

Chapter 21 International Capital Budgeting

Quiz Questions

True-False Questions

- _____ 1. Net Present Value analysis assumes that the risk of the project is constant.
- _____ 2. ANPV and WACC are essentially substitutes; neither is superior to the other.
- _____ 3. The sum of a project's profits, when accumulated over time without taking time value into account, is identical to the sum of the project's cash flows.
- _____ 4. The sum of a project's investments and disinvestments in working capital, when accumulated over time without taking time value into account, is zero.
- _____ 5. When the firm has the choice between either gradually depreciating an investment or charging the investment off entirely to the year's profit and loss account, the first choice is generally recommendable. It does not affect the total amount paid in taxes (over the project's entire life), and it avoids unnecessary fluctuations in profits.
- _____ 6. When applying NPV, you should take great care in reallocating the firm's general overhead, and charge a fair portion of this overhead to the new project—for instance, proportionally with sales or direct costs.
- _____ 7. When valuing a project, you should not include in the cash flows the (arm's length) profits made by other business units on their sales to the new unit. That is, the project should be viable even when it must pay normal (arm's length) prices for the components it buys.
- _____ 8. Adjusted NPV contains corrections for qualitative aspects that were ignored in the first-pass NPV calculations.
- _____ 9. Since borrowing reduces corporate taxes, one should always compute the tax savings ($\text{borrowing capacity} \times \text{interest rate} \times \text{tax rate}$), and add their present value to the first-pass NPV.
- _____ 10. The WACC correctly measures the gain to the shareholders from undertaking a project, if and only if (1) the project is either a perpetuity or a one-period venture; (2) the tax shield is always fully used; and (3) all gains accrue to the shareholders.
- _____ 11. Exports occur through a dependent agent or through a branch, while operating through a subsidiary falls into the category of international marketing.
- _____ 12. A firm that is very good at marketing will often become a franchisee; similarly, a firm that is very good at developing a new technology or that possesses a valuable brand name will typically become a licensee.
- _____ 13. The licensor or franchiser typically receives a stated fraction of the project's profits.
- _____ 14. Having a foreign branch is like having a dependent agent abroad, except that the foreign operations are incorporated as a separate company.
- _____ 15. The incremental value principle says that since the gains from tax planning and treaty shopping are unambiguously related to the project, these gains should be considered in the decision to accept or reject.
- _____ 16. When conducting an NPV analysis, one should be as realistic as possible, and subtract, for example, the license fees, interest payments and amortization of intra-company loans, and management fees from the project's cash flows.
- _____ 17. Since the money paid to bank(s) to service loan(s) does not accrue to the shareholders, one should subtract these payments from the operational cash flows before computing the NPV.
- _____ 18. A sound rule of thumb is that the company should borrow in a weak currency. The reason is two-fold. First, the firm can expect a capital gain

when the loan is paid back. Second, the high interest payments mean that there is a large interest tax shield.

- _____ 19. To account for expropriation risk, one simply deducts the insurance premium (after taxes) because this premium is equal to the market's risk-adjusted expected cost of expropriation.
- _____ 20. The best way to account for transfer risk is to add a risk premium to the discount rate. The next best way is to subtract the expected losses on blocked funds from the operating cash flows.
- _____ 21. Leading and lagging are ways to speculate on changes in transfer prices.

Ans. 1. true; 2. false; 3. true; 4. true; 5. false: you lose time value by voluntarily speeding up taxes; 6. false: only incremental overhead matters (the increase in overhead caused by the project); 7. false: We use the NPV rather than the ill-defined "arm's length" profits. The discounting implicitly subtracts the normal return on investment and normal reward for risk from the supplying units cash flows. If the NPV of the supplying units cash flows is truly equal to zero, they will not affect the project NPV. So no harm is done by including them. If, on the other hand, the supplying units cash flows do have a positive NPV, we clearly have to include them; 8. false; 9. false; 10. false; 11. false; 12. false; 13. false; 14. false; 15. false; 16. false: the license payments have to be added back to the project cash flows; 17. false: one decides on the basis of a full-equity analysis; 18. false: in terms of risk-adjusted expectations, there is no difference in the currency of borrowing if the spot and forward markets are in equilibrium and the capital gains tax is the same as the tax on interest income; 19. false; 20. false; 21. false.

Additional Quiz Questions

- Q1. What are the reasons why the tax savings from corporate borrowing are often smaller than the present value of (borrowing capacity \times borrowing rate \times tax rate)?
- A1.
 - Not all of the tax shield may be used if the earnings before interest are not large enough.
 - There is a loss of time value when an interest tax shield is carried forward.
 - The formula only looks at corporate taxes and ignores the total tax burden.
 - Generally, part of the tax subsidy will accrue to the shareholders and part to the bondholders, but just how much each will receive is unknown.
- Q2. Why does a firm often combine, for example, exports, foreign marketing, and licensing—rather than choosing only one of the above methods of operations?
- A2. Each mode of foreign activity is not mutually exclusive, and a company may create synergies by combining various modes. These synergies include: reducing the total tax burden, reducing political risk, and distributing the risk and the revenues.
- Q3. What are the main differences between an independent agent and a dependent agent? A dependent agent and a branch? A branch and a subsidiary? A subsidiary and a joint venture?
- A3.

	Independent agent	Dependent agent	Branch	WOS	JV
Type of activity	Sells units on its own account	Sells on account of firm	Produces and/or sells for the parent firm	Produces and/or sells on its own account	Produces and/or sells on its own account
Company legal present in host country	No	No	Yes, but not separate from the parent	Yes, as a separate company that is owned by the parent firm	Yes, but as a separate company with two or more parents

- Q4. Why is it recommendable to separate the analysis of intra-company financial arrangements from:
- The analysis of the operations?
 - The analysis of the effects of external financing?
- A4. (a) Intra-company financial arrangements should be examined separately from the operational aspects because the royalties or interest on an intra-company loan are a "cost" to the subsidiary, but at the same time, income to the parent. Also, royalties and interest payments result in lower host country taxes, but greater taxes on home country income.
- (b) 1) Tax planning is complex and technical; 2) the assumptions concerning the size and timing of dividends may be tenuous and the potential closing of tax loopholes may eliminate any savings from tax planning; and, 3) tax savings should only be viewed as a welcome boon, and not the element which will make or break an NPV calculation.
- Q5. Describe how the pro-active and reactive management of transfer risk differ.
- A5. If a country with foreign currency reserve problems is going to begin blocking some forms of remittances, it is helpful if a company has already established a tradition of proactive transfer risk management using techniques like leading and lagging or using a bank as a front for a loan. The reason is that once capital controls have been imposed, if a company changes its remittance policy, the host government will recognize the changes as tactics for avoiding controls and disallow transfers of funds. Likewise, when a host country blocks some or all payments, you will no longer have the opportunity to dress up an intra-company loan as a loan from a bank. Thus, this has to be done pro-actively.
- Q6. What cash flows are not shown in the projected profit-and-loss accounts for the project, but should nevertheless be taken into account when doing an NPV analysis?
- A6. Depreciation should be added back because it is not a real cost, and the initial costs and the actual production costs should be recognized as they occur.
- Q7. When the host and home capital markets are integrated, why is it, in principle, immaterial whether one conducts the analysis in terms of the host currency or in terms of the home currency? In practice, which of the two approaches is most convenient, and why?
- A7. In the absence of capital markets, arbitrage and portfolio adjustment equates prices, discount rates and values. In practice, it is simplest to discount the cash flows at the host-country risk-adjusted cost of capital and convert them at the spot rate.

Exercises

- E1. Consider Example 21.2. Suppose that intra-company transactions represent one-fourth of a project's variable costs, and every delivery valued at the arm's-length price of 100 pesetas increases the profits of the supplying unit by 50 pesetas; that is, variable costs are half of the transfer price. Additional deliveries of coating material will not require any additional investment, nor will they affect the company's overhead. Evaluate the profits the parent makes on its intra-company sales, and incorporate them into the NPV analysis.

To take into account leads and lags (investments in working capital), assume that:

- The supplying unit ships the coating, on average, six months before the subsidiary sells its final product (that is, shipment occurs at times 1, 2, ..., 5).
- Production of the coating consists of grinding and mixing, and takes virtually no time; the supplying unit usually has about one month's worth of raw material in inventory, and pays its own suppliers thirty days after delivery. Workers are paid every week. Thus, the supplying unit's cash outflows also take place at times 1, 2, ..., 5.
- The new business unit pays sixty days after delivery; taking into account one month for the actual shipment, this means that the supplying unit is paid at times 1.25, 2.25, ..., 5.25.

- A1. The data imply the following cash flows from the sales to the new unit:

**Present value of the additional cash flows generated
in supplying the business unit**

Reporting year	(a) Sales	(b) Variable costs	(c) Over- head	(d) Depre- ciation	(e) Taxable	(f) Tax (35%)
1	65	33	0	0	33	11
2	100	50	0	0	50	18
3	110	55	0	0	55	19
4	60	30	0	0	30	11
5	30	15	0	0	15	5
PV	218	109				38

Sales of coating by the supplying unit to the proposed new business unit represent one-fourth of the project's variable costs; that is, (a) is one-fourth of column (b) from Table 21.1. The variable costs of producing this coating are half the transfer price, that is, (b) = (a)/2, (e)=(a) - (b) - (c) - (d), and (f) = (e) × 0.35.

On the basis of the figures in this exhibit, value the profits the parent makes on its intracompany sales as follows:

$$\begin{aligned}
 \text{NPV} &= \sum_{t=1}^5 \frac{\text{sales}_t}{1.2^{(t+0.25)}} - \sum_{t=1}^5 \frac{\text{variable costs}_t}{1.2^t} - \sum_{t=1}^5 \frac{\text{taxes}_t}{1.2^{(t+1)}} \\
 &= 218 - 109 - 38 = \text{ESP } 71.
 \end{aligned}$$

- E2. Again consider Example 21.2. We add a second interaction. Specifically, assume that Weltek UK is currently exporting to Spain, via an independent agent. If Weltek

chooses to continue exporting instead of setting up production in Spain, unit variable costs will be higher (due to transportation cost, tariffs, etc.); and sales will be lower than expected because the agent is not as interested in promoting Weltek's goods as Weltek itself. On the other hand, no investments in fixed assets and marketing organization are required if exporting remains the mode of operation, and exporting does not create any extra overhead. Weltek's profits from exporting, and the corresponding taxes, are presented below.

	(a) Sales	(b) Variable costs	(c) Overhead	(d) Depre- ciation	(e) Taxable	(f) Tax (35%)
Year t						
1	420	231	0	0	189	66
2	551	303	0	0	248	87
3	463	255	0	0	108	73
4	243	134	0	0	109	38
5	128	70	0	0	58	20
PV	1,169	673	0	0	0	153

(e) = (a) - (b) - (c) - (d) ; (f) = (e) \times 0.35.

Due to shipping delays and the increased inventory levels needed in view of the distance, production for exports takes place six months before the moment of sale to the final Spanish customer (that is, at times 1, 2, ..., 5). Production costs lead production by three months. Compute the PV of the export profits lost when the project is undertaken, and decide whether Weltek should still consider direct investment in Spain. Use a 20 percent cost of capital.

A2. The present values of the cash flows are:

$$PV = \sum \frac{\text{sales}_t}{1.20^t} - \sum \frac{\text{variable costs}_t}{1.2(t - 0.25)} - \sum \frac{\text{tax}_t}{1.20^{(t+1)}} = 1169 - 673 - 153 = 343.$$

Now evaluate the project. The true NPV of the incremental cash flows equals (in millions of ESP)

– The NPV of the cash flows realized in Spain	-13
– Plus the PV of the profits Weltek makes at home,	71
– Minus the PV of the profits Weltek loses by no longer exporting	- 343
Total:	- 285

Thus, under this modified scenario, the investment project is no longer profitable.

