Topic 8: International Capital Budgeting

THINGS TO NOTE:

1. Why is Capital budgeting analysis so important to the firm?

The primary goal of the financial manager is to maximise shareholder wealth. Capital investments with positive NPV or APV contribute to shareholder wealth. Capital expenditures generally represent large expenditures relative to the value of the firm and these investments determine how efficiently (and expensively) the firm will produce its product. Thus, these expenditures determine the competitive position of the firm.

2. What is the intuition behind the NPV capital budgeting framework?

The NPV method is a discounted cash flow technique. It compares the present value of all cash inflows associated with the proposed project versus the present value of all project outflows. If inflows are sufficient to cover all operating and financing costs, the project adds wealth to shareholders.

3. Discuss what is meant by the incremental cash flows of a capital project.

Incremental cash flows are denoted by the change in total cash inflows and cash outflows that can be traced directly to the project under analysis. Incremental cash flows can differ from the total cash flows for a variety of reasons and these may include:

(i)   The cannibalization of a company's products that may not add to the proposed project's profits as the new product might just be taking sales from other of the company's products.

(ii)   The proposed project might create additional sales for other product lines (or subsidiaries) of the firm.

(iii)   Transfer Pricing is used by companies to manipulate the profitability of a project by either increasing or decreasing the price at which the project sells its output to other subsidiaries.

4.   Discuss the difference between performing the capital budgeting analysis from the parent firm's perspective as opposed to the project perspective.

A capital project of a subsidiary of the parent may have a positive NPV (or APV) from the subsidiary's perspective yet have a negative NPV (APV) from the parent's perspective if certain cash flows cannot be repatriated to the parent due to restrictions on remittances by the host country, or if the home currency is expected to appreciate substantially over the life of a project, yielding unattractive cash flows when converted into the home currency of the parent. Additionally, a higher tax rate in the home country may cause the project to be unprofitable from the parent's perspective.

5. **Early results on the Lexus, Toyota's upscale car, showed it was taking the most business from customers changing from either BMW (15%), Mercedes (14%), GM's Cadillac (12%) and Ford's Lincoln (6%). With what in the auto business is considered a high percentage of sales coming from its own customers, how badly is Toyota hurting itself with Lexus?**

Toyota appears to be hurting itself. But, in fact, Lexus actually has succeeded in retaining customers as many of Toyota's customers who switched to Lexus. These customers (the ones who traded up to a luxury) would have been lost to BMW or Mercedes, if Toyota did not have a luxury model. In this case cannibalisation has served to prevent (or minimise) lost sales.

6. **Suppose a firm projects a $5 million perpetuity from an investment of $20 million in Spain. If the required return on this investment is 20% how large does the probability of expropriation in year 4 have to be before the investment has a negative NPV? Assume that all cash inflows occur at the end of each year and that the expropriation, if it occurs, will occur prior to the year 4 cash inflow or not at all. There is no compensation in the event of expropriation.**

Let us look at this problem from by breaking the cash flow stream into two components – with expropriation and without expropriation. The expected value of these streams is found by multiplying the first component by the probability that expropriation will (or will not) take place. All cash flows prior to year 4 are identical.

Year	0	1	2	3	4	5+
CF with expropriation	-$20	$5	$5	$5	0	0
CF without expropriation	-$20	$5	$5	$5	$5	$5

If the probability of expropriation in year 4 is p, then the expected cash flows are

Year	0	1	2	3	4	5+
CF with expropriation	-$20	$5	$5	$5	$5 (1-p)	$5 (1-p)

The NPV of these cash flows discounted at a 20% required return is

NPV $= -20 + 5/1.2 + 5/(1.2)^2 + 5/(1.2)^3 + 5 * (1-p)/(1.2)^4 + \ldots + 5 * (1-p)/(1.2)^t$

$\quad = -20 + 5/0.2 - (5p/0.2)/(1.2)^3$

$\quad = -20 + 25 - 14.468p$

If this expression is set equal to 0, p = 34.6%. This means that the probability of expropriation has to be 34.6% before the investment no longer has a positive NPV.

