

# Mortgage Convexity Risk

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## MBS Strategies

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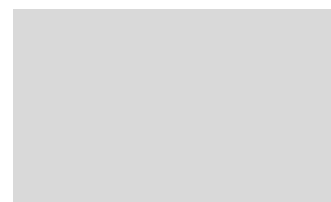
*Extension risk is at the forefront of investors' concerns in the event of a selloff.*

Mortgage convexity risk is a topic which has received much attention from both mortgage as well as non-mortgage players. With a steady increase in the size of the mortgage asset class as well as increased consolidation of this risk in the hands of active hedgers, the duration rebalancing and volatility needs of these players has had a significant impact on the overall fixed income markets. Until now, the most pronounced period of mortgage hedging related flows was in late '00/early '01 when the markets witnessed secular spread tightening and spread curve flattening due to a strong need to receive fixed in long swaps.

In the current environment, the question that is on many investors' minds is, what happens to the mortgage market in a selloff? The term extension risk has reached the popular press and there is a fair degree of speculation around the potential impact of mortgage hedging activity on the fixed income markets. In the following analysis, we examine the issue of mortgage convexity risk in more detail. Our analysis is structured as follows: First, we give a brief history of the impact of mortgage hedging activity and the reasons that have made it so pronounced in the past. Second, we take a detailed look at the factors that impact mortgage hedging flows – risk profile of the asset(s), proportion in the hands of active hedgers and prevalent hedging practices. After examining these factors in the current context, we present our outlook for mortgage convexity risk. To summarize:

- The risks to the market are skewed towards the extension side and the magnitude is large. We expect the impact of mortgage hedging flows to become pronounced in a selloff and should manifest in the form of a secular spread widening, spread curve steepening and a spike in implied volatility.
- As premium mortgages are replaced by the lower coupons each month, the effect is quite similar to an orderly selloff. The overall duration of the mortgage market will extend and the risk profile will become more symmetric.
- Within liquid markets, we expect mortgages to end up as the worst performers in a market downgrade. Apart from having to worry about managing the duration of the asset, the mortgage market will have to contend with a sharp decline in bank demand as well as servicer selling of mortgage hedges.

PLEASE SEE IMPORTANT ANALYST CERTIFICATION ON PAGE 13 OF THIS REPORT.



## UNDERSTANDING MORTGAGE CONVEXITY RISK

*Convexity risk confronted by asset/liability managers needs to be managed actively.*

We define mortgage convexity risk as the impact of active risk management of mortgage portfolios on the overall fixed income markets. Due to the sheer size of the mortgage market, the fixed income markets are net short volatility to homeowners in the form of the prepayment option. To the extent that mortgage-backed securities are held by investors benchmarked to an Index, it is not a big cause for concern. However, the component of this risk sitting in the hands of asset/liability players needs to be managed actively from both a duration and convexity standpoint. This form of active hedge management – both dynamic delta hedging as well as outright purchase of options – has had a pronounced impact on the bond markets. To give some perspective, over the past two years, the OAD of the MBS Index has shortened by 2.2yrs – an equivalent of \$985B 10yrs.

### A Brief History of Time

*Late '00 thru early '01, mortgage convexity hedging had a marked impact on spreads/volatility.*

There have been many time periods during which the impact of mortgage convexity hedging was felt and documentation of this effect can be found as early as the early '90s. In this analysis, we focus on the episode during late '00 and early '01 when overall mortgage hedging flows had a very pronounced impact on spreads/volatility. In addition, this is also the right benchmark for understanding the potential impact of mortgage extension risk in a sharp market downtrade. At the outset, there are three main factors that contributed towards the build-up of mortgage convexity risk towards late '00:

#### Testing Swaps as a Benchmark Hedge Instrument

*Swaps emerged as the new benchmark, following the '98 crisis which left permanent high volatility and saw a shrinking supply of Treasuries.*

The '98 crisis episode cast serious aspersions on the role of Treasuries as a benchmark hedging instrument. Not only did spreads widen dramatically in the fall of 1998, subsequent spread volatility remained high and never reverted back to pre-crisis levels. The Treasury buybacks and concerns around shrinking supply during early 2000 further limited their role as a hedge instrument. Against this backdrop, there was a very strong correlation between spread sectors, and swaps surged as the new benchmark. However, swaps were really tested as the benchmark hedge instrument for the first time during the rally late '00. As mortgage hedgers tried to buy back duration by receiving fixed on swaps, the sector proved to lack the depth to absorb their large flows.

