

Please do not request edit access. Instead, go to File > Make a copy of any document.

Assignment: Price Elasticity Modeling for Airline Ticket Pricing

Problem Statement:

You are working as a pricing analyst at a regional airline. The revenue team is trying to optimize pricing strategies across different routes and fare classes to improve profitability. While the airline has access to booking history and competitor prices, its current pricing is largely static and doesn't account for **demand elasticity** or **seasonal fluctuations**.

Your goal is to build a **price elasticity model** that helps determine the optimal price for different ticket types and departure windows. This model should account for changes in customer demand with respect to price, competitor positioning, and seasonal trends.

Business Challenge:

- Understand how sensitive customer demand is to price changes.
- Model elasticity by route, fare class, and season.
- Identify price points that maximize revenue (not just volume).
- Simulate outcomes of A/B pricing strategies.
- Inform pricing decisions for promotional campaigns and off-peak travel periods.

Available Data:

You are provided with a dataset containing ticket-level data:

Flight Booking Data Sheet:

- **Flight_ID**: Unique identifier for a flight.

- **Route:** Origin-Destination pair (e.g., JFK-LAX).
- **Date:** Date of the flight.
- **Days_to_Departure:** Number of days from booking to flight.
- **Fare_Class:** Economy, Premium, Business.
- **Ticket_Price:** Price paid by customer.
- **Competitor_Price:** Average price offered by competitors.
- **Seats_Sold:** Number of tickets sold at that price.
- **Total_Seats:** Capacity of the flight.
- **Season:** Peak, Off-Peak, Holiday.

Tasks to be Solved:

Step 1: Medium-Level Analysis (Elasticity Estimation)

1. Group data by Route, Fare_Class, and Season.
2. Calculate **Price Elasticity of Demand** using the formula:
 - $\text{Elasticity} = (\% \text{ Change in Quantity}) / (\% \text{ Change in Price})$
3. Identify routes or fare classes with high elasticity (very price sensitive).

Step 2: Advanced Analysis (Revenue Maximization Modeling)

1. Estimate revenue at different price points.
2. Plot **Demand Curves** and identify the price that maximizes revenue.
3. Compare actual vs. theoretical optimal prices for each segment.

Step 3: Real-World Application (A/B Testing and Price Simulation)

1. Simulate an **A/B test** where customers are shown two different prices.
2. Estimate **conversion rates** and expected revenue.
3. Recommend new pricing strategies based on test results and elasticity curves.

Deliverables:

1. **Excel or CSV File** containing:
 - Elasticity calculations by segment.
 - Revenue optimization table per route/class.
 - A/B pricing simulation outcomes.
2. **Brief Report** summarizing:
 - Elastic vs. inelastic segments.
 - Pricing opportunities for high-margin growth.
 - Next steps for dynamic pricing implementation.

Evaluation Criteria:

- **Analytical Accuracy (30%)** – Proper estimation of elasticity and revenue impact.
- **Model Effectiveness (30%)** – Logic and feasibility of price optimization.
- **Business Insight (20%)** – Actionable insights from simulations.
- **Presentation & Clarity (20%)** – Clear structure of recommendations.

Concepts of elasticity

What is Price Elasticity of Demand?

Price Elasticity of Demand (PED) measures how sensitive customer demand is to a change in price.

Elasticity = (% Change in Quantity) / (% Change in Price)

Excel Formula (with explanation)

If you're tracking airline ticket pricing and sales in a spreadsheet, use this:

Cell	Meaning
A2	Old Price (before change)
B2	New Price (after change)
C2	Old Quantity (tickets sold before)
D2	New Quantity (tickets sold after)

Excel Formula:

$$=((D2 - C2) / C2) / ((B2 - A2) / A2)$$

Breakdown:

- $(D2 - C2) / C2 \rightarrow$ % change in quantity sold
- $(B2 - A2) / A2 \rightarrow$ % change in price
- Dividing the two gives elasticity

Real-World Airline Example

Imagine an airline increased the price of a flight ticket from **\$200** to **\$250**, and as a result, sales dropped from **1000** to **800** tickets.

