Lev Dynkin 212-526-6302
ldynkin@lehman.com
Peter Lindner 212-526-0585
lindner@lehman.com
Sandeep Mody 212 526 7922
smody@lehman.com

SWAPS AS A TOTAL RETURN INVESTMENT

Introduction

Fixed-for-floating swaps have been in existence for more than 20 years. Over that period, liquidity and market breadth of the swaps market have increased tremendously. The notional amount of outstanding swaps went from $865 billion in the second half of 1987 to $82.4 trillion in the first half of 2002. The rate paid on the fixed leg of a swap represents an average of forward LIBOR rates. Because of that, we can expect swaps rates to be subject to systemic risks similar to those that affect credit spreads. Changes in credit risk premium influence both swap and credit spreads. Expectations of significant changes in future Treasury supply, as well as specialness of individual Treasuries, are among the factors that affect the spreads over Treasuries of both swaps and other spread product.

At the same time, some factors affect swap spreads differently. For example, the fixed legs of generic fixed-for-floating interest rate swaps are not subject to the call risk that callable bonds or mortgages are exposed to. Swaps carry very little default risk, and they trade with relatively high liquidity.

Some of the biggest users of swaps are corporations, U.S. agencies, and hedge funds. The ability of the agencies to access the bond market, the mortgage market, and the swaps markets with equal ease makes spreads in those markets follow each other closely. Banks, which are often funded at LIBOR, are significant investors in mortgage-backed and asset-backed securities (MBS and ABS, respectively). The spreads of these two asset classes are therefore highly correlated with swap spreads, too.

Swapping activity by corporations, on the other hand, leads to lower correlation overall of swap spreads with spreads of other asset classes. A steep yield curve leads corporate issuers to shift into lower cost funding by swapping their long-term fixed rate issuance into short-term LIBOR payments by receiving fixed and paying floating on a swap. This activity tends to tighten swap spreads.

Given the close interaction of swap spreads with spreads on other assets, investors can track the returns on spread product more successfully with swaps than with Treasuries. On the other hand, the impact of technical demand and supply factors on swap spreads makes them less than perfectly correlated with spreads on other products. The Lehman Brothers Swap Indices provide market participants with a high quality, institutionalized source for swaps pricing, returns, and analytics.[1]

In the remainder of this study, we use total returns on the components of the Lehman Brothers Swap Index. This index reports price return on the fixed leg of par swaps of various maturities. The floating leg of the swap is cancelled assuming cash is invested in 3-month LIBOR. In practice, getting such a return on cash may entail other risks. For example, buying an ABS-floater would mean exposure to spread risk in proportion to its spread duration. The least risky mechanism of obtaining returns close to LIBOR might

[1] For details about the Lehman Brothers Swaps Indices, see *The Lehman Brothers Swap Indices*, Lehman Brothers, January 2002.

be term repo. On the other hand, risks in investing cash may be a source of additional return. This paper will not consider the practical aspects of cash investing.

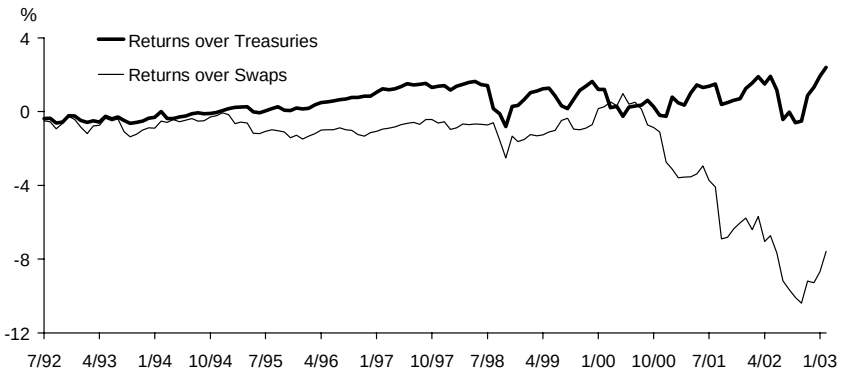
Swaps have been used on an opportunistic basis by real money and hedge fund managers for awhile. This study does not in any way address the issue of timing investments in swaps. In fact, at the time of this study,swap spreads are at historically tight levels. Rather, it addresses the properties of swaps in a portfolio-allocation context. Here we present an analysis of swaps *as an asset class* from a strategic perspective. Should swaps be considered along with cash instruments for asset allocation in total return portfolios? What are the risk-adjusted performance characteristics of swaps compared to other fixed-income asset classes? What are the properties of indices consisting of swaps and conventional fixed-income asset classes?

The changing quality composition of the Credit Index provides an additional reason for incorporating swaps into the portfolio asset mix or into the benchmark. From the end of June 1992 to the end of February 2003, the market value share of single-A and higher rated securities has decreased from more than three-quarters of the index to less than two-thirds. This study will show that swaps can serve as a substitute for high grade credit instruments, as their spread changes are higly correlated to those of single-A or better rated corporates.