#### Secular Increase in Mortgage Callability

*Mortgage callability increased with improvements in underwriting guidelines and larger loan balances.*

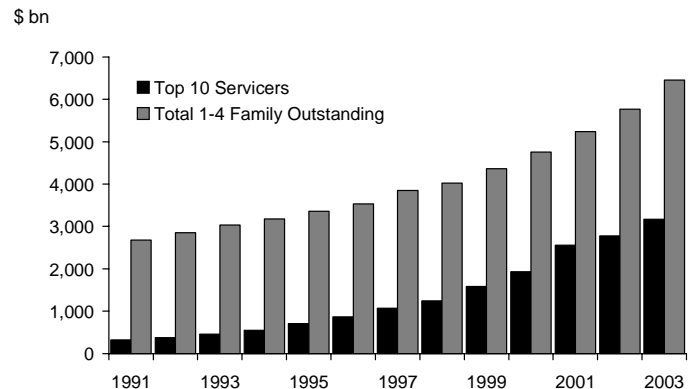
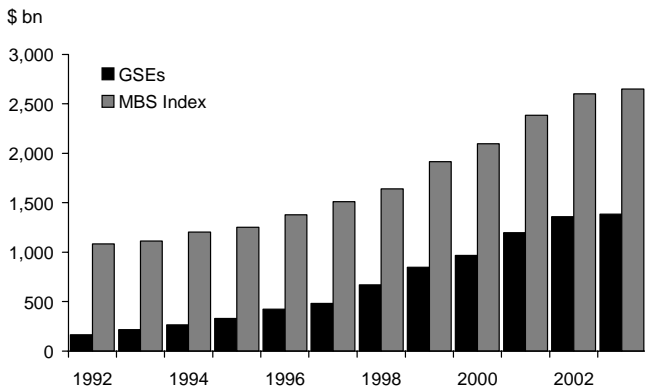
Another factor that had contributed to a marked impact of mortgage hedging activity was the secular increase in mortgage callability. Again, the steady increase in mortgage callability has been well documented and the corresponding pain is well appreciated by mortgage players. A combination of technological improvements, changes in GSE underwriting guidelines and sharp increase in average loan balances reduced the cost of refinancing while increasing the incentive to refinance. The impact can be best summarized by observing prepayment rates during 1992 and 1998. Loans with a 100bp refinancing incentive prepaid around 20% CPR faster during the '98 refinancing wave. The primary implication of greater mortgage callability is greater negative convexity of mortgages and consequently, increased hedging needs.

*And a greater portion of mortgage convexity risk shifted to investors who need to actively manage duration and other risks.*

**Growth and Consolidation of Mortgage Convexity Risk**

Against this backdrop, the overall impact of mortgage hedgers was further exacerbated by the growth and consolidation of mortgage convexity risk. As we had mentioned earlier, it is not the sheer size of mortgage optionality that is important. Instead, what really matters is who owns the asset. From that perspective, there has been a steady consolidation of mortgage convexity risk in the hands of investors who need to actively manage their duration and other risk exposures. By that, we are referring to the increase in the proportion of mortgages in the hands of the GSEs as well as the consolidation in the servicing industry over the past decade (Figure 1). As the proportion of mortgage convexity risk for these players has grown, so has the overall hedging need from the mortgage market.

Figure 1. Consolidation of Mortgage Convexity Risk



*Historically mortgage convexity hedging has resulted in secular spread tightening and a flattening of the spread curve.*

### The Historical Impact of Mortgage Hedging

We pick the time period 11/00 to 01/01 to highlight the historical impact of mortgage hedging activity. Over this period, mortgage rates rallied by around 73bp resulting in the OAD of the MBS Index shortening by a year or \$233B 10yr equivalents. Equally important, the duration shortening of the MBS Index was pronounced in the long end of the curve. For instance, the duration exposure of the Index to the 10yr part of the curve, i.e 10yr partials shortened by around \$140B 10yrs while 2yr partials *extended* by \$37B 10yrs (Figure 2). Mortgage investors looking to delta hedge their positions needed to come into the swaps market and receive fixed. Given that the duration shortening was mostly in the long end, the need to receive fixed was also more pronounced in the backend of the curve. The net result of all this hedging activity was a secular spread tightening as well as a flattening of the spread curve. Over the time period that we considered, 10yr swap spreads tightened by close to 45bp with the 2s/10s spread curve flatter by 40bp. With a sharp increase in mortgage convexity related flows, demand for implied volatility also increased and the Lehman Brothers Swaption Volatility Index increased by 4.3 bp/yr during this rally.