Old Price	New Price	Old Quantity	New Quantity
\$200	\$250	1000 tickets	800 tickets

Step-by-Step Calculation:

$$\% \text{ Change in Quantity} = (800 - 1000) / 1000 = -0.2 \quad (-20\%)$$

$$\% \text{ Change in Price} = (250 - 200) / 200 = 0.25 \quad (+25\%)$$

$$\text{Elasticity} = -0.2 / 0.25 = -0.8$$

Interpretation:

Elasticity = -0.8

- We often drop the minus sign for interpretation: **|Elasticity| = 0.8**
- Since it's **< 1**, demand is **inelastic**:
 - **Customers aren't very sensitive** to this price change.
 - Increasing price caused a **small drop** in demand.

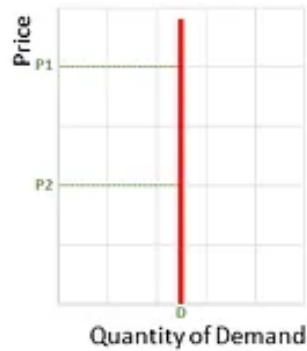
Practical Insight for Airlines:

- If demand is **inelastic**, the airline **can raise prices** to increase revenue (fewer people fly, but the higher price offsets it).
- If elasticity were > 1 , price hikes would lead to a larger drop in sales — not ideal for profit.

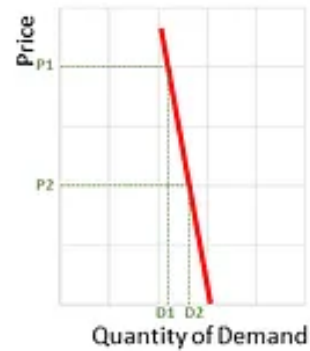
Price Elasticity of Demand – Airline Examples for Each Type

Price Elasticity of Demand

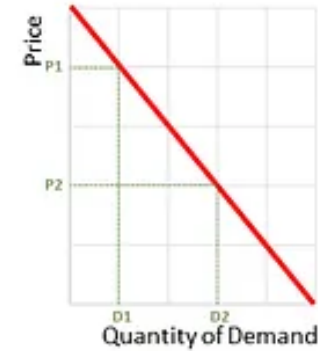
1) Perfectly Inelastic Demand



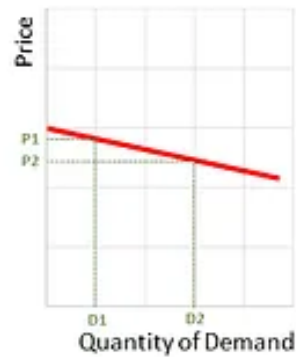
2) Inelastic Demand



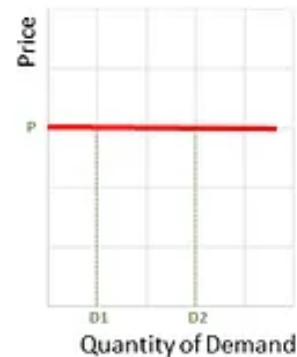
3) Unitary Elastic Demand



4) Elastic Demand



5) Perfectly Elastic Demand



LearnBusinessConcepts.com 

1) Perfectly Inelastic Demand (Vertical Line)

- Elasticity = 0
- **Meaning:** No matter how much you change the price, the quantity demanded doesn't change.

Airline Example:

Emergency medical evacuation or last-minute air travel for a family emergency. People **must fly** regardless of price — they will pay \$200 or \$2000 if needed.

2) Inelastic Demand (Steep Slope)

- **Elasticity** < 1
- **Meaning:** A change in price causes a **smaller** percentage change in quantity demanded.

Airline Example:

Business travelers flying between financial hubs like New York and London. Even if prices rise from \$1000 to \$1200, companies may still send employees — demand drops a bit, but not drastically.

3) Unitary Elastic Demand (45° Line)

- **Elasticity** $= 1$
- **Meaning:** % change in price = % change in quantity demanded.

Airline Example:

A typical budget airline route, like Mumbai to Goa. If prices go up by 10%, sales drop by 10% — total revenue stays the same.

4) Elastic Demand (Flatter Slope)

- **Elasticity** > 1
- **Meaning:** A change in price causes a **larger** percentage change in demand.

Airline Example:

Leisure travel during off-season — e.g., flying to a holiday destination in monsoon. If prices drop from \$200 to \$150, bookings **jump significantly**. But if prices rise, people quickly cancel or postpone.

