Macquarie Investment Management

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Agency mortgage-backed securities

An alternative opportunity set for absolute return outcomes

Contents

About the team

Ion Dan
Senior Portfolio Manager, Agency MBS

Ion Dan is a member of Macquarie Investment Management's fixed income portfolio management team, with primary responsibility for portfolio construction and strategic asset allocation. He is the lead co-portfolio manager for the Absolute Return Mortgage-Backed Securities strategy, and senior analyst and trader for agency mortgage-backed securities.

Brian C. McDonnell, CFA
Senior Portfolio Manager, Structured Credit

Brian C. McDonnell is a member of Macquarie Investment Management's fixed income portfolio management team, with primary responsibility for portfolio construction and strategic asset allocation. He is a co-portfolio manager for the Absolute Return Mortgage-Backed Securities strategy, and he serves as lead analyst for residential mortgage-backed securities.

Executive summary

Introduction

With a background of low bond yields and muddling global growth, investors are looking for alternative ways to construct fixed income allocations. Absolute return strategies that target a positive return irrespective of market direction are gaining popularity, as lower return expectations and the potential for capital losses have led to increasing demand for income oriented investments that focus on capital preservation.

The US agency mortgage-backed securities (MBS) market may provide an attractive solution for investors seeking a liquid and high-quality asset class that provides diversification to risk assets with added benefits for absolute return such as a consistent yield advantage and downside protection features.

This paper is the first in a two-part series by Macquarie Investment Management. Part I describes the agency MBS opportunity set, highlighting the standalone and absolute return features of the asset class while providing a case study of historical performance in a rising rate environment. Part II presents Macquarie's Absolute Return Mortgage-Backed Securities strategy, which uses this unique asset class in its aim to provide investors with consistent strong risk-adjusted returns and downside protection.

Overview

Agency MBS are pools of securitized residential mortgage loans that are issued and guaranteed by US government agencies. These securities allow investors to take advantage of attributes that include:

- **Government guarantee** – The issuing agencies offer explicit (Ginnie Mae) and implicit (Fannie Mae and Freddie Mac) government guarantees as to the principal and interest cash flows of agency MBS.
- **Scalable market with high liquidity** – With a market size of more than $US7.5 trillion and a daily trading volume averaging $US235 billion, agency MBS are the world's largest and most liquid fixed income asset class after US Treasurys (UST).[1]
- **Yield advantage over US Treasurys** – Agency MBS can offer enhanced yield over US Treasurys with little to no credit risk. This yield advantage can compensate for prepayment risk, as US mortgage borrowers are permitted to repay their mortgages in full or in part at any time prior to maturity.
- **Diversification** – Historical agency MBS returns have a high correlation to sovereign bonds (US Treasurys in particular) and a lower correlation to stocks, which can provide diversification in portfolios exposed to equity market risk.

The inherent liquidity of agency MBS can provide a competitive advantage for risk management in the current environment, but the additional features noted below can be advantageous, particularly for absolute return strategies.

- **Downside protection with high risk-adjusted returns** When compared to other fixed income investments, agency MBS have had a very low number of negative quarters, while the drawdown (loss) magnitude has been less severe.[2] In addition, when adjusted for volatility, the historical return/risk profile of agency MBS is distinctive, reflecting the relative consistency of its yield advantage.
- **Optimal security selection** – The agency MBS market's depth and breadth includes more than one million securities across various types (forward securities, specified pools of agency MBS and structured securities) and pricing buckets (discounts and premiums). Active managers have the flexibility to select what they view as the optimal mix to capitalize on prevailing market conditions. For example, in a rising interest rate environment, interest-only securities and higher coupons can benefit from slower prepayments, while floating-rate agency MBS coupons reset to higher yields.

In addition, absolute return strategies typically employ unconstrained investment guidelines in an effort to deliver positive outcomes. For example, flexible duration bands allow the ability to reduce total interest rate exposure and protect capital in the case of rising interest rates.

1 Securities Industry and Financial Markets Association, as of June 2017.

2 Based on analysis of quarterly performance data from January 1994 through April 2017. Data sources: Bloomberg, Barclays.

Agency MBS overview

This section sets out the various security types in the agency MBS universe.

Agency MBS

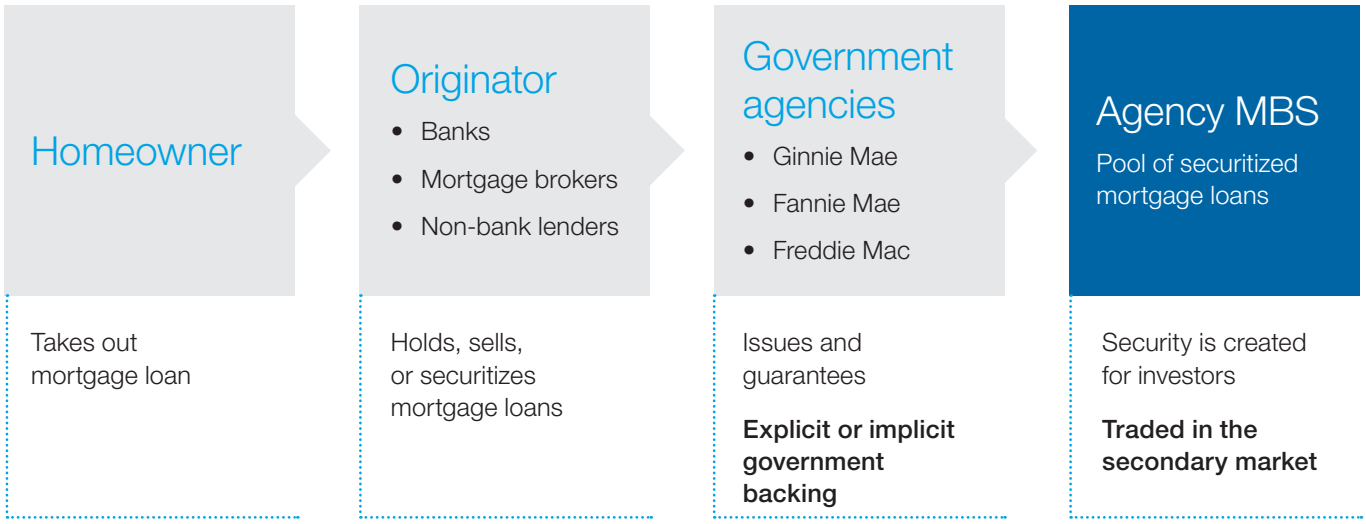
Structure

Agency MBS are constructed from pools of securitized mortgage loans that are issued and guaranteed by US government agencies.

- A borrower takes out a home loan from a mortgage originator, such as a bank or mortgage broker.
- The mortgage originator sells the loan, including the principal and interest repayments, to a government agency, while generally retaining the servicing rights.
- The government agencies segregate loans into pools based on loan attributes (such as term and coupon) and issue agency MBS, using the underlying loans as collateral.
- Agency MBS are a pass-through structure in which the agencies guarantee the credit quality of cash flows and the investor receives a pro-rata share of monthly principal and interest payments from the pool of loans.

Exhibit 1 illustrates this process, beginning with the homeowner's decision to obtain a mortgage and ending with the creation of the security.

Exhibit 1: Securitization process, from mortgage borrower to the creation of the agency MBS



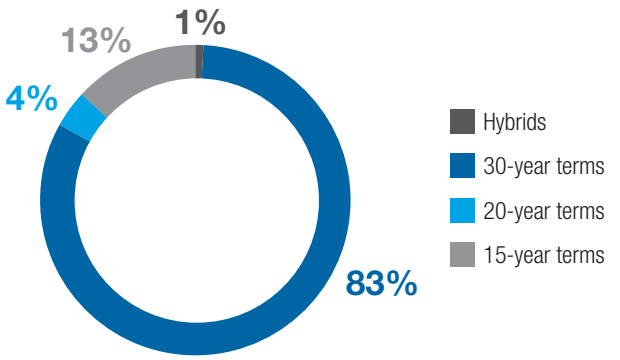
Loan terms

Agency MBS are typically composed of fixed-rate loans with terms of 30, 20, or 15 years, while floating-rate mortgage loans are less prevalent in the US, with hybrids (fixed for 3, 5, 7, or 10 years and floating thereafter) representing a small share of outstanding securities.

