

15.879 PD - Analysis Report

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Model Equations

Relative Measures

$$RP = \frac{P}{CP} \quad (1)$$

$$RQ = \frac{C}{CC} \quad (2)$$

Prestige

$$\text{Ind PR} = \left(\frac{RP}{RP + 1} \right)^{\text{PR Sens to RP}} \cdot (1 - A)^{\text{PR Sens to A}} \quad (3)$$

$$\frac{dPR}{dt} = \begin{cases} \frac{\text{Ind PR} - PR}{Tg} & \text{if Ind PR} > PR \\ \frac{\text{Ind PR} - PR}{Tl} & \text{otherwise} \end{cases} \quad (4)$$

Accessibility

$$\text{Sales} = \min(Qs, \Sigma Qd_i) \quad (5)$$

$$\text{Fraction Price Sensitive Demand (FPSD)} = \frac{Qd_s}{\Sigma Qd_i} \quad (6)$$

$$\text{Sales to Price Sensitive Segment (QSS)} = \text{FPSD} \cdot \text{Sales} \quad (7)$$

$$\text{Ind A} = \text{SMOOTH}(\text{ZIDZ}(\text{QSS}, \Sigma Qd_i), Ts) \quad (8)$$

$$\frac{dA}{dt} = \frac{\text{Ind A} - A}{Ta} \quad (9)$$

Elasticity and Demand

$$Qd_i = \text{BQd}_i \cdot (1 + \text{PAF}_i \cdot PR) \cdot RP^{-E_i \cdot (1 - \text{PIF}_i \cdot PR)} \cdot \text{Consumers}_i \quad (10)$$

Profit Equation

$$\text{Net Income} = \text{Sales} \cdot P - Qs \cdot C \quad (11)$$

$$\frac{d\text{Cumulative Profit}}{dt} = \text{Net Income} \quad (12)$$

Model Parameters

Vensim Variable Name	Description	Value
Supply (Qs)	Quantity supplied	-
Price (P)	Per unit price	-
Quality/Cost (C)	Unit cost	600
Competitor Price (CP)	Competitor per unit price	1000
Competitor Quality/Cost (CC)	Competitor unit cost	600
PR Sens to RP	Sensitivity of prestige to relative price	$\frac{1}{3}$
PR Sens to A	Sensitivity of prestige to accessibility	1
Baseline Price Elasticity (E)	[I, S] elasticities	[1, 3]
Baseline Qd (BQd)	[I, S] base demand levels	[0.01, 0.004]
PR Elasticity Influence Factor (PIF)	[I, S] influence of prestige on elasticity	[0.9, 0.6]
PR Demand Amplification Factor (PAF)	[I, S] amplification of demand by prestige	[1, 0.5]
Price Sensitive Fraction	Share of price sensitive customers	0.9
Total Consumers	Total potential buyers	100000
Season Duration (Ts)	Time constant for accessibility smoothing	6
Time to Perceive A (Ta)	Delay to adjust accessibility	2
Time to Gain Prestige (Tg)	Delay to increase prestige	24
Time to Lose Prestige (Tl)	Delay to lose prestige	6