A detailed discussion of the swaps market and the relationship of swaps with other fixed-income assets is provided in a previous Lehman Brothers publication.[2] This study will present empirical evidence looking at swaps as an asset class, comparing them with other fixed-income assets. Subsequently, we look at the drivers of the observed performance differential of swaps over conventional fixed income assets.

[2] See "Weaker Swap-Credit Market Correlation: Temporary or Permanent?" *Global Relative Value*, November 2001.

Figure 1. **Cumulative Returns:**
U.S. Aggregate over Treasury and Swaps Mirror Index
July 1992-February 2003



Swaps versus Bonds in Historical Perspective

Spreads and Excess Returns

When investigating the properties of one asset class compared with others, the first comparison is of the risk-return tradeoff between them. To that end, we first conduct a comparison of historical performance.

Figure 1 presents the cumulative excess return of the Aggregate Index versus key-rate duration-matched Treasuries and swaps.[3] These key-rate duration-matched swaps indices are known as mirror indices and are published as part of the Lehman Brothers Family of Indices.

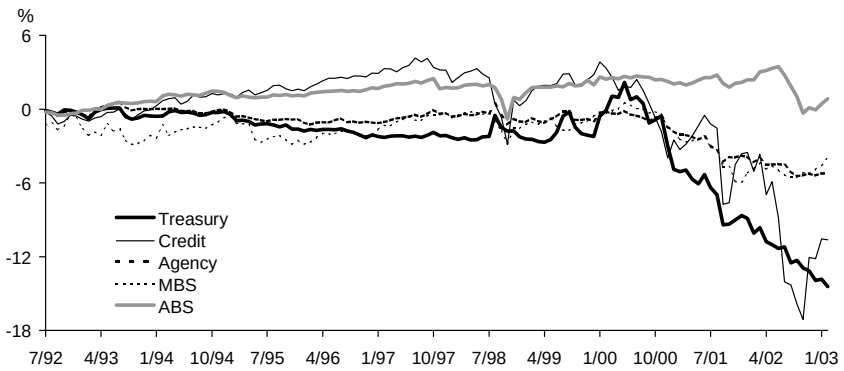
We observe that prior to the middle of 2000, the two excess return series moved together, with swaps outperforming the Aggregate Index modestly most of the time. After June 2000, the Swap Mirror Index has outperformed the U.S. Aggregate, as well as the Treasury Index, very significantly. Figure 2 illustrates the cumulative excess returns of various components of the U.S. Aggregate over their respective Swap Mirror Indices.

"Wow! Had I just invested in swaps, I would be on vacation right now," any investor in the U.S. debt markets would say. As illustrated, Treasuries underperformed their Swap Mirror Index the most, followed by credit, MBS, and agencies. The only asset class generating positive outperformance was ABS. Credit was led by its rapid recovery after October 2002 to finish ahead of Treasuries, with 10.6% underperformance versus Treasuries' 14.4 %. Agencies and MBS underperformed their swap mirror indices by 5.2% and 4.0%, respectively. ABS was the only fixed-income asset class that broke approximately even to swaps over this period. Therefore, we conclude that swaps performed well on an relative return basis versus most cash instruments.

Figure 3 illustrates the performance of the Investment Grade Credit Index and its subcomponents by quality. Significant differences are apparent: The Baa's ended February

[3] Before December 2000, the excess returns are computed over the returns of duration-matched Treasuries and swaps.

Figure 2. **Cumulative Excess Returns over Swaps: Asset Class Components of U.S. Aggregate**
July 1992-February 2003



2003 at -15% outperformance over their mirror index, the single-A's at -10.8%, and the Aa-Aaa's at only about -2%. At the end of October 2002, the outperformance of the Baa over its mirror index stood at almost -25% and had been as high as 8.7% in January 2000. In addition, Figures 2 and 3 indicate that the Baa's exhibit the highest excess return volatility of all the components of the Aggregate and the Credit indices at 93 bp/month. For comparison, it was 61 bp/month for the single A's (the second highest number), and only 28 bp/month for the Aggregate.[4]

For the Aggregate, Treasury, and MBS indices, the maximum cumulative outperformance over their respective mirror indices occurred in January 2000. The Aggregate and its components began to underperform their mirror indices substantially from then on. Also, every spread component index of the Aggregate underperformed its swap mirror index during the financial crisis from August through October 1998. Clearly, the outperformance of swaps over cash product was not monotonic. For the five components of the Aggregate that we are considering, we would have been better off staying in the cash product underlying the indices until about the first half of 2000. But even then, swaps underperformed very modestly. The observed outperformance was clearly time-dependent.

