Chapter 12

(When) Should a Firm Hedge its Exchange Risk?

From Chapters 3 and especially 10-11 you may, I hope, remember that (i) deviations from purchasing power parity are sufficiently large and persistent so as to expose firms to real exchange rate risk, and that (ii) it is difficult to predict exchange rates. In earlier chapters we already described how forward or spot contracts can be used to reduce or even eliminate the effect of unexpected exchange rate changes on the firm's cash flows. We have not yet discussed the relevance of doing so. Thus, the central question that we address in this chapter is: Do firms add value when hedging their foreign exchange risk?

A key element in the discussion will be the zero-initial-value property of a forward contract: when the hedge is set up, its net asset value is zero. In light of this we can rephrase the question as follows: how can adding a zero-value contract increase the value of the firm? We will argue that hedging does add value if its effect is not just to add a gain or loss on the hedge but also to change something else in the firm, like decreasing the chances of financial distress. But there is a second question we need to address too, namely: if the hedge does add value, cannot the shareholders do the hedging if the firm does not? To this question we will answer that there are many good reasons why home-made hedging is not a perfect substitute for corporate hedging. The bottom line of this chapter is, however, not that hedging adds value (full stop): rather, we'd say that there are circumstances under which hedging helps, but these circumstances surely do not apply to all firms all the time.

In the first section of this chapter, we describe how/when hedging may achieve more than just adding a gain or loss on a forward or spot contract. In Section 2, we dismiss some bad reasons that lesser human beings occasionally advance in favor of, or against, hedging and some FAQs, starting with the issue whether companies can't simply leave hedging to the shareholders. Our conclusions are presented in Section 3.

12.1   The effect of corporate hedging may not just be "additive"

Hedging affects, quite possibly, the expected future cash flows of the firm, and it surely affects risk. How can we simultaneously take these two aspects into account? A finance person would immediately point out one excellent summary measure of the expected-value and risk effects of hedging: look at its net effect on present value. So in this chapter we adopt the Modigliani-Miller-style point of view that financial decisions should be rated on the basis of their impact on the company's market value.

In this light, then, one way to focus the discussion is to raise the zero-initial-value property of a forward contract: when the hedge is set up, its net asset value is zero. So we can rephrase the question as follows: how can adding a zero-value contract increase the value of the firm? One innocent answer would be that the zero-value property is a short-lived affair: almost immediately after being signed, the contract's value already changes. But the reply to this red herring is that one cannot even predict whether the value change will be for better or for worse. So, again: how can a contract add value if, roughly speaking, the chance that it acquires a negative value is fifty percent?[1]

The serious answer is that the zero-value property applies to the cash flows generated by a stand-alone forward contract: $\mathrm{PV}_t(\tilde{S}_T - F_{t,T}) = 0$. But the effect of hedging may very well be that the firm's other cash flows—anything that has to do with investing and producing and marketing and servicing debt etc—are affected by the hedge operation too. If (and only if) that is the case, hedging adds value—not because its own cash flow $\tilde{S}_T - F_{t,T}$ would have a positive net value in itself, we repeat, but because that cash flow has by assumption beneficial side effects on the firm's existing or future business. So the added value, if any, stems from a useful interaction between the hedge's cash flow and the other cash flows of the firm.[2]

This gets us to the real question: how can hedging interact with the firm's other cash flows? Below, we discuss (*i*) reduction of financial-distress costs, both *ex post*

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[1] A variant of the above puzzle runs as follows. In an efficient market, the argument says, the gain from hedging or from any forward deal must have zero expected value, so that on average hedging does not help. This version of the puzzle is factually wrong: the forward rate is a biased predictor of the future spot rate, implying that $\mathrm{E}(\tilde{S}_T - F_{t,T}) \neq 0$. Also, the claim confines the effect of hedging to a purely additive one; but we already know that any value from hedging must stem not from $(\tilde{S}_T - F_{t,T})$, but rather from interactions with other cash flows. Lastly, the argument focuses on expectations, ignoring risks. One should look at PV instead.

[2] This echoes a argument that may be familiar from the Modigliani-Miller literature: one of the sufficient conditions for the irrelevance of the company's debt or pay-out policy is that the firm's "investments"—operations, really—are not affected. This assumption rules out interactions between the debt or pay-out decisions and the other cash flows. Many post-MM arguments question precisely this assumption—most prominently, Jensen's "free cash flow" theory and MM's tax theory.

Figure 12.1: **SS Silja Europe—from choppy waters to a safe haven**

Key On the left, the ship in its (red and white) Viking colors; right: the white and blue Silja version. Source: Wikipedia.

and *ex ante*; (*ii*) reduction of agency costs; (*iii*) lower expected taxes; and (*iv*) less noise in the profit figures.

12.1.1 Corporate Hedging Reduces Costs of Bankruptcy and Financial Distress

The most obvious route through which hedging can affect the firm's prosperity is by decreasing its risk of financial distress. A firm is said to be in financial distress when its income is not sufficient to cover its fixed expenses, including financial obligations. The state of financial distress can lead to bankruptcy, which of course involves direct costs from reorganization or liquidation and the like. Large, uncovered exposures, combined with adverse exchange rate movements, may send a firm into insolvency and bankruptcy, or may at least contribute to such an outcome.