Note. The summation of the terms in the NPV equation uses the fact that the sum of an infinite annuity (a perpetuity) is *a/r*, where *a* is the annuity and *r* is the discount rate. Recognize also that the expected cash flow can be split into two annuities--one beginning in year 1 and equal to 5 per annum and the other beginning in year 4 and equal to -5p per annum.

7.   Suppose a firm has just made an investment in France that will generate $2 million annually in depreciation, converted at today's spot rate. Projected annual sales of inflation in France and in the US are 7% and 4% respectively. If the real exchange rate is expected to remain constant and the French tax rate is 50%, what is the expected real value (in terms of today's dollars) of the depreciation charge in year 5, assuming that the tax write-off is taken at the end of the year?

If the real exchange rate is expected to remain constant, then the real dollar value of the Franc is expected to decline at the same rate as the real franc value, namely 7% French inflation rate. Hence, the real dollar value of the depreciation tax write-off will decline at the rate of 7% per annum. If the French tax rate is 50%, then a depreciation charge of $2 million is worth $1 million in today's dollars. If the real dollar value of the write-off is declining at the rate of 7% annually, then its real value in year 5, given that the write-off is taken at the end of the year, is $1,000,000/(1.07)^5 = \$712,986$.

8.   What is the terminal value of a project? How is it calculated?

The terminal value of a project is the present discounted value of all future free cash flows in the years beyond an explicit forecasting horizon. If we generate explicit forecasts of free cash flows for the next 10 years, the terminal value is the present discounted value of free cash flows in years 11 to infinity. One typically assumes that future free cash flows will grow at the rate g, and the discount rate for these perpetual cash flows is r. The starting value in year 11 is (1+ g) higher than the expected free cash flows in year 10. From the perpetuity formula for a growing cash flow, we know that

$$\text{Terminal value in year 10} = \frac{E_t[\text{FCF(t+10)}](1 + g)}{(r - g)}$$

After calculating the terminal value in year 10, that quantity must then be discounted to year 0 by multiplying by the appropriate discount factor, which is $1 / (1 + r)^{10}$:

$$\text{Terminal value in year 0} = \frac{\text{Terminal value in year 10}}{(1 + r)^{10}}$$

The growth rate g should reflect the expected rate of inflation in the currency of the forecasts because the project's real capacity from its CAPX assumptions will be fully utilized, and new real investments would have to be made for there to be additional real growth. These real investments are typically not in the forecasts, so the only source of growth in nominal terms is expected inflation.

9. What is meant by the cannibalization of an export market?

When you choose to change how you service a market to which you are exporting, either because you are building a new plant in the foreign country or you are expanding production in an existing plant, you would like to know the incremental profitability of this new project. Cannibalization of exports refers to the lost exports in this market that you are now serving differently if no market can be found for the goods that were formerly being exported to that country. These lost exports could be from the parent or from another one of its foreign subsidiaries in a different country. The lost profits on these exports must be considered to be a cost of accepting the new project. If the exports that were formerly being sent to the country can be sold elsewhere in the world, there is no cannibalization.

10 Why is it necessary to consider real currency appreciation and depreciation forecasts when doing an international capital budgeting analysis?

The most important reason to consider forecasts of real currency appreciation or depreciation is that it is likely that a change in the real exchange rate will affect the cash flows of the project. Remember that a real depreciation of the domestic currency makes domestic exporters more profitable and domestic importers less profitable. Also, real appreciations typically reverse themselves somewhat slowly, so that knowledge of the current situation is necessary to know whether the future expected changes in the real exchange rate are going to enhance or detract from the cash flows of the project. Finally, if forecasts of nominal exchange rates are being

made with uncovered interest rate parity, these will be somewhat different than forecasts based on relative purchasing power parity. If the market thinks that there will be a real appreciation or depreciation in the future, forecasts of nominal exchange rates based on relative purchasing power parity will not be correct.