This means that agency MBS are typically fixed-rate securities, but there is a small universe of floating-rate / hybrid agency MBS. The composite of the agency MBS market by loan term is shown in Exhibit 2.

Exhibit 2: Agency MBS by loan terms

30-year fixed rate represent the largest sector in agency MBS

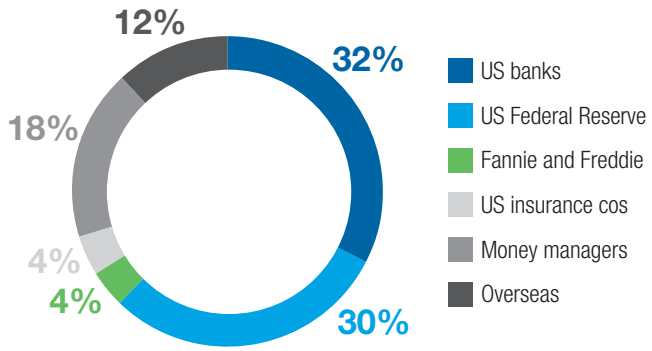


Source: Bloomberg Barclays US Agency MBS index as of April 2017.

Investor base

The ownership of agency MBS extends beyond money managers. As shown in Exhibit 3, US banks, the US Federal Reserve, and overseas investors are significant investors.

Exhibit 3: Holders of agency MBS



Source: Bank of America Merrill Lynch. Data as of December 31, 2016.

To be announced (TBAs)

The vast majority of agency MBS trading occurs through the TBA market. A TBA is effectively a forward security in which the parties contract to buy or sell an agency MBS on a specific date in the future. The seller of the agency MBS agrees on a sale price, but does not specify which particular pool of mortgages will be delivered to the buyer on settlement day. Instead, only a few basic characteristics of the pool are agreed upon, such as the issuer, maturity, coupon rate, and the face value. The specific pool of mortgages is then announced to the buyer 48 hours prior to the trade settlement date.

The TBA market is based on the fundamental assumption that at a high level, one agency MBS pool can be considered interchangeable with another pool, given that both pools are assumed to contain so-called standard loans. Standard loans, while not always precisely the same, nevertheless share many general characteristics and thus are expected to perform in a consistent manner.

This TBA trading convention enables an extremely heterogeneous market consisting of thousands of different agency MBS pools (backed by millions of individual mortgages) to be reduced – for trading purposes – to only a few liquid standardized TBA contracts.

TBAs can be used in agency MBS strategies as an additional source of alpha, as detailed later in this paper.

Agency collateralized mortgage obligations (CMOs)

Agency CMOs are constructed from agency MBS pools by redistributing the principal and interest cash flows into various tranches. These tranches can have customized average life and convexity, offering a wider range of yield and duration profiles. Similar to agency MBS, the cash flows of agency CMOs are guaranteed by the agencies.

The development of this market stems from the asset-liability constraints of banks and insurance companies. Banks typically seek shorter average life securities with less extension risk (that is, the possibility for increased duration), while insurance companies have longer duration liabilities and are looking to maximize book yield. Currently, the agency CMO market size is more than $US1 trillion, with annual issuance averaging approximately $US200 billion.* These securities are also an additional investment in agency MBS strategies, and their characteristics are detailed later in this paper.

*Data: Securities Industry and Financial Markets Association, as of June 2017

Agency MBS characteristics

This section outlines some of the key characteristics of agency MBS.

Government guarantee

Fannie Mae and Freddie Mac are government-sponsored enterprises (that is, they carry an implicit guarantee) with lines of credit to the US Treasury, chartered by Congress and regulated by the Federal Housing Finance Agency (FHFA). The FHFA ensures that the agencies operate in a safe and sound manner to provide liquidity and funding for housing finance. The FHFA requires strict underwriting standards, including a maximum acceptable loan size and restrictions on borrowers' down-payments and credit histories. Loans meeting these criteria are called conforming conventionals and have a higher credit quality relative to Ginnie Mae or non-agency securitizations, which are collateralized by less prime borrowers.

Ginnie Mae is a US government agency (that is, there is an explicit guarantee) that supports loans originated by the Federal Housing Administration (FHA), the Department of Veterans Affairs (VA) and the Department of Agriculture Rural Housing Service (RHS), which supports disadvantaged borrowers.

Exhibit 4 sets out the key features of the securities issued by these government agencies.

Exhibit 4: Features of conventional (Fannie Mae and Freddie Mac) and Ginnie Mae securitizations

	CONVENTIONALS	FHA	VA	RHS
Government backing	Implicit	Explicit	Explicit	Explicit
Issuer	Fannie Mae and Freddie Mac	Ginnie Mae	Ginnie Mae	Ginnie Mae
Guarantor	Fannie Mae and Freddie Mac	Federal Housing Administration	Department of Veterans Affairs	Department of Agriculture Rural Housing Service
Market share	73%	17%	8%	2%
Average coupon	3.91%	3.80%	3.54%	3.75%
FICO (credit quality)	748	678	710	693
Loan to value	76%	93%	95%	100%
Purchase loan %	53%	65%	47%	93%

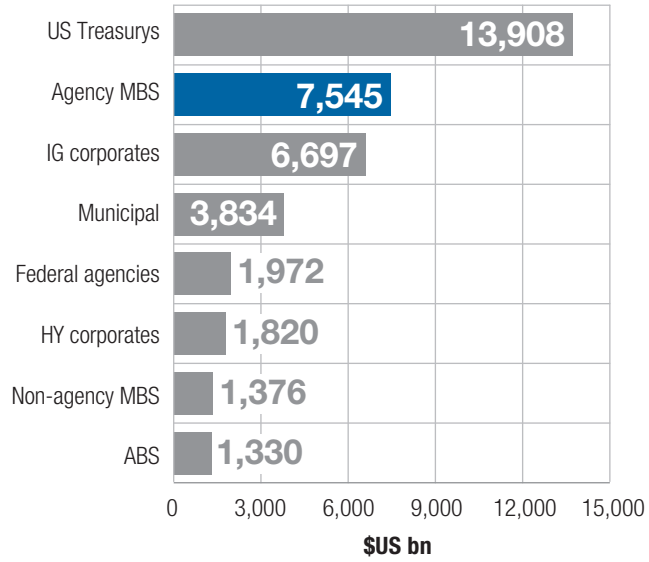
Source: Bank of America Merrill Lynch, CPR/CDR as of December 31, 2016.

Scalable market with high liquidity

With a market size of $US7.5 trillion, agency MBS represent the second-largest fixed income asset class after US Treasurys, as illustrated in Exhibit 5.

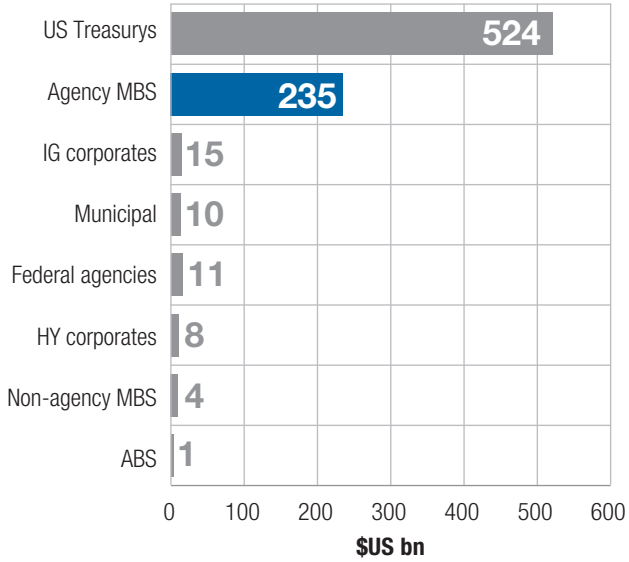
Liquidity is also a key characteristic of agency MBS, as illustrated in the daily trading volumes shown in Exhibit 6. Strategies focused on agency MBS can offer transactional and risk management efficiencies, important features in the current environment of constrained market liquidity.

Exhibit 5: Market size of key US fixed income asset classes



Source: Securities Industry and Financial Markets Association (SIFMA). Data as of December 31, 2016.