This time-dependence of the performance of cash bonds relative to swaps confirms that there is value in swaps as an asset class alternative to the Aggregate Index and its components. In the next section, we look at some commonly used summary statistics to compare swaps more formally with other fixed income asset classes.

Sharpe and Information Ratios

Figure 4 displays the mean and volatility of returns over 1-month LIBOR, as well as Sharpe ratios for the indices discussed above. In addition, we present these statistics partitioned for two subperiods, July 1992-July 1998 and August 1998-January 2003, to illustrate the impact of the significant increase in spreads and spread volatilities that took place since the summer of 1998. Using the mean outperformance numbers as a gauge, the Treasury mirror indices underperform their respective indices for the full period. However, for the swap mirror

[4] See Figure 6.

Figure 3. **Cumulative Excess Returns over Swaps: Credit Index and Quality Components of Credit Index**
July 1992-February 2003

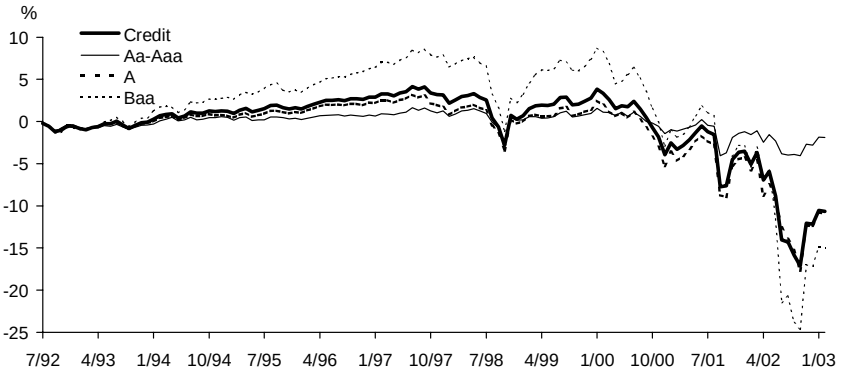


Figure 4. **Sharpe Ratios of Monthly Total Returns of the Aggregate Index and its Major Components versus Duration-Matched Treasury Index and Mirror Swap Index,1-Month LIBOR Was Used as the Risk-Free Rate**

July 1992 - February 2003

	Aggregate			Treasury		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	22.5	21.7	25.4	23.3	23.3	28.4
Stdev (bp/month)	107.0	112.8	121.6	126.9	126.9	137.3
Sharpe Ratio (ann.)	0.73	0.67	0.72	0.63	0.63	0.72

	Credit			Agency		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	26.3	26.2	30.1	23.2	20.8	25.1
Stdev (bp/month)	136.4	142.0	152.4	112.4	109.8	118.0
Sharpe Ratio (ann.)	0.67	0.64	0.68	0.72	0.65	0.74

	MBS			ABS		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	19.5	18.0	21.1	18.8	14.9	18.6
Stdev (bp/month)	83.2	88.9	95.3	74.5	77.2	81.2
Sharpe Ratio (ann.)	0.81	0.70	0.77	0.88	0.67	0.79

July 1992 - July 1998

	Aggregate			Treasury		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	20.6	19.4	21.4	20.6	20.6	22.7
Stdev (bp/month)	112.3	116.5	123.2	120.9	120.9	128.9
Sharpe Ratio (ann.)	0.64	0.58	0.60	0.59	0.59	0.61

	Credit			Agency		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	27.5	23.8	25.5	20.6	18.5	21.0
Stdev (bp/month)	143.7	144.0	152.5	116.2	112.5	119.0
Sharpe Ratio (ann.)	0.66	0.57	0.58	0.62	0.57	0.61

	MBS			ABS		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	17.2	15.7	17.6	13.3	9.7	11.5
Stdev (bp/month)	89.0	99.2	103.7	68.7	69.3	72.1
Sharpe Ratio (ann.)	0.67	0.55	0.59	0.67	0.48	0.55

August 1998 - February 2003

	Aggregate			Treasury		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	25.1	24.8	30.7	26.7	26.7	35.9
Stdev (bp/month)	100.6	108.7	120.2	135.5	135.5	148.6
Sharpe Ratio (ann.)	0.86	0.79	0.88	0.68	0.68	0.84

	Credit			Agency		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	24.8	29.3	36.3	26.7	23.8	30.7
Stdev (bp/month)	127.3	140.5	153.5	108.2	107.2	117.5
Sharpe Ratio (ann.)	0.68	0.72	0.82	0.85	0.77	0.90

	MBS			ABS		
	Index	Treasury Mirror	Swap Index	Index	Treasury Mirror	Swap Index
Mean (bp/month)	22.6	21.0	25.7	26.1	21.8	27.9
Stdev (bp/month)	75.4	73.9	83.5	81.6	86.8	91.7
Sharpe Ratio (ann.)	1.04	0.98	1.07	1.11	0.87	1.06

indices, we observe outperformance versus their respective asset class indices, with the exception of ABS that performed roughly in line with swaps.

