The Effect of 1994's Higher Rates on Interest Rate Risk

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Reasons for Recent Increases in Interest Rate Risk Among Thrift Institutions

As interest rates rose between March and December 1994[1], the OTS Net Portfolio Value Model showed a general increase in the level of interest rate risk in the thrift industry. A number of institutions have asked, "If no significant changes occurred in our asset or liability structure, why is the OTS Model showing that our level of interest rate risk has gone up?" Aside from the fact that some institutions *have* changed their portfolios significantly, levels of risk have increased primarily because of two factors: extension of fixed-rate mortgages/MBS and interest rate caps in adjustable-rate mortgages/MBS. The Model's results are consistent with the effects one would expect rising interest rates to have on these types of instruments. The purpose of this release is to explain these sources of increased risk.

Part 1: "Extension" of Fixed Rate Mortgages

The interest rate sensitivity of fixed-rate mortgages increased during 1994. In March '94, the OTS Model estimated that the industry's aggregate holdings of fixed-rate mortgages/MBS would decline in value by 7.9% under an immediate interest rate shock of +200 b.p. In December '94, the amount of the estimated decline under the same rate shock was 8.4%. The main reason for this increase in interest rate sensitivity was that decreases in expected prepayments caused the effective maturities of fixed-rate mortgages to "extend," or lengthen.

Investors in mortgages and mortgage securities are faced with the possibility that the mortgages will be prepaid at a different speed than was anticipated. For most fixed-rate mortgages, prepayments represent a major portion of projected near term cash flows, so changes in prepayment rates can have a significant effect on mortgage prices. For example, in March '94, prepayments on a seasoned 8% FNMA MBS were projected to be 16% per year, a cash flow stream twice as large as that resulting from interest payments on the security. Between March and December '94, the FNMA60-day commitment rate for 30-year

1 During this nine-month period, 1-year Treasury yields increased by 275 b.p., 5-year yields, by 160 b.p., 10-year yields, by 110 b.p., and 30-year yields, by 80 b.p.

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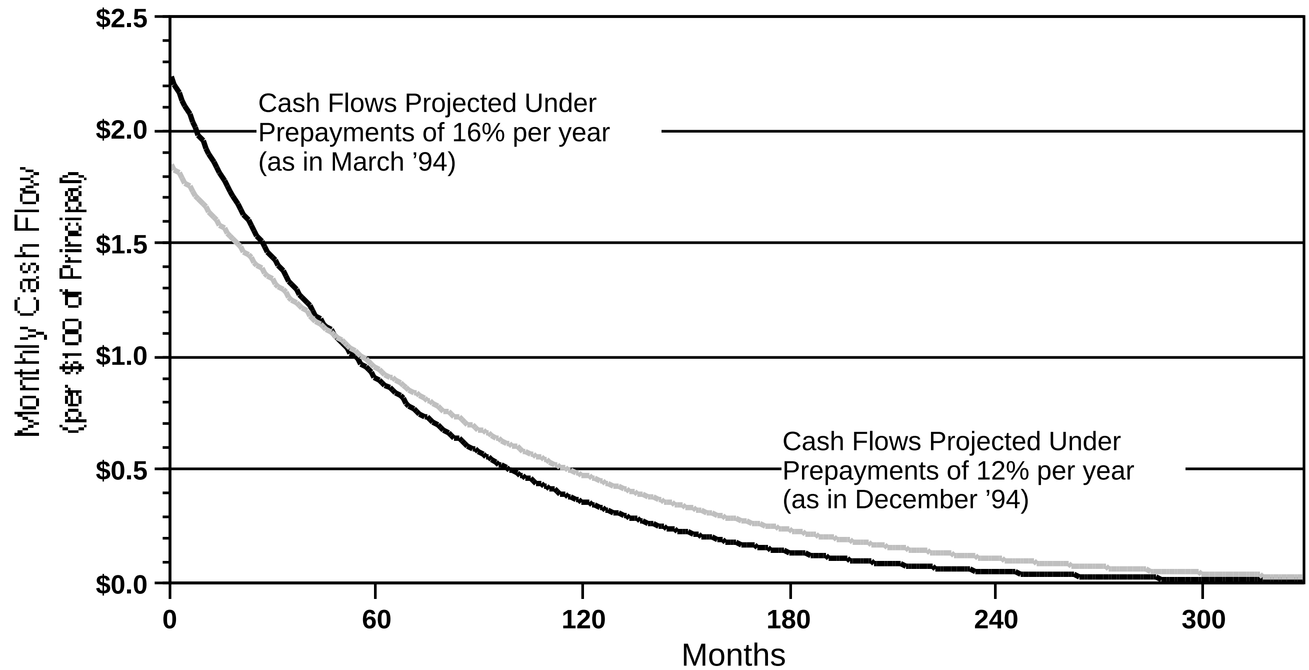
Figure 1. Comparison of Fixed-Rate Mortgage Cash Flows Under 16% and 12% Prepayment Rates