Example 12.1 ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯

In 1992, Rederi AB Slite, a Swedish shipping company that ran a ferry between Sweden and Finland for the Viking Lines, should have taken delivery of a very large ship. She had been ordered some years before from Meyer Werft in Papenburg, Germany. At the time of signing the purchase contract, Slite had decided not to hedge the DEM outflow because the SEK was tied to a basket in which the DEM had a large weight, and because the DEM was at a substantial forward premium relative to the SEK. However, by September 1992, Sweden had been forced to abandon the link between the SEK and the DEM, which had appreciated substantially against the SEK by the end of 1992. As a consequence of the appreciation of the DEM, Slite could no longer afford the ship (which was already painted in Viking's red&white colors, see picture 1). So Meyer Werft kept it and soon managed to charter it to Viking Line's rival, Silja Line, which repainted it (white, mostly, picture 2), named it Silja Europe and put it on the—you guessed it—Stockholm-Helsinki line.[3] A few

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[3]Adding insult to injury, the world's first floating McDonald's restaurant was located onboard the Silja Europa from its maiden trip until 1996, Wikipedia tells us. But in 1996 the McDonalds

months later, Slite keeled over and went bankrupt. ⸻

Outright bankruptcy is costly because of the costs associated with liquidation. In the absence of these costs, Slite's shareholders would simply have lost control of the firm to the bondholders and banks, who would have carried on the business as before or who would have sold their ownership rights to others who, in turn, would have gone on running the firm as before. That is, in the absence of what Miller and Modigliani (MM) call bankruptcy costs, the event of insolvency would not have affected the value of the firm as a whole. In reality, of course, bankruptcy is costly; and the cost includes not only the fees paid to receivers, lawyers, assessors, and courts, but also the potential end of operations, loss of clientèle and reputation, and therefore liquidation at fire-sale prices rather than at going-concern value.

Example 12.2 ⸻
In 2006, a company called Schefenacker that made mirrors for Mercedes and BMW and the like, got in trouble and had to go through a reorganisation. Bondholders lost over half of their stake, and Mr Schefenacker himself surrendered three quarter of his shares to debtors in lieu of repayment. The company even moved its HQs to the UK so as to be able to restructure under English law. Only the legal advisors were radiant, coming out EUR 40m the richer, which was almost 10 percent of the company's original debt.

In the same year, British Energy was an even greater bringer of Joy & Happiness to the legal crowd: with debts of GBP 1.2b (plus liabilities for taking care of spent nuclear fuel and decommissioning power stations) it paid GBP 121m for legal advice related to its restructuring. (*The Economist*, December 15 2007, p 67). Even in a relatively simple case like Northern Rock's, the English bank that skirted failure in the 2007/08 subprime mess, Deringer (a London law firm) made USD 20m from advice to the bank, Slaughter & May made USD 6m from advice to the Treasury, and Clifford Chance Linklaters made undisclosed amounts from working for third parties (*The Economist*, March 15 2008, p 78). ⸻

Costs of restructuring are soaring because financial structures are more complex now. Instead of e.g. three levels (senior, unsecured, and subordinated—once viewed as quite byzantine) we now see e.g. first-lien senior / second-lien senior / mezzanine / senior subordinated / junior subordinated. In each of these "classes" a majority has to approve the deal, giving each such class a veto right and, thus, endless possibilities of wrangling and blackmailing.

Example 12.3 ⸻
Another car-parts maker, Meridian Automotive System of Michigan, took 20 months to organize. First-lien lenders had to yield part of their rightful takings to second-lien colleagues, which meant that seniority no longer meant seniority. In the case of

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was closed down and replaced by Silja Line's own hamburger restaurant.

yet another car-parts firm, American Remanufacturers, second-lien lenders vetoed a proposal by first-lien lenders to refinance. Rather than paying them off, the first-lien group upped sticks and let the firm go bankrupt; neither class got anything, in the end. The two groups of lien holders "just shot each other", one lawyer said. Unusually (and disappointingly for the lawyers) the whole thing took just eleven days. (*Ibid.*)

But even before a firm actually goes bankrupt, the mere potential of future financial distress can already affect the operations and the value of the firm significantly. Thus, if hedging can reduce the volatility of the firm's cash flows, and hence the likelihood of the firm being in financial distress, hedging increases the firm's current value. Let us consider three specific links between the financial state of a firm and its real operations.

- **The Product Market and Reorganization Costs** Many firms sell products for which after-sales service is needed. The firms typically offer product warranties. A buyer's decision to purchase such products depends on his or her confidence in the firm's after-sales service. These firms sell more and must, therefore, be worth more the lower the probability of their going out of business. Hedging, by reducing the volatility of cash flows, decreases the probability of (coming uncomfortably close to) bankruptcy.

  Example 12.4
  When the US computer manufacturer Wang got into financial problems, one of Wang's customers noted that, "Before the really bad news, we were looking at Wang fairly seriously [but] their present financial condition means that I'd have a hard time convincing the vice president in charge of purchasing. At some point we'd have to ask 'How do we know that in three years you won't be in Chapter 11 [bankruptcy]'?" (Rawls and Smithson, 1990, p. 11).

- **The Labor Market and Wage Costs** Risk-averse employees are likely to demand higher wages if their future job prospects are very uncertain. In the event of bankruptcy, a forced change of job generally entails monetary and/or nonmonetary losses to employees. Thus, the employees want to protect themselves by requiring higher wages when working for a firm that is more likely to be in financial distress. If they do not get the risk premium, they quit—and especially the best ones, who can easily start elsewhere. This does *not* sound good.

- **The Goods Markets and Purchasing Costs** Risk-averse suppliers are similarly likely to demand cash upon delivery payment or, if they want to avoid even the risk of useless truck rides, cash before delivery. Trade credit would now be possible only in return for a big mark-up for default risk. Again, this is not the best a firm can overcome.

