A Swap Spread Puzzle and Some Thoughts on This Time Being Different
By JM
January 30, 2010

This article has two weekend brainteasers. I don't understand their significance fully. I know that human beings create beautiful delicate architectures to manage risk and they work imperfectly. Whether the motive is extinction avoidance, or to build a heaven out of hell, or eros playing off logos; creativity is the reason for beings. I enjoy studying the archaeology of risk mitigation.

Remember volatility first cracked a smile after October 1987, because sellers of equity puts became more afraid of jumps than they were before. Smiles and skews endure to *this day*, as classical tribute to persistence.

My point is that there are times *when it really is different*. This may be one of those times. Further, I'm not sure how to interpret these new things. Here are two open questions for the weekend related to some artifacts I found.

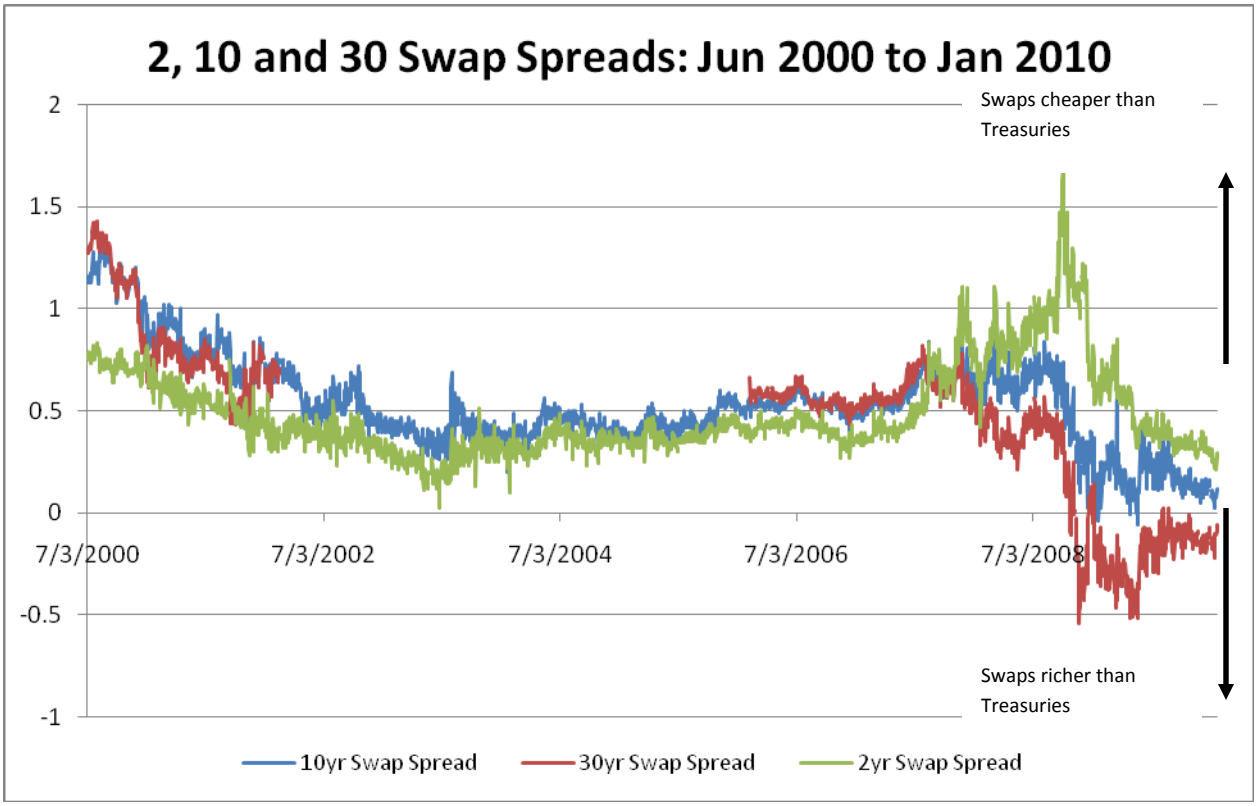
The Swap Spread Cross

First some background. The swap spread is the difference between treasury strips and same duration interest rate swaps. Because of the counterparty risk associated with the swap, swaps have a higher yield than treasuries.

Since October-November 2008, the 30 year swap spread is now consistently negative, even as the creditworthiness of the issuing banks are hosed. If anything the spread should widen to compensate for the increased credit risk, no?

This isn't the open question. Such behavior simply means that we live in a liquidity desert, and swaps are a liquidity-efficient vehicle to achieve nominal interest rate exposure. Thirty years is a long time to lock up capital, and liquidity premium trumps everything in a financial desert.

