Milliman Mortgage Secondary Market Solutions

Introduction to mortgage pipeline hedging

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Introduction

Milliman's Mortgage Secondary Market Solutions (MS2) is a cloud-based software solution that allows mortgage originators and investors to calculate effective hedging strategies for mortgage pipeline risk and mortgage servicing rights. The software includes state-of-the-art models, data management, and trade management to evaluate pipeline exposure to market changes and calculate optimal hedge positions.

This white paper introduces the secondary markets function for mortgage companies and provides an overview of pipeline risk inclusive of pull-through risk. It also demonstrates how hedging mitigates price risks consistent with selling loans forward. (Please also see our related paper, "Introduction to Mortgage Pipeline Hedging: Hedging with TBAs," (to-be-announced securities) available at https://www.milliman.com/en/insight/mortgage-secondary-pipeline-hedging-tbas.)

Secondary markets function

The primary responsibility of a mortgage company's Secondary Markets department is to manage the financial risk inherent in originating, selling, and servicing mortgages and to preserve the capital of the mortgage company. These responsibilities include loan pricing, hedging, executing loan sales, and managing mortgage servicing rights. For hedging, Secondary Markets executes trades (i.e., hedges) where the value of the hedged asset appreciates (depreciates) when the value of the mortgage asset depreciates (appreciates). These hedges protect the mortgage company's capital from price fluctuations in financial markets. There are different approaches to hedging this risk, and the type of hedging strategy depends on several factors, including liquidity, cost, market conditions, and management strategy.

The mortgage pipeline

One critical risk that Secondary Markets manages is pipeline risk. For mortgage originators, the "pipeline" refers to the inventory of mortgage applications inclusive of the initial application, approval, funding, and ultimately the sale of the mortgage to an investor. Upon receiving a mortgage application, the lender will review the credit worthiness of the borrower and loan application to decide whether to approve the application.[1] If the application is approved, the lender will provide the borrower with terms for a mortgage (e.g., interest rate, amortization schedule), which are valid for a set number of days (e.g., 60 days). If the borrower accepts the terms, the lender will lock the interest rate for the borrower.

1. Often, loans are approved if they meet the underwriting requirements of Freddie Mac, Fannie Mae, or the requirements for mortgages sold in Ginnie Mae securities (i.e., FHA, VA, and USDA mortgages).

Once a loan is locked, the borrower has an option to borrow funds from the lender over the lock period. However, the borrower may not borrow the funds for several reasons. For example, the transaction may fall through following the property inspection, the borrower may get a lower interest rate from a different lender, or interest rates may decline from the time of the lock to the time of funding. Therefore, the lender faces uncertainty regarding how many locks will "pull through" to a funded mortgage. The lender reviews historical pull-through rates and develops models to estimate the probability that a lock will result in a funded loan. The lender's models could over- or underestimate the actual volume of locks that result in funded loans, and differences between how many locks pull through versus how many locks the lender expects to pull through will impact the profitability of the mortgage company. This risk is known as pull-through risk in the industry.

Pull-through risk

This section first discusses pull-through risk and how differences between actual and expected pull-through rates impact the mortgage lender's margin. For demonstration purposes, we first assume that the lender is selling all loans forward through TBAs. We then show how these same economics can be replicated by hedging the pipeline risk without selling loans forward.

To demonstrate why pull-through rates can be a risk to a lender, let us assume a lender pools their mortgage pipeline and sells loans forward through the TBA market. The TBA market allows investors to buy unknown pools of mortgages in advance of their origination on the condition that the mortgages are all of the same mortgage type (i.e., government or universal mortgage-backed security [MBS]), tenor (e.g., 30-year mortgages), and security coupon rate (e.g., 5.0% or 5.5%). Selling forward into TBAs provides the lender with price certainty at the time of sale. TBA delivery requires a specified amount of loans at a specified date (which is a risk to the lender), but it provides the lender with price certainty. Note, the lender may accurately estimate pull-through rates but be off on the timing of when loans close. Therefore, uncertainty exists with respect to the volume of TBAs to sell, and risks are associated with over- or underestimating actual closed loan volume.