- **The Capital Market and Refinancing Costs** Loan covenants can trigger early repayment if the firm's income falls below a stated level, or credit lines can be canceled and outstanding credits called if there is a material deterioration in

the firm's creditworthiness. To the extent that refinancing is difficult or costly when things do not look bright, it is wise for the firm to reduce income volatility by hedging. Costs associated with refinancing include not just an increased risk spread but also the hassle and distraction of transacting and negotiating, new restrictions on management, additional monitoring and reporting, and so on.

Financial distress costs are not the only link between hedging and the firm's operations. Following Jensen (1986), one could argue that also agency costs create such a link.

12.1.2 Hedging Reduces Agency Costs

Agency costs are the costs that arise from the conflicts of interest between shareholders, bondholders, and the managers of the firm. We will argue that these agency costs can affect the firm's wage bill, its choice of investment projects, and its borrowing costs. Hedging, by reducing the volatility of a firm's cash flows, can reduce the conflict of interests between different claimants to the firm's cash flows and can increase the firm's debt capacity and reduce its cost of capital.

One conflict is that between the managers of the firm and the shareholders. The source of the problem is that, through their wages and bonus plans, the wealth of the managers depends to a large extent on the performance of the firm. Since managers cannot sell forward part of their lifetime future wages in order to diversify, the only way that they can reduce the risk to their human wealth is to hedge the exposure by creating negatively correlated cash flows through positions in the foreign exchange, commodity futures, and interest futures markets. As argued below, "home-made" hedging (by shareholders or, here, by managers) is not a good substitute for corporate hedging because personal hedging is expensive and difficult. In addition, there is likely to be a maturity mismatch between the hedge and the exposed human wealth, which creates a ruin-risk problem similar to the one mentioned in connection with marking to market in futures markets (see Chapter 6). The reason for the mismatch is that affordable forward contracts are likely to have short maturities, while the wages that are exposed are realized in the longer run. The maturity mismatch between the short-term hedge and the long-term exposure becomes a problem when the value of human wealth goes up. Then, the short-term hedge triggers immediate cash outflows, while the benefits in terms of wages will not be realized until much later. That is, the personal hedge creates liquidity problems and, in the limit, may lead to personal insolvency.

For the above reasons, managers dislike hedging on a personal basis, and want the firm to hedge instead. If the firm does not hedge, managers can react in two ways. First, they are likely to insist on higher wages, as a premium for the extra risk they have to bear. Second, if the firm has investment opportunities that are very risky, the managers may refuse to undertake such projects even if they have a positive net present value. As the shareholders have imperfect information about the firm's

investment opportunities or the management's diligence and motives, there is little they can do about these actions of the managers. Thus, the shareholders are better off if the firm hedges its exposures: this will automatically also hedge the managers' exposures, and thus make them look more kindly on the once-risky projects as well as their own pay checks.

Another example of agency costs is the conflict that arises between shareholders and bondholders in the choice of investment projects. This conflict arises because bondholders get (at most) a fixed return on their investment, while shareholders receive the cash left over after bondholders have been paid off. That is, the shareholders have a call option on the value of the firm, with the face value of the firm's debt as the option's strike price. The value of an option increases when the volatility of the underlying asset increases. (If this last bit is new to you, you did not properly read Chapter 8 on options.) Thus, in the case of a levered firm that is close to financial distress, shareholders may have an incentive to undertake very risky projects even if the project's net present value is negative. This *overinvestment problem* (Jensen and Meckling, 1976) arises if, due to increased uncertainty, the value of equity (the option on the future value of the firm as a whole) increases even though the current value of the firm as a whole goes down.

Example 12.5 ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
A company has assets worth 60, currently invested risk-free, and debt with face value 50. For simplicity, assume risk neutrality and a zero risk-free rate. An investment opportunity arises where the investment would be 60, and the proceeds either 100 or 0 with equal probability. Therefore, the NPV is $(100 + 0)/2 - 60 = -10$. But the shareholders might nevertheless be tempted by this plan because it would distribute more than enough wealth away from the bondholders and toward themselves:

decision	future outcome		resulting PV
don't invest	$V_1 = 60$: bonds 50		bonds 50
	stocks 10		stocks 10
			total = 60
invest	Lucky: $V_1 = 100$	unlucky: $V_1 = 0$	
	bonds 50	bonds 0	bonds 25
	stocks 50	stocks 0	stocks 25
			total = 50

Obviously, if the shareholders are sufficiently ruthless to undertake this investment, the bondholders are worse off. Similarly, when a firm is close to bankruptcy, shareholders may have an incentive not to take on risk-reducing projects, even if these projects have a positive net present value. This *"debt overhang" underinvestment problem* (Myers, 1977) occurs if the current value of the firm goes up when the project is undertaken but the value of the option on the firm (the equity) goes down.

Bondholders, of course, recognize and anticipate these potential conflicts of interest and, therefore, adjust the terms of their loan appropriately. One way is to increase the interest charged on the loan. Another is to impose restrictions on management (the bond covenant) which requires costly monitoring by a trustee, slows down management, and may inadvertently even prevent good investments. Thus, if by hedging one reduces the variability of the firm's cash flows, one also reduces the potential for conflicts of interest associated with financial distress, and one thereby avoids the above extra costs of borrowing.

