Making the Risk of a Collateralized Mortgage-Obligation (CMO) transparent

Interest rate risk of a CMO tranche can be significant because of the complex waterfall structure allocating the cashflow to each tranche of the deal. Can we measure the CMOs' performance accurately given a complex structure? If so, can bond analytics assist us to select bonds for our portfolios? The use of (1) Waterfall Structure Graph, (2) Option adjusted spread (OAS) analytics, and (3) return attribution can provide a systematic in selecting a CMO bond. The waterfall graph depicts the risk of a tranche within a deal given the principal and interests allocations. OAS analytics give the measures of value and cheap/rich. (3) Return attribution interprets the analysis, providing us the feedback on our decision making process. This systemic approach can satisfy the regulatory requirements on understanding a complex structure of a CMO.

To illustrate a CMO waterfall structure, let us consider the deal FNR 2 6/25/2042, in particular the composite tranche FNR 13-001 PG (3136ABB28).

A CMO Structure Explained

Table 1 provides a summary of the FNR 13-001H structure. For our analysis to follow, note that PG and PD are PAC bonds supported by ZU as explained in the Table.

Table 1 | FNR 13-001H Structure

Class	Group	Original Class Balance	Principal Type(1)	Interest Rate	Interest Type(1)	CUSIP Number	Final Distribution Date
PG	8	144,723,000	PAC/AD	2.00	FIX	3136ABB28	June 2042
PI	8	54,271,125(2)	NTL	4.00	FIX/IO	3136ABB44	June 2042
PD	8	8,000,000	PAC/AD	3.50	FIX	3136ABYW7	February 2043
ZU	8	33,110,334	SUP	3.50	FIX/Z	3136ABYX5	February 2043
FB(3)	8	37,166,666	PT	(4)	FLT	3136ABYY3	February 2043
SA(3)	8	37,166,666(2)	NTL	(4)	INV/IO	3136AB Y Z 0	February 2043
IB(3)	8	37,166,666(2)	NTL	(4)	INV/IO	3136AB Z A 4	February 2043

(1) See "Description of the Certificates—Class Definitions and Abbreviations" in the REMIC prospectus.
(2) Notional principal balances. These classes are interest only classes. See page S-6 for a description of how their notional principal balances are calculated.
(3) Exchangeable classes.
(4) Based on LIBOR.

Waterfall Graphs

Figure 1 and Figure 2 waterfall structure graphs below depict the principal redemption of each bond in FNR 13-001H under 100 PSA and 200 PSA respectively. The graphs show that the weighted average life of the supporting tranche ZU shortens significantly at a higher prepayment speed, while PG and PD are somewhat protected. The waterfall graphs can clearly depict the behavior the bonds within a composite and therefore provides the reasons behind the risk or stability of a bond cash flow.

Figure 1 | Waterfall Structure of FNR 13-001H 100 PSA

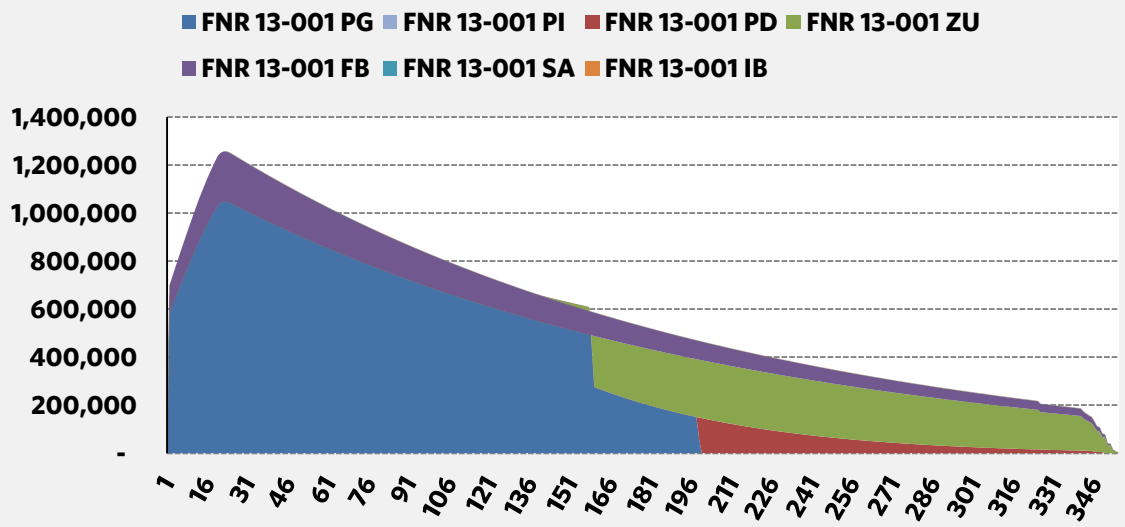
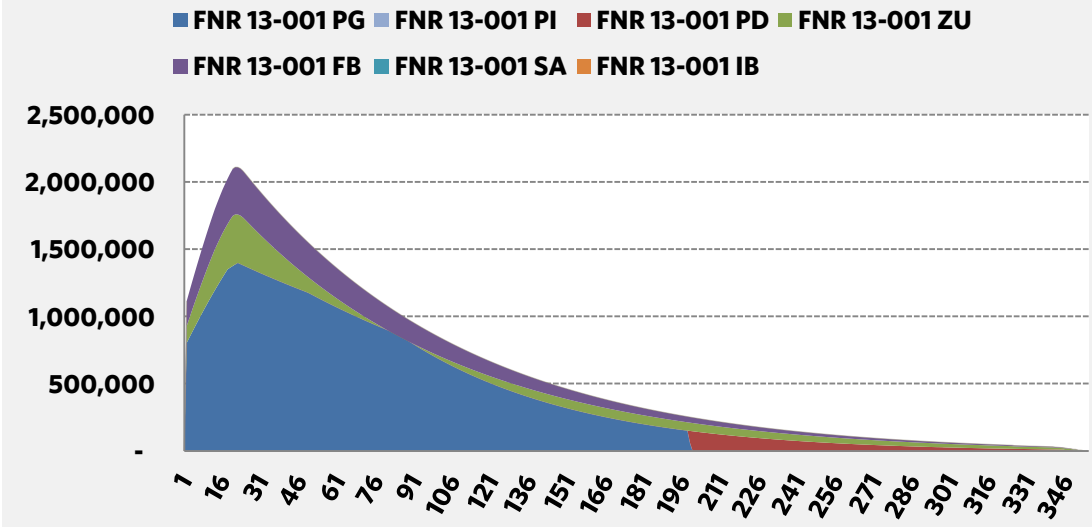


