HOW TO SUCCEED IN DERIVATIVES WITHOUT REALLY BUYING

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The treasurer's voice cracked with rage as he complained that his state utility regulators had blocked his company's proposal to refund a $100-million issue of 9 25% bonds due in 2015 Long Treasury rates had dropped down to 7.5%. "Who are these guys to tell me how to run my business?" he fumed. "Rates are the lowest they've been in 20 years and they're bound to go up soon."

A high degree of risk aversion and more than 15 years of treasury experience told him that the time was now His company could save $2.63 million in present value simply by calling the bonds and refunding them at the lower rate of 8.25%, 75 basis points over Treasuries.

He eventually cooled down enough to check his conviction about the imminent direction of interest rates against the combined wisdom of Wall Street's best brains, who, it turned out, were more ambivalent about the direction of rates He turned to the swaptions market—the market for options on interest rate swaps—and designed a transaction which showed him an immediate cash value he could use as a benchmark to guide his own decision

The price at which he could do this proxy transaction spoke volumes about why he should not refund the debt. It turned out he could receive a check for $4 2 million from his synthetic transaction, roughly $1 5 million more than he could save from doing the actual refunding. We'll see why later.

Our treasurer would just as soon cut off his own hand as traffic in interest rate derivative securities. But his aversion to these arcane instruments didn't prevent him from using the information trail they provide to evaluate transaction he was planning.

It just goes to show the importance of the growing market in derivative securities. Even a corporate treasurer confined to the cash markets can look at derivative market levels to gauge current trends in market pricing, as well as to sort out the many deals that come across his desk from Wall Street firms. As this article is meant to demonstrate, an appreciation of the derivative markets allows a treasurer to distinguish between good and bad pricing, to separate true financial innovation from mere novelty. All the treasurer needs is a healthy amount of skepticism and a push in the right direction.

OPTION VALUATION BY PROXY

How did our treasurer come to realize that he shouldn't call the bonds? He already knew the benefits of doing the refunding. By calling his 9.25% bonds and replacing them with new 23-year debt at 8.25%, he could lock in annual interest rate savings of 1% until maturity. Discounted at his current cost of debt (8.25%), those savings had a present value of $10.23 million. But that figure had to be adjusted downwards for the $6.66 million call premium (pre-tax)[1] and $940,000 in underwriting fees on the new issue. So by calling the bonds and refunding them with lower-cost debt, he could lock in NPV savings of $2.63 million. Our treasurer thought he had spotted a winner.[2]

Unfortunately, things were more complicated than they appeared. He had neglected the critical second step needed to reach the correct conclusion. In calling the bonds today, the treasurer would give up something of value—the right to call them tomorrow. If interest rates continued to fall, the company could receive even more savings doing the same transaction later. Such an opportunity could come at any time over the remaining life of the bonds, so its value depended on current expectations about future interest rate volatility.[3]

Our treasurer found a way to measure his option's value by building a proxy transaction in the swaptions market. A swaption—an option on an interest rate swap—gives its holder the right to enter into a specified interest rate swap. And swaption market-makers are prepared to bid on complicated custom deals. Our treasurer designed a swaption that would transform his callable debt into non-call-life 9.25% bonds. The price an investment bank would pay for that swaption would be a good estimate of the value of the call option in his bonds.[4]

Both the swaption and its underlying swap were set to expire in 2015. The fixed-rate leg of the swap would be 8.6%, and the other leg would float at LIBOR plus 40 basis points.[5] Interest would be figured on a notional principal amount of $107.5 million. If the holder exercised the swaption, the utility would be required to pay fixed and receive floating.

The price he got from the swaptions desk—$4.2 million—told him in a flash that he was better off not calling the bond. How did he come to his conclusion?

Let's suppose he actually sold the swaption, and follow the possible outcomes. To begin with, the check for $4.2 million was already $1.5 million more than the present value of his savings from calling the bonds. But had he placed his company at risk?

If the option were exercised immediately, the utility would pay the bank 8.6% of $107.5 million, or $9.245 million annually, just about what it had been paying on the bonds (9.25% on $100 million, or $9.25 million). At the same time, the treasurer would call the bonds at a cost of $106.66 million plus expenses, and refinance with floating-rate debt at a spread of about 40 basis points to LIBOR; those interest payments would be covered by the floating rate side of the swap. So if the option were exercised, he would have pocketed $4.2 million and, apart from some accounting and tax headaches, seen no change in his net cash flow going forward.

If the option were exercised at a later date, the call premium on the bonds would be smaller, and some additional cash flow benefits would accrue. And if the option were never exercised, the cash flow going forward would be unchanged, and he would still have the $4.2 million from the sale of the option. It was a perfect hedge.

