

# International Capital Budgeting

Chapter  
Seventeen

17

## Chapter Objective:

This chapter discusses the methodology that a multinational firm can use to analyze the investment of capital in a foreign country.

# Chapter Outline

- Review of Domestic Capital Budgeting
- The Adjusted Present Value Model
- Capital Budgeting from the Parent Firm's Perspective
- Risk Adjustment in the Capital Budgeting Process
- Sensitivity Analysis
- Real Options

# Review of Domestic Capital Budgeting

1. Identify the **SIZE** and **TIMING** of all relevant cash flows on a time line.
2. Identify the **RISKINESS** of the cash flows to determine the appropriate discount rate.
3. Find *NPV* by discounting the cash flows at the appropriate discount rate.
4. Compare the value of competing cash flow streams at the same point in time.

# Review of Domestic Capital Budgeting

The basic net present value equation is

$$NPV = \sum_{t=1}^T \frac{CF_t}{(1+K)^t} + \frac{TV_T}{(1+K)^T} - C_0$$

Where:

$CF_t$  = expected incremental after-tax cash flow in year  $t$ ,

$TV_T$  = expected after tax cash flow in year  $T$ , including return of net working capital,

$C_0$  = initial investment at inception,

$K$  = weighted average cost of capital.

$T$  = economic life of the project in years.

# Review of Domestic Capital Budgeting

The *NPV* rule is to accept a project if  $NPV \geq 0$

$$NPV = \sum_{t=1}^T \frac{CF_t}{(1+K)^t} + \frac{TV_T}{(1+K)^T} - C_0 \geq 0$$

and to reject a project if  $NPV \leq 0$

$$NPV = \sum_{t=1}^T \frac{CF_t}{(1+K)^t} + \frac{TV_T}{(1+K)^T} - C_0 \leq 0.$$

# Review of Domestic Capital Budgeting

For our purposes it is necessary to expand the *NPV* equation.

$$CF_t = (R_t - OC_t - D_t - I_t)(1 - \tau) + D_t + I_t(1 - \tau)$$

$R_t$  is incremental revenue       $I_t$  is incremental interest expense

$C_t$  is incremental operating cash flow       $\tau$  is the marginal tax rate

$D_t$  is incremental depreciation

# Review of Domestic Capital Budgeting

For our purposes it is necessary to expand the NPV equation.

$$\begin{aligned}CF_t &= (R_t - OC_t - D_t - I_t)(1 - \tau) + D_t + I_t(1 - \tau) \\&= (NI_t + D_t + I_t(1 - \tau)) \\&= (R_t - OC_t - D\tau)(1 - \tau) + D_t \\&= NOI_t(1 - \tau) + D_t \\&= (R_t - OC_t)(1 - \tau) + \tau D_t \\&= OCF_t(1 - \tau) + \tau D_t\end{aligned}$$

# Review of Domestic Capital Budgeting

We can use  $CF_t = OCF_t(1 - \tau) + \tau D_t$

to restate the *NPV* equation

$$NPV = \sum_{t=1}^T \frac{CF_t}{(1+K)^t} + \frac{TV_T}{(1+K)^T} - C_0$$

as:

$$NPV = \sum_{t=1}^T \frac{OCF_t(1 - \tau) + \tau D_t}{(1+K)^t} + \frac{TV_T}{(1+K)^T} - C_0$$



# The Adjusted Present Value Model

$$NPV = \sum_{t=1}^T \frac{OCF_t(1-\tau)}{(1+K)^t} + \frac{\tau D_t}{(1+K)^t} + \frac{TV_T}{(1+K)^T} - C_0$$

Can be converted to **adjusted present value (APV)**

$$APV = \sum_{t=1}^T \frac{OCF_t(1-\tau)}{(1+K_u)^t} + \frac{\tau D_t}{(1+i)^t} + \frac{\tau I_t}{(1+i)^t} + \frac{TV_T}{(1+K_u)^T} - C_0$$

By appealing to Modigliani and Miller's results.

# The Adjusted Present Value Model

$$APV = \sum_{t=1}^T \frac{OCF_t(1-\tau)}{(1+K_u)^t} + \frac{\tau D_t}{(1+i)^t} + \frac{\tau I_t}{(1+i)^t} + \frac{TV_T}{(1+K_u)^T} - C_0$$

The APV model is a *value additivity* approach to capital budgeting. Each cash flow that is a source of value to the firm is considered individually.

