

FX PRODUCTS

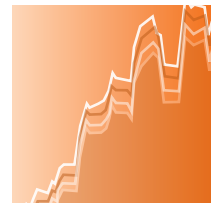
## Managing Currency Risks with Futures

*John W. Labuszewski*

MANAGING DIRECTOR

RESEARCH AND PRODUCT DEVELOPMENT

[jlab@cmegroup.com](mailto:jlab@cmegroup.com)



---

## The world is increasingly “getting smaller.” As international commerce flourishes, businesses increasingly take on the risks associated with volatile exchange rates.

They say that the world is getting smaller ... nowhere is this more apparent than in the increasingly globalized world of international commerce.

A number of factors have coalesced in the early 21st century to promote free trade across distance and political boundaries. Political advances promoting free trade include: reduction or elimination of restrictive tariffs, capital controls and subsidization of local businesses. Intellectual property rights are increasingly respected on a broad international basis. Technical advances include reduced transportation costs promoted by containerization of products for ocean shipping and advanced telecommunication systems lead by the emergence of the World Wide Web.

Thus, today’s modern corporation frequently conducts business outside its native country and, in the process, earns revenues or incurs liabilities denominated in currencies apart from their native currency. In the process, these corporations may become exposed to the risk that foreign exchange rates are unpredictable and can fluctuate in adverse directions. These uncertainties may make it difficult to manage current cash flows, plan future business expansion or to succeed in a competitive market environment.

CME Group has offered foreign currency futures dating back to the breakdown of the post WWII Bretton Woods agreement in 1972 that imposed fixed exchange rates between the world’s currencies. These contracts provide an ideal tool to manage currency or FX risks in an uncertain world. Product innovation, liquidity and financial surety are the three pillars upon which CME Group has built its world class derivatives market. We provide products based on a wide range of frequently transacted currencies; liquidity offered on the state-of-the-art CME Globex electronic trading platform; and, financial sureties afforded by its centralized clearing system.

This document is intended to provide an overview of the mechanics of our currency futures. Further, we offer a review of various strategies and applications that may be deployed in the context of a corporate currency management program.

This represents an overview of our currency futures and how they can be deployed in a risk management program.

## CURRENCY FUTURES FUNDAMENTALS

Currency futures were developed in 1972 by Chicago Mercantile Exchange and Chairman Leo Melamed working in concert with the Nobel Prize winning economist Milton Friedman. This development may be considered a direct response to the breakdown of the Bretton Woods Accord and represented the first financial futures contract ever successfully introduced.

Currency futures were first successfully introduced on Chicago Mercantile Exchange in 1972 by Leo Melamed working with Milton Friedman.

Over the years, many currency contracts have been added and the listings now include contracts on EuroFX, Japanese yen, British pound, Swiss franc, Canadian dollar, Australian dollar, Mexican peso, New Zealand dollar, Russian ruble, South African rand, Brazilian real, Polish zloty, Norwegian krone, Swedish krona, Hungarian forint, Czech koruna and Israeli shekel.

Most recent additions to the line-up include Chinese renminbi and Korean won. Further, CME lists smaller sized, financially settled “E-micro” versions of the EUR/USD, USD/JPY, GBP/USD, USD/CAD, AUD/USD and USD/CHF contracts. Major cross-rate contracts included EUR/GBP, EUR/JPY, EUR/CHF, GBP/CHF, GBP/JPY and many others. CME offers options on many of these currency futures contracts.

Futures are akin to a forward contract and call for the future delivery of a specified quantity of currency.

*Mechanics of Currency Futures* – Futures may be considered akin to a forward contract, and typically are priced as such, except that they are traded on a regulated futures exchange subject to standardized terms and conditions. Exchange traded currency futures have historically been distinguished from OTC FX transactions by their standardization vs. flexibility or customization inherent in working with a dealer. But exchanges are introducing greater degrees of flexibility in their trading practices.

FX futures are traded on the CME Globex electronic trading platform and on the floor of the Exchange in an open outcry environment, although approximately 99 percent of the trade is electronic. These contracts generally call for delivery of a specified quantity of a specified currency, or a cash settlement, during the months of March, June, September and December (the “March quarterly cycle”).

FX futures are generally traded on the CME Globex electronic trading platform.

Thus, one may buy or sell 12,500,000 Japanese yen for delivery on the third Wednesday of December 2006; or, 125,000 euros for delivery on the third Wednesday of March 2007. E.g., traders who “go long” or buy Japanese yen futures are committed to take or accept delivery of 12,500,000 Japanese yen; while, traders who “go short” or sell EuroFX futures are committed to make delivery of 125,000 euros. The short making delivery is compensated by the buyer accepting delivery by an amount equal to the futures settlement price quoted in U.S. dollars on the last day of trading.

