A Capital Markets View of Mortgage Servicing Rights

Simon P.B. Aldrich, William R. Greenberg, and Brook S. Payner

Simon P.B. Aldrich is a director at CDC Mortgage Capital in New York City.

William R. Greenberg is a director at CDC Mortgage Capital in New York City.

Brook S. Payner is a managing director at CDC Mortgage Capital in New York City.

The market for mortgage servicing rights has undergone a significant transformation as the trend toward consolidation in the industry continues. There are now nine servicers with over \$100 billion in servicing, while the top ten servicers together represent 41.6% of the market.[1]

The objective of consolidation among these mega-servicers is achievement of economies of scale. Profitability should improve if marginal cost is much lower than average cost, and marginal revenue should increase from greater cross-selling opportunities. The notion of the "customer for life" and the profits to be garnered from its business have driven competition among the mega-servicers to new levels, as market prices for mortgage servicing rights (MSRs) are at multiples that have not been seen in many years, if ever.[2]

As a consequence, smaller servicers have largely chosen to sell to the mega-servicers and recognize any gains in current earnings, thereby satisfying management and shareholders while eliminating the interest rate risk associated with holding the asset. This has been particularly true of so-called pre-FAS 122 servicing, which was booked at zero value and therefore effectively not on the balance sheet.[3]

Even as smaller originators have sold most of their servicing, more recent originations of on-balance sheet servicing have been brought to market as well. Another consequence of the consolidation trend is that smaller servicers are becoming more broker-like, originating loans and selling their servicing on a flow basis to the very largest servicers.

Another development in the mortgage servicing market in recent years is the recognition of the substantial market risks inherent in owning MSRs. Many market participants still use a static analysis of risk, which significantly understates the true exposure. Dynamic interest rate and prepayment models give a more realistic picture of the risks involved in owning MSRs, although these models are still deficient in practice, as significant differences between theoretical and market valuations can persist over long periods of time.

Furthermore, the adoption of FAS 133 has focused attention on the issues of valuing and hedging MSRs. The detailed requirements of FAS 133 are too complex to describe succinctly here. Assuming the requirements can be met, the new rule states that MSRs are essentially marked to market, as are the derivative hedges. The result is that any profit and loss volatility between the market value of the hedges and the market value of the servicing flows through to current earnings.[4]

For the mega-servicers who own hundreds of billions of dollars in servicing, this volatility could be in the neighborhood of \$100–\$150 million per quarter. For publicly traded companies whose earnings are in the \$500 million–\$1 billion per quarter range, the earnings volatility due to mortgage servicing is very significant. Thus, the question of how to hedge MSRs precisely has become crucially important.[5]

The risks associated with mortgage servicing rights are similar in many respects to those associated with interest-only (IO) securities in the mortgage-backed securities markets. The biggest risk is prepayment risk. When mortgage rates decline, prepayments increase, and the value of IOs and mortgage servicing alike declines. IOs, however, are securities that are actively traded in a relatively liquid market. The prices of most trust IOs are easy to obtain. Not so for MSRs, since the market is nowhere near as liquid. MSRs are not securities and do not have uniform characteristics like IO strips.

Furthermore, investors in IO securities are very different from investors in mortgage servicing. Mortgage servicing investors are primarily interested in earning fees from servicing the customer, collecting loan payments, and processing the clerical aspects of the business. IO investors have no direct interest in the customer, but instead hope to extract a spread between the income generated from the security and the cost of funding. They do not care about the underlying customer and can never sell it anything (nor do they want to), and since the IO is a security, they do not have any of the accounting difficulties that servicers face daily. Moreover, once a loan pays off, the IO investor realizes the loss immediately. Mortgage servicers can sometimes recapture a loan that prepays, thereby reducing the loss realized from prepayment.[6]

Nevertheless, since the financial risks are so similar, it makes sense to try to extract information about MSRs from the IO market. We describe a consistent method of looking at the valuation and hedging of MSRs in the context of the IO market (using option pricing techniques): a capital markets approach to valuing and hedging MSRs. We hope our results provide new insights regarding the current state of the mortgage servicing market as well as the valuation and hedging of mortgage servicing rights.

I. CHARACTERISTICS OF MORTGAGE SERVICING

Mortgage servicing rights grant the owner the right to receive certain cash flows and encumber the owner with the responsibility to pay certain other cash flows. A very simple model divides the servicing cash flows into six separate components: the servicing fee, the net cost to service, the float on taxes and insurance, the float on principal and interest, the gain from prepayments, and the loss due to compensating interest.

1. The mortgage servicer actually receives the gross servicing fee but gets to retain only the net servicing fee. The gross servicing fee is the difference between the coupon on the underlying mortgage and the coupon on the loan purchased by an investor such as a government-sponsored enterprise (GSE) or a private investor. The net servicing fee is that amount of the gross servicing fee that is left after paying the GSE's guarantee fees and other fees. Typically, for conventional servicing, the net servicing fee is about 25 basis points (0.25%) of the balance of the underlying loan; for GNMA servicing, the net servicing fee is typically 44 bp.

   It is important to note that the servicing fee retained by the servicer is not necessarily the same for every loan. If the servicing fees on the loans constituting a pool are different, then at the pool level, the net servicing fee realized by the servicer can rise if the lower-service fee loans pay off early, or it can drop if the higher-service fee loans pay off sooner. Typically, the higher-service fee loans correspond to higher mortgage rates, so it is more common for these loans to pay off sooner, and the servicing fee typically declines over time. In the securities market, this is similar to a so-called weighted-average coupon IO (WAC IO).
2. The second component is the net cost to service. Unlike the IO investor, the servicer is actually required to spend money to go out and collect the service fee. Systems and people are required for the billing, collection, processing, and customer service associated with mortgage payments. Late charges due to delinquent loans, as well as other ancillary fees assessed sporadically, accrue to the benefit of the servicer. This is another big difference between the IO buyer and the servicing buyer. Getting a handle on the actual costs a company faces (and benefit it receives) in servicing its loans is one of the biggest challenges it faces. The prices at which portfolios of servicing rights are exchanged imply a certain cost to service.

   It is also interesting to question whether it is the average cost to service the loans or the marginal cost that is relevant and for which purposes. In evaluating the total economics of a servicing business, it makes sense to use the average cost per loan in calculating profitability. For pricing portfolios of servicing, however, it makes sense to use the marginal cost, since that most accurately reflects the cost of adding more loans to an existing platform.

Our approach has been to combine the costs to service with the benefit of late charges and other ancillary income. For example, it might cost $40 per loan per year to service a loan, and the servicer might realize $30 per loan per year in late charges and ancillary income, for a net $10 cost. Alternatively, the servicer might realize $60 per loan per year in ancillary income and it might cost only $25 to service for a net gain of $35 per loan per year. Most servicers agree that, after taking all these factors into account, the industry marginal cost to service, net of ancillary and late charges, is probably somewhere in the $0-$20 net cost range. Throughout the article, we use $10 per loan per year cost to service, net of ancillary income and late fees.

3. The third component is the income generated from the float on taxes and insurance. The servicer collects these monies from the homeowners and pays them to the appropriate investing entities. The investing entities do not all expect the money at the same time; the servicer holds the funds and invests them for some period of time. Different states have different requirements as to when and how often taxes must be remitted. Servicing from a state that requires the taxes to be remitted only once per year is more valuable than servicing from a state that requires remittances more than once per year, everything else being equal. Additionally, some states require that the servicer credit the mortgagor with a certain rate of interest on these balances. Typically, the London InterBank Offer Rate is used as the crediting rate for the float income on T&I.

   One important feature of T&I float is that it grows over time as a percent of the remaining loan balance. That is, as long as homeowners own the property, they have to pay taxes and insurance based on the value of the house, regardless of the principal balance outstanding on the loan.
4. Similarly, the servicer is able to invest the principal and interest payments that the homeowner makes before remitting to the agencies. The exact number of days that the servicer can invest this money depends on the remittance program of the GSE. The days of possible investment range from 0 in "actual/actual" programs to as long as 45 days, depending on when the homeowner makes the monthly payment.[7]
5. Prepayments also present the possibility of a further gain on the float components. When a loan prepays, the servicer invests the loan balance until the remittance date and earns interest on the balance.
6. Finally, depending on the servicing remittance type, the servicer may be required to remit to the agencies a full month of interest on each underlying loan, regardless of when a loan may have paid off during that month. If a loan pays off in the middle of a month, the homeowner pays only the pro rata share of the interest; the servicer must make up the rest. This is known in the securities markets as compensating interest.

