

Hedging Mortgage Servicing Rights

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Mortgage servicing rights (MSRs) represent the right to receive income in exchange for providing a set of servicing related functions for mortgage loans. This income is computed as a percentage of the unpaid principal balance of the servicing portfolio. The value of MSRs is sensitive to changes in interest rates. In particular, when rates fall borrowers are more likely to exercise their prepayment option. Prepayment lowers the unpaid principal balance and thereby reduces MSR value. Such fluctuations in value represented over 28% of earnings, on average. Given the well-known stylized fact that some managers engage in earnings smoothing, such volatility would necessitate hedging. This research examines the extent to which a sample of publicly traded companies has effectively hedged its MSRs. The adoption of the accounting rule FAS 156 governing the accounting for MSRs makes it possible to examine the hedging performance. Based on the reported market value changes of MSRs and reported hedging gains and losses contained in the financial disclosures, these publicly companies appeared very successful as a group in hedging changes in MSR values.

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1. Introduction

Mortgage servicing rights (MSRs) represent the right to receive income in exchange for providing a set of servicing related functions for mortgage loans. This income is calculated as a percentage of the unpaid principal balance (UPB) of the servicing portfolio. The value of the servicing rights is determined by discounting these future revenues, net of expected costs, back to the present. When rates decline, borrowers are more likely to exercise their option to prepay early. Prepayment reduces the UPB and thereby reduces the amount of servicing income. Consequently, declines in mortgage rates can cause a significant reduction in the value of servicing rights. For firms using fair value accounting to account for the subsequent (to their acquisition or origination) valuation of MSRs, the change in market value of MSRs is reflected in the earnings of the company. Such changes in the value of servicing rights represented over 28% of earnings on average. Given the well-known stylized fact that some managers engage in earnings smoothing, such volatility would necessitate hedging. This research examines the hedging effectiveness of a sample of publicly traded financial firms with mortgage servicing portfolios that used fair value accounting and chose to hedge the value of their MSRs. Hedging for these firms was very successful in eliminating the volatility in earnings created by changing MSR values.

The paper is organized as follows: Section 2 discusses mortgage servicing rights in more detail, focusing on their characteristics, valuation, risk profiles, and the nature of the hedging problem. Section 3 contains an in-depth analysis of public companies that hedged their servicing portfolios, first discussing the accounting treatment and then the hedging performance of the companies. Section 4 concludes the paper.

2. Discussion of Mortgage Servicing Rights

2.1 Description of Asset

Mortgage servicing rights (MSRs) represent the right to receive income in exchange for providing a set of servicing related functions for a portfolio of mortgage loans. These servicing functions include the monthly collection of and accounting for principal and interest payments from

borrowers, the pass through of principal and interest to investors, managing and accounting for escrow payments for taxes and insurance, providing tax information to borrowers and investors, sending out late notices, engaging in loan modifications, and engaging in foreclosure activities. In return for these servicing activities, mortgage loan servicers receive servicing fees typically in the range of 25 to 40 basis points of the unpaid principal balance (UPB). Servicers may also receive other ancillary revenues associated with late payments, foreclosures, loan modifications, or other specific incremental services provided to either the borrowers or investors. Additionally, the servicer will receive float income from interest income earned on the principal, interest, and escrow payments received in advance of their payment by the servicer, net of any funds advanced to investors prior to their receipt from the borrower.

2.2 Valuation

The value of MSR is determined by discounting the future expected servicing income, net of associated costs, back to the present. Though conceptually simple, valuation is difficult in practice because the level and timing of future cash flows is unknown. In particular, the amount of future cash flows and hence their value depends on a number of variables. The primary factors determining MSR value include prepayment speed, servicing costs, ancillary revenues, and default rates.¹ These variables are in turn determined by the loan composition of the underlying servicing portfolio (i.e., fixed v. adjustable rate) and the relation between servicing portfolio loan rates and current market rates.² When market rates fall, borrowers are more likely to exercise their prepayment option. Prepayment reduces the UPB of the servicing portfolio, which reduces the servicing income. The MSR will experience a decrease in value if these prepayments are greater than what was expected or priced at the time the MSR was either originated or acquired.

