

RISK MANAGEMENT: PROFILING AND HEDGING

To manage risk, you first have to understand the risks that you are exposed to. This process of developing a risk profile thus requires an examination of both the immediate risks from competition and product market changes as well as the more indirect effects of macro economic forces. We will begin this chapter by looking at ways in which we can develop a complete risk profile for a firm, where we outline all of the risks that a firm is exposed to and estimate the magnitude of the exposure.

In the second part of the chapter, we turn to a key question of what we should do about these risks. In general, we have three choices. We can do nothing and let the risk pass through to investors in the business – stockholders in a publicly traded firm and the owners of private businesses. We can try to protect ourselves against the risk using a variety of approaches – using options and futures to hedge against specific risks, modifying the way we fund assets to reduce risk exposure or buying insurance. Finally, we can intentionally increase our exposure to some of the risks because we feel that we have significant advantages over the competition. In this chapter, we will consider the first two choices and hold off on the third choice until the next chapter.

Risk Profile

Every business faces risks and the first step in managing risk is making an inventory of the risks that you face and getting a measure of the exposure to each risk. In this section, we examine the process of developing a risk profile for a business and consider some of the potential pitfalls. There are four steps involved in this process. In the first step, we list all risks that a firm is exposed to, from all sources and without consideration to the type of risk. We categorize these risks into broad groups in the second step and analyze the exposure to each risk in the third step. In the fourth step, we examine the alternatives available to manage each type of risk and the expertise that the firm brings to dealing with the risk.

Step 1: A listing of risks

Assume that you run a small company in the United States, packaging and selling premium coffee beans for sale to customers. You may buy your coffee beans in

Columbia, sort and package them in the California and ship them to your customers all over the world. In the process, you are approached to a multitude of risks. There is the risk of political turmoil in Columbia, compounded by the volatility in the dollar-peso exchange rate. Your packaging plant in California may sit on top of an earthquake fault line and be staffed with unionized employees, exposing you to the potential for both natural disasters and labor troubles. Your competition comes from other small businesses offering their own gourmet coffee beans and from larger companies like Starbucks that may be able to get better deals because of higher volume. On top of all of this, you have to worry about the overall demand for coffee ebbing and flowing, as customers choose between a wider array of drinks and worry about the health concerns of too much caffeine consumption.

Not surprisingly, the risks you face become more numerous and complicated as you expand your business to include new products and markets, and listing them all can be exhausting. At the same time, though, you have to be aware of the risks you face before you can begin analyzing them and deciding what to do about them.

Step 2: Categorize the risks

A listing of all risks that a firm faces can be overwhelming. One step towards making them manageable is to sort risk into broad categories. In addition to organizing risks into groups, it is a key step towards determining what to do about these risks. In general, risk can be categorized based on the following criteria:

- a. Market versus Firm-specific risk: In keeping with our earlier characterization of risk in risk and return models, we can categorize risk into risk that affects one or a few companies (firm-specific risk) and risk that affects many or all companies (market risk). The former can be diversified away in a portfolio but the latter will persist even in diversified portfolios; in conventional risk and return models, the former have no effect on expected returns (and discount rates) whereas the latter do.
- b. Operating versus Financial Risk: Risk can also be categorized as coming from a firm's financial choices (its mix of debt and equity and the types of financing that it uses) or from its operations. An increase in interest rates or risk premiums

- would be an example of the former whereas an increase in the price of raw materials used in production would be an example of the latter.
- c. Continuous Risks versus Event Risk: Some risks are dormant for long periods and manifest themselves as unpleasant events that have economic consequences whereas other risks create continuous exposure. Consider again the coffee bean company's risk exposure in Columbia. A political revolution or nationalization of coffee estates in Columbia would be an example of event risk whereas the changes in exchange rates would be an illustration of continuous risk.
 - d. Catastrophic risk versus Smaller risks: Some risks are small and have a relatively small effect on a firm's earnings and value, whereas others have a much larger impact, with the definition of small and large varying from firm to firm. Political turmoil in its Indian software operations will have a small impact on Microsoft, with its large market cap and cash reserves allowing it to find alternative sites, but will have a large impact on a small software company with the same exposure.

Some risks may not be easily categorized and the same risk can switch categories over time, but it still pays to do the categorization.

Step 3: Measure exposure to each risk

A logical follow up to categorizing risk is to measure exposure to risk. To make this measurement, though, we have to first decide what it is that risk affects. At its simplest level, we could measure the effect of risk on the earnings of a company. At its broadest level, we can capture the risk exposure by examining how the value of a firm changes as a consequence.

Earnings versus Value Risk Exposure

It is easier to measure earnings risk exposure than value risk exposure. There are numerous accounting rules governing how companies should record and report exchange rate and interest rate movements. Consider, for instance, how we deal with exchange rate movements. From an accounting standpoint, the risk of changing exchange rates is captured in what is called **translation exposure**, which is the effect of these changes on the current income statement and the balance sheet. In making translations of foreign

operations from the foreign to the domestic currency, there are two issues we need to address. The first is whether financial statement items in a foreign currency should be translated at the current exchange rate or at the rate that prevailed at the time of the transaction. The second is whether the profit or loss created when the exchange rate adjustment is made should be treated as a profit or loss in the current period or deferred until a future period.

Accounting standards in the United States apply different rules for translation depending upon whether the foreign entity is a self-contained unit or a direct extension of the parent company. For the first group, FASB 52 requires that an entity's assets and liabilities be converted into the parent's currency at the prevailing exchange rate. The increase or decrease in equity that occurs as a consequence of this translation is captured as an unrealized foreign exchange gain or loss and will not affect the income statement until the underlying assets and liabilities are sold or liquidated. For the second group, only the monetary assets and liabilities¹ have to be converted, based upon the prevailing exchange rate, and the net income is adjusted for unrealized translations gains or losses.

Translation exposure matters from the narrow standpoint of reported earnings and balance sheet values. The more important question, however, is whether investors view these translation changes as important in determining firm value, or whether they view them as risk that will average out across companies and across time, and the answers to this question are mixed. In fact, several studies suggest that earnings changes caused by exchange rate changes do not affect the stock prices of firms.

While translation exposure is focused on the effects of exchange rate changes on financial statements, **economic exposure** attempts to look more deeply at the effects of such changes on firm value. These changes, in turn, can be broken down into two types. **Transactions exposure** looks at the effects of exchange rate changes on transactions and projects that have already been entered into and denominated in a foreign currency. **Operating exposure** measures the effects of exchange rate changes on expected future cash flows and discount rates, and, thus, on total value.

¹ Monetary assets include cash, marketable securities and some short terms assets such as inventory. They do not include real assets.

In his book on international finance, Shapiro presents a time pattern for economic exposure, in which he notes that firms are exposed to exchange rate changes at every stage in the process from developing new products for sale abroad, to entering into contracts to sell these products to waiting for payment on these products.² To illustrate, a weakening of the U.S. dollar will increase the competition among firms that depend upon export markets, such as Boeing, and increase their expected growth rates and value, while hurting those firms that need imports as inputs to their production process.

Measuring Risk Exposure

We can measure risk exposure in subjective terms by assessing whether the impact of a given risk will be large or small (but not specifying how large or small) or in quantitative terms where we attempt to provide a numerical measure of the possible effect. In this section, we will consider both approaches.

Qualitative approaches

When risk assessment is done for strategic analysis, the impact is usually measured in qualitative terms. Thus, a firm will be found to be vulnerable to country risk or exchange rate movements, but the potential impact will be categorized on a subjective scale. Some of these scales are simple and have only two or three levels (high, average and low impact) whereas others allow for more gradations (risk can be scaled on a 1-10 scale).

No matter how these scales are structured, we will be called upon to make judgments about where individual risks fall on this scale. If the risk being assessed is one that the firm is exposed to on a regular basis, say currency movements, we can look at its impact on earnings or market value on a historical basis. If the risk being assessed is a low-probability event on which there is little history as is the case for an airline exposed to the risk of terrorism, the assessment has to be based upon the potential impact of such an incident.

While qualitative scales are useful, the subjective judgments that go into them can create problems since two analysts looking at the same risk can make very different

² Shapiro, A., 1996, *Multinational Financial Management* (Seventh Edition), John Wiley, New York.

assessments of their potential impact. In addition, the fact that the risk assessment is made by individuals, based upon their judgments, exposes it to all of the quirks in risk assessment that we noted earlier in the book. For instance, individuals tend to weight recent history too much in making assessments, leading to an over estimation of exposure from recently manifested risks. Thus, companies over estimate the likelihood and impact of terrorist attacks right after well publicized attacks elsewhere.