We have built a simple model of mortgage servicing cash flows that incorporates all these components. Other models can be used that include more inputs, but we believe that most of the additional components can be included in the net cost to service or in another component.

At time t the cash flow from a mortgage servicing portfolio CF(t) can be written as:

$$CF(t) = S(t) + C(t) + PI(t) + TI(t) + G(t) + L(t) \tag{1}$$

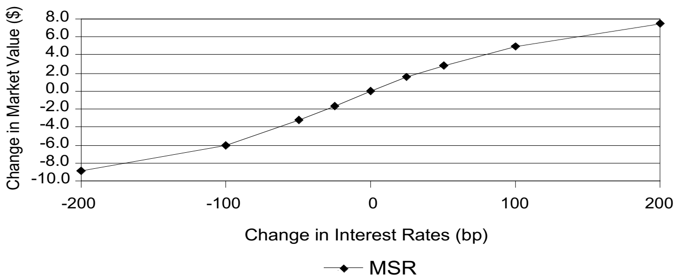
where: S(t) is the contribution due to the IO strip; C(t) is the contribution due to the net marginal cost; PI(t) is the contribution due to the scheduled P&I float; TI(t) is the contribution due to the T&I float; G(t) is the contribution due to the prepay gain component; and L(t) is the contribution due to the prepay loss component.

Explicitly, these components are given by the expressions:

$$\begin{aligned}
S(t) &= \frac{s}{12} B(t) \\
C(t) &= cN(t) \\
PI(t) &= r_{pi} PI_{sched}(t) \frac{d_{sched}}{360} \\
TI(t) &= r_{ti} N(t) \left(1 + \frac{i}{12}\right)^t \frac{TI(0)}{N(0)} \\
G(t) &= r_{pi} PI_{unsched}(t) \frac{d_{unsched}}{360} \\
L(t) &= PI_{unsched}(t)(s - w) \frac{d_{loss}}{360} \\
N(t) &= N_0 \frac{B(t)}{B_0(t)}
\end{aligned}$$

E X H I B I T 1

Change in Servicing Value for Instantaneous Changes in Rates



where s is the annualized net servicing fee (e.g., 25 bp); B(t) is the balance of the pool at time t; and c is the cost of service per loan net of ancillary income and late charges, per month (e.g., \$10 net cost would be –\$0.8333 per loan, per month). N(t) is the number of loans outstanding at time t; N(0) is the number of loans at t = 0, or the original number of loans.

The rates r_{pi} and r_{ti} represent the crediting rate for principal and interest and for taxes and insurance for the floating-rate components. These numbers are typically one-month LIBOR-based, and may or may not include a spread. PI_{sched} and $PI_{unsched}$ represent the scheduled and unscheduled principal and interest payments, which are projected from interest rate and prepayment models, given the underlying mortgage characteristics.

d_{sched}, $d_{unsched}$, and d_{loss} represent 1) the number of days the servicer is entitled to hold the scheduled principal and interest payments, 2) the number of days the servicer is entitled to hold the unscheduled principal payments, and 3) the number of days of compensating interest necessary to make up one entire month of interest that must be remitted to the agency, depending on the remittance type and the day of the month the mortgagor pays off the loan.

The inflation rate, i, represents the rate at which T&I payments grow. The quantity TI(0) is equal to the T&I constant multiplied by the state T&I factor. The gross WAC of the underlying mortgage is denoted by w. Finally, $B_0(t)$ is the projected balance of the mortgage pool, using the interest rate and prepayment models, assuming 0 conditional prepayment rate. This quantity is used in our model to project the number of loans remaining in the pool.

The change in value of a sample mortgage servicing portfolio for instantaneous changes in interest rates is shown in Exhibit 1, based on the model described above and our prepayment and interest rate models. The profile shown in Exhibit 1 is a clearly IO-like profile, where the value of the asset increases when interest rates rise and decreases as rates drop. The plot assumes the yield curve makes parallel shifts.

II. THE IO SECURITIES MARKET AS A BENCHMARK FOR MSR VALUATION

One of our main points is to show how to look at mortgage servicing from a capital markets point of view. In the capital markets, there is a relatively large and liquid market for interest-only and principal-only securities. Trust IOs and POs issued by FNMA or FHLMC are the most liquid. These issues are typically around \$1 billion in notional size each. Even among trust IOs, certain issues have attained benchmark status, and trade both at richer levels and with tighter bid/offer spreads than non-benchmark trust IOs. A priori, there is no way to know which trusts are more liquid than others and which are so-called benchmarks. Non-benchmark, off-the-run trust IOs usually trade at a price that is ¼ - ¾ of a point lower than the benchmark.

Trust IOs are the most liquid securities of their kind because of the large size of the issues and the homogeneity of the security. Structured IOs can be of many different types: sequential, support, PAC, inverse floating rate. There are also IOs, both structured and strip, on whole loan collateral and not issued by FNMA or FHLMC. Agency structured IOs are usually no bigger than \$100 million, and therefore typically trade cheaper than comparable trust IOs simply for liquidity reasons, even if the fundamental theoretical value is the same or greater.

A common measure used in the securities markets to measure relative value among IOs and between trust IO and structured IO is the option-adjusted spread (OAS). Under the OAS methodology, an interest rate model and a prepayment model are used to generate cash flows. These cash flows are discounted to their present value again using the interest rate model. The option-adjusted spread, OAS, is the spread that must be added to every discount rate so that the sum of the discounted cash flows equals the market price. The OAS is thus a measure of how much extra yield over the reference discount factors an investor is expected to earn by holding the security.[8]

IO market participants often talk about relative value between structured IO and Trust IO in terms of OAS. That is, an off-the-run trust IO will trade approximately 50 basis points of OAS cheaper than the benchmark of that issue. Other kinds of sequential or support IO might trade 100 to 200 basis points of OAS cheap to the bench-

EXHIBIT 2

MSR versus Trust IO Characteristics and Pricing

7/31/00	UPB	WAC	WAM	WALA	"Coupon"	Avg. Esc	Int on Esc.	Price	Multiple	OAS
FN/FH MSR										
30 YR	302m	7.72%	257	100	0.32%	1.10%	0.25%			
15 YR	155m	7.52%	85	91	0.35%	1.60%	0.25%			
Total	457m	7.65%	205	93	0.33%	1.25%	0.25%	1.55%	4.67	420
FN Trust IO										
T240	NA	7.48%	259	85	7.00%	NA	NA	30.50%	4.36	43
T252	NA	7.92%	258	88	7.50%	NA	NA	30.60%	4.08	111
Average	NA	7.70%	259	86.5	7.25%	NA	NA	30.55%	4.22	77

EXHIBIT 3

Countrywide Excess Servicing IO versus Trust IO Characteristics and Pricing

7/31/00	WAC	WAM	WALA	"Coupon"	Avg. Esc	Int on Esc.	Price	Multiple	OAS
FHS 183 IO	7.63%	306	42	7.00%	NA	NA	30.69%	4.38	94
FN 305 16	7.78%	305	44	7.00%	NA	NA	30.03%	4.29	94
FN 305 16	(98% of equal OAS price)						29.43%	4.20	145

mark. Inverse floating-rate IOs might trade 300-1,000 bp cheap to the benchmark.

It has been our approach to treat mortgage servicing as just another structured IO that should be valued at some spread to the benchmark trust IO. Furthermore, it is our view that by considering only the difference in OAS between servicing and trust IOs, we greatly reduce the model dependence introduced by using particular interest rate and prepayment models. That is, while the details of the results presented here might change slightly if a different prepayment or interest rate model is used, the general trends and conclusions would still hold true.

Exhibit 2 gives an example of how the model is applied. The servicing package is a $457 million portfolio with a 7.65% gross weighted-average coupon (WAC), $302 million backed by 30-year mortgages and $155 million backed by 15-year mortgages. The weighted-average servicing fee is 33 bp. The average escrow balance (T&I), is about 1.25% of the unpaid balance, and LIBOR - 25bp on the T&I float and LIBOR flat on the P&I float are earned. The weighted average loan age (WALA) for the portfolio was 93 months. A servicing broker priced this portfolio at 1.55% as of July 31, 2000. According to the model, the OAS is 420 basis points.

