



December 17, 2015

Weekly Post: Adjustable Rate Mortgages (ARMs) Risk-Adjusted Profitability

Dear Clients-

Unlike fixed rate mortgages (FRM), adjustable rate mortgages (ARMs) are more often customized to market demands, resulting in many ARM types. More generic ARMs are the 1-1, 3-1, 5-1, 7-1 and 10-1 loans, but there are also 3-3, 5-5 and 7-7. Each ARM's adjustable rate pays a margin off an index, which can be LIBOR, Prime, and Treasury. Furthermore, ARMs also have caps and floors on the adjustable rates, with the amortization of principals over 20 or 30 years.

Determining risk-adjusted profitability of ARMs is important because this analysis enables you to price and design the loans for your customers.

Challenge

The non-standard structure of ARMs poses many challenges in determining their profitability.

- The projected interest rates determine the ARMs future cash flows and hence the yield. What are the reasonably projected rates to determine the yield of an ARM loan?
- How should the caps and floors affect the pricing of ARMs?
- How should the credit risk be treated?

Solution

The THC Mortgage Model based on the option pricing methodology provides a comprehensive analysis of ARMs. By way of comparison, the Mortgage Analytics Report presents a comparison of a 30 year fixed rate mortgage and a 1-1 ARM (life ceiling rate 9.45%, life floor rate 4.55%, 30 years original amortization term, 5 years aged, the current coupon rate 4.55%, indexed to 1 year treasury with 2.65% margin, annual coupon reset frequency). The appendix below provides a description of the model.

YTM	Yield Attribution(%)			Interest Rate Risk			
	Time Value	Option Spread	Credit Spread	Clean OAS	WAL	Eff. Dur	Eff. Con
ARM 3.893	2.309	-0.159	0.111	1.632	6.74	3.22	1.105
FRM 3.875	1.757	0.330	0.050	1.738	4.51	3.73	-1.440

- Time Value: The funding cost of the projected cash flow based on the forward rates.
- Option Spread: Interest rates can go up or down. For FRM, when the rates go up, the prepayment slows, the mortgagor's options come in, adverse to the bank, with a charge of 33.0 bpt. in the above



table. The ARM has a different situation. The floors can be advantageous to the bank. The option can be positive or negative depending on the cap, floors and the likelihood of negative interest rates.

- Credit Spread: ARM's credit spreads are higher than FRM, in general. CDR is the conditional default rate before recovery.

Numerical Example

The results also show that the ARM has a lower short-term prepayment rate. However, historically, the Conditional Prepayment Rate [CPR] prepayment increases around the first reset date. The default is the present value of the projected net losses as related to Current Expected Credit Loss [CECL].

Cashflow Analysis					
short term		long term		Default \$	
CPR(%)	CDR(%)	CPR(%)	CDR(%)		
ARM	9.58	0.85	10.78	0.97	1,638
FRM	18.28	0.61	13.18	0.21	469

Profitability can be analyzed:

- Clean OAS in basis points is the risk-adjusted profitability. The time-value measure isolates the hedge cost of the interest rate risk; the options cost isolates the loan extension risk or the caps and floor net option cost. Credit spread has netted the credit reserve. Therefore, the clean OAS can compare the profitability of different ARMs.
- Typically, the clean OAS of an ARM is around 100 basis points at origination.
- The credit spread should depend on the institution's credit analysis. If the loan is considered to have less credit risk, then the credit spread amount deducted can be added to the clean OAS.

Conclusions

ARMs values are determined by many factors, making a relative valuation complicated. The accurate valuation enables you to more accurately design and price your products, taking these various risk factors into consideration.

A robust ARM valuation model can accurately determine the clean OAS which allows you to determine the risk-adjusted profitability of a loan

Appendix Stochastic Interest Rate Model

Step 1: Use an arbitrage-free pricing model to project interest rate scenarios (yield curves going out). These projections have to be meaningful: (1) yield curves should be mean reverting; (2) cannot go negative in consequential ways; (3) the scenario uncertainties (probability of going up or down) should be consistent with what the market is anticipating. The scenarios would be wider in times of uncertainties, for example 2007.



Step 2. Given any bond, the model calculated the cashflows of the bond and discounted it back along that scenario yield curve. That is: if rates are projected high, then that cashflow is discounted at a higher rate. The value of a bond is the average of these present values given many interest rate scenarios (THC uses an equivalent of over 1,000 scenarios, and that is why valuing 570 mortgages can take time despite using servers)

Step 3. when Step 2 is applied to a simple bond (say ten years zero coupon bond), then the step 2 valuation should equal the simple discount cash flow model based on the treasury curve. This is called the arbitrage-free condition. That is the value of a bond should be independent of the valuation method that you use.

Please do not hesitate to contact THC to analyze alternative ALM strategies to optimize your performance.

Regards,

Tom Ho

Tom.ho@thomasho.com

1-212-732-2878

THE THC CONTENT IS PROVIDED AS IS, WITHOUT REPRESENTATIONS OR WARRANTIES OF ANY KIND. TO THE MAXIMUM EXTENT PERMISSIBLE UNDER APPLICABLE LAW THC HEREBY DISCLAIMS ANY AND ALL WARRANTIES, EXPRESS AND IMPLIED, RELATING TO THE THC CONTENT, AND NEITHER THC NOR ANY OF ITS AFFILIATES SHALL IN ANY EVENT BE LIABLE FOR ANY DAMAGES OF ANY NATURE WHATSOEVER, INCLUDING, BUT NOT LIMITED TO, DIRECT, INDIRECT, CONSEQUENTIAL, SPECIAL AND PUNITIVE DAMAGES, LOSS OF PROFITS AND TRADING LOSSES, RESULTING FROM ANY PERSON'S USE OR RELIANCE UPON, OR INABILITY TO USE, ANY THC CONTENT, EVEN IF THC IS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR IF SUCH DAMAGES WERE FORESEEABLE