

Financial Risk Management

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Introduction

It is often cited that the role of managers and officers of enterprises should be mainly concerned with 'adding value to the firm', which means maximizing the present value of the expected future cash flows. The connotations of this goal are far reaching and managers are becoming actively interested in all vacuums and pressures potentially affecting their objective. Historically, commodity prices were the main factor affecting the firm. However, various events in the past decades have strained new exposures into the business environment. For example in the early 1970s, the US government, with strong prodding from academic economists including Milton Friedman, finally abandoned the tie of gold to the dollar. The wide fluctuations in exchange rates that followed, added major new uncertainty to all international transactions. During that time, the increased volatility of exchange rates and interest rates had their toll on many firms. One classic example was the demise of Laker Airlines¹. Another effect of foreign exchange exposure was the impact on the firm's ability to compete, such as the case of Caterpillar. When the dollar strengthened relative to the yen in the 1980s, Caterpillar equipment rose relative to the price of Komatsu equipment giving Komatsu a competitive advantage. As a result, Caterpillar's sales fell off sharply.

Realities such as these dovetailed with sudden financial innovation over the past two decades contributed positively to managers' increased interest in their firm's competitive exposures that include the impact of foreign exchange rates, interest rates or commodity prices on the firm's sales market share and ultimately net cash flows.

A new discipline commonly referred to as '*risk management*' evolved and specialists in the field would be looking hard at all potential disruptions that may cause the firm to stray off-course. Not that our forefathers in business did not manage their risks properly, but in recent decades various schools of management mushroomed, all with specific specialisations. The modern risk manager would be trained to gain:

1. a thorough understanding of the business process
2. an active imagination and tools to generate ideas about possible effects of risks (*what-if analysis*)
3. a framework of risk model and a common language to discuss risk.

¹ Laker Airlines was doing so well that it bought five more DC10s to handle the exciting volume of British vacationers. The additional aircraft was financed in US dollars even though the airline's revenues were mainly in pounds. When the dollar strengthened in 1981, revenues declined because British travellers could no longer afford the resulting higher cost of trans-Atlantic flights. The increased value of the foreign liability sent Laker reeling into bankruptcy.

The risk manager will be concerned with addressing all of the assets at risk in the organisation. These include

- *financial assets (cash, credit and negotiable instruments)*
- *physical assets (land building and equipment)*
- *human assets (knowledge, skills and commitment of people)*
- *intangible assets (reputation, brand and information)*

In the text below we seek to encapsulate the risk manager's approach to restraining risk exposure that affect the firm's financial assets – hence, to *financial risks*. One way of doing this is by using 'on-balance-sheet' transaction such as borrowing in the competitor's currency or by moving production abroad. Using a hypothetical organisation we shall attempt to demonstrate how the risk manager can use 'off-balance-sheet' modern financial derivatives that include options, forwards and futures, to hedge effectively against changes in foreign exchange rates, interest rates and commodity prices. We have to say at the outset that derivatives are like building blocks that can be used in a variety of ways as interrelated instruments to manage financial risk. Therefore, the examples in this text do not exhaust all the possible permutations available to our risk manager.

Hypothetical Organisation

The study below attempts to demonstrate the methods that can be used to manage financial risks within an organisation that is involved in the manufacture and selling of orange juice. The company is established in the UK and its manufacturing plant is also in the UK. Oranges are imported from the US, amongst other countries like Israel. The finished product is sold mainly in the UK with some exports to other European markets. The company is assumed to have access to credit lines.

Scope for Financial Risk Management

Before the company embarks on a risk management programme, two questions need to be answered, namely:

1. what is the *extent of the risk exposure*?
2. would the programme *increase the value of the firm*, and if so, how?

The main reason for posing these two simple questions is to assist management through the decision tree. Basically, the firm may decide on various approaches² that include:

² David McNamee, 1999, Targeting Business Risk, www.mc2consulting.com/target.htm - 15k

1. avoid – redesign the process to avoid particular risks so as to reduce overall risk
2. diversify – spread the risk among numerous assets to reduce overall risk of loss or impairment
3. control – design systems that prevent or detect adverse events
4. share – distribute part of the risk through, say, a contract of insurance
5. transfer – distribute all of the risk to a third party through outsourcing
6. accept – allow minor risks to exist so as to avoid costs of managing them

So the first question that may be commonly asked is, *to what degree one's firm is exposed to financial risk*. In order to answer such a question, the firm must establish its risk profile for the various exposures it can identify.