To choose the appropriate benchmark trust IO, we look only at the 30-year component of the servicing. In this example, the 30-year WAC and weighted-average maturity (WAM) are 7.72% and 257 months, respectively. These are about halfway between FNMA Trust 240 and FNMA Trust 252. Their average WAC is 7.70% and average WAM is 259 months, pretty close to the 30-year servicing. Each of the trust IOs is run through the model, using market prices, to obtain OAS of 43 bp and 111 bp, respectively. The average OAS of the two trusts is 77 bp. Thus, as of the end of July 2000, this average IO was valued at 343 bp richer than the servicing package.[9]

It is interesting in this analysis to also look at a comparison of the pricing multiples. The multiple is simply the price of the asset divided by the coupon. Exhibit 2 indicates that the servicing multiple is greater, by about 0.45, than the trust IO multiple. One might claim that servicing is rich relative to the trust IO just because the multiple is higher. This is not true. Because the floating-rate components, T&I and P&I float, contribute about 30% to the value of a servicing package but do not increase the coupon, the multiple on the overall servicing package is naturally higher than that on just the strip portion. Indeed, the servicing is 343 bp cheap on an OAS basis.

Exhibit 3 shows a separate analysis for FNMA Trust 305. This FNMA trust was created in the latter half of 1999 and consists of collateral contributed by Countrywide Home Loans Co. Countrywide stripped off all the excess servicing from a portion of its conforming mortgage portfolio (all servicing fees greater than 25 bp) and securitized it in this form. The total deal size was about $225 million in proceeds stripped off $36 billion in (original) outstanding servicing unpaid principal balance (UPB). Countrywide retained the float components and the base servicing fee of 25 bp.

EXHIBIT 4

MSR versus Trust IO Characteristics and Pricing—ADCO Prepay Model

7/31/00	UPB	WAC	WAM	WALA	"Coupon"	Avg. Esc	Int on Esc.	Price	Multiple	OAS
FN/FH MSR										
30 YR	302m	7.72%	257	100	0.32%	1.10%	0.25%			
15 YR	155m	7.52%	85	91	0.35%	1.60%	0.25%			
Total	457m	7.65%	205	93	0.33%	1.25%	0.25%	1.55%	4.67	509
FN Trust IO										
T240		7.48%	259	85	7.00%	NA	NA	30.50%	4.36	131
T252		7.92%	258	88	7.50%	NA	NA	30.60%	4.08	201
Average		7.70%	259	86.5	7.25%			30.55%	4.22	166

EXHIBIT 5

Countrywide Excess Servicing IO versus Trust IO Characteristics and Pricing

7/31/00	WAC	WAM	WALA	"Coupon"	Avg. Esc	Int on Esc.	Price	Multiple	OAS
FHS 183 IO	7.63%	306	42	7.00%	NA	NA	30.69%	4.38	196
FN 305 16	7.78%	305	44	7.00%	NA	NA	30.09%	4.30	196
FN 305 16	(98% of Equal OAS Price)						29.47%	4.21	249

The deal is structured into 26 tranches, 21 fixed-rate and 5 variable-coupon or WAC bonds. When the deal initially came to market, the fixed-rate tranches were trading at 93% of trusts and the WAC bonds at 89%. At the time of this writing, the fixed-rate tranches were trading at around 98%, and the WAC bonds at 95% to 96%.

To use an example, we choose the 16 class of the 305 deal. This IO has a 7.78% WAC, 305 WAM, and a 7% coupon.

For a trust IO comparison, we choose FHLMC PC 183 IO. At the end of July 2000, Trust 183 IO had a price of 30-22 (30 and 22/32 %), which corresponded to an OAS of 94 bp in our model. To correct for WAC and WAM differences, the Trust 305 16 class was also run at 94 bp OAS to obtain a price of 30-01; 98% of that price is 29-14, which was the market price of that security at that time.

Applying the price of 29-14 to our model results in an OAS of 145 bp. That is, Trust 305 16 was valued approximately 51 bp cheaper than the benchmark trust IO. In contrast, the sevicing in Exhibit 2 was 343 bp cheap to Trusts on an OAS basis.

There are both similarities and differences between Trust 305 and mortgage servicing. On the one hand, Trust 305 certainly has some of the same risks as servicing, namely, single-servicer concentration and specific rather than generic geography. Indeed, the perception in the IO market was that with Countrywide's reputation as an aggressive solicitor of refinancing, prepayments on Trust 305 would be much faster than other trust IO. So far, this fear has been unjustified. On the other hand, Trust 305 includes only service fee or strip cash flows, so it is directly comparable to a trust IO.

Given the difficulties surrounding the implementation of FAS 133, other servicers may find this execution compelling in order to reduce their risk. In July 2000, Trust 305 traded only 50 basis points cheaper than the benchmark trust IOs; in January 2001, Trust 305 traded 200 bp cheaper. A pool of servicing, albeit less than $1 billion in size, traded by contrast more than 300 basis points cheaper than the benchmark trust IOs.

It is unclear, however, how the IO market would react to more servicers coming to market with this sort of transaction. When the Countrywide deal came to market, the supply concerns weighed on the market for months (approximately $800 million of IO and no extra PO were created).[10] Were another few billion to also appear without complementary PO, it is not clear that the secondary trading levels of the Countrywide IO deal could be attained.

One of our most important points is that valuing mortgage servicing using an OAS spread to some benchmark trust IO cancels out most of the biases in the prepayment and interest rate models, making the result largely model-independent. To show that this is the case, we recalculate the results in Exhibits 2 and 3 using the Andrew Davidson & Co. prepayment model instead of our proprietary model. The results are shown in Exhibits 4 and 5.

A comparison of Exhibits 2 and 4 shows that although the prices of the trust IOs and servicing give different OAS, the spread between the servicing and the trusts remains unchanged at 343 bp. Much the same pattern is observed in Exhibits 3 and 5. Namely, pricing Trust 305 16 at 98% of the equal OAS price results in a difference in OAS due to prepayment models of merely 2 basis points.

III. THE MORTGAGE SERVICING MARKET IN 2000

Since December 1998, the top ten mortgage servicers have increased their market share from 34.85% to 41.62% and the total amount of mortgages serviced from \$1.57 trillion to \$1.99 trillion, an increase of \$420 billion in loans. The servicers listed in Exhibit 6 generally did not come by their huge volumes purely by origination. Rather, they have been large buyers of servicing in the open market, both in bulk and on a flow basis.

Consolidation in the servicing industry is consistent with that in other industries with large fixed costs and low marginal costs, and where technologically driven platforms can be expanded relatively easily. The motivation for servicer consolidation goes beyond cost advantages, however. Servicers are also driven by the desire to capture "the customer for life."

The thinking goes that once a customer has a relationship with an institution from the mortgage process, it will then be easier to sell that customer other products such as credit cards, checking accounts, mutual funds, or even encyclopedias. Once a customer has a mortgage with an institution, it may be more likely for that institution to capture the next mortgage that customer takes out. These retention and ancillary income benefits have received a lot of attention in recent years and are a common explanation for why servicing prices have increased as much as they have.

The demand for the very largest servicers to grow has led to a tiering in the mortgage servicing market by size of the servicing package. We obtained trade price (or high bid) data for every bulk servicing package that has traded in the market since the beginning of 1999. We filtered out the sales that consisted of at least 90% in balance of fixed-rate conventional FNMA/FHLMC servicing. Then we assign a benchmark trust IO and compare its OAS with the OAS of the servicing package. For every trade that occurred in a month, we take a balance weighted average of the OAS. We segregate the servicing sales by size: sales of less than \$200 million in unpaid balance, those between \$200 million and \$800 million, and those greater than \$800 million.[11]

As is seen clearly in Exhibit 7, the largest packages trade roughly flat to IO OAS; medium-sized ones trade 300-500 basis points cheap to benchmark IO; and the smallest packages trade 400-600 bp cheap to IO. Note that the graph aggregates sales of different coupons, because we assume that comparison to the relevant benchmark IO takes out most of the coupon-related effects.