Quantitative approaches

If risk manifests itself over time as changes in earnings and value, you can assess a firm's exposure to risk by looking at its past history. In particular, changes in a firm's earnings and value can be correlated with potential risk sources to see both whether they are affected by the risks and by how much. Alternatively, you can arrive at estimates of risk exposure by looking at firms in the sector in which you operate and their sensitivity to changes in risk measures.

1. Firm specific risk measures

Risk matters to firms because it affects their profitability and consequently their value. Thus, the simplest way of measuring risk exposure is to look at the past and examine how earnings and firm value have moved over time as a function of pre-specified risk. If we contend, for instance, that a firm is cyclical and is exposed to the risk of economic downturns, we should be able to back this contention up with evidence that it has been adversely impacted by past recessions.

Consider a simple example where we estimate how much risk Walt Disney Inc. is exposed to from to changes in a number of macro-economic variables, using two measures: Disney's firm value (the market value of debt and equity) and its operating income. We begin by collecting past data on firm value, operating income and the macroeconomic variables against which we want to measure its sensitivity. In the case of the Disney, we look at four macro-economic variables – the level of long term rates measured by the 10 year treasury bond rate, the growth in the economy measured by changes in real GDP, the inflation rate captured by the consumer price index and the strength of the dollar against other currencies (estimated using the trade-weighted dollar

value). In table 10.1, we report the earnings and value for Disney at the end of each year from 1988 to 2003 with the levels of each macro-economic variable.

Table 10.1: Disney's Firm Value and Macroeconomic Variables

Period	Operating Income	Firm value	T.Bond Rate	Change in rate	GDP (Deflated)	% Chg in GDP	CPI	Change in CPI	Weighted Dollar	% Change in \$
2003	\$2,713	\$68,239	4.29%	0.40%	10493	3.60%	2.04%	0.01%	88.82	-14.51%
2002	\$2,384	\$53,708	3.87%	-0.82%	10128	2.98%	2.03%	-0.10%	103.9	-3.47%
2001	\$2,832	\$45,030	4.73%	-1.20%	9835	-0.02%	2.13%	-1.27%	107.64	1.85%
2000	\$2,525	\$47,717	6.00%	0.30%	9837	3.53%	3.44%	0.86%	105.68	11.51%
1999	\$3,580	\$88,558	5.68%	-0.21%	9502	4.43%	2.56%	1.05%	94.77	-0.59%
1998	\$3,843	\$65,487	5.90%	-0.19%	9099	3.70%	1.49%	-0.65%	95.33	0.95%
1997	\$3,945	\$64,236	6.10%	-0.56%	8774	4.79%	2.15%	-0.82%	94.43	7.54%
1996	\$3,024	\$65,489	6.70%	0.49%	8373	3.97%	2.99%	0.18%	87.81	4.36%
1995	\$2,262	\$54,972	6.18%	-1.32%	8053	2.46%	2.81%	0.19%	84.14	-1.07%
1994	\$1,804	\$33,071	7.60%	2.11%	7860	4.30%	2.61%	-0.14%	85.05	-5.38%
1993	\$1,560	\$22,694	5.38%	-0.91%	7536	2.25%	2.75%	-0.44%	89.89	4.26%
1992	\$1,287	\$25,048	6.35%	-1.01%	7370	3.50%	3.20%	0.27%	86.22	-2.31%
1991	\$1,004	\$17,122	7.44%	-1.24%	7121	-0.14%	2.92%	-3.17%	88.26	4.55%
1990	\$1,287	\$14,963	8.79%	0.47%	7131	1.68%	6.29%	1.72%	84.42	-11.23%
1989	\$1,109	\$16,015	8.28%	-0.60%	7013	3.76%	4.49%	0.23%	95.10	4.17%
1988	\$789	\$9,195	8.93%	-0.60%	6759	4.10%	4.25%	-0.36%	91.29	-5.34%
1987	\$707	\$8,371	9.59%	2.02%	6493	3.19%	4.63%	3.11%	96.44	-8.59%
1986	\$281	\$5,631	7.42%	-2.58%	6292	3.11%	1.47%	-1.70%	105.50	-15.30%
1985	\$206	\$3,655	10.27%	-1.11%	6102	3.39%	3.23%	-0.64%	124.56	-10.36%
1984	\$143	\$2,024	11.51%	-0.26%	5902	4.18%	3.90%	-0.05%	138.96	8.01%
1983	\$134	\$1,817	11.80%	1.20%	5665	6.72%	3.95%	-0.05%	128.65	4.47%
1982	\$141	\$2,108	10.47%	-3.08%	5308	-1.61%	4%	-4.50%	123.14	6.48%

Firm Value = Market Value of Equity + Book Value of Debt

Once these data have been collected, we can then estimate the sensitivity of firm value to changes in the macroeconomic variables by regressing changes in firm value each year against changes in each of the individual variables.

- Regressing changes in firm value against changes³ in interest rates over this period yields the following result (with t statistics in brackets):

$$\begin{aligned} \text{Change in Firm Value} &= 0.2081 & - 4.16 \text{ (Change in Interest Rates)} \\ &(2.91) & (0.75) \end{aligned}$$

³ To ensure that the coefficient on this regression is a measure of duration, we compute the change in the interest rate as follows: $(r_t - r_{t-1})/(1+r_{t-1})$. Thus, if the long term bond rate goes from 8% to 9%, we compute the change to be $(.09-.08)/1.08$.

Every 1% increase in long term rates translates into a loss in value of 4.16%, though the statistical significant is marginal.

- Is Disney a cyclical firm? One way to answer this question is to measure the sensitivity of firm value to changes in economic growth. Regressing changes in firm value against changes in the real Gross Domestic Product (GDP) over this period yields the following result:

$$\begin{array}{rcl} \text{Change in Firm Value} & = & 0.2165 \quad + 0.26 \text{ (GDP Growth)} \\ & & (1.56) \quad (0.07) \end{array}$$

Disney's value as a firm has not been affected significantly by economic growth. Again, to the extent that we trust the coefficients from this regression, this would suggest that Disney is not a cyclical firm.

- To examine how Disney is affected by changes in inflation, we regressed changes in firm value against changes in the inflation rate over this period with the following result:

$$\begin{array}{rcl} \text{Change in Firm Value} & = & 0.2262 \quad + 0.57 \text{ (Change in Inflation Rate)} \\ & & (3.22) \quad (0.13) \end{array}$$

Disney's firm value is unaffected by changes in inflation since the coefficient on inflation is not statistically different from zero.

- We can answer the question of how sensitive Disney's value is to changes in currency rates by looking at how the firm's value changes as a function of changes in currency rates. Regressing changes in firm value against changes in the dollar over this period yields the following regression:

$$\begin{array}{rcl} \text{Change in Firm Value} & = & 0.2060 \quad -2.04 \text{ (Change in Dollar)} \\ & & (3.40) \quad (2.52) \end{array}$$

Statistically, this yields the strongest relationship. Disney's firm value decreases as the dollar strengthens.

In some cases, it is more reasonable to estimate the sensitivity of operating cash flows directly against changes in interest rates, inflation, and other variables. For Disney, we repeated the analysis using operating income as the dependent variable, rather than firm value. Since the procedure for the analysis is similar, we summarize the conclusions below:

- Regressing changes in operating cash flow against changes in interest rates over this period yields the following result –

$$\begin{array}{rcl} \text{Change in Operating Income} & = & 0.2189 \quad + 6.59 \text{ (Change in Interest Rates)} \\ & & (2.74) \quad (1.06) \end{array}$$

Disney's operating income, unlike its firm value, has moved with interest rates. Again, this result has to be considered in light of the low t statistics on the coefficients. In general, regressing operating income against interest rate changes should yield a lower estimate of duration than the firm value measure, for two reasons. One is that income tends to be smoothed out relative to value, and the other is that the current operating income does not reflect the effects of changes in interest rates on discount rates and future growth.

- Regressing changes in operating cash flow against changes in Real GDP over this period yields the following regression –

$$\begin{array}{rcl} \text{Change in Operating Income} & = & 0.1725 \quad + 0.66 \text{ (GDP Growth)} \\ & & (1.10) \quad (0.15) \end{array}$$

Disney's operating income, like its firm value, does not reflect any sensitivity to overall economic growth, confirming the conclusion that Disney is not a cyclical firm.

- Regressing changes in operating cash flow against changes in the dollar over this period yields the following regression –

$$\begin{array}{rcl} \text{Change in Operating Income} & = & 0.1768 \quad -1.76 \text{ (Change in Dollar)} \\ & & (2.42) \quad (1.81) \end{array}$$

Disney's operating income, like its firm value, is negatively affected by a stronger dollar.