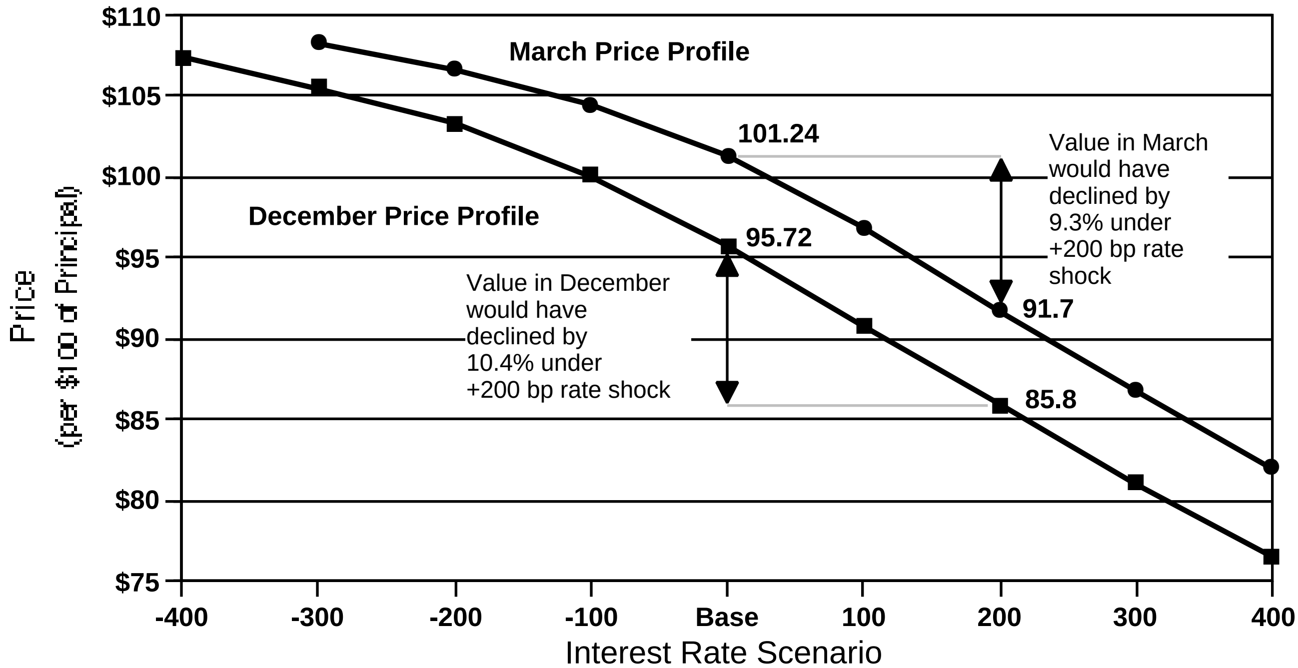
fixed-rate mortgages rose from 8.5% to 9.6%. As would be expected, that rate increase resulted in a reduction in projected mortgage prepayments, as the potential gain available to mortgagors from refinancing existing mortgages was reduced. Dealer prepayment projections for the seasoned 8% fixed-rate MBS declined from 16% per year, in March, to 12% in December.

