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WEAKER SWAP-CREDIT MARKET CORRELATION: TEMPORARY OR PERMANENT?

Introduction

"If only I had hedged with swaps!" This was an oft-heard cry from investors and dealers after the liquidity crisis of 1998. As the crises unfolded, U.S. Treasuries rallied as investors sought liquidity and safety. Spread product, even AAA-rated spread product, widened significantly versus Treasuries. As a result, investors who sold Treasuries to hedge spread product, a practice that had worked relatively well for years, suffered badly. Investors were quick to notice that U.S. dollar swaps tracked the widening spreads in the credit, MBS and ABS markets much more closely than did Treasuries. As the swaps market is liquid, investors began to consider using swaps to hedge spread product essentially viewing swaps as a proxy for spread product.

The Treasury buyback announcement of 2000 further accelerated the reconsideration of Treasuries to hedge spread product. The beginning of the buybacks caused the behavior of long maturity Treasuries to become highly idiosyncratic. The credit spread to Treasuries began to reflect not only credit risk, but the liquidity premium and idiosyncratic risk of Treasuries as well.[1] Swap spreads also reflected the fluctuations in the liquidity premium and idiosyncratic risk of Treasuries. Consequently, the correlation of swap spreads to credit spreads increased. This increased correlation had a positive feedback effect as investors and dealers increased their use of swaps as a hedge for spread product.

The increased correlation of credit product and swaps has led investors to ask Lehman Brothers to introduce total return indices for swaps. These swap indices will be launched and described in a separate research publication by the end of the year.[2]

Recent events, however, may have reduced the prospects for continued credit-swap spread correlation. For example, the possibility of renewed Treasury deficits and sufficient Treasury supply may remove the idiosyncratic risk of Treasuries and again permit effective hedging of spread product with Treasuries. Also, to be discussed below, greater concerns about corporate credit quality and a much steeper yield curve may cause the credit-swap spread correlation to weaken. However, offsetting these events was the recent Treasury announcement suspending sales of the 30-year Treasury bond. This announcement increased the scarcity value of both the 30-year (and 10-year) Treasury issues that may lead to greater credit-swap spread correlation as investors and traders seek to avoid a highly idiosyncratic hedging instrument.

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[1] As a result of these changes in the market, a related study concluded that Treasuries were no longer a perfect proxy for risk-free interest rates, nor a benchmark for fixed-income instruments, especially for long duration ones. *Identifying the Benchmark Security in a Multifactor Spread Environment*, by A. Kocic, C. Quintos and F. Yared, Lehman Brothers, September 2000.

[2] For a preliminary look please refer to "The Lehman Brothers Swap Indices," by Yuri Greenfield, *RISK*, September 2001.

We present an updated analysis of the correlation of swap and credit spreads. Specifically, we ask:

1) Have swap spreads remained highly correlated with credit spreads? If not, is the weakened correlation likely to persist? and
2) Is there a difference in the correlation between swap spreads and credit spreads depending on the quality of the credit sector?

We begin with a brief discussion of why swap spreads and credit spreads might be correlated. Then, we present the correlation data. Finally, we discuss the prospects for credit-swap spread correlation going forward.

The Relationship between Swap Spreads and Credit Spreads

How strong a correlation might we expect between swap spreads and credit spreads? Is there a natural and stable relationship between these two markets that can be relied on for hedging? Or, perhaps, are swap spreads more closely correlated with a subcomponent of the credit index? Below, we discuss and analyze some of the common arguments offered for a strong relationship between the two markets.

A standard interest rate swap works as follows. Two parties, A and B, contract to exchange payments based on an agreed *notional amount* for a period of time, known as the *term* of the swap. Typically, Party A makes quarterly interest payments on the notional amount, based on the 3-month London Inter Bank Offer Rate (LIBOR) observed at the beginning of each three-month period. In turn, Party B makes semiannual interest payments on the same notional amount, but at a fixed coupon rate known as the *swap rate*. The stream of payments tied to LIBOR is called the *floating leg* of the swap, and fixed coupon payments are simply called the *fixed leg*. In this transaction, Party A has a receive fixed swap while Party B has a pay fixed swap.