12.1.3   Hedging Reduces Expected Taxes

Hedging reduces expected cash flows if taxes are convex rather than linear functions of income. One example of a convex tax function is a progressive tax schedule, where the tax rate increases with income. In this case, smoothing the income stream will imply a lower average tax burden.

Example 12.6 ⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻
Suppose that if income is USD 100, you pay USD 45 in taxes, while if income is USD 50, you pay only USD 20 in taxes. The expected tax when the earnings are USD 50 without risk then equals USD 20, while the expected tax is USD 22.5 when earnings are, with equal probability, either USD 100 or 0.⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻

It may be argued that most countries' corporate tax rate schedules are, for all practical applications, flat. However, a more subtle type of convexity is created by the fact that, when profits are negative, taxes are usually not proportionally negative. In some countries, there are negative corporate taxes, but the amount refunded is limited to the taxes paid in the recent past. Such a rule is called *carry-back*: this year's losses are deducted from profits made in preceding years, implying that the taxes paid on these past profits are recuperated. Still, carry-back is limited to the profits made in only a few recent years, which means that negative taxes on losses are limited, too. In other countries, there is no carry-back at all. All one can do is deduct this year's losses from potential future profits (*carry-forward*), which at best postpones the negative tax on this year's losses.

Example 12.7 ⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻⸻
In Belgium, firms are not allowed to carry back losses. If a particular Belgian firm's profits are either EUR 35m or EUR 15m with equal probability, the expected profit is EUR 25m and the expected tax (at 30 percent) is EUR 7.5m. In contrast, if its profits are either EUR 100m or –EUR 50m with equal probability, the expected profit is still EUR 25m but now the expected tax is (EUR 100m × 0.3 + EUR 0)/2 = EUR 15m. It is true that the potential EUR 50m loss can be carried forward and deducted from subsequent profits, but these later tax savings are uncertain, and even if they were certain, there would still be the loss of time value. ⸻⸻⸻⸻⸻⸻⸻⸻

Now consider a case where a firm is allowed to carry back its losses. Even in this case, excessive variability of income can affect the tax liability if the current losses

are larger than the profits against which they can be set off. In the US, for instance, there is a three-year carry-back provision. Suppose that a particular firm's profits in the last three years amounted to USD 30m. If, for the next year, its profits are either USD 35m or USD 15m with equal probability, the expected profit is USD 25m and the expected tax (at 30 percent) is USD 7.5m. In contrast, if its profits are either USD 100m or –USD 50m with equal probability, the expected profit is still USD 25m but the potential loss now exceeds the profits made in the past three years. This means that in case of losses, the firm can recuperate the taxes paid on the USD 30m recent profits (that is, there is a negative tax of USD 30m × 30% = USD 9m), and the remaining USD 20m "unused" losses can be carried forward. Thus, the expected tax is [(USD 100m × 0.3) + (–USD 30m × 0.3)]/2 = USD 10.5m rather than USD 7.5m. It is true that the unused losses of USD 20m can be deducted from subsequent profits, but these later tax savings are uncertain, and even if they were certain, there would still be a loss of time value.

While the convex-taxes argument in favor of hedging is logically unassailable, you will probably agree that quantitatively this looks like a less important effect than the earlier ones (and especially financial distress), unless losses cannot be carried back nor forward—for instance because the company is not likely to survive anyway.

12.1.4 Hedging May Also Provide Better Information for Internal Decision Making

Multidivisional multinationals need to know the operational profitability of their divisions. By having each division hedge its cash flows, a multinational knows each division's operating profitability without the noise introduced by unexpected exchange rate changes. This may lead to better decision making and may, thus, lead to an increase in expected cash flows.

Of course, the same information can be obtained in different ways, and the alternatives may be cheaper. The firm could request that all divisions keep track of their contractual exposure at every moment, and could afterwards compute how profitable each division would have been if it had actually hedged. Nowadays, this just requires some programming. Another alternative, similar in spirit, is to shift all exchange risk towards a reinvoicing center. Under such an arrangement, a Canadian production unit, for instance, sells its output to a reinvoicing center on a CAD invoice, while a Portuguese marketing subsidiary buys these products from the center on a EUR invoice. In terms of information per subsidiary, this achieves the same objective as the subsidiary-by-subsidiary hedging policy. The corporation may then decide, on other grounds, whether or not the reinvoicing center should hedge the corporation's overall exposure.[4]

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[4]If the reinvoicing center is instructed to hedge its exposure, this is likely to be cheaper than a policy where each subsidiary hedges its own exposures. First, the reinvoicing center can economize

Actual hedging entails a (small) cost, but as-if-hedged financial reporting is not costless either, and the corporation's operations may be too small to justify the fixed costs of a reinvoicing center. Thus, the bottom line is that the choice between actual hedging and as-if-hedged financial reporting or reinvoicing will depend on the circumstances.

12.1.5 Hedged Results May Better Show Management's Quality to Shareholders, and Pleases Wall Street

This argument is very close to the previous one: without exchange-rate-induced noise, one better sees the effect of management's decisions. The difference is that now the audience targeted by the clearer picture is the outside shareholder, not headquarters. Thus, the effect on value is more direct, and informal solutions like pro forma as-if-hedged financial statements would be confusing or not credible.

A related argument is that analysts and investment bankers like stable profits, as this makes prediction and valuation easier. A hedging policy would contribute to that.

We conclude with a review of some open issues.