*Understanding the impact of mortgage convexity hedging this time around means grappling with the current drivers of this risk.*

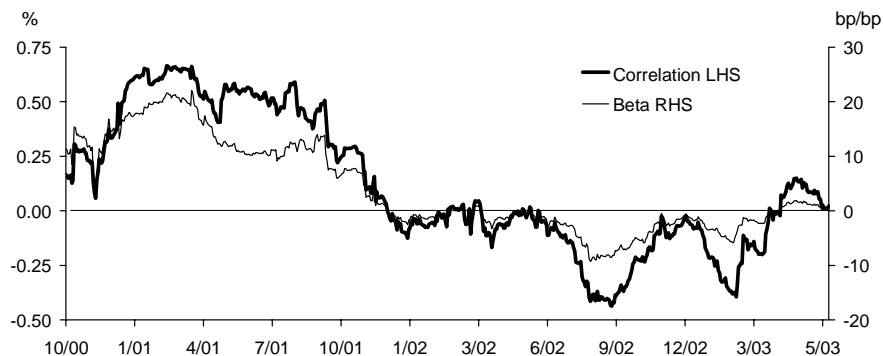
### Can I Use the Lookback Option?

As much as we would like to wax eloquent explaining historical spread and volatility movements, the real challenge is being able to predict mortgage hedging flows. From that perspective, a simple lookback option does not work. A key indicator of mortgage hedging activity during late '00 was swap spread directionality. As the market rallied and hedgers needed to buy duration by receiving fixed on swaps, there was a positive correlation between spreads and rates. As shown in Figure 3, during early '01, correlation between changes in 10yr swap spreads and swap rates was as high as 60% and swap spreads were tightening around 2.6 bp for every 10bp rally. However, by the summer, the directionality became less pronounced as every 10bp rally resulted in less than a basis point of spread tightening. In the more recent past, even the correlations have completely broken down. If you perused some of our research during this time, we had correctly predicted a decline in the impact of mortgage convexity hedging arguing for increased hedge diversification and latter on, an improvement in the convexity profile of the mortgage asset. Having finished the infomercial, the point that we are highlighting is that in order to gauge the potential impact of mortgage hedging activity, it is necessary to understand the drivers of this risk.

Figure 2.

Change in Partial Durations of the MBS Index						Swap Spreads to the fitted Treasury Curve, bp				
	OAD	Partial Durations					2-yr	5-yr	10-yr	30-yr
		2-yr	5-yr	10-yr	30-yr					
11/30/00	3.5yr	0.98yr	1.20yr	1.17yr	1.15yr	11/30/00	65	96	102	107
01/08/01	2.5	1.04	0.80	0.63	0.03	12/29/00	63	88	81	78
Change	(1.0)	0.06	(0.04)	(0.54)	(0.12)	01/08/01	59	67	58	54
		Duration Drift (10-yr Equivalents, \$bn)					Change			
		37	(96)	(141)	(34)	11/30/00-1/8/01	-6	-29	-44	-54

Figure 3. Correlation between 10yr Swap Spreads and 10yr Swap Rates



### DRIVERS OF MORTGAGE CONVEXITY RISK

In this section, we examine the primary drivers of mortgage hedging needs. The aim is to compare and contrast these factors in the current context with those observed during late '00. The primary drivers of hedging needs are fairly intuitive:

- Risk profile of the asset – both MBS as well as servicing portfolios
- Proportion of the risk sitting in the hands of active hedgers
- Sources of volatility and other hedging practices

#### Risk Profile of the Asset

*The asymmetry of the MBS Index increases with wider rate moves.*

Starting with fundamentals, the impact of mortgage hedging needs begins with understanding the risk profile of the asset that will be hedged. In the remainder of this piece, we do just that and caveat that our rates are based on the 6/4/03 closes. It is no secret that for MBS portfolios, the risk is currently skewed towards the extension side. The duration extension in an instantaneous 50bp rate backup for the MBS Index is around \$170B 10yrs, twice the amount of shortening for a 50bp rally (Figure 4a). The asymmetric risk profile of the MBS Index becomes more and more pronounced as we look over a wider range of interest rate moves. In a 100bp selloff, the duration extension is almost four times the shortening for a similar rally. The shift in the partial durations is also fairly intuitive. Similar to late '00 when the duration shortening was more pronounced in the long end, in a market selloff currently, the duration extension will be more pronounced in the backend. In addition to duration extension, the vega exposure of the MBS Index will increase significantly in a rate backup as we move closer to a discount environment.

