Macquarie Investment Management

MACQUARIE

Agency mortgage-backed securities

An alternative opportunity set for absolute return outcomes

Part 2 of 2

Contents

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Executive summary

Against a backdrop of low bond yields and modest global growth, investors are looking for alternative ways to structure their fixed income portfolios. 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.

This paper details how Macquarie uses US agency mortgage-backed securities (MBS) to deliver an absolute return solution to investors. These securities provide investors with attractive features including a government guarantee, high level of liquidity, and diversification against risk assets.

The Macquarie Absolute Return Mortgage-Backed Securities (ARMBS) strategy uses this unique asset class in its aim to outperform LIBOR by +3% over the market cycle and takes a conservative, high quality and time-tested approach to absolute return fixed income investing.

The ARMBS investment philosophy is not designed to achieve outsized returns (versus a benchmark, market or otherwise) but rather aims to deliver, in a risk-controlled fashion, positive returns for its investors in all interest rate environments.

The ARMBS investment approach, detailed in the paper, is centred on core portfolio construction and optimal security selection, enhanced by active management and overlay strategies to provide principal protection and effective risk management in periods of stress.

We believe that when combined with an investment process focused on fundamental research and capital preservation, agency MBS offer a structurally attractive risk/reward profile for an absolute return strategy and an attractive solution to investors in the current environment of constrained financial markets liquidity and increased uncertainty.

Introduction

In the current environment of low bond yields and modest global growth, investors are looking for alternative ways to manage fixed income portfolios. 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 the added absolute return benefit of downside protection.

This is the second paper in the agency MBS series. The first paper explained the key features of the asset class along with the investible universe which extends to the To Be Announced (TBA) and agency Collateralised Mortgage Obligations (CMO). In summary agency MBS provide the following key attributes to investors:

- **Government guarantee** – The issuing agencies offer explicit (Ginnie Mae) and explicit (Fannie Mae and Freddie Mac) government guarantees 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 Treasuries (UST).[1]
- **Yield advantage over US Treasuries** – Agency MBS can offer enhanced yield over US Treasuries 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 Treasuries in particular) and a lower correlation to stocks, which can provide diversification in portfolios exposed to equity market risk.
- **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.

This second paper details how we use this asset class in the Macquarie Absolute Return Mortgage-Backed Securities (ARMBS) strategy which aims to provide investors with consistent, strong, risk-adjusted returns and downside protection.

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.

ARMBS strategy

ARMBS employs a conservative, high quality and time-tested approach to absolute return fixed income investing.

Objective

ARMBS seeks to return LIBOR +3% over a market cycle, while minimising the occurrence and magnitude of negative performance periods through active management.

Investible universe

- US agency MBS:
  - Agency MBS pools- securitised residential mortgage loans, issued and guaranteed by US government agencies.
  - To Be Announced (TBA)- forward settling transactions where buyers and sellers agree to exchange agency MBS on a specific date in the future.
  - Agency Collateralised Mortgage Obligations (CMO)- securities constructed from agency MBS pools by redistributing the principal and interest cash flows.
- US Treasury securities and futures are used for hedging and relative value opportunities.

Key features

The strategy aims to provide investors with the following:

- Low correlation to equities and credit risk
- Attractive liquidity positioning
- Consistent returns with relatively low volatility
- Focused on downside protection

Strategy differentiation

ARMBS investment process

This section details the investment philosophy and process of ARMBS and illustrates how we use this unique asset class in our aim to deliver an absolute return outcome for our investors.

Investment philosophy and process

The ARMBS investment philosophy is not designed to achieve outsized returns (versus a benchmark, market or otherwise) but rather aims to deliver, in a risk-controlled fashion, positive returns for its investors in all interest rate environments.

When combined with an investment process focused on fundamental research and capital preservation, agency MBS offer a structurally attractive risk/reward profile for an absolute return strategy and a potentially attractive solution to investors in the current environment of constrained financial markets liquidity and increased uncertainty. We believe optimal security selection and portfolio construction, enhanced by active management can lead to total return consistency and lower volatility outcomes.

The security selection process starts with an analysis of macro factors that shapes our views on prepayment risk and narrows the investable universe. This is supplemented by fundamental research focused on borrowers' payment behaviour, trends in underlying loan attributes and structural analysis of mortgage cash flows. We seek optimal-risk adjusted securities given our base case outlook on prepayments but also focus on achieving consistent returns across multiple market scenarios.

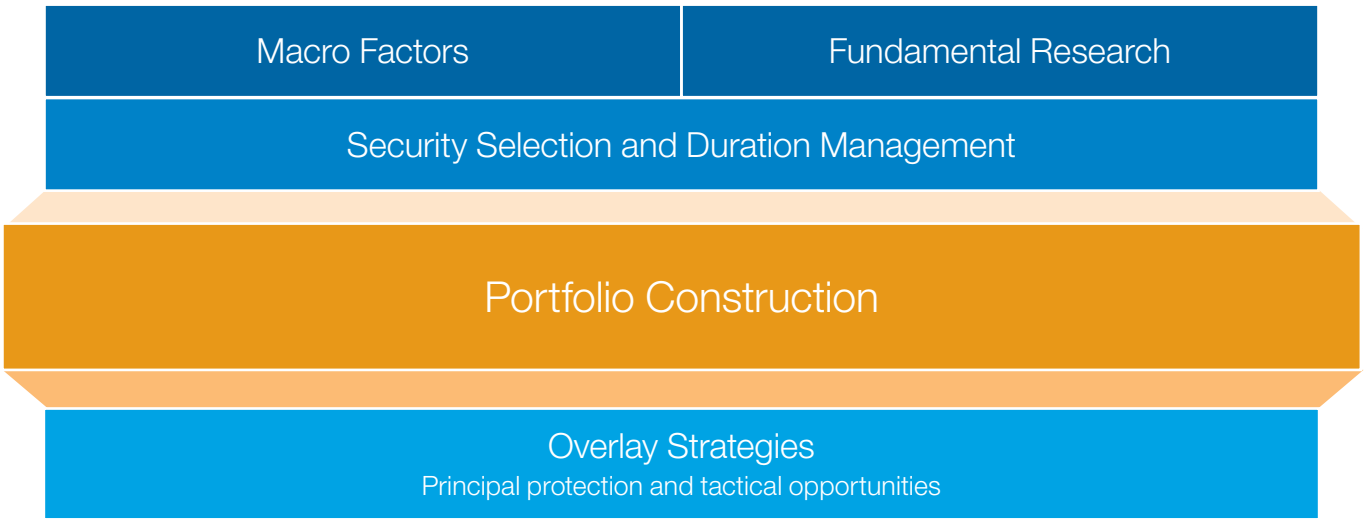
The duration limit for the strategy is 0-6 years, which provides flexibility for risk management. We intentionally do not permit negative duration to preserve the low return correlation of agency MBS to equities (negative duration is often positively correlated to equities). This is a key consideration for investors seeking the portfolio diversification features provided by traditional fixed income. We aim to control interest rate exposure in the context of core portfolio positioning such that holistically the inherent yield advantage of our security selection drives the consistency of performance.

Overlay strategies are implemented to protect principal (hedge the core portfolio) or enhance returns through tactical relative value or duration trading opportunities. We use US Treasury futures and forward settling agency MBS (TBAs), which offer a liquidity advantage and transactional efficiencies.

Overall, our approach to portfolio construction seeks securities with an optimal return potential, influenced by our views on prepayment risk. The security selection process combines macro analysis and bottom-up fundamental research to narrow the investable universe and focuses on maximising yield outcomes. Total interest rate exposure managed through duration management and overlay strategies protects capital and lowers volatility.

An overview of the investment process is provided in exhibit 1.

Exhibit 1: ARMBS investment process



We will next step through each factor in the investment process.

Macro factors analysis

This involves a multi-faceted analysis of the significant factors impacting prepayments.