E3. An Andorra company, Walden Inc., considers a proposal to produce and sell market inverters in Prisonia. The Prisonian dollar (PRD) is fully convertible into any OECD currency, and the country's capital market is unrestricted and well-integrated with western markets. The life of the project is three years. The initial investment consists of land (PRD 1,000) with an expected liquidation value of PRD 1,100; plant and equipment, and entry costs equal PRD 6,000, and are to be depreciated at 66 percent in year 1, 33 percent in year 2, and 1 percent in year 3. Estimated figures for sales, variable costs, and overhead are as follows:

	(a1) Sales	(a2) Sale of the land	(b) Variable costs	(c) Overhead	(d) Depre- ciation	(e) Taxes
Book year						
1	5,500	—	2,500	1,000	3,960	-784
2	10,000	—	4,200	1,200	1,980	1,048

3	12,800	—	5,600	1,300	60	2,336
4	—	1,100	—	—	—	400

* proceeds from the sale of the land

Sales occur, on average, in the middle of the year; variable costs are disbursed one month earlier, and customers pay three months later. Overhead and taxes are paid in the middle of the year. The investment occurs in the middle of year 0, and liquidation occurs in the middle of the fourth year. The discount rate is 15 percent for the operating cash flows, and 10 percent for the investment itself. Is this a viable proposal?

$$\begin{aligned}
 \text{A3.} \quad & \frac{\text{investment}}{1.15^{0.5}} = <6,674.24> \\
 & \sum_{t=1.75}^{3.75} \frac{\text{sales}}{1.15^t} = 18,694.30 \\
 & \sum_{t=1.25}^{3.25} \frac{\text{varcost}}{1.15^t} = <8,516.90> \\
 & \sum_{t=1.5}^{3.5} \frac{\text{overhead} + \text{taxes}}{1.15^t} = <3,989.60> \\
 & \frac{\text{sale land} - \text{tax}}{1.15^{4.5}} = \underline{373.21} \\
 & \text{NPV} = -113.23 < 0
 \end{aligned}$$

Mind-Expanding Exercises

- ME1. Consider a firm with a healthy cash flow but very low profits—because, for example, because of high depreciation allowances. Your boss argues that such a firm should probably borrow in a strong (low-interest) currency, because the high tax shield from weak-currency loans is more likely to be lost than the low tax-shield from strong-currency loans. Is this analysis complete?
- A1. No. The initial interest payments may be low, but for more distant dates the home-currency value of the service payments (including amortization) from a strong-currency loan is expected to go up and create a correspondingly large potential tax shield. A firm with low accounting profits may not be able to fully and immediately use these tax shields, especially if amortization comes in one big payment at the end. Thus, it is difficult to come up with a general rule as to which currency is the best choice in this instance.
- ME2. Denote the initial investment by I_0 , the operating cash flows by OC_t , the loan by D_0 , and the service payments on this loan by $Serv_t$. The standard NPV is computed as:

$$\sum_{t=T_1}^{t=T_N} \frac{OC_t}{(1+R)^t} - I_0.$$

- (a) Assume zero taxes and no uncertainty. One could, conceivably, compute an NPV from the shareholders' point of view by considering the cash flows after interest payments and the initial investment over and above the amount borrowed:

$$\sum_{t=T_1}^{t=T_N} \frac{(OC_t - Serv_t)}{(1+R)^t} - (I_0 - D_0).$$

Explain why, with zero taxes and no uncertainty, this produces the same answer as a standard NPV analysis. (Hints: (1) How does one compute the PV of a sum (or difference) of two risk-free cash flows? (2) What is the link between the PV of the service payments and the amount borrowed, D_0 ?)

- (b) Does uncertainty affect this conclusion?
- (c) Does the introduction of taxes affect this conclusion?

A2. (a) Value additivity means that:

$$\sum_{t=T_1}^{t=T_N} \frac{(OC_t - Serv_t)}{(1 + R)^t} = \sum_{t=T_1}^{t=T_N} \frac{OC_t}{(1 + R)^t} - \sum_{t=T_1}^{t=T_N} \frac{Serv_t}{(1 + R)^t}.$$

Moreover, $\sum_{t=T_1}^{t=T_N} \frac{Serv_t}{(1 + R)^t} = D_0$. Thus, both approaches are identical:

$$\sum_{t=T_1}^{t=T_N} \frac{(OC_t - Serv_t)}{(1 + R)^t} - (I_0 - D_0) = \sum_{t=T_1}^{t=T_N} \frac{(OC_t)}{(1 + R)^t} - I_0.$$

- (b) No, as long as the operating cash flows are not affected by financial distress. When there is uncertainty, the risks of OC_t and of $Serv_t$ are likely to be different, which implies that the correct discount rate depends on whether the series being discounted is OC_t or $Serv_t$ or $(OC_t - Serv_t)$. However, when the operating cash flows are not affected by financial distress, value additivity still holds, and the amount D_0 is still equal to the present value of the service payments. Thus,

$$\begin{aligned} PV(OC_t - Serv_t) - (I_0 - D_0) &= [PV(OC_t) - PV(Serv_t)] - (I_0 - D_0) \\ &= [PV(OC_t) - D_0] - (I_0 - D_0) \\ &= PV(OC_t) - I_0 \\ &= \text{Standard NPV} \end{aligned}$$

- (c) Yes. When there are taxes, one has to consider the effect of corporate and personal taxes on the cash flows accruing to the shareholders. That is, the annual cash flow to the shareholder is, in general, equal to $(OC_t - Serv_t + \text{tax effects}_t)$. Thus, with corporate and personal taxes:

$$PV(OC_t - Serv_t + \text{tax effects}_t) - (I_0 - D_0) = \text{standard NPV} + PV(\text{tax effects}_t).$$

Chapter 22 Exchange Risk and Capital Segmentation

Quiz

True-False Questions

- _____ 1. The entire NPV analysis can be conducted in terms of the host currency if money markets and exchange markets are fully integrated with the home market.
- _____ 2. The entire NPV analysis can be conducted in terms of the host currency if money markets, stock markets, and exchange markets are fully integrated with the home market.
- _____ 3. Forward rates can be used as the risk-adjusted expected future spot rates to translate the host-currency cash flows into the home currency. The home currency cash flows can then be discounted at the home-currency discount rate, if money markets and exchange markets are fully integrated with the home market.
- _____ 4. Regardless of the degree of market integration, the host-currency expected cash flows can always be translated into the home currency (by multiplying them by the expected spot rate), and then discounted at the home-currency discount rate.
- _____ 5. Regardless of the degree of market integration, the host-currency expected cash flows can always be translated into expected cash flows expressed in home currency. The home-currency cash flows can then be discounted at the home-currency discount rate that takes into account all risk.
- _____ 6. If you use the forward rate as the risk-adjusted expected spot rates, there is no need to worry about the dependence between the exchange rate and the host-currency cash flows.
- _____ 7. If markets are integrated and you translate at the forward rate, the cost of capital need not include a risk premium for exchange rate exposure.
- _____ 8. If markets are integrated and you translate at the forward rate, the cost of capital need not include a risk premium for exposure to the host-currency exchange rate to any currency.
- _____ 9. If you discount expected cash flows that are already expressed in home currency, the cost of capital should include a risk premium for exposure to the host-currency exchange rate.
- _____ 10. If you discount expected cash flows that are already expressed in home currency, the cost of capital should include a risk premium for exposure to all relevant exchange rates.
- _____ 11. If you translate at the forward rate, you can entirely omit exchange rate expectations from the NPV procedure.
- _____ 12. Exchange rate risk premia are sizeable. In fact, they are about as large as the (world) market risk premium.
- _____ 13. A highly risk-averse investor will accept risk only if he or she is certain to be compensated for this risk.
- _____ 14. A highly risk-averse investor will never select a high-risk portfolio.
- _____ 15. A risk-averse investor will select a high-variance portfolio only if the expected excess return is sufficiently high.
- _____ 16. A risk-averse investor will select a low-return portfolio only if the variance is sufficiently low.
- _____ 17. A particularly risk-averse investor will always select a low-return portfolio. This is because low return means low risk, and because the investor does not want to bear a lot of risk.

Ans. 1. false; 2. true; 3. true; 4. false: this statement ignores the covariance term; 5. true; 6. false; 7. false: there may still be some exposure to other exchange rates; 8. false; 9.

true; 10. true; 11. false; 12. false; 13. false: "certain" is nonsense; 14. false; 15. true; 16. true; 17. false

True-False Questions

Assume that money markets and exchange markets are free and the host-currency cash flow is risk-free.

- _____ 1. You can translate at the expected spot rate and discount at a risk-adjusted home-currency cost of capital.
- _____ 2. You can translate at the forward rate, and discount at a home-currency rate that takes into account exchange risk.
- _____ 3. You can translate at the forward rate, and discount at the risk-free home-currency rate.
- _____ 4. You can discount the host-currency cash flows at the foreign risk-free rate, and then translate the result at the current spot exchange rate.
- _____ 5. You can discount the host-currency cash flows at the foreign risk-free rate, and then translate the result at the expected future spot exchange rate.
- _____ 6. You can discount the host-currency cash flows at the foreign risk-free rate, and then translate the result at the forward exchange rate.
- _____ 7. If access to forward markets or foreign and domestic money markets is restricted, then the true value is always overstated if the foreign currency cash flow is translated at the forward exchange rate and then discounted at the domestic risk-free rate.

Ans. 1. true; 2. false; 3. true; 4. true; 5. false; 6. false; 7. false.

Additional Quiz Questions

- Q1. Suppose that you observe an efficient portfolio. There are the two methods with which you can infer the degree of risk-aversion of the investor who selects this particular portfolio. What are these two methods?
- A1. 1) By looking at how much the investor invests in the market portfolio and how much he invests in the risk-free asset.
2) The ratio of expected excess return to portfolio variance or the ratio of excess return over the covariance of the portfolio return with any individual asset.
- Q2. What's wrong with the following statement: "The CAPM says that the expected return on a given stock j is equal to the best possible replication one can obtain using the risk-free assets and the set of all risky assets (other than stock j)."
- A2. The statement should read: "The CAPM says that the expected return on a given stock j is equal to the best possible replication one can obtain using the risk-free assets and the market portfolio of all risky assets."
- Q3. Below, we reproduce some equations from the derivation of the CAPM. Equation [1] is the efficiency criterion. Equation [4] is the CAPM. Explain how and (especially) *why* the intermediary equations are derived.

$$\frac{E(\tilde{r}_j - r)}{\text{cov}(\tilde{r}_j, \tilde{r}_m)} = \theta, \quad \text{for all risky assets } j = 1, \dots, N \quad [1]$$

$$E(\tilde{r}_j - r) = \theta \text{ cov}(\tilde{r}_j, \tilde{r}_m) = [\theta \text{ var}(\tilde{r}_m)] \frac{\text{cov}(\tilde{r}_j, \tilde{r}_m)}{\text{var}(\tilde{r}_m)} = [\theta \text{ var}(\tilde{r}_m)] \beta_j \quad [2]$$

$$\sum_{j=1}^N x_j E(\tilde{r}_j - r) = \theta \sum_{j=1}^N x_j \text{cov}(\tilde{r}_j, \tilde{r}_m) = \theta \text{cov}\left(\sum_{j=1}^N x_j \tilde{r}_j, \tilde{r}_m\right) = \theta \text{cov}(\tilde{r}_m, \tilde{r}_m) \quad [3]$$

$$E(\tilde{r}_j) - r = \beta_j (E(\tilde{r}_m) - r) \quad [4]$$

A3. See the text on page 594.

Q4. Suppose investors from a country have access to a large set of foreign stocks, and that foreign investors can also buy stocks from that country. Which of the following statements is (are) correct?