The floating leg of a swap, together with the notional cash flow at the end, can be thought of as floating rate borrowing by a generic highly-rated entity who pays LIBOR every three months. Since swaps are initiated at zero cost, the fixed leg, together with the notional cash flow at the end, must be an economically equivalent borrowing arrangement for the same entity. Thus, the swap rate can be interpreted as fixed rate borrowing by the same entity for the same maturity as the swap.

LIBOR is an average interest rate at which leading banks are willing to lend to each another for a particular period of time. It is important to note that if a particular bank were to experience serious credit quality issues, it would be excluded from participating in the rate setting. This limits the idiosyncratic risk of LIBOR. However, systematic credit problems that affect most banks would have an effect on LIBOR.

Swaps are also considered to have very low credit risk, comparable to highly rated corporate issuers. As mentioned above, swap rates should not be affected by isolated credit events as the LIBOR setting excludes banks that experience isolated credit problems.

The main risk associated with swaps and bonds is counterparty default risk. However, unlike the case for bonds, there is no risk to the principal amount in a swap (as there is no principal amount at risk), only the current mark-to-market value which could range up to a few percentage points of the notional value. In addition, netting and collateralization agreements can further reduce the risk of swaps.

Why might swap spreads be correlated with credit spreads? To some degree, arbitrage helps ensure that swap spreads track spreads in other credit markets. We present several examples of this arbitrage activity.

The first arbitrage argument relies on the fact that short-dated swaps and term inter-bank deposit rates can both be replicated with Eurodollar futures contracts. Eurodollar futures are futures contracts on LIBOR deposit rates. As Eurodollar futures are actively traded out to about five years, swaps and short deposit rates should track each other closely. Consequently, the short end of the par swap rate curve can be viewed as a generic yield curve for highly rated financial institutions.

In contrast to the short end, the longer end of the swap curve is not tied down *via* arbitrage as closely to an actively traded credit market. Instead, the long end of the swap market is loosely tied to the long end of the corporate credit market through corporate swap activity and leveraged traders. For example, corporations are constantly striving to reduce borrowing costs. Often, higher credit entities have a *comparative* advantage funding at long fixed rates than do lower credit entities, and lower rated credit entities often have a *comparative* advantage funding at floating rates. Consequently, if long swap spreads were particularly wide versus credit spreads, it might be economical for higher-rated corporations to issue long debt and enter into a receive fixed swap to produce LIBOR funding at lower cost than if they issued floating rate debt directly. Similarly, a lower-rated corporation is often better off by issuing floating rate debt and enter into a pay fixed swap to produce fixed rate funding at lower cost than if they issued long dated fixed rate debt directly. The two corporations would have an incentive to be counterparties to the same swap.

A stonger arbitrage influence at the long end of the swap curve is the activity of leveraged investors who can borrow at a rate tied to LIBOR. To produce rates of return comparable to equity investments, leveraged investors will buy long credit product, and then enter into pay fixed swaps to convert their holdings to a spread over LIBOR. Swapping their fixed rate holdings to LIBOR minimizes any value fluctuations due to interest rate moves. However, these investors are still exposed to any credit events that would affect their assets. To minimize this credit exposure, leveraged investors generally restrict themselves to more highly-rated credits (*e.g.*, AAA or AA-rated issuers). Overall, the total returns for these investors will then be a multiple of the difference between their asset spread to LIBOR less their funding spread to LIBOR. If this credit-swap spread is wide, then leveraged investors will buy long credit product which will tend to reduce long, highly rated credit spreads and enter into pay fixed swaps which will tend to widen swap spreads. If the spread is narrow, then leveraged investors will reduce demand for long spread product which will tend to

widen credit spreads and will reduce demand for pay fixed swaps which will tend to narrow swap spreads causing the credit-swap spread to widen. As leveraged investors rarely buy lower-rated assets, we would expect the correlation of swap spreads and lower-rated (*i.e.*, BBB) credit spreads to be less than for more highly rated credits.

While the activity of leveraged investors will help keep long, highly rated credit spreads in line with swap spreads, the influence of leveraged investors can wax and wane. Leveraged investors require the willingness of financial institutions to extend credit but this willingness fluctuates with overall business conditions. During periods of volatile spreads or reduced access to credit, leveraged investors may have a limited arbitrage role in the swaps and credit markets. Consequently, it is possible, at times, for long swap spreads to move independently of long, highly rated credit spreads. For example, as LTCM was unwound, credit spreads widened dramatically versus swap spreads as spread product was sold and pay fixed swaps were unwound.