In practice MSR is valued using proprietary models. These models are either developed by the servicer or acquired from third parties. Many servicers will use more than one model. The models are typically validated by reference to transaction prices when MSR exchange hands, or by reference to third party models. Though the models are highly mathematical, they also depend on a number of judgments and estimates that are portfolio specific. Model assumptions are continuously monitored and updated when experience dictates. In a recent declining mortgage rate environment, prepayments increased less than expected for some servicing portfolios because many of the underlying loans had UPB's that exceeded the value of the home, constraining the borrower's ability to refinance. Similarly, when defaults and delinquencies increase more than expected, servicing costs are higher than expected. On the other hand, higher delinquencies and defaults may create opportunities for loan modification fees and other ancillary income.

Early MSR valuation models were static models of estimated future cash flows, which failed to take into account the stochastic nature of interest rates and the interest rate path dependency of mortgage and MSR cash flows. Later models encompass an Option Adjusted Spread approach (OAS) to evaluate the effect of prepayments on MSR values. Specific valuation models are beyond the scope of this paper, but the reader is encouraged to see Lin, Chu, and Prather (2006) and Van Drunen and McConnell (1988) and the references therein.

In order to compare MSR values across firms a standard valuation measure is needed. The measure most commonly used in the industry is the value of the MSR divided by the unpaid principal balance (UPB) of the servicing portfolio. This measure is in basis points. As an example, a multiple of 1.05 indicates that MSR is valued at 1.05% of the underlying servicing portfolio. Consequently, the servicing rights for a \$100,000 loan would be valued at \$1,050. MSR/UPB multiples obviously depend on the characteristics of the underlying servicing portfolio of the firm.

¹ Prepayment speeds are typically measured either by the conditional (sometimes called 'constant') prepayment rate, CPR, or by reference to a Public Securities Association (PSA) benchmark. See Fabozzi (2006), Chapter 3 for a more detailed explanation of prepayment rates.

² For example, when market mortgage rates fall a borrower with a short-term ARM loan will allow the rate on the existing loan to reset rather than refinance the loan.

To provide some perspective on MSR valuations, Chart I plots mortgage rates along with the mean MSR/UPB by quarter for companies in the sample for the period under study, March 2006 through December 2011.³ During this period mortgage rates were volatile and trended downward. MSR values track the mortgage rates very closely.⁴ MSR/UPB multiples ranged from a low of .59% to a high of 1.80% for these companies during the period.

2.3 Description of Hedging Problem

As previously discussed, MSR values are most sensitive to a decline in rates, which increases the likelihood that borrowers will exercise their option to prepay and thus increase prepayment speeds for the MSR portfolio. Chart II depicts a typical risk profile for an MSR portfolio.⁵ Chart II indicates the model estimated MSR value for a given 'shock' to rates. There are a couple of points to note. First, the risk profile has a positive slope, indicating MSR values are positively related to rates. Second, the risk profile is non-linear. That is, a decrease in rates leads to a larger decline in value than the increase in value created by an equivalent increase in rates. This property is known as 'negative convexity' and will typically be present over some range of interest rate declines. As interest rates continue to decline the negative convexity will turn positive.

Chart III decomposes the risk profile for the same servicing portfolio into ARM loans and all other loans. The risk profile for the ARM loans is very flat – the prepayment option is exercised much less frequently because it is usually more cost effective for the borrower to simply let the loan rate reset when rates fall rather than refinance. The non-ARM portion of the portfolio is significantly more sensitive to rates.