We attribute this tiering to the fact that the mega-servicers' demand for growth can best be accomplished by buying the largest packages in the market. Purchases of smaller packages require nearly the same amount of time and effort

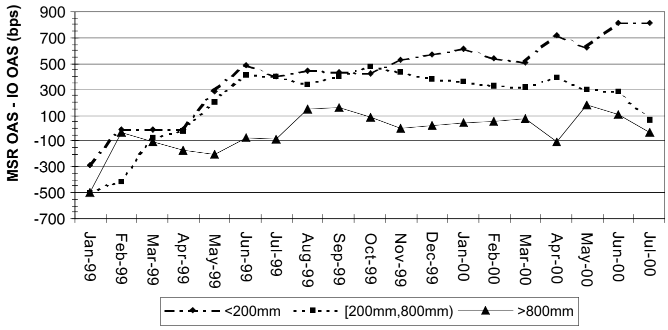
EXHIBIT 6
Top 10 Servicers and Volume

Rank Mar-00	Rank Dec-98	Name	Vol Mar-00	Vol Dec-98	Mkt Sh Mar-00	Mkt Sh Dec-98
1	4	Chase Mortgage	\$324,730	\$249,661	6.79%	5.55%
2	1	Bank of America	\$324,702	\$247,316	6.79%	5.50%
3	2	Wells Fargo	\$286,398	\$208,599	5.99%	4.64%
4	3	Countrywide	\$253,437	\$206,347	5.30%	4.59%
5	8	Washington Mutual	\$165,095	\$139,608	3.45%	3.10%
6	7	Homeside Lending	\$152,501	\$120,098	3.19%	2.67%
7	5	GMAC Mortgage	\$150,000	\$118,797	3.13%	2.64%
8	6	Fleet Mortgage	\$138,800	\$107,612	2.90%	2.39%
9	9	First Nationwide	\$101,254	\$ 86,355	2.12%	1.92%
10	-	CitiMortgage	\$ 93,626		1.96%	
-	10	GE Capital		\$ 83,273		1.85%
Total			\$1,990,543	\$1,567,666	41.62%	34.85%

Source: Mortgage Servicing News, August 2000.

EXHIBIT 7

MSR Pricing (Spread to IO OAS) as Function of Size



to close as larger packages. Although comprehensive pre-1999 data are unavailable, we have quarterly data on our own servicing portfolios in each tier, prior to the beginning of 1999. The evidence is that the tiering began in the fall of 1998. Prior to that, servicing packages of all sizes were priced comparably on an OAS spread to IO basis.

It is also interesting to note that at the beginning of the period, January 1999, all servicing traded very rich on an OAS basis relative to IO. Over the period, all servicing cheapened dramatically. The smallest packages cheapened about 1,000 bp and the largest ones only about 500 bp.

IV. VALUING MORTGAGE SERVICING

As of July 31, 2000, the FNMA/FHLMC MSR described in Exhibit 2 had a market price of 1.55%. Exhibit 8 indicates that most of the value of servicing lies in the servicing fee strip and in the T&I float. IO investors may be unaware that anywhere from 15% to 50% of the value of a servicing portfolio is in the T&I float; 26.4% of the value of our sample servicing portfolio is in that component.

As loans age and balances pay down, both the absolute and the share of value of the T&I float increase. This is because T&I deposits continue as long as the loan is outstanding, regardless of the unpaid balance on the loan. Furthermore, inflation, assumed in this case to be 3% per year, increases the property value and adds incremental value to the T&I component over time. These effects mean that for seasoned loans, the value of the T&I float component can be even larger than that shown in Exhibit 8. Newer servicing portfolios have closer to 15% of their value in the T&I component, while very seasoned ones may have closer to 50%.

While the pure servicing fee strip accounts for 70% of the value of this servicing package, it accounts for only 41% of the dollar duration of the servicing. The T&I float accounts for almost half of the duration. Interest rate convexity (the rate of change in interest rate duration for a 1% parallel shift in interest rates) and prepayment duration (the percentage change in price due to a 10% change in the monthly mortality rates) are similar: 25% of the convexity and 32% of the prepayment duration are in the T&I float. This is a significant amount of value and risk that must be evaluated and managed very carefully within a servicing portfolio. It is thus incorrect and inaccurate to assume that mortgage servicing behaves just like an IO.

It is also interesting to consider the investment characteristics of the servicing components other than the IO strip and the T&I float. First, notice that the prepay gain component has positive duration, positive convexity, and positive prepay duration. That is, it has investment characteristics that are more like a PO than an IO. This component results from the growing cash flows derived from increasing prepayments that are held before remittance to the agencies. As rates fall, there are more prepays, and this component is worth more.

EXHIBIT 8

Percentage Contributions of MSR Components to Value and Risk

Description		Value		Duration		Convexity		Ppay Dur	
		($MM)	(%)	(years)	(%)	(years ^{2})	(%)	(years)	(%)
IO Strip	S(t)	1.09	70.20%	-6.38	40.55%	-5.46	73.24%	-3.421	70.13%
Net Marginal Cost	C(t)	-0.07	-4.66%	-6.60	-2.78%	-4.72	-4.21%	-3.669	-5.00%
Sch P&I Float	PI(t)	0.10	6.45%	-18.13	10.59%	-3.55	4.38%	-3.167	5.97%
T&I Float	TI(t)	0.41	26.40%	-19.51	46.64%	-4.87	24.57%	-4.208	32.45%
Prepay Gain	G(t)	0.09	5.47%	2.29	-1.13%	3.63	-3.80%	5.989	-9.57%
Prepay Loss	L(t)	-0.06	-3.86%	17.02	5.95%	7.84	5.79%	5.306	5.99%
Servicing		1.55	100%	-11.05	100%	-5.23	100%	-3.420	100%

The $10 net cost component of servicing rights also has PO-like characteristics. Because this is a cost, the value is negative. So, when rates are low and prepays are high, there are fewer loans, so the negative value is smaller. Note that even though the duration of the cost component is negative, the dollar duration is positive.

It is also interesting that the durations of the P&I float and T&I float are three times as high as the pure strip component duration. So is the prepay loss component, but in the opposite direction.

Although servicing is not identical to an IO, the IO component (pure service fee) constitutes 70% to 80% of the value. Furthermore, the other components of servicing are IO-like in that when a loan pays off, the servicing cash flows, like the IO cash flows, vanish. While modeling servicing as an IO mischaracterizes the risks associated with servicing, IOs nonetheless serve as the best benchmark security for determining relative value in the servicing market.

Exhibit 9 shows the spread difference between IOs and our canonical servicing portfolio over the past five years. On the right-hand axis and represented by the solid line is the FNMA mortgage rate from the period starting in May 1995 through the end of August 2000. On the left-hand axis and represented by the dashed line is shown the OAS spread between our canonical mortgage servicing package and the benchmark trust IO most comparable to the servicing, in this case FNMA Trust 252.

From mid-1995 through mid-1997, servicing traded between 300 and 800 basis points cheap to the benchmark trust. When mortgage rates started to fall, servicing richened on an OAS basis compared to the trust until, during the depths of the global financial crisis in October 1998, servicing was trading more than 1,000 bp rich to the trust IO. During this period, most servicers were hedged with Treasury-based instruments. As mortgages, swaps, and every other spread product widened dramatically, servicers were profitable because servicing outperformed most other assets.

As the bond market sold off in the spring of 1999, servicing cheapened by hundreds of basis points in OAS relative to IO. During this rising rate environment, servicing underperformed most other assets. Unless servicers unwound their hedge positions, much of the profits earned during the fourth quarter of 1998 were lost in the spring of 1999.

The same relationship is shown in Exhibit 10 in price terms rather than OAS terms. We have normalized both the mortgage servicing price and the Trust 252 IO price by their values in May 1995. Again, the mortgage commitment rate is shown on the right axis and by the solid line. The normalized mortgage servicing price is shown as the dashed line, and the FNMA Trust 252 normalized price is shown as the dot-dashed line.

By the summer of 1996, mortgage rates had risen 50 bp, and Trust 252 IO rose to almost 120% of its initial value. The servicing package actually declined in price, and was at only 95% or so of its initial value. In the depths of the financial crisis in October 1998, mortgage commitment rates fell to 6.40%, and Trust 252 IO plummeted to 42% of its initial value. Meanwhile, mortgage servicing retained most of its value, falling to only 76% of its initial value. At that level, *the dollar price of the servicing was actually greater than the undiscounted sum of the projected cash flows.*[12]