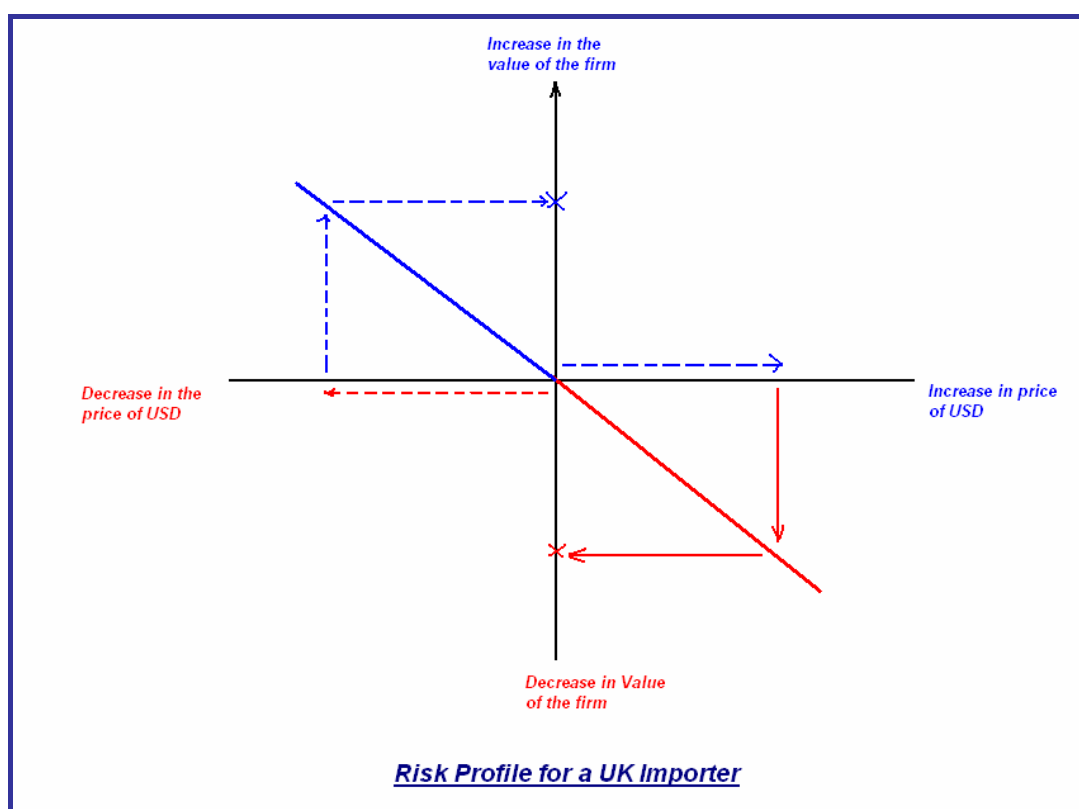


Figure 1 - Risk Profile for Transaction Exposures

The straight line passing through the top left and bottom right quadrants represents the inherent risk of the specific risk profile. A rise in the spot price at some date in the future will result in a drop in the value of the firm in the bottom right quadrant.

Having identified the risk profiles, the firm is then concerned with the slope of the risk profile, that is the magnitude of the effect of a change in the price of the USD for the UK importer, on the value of the UK firm.

David Fiedler of Kodak once said³ that in managing the economic problem, he has to make an estimate of its magnitude even though he realised that there is a large margin of error. The **extent of risk exposure** to movement in financial prices such as interest rates, foreign exchange rates and commodity prices within a specific company can be measured using the *'flow measure'* or the *'stock measure'*. The former method evaluates the sensitivity of income flows to changes in financial prices as part of the budgeting process by using simulation models such as the 'what-if' analysis. This measure however requires substantial data and forecasts under alternative assumptions about the financial prices. The 'stock measure' focuses on the value of the firm's equity. A statistical regression equation regresses the rate of return on the firm's equity against the rate of return on the market portfolio to determine a correlation coefficient called β ('beta'), which is a measure of market or non-diversifiable risk. The regression equation model⁴ is then expanded to measure the 'diversifiable' risks such as interest rates, foreign exchange rates and commodity prices. The resulting correlation coefficients can serve as estimates of the sensitivity of the firm's value to changes in each of these financial prices.

That found, one would tend to conclude that if the value of the firm is sensitive to movements in interest rates, foreign exchange rates or commodity prices, then it should necessarily rise if the said exposure is managed. The value of the firm can be taken as the sum of future expected net cash flows discounted by the company's cost of capital. Therefore, it would be expected that if value were to increase through effective risk management, then risk management should either increase the expected cash flows or else reduce the cost of capital. Two pillars of modern finance theory are the concepts of efficient markets and diversification. Market efficiency means that information that is freely accessible is accurately incorporated in share prices with sufficient speed. The lesson of

³ Donald H Chew, Jr, The New Corporate Finance, Third Edition, McGraw-Hill, Page 394

⁴ A specimen regression equation might look like

$$R_t = \alpha + b_1(\Delta 3_{ML} / 3_{ML}) + b_2(\Delta 10_{YT} / 10_{YT}) + b_3(\Delta P_{GBP} / P_{GBP}) + b_4(\Delta P_{Yen} / P_{Yen}) + b_5(\Delta P_{Oil} / P_{Oil})$$

where R_t is the rate of return for holding the firm's stock, $\Delta 3_{ML} / 3_{ML}$ is the percentage change in three month LIBOR, $\Delta 10_{YT} / 10_{YT}$ is the percentage change in the 10 year Treasury rate, $\Delta P_{GBP} / P_{GBP}$ and $\Delta P_{Yen} / P_{Yen}$ is the percentage change in dollar prices of pounds and Yen respectively, and $\Delta P_{Oil} / P_{Oil}$ is the percentage change in crude oil price. The b coefficients provide measures of the sensitivity of the value of the firm to changes in LIBOR rate, Treasury rate, exchange rates and commodity price of oil.