## SPECIFICATIONS OF POPULAR FX FUTURES

|                                  | EuroFX Futures   | Japanese Yen Futures         | British Pound Futures       | Swiss Franc Futures          |
|----------------------------------|--|------------------------------|-----------------------------|------------------------------|
| Trade Unit                       | 125,000 euros  | 12,500,000 yen               | 62,500 pounds               | 125,000 francs               |
| Minimum Price Fluctuation (Tick) | \$0.0001 per euro (\$12.50)  | \$0.000001 per yen (\$12.50) | \$0.0001 per pound (\$6.25) | \$0.0001 per franc (\$12.50) |
| Price Limits                     | No Limits  |                              |                             |                              |
| Contract Months                  | 1st 6 months in March quarterly cycle (March, June, Sep & Dec)                   |                              |                             |                              |
| CME Globex Trading Hours         | Sundays thru Mondays: 5:00 p.m. to 4:00 p.m. the following day (Chicago Time/CT) |                              |                             |                              |
| Trading Ends at                  | 2nd business day before 3rd Wednesday of contract month                          |                              |                             |                              |
| Delivery                         | Thru Continuous Linked Settlement (CLS) Facilities                               |                              |                             |                              |
| Position Limits                  | No Limits  |                              |                             |                              |
| Ticker                           | "EC"   | "JY"                         | "BP"                        | "SF"                         |

The contracts in this piece are listed with, and subject to, the rules and regulations of CME.

We offer a full array of futures based on major and many secondary currencies. We also offer cross-rate contracts and options on futures.

Noting that the Japanese yen futures contract is based on 12,500,000 yen, this means that the September 2008 contract was valued at \$113,625.00 (=12,500,000 yen x 0.009090 dollars/yen). The minimum allowable price fluctuation or "tick" in yen futures is \$0.000001 yen per dollar or \$12.50 (= \$0.000001 x 12,500,000 yen) or ½ tick (= \$6.25) for a calendar spread. The following table illustrates quotation practices in four of the most significant of these currency futures markets.

## SELECT FX FUTURES (AUGUST 18, 2008)

|   | Open Range    | High      | Low      | Settlement | Volume  | Open Interest |
|---|---------------|-----------|----------|------------|---------|---------------|
| British pounds (62,500 pounds sterling) |               |           |          |            |         |               |
| Sep-08                                  | 1.8621-1.8620 | 1.8655B   | 1.8599   | 1.8602     | 60,643  | 102,540       |
| Dec-08                                  | 1.8473        | 1.8473    | 1.8473   | 1.8481     | 572     | 2,217         |
| Mar-09                                  |               |           |          | 1.8364     | 153     | 1,100         |
| EuroFX (125,000 euros)                  |               |           |          |            |         |               |
| Sep-08                                  | 1.46910       | 1.47200B  | 1.46670A | 1.46750    | 178,093 | 135,370       |
| Dec-08                                  | 1.46130       | 1.46500B  | 1.46010  | 1.46050    | 2,027   | 5,254         |
| Mar-09                                  |               |           |          | 1.45430    | 206     | 626           |
| Japanese yen (12,500,000 yen)           |               |           |          |            |         |               |
| Sep-08                                  | 0.009087      | 0.009095B | 0.009087 | 0.009090   | 75,523  | 184,464       |
| Dec-08                                  | 0.009135      | 0.009135  | 0.009135 | 0.009141   | 721     | 23,194        |
| Mar-09                                  |               |           |          | 0.009198   |         | 548           |
| Swiss franc (125,000 francs)            |               |           |          |            |         |               |
| Sep-08                                  | 0.9105        | 0.9135B   | 0.9090A  | 0.9111     | 58,239  | 58,408        |
| Dec-08                                  | 0.9113        | 0.9113    | 0.9113   | 0.9118     | 421     | 1,943         |
| Mar-09                                  |               |           |          | 0.9130     | 4       | 513           |

Currency futures are typically quoted in “American terms” or U.S. dollars per foreign unit. This is at variance from normal interbank market practices.

Digging in a bit more deeply, the table below illustrates how Japanese yen futures may be quoted. Note that the contract is quoted in “American” terms, i.e., in terms of dollars per foreign unit. This is at variance from the typical interbank practice of quoting foreign exchange transactions in terms of foreign unit per U.S. dollar.

## QUOTING JAPANESE YEN FUTURES (AUGUST 18, 2008)

| Month  | Open     | High      | Low      | Settlement | Chg | Volume | Open Interest |
|--------|----------|-----------|----------|------------|-----|--------|---------------|
| Sep-08 | 0.009087 | 0.009095B | 0.009087 | 0.009090   | +28 | 75,523 | 184,464       |
| Dec-08 | 0.009135 | 0.009135  | 0.009135 | 0.009141   | +28 | 721    | 23,194        |
| Mar-09 |          |           |          | 0.009198   | +28 |        | 548           |
| Jun-09 |          |           |          | 0.009235   | +28 |        | 3,401         |
| Sep-09 |          |           |          |            |     |        |               |
| Dec-09 |          |           |          | 0.009373   | +28 |        | 6             |
| TOTAL  |          |           |          |            |     | 76,244 | 211,613       |

Of course, you can convert these quotes from dollars per foreign unit to foreign units per dollar by simply taking the reciprocal. For example, if September 2008 Japanese yen futures close at 0.009090 dollars per yen, this may readily be converted into 110.01 Japanese yen per one U.S. dollar ( $1/0.009090$ ) as illustrated below.

