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Mortgage Strategies Group

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On Call Protection (and Convexity)

Overview

Portfolio managers that are concerned with prepayment risk should be purchasing call protection and convexity for their portfolios. There are a number of strategies and securities that can be used to provide call protection, short of being in Treasuries. In the Agency passthrough sector, the most common call protection strategies are the down-in-coupon strategy and the barbell strategy. However, there are numerous other securities that offer superior and cheaper call protection. In this report, we analyze the following strategies and securities that can be used to increment and optimize portfolio returns by adding convexity:

- I. The Down-in-Coupon Strategy
- II. Barbell Strategies
- III. PAC and Sequential CMOs with Principal Lockouts
- IV. GNMA PACs
- V. Non-Agency PACs and Sequential CMOs with Principal Lockouts
- VI. Premium and "Busted" PACs, and Premium Sequentials, with Principal Lockouts
- VII. Relocation MBS-backed CMOs
- VIII. Shifting Interest Subordinated Securities (B-pieces and Mezzanines)

Our analysis leads us to reiterate our prior recommendations: that investors should continue to (a) focus on structured products over MBS passthroughs, and (b) prefer Treasuries over passthroughs. Within structured products, we believe that GNMA-backed and Relocation MBS-backed CMOs offer cheaper convexity than conventional-backed CMOs. In addition, we suggest that investors who are not burdened by capital restrictions and regulations investigate opportunities in non-agency shifting interest subordinated securities and other non-traditional mortgage investments.

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I. The Down-In-Coupon Strategy

This strategy involves swapping into the "current coupon" MBS as the market rallies, out of the prior current coupon, before prices on the higher coupon MBS begin compressing, and before that bond begins to experience refinancing related prepayments. The theory is that new production MBSs are relatively immune from prepayments, and should therefore participate in market rallies up to the point at which they become refinaneable. Since the current coupon is also the security that has the greatest demand for CMO issuance, it also has the added "advantage" of often being dollar-rollable at attractive financing levels, as dealers often print more CMOs than the available float for a given coupon/WAM combination. This strategy is heavily used by total return managers with large portfolios, and those who are limited to U.S. government or agency securities, who prefer passthroughs for their liquidity and ability to be executed in size. It is also a strategy that is often applied to portfolios of PAC bonds, in order to prevent prices from rising to the point where they begin to lose liquidity.

Table 1 estimates the historical total returns earned during the prior 12-months by using the "down-in-coupon" strategy, for GNMA, FNMA, and Dwarfs, compared to their Treasury benchmarks. The table suggests that the down-in-coupon strategy does not consistently provide adequate convexity protection in a rallying market.

Table 1
The Down-in-Coupon⁺ Strategy vs. MBSs and Treasuries
12-month Historical Holding Period TRRs
7/1/92 - 7/1/93

MBS Type	TRRs *	Benchmark UST	UST TRR	MBS Performance Pickup
GNMA Down-in-Coupon	14.28 %	10-yr	16.74 %	-2.46 %
FNMA Down-in-Coupon	13.87 %	7-yr	13.98 %	-0.11 %
Dwarf Down-in-Coupon	12.81 %	5-yr	11.90 %	0.91 %

+ Also incorporates a few instances of rolling up into the current coupon, in November & December '92. We have not included any incremental pickup from dollar-rolling the collateral.

* Assumes coupon rolling decisions are made on a monthly basis.

The risks in this strategy arise primarily from the "spread widening" vulnerability inherent in MBSs. Since current coupon MBSs have relatively long durations and "spread durations", spread widening can cause them to underperform Treasuries very easily. (Please refer to the 3/9/93 Strategy report entitled *Can Current Coupon MBSs Outperform Treasuries?*, for a *more detailed discussion of spread widening risk*.) The dollar-roll "advantage" often tends to be illusory too, for it (being a money market rate advantage) is easily overwhelmed by the spread duration of MBSs. The ability to dollar-roll is not, in our opinion, sufficient reason to participate in MBSs. In addition, MBSs do not "roll down the curve", unlike Treasuries (especially the 5-year and 7-year), which do.

Table 2 shows the break-even yield spreads required for current coupon MBSs to achieve the same total returns as their benchmark Treasuries, over a 6-month horizon. The relatively low threshold of spread widening that these coupons can tolerate suggests that the risk-return tradeoff is currently biased in favor of Treasuries.

