Revenue Optimisation & Booking Management Decision Support System

PRESENTED BY: BA HUY HOANG LE

1. Introduction

Case Context

- Coastal Nest Motel: A 20-unit boutique, Airbnb-style property on a popular beachside route in Melbourne

- Preparing for three peak-season windows (Dec 1 – Feb 28/29) over 2022–2025

- Management seeks a spreadsheet-based decision model to balance occupancy, pricing, overbooking, and risk

Objective

1. Build Model Structure

2. Scenario Analysis

3. Distribution and Simulation

4. Risk Analysis

5. Recommendations

2. Model Description

Model Description

The model integrates four sources of uncertainties with three managerial levers and five fixed input parameters. It simulates each day's occupied rooms, bumped guests, revenues, and costs to deliver two key metrics.

Stochastic Inputs

1. Daily online reservations
2. Late-cancellation percentage
3. Walk-in arrivals
4. Miscellaneous expense

Fixed Inputs

1. Total number of rooms
2. Utilities cost
3. Housekeeping cost
4. Management and marketing cost
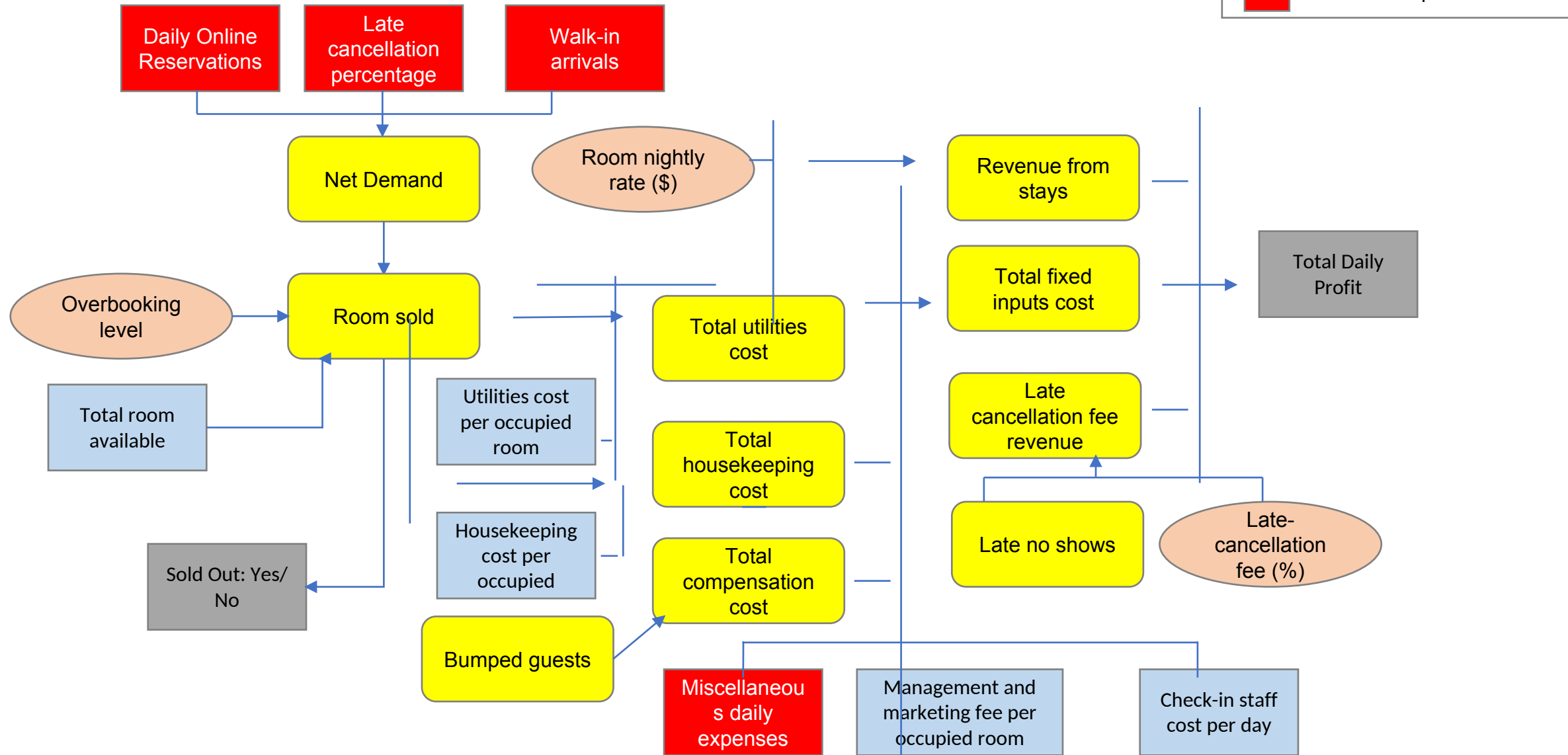5. Check-in staff cost

