Last Lecture
International diversification pays. Firms select projects to improve their risk/return profile. The projects were sent to us (evaluated by somebody else) with risk and returns attached to them.

This Lecture
We study how firms undertake the evaluation of projects (NPV) and do sensitivity analysis.

Chapter 14 - Multinational Capital Budgeting
MNCs receive project proposals from foreign subsidiaries. In general, they have several competing ones. In this chapter we will go over how MNCs evaluate different projects.

Q: How to Evaluate the Desirability of Projects?
A: NPV. The evaluation of an MNC’s project is similar to the evaluation of a domestic one.

• Data Needed for Multinational Capital Budgeting:
  1. CFs (Revenues[P & Q] and Costs[VC & FC])
  2. Initial Outlay (I.O. or CF₀)
  3. Maturity (T)
  4. Salvage Value (SVₜ)
  5. Depreciation
  6. Taxes (local and foreign, withholding, tax credits, etc.)
  7. Exchange Rates (S₀)
  8. Required Rate of Return (k)
  9. Restrictions to Capital Outflows

In general, CFs are difficult to estimate. A point estimate (a single estimated number) is usually submitted by the subsidiary. The Parent will attempt to adjust for CFs uncertainty. Usually, this is done through the discount rate, k: Higher CF’s uncertainty, higher k.

• International Taxation: Tax Neutrality
DFIs are subject to foreign and/or local taxes. All countries attempt to eliminate double taxation to achieve tax neutrality:

⇒ Tax neutrality: No tax penalties associated with international business.

Two approaches to achieve tax neutrality:

(1) Capital import neutrality (CIN), based on territorial income.
(2) Capital export neutrality (CEN), based on worldwide income.

(1) CIN Approach (most European countries, Canada, Hong Kong, Singapore)
- No penalty or advantage attached to the fact that capital is foreign-owned
- Foreign capital competes on an equal basis with domestic capital.
- Local tax authorities exempt foreign-source income from local taxes.
  ⇒ For MNCs: Exclusion of foreign branch profits from U.S. taxable income (exclusion method).

(2) CEN Approach (U.S., Brazil, South Korea, Israel, India, Mexico)
- No tax incentive for firms to export capital to a low tax foreign country.
- Overall tax is the same whether the capital remains in the country or not.
- Local authorities "gross up" the after-tax income with all foreign taxes; then apply the home-country tax rules to that income, and give credit for foreign taxes paid.
  ⇒ For MNCs: Inclusion of "pre-tax" foreign branch profits in U.S. taxable income (gross-up income). A tax credit is given for foreign paid taxes (credit method).

• Typical Problem: Agency Problem - Subsidiary vs. Parent
  The subsidiary will want to undertake projects (prestige of subsidiary in host country, local political pressure, incentives for local revenue, etc), whereas the Parent only cares about Profitability. Subsidiary can misstate Revenues, Costs, and Salvage Value.

Example: Project in Hong Kong (Data provided in HKD)
- T= 4 years
- CF₀= HKD 70M
  Price for Product = HKD 20
  Year 1 Year 2 Year 3 Year 4
  Quantity = 1.00M 0.95M 0.90M 0.85M
  T= 4 years
  CF₀= HKD 70M

  • VC = HKD 5/unit
  • FC = HKD 3M
  • Depreciation = 10% of initial outlay (HKD 7M/year)
  • Taxes: HKD 17%, US 35% (CEN system: Gross-up, credit for foreign taxes)
    Withholding tax=10%
  • S.locale= 7 HKD/USD (use RW to forecast future S.locale’s)
  • SV₄= HKD 25M
  • k = 15%