Figure 1 plots the expected monthly cash flows from the 8% MBS under the two different prepayment speeds. It shows that the decline in expected prepayments had the effect of "pushing" expected cash flows further into the future, by generating smaller monthly cash flows for approximately the first 48 months and then larger ones after that. This sort of change in the profile of projected cash flows has been termed "extension," and represents an effective lengthening of the maturity of the mortgages involved.

Not surprisingly, the market price of fixed-rate mortgages and MBS declined during the March to December period as interest rates rose. For example, the 8% FNMA security depicted in Figure 1 declined in value from $101.24 per $100 of outstanding principal in March, to $95.72 in December. This may be seen by referring to the Base Case scenario of Figure 2, which shows the price profile of the 8% FNMA MBS, as modeled in March and December 1994. Moreover, as illustrated in that figure, the *price sensitivity* of fixed-rate MBS also changed, becoming more sensitive to changes in interest rates. To facilitate comparison, the result of a +200 b.p. interest rate shock on the value of the security is shown for both March and December. The security showed about one percentage point more price sensitivity in December than it did in March -- declining by 10.4% from the base case price in December, versus a 9.4% decline in March.

The increased price sensitivity reflected in the results of the OTS Model for fixed-rate mortgages and MBS between March and December was consistent with what one would expect of these mortgage instruments in a rising rate environment. For a given coupon and yield, the longer a

Figure 2. Comparison of Price Profile of 8% MBS in March and December '94



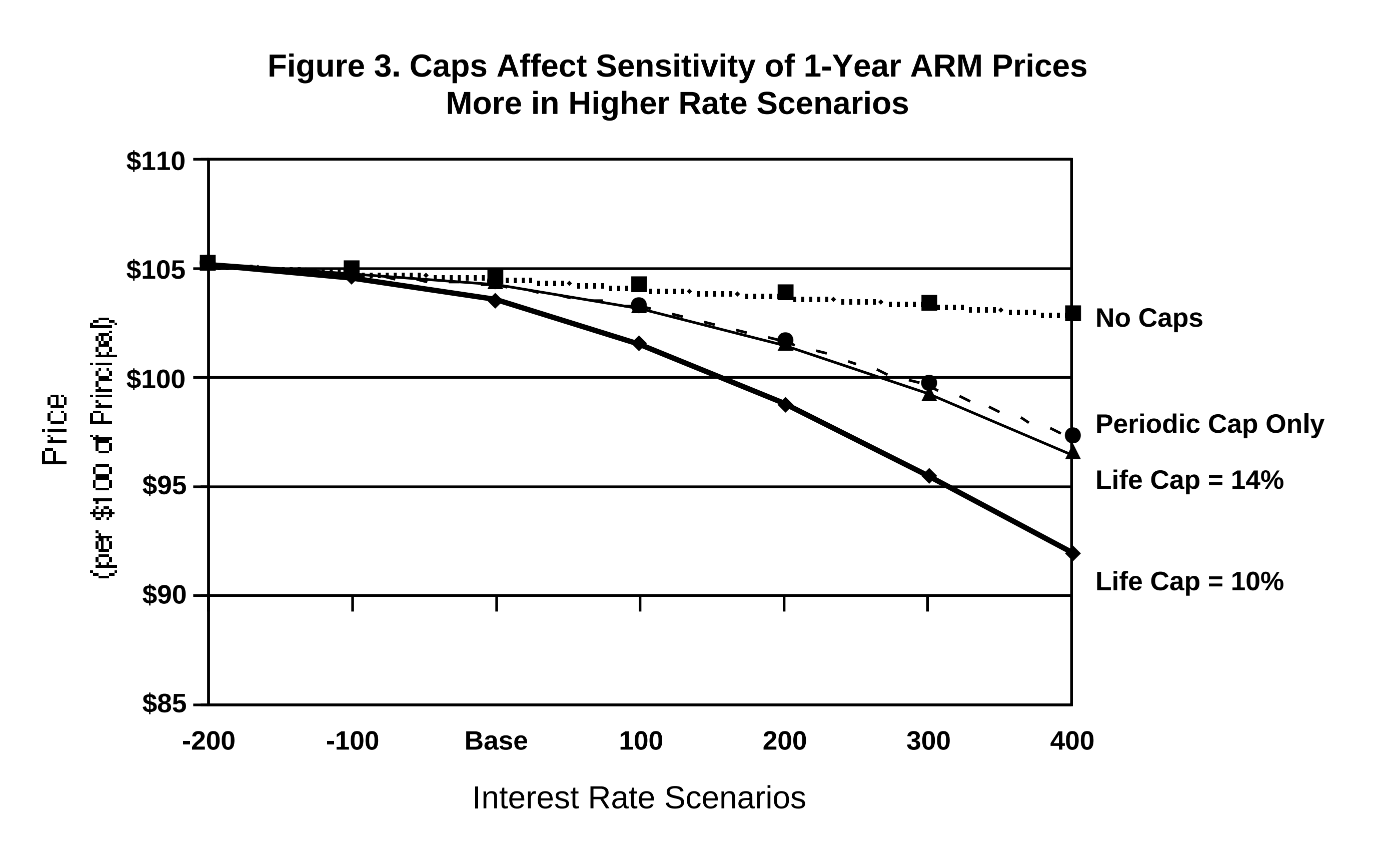
security's term to maturity, the more sensitive is its price to changes in interest rates. As interest rates rise and mortgage prepayments slow, the effective maturity of a fixed-rate mortgage security lengthens. Thus, as interest rates rise, the interest rate sensitivity of a mortgage security will increase.