Arbitrage activity helps keep swap spreads loosely aligned with the longer portion of the corporate credit curve. However, this arbitrage activity is limited and does not always prevent long swap spreads from moving away from corporate spreads. For example, anticipated movements in the yield curve could cause swap spreads to move independently of credit spreads. If corporations anticipate declines in short interest rates, there would be strong demand for receive fixed swaps to effectively convert outstanding fixed rate debt into floating rate debt. This activity would tend to put downward pressure on swap spreads irrespective of movements in fixed rate credit spreads. Consequently, in an environment of a steep Treasury yield curve, we might expect the credit-swap spread correlation to be weaker.

Heightened credit concerns may also cause the credit-swap spread correlation to weaken. As discussed above, swaps are considered to be very liquid and have very low credit risk. They are also somewhat immune to event risk due to the LIBOR setting process and their quarterly mark-to-market feature. Corporate credits, on the other hand, are less liquid and are susceptible to event risk that can have debilitating effects on total returns. Consequently, during periods when the market is concerned about liquidity and corporate event risk, credit spreads may widen versus swap spreads.

Another potential force which might weaken the credit-swap spread correlation is the hedging activity of mortgage investors. As mortgage yields decline, the negative convexity of mortgages causes them to shed duration. To offset the shortening duration during a time of declining interest rates, some mortgage investors try to add duration and positive convexity to their portfolio. One way to accomplish this is to add receive fixed swaps. This activity puts downward pressure on swap spreads. Consequently, during times of convexity hedging by mortgage investors, swap spreads may weaken versus credit spreads.

Overall, it is reasonable to expect swap spreads to be correlated with credit spreads and to be most highly correlated with highly rated credit spreads. However, the correlation of credit-swap spreads may decline during periods of large changes in the slope of the yield

curve, heightened concerns about liquidity and credit event risk, and during times of convexity hedging by mortgage investors.

CORRELATIONS

Figure 1 presents the correlation of swap spreads and credit spreads. Swap spreads are measured as the average of the 5- and 7-year swap spreads to the off-the-run Treasury par curve. Credit spreads are represented by the average OAS over Treasuries (the Lehman Treasury spline curve) of the 5-10 year Lehman Credit Index (bullets only). The correlation plotted is the trailing three-year correlation of the monthly changes in swap and credit spreads.

As the figure shows, the correlation of swap and credit spreads increased sharply after mid-1998, rising from approximately 50% to roughly 70%. The correlation has remained at this higher level until recently when it fell back down to the level that prevailed before the 1998 crisis. For October 2001 the trailing three-year correlation value is 0.47. It is important to note that the sharp decline is due to relative spread movements in September 2001. As of August 2001, the trailing three-year correlation coefficient value was 0.65.

To check that the drop-off in the correlation coefficient is not due to the removal of the late summer 1998 observations from the three-year correlation, Figure 2 presents the two-year trailing coefficient. As shown, the two-year trailing correlation also drops off sharply well after the summer 1998 observations are removed from the correlation coefficient calculation. For October 2001 the trailing two-year correlation value is 0.46. Again, the sharp drop off is due to the September 2001 observation. As of August 2001, the trailing two-year correlation coefficient value was 0.79.

We next examine how the correlation of credit-swap spreads depends on the quality of the credit sector. Figure 3 presents the correlation of swap spreads to various quality components of the Credit Index. In general, the three correlations for each of the three credit qualities have moved similarly. As expected, BBB-rated credits tend to have the lowest correlation with swap spreads, and the AA or better credits tend to have the highest correlation. Again, all three correlation series display a recent sharp drop off due to relative spread movements in September 2001. Without the September and October 2001 observations, the correlation coefficients would be 0.69 for AA, 0.67 for A and 0.48 for BBB.

Finally we examine the impact of the slope of the Treasury curve on the credit-swap spread correlation. As discussed above, large changes in the slope of the yield curve (measured by the difference in the 10-year and 2-year par Treasury yields) may cause swap spreads to move independently of credit spreads. As the curve steepens, there is strong demand to pay floating (receive fixed) in a swap. Issuers with outstanding fixed debt will add a receive fixed swap to convert the debt to floating. This gives swap spreads a tendency to tighten. Credit spreads, however, do not react very much.