Note that with the APV model, each cash flow is discounted at a rate that is appropriate to the riskiness of the cash flow.

# Capital Budgeting from the Parent Firm's Perspective

- Donald Lessard developed an APV model for a MNC analyzing a foreign capital expenditure. The model recognizes many of the particulars peculiar to foreign direct investment.

$$\begin{aligned}
 APV = & \sum_{t=1}^T \frac{\overline{S}_t OCF_t (1 - \tau)}{(1 + K_{ud})^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau D_t}{(1 + i_d)^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau I_t}{(1 + i_d)^t} \\
 & + \frac{\overline{S}_T TV_T}{(1 + K_{ud})^T} - S_0 C_0 + S_0 RF_0 + S_0 CL_0 + \sum_{t=1}^T \frac{\overline{S}_t LP_t}{(1 + i_d)^t}
 \end{aligned}$$

# Capital Budgeting from the Parent Firm's Perspective

$$\begin{aligned}
 APV = & \sum_{t=1}^T \frac{\overline{S}_t \phi CF_t (1 - \tau)}{(1 + K_{ud})^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau D_t}{(1 + i_d)^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau I_t}{(1 + i_d)^t} \\
 & + \frac{\overline{S}_T TV_T}{(1 + K_{ud})^T} - S_0 C_0 + S_0 RF_0 + S_0 CL_0 + \sum_{t=1}^T \frac{\overline{S}_t LP_t}{(1 + i_d)^t}
 \end{aligned}$$

The operating cash flows must be translated back into the parent firm's currency at the spot rate expected to prevail in each period.

The operating cash flows must be discounted at the unlevered domestic rate

# Capital Budgeting from the Parent Firm's Perspective

$$\begin{aligned}
 APV = & \sum_{t=1}^T \frac{\overline{S}_t \overline{OCF}_t (1 - \tau)}{(1 + K_{ud})^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau D_t}{(1 + i_d)^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau I_t}{(1 + i_d)^t} \\
 & + \frac{\overline{S}_T TV_T}{(1 + K_{ud})^T} - S_0 C_0 + S_0 RF_0 + S_0 CL_0 + \sum_{t=1}^T \frac{\overline{S}_t LP_t}{(1 + i_d)^t}
 \end{aligned}$$

$OCF_t$  represents only the portion of operating cash flows available for remittance that can be legally remitted to the parent firm.

The marginal corporate tax rate,  $\tau$ , is the larger of the parent's or foreign subsidiary's.

# Capital Budgeting from the Parent Firm's Perspective

$$\begin{aligned}
 APV = & \sum_{t=1}^T \frac{\overline{S}_t OCF_t (1 - \tau)}{(1 + K_{ud})^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau D_t}{(1 + i_d)^t} + \sum_{t=1}^T \frac{\overline{S}_t \tau I_t}{(1 + i_d)^t} \\
 & + \frac{\overline{S}_T TV_T}{(1 + K_{ud})^T} - S_0 C_0 + S_0 RF_0 + S_0 CL_0 + \sum_{t=1}^T \frac{\overline{S}_t LP_t}{(1 + i_d)^t}
 \end{aligned}$$

$S_0 RF_0$  represents the value of accumulated restricted funds (in the amount of  $RF_0$ ) that are freed up by the project.

Denotes the present value (in the parent's currency) of any *concessionary loans*,  $CL_0$ , and loan payments,  $LP_t$ , discounted at  $i_d$ .

# Estimating the Future Expected Exchange Rates

We can appeal to PPP:

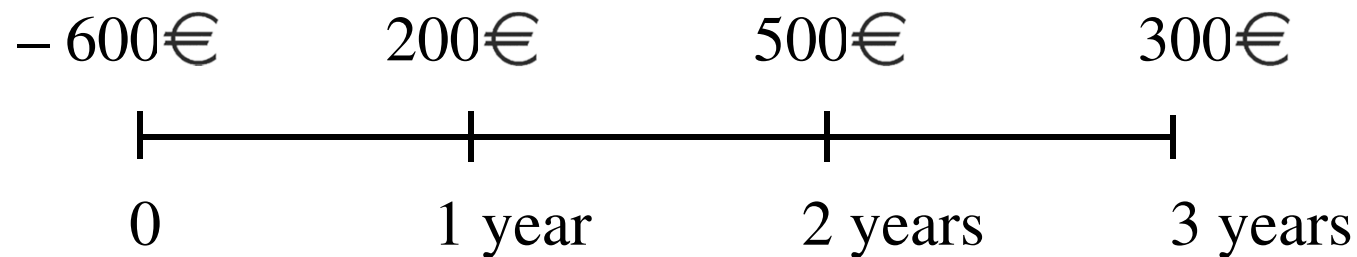
$$\bar{S}_t = S_0 \frac{(1 + \pi_d)^t}{(1 + \pi_f)^t}$$

