For release on delivery
1:30 p.m. EDT
March 22, 2007

Asset-Pricing Puzzles, Credit Risk and Credit Derivatives

Remarks by

Donald L. Kohn

Vice Chairman

Board of Governors of the Federal Reserve System

at the

Conference on Credit Risk and Credit Derivatives

Washington, D.C.

March 22, 2007

Good afternoon. I am pleased to participate in the Board's conference on credit risk and credit derivatives. Song Han, Matt Pritsker, and Hao Zhou have worked hard to put together a stimulating program of cutting-edge research in this area.[1] Your conference focuses on improving our understanding of credit risk and credit derivatives, but I will begin my talk by taking a step back and discussing a wider range of asset markets, in which our understanding is also limited. Then I will examine how the research in this conference can help sharpen our focus on this broader range of asset markets.

At the Federal Reserve, we have considerable interest in credit risk and credit derivatives. As these markets develop and become more complete, they facilitate risk transfer and diversification, thereby increasing the resilience of our financial system. With participants coming to rely more on these markets to manage risk, we have focused increasingly on their liquidity and structure. We have worked closely with the private sector to strengthen the clearing and settlement infrastructure and to understand how these markets will function under stress.

But my emphasis today will be not the structure or mechanics of credit markets but rather the information contained in the prices we observe in these markets. We at the Federal Reserve use this information in nearly every area of our responsibility. For example, in our roles as bank supervisors and protectors of financial stability, we monitor the credit spreads of financial institutions as early warning signs of possible financial stress. In our role as monetary policy makers, we analyze information from credit-risk markets to get readings on the cost of capital to businesses and on forward-looking

[1] Mike Gibson, Song Han, Matt Pritsker, and Hao Zhou, of the Board's staff, contributed to these remarks.

indicators of the health of the corporate sector that can have implications for future macroeconomic developments.

Extracting Information from Asset Prices

As a consequence, the staff at the Federal Reserve puts considerable effort into research on asset prices and into reporting the results of that research to policymakers. One reason we do so is to try to understand the expectations that households, businesses, and market participants have about the future. Expectations are critical to understanding the economy and developments in the financial system. Of course, we look at a great deal of data from the nonfinancial side of the economy, such as gross domestic product (GDP) growth, the unemployment rate, and changes in the prices of goods and services. These data certainly reflect expectations but not always in a transparent way. And, these data take some time to compile and so are never available in real time.

Because financial asset prices embody expectations about the future, they also contain forward-looking information about prospective developments, and many are available continuously and instantaneously. We pay attention to an extensive range of asset prices, including those of Treasury securities (both nominal and real), corporate debt and equities, and derivatives. Although it is not easy, we use these asset prices to tease out information about expectations that help us to interpret and predict the pace of economic activity and prices.

The price of an asset reflects the future cash flows that investors expect to receive from owning that asset. The price also reflects a risk premium, which is the excess expected return over the risk-free rate that investors require for holding risky assets in their portfolios. Each asset's risk premium depends on the asset's risk--as measured by

the possible variability of its cash flows from their expected level--and on investors' risk aversion, which represents the extent of investors' appetite for risk. And we try to measure and understand the elements of the risk premium, in addition to the embedded expectations.

In equity markets, corporate earnings are the future cash flows that affect equity prices. Given the market's outlook for corporate earnings--as embodied, for example, in the predictions of market analysts--we make a crude estimate of the risk premium on equities as the difference between the ratio of trend earnings to price and a real long-term Treasury yield. On occasion, we go further and use structural economic models to decompose the risk premium into components related to risk and to investors' risk appetite.

In the credit market, the relevant future cash flows are the coupons on corporate debt, less an allowance for expected losses from future defaults. In one exercise, we forecast future defaults with a simple regression model and estimate the credit-risk premium as the difference between corporate yields and Treasury yields that is in excess of what would be required to compensate investors for their estimates of expected credit losses. We also estimate a term structure of credit-risk premiums by repeating this analysis using debt that has different maturities. To judge what market prices of risk might be telling us, we try to understand how the resulting credit-risk premiums relate to other sources of information, such as the strength of business balance sheets, historical levels of risk premiums, and premiums observed in related markets, like that for equities. This approach helps us to assess the current attitudes and expectations of market

participants as well as possible future movements in risk premiums under alternative scenarios.

We look to prices in Treasury markets and in markets for interest rate options and futures to infer investors' expected future path of monetary policy and their uncertainty about that path. To do so, we need to model term premiums to tease out the links between long-term interest rates and investors' expectations of future short-term rates. We also compare the Treasury yield curve with the prices on Treasury inflation-protected securities to infer expected inflation, a key variable tracked by monetary policy makers.