Figure 4 presents the slope of the Treasury curve since June 1989. In addition, the figure shows the difference between the AA 5 year-10 year Credit Index (bullets only) and the average of the 5- and 7-year swap spread. The figure shows that the credit-swap spread

Figure 1. **Correlation of Swap Spreads and Credit Spreads**
Three-Year Trailing Correlation
June 1992-October 2001

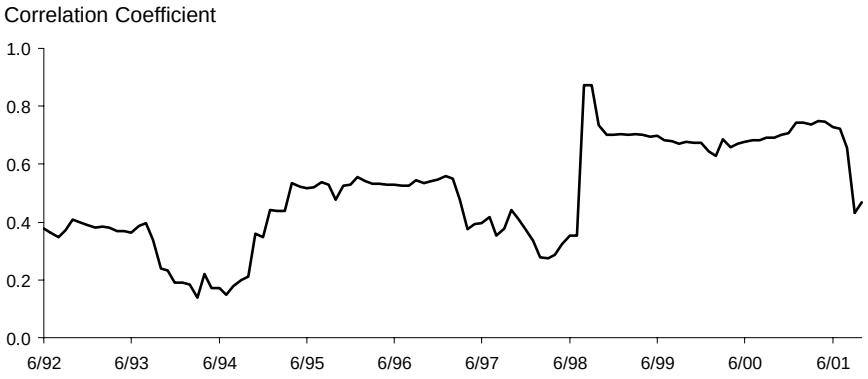
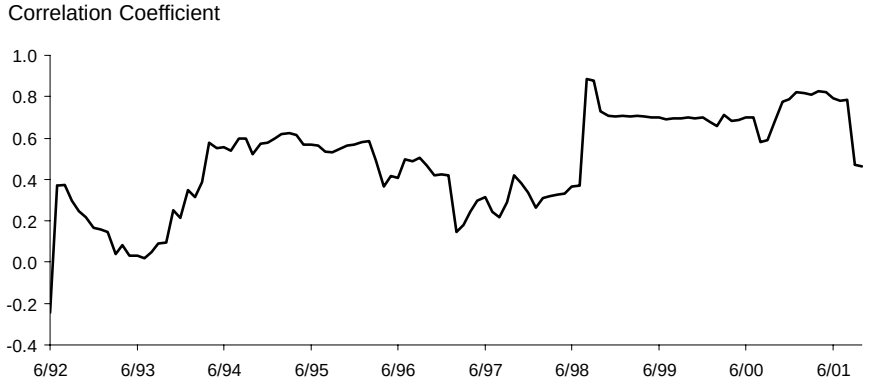


Figure 2. **Correlation of Swap Spreads and Credit Spreads**
Two-Year Trailing Correlation
June 1992-October 2001



difference is positively related to the slope of the Treasury curve. Whenever the curve steepens, the spread between swaps and corporates increases and *vice versa*. The two variables have a common trend – they rarely stray away from each other and when they do, they get back together quickly. In other words, the spread between swaps and corporates have a long-term relationship. As a consequence, there exists a combination of the two that is free of trends and regime shifts. The combination is made such that the two variables offset each other's trends and the resulting series contains only the factors that are not common to both variables. This combination is illustrated in Figure 5 as the spread difference not explained by the curve slope. We notice that, unlike the spread or slope curves in Figure 4, it is range bound without trend and structural changes.

We used regression to further support the visual result in Figure 4. The difference in monthly changes of the AA credit spread and swap spread are regressed on changes in the 2-10 year Treasury par yield difference and changes in the level of the 5-year par Treasury yield. We add the 5-year par Treasury yield to capture the effect of any convexity hedging by mortgage investors who may have a convexity-driven demand for receive fixed swaps as yields decline and their mortgage portfolios shed duration as the market rallies.

