

Central Bank Footprints in CTA Markets

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Systematic CTA's were trounced yet again in 2013 by equities and equity hedge funds, and they have also had a rocky start in 2014. The simplest of all investment strategies, buying and holding the S&P 500, produced a year-on-year return of nearly 30% in 2013. Those investors with the resources to invest in a diversified portfolio of hedge funds would have earned 7-10% over the same period, but with much lower volatility. Yet systematic CTA managers, with our sophisticated computer systems and scientific market analysis, produced on the whole a small loss for investors--the fourth losing year in the last five years for the industry as a whole!¹ This is particularly striking given that in the 22 years before 2009, CTA's as an industry delivered only one losing year.² Many investors chose CTA's as a hedge, thanks to their lack of correlation with these other investments. CTA's have indeed performed well during periods when equities were weak these last 5 years. Still, few investors are willing to stick with a losing hedge, especially if they can't understand why it's losing.

Seizing on the unusual economic environment of the past several years, commentators have provided plenty of explanations, among them increasing correlations, decreasing volatilities, low yields, and too much money invested in CTA's. Of course, central bank interventions have also been blamed by some commentators, though without much in the way of concrete evidence or explanation. Although central banks don't trade futures, their asset purchases--which involve the sovereign debt that underlies various bond futures as well as the currencies they are priced in, among other assets of interest to CTA's--and their attempts at "transparency" in their communications, which typically causes fits in the equity and commodity markets--are but a step away from the derivative markets. Because yesterday's "unconventional" monetary policy tools have become utterly conventional today, it would be of some benefit to better understand the connection between central bank interventions and systematic strategies traded by CTA's.

In this article we will do what we can to uncover evidence for this connection. We will first look directly at CTA returns for some evidence; but as my firm dormouse is a non-trend, systematic macro manager, we will also look for evidence in a few of the macroeconomic relationships commonly used as strategy building blocks by systematic macro CTA managers. For the aforementioned reasons, it is difficult to establish a perfectly clear connection between the recent struggles of CTA's and central bank interventions; but if we can't directly see the shadowy QE figure, we can at least see its footprints.

To set the context, however, it will be helpful to first review recent CTA performance and the

¹ The Barclay Hedge Fund Index returned 11.11% in 2013, the Bloomberg Hedge Fund Aggregate Index returned 7.4%, and the HFRX Global Hedge Fund Index returned 6.72%. The Barclay Hedge BTOP50 Index returned 0.74% and the HFRX Systematic Diversified CTA Index lost 1.30%.

² Between 1987 and 2009, the Barclay Hedge BTOP50 had only one losing year: 1994.

recent history of central bank interventions. Because systematic macro strategies comprise only a small portion of the CTA industry, there is no good systematic macro index to review. We will instead look at a few of the macroeconomic relationships commonly used by systematic macro CTA's.

A Brief History of Central Bank Interventions

Since the 2008 financial crisis³, the world's central banks have engaged in a number of unconventional interventions. Unquestionably the most influential of these has been the policy of quantitative easing (QE) engaged in by the United States Federal Reserve Bank, though many other central banks have also intervened--the Bank of England has engaged in QE via its gilt purchases, the Swiss National Bank placed a cap on the Swiss franc and defends it in essence by printing francs, and the Bank of Japan implemented Abenomics--QE on a scale relative to the Japanese economy much larger than the US QE program. Table 1 lists a few dates of importance around these programs. Because the US program of QE has had the strongest effect globally, only it will be considered in this article.

November 25, 2008	US FRB Begins QE1 (MBS, Agencies)
March 5, 2009	Bank of England Begins QE (Gilts)
March 18, 2009	US FRB Extends QE1 to Treasuries
November 15, 2009	Bank of England QE Winds Down
September 23, 2009	US FRB QE1 Stops Purchasing Treasuries
November 3, 2010	US FRB QE2 Begins (Treasuries)
June 29, 2011	US FRB QE2 Winds Down
September 6, 2011	SNB Places Ceiling on CHF
September 29, 2011	US FRB "Maturity Extension/Operation Twist" Begins
October 10, 2011	Bank of England resumes QE
September 13, 2012	US FRB QE3 Announced (MBS, Agencies)
December 26, 2012	US FRB Extends QE3 to Treasuries
April 4, 2013	BOJ announces Abenomics
May 22, 2013	Bernanke Tapering Speech

Table 1: Notable Recent Central Bank Interventions⁴

³ Of course, Japan unsuccessfully employed QE well before the 2008 financial crisis.

⁴ The US FRB has a very nice timeline of the various QE programs at http://www.federalreserve.gov/monetarypolicy/bst_openmarketops.htm and the Bank of England's is at <http://www.bankofengland.co.uk/monetarypolicy/Pages/qe/default.aspx>.

Historically, central banks have intervened in markets using their conventional tool of manipulating the very short-term (overnight) end of the yield curve. When the overnight rate is already zero, what's a "responsible" central bank to do? Why, try to drive down yields at longer maturities, of course. This is most obviously done by digitally "printing" money and buying longer-term bonds. Massive "shock and awe" bond buying by the central bank should drive bond prices up, which means that their yields go down. Throwing gobs of money (the "quantitative" part) around should lower interest rates (that's the "easing" part). Japan first experimented with quantitative easing in the early 2000s, concluding that it was not effective. This "unconventional monetary policy" was thus an economic footnote until ten years later, when a fresh FRB chairman nicknamed for his ability to airlift heaps of cash embraced it with gusto.

