Adventures in the Carry Trade

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A carry trade is a strategy in which the trader invests in a high yielding instrument financed by borrowing in a low yielding instrument. Popular carry trades include investments in low grade bonds financed by borrowings in high grade bonds, investments in long maturity bonds financed by borrowings in short maturity bonds, and options strategies in which the investor is long theta (receiving time premium).

Historically, one of the most popular carry trades has been in the foreign exchange markets where carry traders invested in high yielding currencies using funds provided by borrowing in low yielding currencies. The classic examples of these trades were Australian dollar investments financed by Japanese yen borrowings, and Mexican peso investments financed by U.S. dollar borrowings. The academic literature on the carry trade has confirmed that these positions have historically resulted in excess returns on average, while being occasionally subjected to large downside risk.

In the past few years, the profitability of the traditional currency carry trades has declined as the central banks of major developed countries have pursued quantitative easing policies that are designed to keep interest rates low. As a result, short term interest rates in the United States, Europe, and Japan are all close to zero and there are few opportunities for profitable carry trades. Even the traditional investment currencies of the carry – Australia, New Zealand, and Mexico – currently have short term interest rates that are between two and three percent. These rates are too low to compensate for the substantial risk associated with currency fluctuations.

Opportunities for currency carry trades do, however, continue to exist in the emerging markets. In this note, I will describe these opportunities and the alternative methods that are available for implementing carry trades. I will also discuss the risks associated with these positions.

[1] The data are taken from the Bloomberg page BQ on July 25th, 2013. The money market rates are calculated from the spot and forward bid-ask spreads on the exchange rate and the bid-ask spread on USD Libor. Money market interest rates on the major currencies were taken from the Financial Times at www.ft.com/markets. Details on the calculation are available from the author.

The basic idea behind the carry trade is described in Table 1, which lists the current exchange rates and interest rates for a number of popular currencies. In order to make the case as simple as possible, I have avoided the institutional complications of foreign exchange market quotation practices by expressing all of the prices in U.S. dollar terms and by expressing the forward prices in terms of money market interest rates of three months duration.

The table lists the bid/offer spreads on both the exchange rates and the interest rates for a sample of emerging market currencies and also for the global currency majors – Sterling, Euro, Yen and Dollar. As an example, the first line gives the quotes for the Indian rupee. I can buy 100 Indian rupees for $1.6920 and I can sell 100 Indian rupees for $1.6916. In the money market, I can borrow rupees at a rate of 8.26% and I can invest in rupees at a rate of 7.75% at the three month duration.

These quotes can be used to create a carry trade between any two of the currencies. Suppose, for example, that an investor wants to borrow USD $1 million for three months at 0.35%. He uses the funds to purchase Indian Rupee [100*USD 1m/1.6920 = INR 59.102 m] and he invests the funds at the INR rate of 7.75%. At the end of the period, he will receive INR 60.246 m and he will have to repay USD 1.000875 m. If the exchange rates do not change over this period – a highly unlikely event – the USD value of the investment will be USD 1.019134 m, and the excess return will be $18,259. Expressed as an annual rate, the excess return on the carry is 7.3036% per annum.

It is important to note that the excess return of 7.3036% is less than the quoted rate of 7.75%. Most of the difference is due to the use of an excess return measure, which means that the investor has to borrow the USD to finance the INR position. However, it is also due to the spread between borrowing and lending rates in the spot foreign exchange market. The global carry trade loses money because of the bid/ask spreads in both the foreign exchange and the money markets.

TABLE 1: Exchange Rates and Interest Rates

Country	Currency	FX-Bid	FX-Offer	MM-Bid	MM-Offer
India	100INR/USD	1.6916	1.6920	8.26	7.75
Brazil	BRL/USD	0.4458	0.4460	8.04	7.55
Turkey	TRY/USD	0.5186	0.5194	7.88	6.71
Russia	10RUB/USD	0.3058	0.3060	6.87	5.96
S. Africa	ZAR/USD	0.1025	0.1026	5.84	5.22
Mexico	10MXN/USD	0.7931	0.7933	3.68	3.45
Australia	AUD/USD	0.9246	0.9248	2.86	2.77
N. Zealand	NZD/USD	0.8079	0.8082	2.98	2.76
Poland	PLN/USD	0.3138	0.3145	3.33	1.75
Sterling	GBP/USD	1.5386	1.5388	0.54	0.53
Euro	EUR/USD	1.3276	1.3277	0.25	0.05
Yen	100JPY/USD	1.0074	1.0075	0.14	0.02
USD	USD/USD	1.0000	1.0000	0.35	0.25

The actual excess return on the carry will depend upon the evolution of the exchange rate during the holding period. If the price of the Indian rupee increases to 1.70 bid, the excess return would increase to 9.3279%. On the other hand, if the price falls to 1.65 bid, the excess return would be -2.721%. It is clear from this example that a small adverse move in the exchange rate can easily wipe out the expected excess returns from the carry trade.

