A Note on Currency Futures:

Vocabulary:

Long Position: Buyer of a futures contract has a "long position". If futures contract price goes up, an trader with a long position makes money. If futures contract price goes down, a trader with long position loses money.

Short Position: Seller of a futures contract has a "short position. ". If futures contract price goes down, an trader with a short position makes money. If futures contract price goes up, a trader with short position loses money.

Margin: Collateral specified for each contract.

A number of characteristics sets Futures apart from Forward Contracts:

1) Trading Environment (Organized Exchange)

Forwards are, by definition, over-the-counter (OTC) contracts, whereas futures are, by definition, "exchange-traded" contracts or exchange-traded derivatives (ETDs).

Forwards are **individually negotiated agreements** between two counterparties. As such they may be tailored in any way that the two parties see fit. This means that they may (and actually must) specify the amount (or notional or face), the (forward) price, the type, nature, quality of the underlying, the mechanism for delivery (timing, location), and possibly some additional features as part of the contract. Futures contracts are **standardized** contracts; that is, they specify the amount, typically quote the price in certain minimum increments, identify the nature or quality of the deliverable asset, have set maturities and delivery dates (or delivery windows), and well-defined delivery processes.

2) Central Clearing

When one buys or sells a future, the transaction is actually done between members of the exchange. These may involve brokers acting on behalf of customers, locals trading their own financial capital, or any of the members of the exchange (which could represent larger banks and broker/dealers). Once a transaction is agreed upon, executed, and confirmed, though, the exchanges and clearing houses act as the counterparties to both sides of the trade. In the words of the Chicago Mercantile Exchange,

> Although many different customers trade at CME, all trades are ultimately conducted between CME and a clearing member. **CME serves as the buyer to every seller and the seller to every buyer,** with a clearing member assuming the opposite side of each trade. In so doing, clearing members essentially vouch

(guarantee) that the financial obligation will be met for all trades matched and executed in CME facilities.[1]

What this means is that the buyer of the future contract (that is, the individual who has agreed to buy the underlying asset at some point in the future) is effectively long the asset from the exchange, and the seller of the future (the individual who has agreed to sell the underlying asset in the future) is short the asset to the exchange. The implication is that, once the trade is done ("I thought I bought it; you thought you sold it—for a specific asset, for a specific time in the future and at a specific price"), the exchange takes on the role of the counterparty to both sides of the transaction. The attractiveness of this feature is that the exchange and clearing houses assume the counterparty or credit risk associated with every trade and ensure the performance for that agreed upon transaction.

3) Collateral/Margin

Because the exchange and the clearing houses don't trust either of the counterparties to the trade, though, they ask both the buyer and seller to "post margin"; **margin** is simply a collateral deposit (of cash and sometimes, in part, negotiable securities), which provides a buffer should the future's buyer or seller disappear (as in "go bankrupt," fail to deliver/purchase, etc.).

Contract	Exchange	Initial Margin	Maintance Margin
Australian Dollar (6A)	Globex	$1,148	$850
British Pound (6B)	Globex	$1,688	$1,250
Canadian Dollar (6C)	Globex	$1,148	$850
E-mini Euro FX (E7)	Globex	$1,418	$1,050
Euro FX (6E)	Globex	$2,565	$1,900
Japanese Yen (6J)	Globex	$2,430	$1,800
E-Mini Japanese Yen	Globex	$1,215	$900
Swiss Franc (6S)	Globex	$1,755	$1,300

The intial margin is posted at the inception of the contract. If the margin is depleted to maintanance margin level because of losses in the contract, exchange requires margin to be replanished to the inital margin level.