## TRANSLATING FROM AMERICAN TO EUROPEAN TERMS (AUGUST 18, 2008)

| CME Quotes  | American Terms  | European Terms |
|-------------|-----------------|----------------|
| USD per EUR | 1.46750 USD/EUR | 0.6814 EUR/USD |
| USD per JPY | 0.009090 USD/JY | 110.01 JY/USD  |
| USD per GBP | 1.8602 USD/GBP  | 0.5376 GBP/USD |
| USD per CHF | 0.9111 USD/CHF  | 1.0976 CHF/USD |

Take the reciprocal of a CME quote to arrive at a figure comparable to interbank quotations.

These popular currency futures tend to be sized smaller than most typical institutional interbank currency transactions in the range of perhaps \$100,000 to \$200,000 in notional value. This is intended to render the contracts accessible to retail in addition to institutional traders and thereby add another element of liquidity to the marketplace, noting that one might readily trade in multiples of a single standard contract size.

Currency futures are designed to be accessible with contract sizes that are typically modest relative to the size of many interbank transactions.

## SIZING QUOTING JAPANESE YEN FUTURES (AUGUST 18, 2008)

|                | Contract Size | Sep 2008 Contract | Contract Value | Tick Size  | \$ Value of Tick |
|----------------|---------------|-------------------|----------------|------------|------------------|
| EuroFX         | 125,000       | 1.4675            | \$183,437.50   | \$0.0001   | \$12.50          |
| Japanese yen   | 12,500,000    | 0.009090          | \$113,625.00   | \$0.000001 | \$12.50          |
| British pounds | 62,500        | 1.8602            | \$116,262.50   | \$0.0001   | \$6.25           |
| Swiss francs   | 125,000       | 0.9111            | \$113,887.50   | \$0.0001   | \$12.50          |

Like any futures contract, FX futures are secured by performance bonds that are posted by both buyers and sellers. The performance bond or margin requirement will reflect one day's maximum anticipated price movement. Subsequently, these positions are marked-to-market (MTM) daily by the Exchange clearing house. I.e., any profits or losses are posted to the trader's account on a daily basis. Thus, there are no paper profits or losses in futures.

Currency futures require an initial performance bond deposit and are marked-to-market (MTM) subsequently.

*Deliverable vs. Non-Deliverable Futures* – The four major currency futures highlighted above call for the actual delivery of these currencies on deposit at designated foreign financial institutions through the Continuous Linked Settlement (CLS) system. CLS may be thought of as essentially an escrow service ensuring that payment of one currency is made vs. the other currency.

Many futures contracts call for a physical delivery facilitated by the CLS system. But some call for a cash settlement analogous to the way a non-deliverable forward (NDF) may trade in the interbank markets.

But often times it becomes impractical to provide for such delivery when, for example, exchange restrictions are in force with respect to a particular currency. Under such cases, the currency may trade as non-deliverable forward (NDF) in the over-the-counter or interbank currency markets as described above. There are, in fact, some currency futures contracts based on non-deliverable currencies, which are settled in cash upon futures contract expiration. This provision allows us to extend the futures product line to currencies including the Chinese renminbi, the Russian ruble, Brazilian real, Korean won, renminbi/euro, renminbi/yen and others. These contracts are cash settled versus a representative price surveyed from the interbank NDF markets.

*The Basis* – Futures are most closely compared to outright FX forward transactions and are priced in accordance with so-called cost of carry considerations. Futures market participants often speak of “the basis” or the relationship between futures and spot prices. The basis may be thought of as the futures price less the spot or cash price of the currency in question.

Basis = Futures Price - Spot Price

The basis represents the difference between the futures price and the spot value of the currency. The basis is driven by the same factors that affect the price of forwards in the interbank markets.

The basis may be either positive or negative contingent upon relationship between short-term interest rates prevailing with the respect to the so-called “base” and “terms” currencies. FX futures are generally quoted in terms of U.S. dollars (USD) per the named currency and, thus, that USD is thought of as the terms currency and the named currency is the base currency. The appropriate level for the futures contract, or the “fair market value,” may be calculated per the following formula.

$$\text{Futures} = \text{Spot Rate} \times \left[ \frac{1 + [R_{\text{term}} \times (d/360)]}{1 + [R_{\text{base}} \times (d/360)]} \right]$$

The relationship between the short-term interest rates associated with the term and base currency dictate the nature of the basis.

Where the terms rate exceeds the base rate, futures should trade at premium to the spot price of the currency and the basis (of futures less spot) may be quoted as a positive number. This is a condition known as “negative carry” in futures markets because costs are incurred to buy and carry base currency.

But when the terms rate is less than the base rate, futures should trade at discount to spot and the basis (futures less spot) may be quoted at a negative number). This is a circumstance known as “positive carry” because earnings accrue from buying and carrying the base currency. Note that the futures basis is analogous to “forward points” as quoted in interbank or over-the-counter (OTC) currency markets.