Comparison of Luxury and Ordinary Goods Market

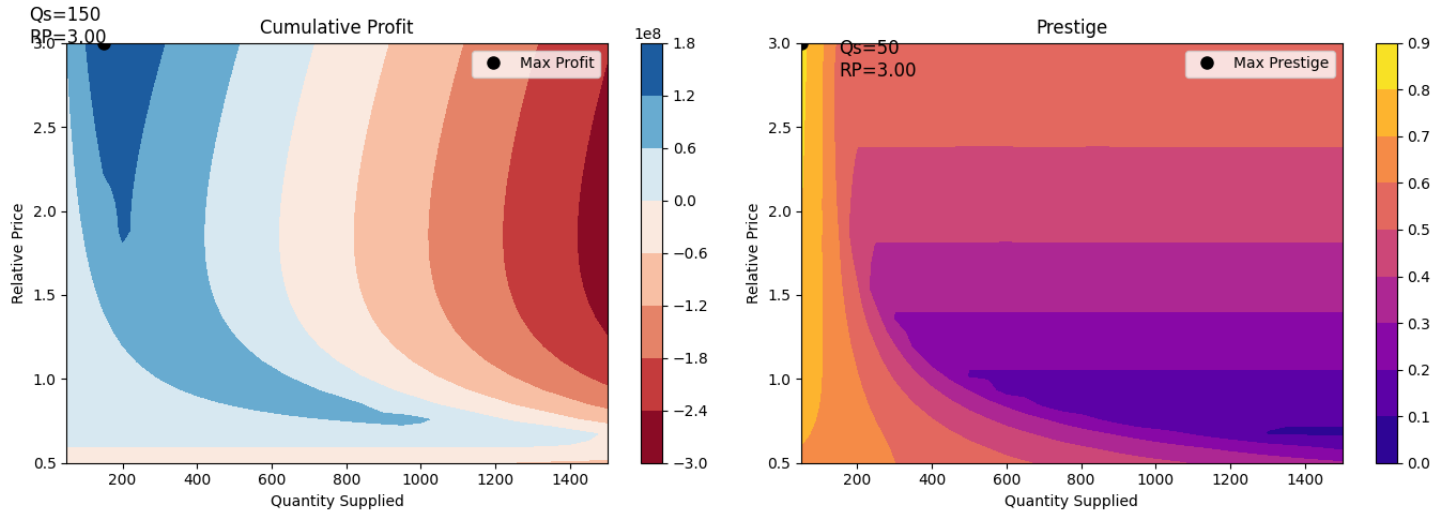


Figure 1: Luxury Goods - Profit and Prestige Outcome