Source: Donald H Chew, Jr, The New Corporate Finance, Third Edition, McGraw-Hill, Page 395

market efficiency is that an attempt to earn higher returns in most financial markets generally means bearing large and unfamiliar risks. We mentioned earlier that the cost of capital or the required rate of return, depends on the systematic or non-diversifiable risk of the firm, not on its total risk. Therefore, in other words, the firm's cost of capital depends on the strength of the firm's tendency to move with the broad market. Financial risks are all diversifiable risks and shareholders can manage such risks effectively and inexpensively by holding well-diversified portfolios. It follows that active management of these risks by the firm will not be rewarded by investors, with lower required rates of return. It also follows that risk management should therefore have a bearing on the expected cash flows if it were to increase the value of the firm. In order to come to this, risk management must either:

- reduce the firm's expected costs of financial distress or
- reduce taxes or
- improve its investment decisions

We shall at this point take a brief canter through each of the above points to bring out the importance of risk management.

Financial distress results when a firm's income is insufficient to cover its fixed claims. Its probability is measured by two factors namely *fixed claims coverage* and *income volatility*. Financial distress may lead to legal and accounting costs due to potential bankruptcy. It may also lead to indirect costs such as erosion of creditworthiness even with non-investor groups such as managers, employees, customers and suppliers. For example employees might perceive the possibility of financial distress as a greater risk and might therefore demand higher wages. Suppliers might be reluctant to enter into long-term contracts and might charge more and be less flexible with companies whose prospects are more uncertain. If the shareholders of a firm view bankruptcy as a real possibility, then the costs of reorganisation will probably be reflected in the company's market value. The effects of risk management on bankruptcy costs and the value of the firm are illustrated in the pictogram below labelled *Figure 2* on page 8. This diagram depicts the distribution around the mean cash flows and the effect of hedging on the probability of financial distress.

By reducing the possibility of bankruptcy, risk management increases the value of the firm by an amount roughly equal to the bankruptcy costs multiplied by the probability of bankruptcy if the firm remains unhedged.

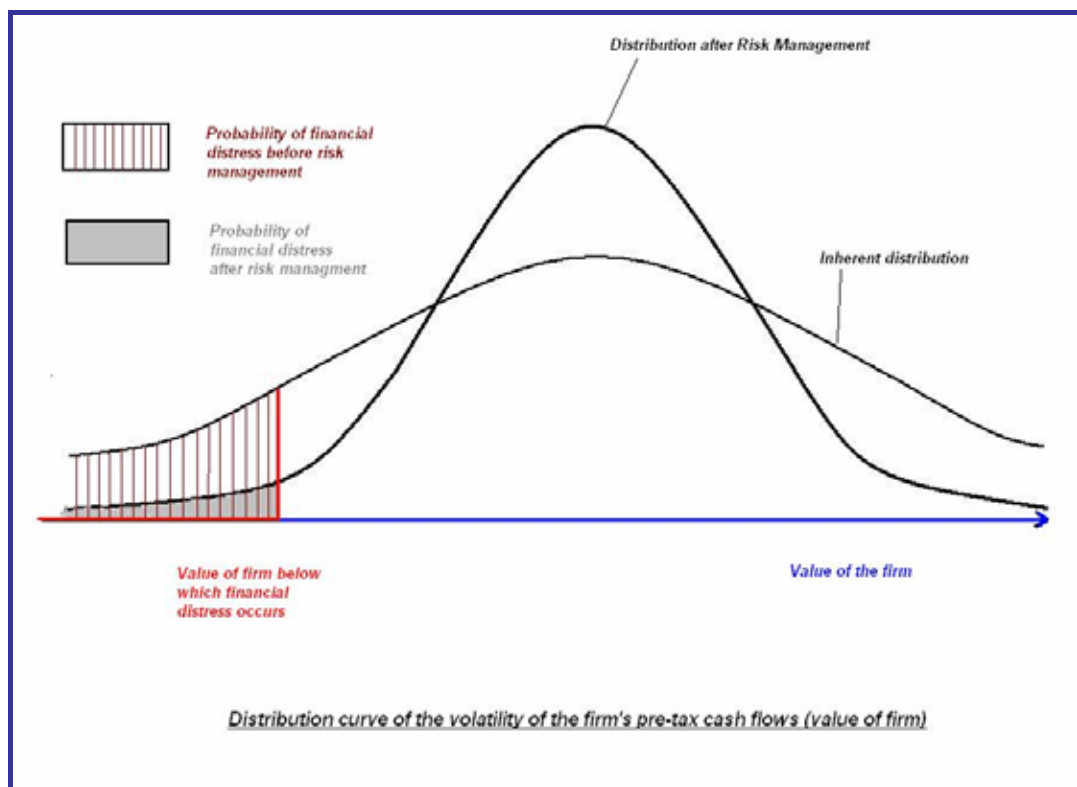


Figure 2 - Impact of hedging on the probability of financial distress

Cash flows of a firm are also affected by taxes. Tax shields and tax credits make the tax schedule more convex, which is one in which the firm's average effective tax rate is rising as pre-tax income rises. Risk management may reduce the volatility of earnings and may therefore move high pre-tax income resulting from unplanned gains, towards the mean pre-tax income thereby **reducing taxes** and increasing the value of the firm.

Reducing the volatility of cash flows can also increase the value of the firm by reducing the probability of default thereby reducing the shareholder-bondholder conflict. Potential bondholders will be willing to pay more for the bond and therefore the debt capacity of the firm increases. This will in turn **improve investment decisions** and management's opportunities to undertake all positive NPV⁵ projects while rejecting unprofitable ones.