Although we use a variety of techniques for extracting information from asset prices, what we can learn has limits. First, asset prices are tough to work with. They change rapidly and are subject to short-run technical factors--swings in prices that are not related to fundamental and persistent shifts in supply and demand. Second, and perhaps even more important, how asset prices embody risk and investors' risk attitudes is complicated and varies over time. We must use models to extract information on risk and risk preferences from prices, and because all models are simplifications of reality, we have to recognize that the results are only approximations of the underlying attitudes and circumstances and thus are subject to error.

Asset-Pricing Puzzles

Researchers are well aware of the difficulties of decomposing an asset's required return into components that are related to expected future cash flows, risk aversion, and risk. Moreover, risk preferences that should be related in a predictable way across markets often do not appear to be so. For example, the risk preferences required to fit

consumption data from the goods market are inconsistent with the risk preferences implied by prices in the equity market.

This problem is well known to most economists and to everyone in this room and is known as the "equity-premium puzzle." The equity premium is defined as the return that an investor expects to earn on a broad equity index in excess of the return on a U.S. Treasury security. Although theory suggests that the equity premium should be related to investors' risk preferences as well as the fundamental volatility of the corporate sector, it is difficult to find plausible risk preferences that can rationalize the high level of the historical equity premium. Also, we observe that required returns appear to vary over time, but we do not understand all the reasons for the fluctuation. Both of these problems complicate our interpretation of what implications, if any, movements in equity markets have for the macroeconomy.

The equity-premium puzzle is not the only aspect of the behavior of financial asset prices that is difficult to reconcile with economic theory or experience in related markets. A second puzzle is the "credit-spread puzzle." The spread between a corporate bond and a similar-maturity Treasury bond compensates an investor for the risk that the bond's issuer will default and recoveries on the defaulted bond will be low. Credit-risk spreads vary substantially over the cycle, and right now they are on the low side of historical experience. However, over long periods, actual percentage losses on corporate bonds have been well below historical averages of credit spreads at all maturities, especially in the high-grade, short-maturity segment of the market. Again, it is difficult to reconcile this observation with standard models of investor preferences. Other

explanatory factors, such as the different tax treatment of corporate and Treasury bonds, appear to explain only part of the puzzle.

A third puzzle concerns the behavior of financial market volatility. Volatility and measures of expected volatility derived from options prices vary over time but not in ways that are easy to link to economic fundamentals or to the variation of expected returns in asset markets. Moreover, the relationship between financial market volatility and the volatility of macroeconomic variables such as GDP is not well understood.

A fourth puzzle related to the pricing of risk concerns the term premium, which is the additional compensation that investors require to hold longer-term securities. We estimate from the Treasury market that the term premium has declined substantially in recent years to unusually low levels, which has contributed to the inversion of the yield curve. But we do not understand why, and consequently we do not know to what extent we are seeing a permanent decline in the term premium--perhaps due to a general reduction in the volatility of economic activity and inflation over the past twenty-five years. Or we may be seeing a temporary decline due to the influence of recent macroeconomic conditions or special factors affecting the demand for long-term bonds.

In addition to these well-known puzzles, are also a large number of puzzles across all asset markets that I will group under the common theme of risk harmonization. Risk-harmonization puzzles concern whether a given risk is priced the same way in all markets in which that risk is traded. In the absence of transaction costs, broadly defined, the law of one price should hold--there should be no risk-free arbitrage--and all risks should be priced the same way in all markets.

In fact, risk harmonization is limited because transaction costs, viewed in a broad way, are quite material in many markets. A broad notion of transaction costs includes not only the direct fees paid when transacting and trading but also the full set of risks that are involved when arbitraging among markets. These include various types of basis risk, which is the risk that long and short positions exposed to the same risk in different markets might not offset each other. Another important risk is model risk, which is the risk of misjudging an apparent price anomaly when trading owing to not having the correct model. Some of the conference papers focus on markets in which risk harmonization appears to be incomplete.

How the Common Lens of Credit Risk Improves Our Understanding

Papers in this conference contribute to our overall understanding of how credit risk, as well as other risks such as those associated with volatility and liquidity, are priced in financial markets. One of the contributions of the conference is that it views many of the asset-pricing puzzles through the common lens of credit risk. This approach holds the hope of addressing the various puzzles in an internally consistent way that helps us to understand how the puzzles may be related.

One strand of the literature on the equity-premium puzzle attempts to explain the puzzle with a somewhat controversial refinement of standard risk preferences. The first paper in the conference examines the plausibility of these preferences by analyzing whether they can also explain the average pattern of credit spreads in the bond market. The results are mixed. Part of the credit-spread puzzle is explained, lending some credence to these preferences, and suggesting the two puzzles are related, but a part remains unexplained. And the paper identifies better modeling of the situation in which

firms are forced into default as one research direction that may help to explain the remaining part of the credit-spread puzzle. This research direction is pursued in a separate paper in the conference.