EXHIBIT 9
MSR OAS – IO OAS

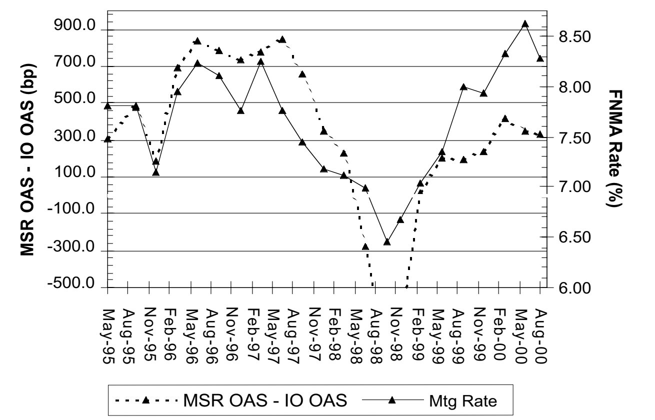


EXHIBIT 10
IO and MSR Price Performance

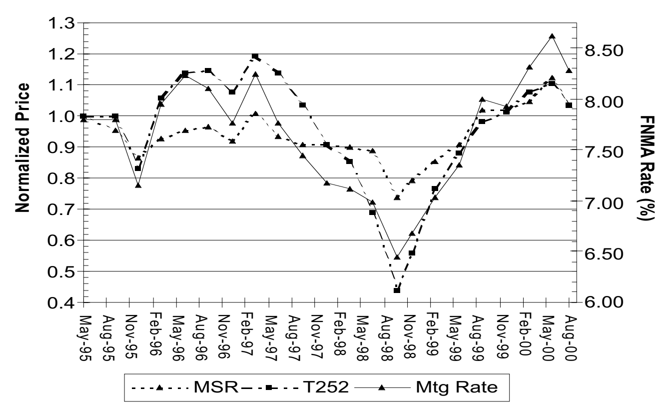


EXHIBIT 11

Static and OAS Pricing for Mortgage Servicing

Prepay = 150 PSA a/o 3/31/00		Static Yield	Static Price	OAS Spread	OAS Spread	OAS Price	Static Yield
IO Strip	S(t)	9.50%	1.29%	-48	174	1.21%	11.71%
Net Marginal Cost	C(t)	9.50%	-0.09%	-30	174	-0.08%	11.52%
P&I Float	PI(t)+G(t)+L(t)	9.50%	0.12%	723	174	0.14%	6.25%
T&I Float	TI(t)	9.50%	0.40%	447	174	0.45%	7.11%
Total		9.50%	1.72%	174	174	1.72%	9.50%

Finally, as rates rose, IOs rose from 41% back to 103% at the end of July 2000, an increase of 150%, while servicing prices rose to 103%, an increase of only 40%. Servicing looked cheap when mortgage rates were high, richened as mortgage rates declined, and cheapened again as rates rose.

As shown in Exhibit 8, the durations of the servicing portfolio and the trust IO are not the same. Therefore, the price movements should not be the same. In fact, the duration differences actually imply that servicing price changes should have been greater than the IO price changes. The price and spread changes shown in Exhibits 9 and 10 highlight the extreme movements in the relative pricing of servicing and trust IOs. The capital markets approach to valuing servicing suggests huge mispricings of the options embedded in MSRs compared to trust IOs.

Typical IO market participants and typical servicing market participants evaluate their investments very differently. Exhibit 11 has two sections. The left half shows a method many mortgage servicers use to evaluate MSRs. Again, we have taken our example mortgage servicing package defined in Equation (1). At the end of March 2000, a servicing broker marked this servicing portfolio at 1.72%.[13]

Many mortgage servicers value MSRs on a static basis. That is, they assume a static discount rate, say, 9.5%, a static prepayment speed, say, 150 PSA, and a static crediting rate for the P&I and T&I float, say, 6.13%, which was the value of one-month LIBOR at that time. Assuming these parameters are applied equally across servicing components, the prices for each component are shown in the static price column of the first subsection of Exhibit 11. Keeping those static prices constant, we apply our model to the servicing and to the benchmark trust IO to compute the spread between the OAS of each component and the Trust IO. These spreads are shown in the OAS spread column.

As of the end of March, the OAS spread between the servicing and the benchmark trust IO was 174 bp. The interesting result is that in the static method employed by some servicers, the service fee component, which is the largest component of servicing value, is implicitly priced 400-800 bp richer than the floating-rate components.

In the right half of Exhibit 11, we show the servicing valuation from the capital markets point of view. Namely, at the broker-determined price of 1.72%, the OAS spread to the benchmark IO is 174 bp. If that same 174 bp spread is applied to each servicing component, the prices obtained are displayed in the OAS Price column. In both cases, the total price is unchanged, as is the total OAS, but the strip price is higher in the static method and float components are priced higher in the OAS method.

If the static parameters are again applied (150 PSA, and 6.13 crediting rate), the static yields that result are shown in the last column. The service fee is more like 11.71% yield, and the float yields are 6.25% and 7.11%. In this case, the static yields on the service fee more resemble the static yields on the trust IO, while the float components have lower yields.[14]

The lower yields on the float components, however, are misleading, because static yields calculated on floating-rate instruments can be either high or low, depending, for example, on the shape of the yield curve. Indeed, when we calculated Exhibit 11, the forward one-month LIBOR was more like 7.40% for several years out, with a peak at 7.60% two years forward. So the low yields reflect the fact that the static method assumes LIBOR is fixed at 6.13% rather than increasing along with forward rates.

In a steep LIBOR curve environment, the static pricing method will undervalue the float component, which will result in high OAS for those components in a dynamic pricing method. Conversely, in a dynamic pricing method, the price for the floating-rate components will result in a low static yield when a lower-than-average crediting rate is applied.

Of course, since by construction both the static pricing and dynamic pricing methods start with the same price for the entire package, the shape of the LIBOR curve will affect only the relative value of the components within the servicing asset. When the floating-rate components appear cheap, the strip component will appear rich, and vice versa. As the yield curve changes shape, however, the static yield method will require a different yield to compute the correct price. Similarly, packages with different components of float and service fee will need to be priced at different yields. This analysis shows some of the difficulties in a static pricing methodology.

One interesting observation in servicing pricing is that MSRs with significant excess servicing trade at lower multiples than the same portfolio without excess servicing. A common interpretation is that servicers are really after customers, and therefore prefer to have a smaller strip component, other things being equal. The claim is that servicers pay less for excess servicing for this reason. Yet the decomposition in Exhibit 11 shows clearly that doubling the strip component, even priced at the same OAS, lowers the multiple, since the other components are unchanged and contribute significantly to the value of the servicing package.

V. HEDGING MORTGAGE SERVICING

In order to evaluate a hedging strategy for MSR, it is important to begin with a statement of the hedge objective. Over the years, the hedge objective of most servicers has evolved from not at all for pre-FAS 122 off-balance sheet servicing, to hedging changes in MSR values determined by a lower of cost or market accounting methodology. Recall that the LOCOM method of accounting allows MSR to be marked down or up but only up to the original (or amortized) cost. In addition, under hedge accounting, MSR can be marked up or down to the extent of changes in the value of a derivative hedge.

For servicers who hedge LOCOM without getting hedge accounting treatment, the values based on LOCOM are equivalent to the payoff function of a short put option position on the underlying MSR with a strike price equal to the original purchase price. Clearly, the strategy of hedging LOCOM accounting or a short at-the-money put option position is not the same as hedging the value of MSR for all changes in interest rates. In fact, hedging the option position is even more complex than hedging the outright position since the option is on an underlying instrument that itself includes embedded (prepayment) options. In addition, the goal of hedging the LOCOM values is driven by accounting rules and not by the economics of the business.

Exhibit 12 shows the payoffs of the market value hedge and the LOCOM hedge in terms of market values. Exhibit 13 shows the hedge outcomes in terms of accounting values. Although the market hedge theoret-

EXHIBIT 12
Payoff Function of MSR (Market Value) and LOCOM Hedge on Market Value Basis