Over the full study period, in terms of risk-adjusted performance based on Sharpe ratios, each Treasury Mirror Index underperforms its respective asset class index. However, the performance for the Swap mirror index depends upon the asset class. For credit and agencies, the Swap mirror index outperforms, and for the Aggregate, MBS, and ABS indices, swaps underperform. During the period from August 1998 to February 2003, the risk-adjusted performance of the swap mirror indices exceeds their respective asset class indices' risk-adjusted performance, with the exception of ABS.

The situation is different for the first subperiod, July 1992-July 1998, as shown in Figure 4. The Sharpe ratios of the Swap Mirror Indices exceed those of the Treasury Mirror Indices, but except for the Treasury Index, the Sharpe ratios exhibited by the components of the Aggregate, as well as the one of the Aggregate itself, are above the Sharpe ratios of their Swap Mirror Indices. During the second sub-period, August 1998-February 2003, this relationship changed substantially. The mean returns of the Swap Mirror Indices exceed the mean returns of the underlying indices for all six indices considered. For the Credit Index, the outperformance of the Swap Mirror Index approaches almost 12 bp/month. The mean returns of the Treasury Mirror Indices are usually either somewhat above or below the corresponding mean index returns, but always below the Swap Mirror Index returns. The Sharpe ratios of the Swap Mirror Index returns exceed the Sharpe ratios of the Aggregate and its components, again with the exception of ABS.

Figure 4 brings to the forefront the fact that the risk-return relationships between the asset classes vary over time. Figure 5 illustrates the time series of 3-year trailing Sharpe ratios from June 1995 to February 2003.

Figure 5 shows how the Sharpe ratios moved with the returns of the markets, and the level of short-term rates. For example, with the Aggregate Index logging its second negative annual total return since inception in 1999 and short rates increasing from July 1999 through the beginning of 2001, Sharpe ratios hovered around zero throughout 2000. Overall, the three series of Sharpe ratios follow each other closely. Since the end of 2000, the trailing Sharpe ratios of the swap mirror index exceeded the Sharpe ratios of the Treasury mirror index and the Aggregate Index itself. In February 2003, the 3-year rolling Sharpe ratio of the Aggregate was 1.60; for the Treasury mirror index, 1.76; and for the Swap Mirror Index, 1.78.[5]

Information ratios for the Aggregate, its five main components, and the Swap Mirror Indices are shown in Figure 6.[6]

For the full period, the Swap Mirror Index does better than the underlying index for the Aggregate, as well as for all of its main components except ABS. During the first subperiod, July 1992-July 1998, this was the case for the Aggregate and only three of its components. In the cases in which the mirror index provided positive outperformance

[5] The time series graphs for the components of the Aggregate are similar to Figure 5.

[6] The information ratio is defined as the mean of mirror index returns minus index return, divided by the volatility of this magnitude.

over the underlying index, the information ratios are lower than the corresponding numbers in Figure 6. All six of the mirror indices show positive outperformance during the second subperiod, August 1998-February 2003, even for ABS. Except for credit, the information ratios are the highest observed.

A major reason for the recent outperformance of swaps was the steepening of the Treasury curve, and the resulting demand to receive fixed and pay floating. This causes swaps spreads to contract.

Clearly, in terms of the index versus mirror index comparison, swaps have shown outperformance potential on an absolute return as well as on a risk-adjusted basis. In the next section, we will discuss the contribution of swaps to a portfolio consisting of spread product.

Figure 5. **U.S. Aggregate Trailing 3-Year Trailing Sharpe Ratios over 1-Month LIBOR**
June 1995-February 2003

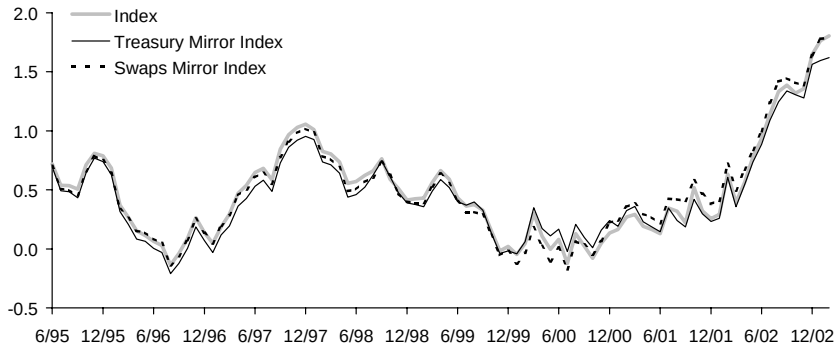


Figure 6. **Annualized Information Ratios**
Aggregate and Components over Swaps Mirror Indices
Means and Standard Deviations (bp/month)
July 1992-February 2003 and Sub-Periods