There are two general approaches to hedging MSRs. The first is a delta hedge that attempts to hedge against small changes in the level of interest rates. Delta hedging typically uses one hedging instrument, such as Treasury futures, and requires constant rebalancing as interest rates change. Because of the frequent rebalancing required, delta hedging is sometimes referred to as dynamic hedging. However, delta hedging does not take into account negative convexity or non-parallel yield curve changes. The risk profile of each servicing portfolio is unique, and there is no single financial instrument that exactly offsets the risk profile of an MSR portfolio. The second approach explicitly considers the negative convexity and effects of non-parallel shifts in the yield curve. The second approach generally entails using more than one hedge instrument and is sometimes referred to as a 'gamma' hedge or a 'two-bond' hedge or even 'three factor' hedge. For further discussion of the hedging problem see Ortiz et al (2007, 2008, and 2010).

2.4 Previous Research Related to MSR Hedging

There is very little academic research related to hedging MSR value, and much of the research that does exist uses interest only strips (IOs) as a proxy for actual MSR portfolios. Goodman and Ho (2001) examined the hedging of mortgage servicing rights by examining the hedging effectiveness of a variety of financial instruments against changes in the value of IOs. Using daily data and holding periods ranging from five to twenty days, the authors determined that MBS principal only (POs) performed best. However, 10-year Treasuries and Swaps performed about as well. The authors did not examine options. In addition, rather than using actual MSRs the authors used IOs as a proxy for MSRs. The authors used daily price data and daily rebalancing to first examine correlations between the IO's and potential hedge instruments. Not surprisingly PO's had the highest correlation. They then examined hedge effectiveness by measuring the standard deviation of daily net profit and loss for holding periods ranging from five to twenty days. Smith

³ Rates are from the Primary Mortgage Market Survey (PMMS) for 30 year, fixed mortgages. This index is based on weekly surveys performed by Freddie Mac

⁴ The correlation between mortgage rates and MSR/UPB values was 94.8% during the period. In addition, the correlation between the percentage change in MSR values and the percentage change in mortgage rates was 82.3%.

⁵ Data for this graph was obtained from September 2007 valuations provided by Interactive Mortgage Advisors, LLC of Denver, CO for Central Mortgage Co. of Little Rock, AR, a privately owned servicer.

and Goodman (2006), in a more recent updated version of this research, found similar results. They also addressed the use of MBS TBA's and call options. MBS TBA's exhibit negative convexity, like MSR's, and thus exacerbate the problem rather than mitigating it. These authors considered options too expensive to roll on an ongoing basis. Golub and Yerneni (2006) find that MSR hedging effectiveness depends on the type of MSR valuation model used, and that OAS based valuation models result in a lower volatility of hedged returns.

Hedging MSRs in practice is a much different exercise than simulating hedge performance using IOs as a proxy. IOs trade in relatively liquid markets with daily observable prices. MSRs trade very infrequently with no quoted market prices. MSR values are not practically available on a daily basis. In addition, as previously discussed, the available MSR values are based on models that contain a number of estimates of dynamically changing variables rather than on arms-length transaction values.

3. Analysis of Public Company Hedging Performance

3.1 Discussion of FAS 156 and Prior Accounting Treatment

Prior to the issuance of Statement of Financial Accounting Standards 156 (FAS 156), *Accounting for Servicing of Financial Assets – an amendment of FASB Statement No. 140*, accounting for MSRs and any related hedging was governed by FAS 140 and FAS 133.⁶ Based on FAS 140, MSRs were effectively carried on the books at the lower of cost or market and then amortized over their estimated servicing lives. In addition, MSR portfolios were stratified into different risk tranches and tested for impairment, on a tranche by tranche basis, in each reporting period. Companies that chose to hedge were additionally governed by FAS 133, which immensely complicated the reporting guidelines. The various accounting choices available to companies, complexity of hedge accounting, and the tranche level analysis required made it virtually impossible to track the hedging performance of companies that hedged their MSRs. Wallace and Williams (2004) further discuss some of the accounting complexities involved prior to the issuance of FAS 156.