- Regressing changes in operating cash flow against changes in inflation over this period yields the following result –

$$\begin{array}{rcl} \text{Change in Operating Income} & = & 0.2192 \quad +9.27 \text{ (Change in Inflation Rate)} \\ & & (3.01) \quad (1.95) \end{array}$$

Unlike firm value which is unaffected by changes in inflation, Disney's operating income moves strongly with inflation, rising as inflation increases. This would

suggest that Disney has substantial pricing power, allowing it to pass through inflation increases into its prices and operating income..

The question of what to do when operating income and firm value have different results can be resolved fairly simply. The former provides a measure of earnings risk exposure and is thus narrow, whereas the latter captures the effect not only on current earnings but also on future earnings. It is possible, therefore, that a firm is exposed to earnings risk from a source but that the value risk is muted, as is the alternative where the risk to current earnings is low but the value risk is high.

2. Sector-wide or Bottom up Risk Measures

There are two key limitations associated with the firm-specific risk measures described in the last section. First, they make sense only if the firm has been in its current business for a long time and expects to remain in it for the foreseeable future. In today's environment, in which firms find their business mixes changing from period to period as they divest some businesses and acquire new ones, it is unwise to base too many conclusions on a historical analysis. Second, the small sample sizes used tend to yield regression estimates that are not statistically significant (as is the case with the coefficient estimates that we obtained for Disney from the interest rate regression). In such cases, we might want to look at the characteristics of the industry in which a firm plans to expand, rather than using past earnings or firm value as a basis for the analysis.

To illustrate, we looked at the sector estimates⁴ for each of the sensitivity measures for the four businesses that Disney is in: movies, entertainment, theme park and consumer product businesses. Table 10.2 summarizes the findings:

Table 10.2: Sector Sensitivity to Macroeconomic Risks

	Coefficients on firm value regression				Disney Weights
	Interest Rates	GDP Growth	Inflation	Currency	
Movies	-3.70	0.56	1.41	-1.23	25.62%
Theme Parks	-6.47	0.22	-1.45	-3.21	20.09%

⁴ These sector estimates were obtained by aggregating the firm values of all firms in a sector on a quarter-by-quarter basis going back 12 years, and then regressing changes in this aggregate firm value against changes in the macro-economic variable each quarter.

Broadcasting	-4.50	0.70	-3.05	-1.58	49.25%
Consumer Products	-4.88	0.13	-5.51	-3.01	5.04%
Disney	-4.71	0.54	-1.71	-1.89	100%

These bottom-up estimates suggest that firms in the business are negatively affected by higher interest rates (losing 4.71% in value for every 1% change in interest rates), and that firms in this sector are relatively unaffected by both the overall economy. Like Disney, firms in these businesses tend to be hurt by a stronger dollar, but,, unlike Disney, they do not seem have much pricing power (note the negative coefficient on inflation. The sector averages also have the advantage of more precision than the firm-specific estimates and can be relied on more.

Step 4: Risk analysis

Once you have categorized and measured risk exposure, the last step in the process requires us to consider the choices we can make in dealing with each type of risk. While we will defer the full discussion of which risks should be hedged and which should not to the next section, we will prepare for that discussion by first outlining what our alternatives are when it comes to dealing with each type of risk and follow up be evaluating our expertise in dealing with that risk.

There are a whole range of choices when it comes to hedging risk. You can try to reduce or eliminate risk through your investment and financing choices, through insurance or by using derivatives. Not all choices are feasible or economical with all risks and it is worthwhile making an inventory of the available choices with each one. The risk associated with nationalization cannot be managed using derivatives and can be only partially insured against; the insurance may cover the cost of the fixed assets appropriated but not against the lost earnings from these assets. In contrast, exchange rate risk can be hedged in most markets with relative ease using market-traded derivatives contracts.

A tougher call involves making an assessment of how well you deal with different risk exposures. A hotel company may very well decide that its expertise is not in making real estate judgments but in running hotels efficiently. Consequently, it may decide to hedge against the former while being exposed to the latter.

To Hedge or Not to Hedge?

Assume now that you have a list of all of the risks that you are exposed to, categorizes these risks and measured your exposure to each one. A fundamental and key question that you have to answer is which of these risks you want to hedge against and which you want to either pass through to your investors or exploit. To make this judgment, you have to consider the potential costs and benefits of hedging; in effect, you hedge those risks where the benefits of hedging exceed the costs.

The Costs of Hedging

Protecting yourself against risk is not costless. Sometimes, as is the case of buying insurance, the costs are explicit. At other times, as with forwards and futures contracts, the costs are implicit. In this section, we consider the magnitude of explicit and implicit costs of hedging against risk and how these costs may weigh on the final question of whether to hedge in the first place.

Explicit Costs

Most businesses insure against at least some risk and the costs of risk protection are easy to compute. They take the form of the insurance premiums that you have to pay to get the protection. In general, the trade off is simple. The more complete the protection against risk, the greater the cost of the insurance. In addition, the cost of insurance will increase with the likelihood and the expected impact of a specified risk. A business located in coastal Florida will have to pay more to insure against floods and hurricanes than one in the mid-west.

Businesses that hedge against risks using options can also measure their hedging costs explicitly. A farmer who buys put options to put a lower bound on the price that he will sell his produce at has to pay for the options. Similarly, an airline that buys call options on fuel to make sure that the price paid does not exceed the strike price will know the cost of buying this protection.

Implicit Costs

The hedging costs become less explicit as we look at other ways of hedging against risk. Firms that try to hedge against risk through their financing choices – using

peso debt to fund peso assets, for instance – may be able to reduce their default risk (and consequently their cost of borrowing) but the savings are implicit. Firms that use futures and forward contracts also face implicit costs. A farmer that buys futures contracts to lock in a price for his produce may face no immediate costs (in contrast with the costs of buying put options) but will have to give up potential profits if prices move upwards.

The way in which accountants deal with explicit as opposed to implicit costs can make a difference in which hedging tool gets chosen. Explicit costs reduce the earnings in the period in which the protection is acquired, whereas the implicit costs manifest themselves only indirectly in future earnings. Thus, a firm that buys insurance against risk will report lower earnings in the period that the insurance is bought whereas a firm that uses futures and forward contracts to hedge will not take an earnings hit in that period. The effects of the hedging tool used will manifest itself in subsequent periods with the latter reducing profitability in the event of upside risk.

The Benefits of Hedging

There are several reasons why firms may choose to hedge risks, and they can be broadly categorized into five groups. First, as we noted in the last chapter, the tax laws may benefit those who hedge risk. Second, hedging against catastrophic or extreme risk may reduce the likelihood and the costs of distress, especially for smaller businesses. Third, hedging against risks may reduce the under investment problem prevalent in many firms as a result of risk averse managers and restricted capital markets. Fourth, minimizing the exposure to some types of risk may provide firms with more freedom to fine tune their capital structure. Finally, investors may find the financial statements of firms that do hedge against extraneous or unrelated risks to be more informative than firms that do not.

a. Tax Benefits

A firm that hedges against risk may receive tax benefits for doing so, relative to an otherwise similar firm that does not hedge against risk. As we noted in chapter 9, there are two sources for these tax benefits. One flows from the smoothing of earnings that is a consequence of effective risk hedging; with risk hedging, earnings will be lower than

they would have been without hedging, during periods where the risk does not manifest itself and higher in periods where there is risk exposure. To the extent that the income at higher levels gets taxed at higher rates, there will be tax savings over time to a firm with more level earnings. To see why, consider a tax schedule, where income beyond a particular level (say \$ 1 billion) is taxed at a higher rate – i.e., a windfall profit tax. Since risk management can be used to smooth out income over time, it is possible for a firm with volatile income to pay less in taxes over time as a result of risk hedging. Table 10.3 illustrates the tax paid by the firm, assuming at tax rate of 30% for income below \$ 1 billion and 50% above \$ 1 billion:

Table 10.3: Taxes Paid: With and Without Risk Management

<i>Year</i>	<i>Without risk management</i>		<i>With risk management</i>	
	<i>Taxable Income</i>	<i>Taxes Paid</i>	<i>Taxable Income</i>	<i>Taxes Paid</i>
<i>1</i>	600	180	800	240
<i>2</i>	1500	550	1200	400
<i>3</i>	400	120	900	270
<i>4</i>	1600	600	1200	400
<i>Total</i>	4100	1450	4100	1310