In the early literature on the carry trade, the efficient markets hypothesis was used to argue that the expected excess return on the carry trade should be zero which means that the interest rate differential is a market expectation of the expected change in the value of the exchange rate. The efficient market perspective was based upon the idea that we could assume that risk premia on instruments like emerging market currencies should be close to zero because the excess returns were uncorrelated with the wider financial market. In other words, the beta of the trade is close to zero and so the expected excess return should also be close to zero. More recently, economists have recognized that market risk premia can arise in ways that are not necessarily related to traditional markets.

In the carry trade, there are three important sources of risk. The great economist Milton Friedman pointed out that the high interest rates paid on emerging market currencies could be due to hidden catastrophic events that had not yet occurred. He called this phenomenon the "peso problem" after the situation in Mexico where the central bank was maintaining a fixed, but unsustainable, exchange rate against the dollar. The markets recognized that the peso was eventually going to fail and priced this risk into Mexican interest rates. Studies of the excess returns before the peso devaluation gave the false appearance of excess profits.

Another type of risk relates to contagious crises in emerging markets. Because many of the players in the carry trade are present in all of the emerging market currencies, a crisis in one currency can carry over and cause additional chaos in other markets. Examples of this phenomenon include the "Rumble in the Ruble", the "Tequila Crisis", and the "Asian Crisis" in which financial breakdowns in Russia, Mexico and Thailand spread to neighboring countries.

The final type of risk that carry traders should be aware of is the exposure of the trade to a financial crisis in the developed markets. During the global financial crisis of 2008, the carry trades were hit very hard. This was not because these markets were the source of the crisis, since the source could clearly be found in the housing market, but because traders who were forced to liquidate positions to satisfy client demand for funds were using the most liquid markets, including foreign exchange and money markets, to obtain funds to cover withdrawals.

For each type of risk, there is an appropriate strategy to mitigate the problem. The solution to the peso problem is to diversify across a group of currencies. The solution to contagion is to diversify across strategies. The solution to a global financial crisis is to diversify into countercyclical instruments like metals and bonds. In the following example, these risk management principles will be described in a short case study of the emerging market carry trade.

In the following table, I describe a representative carry trade portfolio. The construction of the portfolio is based upon the well-established principles of mean-variance optimization originally developed by Markowitz. For the mean, or expected return, the model uses the interest rate differential. The covariance is estimated from weekly data on excess returns over the past two years. Since the emerging markets exist in different time zones, weekly data provides a better estimate of the covariance between returns relative to daily data.

TABLE 2: Representative Carry Trade Portfolio

Currency	Invest	Rate	Currency	Borrow	Rate
INR	49%	7.75%	MXN	10%	3.68%
BRL	36%	7.55%	AUD	17%	2.86%
TRY	27%	6.71%	NZD	13%	2.98%
RUB	25%	5.96%	PLN	1%	3.33%
ZAR	6%	5.22%	GBP	18%	0.61%
JPY	14%	0.02%	EUR	35%	0.25%
			USD	63%	0.35%
Total	157%	10.13%	Total	157%	1.69%

The left hand side of the table lists the recommended investment positions, expressed as a percentage of capital. For example, the first entry recommends an investment of 49% of capital in Indian Rupee earning an interest rate of 7.75%. The first five investment positions represent the core of the carry trade portfolio: a globally diversified set of investments in emerging market money market instruments from India, Brazil, Turkey, Russia and South Africa. The wide geographical spread of this portfolio provides protection against the peso problem described by Professor Friedman. While any one of these countries could experience financial difficulty, the likelihood of a simultaneous outbreak of individual difficulties is small.

The next position on the investment side is a 14% investment in Japanese yen. While it may seem strange that the portfolio is investing in Japanese yen, where the interest rate if 0.02%, this position provides an important hedge against the risk inherent in other parts of the portfolio. Because of its long history of low rates, combined with very high savings rates relative to other developed countries, Japan has historically been a major participant in the carry trade. If there is a significant retreat from the carry, Japanese investors attempt to bring their money home. In doing so, they drive the value of the yen up. Consequently, long positions in Japanese yen provide protection against the systematic risks of the carry trade.