In March 2006 FAS 156 was issued, which required companies beginning in September 2006, with early adoption permitted beginning in January 2006, to initially measure a servicing asset at fair value and then to subsequently use either an amortization method or fair value method to measure the asset.⁷ Fair value accounting is governed by FAS 157, *Fair Value Measurements*, which discusses different approaches to fair value measurement and the related disclosure requirements. The income approach of FAS 157 is most commonly used to measure MSR value. Cochran, et al (2007), (2005) and (2004) examine the separate issues of how MSR values are determined by companies, whether firm specific, as opposed to portfolio specific, characteristics affect reported values, and how the market values these changes. This research takes the MSR values as reported in the financial statements as given.⁸ Most publicly traded institutions with MSRs chose to use the fair value method for subsequent measurement, with a majority choosing the early adoption date. In addition, of the companies that chose the fair value method virtually all chose to hedge their MSR values. Consequently, the change in accounting rules and disclosure requirements makes it possible to track the effectiveness of the hedge.

3.2 Methodology and Descriptive Statistics

Changes in the market value of MSRs and the related hedging gains or losses were gathered from the 10Q's, 10K's, and supplementary disclosures for 19 publicly traded financial companies

⁶ FAS 140, *Accounting for Transfers and Servicing of Financial Assets and Extinguishments of Liabilities – a replacement of FASB Statement No. 125*. FAS 125 superseded FAS statement 122 and amended and extended FAS Statement No. 65. FAS 133, *Accounting for Derivative Instruments and Hedging Activities*, addresses hedge accounting.

⁷ Companies choosing the amortization method must continue to test the MSR portfolio for impairment on a stratified basis.

⁸ For the companies included in this research only 25 out of 335 reported quarterly changes in MSR value were of opposite sign as the dominant change in value during a quarter. Of these, 11 were in two contiguous quarters having changes that were relatively small as a percentage of MSR value. Thus, directionally the valuation models appeared consistent.

with mortgage loan servicing portfolios. These included all publicly traded firms in the top residential servicers per *Mortgage Servicing News*' December 2011 list for which relevant data was available.⁹ One servicer accounting for over 7% of outstanding mortgages, Citibank, did not contain specific enough information in their footnotes to enable inclusion in the sample. Table 1 contains a list of the firms included in the sample and the average quarterly UPB serviced by each. These firms serviced an average of \$5.26 trillion of UPB, or nearly 52% of the estimated average U.S. outstanding mortgage debt of \$9.8 trillion during the period 2006 - 2011. Appendix 1 contains further notes about each of the companies and indicates which quarters were included in the analysis for each firm.

Table 1
Summary Statistics - Publicly Traded Companies

Company	Quarterly Average UPB (\$'000)	MSRs as a % of Assets	MSRs as a % of Equity
Bank of America	1,057,630,750	0.48	4.61
Bank of Oklahoma	7,361,744	0.36	3.75
BB&T	63,704,583	0.42	4.06
Countrywide	1,234,181,300	8.72	125.0
First Horizon	64,943,142	2.12	35.1
Flagstar	53,504,630	3.93	65.9
GMAC	387,495,458	1.83	22.6
Huntington	11,619,162	0.32	3.2
IndyMac	148,304,435	6.87	127.5
JP Morgan	854,437,500	0.58	7.3
National City	175,778,909	1.63	17.3
PHH	140,477,182	18.50	121.3
PNC	138,575,833	0.39	3.3
Regions	24,511,750	0.17	1.3
Suntrust	135,732,057	0.63	5.1
Trustmark	4,454,167	0.64	5.9
USB	128,508,708	0.59	6.3
WaMu	478,005,300	2.08	24.7
Wells Fargo	1,587,750,000	2.08	23.6
Aggregate Average	5,266,960,742¹⁰	1.0¹¹	10.5

3.3 Significance of MSR Changes in Market Value

The question of whether a publicly traded company should engage in hedging activities has been addressed previously. See for example Mayers and Smith (1982), Stulz (1996), and Nance, et al (1993). However, if some managers engage in income smoothing behavior, then significant changes in income due to changes in MSR values would necessitate hedging. The evidence and literature on income smoothing by managers is vast and beyond the scope of this paper, but for a sample see Bouwman (2012), Tan and Sidhu (2012), Shu, et al (2012), and particularly the references therein. I examine the significance of the un-hedged change in value of the MSR's relative to both the company's equity and to the absolute value of the company's pre-tax, pre-change in MSR value, income. The change in MSR value is the change due solely to valuation changes and not due to