- (a) The single-market CAPM, where the market portfolio is measured by the index of all stocks issued by local companies, is wrong.
- (b) The single-market CAPM, where the market portfolio is measured by the index of all stocks held by local investors, is wrong.
- (c) The single-market CAPM, where the market portfolio is measured by the index of all stocks held by local investors, is formally correct but not fit for practical use, because the correct index is not readily observable.
- (d) The single-market CAPM, where the market portfolio measured by the index of all stocks worldwide, is correct provided that there is a unified world market for all stocks.
- (e) The single-market CAPM, where the market portfolio is measured by the index of all stocks worldwide, is correct provided that there is no (real) exchange risk.
- (f) The international CAPM, containing the world market portfolio of all stocks and bonds is correct if there is a well-integrated world market and if all exchange risk is real.

A4. (a) is correct when it says it is wrong; (b) is incorrect when it says it is wrong; (c) is true; (d) is false (ignores real exchange risk issue); (e) is true; (f) false.

Exercises

E1. Suppose that you have the following data:

$E(\tilde{r}_j - r)$	(co)variance risks	
0.03	$\text{var}(\tilde{r}_1) = 0.04$	$\text{cov}(\tilde{r}_1, \tilde{r}_2) = 0.02$
0.04	$\text{cov}(\tilde{r}_2, \tilde{r}_1) = 0.02$	$\text{var}(\tilde{r}_2) = 0.06$

Asset 0 is the (domestic) risk-free asset, and asset weights in a portfolio are denoted as x_j , where $j = 0, \dots, 2$. Which of the following portfolios is efficient, and if the portfolio is efficient, what is the investor's degree of risk aversion?

- (a) $x_0 = 0, x_1 = 0.4, x_2 = 0.6$.
- (b) $x_0 = 0, x_1 = 0.6, x_2 = 0.4$.
- (c) $x_0 = 0, x_1 = 0.5, x_2 = 0.5$.
- (d) $x_0 = 0.2, x_1 = 0.4, x_2 = 0.4$.
- (e) $x_0 = 0.5, x_1 = 0.25, x_2 = 0.25$.
- (f) $x_0 = -1, x_1 = 1, x_2 = 1$.
- (g) $x_0 = 1, x_1 = 0, x_2 = 0$.
- (h) $x_0 = 2, x_1 = -0.5, x_2 = -0.5$.

A1.

	$\frac{E(\tilde{r}_1 - r)}{\text{cov}(\tilde{r}_1, \tilde{r}_p)}$	$\frac{E(\tilde{r}_2 - r)}{\text{cov}(\tilde{r}_2, \tilde{r}_p)}$
(a)	1.071	0.909
(b)	0.938	1.111

(c)	1.000	1.000
(d)	1.250	1.250
(e)	2.000	2.000
(f)	5.000	5.000
(g)	0.000	0.000
(h)	-1.000	-1.000

Portfolios (a) and (b) are inefficient. Portfolio (c) is efficient, and is held by the investor with relative risk aversion equal to unity; (c) is also the tangency portfolio of risky assets. Portfolios (d), (e), and (f) are efficient, because they consist of positive combinations of the tangency portfolio of risky assets and the risk-free asset. Portfolio (g) is efficient, and corresponds to infinite risk aversion. Portfolio (h) is inefficient: the tangency portfolio is sold short rather than held long.

- E2. Return to the example discussed in Chapter 21, of Weltek UK, which is considering an investment in Spain. Suppose that Spain has reverted to its pre-1970 policies, and does not allow its residents to buy foreign assets; nor are foreigners allowed to buy Spanish shares in the stock market. Moreover, Spanish interest rates are set by the government. Local industry is heavily protected, and trade with the rest of the OECD is minimal. Foreign direct investment is permitted but only after obtaining a license. From our previous discussion, we determine that we must use approach 1 (expected spot rates, etc.). We make one possible set of assumptions.

Assumption 1:

Expected Spot Rates. The ESP is deemed to be initially overvalued, which implies an expected devaluation of 12 percent either this or next year. On top of this, we expect a further depreciation by about 3 percent *p.a.* to reflect Spain's higher expected inflation rate relative to the UK.

Year	0	1	2	3	4	5	6
a) Lagged adjustment	1	0.940	0.890	0.890	0.890	0.890	0.890
b) Forecast	1	0.913	0.833	0.810	0.787	0.764	0.706

Line a) models the expected 12 percent devaluation in years 1 or 2 by two consecutive 6 percent devaluations. The lagged adjustment would be the forecast if, as of year 0, Spain's inflation rate were equal to the UK's inflation rate. But Spain's future inflation rate is expected to be 5 percent *p.a.*, versus only 2 percent in the UK. In line b) we therefore add the effect of differences in the expected future inflations by multiplying each year's line (a) number by $(1.02/1.05)^T$.

Assumption 2:

Covariance Risk of ESP Cashflows with the Exchange Rate. Because of trade barriers, the exchange rate has no impact on the ESP cash flows. Thus, we can set the covariance equal to zero. The expected GBP cash flows are then equal to the ESP expected cash flow times the expected exchange rate.

Assumption 3:

Cost of Capital. The cost of capital is estimated at 17 percent, close to risk-free rate. This is because the Spanish economy is (assumed to be) very isolated from the rest of the world, implying that neither the cash flows (in pesetas) nor the GBP/ESP exchange rate is correlated with the OECD market portfolio.

Compute the NPV of Weltek UK's investment in Spain.

- A2. To compute the NPV, use Table 21.1 to first convert the ESP value of each cell in the table into GBP at the expected future spot rate; and then we compute present values. The following exhibit summarizes the resulting GBP cash flows. The NPV is:

$$1634 - 37 - 653 - 235 - 174 - \frac{700}{1.12^{(0.5)}} = -52. \bullet$$

	(a1) Sales	(a2) Sale of land	(b) Variable costs	(c) Over- head	(d) Depre- ciation	(e) Taxable	(f) Tax (35%)
year t							
1	593	—	237	96	110	151	53
2	840	—	336	92	101	311	109
3	897	—	358	95	98	346	121
4	476	—	190	97	95	94	33
5	232	—	93	99	93	-53	-18
6	—	93	—	—	—	22	8
PV	1,634	37	653	234	247	174	174

ESP data are the same as in Exhibit 1 of Chapter 21. The GBP values in the current exhibit are computed by multiplying the ESP cash flows for each year T by the exchange rate forecast given in the assignment. (e) = (a) - (b) - (c) - (d) ; (f) = (e) \times 0.35. Sales in year 6 reflect the sale of the land.

- E3. Suppose the capital markets of the following three countries are well integrated: North America (with the dollar), Europe (with the ECU), and Japan (with the yen). Suppose that you choose the yen as the reference currency.
- Why does the average investor care about the JPY/USD and JPY/ECU exchange rates (besides how it relates to how his wealth is measured in JPY)?
 - What moments are needed in a mean-and-(co)variance framework, to summarize the joint distribution? Which of these are affected by the portfolio choice?
- A3. (a) Investors need the exchange rates to translate foreign returns into yens. In addition, American investors will worry about the JPY/USD exchange rate (because they care about their wealth as measured in USD), and Europeans will worry about the JPY/ECU exchange rate (because they care about their wealth as measured in ECU). Thus, the average investor cares about world market return (in JPY) and the changes in the JPY/USD and JPY/ECU exchange rates.
- $E(\tilde{r}_w)$, $\text{var}(\tilde{r}_w)$, $\text{cov}(\tilde{r}_w, \tilde{s}_{\text{JPY/USD}})$, $\text{cov}(\tilde{r}_w, \tilde{s}_{\text{JPY/ECU}})$, $E(\tilde{s}_{\text{JPY/USD}})$, $E(\tilde{s}_{\text{JPY/ECU}})$, $\text{var}(\tilde{s}_{\text{JPY/USD}})$, and $\text{var}(\tilde{s}_{\text{JPY/ECU}})$. The first four are affected by an individual's portfolio choice.
- E4. Suppose that your assistant has run a market-model regression for a company that produces sophisticated drilling machines, and finds the following results (t-statistic in parentheses):

$$r_j = \alpha + \beta r_m + \gamma s + e_j$$

$$r_j = 0.002 + 0.56 r_m + 4.25 s + e_j$$

(0.52) (1.25) (2.06)

Your assistant remarks that, as the estimated beta is insignificant, the true beta is zero. The exposure, in contrast, is significant, and must be equal to the estimated coefficient. How do you react?

- A4. You cannot simply conclude that $\beta = 0$. The low t-statistic says that, on the basis of only the sample information, it is *possible* that the true beta is zero. But you know more than a computer or calculator (which evaluate only the sample information). As an intelligent human being, you would not expect the true beta for a highly cyclical sector

(machine tools) to be zero, or even much below unity. Thus, the estimate 0.56 is probably better than the conjecture $\beta = 0$. An industry β would be more reliable.

The high t-statistic for the exposure (γ) means that one can reject, beyond what most statisticians would call a reasonable doubt, the hypothesis that the true exposure is zero. However, from a purely statistical point of view, the true exposure could still be 0.5, or 0.75, or 1—in fact, with $\sigma = 4.25/2.063 = 2.06$, anything in the range of $4.25 \pm (2 \times 2.063)$ is statistically acceptable. However, your common sense tells you that true exposures are unlikely to exceed unity. Thus, the estimated beta may be erring on the downward side, and the estimated γ almost surely errs on the upward side.

- E5. Suppose the world beta for a German stock (in DEM) equals 1.5, and its exposures to the dollar, the yen, and the pound are 0.3, 0.2, and 0.1, respectively.
- What is the best replicating portfolio if you can invest in a world-market index fund, as well as in dollars, yens, pounds, and marks?
 - What additional information is needed to identify the cost of capital?
- A5. (a) $x_W = 1.5$, $x_{USD} = 0.3$, $x_{JPY} = 0.2$, $x_{GBP} = 0.1$, and $x_{DEM} = 1 - 1.5 - 0.3 - 0.2 - 0.1 = -1.1$.
- (b) The expected excess returns on each of these assets (including, for the currencies, the risk-free rates).
- E6. Suppose that there are two countries, the US and Canada. The exposure of the company XUS, in terms of USD, is estimated as follows:

$$\tilde{r}_{XUS}^* = 0.12 + 0.30 \tilde{s}_{USD/CAD} + \varepsilon$$

What is the company's exposure in terms of CAD?

- A6. Over short periods, the percentage change in the CAD/USD rate is approximately equal to the negative of the change in the CAD/USD exchange rate. Thus, a 1 percent rise in the USD/CAD value means a -1 percent drop in the USD/CAD rate, and on average a -0.3 percent drop in the stock's USD price. Thus, the total effect on the CAD return from XUS of a 1 percent rise of the USD is $1 - 0.30 = 0.70$: $r_{XUS} = a + 0.7 \tilde{s}_{CAD/USD} + \varepsilon$

Mind-Expanding Exercises

- ME1. Critically discuss the following popular statements:
- "If an investor buys foreign stocks, he or she is also investing, in a sense, in the corresponding foreign currency."
 - "If a German investor buys oil futures, he or she is also investing in USD because oil prices are quoted in USD."
 - "If a German investor buys zinc or lead futures on FOX, London's (commodity) Futures and Options Exchange, the investor is also investing in GBP because the zinc or lead futures are quoted in GBP."
- A1. (a) Correct in the sense that there is likely to be a positive exposure to the foreign currency; however, the relative exposure need not be unity (as conventional wisdom often suggests).
- (b) This would be true if, as was the case in the second half of the seventies, oil prices were actually *fixed* (by OPEC) in terms of USD. Then a 10 percent appreciation of the USD meant a 10 percent increase in the DEM price of oil. Nowadays, oil prices are no longer fixed in USD, though. An 10 percent appreciation of the

USD combined with a constant USD oil price would lead to a drop in demand for oil outside the US, which would then exert a downward pressure on the USD price of oil. That is, a 10 percent appreciation of the USD is likely to be associated with a drop in the USD price, implying that, to a German investor, the dollar exposure of oil futures is likely to be below unity.

