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# Impact of the Financial Crisis on Derivative Valuation

Samuel M. Berklacich  
sberkla1@utk.edu

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**Impact of the Financial Crisis on**  
**Derivative Valuation**

Sam Berklacich

## **INTRO**

The financial crisis of 2007 highlighted some tremendous flaws within the financial industry. In a little over a year, close to \$8 trillion was wiped out from the U.S. economy with significant ripples sent through out the global economy. The world's largest economy had fallen victim to one of the most exotic and complex of financial instruments in the global economy: derivatives. With a present day market valued over 5x the domestic GDP, financial derivatives still play a major role within the industry. Furthermore, a very significant portion of the derivatives market is traded "over-the-counter" with much less regulation. The derivatives market is still a significant player on the balance sheets of large financial institutions. As evident from the crisis, these institutions are pivotal factors to the health and vitality of our economy. Therefore, due to the immense size of the derivatives market and the vast influence of such instruments on our economy, serious reform, regulation, and risk evaluation was required to reign in the rampant market.

For this paper, I will be analyzing the impact of the liquidity/credit crisis on derivative valuation. At the beginning of the 21<sup>st</sup> century, derivatives were a relatively new financial asset with little regulation and oversight. A derivative, in essence, "derives" its value from some underlying asset. Derivatives can be structured on assets such as equities, equity indices, foreign exchange rates, as well as interest rates. The market for derivatives expanded drastically in the years preceding the financial crisis, with all major banks holding stake in the market. Derivatives can also be customized to the needs for specific deals. This unique

nature, coupled with minimal oversight, made derivatives a very appealing asset to financial institutions. The lack of regulation, however, created an immense amount of confusion surrounding the market for derivatives.

In addition to the lack of regulation, financial institutions were creating a variety of instruments that were connected to derivatives. Out of the asset-backed securities, banks created Collateralized Debt Obligations. Additionally, banks would sell insurance on their liabilities in the form of Credit Default Swaps, an instrument used to protect institutions from loan defaults. Liabilities were being packaged and dispersed through out the market, but the risk was never minimized. Banks became highly leveraged and dependent on the web of liabilities, with no one analyzing the effects of default or risk. Therefore, when the payments for asset-backed securities dried up, institutions found themselves with minimal capital to fulfill short-term obligations. The banks had repackaged and sold a majority of their assets, leaving their balance sheets occupied with toxic assets. When the fear of default became a reality, many financial institutions became wary of the credit quality of their counterparts. This created a hoarding mentality as institutions doubted the credibility of counterparties and the demand for liquidity spiked. LIBOR, the determinant rate for borrowing in the short-term market, is also used to discount future cash flow payments, ultimately calculating a present value in all derivatives positions. When banks began hoarding, rates at which they lent rose significantly and drastically affecting derivative valuations. For years, collateralized derivatives were discounted at the LIBOR rate when it was believed to be “risk-free.” Now, financial institutions see the flaw in this rate and are transitioning to a multi-curve

discount approach involving the Overnight-Indexed-Swap rates. Thus, I will be examining the impact of transitioning to OIS discounting on derivative valuation and the foreseeable effects on financial institutions.

### **Derivatives and the Financial Crisis**

The years leading up to the financial crisis were highlighted by the rise in asset-backed securities, collateralized debt obligations, and various other forms of exotic derivatives. The market for these financial instruments skyrocketed and quickly caught the attention of financial institutions. The largest player, mortgage-backed securities, is considered the most instrumental component in the financial crisis. In essence, banks began pooling loans of mortgages from all across the country and slicing them in to tranches to then be sold to investors. These assets were attractive due to high rate of return offered on the payment of mortgages and the seemingly endless supply of mortgages loans. At this point, the real estate market in the United States was posting gains year after year, fueled by Fed sponsored low-interest rates that spanned every corner of the domestic market. In this credit expansion, capital flowed to those in need and created an influx of mortgages as people sought to capitalize on the gains in the real estate market. A vicious cycle was created, littered with textbook definitions of agency problems as financial institutions, loan originators, and ratings agents all acted on personal interest. Additionally, banks began highly-leveraging their financial statements by creating collateralized debt obligations from the original mortgage-backed securities. Instead of mitigating risk, this financial asset increased risk exponentially as more and more tranches of mortgages were split-up, repackaged, and sold into