  1. Subsidiary’s NPV (in HKD including local taxes)

```
<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues</th>
<th>Year 1</th>
<th>20M</th>
<th>23.75M</th>
<th>27M</th>
<th>29.75M</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost</td>
<td></td>
<td>5M</td>
<td>4.75M</td>
<td>4.5M</td>
<td>4.25M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3M</td>
<td>3M</td>
<td>3M</td>
<td>3M</td>
</tr>
<tr>
<td>Gross Profit</td>
<td>12M</td>
<td>16M</td>
<td>19.5M</td>
<td>22.5M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dep.</td>
<td>7M</td>
<td>7M</td>
<td>7M</td>
<td>7M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EBT</td>
<td>5M</td>
<td>9M</td>
<td>12.5M</td>
<td>15.5M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td>.85M</td>
<td>1.53M</td>
<td>2.125M</td>
<td>2.635M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAT</td>
<td>4.15M</td>
<td>7.47M</td>
<td>10.375M</td>
<td>12.865M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free CFs</td>
<td>11.15M</td>
<td>14.47M</td>
<td>17.375M</td>
<td>19.865M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free CF +SV</td>
<td>11.15M</td>
<td>14.47M</td>
<td>17.375M</td>
<td>44.865M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
NPV (in HKD) = -70M + 11.15M/1.15 + 14.47M/1.15^2 + 17.375M/1.15^3 + 
+ 44.865M/1.15^4 = - HKD 12.2869M <0

Note: If SV4 is changed to HKD 80M, then NPV = 19.16M ⇔ Subsidiary would accept 
the project. (This is likely to happen: the subsidiary will never submit a project to the 
parent company with a NPV<0.) Thus, SV is very important!

2. **MNC's NPV** (in USD, including all taxes)

<table>
<thead>
<tr>
<th>CFs to be remitted</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>HKD</td>
<td>11.15</td>
<td>14.47</td>
<td>17.375</td>
<td>19.865+25</td>
</tr>
<tr>
<td>CFs in USD</td>
<td>1.59M</td>
<td>2.067M</td>
<td>2.48M</td>
<td>2.84M+3.57M</td>
</tr>
<tr>
<td>Withholding</td>
<td>.159M</td>
<td>.2067M</td>
<td>.248M</td>
<td>.284M</td>
</tr>
<tr>
<td>CFs remitted</td>
<td>1.431M</td>
<td>1.86M</td>
<td>2.3M</td>
<td>2.56M+3.57M</td>
</tr>
<tr>
<td>(US Tax)</td>
<td>.6M</td>
<td>.8M</td>
<td>.975M</td>
<td>1.125M</td>
</tr>
<tr>
<td>Tax Credit</td>
<td>.281M</td>
<td>.425M</td>
<td>.552M</td>
<td>.660M</td>
</tr>
<tr>
<td>Net Tax</td>
<td>.319M</td>
<td>.375M</td>
<td>.423M</td>
<td>.465M</td>
</tr>
<tr>
<td>EAT</td>
<td>1.114M</td>
<td>1.486M</td>
<td>1.811M</td>
<td>2.09M+3.57M</td>
</tr>
</tbody>
</table>

NPV = - US 10M + 6.5195M = - **USD 3.48M** < 0 ⇒ No to the project.

A subsidiary will never submit a project like this (they want to undertake the project.) A 
subsidiary will inflate some numbers, for example, SV_T.

If SV_T=4 = HKD 80M, then

\[
NPV(USD M) = 10 - \{1.114/1.15 + 1.486/1.15^2 + 1.811/1.15^3 + (2.095 + 80/7)/1.15^4\}
\]
\[
= **USD 1.01181 M** > 0 \Rightarrow Yes.
\]

Note: Computation of US Tax, using the credit method:

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross-up</td>
<td>12.0</td>
<td>16.0</td>
<td>19.5</td>
<td>22.5</td>
</tr>
<tr>
<td>US-tax</td>
<td>4.20</td>
<td>5.60</td>
<td>6.83</td>
<td>7.88</td>
</tr>
<tr>
<td>Foreign Tax credit</td>
<td>1.97</td>
<td>2.98</td>
<td>3.86</td>
<td>4.62</td>
</tr>
<tr>
<td>Net US tax (in HKD M)</td>
<td>2.235</td>
<td>2.623</td>
<td>2.963</td>
<td>3.254</td>
</tr>
<tr>
<td>US-tax (in USD M)</td>
<td>0.600</td>
<td>0.800</td>
<td>0.975</td>