12.2   FAQs about hedging

12.2.1 FAQ1: Why can't Firms leave Hedging to the Shareholders— Home-made Hedging?

Fans of the original MM article may remember that the options of home-made leveraging (or unleveraging) and home-made dividends play a big role in the argument. So we likewise ask the question, here, whether the firm cannot simply leave the hedging to the shareholders. There are many arguments saying that home-made hedging will not do, or not do as well as corporate hedging:

- The existence of financial-distress costs or agency costs is the most fundamental reason why "home-made" hedging is an imperfect substitute for corporate hedging. In reality, no individual shareholder can buy a contract that perfectly hedges against the costs of financial distress, like the loss of value when customers vote with their feet or employees flee. The problem, in short, is that the home-made hedge just produces the final cash flow $\tilde{S}_T - F_{t,T}$, and not the interactions with the firm's other business that provide the true advantage from hedging.

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on hedging costs because it can "net" (clear) offsetting exposures. Second, there are likely to be benefits from specialization and scale economies. Third, the reinvoicing center is often located in a tax haven and simultaneously serves to reduce (or at least postpone) taxation on part of the group's profits.

- But even if hedging were purely additive, home-made hedging would not do as well as corporate hedging:

  - One reason is that, in the real world, shareholders have far less information than the managers about the firm's exposure. If shareholders have very imprecise knowledge of the firm's exposure, "home-made" hedging will be far less effective than corporate hedging.

  - Because of economies of scale, firms can obtain better terms for forward or money-market hedging than the individual shareholder. Thus, shareholders may value financial transactions undertaken for them by the firm.

  - Short-selling constraints can provide an additional reason why hedging is better undertaken by the firm rather than left to individual shareholders. In idealized markets, investors can easily borrow (or sell forward) any currency that they choose. However, in financial markets, personal borrowing in foreign currencies is not easy, and forward positions require substantial margin or else are discouraged by banks. It is true that going short is easy in futures markets; but the size of the futures contracts, however modest, may still be too large for shareholders with small positions in exposed equity. Moreover, for many currencies, there simply are no futures markets.

  Thus, corporations have better hedging opportunities than individual shareholders, which again means that "home-made" financial decisions are a poor substitute for corporate decisions.

12.2.2 FAQ2: Does Hedging make the Currency of Invoicing Irrelevant?

Does it matter whether prices are quoted in terms of the home currency or the foreign currency?

- The traditionalists state that someone must bear the exchange risk. Either you invoice in HC, in which case the foreign customer bears the exchange risk, or you invoice in FC, in which case you bear the exchange risk.

- The radical young turks believe that, with the existence of a forward market, there is no problem.

  Example 12.8 ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯
  Giovanni wants to buy his Carina GTI directly from Japan and calls Mr Toyota. We could envision two ways to set (and pay) the price:
  - In story 1, Mr Toyota ask JPY 2m 60 days. Giovanni agrees and immediately hedges at JPY/EUR 125 60 days. Thus, Giovanni's cost is locked in at 2m/125 = EUR 16,000 60 days.

  - Alternatively, Mr Toyota could ask EUR 16,000 60 days. If Giovanni agrees, Mr Toyota immediately hedges at JPY/EUR 125 60 days, and locks in an inflow of $16,000 \times 125 =$ JPY 2m 60 days.

> So the currency of invoicing, in the young turks' view, merely shifts the hedging from seller to buyer, or vice versa. Finally, it does not matter which party hedges since, at a given point in time, each party can buy the foreign currency at the same rate.

While the above point of view is correct, you should realize that the example has two special features that are surely not always present. Notably, in the Toyota example the buyer and the seller are effectively able to hedge at the same moment and at the same rates. Conversely, the invoicing currency may matter as soon as (*i*) there is a time lag between the moment a price is offered by the exporter and the moment the customer decides to actually buy the goods, or (*ii*) the cost of hedging differs depending on who hedges. We illustrate these situations in the examples below. The first one focuses on the delay between the price offer and the customer's decision, the second one about differential costs:

Example 12.9
The currency of invoicing matters when you publish a list of prices that are valid for, say, six months. The problem here stems from the fact that there is a lag between the time that the FC prices are announced and the time the customer purchases an item. Since you do not know the timing and volume of future sales, you cannot hedge perfectly if you list prices denominated in foreign currency. Not hedging until you do know, on the other hand, may mean that by that time the rate has changed against you.

Example 12.10
The Argentina sales branch of a Brazilian stationery distributor instructs its customers to pay in BRL. Since the orders are frequent, and usually small, the Argentinian customers pay substantial implicit commissions whenever they purchase BRL. It would be cheaper if the exporter let them pay in Peso (ARS) and converted the total sales revenue into *Real* once a day or once a week.

In situations like this, one can still hedge approximately if sales are fairly steady and predictable. Many companies hedge all expected positions within a twelve-month horizon, and adjust their forward positions whenever sales forecasts are revised. However, in other cases, the time lag between the exporter's price offer and the importer's purchase decision may imply substantial sales uncertainty. In perfect markets, even this risk should be hedgeable at a low cost. In practice, the cost of hedging may very well depend on the currency in which prices are expressed.

Example 12.11
Here we consider an international tender, characterized by a time delay and a differential cost of hedging. Suppose that a Canadian hospital invites bids for a scanner.

1. **Buyer's currency** In an international tender, suppliers are usually invited to submit bids in the buyer's currency (CAD, in this case). A foreign contender's dilemma is whether or not to hedge, considering that:

- Forward hedging may leave the contender with an uncovered, risky forward position. Specifically, if the contract is not awarded to him, the bidding firm would then have to reverse: it would have to buy CAD spot—or forward, if the contract is reversed earlier—just to be able to deliver them, as stipulated in the forward contract. The rate at which such a time T purchase will be made is uncertain and can surely lead to losses.