the marketplace. Banks became very leveraged without anyone ever noticing the environment that had been created. No one ever stopped to analyze the effects of risk of default from the mortgage payments and how ensuing impact. Furthermore, a majority of these trades were funded through various forms of collateral and no one stopped to analyze the effect of a shortage of collateral to margin-funded transactions. According to Markus Brunnermeier, due to highly leveraged transaction and reliance on short-term capital, “any reduction in lending would cause significant stress on the system” (Brunnermeier). Unbeknownst to the U.S. economy, a reduction in lending was imminent and would send the market into a downward spiral.

During August 2007, liquidity in the mortgage market was drying up rapidly with companies like Countrywide facing severe pressure to roll over commercial paper. In fact, Countrywide issued a write-down of almost \$11.5 billion due to the lack of funding. Analysts began reversing position on the stock, labeling the company with negative outlook. At the end of the week, shares of Countrywide had declined close to 15%, a 50% decline on the year. The shortage of liquidity in the market had made it near impossible to determine the fair value of mortgage-backed assets. In a recent study, the U.S. Government Pricing Agency estimated that up to 95% of all lower-rated tranches were impaired due to the sub-prime mortgages. Add such market uncertainty to spiking interest rates and determining fair value for asset-backed securities became near impossible. During the same time period, BNP Paribas suspended three investment funds with over \$2.2 billion assets between them – with “over 30% of all assets rated AA or higher” (GPO). The bank issued a

statement saying “the complete evaporation of liquidity in certain market segments has made it impossible to value certain assets,” regardless of their quality of credit rating (GPO). The liquidity evaporated because banks became wary of the credit standing of other institutions. In this time, many institutions had balance sheets comprised of subpar assets. With default becoming a very possible scenario, banks tightened lending standards to preserve capital. Between the months of May and August, the market for asset-backed commercial paper shrank from \$35 billion to \$4 billion. Furthermore, the average maturity of short-term loans declined over 25% as institutions assessed the credit-worthiness of counter parties in shorter intervals. Uncertainty among financial institutions increased from 2007 to 2008, sending interest rates to record levels, and further complicating the valuation for derivative transactions.

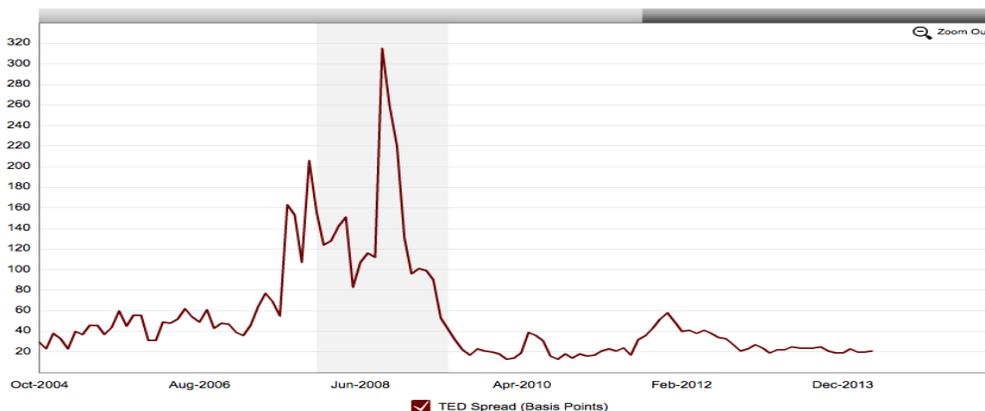
### **LIBOR/TED**

Until this point, the prices for all derivatives were discounted using LIBOR as the risk-free rate. LIBOR is an acronym that stands for London Interbank Offered Rate. It is the “average interest rate estimated by leading banks in London that they would be charged if borrowing from other banks” (Risk.net). Comprised of 16 leading banks, the group determines the LIBOR rate by providing bids for the interest rates they would offer to other prominent banks. Although it was first used in 1984, LIBOR has become the prominent rate for determining borrowing rates among financial institutions, In today’s market, the 16 banks that determine LIBOR “have placed rates on a staggering \$360 trillion financial instruments across the globe” (Risk). Essentially, LIBOR is a very prominent rate and has significant impact