Figure 1 displays the Treasury Assets held by the US Federal Reserve Bank (as recorded in the Federal Reserve Board H.4.1 report) on the top panel and the range of corresponding treasury yields (as recorded in the FRB H.15 report) on the bottom panel. The colored bands indicate when US QE was in effect: green for balance sheet expansion, i.e. QE 1-3, and blue for "operation twist."

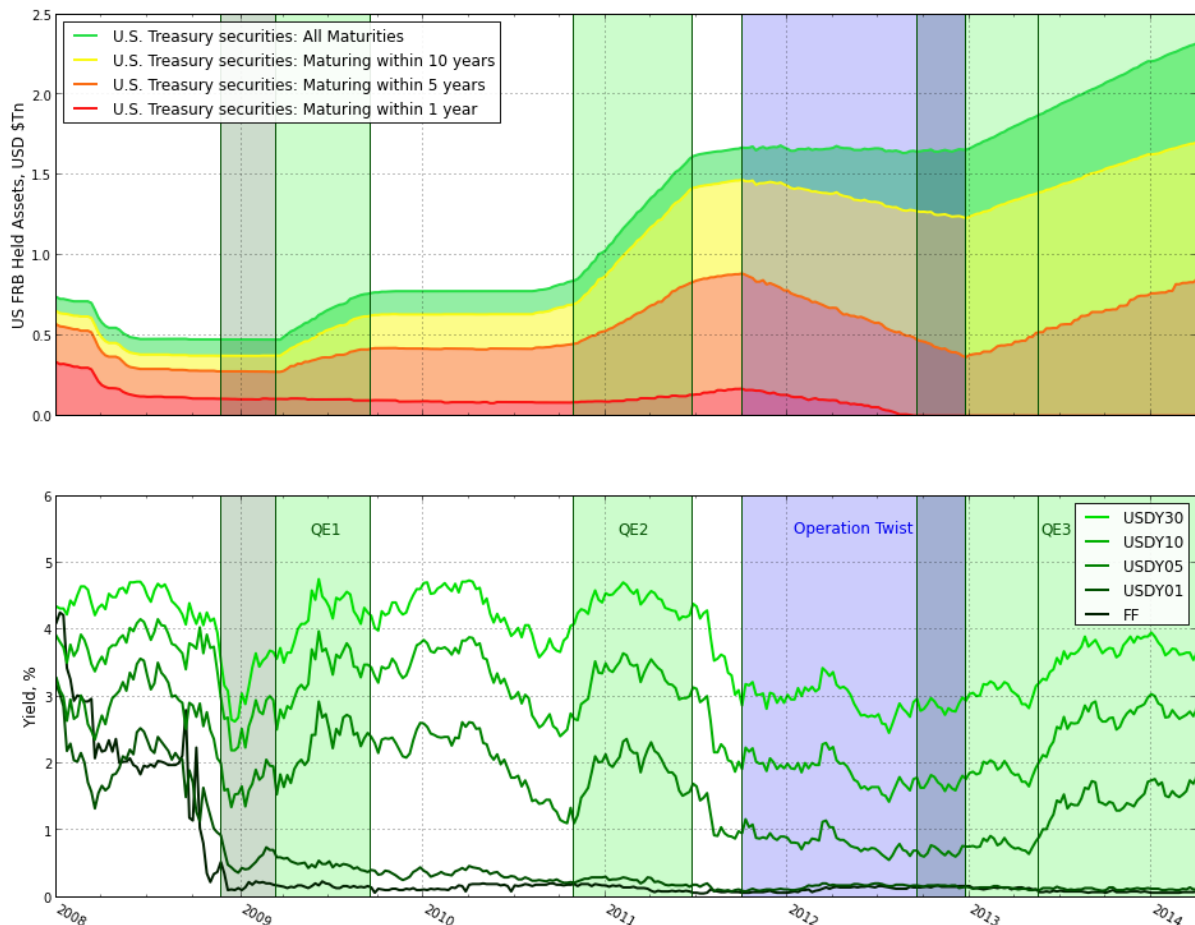


Figure 1: The US Federal Reserve Bank balance sheet: Treasury Assets

Let's walk through this figure. Remember, the aim of QE is to drive down interest rates in an attempt to stimulate the economy. Since the "conventional policy tool" of adjusting the overnight rate was all used up at the beginning of QE1 due to the so-called "Zero Interest

Rate Policy” or ZIRP--overnight yields were 0-0.25%--the US FRB resorted to QE. After Bernanke announced QE, and throughout QE1, treasury yields mainly rose--not quite what Bernanke had in mind, I’m sure. At least the one-year yield dropped a few bps (the bulk of the buying was between 1 and 10 years). A year after QE1 was over, yields had finally dropped back to near the levels they were at when QE1 was announced.

Not one to give up hope with a measly \$700,000,000,000 of stimulus (nearly half of that was Treasuries), Bernanke announced QE2 just as yields had bottomed--and once again, throughout the \$800,000,000,000 Treasuries binge, yields increased. Once again, immediately *after* the QE2 buying spree had petered out, yields again dropped to all-time lows. Is this making sense yet?

Even though the goal of low rates at the long end of the yield curve was now a reality (whether or not the FRB could take credit), Bernanke was not one to let a good crisis go to waste, so Operation Twist commenced. As Figure 1 shows, this involved the Fed selling Treasury holdings with less than a 5-year maturity and using the proceeds to buy mainly Treasuries with a maturity of 5-10 years (and some with longer maturities as well). The intent was to lower longer-maturity bond yields while possibly increasing shorter-term yields. And this without printing a dime! This \$500,000,000,000 intervention does seem to have dropped yields by 0.1% or so--but mainly at the shorter maturities (i.e. the ones being sold, the ones which could have been allowed to rise if it resulted in the longer maturity yields dropping).