⁵ Net present value – a project's net contribution to wealth – discounted value of future cash flows minus initial investment

Tools for managing Financial Risks

We have seen above the broad considerations that the management of our firm would make to identify risk profiles, their slope or extent, and whether risk management programmes would increase the value of the firm. It is worth mentioning at this stage that the approach to risk management needs to be well structured with robust policies⁶ and strategies. If the firm identifies that it is subject to significant financial price risks, management may choose to hedge that risk. The four fundamental instruments other than on-balance sheet methods⁷ are Forwards, Futures, Swaps and Options. These tools can be used to deal with managing financial risk, both in isolation and as interrelated instruments to derive apparently new derivative products.

Forward Contracts

Of the financial derivatives, forward contracts are the most familiar, appearing in transactions as common as buying a puppy. 'I'll pay you \$x for that puppy with the spot on its right hind leg when it is weaned.'⁸ A forward contract is one in which a party agrees to buy (*long position*) from another party (*short position*), an item (*underlying asset*) on a future date (*maturity, expiry or expiration*) at a price (*forward price*) that is agreed in the contract.

The diagram labelled **Figure 3** below helps illustrate the definition of the forward contract. The top panel illustrates a *foreign exchange forward*, in which our company has agreed to pay at time T, GBPx in order to receive USDy. Recall that our company imports oranges from the US and will therefore most likely have to pay for them in USD. Exchange rate fluctuations might expose the company to differences on exchange which our risk manager would like to hedge for.

Apart from the exchange rate fluctuations, our company is exposed also to *commodity price risks*, that is, the risk of fluctuations in the market price of oranges. In planning the raw material requirements for the forthcoming production runs, our company will discuss the risk profile in a round table discussion involving the procurements section, the sales division and the risk management team. The sales department might show concern about

⁶ Donald H Chew, Where Theory meets practice, McGraw-Hill, third edition page 490:
Policy at Lukens Inc address issues of implementation such as

- Who is to be on the risk management team?
- Who is responsible for executing trading activities?
- What are the limits of their decision-making authority?
- What approvals are required for decision-making that goes beyond these limits?
- How are positions to be reported to the management and the Board?

⁷ Such as borrowing in the competitor's currency or moving production abroad.

⁸ Charles W Smithson & Clifford W Smith Jr, Managing Financial Risks, Irwin Professional Publishing, Page145.

the selling prices that seem to be competing in a fierce market and therefore the cost of the purchased oranges plays a significant role in the level of the bottom lines of the company. The risk management team, in consultation with the procurements managers, might fear that the actual price (*spot price*) of the underlying asset, that is oranges, at the time T when the shipment is due, may be higher than the price used in the budgets. The lower panel of the figure labelled Figure 3, illustrates a *commodity forward contract* in which our company has agreed at time 0 to pay USD y for x tonnes of oranges to be delivered and paid for at time T.

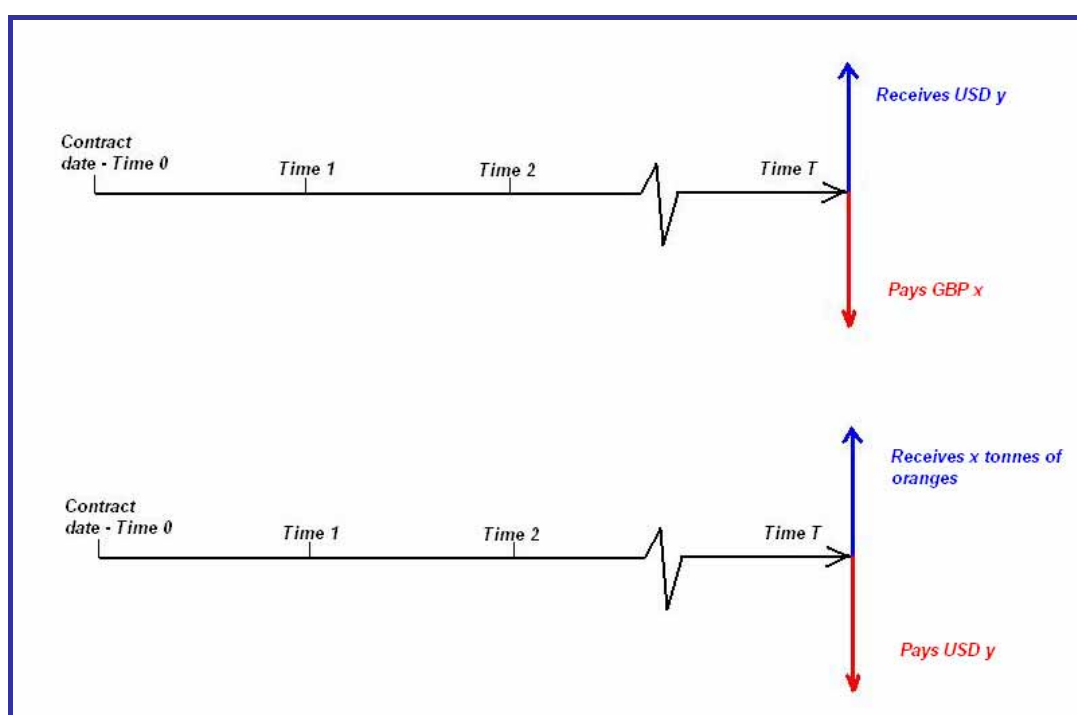


Figure 3 - Illustrative Forward Contracts⁹

Our company actually could have considered using the cash markets to hedge, that is by buying the oranges today at time 0 for shipment at time T. However, this method would have affected the cash outflow of the company immediately. The advantage with the forwards is that buyers who do not have the cash immediately do not have to borrow, and those who do have the liquidity need not spend it on the contract date.