Part 2: Interest Rate Caps on Adjustable Rate Mortgages

In March 1994, the OTS Model estimated that the industry's aggregate holdings of adjustable rate mortgages and MBS would decline in value by 2.9% under an immediate interest rate shock of +200 b.p. In December 1994, for the same rate shock, the decline would have been 4.6%. This large increase in interest rate sensitivity resulted because interest rate caps constrained ARM coupons from adjusting to the rapid run-up of market interest rates experienced during 1994. The effect was exacerbated by the heavy origination of very aggressively priced "teaser" ARMs during this period.

Most adjustable-rate mortgages owned by thrifts have both periodic and lifetime interest rate caps. As an ARM's coupon approaches its lifetime cap, its price sensitivity begins to resemble that of a fixed-rate mortgage. In a period of rapidly increasing interest rates, the combination of lifetime and periodic rate caps make the mortgages considerably more interest rate sensitive than one might expect of an adjustable rate instrument. In fact, by December some ARMs (particularly those with aggressive teaser rates) had price sensitivities more commonly associated with fixed-rate mortgages than with ARMs.

The effect of the caps on an ARM's price sensitivity can be seen by comparing the prices of an ARM having no caps with those of ARMs having various different caps. Figure 3 shows such a comparison for four 1-year Treasury ARM securities in March '94. The four securities shown all have coupons of 6%, net margins of 225 b.p., 300 months of remaining maturity, and 6 months until their next reset. They differ only in terms of their interest rate caps, and



those differences cause the divergence between their price profiles that is shown in the figure.