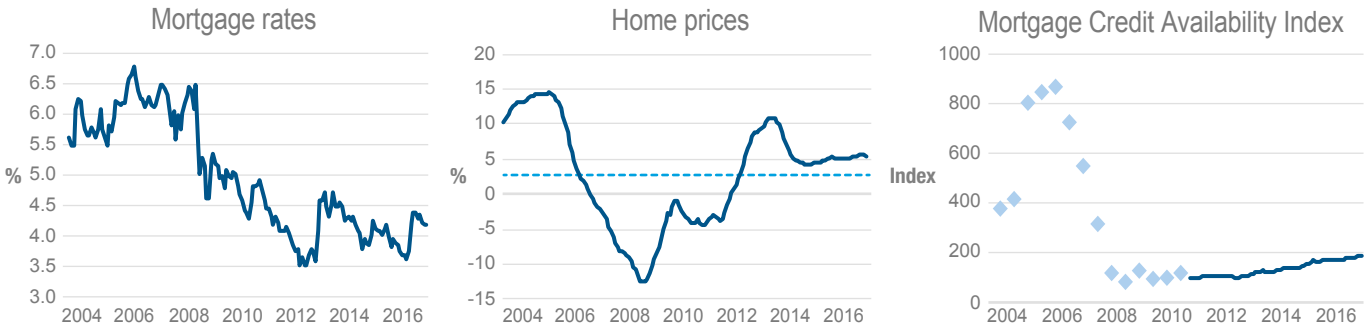
Prepayment risk is the biggest risk facing agency MBS investors as US mortgage borrowers are permitted to repay their mortgage in full or in part at any time over the life of their loans. This introduces cash flow timing variability, as prepayments create uncertain maturities for investors. Prepayments can occur for a variety of reasons, including housing turnover or an increase in refinancing activity, which causes an earlier than expected return of principal to investors. Agency MBS offer a yield advantage over US Treasuries to compensate for this risk.

The ARMBS investment process begins with a top-down analysis of all factors impacting prepayments, which narrows the security selection universe by focusing on:

- **Economic backdrop:** Trends in economic activity (consumption, investment, government spending and trade), employment and inflation, monetary policy and geopolitical factors shape the direction of financial markets. Our analysis is focused on tendencies between outcomes and expectations.
- **Mortgage rates:** A decrease in mortgage rates incentivises borrowers to refinance their mortgages to reduce monthly payments. Agency MBS investors must then reinvest principal flows at lower market rates. Conversely, when mortgage rates increase, agency MBS durations extend as prepayment activity slows. The movement of mortgage rates will be influenced by a number of different macroeconomic factors, such as the general level of economic activity, inflation expectations and the willingness of lenders to extend credit.
- **Housing market outlook:** Home prices will be influenced by the economic backdrop as well as supply and demand factors, such as the availability of homes for sale, population growth trends, rents and the ability to finance the purchase of a house. Rising home prices increase borrowers' equity and supports housing turnover and cash-out (equity extraction) activity. This in turn will support economic growth through multiplier effects.
- **Ability to borrow:** The availability of credit drives new loan trends. The willingness of originators (banks, brokers and non-bank lenders) to underwrite mortgages is influenced by the regulatory environment and borrowers' eligibility factors such as credit scores, loan types and home equity position (loan-to-value).
- **Government policies:** The prepayment landscape and the supply/demand technical of agency MBS are often impacted by changes in government policies. After 2008, government sponsored programs were targeted at borrowers with negative home equity, while lenders' underwriting standards tightened. These policy initiatives significantly impacted borrowers' prepayment activity. On the demand side, Basel bank regulation and the US Federal Reserve's asset purchase program supported agency MBS and reduced price volatility.

Exhibit 2 illustrates the historical trends of the key macro factors impacting agency MBS. Low mortgage rates contributed to the recovery in home prices, while conservative mortgage lending improved the credit fundamentals of agency MBS, constrained refinancing and purchase activity, and limited supply.

Exhibit 2: Agency MBS key macro factors



Source: Mortgage Bankers Association, S&P Core Logic

Qualitative views around the base case outlook for prepayment risk are generated through daily interactions and influenced by formal discussions within the broader fixed income team. The ARMBS team participates in weekly global multi-sector meetings, monthly macro meetings focused on risk management and relative value, and quarterly strategic forums. This process is complemented by quantitative tools such as scorecards, which systematically measure the drivers of rates markets and the risk/reward of spread sectors. The outcome of this analysis is to form a holistic view on the direction of interest rates and, key to this strategy, a view on prepayment activity and how the team may best construct and risk manage the core portfolio.

Fundamental research

Fundamental research involves the bottom-up analysis of underlying borrowers' prepayment sensitivity. This analysis is conducted across the full agency MBS investible universe and is detailed below.

Agency MBS pass through

The agency MBS market's depth and breadth is un-paralleled with over one million securities available across the universe (agency MBS specified pools, TBAs and CMOs).

We conduct in-depth fundamental research to determine the investible universe for core portfolio construction.

Our analysis focuses on the underlying loan characteristics such as the borrowers' mortgage rate, loan size, time since issuance (loan age or seasoning, which is measured in months), credit score, loan-to-value position, geographic and servicer distributions.

An example of various 4% coupon agency MBS pools is shown in exhibit 3 along with details of the various features analysed. While the seasoning (WALA) and coupon of the three pools is similar, differences in loan size (WAOLA) and credit quality (WAOCS) lead to different prepayment outcomes (12m CPR).

Exhibit 3: Underlying loan characteristics drive prepayment behaviour

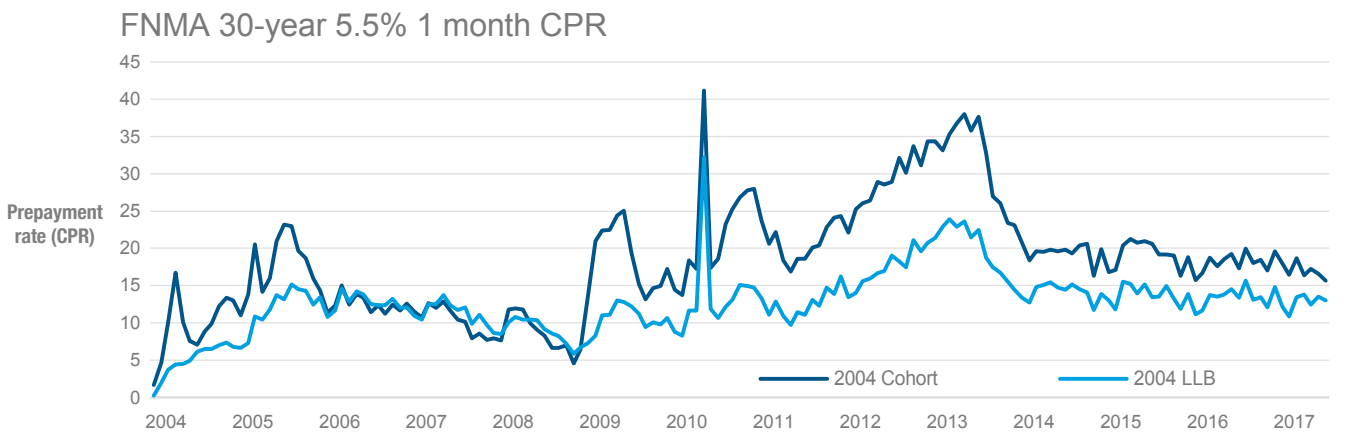
AGENCY	SECURITY (POOL #)	TERM	COUPON	WAC	WALA	WAOLS	MAXLS	WAOCS	LTV	12M CPR
Freddie Mac	FG (V82069)	30-yr	4%	4.47	22	326,434	980,000	729	79	16
Freddie Mac	FG (G60344)	30-yr	4%	4.39	25	132,733	150,000	731	78	12
Ginnie Mae	GN (AM9018)	30-yr	4%	4.55	25	187,204	382,771	692	96	22

Source: Bloomberg

- Term = loan term
- WAC = weighted average coupon
- WALA = weighted average loan age
- WAOLS = weighted average original loan size
- MAXLS = maximum loan size
- WAOCS = weighted average original credit score, FICO
- LTV = loan-to-value
- CPR = conditional prepayment rate over last 12 months

Borrowers' prepayment sensitivity is analysed in the context of loan attributes relative to cohort behaviour. Exhibit 4 illustrates the historical prepayment rates of similar vintage (seasoning) Fannie Mae 30-year issued mortgages with a 5.5% coupon with the cohort representing all loan attributes grouped together, while the low loan balance (LLB) represents only lower loan balances with a maximum loan size of $US85,000 in the distribution of underlying borrowers. Since issuance, the lower loan size group displayed a lower prepayment sensitivity relative to the cohort level.

