Fixed Income Digest Educational Series

Primer on Mortgage Backed Securities

Primer

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United States

Owning a piece of the mortgage market

A mortgage backed security (MBS) is a form of ownership in mortgage loans. The holder of the MBS is essentially on the other side of the mortgage payment made by a household: the MBS investor receives a monthly payment that consists of a combination of principal and interest on the outstanding mortgage loans. Historical evidence suggests that MBS can be a good source of high-quality income for investors who can be flexible about the timing of their cash flows.

Mortgage passthroughs

This primer covers residential mortgage backed passthroughs issued by Fannie Mae, Freddie Mac, and Ginnie Mae. The returns on these securities have held up well over time, even when the housing market was tumbling. This primer does not cover private label or commercial MBS, which suffered the largest losses in 2007 and 2008.

Prepayments affect returns

The return of principal on MBS and the cash flows that investors ultimately receive are sensitive to the speed of mortgage prepayments, which in turn depend upon several factors including the course of mortgage rates. In return for this uncertainty investors usually receive a higher yield than what is available on similar securities with similar credit quality but more predictable payment streams.

Strong credit quality

The MBS of Ginnie Mae are backed by the full faith and credit of the US government. The securities from Fannie Mae and Freddie Mac do not have the full backing of the US, but they presently have strong government support. Future legislation or actions by the US Treasury could change the government support for Fannie and Freddie.

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The basics of mortgage backed securities

A mortgage backed security (MBS) is a form of ownership in mortgage loans that are originated by banks and other financial institutions. The holder of the MBS is essentially on the other side of the mortgage payment made by a household: the MBS investor receives a monthly payment that consists of a combination of principal and interest on the outstanding mortgage loans.

This primer covers mortgage passthroughs issued by Fannie Mae, Freddie Mac, and Ginnie Mae.

In this primer we will consider the most common mortgage structure--the conventional "passthroughs" issued by government sponsored enterprises (GSEs) Fannie Mae, Freddie Mac and Ginnie Mae. We do not cover private label or commercial MBS securities, or the structured MBS securities that suffered big losses during the financial crisis in 2007-8.

This document is intended as an educational piece and does not recommend investment in MBS securities. Investors should consult with their Merrill Lynch Financial Advisor before investing in MBS.

Chart 1: 12 month returns on BofA ML MBS index

Source: BofA Merrill Lynch Global Research. Index M0A0

The mortgage passthrough

In the conventional passthrough, the bank or loan originator sells monthly principal and interest payments from a pool of mortgages to a GSE. These entities then distribute (pass through) the payments to the various holders of the MBS while guaranteeing the timely payment of principal and interest.

Traditional mortgage backed passthroughs have generally delivered good returns, and even held up during the financial crisis 2007-8, when the more exotic structured mortgage backed securities collapsed. Chart 1 shows the 12 month returns on MBS, based upon the BofA Merrill Lynch U.S. Mortgage Backed Securities Master Index (BofAML M0A0)[1], going back to the inception of the index in 1975. MBS suffered big losses during the severe bear market in bonds in 1979-81. The worst 12 month return

[1] The BofA Merrill Lynch U.S. Mortgage Backed Securities Index (M0A0) tracks the performance of U.S. dollar-denominated residential mortgage pass through securities publicly issued by U.S. agencies. The index presently consists of 479 issues with a face value of $5.4 trillion.

for the asset class during that period was a 12.6% loss. Since 1990 the 12 month returns have ranged between -2.4% and +17.0%.

To be sure, the historical performance has been helped by the decline in market yields that has helped most of the bond market since the early 1980s. But as we will show later, MBS returns have also fared well in relation to other types of bonds.

The size of the MBS market has pretty much mirrored that of the housing market overall. The market grew in value from about $1 trillion in 1990 to $4 trillion in 2008, according to the BofAML Mortgage Master Index. The market has moved irregularly since then, and presently stands at $5.4 trillion. That's about 24% of the domestic taxable bond market. MBS rank third in size to Treasury securities in the bond market, just behind investment grade corporate bonds.

The issuers: Fannie, Freddie and Ginnie

The issuers of MBS are the Government Sponsored Enterprises (GSEs) Fannie Mae, Freddie Mac and Ginnie Mae.

