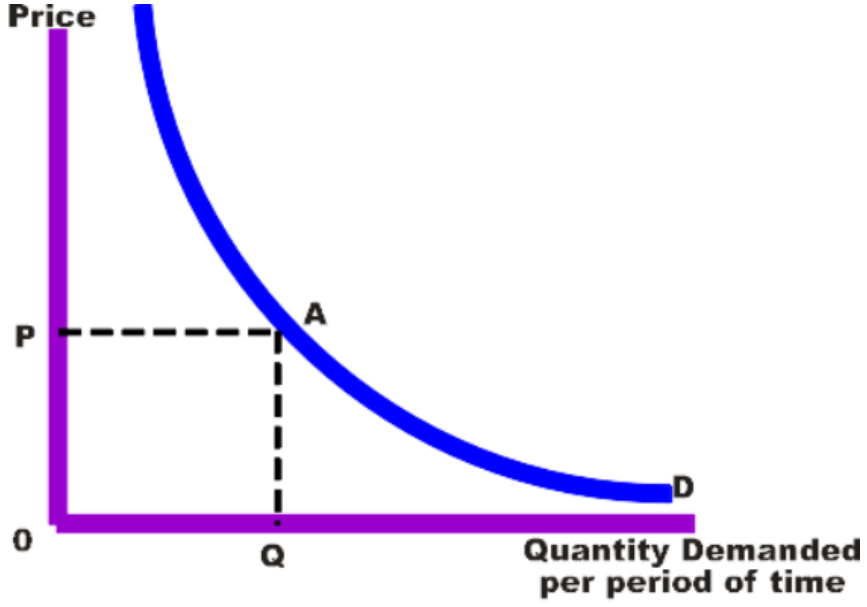
Monte Carlo Simulation

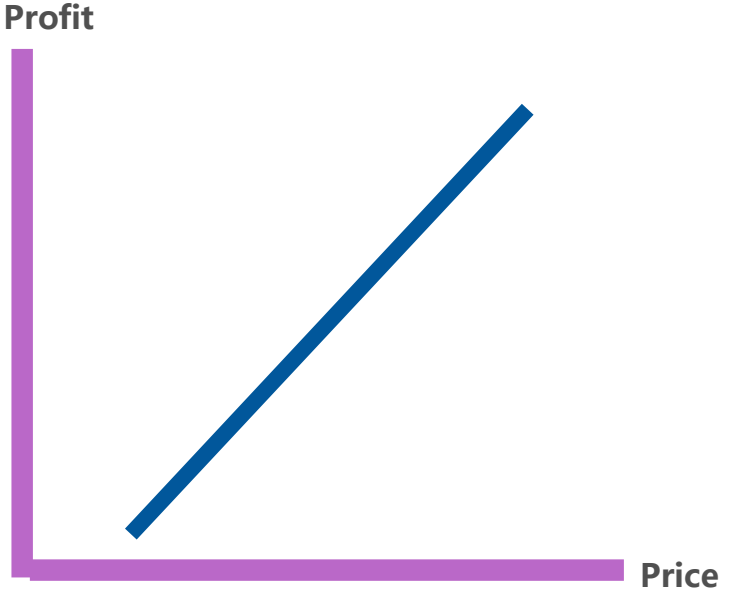
Of Profit Prediction

Based on Price discrimination

Price Discrimination

A selling strategy that charges customers different prices for the same products.





Hypothesis

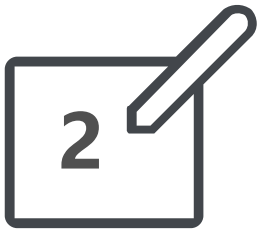
A well-designed price discrimination strategy could increase profit.

Assumptions  *Retailer*

- **Every retailer sell the same products with the same cost**
- **Every retailer must select a price strategy from 3 types**

Type Ⅰ	No price discrimination.
Type Ⅱ	Price Discrimination based on the accumulated purchase amount E.g. 20% off when the amount over $500
Type Ⅲ	Random Price Discrimination E.g. Randomly selected customers to offer random discount no more than 50%

Assumptions



Product

- The standard price of all products follows the normal distribution
- The probability of one product being viewed is dependent on its popularity
- The popularity of all products also follows the normal distribution
- The profit rate of all products are same

Assumptions

Customer

- The daily number of customers visiting any store follows the triangular distribution

