# A Framework For Risk Management

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In recent years, managers have become increasingly aware of how their organizations can be buffeted by risks beyond their control. In many cases, fluctuations in economic and financial variables such as exchange rates, interest rates, and commodity prices have had destabilizing effects on corporate strategies and performance. Consider the following examples:

☐ In the first half of 1986, world oil prices plummeted by 50%; overall, energy prices fell by 24%. While this was a boon to the economy as a whole, it was disastrous for oil producers as well as for companies like Dresser Industries, which supplies machinery and equipment to energy producers. As domestic oil production collapsed, so did demand for Dresser's equipment. The company's operating profits dropped from $292 million in 1985 to $139 million in 1986; its stock price fell from $24 to $14; and its capital spending decreased from $122 million to $71 million.

☐ During the first half of the 1980s, the U.S. dollar appreciated by 50% in real terms, only to fall back to its starting point by 1988. The stronger dollar forced many U.S. exporters to cut prices drastically to remain competitive in global markets, reducing short-term profits and long-term competitiveness. Caterpillar, the world's largest manufacturer of earthmoving equipment, saw its real-dollar sales decline by 45% between 1981 and 1985 before increasing by 35% as the dollar weakened. Meanwhile, the company's capital expenditures fell from $713 million to $229 million before jumping to $793 million in 1988. But by that time, Caterpillar had lost ground to foreign competitors such as Japan's Komatsu.

In principle, both Dresser and Caterpillar could have insulated themselves from energy-price and exchange-rate risks by using the derivatives markets. Today more and more companies are doing just that. The General Accounting Office reports that between 1989 and 1992 the use of derivatives–among them forwards, futures, options, and swaps–grew by 145%. Much of that growth came from corporations: one recent study shows a more than fourfold increase between 1987 and 1991 in their use of some types of derivatives.[1]

In large part, the growth of derivatives is due to innovations by financial theorists who, during the 1970s, developed new methods–such as the Black-Scholes option-pricing formula–to value these complex instruments. Such improvements in the technology of financial engineering have helped spawn a new arsenal of risk-management weapons.

Unfortunately, the insights of the financial engineers do not give managers any guidance on how to deploy the new weapons most effectively. Although many companies are heavily involved in risk management, it's safe to say that there is no single, well-accepted set of principles that underlies their hedging programs. Financial managers will give different answers to even the most basic questions: What is the goal of risk management? Should Dresser and Caterpillar have used derivatives to insulate their stock prices from shocks to energy prices and exchange rates? Or should they have focused instead on stabilizing their near-term operating income, reported earnings, and return on equity, or on removing some of the volatility from their capital spending?

Without a clear set of risk-management goals, using derivatives can be dangerous. That has been

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made abundantly clear by the numerous cases of derivatives trades that have backfired in the last couple of years. Procter & Gamble's losses in customized interest-rate derivatives and Metallgesellschaft's losses in oil futures are two of the most prominent examples. The important point is not that these companies lost money in derivatives, because even the best risk-management programs will incur losses on some trades. What's important is that both companies lost substantial sums of money – in the case of Metallgesellschaft, more than $1 *billion* – because they took positions in derivatives that did not fit well with their corporate strategies.


Our goal in this article is to present a framework to guide top-level managers in developing a coherent risk-management strategy – in particular, to make sensible use of the risk-management firepower available to them through financial derivatives.[2] Contrary to what senior managers may assume, a company's risk-management strategy cannot be delegated to the corporate treasurer – let alone to a hotshot financial engineer. Ultimately, a company's risk-management strategy needs to be integrated with its overall corporate strategy.

Our risk-management paradigm rests on three basic premises:

☐ The key to creating corporate value is making good investments.

☐ The key to making good investments is generating enough cash internally to fund those investments; when companies don't generate enough cash, they tend to cut investment more drastically than their competitors do.

☐ Cash flow – so crucial to the investment process – can often be disrupted by movements in external factors such as exchange rates, commodity prices, and interest rates, potentially compromising a company's ability to invest.

A risk-management program, therefore, should have a single overarching goal: to ensure that a company has the cash available to make value-enhancing investments.

By recognizing and accepting this goal, managers will be better equipped to address the most basic questions of risk management: Which risks should be hedged and which should be left unhedged? What kinds of instruments and trading strategies are appropriate? How should a company's risk-management strategy be affected by its competitors' strategies?

## From Pharaoh to Modern Finance

Risk management is not a modern invention. The Old Testament tells the story of the Egyptian Pharaoh who dreamed that seven healthy cattle were devoured by seven sickly cattle and that seven healthy ears of corn were devoured by seven sickly ears of corn. Puzzled by the dream, Pharaoh called on Joseph to interpret it. According to Joseph, the dream foretold seven years of plenty followed by seven years of famine. To hedge against that risk, Pharaoh bought and stored large quantities of corn. Egypt prospered during the famine, Joseph became the second most powerful man in Egypt, the Hebrews followed him there, and the rest is history.

In the Middle Ages, hedging was made easier by the creation of futures markets. Rather than buying and storing crops, consumers could ensure the availability and price of a crop by buying it for delivery at a predetermined price and date. And farmers could hedge the risk that the price of their crops would fall by selling them for later delivery at a predetermined price.