Fannie Mae and Freddie Mac (F/F) issue debt directly to the public, called agency or GSE debt, and use the funds raised to either purchase qualified mortgages or else guarantee pools of mortgages that other financial institutions originate. The agencies then "securitize" the loans by issuing securities. These MBS represent fractional undivided interest in the pool of securities.

Credit quality: Fannie and Freddie

> The government presently provides a line of credit to Fannie and Freddie in order to enable them to continue payments on their bonds and MBS.

Both Fannie Mae and Freddie Mac (F/F) are chartered by Congress. The companies ran into serious financial trouble in the wake of the collapse of the housing market beginning in 2007. In response, the Treasury placed F/F into conservatorship in September 2008, and the companies suspended dividend payments on their common and preferred shares.

The conservatorship arrangement also provided for a government line of credit to the companies in order to enable them to continue payments on their bonds and MBS. Under that arrangement, the US government lent a total of $187 billion to F/F. Since August 2011 the companies have been required to remit virtually all of their profits to the government. The profits of the companies have since revived, and they have now paid back more to the government than they borrowed. The government currently owns about an 80% stake in each company

It is possible that future legislation or actions by the US Treasury could change the favorable status that has been afforded to F/F, but no such measures appear imminent. In the past, members of Congress have considered privatizing the companies, which might remove the government support for the bonds.

Credit quality: Ginnie Mae

> Ginnie Mae's securities are backed by the full faith and credit of the U.S.

Ginnie Mae MBS are backed by the full faith and credit of the U.S. Treasury. Ginnie Mae is owned by the government within the Department of Housing and Urban Development. It does not issue debt or purchase MBS. Instead, it guarantees the timely payment of principal and interest on MBS that are backed by federally insured or guaranteed loans — mainly loans insured by the Federal Housing Administration or guaranteed by the Department of Veterans Affairs.

Chart 2: Yield spread: MBS vs. Treasuries

Soruce: BofA Merrill Lynch Global Indexes, M0A0

Market and Fed have favorable view of credit quality

The rating agencies currently assign the same rating to Fannie/Freddie and Ginnie Mae mortgage debt as for the U.S. Treasury, on the view that the federal government will continue to provide support for the companies

The market has a generally favorable view of the credit quality of MBS. Chart 2 plots the option-adjusted spreads (the extra yield over Treasury securities adjusted for prepayment options) for the BofAML M0A0 Index versus Treasury securities. The spread for MBS debt over Treasury debt is usually close to that afforded to top quality corporations. The spread widened sharply during 2008 amid worries about the health of F/F, but then narrowed when the Federal Reserve began purchasing MBS as part of its quantitative easing program.

Indicative of the perception of high quality, MBS securities are widely held by central banks. Presently, the Federal Reserve owns about $1.8 trillion of MBS and $12 billion in debt obligations from the GSEs. As of December 31, 2016, foreign central banks held $988 billion in GSE debt and MBS.

The design of MBS

The payments on MBS differ from traditional bonds. Traditional bonds pay interest semiannually and return the full principal amount at maturity or when the issuer calls the bonds. In contrast, the payments on MBS are usually made monthly and consist of both interest and a portion of the principal. The principal portion includes both scheduled principal payments on the mortgage loans and unscheduled principal *prepayments* that result when homeowners pay off their mortgages, in full or in part, ahead of time.

The uncertainty about the timing of the return of principal payments is what sets MBS apart from other securities. Investors who purchase MBS must be willing to accept uncertainty about the timing of the payouts. We turn to that next.

Timing of principal prepayments

Because homeowners have full discretion to prepay their mortgages at any time, the cash flow on MBS is irregular. When mortgage rates decline, prepayments on MBS usually rise as homeowners become more inclined to re-finance their mortgages. Prepayments might also rise because homeowners sell their homes to relocate, or simply make extra principal payments in order to pay off their mortgages sooner. Defaults or foreclosures also lead to a rise in prepayments.