on the financial markets. While discarding outliers in the calculation, the LIBOR rate provides an illustration for liquidity in the market on differing maturities. Most institutions adhered to the principal that all cash flows received by the institution from derivatives should be discounted at the rate that banks would need to fund the transaction. This belief also held true for transactions of all maturities. For the years preceding the crisis, all banks believed that capital would be readily available to borrow at LIBOR. Yet, the credit and liquidity aspects of the financial crisis proved LIBOR to be unreliable as a risk free rate. The toxic assets that comprised so many financial statements and balance sheets created uncertainty among major banks. Many institutions did not trust their counterparties and therefore offered record-breaking rates to determine the new LIBOR rate. The easy lending policies that fueled the housing boom began to change.

In the beginning, housing prices declined across the country and many people saw their equity stakes in homes fall drastically. Delinquencies on mortgages were rampant and loan payments dried up quickly. Therefore, the financial assets that converted such loans in to securities began to fall. The various CDOs that were created from dozens mezzanine tranches across a series of asset-backed securities followed suit. Additionally, high percentages of these derivatives were funded through margin. When a bank cannot meet margin requirements, it must default in the transaction. According to the Federal Reserve, banks were “concerned about the size and location of the exposure to subprime-related assets and decided to stop lending to other banks”(Federal Reserve). Banks began scrambling to scrap together any readily available capital that could be posted as collateral for the transactions.

Unfortunately, banks began to fail as capital requirements could not be met and bankruptcy was forced upon them. Consequently, the market for short-term loans began to dry up as institutions attempted to roll over obligations. The result was a LIBOR rate that spiked drastically, sending the TED spread to an unprecedented 460 basis points. The TED spread is the difference between LIBOR and the Federal Funds Rate. Any spike in this rate signals distress within the economy and a lack of trust among bank lenders. With a record-breaking LIBOR rate, financial derivatives and all related cash flows would be priced far below fair value. LIBOR could not longer be considered a risk-free rate.



The fall of Lehman Brothers in 2008 sent the market in to frenzy. Lehman Brothers had over 900,000 derivatives contracts outstanding, with over 150,000 attached to other prominent investment banks. The possibility of default became evident within every bank that held toxic assets. Prominent institutions began doubting counterparts and uncertainty impacted the borrowing rates. As interest rates soared, skepticism in the derivatives market grew and trading grinded to a near halt. Banks began liquidating positions in derivatives transactions, as well as the credit default swaps used to hedge those transactions. The bid-ask spread for

OTC transactions soared as banks became wary of the credit worthiness of their counterparties. Banks began a flight for quality in an attempt to relieve their institutions of the toxic assets and regain credible standing within the markets. Two important characteristics forced financial institutions to reevaluate their exposure to derivatives: a sharp increase in short-term interest rates and further uncertainty of the intrinsic value of derivatives.

### **OIS and Derivative Valuation**

The graph above provides an illustration for the “global reach of the liquidity crisis around the financial crisis and makes clear that a spread that has been constant for years can suddenly explode” (Jens van Egmond). Previously the LIBOR rate had been known for representing the risk-free rate and offering a prediction for the liquidity environment. Yet, during the peak of the crisis, banks began hoarding funds and severely hindering capital lending for fear of bankruptcy. The downfall of Bear Sterns and Lehman Brothers reacquainted fear in to the market. Now, the question of derivative valuation becomes a concern and financial institutions must configure a more reliable approach to discounting future cash flows. For instance, the collateral aspect of derivatives must also be revalued. Banks and large institutions that dealt with derivatives began paying closer attention to the collateralized side of transactions. For example, an interest rate swap starts out with an intrinsic value of zero. It isn't until some time until one party of the transaction has a negative value and owes money to the other party. These payments are recorded mark-to-market in order to reflect the true value of the transaction. The

