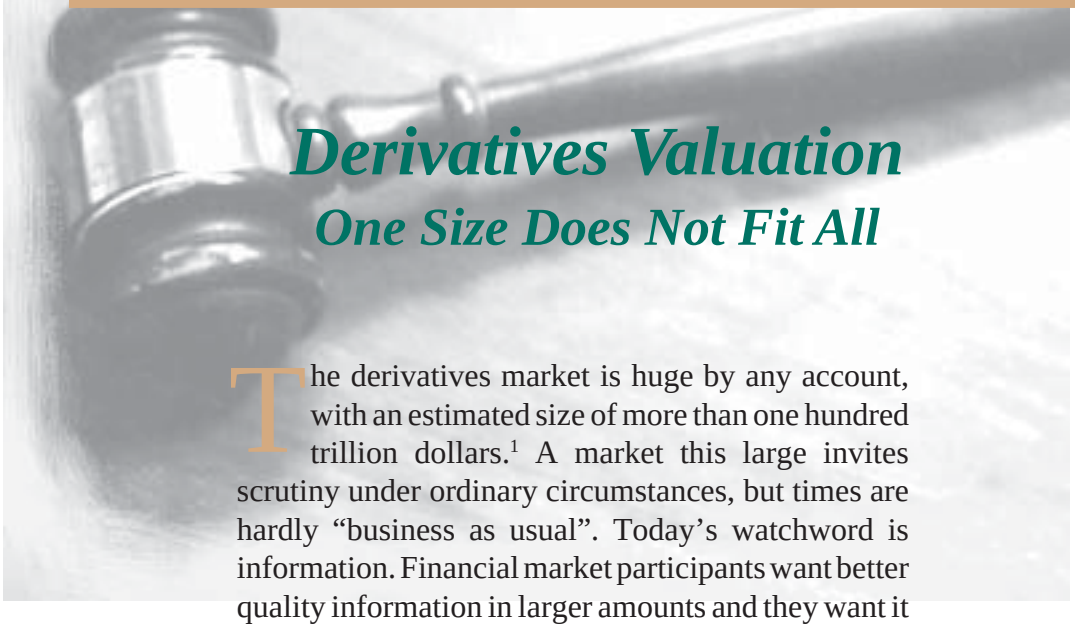
THE MICHEL-SHAKED GROUP

RESEARCH FROM OUR EXPERTS



Derivatives Valuation

One Size Does Not Fit All

The derivatives market is huge by any account, with an estimated size of more than one hundred trillion dollars.[1] A market this large invites scrutiny under ordinary circumstances, but times are hardly "business as usual". Today's watchword is information. Financial market participants want better quality information in larger amounts and they want it now. Corporate misdeeds and black box investing has led to unhappy investors seeking redress through the courts as their portfolios have plummeted in value. Policy-makers have been busy too.

New regulations have put derivatives at center stage, all of which entail more information gathering about these products and how they are used to minimize risk, enhance return, raise funds or synthesize securities. Summary of Statement No. 133, Accounting for Derivative Instruments and Hedging Activities, extends earlier accounting standards by requiring publicly traded companies to regularly value any financial instrument that meets the definition of a derivative.[2] This is in addition to the Securities and Exchange Commission's disclosure requirement that companies with a market capitalization larger than $2.5 billion must provide risk information about "market risk sensitive instruments."[3] Corporations

Dr. Susan M. Mangiero, CFA, FRM has spent her career in the areas of risk management and valuation. She is currently completing a book about risk management for pensions, endowments and foundations and regularly leads seminars about modeling and valuation issues.

The opinions expressed in this article are those of the author and do not necessarily reflect those of The Michel-Shaked Group.

are not alone. Banks face challenges in the form of the new Basel Capital Accord, much of which involves the proper estimation of risk as a way to determine statutory capital amounts.[4] Additionally, the Sarbanes-Oxley Act of 2002 sets forth a wide array of rules that affect publicly traded firms that use derivatives.[5] Even closely held companies and non-profit organizations are evaluating whether they should comply with this new legislation even though they are not obliged to do so.