Exhibit 4: Prepayment rate history



Source: JP Morgan

Collateral Mortgage Obligations (CMO)

Agency CMOs are constructed from agency MBS pools by redistributing the principal and interest cash flows into various tranches. These tranches can have customised 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. In general CMO's offer enhanced yield over agency MBS to compensate for their lower liquidity profile and their customised prepayment profile. Currently, the agency CMO market size is more than $US1 trillion, with annual issuance averaging approximately $US290 billion over the last 3 years.[3]

Security structure is a key consideration in determining the investible universe for CMOs and below is a sample of different structures available:

In the basic sequential CMO structure (structure 1 in exhibit 5), 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 last cash flow (LCF) tranche receiving principal last. The underlying collateral prepayment performance drives the variability of each tranche and the length of principal lockout.

LCF tranches, which typically trade at a discount (to compensate for the fact they are lower down in the CMO structure) offer attractive total return if prepayments increase and the length of principal lockout shortens. This is because the investor is holding a security priced below 100 and they benefit if par valued principal is returned sooner and prior deal tranches are retired faster, which occurs when prepayments increase as rates fall.

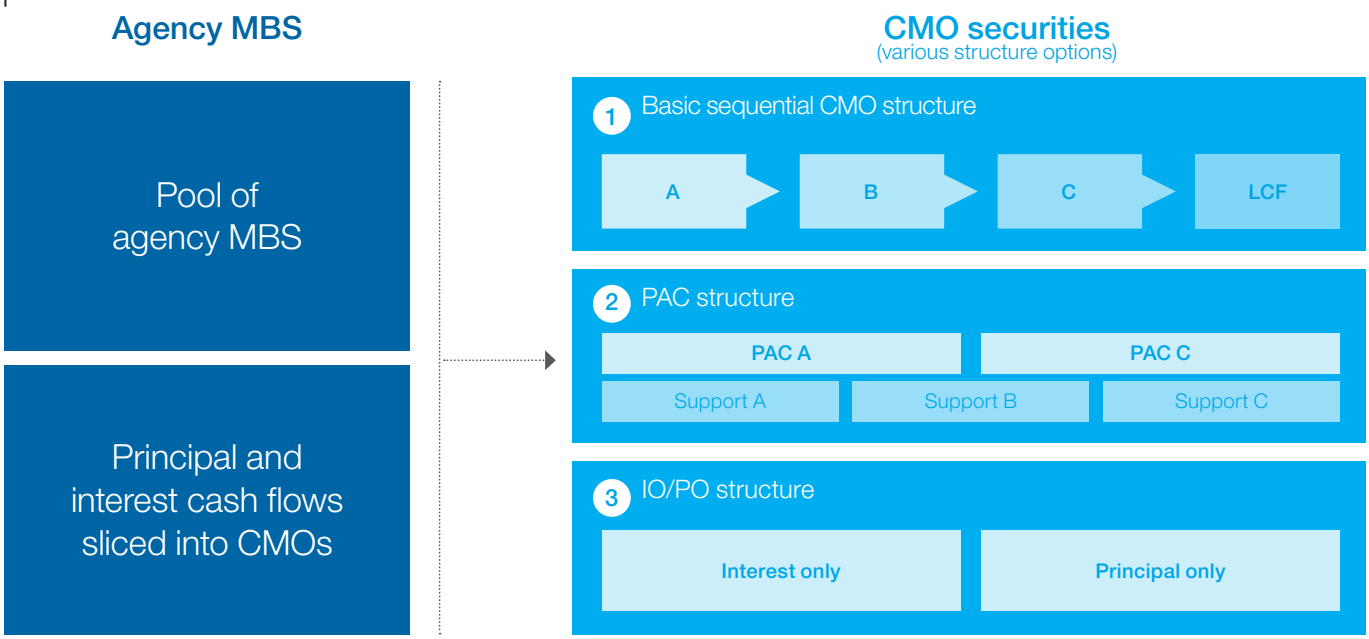
The planned amortisation class (PAC) structure (structure 2 in exhibit 5) is designed to create a stable set of bonds by directing the prepayment risk of the underlying collateral to other bonds in the structure, which are referred to as support bonds.

Interest only (IO) and principal only (PO) structures (see structure 3 in exhibit 5) 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.

IOs benefit from rising interest rates, which drive prepayments down. As principal remains outstanding for a longer period of time, additional interest payments are made to holders of IOs. The impact of additional future interest payments is much greater than that of higher discount rates. As a result, higher interest rates lead to higher bond prices (and vice versa), a characteristic that gives IOs negative duration.

3 Securities Industry and Financial Markets Association, as of December 2017.

Exhibit 5: From agency MBS to agency CMO



Security selection

Security selection is key to the performance consistency of ARMBS. The process encompasses the team's top-down macro factor views and fundamental research of individual securities as described above. We focus on securities that have the potential to deliver optimal risk-adjusted returns in the context of our views on prepayment risk, seeking securities with less variable prepayment outcomes (more predictable cash flows) to maximise yield per unit of duration, while maintaining portfolio diversification.

Core positioning is relatively stable with material shifts generally occurring only when the macro outlook changes. The consistency of returns is achieved through the flexibility of our approach – altering the structure of the core portfolio through the market cycle, while using overlay techniques for tactical risk management.

Typically, the core portfolio will include:

- **Higher coupon seasoned agency MBS pools**
  The time passed since purchasing a house and taking out a loan is a key consideration. Initially, after purchasing or refinancing, relocation costs and mortgage underwriting constrains prepayments. As the loan seasons, housing turnover picks up. If rates decrease, refinancing activity will also increase. However, as time passes certain agency MBS pools may have been exposed to multiple refinance opportunities, and borrowers that remain outstanding exhibit selection biases. More prepayment sensitive borrowers will take advantage of lower rates, while less reactive borrowers continue to amortise the original loan. As a result, the prepayment propensity of more seasoned borrowers becomes more predictable. This is illustrated in exhibit 6 where we compare two Freddie Mac (FGLMC) securities with a 5.5% coupon – one with a longer loan age of 159 months versus a less seasoned one with a loan age of 99 months. The more seasoned security had a lower prepayment rate (CPR) and a higher average annualised return.

Exhibit 6: More seasoned securities have had more predictable prepayments

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

Source: Bloomberg & Barclays. Returns and statistics calculated from 31-Dec-15 to 31-Dec-16. **Past performance is not a guarantee of future results.**
^The conditional prepayment rate is the loan prepayment rate equal to the portion of the principal paid off prematurely in each period.

- **Smaller loan size pools**
  Borrowers with smaller loan sizes will have less payment savings from a lower mortgage rate relative to borrowers with larger loans. For this reason, the prepayment sensitivity of smaller loan size pools, especially those with a maximum loan size cap, is more predictable. This is illustrated in exhibit 7 whereby the Freddie Mac (FGLMC) security with a 4% coupon and a maximum loan size of $US150,000 has a lower prepayment rate and a higher average annualised return than the equivalent 4% security with an average loan size of $US246,000.

Exhibit 7: Securities with smaller loan sizes have had more predictable prepayments

AGENCY	SECURITY	LOAN SIZE	CONDITIONAL PREPAYMENT RATE^ (AVERAGE)	ANNUALISED RETURN
Freddie Mac	FGLMC 30-years 4% coupon	$246,000 Average	19	1.69%
Freddie Mac	**FGLMC 30-years 4% coupon (pool # G60344)**	**$150,000 Maximum**	**9**	**2.45%**

Source: Bloomberg & Barclays. Returns and statistics calculated from 31-Dec-15 to 31-Dec-16. **Past performance is not a guarantee of future results.**
^The conditional prepayment rate is the loan prepayment rate equal to the portion of the principal paid off prematurely in each period.