⁹ In order to be included in the analysis both the change in MSR value due to changes in model assumptions, i.e. interest rates, and hedging gains or losses specifically related to MSRs had to be disclosed. For Bank of America, changes in MSR value were available in 2006, however specific MSR hedging gains and losses were not disclosed until March 2008.

¹⁰ Aggregate average is the average of the quarterly sum of the banks and not the total of the column in Table 1. The total of the first column in Table 1 would double count Countrywide's mortgages for example because such mortgages are also included in Bank of America's averages.

¹¹ Aggregate average MSR as a % of equity (assets) is calculated by dividing the quarterly total MSR's for all banks by the quarterly total equity (assets) for all banks and then averaging across quarters.

sales, acquisitions, or other changes to the portfolio. It should be noted that many of these institutions are very complex and that the decision to hedge MSR values is really part of a more dynamic set of hedging activities that span other assets and liabilities of the institution. In addition, for those institutions that initiate mortgage loans, there is a natural production hedge whereby a decline in interest rates typically increases the production of new mortgages, either through refinancing or increased home sales, or both. This research examines only the effect of financial hedges implemented specifically to hedge changes in MSR values.

Before indicating the results on a per bank basis, Table 2 first reports summary information for all banks.

Table 2
Aggregate Change in Value and Hedging Performance Summed Across All Banks
March 2006 – December 2011

Aggregate Change in MSR Values	(\$41,667,475,000)
Aggregate Hedging Results	\$58,610,770,000
Net	\$16,943,295,000
% of Average Aggregate Equity	2.9%

Table 3 reports the significance of the change in the value of MSRs for each company relative to equity, while Table 4 examines the significance of the change in the value of MSRs relative to pre-MSR, pre-tax income. Because the results by company are averaged across time and thus positive and negative changes in MSRs offset to some extent, the absolute value of the change relative to the book value of equity of the firm and the absolute value of the change in MSRs as a percentage of the absolute value of income excluding the effects of the change in MSR value and taxes are reported. In addition, the median, maximum, and minimum raw changes are reported.

Table 3
Significance of % Changes in MSR Value Relative to Equity

Company	Absolute Value of Change in MSR Value as a % of Equity	Median Change in MSR Value as % of Equity	Max Change in MSR Value as a % of Equity	Min Change in MSR Value as a % of Equity
Bank of America	1.0	0.0	1.4	-4.1
Bank of Oklahoma	0.4	-0.1	1.0	-1.4
BB&T	0.6	-0.2	1.2	-1.7
Countrywide	7.2	0.0	18.2	-11.1
First Horizon	2.9	-0.3	8.5	-10.8
Flagstar	8.8	-2.8	10.8	-55.7
GMAC	2.6	-0.6	7.9	-7.0
Huntington	0.3	-0.1	0.9	-0.9
IndyMac	4.2	1.5	10.9	-7.5
JP Morgan	1.0	-0.4	2.5	-4.2
National City	1.4	-0.4	2.6	-2.5
PHH	7.6	-0.1	11.2	-13.8
PNC	0.5	-0.1	1.4	-0.9
Regions	0.2	-0.1	0.3	-0.5
Suntrust	0.8	-0.2	1.6	-1.9
Trustmark	0.6	-0.2	1.4	-3.1
USB	0.6	-0.2	1.2	-2.4
Wamu	1.3	-0.3	2.0	-1.9
Wells Fargo	2.1	-0.7	8.6	-5.2
Median	1.0	-0.2	2.0	-3.1

The absolute value of changes in MSR values are approximately 1% of equity but over 28% of income before the effects of tax and the change in MSR value. Raw changes on average reduced pre-MSR, pre-tax income by nearly 15%, and over half of the companies had decreases in MSR values that exceeded 100% of pre-MSR, pre-tax income. Consequently, ignoring potential mitigating effects on income in other areas of the institution due to interest rate changes, the magnitude of the effect on income of marking MSRs to market is very significant. Given the well-known observation that some managers engage in income smoothing behavior, these significant effects on earnings from changes in MSR value would necessitate hedging activities.