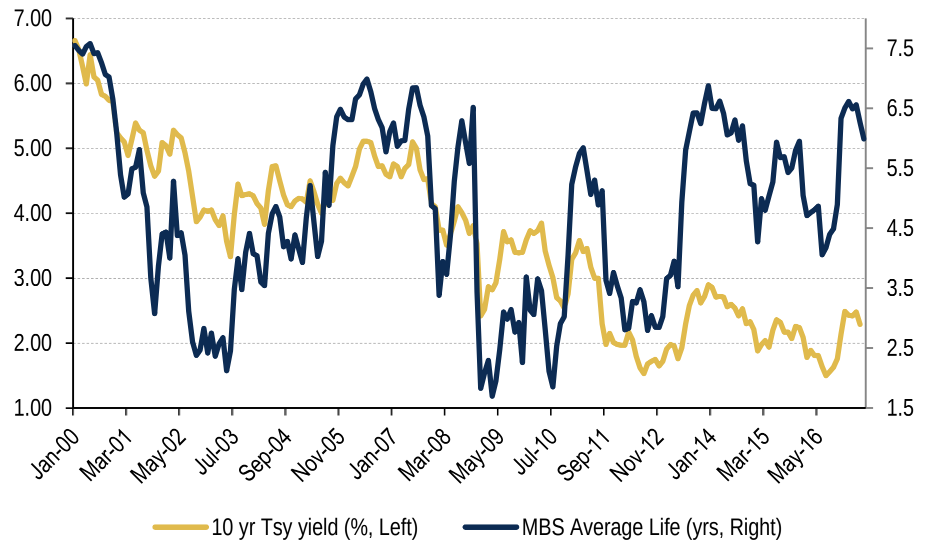
This *prepayment risk* can be a disadvantage when rates are declining because investors would receive their principal back at a time when yield opportunities elsewhere are less attractive.

On the other side of the coin, when rates rise, MBS investors face *extension risk.* The return of principal would likely come more slowly (prepayments would decline) because higher rates would make homeowners less inclined to refinance. As a result, the price of the MBS might decline by more than it would for a bond that did not have any prepayment or call features. The price decline is usually greater the more positively sloped the yield curve is, because a longer maturity means a higher yield/lower price.

We will discuss the types of MBS that are more prone to prepayment risk and those more prone to extension risk on pages 7-8.

Chart 3: MBS average life vs. 10-year Treasury yield

MBS life moves with market yields



Source: BofA Merrill Lynch Global Research

Weighted Average Life

Mortgage securities are usually evaluated in terms of their "weighted average life" (WAL) rather than their maturity. The WAL is an estimate of the average amount of time until the principal is repaid in full. Since it is an average, some of the principal will be returned sooner than the WAL, and some will be returned later.

Because of prepayments, the WAL will be shorter than the average maturity of the mortgages in the pool. For example, the WAL of a 30-year mortgage pool averages about five years and has ranged from as low as two years to as long as ten years. Chart 3 above shows how the WAL of the BofAML M0A0 Index has varied and generally moved in the same direction as the 10-year Treasury yield since 2000.

Part of estimating the WAL involves estimating the speed of prepayment of the principal. One industry standard is the Prepayment Standard Assumption (PSA). That model assumes that the rate of prepayment ramps up steadily from 0 to 6% over the first 30 months, and then continues at an annual rate of 6% per month afterward. Mortgage prepayment estimates often assume some multiple of the PSA calculation.

