

Don't Leave Home Without Them

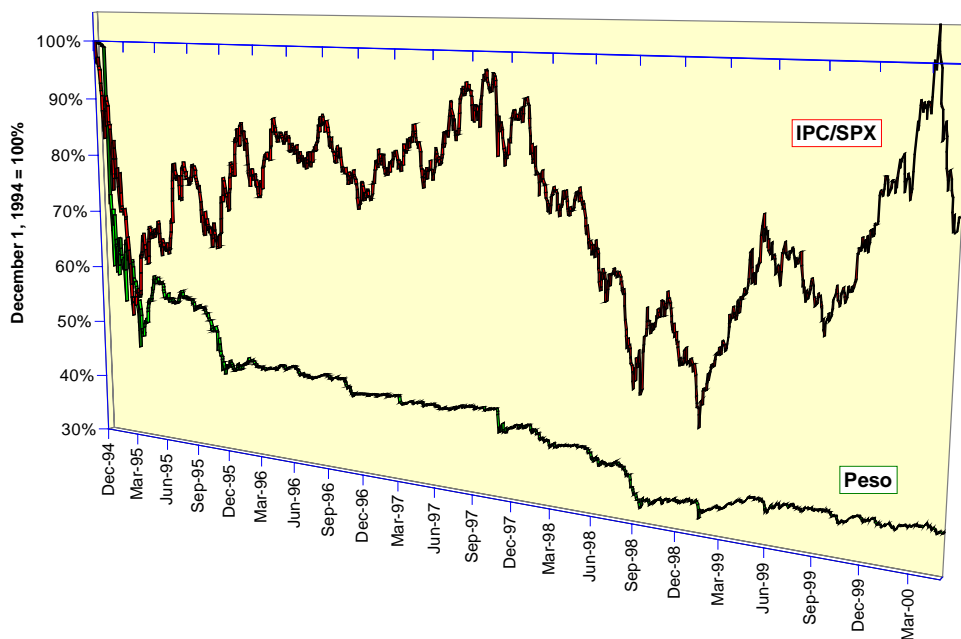
Inspirational quotations from football coaches are best relegated to the insipid wall posters sold in airline magazines. However, we can all learn two important investment lessons from longtime Ohio State sideline prowler Woody Hayes. First is the philosophy of "three yards and a cloud of dust." This business rewards -- but does not attract -- the patient and plodding more than the flashy and spectacular.

The second maxim regards the outcome of a forward pass, "When you throw the ball, three things can happen, and two of them are bad." This certainly pertains to international investing. When you buy foreign financial assets three things can happen. The first is you'll make money in both the local currency and when you translate the investment back to your currency. That's good, no? The second is you'll lose money outright in both currencies, and the third is you'll profit in the local currency but then lose money upon translation. We should note, for the sake of completeness, you could have lost money in the local currency and then profited upon translation, but that's really nothing more than an unintentional winning currency trade dominating a bad investment.

The problem, of course, is compounded when the performance of the foreign investment is correlated with the performance of the currency. This is true not only for export-oriented, highly-developed countries such as Japan, but for emerging markets as well. We only need recall the devastation to the Mexican market in the aftermath of the December 1994 devaluation or to the various south Asian markets during the 1997 crisis. International capital flows, whether we wish to refer to them as "hot money" or not, have self-reinforcing effects on all aspects of a country's financial markets.

The impact of massive currency changes on an investment can be illustrated by comparing the relative performance of the Mexican IPC stock index to the S&P 500 and overlaying the Mexican peso exchange rate. We can narrate this relationship from December 1, 1994, the approximate takeoff point of the S&P 500's late 1990s rally. The initial break in the peso pulled the IPC down quickly as money fled Mexico. A second downturn in the currency in late 1995 hurt the relative performance of Mexican equities again, as did fresh downturns associated with the Asian and Russian financial crises in 1997 and 1998, respectively. It wasn't until the peso stabilized in early 1999 that the IPC caught fire and matched the S&P 500's gains by early 2000. Even then, an American holder of Mexican equities would have lost a considerable sum over the five-year period by virtue of currency fluctuations alone.