- (c) The GBP exposure of zinc futures is probably quite low. Since most of the lead and zinc consumption actually originates from outside the UK, an increase in the value of the pound would seriously affect demand from the rest of the world if the GBP price would stay constant. Thus, the GBP price of zinc would drop so as to undo (most of) the effect of the appreciation of the GBP, implying that, to a German investor, the GBP exposure of zinc futures is probably rather low.

- ME2. Suppose that there are just two countries. The CAD T-bill rate is 6 percent *p.a.*, and the USD rate 5 percent. In terms of CAD, the world market portfolio and the USD T-bill are expected to outperform the CAD T-bill rate by 8 percent and 1 percent *p.a.*, respectively. You run a regression on past data, which yields the following estimates:

$$\tilde{r}_{XUS} = 0.08 + 0.8 \tilde{r}_w + 0.25 \tilde{s}_{CAD/USD} + \epsilon.$$

What is the expected return, in CAD, on XUS common stock (a) if you use the International CAPM, and (b) if you use the regression only? How do you explain the differences? Which is more trustworthy?

- A2. According to the International CAPM, $E(\tilde{r}_{XUS}) = 0.06 + (0.8 \times 0.08) + (0.25 \times 0.01) = 0.1265$. This is different from the expected value obtained from the regression output. The regression itself would predict a return equal to $0.08 + 0.8 \times [0.08 + 0.06] + 0.25 \times [0.01 - 0.05 + 0.06] = 0.197$.¹ In light of the CAPM, one possible diagnosis is that the estimated intercept, 0.08, is too high: during the sample period, the stock happened to realize an average return that was higher than expected. In that sense, the international CAPM is more trustworthy than the regression, since it avoids excessive reliance on the sample mean return from the stock. However, the beta or gamma is also likely to contain some measurement error, and your expected world market return and expected risk premium on the USD T-bill may be inexact. The message is that, even with the guidance from CAPM, the cost of capital remains an estimate subject to error and is worth some sensitivity analysis.

- ME3. Suppose that there are three countries: the US, Canada, and the European Union. So from the US point of view, there are two exchange rates, USD/CAD and USD/ECU. The exposure of company XUS, in terms of USD, is estimated as follows:

$$\tilde{r}_{XUS}^* = 0.03 + 0.20 \tilde{s}_{USD/CAD} + 0.15 \tilde{s}_{USD/ECU} + \epsilon^*.$$

What is the exposure in terms of CAD? That is, what are $\gamma_{XUS,CAD/USD}$ and $\gamma_{XUS,CAD/ECU}$ in

$$\tilde{r}_{XUS} = \alpha + \gamma_{XUS,CAD/USD} \tilde{s}_{CAD/USD} + \gamma_{XUS,CAD/USD} \tilde{s}_{CAD/USD} + \epsilon?$$

Hint: substitute $\tilde{s}_{CAD/USD} \hat{=} -\tilde{s}_{USD/CAD}$ and $\tilde{s}_{USD/ECU} \hat{=} \tilde{s}_{CAD/ECU} - \tilde{s}_{CAD/USD}$ into the original exposure regression, and then use $\tilde{r}_{XUS}^* \hat{=} \tilde{r}_{XUS} + \tilde{s}_{CAD/USD}$. It can be shown that these linear approximations induce very little error in the implied CAD exposures, although they are more off the mark with regard to the implied CAD intercept.²

¹ The terms within square brackets are the expected returns. $E(r_w) = [E(r_w) - r] + r = 0.08 + 0.06$; similarly, $E(\tilde{s}_{CAD/USD}) = [E(\tilde{s}_{CAD/USD}) + r_{USD} - r] - r_{USD} + r = 0.01 - 0.05 + 0.06 = 0.02$.

² See Sercu (1981, Appendix) for a more formal derivation of the link between the two exposure regressions.

- A3. Start from the exposure regression in terms of USD. First, rewrite the exchange rates in CAD terms:

$$\tilde{r}_{XUS} = 0.03 + 0.20 \tilde{s}_{USD/CAD} + 0.15 \tilde{s}_{USD/ECU} + \varepsilon$$

$$\cong 0.03 + 0.20 [-\tilde{s}_{CAD/USD}] + 0.15 [\tilde{s}_{CAD/ECU} - \tilde{s}_{CAD/USD}] + \varepsilon.$$

Then, add $\tilde{s}_{CAD/USD}$ on both sides to obtain the return in CAD:

$$\tilde{r}_{XUS}^* \cong \tilde{r}_{XUS} + \tilde{s}_{CAD/USD}$$

$$\cong 0.03 - 0.20 [\tilde{s}_{CAD/USD}] + 0.15 [\tilde{s}_{CAD/ECU} - \tilde{s}_{CAD/USD}] + \tilde{s}_{CAD/USD} + \varepsilon$$

$$= 0.03 + (1 - 0.20 - 0.15) \tilde{s}_{CAD/USD} + 0.15 \tilde{s}_{CAD/ECU} + \varepsilon$$

$$= 0.03 + 0.65 \tilde{s}_{CAD/USD} + 0.15 \tilde{s}_{CAD/ECU} + \varepsilon.$$

Thus, the new exposure to the old reference currency (0.65 for the USD) is equal to unity minus the sum of the old exposures (that is, $1 - 0.2 - 0.15$), while the exposure to third currency (the ECU) is not affected.

Chapter 23 International Taxation

Quiz

True-False Questions

- _____ 1. The term "permanent establishment" (PE) is just tax-speak for "branch." That is, every branch is a PE and vice versa.
- _____ 2. As soon as there is a permanent physical presence abroad, there is a PE.
- _____ 3. A PE has a separate accounting system, while a branch does not.
- _____ 4. If a person lives or earns in more than one country, there may be double taxation.
- _____ 5. The source principle says that any person earning money in a particular country is taxable in that country on his or her world-wide income.
- _____ 6. Withholding taxes are levied by the host country on the taxpayer's world-wide income.
- _____ 7. The legal basis for withholding taxes on nonlabor income paid to foreigners is the residence principle.
- _____ 8. The Capital Import Neutrality principle says that the foreign branch ought to be taxed as if it were a locally owned company.
- _____ 9. The Capital Export Neutrality principle says that the foreign branch ought to be taxed as if it were a locally owned company.
- _____ 10. The Capital Export Neutrality principle says that there should be no fiscal benefit or penalty associated with the fact that ownership and operations straddle two countries.
- _____ 11. The deferral principle applies equally to the exclusion system and the credit system.
- _____ 12. Disagreement on how to compute the income of a foreign branch arises only under the credit system.
- _____ 13. Disagreement on how to compute the income of a foreign branch arises under both the credit system and the exclusion system.
- _____ 14. Disagreement on how to compute the income of a foreign subsidiary arises only under the credit system.
- _____ 15. Disagreement on how to compute the income of a foreign subsidiary arises under both the credit system and the exclusion system.

Ans. 1. false; 2. false; 3. false; 4. true; 5. false; 6. false; 7. false; 8. true; 9. false; 10. false: this is a definition of universal neutrality; 11. false: also arises under exclusion in the branch case; 12. false; 13. true; 14. true; 15. false.

Below, a *marginal* tax rate is to be understood as the *additional* taxes you pay per cent or penny or öre for each additional unit of foreign income from one particular host country. The average

tax rate is to be understood as the total tax paid on all foreign income as a percentage of the foreign income. For the questions that relate to the credit system, it is assumed that foreign income is taxed separately from domestic income. Verify whether the following statements are true or false.

- _____ 16. Under a 100-percent-exclusion system, the marginal tax rate on foreign income is the foreign corporate tax rate (τ_c^*).
- _____ 17. Under a 100-percent-exclusion system, the marginal tax rate on foreign income is the foreign corporate tax rate (τ_c^*) plus the foreign withholding tax (τ_w).
- _____ 18. Under a 100-percent-exclusion system, the marginal tax rate on foreign income is given by
- $$1 - (1 - \tau_c^*)(1 - \tau_w) = \tau_c^* + \tau_w - \tau_c^* \tau_w.$$
- _____ 19. Under a credit system, the marginal tax rate on foreign income is the home-country corporate tax rate τ_c .
- _____ 20. Under a credit system, the marginal tax rate on foreign income is the higher of either the home-country corporate tax rate τ_c or the marginal foreign tax.
- _____ 21. Under a credit system, the marginal tax rate on foreign income is bounded from above and below by the home-country corporate tax rate τ_c and the marginal foreign tax.
- _____ 22. Under a credit system, the average tax rate on foreign income is the home-country corporate tax rate τ_c .
- _____ 23. Under a credit system, the average tax rate on foreign income is either the home-country corporate tax rate τ_c or the average foreign tax—whichever the higher.
- _____ 24. Under a credit system, the average tax rate on foreign income is bounded from above and below by the home-country corporate tax rate τ_c and the average foreign tax.

- A. 16. false: ignores withholding taxes; 17. false: corporate and withholding tax rates are not additive; 18. true; 19., 20., 21. false: the marginal tax rate may even be zero, notably if the additional foreign income from a particular country can use tax credits that would have been entirely unused in the absence of the additional income; 22. false: could be higher, if there are unused tax credits; 23. false: you could also pay a rate in between the two tax rates: (a) if the average foreign rate is below the domestic rate, you pay the domestic rate, (b) if the average foreign rate is above the domestic rate, you have excess tax credits, (c) if the excess tax credits can be fully used, you still pay only the domestic rate (on average). (d) if they can be used only partially (or with a delay), you pay more than the domestic rate but less than the average foreign rate, (e) if the excess tax credits are fully lost, you pay the (average) foreign rate; 24. true: see (8).

Additional Quiz Questions

- Q1. Suppose that foreign activity is conducted through a wholly owned subsidiary. Which assumptions are needed to achieve both Capital Import and Capital Export Neutrality?
- (a) The home and host corporate tax rates are the same.
- (b) There is no withholding tax on dividends.

- (c) The tax basis is computed in exactly the same way in both countries.
 - (d) Full payout.
 - (e) No interest payments, no license payments, no lease payments, and no management fees between WOS and parent.
 - (f) A credit system applies to nondividend remittances from WOS to parent.
- A1. (a), (b), and (c) are needed for a branch. For a subsidiary, either (c) or (f) are needed.
- Q2. What does one mean by the *residence principle* and the *source principle*? What do these principles imply for the taxation of income on
- (a) Pure (direct) exports?
 - (b) Exports through a dependent agent?
 - (c) Exports through a branch/PE?
 - (d) Foreign activities through a subsidiary?
- A2. (a) Income will only be taxed in the home country.
(b) and (c) Income will be taxed in the host country based on the source principle and in the home country based on the residence principle.
(d) In the host country, the subsidiary's profits (using the host-country's income tax) and its remittances (using the host-country's withholding tax) to the parent will be taxed based on both the residence and source principles, and in the home country, the remittances will be taxed based on the residence principle.
- Q3. Explain, using a numerical example of your own, how differences between the host and home-country rules for the allocation of overhead can impair the neutrality of a credit system or an exclusion system.
- A3. Just do it.
- Q4. How do companies take advantage of the basic exclusion system for dividends? Which additional tax rules can be applied to prevent these unintended uses?
- A4. Firms make pre-tax royalty, interest or lease payments to a holding company in a tax haven. The holding company pays a minimal tax on this income and then remits it in the form of tax-free dividends. To close this loophole, countries often refuse to sign bilateral tax treaties with tax havens such that an exclusion on income from a subsidiary in a tax haven is only partial. In addition, tax authorities also use look-through rules.
- Q5. How can one reduce excess foreign tax credits by transforming domestic income into foreign income? Which additional tax rules can be applied to prevent such tactics?
- A5. For instance, a US firm could replace its domestic USD-denominated bonds by foreign-issued USD bonds of the same quality so that domestic interest income is replaced by (low-taxed) "foreign" interest income. Then the firm can use its excess foreign tax credits from its foreign operations to avoid taxes on this interest income. One tax rule to disallow this is to define foreign income in baskets (such as active or passive). Any tax credits from one basket cannot be transferred to another.
- Q6. Conventional wisdom says that tax planning means minimizing foreign taxes. Is this true under the exclusion system? Is it true under the credit system? If your answer was yes in both cases, is there no difference between these systems regarding the tax savings you make by tax planning?
- A6. Tax planning means minimizing foreign taxes under both systems, but each takes a different approach. Under the credit system, additional home taxes are due if foreign taxes are less than the domestic norm. That is, the firm cannot keep foreign tax savings if they are below the domestic norm. Under the exclusion system, all foreign tax savings on profits and dividends can be kept.