It is easy to see why Pharaoh, the consumer, and the farmer would want to hedge. The farmer's income, for example, is tied closely to the price he can get for his crop. So any risk-averse farmer would want to insure his income against fluctuations in crop prices just as many working people protect their incomes with disability insur-

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DRAWINGS BY ERIC DEVER

ance. It's not surprising, then, that the first futures markets were developed to enable farmers to insure themselves more easily.

More recently, large publicly held companies have emerged as the principal users of risk-management instruments. Indeed, most new financial products are designed to enable corporations to hedge more effectively. But, unlike the farmer, the consumer, and Pharaoh, it is not so clear why a *corporation* would want to hedge. After all, corporations are generally owned by many small investors, each of whom bears only a small part of the risk. In fact, Adolf A. Berle, Jr., and Gardiner C. Means argue in their classic book, *The Modern Corporation and Private Property*, that the modern corporate form of organization was developed precisely to enable entrepreneurs to disperse risk among many small investors. If that is true, it's hard to see why corporations themselves also need to reduce risk – investors can manage risk on their own.

Until the 1970s, finance specialists accepted this logic. The standard view was that if an investor does not want to be exposed to, say, the oil-price risk inherent in owning Dresser Industries, he can hedge for himself. For example, he can offset any loss on his Dresser Industries stock that might come from a decline in oil prices by also holding the stocks of companies that generally benefit from oil-price declines, such as petrochemical firms. There is thus no reason for the corporation to hedge on behalf of the investor. Or, put somewhat differently, hedging transactions at the corporate level sometimes lose money and sometimes make money, but on average they break even: companies can't systematically make money by hedging. Unlike individual risk management, corporate risk management doesn't hurt, but it also doesn't help.


Corporate finance specialists will recognize this logic as a variant of the Modigliani and Miller theorem, which was developed in the 1950s and became the foundation of "modern finance." The key insight of Franco Modigliani and Merton Miller, each of whom won a Nobel Prize for his work in this area, is that value is created on the left-hand side of the balance sheet when companies make good *investments* – in, say, plant and equipment, R&D, or market share – that ultimately increase operating cash flows. How companies finance those investments on the right-hand side of the balance sheet – whether through debt, equity, or retained earnings – is largely irrelevant. These decisions about financial policy can affect only how the value created by a company's real investments is divided among its investors. But in an efficient and well-functioning capital market, they cannot affect the overall value of those investments.

**The key to making good investments is generating the cash to fund them internally.**

If one accepts the view of Modigliani and Miller, it follows almost as a corollary that risk-management strategies are also of no consequence. They are purely financial transactions that don't affect the value of a company's operating assets. Indeed, once the transaction costs associated with hedging instruments are factored in, a hard-line Modigliani-Miller disciple would argue against doing any risk management at all.

Over the past two decades, however, a different view of financial policy has emerged that allows a more integral role for risk management. This "postmodern" paradigm accepts as gospel the key insight of Modigliani and Miller – that value is created only when companies make good investments that ultimately increase their operating cash flows. But it goes further by treating financial policy as critical in *enabling* companies to make valuable investments. And it recognizes that companies face real trade-offs in how they finance their investments.[3]

For example, suppose a company wants to add a new plant that would expand its production capacity. If the company has enough retained earnings to

pay for the cost of the plant, it will use those funds to build it. But if the company doesn't have the cash, it will need to raise capital from one of two sources: the debt market (perhaps through a bank loan or a bond issue) or the equity market.

It is unlikely that the company would decide to issue equity. Indeed, on average, less than 2% of all corporate financing comes from the external equity market.[4] Why the aversion to equity? The problem is that it's difficult for stock market investors to know the real value of a company's assets. They may get it right on average, but sometimes they price the stock too high and sometimes they price it too low. Naturally, companies will be reluctant to raise funds by selling stock when they think their equity is undervalued. And if they do issue equity, it will send a strong signal to the stock market that they think their shares are overvalued. In fact, when companies issue equity, the stock price tends to fall by about 3%.[5] The result: most companies perceive equity to be a costly source of financing and tend to avoid it.

The information problems that limit the appeal of equity are of much less concern when it comes to debt: most debt issues – particularly those of investment-grade companies – are easy to value even without precise knowledge of the company's assets. As a result, companies are usually less worried about paying too high an interest rate on their borrowings than about getting too low a price for their equity. It's therefore not surprising that the bulk of all external funding is from the debt market.

However, debt financing is not without cost: taking on too much debt limits a company's ability to raise funds later. No one wants to lend to a company with a large debt burden, because the company may use some of the new funds not to invest in productive assets but to pay off the old debt. In the extreme, high debt levels can trigger distress, defaults, and even bankruptcy. So while companies often borrow to finance their investments, there are limits to how much they can or will borrow.

The bottom line is that financial markets do not work as smoothly as Modigliani and Miller envisioned. The costs we have outlined make external financing of any form – be it debt or equity – more expensive than internally generated funds. Given those costs, companies prefer to fund investments with retained earnings if they can. In fact, there is a financial pecking order in which companies rely first on retained earnings, then on debt, and, as a last resort, on outside equity.

What is even more striking is that companies see external financing as so costly that they actually cut investment spending when they don't have the internally generated cash flow to finance all their investment projects. Indeed, one study found that companies reduced their capital expenditures by roughly 35 cents for each $1 reduction in cash flow.[6] These financial frictions thus determine not only how companies finance their investments but also whether they are able to undertake those investments in the first place. Internally generated cash is therefore a competitive weapon that effectively reduces a company's cost of capital and facilitates investment.