4) Cash Flows (Variation Settlement)

Unlike forward contracts, futures contracts are marked to market on a daily basis. Futures exchange (more specifically clearing house) determines the price of each contract at the end of the trading day. This price is referred to as “Settlement Price”. Each standing futures contract price is compared to settlement price. For a futures buyer (who has a long position), if the settlement price is larger than the contract price, the difference is credited

[1] From the "Clearing Membership" section of "Trade CME Products" on the Chicago Mercantile Exchange web site: http://www.cme.com.

in the buyer's account. This is called variation settlement. For instance on a give day t, the variation settlement for a long contract holder will result in the following cash flow:

Cash Flow=[Settlement Price(t)-Futures Contract Price (t-1)]xContract Size x #of Contracts

Since Settlement Price becomes the new contract price, we can write the formula simply as:

Cash Flow=[F(t)-F(t-1)]xContract Size x # of contracts.

Example-1: Assume trader John Smith holds 10 Euro contracts. The previous day contract settled at $1.3940 per Euro. Today, at the end of trading day, the settlement price is set to 1.3949. Calculate the cash flows into or out of Mr. Smith's account.

Solution: Cash Flow=[F(t)-F(t-1)]xContract Size x # of contracts.

Cash Flow =(1.3949-1.3940)x125,000 x 10 =$1,125

In this case the account of Mr. Smith is credited by $1,125. In general we call these cash flows as Futures Gains or Losses. The variation settlement is repeated every day that the contract is active. The following table shows daily cash flows associated with 100 AUD contracts.

Date	Spot	Futures	Δ Futures	Net Cash Flow
1/1/2007	0.7726	0.7866	0.0000	$0
1/2/2007	0.7774	0.7946	0.0080	$80,000
1/3/2007	0.7834	0.7907	-0.0039	-$39,000
1/4/2007	0.7845	0.7830	-0.0077	-$77,000
1/5/2007	0.7868	0.7771	-0.0059	-$59,000
1/8/2007	0.7862	0.7783	0.0012	$12,000
1/9/2007	0.7851	0.7799	0.0016	$16,000
1/10/2007	0.7898	0.7754	-0.0045	-$45,000
1/11/2007	0.7895	0.7798	0.0044	$44,000
1/12/2007	0.7919	0.7821	0.0023	$23,000

ΔFutures=Change in the Futures Prices Net Cash Flow=[(F(t)-F(t-1)]xContract Size

5) Early Exit (Contract reversal)

Unlike forward contracts, Futures contracts can be liquidated at any point. In order to liquidate a contract, a buyer (long) will have to reverse his/her position and sell (short) the contract . The long and short positions cancel each other out, and the trader leaves the exchange with the accumulated/lost cash.

Example-2:

XYZ Inc. has AUD10m payable due in 67 days. In order to hedge against the risk of AUD appreciation, XYZ takes AUD10m long position in March AUD futures in CME which expires in 80 days. XYZ will have to exit the contract early, and liquidate his/her position on day 67. Suppose XYZ entered the contract at 0.7866. On day 67 contract traded at 0.7745. Discuss the implication of early exit for XYZ.

Solution:

Since we do not know the daily contract prices between day 0 and 67, we will aggregate the XYZs gains and losses. We can calculate cumulative cash flows as follows:

Futures Gains/Losses=$[F_{67}-F_0]$x100,000 x 100

=($0.7745-$0.7866)x100,000x100

= -$121,000

This means that XYZ can liquidate the contract at a loss of $121,000. Once the contract is liquidated, XYZ will have to use spot markets to purchase AUD10m.

6) Delivery Conditions (non-delivery)

   Unlike forward contracts, futures contracts do not always end with real exchange of underlying currencies. About 98% of the contracts are liquidated prior to contract expiration. When contract expires, delivery is handled according to the guidelines outlined in each contract.

7) Cost (Brokerage Commissions)

   Trading futures contracts require commission payments to the futures brokers. Brokers charge roundtrip fees upfront.

HEDGING WITH FUTURES CONTRACTS:

PAYABLE (Short)	RECEIVABLE (Long)
RISK: Foreign Currency Appreciation	RISK: Foreign Currency Depreciation
Loses money as V(FC) ↑	Loses money as V(FC) ↓
ACTION:	**ACTION:**
Buy Futures Contract	Sell Futures Contract
(Long)	(Short)
Gains money as V(FC) ↑	Gains money as V(FC)↓

V(FC)=Value of foreign currency expressed in local currency terms

The above chart is useful to analyze futures contracts as hedging instruments.