- **CMO combinations**
  CMOs with offsetting exposures can be used to enhance yield relative to agency MBS specified pools. For example, we typically employ the following barbell strategy whereby we combine interest only securities with last cash flow securities.
  - IOs which represent the interest portion of the agency MBS cash flows can benefit when rates rise and prepayments slow. This is because IO's only receive interest when principal is outstanding and if prepayments slow owners of the security receive interest for a longer period of time.
  - Conversely, LCFs which are the last tranche to receive principal in a basic sequential CMO structure can benefit if rates decrease and prepayments increase. This is because LCF's typically trade at a discount (<100) and benefit when principal / par value is returned sooner.

Combining different mixes of IO and LCF bonds can facilitate better yield per unit of duration outcomes as illustrated in exhibit 8.

Exhibit 8: IO and LCF combination vs. agency MBS pool

STRUCTURE TYPE	AGENCY	SECURTIY	PAR AMOUNT	PRICE	MV ($)	DURATION	YIELD
Pool	**Fannie Mae**	**FN BM1121**	**96**	**104-02**	**100**	**5.2**	**2.87**
CMO combo		**LCF+IO**	**341**		**100**	**5.2**	**3.20**
LCF	Ginnie Mae	GNR 16-83 AB	60	97-20	58	10.8	3.17
IO	Freddie Mac	FHR 4612 PI	281	14-25	42	-2.8	3.24

Source: Yield Book. Projected yields as of 8/25/17, assuming gradual rate shocks over a 12-months horizon.

Focusing on collateral attributes is particularly important in CMO security selection. Exhibit 9 shows the borrowers' attributes of the securities used in the example above. The LCF tranche is backed by higher loan sizes, which are more likely to experience higher prepayment sensitivity, improving the total return outcomes of a discount security. Conversely, the IO security is backed by lower loan size collateral, which is less reactive to prepayments.

Exhibit 9: Collateral attributes in CMO security selection

STRUCTURE TYPE	AGENCY	SECURTIY	COUPON	WAC	WALA	WAOLS	MAXLS
Pool	Fannie Mae	FN BM1121	3.5%	4.04	12	123,663	150,000
LCF	Ginnie Mae	GNR 16-83 AB	3.0%	3.43	15	573,300	1,744,500
IO	Freddie Mac	FHR 4612 PI	3.5%	4.04	20	99,100	110,000

Source: Bloomberg
WAC (weighted average coupon), WALA (weighted average loan age), WAOLS (weighted average original loan size), MAXLS (maximum loan size)

Diversification is a key component of core portfolio construction. Typically, we will hold between 200-300 securities. This approach requires constant monitoring of prepayment performance.

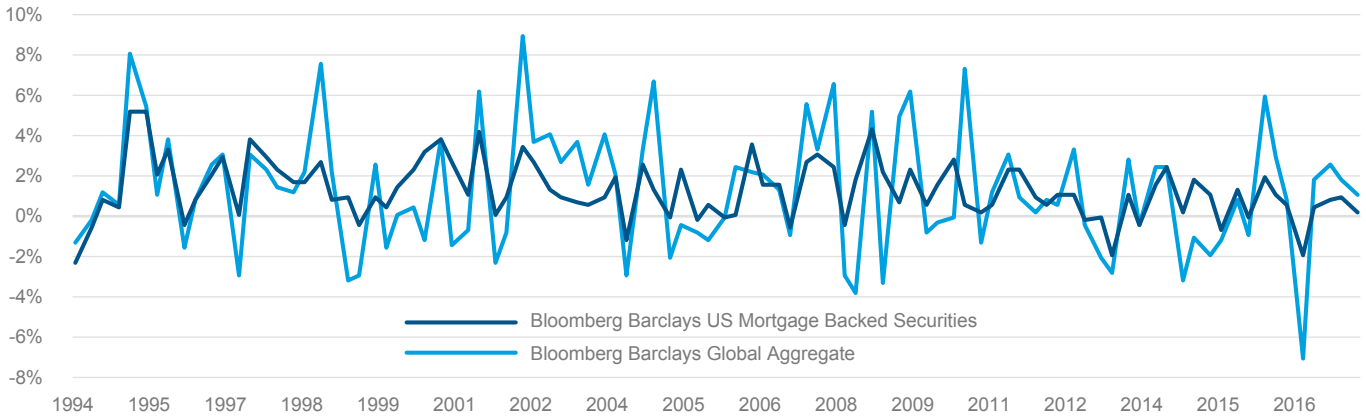
Duration management

The ARMBS duration range is 0-6 years, which provides flexibility for hedging (principal protection) and extracting incremental alpha from tactical opportunities.

The reason we opted for a long-only duration approach, as opposed to negative duration, is rooted in the general consistency of agency MBS returns (exhibit 10) and their correlation with equities (exhibit 11).

Allowing negative duration with the hope of improving returns during periods of strong equity performance is not supported by historical correlations, and introduces a timing element and the possibility of negative returns due to the impact of negative carry.

Exhibit 10: Quarterly returns — US agency MBS vs. Global Aggregate



	US AGENCY MBS	GLOBAL AGGREGATE
Number of negative quarters	17	39
Average number of negative quarters	-0.69%	-1.73%
Worst quarter	-2.32%	-7.07%

Exhibit 11: Agency MBS correlation to S&P® 500

	PERIOD	CORRELATION
Historical	1994-2017	0.00
Last 10 years	2007-2017	-0.12
Equity stress	2000-2002	-0.21
Equity stress	2007-2008	-0.02
Months when S&P 500 return > 3%	1994-2017	-0.03
Months when S&P 500 return > 5%	1994-2017	0.27
Months when S&P 500 return < -3%	1994-2017	-0.04
Months when S&P 500 return < -5%	1994-2017	0.00

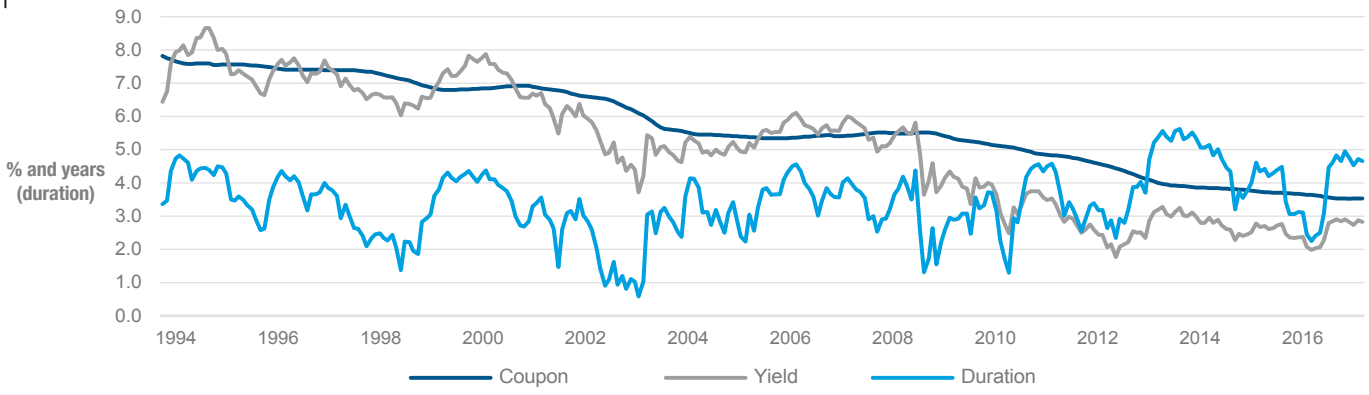
Source: Bloomberg and Barclays monthly index data from 1994-2017.

The upper bound of our duration is constructed in the context of the historical yield of agency MBS, with the objective of balancing yield, a key component of fixed income returns over longer horizons, and duration risk, the shorter-term driver of price volatility. We believe an absolute return strategy should focus on allowing limited interest rate risk flexibility above the yield potential of the investing universe.