⁹ Adopted from Charles W Smithson & Clifford W Smith Jr, Managing Financial Risks, Irwin Professional Publishing, Page 146

Forward contracts are by nature credit instruments in that at time T, a party to the contract who might find that the spot price then is more favourable than that agreed upon in the forward contract, might decide to abrogate the contract. This would leave the other party exposed as much as one would be out a sum of money in the case where a borrower reneged on a loan. Therefore, it is evident that Forward contracts entail credit risks. For this reason, realistically, the forward market is less appropriate for the individual, the sole proprietor or the small company. The parties in a forward contract fall under four categories, namely:

1. businesses who need the underlying asset in the future
2. businesses who want to supply the underlying asset in the future
3. speculators
4. intermediaries

In our case, the parties to the contract are the company and an intermediary. The foreign exchange forward described above as a tool available for our company to hedge against fluctuations in the price of USD for GBP, is contracted with a currency dealer such as a bank. The commodity price forward is either done with the farmer himself, which is cumbersome, or done over-the-counter with a merchant or a dealer. When the forward contracts are agreed with the intermediaries, it is the intermediaries who set the forward prices. Very often, the forward price P_F exceeds the current spot price P_S (*contango*). The relationship between P_F and P_S is usually related to C, the cost of carrying the underlying asset from now until maturity. In the case of foreign currency, C would be the interest lost on the domestic currency GBP that is used to buy the USD minus the interest that the USD itself earns. That said, the *Interest Rate Parity Theorem* states that all differences between spot and forward exchange rates are offset by differences in interest rates. Therefore, P_F is related to P_S by the domestic interest rate r_D , the foreign interest rate r_F , and the time to maturity in years, T. This relationship is expressed as follows:

$$P_F = P_S \left[\frac{(1 + r_D)}{(1 + r_F)} \right]^T$$

In the case of the oranges, C would chiefly be the interest lost on the GBP used to buy them plus the cost of storing them. However, it is generally thought that P_F will be slightly below P_E (expected price) by an amount that reflects the risk premium which faces investors who agree forward contracts on those commodities. The modern view for commodities is based on the portfolio theory which states that forward prices will always be below expected future prices for all those commodities whose prices tend to rise when the economy expands. Under this theory, P_F is related to P_E as follows:

$$P_F = \frac{P_E(1+r)}{(1+r+\beta p)}$$

where

r is the risk-free interest rate,

p is the market portfolio risk premium and

β is the beta¹⁰ of the underlying asset.

That said, a study by Dusak in 1973 argued that for many commodities β was close to zero, in which case P_F would be very close to P_E ¹¹.

