Cost-Volume-Profit Decisions at Edison Automobile

Prof James Ryans

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Cost-volume-profit analysis in a simulation-type setting to incorporate some real-world complexity.

Edison Automobile

Edison Automobile is a leading manufacturer of electric vehicles. Their models have fewer parts and are simpler to assemble than competing vehicles, and as a result carry high contribution margins for the automotive industry.

Edison has two products in production: the Model A, a high performance SUV-type vehicle that competes with alternatives such as the Porsche Cayenne and the BMW X5. The Model B is a saloon which competes with alternatives such as the Audi A4/A6, BMW 3/5 series, Mercedes C/E classes.

Edison has built one assembly factory to date, which can produce any mix of Model A or Model B. If Edison were to build additional factories, the firm expects new factories to have the same capacity and annual fixed costs as the existing factory.

Strategic planning project: Pricing and capacity decisions

Edison needs to set prices and plan for factory construction in order to satisfy expected demand. Your task is to make a recommendation on pricing and capacity planning to *maximize operating profit*. Unlike a textbook simple linear cost-volume-profit analysis, Edison has conducted significant market testing to understand the price-demand relationship for its vehicles, and has sufficient manufacturing experience to recognize certain economies of scale that reduces variable costs with higher levels of production.

Demand and variable cost functions are illustrated in Figures 1 and 2, with details presented in Table 1. These functions follow a modified logistic curves rather than simple linear relations. At higher output volumes, variable costs decline by as much as 10% from low volume production, but this benefit is exhausted beyond a certain production level. Likewise, the price elasticity of demand diminishes at low and high prices.

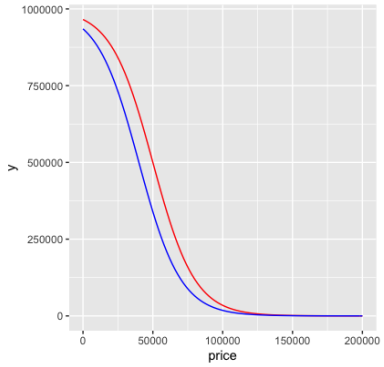

Figure 1: Price vs. quantity estimates for Models A and B

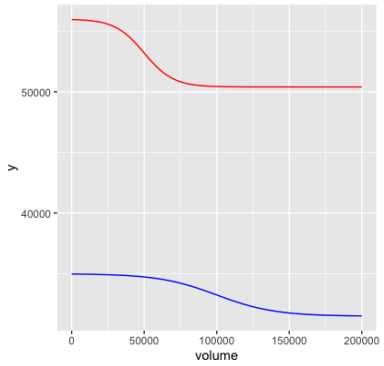

Figure 2: Variable cost per unit by volume estimates for Models A and B

Table 1: Edison planning paramaters

Factory capacity (annual units)	250,000
Factory fixed cost (annual, €)	2 billion
Model A demand (units)	$Q_A = 1000000 - \frac{1000000}{1+\exp(-(\frac{1}{15000})(P_A-50000))}$
Model B demand (units)	$Q_B = 1000000 - \frac{1000000}{1+\exp(-(\frac{1}{15000})(P_B-40000))}$
Model A variable cost (€ per unit)	$VC_A = 56000 - \frac{5600}{1+\exp(-(\frac{1}{10000})(Q_A-50000))}$
Model B variable cost (€ per unit)	$VC_B = 35000 - \frac{3500}{1+\exp(-(\frac{1}{20000})(Q_B-100000))}$

Where P_A and P_B are the vehicle unit prices for Models A and B, respectively.

Project report memo

Your project report should include a summary memo of *two page or less* that addresses the following points:

1. Determine the optimal price, number of factories, and volume to maximize operating profit. [8 points]
2. Illustrate the price vs. operating profit relationship with a single figure (e.g., a heatmap type chart), and describe how the chart illustrates the main factory capacity planning breakpoints and optimal pricing levels. [4 points]
3. Describe briefly in words the general strategy that the analysis in steps 1 and 2 reveal about how to maximize profits using the lever of price? [2 points]
4. What if variable costs were fixed per unit (did not depend on volume)? Compare the optimal scenario from step 1 with a revised estimate that maximizes profits when the variable costs are fixed at their maximum levels (i.e., 56,000 for Model A and 35,000 for Model B). [2 points]
5. What else might Edison to increase profits further, beyond optimizing prices? [4 points]

Note on collaboration

While this is a *group assignment*, you may only collaborate within your group.

Collaboration betweeen groups is not permitted, except for general technical support questions posted to the discussion board.

Note on analysis and presentation

1. Your analysis should be completed in R.
2. Your submission should include
   (a) Your report solution memorandum document in PDF format; and
   (b) A zipped directory that contains your R program and any necessary code and data files such that it can be executed independently.