	Aggregate	Treasury	Credit	Agency	MBS	ABS
July 1992-February 2003						
Mean*	2.8	5.1	3.8	1.9	1.6	-0.3
Stdev	28.3	34.3	61.9	18.3	34.0	22.6
Information Ratio*	0.35	0.52	0.21	0.36	0.16	-0.04
July 1992-July 1998						
Mean*	0.8	2.1	-2.0	0.3	0.4	-1.8
Stdev	19.1	16.4	24.7	15.5	38.0	13.4
Information Ratio*	0.14	0.44	-0.28	0.07	0.04	-0.48
August 1998-February 2003						
Mean*	5.6	9.2	11.5	4.0	3.1	1.8
Stdev	37.2	48.8	90.0	21.5	28.2	30.9
Information Ratio*	0.52	0.65	0.44	0.64	0.38	0.21

* A positive number indicates outperformance of the Swaps Mirror Index.

Swaps in the Portfolio Context

Correlations across the relevant asset classes are an important consideration in portfolio allocation decisions. Before examining the optimal portfolio allocations, we present an analysis of the correlation of excess returns over Treasuries of the main spread components of the Aggregate Index, together with 5-year swaps.[7] As we see in Figure 7, over the period July 1992-February 2003, swaps had a lower correlation with the Aggregate Index than any of its five main components.

This low correlation shows that swaps can have a risk-reducing effect if integrated into a portfolio with the Aggregate Index. Except for their somewhat higher excess return correlation with agencies, swaps also exhibit fairly low excess return correlations with the other components of the Aggregate.

Excess returns are largely driven by changes in spreads. Yield or spread levels by themselves do not greatly contribute to return or excess return volatility.[8] The same is true for correlations of yields or spreads. Excess returns and spread movements are to the first order related by duration. Since spread movements are the driving force behind return volatilities, we analyze the relationship between the different sectors and their historically observed excess returns in terms of spreads. Figure 8 illustrates the time-dependent relationship of the 3-year rolling correlations of changes in spreads across the four components of the Aggregate with changes in 5- to 7-year swap spreads.[9] We modify our Credit and Agency indices to limit the correlation calculation to 5-10 year bullet issues.[10]

Prior to July 1997, the correlations of spread changes were below 0.6. From July 1997 to the end of May 1998, correlations between the four asset classes and swaps declined to

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[7] We use 5-year swaps in this study, because they represent a liquid point of the swaps curve and their durations are close to index durations. The swap spreads used are spreads over the Lehman Brothers off-the-run par curve. This removes the influence of specialness of on-the-run Treasury bonds that is embedded in the conventionally quoted swap spreads.

[8] When reference is made to the volatility of yields or spreads and to their correlations, monthly changes of these variables are used in the context of this study.

[9] When comparing excess return correlations with spread correlations, we generally find them to be within +/- 0.1 of each other. The exception is provided by mortgages, whose excess return correlation with swaps is 0.16 lower than the correlation of their spreads with swaps spreads. This can be traced to the relatively higher volatility of their durations.

[10] Swap spreads do not include the influence of any optionallity. To allow a fair historical comparison between swaps and bond spreads, we use only bullet spreads for credit and agency bonds. We also narrowed the maturity range to minimize the impact of non-parallel spread curve movements.

Figure 7. **Correlation Matrix**
Excess Returns over Treasuries: July 1992-February 2003

	Aggregate	Credit	Agency	MBS	ABS	5-Yr Swaps
Aggregate	1.00	0.89	0.59	0.74	0.63	0.51
Credit		1.00	0.42	0.37	0.59	0.40
Agency			1.00	0.49	0.54	0.73
MBS				1.00	0.41	0.35
ABS					1.00	0.42
5-Year Swaps						1.00

such an extent that for agencies, MBS, and ABS they became negative. However, this decline proved short-lived. By August 1998, correlations for all four asset classes returned to positive levels and remain there to the present. Correlations are now close to the historically high level for MBS, ABS, and agencies. Figure 9 presents a snapshot of the correlations levels for the end of July 1998, August 1998, and January 1998. We conclude from this analysis that, prior to the crisis in 1998, Treasuries were a more effective hedge for MBS, ABS, and Agencies than swaps. After the crisis, swaps became the instrument of choice for hedging MBS, ABS, agencies, and credit.

Recently, however, the positive relationship between credit and swap spreads has diminished. As Figure 10 shows, the three sets of correlations followed each other closely until August 2001.[11] At this point, the quality sectors begin to decouple, reaching a maximum difference between Aa-Aaa and Baa-rated credit securities of 0.42 in March 2002. Figure 10 reflects the effects of recent credit events on the correlation between swap and credit spreads. The Baa component of the Credit Index was more affected by these than the A- and Aa-Aaa components of the Credit Index.