**The role of risk management is to ensure that a company has the cash available to make value-enhancing investments.**

This is the most critical implication of the postmodern paradigm, and it forms the theoretical foundation of the view stated earlier – that the role of risk management is to ensure that companies have the cash available to make value-enhancing investments. Although the practical implications of this idea may seem vague, we will demonstrate how it can help to develop a coherent risk-management strategy.

## Why Hedge?

Let's start with the case of a hypothetical multinational pharmaceutical company, Omega Drug. Omega's headquarters, production facilities, and research labs are in the United States, but roughly half of its sales come from abroad, mainly Japan and Germany. Omega has several products that are still protected by patents, and it does not expect to introduce any new products this year. Omega's main uncertainty is the revenue it will receive from foreign sales. The company can forecast its foreign sales volume very accurately, but the dollar value of those sales is hard to pin down because of the uncertainty inherent in exchange rates. If exchange rates remain stable, Omega expects the dollar value of its cash flow from foreign and domestic operations to be $200 million. If, however, the dollar appreciates substantially relative to the Japanese yen and the German mark, then Omega's cash flow will

fall to $100 million, since the weaker yen and mark mean that foreign cash flows are worth less in dollars. Conversely, a significant dollar depreciation would increase Omega's cash flow to $300 million. Each of these scenarios is equally likely.

Like most multinational corporations, Omega frequently receives calls from investment bankers trying to persuade the company to hedge its foreign-exchange risk. The bankers typically present an impressive set of calculations showing how Omega can reduce the risk in its earnings, cash flow, stock price, and return on equity simply by trading on foreign-exchange markets. So far, Omega has resisted those overtures and has chosen not to engage in any substantial foreign-exchange hedging. "After all," Omega's top-level officers have argued, "we're a pharmaceutical company, not a bank."

Omega has one thing going for it: a healthy skepticism of bankers trying to sell their financial services. But the bankers also have something going for them: the skills to insulate companies from financial risk. What neither the company nor the bankers have is a well-articulated view of the role of risk management.

The starting point for our analysis is understanding the link between Omega's cash flows and its strategic investments, principally its R&D program. R&D is the key to success in the pharmaceutical business, and its importance has grown dramatically during the last two decades. Twenty years ago, Omega was spending 8% of sales on R&D; now it is spending 12% of sales on R&D.

Last year, Omega's R&D budget was $180 million. In the coming year, the company would like to spend $200 million. Omega arrived at this figure by first forecasting the increase in patentable products that would result from a particular level of R&D. As a second step, managers valued the increased cash flows through a discounted-cash-flow analysis. Such an approach could generate only rough estimates of the value of R&D because of the uncertainty inherent in the R&D process, but it was the best Omega could do. Specifically, the company's calculations indicated that an R&D budget of $200 million would generate a net present value of $90 million, compared with $60 million for R&D budgets of $100 million and $300 million. (See the table "Payoffs from Omega Drug's R&D Investment.") The company took comfort in the knowledge that the $200 million budget was, on a relative basis, roughly in line with the budgets of its principal competitors.

Given its comparatively high leverage and limited collateral, Omega is not in a position to borrow any funds to finance its R&D program. It is also reluctant to issue equity. That leaves internally generated cash as the only funding source that Omega's managers are prepared to tap for the R&D program. Therefore, fluctuations in the dollar's exchange rate can be critical. If the dollar appreciates, Omega will have a cash flow of only $100 million to allocate to its R&D program – well below the desired $200 million budget. A stable dollar will generate enough cash flow for the program, while a depreciating dollar will generate an excess of $100 million. (See the table "The Effect of Hedging on Omega Drug's R&D Investment and Value.")

**Payoffs from Omega Drug's R&D Investment**

| R&D Level* | Discounted Cash Flows* | Net Present Value* |
|---|---|---|
| 100 | 160 | 60 |
| 200 | 290 | 90 |
| 300 | 360 | 60 |

*in millions of dollars

Will Omega be better off if it hedges? Suppose Omega tells its bankers to trade on its behalf so that the company's cash flows are completely insulated from foreign-exchange risk. If the dollar appreciates, the trades will generate a $100 million gain; if the dollar depreciates, they'll post a $100 million loss. The trades will generate no gain or loss if the dollar remains at its current level. Effectively, the hedging program locks in net cash flows of $200 million for Omega – the cash flows that the company would receive at prevailing exchange rates. Whatever the exchange rate turns out to be, Omega will have $200 million available for R&D – just the right amount.

If Omega doesn't hedge, it will be able to invest only $100 million in R&D if the dollar appreciates. By hedging, Omega is able to add $100 million of R&D in this scenario, increasing discounted future cash flows by $130 million (from $160 million to $290 million). On the other hand, if the dollar *de-*

## The Effect of Hedging on Omega Drug's R&D Investment and Value

| The Dollar | Internal Funds* | R&D Without Hedging* | Hedge Proceeds* | Additional R&D from Hedging* | Value from Hedging* |
|---|---|---|---|---|---|
| Appreciation | 100 | 100 | +100 | 100 | +130 |
| Stable | 200 | 200 | 0 | 0 | 0 |
| Depreciation | 300 | 200 | –100 | 0 | –100 |

*in millions of dollars

*preciates*, Omega will lose $100 million on its foreign-exchange transactions. However, the $130 million gain clearly outweighs the $100 million loss. Overall, Omega is better off if it hedges.

