MIS775 · DECISION MODELLING FOR BUSINESS ANALYTICS

Alpine Peak Snow Resort

Simulation Modelling to Maximise Daily Net Profit

A Monte Carlo pricing & overbooking study

Alpine Peak Snow Resort · 50-room mid-tier alpine property · Victoria, Australia

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ASSESSMENT 3 — PART A (REPORT) | Prepared for the Sales Manager, Alpine Peak Snow Resort

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CONTENTS

What this report covers

Introduction & business context

THE CHALLENGE

Alpine Peak Snow Resort is a 50-room mid-tier ski property in Victoria's alpine region. Each winter peak season it faces a surge in demand, and the Sales Manager must set two levers — the nightly room rate and how far to overbook — to maximise daily net profit while managing three sources of uncertainty: fluctuating online reservations and walk-in arrivals, late cancellations under the non-refundable 30-day policy, and variable daily operating costs.

THE MODEL

A single-day stochastic decision model combining four random inputs (online reservations, walk-ins, late cancellations, miscellaneous costs), five fixed parameters, and two decision variables. A Monte Carlo simulation of 1,000 trials per scenario produces the full profit distribution, enabling comparison of expected return and downside risk across pricing and overbooking combinations.

Objective: maximise expected daily net profit and quantify downside risk of each pricing decision.

50	rooms — physical capacity
~45/day	expected online bookings (peak)
3 hrs	drive from Melbourne
$350–$450	decision variable range
$250	late-cancellation fee retained
1,000	Monte Carlo trials per scenario

Key assumptions

Demand

Online reservations and walk-ins are independent across days; the peak-season rate is stable through July–August.

Costs

Fixed daily operating cost ($3,200) is constant; housekeeping ($65) is incurred only for occupied rooms.

Cancellations

Each existing booking cancels independently with probability p=0.05, reflecting the non-refundable 30-day policy.

Cancellation revenue

The $250 retained fee per late cancellation is counted as same-day revenue.

Overbooking

Compensation to a displaced guest equals one night's room rate, per the assignment specification.

Walk-in policy

Walk-ins are accepted only while total reservations stay within the overbooking ceiling.

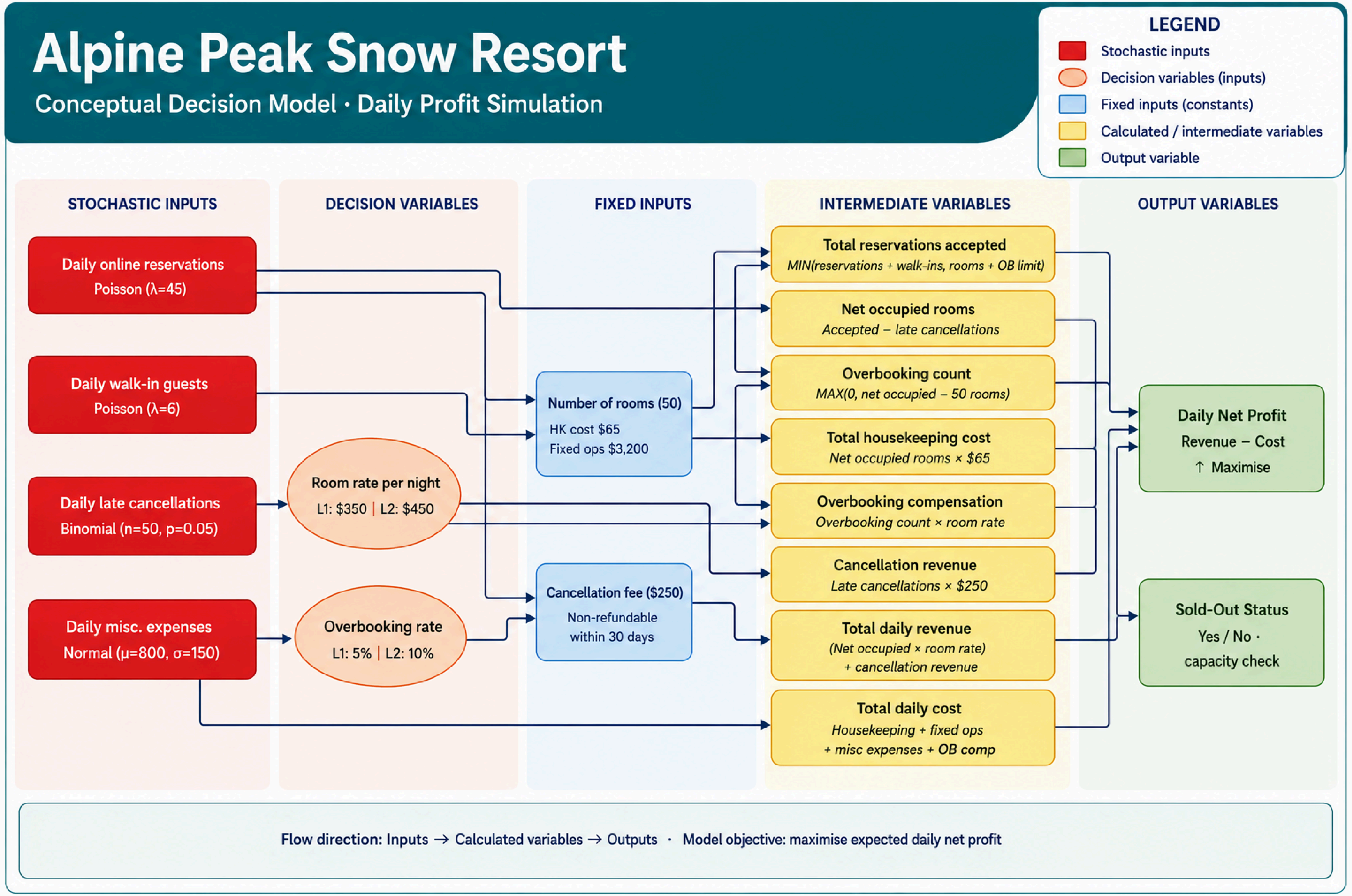
Room types

A single mid-tier room category is modelled — price and demand do not vary by room class.

Time horizon

A single 24-hour decision window — no carry-over of rooms or bookings between days.

