

Techniques for Managing Exchange Rate Exposure

A firm's economic exposure to the exchange rate is the impact on net cash flow effects of a change in the exchange rate. It consists of the combination of transaction exposure and operating exposure. Having determined whether the firm should hedge its exposure, this note will discuss the various things that a firm can do to reduce its economic exposure. Our discussion will consider two different approaches to handling these exposures: real operating hedges and financial hedges.

Transaction Exposure

Financial Techniques of Managing Transaction Exposure

Transaction exposure hedging should have been discussed in some detail in the previous international finance course; however, we will briefly go over the standard financial methods available for hedging this exposure. The main distinction between transaction exposure and operating exposure is the ease with which one can identify the size of a transaction exposure. This, combined with the fact that it has a well-defined time interval associated with it makes it extremely suitable for hedging with financial instruments. Among the more standard methods for hedging transaction exposure are:

i) Forward Contracts - When a firm has an agreement to pay (receive) a fixed amount of foreign currency at some date in the future, in most currencies it can obtain a contract today that specifies a price at which it can buy (sell) the foreign currency at the specified date in the future. This essentially converts the uncertain future home currency value of this liability (asset) into a certain home currency value to be received on the specified date, independent of the change in the exchange rate over the remaining life of the contract.

ii) Futures Contracts - These are equivalent to forward contracts in function, although they differ in several important features. Futures contracts are exchange traded and therefore have standardized and limited contract sizes, maturity dates, initial collateral, and several other features. Given that futures contracts are available in only certain sizes, maturities and currencies, it is generally not possible to get an exactly offsetting position to totally eliminate the exposure. The futures contracts, unlike forward contracts, are traded on an exchange and have a liquid secondary market that make them easier to unwind or close out in case the contract timing does not match the exposure timing. In addition, the exchange requires position taker to post a bond (margins) based upon the value of their positions. This virtually eliminates the credit risk involved in trading in futures.

iii) Money Market Hedge - Also known as a synthetic forward contract, this method utilizes the fact from covered interest parity, that the forward price must be exactly equal to the current spot exchange rate times the ratio of the two currencies' riskless returns. It can also be thought of as a form of financing for the foreign currency transaction. A firm that has an agreement to pay foreign currency at a specified date in the future can determine the present value of the foreign currency obligation at the foreign currency lending rate and convert the appropriate amount of home currency given the current spot exchange rate. This converts the obligation into a home currency payable and eliminates all exchange risk. Similarly a firm that has an agreement to receive foreign currency at a specified date in the future can determine the present value of the foreign currency receipt at the foreign currency borrowing rate and borrow this amount of foreign currency and convert it into home currency at the current spot exchange rate. Since as a pure hedging need, this transaction replicates a forward, except with an additional transaction, it will usually be dominated by a forward (or futures) for such purposes; however, if the firm needs to hedge and also needs some short term debt financing, wants to pay off some previously higher rate borrowing early, or has the home currency cash sitting around, this route may be more attractive than a forward contract.

iv) Options - Foreign currency options are contracts that have an up front fee, and give the owner the right, but not the obligation to trade domestic currency for foreign currency (or vice versa) in a specified quantity at a specified price over a specified time period. There are many different variations on options: puts and calls,

European style, American style, and future-style etc. The key difference between an option and the three hedging techniques above is that an option has a nonlinear payoff profile. They allow the removal of downside risk without cutting off the benefit from upside risk.

There are different kinds of options depending on the exercise time the determination of the payoff price or the possibility of a payoff. While many different varieties exist, there are a few that corporations have found useful for the purposes of hedging transaction exposures.

One of these is the average rate (or Asian or Look back) option. This option has as its payoff price, not the spot price but the average spot price over the life of the contract. Thus these options can be useful to a firm that has a steady stream on inflows or outflows in a particular currency over time. One large average rate option will basically act as a hedge for the entire stream of transaction. Moreover, the firms will lock in an average exchange rate over the period no worse than that of the strike price of this option. Finally, because the average rate is less volatile than the end of period rate (remember the average smoothes volatility this option will be cheaper than equivalent standard options. Thus the firms obtains in a single instrument hedging for a stream of transaction so reduces transaction costs plus benefits from the “hedging” over time of the averaging effect.

Another popular exotic option for corporations is the basket rate option. Rather than buy options on a bunch of currencies individually, the firms can buy an option based upon some weighted average of currencies that match its transaction pattern. Here again since currencies are not perfectly correlated the average exchange rate will be less volatile and this option will therefore be less expensive. There firm can take advantage of its own natural diversification of currency risk and hedge only the remaining risk.

Choosing between Instruments

In choosing between these different financial techniques the firm should consider the costs and the ultimate home currency cash flows (appropriately adjusted for time value) of each method based upon the prices available to the firm. The different techniques involve different types of cash flows at different points in time and this must also be taken into account by the firm. In efficient markets, under the assumption of risk neutrality, all of these contracts should be priced so that their expected net present value is zero. In other words, contracts, such as forward and futures, that have no up front payment will have a zero expected payoff; while options, depending on their strike price and maturity, will have an expected payoff whose discounted value is equal to the up front premium.

There is another important distinction between the first three techniques and options for hedging exposures that the firm should consider in making its choice of hedging techniques. All of these techniques provide variance reduction to the ultimate payoff on a foreign currency denominated contract. In the case of the forward contract and the money market hedge, the variance of the final cash flows is eliminated entirely. For most futures contracts and options, volatility still exists, but it has been substantially reduced. Options on the other hand also provide insurance to their purchaser. They provide a guarantee against losses above some preset amount, but do not lock the transaction into a fixed price, in case the price may turn out later to be wrong. Thus, one aspect of the decision of which financial instrument to use to hedge a known foreign currency transaction is whether one is really desiring variance reduction (say for making budgeting easier) or insurance against losses.

Transaction Hedging Under Uncertainty

Uncertainty about either the timing or the existence of an exposure does not provide a valid arguments against hedging.