Exhibit 6: Average daily trading volumes in US fixed income markets since the global financial crisis



Source: SIFMA. Data as of December 31, 2016, calculated as average since 2010.

Yield advantage

Agency MBS can offer enhanced yield over similar duration high-quality sectors, including US Treasurys with zero credit risk, as shown in the average yield data in Exhibit 7.

Exhibit 7: Agency MBS can be attractive relative to other high-quality fixed income sectors

	AVERAGE YIELD (%)	AVERAGE DURATION (YRS.)	YIELD PER DURATION	CURRENT YIELD (%)	CURRENT DURATION (YRS.)	YIELD PER DURATION
Agency MBS	**5.11**	**3.48**	**1.47**	**2.81**	**4.74**	**0.59**
Intermediate treasury	3.44	3.50	0.98	1.65	3.96	0.42
Intermediate investment grade (IG) corporate	4.39	4.39	1.00	2.71	4.47	0.61

Past performance is not an indicator of future results.

Sources: Bloomberg and Barclays. Daily index data from January 1, 1994, through April 30, 2017.

The yield advantage of agency MBS relative to US Treasurys is significant. The asset class outperformed intermediate US Treasurys 72% of the time over 1-year horizons, 85% of the time over 3-year horizons, and 99% of the time over 5-year horizons, as illustrated in Exhibit 8.

Exhibit 8: Agency MBS – US Treasurys: Agency MBS outperform US Treasurys over longer horizons

Past performance is not an indicator of future results.

RETURN HORIZON	1-YEAR ROLLING	3-YEAR ROLLING	5-YEAR ROLLING
Positive months	201	239	276
Negative months	79	41	4
Outperformance %	72%	85%	99%
Average return of positive months	1.50%	0.91%	0.71%
Average return of negative months	-0.98%	-0.33%	-0.13%

Past performance is not an indicator of future results.

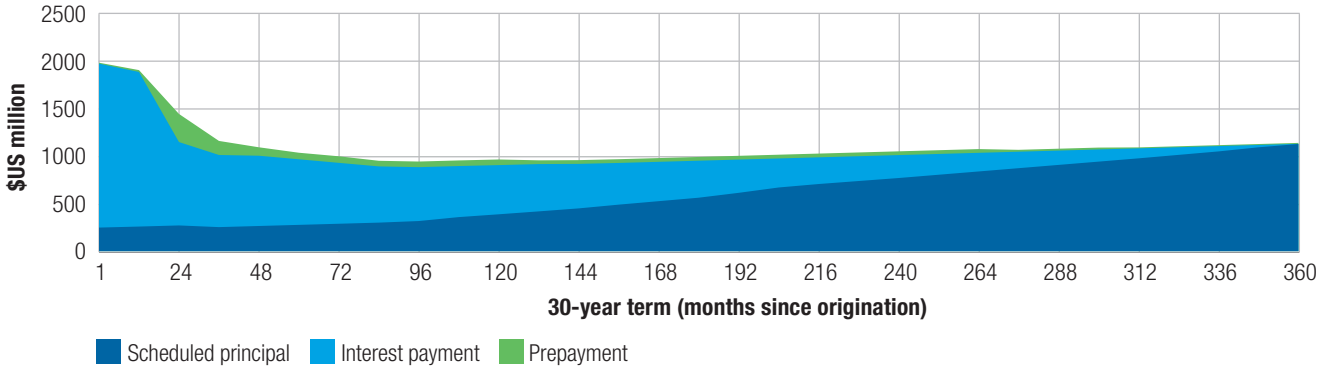
Sources: Bloomberg and Barclays. Monthly index data from January 1, 1994, through April 30, 2017.

This enhanced yield is generally compensation for prepayment risk, which generates some uncertainty in the timing of cash flows and is detailed below.

Prepayment risk

The mortgage contract stipulates the interest payment and scheduled principal amortization over the loan term. However, US mortgage borrowers can repay their loan in full or in part at any time without penalties. This introduces optionality to agency MBS cash flows, as prepayments can create uncertain maturities for investors. The hypothetical repayment schedule of agency MBS including prepayment is shown in Exhibit 9.

Exhibit 9: Hypothetical agency MBS cash flow showing principal repayment



Source: Macquarie.

Prepayments can occur for a variety of reasons, including housing turnover, as borrowers move for employment opportunities or upsize/downsize their homes. However, refinancing activity is the key driver of prepayments, as borrowers can refinance into a lower mortgage rate to reduce monthly payments when interest rates fall. Because of prepayments, the duration of agency MBS is much shorter than the term of a typical 30-year loan, usually between 5 and 7 years.

Due to prepayment risk, agency MBS are said to have an embedded negative convexity. This means that the duration of agency MBS generally changes in the same direction as the change in interest rates, which makes the price sensitivity of these securities different relative to a fixed-rate bond with the same coupon and fixed duration.

As highlighted previously, the level of refinancing activity is dependent on the direction of interest rates. For example, if a mortgage borrower has a loan at a 5% interest rate and prevailing mortgage rates drop to 4%, they can refinance the original loan and take out a new loan at the lower rate. As a result, prepayments increase, which shortens the expected maturity (duration) of an agency MBS. As principal is returned sooner, the investor will be faced with reinvesting at lower rates. Conversely, when rates increase and prepayments slow, the expected maturity of agency MBS cash flows extends. Exhibit 10 summarizes the impact of changing rates on agency MBS.

Exhibit 10: Possible impact of changing rates on agency MBS

	MORTGAGE RATES DECREASE	MORTGAGE RATES INCREASE
Refinancing activity	Increase	Decrease
Prepayments	Increase	Decrease
MBS duration	Decrease	Increase
Reinvestments	More at lower rates	Less at higher rates

Diversification

Agency MBS returns have historically had a high correlation to sovereign bonds (US Treasurys in particular) and a low correlation to stocks, which provides diversification in portfolios exposed to equity market risk, as illustrated in Exhibit 11.

Exhibit 11: Historical correlations of agency MBS

AGENCY MBS VERSUS:	CORRELATION
Intermediate US Treasurys	0.86
Intermediate IG corporate	0.71
High yield (HY) corporate	0.11
Global aggregate	0.60
EM aggregate	0.30
S&P 500	0.00

Sources: Bloomberg and Barclays. Monthly index data, January 1, 1994, through April 30, 2017.

During the 2008 financial crisis, agency MBS maintained their correlation to US Treasurys. While price returns lagged due to the shortening of duration, the drag from paydowns was minor relative to the price volatility of risky assets, as shown in Exhibit 12.

Exhibit 12: Performance in 2008

RETURN SOURCE	AGENCY MBS	INT. US TREASURY	INT. IG CORPORATE	HY CORPORATE	GLOBAL AGGREGATE	EM AGGREGATE	S&P 500
Price return	**2.8%**	7.4%	-10.4%	-33.1%	1.1%	-21.6%	-37.0%
Coupon return	**5.7%**	4.4%	5.5%	6.9%	4.3%	6.4%	0.0%
Paydown	**-0.1%**	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%
Total return	**8.4%**	11.8%	-4.9%	-26.2%	5.8%	-15.2%	-37.0%

Past performance is not an indicator of future results.

Source: Bloomberg Barclays indices. The indices (and the corresponding abbreviations shown above): US Agency MBS Index (Agency MBS); US Intermediate Treasury Index (Int. US Treasury), US Intermediate Investment Grade Corporate index (Int. IG corporate)), US Corporate High Yield Index (HY Corporate), Global Aggregate Index (Global aggregate), Emerging Markets Aggregate Index (EM aggregate) and S&P 500® Index (S&P 500).

Agency MBS have attractive characteristics for absolute return strategies

Absolute return strategies aim to deliver positive returns across all market conditions. Agency MBS possess features (in addition to those detailed above), that make the asset class structurally biased to delivering stable positive returns.

Downside protection and high risk-adjusted returns

The historical performance of agency MBS depicts a risk-reward profile that is attractive for absolute return strategies.

As illustrated in Exhibits 13 through 15, the asset class had a lower frequency of negative quarters, milder drawdowns, and high risk-adjusted returns relative to other types of securities. These are some key considerations when seeking positive returns and low volatility.