- The number of products every customer view follows the triangular distribution

Assumptions

Customer

▹**Customers' preference is evaluated from 2 aspects**

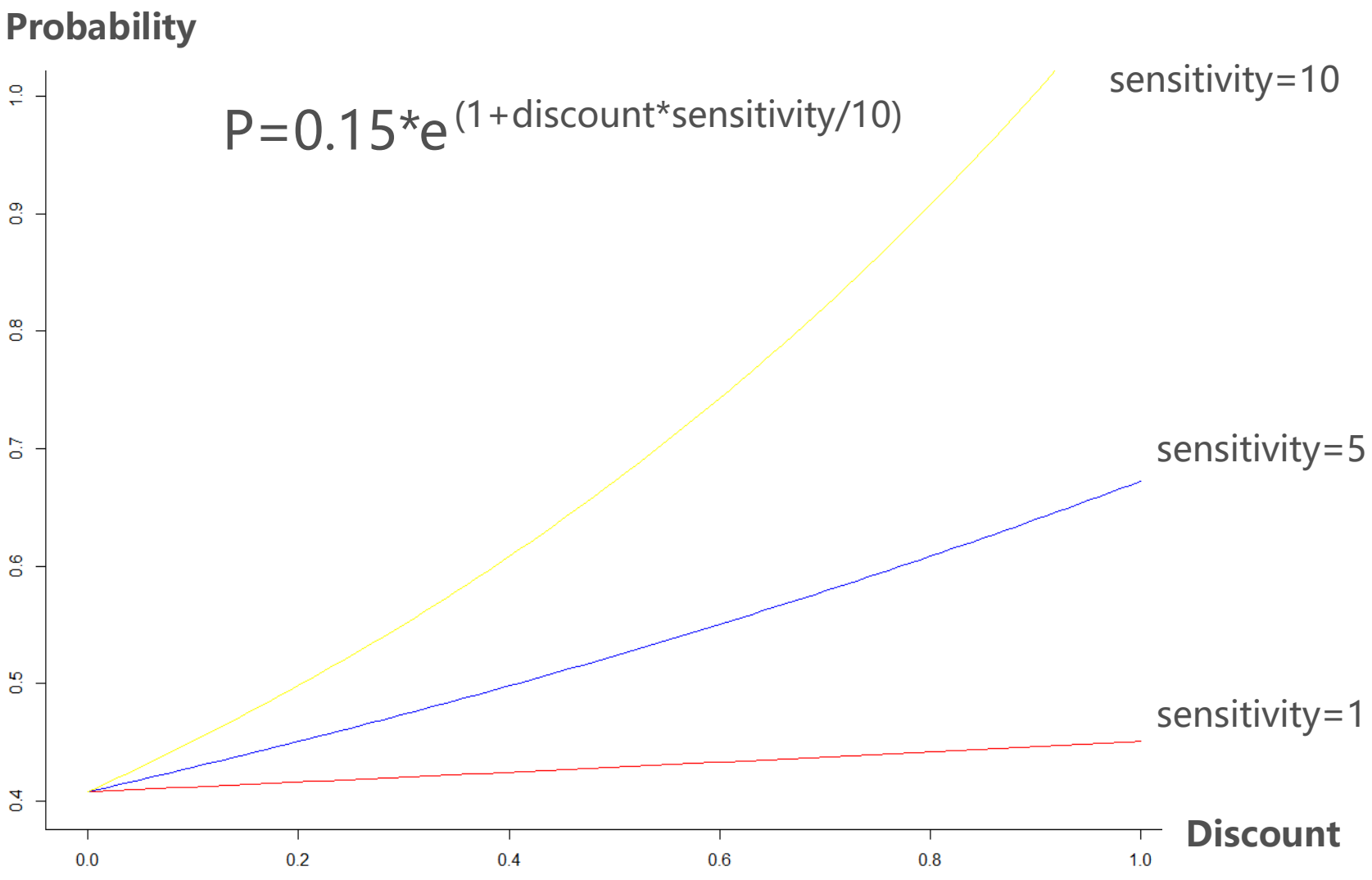
- ♦ **If they prefer to first go to the store where they consume most**
- ♦ **If they prefer to compare the product's price in all stores and choose the cheapest one**

Assumptions  *Customer*

▹**Customers' willingness to pay will increase as the price declines**

♦ **However, price sensitivity varies among customers**

Probability of purchasing on the different price sensitivity



Simulation

- During a given period, simulate the profit of each retailer, based on the given customers and products