Uncertainty about transaction date:

Many corporate treasurers loath to commit themselves to the early protection of foreign currency cash flow. Often the reason is that, although they are sure a foreign currency transaction will occur, they are unsure as of the exact date that the transaction will occur. These fears arising from a possible mismatch of maturities of transaction and hedge are unfounded. Through the mechanism of rolling or early unwinding, financial contracts leave open the

possibility of adjusting the maturity at a later date, when more precise information is available. The resulting risk borne from the maturity mismatch is usually quite small relative to the total risk of leaving a transaction exposed until better information becomes available.

Consider the example of a French exporter who had been expecting to receive, from a foreign purchaser, a payment of \$1 million at a future date t . Early on, he had hedged himself by selling forward the \$1m at a forward price of $\$1 = \text{FF}6.200$. Come date t , he is informed that his foreign customer will pay one month later at date $t+1$. Thus, at date t the French producer must roll over his forward contract on the basis of the then prevailing rates:

Spot rate at t (FF/\$): 5.9375 / 405
 One-month Franc discount 74 / 100 (Outright forward 5.9449 / 5.9505)

Below are the French exporter's transactions:

<u>Time</u>	<u>Transaction</u>	<u>Exchange rate</u>	<u>Cash Flow (FFm)</u>
0	Forward sale of \$1m to t	$\$1 = \text{FF}6.200$	0
t	Roll over: spot purchase of \$1m	$\$1 = \text{FF}5.9405$	6.2000 <u>-5.9405</u> 0.2595
	forward sale of \$1m to $t+1$	$\$1 = 5.9479$ (5.9405 + 0.0074)	
$t+1$	Execute forward contract		5.9479

Notice that the rollover rate is not a regular forward rate. It is calculated by tagging the swap bid rate of 74 Franc points applying normally to the exporter's forward sale of Francs onto the current spot ask price of 5.9405 FF/\$ at which he has just bought dollars. Since the rollover only requires the bank to enter a swap as opposed to a swap and a spot. On a spot purchase with a forward sale transaction, the bank does not charge a bid-ask spread for the forward round trip component.

Now the French exporter collects his Franc in two installments. Suppose he re-invests his profits on the original forward contract, FF 0.2595m for 30 days at the Franc deposit rate, which happens to be 8.25% at the time. This generates a small amount of interest equal to FF 0.0018m. In total the exporter collects an amount equal to FF $5.9479 + 0.2595 + 0.0018 = \text{FF } 6.2092\text{m}$. This can be decomposed as:

$$\text{FF } 6.2092 = \text{FF } 6.200 + 0.0074 + 0.0018$$

or, the proceeds of the original forward rate contracted at time 0 for maturity t , plus the forward premium prevailing at date t for the extra month, plus the interest on the gain from rolling over the forward contract.

While it is difficult to disentangle the interest rate risk arising from the unexpected delay of the payment which was unavoidable and the basis risk arising from hedging the wrong maturity, we can see that the risky components of the roll over return (0.0074 + 0.0018) are small in magnitude relative to the exchange rate risk that would have been borne if the transaction had not been hedged, albeit incorrectly. Thus the fact that the maturity of an identified transaction is not known is not sufficient grounds to delay the hedging of the transaction.

Uncertainty about existence of exposure:

Another form of uncertainty that arises regarding transaction exposure is in submitting bids with prices fixed in foreign currency for future contracts. If and when a bid is accepted, the firm will either pay or receive foreign currency denominated cash flows. This is a special source of exchange rate risk as it is a contingent transaction exposure. In such cases, an option is ideally suited. As mentioned above, the firm is really interested in insurance against adverse exchange rate movements between the time the bid is submitted and the time it may be

accepted. Thus an option can be used to protect the value of the foreign currency cash flows associated with the bid against adverse currency movements. The cost of the option, which can be included in the bid, protects the value of the expected cash flows from falling below a predetermined level and represents the most the firm can lose due to currency risk. Under such a situation there are four possible outcomes: the bid is either accepted or rejected and the option is either exercised or let to expire. The following table summarizes the effective proceeds to the firm per unit of option contract (equal to the net cash flows of the project).

State	Bid Accepted	Bid Rejected
Spot price better than exercise price : let option expire	Spot Price	0
Spot price worse than exercise price: exercise option	Exercise Price	Exercise Price - Spot Price

Operational Techniques for Managing Transaction Exposure

Transaction exposures can also be managed by adopting operational strategies that have the virtue of offsetting existing foreign currency exposure. These techniques are especially important when well functioning forward and derivative market do not exist for the contracted foreign currencies.

These strategies include:

i) Risk Shifting- The most obvious way to reduce the exposure is to not have an exposure. By invoicing all transactions in the home currency a firm can avoid transaction exposure all together. However, this technique can not work for every one since someone must bear transaction exposure for a foreign currency transaction. Generally the firm that will bear the risk is the one that can do so at the lowest cost. Of course, the decision on who bears the currency risk may also impact the final price at which the contract is set.

ii) Currency risk sharing - An alternative to trying to avoid the currency risk is to have the two parties to the transaction share the risk. Since short terms transaction exposure is roughly a zero sum game, one party's loss is the other party's gain. Thus, the contract may be written in such a way that any change in the exchange rate from an agreed upon rate for the date for the transaction will be split between the two parties. For example a U.S. firm A contracts to pay a foreign firm B FC100 in 6 months based upon an agreed on spot rate for six months from now of \$1 = FC10, thus costing the U.S. firm \$10. However, under risk sharing the U.S. firm and the foreign firm agree to share the exchange rate gain or loss faced by the U.S. firm by adjusting the FC price of the good accordingly. Thus, if the rate in 6 months turns out to be \$1 = FC12, then rather than only costing the U.S. firm $100/12 = \$8.50$, the \$1.50 gain over the agreed upon rate is split between the firms resulting in the U.S. firm paying \$9.25 and the foreign firm receiving FC 111. Alternatively if the exchange rate had fallen to \$1 = FC8, then instead of paying \$12.50 for the good, the exchange rate loss to the U.S. firm is shared and it only pays \$11.25 and the foreign firm accepts FC90. Note that this does not eliminate the transaction exposure, it simply splits it.