Table 4
Significance of Changes in MSR Value Relative to Pre-MSR, Pre-tax Income

Company	Absolute Value of Change in MSR Value as % of Absolute Value of pre-MSR, pre-tax Income	Median Change in MSR Value as % of Pre-MSR, Pre-tax Income	Max Change in MSR Value as % of Pre-MSR, Pre-tax Income	Min Change in MSR Value as % of Pre-MSR, Pre-tax Income
Bank of America	29.8	-4.0	1235.1	-306.7
Bank of Oklahoma	7.5	-1.6	38.6	-36.6
BB&T	12.2	-5.2	439.5	-48.2
Countrywide	82.1	1.9	4635.1	-229.7
First Horizon	60.0	-32.3	1062.0	-353.4
Flagstar	67.0	-31.9	361.9	-2553.3
GMAC	49.8	-20.2	485.0	-1126.8
Huntington	6.9	-1.8	44.0	-77.8
IndyMac	48.5	-2.3	154.3	-149.1
JP Morgan	17.8	-5.3	1589.6	-123.6
National City	27.6	-4.2	151.6	-2160.0
PHH	117.2	-117.2	10.0	-220.8
PNC	11.5	-7.0	30.7	-216.7
Regions	14.1	-0.3	46.4	-38.4
Suntrust	40.2	-30.6	46.7	-282.6
Trustmark	9.7	-5.3	136.3	-48.1
USB	9.3	-4.0	29.2	-64.0
Wamu	31.9	6.8	70.5	-46.1
Wells Fargo	28.1	-16.3	140.7	-746.6
Median	28.1	-14.8	140.7	-216.7

3.4 Hedging Performance

The hedging effectiveness discussed in prior research was measured by the standard deviation of daily net profit and loss for holding periods ranging from five to twenty days. These net profits were hypothetical in the sense that MSRs are not traded daily in a liquid market and thus prices are not actually available. Prices that are available are model based and not market generated. Consequently, profit or loss is measured on only a quarterly basis. Hedging effectiveness is here measured by calculating the standard deviation of the gross and net percentage change in MSR value. The gross percentage change is the un-hedged mark to market of the MSRs as a percent of the MSR balance, and the net percentage change is the gross change, net of hedging gains or losses, as a percent of the MSR balance. Table 5 below contains the results. It should first be noted that Countrywide, IndyMac, National City, and Washington Mutual (WaMu) were all acquired by other institutions prior to September 2008, after which volatility in MSR values was over twice as high. Consequently, the standard deviations of these companies' gross percentage changes in MSR value are lower on average than the remaining institutions.

As Table 5 indicates, hedging was very effective, both individually and in the aggregate, in reducing the volatility of changes in income associated with changes in the value of MSRs. In fact, excluding the four companies that were acquired prior to the significant increase in volatility beginning with the fourth quarter of 2008, hedging had the effect of eliminating over 75% of the volatility of changes in income associated with changes in MSR values. In addition to measuring the reduction in volatility of earnings effects, I also examine the effect of hedging on the level of pre-MSR, pre-tax income. These results are contained in Table 6. As Table 6 indicates, the median un-hedged change in MSR value as a percent of pre-MSR, pre-tax income was 28.1%. The median hedged effect on pre-MSR, pre-tax income was 6.3%. The median reduction in the effect on pre-MSR, pre-tax income was 74.7%.