Conceptual decision model



Decision model — inputs

FIXED · STOCHASTIC · DECISION VARIABLES

Category	Variable	Value / Distribution	Source / Justification
FIXED	Number of rooms	50	Mt Buller mid-tier property
FIXED	Housekeeping cost / room	\$65 / occupied room	FWC Hospitality Award + alpine premium
FIXED	Fixed daily operating cost	\$3,200 / day	BusinessDojo (2024) benchmark
FIXED	Late cancellation fee	\$250 / booking	Mt Buller 30-day non-refundable policy
FIXED	OB compensation	1 × Room Rate	Assignment specification
STOCHASTIC	Daily online reservations	Poisson ($\lambda = 45$)	Momondo (2025), ~45/day peak
STOCHASTIC	Daily walk-in guests	Poisson ($\lambda = 6$)	Booking.com (2025), Mt Buller proximity
STOCHASTIC	Daily late cancellations	Binomial ($n=50, p=0.05$)	Non-refundable policy → 5%
STOCHASTIC	Daily misc. expenses	Normal ($\mu=800, \sigma=150$)	BusinessDojo + alpine costs
DECISION	Room rate per night	\$350 | \$450	Market range \$300–\$480 (TripAdvisor, 2024)
DECISION	Overbooking rate	5% (→53) | 10% (→55)	SiteMinder alpine industry norm (2025)

Decision model — calculations & outputs

INTERMEDIATE VARIABLES · FORMULAS

Total Reservations Accepted
= MIN(Online + Walk-ins, Rooms + OB Limit)

Net Occupied Rooms
= Total Reservations − Late Cancellations

Overbooking Count
= MAX(0, Net Occupied − Number of Rooms)

Total Housekeeping Cost
= Net Occupied × $65

Overbooking Compensation
= OB Count × Room Rate

Cancellation Revenue
= Late Cancellations × $250

Total Daily Revenue
= (Net Occupied × Room Rate) + Cancellation Revenue

Total Daily Cost
= Housekeeping + Fixed Ops + Misc + OB Comp

Daily Net Profit = Total Revenue − Total Cost ↑ MAXIMISE

Sold-Out Status = IF(Net Occupied ≥ Rooms, "Yes", "No")

BASE CASE VERIFICATION

Mean inputs · Rate $350 · OB 3 rooms

Net Occupied
47 rooms

Total Revenue
$17,450

Total Cost
$7,055

NET PROFIT
$10,395

Sold-Out
No

Poisson distributions

Poisson (λ = 45)

95% range: 32 – 58 / day

Why: Online reservations are discrete, independent count arrivals at a roughly constant average rate through peak season — the three defining conditions of a Poisson process. λ=45 is the expected daily volume for a 50-room lodge across direct and OTA channels. Because variance equals the mean, the spread (SD ≈ 6.71) is built in — appropriate for count data without forcing symmetry.

Source: Mt Buller has ~150 accommodation operators in peak season; a 50-room mid-tier property captures ~45 booking requests per day. Cross-checked against peak-occupancy norms. Source: Momondo (2025).

Daily Online Reservations

Mean (λ)	45
SD (√λ)	6.71
95% Range	32–58
Skewness	+0.15
Q1 / Q3	40 / 50

Poisson (λ = 6)

95% range: 0 – 13 / day

Why: Walk-ins are rare, independent arrivals — a low-rate Poisson process. Mt Buller's 3-hour proximity to Melbourne drives spontaneous overnight stays. λ=6 represents a conservative peak-day estimate. SD=√λ=2.45 captures realistic day-to-day variation without over-dispersing the count.

Source: Booking.com (2025) reviews note spontaneous overnight stays from Melbourne day-trippers. Peak season walk-in rate estimated at ~6/day for a 50-room property. Formula: =BINOM.INV(1000, 6/1000, RAND()).

Daily Walk-in Guests

Mean (λ)	6
SD (√λ)	2.45
95% Range	0–13
Skewness	+0.41
Q1 / Q3	4 / 8

Binomial & Normal distributions

Binomial (n=50, p=0.05)

95% range: 0 – 6 / day

Why: Each of the 50 existing bookings independently cancels (yes/no) with fixed probability — the textbook Binomial setup. p=0.05 reflects Mt Buller's non-refundable 30-day policy, which financially deters late cancellations. The Binomial caps cancellations at n=50 — a Normal approximation would allow impossible negative values.

Source: Mt Buller Booking Conditions: cancellations within 30 days are non-refundable. General hotel rate is 15–20%; alpine peak season with financial penalty reduces this to ~5%. Formula: =BINOM.INV(50, 0.05, RAND()).

Daily Late Cancellations

Mean (np)	2.5
SD	1.54
95% Range	0–6
Skewness	+0.58
Q1 / Q3	1 / 3

Normal (μ=$800, σ=$150)

95% range: $506 – $1,094

Why: Miscellaneous costs are the sum of many small independent items (repairs, overtime, snow equipment, supplies). By the Central Limit Theorem, their aggregate converges to Normal. The distribution is continuous and symmetric. MAX(0,…) prevents negative draws.

Source: BusinessDojo (2024) hotel benchmark: $500/room/year × 50 rooms = ~$68/day base maintenance. Added alpine-specific costs (snow equipment, heating) to reach μ=$800/day. σ=$150 reflects realistic day-to-day variability. Formula: =MAX(0, NORM.INV(RAND(), 800, 150)).

Daily Misc. Expenses

Mean (μ)	$800
SD (σ)	$150
95% Range	$506–$1,094
Skewness	0
Q1 / Q3	$699 / $901

Descriptive statistics summary

Stochastic Input	Distribution	Min	Q1	Mean	Median	Q3	Max	SD	Skewness
Daily Online Reservations	Poisson(λ=45)	25	40	45	45	50	65	6.71	0.15
Daily Walk-in Guests	Poisson(λ=6)	0	4	6	6	8	13	2.45	0.41
Daily Late Cancellations	Binomial(n=50,p=0.05)	0	1	2.5	2	3	7	1.54	0.58
Daily Misc. Expenses ($)	Normal(μ=800,σ=150)	$350	$699	$800	$800	$901	$1,250	$150	0.00

KEY OBSERVATIONS

Online reservations (skewness ≈0.15) and misc. expenses (skewness=0) are both near-symmetric — confirming the distributional choices. Late cancellations are right-skewed (0.58), as most days see very few cancellations; the Binomial's low-p shape is correctly captured. Walk-ins show mild right-skew (0.41), consistent with occasional high-demand days. All four inputs are stable around their means with realistic spread.

Monte Carlo design & output statistics — 1,000 trials

MONTE CARLO DESIGN

The model simulates a single peak-season day by drawing random values for each stochastic input, computing all intermediate variables and daily net profit, then replicating this 1,000 times via an Excel data table. Results are pasted as fixed values for stable statistical analysis.