Decision Variables

1. Room nightly rate
2. Over-booking level
3. Late cancellation fee

Output metrics

1. Total daily profit
2. Sold-out status

2. Model Description
Conceptual Model

2. Model Description
General Assumptions

- All reservations are for one night only

- Every unit is identical in size, amenities, and rate

- All advance bookings lodge exactly one day before arrival

- No shows free capacity immediately for walk-ins

- Only fill rooms vacated by cancellations or over-booking slots

- No group or multi-room reservations

3. Spreadsheet-based Decision Model

CALCULATED VALUES & OUTPUT (DAILY)	values
Net demand	18
Room sold	18
Bumped guests	0
Revenue from stays	$2,700.00
Total compensation cost	$0.00
Total housekeeping cost	$900.00
Total utilities cost	$270.00
Total fixed inputs cost	$2,095.00
Late no shows	3
Late cancellation fee revenue	$45.00

OUTPUT

Total Daily Profit	$650.00
Sold Out: Yes/ No	No

INPUTS

Stochastic inputs	values
Daily online reservations	18
Late cancellations percentage	15%
Walk-in arrivals	3
Miscellaneuous daily expenses	$300.00

Decision variables	values
Room nightly rate ($)	$150.00
Over-booking level	10%
Late-cancellation fee (%)	10%

Fixed inputs	values
Total rooms available	20
Housekeeping cost per occupied	$50.00
Utilities cost per occupied room	$15.00
Management and marketing fee per occupied room	$425.00
Check-in staff cost per day	$200.00

4. Scenario Analysis

Primary Decision Variable: Room Nightly Rate
Over-booking level and Late Cancellation Fee are kept constant

Justification

1. A small rate change scales directly with every occupied room, driving far profit and loss fluctuations than changes to over-booking or cancellation fees.
2. Price is the market's clearest lever, which means raising or lowering it immediately changes both advanced bookings and walk-ins.
3. By holding over-booing and cancellation fee policies steady, the motel can isolate how rate alone affects occupancy, profit, and sold-out likelihood, which guides its core pricing strategy

Scenario Table

Stochastic inputs	Worst Case	Base Case	Best Case
Daily online reservations	7 bookings	18 bookings	22 bookings
Late cancellations percentage	25% of bookings	15% bookings	5% bookings
Walk-in arrivals	1 guests/day	3 guests/day	8 guests/day
Miscellaneuous daily expense	$600/day	$300/day	$100/day

4. Scenario Analysis

Room Price at $120

Scenarios	Best	Base	Worst
changing cell Daily online reservations	22	18	7
Output result Total Daily Profit	$211.00	$211.00	-$143.00
Sold Out: Yes/ No	Yes	Yes	No
changing cell Late cancellations percentage	5%	15%	25%
Output result Total Daily Profit	$187.00	$211.00	$235.00
Sold Out: Yes/ No	Yes	Yes	Yes
changing cell Walk-in arrivals	8	3	1
Output result Total Daily Profit	$211.00	$211.00	$211.00
Sold Out: Yes/ No	Yes	Yes	Yes
changing cell Miscellaneuous daily expenses	$100.00	$300.00	$600.00
Output result Total Daily Profit	$411.00	$211.00	-$89.00
Sold Out: Yes/ No	Yes	Yes	Yes

- **If post-cancellation demand ≥ 14, we sell all 20 rooms and earn $211/day. Below 7 bookings, we underfill and incur a $143 loss.**

- **Higher no-shows (25%) raise profit to $235 by freeing rooms for spill-over sales plus fee income; low no-shows (5%) cut profit $187 by forfeiting those benefits.**

- **With 15 advance arrivals and 10% over-booking, even 1 walk-in ensures 20 rooms sold, so profit stays fixed at $211 regardless of spill.**

- **Varying $100 to $600 swings profit from $141 down to -$81, since full occupancy makes these expenses the sole driver of daily margin**