PROBLEMS

(1)   Suppose that a foreign project has a beta of 0.85, the risk-free return is 12%, and the required return on the market is estimated at 19%. What is the cost of capital for the project?

The cost of capital for the project is

$$\text{Cost of capital} = R_f + \beta^{*} \times [E(R_m) - R_f]$$

where R_f is the risk-free required return, β^{*} is the project beta, and $E(R_m)$ is the expected return on the market. Substituting in the numbers provided in the problem yields

$$\text{Cost of capital} = 0.12 + 0.85 \times (0.19 - 0.12) = 17.95\%$$

(2)   Jim Toreson, CEO of Xebec Corp., a California, manufacturer of disk-drive controllers, must decide whether to switch to offshore production. Given Xebec's well-developed engineering and marketing capabilities, Toreson could use offshore manufacturing to ramp up production, taking advantage of low-wage labor, tax holidays, low-interest loans, and other government largess. Most of his competitors seem to be doing it. The faster he follows suit, the better off Xebec would be according to the conventional discounted cash-flow analysis, which shows that switching production offshore is clearly a positive NPV investment. However, Toreson is concerned that such a move would entail the loss of certain intangible strategic benefits associated with domestic production.

a.   What might be some strategic benefits of domestic manufacturing for Xebec? Consider the fact that its customers are all U.S. firms and that manufacturing technology – particularly automation skills – is key to survival in this business.

Short-run benefits include better quality control and communication with customers and the ability to adapt quickly to changing markets. Longer term, a domestic manufacturing facility would give Xebec a laboratory to apply the latest thinking about automated production. By working with the production process on a daily basis, Xebec would have a better sense of the technology's wider potential. For example, running a highly automated production operation next door to the engineering group would enable Xebec to provide production-related input in the early stages of product design – which offshore production managers can rarely do. With successfully automated production, Xebec's

6

new disk drives could be offered at a price and quality level to match those of potential competitors from Japan or anywhere else. By contrast, contracting to have its products built by a potential competitor in a country like Taiwan or Japan might cost Xebec both market share and its technological edge.

The video recorder[#] is an example of how production know-how can yield important technical advances. Sony, along with Matsushita Electric and its partner, Japan Victor Corp. (JVC), redesigned a professional- use product from the U.S. costing $20,000 or more and turned it into a $1,500 home product with a relatively small market. Japanese designers then worked closely with Japanese factories to make every component smaller and less expensive. Cooperation between Matsushita's design teams and employees on the shop floor eliminated more than three quarters of the product's cost while dramatically improving its quality. In the process, the firm turned a niche product into the mass-market success story of the 1980s.

[#] Video recorders, now ancient technology, was prevalent in the 1980s and 1990s. These were superseded by DVD players which themselves have been rendered useless by direct streaming. Same story with disk-drives which computers no longer have.

b. What analytic framework can be used to factor these intangible strategic benefits of domestic manufacturing (which are intangible costs of offshore production) into the factory location decision?

The intangible strategic benefits of domestic manufacturing can be factored into the factory location decision by using the option pricing framework. By investing in domestic manufacturing, Xebec creates for itself a series of opportunities to invest capital in the future so as to increase the profitability of its existing product lines and benefit from expanding into new products or markets or new process technologies. Whether Xebec will exercise these growth options depends on what happens in the future, which is unknowable today.

The value of these growth options depends on several factors:

i) *The length of time the project can be deferred.* Factory automation allows Xebec to wait a longer time before responding to changes in the marketplace (since automation enables it to respond so quickly once it decides to). The investment in automation also provides Xebec with a set of long-lasting skills.

ii) *The risk of the project.* The riskier the investment the more valuable is an option on it. Thus, an investment in automation is likely to be especially valuable since it so risky.

iii) *The level of interest rates.* The higher the interest rate the more valuable are projects that contain growth options.

iv) *The proprietary nature of the option.* An exclusively owned option is clearly more valuable than one that is shared with others. Learning about the automation process is

clearly a proprietary skill and so more valuable than investing in a new piece of equipment that everyone has access to.