Table 2
Current Coupon Agency MBSs
Break-Even MBS Yield Spreads to Benchmark Treasuries
6-month horizon TRRs

MBS	Current Spread	B/E * Spread	B/E Widen	UST TRRs
GN 6.5 / 10-yr	84	91	7	5.72
GN 7 / 10-yr	96	105	9	5.72
FN 6.5 / 7-yr	123	131	8	5.80
FN 7 / 7-yr	130	140	10	5.80
Dwarf 6 / 5-yr	110	113	3	5.83
Dwarf 6.5 / 5-yr	114	112	-2	5.83
FN 7-Yr Balloon 6 / 5-yr	64	62	-2	5.83

* We do not include the incremental impact of dollar-rolling MBSs. However, as discussed in *Can Current Coupon MBSs Outperform Treasuries?*, this advantage is usually marginal, and is overwhelmed by the spread duration of the MBSs.

II. Barbell Strategies

Maintaining a coupon barbell, where current or discount coupons (long duration) and premium coupons (short duration) MBSs are owned, while "cuspy" intermediate coupons are sold, is a very simple method to outperform any market-weighted MBS index. (Please refer to the 12/15/92 and 4/22/93 Research reports *Restructuring Portfolios to Beat the Mortgage Index*, and *Maintain the Barbell, Trounce the Index*.) The mortgage market is heavily concentrated in the intermediate sectors, which are the most vulnerable to refinancing related prepayments, and is therefore biased towards underperforming Treasuries during rallies. To outperform such an index, then, is a matter of avoiding prepayment surprises, while maintaining a duration similar to that of the index. This is done by owning discount coupons or current coupons, which are unlikely to get prepaid, and premium coupons, which are "burnt-out" and whose prepayments do not accelerate significantly beyond expected levels.

While barbell strategies consistently outperform the mortgage index, they do so because the index, the performance benchmark, is such a poor indicator of what is achievable in the mortgage market. This can be observed in Table 3, which shows the first quarter 1993 holding period total returns for the mortgage index (whose duration on 12/31/92 was 3.56 years), a duration neutral MBS barbell, and a duration neutral Treasury barbell.

Table 3
Nomura Agency MBS Index vs. Duration Neutral MBS and UST Barbells
1st Quarter '93 - Holding Period Returns

MBS Index	MBS Barbell (*)	UST Barbell (+)
3.02 %	3.21 %	4.18 %

(*) 50%/50% Extra-long MBSs (5.51 Duration) and Extra-short MBSs (1.54 Duration)

(+) 44%/56% 3-yr UST and 5-yr UST

The shortcomings of the MBS Barbell Strategy arise from opportunity cost: there are usually other securities that can offer superior call protection and returns than Agency MBSs, as is evident in Table 3, when one considers the Treasury barbell as an alternative to MBSs. However, some of the alternatives described are often unsuitable for certain types of accounts, usually for credit or liquidity reasons, often leaving them with the barbell as their best alternative.

III. PACs and Sequential CMOs with Principal Lockouts

While both PACs and Sequential CMOs were created to provide call protection for MBSs, giving them fundamentally better convexity and call protection than the underlying collateral, the market has tended to penalize structured products during rallies, giving them very poor price performance and often much worse "effective convexity". They have therefore often been shunned by indexed accounts, and by those customers who have to mark their portfolios to market on a periodic basis, like mutual funds, further worsening their liquidity. However, these securities, on a buy and hold basis, can offer superior returns to collateral, with their yields being more representative estimates of their probable return than the yield on collateral, as a result of their principal lockouts. In addition, they have the added benefit of rolling down the curve, appreciating in price, thus adding to their returns.

Principal lockouts are very valuable features of securities that are often misvalued by the markets. The yield calculation assumes reinvestment at the yield rate, which, in a steep yield curve environment, causes the yields on securities that receive principal cashflows to overestimate returns. This is because cashflows have to be reinvested at a lower rate in a steep yield curve environment, lowering the return on securities that receive large cashflows.

The extent of the call protection provided by lockouts can be measured by comparing the break-even horizon spreads required for a security to equal the return on a benchmark (we'll use the comparable Treasuries) over a horizon that is close to the securities' maturities. Securities with lockouts, like PACs and Sequentials, typically can suffer greater spread widening, and still equal the return on a benchmark, than securities that have do not have lockouts, like collateral. This is because, for securities that do not have lockouts, the unanticipated cashflows get reinvested at lower rates than the yield, requiring the now-smaller outstanding bond balance to make up the loss in return through price performance.