Negative carry is said to prevail when the terms rate exceeds the base rate and futures trade to higher and higher levels in successively deferred months into the future.

As an example, consider the fair market value for a September 2008 EuroFX futures contract as of August 19, 2008. At the time, note that the spot value of the euro (EUR) was 1.4766 EUR per USD. There were 29 days between the assumed spot value dates of August 21st until the September 17th futures delivery date. The term rate (or USD rate) stood at 2.557 percent per a 360 rate convention while the base rate (EUR rate) was at 4.470 percent, likewise with 360 rate convention. As such, the September 2008 EuroFX futures price could have been calculated as 1.4745.

$$\text{Futures} = \text{Spot Rate} \times \left[ \frac{1 + [R_{\text{term}} \times (d/360)]}{1 + [R_{\text{base}} \times (d/360)]} \right]$$

$$\begin{aligned} \text{Futures} &= 1.4766 \times \left[ \frac{1 + [2.557\% \times (27/360)]}{1 + [4.470\% \times (27/360)]} \right] \\ &= 1.4745 \end{aligned}$$

The basis may be quoted at -21 points (= 1.4745 - 1.4766). Note that the futures price is less than the spot price and that the basis will tend to increase in further deferred futures contract months, i.e., futures in successively deferred months run to higher and higher levels. This is a condition of negative carry because costs are incurred when borrowing USD to buy EUR because U.S. rates ("terms rate") exceed euro rates ("base rate").

$$\begin{aligned} \text{Basis} &= \text{Futures Price} - \text{Spot Price} \\ &= 1.4745 - 1.4766 \\ &= -0.0021 \text{ or } -21 \text{ points} \end{aligned}$$

The table below depicts this condition in deferred months. Note that while the September 2008 contract traded at a basis of -21 points, the December 2008 basis is even lower at -92 points while the theoretical March 2009 basis is lower yet at -154 points. Note further, that we apply different short-term rates to different terms in recognition of the shape of the U.S. and euro denominated short-term yield curve.

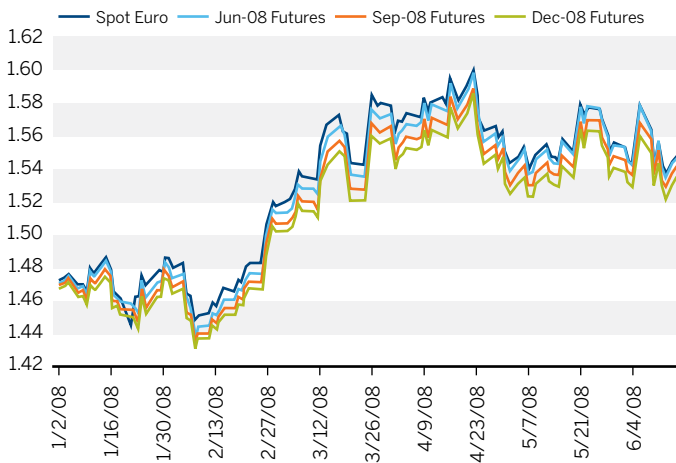
## FORWARD PRICING OF EUROFX FUTURES (AUGUST 19, 2008)

|      | Price  | Basis   | "Fair Value" | Value Date | Days | Term Rate | Base Rate |
|------|--------|---------|--------------|------------|------|-----------|-----------|
| Spot | 1.4766 |         |              | 8/21/08    |      |           |           |
| ECU8 | 1.4745 | -0.0021 | 1.4745       | 9/17/08    | 27   | 2.557%    | 4.470%    |
| ECZ8 | 1.4674 | -0.0092 | 1.4675       | 12/17/08   | 118  | 3.107%    | 5.020%    |
| ECH9 |        |         | 1.4612       | 03/18/09   | 209  | 3.329%    | 5.176%    |

Over time as we approach expiration of a futures contract, that basis will tend to converge towards zero. This is attributed to the fact that the impact of the differential short-term rates becomes less relevant as expiration approaches. Finally, by the time the futures contract becomes deliverable, the futures contract becomes a direct proxy for the spot delivery of the currency in question and the basis is said to converge to zero.

Spot and futures prices will tend to converge such that the basis will gravitate towards zero by the time the contract is about to expire.