Clearly, understanding how to value instruments that "derive" their value from some underlying asset is an important topic for investors, regulators, attorneys and managers alike. Climbing the learning curve, however, is easier said than done. Derivative instrument valuation is a complicated business that requires a solid understanding of the many factors that determine fair value. An important first step is the selection of an appropriate model.

A Letter From Our Managing Directors

Dear Friend:

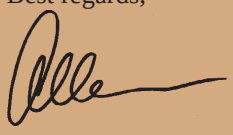
Derivative valuation has received significant attention in recent years from regulators, attorneys and academics. In particular, publicly traded companies must regularly value their derivative instruments. The valuation is typically complex.

We are fortunate to have a leading derivatives practioner/scholar present her insights about the difficulties inherent in their analysis and valuation. Dr. Susan Mangiero CFA, FRM has lucidly laid out the problems associated with using a plain vanilla approach to valuing all derivatives. Each derivative is different and requires different modeling.

Fortunately, there are tools to handle the myriad complexities encountered in derivative modeling. Dr. Mangiero describes the nature of some of the derivative characteristics making their valuation both interesting and complex. Because of her wealth of experience and ability to articulate the issues, she makes clear numerous factors which must be resolved in derivatives litigation.

We hope you find her work both useful and stimulating.

Best regards,



Allen Michel

Israel Shaked

Model Selection

Derivatives come in all shapes and sizes and no one model can possibly work all of the time. The partial list shown in the following table hints at the problems associated with the "one size fits all" concept. The variety of derivative instruments mandates the use of different models for different situations. The model used to value a commodity forward is completely different from that used to value an equity swap. Even when derivatives can be classified similarly, valuation model selection is still not a straightforward task.

Consider two options: a warrant issued by a closely-held company and the option embedded within a callable bond that gives the issuer the right to buy the bond back before its original maturity date.[6] The Black-Scholes option-pricing model provides one way to value the warrants as long as adjustments are made to reflect the fact that the warrant does not trade in an established market. Unfortunately, the assumption of a constant interest rate makes the Black-Scholes model a poor choice for valuing the callable bond option.

An alternative is to use a model that recognizes the possibility that interest rates can move around over time. With something known as the lattice approach, an analyst starts by forecasting interest rate scenarios for each time period during which the bond is outstanding. The future expected interest rates are then used to value the callable bond on each coupon payment date. The process is repeated to generate a value for the option-free bond. The final step requires finding the value of the embedded option as the difference between the option-free bond and the callable bond.[7]

Importantly, both situations involve options but the valuation is completely different because the options are themselves different. The warrant is a

call on equity and assumes stable interest rates. The callable bond option is quite sensitive to interest rate movements and must be priced accordingly.

"...the Sarbanes-Oxley Act of 2002 sets forth a wide array of rules that affect publicly traded firms that use derivatives."

Model Implementation

Identification of an appropriate method is just the beginning. Implementing the model requires care in evaluating inputs. What frequency of data should be used? Will valuation estimates be consistent across different data vendors? Will the input form affect the outcome and, if so, what is the likely result? Is the data stable over time? For more complicated valuations, the objective will guide the tradeoff between precision and computational costs. An average or range may suffice for purposes of regulatory compliance or assessing legal damages.[8] Other situations call for a point estimate. This might occur if the derivative position will be sold or, if used to hedge something else, it must be adjusted for size.

Sometimes the inputs themselves must be modeled. When this happens, valuation of the derivative instrument will be based on what is referred to as a nested model. Consider the example of a path dependent bond such as a mortgage-backed security. The first task is to simulate a sufficient number of interest rate paths for all time periods until the bond matures. The output from this first model is used as an input for a second model. The goal is to project future cash flows that reflect prepayment of principal when rates decline. Complicating things, the prepayment rate depends on multiple factors such as changes in interest rates, population mobility, household disposable income, economic expectations and overall financial market health.