After The Collapse: Relative Performance of Mexican Peso And IPC



Risk Management Menu

The combination of pervasive currency risks and the perceived need to diversify portfolios internationally has given birth to four general types of option strategies for protecting international investments, culminating with the quantos that will be our focus:

1. A foreign equity option struck in a foreign currency. These can be exchange-traded, such as an euro-denominated option on the DAX traded on the Eurex, or, for that matter, a dollar-denominated S&P 500 option held by a non-U.S. investor. These options do not provide direct currency protection, and therefore need to be combined with currency options for a complete hedge.
2. A foreign equity option struck in the domestic currency. These, too, can be exchange-traded, such as the Nikkei 225 contract at the Chicago Mercantile Exchange. The correlation between the equity market and the exchange rate affects these hedges, and like our first trade, require a combination of equity and currency instruments.
3. An equity-linked foreign exchange option. The focus of this instrument, which combines a currency option with an equity forward, is on the currency risk itself. These instruments are traded over-the-counter.
4. A fixed exchange rate foreign equity, or quantity-adjusting (quanto), option, which are also traded over the counter, but sometimes are embedded within listed equity products. Since quantos allow the holder to focus on the value of the underlying equity investment, they are referred to frequently as “wrappers” for the equity hedge. A quanto is executed at a fixed exchange rate agreed to by the parties, and this rate may not be near the present spot rate.

Quanto Behavior

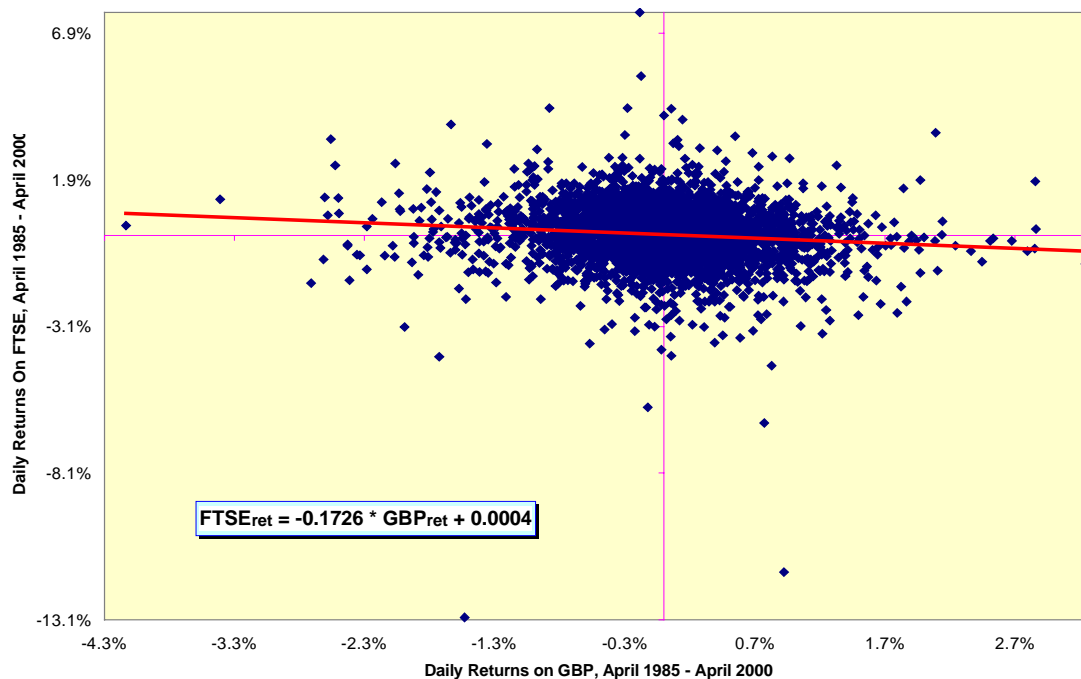
A quanto is settled in foreign currency at expiration. This settlement is then converted back into the domestic currency at the fixed rate contained in the option contract. The payoff on a quanto call can be expressed in two different ways, as shown below.