- Not hedging at all means that, if the contender does make the winning bid, the CAD inflow is risky.

Thus, whether or not the contender hedges, there is a potential risky cash flow in CAD. It is true that banks offer conditional hedges, that is, contracts that become standard forward contracts (or standard options) when the potential supplier wins the tender but are void otherwise. However, these products are very much tailored to specific situations. The bank must assess and monitor the probability that a particular contender makes the winning bid, which makes such a contract expensive in terms of commissions. Thus, hedging is costly when bids are to be expressed in the customer's currency.

2. **Supplier's currency** The alternative is that the buyer invites bids in the suppliers' own currencies. Indeed, the buyer can easily wait until all bids have been submitted, then translate them into CAD $_T$—using the prevailing forward rates—and, at the very same moment she notifies the lucky winner, lock in the best price by means of a standard forward contract. In this way, all risk and all unnecessary bid-ask spreads in hedging disappear. To illustrate this, suppose that the Canadian hospital's procurement manager receives three bids in three different currencies, shown in column (a) below. She looks up the forward rates CAD$_T$/FC$_T$ shown in column (b), and extracts the following CAD$_T$ equivalent bid prices:

supplier	price	forward rate	CAD cost hedged
Oetker & Kölner, Bonn	EUR 120,000	CAD/EUR 1.65	CAD 198,000
Johnson Kleinwortsz, PA	USD 150,000	CAD/USD 1.35	CAD 195,000
Marcheix, Dubois & Fils, Québec	CAD 200,000		CAD 200,000

If price is the only consideration, she accepts the US offer, and immediately buys forward USD. Thus, when prices are to be submitted in the supplier's currency, a standard (and therefore cheap) forward hedge will suffice. _____

What this example shows, again, is that the currency of invoicing matters if the cost of hedging is not independent of the way prices are quoted. The Canadian hospital can use a cheap, standard contract if prices are submitted in the contending suppliers' home currencies. In contrast, with bids to be submitted in CAD, hedging is difficult and expensive for the bidders—because they are unsure about being awarded the contract. The solution in this case is to let the suppliers quote bids in their own currency. The general message to remember is that the option to hedge forward does not make the currency of invoicing irrelevant.

12.2.3   FAQ3: "My Accountant tells me that Hedging has cost me 2.17m. So how can you call this a Zero-cost Option?"

You accountant may have meant either of at least three things. First, she may have calculated that if you had not hedged, you would have raked in an extra 2.17m. Stated differently, the ex post sum of all the gains/losses $(\tilde{S}_T - F_{t,T})$ was –2.17m. This is sad indeed. But this is hindsight. All you can use, for decision-making purposes, is a PV criterion. And this brings us irrevocably back to the diagnosis that, in light of the zero-NPV property of $(\tilde{S}_T - F_{t,T})$, value stems from positive interactions, if any. The *ex post* value is just good or bad luck and is useless for decision making.

Alternatively, your accountant may have meant that the accounts show an *ex ante* cost of 2.17m. This concept is based on the not-infrequent (but misleading) practice of using spot rates to convert FC A/R's or A/P's into HC. If one then hedges, the actual cash flow differs from the book value, and the accountant hilariously calls this the cost of hedging. If, at the moment of booking the invoice, translation had been done at the forward rate, hedging would have entailed no accounting cost nor gain whatsoever.

Example 12.12 _____

Recall our example in Chapter 5 of a Canadian firm that exports NZD 2.5m worth of goods. We were discussing an accounting issue: should we translate the A/R at the spot rate or at the forward? In that example we compared translation at the spot rate (0.90) and at the forward (0.88), and then looked at the outcome if the firm had not hedged. Now we assume the firm does hedge. The cost of goods sold being CAD 1.5m, profits then amount to 2.5m × 0.88 – 1.5m = 2.2m – 1.5m = 0.7m. But the operating profit depends on the initial valuation of the A/R, and the balance (if any) is called the cost/benefit of hedging:[5]

	using $S_t = 0.90$		using $F_t = 0.88$	
• **at** t:				
A/R	2,250		2,200	
COGS		1,500		1,500
operating income		750		700
• **at** T:				
bank	2,200		2,200	
hedging cost (D) or gain (C)	50		—	—
A/R		2,250		2,200

Which view is true? We know that hedging is free, in principle, so booking the

_____

[5]In the old example, without hedging, there was a random capital gain. Here the effect is predictable, so accountants would call this a cost or benefit from hedging rather than a capital gain. Both are financial (i.e. non-operating) items.

forward premium as a cost or gain makes no sense. That accounting definition is a pure construct, based on the flawed practice of translating at the spot rate (see Chapter 4).

Of course, you could shrug off this accounting convention as irrelevant. There is, indeed, nothing wrong with writing weird things in books: the entire SF literature thrives on it. The only problem is that some people might actually believe this is a genuine cost in the same way *e.g.* the gasoil bill is a genuine cost. This risk arises especially among people that have no clue as to what accounting is about and simply believe a cost must be bad, otherwise it would be called a benefit.

In reality, there are in fact costs of hedging: there might be an upfront commission of a few Euros, and the bid-ask spread in the forward rate is always somewhat wider than in the spot. But these transaction costs have nothing to do with the forward premium, and they amount to a few basis points only.

12.2.4 FAQ4: "Doesn't Spot Hedging Affect the Interest Tax Shield, as Interest Rates are so Different Across Currencies?"