Exhibit 13: Less frequent and milder drawdowns

	AGENCY MBS	INT. US TREASURY	INT. IG CORPORATE	HY CORPORATE	GLOBAL AGGREGATE	EM AGGREGATE	S&P 500
Number of negative quarters	**17**	30	21	24	36	26	26
Lowest quarterly return	**-2.32%**	-2.34%	-7.04%	-17.88%	-7.07%	-20.48%	-21.94%
Average return of negative quarters	**-0.69%**	-0.74%	-1.29%	-3.46%	-1.73%	-4.54%	-7.27%

Exhibit 14: Performance during stress scenarios

LOWEST QUARTERLY RETURN	AGENCY MBS	INT. US TREASURY	INT. IG CORPORATE	HY CORPORATE	GLOBAL AGGREGATE	EM AGGREGATE	S&P 500
1994	**-2.32%**	-1.86%	-2.73%	-1.94%	-1.30%	-14.56%	-3.79%
1997	**0.13%**	-0.07%	-0.41%	1.12%	-2.99%	-3.77%	2.68%
2003	**0.51%**	-0.26%	0.16%	2.77%	1.52%	2.08%	-3.15%
2008	**-0.49%**	-2.07%	-7.04%	-17.88%	-3.83%	-9.31%	-21.94%
2013	**-1.96%**	-1.42%	-2.38%	-1.44%	-2.79%	-5.14%	2.91%

Exhibit 15: Attractive risk-adjusted performance

	AGENCY MBS	INT. US TREASURY	INT. IG CORPORATE	HY CORPORATE	GLOBAL AGGREGATE	EM AGGREGATE	S&P 500
Annualized return	**5.36%**	4.50%	5.71%	7.41%	4.91%	9.10%	9.36%
Standard deviation	**2.79%**	3.06%	4.26%	8.64%	5.46%	11.88%	14.61%
Risk-adjusted return	**1.92%**	1.47%	1.34%	0.86%	0.90%	0.77%	0.64%
Sharpe ratio	**0.97**	0.60	0.69	0.53	0.40	0.53	0.45
Skewness	**-0.06**	0.04	-0.91	-1.00	0.07	-2.51	-0.68

Sources: Bloomberg and Barclays. Monthly index data, January 1, 1994, through April 30, 2017.

Sharpe ratio is a risk-reward measure that indicates the average return minus the risk-free return divided by the standard deviation.

Skewness represents the distribution of excess returns, with negative skew less favorable.

Past performance is not an indicator of future results.

Optimal security selection

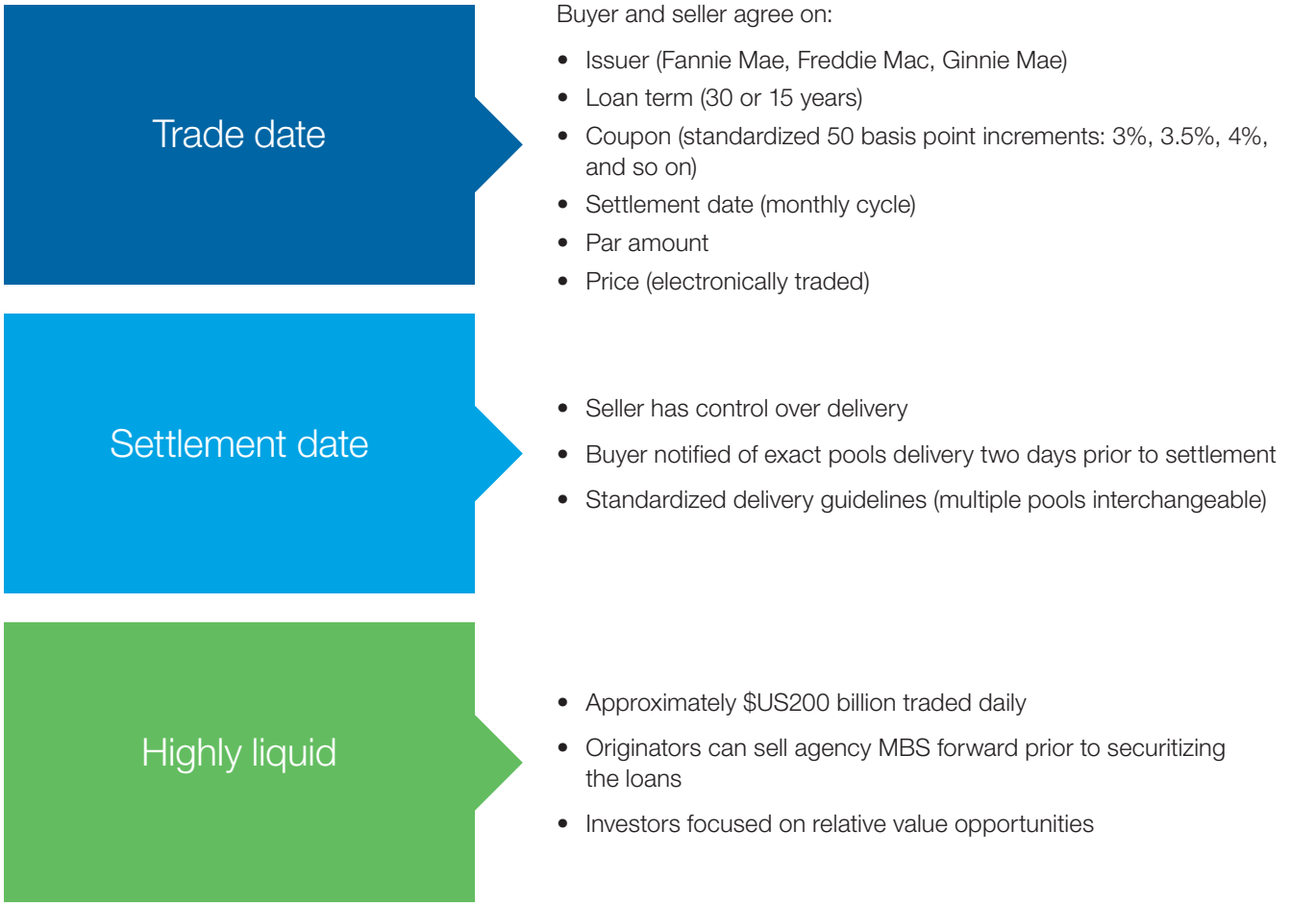
The agency MBS market's depth and breadth includes more than one million securities across various types (forward securities, specified pools of agency MBS and structured securities) and pricing buckets (discounts and premiums). Active managers have the flexibility to select what they perceive as the optimal mix to capitalize on prevailing conditions.

To be announced (TBAs)

TBAs are effectively forward contracts in which the parties agree to buy or sell an agency MBS on a specific date. In a TBA trade, the seller of the agency MBS agrees on a sale price, but does not specify which particular pool of mortgages will be delivered to the buyer on settlement day. Instead, only a few basic characteristics of the pool are agreed upon, such as the issuer, maturity, coupon rate and the face value. The specific pool of mortgages are then announced to the buyer 48 hours prior to the settlement date. The specific characteristics of TBAs are shown in Exhibit 16.

TBAs represent a unique opportunity set for relative value trading and yield enhancement. Supply and demand imbalances may cause temporary dislocations, leading to tactical opportunities in TBAs. The settlement cycle allows the ability to further enhance returns. TBAs with more extended settlements typically trade at a discount relative to those that settle sooner. Each month, the investor can roll to the next forward settlement, avoid delivery and obtain incremental return from the price drop between various settlements.

Exhibit 16: Characteristics of TBAs



Specified pools within agency MBS

Mortgage pools that are not eligible for TBA delivery may be traded in specified pools. Specified pools typically trade at a price premium to comparable TBA coupons. This is because investors can analyze the loan details of the underlying borrowers, looking at attributes such as loan size; seasoning; credit scores and down-payment positions; geography and servicing distribution; and prepayment history. Conventional 30-year specified pools represent the broadest opportunity set (that is, the largest number of available securities) as shown below in Exhibit 17. As a subset of agency MBS, these securities have also outperformed other pool types over the past 22 years.