Although this example is highly stylized, it illustrates a basic principle. In general, the supply of internally generated funds does not equal the investment demand for funds. Sometimes there is an excess supply; sometimes there is a shortage. Because external financing is costly, this imbalance shifts investment away from the optimal level. Risk management can reduce this imbalance and the resulting investment distortion. It enables companies to better align their demand for funds with their internal supply of funds. That is, risk management lets companies transfer funds from situations in which they have an excess supply to situations in which they have a shortage. In essence, it allows companies to borrow from themselves.

Here's another way to look at what happens. As the dollar depreciates, the internal supply of funds – Omega's cash flow – increases. The demand for funds – the desired level of investment – is fixed and independent of the exchange rate. When the company doesn't hedge, demand and supply are equal only if the dollar remains stable. If the dollar depreciates, however, supply exceeds demand; if it appreciates, supply falls short of demand. By hedging, the company reduces supply when there is excess supply and increases supply when there is a shortage. This aligns the internal supply of funds with the demand for funds. Of course, the average supply of funds doesn't change with hedging, because hedging is a zero-net-present-value investment: it does not create value by itself. But it ensures that the company has the funds precisely when it needs them. Because value is ultimately created by making sure the company undertakes the right investments, risk management adds real value. (See the graph "Omega Drug: Hedging with Fixed R&D Investment.")

Risk management enables companies to become better at aligning the demand for funds with the internal supply of funds.

## When to Hedge – or Not

The basic principle outlined above is just a first step. The real challenge of risk management is to apply it to developing strategies that deal with the variety of risks faced by different companies.

What we have argued so far is that companies should use risk management to align their internal supply of funds with their demand for funds. In the case of Omega Drug, that means hedging all the exchange-rate risk. Since we have assumed that the demand for funds – the desired amount of investment – isn't affected by exchange rates, Omega should stabilize its supply by insulating its cash flows from any changes in exchange rates. This assumption may be reasonable in the case of Omega because it is unlikely that the value of investing in R&D in pharmaceuticals would depend very much on exchange rates. But there are many instances in which exchange rates, commodity prices, or interest rates *do* affect the value of a company's investment opportunities. Under-

standing the connection between a company's investment opportunities and those key economic variables is critical to developing a coherent risk-management strategy.

Take the case of an oil company. The main risk it faces is changes in the price of oil. When oil prices fall, cash flows decline because existing oil properties produce less revenue. Therefore, the company's supply of internal funds is exposed to oil-price risk in much the same way that a multinational drug company's cash flows are exposed to foreign-exchange risk.

However, while the value of pharmaceutical R&D investment is unaffected by exchange rates, the value of investing in the oil business falls when oil prices drop. When prices are low, it's less attractive to explore for and develop new oil reserves. So when the supply of funds is low, so is the demand for funds. On the flip side, when oil prices rise, cash flows rise and the value of investing rises. Supply and demand are both high. For an oil company, much more than for a pharmaceutical company, the supply of funds tends to match the demand for funds even if the company does not actively manage risk. As a result, there is less reason for an oil company to hedge than there is for a multinational pharmaceutical company.

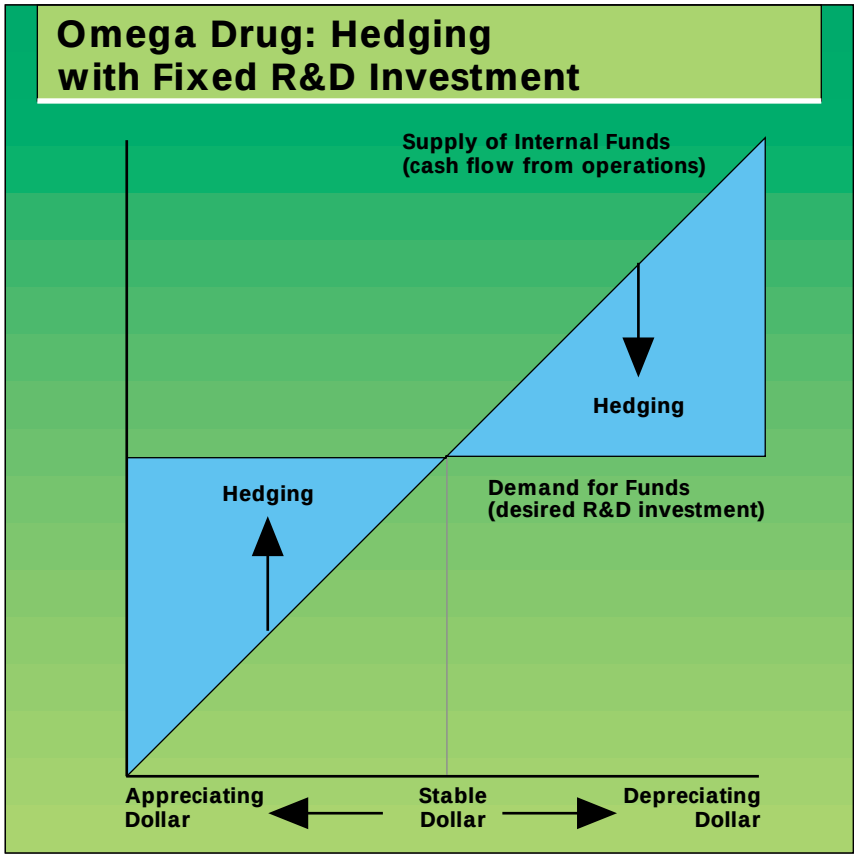
To illustrate the difference more clearly, let's change some of the numbers in our Omega Drug example and rename the company Omega Oil. Let's suppose there are three possible oil prices – low, medium, and high – which generate cash flows of $100 million, $200 million, and $300 million, respectively. The higher the oil price, the more revenue Omega Oil generates on its existing reserves.