Exhibit 12 shows the history of coupon, yield and duration of the agency MBS market since 1994. Over this time frame, the coupon and yield averaged 5.7% and 5.1%, respectively. Based on the balance concept between yield and duration, we opted for a maximum duration limit of 6 years to maintain a favourable risk/reward outcome.

However, from a capital preservation perspective, when there is a lower yield environment, we would bias ARMBS to have a maximum interest rate exposure of around 4 years to realign duration risk with 3-4% yields.

Exhibit 12: History of coupon, yield and duration for US agency MBS



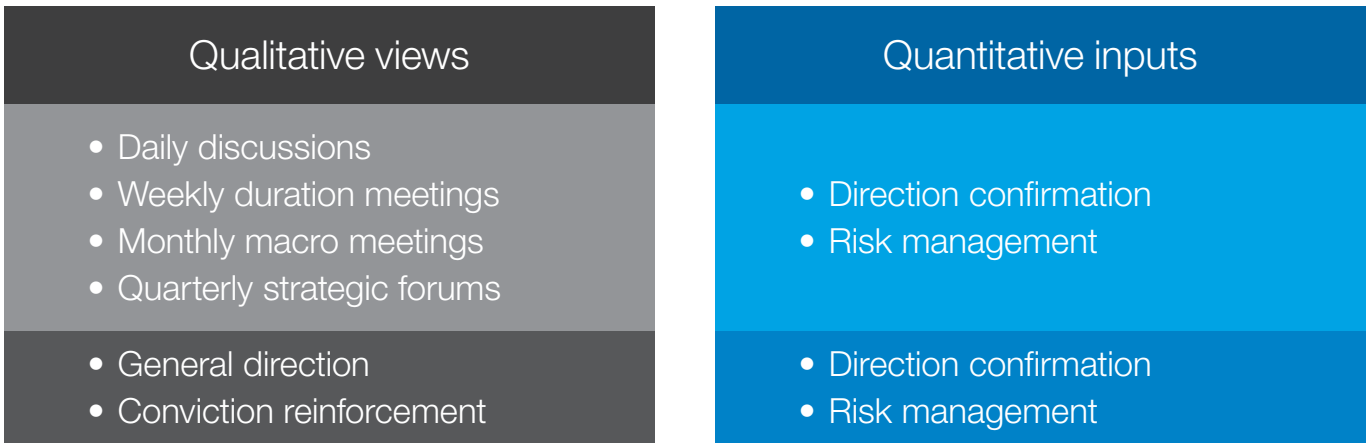
Source: Bloomberg and Barclays monthly index data from 1994-2017.

Duration process

The ARMBS duration process focuses on confirming the investment team's qualitative views with quantitative and technical inputs as illustrated in exhibit 13. This confirmation seeking process re-enforces the conviction level with respect to the acceptable level of interest rate exposure.

Assessing the desired level of interest rate exposure and the horizon of that expectation has implications not only for hedging (principal protection) and tactical alpha, but also for the construction of the core portfolio given a longer-term outlook.

Exhibit 13: The duration management process



The ARMBS portfolio managers are integrated within the global investment strategy framework and their qualitative views are influenced by discussions on market themes with the broader fixed income team. The dynamic information flow and team approach is supplemented by quantitative tools, focused on scoring fundamental and technical drivers of global interest rates. The scoring process is systematic and independent of the team's qualitative views, providing a key consideration for risk management.

Specific to the duration process of ARMBS, the portfolio managers rely on the quantitative inputs generated by the duration scorecard.

The scorecard tracks various fundamental, technical, and thematic indicators, which are scored 1, 0, or -1 with respect to interest rate direction. The total score tallies the scores of all the inputs as illustrated in exhibit 14. An overview of each input is below:

- **Fundamental analysis:** The fundamental analysis score is derived from the scores of the "Economic components", which are equally weighted. The selection of economic indicators from the myriad of public releases was focused on those considered forward looking and global in nature. For example, the labour trigger is constructed from a combination of the trend in jobless claims and a normalised measure of the employment components provided by the Institute for Supply Management (ISM), which assigns a 0.8 weight to employment in services, and a 0.2 weight to employment in manufacturing. The scores on ISM new orders, global manufacturing PMI, and the NFIB small business optimism survey are calculated as a combination of the directional change over the last month, 2 months and 3 months.
- **Technical analysis:** The technical analysis score is generated from the directional momentum indicator (DMI) provided by Bloomberg for on-the-run 10-year Treasury notes. In the case of yields, if the positive directional indicator (DMI+) is greater than the negative directional indicator (DMI-), and the momentum strength is significant, then yields are trending higher and the technical score would be negative.
- **Positioning:** Positioning imbalances are considered as contrarian indicators. We extract this signal from the daily 10-year Treasury dollar-weighted put/call ratio. Traditional (unweighted) ratios simply compare the total number of puts and calls from daily open interest statistics. The enhanced version weights the number of calls and puts for each strike and expiry by the settlement price, hence comparing the total dollar value of outstanding contracts. We normalise this measure and only consider imbalances that exceed +/-1.5 standard deviations.
- **Thematic analysis:** The fair value model was developed by our quantitative research team. The level of 10-year rates is forecasted from the trend in PMIs, consumer confidence, and the unemployment rate. If the fair value yield is greater than the actual yield, the score would be negative.

Exhibit 14: US duration scorecard

	FUNDAMENTAL ANALYSIS	TECHNICAL ANALYSIS	POSITIONING	THEMATIC ANALYSIS
Factors considered	Economic Labour *ISM new orders* *Global manufacturing* *Small business survey*	Technical analysis	Weighted put / call	Fair-value model *Fair-value yield* *Current 10 year yield* *Qualitative input*
Range	-1 to +1	-1 to +1	-1 to +1	-1 to +1

Exhibit 15: Exhibit duration scores and yields

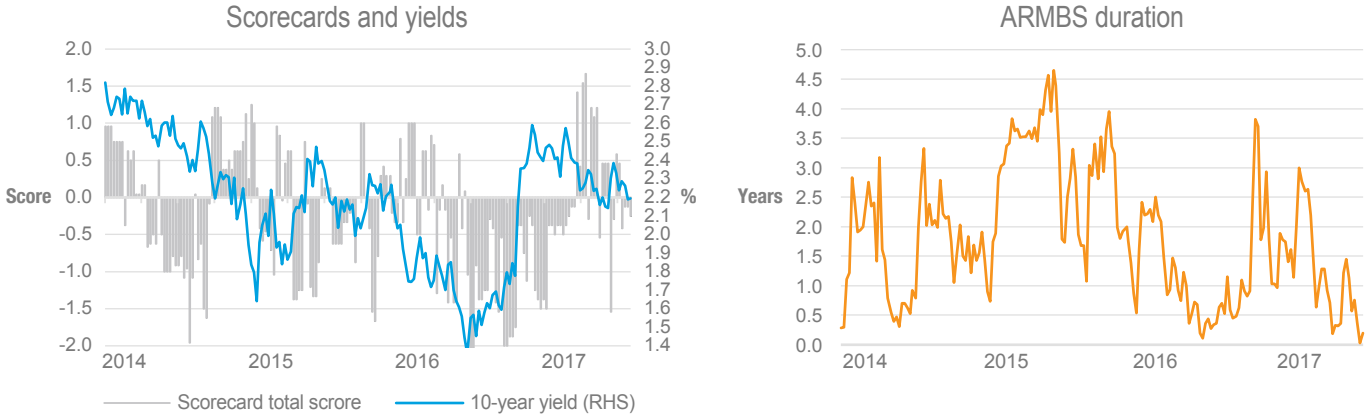


Exhibit 15 illustrates the historical scorecard output, the direction of interest rates and the duration management of ARMBS. Exhibit 16 below is an example of duration positioning (from January 2014 to mid-2017).

