Tactical Currency Allocation

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Market efficiency depends upon rational, profit-motivated investors. Two of the largest communities of currency traders have no profit motive. Central banks trade to dampen volatility. Corporations seek to hedge the currency exposure in their book of business.

Currency profits are based not on the movement of the currency, but on the movement of the currency relative to the forward rate. The forward rate is, in turn, based upon interest rates. If an overseas market has a lower interest rate than the domestic market, its currency will trade at enough of a premium in the forward market to equalize the interest rates when they are currency-hedged. But if an overseas market is trading at a lower interest rate than the domestic rate, investment capital will typically be siphoned away from the lower-yielding market into the higher-yielding market, driving its currency down even as its forward rate points up.

Central banks' tendency to intervene to dampen currency volatility has the effect of introducing serial correlation. If a currency that would have rallied 10% rallies only 5% because of government intervention, it will rally by 5% later. There is a statistically significant pattern: A currency that has gone up will, more likely than not, continue to rally, and vice versa.

The research on tactical asset allocation (TAA) has suggested that the capital markets are inefficient in pricing one asset class relative to another.[1] Indeed, fundamentals-based models for selecting from among asset classes are surprisingly robust, and can be used profitably by the patient contrarian investor. While the fundamental factors that drive currency models are different from those that drive capital markets, we find that simple fundamental comparisons of currencies can be relatively powerful.

That currency markets are inefficient is surprising on one level: One might suppose that a market that trades hundreds of billions of dollars per day must be relatively efficient. But it is important to note that efficient markets are predicated on two key conditions: The investors in the market must, on average, be rational, and they must have a profit motive. Human nature assures that the former condition will not always prevail. And the currency markets include some large "players" (notably governments) whose actions are not profit-motivated.

Our research, while hardly exhaustive, indicates that certain simple fundamental relationships are relatively powerful for detecting opportunity in currency markets. Obviously no single relationship is a reliable source of profit in every month or quarter or year, but several simple intuitive relationships can prove profitable over time.

First, as others have documented, the forward rate is a poor predictor of future currency exchange rates.[2] Indeed, current exchange rates are a better predictor of future exchange rates than forward rates. Because profits in currency trading are not a function of currency movements, but rather of currency movements relative to forward rates, this suggests a potentially profitable rule: If we buy currency forward contracts that are priced at a discount to the current exchange rate, we should profit in the long run.

Second, currencies of countries with a steep bond market yield curve should outpace those of countries with flat or inverted yield curves.

Finally, currency markets have statistically significant "trends." That is, if a currency has been rising, it is more likely to rise further than to retreat. This is not consistent with efficient market pricing.

The interesting paradox in these findings is that the most successful practitioners of currency management typically tend to dismiss fundamental models as "too slow" to be reliable in currency management.

This article addresses several questions. Why should currency markets be inefficient? Why are currency forward markets so very inefficient as predictors of currency movements? What role do yields (and yield curves) play in shaping cross-border demand for curren-

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cies? What are the principles of "purchasing power parity," and do they exert an influence over a practical investment horizon?

WHY SHOULD CURRENCY MARKETS BE INEFFICIENT?

The efficient market hypothesis states, in essence, that if investors are rational, markets should efficiently discount all public information. That is, no model based on public information should be able to predict reliably market direction.[3] The key assumption is investor rationality. In a market in which key players are irrational, markets can be inefficient. That is, even public information can lead to profit opportunities.

It is public information that 5% of any money bet on roulette in Las Vegas is forfeit. The lucky few who travel to Monaco forfeit only 3%. It is public knowledge, which can be statistically proved, that no betting "formula" can change the house "take." Yet, every day, thousands of "investors" place their money on one number at the roulette tables of the world. Public information therefore suggests that it is profitable to own a roulette table, and unprofitable (indeed, irrational) to bet at one.[4] Las Vegas is indisputably an inefficient market.

Common sense suggests that human nature should affect markets. Human beings are social creatures, preferring company to solitude, agreement to disagreement. Saying "buy" when the investment world at large fears the worst is actually contrary to human nature. We all like to have those whom we respect agree with our views. The study of "behavioral finance" has identified countless examples of pricing irrationality. Jack Treynor has suggested that widely circulated opinion from respected sources (e.g., Wall Street research) actually serves to *create* inefficient pricing.[5] Accordingly, even in a liquid market, with profit motive driving the decisions of all participants, an efficient market is a hypothesis, not necessarily (not even likely?) a fact.