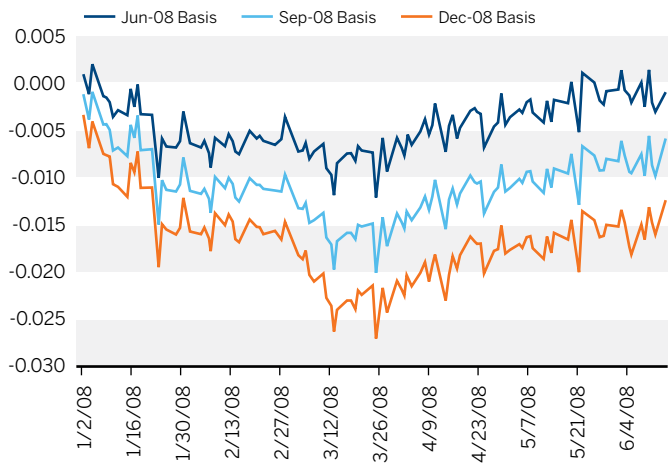
## EUROS: SPOT VS. FUTURES



The accompanying graphics depict this convergence on an outright basis and by following the basis directly. Despite some “flutter,” these basis relationships are really quite predictable as dictated by the relationship between short-term interest rates associated with the two currencies that comprise the transaction. That is due to the fact that arbitrageurs monitor and promptly act upon situations where futures and spot prices are misaligned.

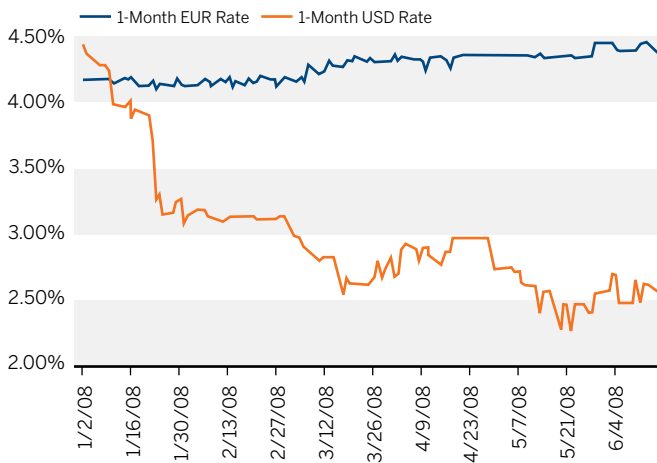
This convergence is very predictable and enforced by arbitrage activities.

## EUROS: FUTURES LESS SPOT BASIS



Note that in early January 2008, USD denominated interest rates were actually just a bit stronger than were EUR denominated rates. As a result, USD/EUR currency futures experienced some slight negative carry and the basis traded near parity. But the Federal Reserve eased rather aggressively in the spring of 2008, pushing the target Fed Funds rate all the way down to 2 percent while European rates held steady or were perhaps just a bit stronger. As a result of the fact that U.S. rates fell significantly below European rates, USD/EUR currency futures began to experience noticeable positive carry and the basis fell sharply. As interest rates stabilized in the early summer and as futures expiration drew closer, the basis experienced convergence towards zero or parity.

## 1-MONTH EUR VS. USD INTEREST RATES



**Fair Value and Arbitrage** – Assume that futures prices were to be trading above their fair value. Under those circumstances, an arbitrageur may sell futures and buy an equivalent amount of the spot currency, eventually making delivery of the currency in satisfaction of the futures contract.

If futures were to trade above their fair market value, arbitrageurs might buy spot currency, sell futures, unwinding the position by making delivery of the spot currency against the futures contract.

In the process, arbitrageurs will bid spot prices up and push futures prices down, achieving an equilibrium pricing relationship.

E.g., if September 2008 EuroFX futures were priced above their fair value of 1.4745, one might buy 125,000 euros in the spot markets (or the equivalent of one futures contract) at the spot value of 1.4766 euros per U.S. dollar on August 19th for value on August 21st, and eventually make delivery against the futures contract. If one leverages the transaction by borrowing at prevailing short-term U.S. rates to purchase the euros, holding the position over the next 27 days until the September 17, 2008 futures contract expiration, one would incur \$1,385 in associated USD finance costs at a rate of 2.557 percent.

Presumably, one invests those euros over the next 27 days at 4.470 percent, earning \$619. The net cost associated with buying and carrying those euros over the 27 day period equals \$184,310 or 1.4745. Any excess over that 1.4745 at which one might be able to sell EuroFX futures represents a potential profit. By buying and carrying spot euros and selling EuroFX futures, arbitrageurs' trading activities may be expected to bid up the spot currency and/or push down futures to reestablish equilibrium pricing levels.

|   |                   |
|---|-------------------|
| Buy 125,000 euros @ 1.4766 EUR/USD        | -\$184,575        |
| USD finance charges @ 2.557% over 27 days | -\$354            |
| Invest euros @ 4.470% over 27 days        | \$619             |
| <b>Net cost over 58 days</b>              | <b>-\$184,310</b> |
| Divided by 125,000 euros                  | 1.4745            |
| Expected futures price                    | 1.4745            |

If on the other hand, futures prices were to trade below their fair value, one might buy futures and sell an equivalent amount of the currency in the spot markets, eventually taking repossession of the currency by accepting delivery of the currency in satisfaction of the futures contract. Of course, by selling euros for U.S. dollars, one enjoys the opportunity to invest those dollars at the prevailing U.S. denominated rate of 2.557 percent, foregoing the opportunity to invest in euros at 4.470 percent. Any amount under fair value of 1.4745 at which one might be able to buy futures represents a potential profit on the part of an arbitrageur. Of course, by selling euros and buying futures, this may have the effect of pushing down euros and/or bidding up futures to establish an equilibrium price level at the fair value. In other words, arbitrage activity essentially enforces fair value pricing.