Risk hedging has reduced the taxes paid over 4 years by \$140 million. While it is true that we have not reflected the cost of risk hedging in the taxable income, the firm can afford to spend up to \$ 140 million and still come out with a value increase. The tax benefits in the example above were predicated on the existence of a tax rate that rises with income (convex tax rates). Even in its absence, though, firms that go from making big losses in some years to big profits in other years can benefit from risk hedging to the extent that they get their tax benefits earlier. In a 1999 study, Graham and Smith provide some empirical evidence on the potential tax benefits to companies from hedging by looking at the tax structures of U.S. firms. They estimate that about half of all U.S. firms face convex effective tax functions (where tax rates rise with income), about a quarter have linear tax functions (where tax rates do not change with income) and a quarter actually have concave tax functions (where tax rates decrease with income). They also note that firms with volatile income near a kink in the statutory tax schedule, and firms

that shift from profits in one period to losses in another, are most likely to have convex tax functions. Using simulations of earnings, they estimate the potential tax savings to firms and conclude that while they are fairly small for most firms, they can generate tax savings that are substantial for a quarter of the firms with convex tax rates. In some cases, the savings amounted to more than 40% of the overall tax liability.⁵

The other potential tax benefit arises from the tax treatment of hedging expenses and benefits. At the risk of over simplification, there will be a tax benefit to hedging if the cost of hedging is fully tax deductible but the benefits from insurance are not fully taxed. As a simple example, consider a firm that pays \$2.5 million in insurance premiums each year for three years and receives an expected benefit of \$7.5 million at the third year. Assume that the insurance premiums are tax deductible but that the insurance payout is not taxed. In such a scenario, the firm will clearly gain from hedging. Mains (1983) uses a variation of this argument to justify the purchase of insurance by companies. He cites an Oil Insurance Association brochure entitled “To Insure or Not to Insure” that argues that self-insure property damages are deductible only to the extent of the book value but that income from insurance claims is tax free as long as it is used to repair or replace the destroyed assets. Even if used elsewhere, firms only have to pay the capital gains tax (which is lower than the income tax) on the difference between the book value of the asset and the insurance settlement. Since the capital gains tax rate is generally lower than the income tax rate, firms can reduce their tax payments by buying even fairly-priced insurance.⁶

b. Better investment decisions

In a perfect world, the managers of a firm would consider each investment opportunity based upon its expected cash flows and the risk that that investment adds to the investors in the firm. They will not be swayed by risks that can be diversified away by these investors, substantial though these risks may be, and capital markets will stand ready to supply the funds needed to make these investments.

⁵ Graham, J.R., and C.W. Smith, 1999, Tax Incentives to Hedge, *Journal of Finance*, v54, 2242-2262.

⁶ Mains, B., 1983, Corporate Insurance Purchases and Taxes, *Journal of Risk and Insurance*, v50, 197-223.

As we noted in chapter 9, there are frictions that can cause this process to break down. In particular, there are two problems that affect investment decisions that can be traced to the difference between managerial and stockholder interests:

- a. Managerial risk aversion: Managers may find it difficult to ignore risks that are diversifiable, partly because their compensation and performance measures are still affected by these risks and partly because so much of their human capital is tied up in these firms. As a consequence, they may reject investments that add value to the firm because the firm-specific risk exposure is substantial.
- b. Capital market frictions: A firm that has a good investment that it does not have cash on hand to invest in will have to raise capital by either issuing new equity or by borrowing money. In a well cited paper, Jensen and Meckling note that firms that are dependent upon new stock issues to fund investments will tend to under invest because they have to issue the new shares at a discount; the discount can be attributed to the fact that markets cannot distinguish between firms raising funds for good investments and those raising funds for poor investments easily and the problem is worse for risky companies.⁷ If firms are dependent upon bank debt for funding investments, it is also possible that these investments cannot be funded because access to loans is affected by firm-specific risks. Froot, Scharfstein and Stein generalize this argument by noting that the firms that hedge against risk are more likely to have stable operating cash flows and are thus less likely to face unexpected cash shortfalls. As a consequence, they are less dependent upon external financing and can stick with long-term capital investment plans and increase value.⁸

By allowing managers to hedge firm-specific risks, risk hedging may reduce the number of good investments that get rejected either because of managerial risk aversion or lack of access to capital.

⁷ Jensen, M.C. and Meckling, W.H. 1976. Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, *Journal of Financial Economics*, 3 (3): 305-360.

⁸ Froot, K.A., Scharfstein, D.S. and Stein, J.C. 1993. Risk Management: Coordinating Corporate Investment and Financing Policies. *Journal of Finance* 48(5): 1629-1658; Froot, K, D Scharfstein and J Stein, 1994, *A Framework for Risk Management*, Harvard Business Review, v72, 59 71

c. Distress Costs

Every business, no matter how large and healthy, faces the possibility of distress under sufficiently adverse circumstances. While bankruptcy can be the final cost of distress, the intermediate costs of being perceived to be in trouble are substantial as well. Customers may be reluctant to buy your products, suppliers will impose stricter terms and employees are likely to look for alternative employment, creating a death spiral from which it is difficult to recover. These “indirect” costs of distress can be very large, and studies that try to measure it estimate they range from 20% to 40% of firm value.⁹

Given the large costs of bankruptcy, it is prudent for firms to protect themselves against risks that may cause distress by hedging against them. In general, these will be risks that are large relative to the size of the firm and its fixed commitments (such as interest expenses). As an example, while large firms with little debt like Coca Cola can easily absorb the costs of exchange rate movements, smaller firms and firms with larger debt obligations may very well be pushed to their financial limits by the same risk. Consequently, it makes sense for the latter to hedge against risk.¹⁰

The payoff from lower distress costs show up in value in one of two ways. In a conventional discounted cash flow valuation, the effect is likely to manifest itself as a lower cost of capital (through a lower cost of debt) and a higher value. In the adjusted present value approach, the expected bankruptcy costs will be reduced as a consequence of the hedging. To the extent that the increase in value from reducing distress costs exceeds the cost of hedging, the value of the firm will increase. Note that the savings in distress costs from hedging are likely to manifest themselves in substantial ways only when distress costs are large. Consequently, we would expect firms that have borrowed money and are exposed to significant operating risk to be better candidates for risk

⁹ Shapiro, A. and S. Titman, 1985, An Integrated Approach to Corporate Risk Management, *Midland Corporate Finance Journal*, v3, 41-55. For an examination of the theory behind indirect bankruptcy costs, see Opler, T. and S. Titman, 1994, Financial Distress and Corporate Performance. *Journal of Finance* 49, 1015-1040. For an estimate on how large these indirect bankruptcy costs are in the real world, see Andrade, G. and S. Kaplan, 1998, How Costly is Financial (not Economic) Distress? Evidence from Highly Leveraged Transactions that Become Distressed. *Journal of Finance*. 53, 1443-1493. They look at highly levered transactions that subsequently became distressed and conclude that the magnitude of these costs ranges from 10% to 23% of firm value.

¹⁰ Smith, C.W. and Stulz, R. 1985. The Determinants of Firm's Hedging Policies. *Journal of Financial and Quantitative Analysis* 20 (4): 391-405; Stulz, R., 1984, Optimal Hedging Policies, *Journal of Financial and Quantitative Analysis*, v19, 127-140.

hedging. Kale and Noe (1990) make this point when they note that risk hedging can actually reduce value at low debt ratios, because any gains from reduced distress costs are likely to be small and overwhelmed by the costs of hedging. In contrast, they note that hedging can increase firm value for firms that are optimally levered and thus carry significant debt loads with concurrent distress costs.¹¹

d. Capital Structure

Closely related to the reduced distress cost benefit is the tax advantage that accrues from additional debt capacity. Firms that perceive themselves as facing less distress costs are more likely to borrow more. As long as borrowing creates a tax benefit, this implies that a firm that hedges away large risks will borrow more money and have a lower cost of capital. The payoff will be a higher value for the business.¹²

The evidence on whether hedging does increase debt capacity is mixed. In supporting evidence, One study documents a link between risk hedging and debt capacity by examining 698 publicly traded firms between 1998 and 2003. This study notes that firms that buy property insurance (and thus hedge against real estate risk) borrow more money and have lower costs of debt than firms that do not.¹³ Another study provides evidence on why firms hedge by looking at firms that use derivatives. The researchers conclude that these firms do so not in response to convex tax functions but primarily to increase debt capacity and that these tax benefits add approximately 1.1% in value to these firms. They also find that firms with more debt are more likely to hedge and that hedging leads to higher leverage.¹⁴ However, there is other research that contests these

¹¹ Kale, J.R., and T.H. Noe, 1990, Corporate Hedging under Personal and Corporate Taxation, *Managerial and Decision Economics*, v11, 199-205.