[11] The fact that this decrease in the correlation occurred almost exactly three years after the crisis of 1998 could lead one to suspect that dropping the late 1998 observations is responsible for it. We computed the rolling correlation with two years worth of data, and found the drop-off in correlations occurring at the same point in time.

Figure 8. **3-Year Rolling Correlations: OAS Change of Credit, Agency, MBS and ABS with Changes in the Average of 5-7 Year Swap Spreads,** June 1992-February 2003

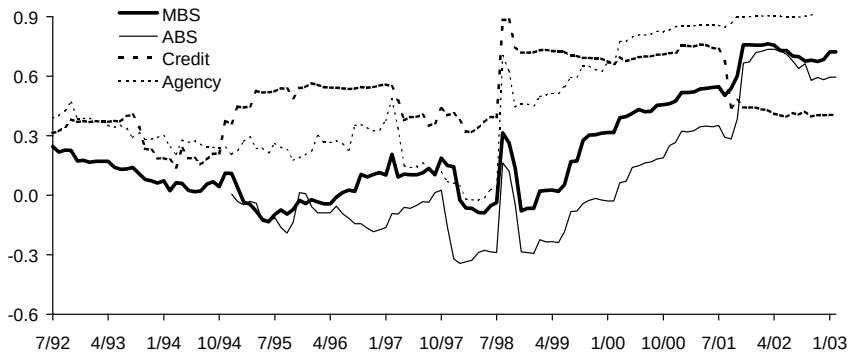


Figure 9. **3-Year Rolling Spread Correlations Snapshot**
July and August 1998 and January 1999

	Credit	Agency	MBS	ABS
July 1998	0.39	0.04	-0.04	-0.29
August 1998	0.88	0.70	0.32	0.16
January 1999	0.72	0.45	-0.07	-0.29

This analysis illustrates the time-varying relationship between swap spreads and the spreads of the major asset class components of the Aggregate Index. This variability affects allocation decisions for portfolios consisting of swaps and spread asset classes and allows us to examine the optimal allocations to swaps within different correlation regimes.

The low correlation between the excess returns of 5-year swaps and spread product implies that adding 5-year swaps to a diversified portfolio consisting of MBS, ABS, agencies, and credit can have risk-reducing benefits. A simple way to test this claim is to construct portfolios consisting of the spread asset classes of the Aggregate Index and 5-year swaps. We then select the share of swaps that minimizes the total portfolio volatility of excess returns. Figure 11 illustrates the cumulative variance over the period

Figure 10. **3-Year Rolling Correlations: OAS Change of Credit Index Components by Quality with Changes in the Average of 5-7 Year Swap Spreads**
July 1992-February 2003

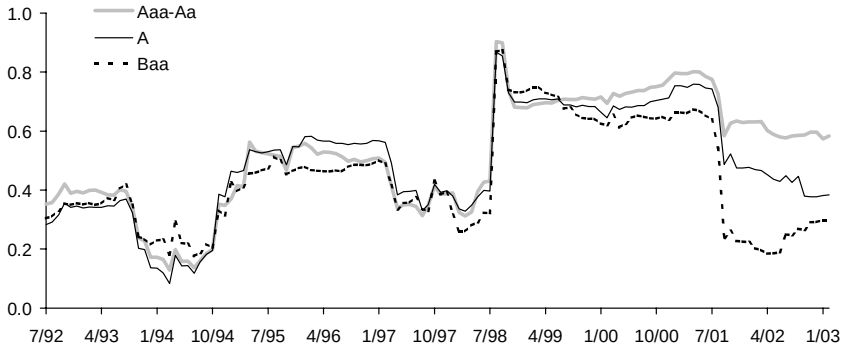
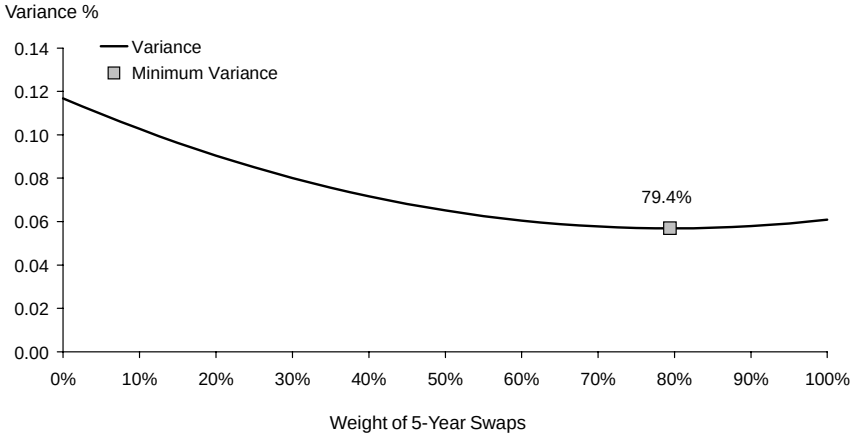