This can be observed in Table 4, which shows the spreads required for a 7-yr PAC, a 7-yr Sequential, and FNMA 7s to equal the total returns on a 7-year Treasury, over a 48-month holding period. In the base and up 100 bps scenarios, the PACs and Sequentials can widen by up to 186 bps to equal the TRR on the Treasury, while the passthrough can only widen by 11 bps. In the case of a rally, the PAC can widen by 61 bps, while the Sequential and passthrough would have to tighten to Treasuries. However, the Sequential still significantly outperforms the passthrough, reflecting its superior convexity attributes.

Table 4
Agency PACs & Sequential CMOs vs. MBSs
Break-Even Yield Spreads to Benchmark Treasuries
48-Month Horizon

MBS Type	Coup/Collat	Prin. Start	Prin. End	WAL	Price	Spread 7-yr	TRRs/Breakeven Spreads to Treasuries		
							-100 bps	Base Case	+100 bps
7-yr TRR	5.50		4/00				6.20	5.76	5.34
PAC (+)	6.45 x FN 7	6/00	9/02	7.99	100-31+	+88	149	224	203
SEQ (*)	7.0 x Gold 7	11/99	5/02	7.47	102-05+	+125	-16	311	253
FNMA 7	N/A	8/93	4/23	7.62	101-16	+130	-133	141	142

+ The PAC used was FNMA 93-99 PG @ 200 PSA; * The Sequential was FHLMC 1548 B @ 200 PSA

IV. GNMA PACs

PACs and Sequentials backed by GNMA collateral can provide greater convexity than conventional PACs and Sequentials. GNMA collateral typically prepays more slowly and is less interest rate sensitive than conventional collateral, and should exhibit greater stability over a larger range of interest rates. This can be observed in the chart below, which shows the relative historical prepayments of seasoned GNMA and FNMA 7.5s. In general, GNMA prepayments tend to be less volatile than conventional prepayments. (Please refer to *The Nice Things about GNMA 7s as Collateral for REMICs*, 6/25/93.)

Prepayments of Seasoned GNMA 7.5s vs. FNMA 7.5s

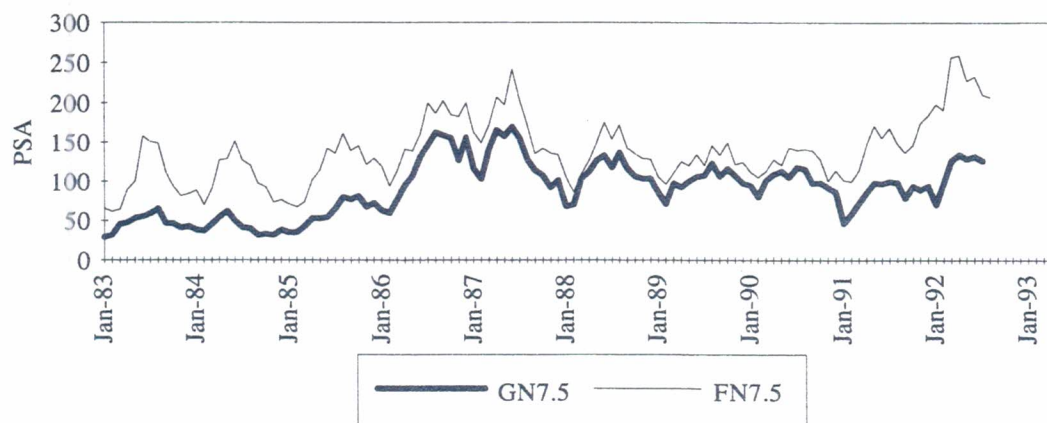


Table 5 compares breakeven spreads to the 10-yr UST, for a 10-year GNMA PAC, a 10-year FNMA PAC, and GNMA 7s. It can be observed that the GNMA PAC has more stable breakeven spreads. Given that GNMA PACs trade at similar yield spreads to conventional PACs, we believe that they are relatively cheaper, as they offer greater convexity for similar yield spreads.