Market inefficiency does not necessarily mean easy profits. The nature of market inefficiencies should change constantly. Any market inefficiency is inherently an arbitrage opportunity. If enough investors become aware of a particular inefficiency, if enough money pursues that inefficiency, the inefficiency should vanish. This happened with some of the clear inefficiencies in the pricing of futures contracts in their early stages.[6] Today such mispricing is generally within bounds that preclude guaranteed profits to the arbitrager, after trading costs.

But the currency story is not so simple. A major class of investors in this market has essentially no profit motive. Central banks are concerned with their perception of the "fair rate," and equally concerned about exchange rate volatility. It is not their goal to enhance taxpayer value or to earn money on behalf of the taxpayer. Nor do they typically expect the market mechanism eventually to equilibrate to a truly "fair" exchange rate. Rather, they choose the Sisyphean chore of stopping the markets from moving where supply and demand would take them. They choose to dampen volatility by selling when a currency rallies and buying when it falls. But reduced short-term volatility creates serial correlation, which is not an attribute common to efficient markets.

Currency profits are not earned by correctly predicting currency direction. Rather, they are earned by correctly predicting currency direction relative to the forward rate, which may be above or below current exchange rates. How is this forward rate set, and is it an unbiased predictor of future currency movements? The rate is set by arbitragers, who ensure that the forward rate is almost exactly equal to the difference between short-term risk-free yields in two given countries. These arbitragers are certainly profit-motivated, but they have no interest in predicting actual fair exchange rates. Indeed, the difference in short rates, with almost 100% correlation with forward rates, has almost zero correlation with future actual currency movements.

Each of these sources of exchange rate inefficiency merits a more detailed study. But we can generalize. Currency markets are not now efficient. Nor are they likely to become efficient so long as governments actively intervene in currency movements and as long as yield curves around the world have different slopes.

WHY DON'T FORWARD RATES PREDICT CURRENCIES?

Table 1 examines two hypotheses. First, it examines whether forward rates are correlated with actual currency movements. Second, it examines whether forward rates can predict currency management profits.

In both cases, because of the lack of historical data on forward rates, we assume that forward rates are equal to current exchange rates less the difference between short-term yields in two countries. This provides, in fact, a very accurate proxy for forward rates. Arbitrage on short-term interest rates ensures it.

How does arbitrage keep the forward rate pegged at current exchange rates, less the difference in short-term rates? Suppose we wish to invest in risk-free instruments over the next 90 days. In the U.S., we could certainly earn the Treasury bill rate. Or we could place the money in Japan, and hedge our exchange rate risk by using 90-day currency forwards. If we did that, we would earn the Japanese cash rate plus or minus the currency gain or loss "locked in" in the forward markets.

Suppose Treasury bills yielded 4% and Japanese cash yielded 5%. Then, if the three-month forward rate on the yen were higher than a 0.25% discount to the current exchange rate (the 1% yield difference multiplied by one quarter per year), we would earn more in Japan than on U.S. Treasury bills. We would sell our Treasury bills, buy Japanese cash instruments and sell the yen forward to hedge our currency exposure. If the forward rate were lower than a 0.25% discount, then we would sell any Japanese cash positions, buy Treasury bills, and lift the currency "forward" contracts.[7]

Table 1. Are Forward Rates Unbiased Predictors for Exchange Rates? Correlations and t-Statistics, 1978–1991

	Correlation (t-statistic) for Monthly Data on Forward Rate—Current Exchange Rate vs. Subsequent One-Month Change in Exchange Rates					
	Canada	France	Germany	Japan	Neth.	U.K.
France	−.053 (0.7)					
Germany	−.057 (0.7)	−.101 (1.3)			Avg. Correlation = −0.16 (9.9)	
Japan	−.242 (3.4)	−.040 (0.5)	−.184 (2.4)			
Netherlands	−.086 (1.1)	−.134 (1.8)	−.108 (1.4)	−.289 (4.1)		
United Kingdom	−.285 (4.0)	−.107 (1.4)	−.174 (2.3)	−.333 (4.8)	−.168 (2.3)	
United States	−.078 (1.0)	−.147 (1.9)	−.236 (3.1)	−.198 (2.6)	−.247 (3.5)	−.207 (2.7)
	Correlation (t-statistic) for Monthly Data on Forward Rate—Current Exchange Rates vs. Subsequent One-Month Forward Market Currency Profits					
	Canada	France	Germany	Japan	Neth.	U.K.
France	−.102 (1.3)					
Germany	−.095 (1.2)	−.046 (0.6)			Avg. Correlation = −0.20 (11.7)	
Japan	−.292 (4.3)	−.101 (1.3)	−.227 (3.0)			
Netherlands	−.130 (1.7)	−.037 (0.5)	−.269 (3.9)	−.326 (4.7)		
United Kingdom	−.332 (4.8)	−.197 (2.6)	−.229 (3.0)	−.374 (5.7)	−.213 (2.8)	
United States	−.092 (1.2)	−.166 (2.2)	−.258 (3.7)	−.219 (2.9)	−.267 (3.9)	−.224 (2.9)