At this point the treasurer concluded it made no sense to call his bonds. He saw that the running call option on the bond had to be worth far more than he could get by exercising it—at least as much, in fact, as he could get for the swaption. Even though he was unwilling to do that transaction, he knew it was still better to stand pat than to call the bonds.

He needed to check his reasoning, so he looked to the active swaps market, where he found the underlying swap to be worth only $3.85 million—$350,000 less than the bank had been willing to pay for the swaption. So the bank would sit on its option, too. He began to wonder what the option might really be worth.

1. In practice, all of this analysis would be done on an after-tax basis.

2. Corporate bonds pay interest semi annually, so all discounting is done on a bond-equivalent-yield basis. The call options embedded in corporate bonds are generally struck at a premium to par which declines over time. These bonds were callable at 106.660% of their face value. The cost of calling the bonds would have to be refinanced with new long-term debt; typical underwriting expenses are [illegible] of the new face value.

3. William M. Boyce and Andrew J. Kalotay, "Optimum Bond Calling and Refunding," *Interfaces* (November 1979).

4. Investment banks used to act as agents rather than as principals in these deals. Today they facilitate liquidity by acting as principals, although they attempt to maintain a balanced book by entering into one or more offsetting transactions.

5. LIBOR, the London Interbank Offering Rate, is a standard index for the floating rate leg of an interest rate swap.

FINDING TRUE VALUE

Wall Street firms do not guess when they calculate the values of bonds and options, even though many corporate treasurers still do. Guessing went out of fashion at least ten years ago—ever since the derivative products markets began to flourish.

By 1986, when declining interest rates led to rampant calls and tenders of bond issues, valuation techniques had expanded to the options locked inside bonds. The same technology was already being used to value options on swaps, as well as interest rate caps, floors, and collars. Arbitrageurs at the large Wall Street houses had come to rely on this sophisticated valuation technology for the derivative securities they use both to hedge proprietary trading and to create synthetic products.

The elegant Black-Scholes formula has been used since 1973 to price options on stocks. It takes only a few inputs—the current stock price, the option strike price, the time to expiration, the current risk-free interest rate, and the volatility of the stock price. When the derivative markets were in their infancy, people tried to apply the same formula.

But Black-Scholes is simply inappropriate to value options on interest rates and their more complex cousins, the options embedded in bonds. The principal reason is that the discounting process for valuing interest rate options must take into account the shape of the yield curve. The yield curve describes the way interest rates depend on maturity and embodies market expectations about the direction of rates. For example, an upward-sloping yield curve is an indication that rates are expected to rise, and this suppresses the time value of a call option on a security paying a fixed interest rate.

Black-Scholes recognizes that the price of a stock can go either up or down. In the same spirit, a model to value options on interest rates must take into account not only that the yield curve may rise or fall, but also that it may twist and turn. Powerful numerical techniques are required to describe the possible changes in the yield curve over the relevant period, which can be several decades—far longer than the time to expiration of any stock option.

Just as the volatility of a stock's price drives the time value of stock options in Black-Scholes, the volatility of the short-term interest rate drives the time value of interest-rate-sensitive options.[6] You can't find this volatility in any newspaper or journal, or see it quoted on a ticker tape,[7] but there are ways of backing into it. The implication of volatility is simple enough to understand: The higher the volatility, the greater the value of an option. Buy low, sell high.

Volatility has become a kind of shorthand way to speak of the value of an interest rate option, in much the same way as bond traders use yield spreads. It provides a quick way to compare similar deals, and knowledge of the implied volatility is the key to unlocking the value in any option-based transaction.

WHAT PRICE VOLATILITY?

Our utility treasurer wasn't concerned about the implied volatility of his swaption. He needed to know if he should exercise his own in-the-money option, and the price he was offered for the swaption told him that. But out-of-the-money options have only time value—they have no exercise value—and volatility is everything.

A multinational received a proposal from an investment bank to monetize the call option[8] in its $150-million 7% bonds due 2009. At the time, the option was out of the money; rates were above 8%, and the bonds were selling well below par.

The deal was similar to the one priced by the utility treasurer: The firm would sell a swaption to the bank giving it the right to enter into an interest rate swap in which the conglomerate would pay a fixed coupon of 7% and receive the floating rate.

The price the banker offered was an even million. Getting $1 million for an out-of-the-money option sounded intriguing. But how could the treasurer determine if the price was right? An analysis showed that the deal was priced at an implied volatility of 8%. A few well-placed telephone calls was all it took for her to find that similar swaptions were trading at a volatility closer to 9.5%.