¹² Leland, H., 1998, Agency Costs, Risk Management and Capital Structure, *Journal of Finance*, v53, 1213-1243. He combined the investment and financing arguments in arguing that firms can increase value by hedging. Firms that pre-commit to hedging against risk can borrow more money and lower their costs of capital.

¹³ Zou, H. and M.B. Adams, 2004, Debt Capacity, Cost of Debt and Corporate Insurance, Working Paper, SSRN.com.

¹⁴ Graham, J.R. and D. A. Rogers, 2002, Do firms hedge in response to tax incentives?, *Journal of Finance*, v57, 815-839.

findings. To provide one instance, Gercy, Minton and Schraud examine firms that use currency derivatives and find no link between their usage and higher debt ratios.¹⁵

e. Informational Benefits

Hedging away risks that are unrelated to the core business of a firm can also make financial statements more informative and investors may reward the firm with a higher value. Thus, the changes in earnings for a multinational that hedges exchange rate risk will reflect the operating performance of the firm rather than the luck of the draw when it comes to exchange rates. Similarly, a hotel management company that has hedged away or removed its real estate risk exposure can be judged on the quality of the hotel management services that it provides and the revenues generated, rather than the profits or losses created by movements in real estate prices over time.

In a 1995 paper, DeMarzo and Duffie explore this issue in more detail by looking at both the informational advantages for investors when companies hedge risk and the effect on hedging behavior of how much the hedging behavior is disclosed to investors. They note that the benefit of hedging is that it allows investors to gauge management quality more easily by stripping extraneous noise from the process. They also note a possible cost when investors use the observed variability in earnings as a measure of management quality; in other words, investors assume that firms with more stable earnings have superior managers. If managers are not required to disclose hedging actions to investors, they may have the incentive to hedge too much risk; after all, hedging reduces earnings variability and improves managerial reputation.¹⁶

The Prevalence of Hedging

A significant number of firms hedge their risk exposures, with wide variations in which risks get hedged and the tools used for hedging. In this section, we will look at some of the empirical and survey evidence of hedging among firms.

¹⁵ Gercy, C., B.A. Minton and C. Schraud, 1997, Why firms use currency derivatives? *Journal of Finance*, v , 1323-1354.

¹⁶ DeMarzo, P.M. and D. Duffie, 1995, Corporate Incentives for Hedging and Hedge Accounting, *The Review of Financial Studies*, v8, 743-771.

Who hedges?

In 1999, Mian studied the annual reports of 3,022 companies in 1992 and found that 771 of these firms did some risk hedging during the course of the year. Of these firms, 543 disclosed their hedging activities in the financial statements and 228 mentioned using derivatives to hedge risk but provided no disclosure about the extent of the hedging. Looking across companies, he concluded that larger firms were more likely to hedge than smaller firms, indicating that economies of scale allow larger firms to hedge at lower costs.¹⁷ As supportive evidence of the large fixed costs of hedging, note the results of a survey that found that 45% of Fortune 500 companies used at least one full-time professional for risk management and that almost 15% used three or more full-time equivalents.¹⁸

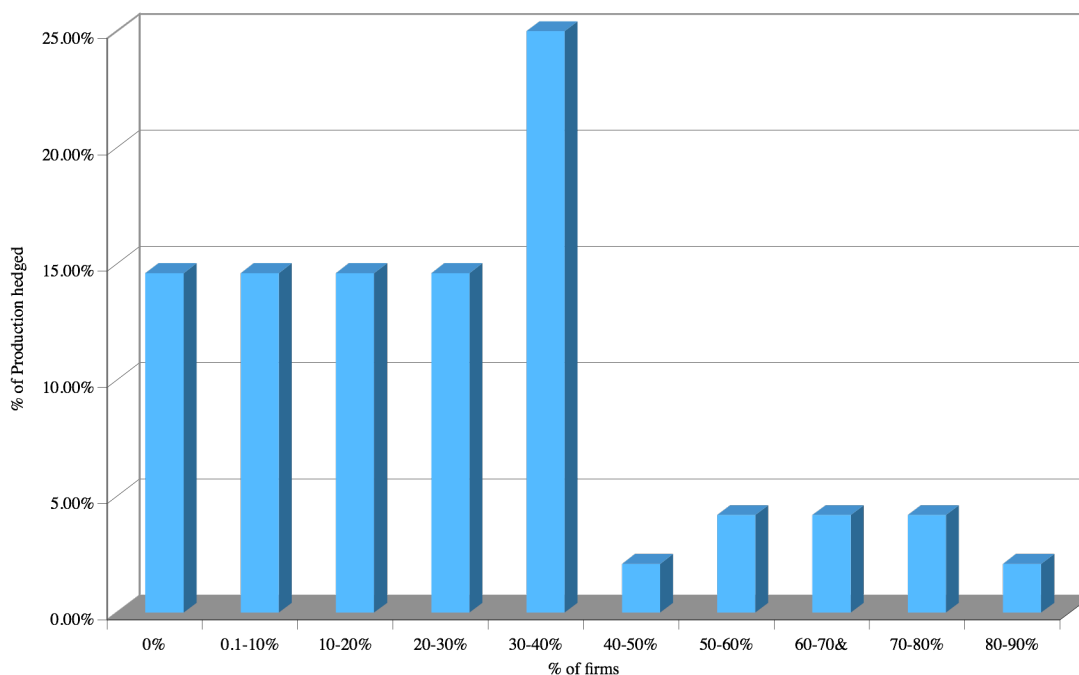
In an examination in 1996 of risk management practices in the gold mining industry, Tufano makes several interesting observations.¹⁹ First, almost 85% of the firms in this industry hedged some or a significant portion of gold price risk between 1990 and 1993. Figure 10.1 summarizes the distribution of the proportion of gold price risk hedged by the firms in the sample.

¹⁷ Mian, S.I., 1996, Evidence on corporate hedging policy, *Journal of Financial and Quantitative Analysis*, v31, 419-439.

¹⁸ Dolde, W., 1993, The Trajectory of Corporate Financial Risk Management, *Journal of Applied Corporate Finance*, v6, 33-41.

¹⁹ Tufano, P., 1996, Who manages risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry, *Journal of Finance*, v51, 1097-1137.

Figure 10.1: Production Hedging at Gold Mining Companies: 1990-93



Source: Tufano (1996)

Second, firms where managers hold equity options are less likely to hedge gold price risk than firms where managers own stock in the firm. Finally, the extent of risk management is negatively related to the tenure of a company's CFO; firms with long-serving CFOs manage less risk than firms with newly hired CFOs.

What risks are most commonly hedged?

While a significant proportion of firms hedge against risk, some risks seem to be hedged more often than others. In this section, we will look at the two most widely hedged risks at U.S. companies – exchange rate risk and commodity price risk – and consider how and why firms hedge these risks.

Exchange Rate Risk

Surveys consistently indicate that the most widely hedged risk at U.S. firms remains currency risk. There are three simple reasons for this phenomenon.

a. It is ubiquitous: It is not just large multi-national firms that are exposed to exchange rate risk. Even small firms that derive almost all of their revenues domestically are often dependent upon inputs that come from foreign markets and are thus exposed to exchange

rate risk. An entertainment software firm that gets its software written in India for sale in the United States is exposed to variations in the U.S. dollar/ Indian Rupee exchange rate.

b. It affects earnings: Accounting conventions also force firms to reflect the effects of exchange rate movements on earnings in the periods in which they occur. Thus, the earnings per share of firms that do not hedge exchange rate risk will be more volatile than firms that do. As a consequence, firms are much more aware of the effects of the exchange rate risk, which may provide a motivation for managing it.

c. It is easy to hedge: Exchange rate risk can be managed both easily and cheaply. Firms can use an array of market-traded instruments including options and futures contracts to reduce or even eliminate the effects of exchange rate risk.

Merck's CFO in 1990, Judy Lewent, and John Kearny described the company's policy on identifying and hedging currency risk. They rationalized the hedging of currency risk by noting that the earnings variability induced by exchange rate movements could affect Merck's capacity to pay dividends and continue to invest in R&D, because markets would not be able to differentiate between earnings drops that could be attributed to the managers of the firm and those that were the result of currency risk. A drop in earnings caused entirely by an adverse exchange rate movement, they noted, could cause the stock price to drop, making it difficult to raise fresh capital to cover needs.²⁰

Commodity Price Risk

While more firms hedge against exchange rate risk than commodity risk, a greater percentage of firms that are exposed to commodity price risk hedge that risk. Tufano's study of gold mining companies, cited earlier in this section, notes that most of these firms hedge against gold price risk. While gold mining and other commodity companies use hedging as a way of smoothing out the revenues that they will receive on the output, there are companies on the other side of the table that use hedging to protect themselves against commodity price risk in their inputs. For instance, Hershey's can use futures contracts on cocoa to reduce uncertainty about its costs in the future.

