The Framing of the Skew

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The dream of winning a Powerball drawing is a concept that is always fun to consider. Visions of islands owned and staff doing our cooking and cleaning are too seductive to resist, despite the statistical unlikelihood of any one of us actually becoming the winner. We are all keenly aware that winning a lottery ticket is the definition of a tail risk event. What is lost in these mental meanderings is how profitable the business of selling lottery tickets actually is to the seller. The only business that is more profitable than selling lottery tickets is conducting a lottery in which someone else is responsible for paying the winner.

In retrospect, this scenario is eerily similar to the role of the proprietary trader at a bank prior to the Global Financial Crises (GFC). Compensation was calculated primarily on number of tickets the trader sold and at what price. There was no regard for what the banks', and, arguably, the American taxpayers', exposure was as traders received their payoffs. Tail risk puts and credit default swaps on sub-prime loans were typical assets sold by these banks' prop traders. This was epitomized by the tale of Boaz Weinstein as described in the Wall Street Journal in 2009.

> *As a chess master, poker and blackjack devotee and top trader at Deutsche Bank AG, Mr. Weinstein made big bets using complex financial instruments, generating large returns for the bank and about $40 million in annual pay for himself. But in 2008 the group he ran saddled the bank with $1.8 billion in losses, erasing more than two years of trading gains.*
>
> *Last month, Deutsche Bank shut down Mr. Weinstein's operation and wound down many of his positions. He left the bank this week, with plans to start a hedge fund.*[1]

The in-house portfolio manager's goal was to finish out the year minimizing losses and effectively hit the reset button on January 1st.

After the GFC, the government passed regulations curtailing what they considered "outsized" risk-taking by these federally insured institutions. Congress passed Dodd-Frank with the intention of reducing the risk culture at these institutions. The first part of the legislation, "The Volcker Rule," more or less eliminated bank prop trading, or, as we described above, "lottery ticket" selling. The second part of Dodd-Frank and the follow-on Basel III accomplished the goal of raising capital requirements on banks. The intended consequences of these regulations made the allocation of bank balance sheets a more difficult and expensive procedure.

1 Deutsche Bank Fallen Trader Left Behind $1.8 Billion Hole, Wall Street Journal, Scott Peterson, February 6, 2009. http://www.wsj.com/articles/SB123387976335254731

The end effect of these two rules and the unintended consequence is that these institutions have gone from being the biggest sellers of tail risk insurance (the bank prop traders) to becoming the largest consumers of this insurance. This is all in an effort to shore up the banks' balance sheet. This has manifested itself in the equity derivative markets in a phenomenon we refer to as "steepening of skew." This steepening of skew has caused the cost of equity portfolio insurance to rise dramatically over the last five years. The goal of this paper is to further consider the causes of this phenomenon and to evaluate its impact on market structure.

WHAT IS SKEW?

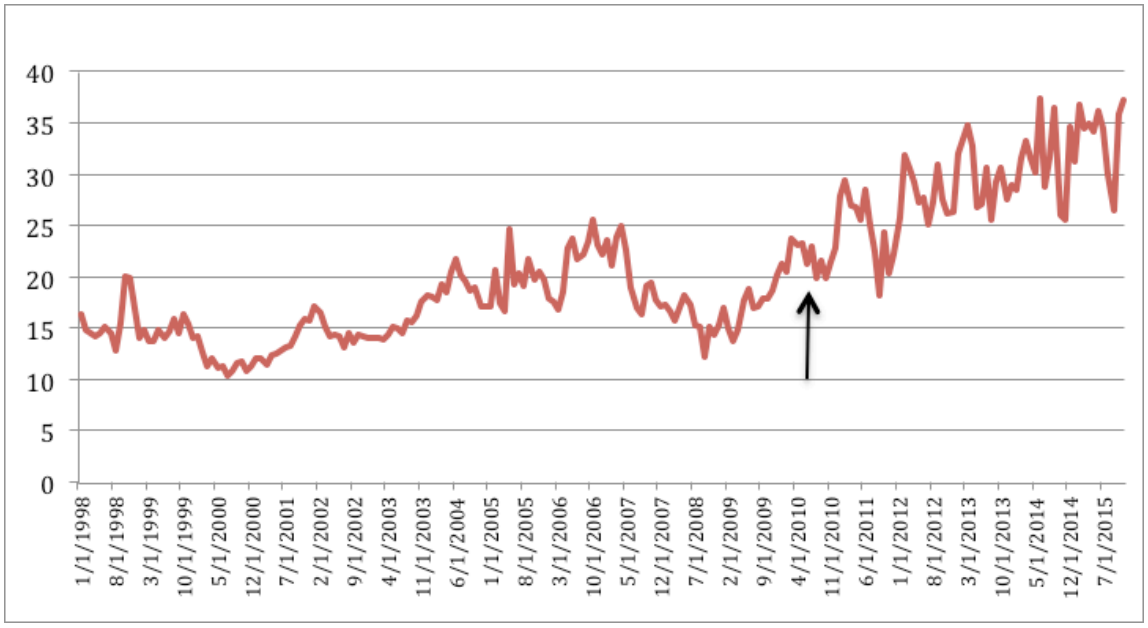
When people think about how expensive options are, they tend to focus on the level of the Volatility Index (VIX)[2] or the volatility of the options market. The CBOE Volatility Index® (VIX® Index) is considered by many to be the world's premier index of equity market volatility. The VIX Index is based on real-time prices of options on the S&P 500® Index (SPX) and is designed to reflect investors' consensus view of future (30-day) expected stock market volatility. The VIX Index is often referred to as the market's "fear gauge." Of equal importance but often overlooked as affecting options pricing is the skew. In simple terms, this can be described as the difference between the price of a downside put compared to the price of an upside call.