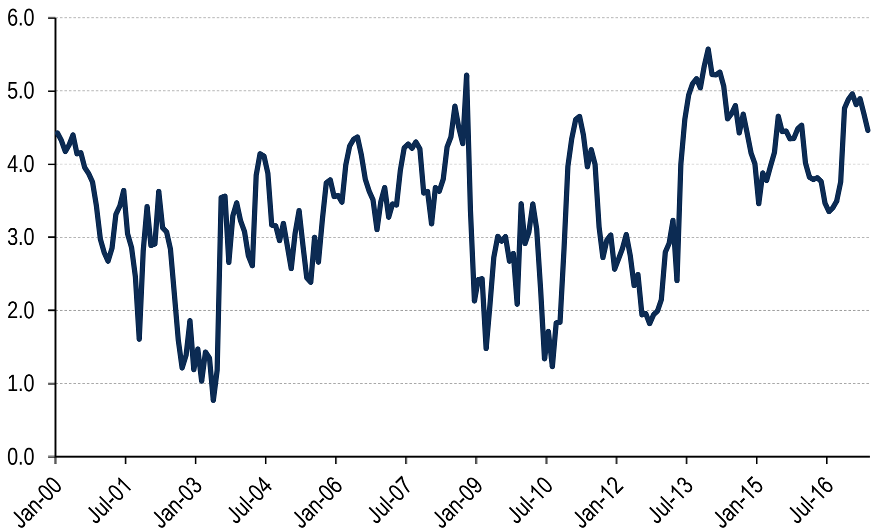
Other things equal, the higher the coupon rate in the mortgage pool in relation to the market rate (the greater the premium), the faster the prepayment assumption because the more likely it is that homeowners will re-finance their mortgages.

Because the WAL of mortgage pools vary over time due to changes in market rates and other factors the sensitivity of the MBS price to changes in market rates also varies. Chart 4 shows how the duration—a measure of the change in the price for a given change in yields--of the BofA Merrill Lynch MBS Master Index has fluctuated since 2000.

The duration of MBS tends to rise when market rates rise and decline when rates decline, a property called negative convexity.[2] For that reason a rise in yields could cause MBS prices to decline by more than the same decline in yields would cause the price to rise. We discuss the sensitivity of MBS returns to changes in yields on the next two pages.

Chart 4: MBS duration (years)

Sensitivity to rate changes varies over time



Source: BofA Merrill Lynch Global Research. Index M0A0

Buying MBS

Investors can purchase MBS pools directly or through funds. Investors who purchase individual MBS generally have more discretion to choose the characteristics of the securities, including WAL and the average coupon. We discuss the characteristics of discount (below market coupon) and premium (above market coupon) on page 7-8.

Investors can also buy MBS through closed-end funds (CEFs), and Exchange Traded Funds (ETFs). Funds offer diversification, and in the case of mutual funds and CEFs, professional management. Not all MBS funds confine themselves to traditional passthroughs—some include non-agency residential mortgages, commercial MBS and other structures. Some funds automatically re-invest principal payments, which is generally not feasible for investors holding MBS directly.

Taxation

The interest income on all MBS securities is subject to federal taxation for individuals. The interest income from Ginnie Mae securities, like the income from Treasury securities, is not subject to state taxation. The income from Fannie Mae and Freddie Mac securities is subject to state taxation.

[2] See our primer on duration and convexity.

How returns vary with changes in rates

The yield measures quoted on funds generally measure the historical payouts.

The yield quoted on funds differs from the yields that investors see for individual MBS pools.

For funds, the quoted yield is backward looking, based upon previous payments. The three most common measures of the yield on MBS funds are:

- The *12-month trailing yield:* the interest payouts to investors over the previous 12 months divided by the sum of the present net asset value (NAV) and any capital gains distributions or principal payments. For example, if a fund paid out $1.00 in interest income during the past 12 months, had no other payouts, and its NAV would be $20.00, its 12-month trailing yield would be 5.00%.

- The *distribution yield:* the most recent monthly distribution, including any capital gains or principal payments, annualized (multiplied by 12) divided by the present NAV. For example, if the most recent monthly payout were $0.10 and the NAV were $25.00, the distribution yield would be 4.8%, ($0.10 * 12/ $25).

- The *SEC (Securities and Exchange Commission) yield*: the interest payout over the past 30 days adjusted for the fund's expenses, divided by the maximum price on the last day of the period.

The yield that investors who purchase MBS funds will actually realize depends in large part upon the course of market yields over the holding period. We discuss that next.

Performance of discounts and premiums as yields change

As with other bonds, prices for MBS usually vary with changes in market yields. But because of how prepayments can vary as yields change, the response of MBS prices could differ substantially from other bonds.

An important consideration in estimating the how returns on MBS pools will change with market yields is whether the security is priced at a discount or a premium.

Many MBS pools are issued at a premium, or above the par value of 100. If mortgage rates subsequently decline, the price of the MBS would rise further above par, meaning that the market rates have fallen further below the average coupon of the mortgage pool. In contrast, if mortgage rates rise, the price of the MBS would fall and the securities will trade at a discount to par.