Exhibit 16: Duration scorecard and ARMBS

TIMEFRAME	DURATION POSITIONING
2014	Early in Q1, economic activity was negatively impacted by the weather, which was confirmed by the scorecard. During the period, the ARMBS duration was increased to about 3 years. By April/May, economic activity data rebounded relative to expectations, while the scores diminished and moved to negative, confirming the team's view to reduce interest rate exposure. By June, as commodity prices came under pressure, duration exposure was increased. The scorecard initially remained negative and scores turned positive into the autumn.
2015	In early 2015, as commodities stabilised and scores diminished, the team reduced interest rate exposure. However, economic and inflation fundamentals remained weak, while commodity prices came under pressure again. By March 2015, the scores confirmed this view but turned negative between May and June. For this reason, the team focused on increasing duration on price weakness and held that view through the summer. During the autumn of 2015, the selloff in commodities continued and economic activity deteriorated relative to expectations. By mid-October, scores turned positive and duration was increased again.
2016	The team remained tactical through the first quarter of 2016, while maintaining a conservative approach to interest rate exposure between 0.5-2.5 years as rates moved below 2%. Between April and July, including the Brexit rates rally, the scorecard did not confirm the move lower in rates with scores remaining negative. Economic activity was better than expectations, while commodity prices were stable. During this period the team was focused on reducing duration exposure and remained defensively positioned into the US election. After the election and into the year-end rates selloff, the scorecard remained negative but the team's view was that market positioning and expectations were extreme. Over the same time frame, agency MBS experienced significant duration extension.

TIMEFRAME	DURATION POSITIONING
2017	December 2016 and during Q12017, the team started increasing duration exposure, as economic data was weaker than expected, a view also confirmed by the scorecard output in April, which further increased the conviction level. Into the summer, economic data stabilised and the scorecard turned negative in June. As a result, the team focused on reducing interest rate exposure.
Over the time horizon described above, interest rate management was tactical in nature and the implementation was done through overlay strategies, generally by increasing or decreasing Treasury hedges.	

Overlay strategies

Overlay strategies offer a significant opportunity set for both hedging and incremental value. The flexibility of our approach which combines core portfolio construction with overlays allows the team to focus on security selection and yield maximisation in the core portfolio, while using the liquidity advantage of Treasury futures and forward settling To-Be-Announced (TBA) agency MBS to risk manage during periods of stress and to enhance returns through tactical trading.

For hedging purposes, the choice between using Treasury futures or TBAs will depend on the market environment. In general, Treasury futures are used as they protect the yield advantage of the core portfolio's agency MBS holdings and have a high correlation with agency MBS (~90%). However, during certain prepayment stress scenarios, TBA hedges can be more effective.

The tactical component of the overlay involves relative value trading between the following:

- Agency MBS (physical and TBAs) and US Treasuries which is known as **basis trading**
- Agency MBS and agency MBS which is known as coupon **swap trading**

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 similar loans.

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 standardised TBA contracts.

Basis trading

The agency MBS relative value process is used holistically, both to support the team's strategic conviction regarding overall agency MBS exposure, acting as an unbiased check for risk management, but also to drive tactical basis trading decisions. In addition to the duration scorecard, which was discussed above, the team developed the agency MBS scorecard process to systematically measure the risk/reward of agency MBS relative to Treasuries and supplement decision-making.

Similar to the duration scorecard process, the agency MBS sector scorecard combines valuations, fundamental and technical indicators as shown in exhibit 17 (see appendix 1 for more details). For example, if scores are positive and increasing, we may consider tactically adding agency MBS versus Treasuries (as an overlay), but more importantly, if we are inclined to reduce the duration of the core portfolio, we would be more focused on using Treasury futures for hedging.

Exhibit 17: Agency MBS scorecard indicators

	VALUATIONS	FUNDAMENTAL ANALYSIS	TECHNICAL ANALYSIS
Factors considered	Nominal spreads Residual of adjusted nominal spreads Option adjusted spreads	Refinancing risk Convexity risk Volatility risk	Spread momentum Qualitative supply / demand
Range	-1 to +1	-1 to +1	-1 to +1

Valuation scores include various spread metrics (equally weighted):

- **Nominal spread:** The yield difference between the current (par or production) coupon agency MBS and an equal blend of 5-year and 10-year Treasury yields.
- **Residual of adjusted nominal spreads:** Regression based analysis of nominal spreads estimated from valuation drivers such as level of rates, volatility and IG corporate spreads.
- **Option adjusted spreads (OAS):** The Treasury OAS derived by the Bloomberg Barclays model.

Fundamental analysis scores track the key risk drivers for agency MBS:

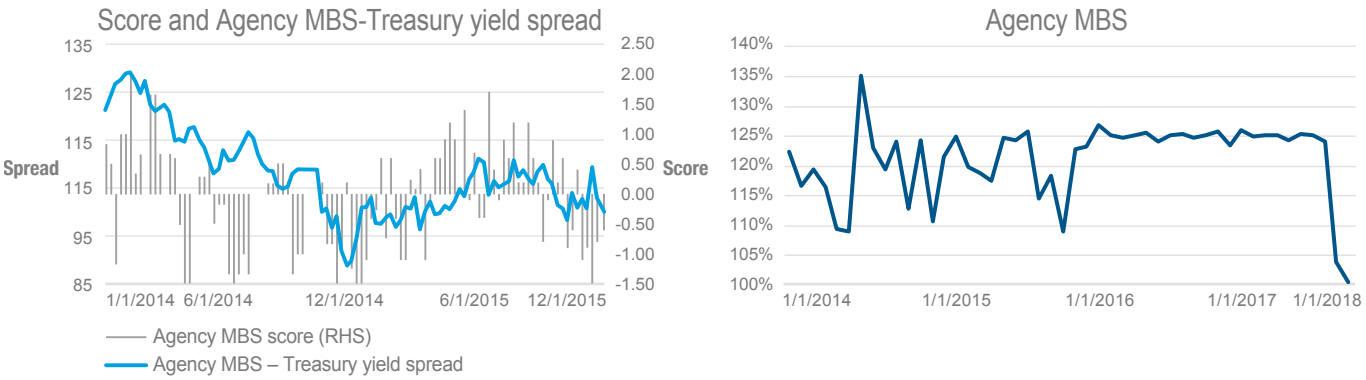
- **Refinancing risk:** The Mortgage Bankers Association Market Basic (MBAMB) index is comprised of both refinance and purchase application activity. When mortgage applications activity is greater than average levels, refinancing risk increases.
- **Convexity risk:** The US agency MBS index option-adjusted duration measures the extension and contraction potential of agency MBS and determines whether there is a negative convexity imbalance, which could impact agency MBS spreads.
- **Volatility risk:** The Merrill Lynch Option Volatility Estimate (MOVE) index is constructed from Treasury options implied volatilities. Historically, this measure has shown mean-reversion features. When interest rate volatility increases, the prepayment risk of agency MBS becomes more uncertain and spreads widen.

Technical analysis scores incorporate a spread momentum indicator and qualitative assessment of supply and demand:

- **Spread momentum:** The momentum trigger is constructed using a similar Directional Momentum Indicator (DMI) approach, similar to the duration scorecard described above.
- **Qualitative supply / demand:** This trigger represents our assessment of the market supply and demand technicals.

Exhibit 18 shows the agency MBS scorecard output, spread levels and the agency MBS exposure of ARMBS. Changes in agency MBS exposure may be outright increases or decreases, or offset with Treasury futures, depending on the team's views on interest rate direction and relative value considerations.

Exhibit 18: The agency MBS scorecard re-enforces qualitative views



Source: Bloomberg and Macquarie

Coupon swaps

The team uses TBAs for coupon swap trading and the tactical allocation is focused on the most liquid (highest trading volume) part of this market. For this reason, we restrict the opportunity set to 50–150 basis points relationships around the current coupon and only use the 30-year fixed rate sector issued by Fannie Mae (FNMA). For example, with mortgage rates around 4%, the opportunity set is composed of the 3%, 3.5%, 4% and 4.5% coupons (or the following pairs specifically: 3.5% vs. 3%, 4% vs 3.5%, 4.5% vs. 4%, 4.5% vs. 3.5%, 4% vs. 3%, and 4.5% vs. 3%).

As a result of this analysis, we either seek to avoid a particular coupon and favor another coupon, or we can go long one coupon and short another (pairs trading).

