Basic Strategies for Managing U.S. Dollar/Brazilian Real Exchange Rate Risk for Dollar-Denominated Investors

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Brazilian Real futures and options on futures at Chicago Mercantile Exchange offer a host of risk management strategies appropriate for those firms and individuals whose profit depends on the dollar/Real exchange rate. In their most basic use, these exchange traded tools permit one to lock up a prospective exchange rate or, alternatively, to protect against an adverse change in this rate, without physically exchanging dollars for Reais or vice versa. This paper demonstrates these applications for the dollar denominated investor with either existing or planned investments in Brazilian Real denominated assets.

CME BRAZILIAN REAL FUTURES

The Real futures contract serves virtually the same economic function as does a forward FX contract. A number of institutional differences do exist, however. While forward contracts can be negotiated for any amount with complete flexibility as to the timing of the actual currency transfer, futures are standardized instruments. That is, futures contracts are available in specific contract amounts (e.g., 100,000 Brazilian Reais), with a set schedule of expirations (e.g., monthly). Also, unlike forwards, which are arranged bilaterally between two counterparties in a private transaction, futures contracts are negotiated in the public arena of a futures exchange. Traditionally, all buyers and sellers of futures contracts come together in one central place[1] -- the pit designated for the exchange of the specific type of contract (e.g., the Euro pit or the Yen pit). Transactions take place at the best bids and offers provided by the exchange members, and all participants -- whether institutional or retail -- are entitled to the same bids and offers. To access these markets, customers need a futures broker or a futures commission merchant (FCM) to execute the order and to satisfy all associated requirements of the contract according to the rules and regulations of the marketplace.

Perhaps the most critical of these rules relates to the daily processing of futures trades. As the futures price changes each day, the change in the value of the futures position is passed between the two parties to the trade, using the clearinghouse as an intermediary. For example, if the price of the futures contract goes up, the buyer (the long position) receives the change in value of the contracts, which is paid by the seller (the short position holder), and vice versa with price declines. Put another way, the futures contract is marked-to-market daily. This daily dollar value that changes hands is called the variation settlement. Again, the broker facilitates these adjustments, but the customer must cover losses in a timely fashion.

[1] The Chicago Mercantile Exchange also lists currency contracts on GLOBEX,® an electronic system where analogous trading practices are performed during hours not served by traditional pit trading.

This cash-flow aspect of the futures contact is perhaps the most difficult conceptual hurdle as well as the hardest operational feature for a potential user of this market. Maintaining a futures position requires position takers, both buyers and sellers, to be ready and able to pay funds into the clearinghouse (via a broker) each day that the futures position generates losses.

Alternatively, efficient participation in the futures market requires that the trader/hedger be ready and able to employ funds that may be generated from profitable futures positions. Typically, the former situation is the one that would cause potential problems. Due to the high leverage nature of the futures contract, the cash-flow requirements of a losing futures position may be quite substantial. The futures participant must either have the cash readily available or have the prearranged capability of financing this requirement.

With futures contracts, customers must provide a performance bond, which typically takes the form of a cash deposit, U.S. government securities, or a letter of credit.[2] The dollar value of this requirement varies depending on the particular futures contract traded; and this amount is adjusted as volatility conditions change. Typically, the notional amount of the performance bond represents a very small fraction of the value of the associated futures contract, often in the range of one or two percent.

USING REAL FUTURES

Currency futures contracts are used primarily as price-setting mechanisms rather than for the physical exchange of currencies. In fact, for Brazilian Real futures specifically, no physical exchange of currencies ever takes place. The contract is *cash settled*; that is, following the final trading session (on the last business day of the month prior to the futures contract month), one last mark-to-market and cash adjustment takes place. The ultimate settlement price is the reciprocal of the same "Exchange rate of Reais per U.S. Dollar for cash delivery" used by the Bolsa de Mercadorias & Futuros (BM&F) to cash settle its U.S. dollar futures contract. This rate is calculated by the Central Bank of Brazil on the last business day of the month for the Central Bank of Brazil immediately preceding the contract month. If this rate is not available, CME uses a back up survey to determine the rate.

Buyers and sellers of futures contracts typically offset their original positions prior to the delivery date specified by the contract by taking an opposite position. For example, if one were to purchase a futures contract initially, offset would involve selling the contract. Conversely, if one started by selling the contract, offset would be arranged by buying the contract. The complete buy/sell (or sell/buy) is referred to as a round turn. With cash settled contracts (e.g., Brazilian Real futures), the offset of all open futures positions is automatic at the contract's expiration, for any outstanding positions as of that time.