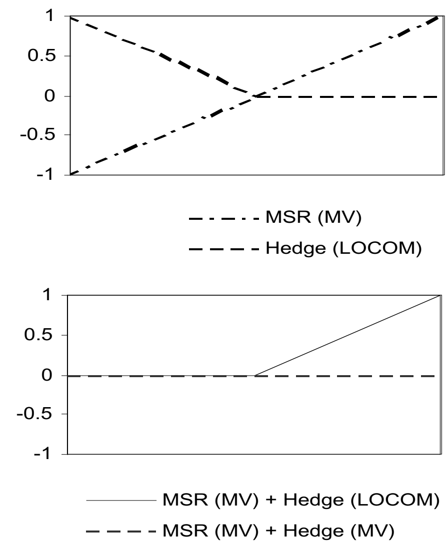


EXHIBIT 13
Payoff Function of MSR (LOCOM) and MV Hedge on Accounting Basis

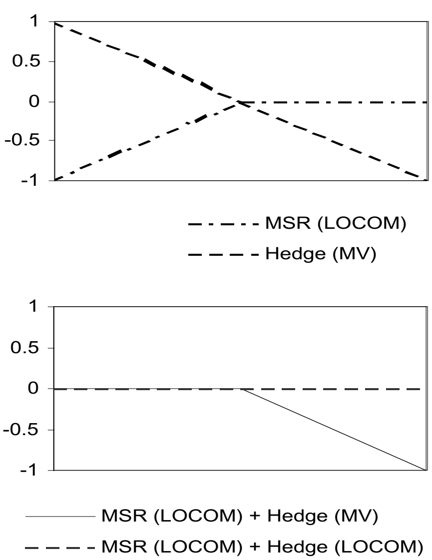
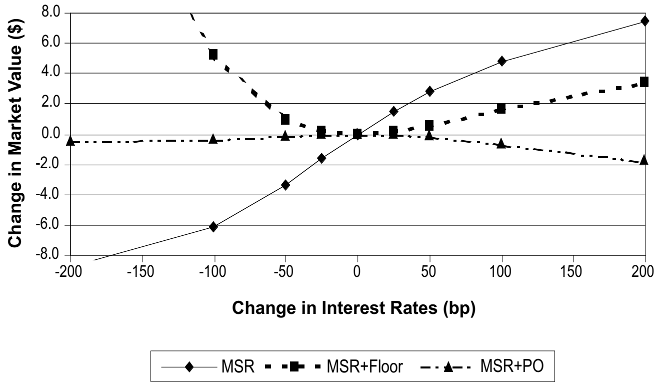


EXHIBIT 14

Change in Servicing Value for Instantaneous Changes in Rates



ically shows volatility of profitability in accounting terms, it in fact shows no volatility in market value terms. The LOCOM hedge theoretically shows no volatility in accounting terms, but in fact shows volatility in market value terms.

One is tempted to argue that the downside of the LOCOM hedge is to understate economic gains, while the downside of the market value hedge is to show accounting losses even when no losses exist in market value terms. Of course, even if one uses the LOCOM hedge and MSR values rise above cost, accounting results would show no change, while true market values would show a gain. Attempting to lock in that gain by hedging at that point would not work because, whether MSR values rise or fall, the accounting value would not change; the hedge value would. Because of accounting distortions, most servicers attempt to use hedge accounting rules, and thereby hedge both gains and losses in their MSR so that accounting and economics most closely resemble each other.

We approach hedging from an economic perspective. We do not attempt to hedge LOCOM accounting rules. Rather, we attempt to hedge market values and will rely on a hedge accounting methodology.[15]

A standard point of departure for hedging mortgage servicing is to begin with Exhibit 1, and then consider constructing a portfolio of hedges that increase in value as rates decrease so as to offset the value erosion in the MSR. The most common hedges are principal-only securities or swaps and interest rate floors.

A common picture displayed to show how easy it is to hedge MSR is the instantaneous rate change picture shown in Exhibit 14. Here, a zero-duration portfolio of MSR and POs is constructed, assuming all interest rates are instantaneously changed by the amounts shown on the horizontal axis. The change in market value due to such an interest rate shock is plotted for each shock magnitude. The same analysis is performed for a zero-duration portfolio of MSR and five-year term, 50bp out-of-the-money, ten-year constant-maturity Treasury interest rate floors.

While Exhibit 14 is interesting, it oversimplifies the issues involved in hedging. For example, it indicates that by hedging with interest rate floors, the portfolio increases in market value for all interest rate changes. If hedging MSR were this easy, servicers would not be concerned about FAS 133 or any other hedging issue. It is indeed more complex.

In Exhibits 9 and 10 it was shown that the servicing-to-IO OAS has been very volatile over the last several years, ranging from +700 bp to –1,000 bp, back to +500 bp. It can also be seen empirically that the servicing prices appear to be much less sensitive to changes in mortgage rates than the trust IO is. If a model gives the result that the OAS consistently widen in a rally and tighten in a sell-off, using that model for hedging will prove to be difficult.[16]

The first point to make about hedging servicing relates to the difference between servicing durations and IO durations. In order to compare the price movements of servicing to IOs, we can compute the theoretical hedge ratio between our servicing package and a trust IO. The theoretical hedge ratio at time t, h(t), is:

$$h(t) = \frac{\Delta P_s(t)}{\Delta P_{io}(t)} = \frac{D_s(t)P_s(t)}{D_{io}(t)P_{io}(t)} \tag{2}$$

where P_s is the MSR price, P_{io} is the IO price, D_s is the MSR duration, and D_{io} is the IO duration.

Exhibit 15 plots the mortgage rate with a solid line. On the right axis and indicated by the dotted line is the ratio of our mortgage servicing portfolio *model* (dollar) duration to the *model* (dollar) duration of just the servicing strip portion of the asset. This is the parameter h(t). The result is rather obvious.

When mortgage rates are high, short rates are likely high as well, and the amount of duration in the float components is also high, resulting in a high ratio of about 1.6 of servicing to strip duration. During periods of low interest rates, the ratio is closer to 1.1.

Although the theoretical hedge ratio between MSR and IOs is calculated by Equation (2), we also compute

EXHIBIT 15
Ratio of MSR Duration to Strip Duration

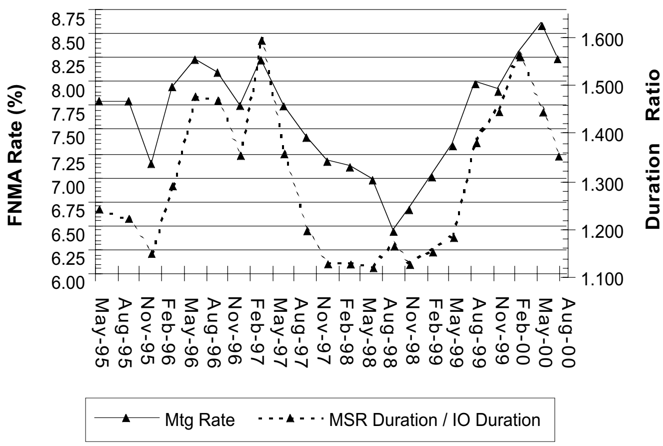
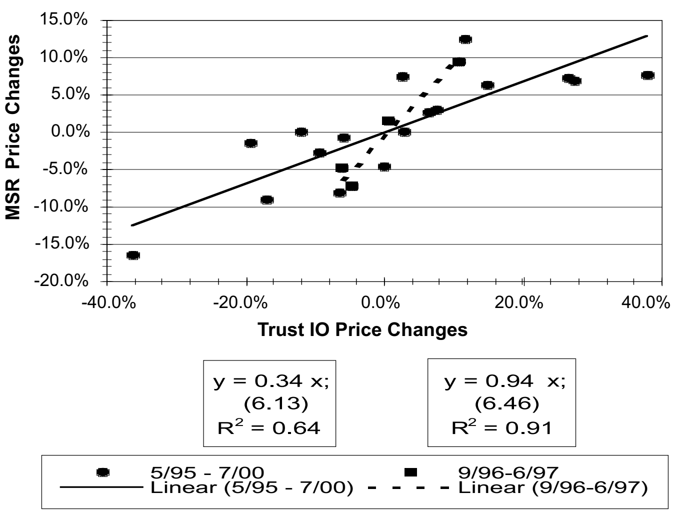


EXHIBIT 16
Empirical MSR Duration



the empirical hedge ratio of servicing to trust IOs by the regression:

$$\Delta P_s(t) = \alpha + \beta\left[h(t)\Delta P_{io}(t)\right] + \varepsilon(t) \qquad (3)$$

where $\Delta P_j(t) = P_j(t) - P_j(t-1)$ for j = s, io. In Equation (3), we test the hypothesis that the relationship between MSR duration and IO duration is indeed given by Equation (2). The regression is computed using $[h(t)\Delta P_{io}(t)]$ as the independent variable. With this formulation, $\beta = 1$ indicates that the theoretical model results hold true. The results are shown in Exhibit 16; t-statistics are in parentheses below the values.

Exhibit 16 shows there have been periods when MSR and IO prices are highly correlated (September 1996-June 1997, for instance, when $\beta = 0.94$) and times when they have been less so. One explanation is that servicing is simply less sensitive than IO to changes in rates, or $\beta < 1$. Indeed, for the entire period of observations shown in Exhibit 16, $\beta = 0.34$. Alternatively, there may be a lag in servicing prices compared to IOs.

It is tempting to postulate this since IOs react in price almost immediately to new conditions, but servicing prices take time due to among other things, servicers' reliance on Bloomberg median prepayment speeds, for example, which are only updated twice per month. Regression results (omitted) do not support the lag hypothesis.