Table 5
GNMA PACs vs. conventional PACs & MBSs
Break-Even Yield Spreads to Benchmark Treasuries
48-Month Horizon

MBS Type	Coup/Collat	Prin. Start	Prin. End	WAL	Price	Spread 10-yr	TRRs/Breakeven Spreads to Treasuries **		
							-100 bps	Base Case	+100 bps
10-yr TRR	6.25		2/03				6.84	5.99	5.16
GNMA PAC (+)	6.75 x GN 7	8/02	9/06	10.94	100-19	+92	175	174	164
FHLMC PAC (+)	7 x Gold 7	8/93	6/06	10.60	102-21	+92	55	175	170
GNMA 7		9/93	7/23	9.00	101-26	+96	-64	92	120

+ The GNMA PAC used was FNMA 93-99 PG @ 160 PSA.

* The conventional PAC used was FHLMC 1468 H @ 200 PSA

V. Non-Agency PAC and Sequential CMOs with Principal Lockouts

Non-Agency CMOs with lockouts offer the same advantages as Agency CMOs, except at wider spreads. Nominally, the wider spread is compensation for credit risk; however, in our opinion, the credit risk of non-agency CMOs is vastly over-rated, especially with "super-senior" classes. The true risk of jumbo collateral and non-agency CMOs lies in the increased prepayment sensitivity of the underlying mortgages, which is often further leveraged with the use of shifting interest senior-subordinated structures. While this gives CMOs backed by jumbo collateral greater negative convexity than comparable CMOs backed by conventional collateral, we believe that this is more than compensated for by the 25 bps (PACs) to 60 bps (short sequentials) greater spread offered over agency CMOs. This can be observed in the breakeven spreads to Treasuries of the bonds shown in Table 6.

Table 6
Non-Agency PACs and Sequential CMOs vs. MBSs
Break-Even Yield Spreads to Benchmark Treasuries
36-Month Horizon

MBS Type	Coup/Collat	Prin. Start	Prin. End	WAL	Price	Spread 5-yr	TRRs/Breakeven Spreads to Treasuries		
							-100 bps	Base Case	+100 bps
5-yr TRR	5.125		6/98				5.99	5.49	5.00
PAC (+)	6.5 x 15/7.14	10/97	11/00	5.63	101-12+	+115	214	285	273
SEQ (*)	7.40 x 8.08	5/98	1/01	6.00	102-21+	+180	399	422	346
DW 6.5	N/A	8/93	4/08	5.69	101-12	+114	-26	122	119

+ The PAC used was RFMSI 1993-S23 A7 @ 300 PSA.

* The Sequential was PHMS 1993-19 A9 @ 350 PSA.

VI. Premium PACs, Premium Sequentials, and "Busted" PACs with Lockouts

Because of the mortgage market's propensity of analyzing securities at current static speeds to life, the market severely penalizes PACs and Sequentials when interest rates decline, often pricing them at higher yields and wider spreads than those for collateral, as compensation for expected average life shortening. As discussed above, lockouts can provide significant return advantages, which become even more important when prices of PACs and Sequentials rally to well above par. This is because premium PACs and Sequentials earn above market premium coupons, which helps increase the breakeven spread widenings required to make them underperform, and allows their payback periods to shorten. By comparison, premium collateral, which typically prepays at very fast speeds, pays a premium coupon on an increasingly diminishing balance. We would tend to prefer premium PACs and X-PACs over premium collateral, and would recommend building a MBS barbell using these securities instead of premium coupon collateral.

The return advantage of holding premium PACs or Sequentials over premium collateral can be observed in Table 7, which shows the 24-month holding period break-even spreads to the 3-year UST, for 3-year WAL Premiums X-PACs, FNMA 9s, 9.5s, 10s, and 10.5s.

Table 7
Premium PACs & Sequentials
Break-Even Yield Spreads to Benchmark Treasuries
24-Month Horizon

MBS Type	Coup/Collat	Prin. Start	Prin. End	WAL	Price	Spread 3-yr	TRRs/Breakeven Spreads to Treasuries		
							-100 bps	Base Case	+100 bps
3-yr TRR	4.25		5/96				4.98	4.63	4.27
X-PAC (+)	7.0 x Dw 8	5/96	10/97	3.53	103-26+	+140	398	378	304
FN 9		9/93	6/17	2.25	106-27	+105	-148	82	358
FN 9.5		9/93	3/18	2.25	108-9+	+82	-226	19	283
FN 10		9/93	11/17	2.14	109-28	+33	*	-130	134
FN 10.5		9/93	10/16	2.14	111-08	+12	*	-186	45

+ The X-PAC used was FN 92-20 PG, priced at 450 PSA.

* FN 10s and 10.5s underperform the 3-year Treasury for all positive horizon yields in the down 100 bp scenario.