4. Scenario Analysis

Room Price at $150

Scenarios	Best	Base	Worst
Daily online reservations	22	18	7
Total Daily Profit	$820.00	$735.00	-$60.00
Sold Out: Yes/ No	Yes	No	No
Late cancellations percent	5%	15%	25%
Total Daily Profit	$790.00	$735.00	$595.00
Sold Out: Yes/ No	Yes	No	No
Walk-in arrivals	8	3	1
Total Daily Profit	$820.00	$650.00	$480.00
Sold Out: Yes/ No	Yes	No	No
Miscellaneuous daily exper	$100.00	$300.00	$600.00
Total Daily Profit	$850.00	$650.00	$350.00
Sold Out: Yes/ No	No	No	No

(Row labels at left: changing cell / Output result for each group — Daily online reservations, Late cancellations percent, Walk-in arrivals, Miscellaneuous daily exper)

- At 18 bookings, we only sell 18/22 rooms for $735 profit; 21 bookings onwards unlocks the $820 "best" outcome.

- Low no-shows (5%) net 20 rooms and $790; high no-shows (25%) drop sales below capacity and profit to $595.

- Need at least 4 walk-ins to hit the 22-room cap; fewer spill leaves rooms empty and profit falls to $650 or $480.

- A $100 to $600 range swings profits by $500, directly impacting bottom line when underfilled.

4. Scenario Analysis

Room Price at $180

Scenarios	Best	Base	Worst
changing cell — Daily online reservations	22	18	7
Output result — Total Daily Profit	$1,429.00	$969.00	-$102.00
Sold Out: Yes/ No	Yes	No	No
changing cell — Late cancellations percen	5%	15%	25%
Output result — Total Daily Profit	-$5.00	-$102.00	-$199.00
Sold Out: Yes/ No	No	No	No
changing cell — Walk-in arrivals	8	3	1
Output result — Total Daily Profit	$703.00	$128.00	-$102.00
Sold Out: Yes/ No	No	No	No
changing cell — Miscellaneuous daily expe	$100.00	$300.00	$600.00
Output result — Total Daily Profit	$328.00	$128.00	-$172.00
Sold Out: Yes/ No	No	No	No

- **Only peak demand (22) unlocks the $1,429 upside at $180/night. Base demand (18) falls to $969 profit, and 7 bookings swings us into a $102 loss.**

- **Even low no-show rates can't fill 20 rooms, so penalty fees never cover the lost revenue—profit remains negative across realistic cancellation scenarios.**

- **An 8-person spill raises profit only to $703, still below peak; average spill (3) yields just $128, and fewer arrivals drive losses.**

- **A $500 swing in miscellaneous costs ($100→$600) shifts us from a small gain ($328) to a $172 loss, with no occupancy buffer to absorb the hit.**

4. Scenario Analysis

Brief conclusion

A $150 nightly room rate delivers the best balance of risk and reward: a strong average profit ($735), full occupancy in base and upside ($820) in peak, while capping worst-case losses (-$60). Lower ($120) margins are too thin, higher ($180) yields volatile swings and frequent losses.
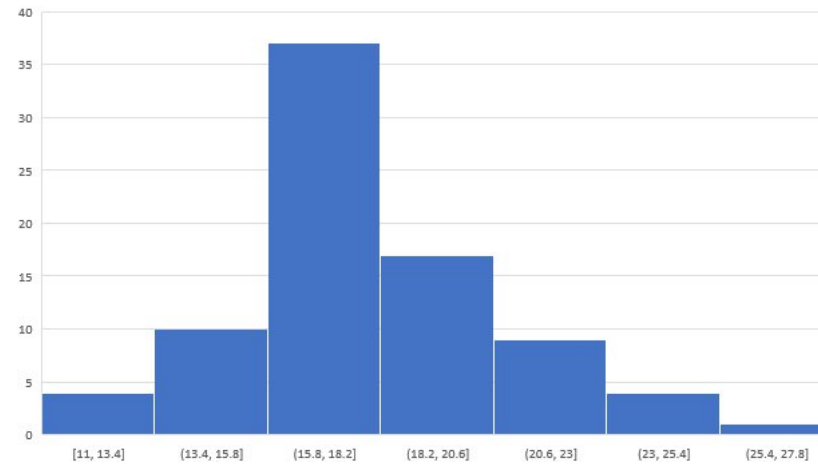
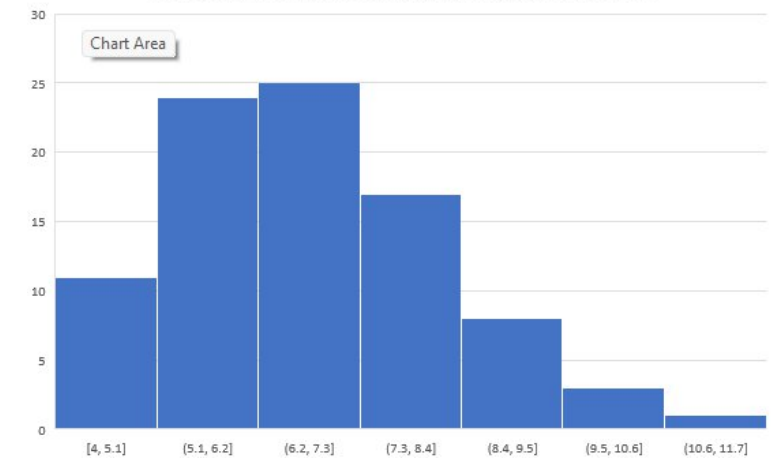# 5. Stochastic Inputs