iii) Leading and Lagging - Another operating strategy to reduce transaction gains and losses involves playing with the timing of foreign currency cash flows. When the foreign currency in which an existing nominal contract is denominated is appreciating, you would like to pay off the liabilities early and take the receivables later. The former is known as leading and the latter is known as lagging. Of course when an the foreign currency in which a nominal contract is denominated is depreciating, you would like to take the receivables early and pay off the liabilities later.

iv) Re invoicing Centers - A re invoicing center is a separate corporate subsidiary that manages in one location all transaction exposure from *intracompany* trade. The manufacturing affiliate sells the goods to the foreign distribution affiliates only by selling to the re invoicing center. The re invoicing center then sells the good to the foreign distribution affiliate. The importance of the re invoicing center is that the transactions with each affiliate are carried out in the affiliates local currency, and the re invoicing center absorbs all the transaction exposure. Three

main advantages exist to re-invoicing centers: the gains associated with centralized management of transaction exposures from within company sales, the ability to set foreign currency prices in advance to assist foreign affiliates budgeting processes, and an improved ability to manage intra affiliate cash flows as all affiliates settle their intracompany accounts in their local currency. Re-invoicing centers are usually an offshore (third country) affiliate in order to qualify for local non resident status and gain from the potential tax and currency market access benefits that arise with that distinction.

Operating Exposure

Real exchange rate changes bring about changes in the relative prices a firm faces. These changes in relative prices will generally have an impact on the competitiveness of the firm. Given that a different competitive environment implies a different economic reality, it is unlikely that the firm's original operational choice will be optimal any longer. Therefore, depending on its perception about the persistence of the real exchange rate change, the firm may want to make changes in its operating strategy. To do this a firm needs to have existing flexibility that allows it some freedom to alter its operations in response to the exchange rate change. If this flexibility, or alternatively real operating options, does not exist, the firm may need temporary cash flow protection while the flexibility is installed or full cash flow insurance to simply ride out the adverse exchange rate fluctuation. This operating flexibility or operating options can be thought of as real hedges that the firm takes out to protect itself from real exchange rate fluctuations. The temporary protection or cash flow insurance will generally be obtained using financial instruments. Thus both real operational and financial hedging strategies are important for the management of a firm's operating exposure to exchange rates.

Operational Strategies for Managing Operating Exposure

By its very definition, operating exposure is the impact of exchange rate changes on the firm's actual operations. Therefore, the first place to consider how to manage this exposure is to consider operation responses to exchange rate changes. Ideally the firm would like to set up its operations, production, sourcing, marketing such that the firm can respond to change in the real exchange rate so as to take advantage of the improved competitive positions and/or limit the harm caused by the degradation of competitiveness. These may be either *ex ante* actions that provide the firm an operating option, or marginal changes in activity intensity that try to mitigate the adverse impact of exchange rate fluctuations on firm value. Unlike financial hedging which provide the firm a deterministic cash flow in response to exchange rate movements with out any real economic actions on the part of the firm, operational strategies require the firms to react to the new economic environments resulting from the exchange rate change and make changes to the economic behavior of the firm. As we shall see below, there are operating strategies which will act as hedges of operating exposure in the short term and others that are more suited to hedge the long term economic exposure of a firm.

Marketing Strategies for Managing Operating Exposure

Market Selection:

A major strategic consideration for a firm is what market to sell in and the relative marketing support to devote to each market. For example, firms may decide to pull out of markets that have become unprofitable due to real exchange rate changes, and more aggressively pursue market share or expand into new markets when the real exchange rate depreciates. These decisions depend, among other things, on the fixed costs associated with establishing or increasing market share. Market selection and market segmentation provide the basic parameters within which a company can adjust its marketing mix over time. They are primarily medium and longer term decisions and may not be feasible strategies to react to exchange rate exposure in the short run. For shorter run marketing reactions to exchange rate exposure, the firm may have to turn to pricing or promotional policies.

Pricing Policies:

As we saw previously, in response to changes in real exchange rates, a firm has to make a decision regarding market share versus profit margin. This involves the passthrough decision with respect to the foreign currency price of foreign sales. Of course, such a decision should be made by setting the price that maximizes dollar profits to the firm; however, since the world is stochastic, this is not always a clear choice. The decision on how to adjust the foreign currency price in response to exchange rate changes will depend upon how long the real exchange

rate change is expected to persist, the extent of economies of scale that occur from maintaining large quantity of production, the cost structure of expanding output, the price elasticity of demand, and the likelihood of attracting competition if high unit profitability is apparent. The longer the exchange rate change is expected to persist, the greater the price elasticity of demand, the greater are the economies of scale and the greater is the possibility of attracting competition, the greater will be the incentive to lower home currency price and expand demand in light of a home currency depreciation, and to keep home currency price fixed and maintain demand in light of a home currency appreciation. However, in deciding to change prices, the firm should take into account the impact on cash flows not just today but in the future as well, as once a customer is lost, he may be lost for a long period of time making it difficult for a firm to regain market share (U.S. auto manufacturers in the 1980s).

On an empirical side, it is the case that data suggests that U.S. firms have a cross sectional average passthrough of around 0.5 to 0.7. This suggests that they adjust prices significantly in response to exchange rate changes.

Theoretical work suggests that the more market power (market share) a firm has, the more passthrough we would expect to see. Also the more competitive the industry on a global basis, the less passthrough we would expect to see. Also the higher the substitutability of a good, the lower the passthrough we would expect.

Promotional Strategies:

An essential issue in any marketing program is the size of the promotional budget for advertising, selling and merchandising. These budgets should explicitly build in exchange rate impacts. An example is European ski areas in the mid 1980s. When the dollar was strong, they found that they obtained larger returns on advertising in the U.S. for ski vacations in the Alps as the costs compared to the Rocky Mountains has fallen due to the currency movements.

Production Strategies for Managing Operating Exposure

All of these responses have involved attempts to alter the dollar value of foreign currency revenues. However, sometime real exchange rates change but such a large margin that marketing strategies and pricing decisions cannot make the product profitable. Firms facing such circumstances must either drop the products or cut costs. Product mix, product sourcing and plant location are the principle production strategies that companies can use to manage competitive risks that cannot be handled by marketing strategies alone. The basic idea is to diversify the production mix such that the effect of exchange rate changes washes out or tie your costs more closely to your foreign competitors.