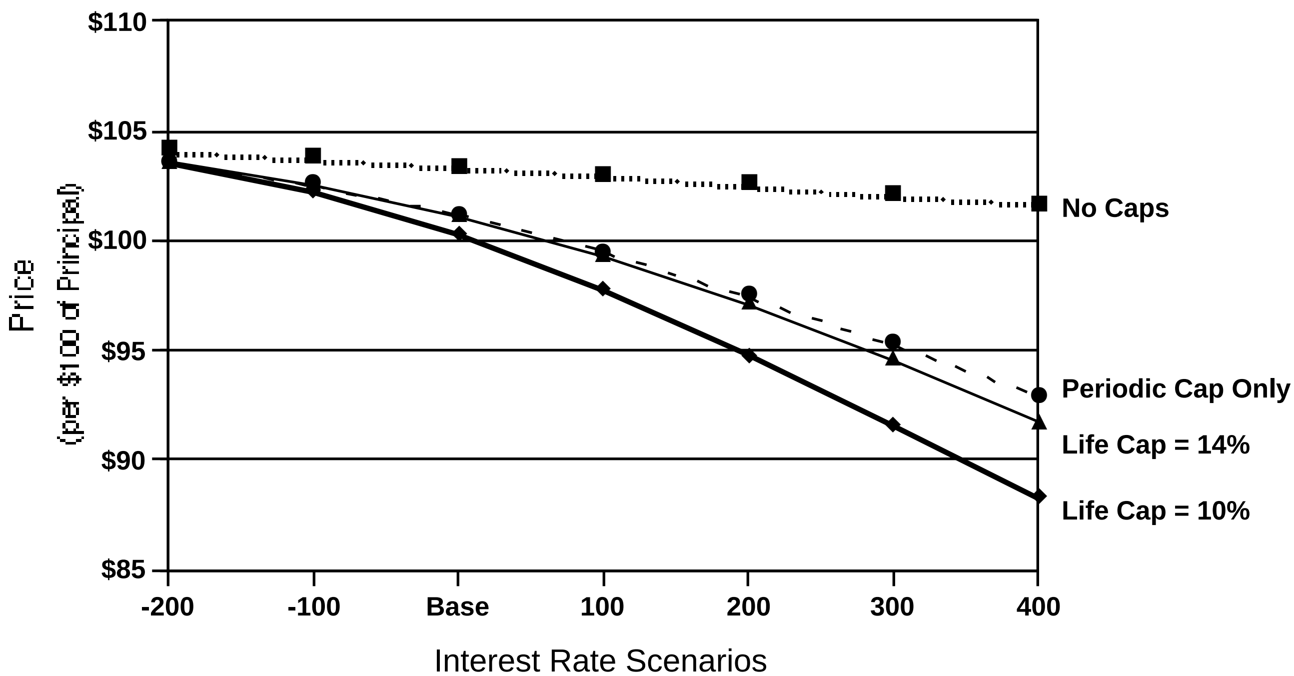
"No Cap" ARM: The curve labeled "No Caps" shows prices for an ARM with neither periodic, nor lifetime, rate caps. Note that, even though this ARM has no caps, it does not have the same price in all scenarios (i.e., it is not a "pure floater"). It is slightly interest rate sensitive because it resets annually and has 6 months until its next scheduled reset date.

"Periodic Cap Only" ARM: The curve labeled "Periodic Cap Only" shows prices for an ARM that has a 2% periodic rate cap. At the next reset date, in 6 months, the ARM interest rate would be capped at 8%. At the end of March, the 1-year Treasury yield was approximately 4.4%, so the fully indexed rate for this ARM (i.e., the interest rate to which the ARM would set if it were scheduled to reset that day) was 6.65% (i.e., the sum of the 1-year Treasury yield and the margin of 2.25%). The fact that the fully indexed rate in March was 135 b.p. below the 8% capped level, combined with a steep yield curve, resulted in a small but significant probability that the ARM would be prevented from adjusting fully at its next rate reset date, in 6 months. As a consequence, in the Base Case, the estimated value of the periodic cap was $0.28, as shown by the fact that the "Periodic Cap Only" ARM was that much lower in value than the "No Caps" ARM.

In the -200 b.p. scenario, the fully indexed rate would have been 335 b.p. below the 8% capped level. At that distance, there would have been minimal likelihood that the periodic cap would have hampered adjustment of the ARM's interest rate. Hence, the periodic cap had virtually no value in the -200 b.p. scenario, and the "Periodic Cap Only" ARM was essentially equal in value to the "No Caps" ARM.

In the +200 b.p. scenario, the fully indexed rate (8.65% = 6.40% + 2.25%) would have been 65 b.p. above the level permitted by the periodic cap at the next reset. Because of the high likelihood that the ARM would be limited to a less than fully indexed level, the value of the periodic cap is

Figure 4. By December Rates Had Risen, So the Effect of Caps Was Greater



considerably larger ($2.10) than it was in the Base Case scenario.

"Life Cap" ARMs: The curves labeled "Life Cap =14%" and "Life Cap =10%" show prices for two ARMs that, in addition to the 2% periodic rate cap, have lifetime rate caps (equal to the indicated levels). The incremental value of the lifetime caps can be inferred by comparing the value of those ARMs with that of the "Periodic Cap Only" ARM.