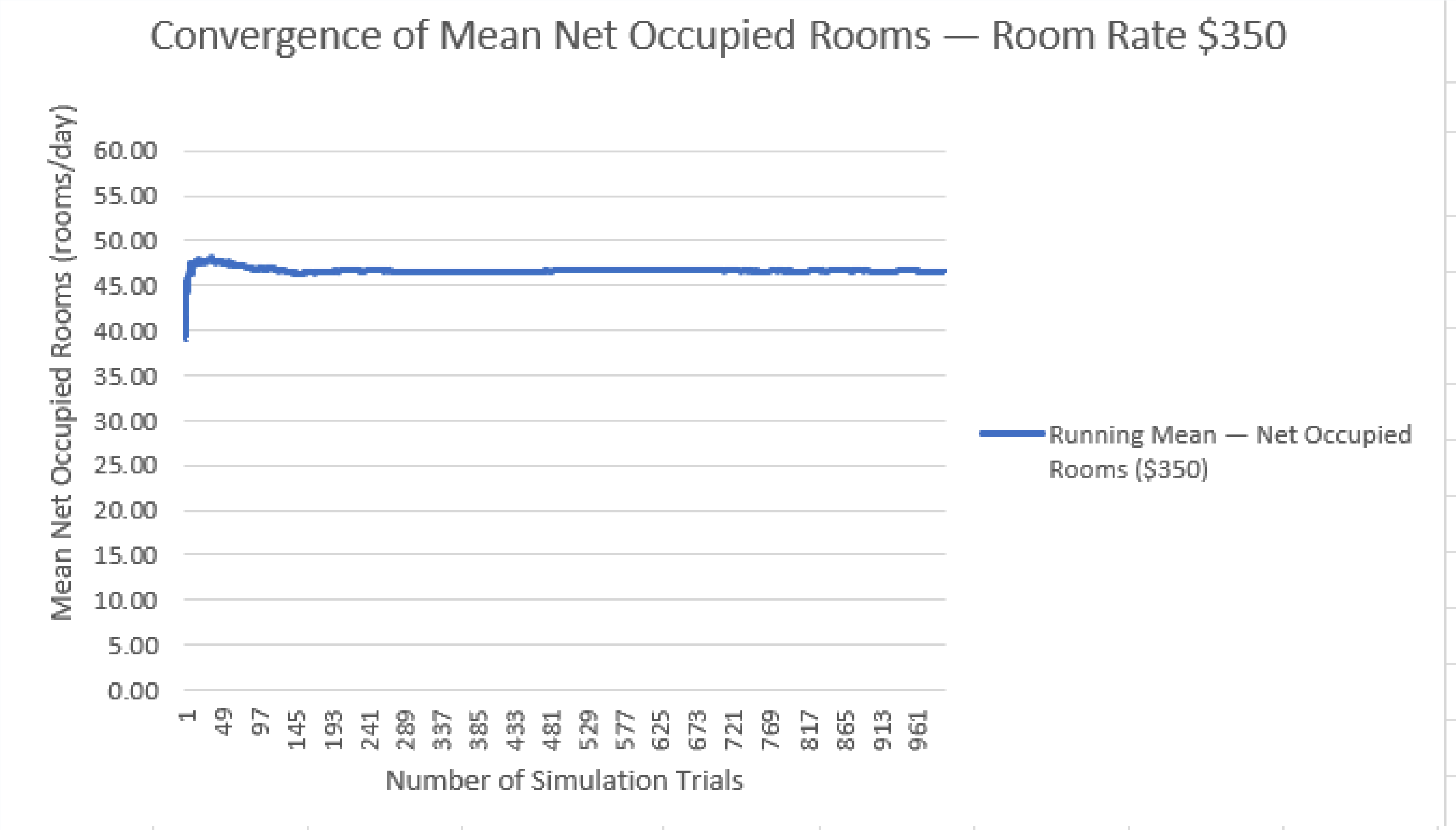
The primary decision variable is Room Rate ($350 vs $450). The Overbooking Limit is fixed at 3 rooms for both main runs, cleanly attributing output differences to the rate change alone.

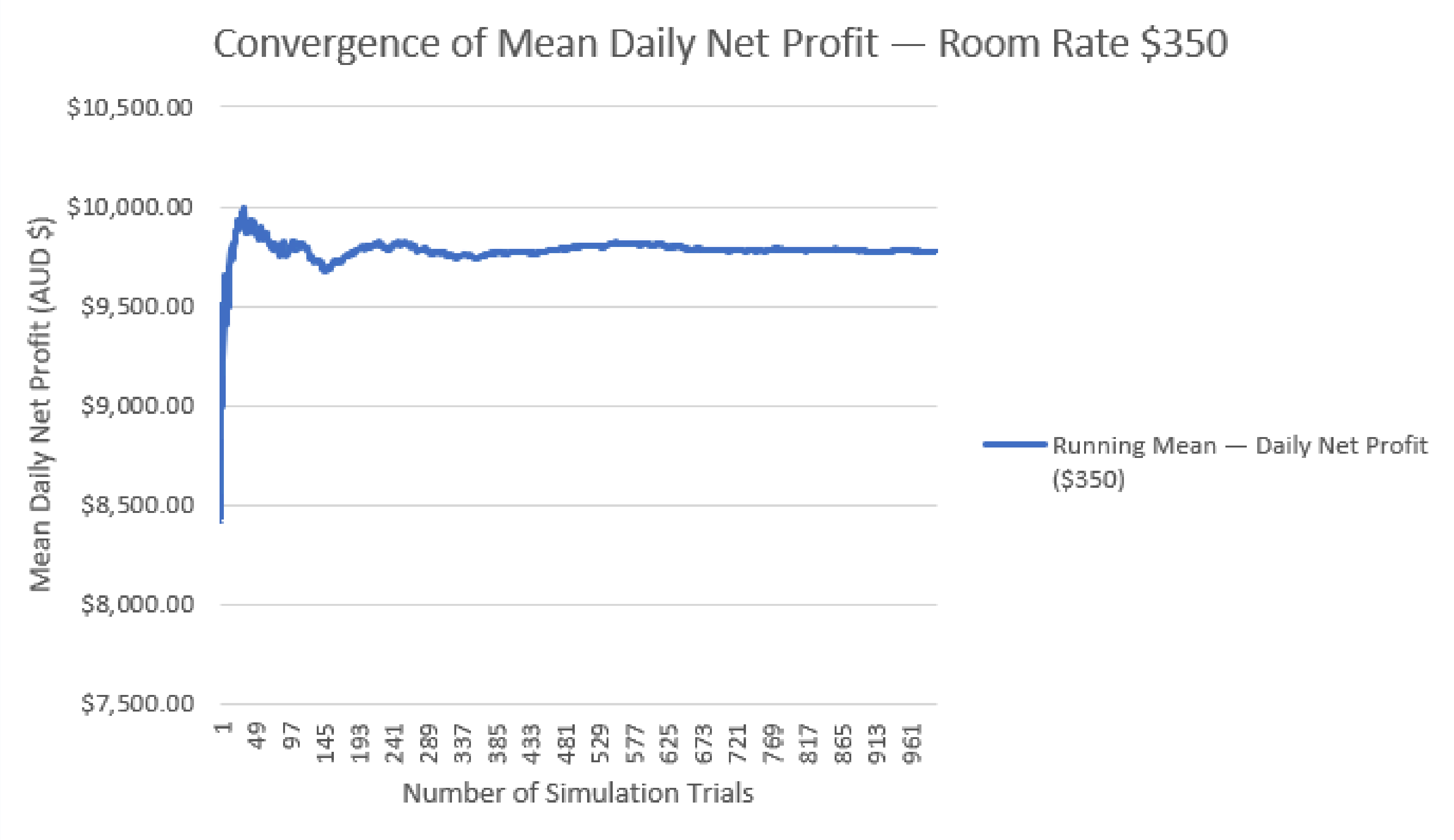
1,000	trials per scenario
2	pricing levels tested
BINOM.INV + NORM.INV	Excel sampling
CV: 11.7% < 12.5%	$450 better risk-adjusted