If futures were to trade below their fair market value, arbitrageurs might sell spot currency, buy futures and unwind the position by accepting delivery of the spot currency against the futures contract.

In the process, arbitrageurs will offer down spot prices and bid push futures prices up, restoring an equilibrium pricing relationship.

|                                     |                   |
|-------------------------------------|-------------------|
| Sell 125,000 euros @ 1.4766 EUR/USD | \$184,575         |
| Invest USD @ 2.557% over 27 days    | \$354             |
| Finance euros @ 4.470% over 27 days | -\$619            |
| <b>Net cost over 58 days</b>        | <b>+\$184,310</b> |
| Divided by 125,000 euros            | 1.4745            |
| Expected futures price              | 1.4745            |

As a practical matter, of course, one must also consider costs attendant to arbitrage, i.e., slippage, commissions, fees, etc. As such, futures tend to trade within a “band” above and below its theoretical fair value and the width of that band is a reflection of the amount of those costs. Thus, when futures fall below that band, arbitrageurs may be recommended to buy futures and sell spot. When futures rise above that band, arbitrageurs may be recommended to sell futures and buy spot. In the context of currency futures, that band tends to be rather tight as the arbitrage is rather straightforward and the attendant costs are low.

$$\text{Fair Value} - \text{Arbitrage Costs} < \text{Futures Price} < \text{Fair Value} + \text{Arbitrage Costs}$$

Arbitrage might only be expected when the anticipated profits cover the costs attendant to the transaction, i.e., execution slippage, commissions, etc.

## HEDGING WITH CURRENCY FUTURES

A firm faced with the risk of volatile exchange rates has many alternate means to address those risks. One of the most efficient and effective risk management tools in this regard is found in the form of our currency futures contracts. Let's explore the possibilities.

**Hedge Ratio** – The first thing that must be considered when constructing a hedging strategy is the amount of risk exposure to which one is subject. That is intuitive to the extent that the purpose of a hedge is to offset possibly adverse price fluctuations in one market with an (ideally) equal and opposite exposure in the hedging vehicle such as futures.

Actually, the identification of a “hedge ratio” (HR) in the context of currencies is rather straightforward and generally a simple function of the relationship between the exposure to be hedged and the futures contract size.

Assume, for example, that a company, domiciled in the United States and whose financial statements are denominated in U.S. dollars, agrees to sell goods to be delivered a couple of months later for a future payment of €50,000,000. As a result, said company is exposed to the risk of a declining euro vs. the U.S. dollar. The appropriate strategy might be to sell EuroFX futures to address the risk exposure. The hedge ratio is found by comparing that €50,000,000 risk exposure with the €125,000 futures contract size.

Hedge Ratio = Value of Risk Exposure/Futures Contract Size  
 = €50,000,000/€125,000  
 = 400 EuroFX futures contracts

Hedging exchange rate exposures with futures is relatively straightforward. The most important thing is to assess the amount of risk exposure to which one is subject and identify the appropriate “hedge ratio” or number of futures needed to offset that risk.

**Short Hedge** – In other words, the appropriate hedge ratio is a simple linear function of the amount of the risk exposure. Let's apply this formula to an example using some actual examples.

**Example 1:** It is August 18, 2008 and the spot value of the USD/EUR rate is at \$1.4704 per one euro. This implies that the current value of that forthcoming payment of €50,000,000 was worth \$73,520,000. Of course, the company may wish to protect this anticipated cash flow by selling futures. In particular, the company might have sold 400 December 2008 euro futures at the then prevailing price of 1.4605. Note that the basis at the time was quoted at  $-0.0099$  (= 1.4605 less 1.4704).

By October 17, 2008, the value of the euro had fallen dramatically vs. the U.S. dollar to a spot value of 1.3425. As a result, the value of those 50,000,000 euros had declined some \$6,395,000 to only \$67,125,000. That represents a decline of 8.7 percent and might very well represent the difference between a profit and a loss on the sale.

The hedge ratio is a linear function of the value of the risk exposure relative to the futures contract size.

|          | Spot USD/EUR | €50MM in USD          | Dec '08 Futures   | Basis   |
|----------|--------------|-----------------------|-------------------|---------|
| 8/18/08  | 1.4704       | \$73,520,000          | Sell 400 @ 1.4605 | -0.0099 |
| 10/17/08 | 1.3425       | \$67,125,000          | Buy 400 @ 1.3420  | -0.0005 |
|          |              | (\$6,395,000)         | +\$5,925,000      | +0.0094 |
|          |              | Net Loss of \$470,000 |                   |         |

By selling futures against a short spot exposure, one may substitute basis risk for the outright risk associated with the spot position.