The fact that empirically $\beta \neq 1$ clearly raises at least as many questions as it answers. One of the most vexing is also probably the most important—the implications for how to hedge mortgage servicing. Models are useful for many relative-value questions, and we believe that spreading to the trust IO reduces much of the model sensitivity. When thinking about hedging, however, one has to be more careful.

In the IO market, it often happens that a particular interest rate model and prepayment model give a duration for the trust IO that is different from the way the market prices are moving with respect to interest rates. A hedger in this situation has two choices: continue to use the model duration in the belief that over the long haul the market-implied duration will converge to the model duration (and realize significant P&L volatility in the interim), or throw out the model and hedge to market-implied or market consensus durations on the IO, reducing the P&L volatility but making the investment seem unhedged on a model basis.

When the model duration diverges from the market-implied duration, it is still possible to hedge perfectly by buying a PO and selling MBS collateral. This is possible only because of the existence of the complement of the IO: the PO.[17] Indeed, some participants in the securities markets argue that this is a reason why even a well-structured PAC IO must trade behind trusts, because of the lack of the complement.

In the case of mortgage servicing, the situation is even worse, since 1) there is no such thing as the complement to the T&I float, and 2) the T&I float component itself does not trade separately in the marketplace. If a particular model is giving the "wrong" duration on trust IO, then that must be also wrong for the float, but the trader or portfolio manager will have no idea how to correct for the errors or how to find the market-implied duration for these components.

Servicers often talk about the "natural" hedge: namely, production of new servicing. Origination volumes rise in periods of low interest rates and drop in periods of high interest rates, partially offsetting the value changes in the MSR on the balance sheet. From a hedging perspective, a servicer can account for this natural hedge by determining how originations will change with interest rates and valuing the change in those originations accordingly. This hedge will never cover 100% of the change in MSR value, because even if a servicer were to retain 100% of the MSR portfolio in a period of high prepayments, there is a cost associated with making those originations, so that the servicer is in effect buying the new servicing (at the cost of originating the new loan).

If the cost to originate were equal to the market value of the servicing, then the natural hedge would not be a hedge at all. It would merely be a method of acquiring replacement servicing at the cost in the market. If the cost to originate were lower than the market value, then the natural hedge could be an important and significant component of servicing values and hedge strategies.

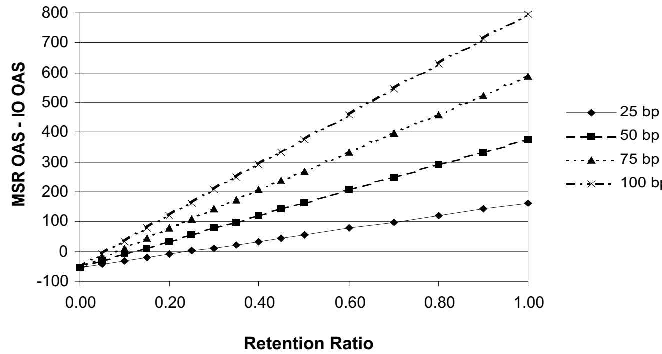
Nonetheless, the loss of value on the prepaid amount will typically be greater than the incremental servicing value acquired (by the cost of origination). Typically, the cost to originate a new loan is somewhere in the neighborhood of 75-100 bp. A "streamlined" loan costs somewhere between 50 and 75 bp. In today's market, the average market value of new servicing is probably 1.50, around a 6.0 multiple. So, in recapturing loans that prepay, the servicer can hope to lose only half its investment in those loans.

Unfortunately, the recapture rate of servicers is only around 10% for prepaying loans. That is, servicers typically lose 95% of their investment in loans that prepay. Even if the recapture rate were as high as 30%, which is a goal of most servicers, the loss would still be 85% of investment.

Nevertheless, one can take account of the amount of prepaid servicing retained in calculating the value and hedge ratio using the techniques we have described.

To see how the retention component affects the results, we look at a servicing portfolio that traded in the marketplace October 11, 2000. This package had an unpaid principal balance of $3.14 billion, a 7.50% WAC,

EXHIBIT 17
OAS Sensitivity to Retention



and a 233-month WAM. The net service fee was a weighted average 39.6 bp. The traded price was 1.97%. Using the methodology described in Exhibit 2, we find an OAS to the benchmark trust IO of –53 bp. (Note that if we price this portfolio statically, using our assumption of $10 net marginal cost, the static yield is 10.56%.) This spread is consistent with where other larger packages are trading in the market as of this writing.

To see the value of the retention, it is necessary to consider two variables: the retention rate, and the difference between the origination cost and the current market value. We make the assumption that whatever loans are retained are immediately sold in the marketplace on a flow basis, and the difference between origination cost and current market value is realized in that period. In this way, the balance of the portfolio declines just as it does without including this component, but there is an extra cash flow amount.

Exhibit 17 plots the spread between the MSR OAS and the IO OAS as a function of the retention rate for four different origination costs. The solid line assumes that the difference between the origination cost and the current market value (at any period) is 25 bp; the dashed line assumes the difference is 50 bp; the dotted line 75 bp; and the dot-dashed line that the difference is 100 bp.

At a 100% retention rate, the OAS is clearly a very important component of valuing mortgage servicing. At current levels of around 10% retention and a cost savings of 50 bp to 75 bp, the OAS pickup is 45-65 bp. This number is not negligible, but neither is it significant.

At aggressive industry levels of 30% retention and again at cost savings amounts of 50 bp to 75 bp, the OAS pickup is 130-195 bp. At that kind of retention level and price, servicing that trades 50 bp rich to the trust IO without consideration of the retention component would be valued 80-140 bp cheap to the trust if retention is included.

What does all this mean for hedging mortgage servicing? One thing is absolutely clear. It is impossible to perfectly hedge the market price of mortgage servicing in the absence of the complement. There is a great amount of spread volatility in historical mortgage servicing price data. As for most prepayment-sensitive assets, there are periods the model duration can accurately describe price movements and there are periods it cannot. As all market participants know, dislocations between aberrant behavior and long-term equilibrium behavior can persist for long periods of time.

New accounting rules have added additional difficulties for mortgage servicers. Just as it is impossible to perfectly hedge servicing without the complement, it is even more difficult to hedge non-economic definitions and accounting rules. Participants in the servicing market should attempt to influence the accounting debate so that the economics are more accurately reflected in the accounting rules.

There are generally not enough price data, nor is there enough homogeneity in the mortgage servicing market, to derive empirical durations for mortgage servicing. Therefore, there remain two approaches to calculate hedge ratios for MSR. One solution is to live with the model durations and to accept the resulting short-term P&L volatility; in the long term, if the prepayment model is reasonably accurate, the P&L from owning mortgage servicing should match the long-term economics. For shorter holding periods, waiting for the convergence of the empirical duration to the long-term equilibrium value may not be feasible.

Our approach to hedging MSR is to make adjustments to model-derived IO hedge ratios and partial durations according to certain empirical results and to apply these same adjustments to the model-derived hedge ratios and partial durations for MSR. For example, if trust IOs are trading to much more negative durations than models would indicate, we might shift the elbow of the prepayment curve by an amount necessary to obtain the empirical trading duration of the trust IO, and then use that same shifted model to compute the duration of mortgage servicing.

It should be stressed that we refer to the price sensitivity of MSR to any market parameter. For simplicity, we have focused on interest rates and mortgage rates. Specifically, in periods of low prepayment volatility, we can apply our methods regarding the hedge ratios of IOs and MSRs, whether the hedge instruments are POs, Treasuries, interest rate swaps, floors, or whatever. Now, it may be true that Treasuries will exhibit larger errors in hedging MSR than, say, POs will, but that is a question not of hedge ratio or duration but of basis risk.

It is also true that we can apply our analysis to the hedging of prepayment duration. Recall that over the period September 1998 through March 1999, the mortgage universe experienced the most massive prepayment wave ever. Unless prepayment-sensitive hedges had been employed, hedges during this period proved inadequate in specifically hedging against prepayment risk. Because there is a limited supply of hedge instruments that have non-vanishing prepayment duration, it is impossible for larger servicers to hedge their sensitivity to prepayments. As a result, prepayments remain, and will always remain, the most significant risk of owning mortgage servicing.

VI. SUMMARY AND CONCLUSIONS

We have shared some of the most interesting results we have observed in tracking the relationships between the IO securities markets and the MSR markets over the last five years. In our view, the most interesting result is the massive servicing-to-IO spread tightening and widening, on the order of more than 1,000 basis points, that has occurred over that time. As a result, hedging mortgage servicing remains extremely difficult. In fact, even assuming that the market sensitivities to price can be completely hedged by using an approach like the one we describe, the spread volatility experienced by MSR dominates the P&L over short time frames.

