

# CAPM-Based Discounted Cash Flow Valuation

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## Introduction

The Capital Asset Pricing Model (CAPM) Discounted Cash Flow (DCF) approach is used to value risky projects, such as startups, by incorporating risk directly into the discount rate rather than adjusting the cash flows themselves.

In this framework, investors require compensation for systematic risk, which is reflected in a higher discount rate derived from market data.

The general approach is as follows:

1. Estimate expected future cash flows.
2. Compute a risk-adjusted discount rate using CAPM.
3. Discount expected cash flows at this rate.
4. Subtract the initial investment to obtain Net Present Value (NPV).

## Step 1: Define Expected Cash Flows

Let  $CF_t$  denote the expected cash flow in year  $t$ .

These cash flows represent probability-weighted expectations across possible scenarios (e.g., best, base, and worst cases).

For a project with time horizon  $T$ , the expected cash flow sequence is:

$$CF_1, CF_2, \dots, CF_T$$

## Step 2: Compute the Discount Rate Using CAPM

The required rate of return is calculated using the Capital Asset Pricing Model:

$$r = r_f + \beta(r_m - r_f)$$

where:

- $r_f$  is the risk-free rate,
- $r_m$  is the expected market return,
- $\beta$  measures the systematic risk of the project relative to the market.

This rate represents the minimum return required by investors for bearing systematic risk.

### Step 3: Discount Expected Cash Flows

Each expected cash flow is discounted using the CAPM-derived rate  $r$ :

$$PV_t = \frac{CF_t}{(1+r)^t}$$

The total present value of operating cash flows is:

$$PV = \sum_{t=1}^T \frac{CF_t}{(1+r)^t}$$

### Step 4: Calculate Net Present Value (NPV)

Let  $I_0$  represent the initial investment at time zero.

The Net Present Value is defined as:

$$NPV = PV - I_0 = \sum_{t=1}^T \frac{CF_t}{(1+r)^t} - I_0$$

A positive NPV indicates that the project creates value above the required return implied by CAPM.

### Step 5: Interpretation

The CAPM-based DCF valuation provides:

- A single risk-adjusted discount rate.
- A valuation grounded in market risk principles.
- A clear investment decision rule based on NPV.

This method assumes that investors are well diversified and that project risk is adequately captured by its beta.

## Conclusion

The CAPM-based Discounted Cash Flow method values risky projects by embedding risk directly into the discount rate rather than adjusting cash flows.

While this approach is theoretically elegant and widely used in practice, it may understate project-specific or early-stage risk when beta estimates are uncertain.

Nevertheless, CAPM-based DCF remains a foundational valuation framework in modern finance due to its simplicity, consistency, and strong theoretical grounding.