Table 5
Hedge Effectiveness: Reduction of Volatility

Company	Stand Deviation of Gross % Change in MSR Value	Standard Deviation of Hedged % Change in MSR Value	% Reduction
Bank of America	22.5	5.3	76.4
Bank of Oklahoma	16.6	5.3	68.1
BB&T	22.2	2.6	88.3
Countrywide	6.7	2.1	68.7
First Horizon	22.6	7.6	66.4
Flagstar	17.4	6.0	65.5
GMAC	18.0	5.1	71.7
Huntington	14.3	6.0	58.0
IndyMac	5.2	2.3	55.8
JP Morgan	22.7	4.5	80.2
National City	9.6	3.2	66.7
PHH	8.1	1.7	79.0
PNC	20.9	4.4	78.9
Regions	18.2	5.2	71.4
Suntrust	18.5	4.9	73.5
Trustmark	20.1	3.9	80.6
USB	15.2	2.4	84.2
Wamu	6.3	1.8	71.4
Wells Fargo	13.0	3.8	70.8
Average	15.6	4.1	73.7
Increasing Rate Environment (8 Qtrs)	6.3	2.5	60.3
Decreasing Rate Environment (16 Qtrs)	13.4	4.5	66.4

Hedging results are also reported for separately for quarters in which interest rates were increasing (8 quarters) and quarters where interest rates were decreasing (16 quarters). Volatility was significantly higher in the decreasing rate environment, where the reduction in volatility through hedging was slightly higher. Relative to situations where commodities or financial assets are being hedged by commodity or financial derivatives and over 90% of the volatility is eliminated, the reduction in volatility here is significantly less. As discussed in section 2.3 above, hedging changes in MSR values is complicated by the fact that MSR values are very significantly impacted by prepayment speeds, and such speeds can be difficult to model. In addition, MSR values are model rather than market determined for the most part, whereas the value of hedging instruments is known continuously and precisely in liquid markets.

Table 6
Hedge Effectiveness: Reduction in Earnings Impact

Company	Change in MSR Value as % of Pre-MSR, pre-tax income	Change in hedged MSR Value as % of Pre-MSR, pre-tax income	% Reduction
Bank of America	29.8	9.3	68.8
Bank of Oklahoma	7.5	2.6	65.2
BB&T	12.2	1.5	87.6
Countrywide	82.1	24.7	70.0
First Horizon	60.0	16.1	73.2
Flagstar	67.0	11.9	82.3
GMAC	49.8	13.8	72.2
Huntington	6.9	2.1	69.7
IndyMac	48.5	6.3	87.0
JP Morgan	17.8	3.7	79.1
National City	27.6	8.2	70.1
PHH	117.2	23.5	79.9
PNC	11.5	4.8	58.4
Regions	14.1	3.0	78.5
Suntrust	40.2	5.4	86.6
Trustmark	9.7	2.7	71.7
USB	9.3	1.9	79.2
WaMu	31.9	6.9	78.3
Wells Fargo	28.1	7.1	74.7
Median	28.1	6.3	74.7
Increasing Rate Environment (8 Qtrs)	40.8	5.4	86.7
Decreasing Rate Environment (16 Qtrs)	22.4	6.1	72.7

4. Conclusion

Mortgage servicing rights are a complex intangible asset on many bank's balance sheets. The value of MSRs is very sensitive to changes in interest rates, particularly to a decline in rates as homeowners refinance and the servicing on the old mortgage is eliminated. The income effects of the changes in MSR value are significant, and consequently managers who are concerned with smoothing earnings have an incentive to hedge against such changes in value. In the sample of publicly traded firms examined in this research, all chose to hedge against such changes. The publicly traded companies in the sample, which hold servicing rights on over half of the outstanding residential mortgages in the U.S., individually and as a group were very successful in reducing risk. Such banks reduced the *volatility* of earnings due to changes in MSR values by nearly 74% on average. The median reduction in the effect on the *level* pre-MSR, pre-tax income was 74.7%. In the aggregate, hedging led to a net income effect of nearly \$17 billion over the period, as hedging gains of nearly \$59 billion more than offset MSR losses of nearly \$42 billion.

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