Figure 2 | Waterfall Structure of FNR 13-001H 200 PSA



Option Adjusted Spread (OAS) Analysis of FNR 13-001 PG (3136ABB28)

The risk and value of a bond as depicted by the Waterfall Structure graph can be quantified using the option adjusted (OAS) approach. OAS is the spread off the Treasury curve net of the value of any embedded option of a bond. The bond is described below as of 6/28/2013.

The tranche FNR 13-001-PG has a coupon rate of 2%, maturity of 29.06 years and is priced at 99.76. The conditional prepayment rate (CPR) of CMO bond (FNR 13-001 PG 3136ABB28), are 17% and 11% for one year and life respectively. Therefore the prepayment profile should be more similar to that of Figure 2 which has a CPR of 12% life. And, Figure 1 shows the impact on the prepayment profile when there is an extension risk.

The OAS analytics as of 6/28/2013 are summarized below.

Table 2 | OAS analytics as of 6/28/2013

YTM (%)	Spread (%)	OAS (%)	WAL (year)	Eff. Dur	Eff. Conv
2.03	0.91	0.46	5.26	5.23	2.23

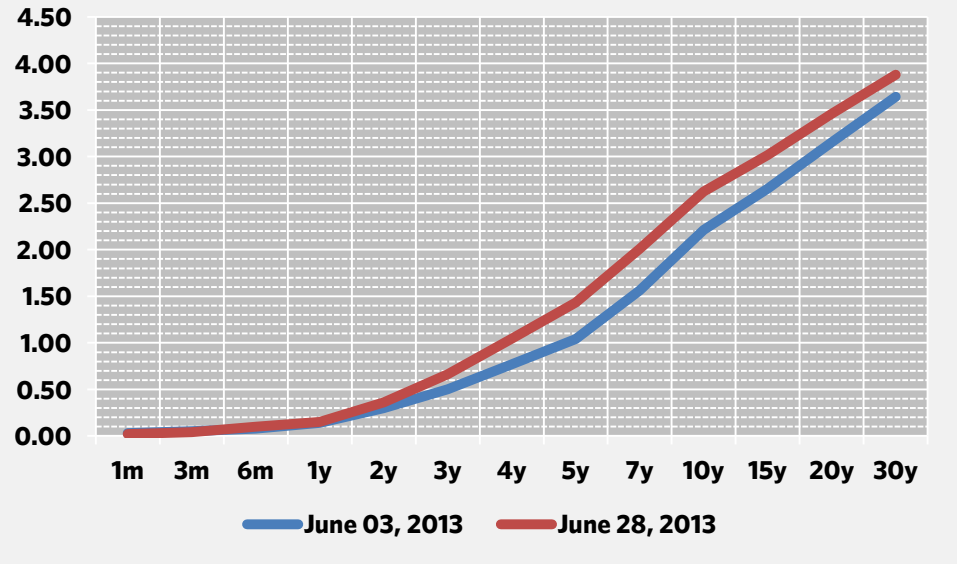
The amortization and prepayments lead to the weighted average life (WAL) to be much lower than its maturity. As a result, the effective duration is 5.23 year and the convexity is quite high. The OAS is 46 basis points while the yield is 2.03%.

