RATELAB

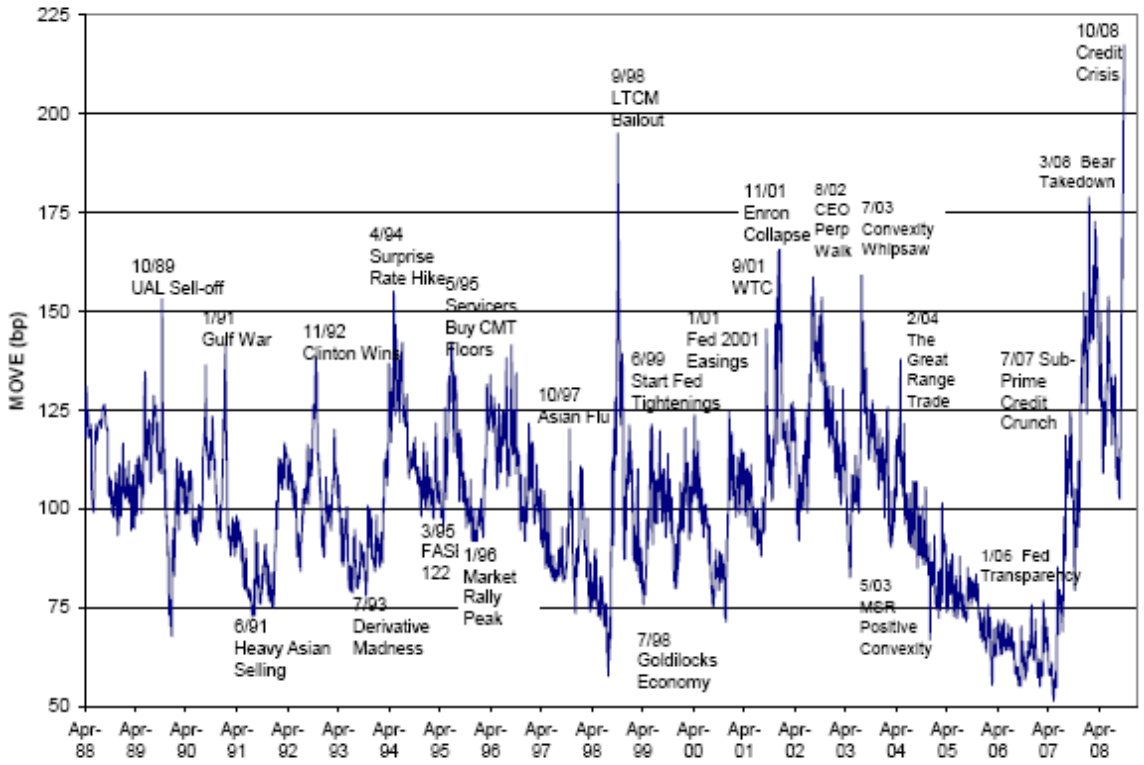
MERRILL LYNCH US RATES STRATEGY

Value Concepts from the ML Trading Desk

Implied Volatility: A Measurement of Fear

The chart below should look familiar to all - It is Merrill Lynch's MOVE Index. It is the blended Implied Normal Volatility for constant one-month at-the-money options on USTreasuries. It's the single best source for the history of short-dated Implied Volatility because of both the length and stability of the data set.

The MOVE index data is available on Bloomberg at: {MOVE Index gp <go>}



We particularly like the chart above as it nicely aligns the peaks and troughs of the MOVE with the critical market events of the time. (The last point is the new all-time record high of 217 set on October 6, 2008.)

With respect to the MOVE, we would like to make two broad observations. First, the "basic range" of the MOVE is 80 to 125. Since this is a Normalized Volatility measure, that Implies a daily Treasury Rate volatility of roughly 5bps to 8bps. There have been highs and lows well beyond this range, but over time, 80 to 125 has captured most of the past twenty years.

Second, and more important, when the MOVE reaches the lower boundary of 80ish, it does not just rebound back to the middle of the range near 100; rather it usually explodes to 125 or beyond. We think this is because an ultra low level of 80 implies that market participants have discarded all risk concerns, specifically by avoiding the purchase of market insurance via options. This observation makes the current environment quite troubling. Usually, the MOVE would spend a few weeks at the lower boundary before launching skyward. And after that peak, the MOVE would somewhat quickly return to the "basic range". In 1998, the MOVE spent a mere 20 trading days under 70 before LTCM imploded and then jumped to a record 198. After that record was set, the MOVE quickly declined back into the range.