In the -200 b.p. scenario, the fully indexed rate would have been so far below the level of the lifetime caps, that the lifetime caps would have had essentially no incremental value. Hence, the values of the two "Life Cap" ARMs would have been nearly the same as the "Periodic Cap Only" ARM.

In the Base Case scenario, the incremental value of the 14% lifetime rate cap was still not material ($0.01), as shown by the fact that the value of the "Life Cap =14%" ARM was almost identical to that of the "Periodic Cap Only" ARM. Even if the ARM had been fully indexed, it would have been more than 7 percentage points below the level of the 14% cap. The incremental value of the 10% lifetime cap was considerably greater, as shown by the greater divergence of the "Life Cap =10%" ARM from the others. Even though the fully indexed rate was still 3.35 percentage points below the 10% cap, that cap was less remote than the 14% cap, and, hence, had considerably higher value ($0.81).

In the +200 b.p. scenario, the incremental value of the lifetime caps would have been greater than in the Base Case, as shown by the wider divergence of the "Life Cap" ARMs from the "Periodic Cap Only" ARM. The lifetime caps increased in value in this scenario because the fully indexed rate would have been closer to the cap rates (i.e., 5.35 and 1.35 percentage points, respectively, from the 14% cap and the 10% cap). That closer proximity increases the likelihood that the cap may prevent the ARM's interest rate from resetting to the fully indexed rate at some future reset date. Because the 10% cap is closer to the fully indexed rate than is the 14% cap, its incremental value is greater ($2.97 versus $0.18).

The most important points illustrated by Figure 3 are that, as interest rates rise, the value of an embedded interest rate cap *increases at an increasing rate* and the value of an ARM with such embedded caps *declines at an increasing rate.* This observation implies that, for a given rate shock, the change in value of an ARM with embedded caps will be greater in a high interest rate environment than in a low one, especially if interest rates have recently risen. For example, in Figure 3, if rates had been shocked upward by 200 b.p., the "Life Cap = 10%" ARM would have declined in value by $4.76 -- primarily as a result of the increasing value of the embedded caps. If rates had then increased by *an additional* 200 b.p. from that level, the decline in value would have been an additional $6.83 -- since the value of the caps would have increased by even more than under the first 200 b.p. rate shock.

The situation portrayed in the previous paragraph resembles what actually occurred in December 1994. The short-term interest rates to which ARMs are tied rose in excess of 200 b.p. from their levels in March, so that in December, the Base Case scenario was located roughly where the +200 scenario had been in March. Figure 4 shows the price profiles of the four ARMs depicted in Figure 3, but estimated as of December.[2] The interest rate sensitivity of the three ARMs with embedded rate caps to a +200 b.p. shock may be seen to have increased from March.

The extent to which the interest rate sensitivity of any particular institution's ARMs increased depended upon the degree to which the embedded caps constrained the adjustability of the ARM interest rate. That, in turn, depended on three factors.

First, an institution with ARMs whose coupons were relatively close to their lifetime caps in March would have shown a greater increase in sensitivity than one whose coupons were further from, and thus less likely ever to reach, their lifetime caps.

Second, an institution whose ARMs have 1% periodic rate caps (e.g., GNMA 1-year Treasury ARM securities) would have shown a greater increase in interest rate sensitivity than one with 2% caps, because a 2% cap is less likely ever to prevent the ARM from resetting to its fully indexed rate.

Third, an institution whose ARMs had interest rates in March that were below their fully indexed rates would have shown a greater increase in interest rate sensitivity than one whose rates were at, or above, their fully indexed rates. The longer, and further, an ARM's interest rate remains below its fully indexed rate, the more constraining is the periodic cap and the lower will be the ARM's value compared with a fully adjustable ARM, and the greater will be its interest rate sensitivity.