<td>1.125</td>
</tr>
<tr>
<td>Foreign Tax credit (in USD M)</td>
<td>0.281</td>
<td>0.425</td>
<td>0.552</td>
<td>0.660</td>
</tr>
<tr>
<td>Net US tax (in USD M)</td>
<td><strong>0.3193</strong></td>
<td><strong>0.3747</strong></td>
<td><strong>0.4232</strong></td>
<td><strong>0.4648</strong></td>
</tr>
</tbody>
</table>

Remark: Not all the countries collect taxes like in the U.S., based on worldwide income. ¶

• **Real Options View**
The original HK project has an NPV<0. Under the usual view, a company will reject this project. But, an MNC company may undertake a negative NPV project if there maybe future benefits to the company associated with the project. For example, an expansion, development of contacts, power to influence future political events, etc.

An MNC may view an initial DFI as an option – a real option -, with the initial investment being the premium paid. The MNC will have some targets for the initial investments (revenue, market share, quality of production, etc.) that will play the role of a strike price. If the strike price is reached, the MNC will exercise the option and expand.

Many MNCs went to China in the early 1990s with negative NPV projects. Years later, many of them substantially expanded their initial investment.

**Adjusting Project for Risk**
MNCs use different techniques to adjust for uncertainty in the estimated CFs submitted by the subsidiaries.

- **Adjusting discount rate, \( k \)**
In general, CF’s uncertainty is incorporated in the evaluation process through the discount rate, \( k \): The higher the uncertainty, the higher \( k \). In general, \( k \) incorporates economic and political uncertainty in the local country. But \( k \) is a point estimate, an *average risk*. Using an average risk may cost an MNC: it may wrongly reject (accept) projects that have a below (above) average risk.

Sometimes, it is better not to work with a point estimate (\( k \)), but a range instead. In this case, an MNC may construct a range for \( k \), say \{\( k_{LB} \), \( k_{UB} \)\}, to create a range for \{NPV(\( k_{LB} \)), NPV(\( k_{UB} \))\}.

**Example:** A range for NPV based on \{\( k_{LB} \), \( k_{UB} \)\} for the HK project.
Suppose the Parent decides to build a range for NPVs based on \{\( k_{LB} = .135 \), \( k_{UB} = .165 \)\} (using SV4 = HKD 80M to get NPV>0):

\[
\Rightarrow \text{Range for NPV: } \{\text{USD 0.535M; USD 1.519M}\}.
\]

The lower end of the range is positive (under the higher \( k_{UB} = .165 \)). This is good for the project.

- **Sensitivity Analysis/Simulation**
In addition to adjusting \( k \), an MNC may use sensitivity analysis for CFs. This analysis is very useful, when CF uncertainty is introduced by the subsidiaries. Recall the agency problem: Subsidiaries may not be forthcoming about true profitability of projects.

An MNC can also increase \( k \) to deal with this uncertainty. But, it is likely more informative to use sensitivity analysis or simulation to evaluate proposals from subsidiaries.

1) Sensitivity Analysis of the impact of Revenues and Costs on the NPV of project
   ◦ Play with different scenarios/Simulation
     Steps:  a. Assign a probability to each scenario/Simulate from a distribution
b. Get an NPV for each scenario.
c. Calculate a weighted average (weight=probability) NPV => E[NPV]
d. If possible, calculate a risk-reward measure (RAPM), say a Sharpe Ratio.