*... while the MSR universe currently enjoys positive convexity.*

In the case of servicing portfolios, the asset has a strong positive convexity in the current environment. The duration of the MSR universe is expected to extend in a rally and shorten in a selloff – a rare luxury in the mortgage world. Based on our models, it will take more than a 100bp market downtrade before servicing portfolios reach a point of negative convexity again (Figure 4b). At first glance, this seems like generally good news for the mortgage market as the amount of convexity risk in the hands of the servicing community is not an issue at current rate levels.

*But record paydowns will cause a marked restriking of the mortgage universe.*

**The Mortgage Market is Continuously Evolving**

Unfortunately, the high prepayment environment does not keep the analysis as clean as desired. With overall paydowns running at record high levels, the mortgage market is continuously evolving as premiums are being replaced by the lower coupons each month. Over the past two years, the average coupon of the MBS Index has declined by 125bp and at current refinancing levels, the dynamic nature of the mortgage universe will become even more pronounced. In Figure 5, we highlight the predicted change in the composition of the MBS Index in an unchanged rate environment. We expect quite a dramatic restriking of the mortgage universe with the share of 30yr 5s/15yr 4.5s to increase from 3% to almost 60% over the coming year. The projected change in Index composition is especially relevant in the current environment where there seems to be near consensus that the market will stay rangebound over the intermediate term before heading higher in rates.

*As a result the duration of the MBS Index over the next 6mo will extend by about \$300B in 10yrs; equivalent to a 75bp instantaneous move.*

**Risk Profile of MBS Portfolios is a Moving Target**

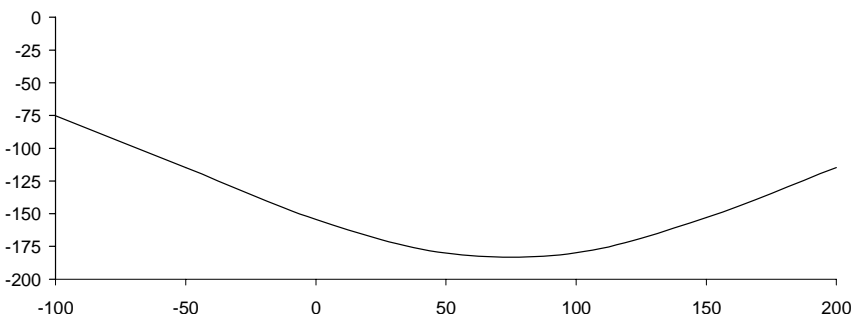
The result of the sheer magnitude of Index restriking is that even in an unchanged rate environment, the risk characteristics of MBS portfolios will change quite dramatically over time. For instance, over the next six months, the duration of the MBS Index will extend by close to \$300B 10yrs with 10yr partials extending by \$150B 10yr equivalents relative to 2yr partials (Figure 6a). The total vega exposure of the Index will also increase quite sharply by close to \$1B, from its current paltry exposure of \$120M. If we compare the change in risk profiles at unchanged rates over time with instantaneous rate moves today, 6 months of unchanged rates seem to have the same general impact as a 75bp instantaneous selloff.

Figure 4a. **Duration Profile of MBS Index for Instantaneous Rate Moves**

Rate Shift, bp	OAD	Partial Durations				OAC	Vega
		2yr	5yr	10yr	30yr		
-100	(95)	6	(44)	(43)	(18)	32	1144
-50	(85)	2	(32)	(58)	(12)	18	656
0	-	-	-	-	-	-	-
50	171	(3)	39	110	26	(16)	(644)
100	411	(7)	136	211	76	(28)	(1563)
200	835	(15)	264	419	127	(11)	(3664)

All duration measures are expressed in 10yr equivalents (\$B). OAC is expressed in 10-yr equivalents for a 10bp change in rates. Vega in \$M. Mortgage Rate: 4.85%. As of 6/4/03.

Figure 4b. **Duration Profile of MSRs for Instantaneous Rate Moves**



All duration measures are expressed in 10yr equivalents (\$B). Mortgage Rate: 4.85%. As of 6/4/03.

The same can be said about servicing portfolios. As premium IOs are replaced by the lower coupon ones, it increases the overall negative duration in the servicing world. Recall that servicing portfolios are expected to shorten or turn more negative in duration for the first 100bp or so move towards higher rates. Roughly speaking, unchanged rates for 6 months is expected to produce the same shift in duration exposure as a 50bp market selloff (Figure 6b).