OUTPUT STATISTICS — 1,000 TRIALS

Statistic	Rate = $350	Rate = $450
Mean	$9,767	$14,442
Median	$10,209	$15,132
Std Deviation	$1,220	$1,684
Minimum	$4,633	$7,206
Maximum	$11,494	$16,381
Q1	$9,072	$13,608
Q3	$10,684	$15,672
Skewness	−1.20 (left)	−1.38 (left)
Kurtosis	1.03	1.36
Coeff. of Variation	12.5%	11.7%
95% CI Lower	$9,691	$14,338
95% CI Upper	$9,842	$14,546

Convergence — Room Rate $350





Key observations

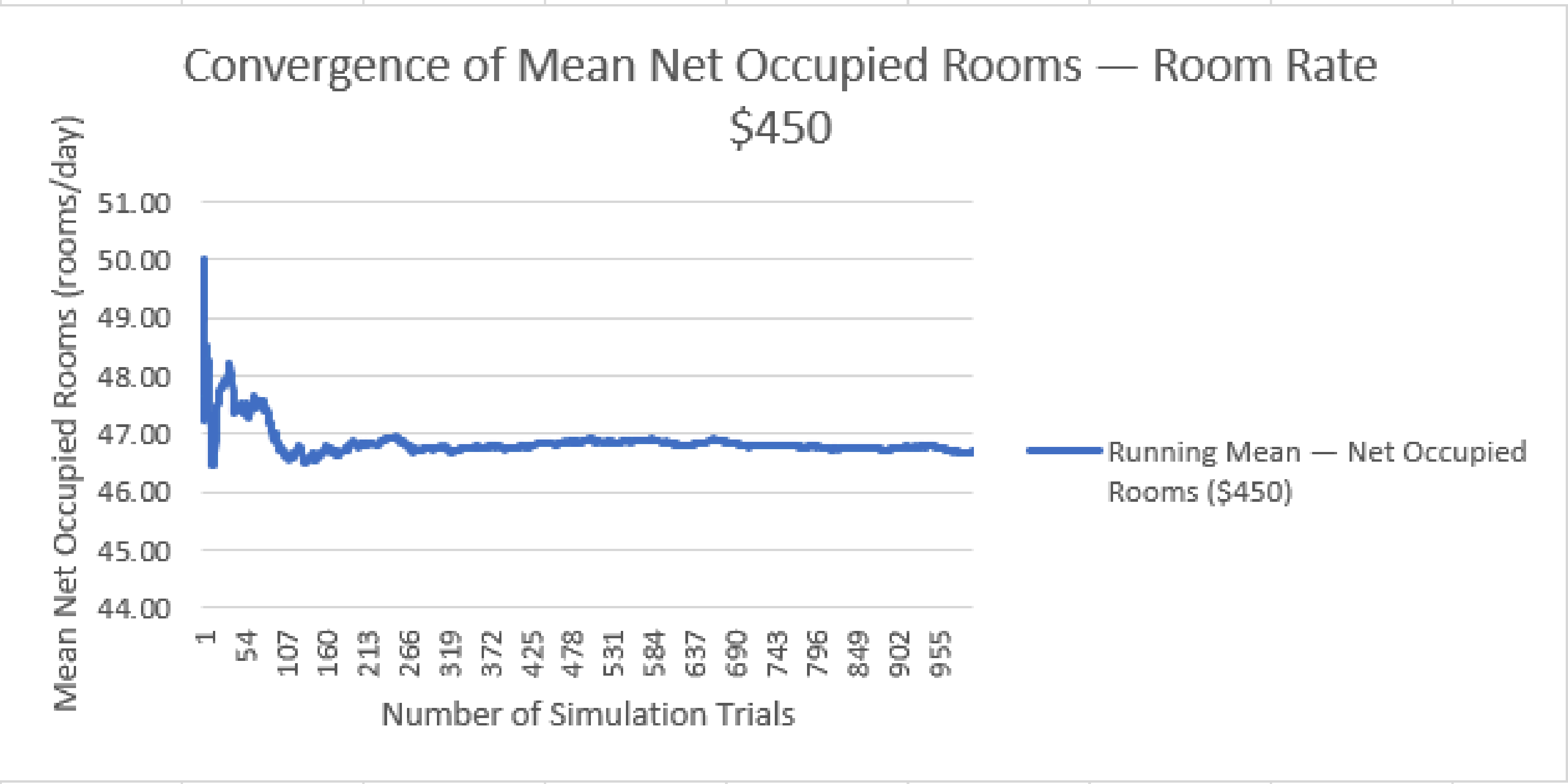
Mean net occupied rooms stabilises near 47 after ~500 trials, confirming adequate sample size.