We use futures contracts under two circumstances:

1) When we have a Foreign Currency Payable (Liability)- We also call this a "short position in the cash market". The term "cash market" is used to differentiate positions arising from the normal course of business from "derivatives" transactions. For instance a firm may have a short position in the cash market simply because they import goods on credit. As a result of their business transaction (import), they have a payable (liability in foreign currency) that is due sometime in the future. The first quadrant captures such transactions. The company has a payable due sometime in the future.

2) When we have a Foreign Currency Receivable (Asset)-We also call this a "long position in the cash market". A receivable arising from an export transaction that will be collected sometime in the future, is considered a foreign currency denominated asset. The second quadrant captures such transactions.

The third and fourth quadrants show how we hedge these foreign currency denominated liabilities (Q1) and assets (Q2).

Q3: Futures Hedge for Foreign Currency Payable:

In order to hedge a short cash market positon or liability in foreign currency we take a long position in the Futures contract. In other words, we buy futures contracts that matches the size of liability.

Example-3:

XYZ Inc. has AUD10m payable due in 67 days. In order to hedge against the risk of AUD appreciation, XYZ takes AUD10m long position in March AUD futures in CME which expires in 80 days.

As the above example suggest, XYZ took a long position equivalent to 10m AUD that mataches the payable in the cash market. What is the logic of this position and why we consider this a hedge?

Note that for XYZ the main risk is an appreciation or increase in the value of Australian dollar. If this happens, spot cost of AUD liability will increase with the appreciation of AUD. That is the main concern for the XYZ is the appreciation of the AUD. Taking a long position in the Futures contract offsets any increase in the cost of the liability. As AUD appreciates, AUD futures contract price goes up and generates a gain (cash inflow) that offsets the incrase increase in the liability.

Q4: Futures Hedge For Foreign Currency Asset

In order to hedge a long cash market positon or asset in foreign currency we take a short position in the Futures contract. In other words, we sell futures contracts that matches the size of asset. Note that in this case, we are concerned about the depreciation of the foreign currency. As foreign currency depreciates, the dollar value of foreign currency asset declines. Short futures, position is set to offset this decline. As foreign currency depreciates, short futures poistion generates gains (positive cash flows) that offsetts the decline in the value of the foreign currency denominated asset.

What happens to hedged positions if the market moves in favor cash market position?

Assume that AUD depreciates in the case of XYZ. This means that the dollar cost of XYZ's liability declines. Unfortunately, XYZ cannot enjoy this advantage, when a hedge is in place. Because of the long futures positon taken in AUD, XYZ will lose money on the futures contracts, and any benefit from the depreciation of the AUD will be offset. In other words, a futures hedge (like a forward hedge) truncates both upside and downside, keeps XYZ locked into a specific cost. Same applies to a short hedge in the case of a foreign currency denominated asset. In this case an appreciation of the FC creates an advantage for the cash market position, but this advantage is lost witht the losses incurred in the long futures position.

Implications of Hedging and Net Cash Flows

SHORT **Payable (Short)** V(Pay)= S(t) x Q	**LONG** **Receivable (Long)** V (Rec)= S(t) x Q
LONG Futures Gain/Loss G/L=[F(t)-F(0)]x Q	**SHORT** Futures Gain/Loss G/L=-[F(t)-F(0)]x Q
Net Cash Flow: -{F(0)+[S(t)-F(t)]} x Q	Net Cash Flow: {F(0)+[S(t)-F(t)]} x Q

V(Pay)=Value of Payable in local currency terms S(t)=Exchange rate at time t expressed as local currency per foreign currency Q=Contract Size or # of foreign currency in the contract G/L=Gain or Loss from futures pozition F(0)=Price of futures contract at T=0 expressed in local currency terms F(t)=Price of futures contract at T=t expressed in localc currency terms

We can use the table above to analyze the effective cash flows associated with hedged positions.

