Certainty-Equivalent DCF Valuation

Marc Aliaga

www.markaliaga.com

January 7, 2026

Introduction

The Certainty-Equivalent (CE) Discounted Cash Flow (DCF) model is used to value risky projects, such as startups, by adjusting future cash flows for risk rather than adjusting the discount rate. This method is particularly useful when cash flows are uncertain and risk is time-dependent.

The general approach is:

1. Start with projected cash flows.
2. Apply certainty-equivalent factors to account for risk.
3. Discount the adjusted cash flows at the risk-free rate.
4. Subtract the initial investment to calculate NPV.

—

1 Step 1: Define Cash Flows and Certainty-Equivalent Factors

Let CF_t be the expected cash flow at year t, and α_t be the certainty-equivalent factor $(0 < \alpha_t \leq 1)$ representing the risk adjustment.

$$CE_t = \alpha_t \cdot CF_t$$

```
# Cash flows CF_t
cash_flows = [100000, 150000, 200000, 250000, 300000]

# Certainty-equivalent factors  _t  (0 <        1)
certainty_factors = [0.9, 0.85, 0.8, 0.75, 0.7]
```

—

2 Step 2: Define the Risk-Free Rate

The risk-free rate r_f is used to discount the certainty-equivalent cash flows:

$$PV_t = \frac{CE_t}{(1 + r_f)^t}$$

```
# Risk-free rate r_f
rf = 0.03
```

---

3 Step 3: Calculate Present Value of Cash Flows

The present value (PV) of the adjusted cash flows is:

$$PV = \sum_{t=1}^{T} \frac{CE_t}{(1 + r_f)^t} = \sum_{t=1}^{T} \frac{\alpha_t \cdot CF_t}{(1 + r_f)^t}$$

```
# NPV function
def npv(rate, cashflows):
    value = 0.0
    for t, cf in enumerate(cashflows, start=1):
        value += cf / (1 + rate) ** t
    return value

# Calculate CE cash flows
ce_cash_flows = [cf * alpha for cf, alpha in zip(cash_flows,
   certainty_factors)]

# Present Value
pv_ce = npv(rf, ce_cash_flows)
```

---

4 Step 4: Calculate Net Present Value (NPV)

The Net Present Value subtracts the initial investment I:

$$NPV = PV - I$$

```
# Initial investment
initial_investment = 400000

```

```
# Net Present Value
npv_ce = pv_ce - initial_investment

print(f"Certainty Equivalent NPV: ${npv_ce:,.2f}")
```

—

5 Step 5: Summary Table

The final results include:

- Year-by-year certainty-equivalent cash flows
- Present value of cash flows
- Initial investment
- Certainty-Equivalent NPV

```
print("Certainty-Equivalent Cash Flows:")
for t, cf in enumerate(ce_cash_flows, start=1):
    print(f"Year {t}: {cf:,.2f}")

print(f"\nPresent Value of CE Cash Flows: ${pv_ce:,.2f}")
print(f"Initial Investment: ${initial_investment:,.2f}")
print(f"Certainty Equivalent NPV: ${npv_ce:,.2f}")
```

—

Conclusion

The Certainty-Equivalent DCF provides a transparent method to value risky projects by:

1. Explicitly adjusting cash flows for risk.
2. Using the risk-free rate for discounting.
3. Calculating NPV after accounting for initial investment.

This method avoids the potential double-counting of risk that can occur when using a risk-adjusted discount rate (e.g., CAPM) and is ideal for startups or projects with uncertain cash flows.