On the borrowing side, we have two major sets of positions: lower yielding carry trade currencies and major funding currencies. The recommended portfolio includes a 40% borrowing in Mexico, Australia and New Zealand. These are the historical carry trade instruments which now have borrowing rates in the 2% to 4% range. While these rates are higher than borrowing rates on the majors, they have the advantage that these currencies are positively correlated with the new emerging market instruments. So if there is a downturn in the carry trade, gains in these positions will partially offset losses on the new instruments.

Finally, we have a group of borrowing positions in the major currencies of the U.K., Europe and the U.S.. Because of quantitative easing, these currencies have very low interest rates. Over the entire portfolio, the recommendation is to borrow 157% of capital at an average interest rate of 1.69% and invest 157% of capital at an average interest rate of 10.13%. Notice that the two sides of the balance sheet are equal which implies that this position does not require the explicit use of the capital. However, capital would be required to cover potential losses on the position. The estimated annualized standard deviation of the excess return on this portfolio over the past two years is approximately 7%. This suggests that a capital buffer of around 20% of capital would be required to cover potential losses.

So far we have been working on the excess return on currency swaps in which we borrow one currency and invest in the other. The swap involves manipulating the bids and offers in both the currency and interest rate markets and appears, on the surface, to be incredibly complicated. Let's begin with the math behind the excess return:

$$r_{t+1} = \frac{S_{t+1}}{S_t}(1+i_t^*) - (1+i_t)$$

In this equation, S represents the spot exchange rate in USD, i* is the foreign interest rate, and i is the USD interest rate. So the first term represents the capital gain on the foreign currency investment position and the second term represents the cost of the borrowing position. Now let us assume that a futures market exists which allows market participants to lock in the future spot price at a price of $F_{t,t+1}$. Since all of the variables are now known at time "t", the excess return on the position must be zero. This means that:

$$0 = \frac{F_{t,t+1}}{S_t}(1+i_t^*) - (1+i_t) \quad or \quad F_{t,t+1} = S_t \frac{1+i_t}{1+i_t^*}$$

This equation states the familiar result – known as the Interest Rate Parity condition – that the futures price is a reflection of the interest rate differential. If we use this condition to replace the current period spot rate from the excess return equation, we can express the excess return as:

$$r_{t+1} = \frac{S_{t+1} - F_{t,t+1}}{F_{t,t+1}}(1+i_t)$$

This equation states that the excess return is simply the percentage difference between the future spot rate and the current futures price.

This little bit of financial math has established three important facts. First, futures prices reflect interest rate differentials. Second, excess returns are directly related to profits and losses on the futures contracts. Third, an investor who is interested in pursuing a carry trade strategy can do so directly though the currency futures markets. The futures markets offer the well-known benefits of security, U.S. regulatory environment, and a large central order book. In order to implement the strategy described above, we need to describe the characteristics of the new futures contracts on emerging market currencies.

Table 3: CME Futures Contract Specifications					
Currency	Size	Price	$Value	Target $10M	Contracts
100INR/USD	5,000,000	1.6706	$ 83,530	49%	59
BRL/USD	100,000	0.4405	$ 44,050	36%	82
USD/TRY	200,000	1.949	$ 200,000	27%	-14
10RUB/USD	2,500,000	0.3033	$ 75,825	25%	33
ZAR/USD	500,000	0.1014	$ 50,700	6%	12
10MXN/USD	500,000	0.78575	$ 39,288	-10%	-25
AUD/USD	100,000	0.9182	$ 91,820	-17%	-19
NZD/USD	100,000	0.8028	$ 80,280	-13%	-16
PLN/USD	500,000	0.31124	$ 155,620	-1%	-1
GBP/USD	62,500	1.5355	$ 95,969	-18%	-19
EUR/USD	125,000	1.3246	$ 165,575	-25%	-15
100JPY/USD	125,000	1.0046	$ 125,575	14%	11

For a list of all CME FX Futures and Options, visit cmegroup.com/fx

Most of CME Group (CME) FX contracts are specified in terms of quantities of foreign currency and price in U.S. dollars. The dollar value of the contract is then the size multiplied by the price. (Even within this convention, there are some minor complications. The Indian Rupee contract is price in U.S. cents, so we have to divide by 100 to obtain a correct dollar value.) The main exception is the Turkish Lira contract which is specified in terms of USD quantities and TRY prices. In either case, the objective is to find the approximate USD value of the contract. We then find the target exposure to the currency by multiplying the account value by the recommended per cent allocation. The target number of contracts is then target exposure divided by the contract value. In Table 3, these calculations are performed for an account with $10,000,000 initial capital.