As a result, we prefer premium PACs and X-PACs over premium collateral, and would strongly recommend using them in MBS barbells as substitutes for premium passthroughs.

VII. Relocation MBS-backed CMOs

Relocation loans are mortgages originated for transferred corporate employees (transferees) to facilitate their purchases of loans at their new job locations. Transferees are typically middle- to high-level managers at mostly Fortune 500 companies, who are often moved again, for reasons of promotion or changing job assignments. Research suggests that the average stay of transferees at a location is around 4-years, with most transferees experiencing more than 4 transfers during their careers. (Please refer to the 1/23/93 and 6/24/93 research reports "*Agency-Guaranteed Relocation Mortgage Backed REMICs*", and "*FHLMC Relo REMIC Series 1558*" for a more detailed description of relocation programs and the characteristics of relocation collateral.)

The primary characteristic of pools of relocation loans is their "two-tiered" prepayment behavior: they prepay slightly slower than non-relo. pools in the initial years, but prepay substantially faster in the subsequent years, as transferees get re-transferred. This tiering pattern stems from the economics of employee transfers: the average cost of relocation exceeds \$50,000, which dissuades companies from re-transferring employees in the earlier years. However, once employees start getting re-transferred, the prepayment speed picks up dramatically, and stay high until most of the pool is paid down. Relo prepayments tend to be more dependent on the rate at which large corporations relocate employees, which is more likely to be dependent on economic conditions than on interest rates.

While one can hardly describe relocation mortgages as being call protected (they prepay at high rates), their prepayment pattern observed is not very interest rate sensitive. Unlike conventional non-relo. mortgages, which prepay at the vagaries of interest rates, and are negatively convex as a result, relo. mortgages tend to have a more predictable prepayment behavior and average lives. We would not expect relo. prepayments to slow down and extend in a rising rate environment, unlike non-relo. loans, which would face extension risk. In a declining rate environment, while it is possible that transferees might refinance their

mortgages if offered lower rates without significant transaction costs, we would not expect them to speed up from their pricing speeds in as dramatic a fashion as non-relo. MBSs. In concept they are more akin to Home Equity loans, in their prepayment rate stability, than MBSs. We would therefore expect relo. collateral to exhibit superior convexity than conventional non-relo. collateral.

CMOs structured off relocation collateral should thus have superior convexity to comparable tranches of non-relo. backed CMOs, with a greater degree of average life predictability, and should trade tighter than regular CMOs. However, they are currently being offered at 8 to 10 bps wider than comparable conventional CMO tranches, reflecting their recent introduction to the markets. In time, however, we would expect them to tighten as an understanding of their characteristics and performance becomes more prevalent in the marketplace.

VIII. Shifting Interest Subordinated Securities (B-Pieces and Mezzanines)

B-pieces are securities structured from non-agency collateral to absorb the credit risk of the underlying mortgages, and to provide credit enhancement to the other bonds in the structure that have more senior claims on principal and interest. To make the credit enhancement more efficient, and to preserve the availability of the subordination, most deals use the "shifting-interest structure", which provides call protection to the subordinated bonds while increasing their exposure to credit risk. This is done by allocating part of the subordinated bond's share of prepayments to the senior bonds according to a schedule, which pays them down first, while allocating losses (from foreclosures or uninsured hazards) to the subordinated bonds. B-pieces typically aggregate to between 4% and 12% of the underlying mortgage loans, depending on the rating agencies' assessment of the quality of the collateral. An example of a typical shifting interest schedule for fixed rate collateral is shown in Table 8.

Table 8
A Typical Shifting Interest Schedule

Months	% Prepay - Senior	% Prepays - Subordinated
1 - 60	100 %	0 %
61 - 72	70 %	30 %
73 - 84	60 %	40 %
85 - 96	40 %	60 %
97 - 108	20 %	80 %
109 - Maturity	0 %	100 %

As can be seen from the table, subordinated bonds typically do not receive any prepayments for 60 months, and are call protected during this period. As the deal seasons, the subordinated bonds get an increasingly larger proportion of the prepayments, until the point at which all the senior bonds are paid off, at which point all cashflows go to the subordinated bonds.

Mezzanine bonds are securities that result from a further tranching of subordinate pieces, through the allocation of losses. Mezzanine bonds are structured as "second-loss" securities, with the remaining B-pieces absorbing first-losses. Mezzanine bonds typically continue to receive the full protection against prepayments of the B-piece, and are thus protected against both prepayments and losses, and trade very well as a result.