The discount (or premium) on forward rates relative to current exchange rates is referred to as the "swap rate." Arbitragers (from all over the world) stand ready to execute either trade if the swap rate differs from the "fair value" of, in our case, 0.25% below current exchange rates by enough to allow profits from the trade to exceed the cost of the trade. The cost should be less than 0.1%, even for relatively large trades. Accordingly, forward contracts are priced very close to this theoretical fair value.

If global markets are efficient, then equivalent risk-free investments should be rewarded equally, and the forward markets should accurately predict future movements in currency. They do not.

The top half of Table 1 shows the predictive power of forward rates. In an efficient market, the forward rate less the current exchange rate should be correlated with actual changes in exchange rates. The null hypothesis, that there is no statistically significant correlation, should be easy to reject. In fact, the null hypothesis is easily rejected, *but with the wrong sign!* If a currency trades at a discount on the forward markets, it most typically rallies, and vice versa.

Currency management profits are not earned on exchange rate movement. Rather, they are earned on exchange rate movement *relative to* the forward rate. In the prior example, if we are bullish on the yen, we buy yen in the forward market. Naturally, we make money if the yen rises, but we can also make money if the currency falls, so long as it falls less than the 0.25% discount in the forward rate. If we are bearish and sell in the forward market, we earn money only if (and to the extent that) the currency falls by more than the 0.25% discount in the forward rate.

In an efficient market, we would expect forward rates to be an unbiased predictor of future changes in exchange rates and, therefore, to be uncorrelated with the profits earned by buying or selling currencies in the forward markets. The null hypothesis, that there is no statistically significant correlation between forward market premium or discount and subsequent profits on currency forward positions, should be difficult to reject. In fact, in every pair of markets tested, the forward rate is inversely correlated (and significantly so) with future currency profits relative to the forward rate. If the forward rate is at a discount to current exchange rates,

we can generally profit by buying forward positions; if the forward rate is at a premium, we can generally profit by betting on a drop in forward exchange rates.

In essence, Table 1 demonstrates that current exchange rates are a better predictor of future exchange rates than forward rates are. Indeed, it persuasively suggests that forward rates are a *perverse* predictor of future currency movements. Because we earn money on currency positions based on the movements of exchange rates relative to forward rates, this means we can earn profits by betting against the forward rates. If they are at a discount to current exchange rates, then buy the currency (in the forward markets); if at a premium, sell the currency.

It is beyond the scope of this article to dwell on the reasons for the relationship. But the essence is rather simple. The reason that currency forwards do not predict future exchange rate movements well is that forward markets are driven by arbitragers, hence by differences in short-term interest rates. But differences in short-term interest rates actually have an inverse relationship to future currency movements: High rates lead to a discount in the forward market, which attracts capital, which pushes up the currency.

HOW DO YIELD CURVES AFFECT EXCHANGE RATES?

Currencies are bought or sold for two principal reasons. First, they are traded as a natural part of global trade. If we sell widgets in Japan, we are paid in yen, which we then sell to buy dollars (or use to buy Japanese-made products). Second, they are traded as a result of international investing. If we buy French government bonds, we must first buy French francs, spend them to buy the bonds, then (if we so choose) sell francs on the forward markets to hedge our currency risk. Both classes of currency trade can affect exchange rates.

The second class of currency trade, motivated by investment capital, is driven by perceived investment opportunities. In mid-February 1992, Japanese investors could buy yen-denominated government bonds at a 5.5% yield. Alternatively, they could buy equally secure U.S. Treasury bonds at an 8% yield. Would they forfeit the 2.5% difference in currency movements? No, they could actually lock in an additional 1.0% per year in the forward markets, for a total realized yield of 9.0%.