Within specified pools, certain loan characteristics can lead to more stable prepayments. A focus on optimal security and collateral selection can enhance returns relative to the agency MBS index. For example:

- Borrowers with smaller loan sizes may have less (dollar) savings from a lowering of mortgage rates relative to larger loan sizes. For this reason, the prepayment sensitivity of smaller loan size pools, especially those with a maximum loan size cap, can be more predictable across scenarios. This is illustrated in Exhibit 18a (see next page) whereby the Freddie Mac (FGLMC) security with a 4% coupon and a maximum loan size of $US150,000 has a higher average annualized return and a lower conditional prepayment rate (CPR) than the equivalent 4% security with an average loan size of $US246,000.
- Time passed since origination (monthly seasoning) can also be an important driver. Initially, after purchasing or refinancing a house, mortgage underwriting and relocation costs can constrain prepayments. As loans season, housing turnover picks up and if rates decrease, refinancing activity increases for underlying borrowers. However, as time passes, certain specific pools may be exposed to multiple refinance opportunities, and borrowers that remain outstanding exhibit selection biases. While more prepayment-sensitive borrowers will take advantage of lower rates, less "savvy" borrowers (potentially due to smaller loan sizes, more marginal credits, geography and servicer differences, etc.) may continue to amortize the original loans. As a result, the prepayment propensity of more seasoned borrowers can become more stable. This is illustrated in Exhibit 18b (see next page) whereby the Freddie Mac (FGLMC) security with a 5.5% coupon and a long loan age of 159 months (that is, more seasoned) has a higher average annualized return and a lower CPR than the equivalent 5.5% security with a loan age of 99 months.

Exhibit 17: Specified pools universe by issuer and loan term

Conventional 30-years have the most number of securities available and the highest average annualized return

	NUMBER OF SECURITIES	ANNUALIZED RETURN	PRICE RETURN	COUPON RETURN	PAYDOWN
Conventional 30-years	475,000	5.55%	0.55%	5.80%	-0.81%
Conventional 15-years	129,000	5.00%	0.44%	5.13%	-0.57%
Ginnie Mae 30-years	133,000	5.46%	0.57%	5.91%	-1.01%
Ginnie Mae 15-years	9,000	4.97%	0.41%	5.15%	-0.59%

Sources: Bloomberg and Barclays. Monthly index data from January 1, 1994, through April 30, 2017. **Past performance is not an indicator of future results.**

Exhibit 18a: Borrowers with smaller loan sizes can have more predictable prepayments

	LOAN SIZE	AVERAGE ANNUALIZED RETURN	CONDITIONAL PREPAYMENT RATE^ (AVERAGE)
FGLMC 30-years 4% coupon	$US246K Average	1.69%	19
FGLMC 30-years 4% coupon (pool # G60344)	**$US150K Maximum**	**2.45%**	**9**

Source: Bloomberg and Barclays. Returns and statistics calculated from December 31, 2015, through December 31, 2016.

^ The conditional prepayment rate is the loan prepayment rate equal to the portion of the principal of a pool of loans assumed to be paid off prematurely in each period.
Past performance is not an indicator of future results.

Exhibit 18b: Borrowers with more seasoning can have more predictable prepayments

	LOAN AGE (MONTHS)	AVERAGE ANNUALIZED RETURN	CONDITIONAL PREPAYMENT RATE^ (AVERAGE)
FGLMC 30-years 5.5% coupon	99	2.46%	21
FGLMC 30-years 5.5% coupon (pool # C01797)	**159**	**3.30%**	**19**

Source: Bloomberg and Barclays. Returns and statistics calculated from December 31, 2015, through December 31, 2016.

^ The conditional prepayment rate is the loan prepayment rate equal to the portion of the principal of a pool of loans assumed to be paid off prematurely in each period.
Past performance is not an indicator of future results.

Relative value between premium and discount securities

An analysis of the risk-adjusted returns of conventional 30-year agency MBS premium and discount securities can identify securities with optimal profiles.

Exhibit 19 illustrates the following:

- Column A: Deeply discounted securities (prices < $98) have the highest return volatility, but have more price upside relative to surrounding buckets in a bond rally as underlying coupons are below prevailing mortgage rates.
- Column B: Securities priced between $98 and $100 have lower volatility and better risk-reward relative to surrounding buckets. Borrowers will typically be moderately seasoned and have below-market coupons.
- Column C: On-the-run coupons (defined as priced at or slightly above $100) have relatively high volatility as any change in rates will impact their expected duration as coupons are already close or at par to the market.
- Column D: Premium securities (prices > $102) are attractive on a risk-adjusted basis. This is due to the seasoning selection biases of borrowers that remain outstanding with higher coupons, as previously discussed.
- Combining moderately seasoned below-market coupons and seasoned high coupon premiums in a barbell approach (the last column of Exhibit 19) also offers an attractive risk-reward profile.

Exhibit 19: Conventional 30-year agency MBS grouped by price buckets

	A PRICE<98	B 98≤PRICE<100	C 100≤PRICE<102	D 102≤PRICE	(B+D)/2 BARBELL PROXY
Average annual return	6.59%	5.29%	4.86%	4.87%	5.06%
Standard deviation	7.24%	4.38%	5.04%	3.05%	3.60%
Risk-adjusted return	0.91%	1.20%	0.93%	1.60%	1.41%
Lowest yearly return	-4.75%	-2.06%	-6.13%	-0.50%	-0.99%

Source: Bloomberg Barclays. Index annual data 1994-2016 (full details in section 3 of the Appendix). **Past performance is not an indicator of future results.**

Agency collateralized mortgage obligations (CMOs)
Agency CMOs are constructed from agency MBS pools by redistributing the principal and interest cash flows into various tranches. These tranches can have customized average life and convexity, offering a wider range of yield and duration profiles with some examples of various structure options illustrated in Exhibit 20. Similar to agency MBS, the cash flows of agency CMOs are guaranteed by the agencies.

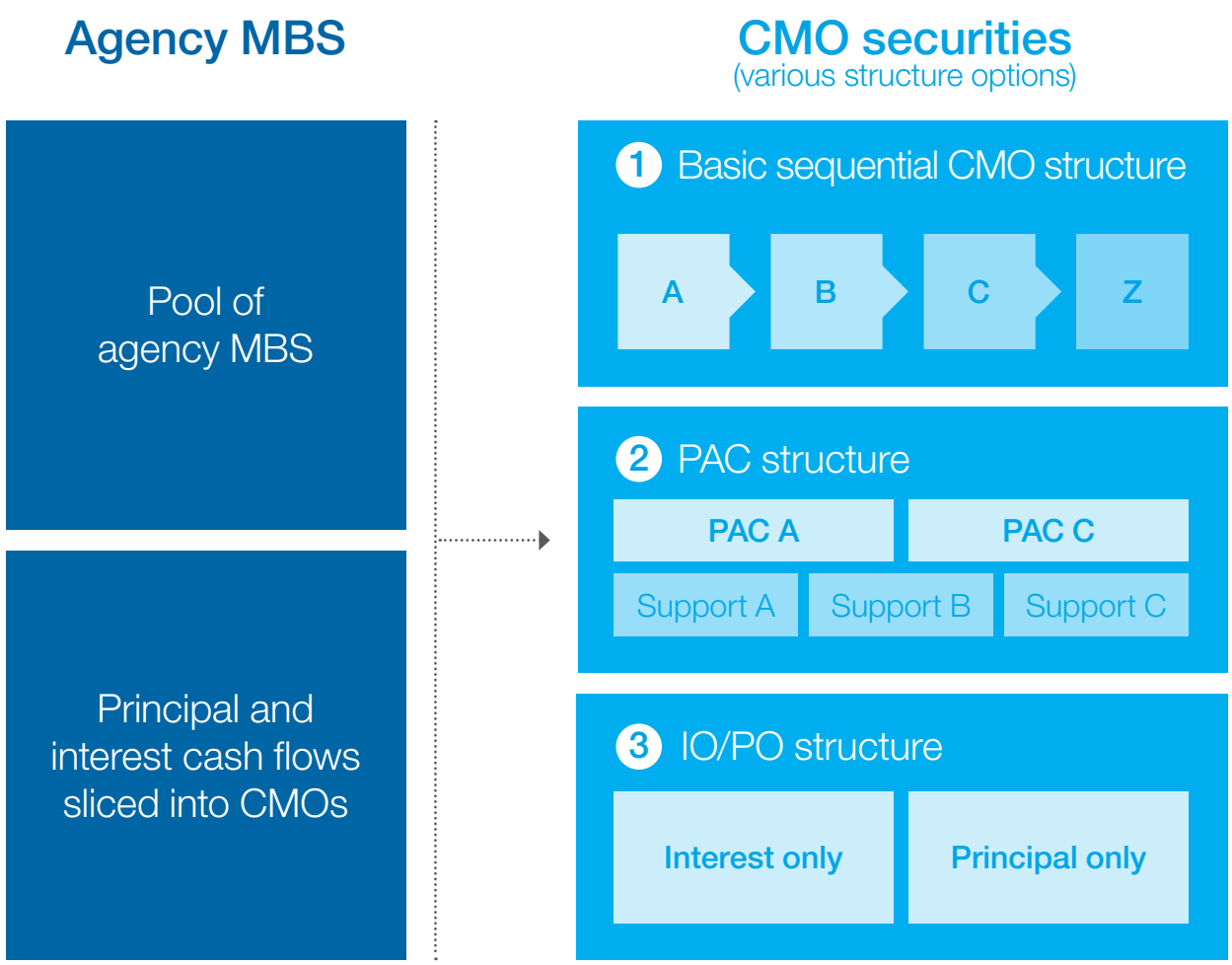
In the basic sequential CMO structure (structure 1 in Exhibit 20), principal is time-tranched between the various tranches. The first tranche A will receive principal first until it retires and then tranche B will begin to receive principal, and so on until all principal has been repaid, with the Z bond receiving principal last.