Finally, with yields firmly at historical lows, it was deemed time to embark on QE3. Initially, this had no effect on yields. However, in May 2013, when Bernanke first raised the spectre of “tapering” QE, yields again began to rise despite the massive ongoing treasury purchases.

In summary, each Fed buying spree seems to have resulted in *higher* yields. On the other hand, the interregna between buying binges have coincided with declines in yield. I haven’t seen the FRB explain this, but the final score is that after \$1,500,000,000,000 of bond buying (and a similar amount of MBS & agency buying), yields are pretty much where they were at the outset of QE1. In other words, the Fed’s actions didn’t really have the intended effects (on the yield curve, at least--they can and do claim that QE nevertheless averted financial armageddon in 2008, but then we’ll never really know how the markets would have handled it without). My main point in this review of QE is not to trash talk the single most powerful economic entity in the world. It’s simply that, if the Fed’s interventions didn’t even have the intended effect upon the very yields that were being manipulated, it is not very likely that the effect upon other asset classes and relationships will be understood or obvious. The “signal” that was intended to be sent by the FRB, through interest rates, wasn’t all that clear.

QE History Through the Eyes of a CTA

During the depths of the financial crisis, CTA’s performed admirably, fulfilling their promise of delivering positive returns uncorrelated with equities. However, since the beginning of QE in November 2008, CTA’s have struggled. Figure 2 shows the performance of the Newedge CTA and Trend Indices and the BarclayHedge BTOP50 Index. The Newedge Trend index is arguably the preferred index as it is pure systematic trend--the others include some

discretionary, non-systematic managers. However, as you can see, their performance profile is very similar. At times, it will be useful to look further back in history than 2000 when the Newedge indices begin, hence the inclusion of the BTOP50.

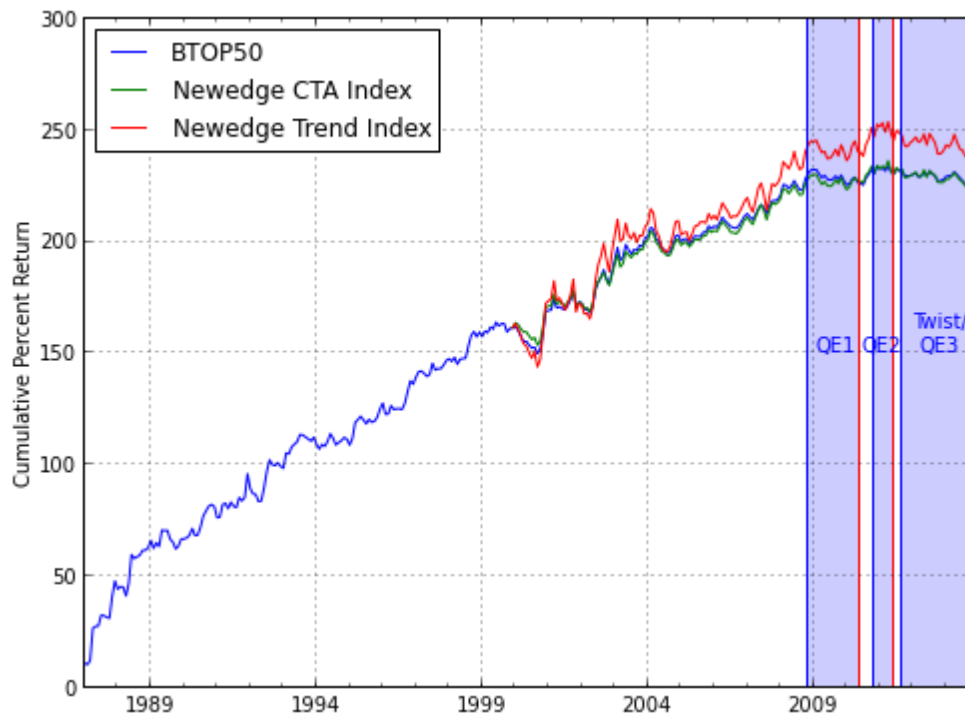


Figure 2: Recent CTA Performance and QE

Additionally, the periods when QE was in effect are labeled. (Here and below, the “Operation Twist” maturity extension program is combined with QE3 as the one extended into the other.) While hardly proof, it is certainly striking that CTA returns flattened out precisely when QE began. Returns were even quite strong after QE1 wrapped up and before QE2 began, when there were no material interventions.

Figure 3 displays the annualized mean return and the 90% confidence interval (so 5% of the annualized returns lie below the band and 5% above) for the mean of the Newedge Trend Index during each phase of QE:

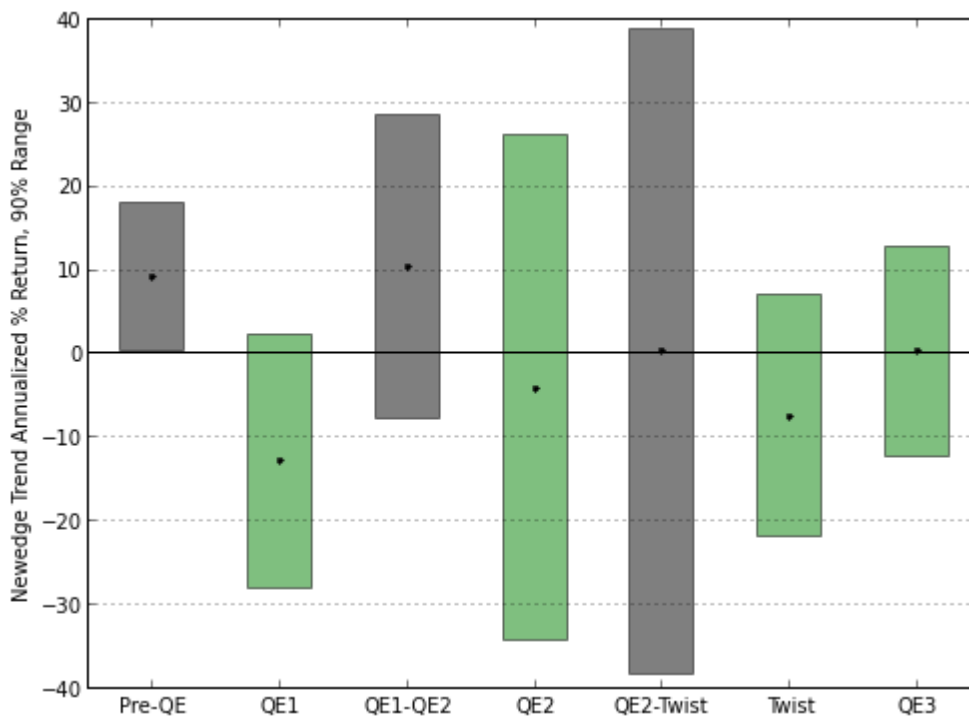


Figure 3: Newedge Trend Index Performance during QE Phases

The green bars represent the distribution of trend returns during QE, and the grey bars represent the distribution of trend returns when there was no QE. The returns pre-QE are better than zero 95% of the time--that's one losing year in twenty, which is about what we had before QE--quite a good track record! In contrast, each of the mean QE returns (the dots in the four green "QE" columns) lies at or below the 90% Pre-QE band. In other words, the chance that the returns during each QE period are consistent with the Pre-QE returns is less than 5%. The QE interregna have been so brief that their distributions are quite wide (small sample size means lots of uncertainty), but generally the returns during the periods when QE was latent were better than the returns when the virtual presses were running.

This merely illustrates the correlation between trend returns and QE--it does not establish causation. Still, it shows in quant-speak what everyone knows: CTA returns have not been what we were expecting since QE began!

Macroeconomic Relationships Used by CTAs

Interest rates lie at the very center of the web of macroeconomic relationships within a market economy. Banks profit by borrowing at cheap rates and lending at high rates. Japanese housewives sell their yen to buy Australian dollars. The high yields in Brazilian bonds attract capital from Europe, where yields are just about zero. Commodity producers cut unprofitable production when their cost of capital increases, driving up commodity prices. Businesses invest less in growth areas when yields increase because their cost of capital increases. Changes or dislocations in interest rates create tremors that redound through this entire macroeconomic web, inducing changes in nearly all other markets. For this reason, they also play a major role in many strategies common to systematic macro CTAs.

As we've said, before QE, central banks confined their interventions to overnight interest rates--this is "conventional monetary policy." Central banks manipulated the overnight rate paid on deposits held on behalf of commercial banks through "sterilized" open market operations--that is, they manipulated the overnight rate without creating new currency units. For example, when a central bank wanted to stimulate its economy, it would lower the overnight rate. In response, because they are receiving a lower yield, commercial banks would withdraw some of their money on deposit with the central bank in order to purchase higher yielding, riskier assets, thereby increasing the money in circulation. Because more currency is then circulating, its value is decreased, even though the total currency including reserves is unchanged. Simultaneously, the prices of riskier assets (including many of interest to CTA's: stocks, commodities, some long-duration bonds) are increased. In short: a drop in interest rates leads to a drop in currency value and an increase in the price of risky assets. Information is transmitted from short-term rates to currencies, bonds, and other risky, higher-yielding assets.

Quantitative easing as a policy tool short-circuits this transmission mechanism. As a rule, QE is "unsterilized:" it involves the creation of new currency units by the central bank, which it uses to itself directly purchase the riskier, higher-yielding assets, most notably longer duration Treasuries. This decouples or reverses the normal transmission mechanism between interest rates and currencies: an increase in currency units results in a decreased currency value and an increase in the price of the risky, yield-bearing assets. Information is no longer transmitted from short-term rates to currencies, but from currencies to other assets. Additionally, QE has only been used when short-term interest rates are already being artificially held very close to zero, when there is simply not much information that can possibly be transmitted by interest rates. There is no information juice to be squeezed from a rate that has varied between 0.00% and 0.14% ever since Operation Twist was carried out.

Due to their fundamental nature, interest rates play a central role in many systematic macro strategies. Perhaps the most well known example is the carry trade. After momentum, carry is likely the single most common strategy among systematic CTAs. If quantitative easing has weakened the information transmission between rates and currencies, we may very well see it in the performance of carry. Because we are looking at the influence of US interest rates on currencies, we consider here only exchange rates relative to the USD.

The carry relationship can be tested directly by calculating the mean return for exchange rates with a positive embedded carry: if the foreign 3-month yield is higher than the US 3-month yield, the return is positive if the foreign currency strengthens relative to the USD; and if the foreign yield is lower than the US 3-month yield, the return is positive if the foreign currency weakens relative to the USD. Figure 4 displays the mean return and its 90% error bars for the positive-carry exchange rates among the major liquid developed-country (G-7) currencies (AUD, GBP, CAD, CHF, EUR, JPY, all against the USD) for the three QE eras defined by the table above as well as the pre-QE era beginning in January 1978.