- Q7. The barman of your favorite pub sneers that, by using transfer pricing, a company can always eliminate its excess foreign tax credits. Do you agree, or do you think that he is forgetting something? Why?
- A7. No, because the tax authorities may find the costs exceed an arm's length level, and reject part of the costs. In such a case, taxes will be higher than before the cost reallocation. Plus, as the prices of the goods increase, so will the import taxes.

Exercises

- E1. A foreign-owned company earns 100,000 in its host country. The host country corporate tax is 50 percent, the withholding tax 20 percent, and the home country tax is 40 percent.
- What is the total tax if there is no relief from double taxation?
 - Still assuming full double taxation, what tax could have been avoided if the business had been conducted through a branch/PE?
 - Go back to the case of a WOS. What is the total tax burden if there is full payout and if the exclusion principle applies in the home country?
 - What is the total tax burden if there is full payout and if the exclusion privilege is only 80 percent?
 - What is the total tax burden if there is full payout and the host country uses a credit system?
 - In question (e), does it matter whether the host country taxes foreign income separately from domestic income?

A1.

	(a)	(b)	(c)	(d)	(e)
Foreign income	100	100	100	100	100
Foreign income tax (50%)	<50>	<50>	<50>	<50>	<50>
Foreign income after tax	50	50	50	50	50
Gross dividend paid out	50	50	50	50	50
Withholding tax (20%)	<10>	n/a	<10>	<10>	<10>
Net dividend	40	50	40	40	40
Add: direct tax credit	n/a	n/a	n/a	n/a	10
indirect tax credit	n/a	n/a	n/a	n/a	50
Tax basis	40	50	0	8	100
Normal home tax (40%)	16	20	0	3.2	40
Credit: direct	n/a	n/a	n/a	n/a	<10>
indirect	n/a	n/a	n/a	n/a	<50>
Net home tax	16	20	0	3.2	0
Excess tax credit	n/a	n/a	n/a	n/a	20*
Total taxes paid	76	70	60	63.2	60**

* Assuming excess tax credit cannot be used elsewhere

** Assuming the excess tax credits can be used elsewhere.

- (f) If domestic and foreign income are first added together before taxes are computed and tax credits invoked, the probability of being able to use excess foreign taxes is higher.
- E2. Suppose that the corporate tax schedule in Finland is as follows:
- 25 percent tax on income below FIM 50,000.
 - 30 percent tax on income between FIM 50,000 and FIM 100,000.
 - 35 percent tax on all income exceeding FIM 100,000.

- (a) What is the tax if a Finnish corporation's income is FIM 200,000, whereof 100,000 are profits on domestic sales and 100,000 are profits on exports to Hong Kong (without PE in Hong Kong)?
- (b) Assume that Hong Kong levies a flat 15 percent corporate tax, and no withholding tax on dividends, and that Finland applies a pure exclusion system. Is there any incentive to set up a branch/PE in Hong Kong? If so, what is the world-wide tax?
- (c) Add to question (b) a rule under which Finland preserves the progressiveness of the tax schedule (See Figure 23.1). Is there still an incentive to set up a branch/PE in Hong Kong? If so, what is the world-wide tax?
- (d) Repeat question (c) and assume that Hong Kong's tax schedule is identical to Finland's, and that Hong Kong also preserves progressiveness. Is there still an incentive to set up a branch/PE in Hong Kong? If so, what is the world-wide tax?
- A2. (a) $(50,000 \times 0.25) + (50,000 \times 0.30) + (100,000 \times 0.35) =$ FIM 62,500
- (b) Yes, there is an advantage. Taxes are as follows:
- | | |
|---|-------------------|
| In Finland: $(50,000 \times 0.25) + (50,000 \times 0.30) =$ | FIM 27,500 |
| In Hong Kong: $100,000 \times 15$ percent = | <u>FIM 15,000</u> |
| World-wide: | FIM 42,500 |
- (c) The advantage is smaller. From (a), the average tax rate applicable to a world-wide income of FIM 200,000 is $\frac{62,500}{200,000} = 31.25$ percent. Thus, the total tax will be as follows:
- | | |
|---|-------------------|
| In Finland: $100,000 \times 0.3125 =$ | FIM 31,250 |
| In Hong Kong: $100,000 \times 15$ percent = | <u>FIM 15,000</u> |
| World-wide: | FIM 46,250 |
- (d) The advantage is eliminated. From (a), the average tax rate applicable to a world-wide income of FIM 200,000 is $\frac{62,500}{200,000} = 31.25$ percent in either country. Thus, the total tax will be as follows:
- | | |
|---|-------------------|
| In Finland: $100,000 \times 0.3125 =$ | FIM 31,250 |
| In Hong Kong: $100,000 \times 0.3125 =$ | <u>FIM 31,250</u> |
| World-wide: | FIM 62,500 |
- E3. The company Think Tankards has a stable foreign income which is taxed at a low rate abroad. In each of the three preceding income years, it effectively paid USD 50m in additional US taxes on foreign income, and it expects to do the same for the years to come. For the current year, however, there is a USD 100m excess foreign tax credit. How is this excess credit treated under each of the following carry-forward/carry-back rules? What is the present value of the loss if future tax breaks are discounted at 15 percent?
- (a) No carry-back, one-year carry-forward.
- (b) No carry-back, two-year carry-forward.
- (c) One year carry-back, two-year carry-forward.
- (d) Two year carry-back, two-year carry-forward.
- A3. (a) USD 50m will be used with a one-year delay, implying a loss of time value of $50\text{m} - \frac{50\text{m}}{1.15} = \text{USD } 6.522\text{m}$. The remaining USD 50m is lost forever. Thus, the total time-value loss is USD 56.522m.
- (b) USD 50m will be used with a one-year delay, implying a loss of time value of $50\text{m} - \frac{50\text{m}}{1.15} = \text{USD } 6.522\text{m}$. The remaining USD 50m will be used with a two-year delay, implying a loss of time value of $50\text{m} - \frac{50\text{m}}{1.15^2} = \text{USD } 12.193\text{m}$. Thus, the total time-value loss is USD 18.715m.

- (c) USD 50m is carried back one year and triggers a refund. The remaining USD 50m will be used with a one-year delay, implying a loss of time value of $50m - \frac{50m}{1.15} = \text{USD } 6.522m$.
- (d) USD 50m is carried back one year, and the remaining USD 50m is carried back two years, thus triggering a total refund of USD 100m. There is no loss of time value.
- E4. A Belgian bank holds BEF 10 billion worth of seven-year BEF Government bonds, with a direct yield of 10 percent (that is, its annual interest income is BEF 1b).
- (a) Until the tax reform in 1992, the bank could transform its interest income into dividend income which enjoyed a 90 percent exclusion privilege. Specifically, the bank sold its bonds to a Dublin dock company (DDC), which was fully-owned by an Irish holding company (IHC), which in turn was fully owned by the Belgian bank (BB). Interest income received by the DDC was taxed at 10 percent, and then paid out as a dividend to IHC, which did not pay any taxes (100 percent exclusion within Ireland). IHC then paid the dividend to its owner, BB.³ Assume no withholding tax between Belgian and Ireland, and a 90 percent dividend exclusion and a 40 percent corporate tax rate in Belgium. What was the annual tax gain?
- (b) A tax consultant suggested that BB would gain even more by swapping its seven-year, 10 percent BEF bonds into NZD, which at that time yielded 20 percent. Thus, the consultant argued, the gains would be doubled. What crucial feature is overlooked in this argument? (Hint: you need an insight from Chapter 4.)
- (c) Although the argument of the tax consultant is full of holes, it is basically correct: there *is* a gain from swapping the BEF into NZD. What is the gain? (Hint: you again need an insight from Chapter 4.)
- A4. (a)
- | | Before | After |
|-------------------------------------|------------|------------------------|
| DDC Interest Income | n/a | 1,000m |
| Taxes (10 percent) | n/a | <u><100m></u> |
| DDC income after tax | n/a | 900m |
| Dividend received by BB | 0 | 900m |
| Interest income from bond portfolio | 1,000m | 0 |
| Taxable income from portfolio | 1,000m | 90m (10% of dividends) |
| Belgian tax | 400m | 36m |
| Total taxes paid | 400m (40%) | 136m (13.6%) |
- Thus, the annual gain is 264m.
- (b) The consultant overlooks exchange rate changes. The 10 percent on BEF 10b is BEF 1b without any exchange risk. In contrast, the 20 percent on the initially equivalent amount of NZD is expected to depreciate (in a risk-adjusted sense). Thus, the annual tax saving is expected to gradually decrease. In addition, the principal (in NZD) is expected to have depreciated substantially by the time the bonds expire, while the value of the BEF bond portfolio will not depreciate.
- (c) If interest income and capital gains/losses are subject to the same tax rates, then there is no gain or loss from swapping in the sense that the value of the portfolio does not increase at the moment the swap is signed. This follows from the (initial) zero-value property of a swap: the higher NZD interest rate is offset, in a risk-adjusted sense, by the expected depreciation of the NZD, and this equivalence remains if everything is taxed at the same rate. However, under the DDC/IHC set up, interest income is taxed at 13.6 percent, while the capital loss (after seven

³ A nice additional detail was that BB held mostly preferred stock of IHC, redeemable after seven years, rather than common stock. Redeemable preferred stock issued by a financial company comes into the same BIS risk class as government bonds, while common stock would have absorbed more capital.

years, when the IHC is liquidated) is a fully realized capital loss, with a 40 percent tax shield. Thus, it pays to increase the interest income and create capital losses.

- E5. Your two foreign outposts, a branch in Germany and one in Singapore, each have sales of 100. The host country tax rates are 40 percent and 20 percent, respectively.
- If your home country uses the credit system and has a 30 percent tax, how would you (try to) allocate total costs (120) over the two subsidiaries? Assuming an unlimited potential to shift costs, is there an incentive to allocate *all* costs to one branch?
 - Assume that your country uses a credit system, and that you have very little leeway in reallocating costs over the two branches. So you consider increasing the transfer price charged by Singapore to Germany. Imports into the European Union are taxed at 25 percent. Would you increase or decrease the transfer price?
 - In question (b), as of what level of the import duty τ_m is the advantage wiped out?
 - Same question as (a), except that your home country applies a 90 percent exclusion rule?
- A5. (a) By shifting costs worth Δ from Singapore to Germany, Singapore profits go up while German profits go down by Δ —implying that Singapore taxes go up by $\Delta \times 0.20$ while German taxes go down by $\Delta \times 0.40$. Minimal foreign taxes reduce the risk of foreign excess taxes. Thus, by maximizing Δ , you minimize costs allocated to Singapore. However, there should not be any losses in Germany: there is no negative tax in Germany, nor is there any negative tax credit at home for foreign losses. In addition, there is no more gain if the average foreign tax rate falls below 30 percent, and this critical level is achieved when German and Singapore profits are equal.
- (b) By increasing the transfer price charged to Germany by Δ , Singapore taxes go up by $\Delta \times 0.20$, as before. However, there is an additional $\Delta \times 0.25$ paid in import duties, thus German costs go up by $\Delta \times 1.25$, saving $\Delta \times 1.25 \times 0.40 = \Delta \times 0.50$ in German income taxes. Thus, the gain is now $\Delta \times 0.05$ rather than $\Delta \times 0.20$, because most of the gain is eliminated by the import duty.
- (c) If $(\Delta \times 0.20) + (\Delta \times \tau_m) = \Delta \times (1 + \tau_m) \times 40\%$, that is, if $\tau_m = \frac{40\% - 20\%}{1 - 40\%} = 33.33$ percent.
- (d) It is still advantageous to shift profits to Singapore. The gain keeps increasing, the more profits you allocate to Singapore—even when the average foreign tax rate drops below 30 percent.
- E6. Your only source of foreign income is a marketing WOS in Hong Kong, where the tax rate is 20 percent. At home you pay 35 percent. There is no withholding tax.
- Under the 100 percent exclusion method, would you use a high transfer price or a low transfer price for sales to the subsidiary?⁴
 - Same question as (a), except that the credit method applies.
 - Same question as (a), but there is a 10 percent import duty on sales to Hong Kong.
- A6. (a) Shifting profits to low-tax Hong Kong is advantageous. Thus, you would use a lower transfer price.
- (b) If there is full payout, there is no gain from shifting profits to low-tax Hong Kong. The only advantage would be to postpone payout and, thus, postpone the additional 15 percent in home country taxes.
- (c) By lowering the amount invoiced to Hong Kong by Δ , home taxes decrease by $\Delta \times 0.35$, while import duties decrease by $\Delta \times 0.10$ and Hong Kong income taxes

⁴ A transfer price is the price charged by one unit (subsidiary, department, unit, etc.) of an organization for a product or service supplied to another unit of the same organization.

increase by $\Delta \times 1.10 \times 0.20$. The gain is $\Delta \times (0.35 + 0.10 - 1.10 \times 0.20) = \Delta \times 0.23$, which is positive (and larger than the difference in the corporate taxes).