Our process does not rely on any single input when analysing relative value. Instead we take a multifaceted approach, as illustrated in exhibit 19 that incorporates various quantitative inputs to confirm our qualitative views and re-enforce the conviction level. The qualitative assessment includes an analysis of yields and durations across multiple prepayment scenarios, as well as any relevant supply/demand factors. Quantitative inputs include: empirical rich/cheap analysis, option-adjusted spread (OAS) relative value, and technical momentum (see appendix 2 for more details).

Exhibit 19: Framework for coupon swap analysis

Overlay risk management

Risk management is a key factor in absolute return strategies, such as Macquarie's ARMBS strategy. The objective of our risk management framework is to allow for the capture of incremental returns in a risk-controlled manner, whilst minimising the occurrence of negative outcomes. Our framework is developed around both the liquidity advantage of the asset class and in particular our choice of overlays – US Treasury futures and agency MBS TBAs.

TBAs offer the potential for leveraged exposure due to their forward settlement. As a result, TBA exposure is limited to 0-125% (net), which allows the ability to use some degree of implicit leverage through forward transactions, while maintaining a conservative risk-return tolerance.

The use of US Treasury futures allows us to risk manage the interest rate exposure of the portfolio. Our risk framework prevents the use of futures creating net short positions (the duration limit of ARMBS is 0-6 years), and adheres to our relevant regulatory and licensing obligations. As a result, the notional value of Treasury futures cannot exceed 100% of the strategy's liquidation value.

On tactical strategies, we implement the following framework (exhibit 20) to minimise losses and increase profitability.

Exhibit 20: Overlay risk management framework for tactical trading

We enter trading positions when the risk/reward ratio is in our favour, as confirmed by multiple inputs. The conviction level will be reflected in sizing decisions. Typically, 10-day moving average crosses (in the same direction as the trade) will be used as a consideration to increase the position size; while shorter time frames, such as 5-day moving averages will be used as trailing stops (when crossed in the opposite direction).

- Basis trades (agency MBS TBAs vs. Treasury futures) or coupon swaps will typically range between 10-30% notional.
- Sizing of tactical duration trades will typically be between 0.5-2 years of interest rate exposure.

Core portfolio and overlays interaction

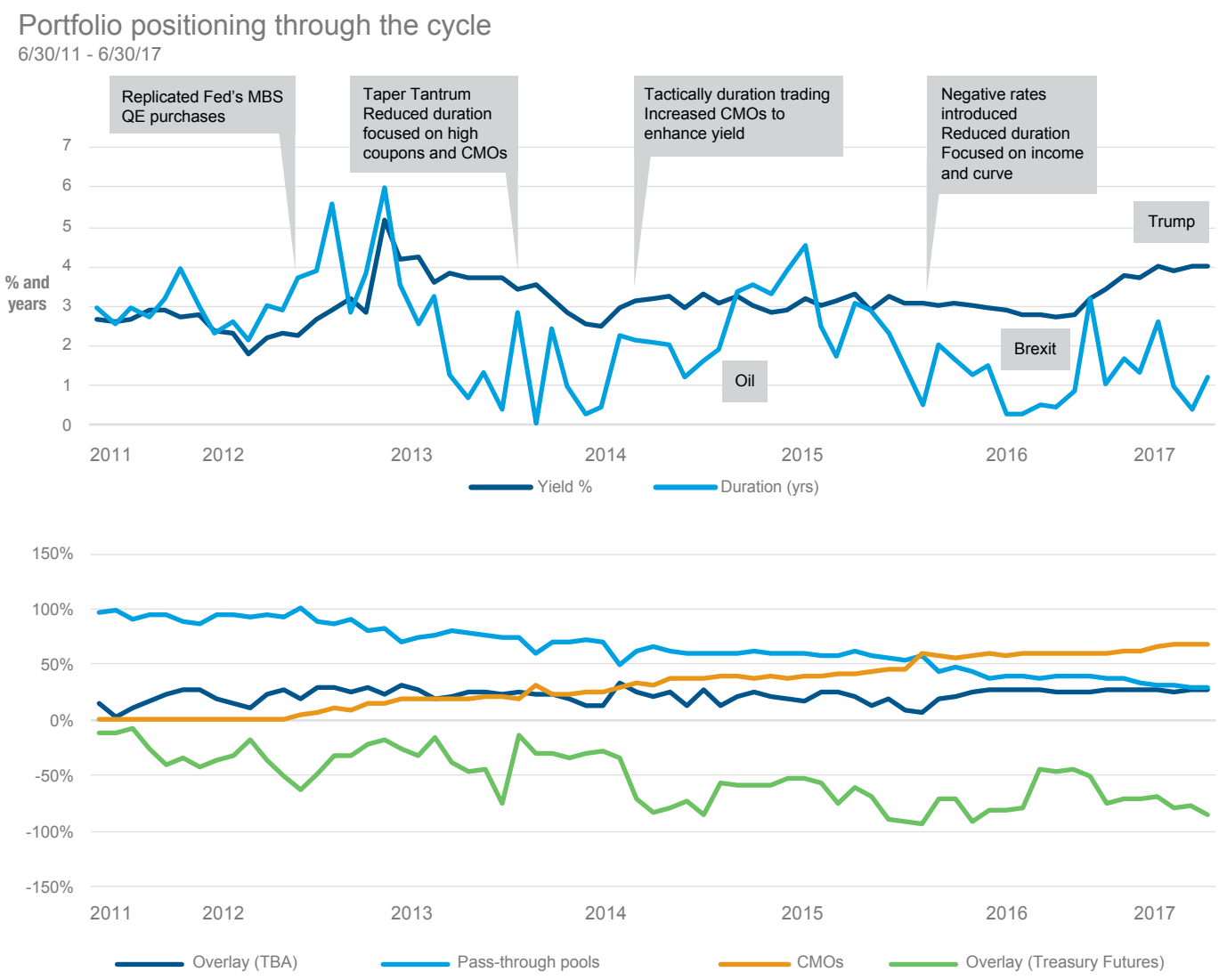
Exhibit 21 illustrates the interaction of the core portfolio and overlays, resulting in the overall portfolio positioning relative to its key performance metrics — yield and duration.

An example of positioning in the core portfolio was the increased allocation to CMOs, beginning in the second half of 2014, to enhance the yield level of the strategy. This allocation increased from 20% to about 50%, which raised the portfolio yield by roughly 60 basis points. The allocation to seasoned high coupon agency MBS pools was decreased from about 75% to 50%. The attractiveness of seasoned high coupons remains a key component of core portfolio construction as these cash flows have limited price sensitivity, given the predictability of prepayment behaviour of underlying borrowers. However, the team gravitated to a barbell approach to capture the yield advantage and portfolio diversification benefits of last cash flow CMOs and interest only securities.

On the duration side, over the same period, the team focused on Treasury futures to control the interest rate exposure of the portfolio.

The top panel highlights key market events over the historical time frame illustrated, and how positioning was changed. For example, during the 2013 Taper Tantrum episode, the team repositioned the core portfolio into higher coupon agency MBS and CMOs, while reducing interest rate volatility through Treasury future overlays.

Exhibit 21: Interaction of core portfolio and overlays



Risks to consider

The primary risk for mortgage-backed securities investments, and for the strategy, relates to prepayment risk.

US mortgage borrowers are permitted to repay their mortgage in full or in part at any time over the life of their loans.

The risks associated with prepayable bonds include:

- Challenges in developing and forecasting the cash flows for the security, due to the possible early redemption of the bond.
- Reinvestment risk. As rates decrease and bonds are prepaid, investors will not be able to invest their proceeds at the old rates and will have to use new, lower market rates to put their cash to work.

Conclusions

Investors are faced with numerous headwinds. Bond market yields are at historically low levels, which translates into lower income potential and higher volatility for fixed income investments. On the other hand, future equity returns could also be challenged as valuations further diverge from economic growth realities. Moreover, the global debt accumulation, unprecedented monetary policies and financial markets liquidity constraints create a backdrop where downside risk to asset prices is a legitimate concern. With this in mind, absolute return strategies may offer many potential advantages to risk-averse investors.