Figure 5. **Predicted Change in the Composition of the MBS Index at Unchanged Rates**

	Today		6-mo Forward		12-mo Forward	
	\$ bn	%	\$bn	%	\$bn	%
30-year	1,894	72%	1,938	70%	2,043	70%
<=5	25	1%	684	25%	1,122	39%
5.5-6.0	926	35%	741	27%	633	22%
>=6.5	942	36%	513	19%	289	10%
15-year	621	24%	744	27%	830	29%
<=4.5	41	2%	353	13%	547	19%
5-5.0	349	13%	260	9%	208	7%
>=6	231	9%	131	5%	75	3%

Mortgage Rate: 4.85%. As of 6/4/03.

Figure 6a. **Risk Measures of the MBS Index- Current vs. Forward**

	OAD	Partial Durations				OAC	Vega
		2yr	5yr	10yr	30yr		
Current	180	225	25	(25)	(10)	(26)	(121)
6mo Fwd*	486	250	100	150	40	(53)	(1088)
12mo Fwd*	688	260	150	270	75	(71)	(1678)
<b>Change from Current</b>							
6mo Fwd	306	25	75	175	50	(27)	(967)
12mo Fwd	508	35	125	295	85	(45)	(1,557)

OAC is expressed in 10-yr equivalents for a 10bp change in rates. Vega in \$M. Mortgage Rate: 4.85%. As of 6/4/03.

Figure 6b. **Duration Profile of MSRs –Current vs. Forward**

	OAD
Current	(154)
6mo Fwd*	(211)
12mo Fwd*	(249)
<b>Change from Current</b>	
6mo Fwd	(56)
12mo Fwd	(95)

Mortgage Rate: 4.85%. As of 6/4/03.

*As such, Index restriking will resemble an extension trade.*

**Is Index Restriking an Extension Trade? Say Yes...**

In many aspects, the Index restriking is similar to an extension trade. As we highlight in Figure 7, the key impact of a market selloff on mortgage portfolios is an overall increase in duration, especially in the long end. As premiums are replaced by the lower coupons, there is a similar impact on the mortgage market. In addition, as the market moves towards higher rates, the duration profile of the mortgage universe turns more symmetric. In addition, the overall vega exposure of the mortgage market turns more negative. Both these effects will be observed in an Index restriking scenario as well. As we mentioned earlier, six months of unchanged rates seems to have the same net impact as an instantaneous 75bp rate increase.

*Increased hybrid supply as well as the a strong bank bid for mortgages will reduce the impact of risk due to Index restriking.*

**Is Index Restriking an Extension Trade? Say No...**

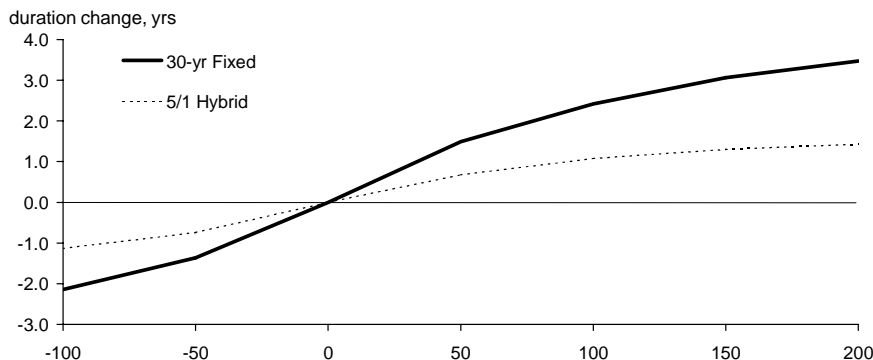
There are, however, some key differences in terms of market impact of MBS extension due to a rate backup versus coupon restriking. The most obvious one, of course, is that the Index restriking will be a much more orderly extension trade than a market selloff on expectations of an economic recovery. So, is the duration extension from restriking of the mortgage universe simply a slow grind towards higher rates? We think that there are a couple of other factors that make Index restriking different from a market downtrade. The first difference comes from increased issuance of hybrid ARMs. As it has been well

Figure 7. **Index Restriking = Market Downtrade**

	OAD	Partial Durations		Duration Chg.		Vega
		2yr	10yr	-50bp	+50bp	
+100bp	410	1	191	(239)	240	(1,563)
6mo Fwd*	306	25	175	(214)	270	(967)
12mo Fwd*	508	35	295	(299)	334	(1,557)

\*6mo fwd and 12mo fwd expressed as change from current. Mortgage Rate: 4.85%. As of 6/4/03.  
All durations expressed in 10 yr Equivalents; OAC expressed in 10 yr Equivalents for a 10bp change in rates; Vega in \$mn.

