

# AI-03696 Deterministic Projection Analysis

Owner	© Rigel Arcayan
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Explain the following and provide me inputs (what information is needed for each:

1. Monte Carlo Analysis
2. Deterministic Projection Analysis

Then give me an example of each

Here's a clear, decision-focused breakdown of both approaches—what they are, what inputs they require, and how they differ in practice.

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## 1. Monte Carlo Analysis

### What it is

Monte Carlo Analysis is a **probabilistic simulation method**. Instead of assuming one fixed future, it runs **hundreds or thousands of scenarios** using random variations in key variables (returns, inflation, lifespan, etc.).

Output is typically:

- Probability of success (e.g., "82% chance your money lasts to age 95")
- Range of outcomes (best case, worst case, median)

It embraces uncertainty.

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### What inputs are needed

## **A. Personal Profile**

1. Current age
2. Retirement age
3. Life expectancy (or planning horizon)

## **B. Financial Starting Point**

1. Current portfolio value
2. Account types (taxable, retirement, etc.)

## **C. Cash Flow**

1. Annual contributions (before retirement)
2. Annual withdrawals (after retirement)
3. Expected spending pattern (fixed vs flexible)

## **D. Investment Assumptions**

1. Expected return (mean)
2. Volatility (standard deviation)
3. Asset allocation (stocks, bonds, etc.)

## **E. Economic Assumptions**

1. Inflation rate (and variability)

## **F. Optional Advanced Inputs**

1. Sequence of returns sensitivity
2. Taxes
3. Social Security / pensions
4. One-time events (home sale, inheritance)

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## **Example (Monte Carlo)**

### Scenario:

- Age: 60
- Portfolio: \$1,000,000
- Withdrawal: \$50,000/year
- Allocation: 60% stocks / 40% bonds
- Expected return: 6%
- Volatility: 12%
- Inflation: 2.5%
- Horizon: 30 years

### Simulation Result:

- 1,000 simulations run
- 78% success rate (portfolio lasts 30 years)
- Worst-case: runs out in year 22
- Best-case: grows to \$3.5M

### Interpretation:

- Not guaranteed
  - Shows risk of failure
  - Helps adjust spending or allocation
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## 2. Deterministic Projection Analysis

### What it is

Deterministic analysis assumes **one fixed path**—no randomness.

It answers:

- “If everything goes exactly as planned, what happens?”

Output:

- A single projected portfolio balance each year
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## What inputs are needed

### A. Personal Profile

1. Current age
2. Retirement age
3. Planning horizon

### B. Financial Starting Point

1. Current portfolio value

### C. Cash Flow

1. Annual contributions
2. Annual withdrawals

### D. Assumptions (Fixed)

1. Fixed annual return (e.g., 6%)
2. Fixed inflation rate (e.g., 2.5%)

### E. Optional

1. Taxes
  2. Pension income
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## Example (Deterministic)

### Same scenario:

- Portfolio: \$1,000,000
- Return: 6% fixed
- Withdrawal: \$50,000/year

- Inflation: 2.5%
- Horizon: 30 years

**Projection:**

- Year 1: \$1,010,000
- Year 10: ~\$1.2M
- Year 20: ~\$1.1M
- Year 30: ~\$900K remaining

**Interpretation:**

- Looks “safe”
- But assumes no bad years
- Ignores volatility and sequence risk

## Key Differences (Critical Insight)

Aspect	Monte Carlo	Deterministic
Nature	Probabilistic	Fixed
Output	Range + probability	Single outcome
Risk awareness	High	Low
Realism	High	Low–Moderate
Ease	Complex	Simple

## When to Use Each

### Use Deterministic when:

1. Doing quick estimates
2. Building a baseline plan
3. Explaining concepts simply

## Use Monte Carlo when:

1. Making retirement decisions
  2. Stress-testing plans
  3. Evaluating withdrawal safety
  4. Understanding risk tolerance
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## Simple Analogy

- Deterministic = "Drive assuming no traffic, perfect weather"
  - Monte Carlo = "Simulate traffic, rain, accidents, delays"
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## Bottom Line

- Deterministic tells you **what could happen if everything goes right**
  - Monte Carlo tells you **what is likely to happen across reality**
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If you want, I can take your earlier retirement data and **run both analyses side-by-side (including a Monte Carlo simulation)** so you can see your actual probability of success.