$$Call_Q = FX_{rate} * \max((Stock_{dom} - FX_{amt}), 0) = \max((Stock_{dom} * FX_{rate}) - FX_{amt}, 0)$$

The fixed exchange rate represents an implicit speculation that this is the correct rate. This transfers the external risk of the market to the internal risk of whether the trade is correct (see “Why Johnny Can’t Hedge,” *Futures*, November 1996). Moreover, quantos cannot and do not solve for the problem of correlation between the equity market and the exchange rate, or of the correlation between equity market volatility and currency volatility. These correlations and volatilities, along with the foreign interest rate, all affect quanto pricing. A combination of equities and both foreign and domestic deposits are required to hedge the quanto. Even with all of this complexity, quantos narrow the overall risk management problem and lower the hedging cost by allowing the investor to focus on the merits of the equities and place the currency risk to one side.

The sheer number of poorly-related variables involved in quanto pricing makes it a daunting task. Rather than embark on a series of Monte Carlo simulations or some other form of statistical self-delusion, let’s narrow the problem down to a series of relationships. Rather than using the thin Mexican market as an example, let’s use the British pound (GBP) and the Financial Times (FTSE) as our currency/equity pair. First, let’s take a long-term look at the correlation between the GBP and the FTSE.

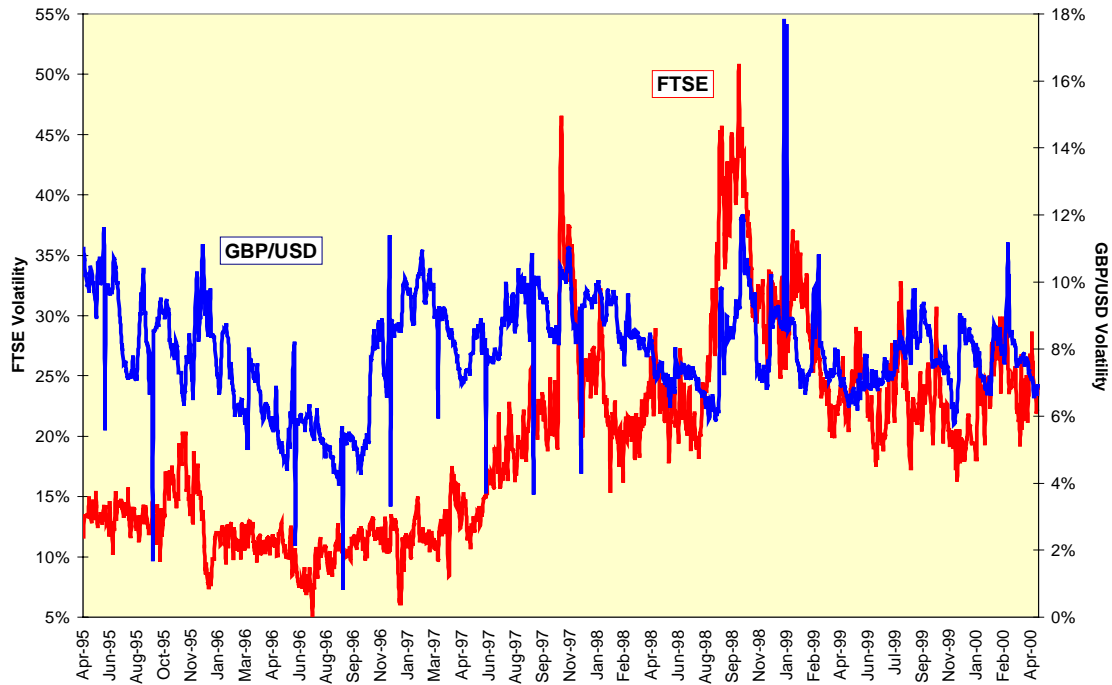
Correlation Between FTSE and GBP Returns, 1985 - 2000



This relationship, as we should expect, is slightly negative. The GBP, all else held equal, should firm on rising British interest rates relative to U.S. rates, but higher interest rates should not be a positive for equities. The correlation between the two markets since 1985 has been -0.1726 .