Here's the problem. Swap spreads of longer maturity should possess higher yield than shorter maturity swaps. But spreads on 2 yr swaps are much higher than 10 and 30 yr swaps from October-November 2008 to this day. To my knowledge, this is entirely new.



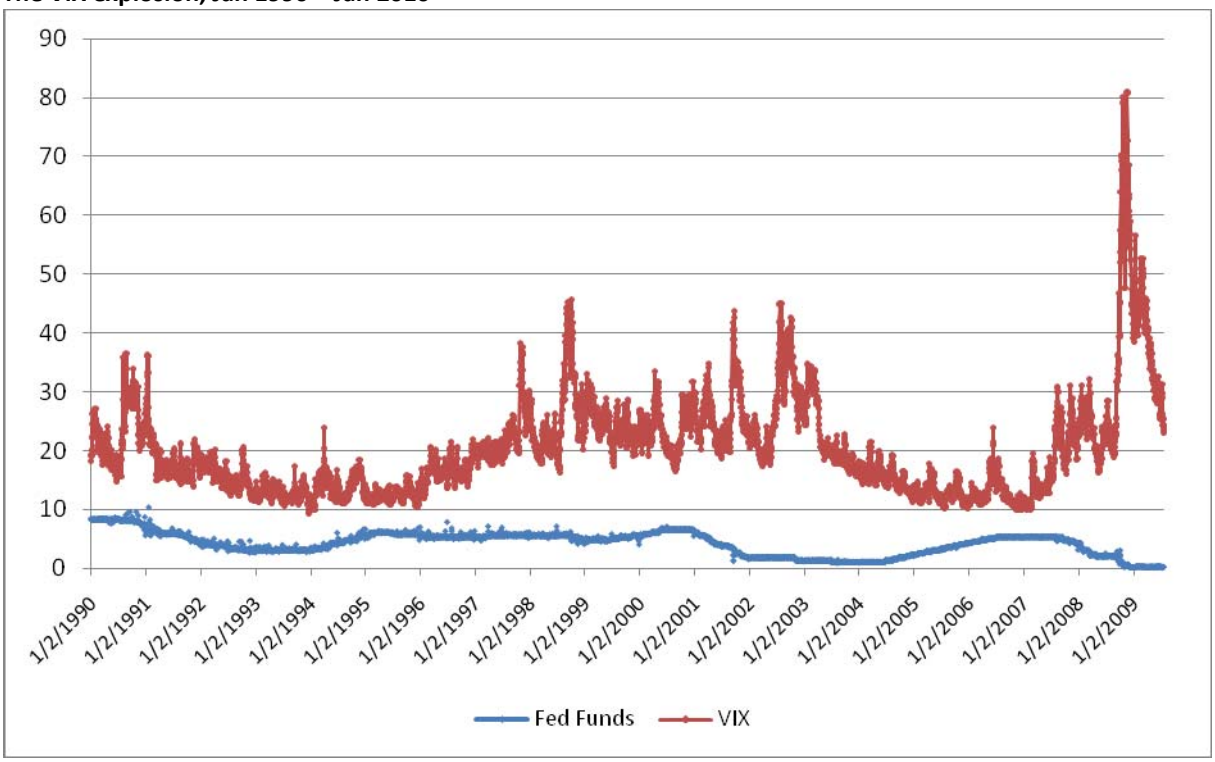
So why have 2 and 10 yr swap spreads crossed with such persistence?

Interest rate expectations affect both long-term swap rates and long-term bond yields. Expectations of higher (or lower) rates generally result in higher (or lower) long-term swap rates as well as higher long-term bond yields. Because of this, the net effect on the differential between the swap curve and the treasury yield curve should be tightly correlated give or take a little. In other words, they should be in synchronicity.