The last fallacy to be discussed is that hedging matters because it affects the interest tax shields. The issue is most often raised when the hedging alternative being considered is a money-market hedge rather than a forward transaction. Suppose, for instance, that a Russian company has accounts receivable denominated in Swiss Francs, and that the firm needs to borrow in order to finance its operations. CHF interest rates are much lower than RUB interest rates—say 6 percent as compared to 20 percent. If it borrows in RUB, the firm has a tax shield of 20 percent, and can reduce its taxes correspondingly. If it borrows in CHF, the loan also acts as a hedge, but the tax shield is a mere 6 percent. Thus, the argument concludes, the currency of borrowing affects the tax shields and, ultimately, the value of the firm.

As pointed out already in Chapter 4, the logical error in this argument is that it overlooks the fact that the taxes are affected not only by the interest paid, but (in the case of foreign currency borrowing) also by the capital gain or loss when the foreign currency depreciates or appreciates during the loan's life. Once this capital gain or loss is also taken into consideration, it is easily proven that, in PV terms, the currency of borrowing does not affect the current value of the firm even when there are taxes, as long as the tax on capital gains equals the tax on interest. Only when there is some form of tax discrimination may hedging affect the PV'ed tax shield.

Example 12.13 ───
The UK used to have a rule that stated that exchange losses on long-term loans were deductible, but capital gains were tax-free. Given the risk-adjusted expectation that the AUD or NZD would depreciate relative to the GBP, a UK company had an incentive to borrow in, for instance, NZD or AUD. The expected capital gain would be tax-free, while the (then) high interest payments would be fully tax-deductible. Here there is a tax effect because taxes are discriminatory. ─────────────

12.3　CFO's Summary

In the opening chapter of Part II we have argued that there are deviations from PPP. These deviations can be very large at any given point in time, and they also tend to persist over time. It typically takes three years before the distance between the actual spot rate and the PPP prediction is reduced by half. Moreover, it is difficult to predict exchange rates. All of this implies that firms that sell goods abroad, or import goods, or firms that compete with foreign firms or may have to compete with foreign producers in the future are exposed to real exchange rate risk. In this chapter, we have argued that it may be important that firms hedge this risk.

The Modigliani-Miller (1958) theorems state that financial policies, such as a firm's hedging strategy, cannot increase the value of a firm. However, this result is true only in perfect markets and if the firm's other cash flows are utterly unaffected by the financial decision at hand. Given the presence of convex tax schedules, costs of financial distress, and agency costs, hedging exchange risk can increase the value of a firm through its effect on future expected cash flows and the firm's borrowing costs. For a well-capitalized and profitable firm those considerations may carry little weight, and we do see many such firms happily ignoring exchange risk.

Not all companies are that lucky, though. For them, hedging adds value. But many comfortably rich companies have hedging policies too, often implemented by a reinvoicing center. Their view is that hedging may add little intrinsic value, but it is a low-cost option with some collateral attractions. For instance, managers like to reduce the risk of not meeting their numbers, Wall Street analysts appreciate predictibility, and HQ strategists prefer not to be distracted by items that have nothing to do with the division's own decisions. Also, strategists may argue that the decision *not* to hedge is not very different from a decision to speculate. There is nothing intrinsically wrong with speculation, but a firm's expertise is likely to be in its own business, not in speculating on foreign exchange. Thus, even thick-walleted companies often hedge their exposure.

12.4 Test Your Understanding

12.4.1 Quiz Questions

True-False Questions

1. In perfect markets, a manager's decision to hedge a firm's cash flows is irrelevant because there is no exchange rate risk.

2. In perfect markets, a manager's decision to hedge a firm's cash flows is irrelevant because the shareholders can hedge exchange risk themselves.

3. If a large firm keeps track of the exposure of each of its divisions, the firm has better information about each division, and is therefore better able to make decisions.

4. If a firm does not have a hedging policy, the managers may insist on higher wages to compensate them for the risk they bear because part of their lifetime future wealth is exposed to exchange rate risk.

5. If the firm does not have a hedging policy, the managers may refuse to undertake risky projects even when they have a positive net present value.

6. The risk-adjusted expected future tax savings from borrowing in your local currency always equals the present value of the expected tax savings from borrowing in a foreign currency.

7. The cost of hedging is roughly half of the difference between the forward premium and the spot exchange rate.

8. A reinvoicing center assumes the exchange rate risk of the various subsidiaries of a multinational corporation if it allows each subsidiary to purchase or sell in its "home" currency.

Valid-Invalid Questions

Determine which statements below are valid reasons for the manager of a firm to hedge exchange rate risk and which are not.

1. The manager should use hedging in order to minimize the volatility of the cash flows and therefore the probability of bankruptcy even though the expected return on the firm's stock will also be reduced.

2. Firms may benefit from economies of scale when hedging in forward or money markets, while individual shareholders may not.

3. The chance of financial distress is greater when a firm's cash flows are highly variable, and financial distress is costly in imperfect markets.

4. Shareholders do not have sufficient information about a firm's exposure.

5. Risk-averse employees demand a risk premium when the volatility of a firm's cash flows is high.

6. Short selling is often difficult or impossible for the individual shareholders.

7. Hedging a foreign currency inflow is beneficial when the forward rate is at a premium, because it is profitable and therefore desirable. In contrast, such hedging is not desirable when the forward rate is at a discount.

8. Since a forward contract always has a zero value, it never affects the value of the firm—but it is desirable because it reduces the variability of the cash flows.