So far, the example is exactly the same as before. Where it differs is on the investment side. The optimal amount of investment in the low-oil-price regime is $150 million; in the medium-oil-price regime, it's $200 million; and in the high-oil-price regime, it's $250 million. Thus, higher oil prices make exploring for and developing oil reserves more attractive. In this example, the supply of funds is not too far off from the demand for funds even if Omega Oil doesn't hedge. Omega Oil sometimes has an excess demand of $50 million and sometimes an excess supply of $50 million; with Omega Drug, the excess demand and excess supply were $100 million. Omega Oil, therefore, doesn't need to hedge its oil-price risk as much as Omega Drug needed to hedge its foreign-exchange risk. Roughly speaking, the optimal hedge for Omega Oil is only half that for Omega Drug.

Here the demand for funds increases with the price of oil. (See the graph "Omega Oil: Hedging with Oil-Price-Sensitive Investment.") The difference between supply and demand is smaller in the example of the oil company than it is when the investment level is fixed, as it was with Omega Drug. To align supply with demand, Omega Oil doesn't need to hedge as much as Omega Drug did. Essentially, Omega Oil already has something of a built-in hedge.

An important point emerges from this example: A proper risk-management strategy ensures that companies have the cash when they need it for investment, but it does not seek to insulate them completely from risks of all kinds.

If Omega Oil follows our recommended strategy and hedges oil-price risk only partially, then its stock price, earnings, return on equity, and any number of other performance measures will fluc-



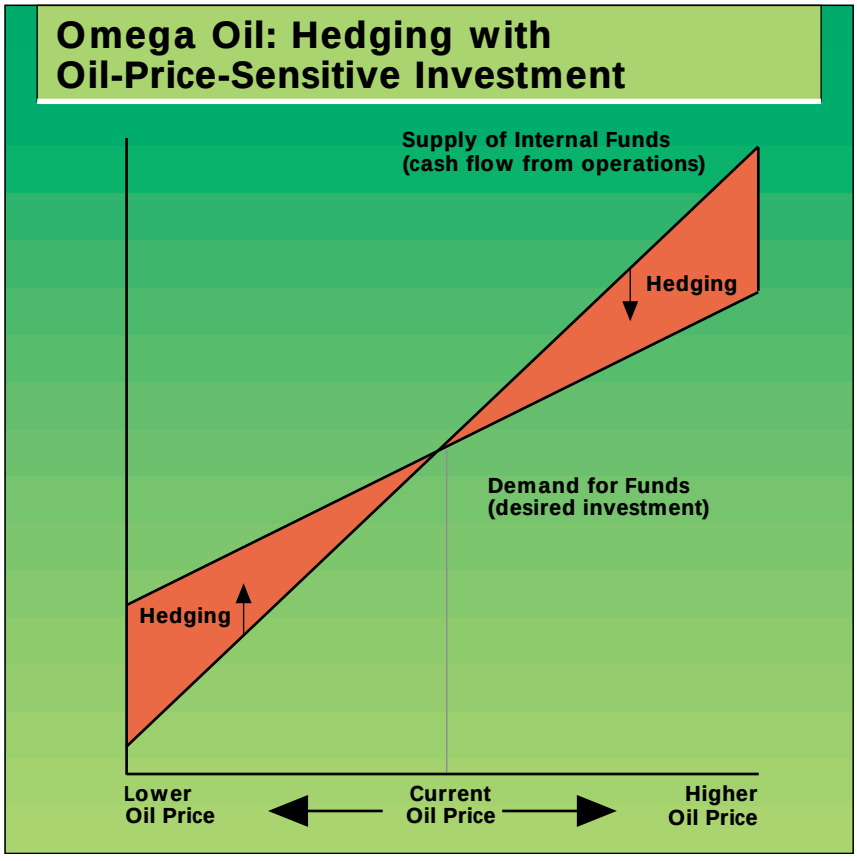
tuate with the price of oil. When oil prices are low, Omega is worth less: the company's existing properties are less valuable, and it will invest less. It's simply less profitable to be in the oil business, and this will be reflected in Omega's performance measures. But there's nothing a risk-management program can do to improve the underlying bad economics of low oil prices. The goal of risk management is not to insure investors and corporate managers against oil-price risk per se. It is to ensure that companies have the cash they need to create value by making good investments.

In fact, attempting to insulate investors completely from oil-price risk could actually *destroy* value. For example, if Omega Oil were to hedge fully, it would actually have an excess supply of funds when oil prices fall: its cash flow would be stabilized at $200 million, and its investment needs would be only $150 million. But when oil prices are high, just the opposite would be true: the company would lose so much money on its hedging position that it would have a shortage of funds for investment. Its net cash flows would still be only $200 million, but its investment needs would rise to $250 million. In this case, hedging fully would prevent the company from making value-enhancing investments.