Diversifying Operations:

One possibility to dealing with the impact of exchange rate exposure on the firm's cash flows is to have the firm diversify into activities with offsetting exposures to the exchange rate. For example, combine the production and exporting of a manufactured good with an importing operation that imports competitive consumer goods from foreign producers. This creates a natural operating hedge that keep total dollar cash flows steady in light of real exchange rate movements. While the benefits of this strategy are obvious, it has some potential drawbacks: it may lead the firm to enter into activities in which it has no apparent comparative advantage resulting in an inefficient source of resources, or alternatively, the firm may view the two activities as complementary and allow cross subsidization to occur for long periods of time and not consider the economic viability of each operation on its own. Put another way, unless done carefully, this can be an expensive way to hedge an operating exposure.

Diversifying Sources of Inputs:

For firms wishing to stick to their knitting, the goal of a production strategy should be to reduce operating costs. The most flexible way to do this in light of a real home currency appreciation is to purchase more components from overseas. As long as the inputs are not priced in a globally integrated market (i.e., gold or oil), then the appreciation should lower the dollar cost of the inputs and thus total production costs. For the longer term, the firm may wish to consider the option of designing new local facilities that provide added flexibility in making substitutions among various sources of inputs, either from domestic sources or foreign sources. However, this strategy does not bode well for the concept of good supplier relations, and potential costs associated with constantly switching suppliers' needs to be taken into consideration when evaluating this strategy.

Plant Location:

The most obvious way to be able to take advantage of relative costs changes due to real currency movements is to have production costs based in different currency by actually having production capacity in different countries. The simplest response is to move production to your competitors market. Then any relative cost advantage he may gain from exchange rate changes also accrues to you as well. Alternatively, placing a plant in a third country based upon the intensity of certain inputs to production (i.e., labor, raw materials) may make more sense; however one needs to think about the correlations between the third country exchange rate and the foreign competitor's exchange rate to evaluate the hedge value of such an decision.

The primary exposure management advantage to having foreign plant locations arises from the ability of the firm to shift production among the plants in response to real exchange rate change. Thus a firm with foreign plants can always produce at capacity in the location where costs are low, and meet additional demand from progressively higher costs locations. This is a generally a method for long run management of operating exposure, as plants take time to build. However, in response to a real exchange rate change that is expected to persist for some time, a firm may decide to undertake the development of foreign production through licensing or foreign acquisition.

Plant Location as a Real Operating (Flexibility) Option:

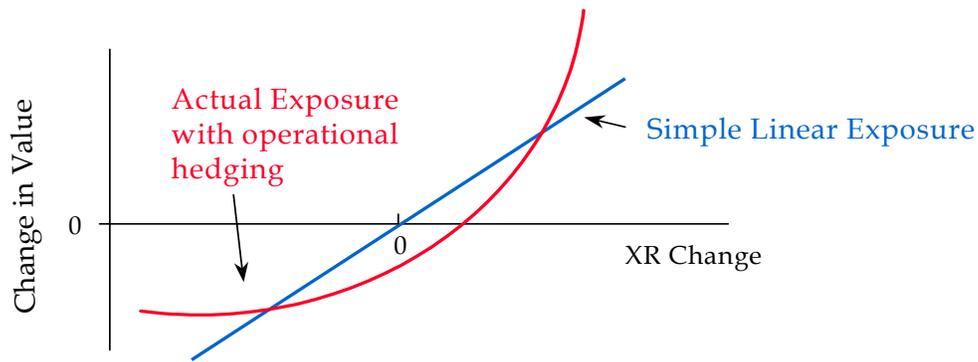
Foreign plant locations are a good example for seeing the relation between real hedges and financial hedges. When neither the domestic or foreign plant are run at capacity, on average, the ability to transfer some production between the domestic and foreign plant is an option that the firm has. Just like a financial option, this real option hedges the firm's cash flows. Moreover, the firm can actually increase cash flows more than linearly with a beneficial change in the exchange rate, by increasing the quantity produced domestically (the low cost source) and reducing production abroad (the high costs source), and similarly reduce cash flows less than linearly with adverse exchange rate changes by increasing the quantity produced abroad (the low cost source) and reducing production domestically (the high costs source). Essentially the firm can alter the size of its exposure with the exchange rate. The existence of a foreign plant provides a real operating option that not only hedges the variability of firm cash flows, but depending on the costs of building and maintaining foreign plants, may actually add to total firm value. Since this is an option, its value will increase with the variability of the real exchange rate. The implication of this is that foreign plants provides a real option that has value, and even in a world where there may be, on average, a cost *disadvantage* to producing abroad, the firm will increase in value by installing production capacity abroad when real exchange rate will be volatile.

The Impact of Operational Hedging on a Firm's Exposure

As is apparent from the description above of the impact of the foreign plant on a firm's cash flows, operational hedges of exchange rate exposure are less to make the variance of cash flows attributable to currency movements zero as they are to allow the firm to take full advantage of beneficial currency movements and to reduce the impact of negative currency fluctuations. This opportunistic behavior that operating hedges allow ends up making the firm's actual operating exposure to exchange rate changes somewhat nonlinear. The firm benefits more than linearly from beneficial movements in the exchange rate and is harmed less than linearly by adverse movements in the exchange rate.

In a volatile world, the investments in flexibility embodied in these operational responses to exchange rate exposure are likely to yield high returns. This can enhance firm value in a way that pure financial hedging in efficient markets cannot. However, the enhancement to value even in these cases also generally depends on some form of market failure--generally the inappropriate pricing of some component of the process. As demonstrated above, these activities, even if they may appear uneconomical at the moment, can pay off by enabling the firm to adjust production, sales, etc. in response to changing exchange rates. However, as with all things, they should be implemented by the firm only when the expected benefit (carefully measured) exceeds the expected cost.

Figure 1: Impact of Operational Hedges on a Firm's Economic



Financial Strategies for Managing Operating Exposure

The financial strategies for hedging operating exposure can roughly be broken down into two groups, the goals of these two groups are the same, it is just the relation to firm operations that differs. These are evaluating and managing the currency structure of a firm's debt, and the addition to the firm of external contracts whose market values or net payoffs are negatively related to the impact of real exchange rate change on firm value.