The planned amortization class (PAC) structure (structure 2 in Exhibit 20) is designed to create a stable set of bonds by directing the prepayment risk of the underlying collateral to other bonds in the structure, which are referred to as support bonds.

Interest only (IO) and principal only (PO) structures (see structure 3 in Exhibit 20) are created by dividing the cash flows from an underlying agency MBS into two pieces. The IO receives all of the interest payments and the PO receives all of the principal payments.

CMOs with offsetting exposures can be used to enhance yield relative to specified pools. For example, IO securities represent the interest portion of the agency MBS cash flows. If rates decrease and prepayments increase, IOs can lose value. Conversely, Z bonds are the last tranche to receive principal in a basic sequential CMO structure. If rates decrease and principal is returned sooner, Z bonds, which typically trade at a discount, will increase in value. Combining different mixes of IO and Z bonds can facilitate better yield per unit of duration outcomes.

Exhibit 20: From agency MBS pools to agency CMO



Rate and curve sensitivity

A clear understanding of the rate and curve sensitivities of fixed income securities is important to delivering consistent positive returns.

To get a sense of the drivers of risk and return across the agency MBS spectrum, we regressed the monthly returns of the different price buckets from Exhibit 19 versus the monthly returns of the Bloomberg Barclays US Treasury Index (a proxy for rate directionality) and Bloomberg Barclays Long US Treasury Index - Bloomberg Barclays US 3-month Treasury Bills Index (a proxy for curve directionality).

The workings of this analysis can be found in section 2 of the Appendix, but some of the practical findings are below:

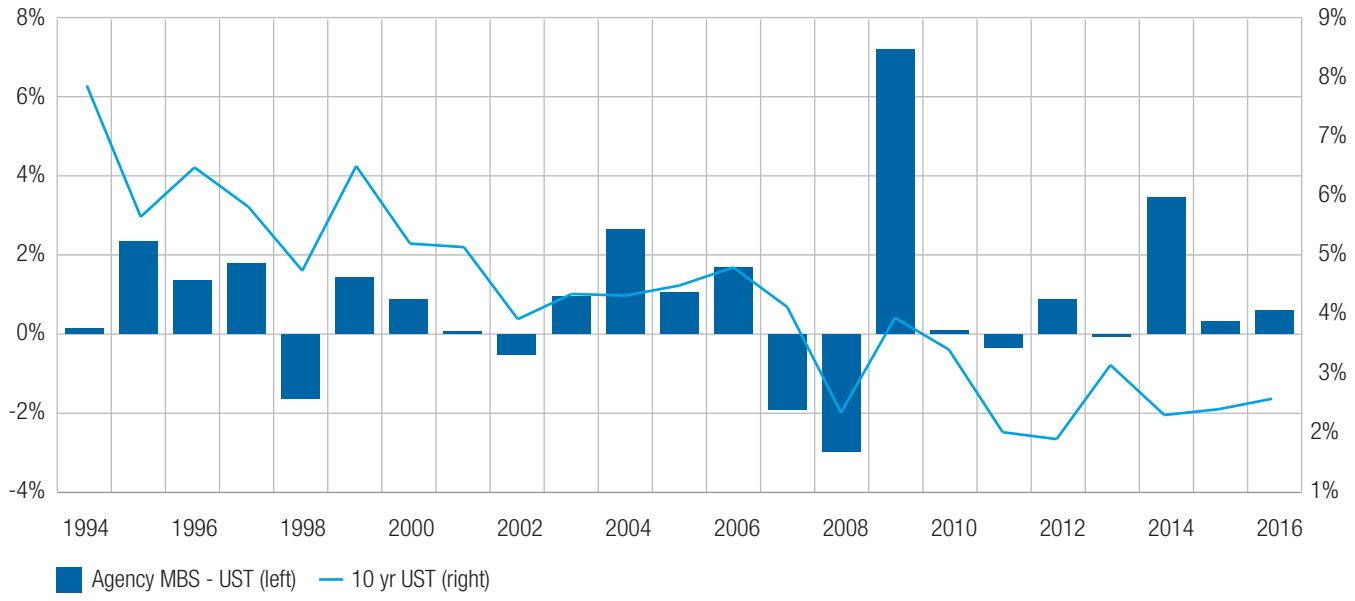
- Agency MBS are more sensitive to changes in rates than curve shifts, which reflects the asset class's high positive correlation with US Treasurys. In particular, securities priced around par have the highest sensitivity to rates and the least sensitivity to the curve. As such, if a manager believes it is in a more volatile rate environment, it would avoid securities priced around par.
- Curve moves are more significant for deeply discounted and premium agency MBS. This affects deeply discounted securities such that when longer-term US Treasurys outperform T-bills (that is, the curve flattens), the expected directional movement of that price bucket is in the same direction as the US Treasury curve. Conversely, this impacts premiums such that when the yield curve steepens (when US Treasurys underperform T-bills) the expected directional movement in the returns of that price bucket is the same direction as the US Treasury curve.

These various sensitivities imply that when constructing an absolute return portfolio of agency MBS, assessing the interest rate cycle is an important consideration for optimal positioning. It further supports the notion that securities around par have the most uncertain prepayment outcomes as their rate sensitivities are the highest, while a barbell approach may minimize rate curve exposures.

Tactical opportunities between agency MBS and US Treasurys

Exhibit 21 illustrates that agency MBS tend to underperform US Treasurys when rates fall, because homeowners have an increasing incentive to refinance their mortgages. Anticipating these periods of relative performance can potentially improve returns through tactical rotation between agency MBS and US Treasurys (basis trading). Additionally, when managing interest rate exposure, using US Treasurys may be optimal to increase duration in a rally since prepayment risk and negative convexity may limit the performance of agency MBS. However, this also underscores the relative value proposition of agency MBS when rates are rising, which is further discussed in the following case study.

Exhibit 21: Agency MBS versus US Treasurys and the direction of interest rates



Source: Bloomberg, through December 31, 2016. **Past performance is not an indicator of future results.**

Case study: Agency MBS in a rising rate environment

In a rising rate environment, which is typically stressful for all fixed rate bonds, agency MBS can experience reduced prepayments (as homeowners are less likely to refinance). Higher rates tend to extend the duration of these securities but may also improve their fundamental outlook, as cash flows can become more predictable.

In fact, certain securities, such as higher coupon premiums, actually benefit from higher rates. For the holder of premium agency MBS, slower prepayments make the higher coupon income stream more stable and these securities tend to outperform other similar duration fixed income sectors. Similarly, interest-only (IO) securities are likely to increase in price as the interest cash flows remain outstanding for longer. Floater agency MBS securities can also benefit in a rising rate environment, as the coupon resets to higher yields.