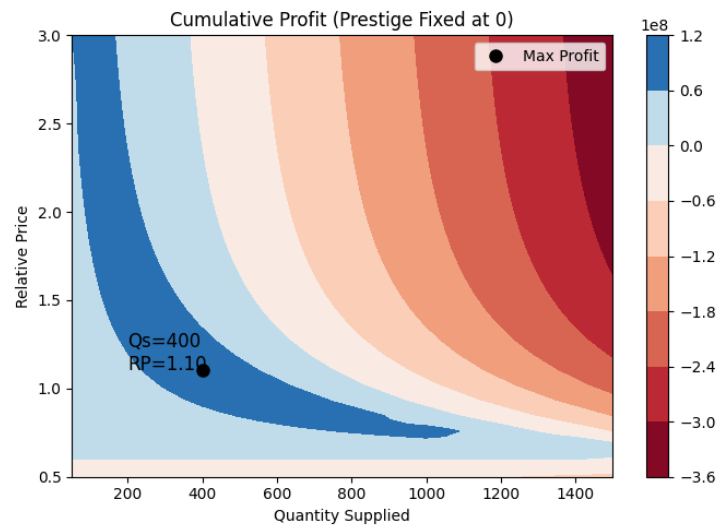
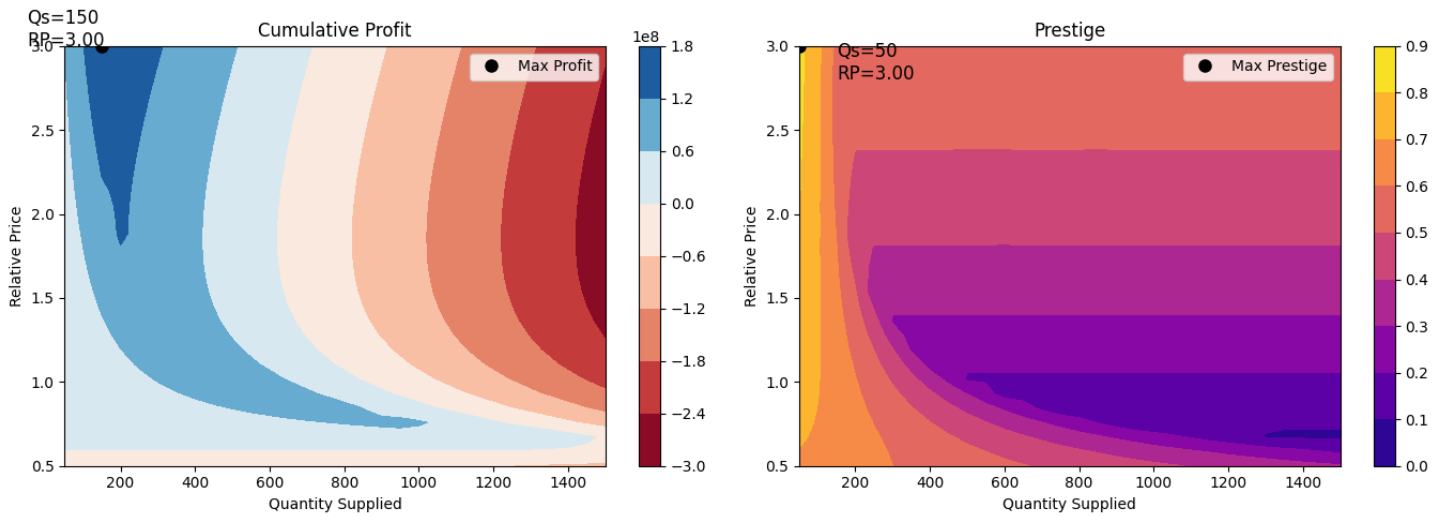
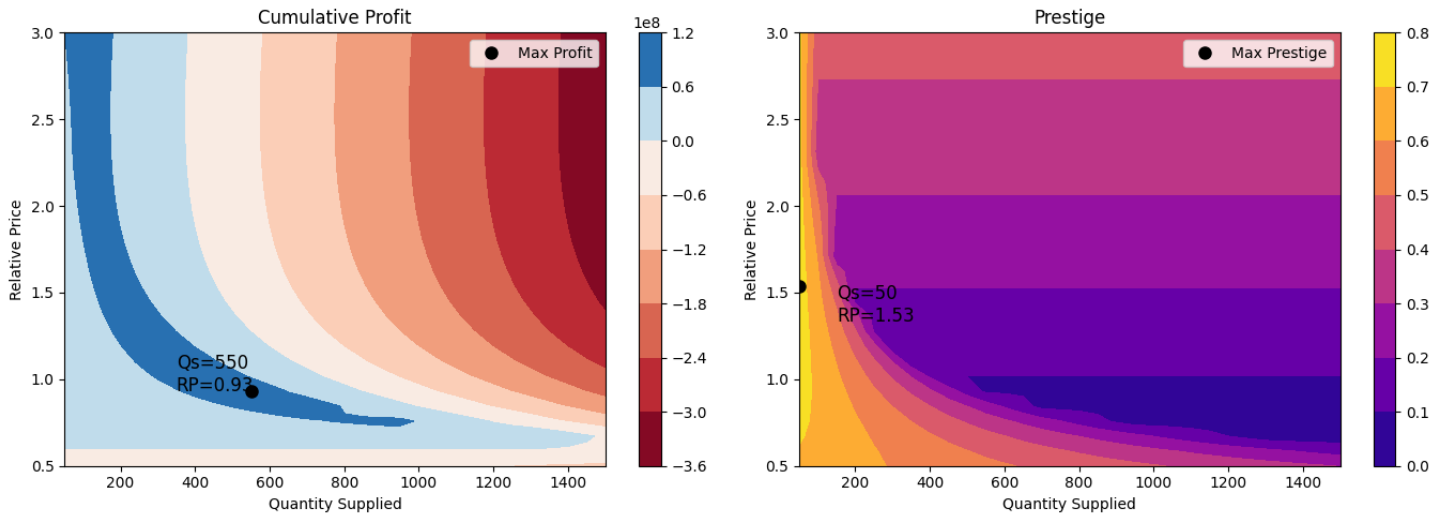
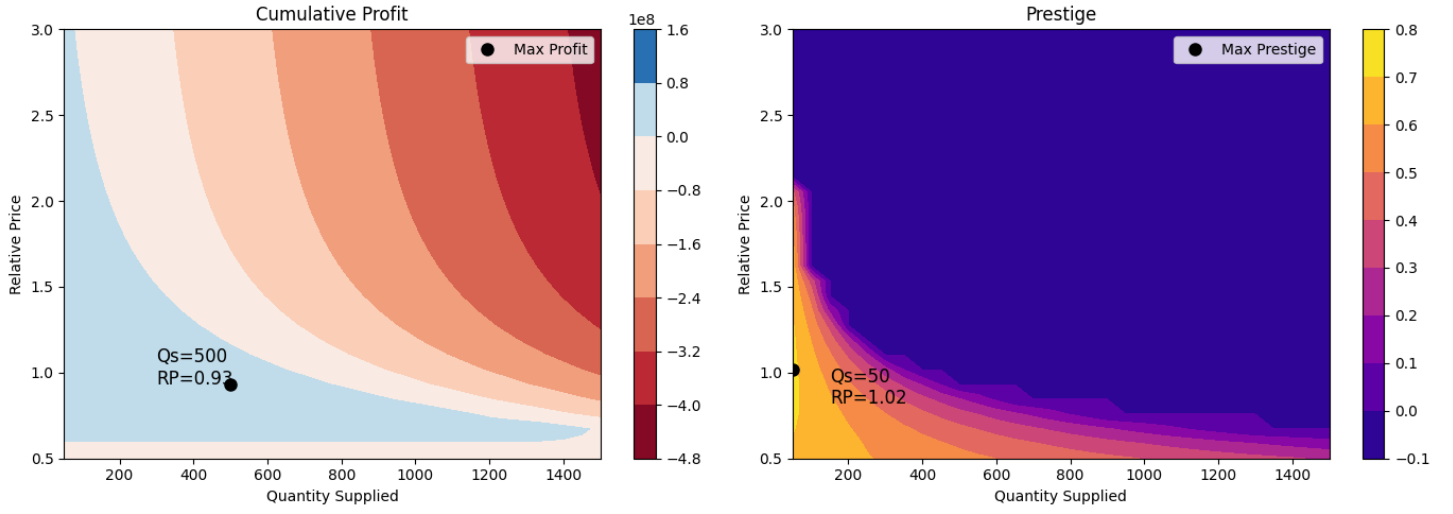