This approach helps managers address two key issues. First, it helps them identify what is worth hedging and what isn't. Worrying about stock-price volatility in and of itself isn't worthwhile; such volatility can be better managed by individual investors through their portfolio strategies. By contrast, excessive *investment* volatility can threaten a company's ability to meet its strategic objectives and, as a result, is worth controlling through risk management.

Second, this approach helps managers figure out how much hedging is necessary. If changes in exchange rates, commodity prices, and interest rates lead to large imbalances in the supply and demand for funds, then the company should hedge aggressively; if not, the company has a natural hedge, and it does not need to hedge as much.

Managers who adopt our approach should ask themselves two questions: How sensitive are cash flows to risk variables such as exchange rates, commodity prices, and interest rates? and How sensitive are investment opportunities to those risk variables? The answers will help managers understand whether the supply of funds and the demand for funds are naturally aligned or whether they can be better aligned through risk management.




## Guidelines for Managers

What follow are some guidelines for how managers can think about risk-management issues. Although these are by no means the only issues to consider, our suggestions should provide managers with useful direction.

☐ **Companies in the same industry should not necessarily adopt the same hedging strategy**. To understand why, take the case of oil. Even though all oil companies are exposed to oil-price risk, some may be exposed more than others in both their cash flows and their investment opportunities. Let's compare Omega Oil with Epsilon Oil. Omega has existing reserves in Saudi Arabia that are a relatively cheap source of oil, whereas Epsilon gets its oil from the North Sea, which is a relatively expensive source. If the price of oil falls dramatically, Epsilon may be forced to shut down those reserves altogether, wiping out an

# Demystifying Derivatives

At first glance, the list of derivative products looks bewilderingly long. Forwards, futures, options, swaps, caps, and floors are just some of the more commonly used derivatives, and new ones are being designed all the time. However, all these products are derived from just two basic building blocks: forwards and options. Understanding how these two instruments work goes a long way toward demystifying derivatives.

### Forward-Based Contracts: Forwards, Swaps, and Futures

Perhaps the most basic type of derivative is the forward contract. With a forward, the user promises to buy or sell an asset – say, oil, Treasury bills, or yen – at a specified price on a specified date. For example, a long forward position of 1,000 barrels of oil at a price of $20 per barrel, with a one-year maturity, obligates the user to buy 1,000 barrels of oil one year hence for $20,000. A short forward position obligates the user to deliver 1,000 barrels of oil (or its cash equivalent) for $20,000. Long positions enable hedgers to protect themselves against price increases in the underlying asset; short positions protect hedgers against price decreases.

Forward contracts have four important features:

*Linearity.* Forward contracts are linear: the gain when the value of the underlying asset moves in one direction is equal to the loss when the value of the asset moves by the same amount in the opposite direction. In the long forward position described above, the user makes a $1,000 profit when the oil price rises by $1 and loses $1,000 when it falls by $1.

*No Money Down.* When a forward contract is initiated, no money changes hands.

*Settlement at Maturity.* Forward contracts are not settled until their maturity date. In the case of the oil forward, no money changes hands for a year. While this feature may be convenient to hedgers, it comes with a price: there is a risk – known as "counterparty" risk – that the other party will be unable to meet its obligations on the maturity date.

*Customization.* Since forwards are privately arranged (traded over the counter) and not traded on an exchange, the terms of the forward – for example, the maturity date and the characteristics of the underlying asset – can be customized for the users.

Swaps are packages of forward contracts and share all the same basic features. They can be used to create hedges that extend over several time periods. A company that issues ten-year floating-rate debt requiring annual interest payments, for instance, can use a swap to convert its floating-rate liability to a fixed-rate obligation, thereby hedging against interest-rate increases. Such a swap is just a bundle of interest-rate forward contracts: one with a one-year maturity, another with a two-year maturity, and so on, up to ten years.

Futures contracts are also closely related to forwards. However, they are marked to market on a daily basis. In other words, cash is paid in by the user to cover any losses on the transaction, and it is paid out to the user to reflect any profits. The advantage of marking to market is that it greatly reduces counterparty risk. This feature enables futures to be traded anonymously on large exchanges, thereby generating both more liquidity and more competitive pricing.

### Option-Based Contracts: Options, Caps, and Floors

The other building-block financial instrument is the option contract. It differs from a forward in that the holder of an option can choose to buy or sell the underlying asset at a specified price on a specified date but is not obligated to do so. For example, a call option on oil might grant the user the right to buy 1,000 barrels of oil at a price of $20 per barrel anytime between now and one year hence. Conversely, with a put option, the user would have the right to sell the oil at the agreed-upon price. Like long forward positions, call options protect hedgers against increases in the price of the underlying asset; like short forward positions, put options protect hedgers against price decreases.

Option-based contracts can be analyzed along the same four dimensions as forward-based contracts:

*Nonlinearity.* The fact that one is not obligated to exercise an option means that its payoffs are nonlinear, or asymmetrical, with respect to gains and losses. The holder of a call option on oil can profit a great deal if oil prices rise; if oil prices fall, however, the option is simply not exercised and the holder can walk away without taking any losses.

*Money Down.* Unlike forward-based contracts, options require an initial investment when the position is established. The user pays an option premium up front in exchange for the right to walk away later on.

*Settlement at Exercise.* While forwards are settled when they mature, options are settled when they are exercised, which may occur before the maturity date. They are typically not marked to market, so beyond the initial premium no further money changes hands until they are exercised.