Valuing an investment in automation that embodies discretionary follow-up projects requires an expanded net present value rule that considers the attendant options. More specifically, the value of an option to undertake a follow-up project equals the expected NPV from investing in the project using the conventional discounted cash flow analysis plus the value of the discretion associated with undertaking the project.

c. How would the possibility of radical shifts in manufacturing technology affect the production location decision?

The possibility of radical shifts in manufacturing technology would increase the benefits from investing in factory automation in the U.S. The phrase "radical shifts" implies that the project is high risk, which increases the option component of value.

For example, companies that in the mid-1970s made the transition from electro-mechanical manually operated machine tools to automatic, electronically controlled ones, were subsequently able to exploit the revolution in capabilities – much higher performance at much lower cost – of the microprocessors and microcontrollers that became available in the early 1980s. For these companies, their operators, maintenance personnel, and process engineers were already familiar and comfortable with electronic technology so that it was a relatively simple task to retrofit powerful microelectronics when they became available. Companies that had deferred investment in the emerging electronic technology were not able to participate in the great technological advances in microelectronics; they had not acquired an option in this new process technology.

d. Xebec is considering producing more-sophisticated drives that require substantial customization. How does this possibility affect its production decision?

The more customization is required, the more important it is to work closely with the customer. To meet the exacting needs of customers, there must be close personal contract between Xebec's engineering and production staff and representatives of the purchasing company, something all but impossible to achieve over 10,000 miles and with severe language and cultural barriers. It is also difficult to coordinate the efforts of the marketing, engineering, design, and manufacturing people when they are spread around the globe. The need for coordination increases the value of domestic production facilities.

e. Suppose the Taiwan government is willing to provide a loan of $10 million at 5% to Xebec to build a factory there. The loan would be paid off in equal annual installments over a five-year period. If the market interest rate for such an investment is 14%, what is the before-tax value of the interest subsidy?

Borrowing at 5% when the market rate of interest is 14% saves Xebec 9% annually on the principal balance. This leads to annual before-tax savings and their associated present values as follows:

Year	Principal	Interest Savings	PV Factor (@ 14%)	Present Value
1	$10,000,000	$900,000	.8772	$789,480
2	8,000,000	720,000	.7695	554,040
3	6,000,000	540,000	.6750	364,500
4	4,000,000	360,000	.5921	213,156
5	2,000,000	180,000	.5194	93,492
			Total	$2,014,668

The value of this five-year stream of cash, discounted at 14%, is $2,014,668.

(3) International Cuckoo Clock Corporation (IC³), a Switzerland based manufacturer of Cuckoo Clocks, is considering an expansion into Asia after its expansion into the US last summer was highly successful. Currently, IC³ does export clocks to Asia, but the increased Asian demand raises the question of an expansion in Asia. IC³ is trying to decide whether to establish a Cuckoo Clock manufacturing plant and office in Japan where the clocks would be built and then sold across Asia.

The cost of the expansion is ¥80,000,000, which must be expended in the very, very near future. Moreover, IC³ would have to fund **additional** working capital of ¥5,000,000 at the time of the expansion. Further investment in net working capital would be ¥5,000,000, ¥8,000,000, and ¥10,000,000 in year 1, 2, and 3 respectively. If it builds the plant, IC³ will **depreciate** it at a rate of ¥5,000,000 per year (starting in year 1) and will have to fund additional **capital expenditures** of ¥8,000,000 per year to maintain and improve the plant. Although the project is assumed to have an **infinite** life, cash-flows are only projected up to three years and the **terminal value** of the project is computed based on the **year 3 free cash-flow (FCF)** assuming a **growth rate** that equals the Japanese long-run GDP growth rate.