Investors who purchase MBS pools directly will generally be presented with a range of yield estimates that will vary according to the possible course of market rates and the speed of prepayments. Investors who purchase individual MBS should examine such yield simulations to be aware of how returns might vary. Investors who purchase through funds also ought to be aware of how yield changes over time can affect their return. We show examples of yield simulations in Table 1 on the next page.

In general, discount issues do better in declining rate environments, while premiums do better in rising rate environments.

The relative performance of discount and premium issues usually differs in rising and declining rate environments. In general, discount issues fare better than premium issues when yields decline, while premium issues outperform when yields rise.

Premium issues

The top half of Table 1 estimates of the yield on a premium (price 105) MBS for various changes in the Treasury yield curve over the holding period. The estimated weighted average life (WAL) at present market yields (the unchanged column) is 6.8 years and the annualized yield is 3.03%.

The premium issue suffers when yields decline because prepayments, made at par, come faster. Moving rightward along the top half of Table 1, a 200 basis point decline in yield on the Treasury trims the yield to 2.10% from 3.03% at present market yields This is an example of the *prepayment ris*k that holders of MBS face when yields fall.

In contrast if yields rise, (moving leftward from the unchanged column) prepayments slow, and the average life extends. The investor receives an above market coupon for longer, boosting the yield. For a 200 basis point rise in yields the average life is 10.3 years and the yield is 3.31%.

Table 1: MBS returns and changes in market yields: premium vs discount MBS

		Change in market yields (bps)						
Premium issue		+300	+200	+100	Unchanged	-100	-200	-300
Fannie Mae 4.0%, 30 year	PSA speed*	96	110	133	103	223	604	679
Price = 105.59	Annualized yield (%)	3.35	3.31	3.26	3.03	2.58	2.10	1.93
	WAL (yrs)	11.0	10.3	9.4	6.8	4.4	3.2	2.9
Discount issue								
Fannie Mae, 2.5%, 30 year	PSA speed*	73	75	79	90	120	298	681
Price =95	Annualized yield(%)	2.60	2.61	2.62	2.64	2.73	3.29	4.87
	WAL (yrs)	10.0	9.9	9.7	9.2	8.1	4.4	1.9

Source: Bloomberg * Bloomberg median prepayment forecasts. WAL = weighted average life.

Premium issues: slower prepayments = better returns

Discount issues

The second issue in Table 1 is priced at a discount (95). It has a 2.5% coupon, which is below the market yield. When yields decline, prepayments speed up and the investor benefits from getting principal value back at par. For a 200 basis point decline in market yields, the yield on the security improves to 3.29%.

When market yields rise and prepayments slow, the yield on this security declines from 2.64% to 2.61% because the investor receives a below market coupon for a longer period. This is an example of the *extension ris*k that holders of MBS face.

Discounts when you expect lower yields; premiums when you expect higher yields

To summarize, investors who purchase individual MBS as opposed to MBS funds can often choose between bonds at a premium or discount.

- Investors who expect market rates to decline should favor discount-priced issues, because the potential return of principal payments at par will improve the realized yield (you buy at a discount, but get the principal returned at par.)

- Investors who expect rates to rise should favor premium issues. Slowing prepayments with rising yields mean that the investor gets to hold the higher coupon MBS for a longer period of time.

Historical Returns on MBS

MBS performance is sensitive to interest rate swings and economic cycles. Historically, MBS have done well compared to other securities over long stretches of time especially when adjusted for volatility.

Even during relatively extreme periods of changes in yields, the damage to MBS is not always severe. For example, when the yield on the 10-year Treasury climbed from 1.36% to 2.60% from July 8 through December 16, 2016, the duration on the BofAML M0A0 index extended from 3.4 to 5.2 years. The price return of the index fell 3.5% and the total return (price change + income) was -2.6%.

We showed the 12 month returns on MBS, based on the BofAML M0A0 Index going back to 1975 in Chart 1 on page 2. Table 2 below indicates how MBS passthroughs have performed relative to alternative assets during ten year. The data apply to the applicable BofAML indexes. Indexes are not investible and the performance of an index may not reflect the return that an investor would have actually realized on purchases of individual securities or funds. Investments are subject to fees and expenses not reflected in index returns.