When hedging with Real futures, the number of contracts required is determined from a straightforward arithmetic calculation: Simply divide the amount of the relevant Real requirement by R$100,000 (i.e., the size of the contract). For example, a hedger seeking to protect the dollar value of a Brazilian investment with market value of ten million Reais would need to sell 100 contracts.

[2] Some other forms are acceptable, but those mentioned above are the most common. Consult with your broker to explore other alternative collateral forms.

As futures expiration dates (and value or delivery dates) fall on a set schedule, the choice of the appropriate futures month may involve a small amount of discretion. The general rule is to select the futures contract month with a value date concurrent with, or immediately following, the desired value date. Brazilian real futures have an added twist that the last day of trading occurs on the last day of the month *preceding* the designated expiration month. For example, the April futures contract expires on the last business day in March, making the April futures the preferred contract to use to protect yourself through the end of the first quarter.

An important consideration when using Real futures deals with the price at which the contract can be transacted. For most currencies, the relationship between spot and futures prices reflects a discipline called covered interest arbitrage. Covered interest arbitrage fosters a difference between the exchange rate for immediate delivery (spot) and exchange rates for deferred delivery (futures or forwards) based on differences in interest rates in the two relevant countries, say, United States versus Brazil. In Brazil, however, limitations of deposit markets and regulatory restrains may prevent this arbitrage activity from operating efficiently. When arbitrage is precluded from occurring, futures prices may reflect more of a consensus forecast of prospective exchange rates rather than classical arbitrage pricing theory.

HEDGING A BRAZILIAN ASSET WITH FUTURES CONTRACTS

To demonstrate how Real futures can be expected to perform, consider the case of a U.S. investor who on March 12 holds an investment in a Brazilian asset having a market value of R$1,000,000. Assuming a spot exchange rate of R$2.9580/$, the dollar value of this investment translates to a market value of $338,066. If the Real weakens, however, the dollar value of this asset will necessarily suffer.

To protect against this risk through the quarter's end, the investor must sell 10 July Real futures (i.e., 1,000,000 / 100,000 = 10). Table 1 shows the prospective outcomes of this hedge under two different market scenarios. In the first case, the dollar appreciates by10 percent through the end of May (i.e., the Real weakens); while in the second scenario, the dollar depreciates a like amount (i.e., the Real strengthens).

Table 1: Futures Hedge Example

Objective: Protect the dollar value of a Brazilian Real-denominated investment through the end of the current quarter
Conditions: Current date: March 12 Spot exchange rate = R$2.9580/$ or $0.338066/R$ Investment market value = R$1,000,000 or $338,066 July 2003 BR Futures price = $0.32120/R$
Actions: March 12: Sell (R$1,000,000)/(R$100,000/contract) = 10 July BR Futures Contracts May 31: Buy 10 July BR futures
Scenario 1: Dollar appreciates 10 percent to R$3.2538/$ (Real depreciates to 1/3.2538 = $0.30733/R$) Final market value of investment = 1,000,000/3.2538 = $307,333 Change in investment's market value = $307,333 - $338,066 = -$30,733 Futures results = 10 x 100,000 x (0.32120 - 0.30733) = $13,867 Combined effects: (-$30,733 + $13,867) = -$16,866
Scenario 2: Dollar depreciates 10 percent to R$2.6622/$ (Real appreciates to 1/2.6622 = $0.37563/R$) Final market value of investment = 1,000,000/2.6622 = $375,629 Change in investment's market value = $375,629 - $338,066 = $37,563 Futures results = 10 x 100,000 x (0.32120 - 0.37563) = -54,429 Combined effects: ($37,563 - $54,429) = -$16,866

The table brings to light two aspects of the hedging process. First, note that in both scenarios, the hedge offset does not precisely match the change in the investment's value. In Scenario 1 where the futures position generates a gain, the offset is insufficient compared to the change in the investment's dollar value. In Scenario 2 where the futures lose, the offset is too large. Note, however, that the consolidated outcomes are essentially the same: the effect of hedging with futures locks in a loss of $16,866, which in this case represents less than two percent of the original asset value.