A second paper at the conference also studies the relationship between equity prices and credit risk but does so from a different perspective by asking whether credit risk is appropriately priced in the stock markets. To address this question, it focuses on companies that are heavily exposed to systematic risk of financial distress--that is, they are relatively likely to experience financial distress during future downturns--and then studies whether the stocks earn a positive premium for this risk. The main finding is that investors in those companies do not earn a premium for distress risk in the stock market. This result suggests a possible failure of risk harmonization in the stock market, which in turn raises the deeper question of identifying why this failure in risk harmonization is not arbitraged away.

In short, papers in the conference deepen our knowledge of some of the asset-pricing puzzles, but they also highlight new aspects of the puzzles that remain to be explained.

How Credit Derivatives Markets Can Improve Our Understanding

This leads to my last topic, which is how credit derivatives markets provide new ways for us to uncover market perceptions of risk. Like all derivatives (such as options and swaps), credit derivatives allow for credit risk to be unbundled and traded independently from other types of risk, which makes it easier to price and measure the different types of risk. Here I will focus on two examples.

The first involves our ability to infer the market's perception of default risk. In the bad old days, about ten years ago, the best way to infer credit risk was from the prices of corporate bonds, but bond prices are contaminated by differences in coupons, taxes, option-like features, bond covenants, and the illiquidity of the corporate bond market itself. All of these features meant that the modeling error involved in the process resulted in credit-risk measures that were noisy and potentially biased.

Now, instead of looking to the bond market to measure default risk, we are increasingly turning to the market for credit default swaps, or CDS. CDS are more standardized than corporate bonds, and, over time, they have also become more liquid. They therefore provide us with new, and in many cases more precise, measures of credit risk. These measures in turn can sharpen our measures of the pricing puzzles. In addition, because the CDS market helps us to strip out the credit-risk component from bond prices, that market also gives us a clearer picture of how important non-credit-risk components of bond prices, such as liquidity, are priced.

The second example involves the pricing of default correlation. Default correlation measures the tendency of firms to default at the same time. Suppose a bank makes a set of loans that appear to be safe when looked at individually. Whether the loans are likely to default at nearly the same time can represent the difference between whether the bank remains healthy or has the potential to become insolvent. For this reason, the modeling of default correlations, and how correlations change with economic conditions, is one of the most important inputs into measures of portfolio credit risk at banks. Default correlations and how they are modeled are also important to bank regulators and are heavily emphasized within the Basel II capital standards.

Collateralized debt obligations, or CDOs, are one of a number of financial instruments whose prices are sensitive to the pattern of default correlations. As a result, the prices of these instruments provide us with a forward-looking picture of the market's perception of default correlations and an indication of how the risks of changes in correlation are priced. Of course, as some of the papers in the conference demonstrate, the pricing of correlation-sensitive instruments is, putting it generously, somewhat less than straightforward. For that reason, there is substantial model risk involved in making inferences from these prices. Nevertheless, the prices of these instruments provide a blurry view of default correlations that I expect will improve through time as credit derivatives markets continue to grow and mature.

Credit derivatives, like all derivatives, are in zero net supply, and, abstracting from the very important issue of counterparty credit risk, they neither add to nor subtract from the stock of financial risk in the economy. They do, however, provide new and more-efficient ways for sharing and hedging the risks that do exist, and they facilitate the transfer of those risks to those who are most willing to evaluate and bear them.

As a consequence, as the credit derivatives market continues to develop and deepen, my guess, and it is just a guess, is that cleaner measures of credit risk will, all else being equal, reduce the costs of arbitraging between markets and will improve the harmonization of risk across markets--one of the asset-pricing puzzles I highlighted.

Two of the other puzzles I described earlier are the credit-spread and equity-premium puzzles. At least a part of these puzzles may be due to imperfect risk sharing among active market participants. If this is indeed part of the puzzle, then financial innovations such as credit derivatives may, again, all else being equal, reduce long-run

average risk premiums in both the equity and credit markets, over time, by facilitating risk sharing among currently active market participants, provided that participants adequately understand and manage the risk of these products. That said, time will tell whether my speculations on this point are correct.

Conclusion

My message to you today has been that the Federal Reserve places a lot of emphasis on understanding financial asset prices to help it meet its public policy objectives. But in doing so, we are handicapped by the extent to which we do not understand important aspects of how financial assets are priced. Your work as researchers in this field--a portion of which is show-cased at this conference--has been helpful in beginning to explain some of the puzzles, and more recent techniques and ideas together with the data series being generated in new markets hold the promise of more progress in the future.

So, I will not keep you from your work any longer. Your contributions are important to the nation's central bank. Please, go solve some puzzles.