In the current situation, the MOVE ranged in the mid-60s for the better part of 16 months (February 2005 to June 2006). We view this as a measure of how long risk was accumulated, often through leverage. This would imply that the MOVE may stay elevated for quite awhile since it should take an equal amount of time to unwind the risk.

On October 6, 2008, the MOVE set a new record high of 217. This could be viewed as the market's vote that Treasury rates will have a daily change of almost 14bps every day for the next month. It also implies that options users expect Treasury rates to be about 50bps higher or lower one month hence, just after the National election.

The last time financial markets were in such disarray was October 19, 1987, also known as "Black Monday". It was on this date that the Dow had its largest single day percentage loss ever of 22%. So the question we have been asked: When was Implied Volatility higher ?

Since the MOVE was not created until mid-1988, we need to go to another data source, namely the Chicago Board of Trade options on Futures contracts where trading started in 1983. However, there are many problems with this data that require some significant parsing.

Issues with CBOT Options

One would initially believe that the cleanest source of data for Implied Rate Volatility would be on the futures exchange. Not only is this the earliest data series, but also it uses publicly disclosed settlement prices. However, there are a few subtle issues that "muddy" the view.

1) The implied volatility data is for the at-the-money "rolling front contract". This is especially problematic for the older data in the series. In the early years, there were only single quarterly expiries (no monthly serial options). As such, the front option could be a one month to three month expiry. Since the slope of one month to three months is often as wide as 15%, date matters. *This was the key innovation of the MOVE, to use a constant one month expiry.*
2) The structure of the futures contract allows for bonds as short as 6.5 years or as long as 10 years to be deliverable into the 10 year contract. The Bond contract allows an even wider range of deliveries – 15 years to 30 years. The raw data source is stored as Implied Price Volatility. This would be fine if we knew which bond was the CTD (cheapest to deliver). This is imperative since Price Volatility is proportional to a bond's Adjusted Duration. Without knowing whether the longest or shortest bond was deliverable, we cannot properly analyze Implied Price Volatility. *This is why the MOVE uses only constant on-the-run Treasuries.*
3) As noted, the data is stored as Implied Price Volatility. Options calculators use Implied Volatility to create the distribution of prices or rates to output a discounted present value for the option. So, a 10% Price Volatility on an 80-dollar future creates a very different value than a 10% Price Volatility on a 120-dollar future. This must be accounted for. *This is why the MOVE uses a blend of Normalized Volatilities.*
4) Until 1998, delivery calculations were based upon an 8% coupon security. After 1998, the contract's specifications were changed to a 6% coupon. This by itself is not a problem, however, since the data is stored simply as Implied Price Volatility, the large jump in the futures price must be accounted for.
5) The shape of the yield curve and the overall yield level will dictate which security is CTD. When the curve is steep or near par, the "delivery option" becomes quite valuable. This will show up in both the dollar price of the futures contract as well as its Price Volatility. Consequently, some of the movement in the raw data could be solely a function of CTD shifts and not of changes in overall Implied Volatility levels.

Enough with the Caveats

Now that we have disclaimed all possible avenues of error, below we place pencil to paper. This should help contextualize the relative fear of '87 vs. '08.

Analysis

TY 10yr

Date	Price	Yield	Price Vol	Yield Vol	Normal Vol
10/16/1987	86-00	10.3%	11.3%	16.9%	175
10/28/1987	92-08	9.2%	16.3%	26.7%	246
11/10/1987	94-12	8.9%	12.0%	20.4%	180
10/7/2008	117-16	3.2%	12.0%	58.6%	190

