Mortgage Duration Risk – The Dark Side of the Conundrum

By Alan Boyce CEO Absalon, May 20, 2010

In the tale of five blind men and an elephant, they each touch a different body part, but only one part. They then discuss what they have felt and discover that they are in complete disagreement. When describing the effects of various Federal Reserve stimulus programs, personal perspective has colored people's views on what has happened and what will happen when the stimulus is withdrawn.

The economists at the Federal Reserve Board and Reserve Bank Presidents think in terms of "factors affecting reserves" and "lender of last resort". This has led economists to place great significance on the withdrawal of two of the seven emergency lending programs begun in December 2007 and the rise in the discount rate on February 18th 2010. Aside from one speech by Brian Sack (December 5th, 2009 to the Money Marketeers), the Federal Reserve consistently views their lending and quantitative easing (Fed Purchase Program or FPP) primarily from this broad theoretical perspective.

This author's perspective, by contrast, is that of a mortgage backed securities trader, who has the responsibility to trade, hedge and finance a position of complex, callable cash flows. Those cash flows come in the form of Agency MBS- either in settled form or in TBA forward delivery form. An MBS trader's primary concerns are duration risk (i.e. change in price for a change in yield), financing costs and the impact of changes in the slope and curvature of the yield curve. Additionally, an MBS trader is also very focused on the interest rate options market. In particular, he focuses his attention on the implied volatility of options on interest rate swaps (IRS). As an owner of callable mortgage backed securities he possesses an inherent short volatility position (i.e. negative gamma) and portfolio risk that is significantly impacted by movements in the implied volatility of IRS options.

Now some aspects to the current situation are clear from all perspectives. Over the last year the administration and the Fed have undertaken several measures, in the form of FPP, that are yielding short term positive benefits. Specifically,

1. Duration-the FRB/Treasury's programs have taken more duration out of the bond market than could be created in 2-3 years. This has kept long term interest rates much lower than they would otherwise have been. The yield curve has been artificially depressed, by at least 75 basis points, due to this reduction in the aggregate duration (price risk of the whole US bond market).

2. Reduced Volatility-The FPP also shorted a huge amount of options, which compressed option/risk premia in every market in the world (drove commodity, VIX and FX volatility down). These were main causes of the Dow rising and some risk seeking activity returning.

The FRB cannot, however, keep this up forever. And this is where the mortgage trader's perspective may prove useful. A clear and consistent focus on mortgage duration risk shows us that we may face a series of large and as yet underappreciated challenges. The sooner we collectively understand these issues, the better we can address them. The rest of this article will describe my efforts to calculate the duration of the FRB/Treasury purchase programs and give my perspective on what will happen when the purchase programs end and underlying dynamics of mortgage duration assert themselves.

The risk of the MBS

Annex 1 is the MBS position of the FRB as of 12/30/09, which includes 'reported' settled positions and forward purchases (reported weekly). Essentially, this is the risk position of the Federal Reserve. An MBS trader (or investor) would calculate their risk using such a position sheet, in combination with various estimates of the duration of each underlying security. All of the analysis is done using 12/30/09 prices and durations.

By using OAD calculations from standard prepay models (which are too fast), the FRB had $460mm of price risk per basis point as of year-end. If you scale this up for the remaining purchases and the purchases by the Treasury Department, you get $776mm/bp. This is using Option Adjusted Durations implied by pre-payment models that were conditioned on the housing market from 2002 to 2008. Those prepayment estimates are significantly faster than what has been experienced in the last two years.

If you use durations implied by coupon spreads (a pretty accurate measure of how the bond market views the price risk) then your DV01 jumps to $643mm. Scaled up for the whole program, you get $1,071mm/bp. If rates go up by 50bp, the FRB and Treasury would expect to lose $54 billion. If rates go up even more, assume durations extend and the losses on the next 50bp increase would be $75-90 billion.

If the FRB and Treasury were to hedge their negative convexity risk (bonds fall more than they rise for a given move in interest rates) they would need to buy interest rate options. The most likely option would be a 3yr into 7yr swaption, which currently trades at 5 points. If you hedged to coupon spread implied durations, you would be buying 3yr into 10yr swaptions, which currently trade at 6.5 points. There would be significant reflexivity if that amount of swaptions were bought (prices would be higher if there were more buyers). I estimate the average price paid would be at least 50% higher and have confirmed this with some of the best option traders in the world.

Bottom line: it would cost $142 billion for the FRB and Treasury to hedge the short optionality of their MBS position.

The risk of the other bonds purchased: Treasuries, Agency debt, TIPs and Maiden Lane

These calculations are again based upon year end positions. The durations are estimated made by breaking each category of debt instrument into several buckets, estimating a duration for the bucket and then calculating a simple weighted average.