Volatility Champagne Supernova

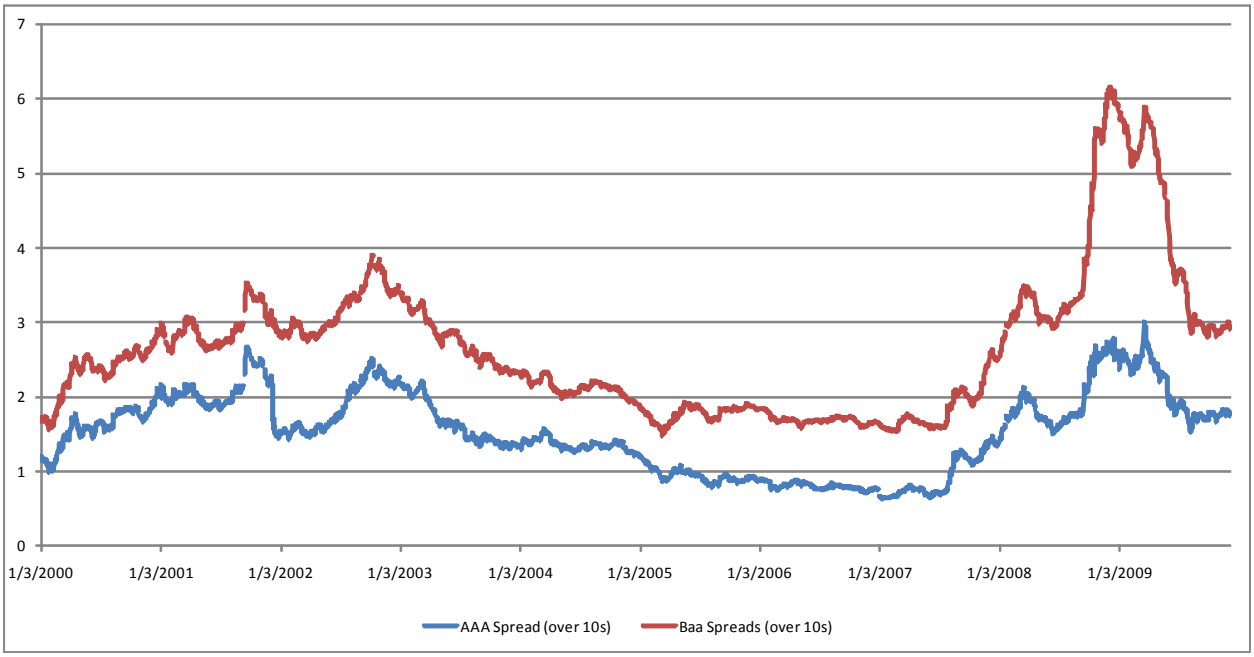
Everybody knows VIX went nuts late 2008-early 2009. Residual signatures still exist as a result of the volatility explosion (VIX, local vol, stochastic vol, implied vol curves and surfaces, et al), and they contain a message system evolution.

The VIX explosion, Jan 1990 – Jan 2010



So what does the chart say? Uncertainty abounds. But also something disturbing and unique just happened. The system itself doubted itself, and I don't think that is going to go away.

This is not an issue of over-complex products never seen before like credit default swaps or interest rate derivatives. The biggest risks have been with us for centuries. Illiquid C-rated bonds, or a deeply out of money call, or even an index of Baa investment grade bonds: just look at that all-kinds-of-crazy spread. Or is it?



When volatility is high, the question of valuation is the hard one, because of what illiquidity does to valuations. The market value of illiquid assets often cannot be known with any degree of certainty. So quants get hired to build models that associate a value to these instruments for mark-to-market purposes.

If models work well, mark-to-model value and the mark-to-market value will coincide within specified tolerance. However, more often than not, models can only satisfice by approaching a "fundamental value" based on future cash flows or future supply and demand. Not the price of the asset if sold on the market in real time. Such models work well enough until the future is an altered state, correlation across asset classes pick up, and well, VIX blows up.

This isn't an attack on mathematics or models or Goldman Sachs thinking they are smarter than the market. The only reason for a trade on Main Street or Wall Street is that the hot-shot (said with affection) thinks the market price isn't right. Indeed, market prices are at times way off and arbitrage-worthy. Investors require a premium for the risks they take trying to beat the market, and these risks evolve randomly over time. So there is no guarantee that today's model will work tomorrow. Current calibration may fit today's prices well, but it may work horribly at fitting tomorrow's price.

The point is that desert-like liquidity conditions make volatility unstable and valuations difficult to arrive at to say the least. Worse, it has made extreme points of the financial system much more synchronized than we've seen in the last twenty years.