Denomination of Firm Debt:

The basic goal of hedging is to try to eliminate exposure. For real operating exposure to exchange rates, this can be done by trying to match (as best as possible) foreign currency inflows with foreign currency outflows. Since operating exposure is based upon long terms currency flows, and we have seen previously that future foreign currency revenues are affected by exchange rate changes, the firm may attempt to hedge some of this exposure by denominating some of their long term debt in foreign currency so as to generate offsetting impacts on expected cash flows. Consider the following example:

There is a German subsidiary of a U.S. parent that has a project that requires \$5 million in capital. Below are the cash flows from the German subsidiary to U.S. parent when the project is financed with \$5 million loan. (inflows are arbitrarily determined, based upon negative exposure to S(USD/EUR)).

<u>S(\$/EUR)</u>	<u>1</u>	<u>.8</u>	<u>1.2</u>
EUR net operating inflows	EUR10	EUR10.5	EUR9.5
USD inflows	\$10	\$8.4	\$11.4
repay USD loan	-\$5	-\$5	-\$5
USD to parent	\$5	\$3.4	\$6.4

Now consider cash flows to U.S. parent with 5 million EUR loan for the project

<u>S(\$/EUR)</u>	<u>.1</u>	<u>.8</u>	<u>1.2</u>
EUR net operating inflows	EUR10	EUR10.5	EUR9.5
repay EUR loan	-EUR5	-EUR5	-EUR5
Net EUR Profit	<u>EUR5</u>	<u>EUR7.5</u>	<u>EUR4.5</u>
US dollars to parent	\$5	\$4.4	\$5.4

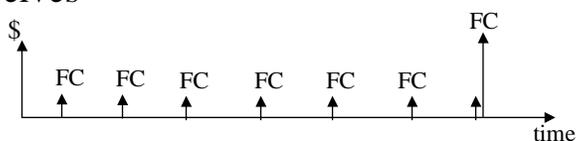
Thus the foreign currency debt has reduced the cash flow volatility resulting from the exchange rate exposure. In this fashion, a firm can move to reduce the impact of exchange rate changes on firm value by denominating debt in foreign currencies in rough approximation to the expected future revenues that they expect over some period.

It may be that firms find it expensive to borrow in foreign currencies because they are less known to foreign lenders or costs of issuing debt abroad are greater than at home. This need not prevent a firm from managing the currency denomination of its debt, as it can always borrow at home in the domestic capital markets and then undertake a swap to convert the home currency obligations of the debt into foreign currency obligations.

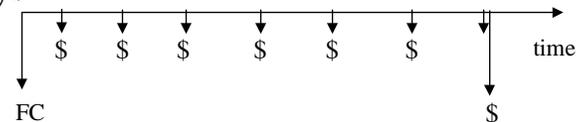
Swaps:

Swaps are a financial instrument that allows the buyer to exchange one set of cash flows for another. Thus the buyer of a swap agrees to make periodic payments based upon some financial price and in return receives periodic payments based upon some other financial price. The most common swaps are interest rate swaps. In these, a firm agrees to pay the market (floating) rate over time (say every six months) on a given principal while at the same time receiving fixed interest rate payments on the same principal amount. Generally, the rates are set so that the PV of the expected payments equal the PV of the fixed receipts. Thus the swap is a zero NPV contract. Since the principal amount is purely notional (only for determining the size of the payments) no money is exchanged up front or at the end.

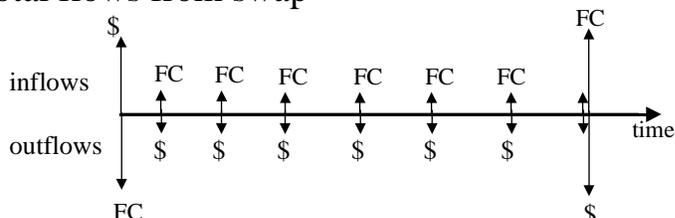
- firm receives



- firm pays



- total flows from swap



Currency swaps are slightly different. Because two currencies are involved we can use either fixed or floating interest rates. The most popular currency swaps are fixed currency swaps in which a fixed rate in one currency is exchanged for a fixed rate in another. Also because different currencies are involved, there is an exchange of initial principal amounts. Usually these principal amounts are equal value given the two currencies' spot rate. At the end of the swap these initial principals are swapped back. Below is a diagrammatic representation of the cash flows to a firm entering a FC swap. Notice the firm's exchange initial principals, cash flows (interest payments) occur periodically and at the end the firm makes the final interest payments and exchanges back the initial principals.

Example of a Swap: Consider a U.S. firm that decides that it should borrow EUR long term in order to hedge the EUR cash flows of its German subsidiary. It finds that the cost of making a EUR debt issue in Frankfurt is substantially higher than its cost of issuing USD debt in New York. Similarly, assume that a German firm decides that it should borrow USD long term in order to hedge the USD cash flows of its U.S. subsidiary. It also finds that the cost of making a USD debt issue in New York is substantially higher than its costs of issuing EUR debt in Frankfurt (currency issue aside). The respective costs for 10 year debt are as follows:

Firm	Borrowing -	USD	EUR
U.S. firm		5%	6.5%
German firm		5.35%	6%

Since each firm has a comparative advantage in issuing debt in its own market, these two firms could benefit from issuing their debt domestically and undertaking a currency swap. Suppose the swap rates are USD 5%/5.125% and EUR 6% / 6.25%

The typical swap agreement specifies that the principal amount exchanged at the start be approximately equal at the current spot exchange rate. In this example the swap could be carried out bilaterally but, more usually, is carried out with the intermediation of a bank. In the above example, let us say that these amounts are EUR30 million and USD30 million (i.e., the initial spot rate is USD1 = EUR1). At the outset of the swap the U.S. firm receives EUR 30m from the financial counterparty and delivers to them USD30m. Thereafter the U.S. firm makes semi annual interest payments of EUR 0.9375m (EUR30m x 6.25%/2) to the counterparty (bank) and receives \$0.7875m (\$30m x 5.25%/2%) from them for the next ten years.

