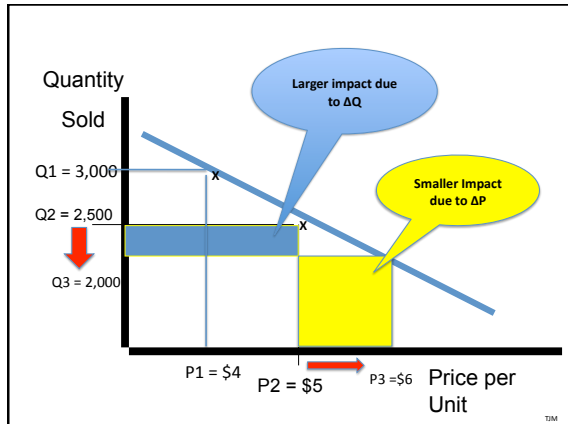
- The impact on the change in Revenue by the increase in the price is calculated as
- $\Delta P = Q_{\min}(\Delta P) = 2,500 \times (\$5 - \$4) = \$2,500$
- The impact on the change in Revenue by the decrease in Quantity is calculated as
- $\Delta Q = P_{\min}(\Delta Q) = \$4 \times (2,500 - 3,000) = -\$2,000$
- The net of two impacts equals the change in Revenue = \$500



- As the price starts very low and grows larger, then the larger the relative size of the two impacts changes.
- When the original price is low and is increased then the positive impact is very large compared to the negative impact of less quantity sold and the revenue increases



- When the original price is high and is increased, the positive impact is very small compared to the negative impact of less quantity sold and the revenue decreases



- When the two impacts of the two changes are equal the revenue is at a maximum

- ### Proof
- The ratio of the impact due to the changing quantity and the impact due to the changing price **is the Arc Elasticity of Price**.
 - Arc Elasticity of Price = $\Delta Q / \Delta P$
 - Arc Elasticity of Price = $P_{\min}(\Delta Q) / Q_{\min}(\Delta P)$
 - Arc Elasticity of Price = $(\Delta Q / Q_{\min}) / (\Delta P / P_{\min})$
 - Arc Elasticity of Price = $(\% \Delta Q_{\min}) / (\% \Delta P_{\min})$

	Period 1	Period 2	Change	%Δ based on minimums
Quantity, Q	3,000	2,500	ΔQ= -500	$\% \Delta Q_{\min} = 500/2,500 = 0.20 = 20\%$
Price, P	\$4	\$5	ΔP = \$1	$\% \Delta P_{\min} = -\$1/4 = -0.25 = 25\%$
Revenue	\$12,000	\$12,500	ΔR= \$500	
Arc Price Elasticity = $\% \Delta Q_{\min} / \% \Delta P_{\min}$				
Arc price Elasticity = 20%/25% = -0.8				

	Period 1	Period 2	Change	%Δ based on minimums
Quantity, Q	3,000	2,500	ΔQ= -500	$I \Delta Q = P_{\min}(\Delta Q) = \$4(-500) = -\$2,000$
Price, P	\$4	\$5	ΔP = \$1	$I \Delta P = Q_{\min}(\Delta P) = 2,500(\$1) = \$2,500$
Revenue	\$12,000	\$12,500	ΔR= \$500	$\Delta R = I \Delta Q + I \Delta P = -\$2,000 + \$2,500 = \500
Arc Price Elasticity = $I \Delta Q / I \Delta P$				
Arc price Elasticity = $\\$2,000 / \\$2,500 = -0.8$				

What did we learn?

- The impact of a change in a variable, (quantity of units sold) is measured in terms of the units it impacted (dollars of revenue)
- The change in Revenue equals the impact of the change in Price, ΔP , **plus** the impact of the change in Quantity, ΔQ
- Arc Elasticity of Price Is equal to the ratio of the two impacts on revenue,
$$\% \Delta Q_{\min} / \% \Delta P_{\min} = \Delta Q / \Delta P$$