But by selling those 400 futures contracts, the company would have generated a sizable profit to offset its spot market losses. Note that futures likewise declined from 1.4605 to 1.3420. This translated into a futures market profit of \$5,925,000 for the company. This profit did not quite offset the \$6,395,000 loss in the spot market. Still, a net loss of \$470,000 is far superior to an unhedged loss of \$6,395,000.

Why did the transaction result in a net loss? Note that the futures/spot basis fluctuated from its original level of -0.0099 to -0.0005 (= 1.3425 less 1.3420). Our company was effectively short the basis because it was short euros in the futures market and long euros in the spot market.

The advance in the basis was largely a function of declining European short-term rates in the period from late August to late October 2008. Note that European economic conditions were slumping to match similar conditions in the United States during this period. As a result, European central bankers were easing to reflect this economic weakness and European rates were pushed down to levels more closely resembling those prevailing in the United States. Of course, it could very well have gone the other way and the basis might have become more negative, a circumstance that would have worked to the benefit of the hedger in our example.

|          | Spot USD/MXN        | 100MM Pesos in USD    | Mar '09 Futures     | Basis     |
|----------|---------------------|-----------------------|---------------------|-----------|
| 10/01/08 | 10.9601 (=0.091240) | \$9,124,004           | Sell 200 @ 0.089425 | -0.001815 |
| 03/06/09 | 15.1941 (=0.065815) | \$6,581,502           | Buy 200 @ 0.065475  | -0.000340 |
|          |                     | (\$2,542,502)         | +\$2,395,000        | +0.001475 |
|          |                     | Net Loss of \$147,502 |                     |           |

**Example 2:** It is October 1, 2008 and the spot value of the Mexican peso (MXN) vs. the U.S. dollar is at 10.9601 pesos per dollar. If we quote that exchange rate in USD per MXN, that equates to \$0.091240 per peso. Assume that our exporter agrees to sell merchandise for 100,000,000 Mexican pesos to be received in March 2009. Thus, our company is exposed to the risk that the peso may decline vs. the U.S. dollar in the interim. The appropriate hedging strategy is to sell 200 Mexican peso futures where the hedge ratio is calculated as the 100,000,000 MXN divided by the 500,000 MXN futures contract size (100,000,000 ÷ 500,000).

By March 6, 2009, the value of the Mexican peso had declined to 15.1941 pesos per dollar or \$0.065815 per peso. By selling 200 March 2009 Mexican peso futures at 0.098425 in October and subsequently covering those contracts at 0.065475 in March, our hedger turned a possible loss of \$2,542,502 into a net loss of only \$147,502.

Again, by being long cash pesos and short peso futures, the hedger is effectively short the basis quoted as futures less spot values. Because the basis advanced somewhat, the net result is a slight loss. However, that loss is far preferable to the unhedged loss that otherwise might have been realized had our exporter not executed a hedge.

**Long Hedge** – Our prior example focused on a situation involving the sale of futures to offset the possibility that the euro might decline relative to the U.S. dollar, or a “short hedge.” But we might likewise examine the opposite situation involving the purchase of futures (short cash) or a “long hedge.”

**Example 3:** To illustrate, consider the plight of a U.S. based importer who has contracted to purchase goods from a Japanese company and who has agreed to pay ¥10,000,000,000 in return. In this case, the importer must be wary about the possibility that the value of the Japanese yen will strengthen vs. the U.S. dollar in the interim between the time the contract is executed and the payment is due.

The spot/futures basis is generally expected to converge towards zero by futures expiration or delivery. But the relationship between the term and base interest rates may affect the basis in the interim.

---

Our first order of business is to identify the appropriate hedge ratio. Note that the Japanese yen futures calls for the delivery of 12,500,000 Japanese yen and is quoted in JPY per USD. Thus, the appropriate hedge ratio is calculated at 800 futures contracts as follows.

$$\begin{aligned}\text{Hedge Ratio} &= \text{Hedged Value Futures/Futures Contract Size} \\ &= \text{¥10,000,000,000/¥12,500,000} \\ &= 800 \text{ yen futures contracts}\end{aligned}$$

One might buy futures to hedge against a short spot exposure. Note that our futures are generally quoted in “American terms,” or in U.S. dollars per other currency.

On August 18, 2008, the U.S. dollars vs. Japanese yen (spot) was quoted at 109.97 dollars per yen. Note, however, that our currency futures are generally quoted in “American” terms. Thus, we take the reciprocal of that number and quote the spot rate at 0.009093 USD per JPY. As such, ¥10 billion equates to \$90,930,000 and it is that value that our company wishes to “lock-up” by buying Japanese yen futures contracts.

