

Elasticity of The Learning Curve or Experience Curve

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- As our experience in solving a problem accumulates the cost of getting the problem done decreases

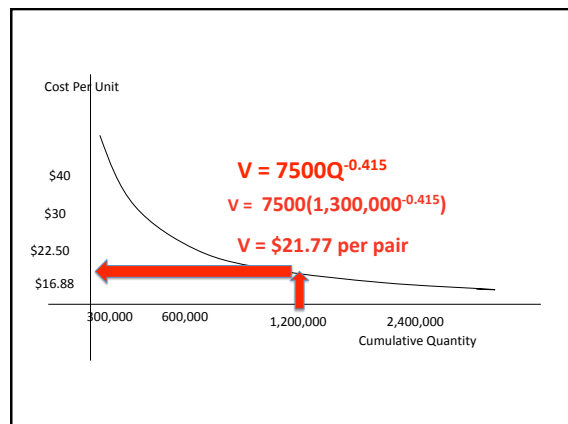
- Elasticity of Learning is the percentage improvement to be expected for a 1% increase in our experience.
- For example if our Elasticity of Learning is -0.415, then when the total history of production increases from by 1%, then we expect the variable cost per unit will drop by 0.415%

Example problem

- Forecasted Unit Sales = 500,000 pairs
 - Cumulative Sales to Last Period = 800,000
 - The learning curve is estimated to be
 - $V = 7500Q^{-0.415}$
- What is the forecasted cost per unit?

Exercise

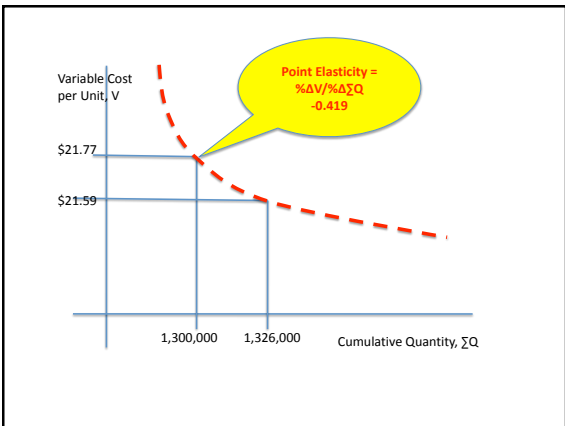
- Forecasted Unit Sales = 500,000 pairs
 - Cumulative Sales to Last Period = 800,000
 - The learning curve is estimated to be
 - $V = 7500Q^{-0.415}$
- What is the forecasted cost per unit?
- $V = 7500(1,300,000^{-0.415})$
 - $V = \$21.77$ per pair



- Estimating the Future cost of making the shoes is easy if somebody gives you the formula for the learning curve that has been statistically estimated from a long history of observations

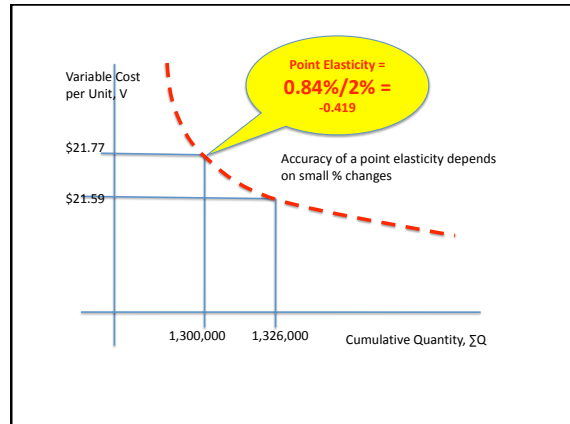
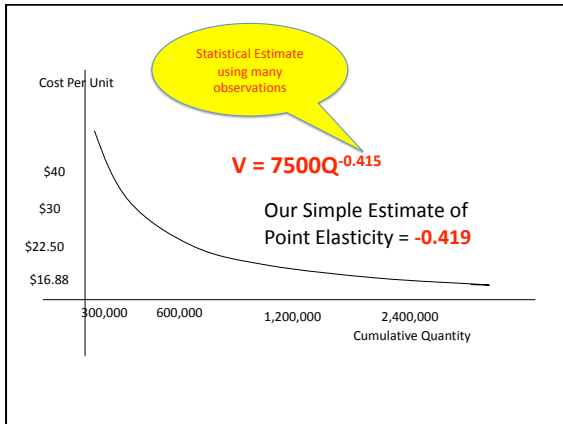
- **How you estimate the rate of improvement from two observations?**
- In period 4 you had a total production history of 1,300,000 units and the variable cost per unit was \$21.77
- In period 5 your sold 26,000 more units so that production history increased to 1,326,000 units and the cost per unit dropped to \$21.59
- You are forecasting sales of 500,000 units in period 6 what is your estimated cost per unit in period 6?