The German firm receives from the swap counterparty USD30m and delivers to them EUR30m at initiation. The German firm then receives semi annual payments EUR 0.900m (EUR 30m x 6%/2) and pays USD0.76875m (USD30m x 5.125%/24%). Each year the bank keeps the differences as its compensation and at the end of ten years the parties re-exchange the original principal amounts with the counterparty.

In principle, the firms have agreed to a series of 20 semiannual forward contracts that require the exchange of \$0.76875m for EUR 0.900m (for the German firm) and EUR0.9375 for \$07875m (for the U.S. firm) and large long dated forward for the re-exchange of principals at USD30m for EUR30m at year ten. The implicit forward rates are such that the present values of the cash flows over the contract are equal, although at early cash flows have a negative present value for the U.S. firm and the later cash flows have a negative present value for the German firm. For both firms, this swaps acts as a hedge for the stream of foreign currency cash flows they expect to receive from their foreign subsidiary. The firms can convert the original principals into domestic currency and use the proceeds to pay off outstanding debt, or even repay the original loan used to originate the swap, (recognizing that it will need to repay that amount of foreign currency at maturity).

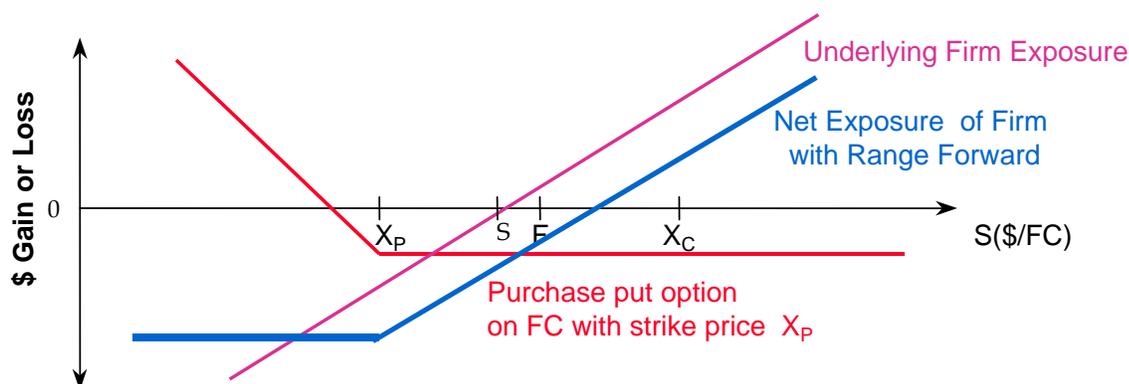
With well developed swap markets that exist today, and the growing number of intermediaries offering to write swaps for customers, a firm can swap just about any set of cash flows for some other form of cash flows. Swaps can also be effectively used to hedge other forms of macroeconomic risk, such as commodity price exposure (i.e., oil) or interest rate exposure.

Options:

Much like with transaction exposure, options are a popular way for the firm to protect the domestic currency value of future foreign currency cash flows. While exchange traded options only extend out for a year, over the counter option can be purchased, or sold, at maturities of up to 5 years (though spreads at these maturities are rather high). By creating a portfolio of long dated call options in foreign currency a firm can provide a financial offset to the impact of potential adverse currency movements on the stream of foreign currency cash flows. As with most hedges of operating exposure, it is virtually impossible to perfectly hedge as the exact quantity of foreign currency cash flows at each point in the future is unknown, but the options are fixed quantity contracts.

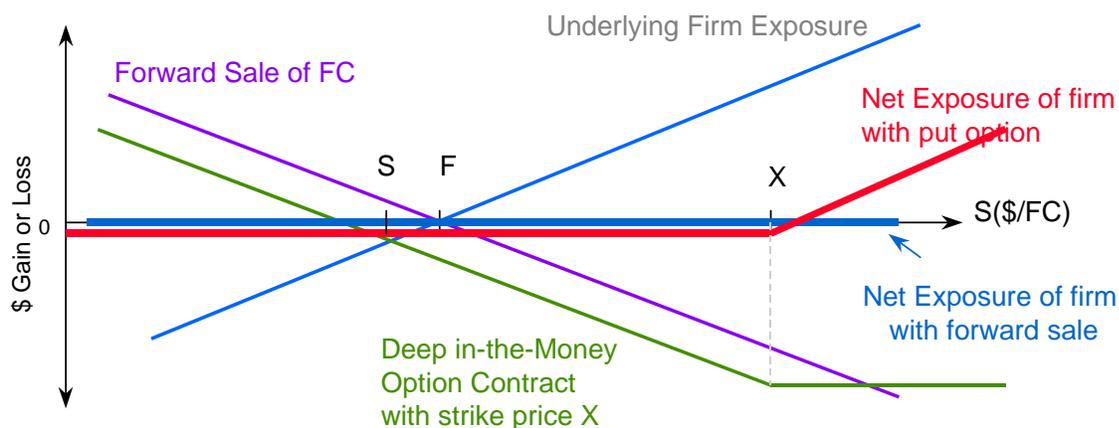
To use options firm first identify their operating exposure. Then, if the home currency value of their operating cash flows fall when the home currency appreciates, or put another way, the firm is long foreign currency in economic terms, then the firm should buy put options on the foreign currency. If the home currency value of the firm's cash flows increase when the domestic currency appreciates, alternatively the firm is short foreign currency in economic terms, then the firm should buy call options on foreign currency. Just to point out again, while options reduce risk they do not eliminate it as do forward type contracts. Options provide the firm an insurance policy that pays off only in certain states of the world when their operating cash flows are low, and helps to place a floor under the domestic currency value of cash flows.

Figure 2: Use of an option to place a floor under future firm cash flows



One objection that arises from the use of options to hedge operating exposure, especially when hedging out several years, is that long maturity options, even when purchased substantially out of the money, can require a substantial up front premium. Often treasurers complain because options are "too expensive" especially in comparison to forward contracts which allegedly "cost nothing". This preconception is buttressed by the idea that some price must be paid for upside potential afforded by the option. However, it is easy to show that out of a collection of options differing only in their exercise prices, that it is the one that is deepest in the money and therefore the highest premium that comes the closest to providing the protection of the forward contract. There is thus no sense in saying that options are more expensive than forwards, both are fairly priced in the market. The source of the concern is more a matter of timing of cash flows and accounting treatment than an economic issue. Nonetheless, management may balk at paying now for some potential benefit in the future due to a concern for currency cash flows even though the option premium represents the market determined premium for the level of insurance the firm is interested in.