Nevertheless, hedging MSRs is still the focus of much attention due to the imminent adoption of FAS 133 and the P&L volatility that will flow through to earnings. Now hedge "ineffectiveness" is offset by gains or losses in the hedge instruments, subject to hedge accounting rules. For larger companies with earnings in the range of $500 million to $1 billion per quarter, the P&L volatility is huge. According to the data underlying Exhibit 9, the quarterly standard deviation of servicing-to-IO OAS over the past five years is about 450 bp. A servicer with $3 Billion-$4 Billion in assets would therefore potentially experience $100-$140 MM in P&L volatility per quarter. The P&L volatility experienced by large mortgage servicers can be very high indeed.

Servicers face many difficult hedging decisions. In the trust IO/PO markets, it is possible to hedge in a model-independent fashion by buying the complement and selling the underlying collateral. Since the complement for servicing does not exist, a MSR hedger must decide how to implement a hedging strategy. In the securities markets, when model IO durations diverge from empirical IO durations, a trader will most often adjust duration to the empirical. Our approach to hedging mortgage servicing has been to treat servicing in a similar manner.

For example, when the model IO duration is different from the empirical, the prepayment model can be adjusted to obtain market-implied hedge ratios, and such an adjusted model can be applied to the MSR. While this methodology will not produce optimal results when the empirical IO duration (and empirical MSR duration) converges to the equilibrium model durations, it will produce better results in the non-convergence case. This methodology certainly requires a regular monitoring and recalibration of the adjusted prepayment model.

The precise nature of the adjustment made to the prepayment model in such circumstances is also subjective. For instance, if prepayments in the model seem to be running too slow, they can be sped up by techniques such as increasing the turnover speed, increasing the peak speed attainable in periods of low rates, shifting the elbow and thereby reducing the refinancing incentive, increasing the so-called media effect, or increasing the steepness of the prepayment curve. Other adjustments might include linking price changes to changes in implied volatility or the shape of the yield curve.

We believe that the focus on hedging mortgage servicing will most likely have a smoothing effect on servicing-to-IO spreads. As servicing market participants focus more on hedging their risks, this will increasingly mean using more prepayment-sensitive hedge instruments, e.g., PO. As the servicers start to pay more attention to the IO/PO market, and shift in and out of PO hedges depending on relative richness or cheapness, it can be argued that the price of servicing will eventually move in a more correlated fashion to the price of IO than has been observed historically.

The smaller- and medium-sized servicers are able to hedge their risks by buying prepayment-sensitive securities and can opportunistically buy mortgage servicing when servicing-to-IO spreads are wide and sell when those spreads are tight.

The larger mortgage servicers are in a different situation. Not only are they unable to hedge their risks completely due to the lack of enough prepayment duration in the securities markets, but they are also unable to buy and sell servicing in the amount needed to be meaningful. Yet the big servicers are in the business to stay.

The adoption of FAS 133 and the attendant P&L volatility caused by massive servicing-to-IO spread movements, even accounting for the benefits of retention, will cause the large mortgage servicers to experience sizeable P&L swings. The mega-servicers must be prepared to accept these swings as the cost of being in the servicing business. To the extent that they or their shareholders are unable or unwilling to accept such large P&L swings in their earnings at current MSR pricing levels, MSR prices will decline to reflect the risks of owning servicing.

We suspect that after some number of servicers take a $100 million or more loss due to servicing hedging mismatch, MSR repricing will not be far behind. This repricing will be painful to many of the large servicers who have their servicing marked at current market levels.

The ultimate clearing level for mortgage servicing is, of course, unknown at this time. We feel that the risks are significant enough that, should this repricing occur, it would not be surprising to find the equilibrium price of servicing at a multiple or more lower than it is today.

ENDNOTES

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[1]According to *Mortgage Servicing News*, June 2000.

[2]The price of servicing is often expressed as a multiple of the servicing strip. For example, a 25 basis point strip of MSRs priced at 200 basis points (up-front) has a multiple of 8.0.

[3]Pre-FAS 122 servicing is servicing originated prior to the adoption of FAS 122.

[4]If hedge accounting treatment is not sought, earnings volatility instead flows through to equity. In this case, the servicing is accounted for on a lower of cost or market (LOCOM) basis, and the hedge instruments, which might include cash instruments, are held in an "available for sale" account. In a falling rate environment, the servicing declines in value, which flows through to income, and the hedges increase in price, which flows through to equity. In order to smooth the changes in value in the equity, the hedge instruments must be sold and new hedge instruments will need to be purchased. This results in no net change to equity and no net change to income. In a rising rate environment, servicing prices are capped, so nothing flows through to income, while hedge instruments decline in value. In this case, the P&L volatility due to LOCOM hedging flows through to equity.

[5]Even if the interest rate risk of servicing is hedged perfectly, spread movements between the servicing and its hedge still are significant. If the spread moves 100 basis points, the spread duration is 3.5 years, and the market value of servicing is $3 to $4 billion, the volatility is conservatively estimated to be $100-$140 million. As shown below, 100 basis points has historically been a relatively small spread movement.

[6]The ability to recapture a prepaying loan implies that servicing values should account for this feature that is irrelevant to IO valuations. The fact that origination volumes typically increase during periods of high prepayments leads to the notion of a "natural hedge" for servicers who also have an origination business.

[7]For a description of various remittance programs and the valuation of the float components, see Angbazo et al. [1988].

[8]For a description of the OAS approach to valuing mortgage-backed securities of many types, see, for example, Fabozzi [1995]. For a general overview, see Kupiec and Kah [1999].

[9]We compare the price of a pool of 15-year and 30-year servicing to 30-year IOs because there are no good benchmarks in the IO market based on 15-year mortgages. The purpose of this analysis is to give an example of how the model is applied. No results are changed if we choose a portfolio of only 30-year servicing. Of course, a 15-year prepayment model is applied to the 15-year portion of the servicing.

[10]IO market participants normalized the $225 million in market value of Countrywide IO to a notional trust IO equivalent of about $800 million based on the net WAC of the underlying trust tranche.

[11]There are typically more sales per data point in the smallest size bucket than in the larger ones. There are 95 sales in the smallest-size bucket; 46 in the medium-sized bucket; and 29 in the largest-sized bucket. The average number of sales in each bucket is 5.0, 2.4, and 1.5, respectively. The highest number of sales in any month for each of the three data sets is 10, 8, and 4, respectively.

[12]Indeed, the price shown in Exhibit 10 is real, since we actually executed a trade during that time at those levels.

[13]At the end of July 2000, the same broker marked this portfolio at 1.55%. We choose the March price only to illustrate the differences between the static and the OAS approaches. Because the yield curve was flatter in July, the differences between the static yields and dynamic OAS were less pronounced for all the components. The very fact that the yield curve shape, volatility, and other factors change over time suggests that the static method will not properly value these changes.

[14]Whether in yield or OAS terms, there is no reason a priori that all the components of servicing must be priced at the same yield or OAS. Nonetheless, we find that different pools of servicing with similar WACs and WAMs tend to trade at similar OAS even if the other characteristics of the servicing are somewhat different. This suggests to us that equal OAS across servicing components is not a bad assumption.

[15]Theoretically, the techniques we describe can be used to hedge LOCOM values by making adjustments necessary for hedging short put options, but hedging an option on an instrument that itself includes embedded options can be very complex.

While we do not go into the details of FAS 133, we expect to follow the requirements to obtain hedge accounting treatment. The difference between the FAS 133 implementation and other implementations has no impact on our methodology.

[16]In practice, if the OAS widening and tightening is a deterministic function of interest rates or IO prices, one could calculate a hedge strategy based on the assumption that the observed spread relationships would be maintained in the future. We observe no consistent patterns in historical spread movements.

[17]Simply buying a PO exposes one to "combo premium" risk. The combo premium is the difference between the sum of the trust IO and PO prices and the collateral price. In general, the combo premium is bounded from below by negative $\frac{1}{32}$ and can be substantially positive. This reflects the fact that different market participants can have different prepayment views and can lever those views in either IO or PO independently. Since December 1997, these premiums have ranged from a few ticks for new collateral to as much as $1\frac{1}{2}$ points for seasoned. Much of the large premiums simply reflect the value of seasoned collateral over new collateral, but the value of seasoned collateral over new did not persist during the financial crisis in the fall of 1998 when combo premiums vanished on all collateral, seasoned and new alike.

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