In addition, when agency MBS are used in an absolute return strategy, these strategies will likely have wide duration band limits. Therefore, certain strategies will be able to reduce the overall interest rate duration exposure (down to potentially nil) to protect investors in times of rising rates.

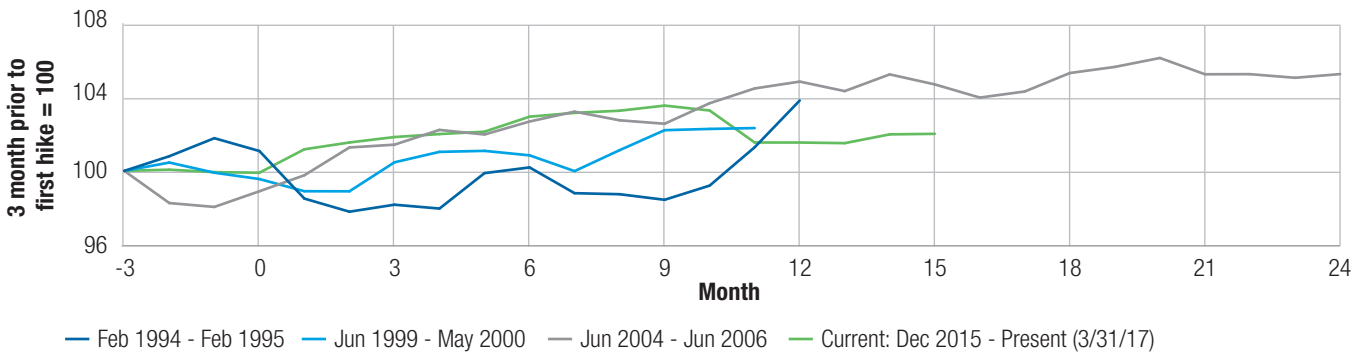
A review of recent history (see Exhibits 22 and 23) reveals that in rising rate environments, including monetary policy tightening cycles, a reduction in prepayment risk tended to support absolute and relative agency MBS returns. This relationship is expected to hold in upcoming tightening cycles, barring policy communication errors or an inflation overshoot. In addition, clear signals from the Federal Open Market Committee (FOMC) about a shallow path for policy rates should serve to limit uncertainty about the interest rate outlook, while a gradual pace of US Federal Reserve balance sheet reduction (through run-off of maturing Treasurys and smaller reinvestments of agency MBS paydowns) will likely mitigate the risk of a sharp increase in net agency MBS supply.

Exhibit 22: Agency MBS returns in years when 10-year US Treasury yield increased

	YIELD CHANGE (%)	TOTAL RETURN (%)			
Year	10-Year UST	10-Year UST	Agency MBS	Intermediate UST	Intermediate IG Corporate Bond
1988	0.28	6.37	**8.72**	6.26	7.99
1990	0.13	6.67	**10.72**	9.46	7.62
1994	2.03	-7.85	**-1.61**	-1.76	-2.66
1996	0.85	0.10	**5.35**	3.98	3.97
1999	1.79	-8.43	**1.86**	0.41	0.16
2003	0.43	1.27	**3.07**	2.11	7.47
2005	0.17	2.07	**2.61**	1.56	1.29
2006	0.31	1.34	**5.22**	3.51	4.55
2009	1.63	-9.76	**5.89**	-1.41	18.56
2013	1.27	-7.81	**-1.41**	-1.34	0.08
2015	0.10	0.91	**1.51**	1.18	1.08
2016	0.18	-0.16	**1.37**	1.06	4.04

Sources: Bloomberg and Barclays. **Past performance is not an indicator of future results**

Exhibit 23: Agency MBS returns during US Federal Reserve rate hikes



Sources: Bloomberg and Barclays. **Past performance is not an indicator of future results.**

Conclusion

Investors today are facing numerous headwinds. On one hand, it is widely acknowledged that bond market yields are at historically low levels, which may translate into unattractive returns for fixed income investors. On the other hand, future equity returns could easily fall short of investor expectations given the divergence between current valuations and subpar economic growth around the world. Moreover, macro uncertainties stemming from the global debt burden, unprecedented monetary policies, demographic trends, regulation, and lack of liquidity create a scenario in which downside risk to asset prices is a very legitimate concern.

With this in mind, agency MBS can offer benefits to investors through the asset class's government guarantees (explicit or implicit), high liquidity, and enhanced yield and diversification.

For investors seeking absolute return within fixed income markets, focusing on agency MBS as the core of a strategy can provide downside protection through higher risk-adjusted returns. Investors can also capitalize on the asset class's depth and breadth (through forward and collateralized securities and specified pools within agency MBS) while selecting the optimal securities for the prevailing environment.

Agency MBS can also be an attractive fixed income solution in times of rising rates. The case study illustrated that certain agency MBS securities — such as premium securities, interest-only, and floating-rate securities — outperform similar duration fixed income sectors in times of rising rates.

This paper illustrates that agency MBS have historically delivered attractive returns compared to US Treasurys and more attractive risk-adjusted returns compared to corporate bonds. From a downside protection standpoint, agency MBS have had the fewest quarters of negative returns relative to other fixed income investments, and the magnitude of loss during those periods has compared favorably for the asset class.

In summary, the agency MBS market can provide an attractive solution for investors seeking a liquid, high quality asset class with a historically consistent yield advantage, diversification benefits, and downside protection features.

Contact us to learn more about agency MBS, including Macquarie's Absolute Return Mortgage-Backed Securities strategy

Fixed income securities and bond funds can lose value, and investors can lose principal, as interest rates rise. They also may be affected by economic conditions that hinder an issuer's ability to make interest and principal payments on its debt.

Fixed income securities may also be subject to prepayment risk, or the risk that the security's principal value may be prepaid prior to maturity, potentially forcing investors to reinvest that money at a lower interest rate.

High yielding, non-investment-grade bonds (junk bonds) involve higher risk than investment grade bonds.

This document may mention bond ratings published by nationally recognized statistical rating organizations (NRSROs) Standard & Poor's, Moody's Investors Service, and Fitch, Inc. For securities rated by an NRSRO other than S&P, the rating is converted to the equivalent S&P credit rating. Bonds rated AAA are rated as having the highest quality and are generally considered to have the lowest degree of investment risk. Bonds rated AA are considered to be of high quality, but with a slightly higher degree of risk than bonds rated AAA. Bonds rated A are considered to have many favorable investment qualities, though they are somewhat more susceptible to adverse economic conditions. Bonds rated BBB are believed to be of medium-grade quality and generally riskier over the long term.

The Bloomberg Barclays US Corporate Investment Grade Index is composed of US dollar-denominated, investment grade, SEC-registered corporate bonds issued by industrial, utility, and financial companies. All bonds in the index have at least one year to maturity.

The Bloomberg Barclays Taxable Municipal Index is a rules-based, market-value-weighted index engineered for the long-term taxable municipal bond market.

The Bloomberg Barclays Long US Corporate Index is composed of US dollar–denominated, investment grade, SEC-registered corporate bonds issued by industrial, utility, and financial companies. All bonds in the index have at least 10 years to maturity. As of April 10, 2017, the average maturity for bonds within the index was 23.76 years.

The Bloomberg Barclays US Corporate High-Yield Index is composed of US dollar–denominated, noninvestment grade corporate bonds for which the middle rating among Moody's Investors Service, Inc., Fitch, Inc., and Standard & Poor's is Ba1/BB+/BB+ or below.

The Bloomberg Barclays Global Aggregate Index provides a broad-based measure of the global investment grade fixed-rate debt markets.

The Bloomberg Barclays Emerging Markets Aggregate Index measures the performance of debt issued by sovereign, quasi-sovereign, and corporate emerging markets issuers.

The Bloomberg Barclays US Agency MBS Index measures the performance of investment grade fixed-rate mortgage-backed pass-through securities that are backed by Ginnie Mae, Fannie Mae, and Freddie Mac.

Bloomberg Barclays US Treasury Index measures the performance of public obligations of the US Treasury with a remaining maturity of one year or more.

The Bloomberg Barclays US Intermediate Treasury Index measures the performance of public obligations of the US Treasury that fall in the intermediate maturity range of the Bloomberg Barclays US Treasury Index.