Figure 8. **Risk Profiles of Hybrid ARMs versus 30yr Conventional MBS**



As of 6/4/03.

publicized (especially by your mortgage broker), the prevailing steep yield curve environment has increased the appeal of hybrids as the mortgage of choice, with close to 25% of issuance in this product. Given the limited extension risk of hybrids, especially when compared with 30yrs, hybrid issuance is a risk reduction trade – both for MBS hedgers as well as servicers (Figure 8). As a result, the total magnitude of extension risk is mitigated in the Index restriking scenario relative to the case of a selloff. The second factor differentiating Index restriking from a market downtrade is the role of banks as the marginal bid for mortgages. Given that banks are typically not the most active mortgage hedgers, this is a yet another risk reduction trade for the market. We discuss this in more detail next.

### Proportion of Risk in the Hands of Active Hedgers

*The bank bid will be an important risk mitigating element in the extension trade.*

As mentioned earlier, one of the important factors that set the stage for mortgage hedging activity late '00 was the consolidation of convexity in the hands of active hedgers. Since then, however, the pace of this consolidation has definitely slowed. In the case of mortgage portfolios, a key reason for this has been the emergence of banks as the marginal demand factor for mortgages. In the face of a strong deposit growth coupled with shrinking C/I loan portfolios, banks have aggressively added to their overall mortgage holdings – both in the form of securities and raw loans (Figure 9). Looking forward, we find it hard to believe that they will step away from the mortgage market anytime soon. As we have highlighted in various research publications, against the prevailing economic backdrop of a slow recovery, the conditions that have kept banks active in the mortgage space are still very much in play over the foreseeable future. This outlook for bank demand has strong implications for the mortgage extension trade:

### Lower Hedging Needs in a Selloff

*The impact of Index restriking will overshadow a potential increase in the cost basis of banks due to fast paydowns.*

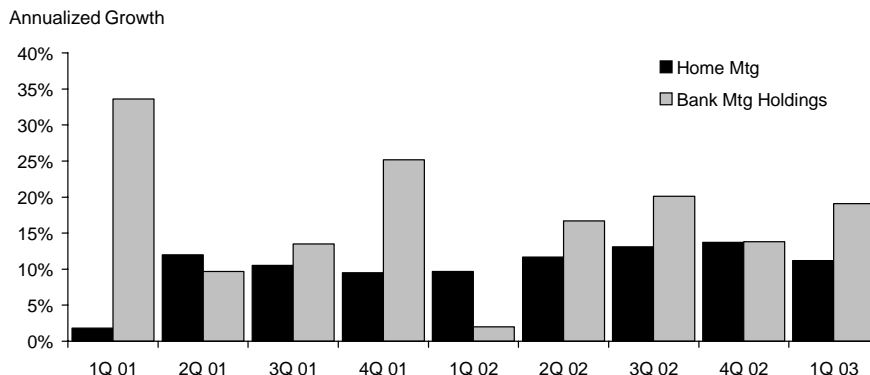
Unlike the GSEs, bank portfolios are not very active around dynamically hedging the duration exposure of their mortgage book. While there are always exceptions to this norm, for the most part, banks are simply net long duration. As a result, in the steady market rally over the past several months, the total amount of unrealized gains sitting on banks' available-for-sale portfolio has surged to over \$13B. This is the biggest hedge for the banking community. The unrealized gains provide a cushion for magnitude of a market downtrade that will be required before bank holdings are essentially under water. We estimate that rates need to selloff by more than 125 bp before bank portfolios run past their average cost basis. To be sure, in an unchanged rate environment, reinvestment of paydowns will increase the average cost basis for these institutions. However, the magnitude of that is much lower than the impact of Index restriking on the overall market. In short, a continued presence of banks as the marginal buyer of MBS is a risk reduction trade for the mortgage market.

### Extension Risk from Bank Activity

*A shift towards C&I loans away from mortgages by banks will cause spreads in the mortgage market to widen significantly.*

The real source of extension risk from banks is very specific to mortgage spreads. While banks may not need to or may be unwilling to sell mortgages/duration in a selloff, they will likely step away as a demand factor for mortgages. To the extent that we see a recovery induced bearish flattener, banks will wean themselves away from the securities market and focus on C/I loan portfolios. The impact of that will be devastating for mortgage spreads. In such an environment, the GSEs will be required to reassume their role as the marginal buyer of mortgages and we expect mortgage spreads can easily widen 25bp versus agency debentures as a result.