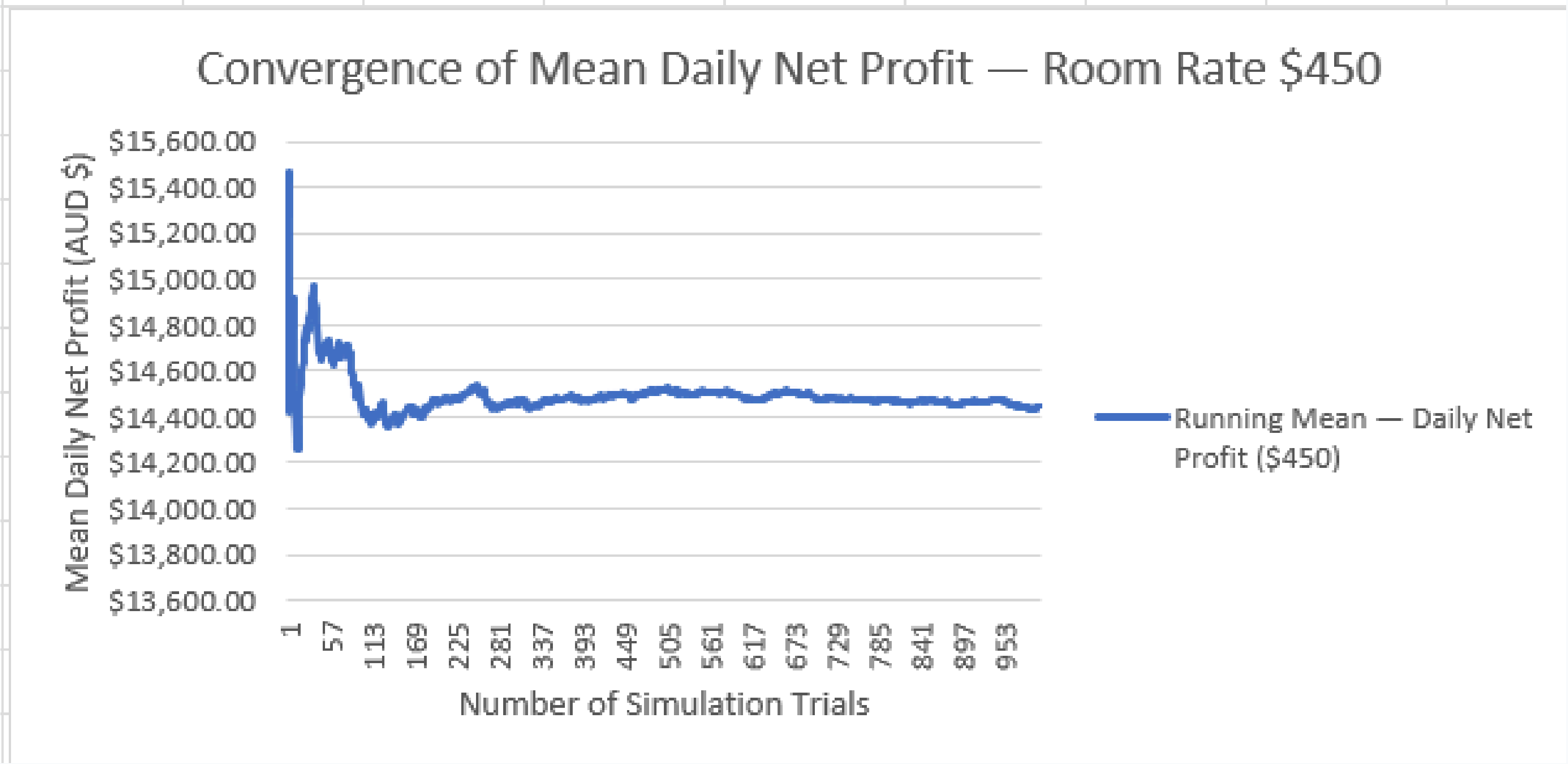
Mean daily profit converges to $9,767 after ~500 trials and remains stable through trial 1,000.

1,000 trials provides reliable estimation.

Converged Mean
$9,767

Convergence — Room Rate $450





Key observations

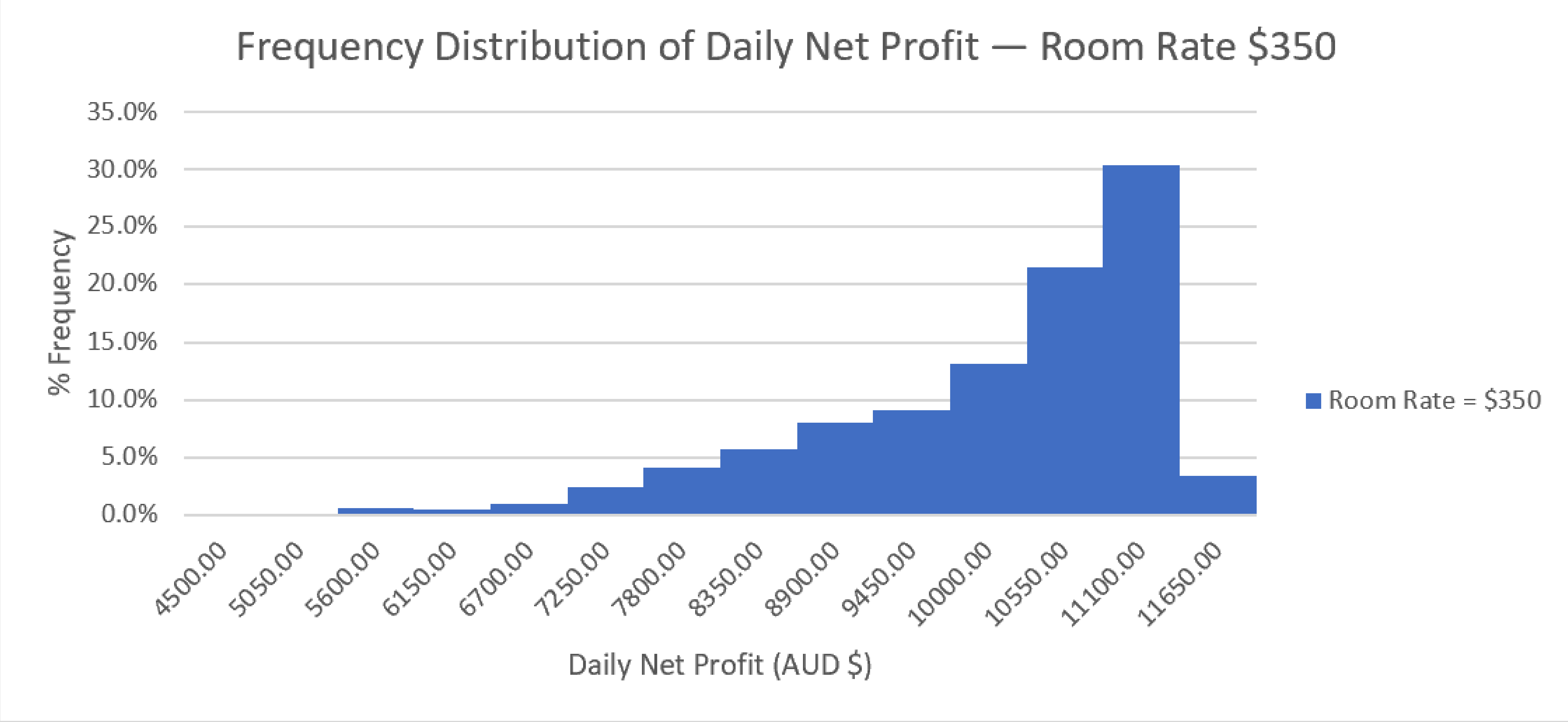
Mean occupancy stabilises near 47 after ~500 trials — same pattern as $350, confirming consistent occupancy.