The Bloomberg Barclays US Intermediate Investment Grade Corporate Index measures the performance of the Intermediate component of the Bloomberg Barclays US Corporate Investment Grade Index.

The Bloomberg Barclays Long US Treasury Index measures the performance of US Treasury bonds and notes that have a remaining maturity of 10 or more years.

The Bloomberg Barclays US 3-month Treasury Bills Index measures the performance of US Treasury bills with a maturity of three months.

The S&P 500 Index measures the performance of 500 mostly large-cap stocks weighted by market value, and is often used to represent performance of the US stock market.

Index performance returns do not reflect any management fees, transaction costs or expenses. Indices are unmanaged and one cannot invest directly in an index.

Appendix

1. Glossary for agency MBS investors

Net coupon and WAC (weighted average coupon)

- Net coupon is the rate at which interest is paid to investors.
- WAC is the average mortgage rate of underlying loans.
- WAC – net coupon = servicing spread.

WAM (weighted average maturity) and WALA (weighted average loan age)

- WAM is the average of the remaining terms (maturities) on underlying loans.
- WALA is the average age (months since issuance) of underlying loans.

Borrowers' credit and down-payment (equity) position metrics

- FICO is the average consumer credit score of underlying loans measured and reported under Fair, Isaac and Company standardized methodology.
- DTI is the average debt to income position of underlying borrowers.
- LTV is the average (current and at origination) loan to value position. For example: 80% OLTV = 20% down-payment, while CLTV is calculated based on current property valuations.

Prepayment rate metrics

- SMM (single monthly mortality) = unscheduled principal payment/scheduled principal.
- CPR (conditional prepayment rate), most commonly used, represents annualized SMM = 100*[1-(1-SMM)^12].
- PSA (public securities association) conventions, CPRs increase from 0-6 linearly by 0.2 per month over 30 months and 6 CPR thereafter. Prepayments measured in %PSA; for example, 100 PSA, 150 PSA, and so on.

Additional loan level disclosures

- Occupancy type (owner occupied, investor, vacation)
- Loan purpose (purchase vs. refinance)
- Property type (single family or multi-family)
- Servicer distribution (% Wells Fargo, % Chase, etc.) and third-party origination
- Geographic distribution

2. Rate and curve sensitivity

This section explains the method we followed when conducting our rate and curve sensitivity analysis.

To get a sense of the drivers of risk and return across the agency MBS spectrum, we regressed the monthly returns of the different price buckets mentioned above, versus the monthly returns of the Bloomberg Barclays US Treasury Index (a proxy for rate directionality) and Bloomberg Barclays Long US Treasury Index - Bloomberg Barclays US 3-month Treasury Bills Index (a proxy for curve directionality). The results are shown in Exhibit 24.

Regression coefficients and statistical relevance values (r-squared and t-stats) are obtained from least square statistical analysis which fits the selected independent (explanatory) variables — rate and curve — to the historical pattern of the dependent variable, in this case the monthly returns of each agency MBS price bucket. Coefficients represent the expected sensitivity (beta) to a given explanatory variable, while the t-stat represents the statistical significance of the selected explanatory variable in predicting the historical pattern of the dependent variable. The sign (+ or -) on the coefficient indicates the expected directional movement in the return of the dependent variable. A high t-stat implies high statistical relevance. Generally, values above 2 or below -2 indicate significance. R-squared is a number that indicates how well data fit a statistical model. A higher R-squared value will indicate a more useful beta figure.

The exhibit illustrates the following characteristics of agency MBS by price bucket:

- Rate coefficients are higher than the curve coefficients reflecting the high positive correlation between agency MBS and US Treasurys. In particular, securities priced around par can have the highest sensitivity to rates and the least sensitivity to the curve. As the direction of rates impacts prepayments, the relatively higher rate sensitivity of securities around par implies more prepayment uncertainty.
- The curve is more significant for deeply discounted and premium agency MBS. Deep discounts can have a positive curve coefficient such that when longer-

Exhibit 24: Conventional 30-year agency MBS return drivers

PRICE BUCKET	COEFFICIENT RATE	COEFFICIENT CURVE	T-STAT RATE	T-STAT CURVE	R-SQUARED
Price<98	0.66	0.30	4.74	4.34	0.69
98≤Price<100	0.83	0.04	11.38	1.24	0.83
100≤Price<102	0.73	0.02	11.49	0.63	0.78
102≤Price	0.65	-0.12	15.01	-6.22	0.66

Source: Bloomberg and Barclays. Monthly index data from 1994-2017. **Past performance is not an indicator of future results.**

term US Treasurys outperform T-bills (that is, the curve flattens), the expected directional movement of that price bucket should be in the same direction. Conversely, the curve coefficient sign of premiums is negative, which means that the expected movement in the returns of that price bucket is more correlated to a steepening of the yield curve (when US Treasurys underperform T-bills).

These various sensitivities can imply that when constructing an absolute return portfolio of agency MBS, assessing the interest rate cycle can be an important consideration for optimal positioning. It further supports the notion that securities around par have the most uncertain prepayment outcomes (as their rate sensitivity coefficients are the highest), while a barbell approach may minimize rate curve exposures.

3. Return history for conventional 30-year agency MBS grouped by price buckets

	A PRICE<98	B 98≤PRICE<100	C 100≤PRICE<102	D 102≤PRICE	(B+D)/2 BARBELL PROXY
2016	2.44	1.82	2.38	1.52	1.67
2015	3.16	1.22	0.14	1.33	1.28
2014	10.23	4.60	5.77	5.44	5.02
2013	-4.09	2.51	-6.13	-0.50	1.00
2012	n/a	1.68	0.67	2.61	2.15
2011	8.03	6.31	11.37	5.66	5.98
2010	8.05	4.03	5.67	5.21	4.62
2009	-2.28	4.09	1.11	6.15	5.12
2008	25.83	8.11	6.59	5.95	7.03
2007	6.43	6.59	6.58	7.14	6.87
2006	5.19	5.30	5.25	4.97	5.14
2005	2.30	3.61	2.23	2.71	3.16
2004	6.00	8.10	4.44	3.49	5.79
2003	5.95	-2.06	1.43	1.64	-0.21
2002	9.62	8.51	11.42	7.51	8.01
2001	10.76	7.82	8.06	7.43	7.63
2000	12.20	10.90	9.60	8.11	9.51
1999	-0.49	0.42	1.62	3.16	1.79
1998	7.16	8.53	7.47	5.72	7.13
1997	10.67	10.07	9.97	8.51	9.29
1996	2.97	3.67	4.51	6.45	5.06
1995	19.59	16.72	15.07	12.18	14.45
1994	-4.75	-1.67	-3.36	-0.32	-0.99
Average return	6.59	5.26	4.86	4.87	5.06
Standard deviation	7.24	4.38	5.04	3.05	3.60
Risk-adjusted return	**0.91**	**1.20**	**0.96**	**1.60**	**1.41**
Lowest yearly return	-4.75	-2.06	-6.13	-0.50	-0.99

Source: Bloomberg Barclays. **Past performance is not an indicator of future results.**

About the authors

Ion Dan
Senior Portfolio Manager, Agency MBS

Ion Dan is a member of Macquarie Investment Management's fixed income portfolio management team, with primary responsibility for portfolio construction and strategic asset allocation. He is the lead co-portfolio manager for the Absolute Return Mortgage-Backed Securities strategy, and senior analyst and trader for agency mortgage-backed securities.

Sarah Scanlon
Fixed Income Investment Specialist

Sarah Scanlon is an investment specialist in Macquarie Investment Management's fixed income team. She works closely with the investment team across all strategies, including the Absolute Return Mortgage-Backed Securities strategy. She is responsible for the production and delivery of strategy, market, and research information.

Contact us by region

Americas

Market Street, Philadelphia

215 255 1200

mim.americas@macquarie.com

Asia

Harbor View, Hong Kong

852 3922 1256

macquarie.funds.hk@macquarie.com

Australia

Martin Place, Sydney

1800 814523

mim@macquarie.com

Europe/Middle East/Africa

Ropemaker Place, London

44 020 3037 2049

mim.emea@macquarie.com