- E7. Suppose that the German parent has sales equalling 200, and the Tunisian branch, 100. Direct costs are 80 and 30, respectively. German tax authorities allocate overhead, which amounts to 120, on the basis of sales, while in Tunisia allocation is proportional to direct cost. German and Tunisian taxes are 40 percent. Are you vexed by or happy with this discrepancy between the rules? Consider both the credit system and the exclusion system.

- A7. Germany gets allocated $120 \times \frac{200}{200 + 100} = 80$ of the overhead, and you will be taxed on an income of $(200 - 80 - 80) = 40$. Tunisia can deduct $120 \times \frac{30}{30 + 80} = 32.72$ for the purpose of Tunisian taxation, and you will be taxed on $(100 - 30 - 32.72) = 37.28$. Thus, not all of the overhead is tax deductible. Under the German rules, the parent reassess the Tunisian income as $(100 - 30 - 40) = 30$.

	Head office	Tunisian taxes	German tax computation on Tunisian income
Sales	200	100	100
Direct cost	<80>	<30>	<30>
Allocated overhead	<80>	<32.72>	<40>
Taxable	40	37.28	30
Tax (40 percent)	16	14.91	12

Under the credit system, the total foreign tax (14.91) is too high relative to the German tax, creating an excess tax credit problem even though both tax rates are equal. If there is enough low-tax income from elsewhere, this excess tax credit may still be recovered.

Under the exclusion system, only 30 is exempt from German taxation even though 37.72 was taxed in Tunisia. The excess tax cannot be recuperated in any way.

- E8. A US corporation has two foreign marketing branches, one in France and one in Hong Kong. The current situation is summarized as follows (all numbers in thousands of USD):

	Hong Kong	France	US (domestic income)	
Sales	1,000	5,000	10,000	*
Costs: purchases from parent	500	2,500	n/a	
other expenses	100	500	6,000	
depreciation	<u>100</u>	<u>500</u>	<u>1,000</u>	
profits	300	1,500	3,000	
Corporate taxes	<u>45</u> (15%)	<u>600</u> (40%)	<u>900</u> (30%)	
Profits after taxes	255	900	2,100	

* Including sales to subsidiaries.

- (a) The US tax rate is 30 percent, and taxation of foreign and domestic income is separated, with the foreign tax credit applied to the tax on foreign income only. Is there still a US tax due, or is there an unused tax credit?
- (b) The parent is currently making a profit on its "sales" to the branches, but considers changing the profit allocation. The company thinks that it can increase or decrease the transfer price by up to 5 percent without creating any problems with the tax authorities, on the condition that the transfer price remains the same for both branches. Should the company increase the price or decrease it?

- (c) Is your conclusion in (a) or (b) affected if domestic and foreign income is taxed together (that is, the tax is computed on world-wide income, and then the tax credit is applied)?

A8. (a) Under the US tax code, the total tax on foreign income should be $(300 + 1,500) \times 30\% = 540$, which is less than the taxes already paid abroad, $45 + 600 = 645$. Thus, there is an unused tax credit of 105.

- (b) A 5 percent increase in the transfer price leads to the following result:

	Hong Kong		France		US (domestic income)	
Sales	1,000		5,000		10,150	*
Costs: purchases from parent	525	(+5%)	2,625	(+5%)	n/a	
other expenses	100		500		6,000	
depreciation	100		500		1,000	
profits	275		1,375		3,150	
Corporate taxes	41.25	(15%)	550	(40%)	945	(30%)
Profits after taxes	233.75		825		2,205	
US tax due	495.00 (30% on 275 + 1,375)					
Credit	<u>591.25</u>					
Excess foreign taxes	96.25					

* Total foreign and domestic taxes are 1,536.25. This is 8.75 less than before the transfer price is increased.

- A 5 percent decrease in the transfer price leads to the following result:

	Hong Kong		France		US (domestic income)	
Sales	1,000		5,000		9,850	*
Costs: purchases from parent	475	(-5%)	2,375	(-5%)	n/a	
other expenses	100		500		6,000	
depreciation	100		500		1,000	
profits	325		1,625		2,850	
Corporate taxes	48.75	(15%)	650	(40%)	855	(30%)
Profits after taxes	275.25		975		1,995	
US tax due	585.00 (30% on 325 + 1,625)					
Credit	<u>698.75</u>					
Excess foreign taxes	113.75					

* Total foreign and domestic taxes are 1,553.75. In this case, total taxes are highest.

Because total taxes paid and the excess foreign taxes are least, the company should increase in the transfer price.

- (c) There would be no unused tax credit, and the corporation would pay 30 percent on its world-wide income no matter how transfer prices are set. Transfer pricing would only affect how much of the 30 percent is paid abroad and how much is paid at home.

E9. Sales and costs are 200 and 100, respectively, for the Tunisian, and 100 and 60 for the Hong Kong branch. The tax rates are 50 percent in Tunisia, and 25 percent in Hong Kong. The parent's home country, Germany, has a 40 percent tax rate and applies the credit system.

- (a) Verify that there is an excess tax credit of 4.

- (b) Verify that when the parent shifts costs worth 40 from Hong Kong to Tunisia, the original excess tax credit has been replaced by a foreign tax shortfall of 6.
- (c) Suppose that the Tunisian tax authorities unexpectedly reject the additional costs (40), so that this part of the costs is not deductible anywhere. What is the total tax?

A9.

	Tunisia	Hong Kong	Total
Before reallocation:			
Sales	200	100	300
Costs	<100>	<60>	<160>
Declared Profit	100	40	140
Host country tax	<50> (50%)	<10> (25%)	
Total foreign taxes	60		
German tax due	$56 = (140 \times 0.4)$		
Excess tax credit	$4 = 60 - 56$		
After reallocation—if it is accepted:			
Sales	200	100	300
Costs	<140>	<20>	<160>
Declared Profit	60	80	140
Host country tax	<30> (50%)	<20> (25%)	
Total foreign taxes	50		
German tax due	$56 = (140 \times 0.4)$		
Excess tax credit	$6 = 56 - 50$		
After reallocation—if the Tunisian authorities object:			
Sales	200	100	300
Costs (declared)	<140>	<20>	<160>
Declared Profit	60	80	140
Rejected costs	40	—	
Tax basis	100	80	
Host country tax	<50> (50%)	<20> (25%)	
Total foreign taxes	70		
German tax due	$56 = (140 \times 0.4)$		
Excess tax credit	$14 = 70 - 56$		

Mind-Expanding Exercise

ME1. A UK company wants to help a long-standing supplier in the US who is in need of cash. The alternatives that are considered are the following:

- The UK company can buy D worth of seven-year bonds, newly issued by the US company, at a *p.a.* interest rate of R_B .
- Alternatively, the UK company can buy D worth of preferred stock, newly issued by the US company. The stock is redeemable after seven years and carries a *p.a.* preferred dividend of R_P .

The rate on the loan, R_B , must be an arm's length rate; that is, R_B is given. In order for the preferred-stock alternative to be acceptable, the preferred dividend rate R_P should be set such that (1) the US company is not worse off with preferred stock, and (2) the UK company is not worse off either. We only investigate the tax aspects. Below, we demonstrate the well-known result that the US company is not worse off if

$R_P \leq R_B (1 - \tau_{US})$, where τ_{US} is the US corporate tax rate:

	Residual cash flows for the US borrower	
	With bonds	With preferred stock
Earnings before interest & taxes <Interest paid>	X < $R_B D$ >	X <0>
Taxable	$X - R_B D$	X
Earnings after taxes <Preferred dividend paid>	$(X - R_B D) (1 - \tau_{us})$ <0>	$X (1 - \tau_{us})$ < $R_P D$ >
Available for common shareholders	$(X - R_B D) (1 - \tau_{us})$	$X (1 - \tau_{us}) - R_P D$

From the last line, the US borrower will accept preferred stock if $R_P \leq R_B (1 - \tau_{us})$.

Your task is to find the condition on R_P that must be met for the UK lender to be no worse off than with debt at R_B . The corporate tax rates are denoted by τ_{uk} and τ_{us} , respectively. The US withholding tax on dividends (including preferred dividends) is 5 percent, and the withholding tax on interest is 10 percent. The UK applies a credit system where foreign-paid taxes can be used as a credit for UK taxes due on worldwide income. You can, therefore, assume that there will be no unused tax credit.

In the table below, we already provide the analysis for the case where bonds are used. Make a similar analysis for the case where preferred stock is used, identify the condition on R_P under which the lender is no worse off than with bonds at R_B , and lastly, verify whether there is a solution that makes neither the lender nor the borrower worse off.

	UK lender: After-tax cash flows	
	With bonds	With preferred stock
Gross income	$R_B D$	
Withholding tax	< $R_B D \times 0.10$ >	
Net (cash) income	$R_B D \times 0.90$	
Gross-up: direct indirect	$R_B D \times 0.10$ none	
Tax basis	$R_B D$	
Tax due	$R_B D \tau_{uk}$	
Credit: direct indirect	$R_B D \times 0.10$ none	
Net UK tax due	$R_B D \times (\tau_{UK} - 0.10)$	
Income after taxes	$= R_B D (1 - \tau_{UK})$ *	

* From [net cash income] - [net UK tax due] = $R_B D [0.9 - (\tau_{UK} - 0.10)]$

A1.

	UK lender: After-tax cash flows	
	With bonds	With preferred stock
Gross income	$R_B D$	$R_P D$
Withholding tax	$<R_B D \times 0.10>$	$<R_P D \times 0.05>$
Net (cash) income	$R_B D \times 0.90$	$R_P D \times 0.95$
Gross-up: direct	$R_B D \times 0.10$	$R_P D \times 0.05$
indirect	none	$R_P D \frac{\tau_{US}}{1 - \tau_{US}}$
Tax basis	$R_B D$	$R_P D (1 + \frac{\tau_{US}}{1 - \tau_{US}})$
Tax due	$R_B D \tau_{UK}$	$R_P D (1 + \frac{\tau_{US}}{1 - \tau_{US}}) \tau_{UK}$
Credit: direct	$R_B D \times 0.10$	$R_P D \times 0.05$
indirect	none	$R_P D \frac{\tau_{US}}{1 - \tau_{US}}$
Net UK tax due	$R_B D \times (\tau_{UK} - 0.10)$	$R_P D [\tau_{UK} - 0.05 - \frac{\tau_{US}}{1 - \tau_{US}} (1 - \tau_{UK})]$
Income after taxes	$= R_B D (1 - \tau_{UK})^*$	$R_P D \frac{1 - \tau_{UK}}{1 - \tau_{US}}^{**}$

* from [net cash income] - [net UK tax due] = $R_B D [0.9 - (\tau_{UK} - 0.10)]$

** from [net cash income] - [net UK tax due] =

$$R_P D [0.95 - \tau_{UK} + 0.05 + \frac{\tau_{US}}{1 - \tau_{US}} (1 - \tau_{UK})]$$

Conclusion: In the absence of excess tax credit problems, the UK lender accepts the preferred stock solution if $R_P \geq R_B (1 - \tau_{US})$.