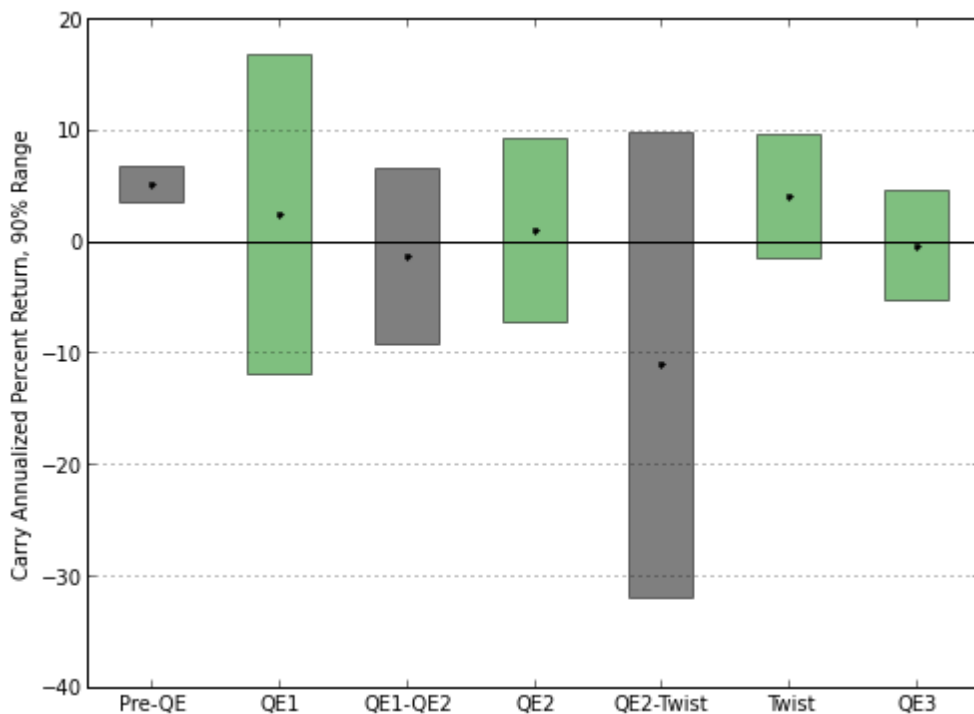


Figure 4: Currency Carry performance during QE phases

The return in the carry trade has been essentially zero, or consistent with zero, ever since QE1 was completed. This is quite a contrast with the situation before QE, when it was quite consistently positive. In part this is due to the decrease in the available carry as central banks around the world have cut rates--figure 5 shows that the average carry has more than halved from 1.9% before QE to 0.7% during the QE3 period. The evidence here is inconclusive--the poor returns since QE1 likely have more to do with having a low available carry rather than the easing itself. Of course, the low available carry is a consequence of the central banks' ZIRP.

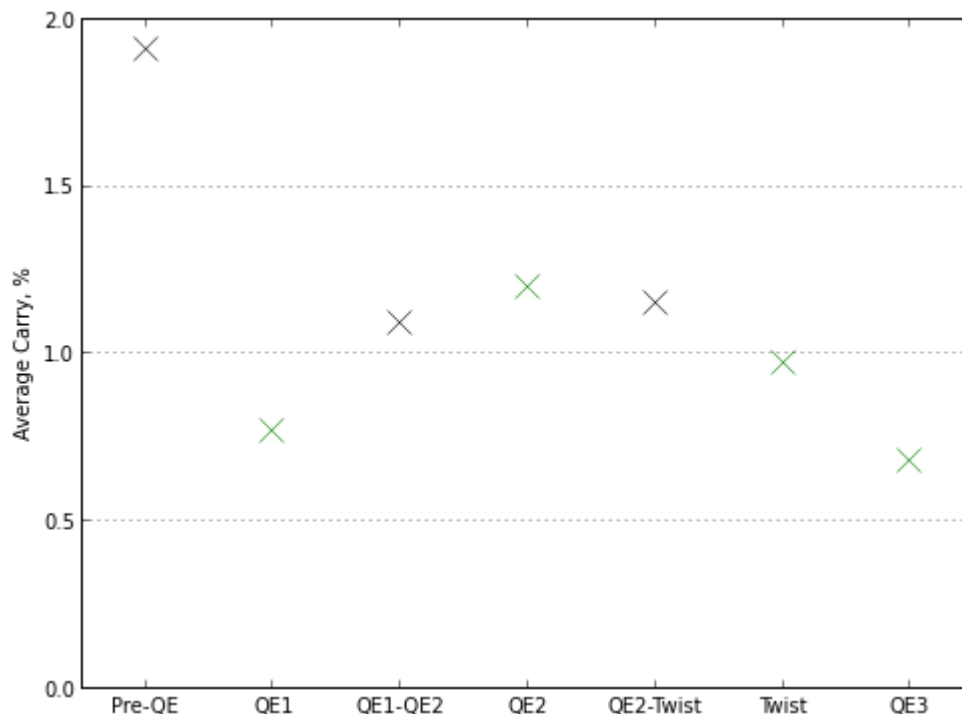


Figure 5: Available Carry during QE phases

An even more sensitive indicator of the relationship between interest rates and currencies which is commonly used in systematic macro strategies is the “first derivative of the carry trade” in quant-speak. It’s also the main principle for conventional central bank policy: namely, when a yield is decreasing, yield preference should result in a decreased preference for the currency with the lower yield, resulting in its depreciation. We can test this relationship using the same set of data as was used for testing carry; but now we assess the distribution of forex returns when carry increases. The results are shown in figure 6.