The process does not end after running the second model. The present value of the expected cash flow outputs are then calculated using the interest rate paths from the first model. The result is a set of discounted cash flow totals that are typically averaged in order to estimate today's value of a particular mortgage-backed security. Inaccuracies can arise from a flawed interest rate model, a poor prepayment model or both. Either way, trouble looms.

Even within a given asset class, the valuation analysis depends on the characteristics of the underlying security. For example, the option that gives homeowners the right to prepay their mortgage when interest rates fall does not affect all mortgage-backed security values in the same way. A Collateralized Mortgage Obligation that consists of principal and interest payments will be less price-sensitive to early payments of principal than is the case with an Interest Only ("IO") strip. When the outstanding principal on underlying mortgages falls, interest on that debt will likewise fall and thereby reduce the dollar cash flows associated with the IO strip.

Derivative Instrument Categories

Forwards	Futures	Options	Swaps
Commodity	Commodity	Commodity	Commodity
Currency	Currency	Currency	Currency
Credit	Equity	Credit	Credit
Equity	Fixed Income	Embedded	Equity
Fixed Income	Index	Equity	Fixed Income
	Swaps Futures	Fixed Income	
		Options on Futures	

Model Risk

Derivative instrument valuation is a time-consuming process that requires care in selection and implementation of a model. The risks associated with a bad or ill-fitted model can be costly, sometimes in the millions of dollars. Low valuations can result in additional tax liabilities and penalties. High valuations might cause a potential buyer to walk away. When a model is being used in court, the consequences are just as dire.[9,10] Model results that fail to meet rules of evidence can be devastating for the attorney who hired the expert witness. The solution is to carefully consider alternative models, the objective at hand and the risk-return tradeoff inherent in what is being valued.

Conclusion

The spotlight shines brightly on derivatives and all signs point to more of the same going forward. Their vast market size makes them a force to be reckoned with. Regulatory action and investor lawsuits share the need to know more about how derivative instruments are being used and the extent to which changes in their value affect the bottom line. This is no time for senior management to stick their heads in the sand. Understanding the economics of derivative instruments and knowing when to call in outside help is de rigueur.

Disclaimer: The information provided by this article should not be construed as financial or legal advice. The reader should consult his or her own advisors.

[1] According to the International Swaps and Derivatives Association, interest rate and currency notional amounts outstanding approximated $98.8 trillion at year-end 2002 with another $4.59 trillion in default swap and equity derivative outstanding amounts.
[2] Summary of Statement No. 133, *Accounting for Derivative Instruments and Hedging Activities*, issued in June 1998, "requires that an entity recognize all derivatives as either assets or liabilities in the statement of financial position and measure those instruments at fair value." Go to www.fasb.org for more information. On April 30, 2003, the Financial Accounting Standards Board issued Statement No. 149, *Amendment of Statement 133 on Derivative Instruments and Hedging Activities*.
[3] See http://www.sec.gov/divisions/corpfin/guidance/derivfaq.htm#risk.
[4] See http://www.bis.org/publ/bcbsca.htm.
[5] Securities and Exchange Commission,"Disclosure in Management's Discussion and Analysis about Off-Balance Sheet Arrangements and Aggregate Contractual Obligations", 17 CFR Parts 228, 229 and 249. See http://www.sec.gov/rules/final/33-8182.htm.
[6] An embedded option cannot be sold separately from the host security.
[7] A callable bond represents a portfolio consisting of a long position in an option-free bond and a short position in a call. This reflects the sale of a call by the investors to the bond issuer.
[8] Even compliance-related valuation will vary since not all regulations require the same thing.
[9] Mangiero, Susan M. "Financial Model Risk Looms Large", *The Investment Lawyer*, Volume 9, Number 11, November 2003, pages 16-21.
[10] Mangiero, Susan M. "Model Risk and Valuation", *Valuation Strategies*, Volume 6, Number 4, March/April 2003, pages 34-39.

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