Other relevant data is given in the tables below. All **taxes** are paid in Japan in the year the income is earned. Tax treaties are in effect so that IC³ will have no tax obligations to the Swiss tax authorities.

	Japan	Switzerland
Price inflation	5%	4%
Annual return on government bonds	9%	7%
Corporate tax rate	40%	30%
Equity market risk premium CHF		8.6%
Spot rate—S(CHF/¥)	0.01000	
Before tax cost of debt		10%
Debt-to-value ratio (**D/V**)	0.40	
Systematic risk (beta)	0.8	
Japanese long-run GDP growth rate	6%	

Free Cash Flows for three years

	Year 0	Year 1	Year 2	Year 3
Net profit before Tax		30.00	40.00	50.00
Taxes	0.00	-12.00	-16.00	-20.00
Net profit after Tax	0.00	18.00	24.00	30.00
Depreciation	0.00	5.00	5.00	5.00
CAPEX	-80.00	-8.00	-8.00	-8.00
NWC	-5.00	-5.00	-8.00	-10.00
FCF	-85.00	10.00	13.00	17.00

(a)   Calculate the cost of capital, in Swiss francs (CHF), for the project.

Re $= Rf + ß \times$ Market risk Premium
      $= 7\% + 0.8 \times 8.6\% = 13.88\%$

$D/V \times Rd \times (1\text{-}T) + E/V \times Re = 0.4 \times 0.10 \times (1\text{-}0.3) + 0.6 \times 13.88\%$
                                          $= 11.128\%$

(b)   Calculate the forward exchange rates, $F_1(CHF/¥)$ through $F_3(CHF/¥)$, for the years 1,2, and 3 based on the spot rate and the interest rates given in the question.

F1 $=$ Spot rate $\times$ (1+Swiss govt bond rate) / (1+Japan govt bond rate)
      $=$ CHF0.01/¥ $\times (1.07)/(1.09) = 0.01 \times 0.9817 = 0.009817$ (CHF/¥)

F2 $= 0.01 \times (0.9817)^2 = 0.009636$ (CHF/¥)

F3 $= 0.01 \times (0.9817)^3 = 0.009460$ (CHF/¥)

(c) Based on a perpetuity formula, the FCF in yen for year 3 and the Japanese growth rate assumption given in the question what is the terminal value as of year 3? Assume the yen ==WACC$_¥$ is 12.7977%==

0	1	2	3	4	5	6	...
-85	10	13	17	17×1.06	17×1.06²	17×1.06³	...

$$\text{Terminal value} = E_t(FCF_3) \times \frac{(1+g)}{(r-g)}$$

Given: g = 6%

$$17 \times \frac{(1.06)}{(0.127977 - 0.06)} = ¥265.0897$$

(d) Calculate the FCF for the years 0, 1, 2 and 3 and the terminal value in CHF using the forward rates calculated in (b).

	Year 0	Year 1	Year 2	Year 3
Forward rate F(CHF/¥)		0.009817	0.009636	0.009460
FCF in Yen	-85.00	10.00	13.00	17.00
FCF in CHF:	-0.85	0.098165	0.125273	0.160813 (mil)*

==Spot rate: CHF0.01/¥)==

t	0	1	2	3	4	5	6	...
JPY	-85	10	13	17	17×1.06	17×1.06²	17×1.06³	...
				==265.0897==				
F	0.01	0.009817	0.009636	0.009460				
CHF	-0.85	0.098165	0.125273	0.160813				
				==2.5077==				

= -0.85 + 0.098165/(1.11128) + 0.125273/(1.11128²) + 0.160813/(1.11128³) +

2.5076/(1.11128³)

=1.284235

(e) Should IC³ expand into the Asian market? Explain completely.

-0.85 + 0.098165/(1.11128) + 0.125273/(1.11128²) + 0.160813/(1.11128³) +

2.5076/(1.11128³) = 1.284235 million CHF

EXPLANATION: Positive NPV Project – Yes they should expand