In the uppormost cell we have the cash flows associated with a short position. The dollar value of payment is equal to

V(Payment)=-[S(t) x Q] where S(t) is the spot rate (dollars per foreign currency) at the time of payment and Q is the foreign currency amount due at that date. Note that the sign of this total is negative as it represents a payment.

Now assume that we take a long position equal to Q at F(0) and liquidate the position at time t at F(t). The gain or loss from this position is:

[F(t)-F(0)]xQ

Combined hedged position will have the following value in dollar terms:

Hedged V(Pay)= -[S(t) x Q]+[F(t)-F(0)]xQ= -{F(0)+[S(t)-F(t)]}Q

Example-4:

XYZ Inc. has AUD10m payable due in 67 days. In order to hedge against the risk of AUD appreciation, XYZ takes AUD10m long position in March AUD futures in CME. Based on the following data determine the effective dollar cost of XYZ's AUD10m liability. In other words, find out the cash flow associated with its hedged position.

	1/1/2007	3/8/2007
Hedge (Long AUD Futures)	10,000,000	
Futures	0.7866	0.7745
Spot	0.7726	0.7758
Days	67	
Futures-Gain/Loss		(121,000)
Spot Cost (10m AUD)		(7,757,951.90)
Net Cost		(7,878,951.90)
Net Unit Cost (USD per AUD)		(0.7879)
Basis		0.0013
F(0)+Basis		0.7879

Note that at the time of payment, dollar value of AUD 10m liability is:

- V(Payable)= -{S(t)xQ}=10,000,000 x 0.7758=-$7,758,000
- The Futures Gain/Loss=(0.7745-0.7866)x10,000,000=-121,000
- Total Cost: -7,758,000-121,000=-7,879,000
- Hedged V(Pay)= -{F(0)+[S(t)-F(t)]}Q ={0.7866+[0.7758-0.7745]}x10,000,000
- Hedged V(Pay)=-$7,879,000
- Per AUD basis cost is ={0.7866+[0.7758-0.7745]}=0.7879

Example-5:

- Xerox treasurers hedged their 10,000,0000 GBP receivables due in three months by using futures contracts.
- Each GBP contract is GBP62,500 and margin requirement per contract is $2000. Xerox enters the contract at F=$1.4325 and liquidates it exactly three months later at F=$1.4620. Since the contract was liquidated before the expiration there is no delivery.
- At the time of the liquidation, the spot rate is S=$1.4520. The GBP 10m was received on the same day the contract was liquidated and it was converted in to dollars in the spot market.

- Calculate the net amount of USDs received by Xerox including the cash flows from the futures contract. (Hint: Do you buy or sell futures contract to hedge this position?)

Solution:

Mapping the Parameters:

- Cash Market Position: GBP10m Receivable (long position in foreign currency)
- Required Offsetting Futures Position: GBP 10m Short Position (Sell GBP Futures Contract)
- Size of futures position GBP 10m or (10,000,000/62,500)=160 GBP Contracts
- Initial Price of the Futures Contract: F_0=$1.4325
- Price at Liquidation F_t=$1.4620

Futures Gain/Loss (t)=- (F_t-F_0)x62,500x160

=-(1.4620-1.4325) x62,500x160

= -$295,000 loss

For this contract we needed to post 2,000 x 160=$320,000 We lost 295,000 of this during the life of the contract. Assuming that we did not get any margin calls, we collect $25,000 residual in our account and leave.