Figure 1 is a representative example highlighting the risk of over- or underestimating closed loan volume, assuming the lender is selling all mortgages forward in TBAs. In this example, assume there were $100 million mortgage locks with the same net coupon that can be delivered to the TBA market. The lender estimates 90% of the locks will fund and therefore sells $90 million of TBAs at par (note, in practice, loans may be sold above par to cover the lender's fees and margins; for demonstrative purposes, we will assume the sale is at par in this example).

FIGURE 1: PULL-THROUGH RISK DEMONSTRATION ($ MILLIONS)

SCENARIO	MORTGAGE LOCKS A	ESTIMATED PULL-THROUGH B	ACTUAL PULL-THROUGH C	LOANS SOLD FORWARD IN TBA D	VOLUME MISMATCH E = D − C
Interest rates rise	$100	$90	$95	$90	$5
No movement in rates	$100	$90	$90	$90	$0
Interest rates fall	$100	$90	$85	$90	($5)

The first row provides a scenario where interest rates rise. If interest rates rise, the borrower is more likely to close the loan and not shop around for a better offer; in addition, the borrower has a greater incentive to close (because the rate could increase in the future). Therefore, the lender might underestimate the pull-through rate during a rising interest rate scenario; in this example, we assume the actual pull-through rate is 95% (up from 90% in our baseline scenario). This results in $5 million in mortgages that will have to be funded and sold upon closing. If interest rates rise, the price of mortgages in the secondary market falls, all else being equal.

Assume mortgage prices fall by 100 basis points. In this scenario, the lender sold forward $90 million in mortgages and will sell the remaining $5 million for 100 basis points less than what they could have sold the mortgages for if they had sold them prior to the interest rate movement. Total proceeds from the sale of the mortgages would be $94,950,000 ($90,000,000 sold at par and $5,000,000 sold at a 100-basis-point discount). For this example, we will ignore funding risks and costs to focus on the sale proceeds of the mortgages. This assumption will be used later in this paper to demonstrate how hedging strategies can be used to replicate the same economics of selling the loans forward to protect the lender from price risk.

The second row in Figure 1 is a scenario where rates do not move. In this scenario, we assume the pull-through estimate is accurate. Total proceeds from the sale of the mortgages are $90,000,000 in this scenario ($90,000,000 sold at par).

The third row in Figure 1 is a scenario where interest rates fall. If interest rates fall, the borrower is less likely to close loans because a different lender could offer a lower interest rate. Therefore, the lender might overestimate the pull-through rate. This results in a shortfall of $5 million in mortgages. To meet the TBA commitment, the lender would have to purchase $5 million in mortgages in the secondary market to deliver to the securities. Furthermore, if interest rates fall, the price of mortgages increases for higher coupon loans. Assume mortgage prices increase by 100 basis points for the mortgages needed to deliver into the TBA. In this scenario, the lender sold forward $90 million in mortgages and will have to purchase $5 million for 100 basis points more than the price they received for the mortgages. The lender would realize a loss of $50,000 on this sale. This is because they would buy the mortgages for $5,050,000, but they already sold them forward at a price of $5,000,000. Total proceeds from the sale of the mortgages would be $84,950,000 ($85,000,000 sold at par less the $50,000 loss from the secondary market transaction).

The above example highlights some of the risks associated with selling locks forward in the TBA market and the importance of accurate pull-through estimates. Over- or underestimating pull-through rates negatively impacts the margin of the mortgage company. In practice, most lenders do not sell forward mortgages in the TBA market as outlined above. Instead, they use TBAs (or other financial instruments) to hedge price risk. This provides lenders with the flexibility of being able to sell mortgages upon funding to the investor with the highest price (i.e., best execution), the ability to cross-hedge (i.e., not needing to estimate the amount and month when loans will close; instead, hedging the full pipeline against price risk), and it provides lenders with the ability to manage the hedge portfolio. Furthermore, the price received by selling mortgages forward through TBAs is generally less than the price received for selling a fully funded mortgage.