Figure 11. **Variance of Excess Returns over Treasuries as a Function of 5 Year Swaps Weight**
July 1992-February 2003



July 1992 to February 2003 of holding various combinations of the spread asset classes and swaps. As shown, the optimal portfolio combination is a weighting of 79.4% to swaps and the remaining 20.6% distributed amongst the spread asset classes in proportion to their respective MV contribution to the Aggregate Index. This allocation achieves a volatility of 23.9 bp/month. Clearly, this simple analysis is not meant to suggest allocating 79% of market value to swaps product. Rather, it is meant to show that swaps can have a valid part in fixed-income portfolios that are build with an eye on risk minimization.

To examine how swaps fit into a multi-asset excess return framework, we will investigate their place within the mean-variance framework.[12] For this purpose, we examine the optimal allocation results from holding a portfolio selected from swaps and the major asset classes of the U.S. Aggregate. These asset classes include MBS, ABS, credit, and agencies.

We look at the resulting optimal portfolio allocations in three distinctively different correlation regimes and by varying the underlying assumption for expected returns of swaps. Figure 12a displays the correlation matrix for the three different time periods. We select these periods to illustrate the impact of different correlations on the resulting asset allocation. The correlations for April 1998 and January 2003 are calculated using trailing

[12] Given normally distributed returns of underlying assets, mean-variance analysis finds sets of portfolios (linear combinations of assets) which exhibit minimum variance for a given level of expected return.

Figure 12a. **Correlation Matrices**
July 1992-February 2003, May 1995-April 1998 and February 2000-January 2003

	Agency	Credit	MBS	ABS	5-Year Swaps
July 1992-February 2003					
Agency	1.00	0.42	0.48	0.54	0.73
Credit	0.42	1.00	0.37	0.58	0.40
MBS	0.48	0.37	1.00	0.41	0.35
ABS	0.54	0.58	0.41	1.00	0.42
5-Year Swaps	0.73	0.40	0.35	0.42	1.00
May 1995-April 1998					
Agency	1.00	0.20	0.18	0.19	0.10
Credit	0.20	1.00	0.40	0.15	0.28
MBS	0.18	0.40	1.00	0.05	0.16
ABS	0.19	0.15	0.05	1.00	-0.25
5-Year Swaps	0.10	0.28	0.16	-0.25	1.00
February 2000-January 2003					
Agency	1.00	0.43	0.56	0.58	0.85
Credit	0.43	1.00	0.47	0.62	0.34
MBS	0.56	0.47	1.00	0.42	0.54
ABS	0.58	0.62	0.42	1.00	0.55
5-Year Swaps	0.85	0.34	0.54	0.55	1.00

Figure 12b. **Expected Return,** bp/month

	Agency	Credit	MBS	ABS
ExpRet (bp)	31.6	171.1	36.2	127.4

3-year excess returns, whereas the correlation matrix for the full period is calculated using excess return data from July 1992 to February 2003.

Generally, the lowest levels of the correlations occur in April 1998, with the highest occurring in January 2003. This is evident by observing the correlations between Agencies and 5-year swaps. In April 1998, the correlation coefficient is 0.10, compared with 0.85 in January 2003. The correlation coefficients between ABS and swaps even switch signs. For the full period, the correlations are, for the most part, between the levels of April 1998 and January 2003.

To obtain the optimal portfolio allocations, we minimize variance subject to a target portfolio annualized expected excess return of 15 bp. This way we can compare allocations to swaps that produce a constant expected portfolio return in different correlation environments. The expected returns for the four major asset classes are set equal to their respective option-adjusted spreads over Treasuries as of December 31, 2002, as shown in Figure 12b. For swaps, we examine expected returns at option–adjusted spread levels of 50, 75, and 100 bp.

As expected, the lower the correlation, the greater the diversification benefits to a portfolio, which results in a larger allocation to 5-year swaps. Figure 13 presents the optimal allocation results. The largest allocation to swaps occurs in April 1998 at 28% with a liberal spread assumption of 100 bp. With a more conservative assumption between 50 to 75 bp, we expect an allocation between 12% and 17%.

Swaps: A Benchmark Free of Idiosyncratic Risk

Swaps have very low credit risk, comparable to highly rated credit issuers. As mentioned above, swap rates should not be affected by isolated credit events because the LIBOR setting process excludes banks that experience credit problems. The counterparty credit risk that is associated with swaps is substantially reduced through netting and collateralization agreements. Given these characteristics, we expect swaps to display much lower levels of idiosyncratic risk than a credit benchmark.