Mean profit converges to $14,442 — $4,675 above the $350 run, attributable entirely to the rate change.

Identical convergence speed; no systematic bias from the rate change.

Converged Mean
$14,442

Frequency distribution — Room Rate $350



Distribution

Left-skewed — most days in the $10K–$11.1K range (54.2%).

Dominant bin: $10,550–$11,100 at 30.4%.

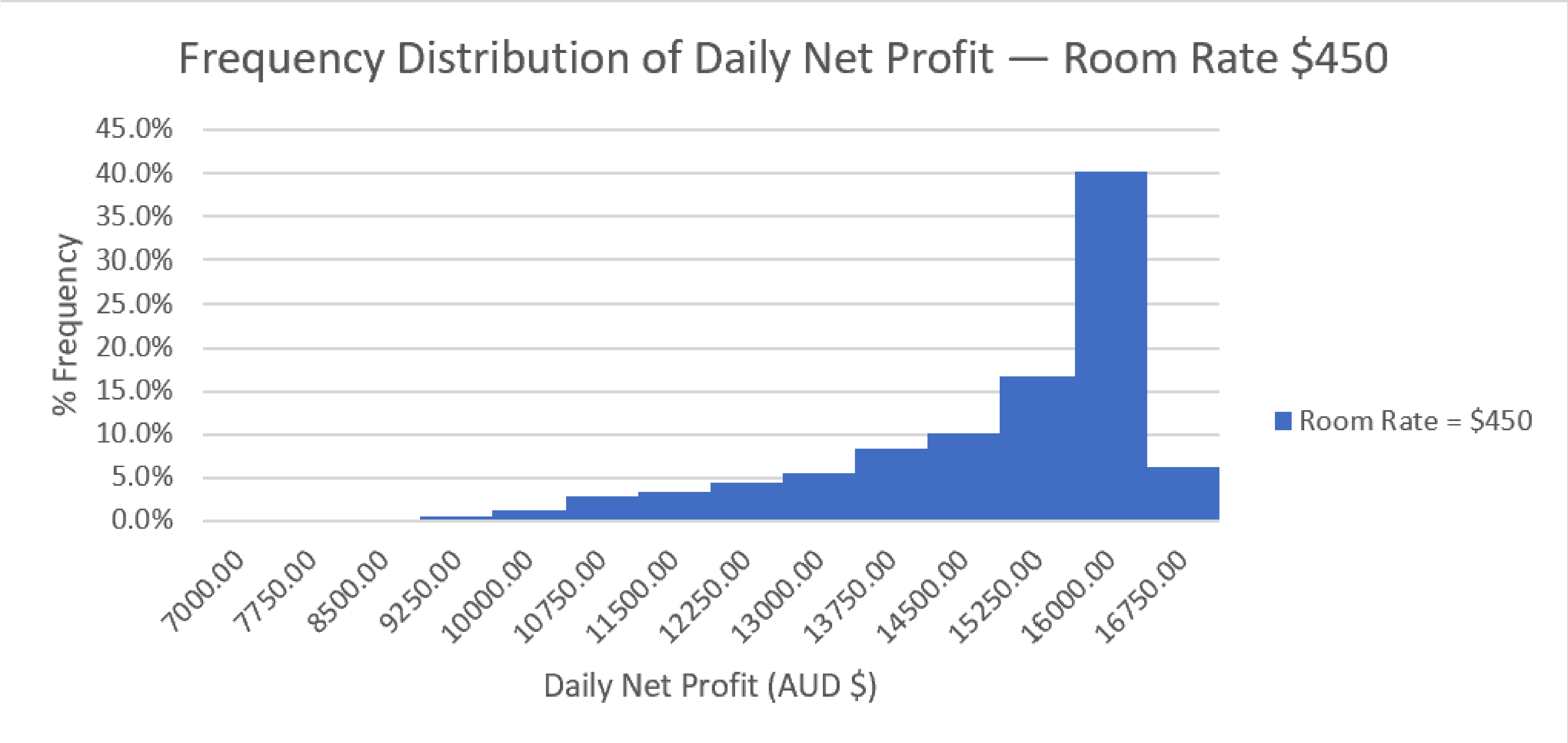
Left tail = rare low-demand days.

Median ($10,209) > Mean ($9,767) confirms skew.

Skewness: −1.20
Kurtosis: 1.03

Mean	Median	SD	Min	Max	95% CI
$9,767	$10,209	$1,220	$4,633	$11,494	$9,691–$9,842

Frequency distribution — Room Rate $450



Distribution

Left-skewed — bulk in $15K–$16K range (40.2%).