9. Hedging reduces agency costs by reducing the variability of the firm's cash flows. Hedging means that the manager bears less personal income risk, making the manager more likely to accept risky projects with a positive net present value.

10. Hedging is desirable for firms that operate in a flat-tax-rate environment because income smoothing means that they can expect to pay less taxes.

11. Managers have an incentive to hedge in order to reduce the variability of the firm's cash flows because even though a firm may be able to carry forward losses, there is the loss of time value.

Multiple-Choice Questions

Choose the correct answer(s).

1. The Modigliani-Miller theorem, as applied to the firm's hedging decision, states that

   (a) in perfect markets and for given cash flows from operations, hedging is irrelevant because by making private transactions in the money and foreign exchange markets, the shareholders can eliminate the risk of the cash flows.

   (b) bankruptcy is not costly when capital markets are perfect.

   (c) a firm's value cannot be increased by changing the proportion of debt to equity used to finance the firm. Thus, the value of the tax shield from borrowing in home currency exactly equals the risk-adjusted expected tax shield from borrowing in foreign currency.

   (d) if the shareholders are equally able to reduce the risk from exchange rate exposure as the firm, then hedging will not add to the value of the firm.

    (e) markets are perfect so hedging by the manager of the firm and the shareholders is irrelevant.

2. Hedging may reduce agency costs because

    (a) some of the uncertainty of a manager's lifetime income has been diversified away.

    (b) the shareholders will always prefer volatile projects while the debtholders will prefer nonvolatile ones.

    (c) risk-averse employees will demand a risk premium from a firm that is more likely to be in financial distress.

    (d) customers will think twice about purchasing goods from a company that may not be able to offer long-term customer service.

    (e) a reduction in the variability of the firm's cash flows may reduce the likelihood for conflicts between the debtholders and the shareholders.

3. Which of the following statements represent capital market imperfections?

    (a) Agency costs.

    (b) The difference between half of the bid-ask spread between the spot and forward markets.

    (c) The potential costs from renegotiating a loan that has gone into default.

    (d) The time value lost from having to carry forward losses into a future tax year.

    (e) Fees for liquidators, lawyers, and courts in the event of bankruptcy.

12.4.2 Applications

1. Using the following data, compute the cost of hedging for each forward contract in terms of implicit commission and in terms of the extra spread as a percent of the midpoint spot rate.

Maturity	Rates	Bid-ask	Hedging cost	Extra spread
Spot	49.858-49.898	0.040		
Fwd 30 days	49.909-49.965	0.056		
Fwd 60 days	49.972-50.043	0.071		
Fwd 90 days	50.061-50.157	0.096		
Fwd 180 days	50.156-50.292	0.136		

2. In the wake of the North American Free Trade Agreement, the firm All-American Exports, Inc. has begun exporting baseball caps and gloves to Mexico. Suppose that All-American is subject to a tax of 30 percent when it earns profits less than or equal to USD 10 million and 40 percent on the part of profits that exceeds USD 10 million. The table below shows the company's profits in USD under three exchange rate scenarios, when the firm has hedged its income and when it has left its income unhedged. The probability of each level of the exchange rate is also given.

	Hedged Profits	Unhedged profits	Probability
S_{hi}	15m	20m	25%
$S_{unchanged}$	10m	10m	50%
S_{lo}	5m	0	25%

(a) Compute the taxes that All-American must pay under each scenario.

(b) What are All-American's expected taxes when it hedges its income?

(c) What are All-American's expected taxes when it does not hedge its income?

3. In order to hedge its Mexican peso earnings, All-American is considering borrowing MXN 25 million, but is concerned about losing its USD interest tax shield. The exchange rate is USD/MXN 0.4, $r_{t,T} = 8\%$, and $r_t^*{}_{,T} = 6\%$. The tax rate is 35 percent.

(a) What is All-American's tax shield from borrowing in USD?

(b) What is All-American's tax shield from borrowing in MXN?

(c) What is the risk-adjusted expected tax shield from borrowing in MXN?

4. Graham Cage, the mayor of Atlantic Beach, in the US, has received bids from three dredging companies for a beach renewal project. The work is carried out in three stages, with partial payment to be made at the completion of each stage. The current FC/USD spot rates are NZD/USD 1.6, DKK/USD 5.5, and CAD/USD 1.3. The effective USD returns that correspond to the completion of each stage are the following: $r_{0,1} = 6.00$ percent, $r_{0,2} = 6.25$ percent and $r_{0,3} = 6.50$ percent. The companies' bids are shown below. Each forward rate corresponds to the expected completion date of each stage.

Company	Stage 1	Stage 2	Stage 3
Auckland Dredging	NZD 1,700,000	NZD 1,800,000	NZD 1,900,000
forward rate NZD/USD	$F_{0,1} = 1.65$	$F_{0,2} = 1.70$	$F_{0,3} = 1.75$
Copenhagen Dredging	DKK 5,200,000	DKK 5,800,000	DKK 6,500,000
forward rate DKK/USD	$F_{0,1} = 5.50$	$F_{0,2} = 5.45$	$F_{0,3} = 5.35$
Vancouver Dredging	CAD 1,300,000	CAD 1,400,000	CAD 1,500,000
forward rate CAD/USD	$F_{0,1} = 1.35$	$F_{0,2} = 1.30$	$F_{0,3} = 1.25$

(a) Which offer should Mayor Cage accept?

(b) Was he wise to accept the bids in each company's own currency? Please explain.