In April of 2009, Dennis Davitt and I worked at Credit Suisse with Ed Tom (current Head of Derivative Strategy at CS) and launched the Credit Suisse Fear Barometer (CSFB Index).[3] The Credit Suisse Fear Barometer was designed to measure what skew is in its most elementary form and to act as a complement to the VIX. The CSFB systematically measures current investment sentiment by pricing a 3-month, zero-cost collar on the SPX. For example, if an investor sold a 10% out-of-the-money (OTM) call, what percentage of the OTM put can that investor afford to buy to create a costless collar? To clarify, at the start of 2016, selling a 10% OTM call generated $3.25. At the same time, that $3.25 would allow an investor to purchase a 37.1% OTM put.

2 VIX Index and Volatility, CBOE Website, http://www.cboe.com/micro/vix-and-volatility.aspx

3 Credit Suisse Fear Barometer – A New Way to Quantify Fear, Barron's, Steven M. Sears April 13, 2009, http://www.barrons.com/articles/SB123940690160209919

CREDIT SUISSE FEAR BAROMETER (1998 – CURRENT)



The chart clearly shows that the cost of buying a put on the S&P 500 has increased dramatically since the financial crisis. The average of the CSFB prior to Dodd-Frank was around 16.5. Post Dodd-Frank, the average has been an elevated 28.5. One might attribute the increase to an elevation of "fear" in the market of another possible economic meltdown. At Harvest, we believe the reason for this can be more readily attributed to structural market issues created by changing bank regulation. We will attempt to show how Dodd-Frank, the Volcker Rule, and Basel III have affected the equity options market.

WHY DOES SKEW EXIST?

Let's first review why skew exists and when it originated. As Sheldon Natenberg shows in "Option Volatility and Pricing"[4], some components of option theory can be explained without having a PhD in Statistics.

The history of skew has some interesting roots. Skew did not exist until the 1987 market crash. All young options traders are indoctrinated with amazing stories about the amount of money made and lost on Black Monday. The long and short of it is if you were long puts, you made enough money in one day to retire. If you were short puts, you were forced to sell your house and were looking for a new career. This outcome forced traders to rethink the value of downside puts. Voila: the skew was invented.

4 Option Volatility and Pricing, Sheldon Natenberg, Probus Publishing Company, 1994

With any mathematical model in finance, assumptions are required and these assumptions come with imperfections. No financial model is perfect, including Black-Scholes, the most widely accepted pricing model for options. Black-Scholes thinks about option pricing as a physicist thinks about a particle's movement in space. Though a particle in space moves randomly, it tends to follow what are referred to as "normal characteristics." Its movements fall under a normal distribution. Black-Scholes assumes a log normal distribution for the movement of stock prices. This tends to be true under normal market conditions. During times of extreme stress, however, emotion can have an outsized impact on decision making and this curve becomes far from "normal." This "tail" of the normal distribution was coined a "Black Swan" event by Nassim Taleb[5] during the financial crisis. Black-Scholes and the majority of financial models do not readily take into account this tail risk event. A slight modification of the model, therefore, is required and it can be supplemented with the concept of skew. From a mathematical perspective, skew is a solution to help compensate for the inefficiencies of the Black-Scholes model.