Daily Online Reservation

Daily Online Reservation when Room Nightly Rate at $120
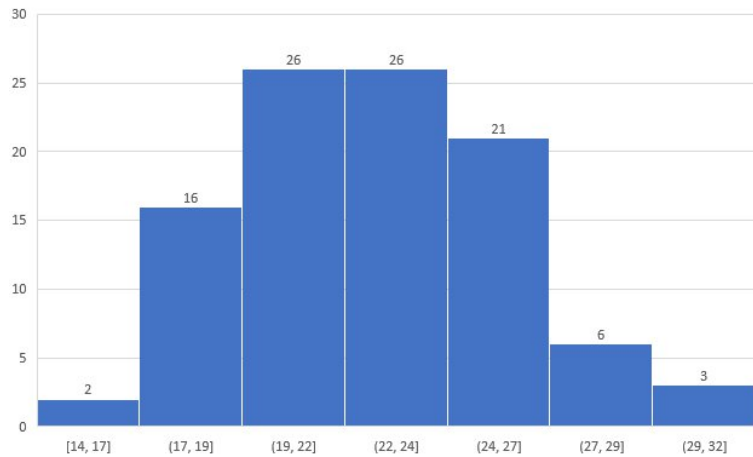
Daily Online Reservation when Room Nightly Rate at $150

Daily Online Reservation when Room Nightly Rate at $180

Three peak holiday seasons of "advance-booking" data cluster around each price-point mean and exhibit a roughly symmetric, bell-shaped spread. The historical counts show symmetrical and near symmetrical distribution around the mean with few extreme outliers, showing that Stochastic Input 1 follows normal distribution

	Mean	Standard deviation	
Price at $120	22	3.79	
Price at $150	18	3.06	
Price at $180	7	1.18	

5. Stochastic Inputs

Late Cancellation Percentage

Late cancellations percentage	Probability of Late cancellation percentage	Probability of Late cancellation percentage (%)	
0.05	73	0.27	
0.1	52	0.19	
0.15	78	0.29	
0.2	40	0.15	
0.25	28	0.10	
	271	1.00	Total

Three peak-season data show cancellation rates clustering exactly at 5 %, 10 %, 15 %, 20 % and 25 %, with observed frequencies of 27 %, 19 %, 29 %, 15 % and 10 % respectively. Because these rates occur in fixed policy tiers rather than a smooth continuum, and our sample counts match those discrete values, modelling late-cancellation percentage with an empirical distribution directly reflects the pattern without forcing it into a theoretical curve.

5. Stochastic Inputs

Walk-in Arrivals

Walk-in arrivals	Count of walk-in arrivals	Count of walk-in arrivals (%)	
0	15	0.06	
1	45	0.17	
2	27	0.10	
3	72	0.27	
4	24	0.09	
5	6	0.02	
6	14	0.05	
7	10	0.04	
8	30	0.11	
9	15	0.06	
10	13	0.05	
	271	1.00	Total

Our historical data show walk-in counts occurring exactly at 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 guests with frequencies of 6 %, 17 %, 10 %, 27 %, 9 %, 2 %, 5 %, 4 %, 11 %, 6 % and 5% respectively. These discrete, policy-driven patterns reflect real-world surges and quiet days that do not fit a smooth theoretical curve. Modelling walk-in arrivals with an empirical distribution preserves these exact observed frequencies and ensures our simulations accurately mirror actual guest behaviour.