Monthly change in AA credit spread - Monthly change in swap spread =

$$\alpha + \beta \bullet (\text{change in 2-10 year Treasury spread}) + \gamma \bullet (\text{change in 5-year par Treasury yield}) + \varepsilon$$

Figure 3. **Correlation of Swap Spreads and Quality Sectors of the Credit Index**
Three-Year Trailing Correlation
June 1992-October 2001

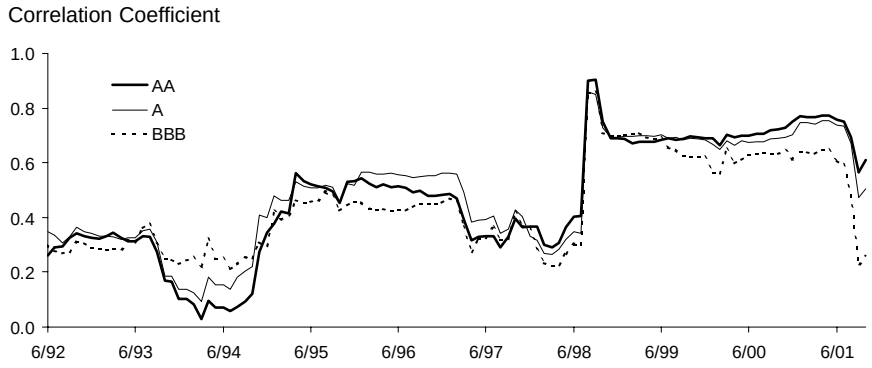
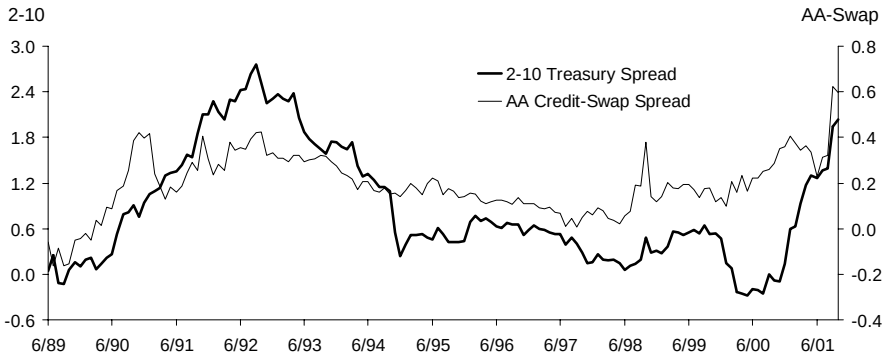


Figure 4. **Slope of the Treasury Curve (2-10) versus the AA-Credit-Swap Difference**
July 1989-October 2001



The regression results are as follows (t-statistics at a 95% confidence level are presented in parentheses):

Monthly change in AA credit spread - Monthly change in swap spread =

$$0.0023 + 0.12 \bullet (\text{change in 2-10 year Treasury spread})$$
$$(0.50) \quad (3.74)$$

$$- 0.02 \bullet (\text{change in 5-year par Treasury yield}).$$
$$(1.08)$$

The adjusted R^2 is 0.10. The coefficient on the 2-10 year Treasury spread has the expected sign and is statistically significant. However, the coefficient on the 5-year par Treasury yield is not significantly different from zero indicating that mortgage convexity hedging has little impact on the credit-swap spread difference. We also ran the regression substituting, in turn, the price of the MBS Index and the convexity of the MBS Index in place of the 5-year par Treasury yield. However, the results were very similar to those presented above.

The relationship between the credit-swap spread difference and the slope of the yield curve is strong. However, Figure 4 shows that the relationship broke down during the period from January 2000-June 2000. During this period, the Federal Reserve began tightening aggressively to slow down the economy. As a result, the curve flattened (2s-10s actually inverted) but the credit-swap spread difference did not narrow as expected. While swap spreads widened, as expected, corporate spreads also widened which caused the credit-swap spread difference to widen also. What happened?

Modeling Other Factors of Swap Spread Movements

Recent research[3] on modeling swap spread movements might shed some insight on movements in the credit-swap spread difference during this period. This non-linear model identifies three types of risk factors that drive swap spreads: liquidity (measured by the yield spread between off-the-run and on-the-run Treasuries), credit risk (measured by the implied equity volatility on S&P500 Index options (VIX)) and idiosyncratic risk. As discussed above, corporates are considered less liquid and more sensitive to credit risk than swaps. It's possible that the unexpected widening of the credit-swap spread difference during a period of a flattening yield curve may be due to spikes in the liquidity and credit risk factors causing credit spreads to widen more than swap spreads.

During the January 2000-June 2000 period the Treasury announced the beginning of its buyback operations that produced a shock to all spread product. In addition, the Federal

[3] *Identifying Relative Value through the Forecasting of Swap Spreads,* A. Kocic and C. Quintos, Lehman Brothers, July 2001.