The other reason for skew is simply supply and demand related. People have a tendency to overwrite portfolios by selling calls and hedge portfolios by buying puts. If an overabundance of upside calls is sold in the market, the price falls. So too, is the opposite. If an overabundance of downside puts is purchased, the price rises. So skew, like all assets, is ultimately subject to the laws of supply and demand.

WHO IS BUYING PUTS NOW?

We previously discussed that prior to the 1987 crash, upside calls and downside puts traded at essentially the same level, or, said differently, skew was flat. After the crash, people started making puts marginally more expensive as they came to recognize the value of downside protection. The financial crisis made things even more interesting. Rather, the changing of government regulation or 'too big to fail' did.

We have described the impact that equity market participants have had on skew, but recently we have noticed that our friends from credit have started to have a growing impact on the equity index options market as well. While the equity prop trader existence we described may be viewed as somewhat of a wild west, it possibly pales in comparison to some of the exotic instruments seen in credit (weapons of mass destruction). In fact, derivatives on derivatives were created with the broad assumption that "it all can't go bad at the same time." The GFC proved them wrong. Credit, too, experienced its 1987 crash during the financial crisis. Fixed Income traders learned what it felt like to have sold flat skew. They also learned that one should not become too confident in their confidence intervals.

Post financial crisis, Congress started to investigate the impact proprietary trading could have on possible bank failures. Their solution was Dodd-Frank. The first conclusion they came to was bank prop trading was bad (Volcker rule). If people are incentivized to sell tail insurance, or paid to take a lot of risk with minimal consequence, banks should be forced to close those businesses for the good of the financial system. As a result, the largest sellers of tail risk (puts) were put out of business and the market supply of cheap insurance disappeared. In the article regarding the aforementioned Mr. Weinstein, Deutsche Bank CEO, Josef Ackermann, addressed this issue.

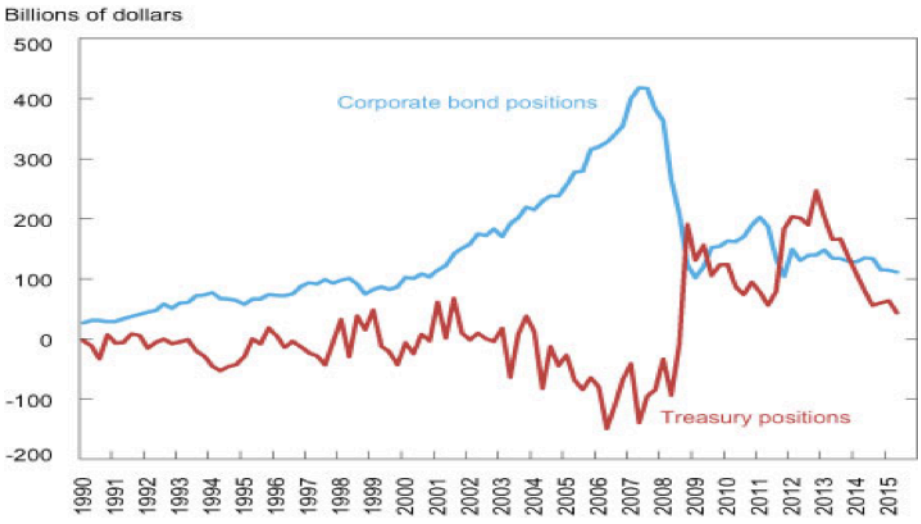
5 The Black Swan, Nassim Taleb, Random House, 2007

Mr. Ackermann, speaking to analysts on Thursday, said that to earn a $1.5 billion profit from proprietary trading the bank needed to risk several times that amount in capital. "You can easily lose two to three billion. That's what we have seen in 2008 and something we don't want to see again"[6]

The second part of Dodd-Frank and Basel III require banks to carry a much larger balance sheet and fewer risk-weighted assets. This is one of the main reasons banks are moving away from credit and fixed income trading - it puts too much regulatory stress on the banks' balance sheets.