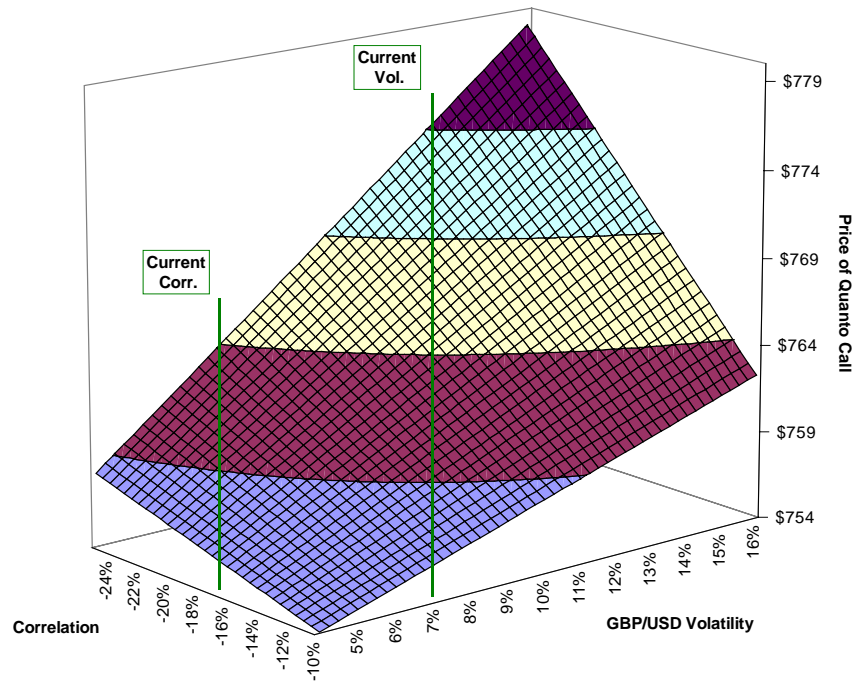
The relationship between the volatilities of the FTSE and the GBP is somewhat random, indicating separate events produce uncertainty in the two markets. For example, GBP volatility spiked in preparation for the launch of the euro as 1999 approached, while FTSE volatility spike during the Asian and Russian crises of 1997 and 1998. This low correlation between relative volatilities is typical of established financial markets, and stands in stark contrast to what we saw for Mexico.

Comparative Volatilities: FTSE And GBP/USD Rate



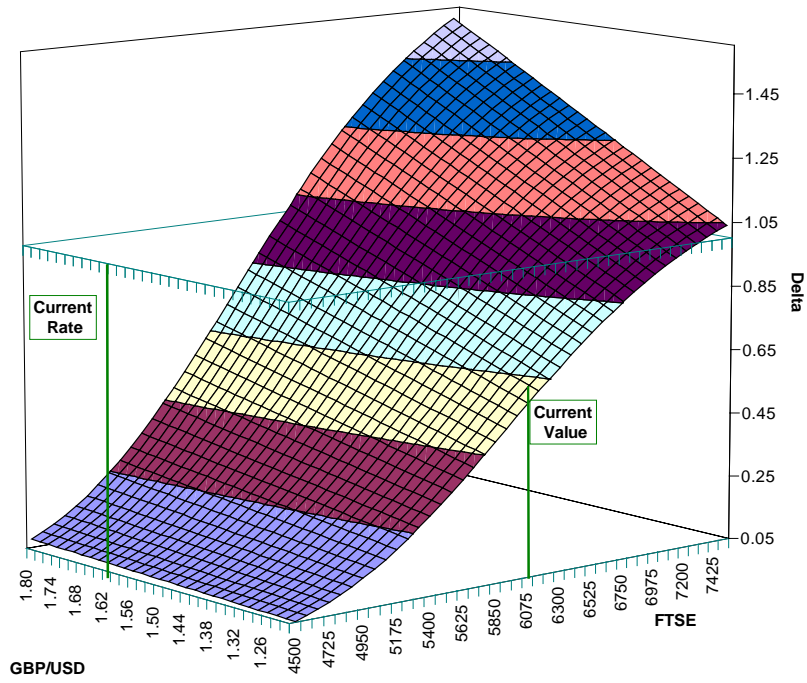
Quanto pricing follows a typical pattern: The greater the probability of a market settling in the money, the higher the price. For example, a six-month at-the-money call on the FTSE, GBP 6300 at 1.55 GBP/USD at the time of this writing, would become cheaper as GBP volatility fell. The quanto would also become cheaper if the correlation between the GBP and the FTSE moved toward zero, as seen in the graph below. Quanto call valuation will increase as a linear function of FTSE volatility, however, and this effect will dominate changes in either GBP-FTSE correlation or GBP volatility.