Reserve also began to tighten aggressively in an effort to slow down the economy. The Federal Reserve's actions also produced a significant break in the stock market in April 2000. These events began to put pressure on credit spreads, which was reflected in the widening of the OAS on the Credit Index from 110bp in January 2000 to 163bp in July 2000. Credit risk and liquidity became a concern in the credit market.

Figure 5 shows the portion of the credit-swap spread difference not explained solely by movements in the yield curve slope. In addition, Figure 5 shows movements in the VIX, which is the model's proxy for credit risk. As shown in the figure, during the January 2000-June 2000 period there was a spike in the credit risk factor, VIX. This helps explain why credit spreads widened during this period preventing the credit-swap spread from declining despite a strong flattening of the Treasury curve.

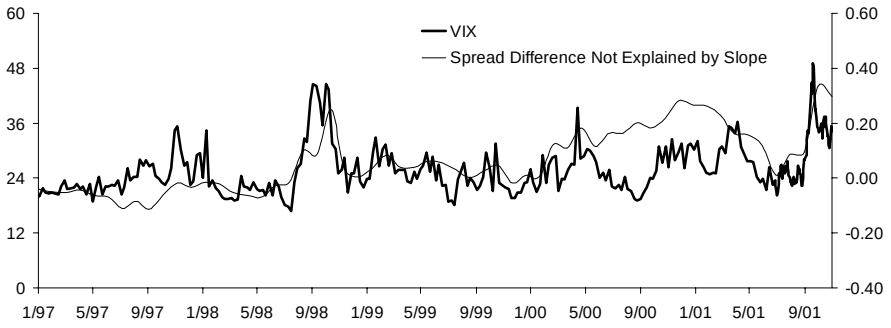
Figure 5 also shows that while some of the very recent widening of the credit-swap spread difference is due to the steepening of the yield curve, another strong spike in the VIX further added to the credit-swap spread widening.

Weaker Credit Spread-Swap Spread Correlation: Temporary or Permanent?

It has been almost four years since the liquidity crisis of 1998 led to the re-pricing of spread product and two years since the Treasury buyback announcement. During this time, swap spreads and credit spreads have been much more correlated than they had been in the past. In the last two months, however, this correlation has weakened. Why?

The last two months have witnessed a dramatic steepening of the yield curve as the Federal Reserve Board aggressively moved to bolster the economy. The steeper curve has pushed down swap spreads as investors increase demand to pay floating and receive fixed, while

Figure 5. **Influence of Credit Risk (VIX) on the Credit-Swap Spread Difference**
January 1997-October 2001



there has been little downward pressure on credit spreads. In fact, the recent increase in credit risk as measured by VIX has put upward pressure on credit spreads. Consequently, the credit-swap spread has widened significantly and has decreased the credit-swap spread correlation.

What are the implications for the future of the credit-swap spread correlation? Although it's not possible to say definitively, it seems reasonable to expect that the very steep yield curve will flatten (or at least not steepen any more) as the economy recovers. In addition, credit risk will abate and recent declines in the VIX indicate that this process has already begun. Consequently, the recent widening of the credit-swap spread will likely soon stop and reverse. Once this occurs, then credit spreads and swap spreads will likely revert to their recent correlation of approximately 0.70.

So, do swaps act as a proxy for spread product? Is it wise to use swaps rather than Treasuries to hedge a credit position? Recent events seem to raise some doubt. Stressful market environments strain many market relationships, even those that are normally very close (remember the breakdown in the correlation of on-the-run and off-the-run Treasuries during the crisis of 1998?). Once the stresses subside, however, the relationships often return to their previous level. This should be the case for credit spreads and swap spreads. In any event, the events of the past few weeks show that the idiosyncratic risk embedded in Treasuries is not going away.

However, the results in this paper indicate that hedging corporates with swaps (on a duration neutral basis) does seem to include an embedded view on the yield curve slope. If the curve were to steepen during the hedging period, then credit spreads would be expected to widen versus swap spreads. Consequently, a longer swap hedge ratio is needed. Conversely, if the curve were to flatten, a shorter swap hedge ratio would be appropriate. We plan to publish further research on constructing swap hedge ratios for credit product.

Publications—L. Pindyck, A. DiTizio, B. Davenport, W. Lee, D. Kramer, J. Threadgill, R. Madison, A. Acevedo, K. Kim, C. Rial, J. Batstone