Figure 9. Growth in Bank Portfolios vs. Overall Mortgage Market



Source: Federal Reserve

### Prevalent Hedging Practices

After considering the risk profile of the asset and the proportion of that risk in the hands of active hedgers, the final component of understanding mortgage convexity risk lies around looking at prevalent hedging practices. In this context, we examine two issues that are most pertinent in the current environment – supply of callables and use of collateral as MSR hedges.

#### Callable Issuance – Focus on Net Supply

Callables play a very important role in determining the potential magnitude of mortgage hedging flows. The end buyers of these products typically do not hedge the embedded optionality. As a result, unlike swaption purchases that simply transfer the burden of hedging to the dealer community, callable issuance is a net source of supply of volatility to the markets. The tremendous surge in the issuance of callables over the recent months would seem to suggest that mortgage hedgers have managed to buy back a significant proportion of their extension risk from this market. However, we don't think that is the case. Since late '00, there have been several months when callable redemptions outpaced issuance. As shown in Figure 10a, if we look at the size of the outstanding callable market, as a proportion of the MBS Index, it is actually lower today than in late '00.

*While callable issuance has surged in the past two months, it has only matched redemptions.*

*The protection from callables today is lower than late '00.*

The overall strikes in this market have moved in the right direction and are skewed towards the high strikes; consistent with the asymmetric extension risk for mortgage portfolios. The average strike of the callable universe during September '00 was centered around a 75bp rally. Today, the same strike is struck for 100 bp selloff (Figure 10b). However, the amount of protection offered by the callable universe currently is lower than late '00. Back then, the duration change of the callable market was projected to absorb 20% of the duration shortening of the MBS Index for a 100bp rally. Today, the same proportion for a 100bp selloff is only 15%. At the same time, bear in mind that this proportion will improve in an unchanged rate environment as the torrid pace of callable issuance continues. Our point is that it will not be dramatically higher than what we saw during late '00.

*While servicing portfolios have enjoyed positive convexity in the current environment, a selloff will reverse this quite dramatically.*

**Servicing Portfolios – When Hedges Need Risk Management**

During this entire analysis, we have consistently pointed out that the convexity risk from servicing portfolios is fairly muted in the current environment. If anything these portfolios enjoy positive convexity and rates need to increase by more than 100bp before for this to change. However, we expect servicing portfolios to wreak severe havoc on the mortgage market due to duration rebalancing in a market downtrade. Why? The widespread use of collateral as a hedge against the MSR takes away most of the convexity advantage of the asset. Most mortgage investors are well aware that since late '01, the use of collateral as a hedge for servicing portfolios became quite popular. For a long time, we were recommending the same, arguing that a) mortgages are cheap and b) the biggest risk for servicing portfolios was on the basis front. This has worked out quite nicely with MBS based hedges outperforming swap based ones by more than 6 points over this period.

*The frequent use of collateral as a hedge against the MSR will eliminate most of the convexity benefit.*

In the current environment, however, we believe that this practice is a recipe for disaster. The use of current coupon mortgages as a hedge against servicing significantly increases the overall amount of extension risk on servicing portfolios. For instance, for a 150bp instantaneous selloff, the duration extension for the servicing universe is minimal.

Figure 10a. **Outstanding Callable Debt vs. MBS Index**

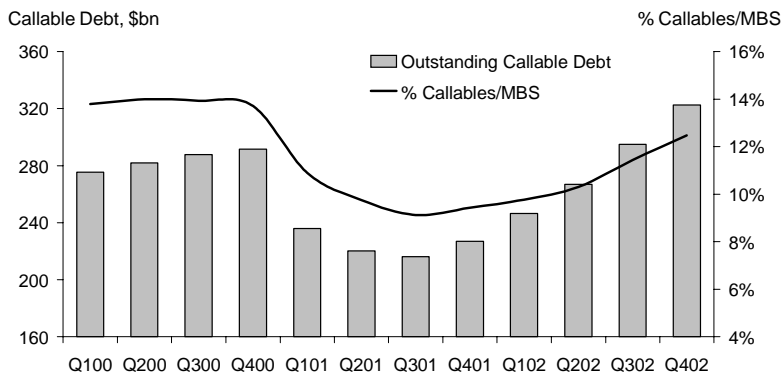
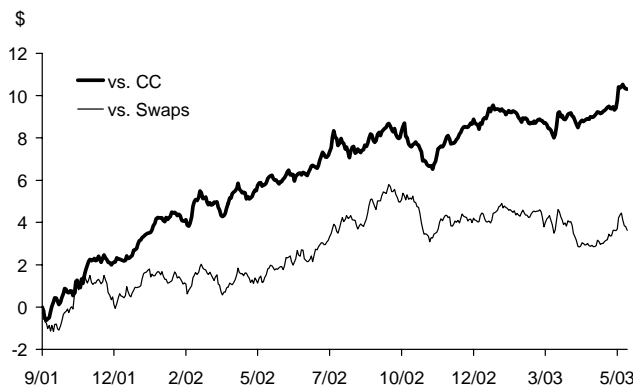