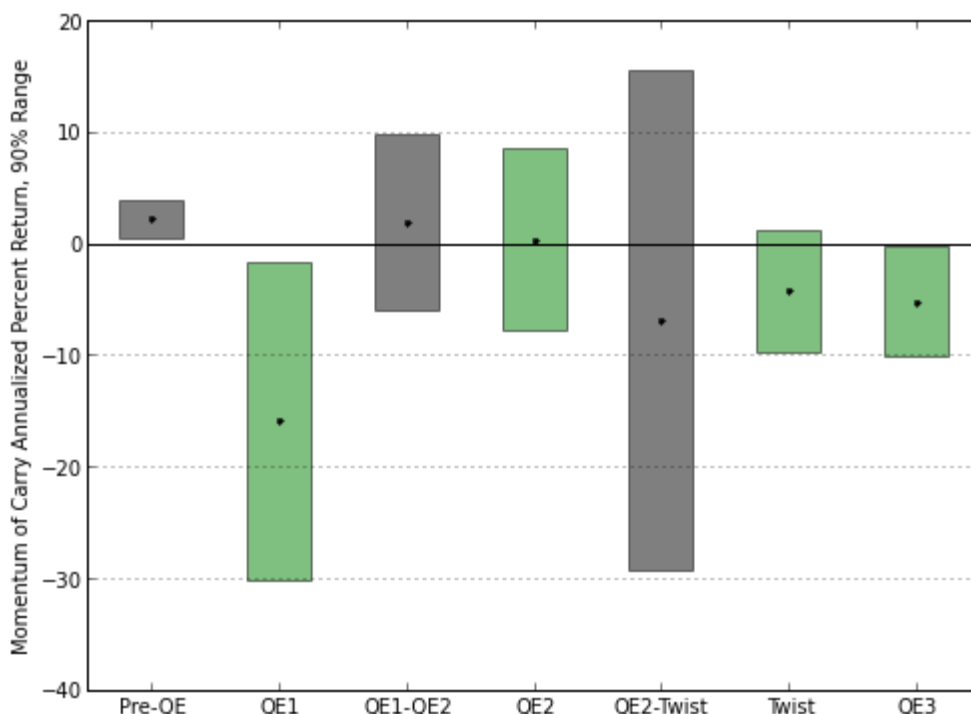


Figure 6: First Derivative of Carry Performance during QE Phases

Again, we see that the relationship between interest rates and currencies has weakened significantly with the advent of QE. Where the relationship was significant at better than the 95% level before QE, it has typically become consistent with zero or negative during QE periods. We get the same degradation in returns whether we use 3-month rates or 10-year rates, which are not so nearly zero.

These two examples, carry and the derivative of carry, are just two common inputs into models typically used by systematic macro managers and are only intended to illustrate the impact that interventions like ZIRP and QE have had on CTA strategies. A good macro manager will include other models and information sources, some of which have been less affected.

Other Common Explanations

Other explanations have been put forward to explain the weak CTA performance over the past five years, including: increased correlations, decreasing volatilities, and low yields. It is worth examining some of these explanations, as well as their relation to QE.

The notion of “increased correlations” has been put forward by a variety of observers.⁵ Presumably, the money created by QE is used to purchase generic risky assets in order to capture a risk premium, causing all their prices to move together. How “correlations” are measured is usually quite vague. To try to assess this explanation, we construct a correlation calculation applicable to systematic macro strategies. The correlations primarily of interest for macro strategies involve equity, currency, and fixed income assets from the major (G-7) economies listed above. The G-7 futures in these categories are reasonably liquid and enjoy a place in many systematic CTA portfolios. Ideally a selection of commodities should be included, but we will here just focus on financial securities (the results are not very much affected by including the most liquid commodities in the analysis). Most of these futures were trading as of January 1996, so the time period covered by this analysis will be from January 1996 through December 2013. Using these futures, we calculate a rolling covariance matrix with a 3-month exponential decay. Then we take the average non-diagonal correlation from this covariance matrix on each day for our measurement of correlation.

In figure 7, the end-of-month values of this estimate of the average correlation are divided into quartiles and the performance of the BTOP50, carry, and first derivative of carry in each of these quartiles is plotted, using data from 1996 through 2013:

⁵ For example: Futures & Options World, CTA Corner: Are Correlations Finally Falling? 16 Oct 2012