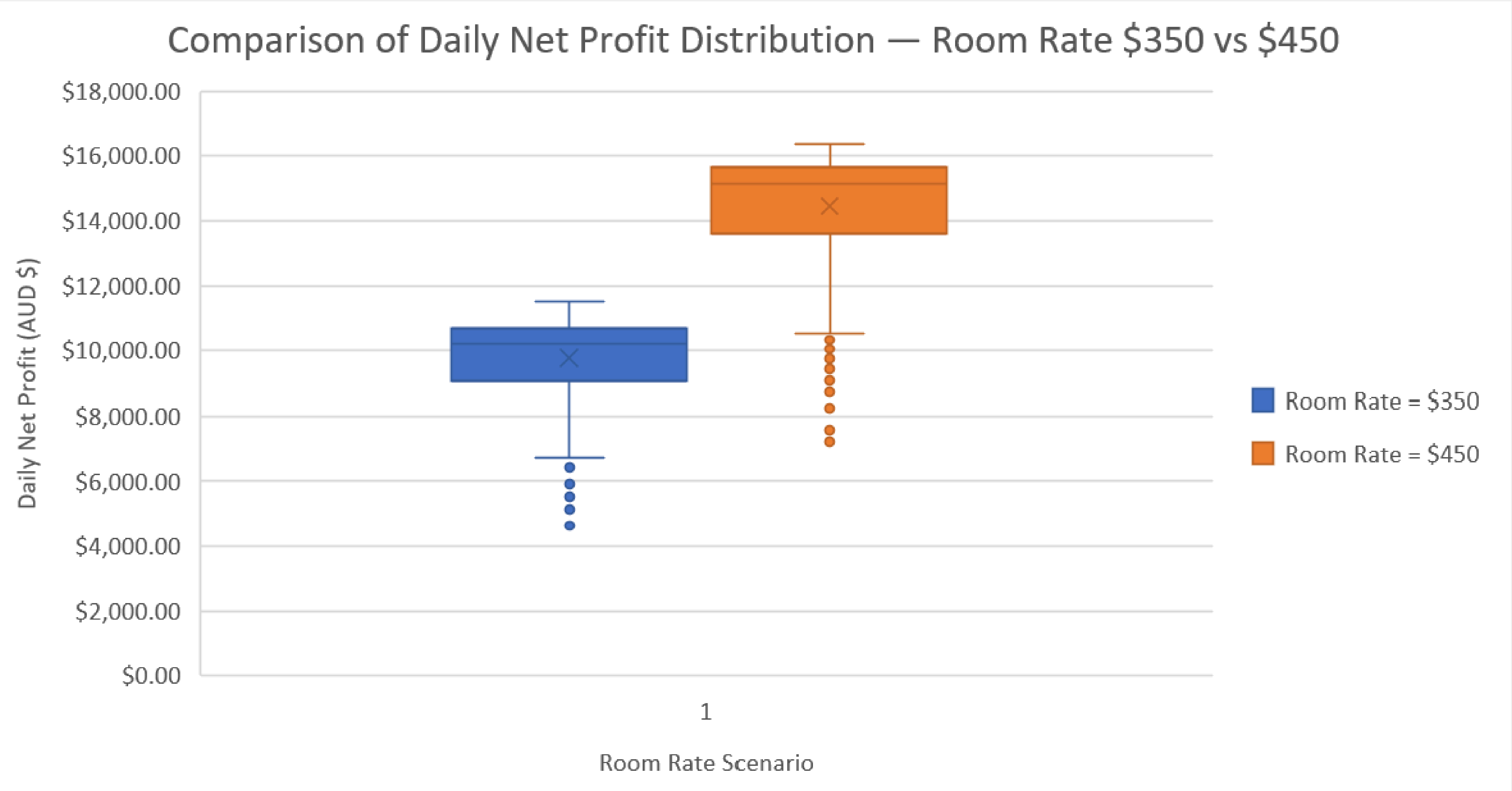
Higher spread (SD $1,684 vs $1,220) reflects amplified demand sensitivity.

Median ($15,132) > Mean ($14,442) confirms skew.

Skewness: −1.38
Kurtosis: 1.36

Mean	Median	SD	Min	Max	95% CI
$14,442	$15,132	$1,684	$7,206	$16,381	$14,338–$14,546

Box & whisker comparison — $350 vs $450



Key insights

- No overlap — $450 Q1 ($13,608) exceeds $350 maximum ($11,494).
- Downside outliers are demand-driven, not cost overruns.
- $450 box wider (IQR $2,064 vs $1,612) — amplified revenue.
- Identical left-tail shape confirms fair comparison.

$450 Q1 ($13,608) exceeds $350 Max ($11,494)

Risk profile & confidence interval comparison

95% CONFIDENCE INTERVAL FOR MEAN DAILY NET PROFIT

KEY INSIGHT | The two 95% CIs do not overlap ($9,691–$9,842 vs $14,338–$14,546). The $450 strategy delivers a statistically higher mean profit — the gap is not sampling noise. We can be 95% confident the true uplift exceeds $4,496 per day.

RISK PROFILE — $350

Under $6,000	1.1%
$6K–$8K	9.4%
$8K–$10K	35.3%
$10K–$12K	54.2%

RISK PROFILE — $450

Under $9,000	0.6%
$9K–$11K	5.1%
$11K–$13K	13.1%
$13K–$15K	32.9%
Over $15K	48.3%

Scenario comparison — best · base · worst

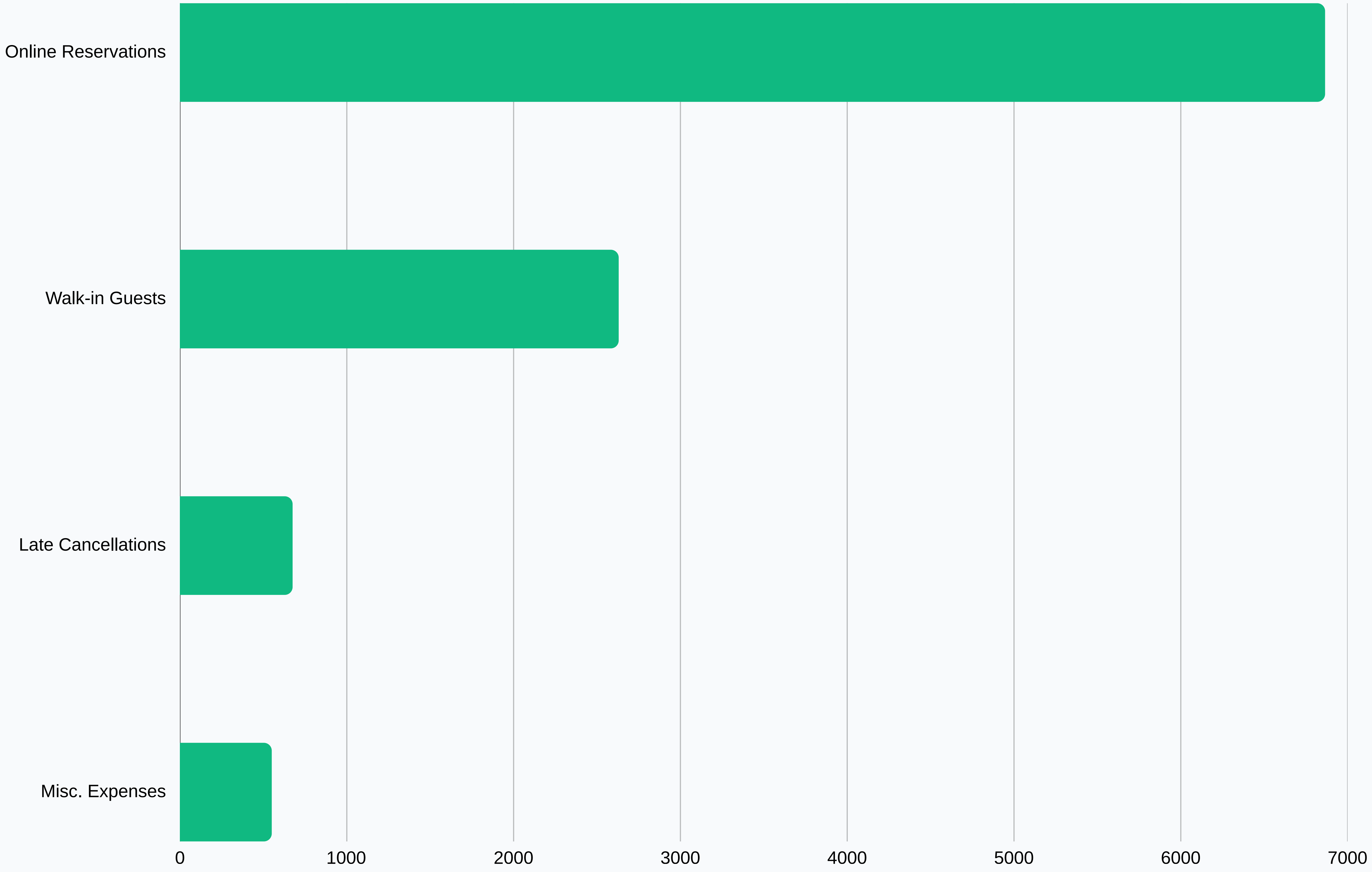
DAILY NET PROFIT ($) BY DECISION COMBINATION — DRIVER-BY-DRIVER