*Customization.* Options are available both on exchanges and over the counter. The over-the-counter market offers greater opportunity for customization.

Caps and floors are to option contracts what swaps are to forward contracts: a cap is simply a package of call options, and a floor a package of put options. For example, if a company issues ten-year floating-rate debt that requires annual interest payments, it might simultaneously purchase a cap that ensures that its total interest costs do not exceed some target level. Such a cap would simply be a series of call options on the underlying interest rate.

important source of its cash flow. Omega would continue to operate its reserves because the cost of taking the oil out of the ground is still less than the oil price. Therefore, Epsilon's cash flows are more sensitive to the price of oil. Hedging is more valuable for Epsilon than it is for Omega because Epsilon's supply of funds is less in sync with its demand for funds.

Similar logic applies when the two oil companies differ in their investment opportunities. Suppose instead that Omega and Epsilon both have essentially the same cash-flow streams from their existing oil properties, but Epsilon is trying to develop new reserves in the North Sea, and Omega in Saudi Arabia. When the price of oil drops, it may no longer be worthwhile to try to develop reserves in the North Sea, since it is an expensive source of oil, but it may be worthwhile to do so in Saudi Arabia. Thus, the drop in the oil price affects both companies' cash flows equally, but Epsilon's investment opportunities fall more than Omega's do. Because Epsilon's demand for funds is more in line with its supply of funds, Epsilon has less incentive to hedge than Omega does.


Again, a simple message emerges: To develop a coherent risk-management strategy, companies must carefully articulate the nature of both their cash flows and their investment opportunities. Once they have done this, their efforts to align the supply of funds with the demand for funds will generate the right strategies for managing risk.

□ **Companies may benefit from risk management even if they have no major investments in plant and equipment.** We define investment very broadly to include not just conventional investments such as capital expenditures but also investments in intangible assets such as a well-trained workforce, brand-name recognition, and market share.

In fact, companies that make these sorts of investments may need to be even more active about managing risk. After all, a capital-intensive company can use its newly purchased plant and equipment as collateral to secure a loan. "Softer" investments are harder to collateralize. It may not be so easy for a company to raise capital from a bank to fund, say, short-term losses that result from a policy of pricing low to build market share. For companies that make such investments, internally generated funds are especially important. As a result, there may be an even greater need to align the supply of funds with the demand for funds through risk management.

□ **Even companies with conservative capital structures – no debt, lots of cash – can benefit from hedging.** At first glance, it might appear that a company with a very conservative capital structure should be less interested in risk management. After all, such a company could adjust rather easily to a large drop in cash flow by borrowing at relatively low cost. It wouldn't need to curtail investment, and corporate value would not suffer much. The basic objective of risk management – aligning the supply of internal funds with the demand for investment funding – has less urgency in this type of situation because managers can easily adjust to a supply shortfall by borrowing. To be sure, hedging wouldn't hurt, but it might not help much either.

But managers in this position should ask themselves why they have chosen such a conservative capital structure. If the answer is, The world is a risky place, and you never know what can happen to exchange rates or interest rates, they have more thinking to do. What they have done is use low leverage instead of, say, the derivatives markets to protect against the risk in those economic variables. An alternative strategy would be to take on more debt and then hedge those risks directly in the derivatives markets. In fact, there's something to be said for the second approach: it's no more risky in terms of the ability to make good investments than the low-debt/no-hedging strategy, but, in many countries, the added debt made possible by hedging allows a company to take advantage of the tax deductibility of interest payments.

□ **Multinational companies must recognize that foreign-exchange risk affects not only cash flows but also investment opportunities.** A number of complex issues arise with multinationals, but many of them can be illustrated with two examples. In each example, a company is planning to build a plant in Germany to manufacture cameras. In Example 1 it will sell the cameras in Germany,

while in Example 2 it will sell them in the United States. In both cases, most of the company's cash flows come from its other businesses in the United States. How aggressively should it hedge the dollar/mark exchange rate?

*Example 1.* If the dollar depreciates relative to the mark, it will become more expensive (in dollar terms) to build the plant in Germany. But this does not mean that the company will want to build a smaller plant – or scrap the plant altogether – because the marks it receives from selling cameras in Germany will also be worth more in dollars. In other words, because the plant's costs and revenues are *both* mark-denominated, as long as the plant is economically attractive today, it will still be attractive if the dollar/mark rate changes. Therefore, just as Omega Drug wants to maintain its R&D despite the dollar's appreciation, this company would want to maintain its investment in Germany despite the dollar's depreciation. This calls for fairly aggressive hedging against a depreciation in the dollar to ensure that the company has enough marks to build the plant.

*Example 2.* The answer here is a bit more complex. Since the company is now manufacturing cameras for export back to the United States, a depreciation in the dollar makes it less attractive to manufacture in Germany. Dollar-denominated labor costs are simply higher when the mark is more valuable. Thus, any depreciation in the dollar raises the dollar cost of building the plant. But it also reduces the dollar income the company would receive from the plant. As a result, the company might want to scale back its investment or scrap the plant when the dollar depreciates. The value of investing falls, so there's less reason to hedge than in Example 1. This case is analogous to that of Omega Oil in that risk that hurts cash flows – namely, a depreciation of the dollar relative to the mark – also diminishes the appeal of investing. As a result, there is less reason to hedge the risk.