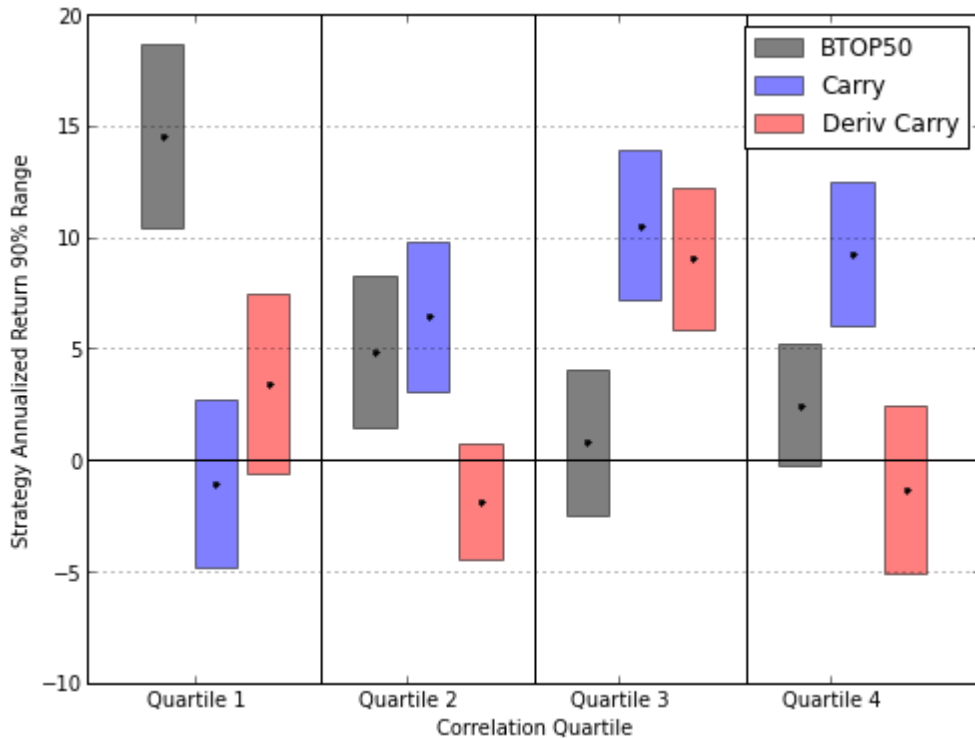


Figure 7: Strategy Performance during Correlation Quartiles

So there is a meaningful relationship between this measurement of correlations and CTA returns: CTA's indeed tend to perform better when correlations are low. Carry tends to perform best at higher correlations, and the "derivative of carry" model is relatively insensitive to correlations. If correlations have indeed been higher during QE, this could help to explain poor CTA performance.

Figure 8 shows the average of all the non-diagonal entries in the correlation matrix, as well as the 5th and 95th percentile values, for each of the same QE/non-QE periods we've looked at.

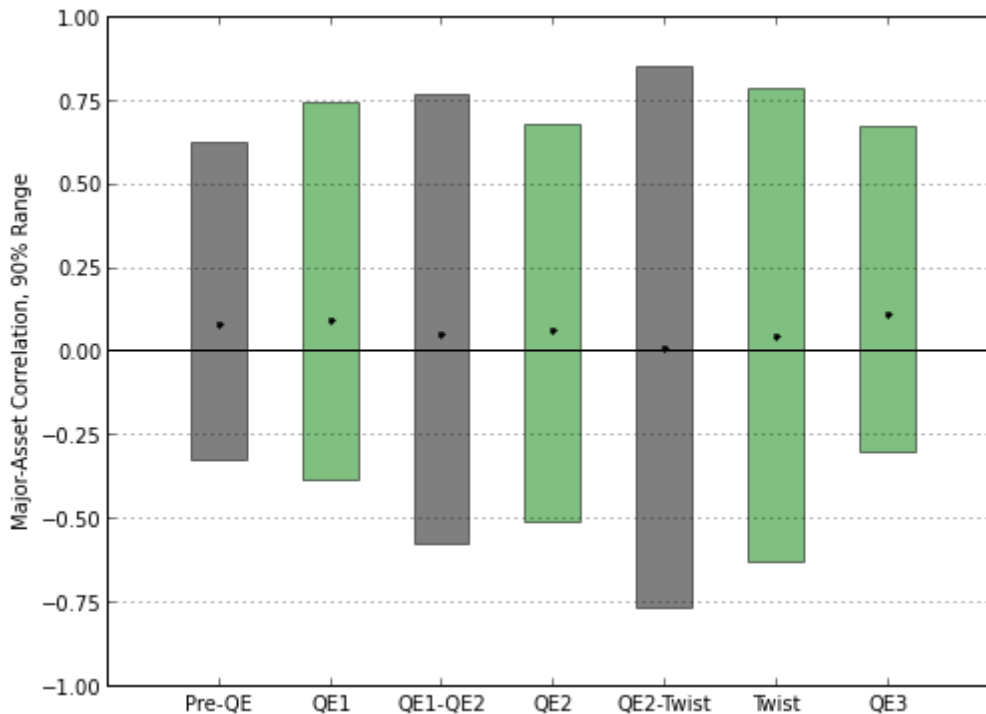


Figure 8: Major Market Correlations during QE phases

It is not at all clear that the correlations have materially changed during the QE periods as a whole. Higher correlations can't be blamed for recent poor CTA performance, even if CTA's do tend to underperform when correlations are low. (Shameless plug: systematic macro models may help to smooth out CTA performance across correlation regimes regardless of whether QE changes correlations--correlations do change!)

There is also an argument that the liquidity created by Fed policy has dampened volatility, and that this lower volatility is what has harmed CTA returns--after all, CTA's are usually considered to be "long vol." Whether decreasing volatilities can explain poor CTA performance can be examined using the volatility component of this same covariance matrix. Figures 9 & 10 compare the volatilities from the covariance matrix to their one-year rolling average to determine whether the overall volatility is high or low (so a value of "2" indicates that the vol for that period was twice its one-year rolling average value).