This outcome follows from the original difference between the price of the futures contract and the spot exchange rate at the start of the hedge. In the current example, this price difference, referred to as the basis, is $0.338066/R$ - $0.3212/R$ = $0.016866/R$ per contract; and given a hedge position of 10 futures, the dollar value of this basis effect is 10 contracts x R$100,000/contract x $0.016866/R$ = $16,866. Sellers of futures contracts in effect lock in this basis effect as a loss; buyers, on the other hand, enjoy the basis effect as a gain. Critically, however, the full extent of the basis effect is realized only if the hedge is maintained though the expiration date of the futures contract.

Importantly, while the basis condition is adverse in this case (as this hedger is always a seller of futures) the effect is market driven. That is, in different economic environments, the magnitude of the basis effect will vary. In fact, the basis effect could be reversed, if and when Real futures prices trade at a premium to the spot price (in American terms), which would occur if U.S. interest rates ever become high relative to Brazilian interest rates, and/or if a sufficiently strong consensus develops that the Real will strengthen over the relevant prospective time horizon.

Besides the futures price per se, a second hedging consideration deals with the performance of the asset in the Brazilian economy, irrespective of the currency exchange rate. In the constructed example the value of the asset in Brazilian Reais remains a constant R$1,000,000 over the hedging horizon. In practice, however, few situations would likely occur with such stability. More typically, the prospective notional value of the Brazilian exposure would be somewhat uncertain.

Two concerns could arise for our dollar-denominated investor/hedger: (1) the investment might appreciate in Reais, while at the same time the Real weakens; and (2) the investment might depreciate in Reais, while the Real strengthens. In the first case, no currency protection is in place for the appreciated value of the asset; in the second, there is the chance that a double loss will occur as the asset value falls and no offset for some portion of the losses on the currency hedge is in place.

Either consequence could be mitigated by adjusting the futures hedge position as the Real exposure changes. That is, with an appreciating investment (in Reais) additional short Real futures would be required, while with a depreciating investment fewer short futures would be needed. The hedger would have to modify the hedge as the market value of the investment changes. Importantly, despite these adjustments in a declining (rising) Brazilian Real exposure, the dynamic hedger will invariably still be somewhat over-hedged (under-hedged); but the mismatch would be smaller than that which would occur with a static hedge.

CME OPTIONS ON BRAZILIAN REAL FUTURES

Besides the futures hedge, dollar-denominated investors might instead consider buying put options on Real futures as an alternative. Puts confer the right to enter a short futures position at a specific price (the strike or exercise price). Given a long put position, if the Real weakens, falling below the strike price of the option, the put will settle to a value commensurate with the effect of the exchange rate move from the strike price. In contrast, if the Real strengthens, rising to an exchange rate above the strike price (again in American terms), no protection benefit would be forthcoming -- or warranted. In either case, however, the purchase of an option position requires the initial cash outlay found by multiplying the number of put options bought by the option price per Real times the size of the contract (R$100,000).

Table 2 demonstrates potential results of using put options to solve the same problem as that offered in Table 1. In this case, the hedge vehicle is the $0.33/R$ strike Put with a July 2003 expiration (i.e., expiring concurrently with the July futures contract, on the last business day of May). Given an option price of $0.01256/R$, the initial cash outlay required to buy these options is (10 contracts) x (R$100,000/ contract) x ($0.01256/R$) = $12,560.

Table 2: Options Hedge Example

Objective: Protect the dollar value of a Brazilian Real-denominated investment through the end of the current quarter
Conditions: Current date: March 12 Spot exchange rate = R$2.9580/$ or $0.338066/R$ Investment market value = R$1,000,000 or $338,066 July 2003 $0.33/R$ strike put price = $0.01256/R$
Actions: March 12: Buy (R$1,000,000)/(R$100,000/contract) = 10 July $0.33/R$ Put Contracts May 31: Sell 10 July BR futures
Scenario 1: Dollar appreciates 10 percent to R$3.2538/$ (Real depreciates to 1/3.2538 = $0.30733/R$) Final market value of investment = 1,000,000/3.2538 = $307,333 Change in investment's market value = $307,333 - $338,066 = -$30,733 Put results = 10 x 100,000 x ((0.33 - 0.30733) - 0.01256) = $10,107 Combined effects: (-$30,733 + $10,107) = -$20,626
Scenario 2: Dollar appreciates 20 percent to R$3.5496/$ (Real depreciates to 1/3.5496 = $0.281722/R$) Final market value of investment = 1,000,000/3.5496 = $281,722 Change in investment's market value = $281,722 - $338,066 = -$56,344 Put results = 10 x 100,000 x ((0.33 - 0.281722) - 0.01256) = $35,718 Combined effects: (-$56,344 + $35,718) = -$20,626
Scenario 3: Dollar depreciates 10 percent to R$2.6622/$ (Real appreciates to 1/2.6622 = $0.37563/R$) Final market value of investment = 1,000,000/2.6622 = $375,629 Change in investment's market value = $375,629 - $338,066 = $37,563 Put results = 10 x 100,000 x (0.00 - 0.01256) = -$12,560 Combined effects: ($37,563 + -$12,560 = $25,003