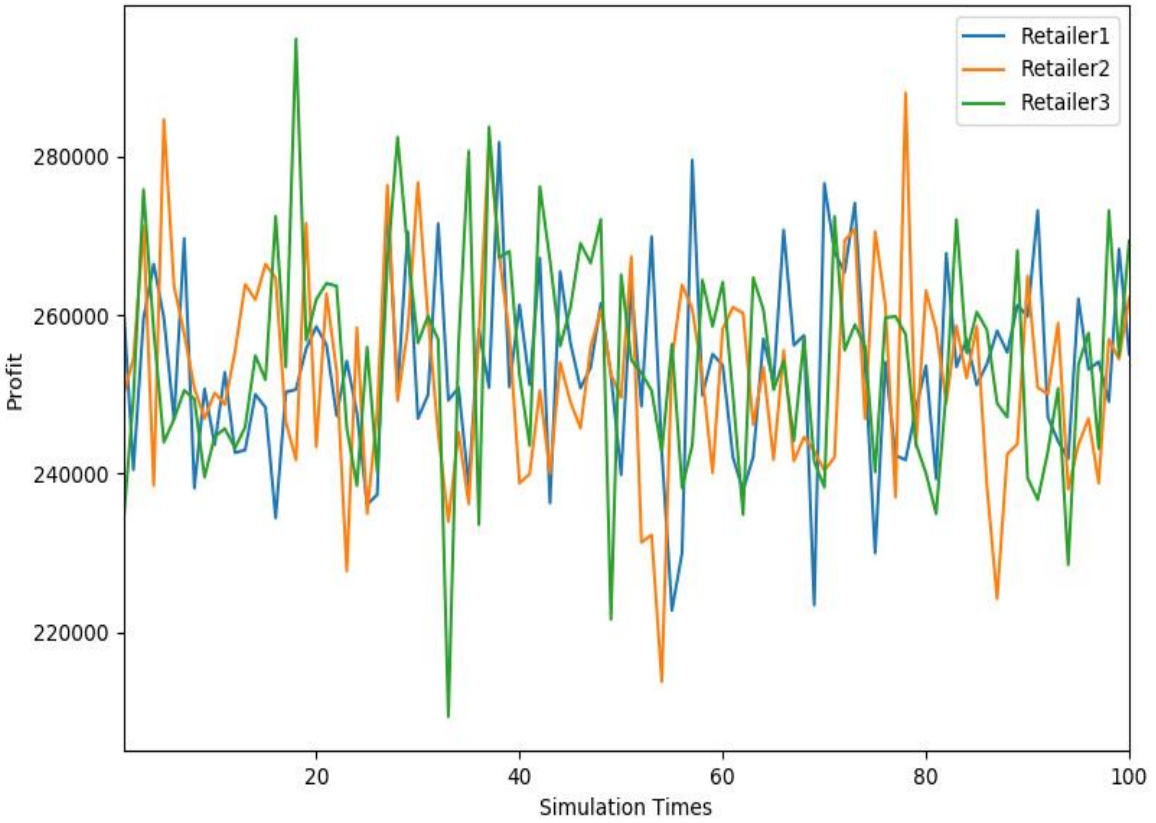
- Repeat the experiment for many times

Situation 1

span=100 times=100 profit rate=40%

	1	2	3
Retailer	No price discrimination	No price discrimination	No price discrimination
Product	price: mean=50, sd=20 popularity: mean=5, sd=1 amount =100	price: mean=200, sd=60 popularity: mean=5, sd=2 amount =200	
Customer	50% first go to the store they consume most 50% compare price sensitivity=5 amount=1000	70% first go to the store they consume most 20% compare price sensitivity=3 amount=500	30% first go to the store they consume most 80% compare price sensitivity=8 amount=100