²⁰ Lewent, J. and J. Kearney, 1990, "Identifying Measuring and Hedging Currency Risk at Merck," Journal of Applied Corporate Finance, v2, 19-28.

Southwest Airlines use of derivatives to manage its exposure to fuel price risk provides a simple example of input price hedging and why firms do it. While some airlines try to pass through increases in fuel prices through to their customers (often unsuccessfully) and others avoid hedging because they feel they can forecast future oil prices, Southwest has viewed it as part of its fiduciary responsibility to its stockholders to hedge fuel price risk. They use a combination of options, swaps and futures to hedge oil price movements and report on their hedging activities in their financial statements.

The motivations for hedging commodity price risk may vary across companies and are usually different for companies that hedge against output price risk (like gold companies) as opposed to companies that hedge against input price risk (such as airlines) but the end result is the same. The former are trying to reduce the volatility in their revenues and the latter are trying to do the same with cost, but the net effect for both groups is more stable and predictable operating income, which presumably allows these firms to have lower distress costs and borrow more. With both groups, there is another factor at play. By removing commodity price risk from the mix, firms are letting investors know that their strength lies not in forecasting future commodity prices but in their operational expertise. A gold mining company is then asking to be judged on its exploration and production expertise, whereas a fuel hedging airline's operating performance will reflect its choice of operating routes and marketing skills.

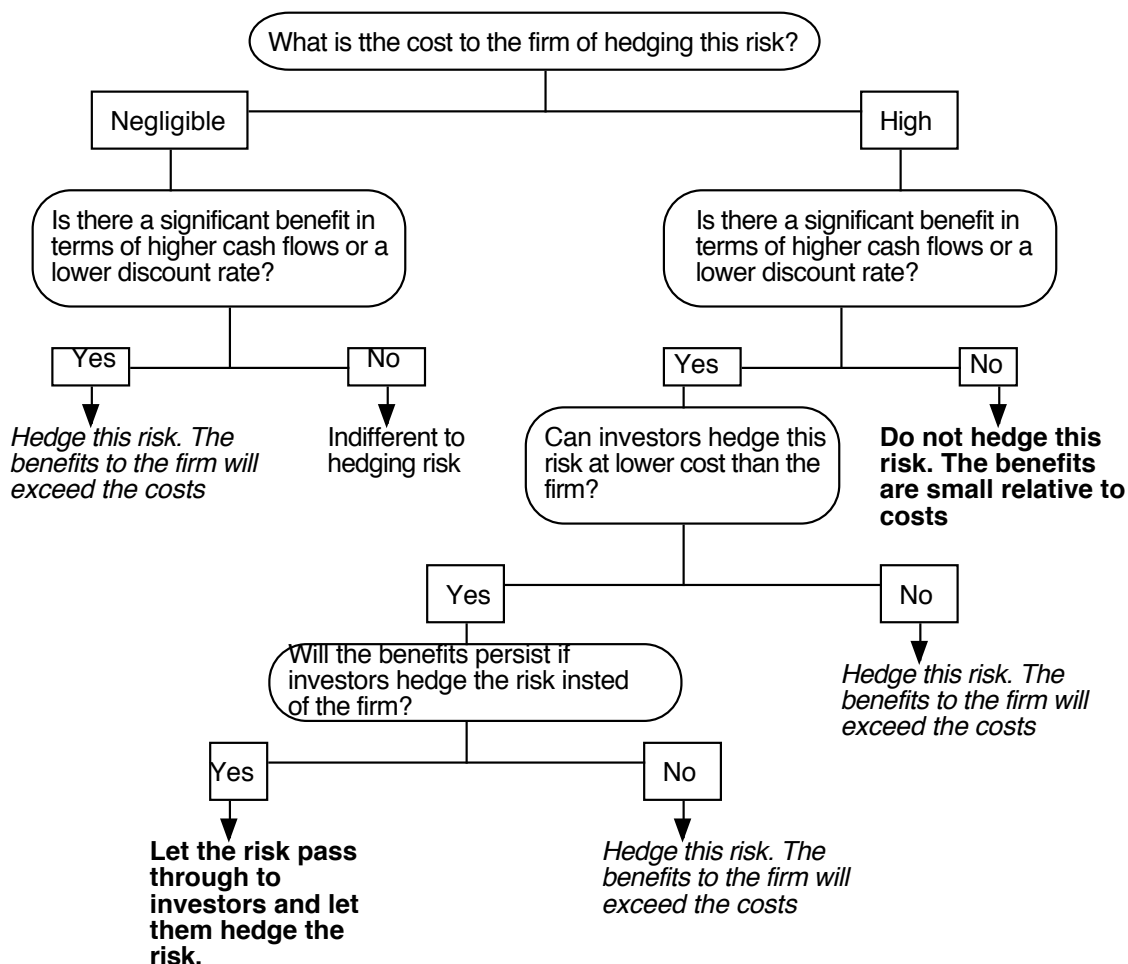
Does hedging increase value?

Hedging risks has both implicit and explicit costs that can vary depending upon the risk being hedged and the hedging tool used, and the benefits include better investment decisions, lower distress costs, tax savings and more informative financial statements. The trade off seems simple; if the benefits exceed the costs, you should hedge and if the costs exceed the benefits, you should not.

This simple set-up is made more complicated when we consider the investors of the firm and the costs they face in hedging the same risks. If hedging a given risk creates benefits to the firm, and the hedging can be done either by the firm or by investors in the firm, the hedging will add value only if the cost of hedging is lower to the firm than it is to investors. Thus, a firm may be able to hedge its exposure to sector risk by acquiring

firms in other businesses, but investors can hedge the same risk by holding diversified portfolios. The premiums paid in acquisitions will dwarf the transactions costs faced by the latter; this is clearly a case where the risk hedging strategy will be value destroying. In contrast, consider an airline that is planning on hedging its exposure to oil price risk because it reduces distress costs. Since it is relatively inexpensive to buy oil options and futures and the firm is in a much better position to know its oil needs than its investors, this is a case where risk hedging by the firm will increase value. Figure 10.2 provides a flowchart for determining whether firms should hedge or not hedge the risks that they are faced with.

Figure 10.2: To Hedge or not to Hedge?



The evidence on whether risk hedging increases value is mixed. In a book on risk management, Smithson presents evidence that he argues is consistent with the notion that risk management increases value, but the increase in value at firms that hedge is small

and not statistically significant.²¹ The study by Mian, referenced in the last section, finds only weak or mixed evidence of the potential hedging benefits— lower taxes and distress costs or better investment decisions. In fact, the evidence is inconsistent with a distress cost model, since the companies with the greatest distress costs hedge the least. Tufano's study of gold mining companies, also referenced in the last section, also finds little support for the proposition that hedging is driven by the value enhancement concerns; rather, he concludes that managerial compensation mechanisms and risk aversion explain the differences in risk management practices across these companies.

In summary, the benefits of hedging are hazy at best and non-existent at worst, when we look at publicly traded firms. While we have listed many potential benefits of hedging including tax savings, lower distress costs and higher debt ratios, there is little evidence that they are primary motivators for hedging at most companies. In fact, a reasonable case can be made that most hedging can be attributed to managerial interests being served rather than increasing stockholder value.

Alternative techniques for hedging risk

If you decide to reduce your exposure to a risk or risks, there are several approaches that you can use. Some of these are integrated into the standard investment and financing decisions that every business has to make; your risk exposure is determined by the assets that you invest in and by the financing that you use to fund these assets. Some have been made available by a large and growing derivatives markets where options, futures and swaps can be used to manage risk exposure.

Investment Choices

Some of the risk that a firm is exposed to is mitigated by the investment decisions that it makes. Consider retail firms like the Gap and Ann Taylor. One of the risks that they face is related to store location, with revenues and operating income being affected by foot traffic at the mall or street that a store is placed on. This risk is lowered by the fact that these firms also have dozens of store locations in different parts of the country; a

²¹ Smithson, C., 1999, Does risk management work?, Risk, July 1999, pp 44-45.

less-than-expected foot traffic at one store can be made up for with more-than-expected foot traffic at another store.

It is not just the firm-specific risks (like location) that can be affected by investment decisions. Companies like Citicorp and Coca Cola have argued that their exposure to country risk, created by investing in emerging markets with substantial risk, is mitigated (though not eliminated) by the fact that they operate in dozens of countries. A sub-standard performance in one country (say Brazil) can be offset by superior performance in another (say India).