In Scenario 1, the profit from the put results from the fact that the option grants the right to sell at $0.33/R$, while market conditions at the end of the quarter price the underlying futures contract at $0.30733/R$. Thus, when the hedge is unwound, the intrinsic value of this option reflects this differential of $0.02267/R$. Given an original option price of $0.01256/R$, holding this put generates a profit of $0.02267/R$ - $0.01256/R$ or $10,107. The decline in the market value of the asset, coupled with the hedge, results in a loss of $20,626.

Scenario 2 reflects the outcome associated with a 20 percent appreciation of the dollar. Note that despite a doubling of the movement of the exchange rate relative to Scenario 1, Scenario 2 generates the same outcome.

Finally, in Scenario 3, where the dollar depreciates, the put option expires worthless. That is, when the underlying futures price is higher than $0.33/R$, the right to sell Reais at $0.33/R$ has no intrinsic value. In this case, then, the put hedge generates a loss equal to the original put value of $12,560, but the stronger Real more than offsets this loss. Thus, in contrast to using a futures hedge, which locks in a combined effect of a loss of $16,866, the long put hedge provides a guaranteed worst-case outcome of a loss of slightly over $20,000, but it also has the potential for generating positive results if the Real gets stronger over the hedging period.

As with the futures hedge, the same consideration is present with respect to the variability of the price of the asset in Reais. So again, the put hedger, like the futures hedger, needs to monitor the size of the asset exposure (i.e., the Real denominated value of the asset) on an ongoing basis, buying additional puts when this magnitude increases and reducing the put coverage as this magnitude shrinks.

HEDGING PROSPECTIVE INVESTMENTS

Thus far, the discussion has focused on managing the currency exposure relating to assets already owned; but futures and options also can be used for managing the exposure on prospective investments. Whereas the prior examples relate to the use of short futures or long put options to cover the risk that the Brazilian Real could weaken, the concern for the prospective buyer is the reverse: the Real could strengthen, making the purchase of the asset more expensive in dollar terms. Hedging this risk would require buying futures or buying call options. Conceptually, as before, the futures hedge will foster virtually the same outcome, irrespective of whether the Brazilian Real strengthens or weakens. The long call option hedge, on the other hand, protects against a strengthening of the Real (beyond the option strike price) while allowing for a smaller expenditure of dollars if the Real weakens.

In an environment, with futures prices trading at a discount to the spot exchange rate (again, in American terms), the basis works in favor of the hedger with this prospective risk. Realizing the full impact of the basis would require that the hedge be maintained through the contract's expiration. Put another way, when the acquisition date precedes the contract expiration, which would likely be the more common situation, liquidation or offset of the hedge is required. As a consequence of this early offset, it is likely that some portion of the expected benefit of the starting basis conditions will not be realized.

SUMMARY AND CONCLUSIONS

Whether to hedge the currency exposure of Brazilian assets already in a portfolio or for a planned asset purchase, Brazilian Real futures and/or options on Real futures can serve as useful risk management tools. Ultimately, the choice of whether to use futures or options rests on the manager's objective. To lock in a terminal value, regardless of the direction of underlying exchange rate movements, a futures hedge is the appropriate choice. In contrast, to ensure against a worst-case outcome but allow for the possibility of improved performance with a beneficial exchange rate move, a long option hedge can be employed. Hedgers also must be comfortable with the institutional workings of the selected instrument. For futures, this comfort requires the capacity to post collateral and mark the hedge position to market, settling the change in value in cash each day. For long options, on the other hand, the buyer need only make an initial outlay of cash equal to the option premium; no daily cash adjustments are subsequently required. Beyond the choice of hedge vehicle, the process of hedge management is deserving of considerable consideration. Much of the benefit of these tools has to do with their flexibility, offering the capacity to adjust hedges incrementally or to substitute one tool for another as objectives vary.

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