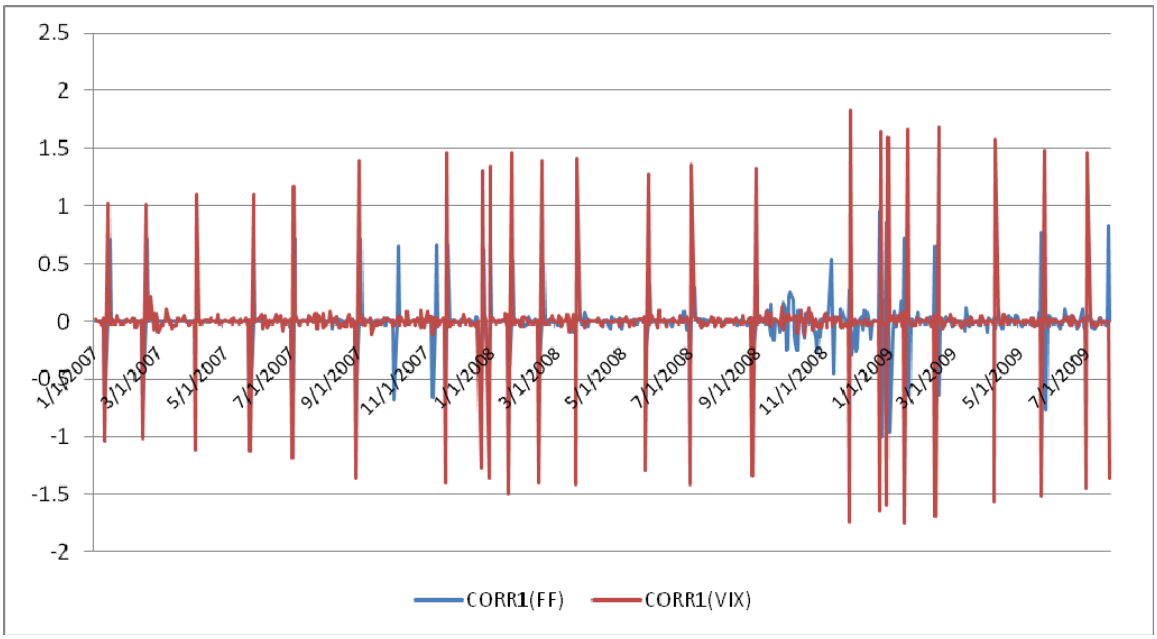
It is nothing new that worsening conditions at the core of the financial system (inter-bank market) disintegrate valuations at the periphery (equity values). But the data suggests that in turn, *equity meltdowns crush the financial system in a negative feedback loop.* Equity market valuations are more tightly coupled to the core than ever before. This synchronicity also implies that once standard harbingers of equity market shipwrecks won't work anymore. Collapses will come all at once without warning signals.

Some facts gleaned from the data:

- From 1990 to 2006 (conditions of easy liquidity), VIX didn't predict the Fed funds rate in the least, but the Fed Funds rate did impact VIX to a marginal degree. The well-known story.
- Post credit-crunch, the landscape is very different. Changes in the Fed Funds rate have a much stronger impact than before, but VIX impacts Fed Funds in the extreme. This is unprecedented from my perspective.

It is pretty common knowledge that when correlations are tight across asset classes, the risk of a melt-down is higher. The second open question: What are the implications of a whole financial system being synchronized?

Perhaps a heart attack:



Model Appendicitis and Some Further Thoughts

So here's how I quantify the evolution of VIX. I tested for Granger "causality" using twenty years worth of monthly VIX and Fed Funds data. I used maximized VAR model with three lags (quarterly structure) to determine if changes in the Fed Funds rate predict changes in VIX. The point is to determine the relation between what lies close to the core of the financial system, and a measure of complacency or melt-down at the periphery of the financial system.

I didn't use a GARCH or other conditional variance model because they require a recalibration of the conditional parameters to get real bang for the buck, and as I'm looking at VIX evolution, it is not the point. I didn't waste time optimizing the lag structure, because it is often just over-fitting data. Missing values were filled by interpolation. The VAR used differenced data.

Granger causality identifies how these two opposite poles interact over time by 1) determining if a change in Fed funds predicts a change in VIX, and 2) if a change in VIX does *not* cause a change in Fed Funds. Note that a smaller $Pr > \chi^2$ number means a more significant causality effect.

1990-2006

Granger-Causality Wald Test			
Test	DF	Chi-Square	Pr > ChiSq
VIX -> Fed Funds	1	0.11	0.7367
Lag(VIX) -> Fed Funds	1	0.36	0.5501
Lag2(VIX) -> Fed Funds	1	0.14	0.7117
Lag3(VIX) -> Fed Funds	1	0.5	0.4786

1990-2006

Granger-Causality Wald Test			
Test	DF	Chi-Square	Pr > ChiSq
Fed Funds -> VIX	1	0.92	0.3378
Lag(Fed Funds) -> VIX	1	0.99	0.3202
Lag2(Fed Funds) -> VIX	1	0.77	0.3802
Lag3(Fed Funds) -> VIX	1	1.41	0.2346

2007-2009

Granger-Causality Wald Test			
Test	DF	Chi-Square	Pr > ChiSq
VIX -> Fed Funds	1	4.55	0.0329
Lag(VIX) -> Fed Funds	1	5.56	0.0184
Lag2(VIX) -> Fed Funds	1	9.29	0.0023
Lag3(VIX) -> Fed Funds	1	6.26	0.0123

2007-2009

Granger-Causality Wald Test			
Test	DF	Chi-Square	Pr > ChiSq
Fed Funds -> VIX	1	2.68	0.1016
Lag(Fed Funds) -> VIX	1	3.51	0.0609
Lag2(Fed Funds) -> VIX	1	3.67	0.0555
Lag3(Fed Funds) -> VIX	1	3.5	0.0615