Mortgage pricing

Before getting into pipeline hedging, it is important to understand how mortgages are priced and the price risks assumed by mortgage originators from initial lock to sale of the loan.

The mortgage originator assumes price risk when they issue a lock and do not sell the mortgage forward. This is because the lender has committed to providing a mortgage to the borrower at a predetermined interest rate for a set number of days. The lender will then sell the loan to an investor once the loan is originated. Investors value mortgages as the present value of expected cash flows; therefore, all else being equal, if interest rates rise, the price of the mortgage declines.

Using historical data to demonstrate this risk, for the 90-day period between January and March 2022, the 30-year mortgage rate increased from 3.11% to 4.67%. Therefore, 90-day locks issued when rates were 3.11% would have been sold when mortgages were being priced at a 4.67% rate, resulting in loss of margin upon sale of the mortgage if lenders were not effectively hedging or did not sell forward the mortgages.

Between the time of the lock and the time the mortgage is sold, interest rates will fluctuate. If interest rates rise between the initial lock and loan sale, the mortgage could be sold at a loss to the lender. Market dynamics such as supply and demand for mortgages can also impact the price of mortgage assets.

A mortgage originator determines the interest rate for a mortgage starting with the cost of funds (e.g., MBS coupon) and then adding external costs (e.g., guarantee fees), the servicing fee, and the profit margin.

Mortgage Interest Rate = MBS Coupon + Guarantee Fees + Servicing Fee + Profit Margin

The MBS coupon is the largest portion of the mortgage interest rate and is estimated at the time of the lock. Guarantee fees and servicing fees generally do not change materially month-to-month. The profit margin takes into consideration the price of the mortgage at the time of the lock, strategic considerations, the mortgage's buyer, the value of servicing, and operational costs. If the lender wants to be aggressive with pricing, they can offer a lower interest rate to the borrower.

The profit margin also takes into consideration the costs of originating the mortgage. Lenders generally fund mortgages by borrowing funds to make the initial loan disbursement. Lenders repay these funds upon sale of the mortgage to an investor. If we assume the cost structure and pricing of mortgages are set with the intent of selling loans for an average price between 102 and 103, then any value received less than this amount would adversely impact the lender's financials.

To manage this risk, lenders hedge price risk using various financial instruments. The hedges are calculated such that the price movements of the hedge instruments offset the price movements of the mortgages. Since mortgage prices vary as a function of interest rates and general market dynamics, both factors (i.e., interest rate risk and market risk) must be considered in the hedge strategy.

Pipeline hedging

TBAs are commonly used to manage pipeline risk because the change in value in TBAs closely matches the change in value of mortgages[2]. Therefore, to offset the price risk inherent in the pipeline, a lender can sell TBAs when loans are locked and then repurchase the securities when the loans are sold. Therefore, the lender receives the change in the price in the TBAs between the sell date and repurchase date. If pull-through rates are estimated accurately (and assuming there is no basis risk in the hedge), the amount of TBAs sold and the change in price will offset the change in price of the mortgages funded through the pipeline.

By hedging with TBAs, the lender avoids committing to delivering securities with the required amount of the mortgage, so the hedging lender would not have to purchase mortgages to fulfill delivery. In addition, the lender can trade various TBAs to match the risk profile (e.g., duration and convexity) of the pipeline. More advanced hedging strategies can be implemented using interest rate futures and derivatives to enhance the effectiveness of the hedge program.

Figure 2 provides a representative example highlighting how hedging could be used to protect the lender from the financial risks of selling forward into TBAs. This example assumes the same scenarios as the example in Figure 1. That is, in the interest rate rise scenario, we assume that interest rates increase, resulting in higher pull-through rates and decreases in the price of mortgages. In the accurate pull-through estimate, we assume that neither interest rates nor mortgage prices change. In the interest rates fall scenario, we assume that interest rates decrease, resulting in lower pull-through rates and increases in the price of mortgages.

2. There are limitations to using TBAs to hedge mortgage pipeline risk; Milliman has published white papers discussing considerations and alternative financial instruments to improve hedge efficiency.