Strategists and top managers of firms that diversify into multiple businesses have often justified this push towards becoming conglomerates by noting that diversification reduces earnings variability and makes firms more stable. While they have a point, a distinction has to be drawn between this risk reduction and the examples cited in the previous two paragraphs. Ann Taylor, The Gap, Citicorp and Coca Cola can all reduce risk through their investment choices without giving up on the base principle of picking good investments. Thus, the Gap can open only good stores and still end up with dozens of stores in different locations. In contrast, a firm that decides to become a conglomerate by acquiring firms in other businesses has to pay significant acquisition premiums. There are usually more cost-effective ways of accomplishing the same objective.

Financing Choices

Firms can affect their overall risk exposure through their financing choices. A firm that expects to have significant cash inflows in yen on a Japanese investment can mitigate some of that risk by borrowing in yen to fund the investment. A drop in the value of the yen will reduce the expected cash inflows (in dollar terms) but there will be at least a partially offsetting impact that will reduce the expected cash outflows in dollar terms.

The conventional advice to companies seeking to optimize their financing choices has therefore been to match the characteristics of debt to more of the project funded with the debt. The failure to do so increases default risk and the cost of debt, thus increasing the cost of capital and lowering firm value. Conversely, matching debt to assets in terms

of maturity and currency can reduce default risk and the costs of debt and capital, leading to higher firm value.

What are the practical impediments to this debt matching strategy? First, firms that are restricted in their access to bond markets may be unable to borrow in their preferred mode. Most firms outside and even many firms in the United States have access only to bank borrowing and are thus constrained by what banks offer. If, as is true in many emerging markets, banks are unwilling to lend long term in the local currency, firms with long-term investments will have to borrow short term or in a different currency to fund their needs. Second, there can be market frictions that make it cheaper for a firm to borrow in one market than another; a firm that has a low profile internationally but a strong reputation in its local market may be able to borrow at a much lower rate in the local currency (even after adjusting for inflation differences across currencies). Consequently, it may make sense to raise debt in the local currency to fund investments in other markets, even though this leads to a mismatching of debt and assets. Third, the debt used to fund investments can be affected by views about the overall market; a firm that feels that short term rates are low, relative to long term rates, may borrow short term to fund long term investments with the objective of shifting to long term debt later.

Insurance

One of the oldest and most established ways of protecting against risk is to buy insurance to cover specific event risk. Just as a home owner buys insurance on his or her house to protect against the eventuality of fire or storm damage, companies can buy insurance to protect their assets against possible loss. In fact, it can be argued that, in spite of the attention given to the use of derivatives in risk management, traditional insurance remains the primary vehicle for managing risk.

Insurance does not eliminate risk. Rather, it shifts the risk from the firm buying the insurance to the insurance firm selling it. Smith and Mayers argued that this risk

shifting may provide a benefit to both sides, for a number of reasons.²² First, the insurance company may be able to create a portfolio of risks, thereby gaining diversification benefits that the self-insured firm itself cannot obtain. Second, the insurance company might acquire the expertise to evaluate risk and process claims more efficiently as a consequence of its repeated exposure to that risk. Third, insurance companies might provide other services, such as inspection and safety services that benefit both sides. While a third party could arguably provide the same service, the insurance company has an incentive to ensure the quality of the service.

From ancient ship owners who purchased insurance against losses created by storms and pirates to modern businesses that buy insurance against terrorist acts, the insurance principle has remained unchanged. From the standpoint of the insured, the rationale for insurance is simple. In return for paying a premium, they are protected against risks that have a low probability of occurrence but have a large impact if they do. The cost of buying insurance becomes part of the operating expenses of the business, reducing the earnings of the company. The benefit is implicit and shows up as more stable earnings over time.

The insurer offers to protect multiple risk takers against specific risks in return for premiums and hopes to use the collective income from these premiums to cover the losses incurred by a few. As long as the risk being insured against affects only a few of the insured at any point in time, the laws of averaging work in the insurer's favor. The expected payments to those damaged by the risk will be lower than the expected premiums from the population. Consequently, we can draw the following conclusions about the effectiveness of insurance:

- a. It is more effective against individual or firm-specific risks that affect a few and leave the majority untouched and less effective against market-wide or systematic risks.
- b. It is more effective against large risks than against small risks. After all, an entity can self-insure against small risks and hope that the averaging process works over

²² Smith, C.W. and D. Mayers, *On the Corporate Demand for Insurance*, Journal of Business, v55, 281-296.

time. In contrast, it is more difficult and dangerous to self-insure against large or catastrophic risks, since one occurrence can put you out of business.

- c. It is more effective against event risks, where the probabilities of occurrence and expected losses can be estimated from past history, than against continuous risk. An earthquake, hurricane or terrorist event would be an example of the former whereas exchange rate risk would be an example of the latter.

Reviewing the conditions, it is easy to see why insurance is most often used to hedge against “acts of god” – events that often have catastrophic effects on specific localities but leave the rest of the population relatively untouched.

Derivatives

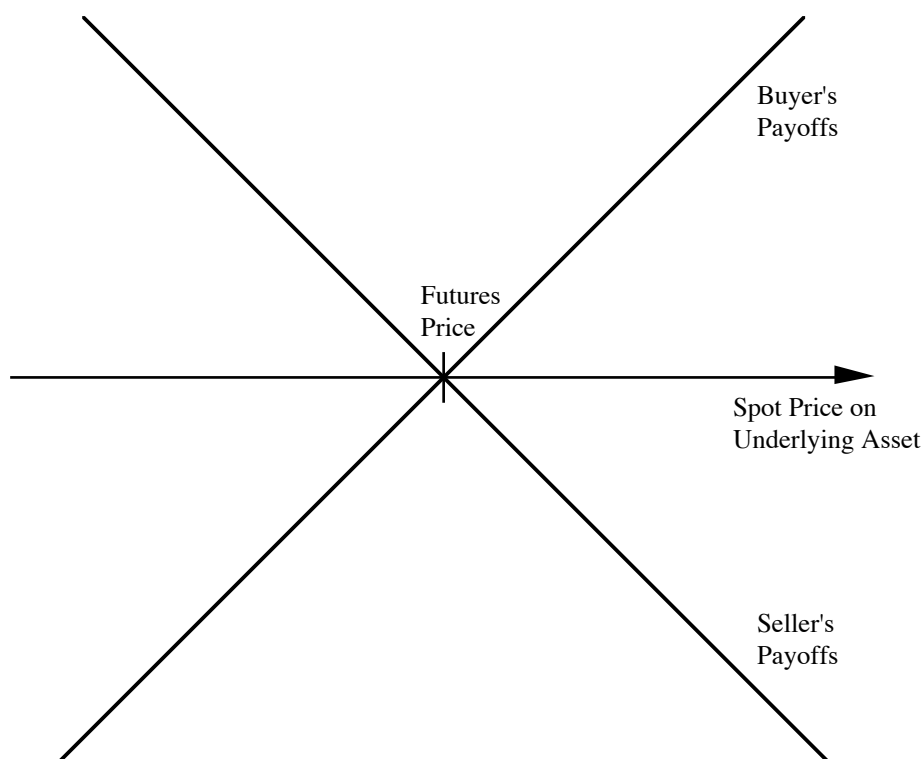
Derivatives have been used to manage risk for a very long time, but they were available only to a few firms and at high cost, since they had to be customized for each user. The development of options and futures markets in the 1970s and 1980s allowed for the standardization of derivative products, thus allowing access to even individuals who wanted to hedge against specific risk. The range of risks that are covered by derivatives grows each year, and there are very few market-wide risks that you cannot hedge today using options or futures.

Futures and Forwards

The most widely used products in risk management are futures, forwards, options and swaps. These are generally categorized as derivative products, since they derive their value from an underlying asset that is traded. While there are fundamental differences among these products, the basic building blocks for all of them are similar. To examine the common building blocks for each of these products, let us begin with the simplest — the forward contract. In a *forward contract*, the buyer of the contract agrees to buy a product (which can be a commodity or a currency) at a fixed price at a specified period in the future; the seller of the contract agrees to deliver the product in return for the fixed price. Since the forward price is fixed while the spot price of the underlying asset changes, we can measure the cash payoff from the forward contract to both the buyer and

the seller of the forward contract at the expiration of the contract as a function of the spot price and present it in Figure 10.3.

Figure 10.3: Cash Flows on Forward Contract



If the actual price at the time of the expiration of the forward contract is greater than the forward price, the buyer of the contract makes a gain equal to the difference and the seller loses an equivalent amount. If the actual price is lower than the forward price, the buyer makes a loss and the seller gains. Since forward contracts are between private parties, however, there is always the possibility that the losing party may default on the agreement.