The first data column in Table 2 shows the total annual return. The next column shows the annualized standard deviation of the returns, calculated from monthly data. The standard deviation is a measure of the volatility in the return. The third data column is the Sharpe ratio, a return measure that adjusts for the risk (standard deviation) in the return. The Sharpe ratio is computed as the excess return on the asset class (the return minus the return on a three-month Treasury bill) divided by the standard deviation of the return-- the excess return per unit of risk.

For the past 10 years though MBS had a better Sharpe ratio than any major fixed-income sector (Table 2). That performance varies over time though. For example, during the past 12 months, MBS had a negative Sharpe ratio, meaning they underperformed Treasury bills.

Investors should balance the generally positive historical return performance of MBS against the uncertainty regarding the timing of the return of principal payments and the risk associated with other investments. The historical evidence suggests that investors who can be flexible regarding the timing of their returns may find MBS to be a good source of high-quality income.

Table 2: Returns and volatility, 10 years ended May 31, 2017

	Annual Return	Annualized standard deviation	Sharpe Ratio	Avg Credit Rating
US Govt / related				
Nominal Treasuries	4.1%	4.4%	0.80	AAA
2-Year Tsys	2.1%	1.4%	1.01	AAA
10-Year Tsys	5.1%	7.6%	0.60	AAA
30-Year Tsys	7.1%	15.5%	0.42	AAA
TIPS	4.4%	6.4%	0.60	AAA
MBS	4.3%	2.6%	1.43	AAA
Other sovereigns				
DM Non-US Svgns	3.2%	8.4%	0.32	AA3
Munis, 35% taxable equiv	7.2%	5.0%	0.80	AA3
EM (USD) Svgns	7.3%	9.0%	0.74	BB1
EM(Local Svgn)	3.1%	10.9%	0.23	BB2
Corporates				
IG Corps	5.6%	5.9%	0.86	A3
HY Corps	7.3%	10.7%	0.63	B1
Preferreds	3.8%	16.1%	0.18	BB1
EM Corps	6.1%	9.7%	0.57	BBB2

Source: BofA Merrill Lynch Global Bond Indices. Returns are based on indexes and do not reflect the returns an investor would receive if invested in products that incur fees and expenses. Index performance is hypothetical in nature. Past performance is not a guarantee of future results. See Appendix for more information on the indices and how to access them.

The investments discussed have varying degrees of risk. Some of the risks involved with bonds include the possibility that the value of the bonds may fluctuate in response to events specific to the companies or markets, as well as economic, political or social events in the U.S. or abroad. Bonds are subject to interest rate, inflation and credit risks.

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This information was provided to support the analysis of financial instruments or transactions discussed in the report and clients are urged to seek tax advice based on their particular circumstances from an independent and professional tax advisor.

Appendix: Description of Indexes

Table 3: Indexes used in Tables 2 and 3

C0A0	BofA Merrill Lynch U.S. Corporate Index
EMCB	BofA Merrill Lynch Emerging Markets Corporate Plus Index
G0QI	BofA Merrill Lynch U.S. Inflation-Linked Treasury Index
GA02	BofA Merrill Lynch Current 2-Year U.S. Treasury Index
GA10	BofA Merrill Lynch Current 10-Year U.S. Treasury Index
GA30	BofA Merrill Lynch Current 30-Year U.S. Treasury Index
H0A0	BofA Merrill Lynch U.S. High Yield Index
IGOV	BofA Merrill Lynch U.S. Emerging Markets Sovereign Plus Index
M0A0	BofA Merrill Lynch U.S. Mortgage Backed Securities Index
N0G1	BofA Merrill Lynch Global Government Excluding U.S. Index
P0P1	BofA Merrill Lynch Fixed Rate U.S. Preferred Securities Index (investment grade)
U0A0	BofA Merrill Lynch U.S. Municipal Securities Index

Investors can access these indexes at www.mlindex.ml.com

Source: BofA Merrill Lynch Global Bond Indices

Disclosures

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