	Period 4	Period 5	Δ	% change from period 4
Variable Cost per Unit, V	\$21.77	21.59	-\$0.18	0.84%
Cumulative Quantity, ΣQ	1,300,000	1,326,000	26,000	2%
Point Elasticity of Learning	$\% \Delta V / \% \Delta \Sigma Q = 0.084\% / 2\% = -0.419$			



- You are planning on selling 500,000 in period 6! That represents a percentage increase in the history of production (experience)
- $500,000 / 1,326,000 = 37.7\%$ increase
- The estimated point elasticity is -0.419
- The decrease in cost $37.7\% \times 0.419 = 15.8\%$ decrease in variable cost
- Current Cost is \$21.58
- Period 6 = $\$21.58 - 15.8\%(21.58) = \18.17

- Compare our simple forecast of a variable cost of **\$18.17** for period 6
- To the correct forecast provide by the My estimated Learning Curve Equation
- $V = 7500 (1,826,000^{-0.415}) = \mathbf{\$18.90}$



- For larger % changes use the **Arc Elasticity** for better accuracy

	Period 4	Period 5	Δ	% change from the minimum
Variable Cost per Unit, V	\$21.77	21.59	-\$0.18	0.834%
Cumulative Quantity, ΣQ	1,300,000	1,326,000	26,000	2%
Arc Elasticity of Learning	$\% \Delta V / \% \Delta \Sigma Q = 0.834\% / 2\% = -0.417$			

Closer to the actual -0.415

Remember the Denominator is KEY

$$\frac{(X_6 - X_5)}{\frac{Y_6 - Y_5}{Y_5}} = \frac{\% \Delta X}{\% \Delta Y} = \text{Point Elasticity of Y}$$

Remember

$$\frac{\frac{\Delta X}{X_5}}{\frac{\Delta Y}{Y_5}} = \frac{\% \Delta X}{\% \Delta Y} = \text{Point Elasticity of Y}$$

Remember

$$\frac{\frac{\Delta X}{X_5}}{\frac{\Delta Y}{Y_5}} = \frac{Y_5 (\Delta X)}{X_5 (\Delta Y)} = \text{Point Elasticity of Y}$$

Remember to Calculate the Arc Elasticity Based on the Minimum Denominator

Remember The Minimum

$$\frac{\frac{(X_6 - X_5)}{X_{\min \text{ of } 5,6}}}{\frac{(Y_6 - Y_5)}{Y_{\min \text{ of } 5,6}}} = \frac{\% \Delta X}{\% \Delta Y} = \text{ARC Elasticity of Y}$$

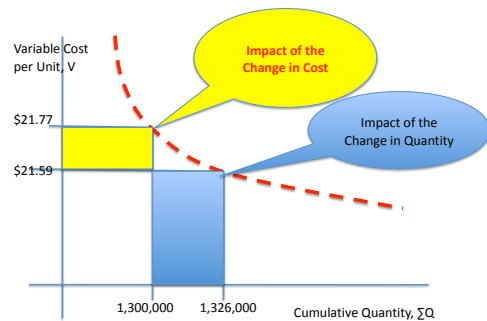
Remember The Minimum

$$\frac{\frac{(X_6 - X_5)}{X_{\min \text{ of } 5,6}}}{\frac{(Y_6 - Y_5)}{Y_{\min \text{ of } 5,6}}} = \frac{Y_{\min \text{ of } 5,6} (\Delta X)}{X_{\min \text{ of } 5,6} (\Delta Y)} = \text{ARC Elasticity of Y}$$

Remember The Minimum

$$\frac{\frac{(X_6 - X_5)}{X_{\min \text{ of } 5,6}}}{\frac{(Y_6 - Y_5)}{Y_{\min \text{ of } 5,6}}} = \frac{Y_{\min \text{ of } 5,6} (\Delta X)}{X_{\min \text{ of } 5,6} (\Delta Y)} = \text{ARC Elasticity of Y}$$

Impact of ΔX
Impact of ΔY



- The Elasticity of Learning is the percentage decrease in variable cost that can be expected for a 1% increase in the total history of quantity built

**Add Another Index to the List
Used as a Measure of Sensitivity**

- The Elasticity of Price (aka Demand elasticity)
- The Elasticity of Advertising
- The Elasticity of Sales Force
- The Elasticity of Markup
- The Elasticity of Marketing Return on Expense
- **The Elasticity of The Learning Curve**

Any Questions on The Elasticity
of Experience?