	Position	Duration	DV01
1)Treasuries	$707b	5yr	$353mm
2)TIPs	$ 47b	6yr	$28mm
3)GSE debt	$160b	2yr	$32mm
4)Other (Maiden Lane etc)	$ 50b	5yr	$25mm
5)Total	$964b	4.55yr	$438mm

The weighted average duration is 4.55 years with a DVO1 of $438mm per basis point. I will assume that since December, the remaining purchases have been in MBS instead of the other debt categories. Together with the scaled up to final size purchases of MBS, that would be $1,509mm per basis point or a $75 billion loss for the first 50 bp move.

Accounting for the net duration additions to the US bond market

Mortgage market duration is estimated to have been roughly the same. There was no large scale refinancing, a sure-fire method to increase duration. The duration embedded in the existing mortgages increased slightly due to lower housing turnover and labor mobility. The recent GSE buybacks of >120 Day delinquent loans acts to reduce the duration of mortgages, as loans that were completely unable to voluntarily prepay are removed from the system.

Municipal market shrank in 2009. This was aided by help from the Federal government in the form of Build America taxable bond issuance and significant grants to State HFAs. Corporate bond market is small and did not grow in 2009.

Net Treasury issuance as $1.4 trillion, with a 4 year maturity and a 3 year duration. This is a net add of duration of which is $420mm/basis point

The net result

The FPP took out $1.509 billion of duration per basis point, The mortgage market, municipal market and corporate bond market are estimated to have added zero net duration to the aggregate. The funding of a very large budget deficit required a significant duration add, $420mm/bp, by the Treasury Department.

Conclusion: the FPP reduced aggregate duration by almost 3.6x the duration that was added to the system!

This has kept long term interest rates much lower than they would otherwise have been. Without this, the yield curve would have been significantly steeper.

The FPP also shorted a huge amount of options, which compressed option/risk premia in every market in the world (drove VIX and FX vol down). These were the main causes of the DOW rising and some risk seeking activity returning.

What are the implications of ending the FPP?

1) Duration: MBS widening out will result in lower prices for agency pass-thrus, this will lead to an immediate increase in the calculated OAD of the aggregate mortgage index and drive the curve steeper. A steepening of another 50bp will cost the FRB another $84b. Agency MBS spreads are 90bp tight to their historical average spread of 120 basis points to US10yr. If spreads widen out to the average (ceteris paribus) the FRB will lose $147b.

2)Options Volatility: The end of FPP shorting options will drive interest rate vol up by 50%, making the cost of covering the short options position to $213b. Options traders tend to be agnostic as to what options markets they play in. When fixed income implied volatility increases, option sellers will be more likely to short options to the bond market and less likely to short options to the commodity, equity and foreign exchange markets. These options markets are all linked by the investors. Expect implied volatility in all other markets to rise when the world's biggest sell program of long dated options ends.

3)Fiscal Policy: If the FRB were to just explicitly short payer swaptions, they would generate significant option premium which they would book as income. That income would revert to the Treasury department and the FRB would be wishing, hoping and praying that interest rates never move. Instead they are implicitly shorting the options though the unhedged purchase of MBS, generating cash income which they report and remit to Treasury. If interest rates were to rise, the curve to steepen and volatility to rise, the FRB would suffer a huge MTM loss, but not report it on their cash basis income statement. They would continue to book cash income, as long as the book yield of their MBS purchases exceeds their financing rate (paying interest on excess reserves). The Federal Reserve does not mark to market, instead runs a "cash income statement". If you look at forward fedfunds (Eurodollar curve less basis swap), the FRB will go negative carry in December 2014, where 3 month financing rates are forecast to be over 5% (just gets worse and worse from there). The point here is that mark to market accounting is an iron law. You cannot escape the losses just because you do not report them. If the FRB loses $200 billion on mark to

market, there will be $200 billion LESS that they remit to the Treasury Department every year. That will require legislation to either raise taxes or lower spending by $200 billion (or run up bigger Federal debt to be paid back by another generation).

4)Excess Reserves: The end to the FPP will not change excess reserves, but who cares since they are being lent back to the FRB at federal funds target rate of 25bp. The Federal Reserve has plans to remove the excess reserves via reverse repo agreements (used to be called matched sales back in the non-borrowed reserve targeting regime). If the Federal Reserve wished to sell all of the bonds purchased, the expectation is that they would receive lower prices than they paid. The FRB would then need to issue "FRB bills" to soak up the remaining excess reserves, equal to the dollar loss on the round-trip bond trade.

Trades to take advantage of the end of the FPP

1)curve steepening trades
2)long volatility trades
3)short correlation trades

A cascade of buying of risk premia could well set off a repeat of the fall of 2008, except this time long Treasuries will be leading the retreat. There are no natural sellers of volatility anymore. Steeper curve will increase OADs of the mortgages, which will drive rates higher and steepen the curve.