Would they forfeit the difference of 3.5% through falling bond prices? A 3.5% loss in U.S. government bonds would seem no more likely than a similar loss in Japanese government bonds. Indeed, with U.S. Treasury bonds yielding 4% more than Treasury bills, one might make the case that U.S. bonds were more likely to rally than fall. Accordingly, many Japanese investors were attracted to U.S. bonds at the time. To buy those bonds first required a purchase of U.S. dollars (although this could be offset by a sale in the forward market).

Many investors are constantly looking the world over for such opportunities. Sometimes they are objective comparisons, such as the February 1992 comparison of yen bonds with dollar bonds. At other times, they are subjective, such as some of the flight to home markets that prevailed in the wake of the 1987 global stock market crash. Whatever the motivation, such trades move exchange rates.

High yields on secure government bonds attract foreign investors. When these investments are not hedged in the forward markets (most often they are not), they can move currencies up. Bond yields far higher than yields on cash equivalents can increase the confidence of foreign investors and attract still more of their capital.

Tables 2 and 3 examine these kinds of relationships. Table 2 examines whether high long-term bond yields attract foreign capital, hence push currency exchange rates higher. Table 3 examines whether steep yield curves tend to push exchange rates higher. The two relationships are positive in almost all cases, and statistically significant in many.

Table 2. Does High Yield Correlate with Exchange Rate Movements? Correlations and t-Statistics, 1978–1991

	Correlation (t-statistic) for Monthly Data, Bond Yield Difference (target market vs. home market) vs. Subsequent One-Month Forward Market Currency Profits					
	Canada	France	Germany	Japan	Neth.	U.K.
France	−.037					
	(0.5)				Avg. Correlation =	
Germany	.102	−.057			0.13 (6.3)	
	(1.3)	(0.7)				
Japan	.182	.118	.142			
	(2.4)	(1.6)	(1.8)			
Netherlands	.075	.064	.223	.235		
	(1.0)	(0.8)	(2.9)	(3.2)		
United Kingdom	.234	.119	.115	.271	.098	
	(4.4)	(1.6)	(1.5)	(3.7)	(1.3)	
United States	.312	−.068	.141	.177	.130	.223
	(4.4)	(0.9)	(1.8)	(2.3)	(1.4)	(2.9)

Table 3. Do Yield Curve Slope Differences Correlate with Exchange Rate Movements? Correlations and t-Statistics, 1978–1991

	Correlation (t-statistic) for Monthly Data, Yield Curve Slope Difference (target market vs. home market) vs. Subsequent One-Month Forward Market Currency Profits					
	Canada	France	Germany	Japan	Neth.	U.K.
France	.061					
	(0.8)				Avg. Correlation =	
Germany	.016	.041			0.10 (5.8)	
	(0.2)	(0.5)				
Japan	.157	.044	.005			
	(2.1)	(0.6)	(0.1)			
Netherlands	.135	.194	.213	.104		
	(1.8)	(2.5)	(2.8)	(1.4)		
United Kingdom	.009	−.030	.164	−.052	.018	
	(0.1)	(0.4)	(2.1)	(0.7)	(0.2)	
United States	.203	.071	.049	.214	.214	.200
	(2.7)	(0.9)	(0.6)	(2.9)	(2.6)	(1.3)

Ironically, if markets are efficient in the long run, then these relationships should not prevail. If default risks are identical, then the expected real yield on long-term bonds and on cash should be identical from country to country. Let's examine how this should affect the links between bond yields and foreign exchange or between yield curve slope and foreign exchange.

If yields are high in an efficient market, then investors must be expecting high inflation. If inflation differs from one market to another, then the doctrine of purchasing power parity suggests that exchange rate movements should take away precisely as much as we gain by moving our capital from a lower-yield into a higher-yield country. If the yield curve is steep in an efficient market, then investors must be expecting rising inflation. Once again, exchange rate movements should take away precisely as much as we gain by moving our capital into a steeper-yield-curve country. But neither pattern of efficiency is evident in currency markets. Accordingly, we must conclude either that the link between yields and inflation is weak or that purchasing power parity has far less influence than the flows of investment capital on short-term currency movements.

SERIAL CORRELATION

Even the weakest form of market efficiency precludes simple price-based relationships. Past movements in a market should not presage future movements. Positive serial correlation, in plain English, suggests "the market has gone up, therefore it will go up." Such logic is counterintuitive yet it prevails in the currency markets.