5. Stochastic Inputs

Daily Miscellaneous Expenses

Miscellaneous daily expenses have no clear central tendency but fluctuate evenly between minor run-of-house costs ($100) and rare "perfect storm" spikes ($600). A uniform distribution on [100, 600] reflects this equal likelihood across the full range of plausible daily incidentals when no further pattern is evident.

6. Simulated Output Distribution

Convergence of Mean Total Daily Profit When Rom Nightly Rate at $120
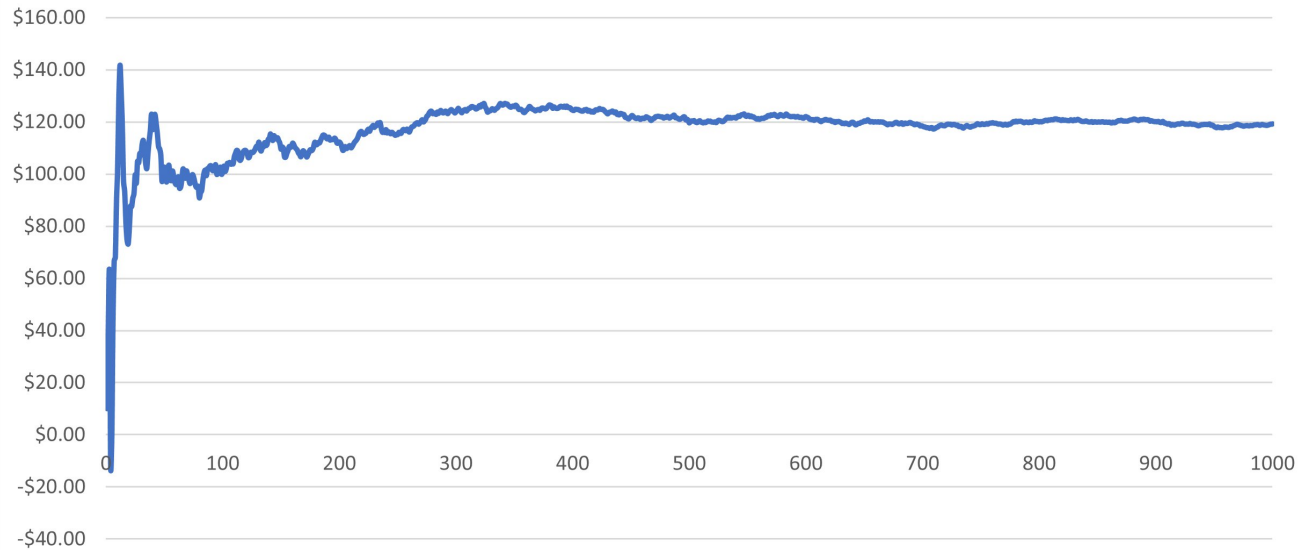
- **First 50 runs swings wildly between -$40 and +$140 as individual extreme days dominate the average.**

- **Between 50 to 300 runs the mean climbs into the $110 to $130 band and fluctuations shrink rapidly.**

- **From 400 runs onwards, the average profit converges tightly around $120/day with +/-$5 variability even out to 1000 simulations.**