Result 1

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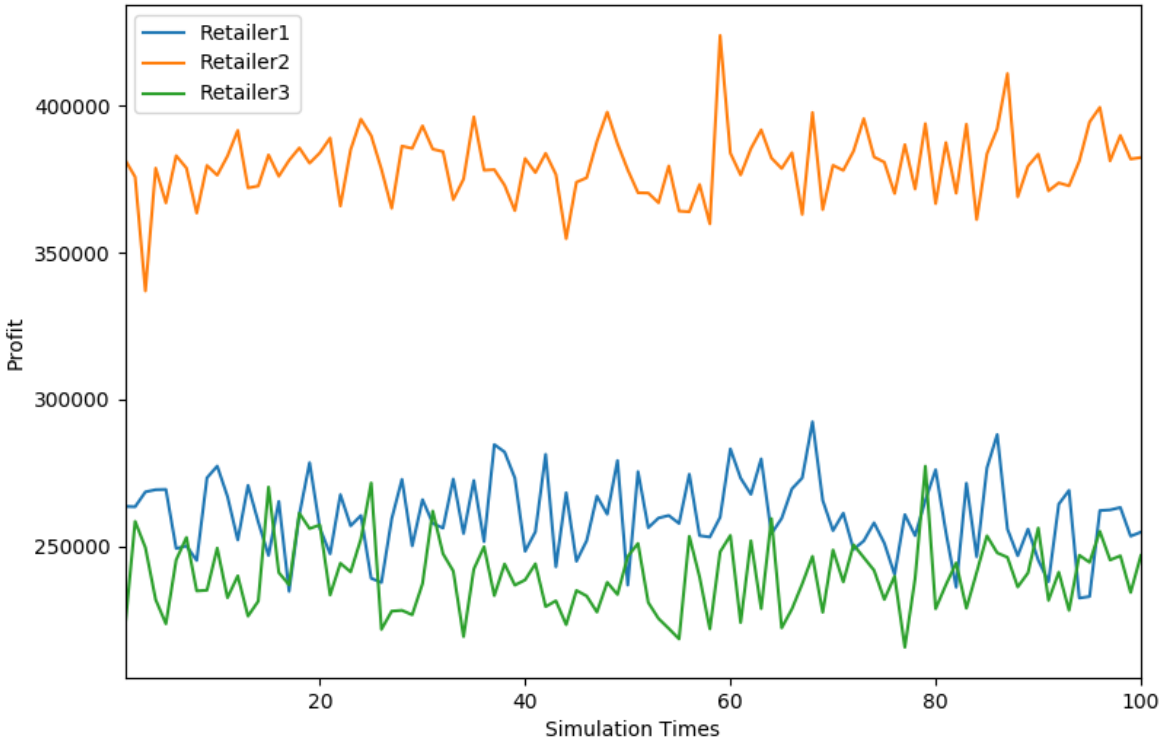
Retailer1   : No price discrimination
Earn 253111.16 on average in 100 days
Rank No.1 for  33   times, rate: 33.00%
Rank No.2 for  31   times, rate: 31.00%
Rank No.3 for  36   times, rate: 36.00%
Retailer2   : No price discrimination
Earn 252461.56 on average in 100 days
Rank No.1 for  29   times, rate: 29.00%
Rank No.2 for  31   times, rate: 31.00%
Rank No.3 for  40   times, rate: 40.00%
Retailer3   : No price discrimination
Earn 254333.46 on average in 100 days
Rank No.1 for  38   times, rate: 38.00%
Rank No.2 for  38   times, rate: 38.00%
Rank No.3 for  24   times, rate: 24.00%
```

Situation 2

span=100 times=100 profit rate=40%

	1	2	3
Retailer	No price discrimination	**20%**off for every customer	Randomly select less than**50%** of customers to offer discount less than **40%**
Product	price: mean=50, sd=20 popularity: mean=5, sd=1 amount =100	price: mean=200, sd=60 popularity: mean=5, sd=2 amount =200	
Customer	50% first go to the store they consume most 50% compare price sensitivity=5 amount=1000	70% first go to the store they consume most 20% compare price sensitivity=3 amount=500	30% first go to the store they consume most 80% compare price sensitivity=8 amount=100

Result 2



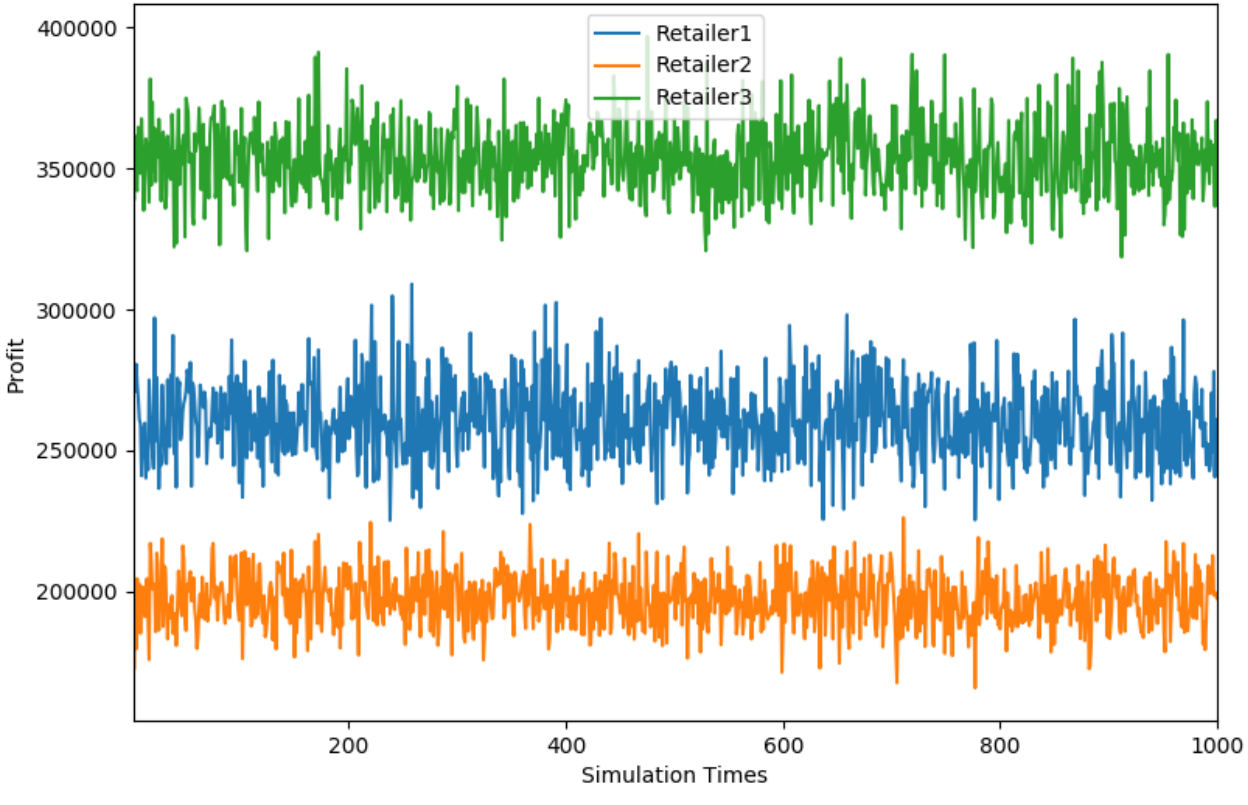