Table 4 demonstrates that currency movements are serially correlated. Virtually all relationships are positive, and nearly half are significant at the 5% level. If a currency has been strong relative to its forward rates, it is likely to continue to strengthen; if it has been weak, the weakness is likely to persist.

Table 4. Do Exchange Rates Trend Enough to Generate Profits? Correlations and t-Statistics, 1978–1991

	Correlation (t-statistic) for Monthly Data, Latest Three-Month Forward Market Profits vs. Subsequent One-Month Forward Market Currency Profits					
	Canada	France	Germany	Japan	Neth.	U.K.
France	−.157					
	(2.1)				Avg. Correlation =	
Germany	−.113	−.036			0.07 (4.1)	
	(1.5)	(0.5)				
Japan	.177	.189	.179			
	(2.3)	(2.5)	(2.3)			
Netherlands	.129	−.026	.014	.177		
	(1.7)	(0.3)	(0.2)	(2.3)		
United Kingdom	.064	−.038	.027	.135	.025	
	(0.8)	(0.5)	(0.4)	(1.8)	(0.3)	
United States	.161	.179	.140	.096	.157	.068
	(2.1)	(2.3)	(1.8)	(1.3)	(2.1)	(0.9)

Why should past market movements presage future market movements, and is this pattern strong enough to offer profit opportunities? The short answer is that government intervention (through central bank open market trades) will tend to dampen short-term volatility, thereby creating an appearance of trending. If the dollar/yen exchange rate encounters enough yen buying to boost the yen 10%, and the central banks intervene enough to cut the yen rally to 5%, the likely follow-on rally of 5% more will lead to serial correlation. Yes, this is a strong enough pattern to generate profits.

Volatility in exchange rates is generally considered a "bad thing." It disrupts the planning of businesses that depend on foreign trade. If pricing is set in the foreign currency, do we wind up selling the product at below our cost (if their currency falls) or at a high enough cost to invite domestic competition (if their currency rises)? What does this do to our profits? If pricing is set in our home currency, the buyer faces similar uncertainty. Over short spans, currency risk can be hedged, protecting buyer and seller alike. Accordingly, central banks will often seek to dampen the volatility through open market trades of their own. Ironically, their actions can affect results only over short spans, which buyers and sellers of foreign trade could hedge without government intervention.

Such a pattern of serial correlation is inconsistent with any kind of efficient market. But remember that market efficiency hinges on rational behavior by investors seeking gain. Central bank intervention is designed to dampen volatility; it is not intended to earn profits (nor does it!). Therefore, this is an inefficiency that can be a source of profits so long as central bank trading, on days when they are active, is a meaningful share of total currency trading. This is likely to remain the case for many years to come.

CONCLUSION

Based on this analysis, we conclude that currency markets are not efficient. Their inefficiencies follow a historically reliable pattern, which is consistent with what we know about global capital flows. Any inefficiency is, of course, an arbitrage opportunity; if enough capital is invested in a fashion that exploits the inefficiency, it can and should disappear. However, the currency markets are large and liquid, and have a major class of investors (the central banks) that does not care about profits. Accordingly, we see no reason for these inefficiencies to dissipate quickly.

FOOTNOTES

1. J.J. Evnine, "Asset Allocation—Reward and Diversification," in R.D. Arnott and F.J. Fabozzi, eds., *Active Asset Allocation* (Chicago: Probus, 1992).
2. S.C. Weaver, "Forward Foreign Exchange Market," in C.R. Beidleman, ed., *Cross Currency Swaps* (Homewood, IL: Business One Irwin, 1992).
3. "Strong-form" efficiency even suggests that non-public information is useless for predicting prices. Few investment professionals or, indeed, academics seriously endorse the strong form of the efficient market hypothesis.
4. Although, after expenses and payoffs to the Mafia, it is possible that profits may not be realized.
5. J.L. Treynor, "Market Efficiency and the Bean Jar Experiment," *Financial Analysts Journal*, May/June 1987.
6. In the opening months of trading, S&P 500 stock index futures routinely traded just above the index level but far below fair value. The earliest traders were able to liquidate equity portfolios, buy stock index futures and lock in as much as 4% in above-market returns, after all expenses. Even larger mispricings were evident in Japanese bond futures in 1987.
7. The 0.25% is an approximation. The exact formula is based on a geometric ratio, which differs slightly from this simpler arithmetic formulation.