Figure 3: Deep in-the-money options provide similar protection to forwards



There are several possible solutions to this problem. One is to simply reduce the level of insurance that one is buying, either in terms of the quantity of options (fewer options) or the amount of protection they provide in terms of the strike price (deeper out of the money options). Another way around this problem is to give up some of the extreme upside of your exposure by writing an option on it in order to finance some of the downside protection that you are interested in buying. By selling an out-of-the money foreign currency call option to finance (some of) the long term out-of-the-money put option which provides the desired downside protection, the firm can obtain the insurance at lower up front cost. Of course the full cost is still the same because part of the cost is conditional,

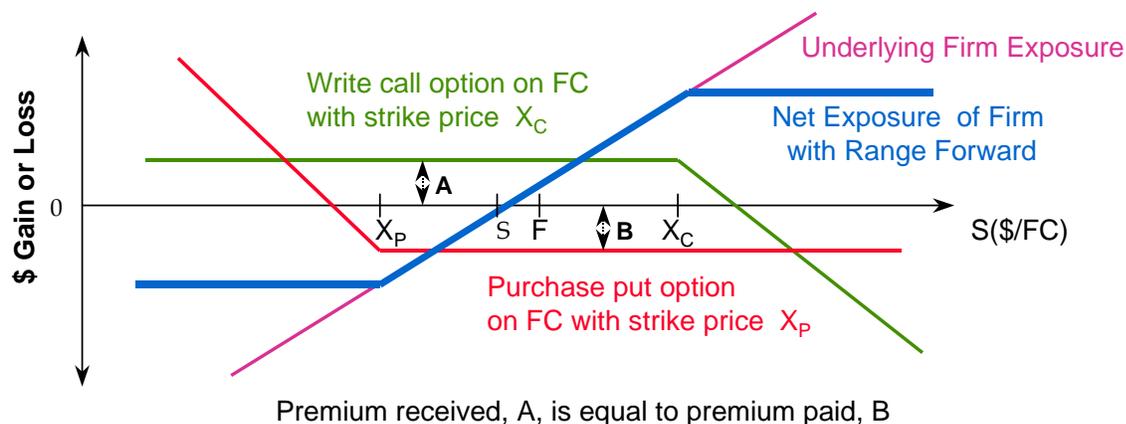
realized only for highly beneficial exchange rate changes whence the firm will have to give up some of its benefit by delivering on the call option. Contracts of this form are known as zero premium hybrid options. Below we present two common variants of this contract (using simple European style options).

Range Forward

The first version is when the nominal amount of the put and call are equal, the separate exercise prices are chosen so that the premiums are the same (one received, one paid). The firm has downside protection below a certain lower level and has paid for it by giving up all the upside gain above a certain higher level. This version of the zero premium hybrid is known as a range forward.

When the firm has a long exposure in FC, creating this instrument involves purchasing a put option for FC in the full amount of the exposure at a strike price (usually out of the money – i.e., below the forward rate for that maturity.) This option has a premium that of an amount equal to FV of B, which must be paid at purchase time. To finance this cost, the firm will sell an equivalent sized call option on FC at a strike price correspondingly out of the money (i.e., above the forward rate for the settlement date). The strike price for this call is chosen so that the premium the firm receives for writing this option exactly offsets the premium it must pay for the put option. Thus the firm has no net premium expense from these option positions. The combination of the two options (one long and one short) is the range forward. When purchased it changes the firms underlying exposure by putting a floor in to the downside loss put also putting a ceiling on the upside gain. The firm is essentially paying for what it really wants, the floor on its possible loss, by selling its upside above a certain exchange rate (X_C).

Figure 4: A Range Forward



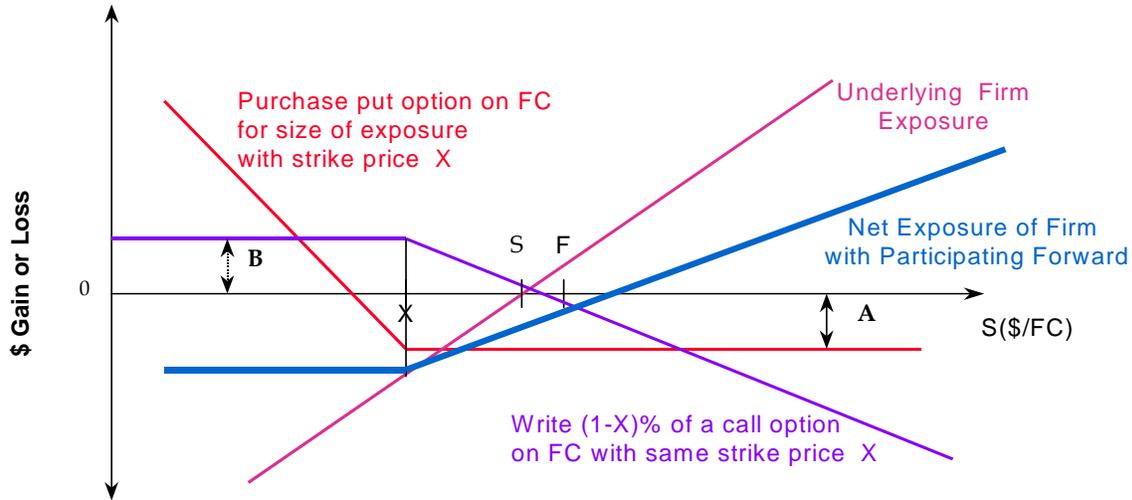
The reason that this is called a range forward is that we can always move the two options above together or farther apart in some ratio such that the premiums stay the same. If we move them towards each other, so that they are both getting more in the money, but doing so in a manner that maintains the similarity of the premiums, we would meet up at the forward rate. This can be proven graphically in that a long put position and a short call position, both with an exercise price of the forward rate for the option's maturity, together create a payoff that is a 45 degree line, the same as a short forward position in forward contract on FC. Since the forward contract on FC costs a firm nothing to enter into today, and it has the same maturity payoff as the combined option position, by arbitrage it must be that the two options (a long put and a short call both with exercise prices = F) also cost nothing today (i.e., their premiums are the same). Thus it will be the case that call and put options of the same maturity with a strike price equal to the forward rate for that maturity have exactly the same premium.