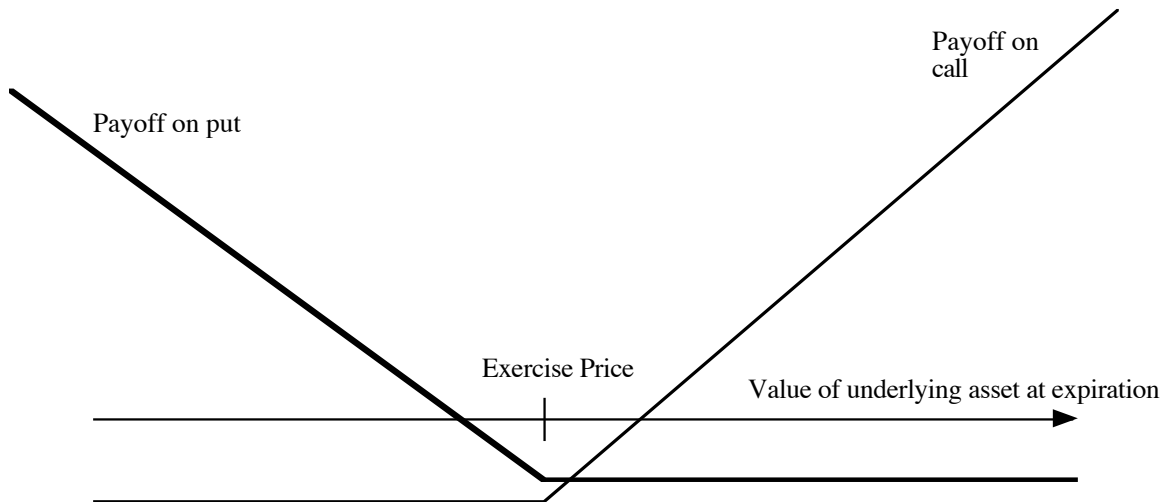
A **futures contract**, like a forward contract, is an agreement to buy or sell an underlying asset at a specified time in the future. Therefore, the payoff diagram on a futures contract is similar to that of a forward contract. There are, however, three major differences between futures and forward contract. First, futures contracts are traded on exchanges whereas forward contracts are not. Consequently, futures contracts are much more liquid and there is no default or credit risk; this advantage has to be offset against

the fact that futures contracts are standardized and cannot be adapted to meet the firm's precise needs. Second, futures contracts require both parties (buyer and seller) to settle differences on a daily basis rather than waiting for expiration. Thus, if a firm buys a futures contract on oil, and oil prices go down, the firm is obligated to pay the seller of the contract the difference. Because futures contracts are settled at the end of every day, they are converted into a sequence of one-day forward contracts. This can have an effect on their pricing. Third, when a futures contract is bought or sold, the parties are required to put up a percentage of the price of the contract as a "margin." This operates as a performance bond, ensuring there is no default risk.

Options

Options differ from futures and forward contracts in their payoff profiles, which limit losses to the buyers to the prices paid for the options. Recapping our discussion in the appendix to chapter 8, call options give buyers the rights to buy a specified asset at a fixed price anytime before expiration, whereas put options gives buyers the right to sell a specified asset at a fixed price. Figure 10.4 illustrates the payoffs to the buyers of call and put options when the options expire.

Figure 10.4: Payoff on Call and Put Options at Expiration



The buyer of a call option makes as a gross profit the difference between the value of the asset and the strike price, if the value exceeds the strike price; the net payoff is the difference between this and the price paid for the call option. If the value is less than the strike price, the buyer loses what he or she paid for the call option. The process is

reversed for a put option. The buyer profits if the value of the asset is less than the strike price and loses the price paid for the put if it is greater.

There are two key differences between options and futures. The first is that options provide protection against downside risk, while allowing you to partake in upside potential. Futures and forwards, on the other hand, protect you against downside risk while eliminating upside potential. A gold mining company that sells gold futures contracts to hedge against movements in gold prices will find itself protected if gold prices go down but will also have to forego profits if gold prices go up. The same company will get protection against lower gold prices by buying put options on gold but will still be able to gain if gold prices increase. The second is that options contracts have explicit costs, whereas the cost with futures contracts is implicit; other than transactions and settlement costs associated with day-to-day gold price movements, the gold mining company will face little in costs from selling gold futures but it will have to pay to buy put options on gold.

Swaps

In its simplest form, titled a plain vanilla swap, you offer to swap a set of cash flows for another set of cash flows of equivalent market value at the time of the swap. Thus, a U.S. company that expects cash inflows in Euros from a European contract can swap these for cash flows in dollars, thus mitigating currency risk. To provide a more concrete illustration of the use of swaps to manage exchange rate risk, consider an airline that wants to hedge against fuel price risk. The airline can enter into a swap to pay a fixed price for oil and receive a floating price, with both indexed to fuel usage during a period. During the period, the airline will continue to buy oil in the cash market, but the swap market makes up the difference when prices rise. Thus, if the floating price is \$1.00 per gallon and the fixed price is \$0.85 per gallon, the floating rate payer makes a \$0.15 per gallon payment to the fixed rate payer.

Broken down to basics, a plain vanilla swap is a portfolio of forward contracts and can therefore be analyzed as such. In recent years, swaps have become increasingly more complex and many of these more complicated swaps can be written as combinations of options and forward contracts.

Picking the Right Hedging Tool

Once firms have decided to hedge or manage a specific risk, they have to pick among competing products to achieve this objective. To make this choice, let us review their costs and benefits:

- *Forward contracts* provide the most complete risk hedging because they can be designed to a firm's specific needs, but only if the firm knows its future cash flow needs. The customized design may result in a higher transaction cost for the firm, however, especially if the cash flows are small, and forward contracts may expose both parties to credit risk.
- *Futures contracts* provide a cheaper alternative to forward contracts, insofar as they are traded on the exchanges and do not have to be customized. They also eliminate credit risk, but they require margins and cash flows on a daily basis. Finally, they may not provide complete protection against risk because they are standardized.
- Unlike futures and forward contracts, which hedge both downside and upside risk, *option contracts* provide protection against only downside risk while preserving upside potential. This benefit has to be weighed against the cost of buying the options, however, which will vary with the amount of protection desired. Giddy suggests a simple rule that can be used to determine whether companies should use options or forward contracts to hedge risk. If the currency flow is known, Giddy argues, forward contracts provide much more complete protection and should therefore be used. If the currency flow is unknown, options should be used, since a matching forward contract cannot be created.²³
- In combating event risk, a firm can either *self-insure* or use a *third party insurance* product. Self insurance makes sense if the firm can achieve the benefits of risk pooling on its own, does not need the services or support offered by insurance companies and can provide the insurance more economically than the third party.

As with everything else in corporate finance, firms have to make the trade off. The objective, after all, is not complete protection against risk, but as much protection as makes sense, given the marginal benefits and costs of acquiring it. A survey of the risk

²³ Giddy, I., 1983, Foreign Exchange Options, Journal of Futures Markets.

products that 500 multinationals in the United States used, concluded that forward contracts remain the dominant tool for risk management , at least for currency risk, and that there is a shift from hedging transaction exposure to economic exposure.²⁴

Conclusion

This chapter examines the questions of which questions to hedge and which ones to pass through. We began by looking at the process of risk profiling, where we outline the risks faced by a business, categorize that risk, consider the tools available to manage that risk and the capabilities of the firm in dealing with that risk. We then move on to look at the costs and benefits of hedging. The costs of hedging can be explicit when we use insurance or put options that protect against downside risk while still providing upside potential and implicit when using futures and forwards, where we give up profit potential if prices move favorably in return for savings when there are adverse price movements. There are five possible benefits from hedging: tax savings either from smoother earnings or favorable tax treatment of hedging costs and payoffs, a reduced likelihood of distress and the resulting costs, higher debt capacity and the resulting tax benefits, better investment decisions and more informational financial statements.

While there are potential benefits to hedging and plenty of evidence that firms hedge, there is surprisingly little empirical support for the proposition that hedging adds value. The firms that hedge do not seem to be motivated by tax savings or reduce distress costs, but more by managerial interests – compensation systems and job protection are often tied to maintaining more stable earnings. As the tools to hedge risk – options, futures, swaps and insurance – all multiple, the purveyors of these tools also have become more skilled at selling them to firms that often do not need them or should not be using them.

²⁴ Jesswein, K., Kwok, C. C. Y. and Folks, W. R. Jr., 1995, “What New Currency Products are Companies Using and Why?,” *Journal of Applied Corporate Finance*, v8, 103-114.