Monte Carlo Simulation — Excel Add-in Guide

1. Getting Started

Installation

1. Open Excel → **Insert** → **Office Add-ins** → **Upload My Add-in**
2. Select `manifest.xml` from this project
3. The **Monte Carlo Sim** task pane opens on the right

Quick Test

Enter this simple DCF model in a worksheet:

Cell	Label	Formula
A1	Base Revenue	`1000000`
B2	Revenue Growth	`=MC.PERT(0.04, 0.08, 0.14, "Revenue Growth")`
B3	Operating Margin	`=MC.TRIANGULAR(0.18, 0.25, 0.32, "Op Margin")`
B4	WACC	`=MC.NORMAL(0.10, 0.015, "WACC")`
B5	Terminal Growth	`=MC.UNIFORM(0.01, 0.03, "Terminal Growth")`
B8	Year 5 Revenue	`=A1*(1+B2)^5`
B9	Year 5 EBIT	`=B8*B3`
B10	Terminal Value	`=B9*(1+B5)/(B4-B5)`
B11	PV of Terminal	`=B10/(1+B4)^5`
B12	Enterprise Value	`=MC.OUTPUT(B11, "EV")`

Click ■ **Run Simulation** in the task pane.

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2. Distribution Functions

All functions live in the `MC` namespace. When **not** simulating, they return a deterministic "expected" value so your spreadsheet stays stable.

Function	Static Return	Description

`MC.PERT(min, mode, max, [name])`	`(min + 4×mode + max) / 6`	Beta-shaped distribution, good for expert estimates
`MC.TRIANGULAR(min, mode, max, [name])`	mode	Simple 3-point estimate
`MC.NORMAL(mean, stdev, [name])`	mean	Gaussian bell curve
`MC.UNIFORM(min, max, [name])`	`(min + max) / 2`	Equal probability across range
`MC.LOGNORMAL(mu, sigma, [name])`	`e^(mu + σ²/2)`	Positively skewed, always > 0
`MC.OUTPUT(value, name)`	pass-through	Marks a cell as a simulation output

> ***Tip**: Always provide a descriptive* `name` *parameter — it appears in charts and reports.*

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3. Simulation Settings

Setting	Description
Iterations	Number of Monte Carlo trials (default 1,000). More = smoother results but slower. 5,000–10,000 is typical for production.
Seed	Controls randomness. `0` = fully random (different results each run). Any positive number = reproducible results (same seed → same output).

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4. Interpreting Results

4.1 Summary Header

The colored header at the top shows three key metrics:

Metric	What it means
Mean	Average outcome across all iterations. Your "expected" enterprise value.
Std Dev	How spread out results are. Higher = more uncertainty in your valuation.
P(X < 0)	Percentage of iterations where the output was **negative**. This is NOT related to the seed setting — it measures downside risk.

Example: Mean = 3.14M, Std Dev = 1.09M, P(X < 0) = 0.0%

→ "The expected EV is $3.14M with $1.09M uncertainty. No scenario produced a negative EV."

> ***When P(X < 0) matters**: For NPV analysis of risky projects, P(X < 0) tells you the probability the project destroys value. A P(X < 0) of 15% means 15% of scenarios show the project is not worth doing.*

4.2 Histogram

The bar chart shows the **frequency distribution** of outcomes:
• **X-axis**: Output values (e.g. Enterprise Value in millions)
• **Y-axis**: Percentage of iterations that fell in each bin
• **Dashed orange lines**: 5th, 50th (median), and 95th percentiles

How to read it:
• The **tallest bars** show the most likely outcomes
• A **right-skewed** shape (long tail to the right) is typical for DCF models — upside scenarios can be very large
• The **5th–95th percentile range** gives you a 90% confidence interval

Example: If the 5th percentile = $1.83M and 95th = $5.08M, you can say: *"There's a 90% probability the EV falls between $1.83M and $5.08M."*

4.3 Cumulative Distribution (CDF)

The S-curve shows the **probability of the output being ≤ a given value**:
• **X-axis**: Output values
• **Y-axis**: Cumulative probability (0% to 100%)
• **Orange dots**: 5th, 50th, 95th percentile markers

How to read it:
• Find a value on the X-axis → read up to the curve → the Y-axis tells you the probability of being at or below that value
• The **steeper** the curve, the more **concentrated** (certain) the outcomes
• A **flat, gradual** curve means high uncertainty

Example: If the curve hits 50% at $2.93M → *"There's a 50/50 chance the EV is above or below $2.93M."*

4.4 Statistics Table

Statistic	Meaning
Iterations	Total trials run
Minimum	Worst-case scenario observed
Maximum	Best-case scenario observed
Mean	Average outcome
Median	Middle value (50th percentile) — more robust than mean for skewed data
Mode	Most frequently occurring value
Std Deviation	Spread of outcomes. ~68% of results fall within ±1 std dev of the mean

Skewness	Shape asymmetry. >0 = right-skewed (long right tail), <0 = left-skewed
Kurtosis	Tail heaviness. >3 = fat tails (extreme outcomes more likely than normal)
P5 / P25 / P75 / P95	Percentiles for building confidence intervals

4.5 Sensitivity Analysis (Tornado Chart)

The tornado chart answers: **"Which inputs matter most?"**

• Bars are sorted by impact (largest at top)
• **Bar length** = Standardized Regression Coefficient (SRC), showing how much each input drives output variation
• **Blue bars (positive SRC)**: Higher input → higher output
• **Red bars (negative SRC)**: Higher input → lower output (e.g. higher WACC → lower EV)

How to read the values:
• SRC of **0.82** for WACC means WACC explains roughly 82% of the output's variation
• SRC of **0.27** for Revenue Growth means it contributes ~27%
• The **sign** tells you the direction: negative means inverse relationship

Practical use: Focus your research and negotiation on the inputs with the longest bars — those are where uncertainty matters most.

4.6 Regression Coefficients Table

Column	Meaning
SRC	Standardized Regression Coefficient — linear correlation strength
Rank ρ	Spearman rank correlation — captures non-linear relationships too

If SRC and Rank ρ differ significantly, the relationship is non-linear.

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5. Export

The **Export** tab writes all simulation results to a new worksheet in your workbook:
• Raw iteration data (all input samples + output values)
• Summary statistics
• Useful for further analysis in Excel or importing into other tools

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6. Tips & Best Practices

1. **Start with 1,000 iterations** for quick testing, then increase to 5,000–10,000 for final analysis

2. **Use a seed** (e.g. 42) when presenting results — it makes them reproducible
3. **Name all your inputs** — unnamed inputs show as cryptic IDs in charts
4. **Check P(X < 0)** for any go/no-go investment decision
5. **Focus on median** over mean for skewed distributions — it's more representative
6. **Use the tornado chart** to identify which assumptions need the most research