```
Retailer1   : No price discrimination
Earn 260174.53 on average in 100 days
Rank No.1 for   0   times, rate: 0.00%
Rank No.2 for  85   times, rate: 85.00%
Rank No.3 for  15   times, rate: 15.00%
Retailer2   : Price discrimination based on consumption amount
Earn 379712.99 on average in 100 days
Rank No.1 for  100  times, rate: 100.00%
Rank No.2 for   0   times, rate: 0.00%
Rank No.3 for   0   times, rate: 0.00%
Retailer3   : Random Price discrimination
Earn 239930.67 on average in 100 days
Rank No.1 for   0   times, rate: 0.00%
Rank No.2 for  15   times, rate: 15.00%
Rank No.3 for  85   times, rate: 85.00%
```

Situation 3

span=100 times=1000 profit rate=40%

	1	2	3
Retailer	No price discrimination	**20%**off when accumulated consumption over**$500**	Randomly select less than **50%** of customers to offer discount less than**40%**
Product	price: mean=50, sd=20 popularity: mean=5, sd=1 amount =100	price: mean=200, sd=60 popularity: mean=5, sd=2 amount =200	
Customer	50% first go to the store they consume most 50% compare price sensitivity=5 amount=1000	70% first go to the store they consume most 20% compare price sensitivity=3 amount=500	30% first go to the store they consume most 80% compare price sensitivity=8 amount=100

Result 3




```
Retailer1   : No price discrimination
Earn 260595.40 on average in 100 days
Rank No.1 for 0.00  times, rate: 0.00%
Rank No.2 for 1000.00 times, rate: 100.00%
Rank No.3 for 0.00  times, rate: 0.00%
Retailer2   : Price discrimination based on consumption amount
Earn 197234.86 on average in 100 days
Rank No.1 for 0.00  times, rate: 0.00%
Rank No.2 for 0.00  times, rate: 0.00%
Rank No.3 for 1000.00 times, rate: 100.00%
Retailer3   : Random Price discrimination
Earn 353448.89 on average in 100 days
Rank No.1 for 1000.00 times, rate: 100.00%
Rank No.2 for 0.00  times, rate: 0.00%
Rank No.3 for 0.00  times, rate: 0.00%
```

Conclusion

Adopting price discrimination can increase a retailer's profit

Whether the price strategy works depends on many factors

- Opponents' strategy
- Customers' preference and price sensitivity
- Profit rate and fixed cost
- Convenience of shopping
- Service
- Advertising ...

Thanks