



January 6, 2016

Weekly Post: Cash Flow Projections: a Case of Step-Up Callable Agency Bonds

Dear Clients-

Projecting balance sheet items' cash flows is fundamental to banking. Projected cash flows are used for loan price, investment decisions, strategic planning, budgeting, and, of course, risk management. But most loans, callable securities, mortgage-backed securities, puttable borrowings, and non-maturity deposits have uncertain projected cashflows.

In most cases, banks typically make some assumptions on the projected cash flows to support their decisions. In order to minimize the "model risk", it is important that you validate the assumptions being used. For example: In budgeting, if you assume your loan portfolio grows 2% in the coming 12 months and the prepayment of loans increases, then the new volume will have to grow faster to maintain the targeted net growth of the loan portfolio. The net growth of a loan portfolio depends on the accurate projected cash flows of the current loan portfolio. In addition, your callable agency bonds and puttable borrowings may be terminated any time, affecting your projected income and liquidity risk profile.

It is important for accuracy purposes that you know the assumptions used in projecting your cash flows. Voluminous research has provided financial models guidance to this problem of accurately projecting cash flows for loans and securities with uncertain cash flows. The use of ad hoc "look-up tables" is an ineffective method to minimize model risk.

Challenge

Let me consider a step-up coupon callable agency bond currently priced around par with maturity 6/6/2028, Bermudan immediately callable. The coupon schedule is given below.

time	2015-2017	2017 - 2021	2021-2025	2025-2028
Coupon rate (%)	2.65	3.65	4.5%	5%

- When will the bond be called? Can I anticipate 3.65% interest income in the years 2017 to 2021?
- How does the step-up coupon feature affect the interest rate risk measures in the rate shock scenarios?

Solution



The agency bond callability, and therefore the pricing, depends on an algorithm called “rational option pricing,” not some ad hoc “look up table.” These call options are typically hedged by FHLBs and GSEs using capital market instruments. As a result, the bonds are called optimally to extract the highest profit, and there is

an algorithm to achieve that maximization. In that sense, the callability of these agency bonds is “predictable” when the model applies the same algorithm as that used by the capital market. THC models use such an algorithm to project cash flows. The algorithm approach used by THC is consistent with capital market convention and helps to minimize the model risk the many ALM applications that I described in the introduction

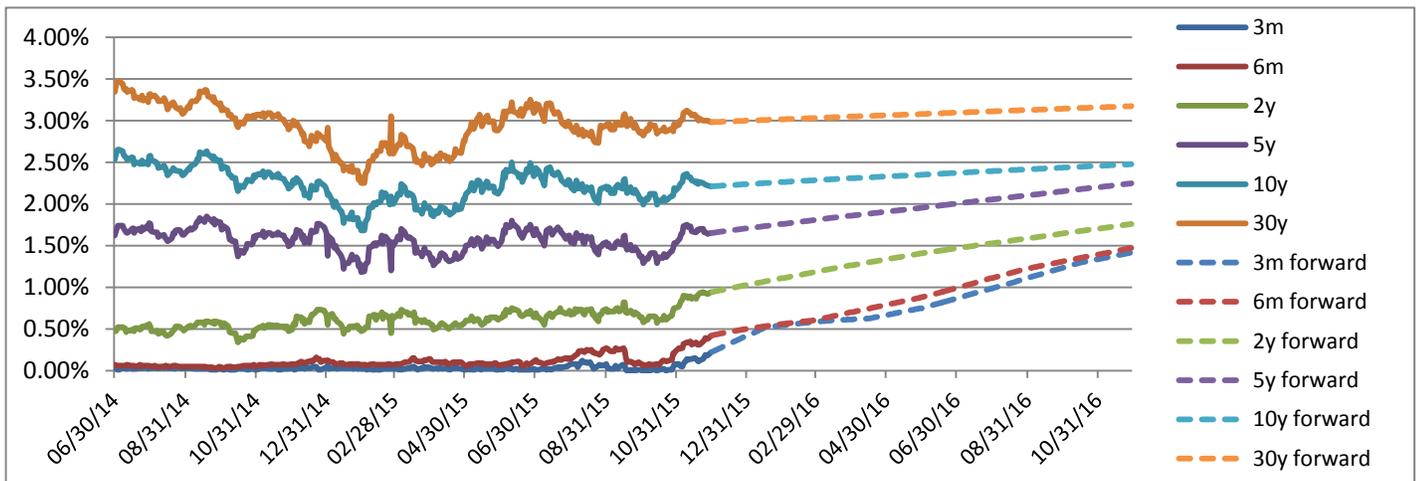
Using the “rational option pricing” algorithm, the THC model can then determine the projected cash flow of the bond under the stress test shock scenario, noting that the projected cash flows are scenario dependent.

The risk of the bond can be determined as follows, using the THC Investment Analytics Report or Trade Simulations

Description	Next Call Date	Coupon Rate(%)	values under interest rate scenarios					YTM (%)	Yield to Worst
			Dn 100BP	Base	Up 100BP	Up 200BP	Up 300BP		
FHLB	12/06/2015	2.650	101	101	97	91	85	3.994	2.347

Numerical Example

As December 10 Weekly Post describes the “base case” assumes forward curves, which are projected to rise gradually. The figure below illustrates the yield curve scenarios of the base case.





Using the projected forward curves as the base case, the THC model generates the monthly projected cash flows (projected interest payments and principal pay down). The call dates are reported below under each scenario:

Scenarios	-100 bpt	Base case	+100 bpt	+200 bpt	+300 bpt
Call date	immediate	Sept 2017	Sept 2026	June 2028	June 2028

Based on the forward curve, the bond is expected to be called Q3 next year. The maturity then extends rapidly, over 10 years under 200 bpt shocks. That means, the current duration may be short, but the duration can extend rapidly when rates rise. This is the reason it is so important that you use a robust financial model to incorporate the rapid change in risk characteristics of balance sheet instruments under different market scenarios. Ad hoc “look up tables” do not take into consideration all these risks.

These instruments are called “Chameleon” to underscore their ability to change their color depending on the market environment: yield curve level, shape, volatility, and the market liquidity spreads. A Look-up Table approach confines the instrument’s behavior exposed to only few market factors, analogous to restricting a Chameleon is see only in black and white – a restriction that may lead to dire consequence.

THC Risk Officer provides simulation of projected cash flows in your EaR, Gap, Financial Simulation, Budgeting and cash flow reports. For interactive application, you can use Cash Flow App for sector projection, Trade Simulation (buy and funding sources – double click on any instrument), Sensitivity Analysis for model risk, and Financial Simulations.

Conclusions

It is often said in financial markets: “Options, options everywhere,” and that is particularly appropriate for our balance sheet. Identifying when the borrowers or lenders exercise their options is central to many banking activities. Your THC model uses the state-of-the-art market convention to minimize model risk, enabling you to project your budgets and price your loans and securities accurately

Please do not hesitate to contact THC to analyze your investments or borrowings when options are used.

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