Figure 2: Ordinary Goods - Profit and Prestige Outcome

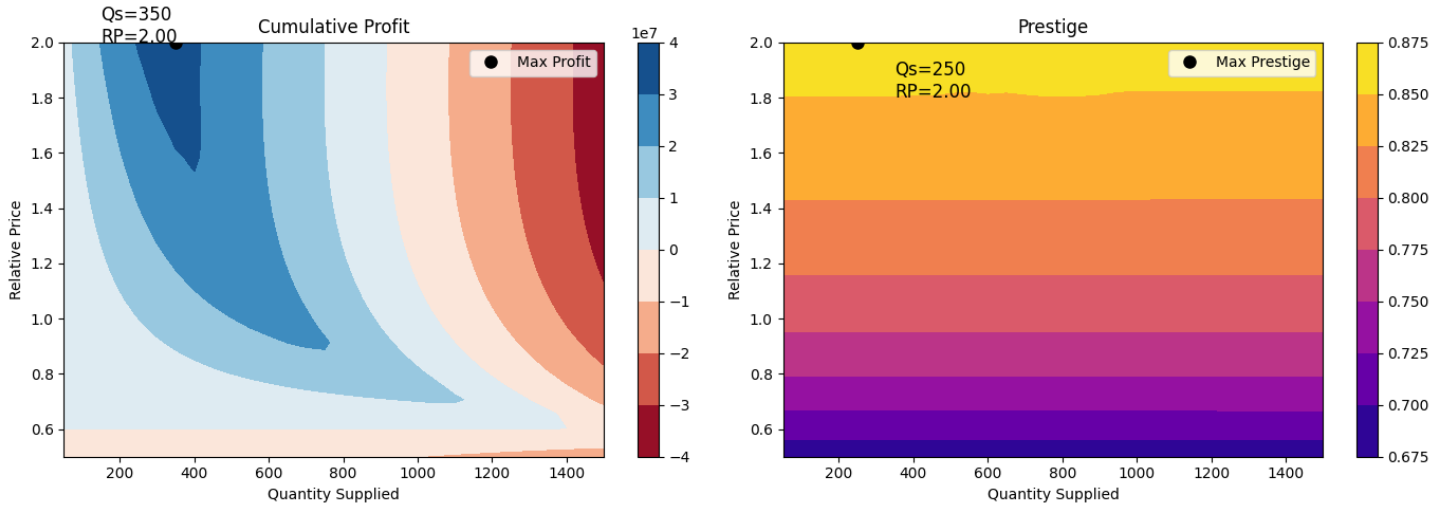
Comparative Static - Price Sensitive Fraction

Figure 3: Optimal strategy (P^* , Qs^*) for different fraction of price sensitive consumer