6. Simulated Output Distribution

Convergence of Mean Total Daily Profit When Rom Nightly Rate at $150
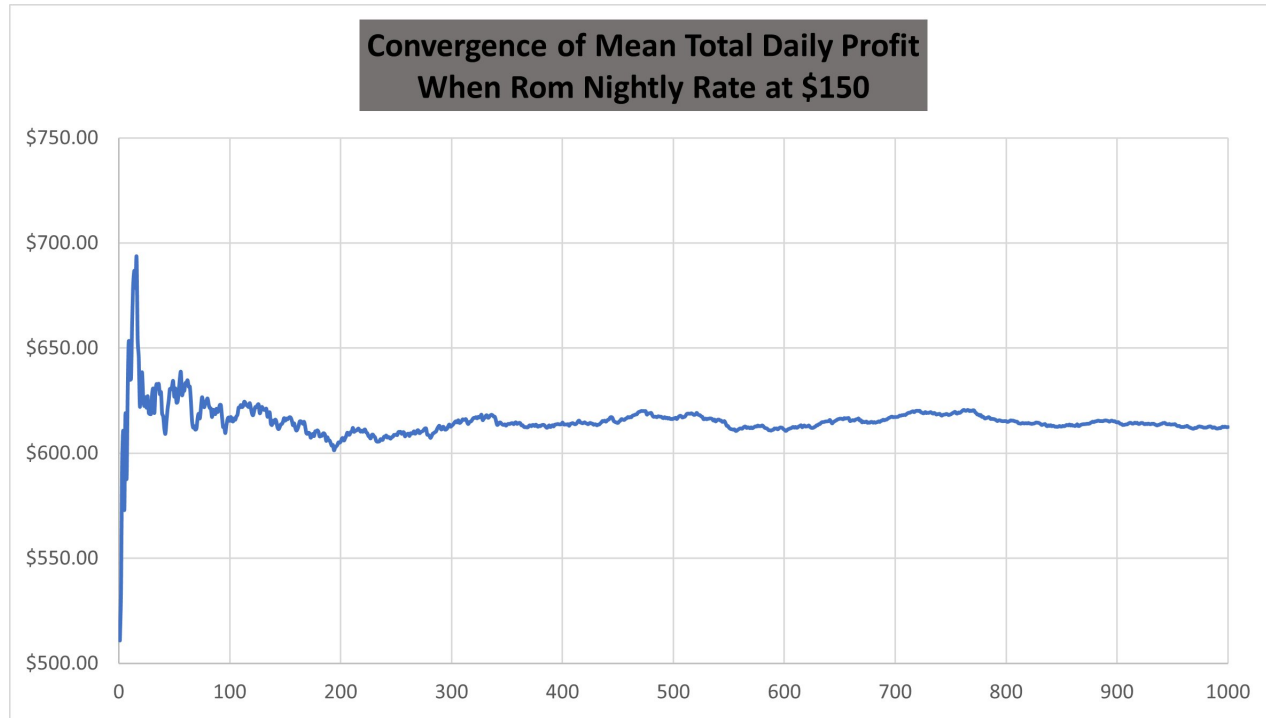
- **The running mean jumps from about $500 up to nearly $680, reflecting high variance in early draws.**

- **Fluctuations narrow into the $600–$640 band as outlier days average out.**

- **Beyond 300 simulations, the mean profit stabilizes around $615/day, with only ±$5 drift out to 1,000 trials.**

6. Simulated Output Distribution

Convergence of Mean Total Daily Profit When Rom Nightly Rate at $180
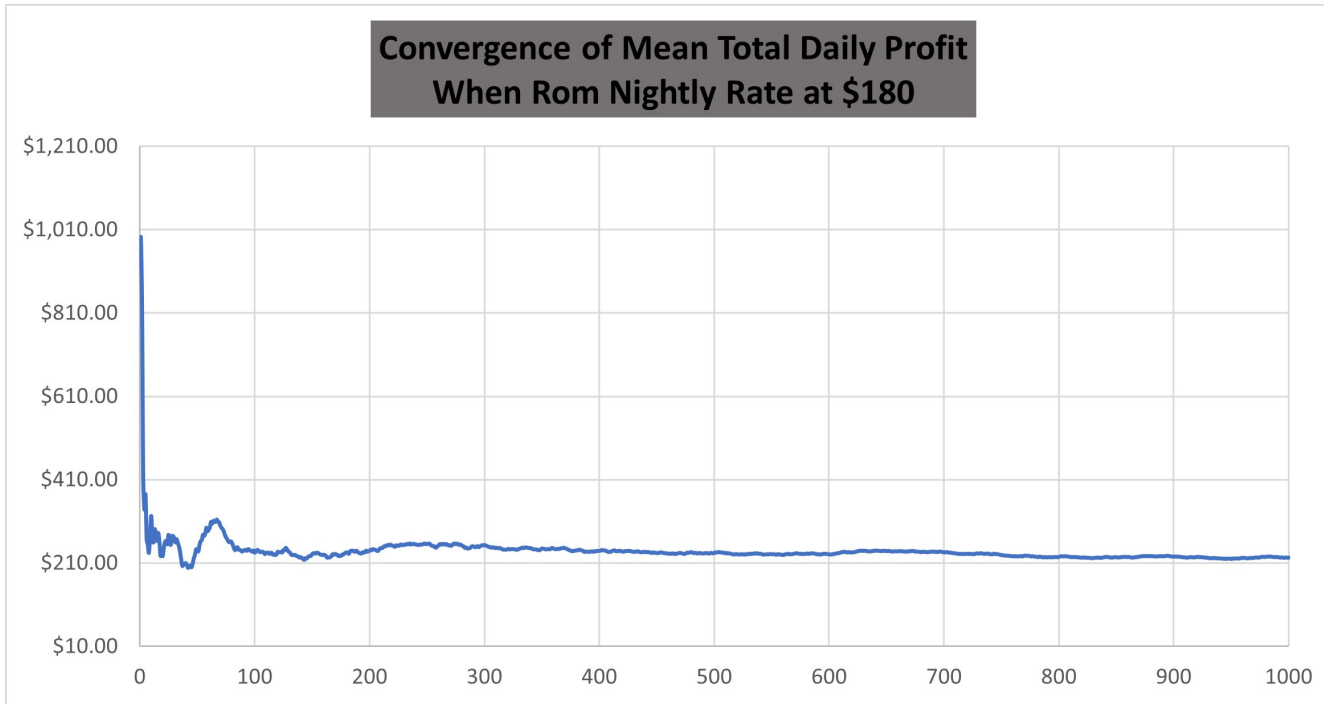
- **The running mean plummets from ~$1 000 to below $300 as large losses dilute early wins.**