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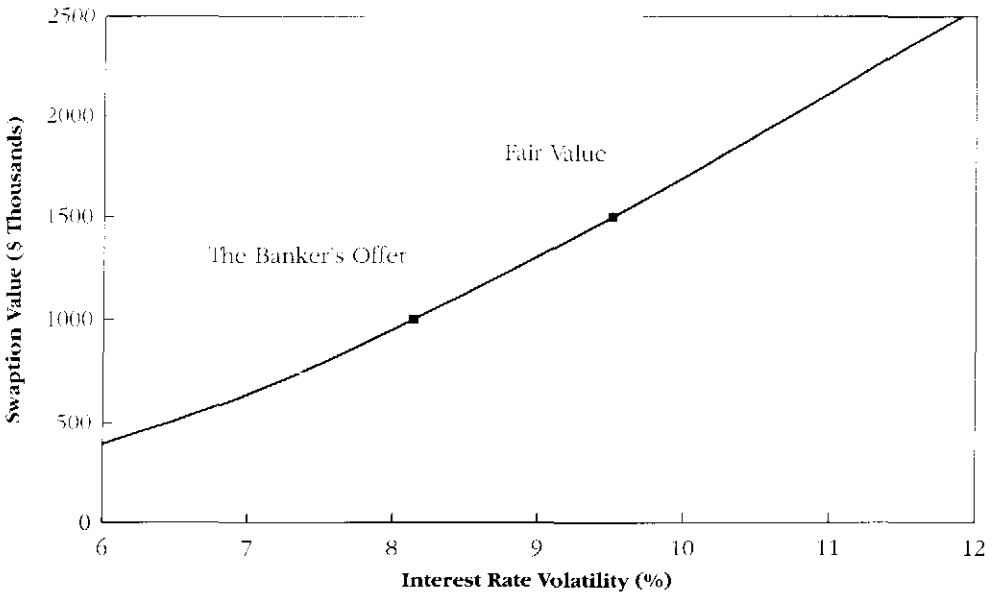
6. Andrew J. Kalotay, George O. Williams, and Frank J. Fabozzi, "A Model for Valuing Bonds and Embedded Options," *Financial Analysts Journal* (May/June 1993).

7. The Chicago Board of Trade introduced volatility-quoted options on Treasury bond and Treasury note futures contacts in February 1993, underscoring the emphasis traders place on volatility.

8. For an account of how to accomplish this, see Keith C. Brown and Donald J. Smith, "Forward Swaps, Swap Options, and the Management of Callable Debt," *Journal of Applied Corporate Finance*, Vol. 2 No. 4 (Winter 1990).

Even a corporate treasurer confined to the cash markets can look at derivative market levels to gauge current trends in market pricing, as well as to sort out the many deals that come across his desk from Wall Street firms. An appreciation of the derivative markets allows a treasurer to distinguish between good and bad pricing, to separate true financial innovation from mere novelty.

FIGURE 1
THE EFFECT OF INTEREST RATE VOLATILITY ON THE VALUE OF THE OUT-OF-THE-MONEY 7% SWAPTION



A small shift in volatility can make a big difference in the price of a long-dated option, as Figure 1 illustrates. This treasurer found that if she did the deal for $1 million, she would be leaving $500,000 on the table. Thus a one-and-one-half-percentage-point difference in implied volatility meant a 50% shift in the value of the option. The structure was right for the company, but the price was wrong!

EPILOGUE

The state regulatory commission did our utility treasurer a favor by denying his refunding proposal. It's doubtful that they would have allowed him to sell the swaption either, given counterparty risk and basis risk, neither of which were addressed here.[9]

He anxiously followed interest rates as he continued to pay a 9.25% coupon. But the long bond rallied further, and corporate spreads tightened.[10] About a year later, he refunded the 9.25% bonds with 7.625% debt, reaping almost $10 million in NPV savings. Although he was less sanguine about whether rates had bottomed, he was confident that there was nothing to be gained by waiting.[11]

The other treasurer walked away from the banker's offer, and the call option on her bonds languished for a time, half-forgotten. But three years later, the call option was in the money to the tune of $5.6 million, and if rates were to fall another eighth of a point, the bonds stood to be called.

9. Laurie S. Goodman, "The Use of Interest Rate Swaps in Managing Corporate Liabilities," *Journal of Applied Corporate Finance*, Vol. 2 No. 4 (Winter 1990).

10. The wave of mortgage refinancing in 1992 and 1993 drove investors from mortgage-backed securities to the bond market, resulting in a compression in corporate spreads.

11. Andrew J. Kalotay, "The Sure Thing—Bond Refunding: How Operations Research Made its Mark on Wall Street," *ORMS Today*, April 1993.

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