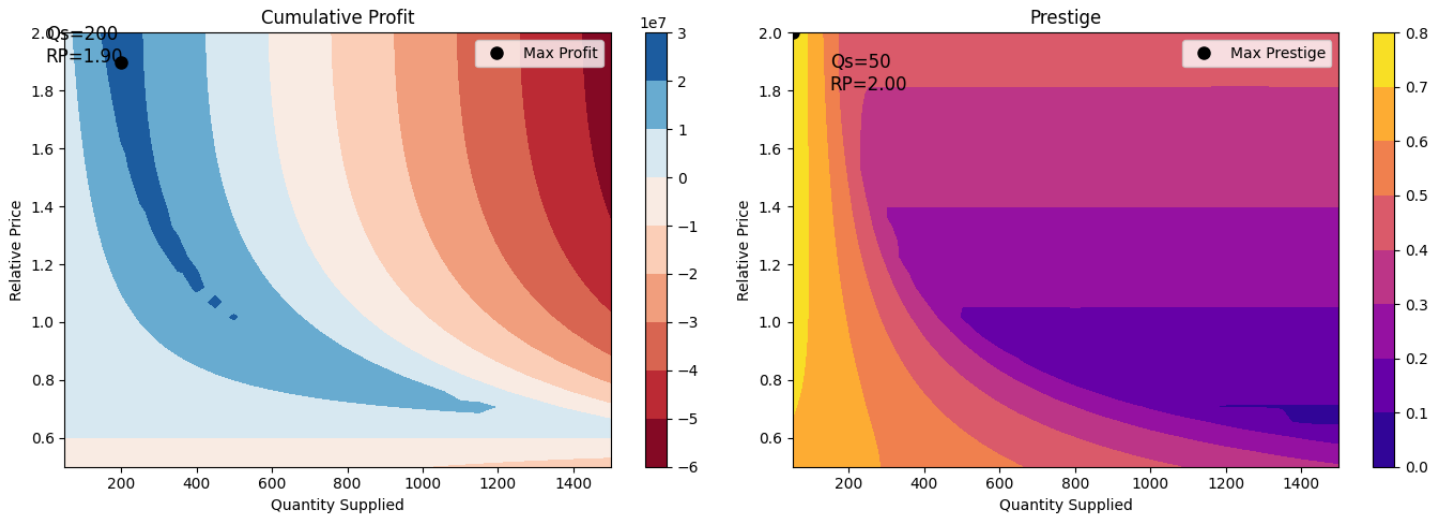


Comparative Static - Sensitivity to Accessibility

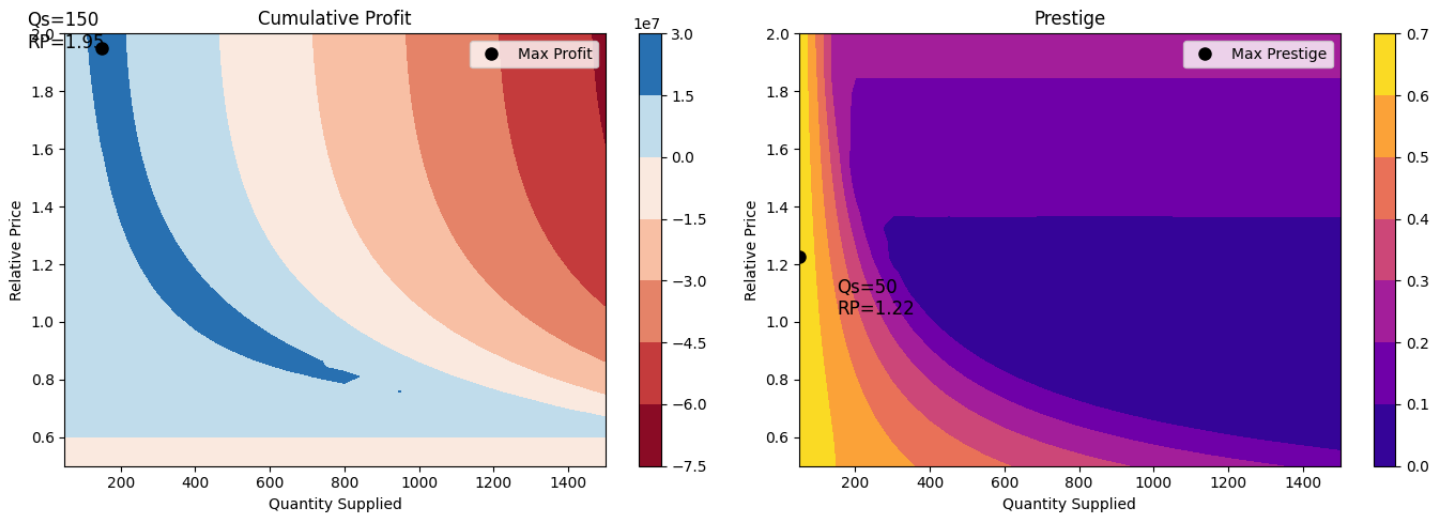
Figure 4: Optimal strategy (P^*, Q_s^*) for different sensitivity to accessibility



(a) sensitivity to accessibility 0



(b) sensitivity to accessibility 1



(c) sensitivity to accessibility 2

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