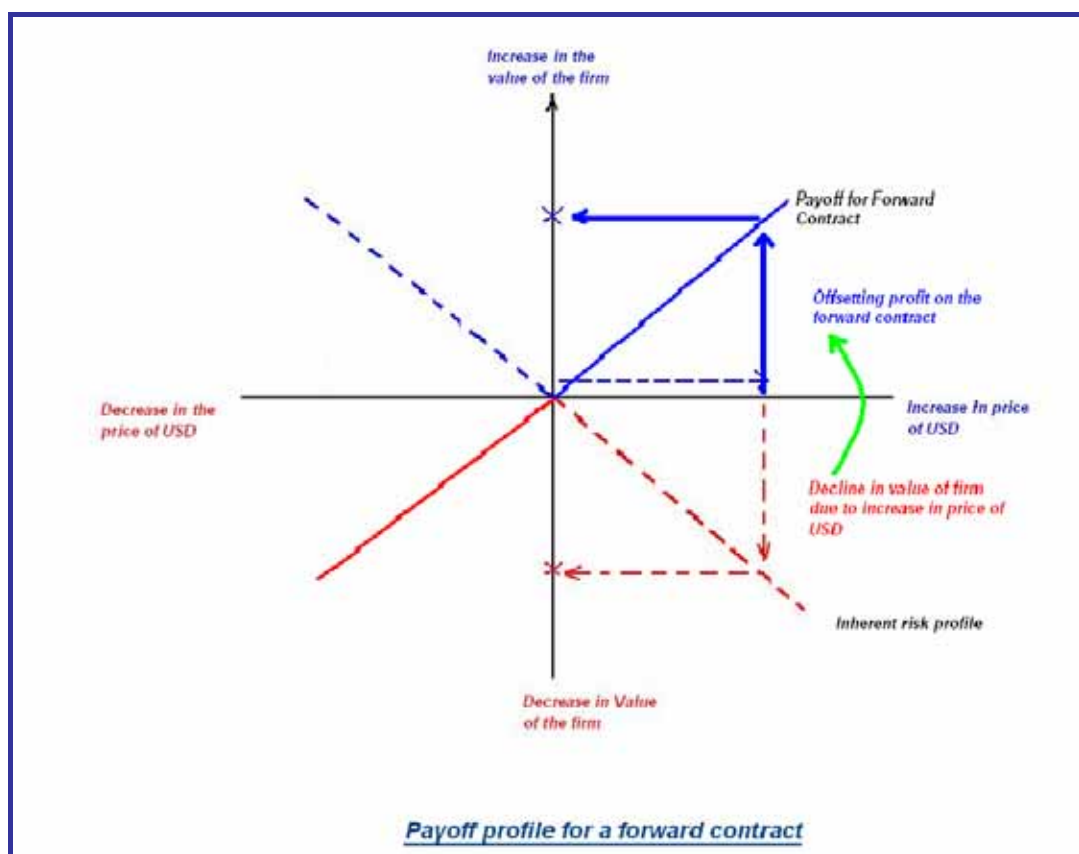


Figure 4 - Payoff profile for a Forward Contract

The above figure illustrates our company's foreign exchange risk profile. If the actual price at contract maturity is higher than expected, the inherent risk results in a decline in the

¹⁰ measure of how the price of the asset responded to market movements

¹¹ David N King, Financial Claims and Derivatives, International Thompson Business Press, First edition, Page122

value of our firm. However, this decline is offset by the profit on the forward contract. Apart from its payoff profile, the forward contract has two other features:

1. the credit or default risk is two-edged and therefore the contract owner either receives or makes a payment depending on whether the price movement of the underlying asset is positive or negative respectively
2. no payment is made either at origination or during the term of the contract

Futures Contracts

Futures, or Future contracts are contracts that resemble forwards in many ways.

Similarities with Forwards:

1. they oblige the parties to deal on a future maturity (expiry) date
2. they specify a futures price or some other value to establish the terms under which the deal is made
3. they are used by both hedgers and speculators
4. the payoff profile illustrated in **Figure 4** on page 12 for the purchaser of a forward contract could also serve to illustrate the payoff to the holder of a futures contract

There are however distinguishing features of futures:

1. futures may only be agreed on recognised futures exchanges unlike forwards that can be agreed anywhere
2. futures exchanges insist on standardised contracts stipulating the quantity that must be agreed in each contract, restricting the choice of maturity dates and even constraining the futures price, and in the case of commodity futures, they also stipulate the quality and delivery points.
3. credit or default risk can be virtually eliminated in a futures market through the '*marked-to-market*' mechanism whereby the value change is settled at the end of each day rather than at the expiry of the contract as with forwards¹², and through the '*margin*' which is a form of performance bond
4. through the exchanges (or clearing houses), the costs of transacting in futures are reduced

Therefore, referring back to the commodity price risk of our company explained on page 9, the risk management team may consider that a futures contract may adequately hedge

¹² Fischer Black likened a futures contract to a 'series of forward contracts in which each day, yesterday's contract is settled and today's contract is written'. Source: Donald H Chew, Where Theory meets practice, McGraw-Hill, third edition page400

against the risk of price fluctuations in oranges. The main reason why the team considers futures is because the company may want to *close out* on the contract because the price of the fruit is more favourable than the contracted price, close to the expiry. Closing out with forward contracts can be hard because the company would have to make a second offsetting contract or reversing trade with the same dealer, who may be reluctant to agree precisely to the same quantity, quality and delivery point. With forward contracts there are so many different maturity dates, quantities, qualities and delivery points, that it could even be harder for the company to find someone other than the dealer willing to take over the contract.

On the other hand, the futures exchange might be able to offer contracts for only six maturity days a year, say the third Wednesday in January, March, May, July, September and November. Also, the exchange might give no choice over the quality or quantity and limited choice on the delivery points. These are possible limitations of futures markets. There might also be a possibility that the exchange will not offer contracts for the specific commodity required, in our case oranges. However, with futures there are appropriate responses that will render hedging far less of a problem than it might appear. The reason for this is that there are plenty of people willing to accept standardised futures contracts and consequently, it is always fairly easy to agree precisely offsetting contracts. We shall below take a brief canter through some responses that render hedging with futures less problematic than it seems.

One problem mentioned above is that futures rarely mature on the day which hedgers would like. In such a case it is always advisable to use futures that mature after the required date and close out on the date required. Therefore, assume our company required to purchase 200 tonnes of oranges on the 10th October and the closest available maturity dates are the third Wednesdays of September and December, say 17th September and 17th December. The best strategy might be to take the 17th December future contract and close out on the 10th October because otherwise, if the September maturity is taken, the company will be exposed during the period 17th September to the 10th October.

Let us for a moment assume that no futures contracts exist for oranges, even though they are available for orange juice (say from the New York Commodity Exchange). Assuming also that the prices of oranges and those for orange juice are perfectly positive correlated, our company's best strategy in this case using futures might seem to be to make a futures contract to buy orange juice and close out just before maturity. The profit or loss made will

offset the loss or profit respectively on the purchase of oranges at the spot price on that day. This transaction is called a '*cross hedge*'. If however the prices of oranges and those of orange juice are not perfectly positive correlated, then our company shall need to establish the relationship using statistical methods. In this situation the appropriate response would then be a '*weighted hedge*'. This might result in a relationship or hedge ratio of say 1.05, or the requirement to buy 105 tonnes of orange juice to hedge for price movements of the 100 tonnes of oranges required.