Participating Forward

Another version is when the firm obtains full downside protection, but retains partial upside participation. This is called a participating forward and is again the combination of a long and short option position. For example for a long FC exposure, the firm again purchases a full size put option (out of the money). To finance this option, the firm writes an in-the-money call at the same strike price as the put. Since this call is more valuable per unit of notional value, it needs only be a fraction of the size of the put (perhaps 35%) sufficient for its premium to offset the premium

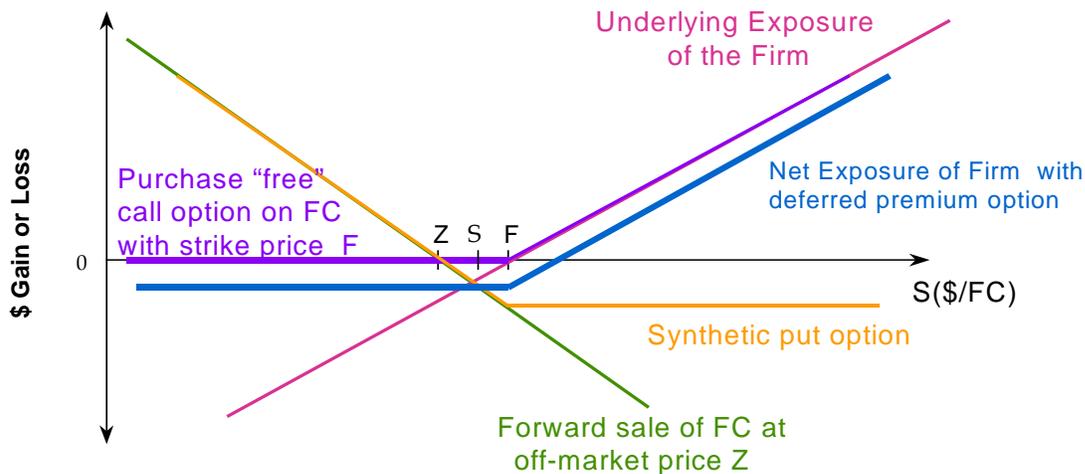
on the put. Because the call option is smaller, the firm is allowed to participate in part of the upside gain when the exchange rate is above the strike price. In this example it would participate in 65% (1 – 35%) of each unit of gain from the FC appreciating against the USD.

Figure 5: A Participating Forward



Another solution to the up front cost of options is instead of contracts with zero premiums to use contracts that offer deferred premiums: premiums that are not paid until maturity. The deferred premium is also hidden from separate accounting recognition as a hedging or option premium expense. In creating a deferred-premium option the banker synthesizes the required option (lets say a foreign currency put) by combining a foreign currency call option with a forward sale of foreign currency in a special way. The call is given an exercise price equal to the current forward rate, but no premium is charged or mentioned in the contract. Instead the contractual forward exchange rate for the foreign currency sale is set below the current market forward rate by the amount of the compounded call premium. As the contract specifies only a (off market) forward exchange rate, the call premium is disguised. As the forward contract settles only at maturity, payment of the call premium is deferred. The result is that the firm has a forward contract with a cancelable option where the option price is embodied in the forward rate. This synthetic put option provides downside protection to the firm equivalent to a regular put option.

Figure 6: Deferred Premium Option



Some Final Thoughts on Financial Hedging of Operating Exposure

There are a couple of important points to keep in mind about financial hedging of operating exposure. First, one must keep in mind that one is attempting to hedge the impacts of real exchange rate fluctuations on the firm using contracts that are denominated in nominal values. Thus by locking in hedge of real operational flows with contracts on specific nominal exchange rates, the firm is substituting domestic price risk for real exchange rate risk. This may be fine as price levels are usually orders of magnitude less volatile than nominal exchange rates; however, it is not the same as having eliminated all risk.

As simple example of this is consider a U.S. exporter that hedges its expected foreign currency cash flows for the year by selling them forward at the currency forward price. Then suppose unexpectedly there was a substantial dollar inflation and accompanying dollar depreciation so the real exchange rate was unchanged. This would have no effect on the expected foreign currency cash flows, but the exporter would have to exchange then at a higher FC/\$ exchange rate than would now be relevant. This results in an economic loss to him because he had hedged nominal exchange rate rather than real exchange rates.

The second point to keep in mind is that financial hedging of operating exposure is a second best solution. Financial hedging of operating exposure should start where strategic hedging of exposure ends. Financial hedges contracts are for a fixed quantity and for a fixed time interval. They will soften the blow of a real exchange rate change but they do not alter the new competitive environment facing the firm. Financial hedges should be seen as temporary shelter for the firm from unpleasant change in the competitive environment that allow the firm the financial capability for a short time to decide on real economic responses to the new competitive environment. At the extreme, financial hedging may be detrimental as it provides a false sense of security to managers who may delay making tough decisions about the real operations of the firm thus degrading shareholder value as the real operations of the firm are supported by financial flows from the hedges.

Evaluating Hedging Results:

Finally, in hedging, remember it just like buying insurance. You pay for it with the hope of never needing to use it. If you do cash in on it it suggests that some undesirable events have occurred. Generally people would prefer these events not happen. Therefore, you want to “waste” money on hedging, just like when you waste money on insurance. However, it isn't really money wasted, it buys peace of mind and some security against bad events. But what this does suggest is that you cannot rationally make a decision on whether a hedge was a good idea or not depending on whether it makes money (produces a profit). Just like insurance, the decision to hedge is an ex-ante one and any evaluation of a hedging decision must also be made from this ex-ante (before knowing what transpired) perspective. This is often a difficult point to remember