In our opinion, credit losses of well underwritten deals from "quality" issuers, are minimal, and that the value afforded by the inherent call protection more than overwhelms the risk of principal and interest loss on these securities. In addition, these securities suffer from regulatory misunderstanding of their risk-return tradeoffs, however, and do not have as liquid markets as the other sectors described above. They are penalized by the OTS and OCC, each of which require the institutions they regulate to hold a greater amount of capital against investments in these securities, as compared to the capital required for agency CMOs. They, however, offer enough yield and call protection that they are cheap, even after adjusting for the additional capital requirements. For those institutions who are not burdened by capital requirements, and who understand the credit analysis required to identify attractive collateral and issuers, it is our opinion that these securities provide the cheapest call protection available in the marketplace.

Conclusions and Recommendations

This article underscores the richness of MBS passthroughs. We strongly believe that investors are not being adequately compensated for the negative convexity in passthroughs at current spread levels. While passthroughs have performed better than might have been expected in the current rally, this performance has been a result of the agencies' (FNMA and FHLMC) purchasing of MBSs to balloon their balance sheets, to take advantage of the attractive levels at which they can issue callable debt (please refer to *Mortgage Market Themes*, 6/1/93). While we expect the agency demand for MBSs to continue, suggesting that current coupon MBSs are unlikely to experience significant spread widening in the near future, we do not expect them to tighten further either, as the agencies appear to have driven out the competition (the CMO arbitrage is all but non-existent in current coupons, and, at these spread levels, it is non-economical for leveraged investors, such as banks, to purchase MBSs for their "spread-over-funding" portfolios). We also show that, in spite of the technical factors that have supported this market, passthrough strategies that are supposed to combat negative convexity, such as "down-in-coupon" trades and barbells, have failed to do so over the past year. Our breakeven spread analysis also emphasizes the spread widening fragility of passthroughs. This should be of import for total return managers who are measured on a year-over-year basis. The risk-return tradeoff of being in passthroughs gets increasingly worse as the year-end approaches, as spread widening can wipe out a significant portion of their gains of the current year.

The article also emphasizes some of the fundamental values and convexity available in structured MBS product. We have absolute conviction that structured products are cheap, to both MBSs and Treasuries. We believe that buy-and-hold strategies in structured products should outperform dynamic portfolio management strategies in passthroughs (like the down-in-coupon strategy) by limiting reinvestment risk and by rolling down the curve. As a result, we would not recommend reducing portfolio allocations for mortgages, but redistributing them between passthroughs and structured products.

On the basis of our analysis, we would make the following recommendations:

- **Insurance companies and pension plans**, which typically have long investment horizons and are not burdened with onerous regulation, should investigate investments in well-underwritten B-pieces and mezzanine securities. These securities offer the most return and convexity protection, albeit at the cost of liquidity. In addition, we would recommend GNMA and FHA project loans and construction loans (look for a report in the near future), as well as commercial mortgages (which we haven't discussed here, either), as their callability is customizable and negotiable at issuance, and they trade significantly wider than passthroughs. We would also recommend long PAC Zs, especially off GNMAAs (which we've discussed in the past), to meet their long duration liabilities.
- **Insurance companies, banks, and thrifts**, and other investors with intermediate horizons, that can ride out the gyrations in market spreads for structured products, should prefer structured products with lockouts, such as GNMA PACs, Conventional PACs, Sequentials, Relocation CMOs and Non-Agency PACs and Sequentials. We would also recommend purchasing premium PACs with lockouts, after the market has dislocated spreads during periods of MBS supply.
- **MBS indexed accounts**, who are measured against MBS indices, should continue to use barbell strategies to beat the index. We would, however, recommend barbells of 5-yr or 7-yr Treasuries in combination with Busted PACs and Premium Sequentials.
- **Indexed accounts that are measured against broader indices** should consider GNMA and Relo PACs as corporate-bond substitutes, and use conventional PACs, Sequentials, X-PACs and Treasuries to replicate the mortgage component of their indices.
- **Arbitrage accounts and hedge funds** should consider forming high yielding core portfolios from securities that, while relatively illiquid, can be hedged using swaps, and thus managed effectively. Such securities should include well-call-protected securities like B-pieces, GNMA PACs, GNMA project loans and construction loans, and commercial mortgages. In the current marketplace, we would recommend that they use Treasuries to implement their duration views and liquidity requirements, and build up positions in structured products during periods of market dislocation.