◊ Breakeven Analysis (same as what we do below for SV).

Note: Decisions
A Parent can base a decision using some risk-reward rule. For example, a firm may look at the SR (using E[NPV] and SD[NPV]), the range –i.e., the difference between best and worst case scenarios-, establishing some ad-hoc tolerable level for the probability of negative NPV, etc. Experience tends to play an important role in an MNC’s decisions.

Example: Scenarios for CFs and E[NPV] & SD[NPV] for HK project
We create different scenarios for the CFs (as a percentage of the CFs submitted by the subsidiary).

<table>
<thead>
<tr>
<th>% of CFs</th>
<th>Probability</th>
<th>NPV (in M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.60</td>
<td>0.01</td>
<td>-0.77918</td>
</tr>
<tr>
<td>0.64</td>
<td>0.025</td>
<td>-0.60009</td>
</tr>
<tr>
<td>0.68</td>
<td>0.05</td>
<td>-0.42099</td>
</tr>
<tr>
<td>0.72</td>
<td>0.075</td>
<td>-0.24189</td>
</tr>
<tr>
<td>0.76</td>
<td>0.09</td>
<td>-0.06279</td>
</tr>
<tr>
<td>0.80</td>
<td>0.10</td>
<td>0.116313</td>
</tr>
<tr>
<td>0.84</td>
<td>0.125</td>
<td>0.295412</td>
</tr>
<tr>
<td>0.88</td>
<td>0.15</td>
<td>0.474512</td>
</tr>
<tr>
<td>0.92</td>
<td>0.15</td>
<td>0.653611</td>
</tr>
<tr>
<td>0.96</td>
<td>0.125</td>
<td>0.832711</td>
</tr>
<tr>
<td>1</td>
<td>0.10</td>
<td>1.01181</td>
</tr>
</tbody>
</table>

E[NPV] = 0.35541
SD[NPV] = 0.64477
Prob[NPV<0] = 0.25

Descriptive Stats
E[NPV] = USD 0.355411 M
SD[NPV] = USD 0.644769 M
Prob[NPV<0] 0.250000
SR= E[NPV]/SD[NPV] = 0.551221
95% C.I. (Normal) = {USD -0.90834M; USD 1.61916M}

• Decision
Rule: Among the projects with E[NPV]>0, The Parent will compare the SRs (or CIs) for different projects and select the project with the higher SR (or the CI with the smallest negative part).

2) Sensitivity Analysis of the impact of SV on NPV
○ Try different scenarios with different values for SV (same as above for CFs). For example:

<table>
<thead>
<tr>
<th>% of SVs (in HKD)</th>
<th>Probability</th>
<th>NPV (in M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.60 (=HKD 48)</td>
<td>0.05</td>
<td>-1.60192</td>
</tr>
<tr>
<td>0.64 (=HKD 51.2)</td>
<td>0.065</td>
<td>-1.34055</td>
</tr>
<tr>
<td>0.68 (=HKD 54.4)</td>
<td>0.085</td>
<td>-1.07917</td>
</tr>
<tr>
<td>0.72 (=HKD 57.6)</td>
<td>0.1</td>
<td>-0.8178</td>
</tr>
<tr>
<td>0.76 (=HKD 60.8)</td>
<td>0.125</td>
<td>-0.55643</td>
</tr>
<tr>
<td>0.80 (=HKD 64)</td>
<td>0.15</td>
<td>-0.29505</td>
</tr>
<tr>
<td>0.84 (=HKD 67.2)</td>
<td>0.125</td>
<td>-0.03368</td>
</tr>
<tr>
<td>0.88 (=HKD 70.4)</td>
<td>0.1</td>
<td>0.227692</td>
</tr>
<tr>
<td>0.92 (=HKD 73.6)</td>
<td>0.085</td>
<td>0.489064</td>
</tr>
<tr>
<td>0.96 (=HKD 76.8)</td>
<td>0.065</td>
<td>0.750437</td>
</tr>
<tr>
<td>1.00 (=HKD 80)</td>
<td>0.05</td>
<td>1.01181</td>
</tr>
</tbody>
</table>

E[NPV] | -0.29505
SD[NPV] | 0.866876
Prob[NPV<0] | 0.70

○ Breakeven Analysis: Calculate SV^{BE}, such that NPV(SV^{BE}) = 0.
⇒ SV^{BE} = \{ IO - \sum CF_t/(1+k)^t \} * (1+k)^T

The higher SV^{BE}, the more dependent the project is on an uncertain CF. To make the NPV>0, we need SV_T > SV^{BE}. (Not good!)
Q: Is the SV_T reasonable? SV^{BE} helps to answer this question.

Example: Calculate SV^{BE} for HK project.
SV^{BE} = \{10M - \{1.114M/1.15 + 1.486M/1.15^2 + 1.811M/1.15^3 + + 2.09M/1.15^4\} * 1.15^4\} = USD 9.65891 (or HKD 67.61236M)

Check:
NPV(USD M) = 10 - \{1.114/1.15 + 1.486/1.15^2 + 1.811/1.15^3 + + (2.09+67.61236/7)/1.15^4\} = 0
A parent company compares the SV$^{BE}$ with the reported SV value:

$$SV^{BE} = \text{HKD 67.61236M} < SV = \text{HKD 80M}. \text{ (Too big!)}$$

Note: You can find the whole set of examples regarding the HK project (and play with different values) in my homepage: www.bauer.uh.edu/rsusmel/4386/npv-int2.xls ¶

Remark: If SV$^{BE}$ is negative, it is good for the evaluation of the project. Its profitability does not depend at all on an uncertain –and difficult to estimate- future CF.

• Judgment call
We presented several techniques that can be used by an MNC to measure and evaluate a project’s risk. But, in practice there is a lot of subjective judgment. MNCs also incorporate their own and/or a consultant’s experience to make a decision. Introducing a judgment call in the process is acceptable, given that in building scenarios, changing $k$, assuming distributions, experience also plays a very important role.

Example: Ad-hoc decision
Rule: The Parent not only requires $E[\text{NPV}] > 0$, but as an additional control for risk that the probability of NPV$<0$ be lower than 30%. In the HK example, the probability of a negative NPV is 25%, which would be acceptable under this ad-hoc risk-reward rule. ¶
CHAPTER 14 – BRIEF ASSESSMENT

1. Dennis Corporation, a U.S.-based MNC, has a subsidiary in Nicaragua that manages coffee fields. The subsidiary believes it could also enter into the sugar export business. The following data has been compiled for the analysis (in córdobas (NIO), Nicaragua’s currency):
   • Initial outlay: NIO 60 million
   • Life of the project: 3 years
   • Revenue per year: NIO 40 million
   • Cost of Goods per year: NIO 10 million
   • Interest expense per year: NIO 2 million
   • Depreciation: 10% of initial outlay
   • Salvage value: NIO 15 million
   • Exchange rate: 25 NIO/USD
   • Forecasted exchange rates:
     \[ E_{t+1} = 24 \text{ NIO/USD}; \quad E_{t+1} = 22 \text{ NIO/USD}; \quad E_{t+1} = 20 \text{ NIO/USD}. \]
   • The Nicaraguan government imposes a 20% tax on profits.
   • The Nicaraguan government also imposes a 10% withholding tax on funds remitted to the U.S. parent house (excluding salvage value).
   • The U.S. government imposes a 10% tax on remitted funds, excluding salvage value. Tax credit is allowed.
   • All the cash flows will be remitted to the parent company.
   • The required rate of return is 12%.

i. What is the evaluation of the project for Dennis Corporation's Nicaraguaan subsidiary?
ii. What is the evaluation of the project for Dennis Corporation?
iii. Calculate \( SV^{BE} \).
iv. Would you recommend the project to Dennis Corporation?

2. Following the previous exercise, what happened to the evaluation of the project if:
   (A) Dennis decides to increase required rate of return to 15%.
   (B) Dennis decides to decrease SV to NIO 5 million
   (C) Dennis decides to use the RW model to forecast exchange rates.
   (D) Dennis adds NIO 10 million to the net present value, as the value of the option to expand.
   (E) Dennis believes there are four scenarios regarding annual revenue:
     - 50% probability annual revenue will be as stated by subsidiary –i.e., NIO 40 million.
     - 25% probability annual revenue will be 10% lower.
     - 15% probability annual revenue will be 20% lower.
     - 10% probability annual revenue will be 30% lower.