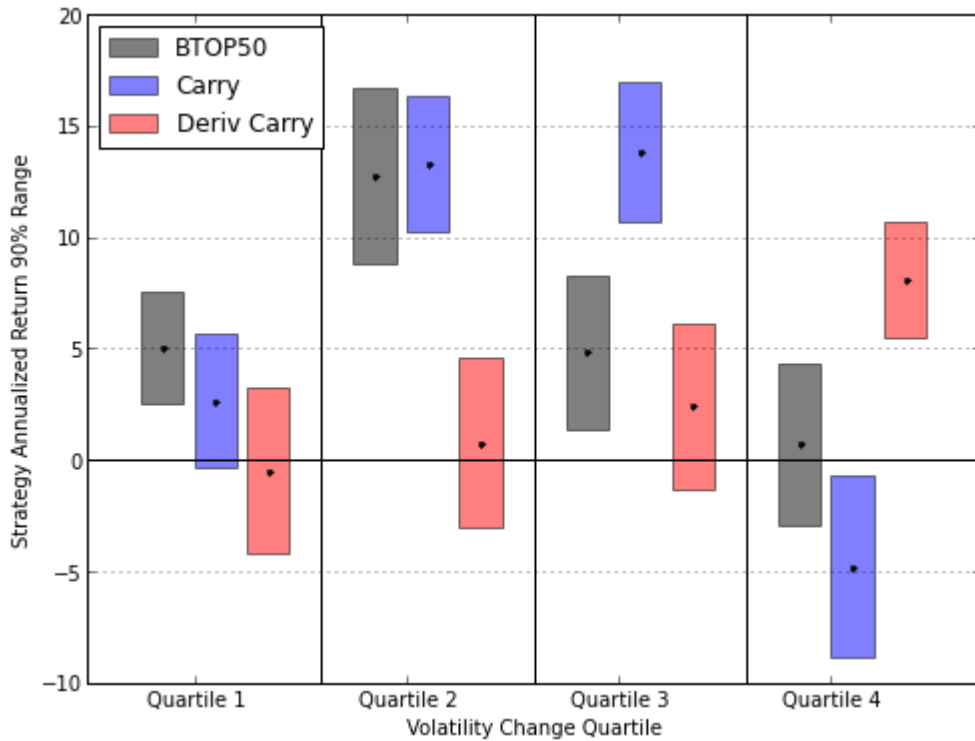


Figure 9: Strategy Performance during Volatility Change Quartiles

CTA's tend to underperform when vol is increasing (the highest quartile), as does carry; whereas the "derivative of carry" model tends to perform best when vol is increasing. Note that, although in some sense trend is "long vol," in fact, a reversal of a trend is usually accompanied by a spike in vol.

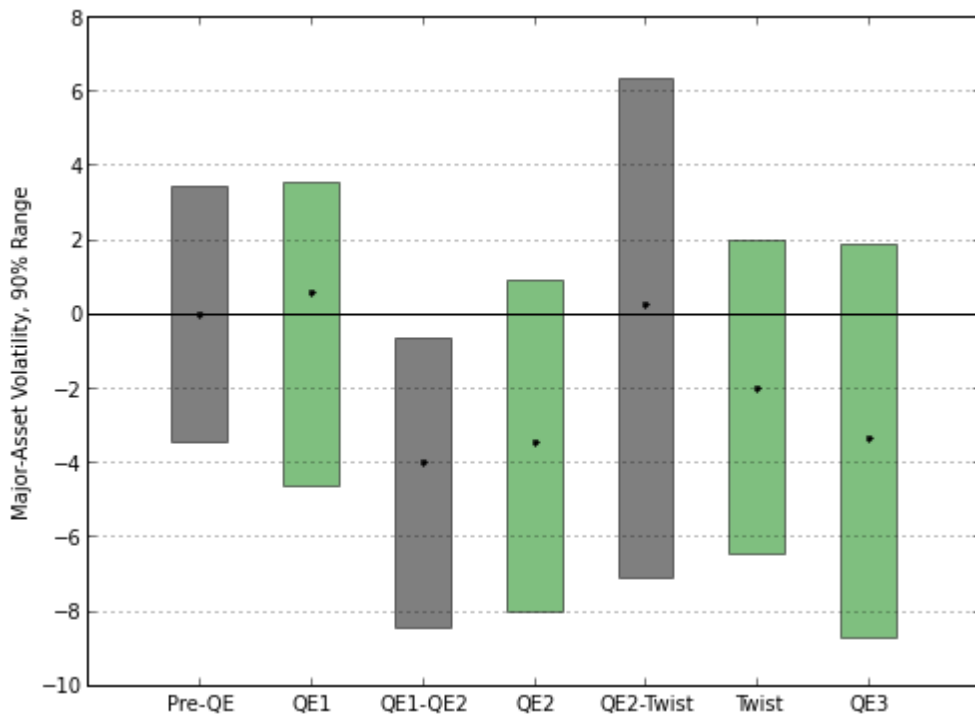


Figure 10: Major-Market Volatility during QE Phases

Generally, in fact, we have seen vols decline during QE; but this has not resulted in strong returns. We can conclude from this analysis that including macro strategies may help to smooth CTA returns across volatility regimes, but it does not seem that it is the drop in volatility itself that is responsible for weak CTA returns during QE.

Conclusion

We have found that, though CTA returns do show some dependence on volatility and correlations, these dependences do not explain the poor CTA performance during QE. Rather, the weak performance is more likely due to the squashed yields and interrupted information flow from yields to other asset classes that have resulted from zero interest rate policy and QE.

Does this provide any guidance for the future? In the near term, at least, the Fed has already begun tapering. Volatilities are increasing in 2014, especially among riskier assets like emerging markets and equities, in large part because of the tapering. It is a certainty that volatilities will increase from the current unusually low values, likely as new trends arise. Correlations have also begun declining, which should be good for CTA performance. Yields may remain low for a little while longer, but eventually they also will increase--indeed, the latter half of 2013 has already seen yields increase at longer maturities and there is talk of ending zero interest rate policy within the next year. This bodes well for CTA performance. In the meantime, diversifying a CTA exposure to include systematic macro strategies may help to smooth out performance across volatility and correlation regimes.

Endnotes

[1] Bank of England QE Program:

<http://www.bankofengland.co.uk/monetarypolicy/Pages/qe/default.aspx>