# International Capital Budgeting

A recipe for international decision makers:

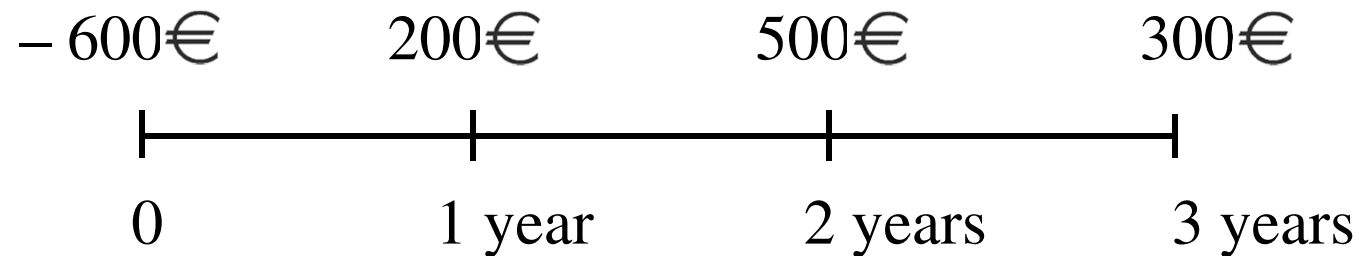
1. Estimate future cash flows in foreign currency.
2. Convert to U.S. dollars at the predicted exchange rate.
3. Calculate *APV* using the U.S. cost of capital.

*Example*





# International Capital Budgeting



*Facts*

$$i_{\$} = 15\%$$

$$\pi_{\$} = 6\%$$

$$\pi_{\text{€}} = 3\%$$

$$S_0(\$/\text{€}) = \$0.55265$$

Is this a good investment from the perspective of the U.S. shareholders?

# International Capital Budgeting

## Solution

$$CF_0 = (\text{₹ } 600) S_0(\$/\text{₹}) = (\text{₹ } 600)(\$0.5526/\text{₹}) = \$331.6$$

$$CF_1 = (\text{₹ } 200)E[S_1(\$/\text{₹})]$$

$E[S_1(\$/\text{₹})]$  can be found by appealing to the interest rate differential:

$$\begin{aligned} E[S_1(\$/\text{₹})] &= [(1.06/1.03) \times S_0(\$/\text{₹})] \\ &= [(1.06/1.03) \times (\$0.5526/\text{₹})] = \$0.5687/\text{₹} \end{aligned}$$

$$\text{so } CF_1 = (\text{₹ } 200)(\$0.5687/\text{₹}) = \$113.7$$

Similarly,

$$CF_2 = [(1.06)^2/(1.03)^2] S_0(\$/\text{₹}) \times (\text{₹ } 500) = \$292.6$$

$$CF_3 = [(1.06)^3/(1.03)^3] S_0(\$/\text{₹}) \times (\text{₹ } 300) = \$180.7$$

$$\begin{aligned} APV &= -\$331.60 + \$113.7/(1.15) + \$292.6/(1.15)^2 + \$180.7/(1.15)^3 \\ &= \$107.3 > 0 \text{ so accept.} \end{aligned}$$

# Risk Adjustment in the Capital Budgeting Process

- Clearly risk and return are correlated.
- Political risk may exist along side of business risk, necessitating an adjustment in the discount rate.

# Sensitivity Analysis

- In the *APV* model, each cash flow has a probability distribution associated with it.
- Hence, the realized value may be different from what was expected.
- In sensitivity analysis, different estimates are used for expected inflation rates, cost and pricing estimates, and other inputs for the *APV* to give the manager a more complete picture of the planned capital investment.

# Real Options

- The application of options pricing theory to the evaluation of investment options in real projects is known as *real options*.
  - A *timing option* is an option on when to make the investment.
  - A *growth option* is an option to increase the scale of the investment.
  - A *suspension option* is an option to temporarily cease production.
  - An *abandonment option* is an option to quit the investment early.

# End Chapter Seventeen