- **Fluctuations settle into the $200–$300 range, driven by frequent under-filled days.**

- **Beyond ~200 trials, the average profit converges around $230/day, with minimal drift through 1 000 simulations.**

6. Simulated Output Distribution

Distribution of Daily Profit ($)

■ Daily Profit at $120   ■ Daily Profit at $150   ■ Daily Profit at $180
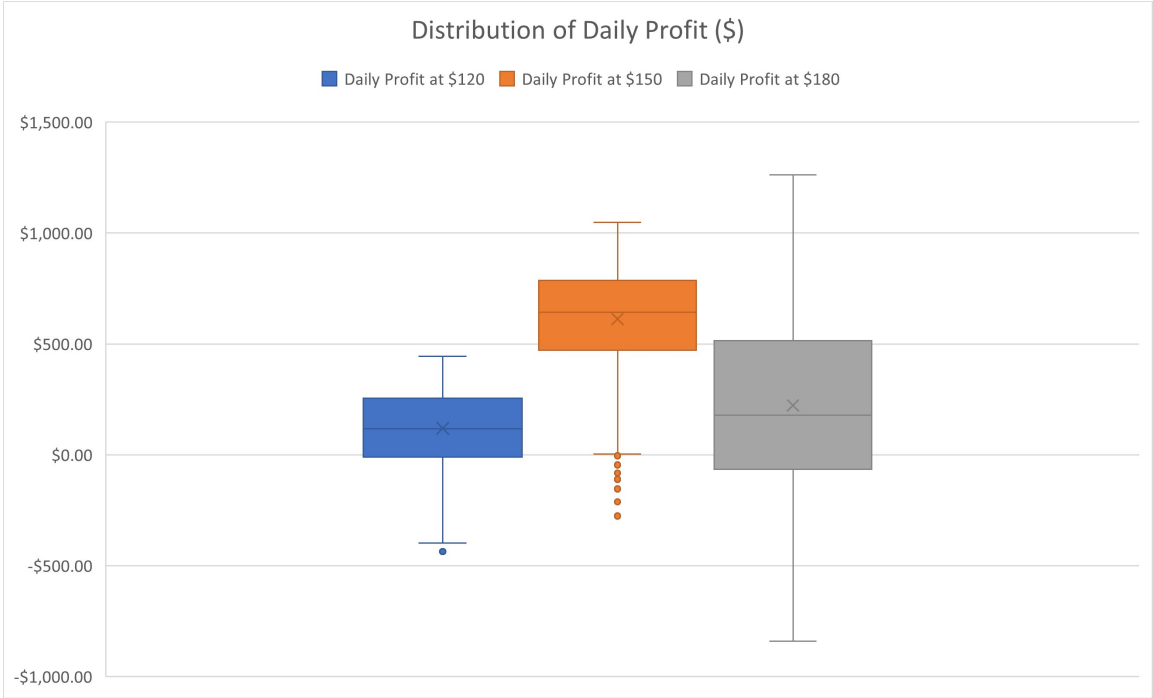
	Daily Profit ($)		
	Nightly Room Rate at $120	Nightly Room Rate at $150	Nightly Room Rate at $180
Mean	$119.30	$612.51	$223.21
Standard Error	$5.26	$7.32	$12.11
Median	$117.50	$643.00	$179.50
Mode	-$22.00	$619.00	-$39.00
Standard Deviatii	$166.39	$231.49	$382.82
Sample Variance	$27,686.59	$53,587.56	$146,554.24
Kurtosis	-$0.29	$0.33	-$0.55
Skewness	-$0.29	-$0.68	$0.32
Range	$880.00	$1,324.00	$2,103.00
Minimum	-$436.00	-$276.00	-$840.00
Maximum	$444.00	$1,048.00	$1,263.00
Sum	$119,299.00	$612,511.00	$223,214.00
Count	1000	1000	1000