Assume that we received the cash market receivable of GBP10m on the same date. We need to convert this to USD at the spot market (as we are out of the contract now). Spot rate is $1.4520, we clear:

GBP10,000,000 x$1.4520=$14,520,000

- Amount we get in the spot market: 14,520,000
- Futures Contract Loss = -$295,000
- Net Receipts= 14,520,000 -$295,00 =14,225,000

Receipt per GBP=$1.4225

SHORT **Payable (Short)** **V(Pay)= S(t) x Q**	**LONG** **Receivable (Long)** GBP10,000,000 x 1.4520 14,520,000
LONG **Futures Gain/Loss** **G/L=[F(t)-F(0)]x Q**	**SHORT** Futures Gain/Loss G/L=-[(1.4620-1.4325)]x10m =-$295,000 (Loss)
Net Cash Flow: **-{F(0)+[S(t)-F(t)]} x Q**	Net Cash Flow: {F(0)+[S(t)-F(t)]} x Q {1.4325+(1.4520-1.4620) } x10m 1.4225x10m=$14,225,000

Example-6:

A US exporter, who incurs costs in US dollars and bills its customers in Canadian Dollars (CAD) is concerned about the appreciation of USD against CAD due to CAD receivables of 10,000,000 in a month. To hedge (protect himself/herself) the position, exporter decides to use futures markets. Currently CAD contracts (100,000 CAD each) are traded at USD0.7089. Spot rate is CAD/USD 1.3910. Suppose the exporter takes an equal futures position to its cash market position (CAD10m) at $0.7089. Futures contract price and spot rates are USD0.7042, CAD/USD1.4120 respectively when the hedge is liquidated.

a. Based on the information provided above, should US exporter buy or sell CAD contracts? (Carefully review slides 14-22, with particular attention to slides 21 and 22). In other words, should the exporter have a short or long CAD futures contract?

Since we have a receivable-asset in foreign currency (CAD), we need to sell CAD futures contracts to balance our position. Our short futures position in CAD will create an offset as USD/CAD price moves. An appreciation of CAD is good news for us because of long CAD position in the cash market! Unfortunately, our futures position will lose money as CAD appreciates, and will offset the gains made on the cash CAD position. Our real concern is a depreciation of CAD! In that case,

our long cash position will lose money! But this loss will be offset by the gains made by the short CAD futures position!!

b. Based on the futures and spot prices provided above can you tell if the hedge is liquidated at the expiration of the contract or before the expiration of the contract? Why?

At the expiration of a futures contract spot and futures prices are always equal to each other. In this case Futures price is $0.7042, but spot price is (1/1.4120=$0.7082). The fact that they are not equal suggest that the contract is liquidated before expiration!!

c. What does "Basis" mean in a futures contract? Can you calculate "Basis" at the liquidation of the contract described above?

Basis mean the difference between spot and futures prices at a given time (t). At the liquidation of the contract the basis=(St-Ft)=(0.7082-0.7042)=0.0040

d. Note that exporter practically converts his/her CAD receipts into USD in a month. In other words, pays CAD to buy USD. What is the cost of one dollar assuming that exporter uses a futures contract?

Futures Gain/Loss=$-(F_t-F_0)$*Contract Size*# of Contracts=
=-($0.7042-$0.7089)*(100,000)*10=$47,000
At the time of liquidation, the spot price of USD is CAD1.4120. At the spot rate:

Spot Cost of USD: CAD10,000,000/CAD/USD1.4120=$7,082,152.9

Net USD Received: Spot Cost +Net Gain/Loss in Futures
Contract=7,082,152.9+47,000=7,129,152

In summary we received effectively $7,129,152 in exchange for CAD10,000,000. Alternatively we can say that we paid (CAD10,000,000/USD7,129,152)=CAD1.4026 per USD

e. How could you express this cost as a short cut by using Initial futures contract price F(0) and basis at the expiration (b(t)) (see slide 28).

A short cut to the above calculation is as follows:

Effective Cost of USD=$-(F_0$+Basis) $\rightarrow$Basis=(1.4120-1.4200)=-0.008
=-[(1.4106)+(1.4120-1.4200)]
= -1.4026

Note that F_0=(1/0.7089)=1.4106 in CAD per USD
S_t=CAD1.4120/USD
F_t=(1/0.7042)=CAD1.4200