party with a negative value must acquire funds to post as collateral in the transaction. The cost of funding this capital is the adequate rate to discount all future cash flows. When liquidity is scarce, the cost of funding the capital increases, effectively decreasing the value of all future cash flows. Furthermore, an interest rate is provided on the payment to reflect the value of the payment as one party holds it. This interest rate is known as the overnight interest rate (OIS) and is the average rate that is charged for loans in the overnight market. In the United States, the applicable overnight rate is the effective Federal Funds rate. According to the St. Louis Federal Reserve, the OIS market provides little risk because “there is no exchange of principal; funds are exchanged only at the maturity of contract, when one party pays the net interest obligation to the other” (St. Louis Fed). The LIBOR rate is greatly affected by an increase in illiquidity while the OIS remains relatively more stable. Before the crisis, the difference between LIBOR and OIS was a mere 7 basis points. During the crisis, however, the LIBOR-OIS spread spiked to record-breaking numbers. Banks became uncertain of default within the lending market and charged higher interest rates when lending to other banks. The LIBOR-OIS can presumably be an indicator on the health of the banking industry and “a barometer of fear for bank insolvency” (St. Louis Fed).



### **Valuation Implications**

Due to the stressed conditions of the market, the LIBOR-OIS spread provides a glimpse into the stability of inter-bank lending. Given the graph above, discounting practices with LIBOR would severely impact the intrinsic value for derivative cash flows. The OIS rate, however, more accurately reflects the ability to lend and borrow within the short-term market. The LIBOR rate provides a much lower value for discounting cash flows, thus low-balling the true price for derivatives. While LIBOR spiked during the crisis, OIS remained relatively stable. The LIBOR rate would provide a much more significant discount to all future cash flows, thus effectively reducing the present value. The consensus rate for discounting must be stable and LIBOR has proven to be volatile in certain situations. Derivatives should be valued using the cost incurred in acquiring funds for the transaction. Additionally, these complex instruments are funded through different sources and must be discounted accordingly. Analyzing the different types of collateral and the effects on derivatives

provides risk management and lessens the possibility of credit risk for firms that are “in-the-money”. When a firm is out-of-the money, capital must be posted to ensure margin requirements for the transaction. Hence, recent reform has created Credit Support Annexes as one part of the ISDA Master Agreement in attempt to mitigate risk among derivative transactions. This reform provides specific instructions for capital requirements on a given transaction. For large institutions, posting capital to meet standards requires borrowing at the overnight rate. Therefore, the overnight rate is the cost that large institutions must incur to secure funding for cash-collateral transactions. There are, however, various forms of collateral in derivative transactions. Reform and regulation will provide transparency to the derivatives market as institutions learn more about the assets.

Changing the valuation of an entire industry is complex and time-consuming. Bootstrapping and rebuilding a 30-year LIBOR model is noticeably different than creating a long-term curve for OIS rates. On average, the LIBOR-OIS spread hovers around 7 basis points when the markets are relatively stable. Long-term curves begin to differ and provide noticeable changes in present value calculations with LIBOR providing the lower value. Obviously, differences in in valuations will create confusion in the market as institutions transition to OIS. Recently, institutions revalued their derivative portfolios and returned varied results. BNP Paribas released a news report that the bank took a “108 million Euro hit during the switch to OIS discounting” (Risk). Morgan Stanley, on the other hand, reported a net gain on principal transactions. Fluctuations in derivative values will also vary based on the volume and type of derivatives in the transaction. While new trades may be quoted

with fresh OIS discounting, older transactions must be revalued to reflect the price of any off-market swaps. Less-sophisticated firms may find it more difficult to implement a new valuation system within the company. Banks and dealers are requesting “LCH Clearnet will need to make some changes to support the establishment of the new pricing standard” (The Price is Wrong). Currently, LCH calculates collateral on interest payments with OIS, but uses LIBOR when discounting future cash flows. Consensus is needed from the regulatory bodies to create more a more efficient derivatives market. Although price discrepancies are not damaging now, further confusion surrounding derivatives transaction might worsen as the market continues to grow.

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