Of course, this assumes that the company hasn't yet committed to building the plant. If it has, then it would make sense to hedge the short-term risk of a dollar depreciation to ensure that the funds are available to continue the project. But if it hasn't committed, it is less important to hedge the longer-term risks.

□ **Companies should pay close attention to the hedging strategies of their competitors.** It is tempting for managers to think that if the competition doesn't hedge, then their company doesn't need to, either. However, there are some situations in which a company may have even greater reason to hedge if its competitors *don't*. Let's continue with the example of the camera company that is considering building capacity to manufacture and sell cameras in Germany. Suppose now that its competitors – other camera companies with revenues mostly in dollars – are also considering building capacity in Germany.

If its competitors choose not to hedge, they won't be in a strong position to add capacity if the dollar depreciates: they will find themselves short of marks. But that is precisely the situation in which the company *wants* to build its plant – when its competitors' weakness reduces the likelihood of industry overcapacity; this makes its investment in Germany more attractive. Therefore, the company should hedge to make sure it has enough cash for this investment.

This is just another example of how clearly articulating the nature of investment opportunities can inform a company's risk-management strategy; in this case, the investment opportunities depend on the overall structure of the industry and on the financial strength of its competitors. Thus, the same elements that go into formulating a competitive strategy should also be used to formulate a risk-management strategy.

□ **The choice of specific derivatives cannot simply be delegated to the financial specialists in the company.** It's true that many of the more technical aspects of derivatives trading are best left to the technical finance staff. But senior managers need to understand how the choices of financial instruments link up with the broader issues of risk-management strategy that we have been exploring.

The choice of specific derivatives should not simply be delegated to the company's financial specialists.

There are two key features of derivatives that a company must keep in mind when evaluating which ones to use. The first is the cash-flow implications of the instruments. For example, futures contracts are traded on an exchange and require a company to mark to market on a daily basis – that is, to put up money to compensate for any short-term losses. These expenditures can cut into the

cash a company needs to finance current investments. In contrast, over-the-counter forward contracts–which are customized transactions arranged with derivatives dealers–do not have this drawback because they do not have to be settled until the contract matures. However, this advantage will probably come at some cost: when a dealer writes the company a forward, he will charge a premium for the risk that he bears by not extracting any payments until the contract matures.

The second feature of derivatives that should be kept in mind is the "linearity" or "nonlinearity" of the contracts. Futures and forwards are essentially linear contracts: for every dollar the company gains when the underlying variable moves in one direction by 10%, it loses a dollar when the underlying variable moves in the other direction by 10%. By contrast, options are nonlinear in that they allow the company to put a floor on its losses without having to give up the potential for gains. If there is a minimum amount of investment a company needs to maintain, options can allow it to lock in the necessary cash. At the same time, they provide the flexibility to increase investment in good times.

Again, the decision of which contract to use should be driven by the objective of aligning the demand for funds with the supply of internal funds. A skillful financial engineer may be good at pricing intricate financial contracts, but this alone does not indicate which types of contracts fit best with a company's risk-management strategy.

An important corollary to this point is that it probably makes good sense to stay away from the most exotic, customized hedging instruments unless there is a very clear investment-side justification for their use. Dealers make more profit selling cutting-edge instruments, for which competition is less intense. And each additional dollar of profit going to the dealer is a dollar less of value available to shareholders. So unless a company can explain why an exotic instrument protects its investment opportunities better than a plain-vanilla one, it's better to go with plain vanilla.

Where do managers go from here? The first step–which may be the hardest – is to realize that they cannot ignore risk management. Some managers may be tempted to do so in order to avoid high-profile blunders like those of Procter & Gamble and Metallgesellschaft. But, as the Dresser Industries and Caterpillar examples show, this head-in-the-sand approach has costs as well. Nor can risk management simply be handed off to the financial staff. That approach can lead to poor coordination with overall corporate strategy and a patchwork of derivatives trades that may, when taken together, reduce overall corporate value. Instead, it's critical for a company to devise a risk-management strategy that is based on good investments and is aligned with its broader corporate objectives.

1. The study, reported in *Derivatives: Practices and Principles*, was conducted by the Group of Thirty, an independent study group in Washington, D.C., made up of economists, bankers, and policymakers.

2. A more technical article on this subject, "Risk Management: Coordinating Corporate Investment and Financing Policies," was published by the authors in the *Journal of Finance*, vol. 48, 1993, p. 1629.

3. This view has been advanced in an influential series of papers by Stewart C. Myers of MIT's Sloan School of Management: "The Determinants of Corporate Borrowing," *Journal of Financial Economics*, vol. 4, 1977, p. 147; "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have," coauthored with Nicholas Majluf, *Journal of Financial Economics*, vol. 13, 1984, p. 187; and "The Capital Structure Puzzle," *Journal of Finance*, vol. 39, 1984, p. 575.

4. See, for example, Jeffrey MacKie-Mason, "Do Firms Care Who Provides Their Financing?" in *Asymmetric Information, Corporate Finance, and Investment*, ed. R. Glenn Hubbard (Chicago: University of Chicago Press, 1990), p. 63.

5. Paul Asquith and David Mullins, "Equity Issues and Offering Dilution," *Journal of Financial Economics*, vol. 15, 1986, p. 61.

6. See, for example, Steven Fazzari, R. Glenn Hubbard, and Bruce Petersen, "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity*, no. 1, 1988, p. 141.

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