For example, consider two 1-year Treasury ARMs, each with 6 months until their next reset date, and with 2% periodic rate caps. Suppose the fully indexed rate for both ARMs is initially 6.65% and that they differ only in their current interest rates: ARM #1 is at the fully indexed rate (6.65%) and ARM #2 is at 6%. Suppose interest rates rise 200 b.p., so that the fully indexed rate changes to 8.65%. Assuming interest rates do not change further, ARM #1 will accrue interest at less than the new fully indexed rate (of 8.65%) for only 6 months, after which it will reset to 8.65%. ARM #2 will accrue interest at less than 8.65% for 18 months. That is, it will accrue at 6% until it resets, in 6 months. On the reset date, the periodic cap will limit the new interest rate to 8%. Thus, an additional 12 months will pass before the interest rate can be reset to 8.65%. Because the interest rate of ARM #2 started out below the fully indexed rate, the periodic cap imposed more of a constraint on the adjustability of its interest rate than in the case of ARM #1 which started out at the fully indexed rate. As a result, the value of ARM #2 will be more sensitive to a rising rate environment.

Effect of Teaser Rates on ARM Sensitivity

One common practice that increased the interest rate sensitivity of the industry's ARMs during 1994 was the origination of ARMs at much less than a fully indexed rate (so-called teaser ARMs). For the reasons described in the previous paragraph, teaser ARMs are more interest rate sensitive than fully

[2] For simplicity the characteristics of the ARMs depicted in Figures 3 and 4 are identical, even though 9 months would have passed between the two sets of estimates. For an actual ARM pool, the coupon and time to next reset would change between March and December.

indexed ARMs, and the more aggressive the teaser rate, the greater is the rate sensitivity of the ARM

In aggregate, the volume of reported teaser ARMs increased from 4.0 percent of total assets, in March, to 5.8 percent, in December. Not only did the proportion of teaser ARMs grow during this time period, but the newly originated ARMs also had more aggressive teaser rates (see Table 1). For instance, in December, the average reported interest rate for the largest single category of teaser ARMs (those tied to current market indexes [primarily 1-year Treasury], in the 7 Month to 2 Year reset category), was about 400 b.p. below the fully indexed rate of that time, while in March they had been only about 200 b.p. below fully indexed.[3] The situation was even more extreme in the case of teaser ARMs tied to lagging market indexes (primarily cost-of-funds-index ARMs), whose average reported interest rate actually *declined* by 30 b.p. between March and December.

Part 3: Has Risk Actually Increased?

To answer the question posed at the beginning, if a thrift institution's asset/liability structure remained unchanged during 1994, there are good reasons to expect its level of interest rate risk to have increased in view of the effects that rising interest rates have on price sensitivities of fixed and adjustable rate mortgages. To say that a static portfolio implies a constant level of risk would be analogous to arguing that, despite the turmoil in the commercial real estate market in the late '80s, the level of risk in a given commercial real estate portfolio must have remained unchanged because it contained the same loans that it did prior to the change in the market environment.

Clearly, the economic value of a portfolio of assets and liabilities can change as a result of changes in outside factors, (e.g., changes in interest rates or customer behavior). Similarly, the rate of change in the value of that portfolio can, and does, itself change in response to changes in the market environment. The general increase in the level of risk at OTS-regulated savings institutions during 1994 was consistent with what one would expect for an industry heavily invested in mortgages in an environment of increasing interest rates.

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Table 1.The Volume of Teaser ARMs Increased and Teaser Rates Became More Aggressive

	Aggregate Teaser ARMs				Aggregate Non-Teaser ARMs			
	Balance ($bn.)		WAC (%)		Balance ($bn.)		WAC (%)	
	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec
Current Market Index ARMs :								
6 Mo or Less	3.0	3.4	4.50	5.43	23.8	29.2	6.05	6.67
7 Mo to 2 Yrs	11.8	16.8	4.95	5.51	72.5	76.7	6.11	6.82
2+ Yr to 5 Yrs	2.3	4.9	6.75	6.88	11.0	15.3	7.56	7.37
Lagging Market Index ARMs:								
1 Month	4.8	7.8	5.57	5.27	87.3	100.9	6.24	6.33
2 Mo to 5 Yrs	7.3	9.9	6.12	5.82	29.6	31.5	6.73	6.59

3 The average fully indexed rate in March was 6.9% (i.e., the 1-year Treasury index was 4.4%, plus the average margin of 2.5%), while the average teaser interest rate was 5.0%. In December, the average fully indexed rate had risen to 9.7% (based on a 1-year rate of 7.2%), while the average teaser interest rate had risen to only 5.5%.