Options

As we have seen above on page 14, the owner of both a forward and a future contract has an *obligation* to perform. An option, on the other hand, gives its owner a right, not an obligation to perform. We have discussed the risk profile of our company buying forward oranges or foreign exchange, starting by **Figure 1** and developing it to **Figure 4**. We have seen that the obligation to perform under both forwards and futures will result in offsetting gains or losses through hedging in the eventuality of either an increase or a decrease in the price on expiry compared to the agreed forward or future price. An ideal contract would shift the payoff line in the lower left quadrant of the pictogram, upwards until horizontal. This would imply that if the actual price decreased on maturity compared to the exercise price, then the owner of the contract would have the possibility to cancel the agreement. This is illustrated in the diagram below labelled **Figure 5**.

This ideal contract is actually possible through *options*. With a *call option* the party intending to buy such as our company, has the option or right to call off the deal. With a *put option* the party intending to sell has this right. If the company opts for *American Style* options, then it would have a right to cancel the option at any point in time. Those options that allow the owner to cancel only at maturity are termed *European Style* options. In return for having this right to cancel, the party who has it has to pay to the other party a *premium* or *price* which is non-refundable. This is shown diagrammatically on **Figure 6**. Basically, this diagram illustrates that if the option is exercised by our company, because the spot price on expiry is higher than the strike price of the option, the gain realised by exercising the option will be reduced by the premium. Similarly, if the spot price is lower than the strike price and the company cancels the option to buy at the spot price, then its sunk cost would still be the premium amount. Therefore those who buy options limit their possible losses to the value of their premiums paid when the options are agreed.