General conclusion: In the absence of excess tax credit problems, both accept the preferred stock solution if $R_P = R_B (1 - \tau_{US})$.

Chapter 24 Valuation and Negotiation of Joint Venture Projects

Quiz Questions

Suppose that company *A* can realize an NPV of 200 from doing the project on its own, while Company *B* can realize 100. The NPV from joint operations is 400. There are no taxes.

True-False Questions

- _____ 1. In a pure-equity contract, *A* will get two-thirds of the equity of the JV, while *B* will get one-third.
- _____ 2. In a pure-equity contract, *A* will get two-thirds of the synergy gain from the JV, while *B* will earn one-third.
- _____ 3. *A*'s bargaining position is stronger than *B*'s (because of its higher threat point), so *A* will get more than half of the synergy gain.
- _____ 4. In a pure-equity contract, *A* will usually receive half of the synergy gain from the JV unless *A*'s bargaining position is stronger or weaker than *B*'s—that is, unless *A* is less impatient or more impatient than *B*.
- _____ 5. In a nonproportional contract, *A* will not usually agree to receive only one-half of the synergy gain of the JV.
- _____ 6. In order to agree to a 50/50 joint venture, *A* will expect an additional payment of 100 from *B*.
- _____ 7. In order to agree to a 50/50 joint venture, *A* will need a side payment of 100 from the joint-venture.

Ans. 1. false: A 's gain = $\frac{2}{3} 400 - 200 \neq B$'s gain = $\frac{1}{3} 400 - 100$; 2. false: unequal impatience may explain a non-equal split, but this has nothing to do with $\frac{NPV_A}{NPV_B}$; 3. false: same reason as question 2; 4. true; 5. false: non-proportional ways of splitting do not invalidate the equal-gain principal; 6. false: this would give *A* a gain of $[\frac{1}{2} 400 - 200] + 100 \neq B$'s gain = $[\frac{1}{2} 400 - 200] - 100$; 7. true: A 's gain = $[\frac{1}{2} (400 - 100) - 200] + 100 = B$'s gain = $\frac{1}{2} (400 - 100) - 100$.

Additional Quiz Questions

- Q1. Why does the investment analysis of a joint venture comprise more than just an NPV analysis?
- A1. Because the JV partners have to agree on how the total NPV of the project must be shared.
- Q2. What additional assumptions are needed to make the following statement true: "In a joint venture where neither partner can achieve anything without the other's help, the ownership should be divided 50/50."

- A2. Given that 1) the contract is pure equity; 2) the markets are integrated; 3) the taxes are the same for each.
- Q3. In negotiating a license contract, one should consider the opportunity cost, that is, money which could have been earned by signing a license contract with another company. How is this accounted for in our approach?
- A3. The alternatives, NPV_A and NPV_B , are the opportunity costs.
- Q4. Why might a company prefer licensing over direct investment?
- A4. Because the taxes may be lower for licensing fees than for dividends. Plus, licensing fees are less risky. Thus, they may be more favorable given asymmetric information and capital restrictions.
- Q5. Tax rules, in themselves, favor corner solutions where either equity or licensing income is not used. Still, we often observe that both are used. Give some reasons why a contract may include both equity and non-equity features.
- A5. Not all decisions are driven by tax considerations. A non-equity solution would mean that one party would have no control in the JV, or the royalty fees may not be deemed "at arm's length". In the pure equity solution, the government may impose limits on the equity share ϕ or a high level of foreign ownership may lead to an undesirable image in the local market.

Exercises

The exercises below focus on the logic used in this chapter rather than on number crunching. You should be able to solve them without using any of the formulas from the text.

- E1. Suppose that Company A's project has an NPV of 200 on its own, while Company B can realize 100. The synergy gain is 200. There are no taxes, the financial markets are integrated, and A and B have equal bargaining strengths.
- How much of the total NPV (500) should go to A, and how much to B?
 - To achieve this, what should be the equity holdings in a pure-equity JV?
 - Suppose that A and B agree that A will receive licensing fees from the JV worth 80 (in present value).
 - How much of the total NPV (500) is now shared pro rata of the original cash inputs?
 - Write down the equal-gains principle, and solve for ϕ .
 - Verify whether the synergy gains are shared equally.
 - Suppose that, instead, A and B agree on a 50/50 joint venture. What is the present value of the licensing income or management fees that A must receive in order to accept this equity structure?
- A1. (a) Company A should get $NPV_A + \frac{\text{synergy gain}}{2} = 200 + \frac{200}{2} = 300$, and B should get $100 + \frac{200}{2} = 200$.
- (b) Company A should get $\frac{300}{500} = 60$ percent of the equity, B should get 40 percent. Then $0.6 \times 500 - 200 = 0.4 \times 500 - 100$.
- (c) (1) The NPV of the JV is now paid out as follows: 80 to the licensor (A), and the balance, $500 - 80 = 420$, to the shareholders on a $\phi/(1 - \phi)$ basis.
- (2) The equal-gains principle says:

$$[\phi 420 + 80] - 200 = (1 - \phi) 420 - 100$$

$$\Rightarrow 2 \phi 420 = 420 - (200 - 100 - 80)$$

$$\Rightarrow \phi = 0.5 + \frac{20}{2 \times 420} = 52.38 \text{ percent}.$$

- (3) Company A gets $52.38\% \times 420 + 80 = 300$, as it should (see question (a)). B gets $(1 - 0.5238) \times 420 = 200$.

$$(d) \quad 0.5 \times (500 - L) + L - 200 = 0.5 \times (500 - L) - 100$$

$$0.5 L - 200 = -0.5 L - 100$$

$$L = 200 - 100 = \text{difference between threat points} = 100.$$

- E2. Suppose that Company A's project has an NPV of 200 on its own, while Company B can realize 100. The synergy gain is 200. There are no taxes, and the financial markets are integrated. Assume, however, that B has a better bargaining position, and is able to obtain a 45 percent of the equity in the first-pass negotiations (the pure-equity joint-venture).

- What part of the synergy gains goes to A, what part to B?
- Suppose that, in the second-stage negotiations, A asks for a license contract worth 80 (in present-value terms). How should the equity shares be adjusted to preserve the division of the synergy gains (that is, to make both parties as equally well-off as in the pure-equity solution)?
- Which licensing contract is compatible with a 50/50 joint venture and the equal bargaining strengths as in part (a) of this question?

- A2. (a) Company A gets $0.55 \times 500 = 275$, which is only 75 above its threat point. That is, a fraction, $75/200 = 37.5$ percent, of the synergy gain now goes to A.
- (b) The NPV of the JV is now paid out as follows: 80 goes to the licensor (A), and the balance, $500 - 80 = 420$, is distributed on a $\phi/(1 - \phi)$ basis. To make both parties equally well-off as in the pure-equity solution, we need to set ϕ such that $[\phi 420 + 80] = 275$, which implies that $\phi = \frac{275 - 80}{420} = 46.43$ percent.
- (c) To make both parties equally well-off as in the pure-equity solution, we need to set L such that $0.5 \times [500 - L] + L = 275$, which implies that $L = 50$.

- E3. In Freedonia and Prisonia there are no taxes, and the capital markets are well-integrated across the two countries. Two multinational utility firms, FreeCorp and PriCorp, have WOS's that compete on the Prisonian market for electric power. Right now, the aggregate annual revenue of both producers is 1,050m/year, without any growth prospects. The current market value of FreeCorp's wholly owned subsidiary is 200m, while PriCorp's WOS is worth 100m. Both companies are fully equity financed. FreeCorp and PriCorp are negotiating a merger of their Prisonian subsidiaries. This would stop competition and would allow the producers to increase the price of electric power by 10 percent. Total sales would drop slightly, to 1,000m/year, but the higher profit margin would lead to a JV with a market value of 400m.

- Assume initially that the newly formed JV would be a fully equity-financed firm (no bonds, royalties, management fees, etc.). The merchant bank that acts as the adviser proposes that, as FreeCorp's assets are currently worth 200m and PriCorp's assets 100m, FreeCorp should get two-thirds of the shares.
 - Evaluate this proposal: who gets how much of the synergy gains?
 - Formulate a counterproposal if you disagree.

- (b) The Prisonian Foreign Investment Act restricts the equity share of foreign owners to 50 percent at most.
- (1) How much of the synergy gain accrues to each parent if $\phi = 50$ percent and if there is no other contract (like a license contract, for instance)?
 - (2) As a result, what is the side payment that PriCorp must make to FreeCorp, one way or another, so that the gains are fairly shared?
- (c) PriCorp proposes that FreeCorp receives an annual management fee of 0.5 percent of annual sales as payment for accounting software contributed by FreeCorp. Given perpetual sales of 1,000m/year and a yield on perpetual bonds equal to 10 percent, the present value of this perpetual management fee is:

$$\frac{0.5\% \times 1000\text{m}}{10\%} = 50\text{m}.$$

However, the proposal is vague about whether the management fee is paid out by the JV or by PriCorp.

- (1) From FreeCorp's point of view, does it make a difference whether the management fee is paid out by the JV or by PriCorp?
 - (2) If it makes a difference, evaluate the proposed management fee for each case, and formulate a counterproposal.
- A3. (a) FreeCorp gains $2/3 \times 400\text{m} - 200\text{m} = 66.67$, PriCorp gains only $1/3 \times 400\text{m} - 100\text{m} = 33.33$. However, to obtain an equal split, we need $\phi \times 400\text{m} - 200\text{m} = (1 - \phi) \times 400\text{m} - 100\text{m}$, which requires $\phi = 1/2 + \frac{200\text{m} - 100\text{m}}{800\text{m}} = 62.5$ percent. Then FreeCorp's gains = $0.625 \times 400\text{m} - 200\text{m} = 250\text{m} - 200\text{m} = 50\text{m}$, which is the same as PriCorp's gain, $0.375 \times 400\text{m} - 100\text{m} = 150\text{m} - 100\text{m} = 50\text{m}$.
- (b) FreeCorp gains $0.50 \times 400\text{m} - 200\text{m} = 0$, while PriCorp gains $0.50 \times 400\text{m} - 100\text{m} = 100\text{m}$. Thus, PriCorp should make an additional payment of 50m to FreeCorp.
- (c) (1) It makes a difference. If the payment is made by the JV, then FreeCorp actually pays half of it, so it only receives 25m net.
- (2) The royalty should be set at 100m if it is paid by the JV.

Chapter 25 International Capital Budgeting Using Option Pricing Theory

Quiz

Capital Budgeting can be compared to a compound American option. Decide which option contract type and exercise decision corresponds with each capital budgeting decision given below. For each option exercise decision choose from: the decision to exercise or to delay exercise of an American call, an American put or an American conversion option.

	Capital Budgeting Decision	Option Exercise Decision
1.	Delay an investment	
2.	Keep a plant in operation	
3.	Close a plant down	
4.	Restart a plant	
5.	Liquidate a plant	
6.	Put a plant to another use	
7.	Postpone market entry	
8.	Exit market	
9.	Invest sequentially	

Ans.