US 30yr

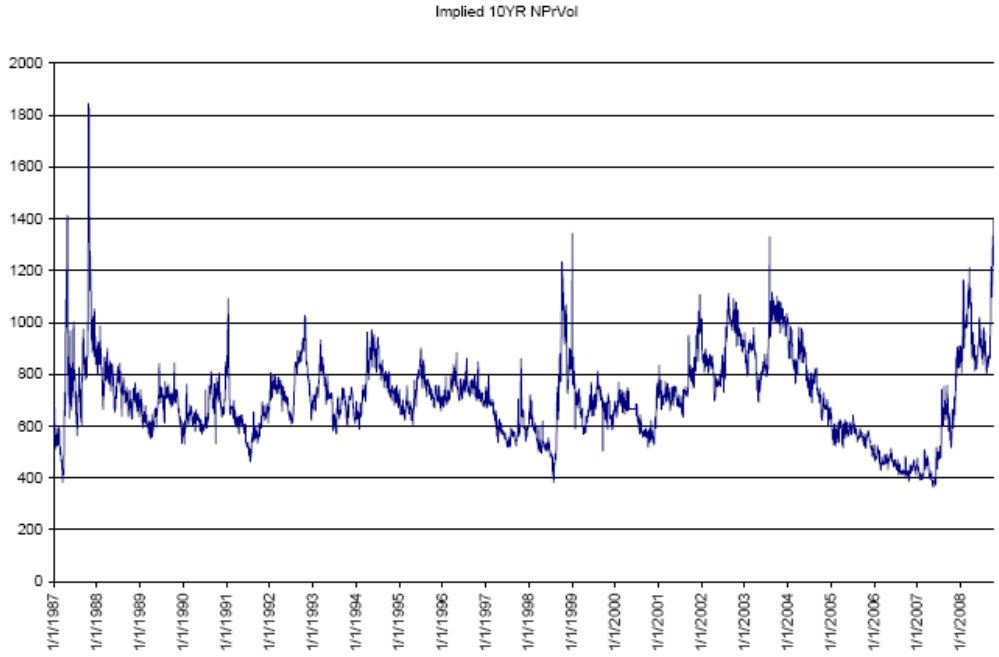
Date	Price	Yield	Price Vol	Yield Vol	Normal Vol
10/16/1987	78-00	10.4%	16.5%	16.8%	176
10/28/1987	86-08	9.4%	23.0%	24.0%	227
11/10/1987	89-12	9.1%	18.0%	19.0%	173
10/7/2008	121-00	4.1%	16.5%	38.7%	157

The prices of the futures contracts and the Implied Price Vols are correct as given in the database. Since the dollar prices of the futures were well below par, we assumed the longest security in the basket was the cheapest-to-deliver. We then used the 8% coupon on the contract to create the yield of the C-T-D. Once that was done, the Adjusted Duration was computed. The Implied Yield Vol and Normal Vol can then be calculated via the standard formula. The dates chosen were representative of the "before", "high", and soon "afterwards". However, we did NOT use the absolute high in the database. This is because on the days immediately after the "crash", the futures contracts hit their "limit" and stopped trading. Since the limit is only on the price change, options that had moved less than the limit continued to trade. As such, the closing option price may not have aligned properly with the official closing futures price and the stated Implied Vols become suspect.

Comments

Let's use the much more liquid and active Ten Year contract (TY) for analysis. Interestingly enough, the current Price Vol of 12% matches the 1987 "before and after" level while it's Normal Vol of 190 is slightly higher. However, the current Yield Vol of 58.6% is vastly higher than even the peak 1987 Vol of nearly 27%. This highlights the most curious aspect of this analysis. In 1987, the starting yield level was about 10.25%. This meant that rates had the potential to make truly massive moves. Presently, the Yield of the CTD is 3.20%. This begs the question: Exactly how low can rates go ? Rates declined by almost 150bps in three weeks in 1987, could that happen now with a starting level of 3.20% ? This is why the Yield Vol is so high. Recall that Normal Vol is nothing more than Yield Vol times Yield. With rates so much lower now, a similar Normal Vol creates a huge Yield Vol. As such, Vols should have been much higher in 1987 to allow for the fact that there was the potential for huge moves. Ignoring the tiny detail that T-Bills recently traded above Par, negative rates seem quite unlikely for longer-term bonds, consequently one might conclude that effective Implied Vols are actually higher now.

The Long View



In the charts above and below, we have tried to "normalize" for many of the caveats previously discussed. We have created what we call Implied Normal

Price Volatility. We have simply multiplied the price of the futures contract times the closing Price Volatility. In the same way the Normal Yield Vol will describe a single annual standard deviation, our Normal Price Vol will do the same. To remind you, a Normal Yield Vol of 100 on a bond that yields 5% would imply that there is a 68% probability that the yield of the bond will be between 4% and 6% a year from now. (Divided by 15.9, the square root of the number of trading days per year, creates the often quoted Implied Daily Volatility). In the above chart, a Normal Price Vol of 800 would mean that a bond priced at par would close the year between 92 and 108 with a 68% probability. (If that bond had a Dv01 of about 8.0, that would equate to a 100 Normal Yield Vol, get it ?)

These two charts are the longest views we have of Implied Volatility on Interest rates. The most recent closes have the TY contract at about 1400 and the US contract at about 2000. Even during 1987, we only have a few closes above these levels. So, are Vols higher now, we will let you be the judge of that.