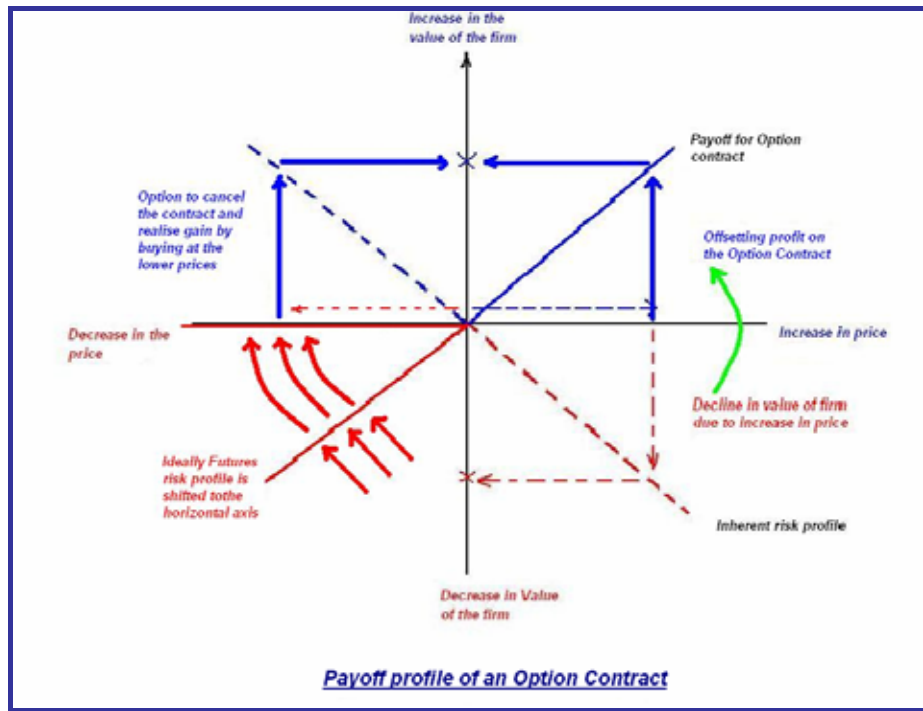


Figure 5 - Payoff profile of an Option Contract

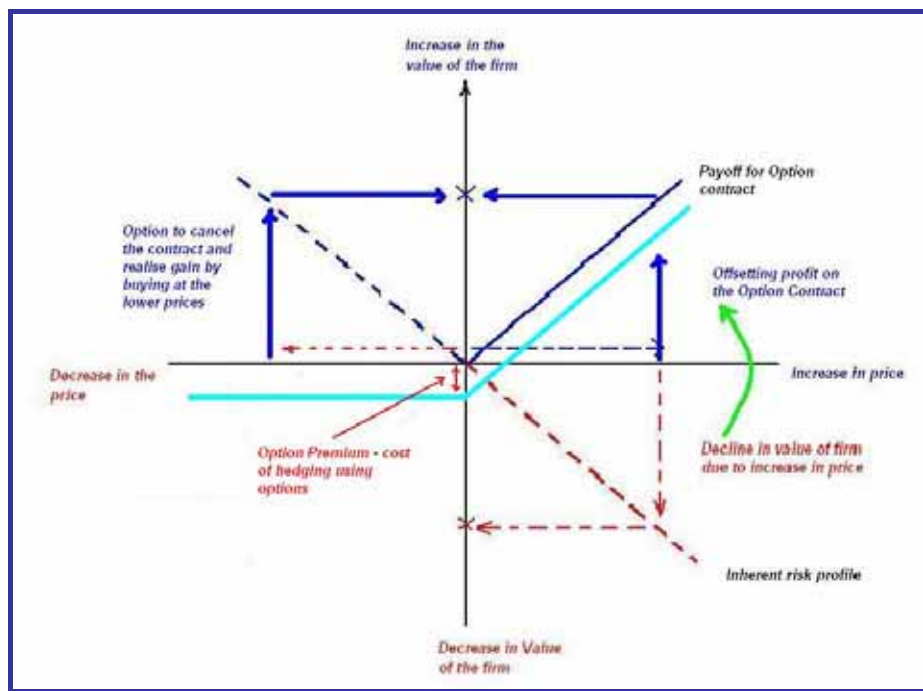


Figure 6 - Payoff Profile of Option contract including Premium

So far we have considered *'at-the-money'* options that are options for which the exercise price is the prevailing expected price. This type of option is paid for by sacrificing a significant amount of the firm's potential gains. If however the company is willing to accept larger potential losses, then it might consider an *'out-of-the-money'* option that attracts a lower premium cost. The comparison between these two types of options is illustrated in **Figure 7** below.

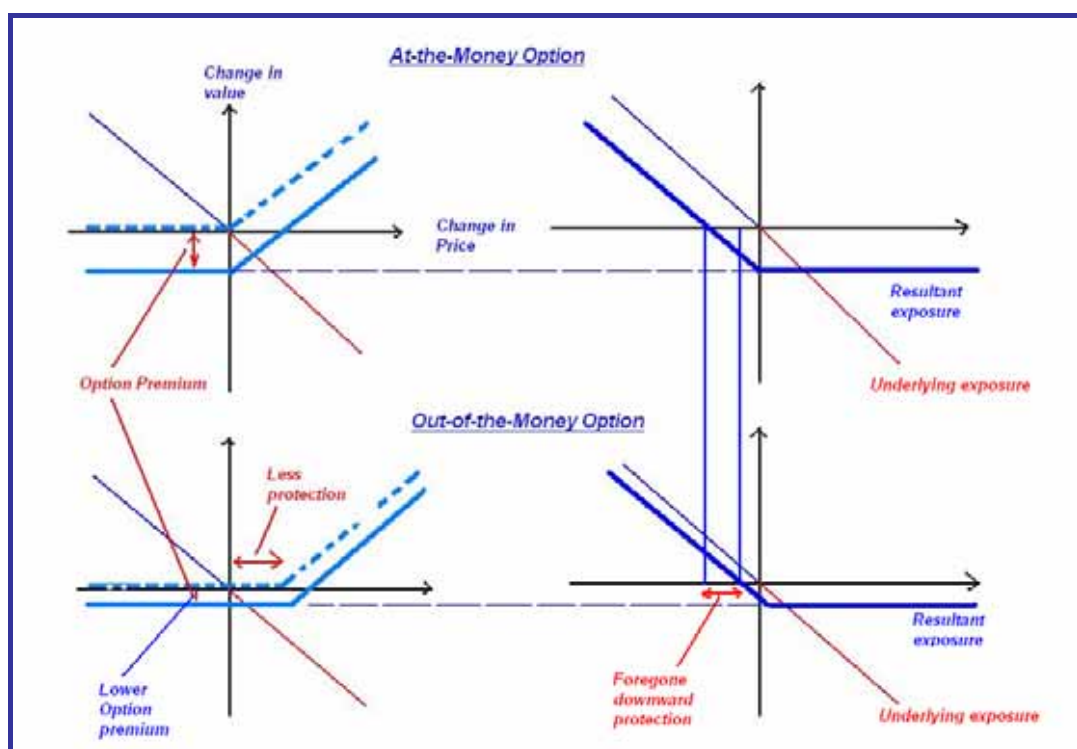


Figure 7 - Risk profile of different Options

Of particular interest is the foregone downward protection for a lower premium. This foregone protection will result in a lower increase in value to the firm for a relative downward price movement when compared to the *'at-the-money'* option. The lesson here is that the option buyer can alter her payoff profile simply by changing the exercise price.

Conclusion

In the text above we have demonstrated how the risk management team of our company can use the various hedging instruments to manage financial price risks. The solutions proposed are just a few in as much as the exposures that may call for hedging may be

different and several. For example our company may have been considering financing an extension of the plant and may have realised that the interest rates proposed by the financiers may change by the time the draw-down of the loan is required. The treasury department of the company might have been considering purchasing equities in the near future to invest funds that were to be released, and would like to hedge against high prices. The world has become so volatile that risk management has become a discipline and a profession in its own right.

This text has attempted to highlight the importance of identifying risk profiles, understanding the potential impact on the value of the firm and methods of hedging against such risks. Earlier on in the introductory paragraphs we described the various hedging instruments as building blocks or tools. The basic component is the forward contract. Futures are like bundles of forward contracts. Options can actually be produced by combining a position in a forward contract on the same asset with a riskless security (such as government stocks). Once these tools are understood, it becomes straightforward to design customised strategy for managing the firm's exposure.

On a final note, risk management practices are becoming ever more important as cut-throat competitiveness intertwined with increasing pressures on management to add to shareholder value are the main concerns of today's businesses. We have seen a rapid flow of sophistications in hedging instruments so as to manage financial price risks to acceptable minimum levels. We have discussed above the main derivatives available. They all have their own characteristics, advantages and disadvantages. At the end of the day, as with many of the different facets of finance, managers have to use their highest degree of judgement skills to understand their particular situation, assess the risks involved, evaluate the various hedging alternatives and finally decide which is best suited for their case.