Our approach to fixed income absolute return focuses on agency MBS, an asset class with an attractive risk/reward profile, including:

- Government guarantee
- Scalable market with high liquidity
- Yield advantage over US Treasuries
- Diversification
- Downside protection with high risk-adjusted returns

Combining these features with an investment process focused on fundamental research and capital preservation has the potential to deliver consistent positive returns for investors in all interest rate environments. Our time tested track record supports this view.

The ARMBS investment approach is centred on core portfolio construction and optimal security selection, enhanced by active management and overlay strategies to provide principal protection and effective risk management in periods of stress.

ARMBS – A conservative, high quality and time-tested approach to absolute return fixed income investing

Appendix 1: Agency MBS scorecard

The Agency MBS scorecard combines three broad categories of indicators: valuations, fundamentals and technical factors.

Under the **valuation scores,** we track three different metrics (equally weighted):

- **Nominal spread:** The yield difference between the current (par or production) coupon agency MBS and an equal blend of 5-year and 10-year Treasury yields.
- **Residual of adjusted nominal spreads:** Regression based analysis of nominal spreads estimated from valuation drivers such as level of rates, volatility and IG corporate spreads.
- **Option adjusted spreads (OAS):** The Treasury OAS derived by the Bloomberg Barclays Model.

The scoring logic for valuation indicators is based on z-score bands. Averages and standard deviations are calculated from rolling 3-years of historical data. The score is:

- 1 (positive for agency MBS vs. US Treasuries) when the current spread is greater than the historical average +1.5 standard deviation;
- -1 when the current spread is less than the historical average -1.5 standard deviation;
- neutral otherwise.

When adjusting the nominal spread in the context of their valuation drivers, we used a regression approach to determine the fair value of nominal spreads based on the level of rates, volatility and investment grade corporate spreads. Predicted (fair value) spreads are estimated from rolling 3-years of historical data, while the shorter-term rich/cheap signal is constructed from 1-year of rolling residuals (actual – predicted values) and their z-score bands. A cheap signal (1) occurs when the residual is greater than the average residual +1.5 standard deviation. Conversely a rich signal (-1) would be generated when the residual is less than the average -1.5 standard deviation. Otherwise, the signal is zero (neutral).

For **fundamental scores**, we track several risk drivers for agency MBS:

- **Refinancing risk:** The Mortgage Bankers Association Market Basic (MBAMB) index is comprised of both refinance and purchase application activity. When the MBA index is greater than the historical average that generates a -1, otherwise the score is 1.
- **Convexity risk:** The US MBS index option-adjusted duration. If the duration of the index is greater than historical average +1 standard deviation, then the score is 1 (the convexity/extension profile is attractive). If the duration is below the average -1 standard deviation, then the score is -1; otherwise the score is 0.
- **Volatility risk:** The Merrill Lynch MOVE index is constructed from Treasury options implied volatilities. Historically, this measure has shown mean-reversion features. When interest rate volatility increases, the prepayment risk of MBS becomes more uncertain and spreads widen. The volatility risk trigger is constructed from a z-score perspective as well. If the MOVE index is above the historical average +1.5 standard deviation, then the score is 1 (volatility is likely to mean-revert). If the MOVE index is less than the historical average -1.5 standard deviation, then the score is -1; otherwise the score is 0.

Under **technicals**, the scorecard incorporates a spread momentum indicator and qualitative assessment of supply and demand.

- **Momentum trigger:** This is constructed using a similar DMI (directional momentum indicator) approach, similar to the duration scorecard. The qualitative supply/demand trigger represents our assessment of market technicals.
- **Qualitative supply / demand:** Other supply/demand considerations may influence this qualitative score such as when the team's views on these factors differ from consensus expectations.

Appendix 2: Coupon swaps / TBA quantitative inputs

Various quantitative inputs are considered when analysing tactical relative value in TBAs, which include: empirical analysis, option adjusted spread (OAS) relative value and technical momentum.

Empirical analysis involves forecasting a particular price spread relationship (price of TBA 1 – price of TBA 2) from fundamental factors that we believe affect its valuation. We model the price relationship as a function of:

1. Level of secondary market mortgage rate (market implied current coupon yield using Bloomberg MTGEFNCL index, as proxy for refinancing risk,
2. The implied carry difference between the two TBA securities (using the price drop between the front and back month prices, aka “dollar roll” differences).

Using linear regression we calculate a predicted value for the relationship and compare it versus the actual value. Signals are based on the residual and how dislocated that residual is versus a historical average, adjusted for the standard deviation of the relationship. Specifically, when the z-score of the residual is greater than 1, the higher coupon in the relationship is cheap versus the lower coupon and the model generates a buy signal for the higher coupon and a sell signal for the lower coupon. Once the dislocation normalises the reversal is triggered. The opposite trade signals are generated when the residual is less than -1. This is a value-oriented approach that assumes mean reversion.

OAS represent the market standard for analysing mortgages. Their calculation is model dependent and different vendors use different assumptions when building their models. Popular OAS providers are Yield Book, Bloomberg Barclays Live, JP Morgan, and Credit Suisse Locus. Generally, we believe OAS signals in isolation are a poor absolute valuation tool because different market participants may get different signals based on individual model assumptions. The back-tested P&L illustrates this point.

Technical analysis relies on the price momentum signal as encapsulating critical insight. Throughout our investment process, we rely on simple 10-day moving average crosses, as indicators of short-term trends. In the case of tactical TBA allocation, we implement the same philosophy.

The exhibit below illustrates the back-tested P&L over three years (2012-2014) of the methodology described above for FN3.5/3 pair (30-year FNMA 3% coupon versus FNMA 3.5% coupon) and FN4/3.5 pair. Other popular trading approaches are illustrated, namely z-score triggers based on OAS spreads for the same coupons, and technical momentum models based on the cross of the 10-day moving average.

Tactical coupon selection model P&L statistics (bps performance)

MODEL	A	B	C	D	E	F	G	H
Good	28	34	24	36	20	20	35	39
Bad	22	11	30	26	12	20	91	90
Total	20	45	54	62	32	40	126	129
Neutral	698	703	694	686	716	708	622	619
#Trades/month	1	1	1	2	1	1	3	3
Hit rate	1.27	3.09	0.80	1.38	1.67	1.00	0.38	0.43
% good	56%	76%	44%	58%	63%	50%	28%	30%
Total P&L	3.08	3.62	0.83	0.15	1.65	-0.43	-0.78	1.09
2012	1.89	1.31	-0.52	-0.79	0.21	-0.55	-1.70	-1.31
2013	0.77	1.41	0.51	0.95	0.79	1.29	1.16	2.03
2014	0.42	0.00	0.85	-0.01	0.64	-1.17	-0.24	0.36
Average/year	1.03	1.21	0.28	0.05	0.55	-0.14	-0.26	0.36

Source: Bloomberg, JP Morgan and Macquarie

P&L bps calculated from closing prices on each pair (price return %= exit/entry-1)

Model description

A FN3.5/3 price regression. Rich/cheap based on +/-1 z-score rules
B FN4/3.5 price regression. Rich/cheap based on +/-1 z-score rules
C FN3.5/3 OAS spread. Rich/cheap based on 30 day rolling windows with +/-1.5 z-score rule
D FN4/3.5 OAS spread. Rich/cheap based on 30 day rolling windows with +/-1.5 z-score rule
E FN3.5/3 OAS spread. Rich/cheap based on 60 day rolling windows with +/-1.5 z-score rule
F FN4/3.5 OAS spread. Rich/cheap based on 60 day rolling windows with +/-1.5 z-score rule
G FN3.5/3 technical model based on cross of 10 day MA
H FN4/3.5 technical model based on cross of 10 day MA

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

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.

The Mortgage Bankers Association Market Basic Index is a report from the Mortgage Bankers Association (MBA) which analyzes data from Ellie Mae's AllRegs® Market Clarity® business information tool.

The Merrill Lynch Option Volatility Estimate Index is a yield curve weighted index of the normalised implied volatility on 1-month Treasury options .

The Bloomberg MTGEFNCL 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.

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

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