By October 17, 2008, the exchange rate declines to 101.54 dollars per yen. Taking the reciprocal of this figure consistent with the specifications of the Japanese yen/U.S. dollar futures contract, this equates to a value of 0.009848 USD per JPY. Thus, that ¥10 billion is now worth the U.S. dollar equivalent of \$98,848,000. This implies an unhedged loss of \$7,918,000.

|          | Spot USD/JPY       | ¥10 bil in USD        | Dec '08 Futures     | Basis     |
|----------|--------------------|-----------------------|---------------------|-----------|
| 8/18/08  | 109.97 (=0.009093) | \$90,930,000          | Buy 800 @ 0.009141  | 0.000048  |
| 10/17/08 | 101.54 (=0.009848) | \$98,848,000          | Sell 800 @ 0.009880 | 0.000032  |
|          |                    | (\$7,918,000)         | +\$7,390,000        | -0.000016 |
|          |                    | Net Loss of \$528,000 |                     |           |

Of course, our company had executed a long hedge by buying 800 December 2008 Japanese yen futures at the prevailing price of 0.009141. A couple of months later, the value of the December contract rose to 0.009880. This translates into a profit in the futures market of \$7,390,000 and a net loss of \$528,000.

While our company still experienced a net loss on the hedged transaction, it is far preferable to absorb a \$528,000 loss as opposed to the unhedged loss of \$7,918,000. Why did our company experience a hedge loss on a hedged basis? Note that the basis defined as futures less cash declined from its original value of 0.000048 (= 0.009141 less 0.009093) to a value of 0.000032 (= 0.009880 less 0.009848) over the two month duration of the hedge.

But our hedger was effectively short the basis by virtue of being long cash and essentially short futures. The basis declined because Japanese short-term interest rates were soft during this period as the economic conditions weakened in Japan reflecting general weakness in the United States and elsewhere in the world. While U.S. short-term rates were relatively low, Japanese rates were even lower and sinking. As such, basis movement worked against the hedger. But it could easily have gone the other way.

Just like in the short hedge, one essentially substitutes basis risk for outright risk by executing a hedge using futures contracts.

|          | Spot USD/EUR | €50MM in USD         | Dec '09 Futures   | Basis   |
|----------|--------------|----------------------|-------------------|---------|
| 8/21/09  | 1.4326       | \$71,630,000         | Buy 400 @ 1.4335  | 0.0009  |
| 12/01/09 | 1.5081       | \$75,405,000         | Sell 400 @ 1.5094 | 0.00013 |
|          |              | (\$3,775,000)        | +\$3,795,000      | -0.0004 |
|          |              | Net Gain of \$20,000 |                   |         |

**Example 4:** On August 21, 2009, the spot value of the USD/EUR rate is at \$1.4326 per one euro. Assume our importer has agreed to pay €50,000,000 in payment for goods to be delivered in December 2009. That is equivalent to \$71,630,000 quoted in U.S. dollars. The company may wish to protect against the possible advance of the euro buying 400 December 2009 euro futures at the then prevailing price of 1.4335. By December 1, 2009, the value of the euro had advanced vs. the U.S. dollar to a spot value of 1.5081. As a result, the value of those 50,000,000 euros had increased some \$3,775,000 to \$75,405,000. But because our hedger had purchased futures to protect against this possibility, the possible loss of \$3,775,000 had turned into a profit of \$20,000 on a net basis. In other words, our hedger has essentially succeeded in locking in the value of the anticipated future cash flow.

For more information on CME Group FX, visit [www.cmegroup.com/fx](http://www.cmegroup.com/fx).

**CME GROUP HEADQUARTERS**

20 South Wacker Drive info@cmegroup.com  
Chicago, Illinois 60606 800 331 3332  
cmegroup.com 312 930 1000

**CME GROUP REGIONAL OFFICES**

|                  |                  |                  |               |                        |                 |
|------------------|------------------|------------------|---------------|------------------------|-----------------|
| <b>New York</b>  | 212 299 2000     | <b>Houston</b>   | 713 658 9292  | <b>Washington D.C.</b> | 202 638 3838    |
| <b>London</b>    | +44 20 7796 7100 | <b>Singapore</b> | +65 6593 5555 | <b>Tokyo</b>           | +81 3 5403 4828 |
| <b>São Paulo</b> | +55 11 2565 5999 |                  |               |                        |                 |

Futures trading is not suitable for all investors, and involves the risk of loss. Futures are a leveraged investment, and because only a percentage of a contract's value is required to trade, it is possible to lose more than the amount of money deposited for a futures position. Therefore, traders should only use funds that they can afford to lose without affecting their lifestyles. And only a portion of those funds should be devoted to any one trade because they cannot expect to profit on every trade. All references to options refer to options on futures.

CME Group is a trademark of CME Group Inc. The Globe Logo, CME, and Chicago Mercantile Exchange are trademarks of Chicago Mercantile Exchange Inc. CBOT and the Chicago Board of Trade are trademarks of the Board of Trade of the City of Chicago, Inc. NYMEX is a registered trademark of the New York Mercantile Exchange, Inc. All other trademarks are the property of their respective owners.

The information within this brochure has been compiled by CME Group for general purposes only. CME Group assumes no responsibility for any errors or omissions. Additionally, all examples in this brochure are hypothetical situations, used for explanation purposes only, and should not be considered investment advice or the results of actual market experience. All matters pertaining to rules and specifications herein are made subject to and are superseded by official CME, CBOT and NYMEX rules. Current rules should be consulted in all cases concerning contract specifications.