The mere existence of security-specific and sector risk in a conventional bond benchmark makes active portfolio managers hesitant to bring portfolio weights in individual names to zero, even if they are very much disliked. This is particularly true for names of relative importance in the benchmark. Significant portfolio underweights of large corporate issuers in the index is risky. Swaps can take on an important place as an alternative benchmark, or an addition to a credit benchmark, because they are free of individual issuer exposure. Despite the fact that the correlation of swaps with Credit product has settled at around 0.4 recently (see Figure 8), it is still clearly positive. A pure swaps

Figure 13. **Optimal Allocation to Swaps**

ExpRet (bp)	**Full Period**	**Apr-98**	**Jan-03**
50	3.10%	11.66%	0.00%
75	4.58%	16.95%	0.09%
100	11.37%	27.71%	8.79%

benchmark, against which Credit is actively managed, will allow the manager to concentrate on name selection purely dependent upon the results of his credit research. Tracking error minimization through alignment of names between portfolio and benchmark is no longer essential.

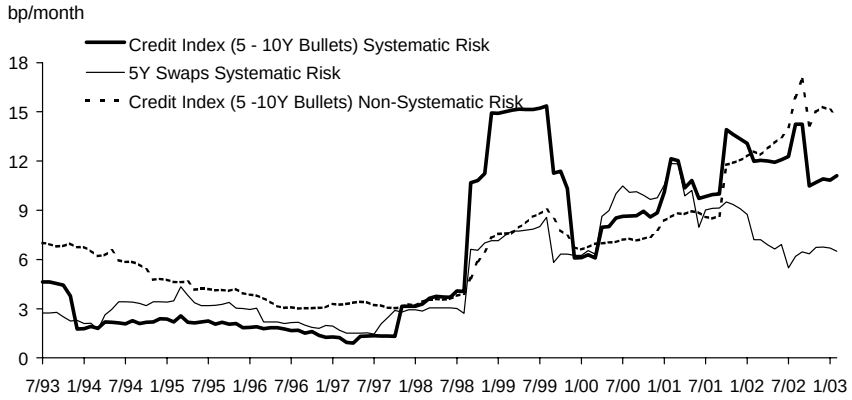
This thought process has led to the use of swaps in benchmarks for credit and mixed credit-agency-MBS and ABS portfolios. In one particular case, the manager was precluded from actually investing in swaps. This clearly creates a problem for the manager because there is no *neutral asset* available for investment. The plan sponsor imposing this restriction should be aware of the tracking error that can occur between the investable set and the benchmark.

We examine the importance of idiosyncratic risk in the Credit Index by plotting over time the behavior of systematic and non-systematic risks associated with the credit index and 5-year swaps. For the credit index, once again, we use only 5- to 10-year bullet issues. As a proxy for systematic risk, we calculate the one-year trailing volatility of the mean monthly changes in OAS. Our proxy for non-systematic risk is the one-year trailing mean of the volatility of individual monthly changes in OAS. Figure 14 displays our results. Since the latter portion of 1999, the systematic and non-systematic risks of the bullet Credit Index increased until October 2002, when the trend reversed. Interestingly, systematic risk decreased far faster than non-systematic risk. The risk of swaps, which went hand-in-hand with systematic credit risk (except during the period of the LTCM-crisis and its aftermath), was lower than systematic credit risk since the middle of 2002.

Conclusions

The notion of *swaps as an asset class* should be considered from a tactical as well as from a strategic asset allocation perspective. In this paper, we presented empirical support for using swaps in both applications. The recent outperformance of swaps over Treasuries, as well as over most other asset classes in the Lehman Aggregate Index, shows that even if swaps are not part of a benchmark, active managers should

Figure 14. **Systematic and Non-Systematic Risk: Credit Index (5- to 10-Year Bullets) and 5-Year Swaps**
One-Year Trailing OAS Change, July 1993-February 2003



be given the option of investing in them. It should be noted that if a manager can engage in payor as well as in receiver swaps, swaps can present a convenient means for shorting the market. The outperformance on an excess return basis was accompanied by superior Sharpe and information ratios that confirmed swaps' performance on a risk-adjusted basis.

Swap spreads are held in line with the spreads on spread product largely via the arbitrage activity of important market participants. Yet certain factors, *e.g.*, a steep yield curve that leads to substantial swapping activity by corporations, can cause significant dichotomy of swap and credit spreads. Although such factors diminish the value of swaps as hedging instruments, they improve their diversification properties.

An important point for plan sponsors is the absence of idiosyncratic risk in swaps. We found that the idiosyncratic risk of the 5- to 10-year bullet Credit Index exceeds its systematic risk. At the same time, swaps' systematic risk was found to be below the systematic risk of this part of the Index. In essence, swaps represent a *benchmark void of idiosyncratic risk*, that can free active managers from the need to invest in large benchmark issuers.

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