Quanto Valuation As A Function of Stock/Currency Correlation And Currency Volatility



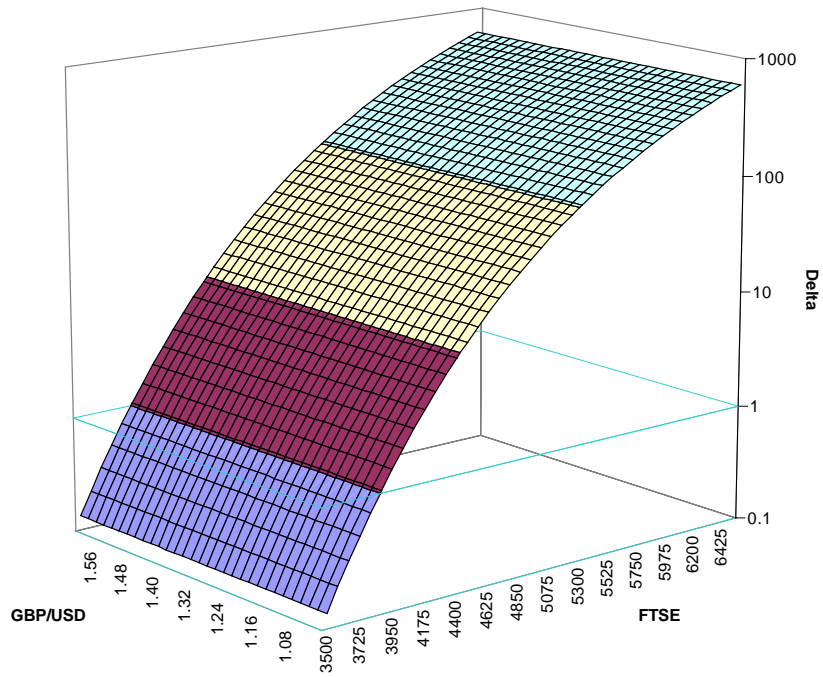
While most options have a single set of derivative statistics, or “Greeks,” quantos have two sets of derivatives for us to follow, one for the currency and one for the underlying equity market. Unlike the delta of a plain vanilla call bounded by 0 and 1.00, the delta of a quanto with respect to price can exceed 1.00 unless the exchange rate falls dramatically. This reflects the increased value of the payoff once the call becomes in-the-money.

Quanto Delta With Respect To Underlying



The delta with respect to the exchange rate almost always exceeds 1.00 since any increase in the exchange rate will affect the payoff in a directly multiplicative manner. The movements in this delta are so extreme they need to be depicted on a logarithmic scale for clarity.

Quanto Delta With Respect To Exchange Rate



A central theme of this series on exotic options has been the notion they represent economic reality far better than the plain vanilla options offered on exchanges. The problem of hedging an asset priced in another currency is but one application where we face a variable underlying. The quantity of the underlying asset to be hedged can fluctuate as well, and that is where we will turn our attention next.