Figure 10b. **...Incremental Cushion from Callable Universe is Minimal**

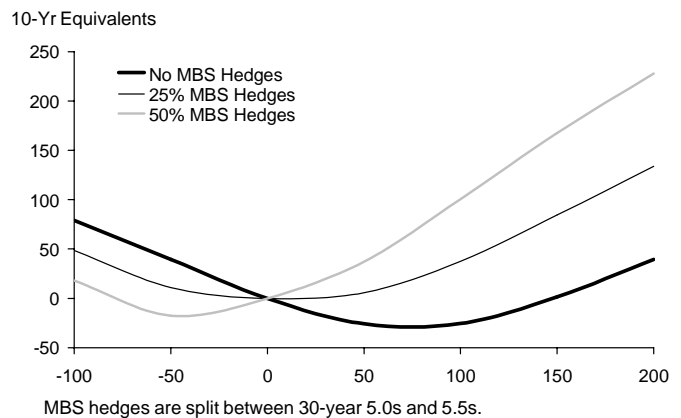
	Sep-00	Jun-03
<b>Size (\$bn)</b>		
Callables	486	516
MBS	2065	2600
Average Strike (vs. Forward, bp)	-77	100
<b>Duration Chg. (10-yr Equiv) (100bp Rally) (100bp Sell-off)</b>		
Callables	81	-60
MBS	-380	411
	21%	15%
<b>Vega Change (\$mn)</b>		
Callables	41	34
MBS	270	-1500

Figure 11.

**P/L of 6.5 IOs hedged with MBS and 10yr Swaps**



**Impact of MBS Hedges on Servicing Portfolios**



However, even if we replace just 25% of the hedges with collateral, the extension for the same market move is over \$100B in 10yrs (Figure 11). In combination with a waning bank appetite for mortgages, this is the biggest risk for the mortgage market from an extension standpoint. While overall supply from originations will dry up, the mortgage market can see a significant amount of supply from servicers as they sell their mortgage hedges for duration management purposes.

### **OUTLOOK FOR MORTGAGE CONVEXITY RISK**

If you have managed to make it till this point, after wading through the pages of verbiage and charts, we feel like we owe you an apology and a crisp summary. We highlight the key implications of our analysis below.

#### **Risk Towards the Extension Side are High...**

For the most part, the impact of mortgage hedging activity has been absent in the rally over the past several months. However, given the staggering amount of extension risk, we think that it will become highly pronounced in the event of a market selloff. The primary effects should be a secular spread widening and a spread curve steepener as mortgage hedgers will need to pay fixed in the long-end of the swaps curve. We also believe that implied volatility is biased upwards in a selloff as the overall convexity and vega exposure of the mortgage market increases significantly.

#### **...Timing of the Turn in Important**

To the extent that the recovery induced downtrade gets pushed out till 2004, there will be a significant shift in the overall risk characteristics of the mortgage market due to premiums being replaced by the current coupons. The Index restriking trade will be similar to an orderly selloff for the most part. The overall duration of the mortgage market will extend and the risk profile will become more symmetric. The magnitude of mortgage convexity risk will be partly mitigated by sustained hybrid issuance, a strong bank demand for mortgages and continued strength of the new issue callable market. In this scenario, we expect to see an increase in both demand for both low strike receivers as well as more longer dated options.

#### **Disaster Scenario for Mortgages**

Within the liquid markets, we expect mortgages to end up as the worst performers in a market downtrade. Apart from having to worry about managing the duration of the asset, the mortgage market will have to contend with a sharp decline in bank demand. In that scenario, the marginal demand for the sector will have to be from the GSEs and spreads need to widen at least 25bp before mortgages look economically viable versus the debenture curve. In addition, we expect the mortgage market to come under pressure due to servicing selling of their MBS hedges.

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