As the chart from The Federal Reserve clearly shows, the amount of corporate bonds held by Securities Brokers and Dealers has fallen dramatically since the crisis and is showing no signs of rebounding. The peak was registered at the end of the 2nd quarter of 2007 at $470b and through the 3rd quarter of 2015 this amount fell to $96B[7]. This is even more striking when viewed in the context of the total size of the market. According to the Securities Industry and Financial Markets Association (SIFMA), the total amount of corporate debt outstanding at the end of 2007 (near the peak of financial institution ownership) was $5,254B compared to the end of the third quarter in 2015 when the issues outstanding totaled $8,247B.[8]

CORPORATE BOND AND TREASURY POSITIONS HAVE BEEN NEGATIVELY CORRELATED SINCE 2000



Source: Federal Reserve Board, "Financial Accounts of the United States."
Notes: Corporate bond positions include domestic and foreign bonds held in the United States by securities broker-dealers. Treasury positions include all U.S. Treasury securities.

6 Deutsche Bank Fallen Trader Left Behind $1.8 Billion Hole, Wall Street Journal, Scott Peterson, February 6, 2009. http://www.wsj.com/articles/SB123387976335254731

7 Federal Reserve Board, "Financial Accounts of United States." Q3/2007 and Q3/2015 Releases

8 Securities Industry and Financial Markets Association www.sifma.org/research/statistics.aspx

NOW THINGS GET INTERESTING

Government regulators have started going through banks' risk-weighted assets with a fine-toothed comb. This new regulatory regime is called the Federal Reserve's Comprehensive Capital Analysis & Review, or CCAR. CCAR started performing stress tests on how one's risk assets might behave in another financial crisis. A favorite tool to measure risk is the Value at Risk or VaR model. VaR was enthusiastically embraced by J.P. Morgan as a tool to consolidate the banks' portfolio risk analysis in the 90s. Though it does a decent job of summarizing the overall risk of a portfolio during normal market action, this is not the case during times of stress.

This brings us back to our Black-Scholes formula. VaR makes the same mathematical assumptions as Black-Scholes. In other words, it has difficulty pricing tail events correctly. The reliance on Black-Scholes assumptions, VaR and other risk models was one of the major contributing factors to the financial crisis of 2008. Risk managers now understand that in periods of dramatic stress, historic correlations should be thrown out the window. A "Correlation One Event', when credit moves much the same way as equities, is now a household term. Simultaneously, we have observed that tail pricing in many credit-related products is at a premium. This has made finding liquid, economical hedges in that asset class much more difficult.

While at Credit Suisse, during the financial crisis, one of my responsibilities was managing equity derivative risk on US banks and insurance stocks. At this time I was introduced to a trading strategy commonly referred to as capital structure arbitrage. In its simplest form, capital structure arbitrage looks at how assets in the capital structure behave during a bankruptcy and attempts to profit from the imbalance. If the investor owns the senior debt of a corporation and also owns a put on the equity of that corporation, they are "hedged" if the company happens to go bankrupt. The investor has a relatively inexpensive hedge for their bonds because the senior debt holders are higher on the capital structure than the equity holders and the put will appreciate as the debt loses value.

Similarly, buying equity index puts is the cheapest and most liquid way to hedge tail risk in a Correlation One Event. This realization, as we have outlined, has converted the biggest seller of tail risk into the biggest buyer. The combination of the banks' taking down risk through the elimination of prop trading and the requirement for them to hedge any potential tail risk on their books has led to the use of S&P 500 puts as an inexpensive and liquid tail risk hedge. Put buying, maybe more importantly, makes the regulators very happy. In our opinion, perhaps the largest buyer of SPX puts in the market has become banks' fixed income desks and/or risk departments and this put buying seems to be driven far more by a government mandate rather than a purchase driven by equity investor fears.

CONCLUSION

While the argument has been that skew and, therefore, the cost of portfolio insurance has gone up due to an increase in traditional equity portfolio hedging, we believe that is not the case. The regulatory environment has caused the banks to go from one of the largest sellers of puts into one of the largest buyers. Isn't it ironic that Dodd Frank, which was designed to safeguard investors, has ultimately led to an increase in the price of protection for many market participants? As expensive as portfolio insurance has become in terms of skew, ignoring this structural shift of who is buying, and why they are being forced to buy, is something a responsible investor needs to be aware of in today's ever changing market structure.