Stochastic input	Case	$350/5%	$350/10%	$450/5%	$450/10%
Online Reservations	Best (55)	$11,185	$10,965	$16,185	$15,865
Online Reservations	Base (45)	$10,395	$10,395	$15,095	$15,095
Online Reservations	Worst (30)	$6,120	$6,120	$9,320	$9,320
Walk-in Guests	Best (10)	$11,185	$10,965	$16,185	$15,865
Walk-in Guests	Base (6)	$10,395	$10,395	$15,095	$15,095
Walk-in Guests	Worst (2)	$9,255	$9,255	$13,555	$13,555
Late Cancellations	Best (2)	$10,465	$10,465	$15,365	$15,365
Late Cancellations	Base (4)	$10,395	$10,395	$15,095	$15,095
Late Cancellations	Worst (8)	$10,290	$10,290	$14,690	$14,690
Misc. Expenses	Best ($550)	$10,645	$10,645	$15,345	$15,345
Misc. Expenses	Base ($800)	$10,395	$10,395	$15,095	$15,095
Misc. Expenses	Worst ($1,100)	$10,095	$10,095	$14,795	$14,795

Highest outcome: $16,185 at $450+5% OB under best demand. Online reservations is the dominant driver.

Sensitivity — which variables drive profit?

PROFIT SWING FROM WORST → BEST ($450 / 5% OVERBOOKING)



WHAT IT MEANS

Demand dominates.

Online reservations swing profit by ~$6,865/day — roughly 10× any other input.

Cost variables are minor.

Misc. expenses move profit by only ~$550/day — negligible against demand variability.

Where to focus.

Anything that lifts demand — marketing, OTA visibility, direct-booking campaigns — returns far more than cost-cutting.

Conclusions

01

Premium pricing dominates

$450 beats $350 at every profit interval. Mean daily profit uplift is +$4,675/day (+47.9%).

02

Overbooking provides modest upside

5% limit (3 rooms) is the optimal setting — 10% adds minimal benefit while raising compensation risk.

03

Favourable distribution shape

Both strategies are left-skewed (−1.20, −1.38). Most days are strongly profitable — no fat-tail catastrophe.

04

Low downside at $450

Probability of profit under $9K is just 0.6% at $450 vs 10.5% under $8K at $350 — premium is also safer.

05

Demand is the master variable

Online reservations drives ~10× more profit variation than any other input, focusing management on demand levers.

06

Statistically significant

Non-overlapping 95% CIs ($9,691–$9,842 vs $14,338–$14,546) confirm the gap is real, not sampling noise.

Recommendations to the Sales Manager

PRIMARY RECOMMENDATION

Adopt Room Rate $450 with a 5% overbooking limit (3 rooms) for the peak season.

Expected uplift ≈ $4,675/day — about $561,000 across a 120-day peak season.

SUPPORTING ACTIONS

A

Invest in demand generation

Demand swings profit ~10× more than any cost lever — prioritise OTA visibility and direct-booking campaigns through the peak window.

B

Monitor cancellations weekly

If the observed cancellation rate exceeds 10%, revisit the non-refundable policy — raise the $250 fee or tighten the booking window.

C

Review overbooking on quiet days

The 5% ceiling rarely triggers at base demand. Protect guest experience — only raise to 10% during confirmed high-demand school holiday weeks.

D

Recalibrate quarterly

Re-fit λ, p, μ and σ to the latest four weeks of data so the distributions keep matching real booking behaviour.

E

Stress-test before committing

Re-run the simulation if bookings fall below ~30/day for three consecutive days — the $450 plan only underperforms in genuine poor-snow spells.

THE DECISION IN FIVE NUMBERS

Why $450 + 5% overbooking wins

+47.9%

higher expected daily profit vs the $350 strategy

$14,442

mean daily net profit at $450 (vs $9,767 at $350)

0.6%

chance of profit under $9,000 — down from 10.5% at $350

~$561K

additional profit across a 120-day peak season

Conclusion

This simulation model provides Alpine Peak Snow Resort with a robust, data-driven decision-support tool for the peak winter season. By combining four stochastic inputs calibrated to real Mt Buller operating data — Poisson online reservations ($\lambda=45$), Poisson walk-ins ($\lambda=6$), Binomial late cancellations ($n=50$, $p=0.05$), and Normal miscellaneous expenses ($\mu=\$800$, $\sigma=\$150$) — with a 1,000-trial Monte Carlo simulation, the model generates a full profit distribution under two pricing strategies.

The analysis strongly recommends $450 per night with a 3-room (5%) overbooking allowance. This strategy delivers a mean daily profit of $14,442 — 47.9% above the $350 alternative — with a 48.3% probability of exceeding $15,000 on any given peak-season day. Zero loss days were observed across all 1,000 trials, confirming operational resilience. The $450 strategy's Q1 ($13,608) exceeds the $350 strategy's maximum ($11,494), making the decision statistically unambiguous.

The model shows that demand management — sustaining online reservation volumes above 45/day — is the most impactful profit lever, generating ~10× the profit swing of any cost variable. Future extensions could add price-elasticity parameters, multi-room-type pricing, and seasonal demand curves.

References

1. BusinessDojo (2024). Hotel operating cost benchmarks. businessdojo.com
2. Booking.com (2025). Mt Buller accommodation reviews and guest data.
3. Expedia (2025). Mt Buller Chalet Hotel and Arlberg Hotel — room inventory.
4. Fair Work Commission (2025). Hospitality Industry General Award — pay guide.
5. Mews (2023). Hotel housekeeping cost benchmarks.
6. Momondo (2025). Mt Buller accommodation operators and peak-season data.
7. Mt Buller Accommodation Booking Conditions (2025). mtbulleraccommodation.com
8. SiteMinder (2025). Hotel overbooking strategies and industry benchmarks.
9. TripAdvisor (2024). Mt Buller Chalet Hotel peak season room rates.

Thank you

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