	Capital Budgeting Decision	Option Exercise Decision
1.	Delay an investment	Delay exercise of an American call
2.	Keep a plant in operation	Delay exercise of an American put
3.	Close a plant down	Exercise an American put
4.	Restart a plant	Exercise an American call
5.	Liquidate a plant	Exercise an American put
6.	Put a plant to another use	Exercise an American conversion option
7.	Postpone market entry	Delay exercise of an American call
8.	Exit market	Exercise American put or Exercise an American conversion option
9.	Invest sequentially	Exercise a series of American calls

Exercises

- E1. Your employer, an Italian company, considers a proposal to use an existing plant to produce for exports to India. To minimize computational problems, assume that the plant's output is either the full capacity level (100 units/period) or zero, and that the output, if positive, can be sold at a known Indian rupee price of INR 10. Thus, sales revenue equals

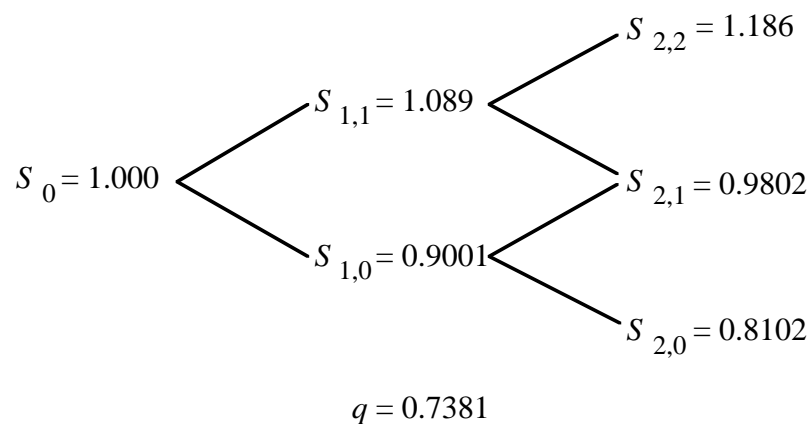
$$\text{Rev}(S_t) = \begin{cases} S_t \times 100 \times 10 & \text{if there is production} \\ 0, & \text{otherwise} \end{cases}$$

At any time, the company can decide to produce, to sell the plant, or to mothball it (that is, just maintain the plant, without any production). Production and distribution take time: to be able to sell in period n , the firm would have to start a production run at time $n - 1$, *before* the period- n exchange rate is known. The life of the equipment ends at time 2. Thus, at time 2 you will sell the plant. The various cash flows are summarized in the table below.

Previous decision:	Produce	Mothball
New decision:		
Produce	No entry cost Other costs: ITL 800 next period Revenue: INR 1,000 next period	Entry cost: ITL 50 now Other costs: ITL 800 next period Revenue: INR 1,000 next period
Mothball	Exit cost: ITL 20 now Fixed cost: ITL 100 next period	No exit cost Fixed cost: ITL 100 next period
Liquidate	Exit cost: ITL 20 now Inflow: ITL 200/172/155 now	No exit cost Inflow: ITL 200/172/155 now

Unit variable production cost is ITL 5. Maintaining a plant in mothballs costs ITL 100/period, while the fixed cost of the plant when it is producing is ITL 300/period. If production is suspended, an exit cost of 20 is incurred, and if the plant is started up again, the entry cost is 50. At any moment, the plant could also be liquidated (or put to another use), at a liquidation value of 200 (at time 0), 172 (at time 1), or 155 (at time 2).

The tree below shows the exchange rate process for the two periods. Also given is the risk-adjusted probability q to be used for the valuation.



At time 0, the company could decide to pay the entry cost and start production. Before computing the value of this decision you need to know what the time-1 decisions will be, conditional on this time-0 decision. The time-1 decisions depend on the exchange rate at time 1 and, of course, on the time-2 cash flow implications of each possible decision. These cash flows are computed below:

Time-2 cash flows from the project, if at time 1 you have decided to produce (decision P_1)

node	S_{j2}	Liqvalue	Sales: $100 \times 10 \times S_{j2}$	Cost	Exit cost	Total
2	1.186	155	1,186	<800>	<20>	521
1	0.9802	155	980	<800>	<20>	315
0	0.8102	155	810	<800>	<20>	145

Time-2 cash flows from the project if at time 1 you have decided to mothball (decision M_1)

node	S_{j2}	Liqvalue	Sales	Cost	Exit cost	Total
2	1.186	155	0	<100>	0	55
1	0.9802	155	0	<100>	0	55
0	0.8102	155	0	<100>	0	55

In questions (a) and (b) we ask you to identify the best time-1 decisions given that the time-0 decision was to start production. Question (c) then relates to the value of the decision to produce at time 0.

- Consider the case where, at time 1, the exchange rate is $S_1 = 1.089$. If you had already paid the entry cost at time 0, what would you decide: to go on producing, mothball, or liquidate? Denote the value of each decision by $V(S_1 = 1.089 | X_1, P_0)$, where the current decision X_1 could be either P_1 (produce), M_1 (mothball), or L_1 (liquidate), and where P_0 refers to the time-0 decision (produce).
- Still assuming that, at time 0, you decided to start production, what would your decision be if the exchange rate moved down at time 1, rather than up? That is, compute $V(S_1 = 0.9001 | X_1, P_0)$ for each new decision X_1 .
- In questions (a) and (b), you have computed the time-2 cash-flow implications of starting up at time 0. What, then, is the value of the P_0 decision at time 0? This value consists of the present value of the operating cash flow realized at time 1, plus the value at time 1 of the (best) subsequent decisions—which you computed in (a) and (b).

The company's alternative at time 0 is to postpone the production decision—that is, pay no entry cost, maintain the plant. In questions (d) and (e) we ask you to identify the best time-1 decisions, given that there was no production at time 0. Question (f), then, relates to the value of the decision to mothball the plant at time 0.

- Consider the case where, at time 1, the exchange rate is $S_1 = 1.089$. If you had decided to mothball the plant at time 0, what would you decide: to start producing, to wait, or to liquidate? Denote the value of each decision by $V(S_1 = 1.089 | X_1, M_0)$, and refer to the last table for the time-2 cash flows.
- Still assuming that, at time 0, you decided to mothball the plant, what would your decision be if the exchange rate moved down at time 1, rather than up? That is, compute $V(S_1 = 0.9001 | X_1, M_0)$ for each new decision X_1 .
- What is the value of the M_0 decision at time 0? This value consists of the present value of the maintenance cost paid at time 1, plus the value at time 1 of the (best) subsequent decisions—which you computed in (d) and (e).

We are now ready to make the time-0 decision:

- At time 0, will you decide P_0 , M_0 , or L_0 ?
- At time 0, what is the exposure of the plant to the time-1 exchange rate? How would you hedge this exposure?

$$A1. \quad (a) \quad V(S_1 = 1.089 | P_1, P_0) = \frac{521 \times 0.7381 + 315 \times (1 - 0.7381)}{1.05} = \mathbf{445}$$

$$V(S_1 = 1.089 | M_1, P_0) = \frac{55}{1.05} - 20 = 32$$

$$V(S_1 = 1.089 | L_1, P_0) = 172 - 20 = 152.$$

$$(b) \quad V(S_1 = 0.9001 | P_1, P_0) = \frac{315 \times 0.7381 + 145 \times (1 - 0.7381)}{1.05} = \mathbf{258}$$

$$V(S_1 = 0.9001 | M_1, P_0) = \frac{55}{1.05} - 20 = 32$$

$$V(S_1 = 0.9001 | L_1, P_0) = 172 - 20 = 152.$$

- (c) If $S_1 = 1.089$, your revenue is ITL 1,089 and production costs are 800, implying an operating cash flow in year 1 of ITL 289. In addition, you decide to continue producing. Thus, the value in year 1 of your risk-adjusted expected profits for year 2 will be worth another ITL 445 (see (a)).

If $S_1 = 0.9001$, your revenue is ITL 900 (after rounding) and production costs are 800, implying an operating cash flow in year 1 of ITL 100. In addition, you decide to continue producing. Thus, the value in year 1 of your risk-adjusted expected profits for year 2 will be worth another ITL 258 (see (b)).

From the discounted expectation of the above cash flows you have to subtract the entry cost, ITL 50. Thus:

$$V(S_0 = 1.0 \mid P_0) = \frac{(289 + 445) \times 0.7381 + (100 + 258) \times (1 - 0.7381)}{1.05} - 50 = 555$$

$$(d) \quad V(S_1 = 1.089 \mid P_1, M_0) = \frac{521 \times 0.7381 + 315 \times (1 - 0.7381)}{1.05} - 50 = \mathbf{395}$$

$$V(S_1 = 1.089 \mid M_1, M_0) = \frac{55}{1.05} = 52$$

$$V(S_1 = 1.089 \mid L_1, M_0) = 172.$$

$$(e) \quad V(S_1 = 0.9001 \mid P_1, M_0) = \frac{315 \times 0.7381 + 145 \times (1 - 0.7381)}{1.05} - 50 = \mathbf{208}$$

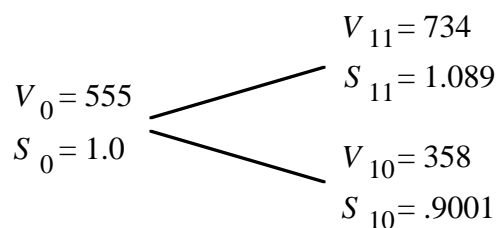
$$V(S_1 = 0.9001 \mid M_1, M_0) = \frac{155 - 100}{1.05} = 52$$

$$V(S_1 = 0.9001 \mid L_1, M_0) = 172.$$

- (f) If $S_1 = 1.089$, you decide to start producing (see (d)), which is worth ITL 395. If $S_1 = 0.9001$, you also decide to produce (see (e)), but the value of this decision is only ITL 208. In either case, you would also pay the maintenance cost implied by the time-0 decision M_0 . Thus,

$$V(S_0 = 1.0 \mid M_0) = \frac{-100 + [395 \times 0.7381 + 208 \times (1 - 0.7381)]}{1.05} = 234$$

- (g) At time 0, we decided to produce (decision P_0), after comparing the answers computed in (c) and (f) with the liquidation value (ITL 200) of the plant at time 0.
 (h) Ignoring all suboptimal values, the tree for the plant's value and for the exchange rate starts out as follows:



$$\text{Thus, Delta} = \frac{V_{11} - V_{10}}{S_{11} - S_{10}} = \frac{734 - 358}{1.089 - 0.9001} = 1,990.5.$$

If desired, the value of the plant could be hedged by selling forward INR 1,990.5 or by creating a similar INR outflow by borrowing.

Mind-Expanding Exercise

ME1. In the above exercise, mothballing was not really a relevant option. At time 0, we immediately began production, and at time 1, it is *a priori* pointless to mothball: stopping production without immediate liquidation would mean a drop in the nominal liquidation value, a loss of time value, and the equally pointless payment of the fixed maintenance cost of 100. All of this is due to the small number of periods.

Suppose a similar exercise is solved with far more periods, say 10 or 15. Where in the exchange rate tree would you expect mothballing decisions to occur? To answer this question, think of the following. Mothballing means keeping the plant as an option for either production or liquidation. First, would *production* decisions be taken when the INR is expensive (when we are in the higher branches the tree), or when the INR is cheap (when we are in the lower branches the tree)? Second, would *liquidation* decisions be taken in the lower end of the tree or in the higher end? Finally, is mothballing (keeping one's options open) more valuable when the remaining life of the plant is long or when the remaining life is short?

A1. Production decisions are in the high branches, liquidation decisions are in the lower end of the tree. Thus, mothballing is somewhere in between. In addition, mothballing occurs when there is a sufficient amount of uncertainty left. For periods close to the plant's maximum life, the best decision is either to liquidate, or to continue operating. A mothballed plant, representing an option on an active plant or on liquidation, has value because of the uncertainty and conversely loses value when there is little risk left. To illustrate this, we show the distribution of the modes in a model with $N = 12$, entry and exit costs equal to 10, and a maintenance cost M of 10, as far as decisions P to M , M to L , or P to L are concerned.⁵

5 The boundary at which you go from M to P is not the same as the boundary for the inverse decision.