- **At $120 per night, profits cluster around $119 daily, with upside capped at $444 and losses down to –$436. The nearly symmetric spread reflects consistent, modest returns.**

- **At $150 per night, average profit rises to $613 and the median to $643. Downside risk narrows (minimum –$276) while volatility allows occasional gains above $1 000 without large swings downward.**

- **At $180 per night, mean profit drops to $223 despite the higher rate. The range expands dramatically, with losses reaching –$840 and peak profits of $1 263, showing most days underperform the mean punctuated by rare extreme gains.**

7. Risk Analysis

Room Price at

	Daily Profit when Room Nightly Rate at $120 (Over-booking Level at 10% and Cancellation Fee at 10%)						Total
	From -$400 to -$200	From -$200 to $0	From $0 to $200	From $200 to $400	From $400 to $600	Over $600	
Probability	3.1%	24.0%	37.9%	33.5%	1.5%	0.0%	100.0%
Max Demand	21	33	33	34	31	0	

- **A 27 percent probability of any loss, including a 3 percent chance of a severe loss between $200–$400.**

- **A 73 percent probability of non-negative profit, with two-thirds of profitable days delivering $0–$400.**

- **Negligible upside beyond $600 – no simulated day exceeded that threshold**

Occupancy shortfalls on low-booking days drive losses, while walk-ins and over-booking cap out profit around $400. This means $120 is a conservative rate: it offers modest, reliable gains most days but leaves little room for outsized returns and carries a meaningful one-in-four risk of loss.

7. Risk Analysis

Room Price at $150

	Daily Profit when Room Nightly Rate at $150 (Over-booking Level at 10% and Cancellation Fee at 10%)									Total
	From -$400 to -$200	From -$200 to $0	From $0 to $200	From $200 to $400	From $400 to $600	From $600 to $800	From $800 to $1000	From $1000 to $1200	Over $1200	
Probability	0.2%	1.2%	3.7%	12.7%	24.9%	34.1%	22.8%	0.4%	0.0%	100.0%
Max Demand	11	16	18	20	23	27	28	22	0	

- Only 1.4% chance of any loss (0.2 % deep losses of $200–$400; 1.2 % losses up to $200).

- 57 % of days earn $600–$1 000

- No days exceeded $1 200.

The $150 rate virtually eliminate daily losses (<2% probability) while delivering strong profits on 97% of days. Over half of the profitable days yield $600–$1 000, providing a robust buffer against cost fluctuations. This rate maximizes average revenue with very low risk, making it the clear optimal choice

7. Risk Analysis

Room Price at $180

	Daily Profit when Room Nightly Rate at $180 (Over-booking Level at 10% and Cancellation Fee at 10%)										
	From -$400 to -$200	From -$200 to $0	From $0 to $200	From $200 to $400	From $400 to $600	From $600 to $800	From $800 to $1000	From $1000 to $1200	From $1200 to $1400	Over $1400	Total
Probability	14%	18%	21%	17%	12%	11%	6%	2%	1%	0%	100%
Max Demand	8	10	10	10	10	9	9	10	9	0	

- **32% chance of a loss**

- **68% chance of modest to strong profit**

- **No days exceed $1400**

A one-in-three chance of loosing money makes $180 rate a high-risk rate. Profits, when they occur, are spread across wide bands but seldom exceed $1 200. This rate's volatility requires stronger demand guarantees or hedges if chosen.

8. Conclusion

- **$150/nightly is the optimal rate during peak holiday seasons. It delivers a high average profit ($613/day), fills nearly all rooms under base demand, and carries a <2% probability of any loss. Over half of profitable days generate $600–$1 000, providing robust upside with minimal downside.**
- **$120/night is too conservative. It Yields only $119/day on average and a 27% chance of any loss.**

- **$180/night is too volatile. Average profit falls to $223/day with a 32% loss probability.**

  Price at $150 for upcoming peak season
  Maintain 10% over-booking and cancellation fee
  Monitor live booking curves