By way of comparison, a FN agency bond of similar duration has a YTM of 1.94%and OAS of 32 basis points and therefore the tranche is cheaper than an agency bond by 14 basis points only.

Return Attributions of FNR 13-001 PG (3136ABB28) 6/3/2013 – 6/28/2013

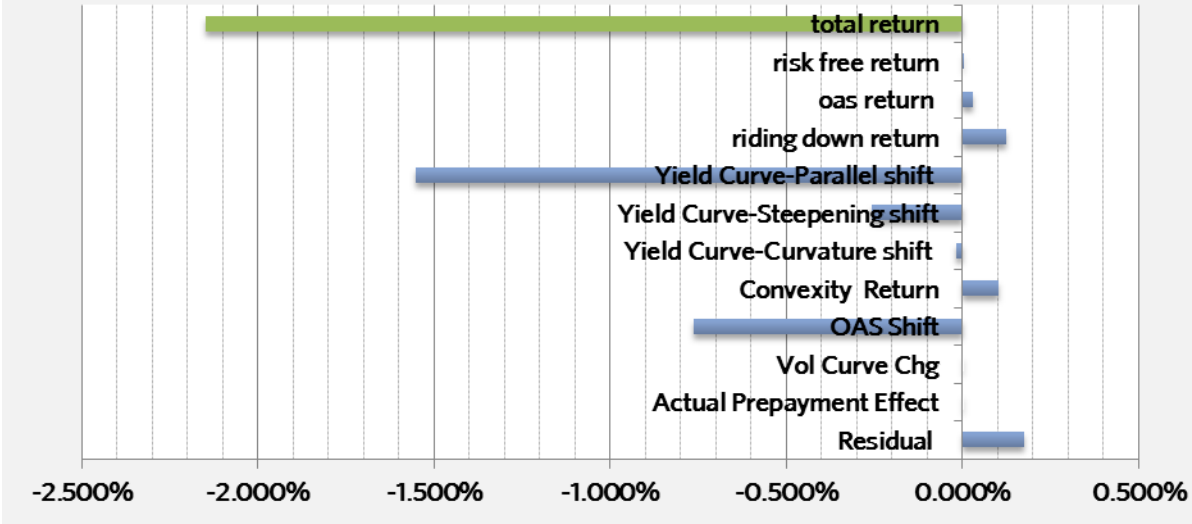
How does the OAS analysis translate into realized performance? We here consider the performance of the bond for the month of May. Below depicts the Treasury spot yield curves at the beginning and end of the month.

Figure 3 | The Treasury Spot Curves



The return attribution results presented below shows that the bond loses over 2.1% over that month. Much of the loss is attributed to the yield curve parallel shift (1.55% loss). Note that the long rate has shifted 40 basis points but the 2 year rate has barely shifted. The result shows that for this bond, the yield curve has shifted roughly 30 basis points on average. (duration* shifts% = % change in value; 5*0.3 = 1.5). During this period, the OAS as also widened resulting in 0.75% loss in value of the bond.

Figure 4 | Jun3-Jun28 Return Attribution FNR 13-001 PG (3136ABB28)



The result shows that duration remain the most important factor and that the OAS may mean revert and may add value in subsequent months. Because the bond is a PAC protected by the supporting tranches, there is no prepayment effect.

Conclusions

While a CMO structure can be complicated, we can analyze any bond by applying: the waterfall graph (identifying the prepayment risk), the OAS analysis (measuring value and risk), return attribution (relating performance to measures- a reality check). This process can apply to a bond or a portfolio.

Contact us if you have any questions, suggestions or comments. What would you like us to discuss in coming issues? We look forward to hear from you.

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Thomas S.Y. Ho PhD, President of THC, senior consultant to federal regulatory agencies and senior consultant to enterprise risk management departments of largest financial institutions 1999-2005.; elected member of the US Financial Economists Roundtable; Board member of the Finance Mathematics Program, Courant Institute of Mathematics, New York University; Research Professor at Owen School of Business, Vanderbilt University; nomination committee IAFE financial engineer of the year. He was named one of the most prolific authors in finance based on a study by Cooley and Heck, (Journal of Finance, 2003). Author of the Ho-Lee model (the first arbitrage-free stochastic interest rate model) and key rate durations (the widely used interest rate risk measure for over $12 trillion assets.). Associate Editor of Journal of Derivatives and Journal of Investment Management; co-authored four books and has published in major journals including Journal of Finance, Journal of Derivatives, Journal of Fixed Income, and Journal of Portfolio Management. Books include The Oxford Guide to Financial Modeling, Strategic Fixed Income Investments, Securities Valuation. Received his Ph.D. in Mathematics in 1978 from the University of Pennsylvania, New York University's Stern School of Business as Professor of Finance from 1978 until 1990; full professor in 1985.