It is possible to reduce the total number of contracts traded, and hence the transaction costs and margin requirements, by directly trading the emerging market instrument for the most appropriate base currency. For example, currencies like PLN and TRY are traditionally traded against the EUR rather than the USD. For AUD and NZD might be more liquid against the JPY rather than the USD.

For the carry trader, the main concern is whether the futures markets are an effective method for implementing the strategy. To explore this issue, we compare the interest rate differentials that were found in the interbank global market page on Bloomberg to the premium/discount on the futures contracts traded at the CME. This comparison was based upon data for July 25, 2013 and the premium/discount on the futures contract was based upon the difference between the September and December contracts. For the standard contracts, the premium discount is calculated as $\frac{(Sep - Dec)}{Sep} * 400$, whereas for the USD/TRY, the calculation is $\frac{(Dec - Sep)}{Sep} * 400$.

Table 4: Comparison of Futures and Interbank Implied Yields

Currency	MM-Bid	MM-Offer	Sept	Dec	Prem/Dis
100INR/USD	8.01	7.40	1.6706	1.6358	8.33
BRL/USD	7.79	7.20	0.4405	0.4327	7.08
USD/TRY	7.63	6.36	1.949	1.9842	7.22
10RUB/USD	6.62	5.61	0.3033	0.299	5.67
ZAR/USD	5.59	4.87	0.1014	0.1001	5.23
10MXN/USD	3.43	3.10	0.78575	0.7795	3.18
AUD/USD	2.61	2.42	0.9182	0.9127	2.40
NZD/USD	2.73	2.41	0.8028	0.7977	2.54
PLN/USD	3.08	1.40	0.31124	0.3096	2.11
GBP/USD	0.36	0.16	1.5355	1.5347	0.21
EUR/USD	0.00	(0.30)	1.3246	1.3251	-0.15
100JPY/USD	(0.11)	(0.33)	1.0046	1.0052	-0.24

Table 5: Comparison for the Recommended Portfolio

Currency	Position	MM	Futures
100INR/USD	49%	7.40	8.33
BRL/USD	36%	7.20	7.08
USD/TRY	27%	6.36	7.22
10RUB/USD	25%	5.61	5.67
ZAR/USD	6%	4.87	5.23
10MXN/USD	-10%	5.59	3.18
AUD/USD	-17%	3.43	2.40
NZD/USD	-13%	2.61	2.54
PLN/USD	-1%	2.73	2.11
GBP/USD	-18%	3.08	0.21
EUR/USD	-25%	0.36	-0.15
100JPY/USD	14%	(0.33)	-0.24
Total		**7.43**	**9.20**

If we use the Indian example again, a strategy of borrowing USD and investing in INR would provide an interest rate pickup of 7.40% in the money market and 8.33% in the futures market. In the Turkish case, the money market pays 6.36% and the futures market pays 7.22%. In the South African market, the money market pays 4.87% and the futures market pays 5.23%. In Brazil and Russia, the money market rates are more favorable than the futures rates, but the difference is quite small.

We can summarize this discussion by comparing the yield on the recommended portfolio from an implementation in the money market relative to the futures market. In this example, we use the MM Offer rates for investment positions and the MM Bid Rates for borrowing positions. This comparison is slightly unfair to the MM rates because the calculations do not take account of bid-ask spreads, commissions and exchange fees in the futures markets. However, with the introduction of electronic trading platforms, bid-ask spreads and fees in futures markets have become very small so it is unlikely that the introduction of these costs would change the overall conclusion of the study.

Over the entire portfolio, the carry strategy would earn an interest rate spread of 7.43% based upon the bid-ask spreads in the money market. In the futures market, the interest rate spread is estimated to be 9.20%. This is an impressive differential which illustrates the benefits of implementing carry trade strategies in the futures markets.

The introduction of futures contracts on emerging market currencies is an exciting development. By encouraging developed country carry traders to invest in these markets, the contracts become a source of capital in the local market that lowers the borrowing costs for local business owners. The carry trade was once described in Robin Hood terms as "borrowing from the rich to lend to the poor." This quote demonstrates that the strategy is an engine for economic growth in emerging markets. It may even be profitable for its investors.