FIGURE 2: PIPELINE HEDGING DEMONSTRATION

SCENARIO	MORTGAGE LOCKS A	ESTIMATED PULL-THROUGH B	ACTUAL PULL-THROUGH C	DOLLAR CHANGE IN HEDGES D = B * CHANGE IN PRICE	DOLLAR CHANGE IN MORTGAGE PRICE E = C * CHANGE IN PRICE	PROFIT (LOSS) ON HEDGING F = E + D
Interest rates rise	$100	$90	$95	$0.90	($0.95)	($0.05)
No movement in rates	$100	$90	$90	$0.00	$0.00	$0.00
Interest rates fall	$100	$90	$85	($0.90)	$0.85	($0.05)

In the first scenario, the lender sells $95 million mortgages at a price of 99. This is because the lender sells the loans once they close. This results in total proceeds of $94,050,000 and represents a loss of $950,000 for the lender. The loss arises because prices declined from par at the time of lock. However, the lender also sold $90 million of TBAs short and realized a gain of $900,000 on the hedge (shown in column D). Therefore, the net proceeds to the lender are $94,950,000 ($94,050,000 for the mortgages and $900,000 for the hedge). This is the same value shown in Figure 1 for the same scenario.

In the second scenario, with price movement or change in pull-through, net proceeds are $90,000,000. This is the same value shown in Figure 1 for the same scenario.

In the third scenario, the lender sells $85 million in mortgages at a price of 101. This results in total proceeds of $85,850,000. This is shown in column E in Figure 2 and is a gain of $850,000 relative to the initial par price at the time of the locks. However, the lender also sold $90 million of TBA futures short and realized a loss of $900,000 on the hedge (shown in column D). Therefore, the net proceeds to the lender are $84,950,000 ($85,850,000 for the mortgages and a loss of $900,000 on the hedge). These results are identical to the results in Figure 1, demonstrating that pipeline hedging can remove the price risk assumed by mortgage originators and would be equivalent to selling forward under these simplified assumptions.

In practice, mortgage lenders evaluate and rebalance their hedge positions daily. A hedge is not implemented at the time of lock and left unchanged through loan closing and sale. Instead, the full portfolio is evaluated and optimal hedge positions are calculated and adjusted based on daily price movements and changes in the pipeline.

Since the financial results were the same in these two examples, it is logical to ask why not just sell forward into the TBA market. The above example makes several simplifying assumptions. First, we assume prices received are the same when selling forward and when selling after loan closing. In practice, the price received for selling loans forward is less than the price received for selling loans at closing. This is because the TBA's buyer is taking the price risk when mortgages are sold forward. Therefore, interest rate risk and the cost of hedging that risk are reflected in the price. In addition, there is considerably more flexibility in being able to deliver loans at the best execution when selling at loan closing as opposed to selling forward into TBAs. If a lender can implement an effective hedge strategy, that lender can generally increase the profitability of their mortgage originations.

MILLIMAN'S MORTGAGE SECONDARY MARKET SOLUTIONS: MS2

Mortgage companies assume financial risk when originating and servicing mortgages. This paper focused on the financial risks associated with originating mortgages. Lenders can effectively manage this risk by hedging pipeline risk with financial securities.

Historically, advanced market hedging techniques have required quant teams and traders and were reserved for larger lenders. Milliman developed MS2 to provide these benefits to all lenders and to help mortgage companies manage their financial risk through either TBAs or hedging with interest rate futures and derivatives. MS2 streamlines these calculations and trading capabilities for mortgage originators. The software includes robust interest rate models (i.e., LIBOR market model) that are calibrated daily to current interest rate market volatility; is cloud-based, enabling efficient calculations and use; and is maintained by a team of financial consultants who manage interest rate risk for mortgage companies, fixed income investors, and insurance companies with embedded interest rate derivatives.

Milliman assists our clients with the development, implementation, and/or ongoing management of hedge programs. To explore these capabilities, contact us to schedule an introduction and demonstration of MS2's capabilities.

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