5) Perfectly Elastic Demand (Horizontal Line)

- **Elasticity** = ∞
- **Meaning:** Even a **tiny increase** in price leads to **zero demand**.

Airline Example:

Highly competitive price-sensitive routes — e.g., short-haul flights on aggregator platforms. If one airline charges even \$1 more than competitors, **everyone books the cheaper one**.

Add-On to Earlier Example (Elasticity Formula in Action):

Let's say:

Flight Type	Old Price	New Price	Old Qty	New Qty	Elasticity
Emergency Flight	\$200	\$400	1	1	0 (Perfectly Inelastic)
Business Route (NY-LON)	\$1000	\$1200	500	480	-0.2 (Inelastic)
Budget Route (Mumbai-Goa)	\$100	\$110	1000	900	-1 (Unitary)

Leisure Route	\$150	\$130	100	150	-3.33 (Elastic)
Price-war Route	\$100	\$101	1000	0	∞ (Perfectly Elastic)

Solution

Step 1: Medium-Level Analysis – Elasticity Estimation

Objective: Estimate price elasticity of demand by segment.

Step 1.1: Create a Segmentation Column

New Column: Segment_Key

To segment by Route + Fare_Class + Season:

=Route & "_" & Fare_Class & "_" & Season

Step 1.2: Calculate Group Averages

For each unique Segment_Key, calculate:

- Avg_Ticket_Price
- Avg_Seats_Sold

Use AVERAGEIFS:

=AVERAGEIFS(Ticket_Price_Column, Segment_Key_Column, Segment_Key)

=AVERAGEIFS(Seats_Sold_Column, Segment_Key_Column, Segment_Key)

Step 1.3: Calculate % Change in Price and Quantity

New Column: %_Change_Price

=(Ticket_Price - Avg_Ticket_Price) / Avg_Ticket_Price

New Column: %_Change_Qty

=(Seats_Sold - Avg_Seats_Sold) / Avg_Seats_Sold

Step 1.4: Calculate Elasticity

Formula:

=%_Change_Qty / %_Change_Price

- If result is **greater than 1** (absolute value), it's **elastic** (price sensitive).
- If **less than 1**, it's **inelastic**.

Step 2: Advanced-Level Analysis – Revenue Maximization

Step 2.1: Calculate Actual Revenue

New Column: Revenue

=Ticket_Price * Seats_Sold

Step 2.2: Simulate Revenue Across Price Points

Choose a few price points (e.g., -10%, +10%).

New Columns:

- Price_A (lower by 10%)
- Price_B (higher by 10%)

=Ticket_Price * 0.9

=Ticket_Price * 1.1

Step 2.3: Estimate Seats Sold at New Prices

Use elasticity to estimate quantity change:

=Seats_Sold * (1 + Elasticity * ((New_Price - Ticket_Price)/Ticket_Price))

Airline Example:

Let's say:

- Original price = \$200
- New price = \$250
- Seats sold at original price = 1000
- Elasticity = -0.8 (Inelastic)

Plug into the formula:

$$\begin{aligned} &= 1000 * (1 + (-0.8 * ((250 - 200) / 200))) \\ &= 1000 * (1 + (-0.8 * 0.25)) \\ &= 1000 * (1 - 0.2) \\ &= 1000 * 0.8 = 800 \text{ seats} \end{aligned}$$

Interpretation: If you raise the price to \$250, you will likely sell **800 seats** – a 20% drop in demand, as predicted by elasticity.

Step 2.4: Calculate Revenue at Simulated Prices

Formula:

$$\begin{aligned} &= \text{Price}_A * \text{Quantity}_A \\ &= \text{Price}_B * \text{Quantity}_B \end{aligned}$$

Compare both revenues and pick the optimal price.

Step 3: Real-World Application – A/B Pricing Test Simulation

Step 3.1: Split Users Into A/B Groups

This is conceptually assumed. Simulate:

- Group A sees Price_A
- Group B sees Price_B

Use projected quantities from previous step.

Step 3.2: Compare Revenue & Conversion

If you have conversion rates (say 8% and 7%), apply:

$\text{Revenue} = \text{Price}_A * \text{Total_Users} * \text{Conversion_Rate}$

Step 3.3: Recommend Strategy

Based on which price brings more revenue or conversion per dollar, recommend the better-performing test