Higher interest rate volatility will increase OADs (see above) and drive up implied and realized volatility in commodities, equities and foreign exchange.

Higher risk premia in all markets will lead to a cascade of "stop loss" trades.

When will this unfold?

Using efficient markets hypothesis, this information is freely available bonds should be fully priced into the financial markets. So why are bonds not falling dramatically by now? The financial markets are not efficient. They are not the best prediction of what will happen in the future. Financial markets are quite myopic, able to see at most three months ahead.

When will this unfold? Yields have already started to rise, only one week after the conclusion of the FPP.

How can this be stopped?

1)GSEs have a legal limit to their balance sheet $300 billion higher than today. They are using their balance sheet to repurchase delinquent loans. Estimates have the GSEs up against their congressionally mandated position limits at the end of this year. If they were to gain an exemption from portfolio limits, the GSEs will have to issue more term debt to finance these loans, which on the margin will be of longer tenor than the financing of the prior MBS owners. Even without issuing term debt, the GSEs run matched positions, so every MBS purchase is offset with a long term liability/interest rate swap. The GSEs also hedge their convexity risk via the purchase of payer swaptions. The net effect will be zero or less than zero. The GSEs will have increased the size of their unnecessary B/S. At current prices, their debt trades 50bp wider OAS than their MBS, so this is a negative arbitrage. Bottom line, the GSEs can provide no real help.

2) The Federal Reserve can extend its purchase program.

3) The GSEs can be used as instruments of public policy and attempt to refinance a significant amount of the existing mortgage stock into Principle of Balance mortgage loans which will act as an automatic bond market stabilizer. This will prevent the massive contingent duration extension embedded in the US mortgage market from blowing up the US financial system (this is the "Dark Side of the Conundrum").

The following steps should be taken.

Lower interest rates paid by homeowners through expanded government guarantee programs

- Super streamlined refinance should waive all requirements except one, the borrower must be current on their existing mortgage, no appraisal required.
- The GSEs should not be charging additional fees for loans they already guarantee.
- The GSEs should refinance current non-agency loans at reduced fees.
- Loan size limit should be $729,750, going up to 130% of this limit in high cost areas.

Consider modifying mortgages so that homeowners have at least 10% positive equity in their homes at current valuations based on an Automated Valuation Model (AVM).

- The conversion of mortgages could be systemic, enforced on the owners of mortgage securities. Servicing companies would be fully indemnified.
- The losses from the write-down of principal would be borne by the bond holders.
- These losses should be treated as full tax credits, counted as Tier I capital and allowed to be used to offset TARP capital injections. The tax credits should be non-transferable.

As a matter of equity, homeowners with written-down mortgages would be subject to higher taxes

- Principal reduction will count against taxpayer's $500,000 exemption from capital gains
- Reduction of capital gain exemption will last for 10 years and apply to the gain from the sale of any residential real estate, not just the home associated with the principal reduction

Conclusion

The FPP has reached it conclusion. The Federal Reserve has been successful in raising the price of mortgage backed securities. They have withdrawn several years of duration from the bond market and created the world's largest short options position. They have not been able to stimulate a large refinancing wave, which would have been the most effective mechanism to reduce the stress on homeowners having a hard time making their mortgage payments. They have not eliminated the threat to the bond market from the gigantic duration extension event buried in our existing mortgage system. Mortgage extension risk remains as the "other shoe to drop" in the slowly unfolding drama of the financial crisis. The scale of the extension risk is multiples of the risk to the bond market from extended periods of large budget deficits or the threat of coordinated selling of Treasuries by foreign central banks.

The US mortgage market suffers from bad design. A negative externality has been imposed upon homeowners by requiring them to redeem their debt at par when rates increase. This leads to significant extension risk embedded into our financial system, with no way for the system to work it out. By securitizing mortgage loans in a way that allows the borrower to redeem his debt at the bond market price, this extension risk is mitigated. Homeowners are turned into counter-cyclical "shock absorbers" for the bond market, adding duration during falling rate periods and subtracting duration when rates rise. There is nothing special about this idea, in fact it is how corporate, municipal and sovereign debt markets function.

The transition path is quite easy. We must issue standardized, transparent mortgage pass-thru securities with the additional feature of alternative redemption offered to the borrower. This is almost

exactly how the US mortgage market has functioned since August 2007, with the addition of some new technology which allows the bond trusts to be more responsive to market conditions. Homeowners can gain a valuable option, which reduces the risk that they become "underwater" on their mortgage when interest rates rise. The bond market can gain an automatic stabilizer that reduces or eliminates the giant contingent extension risk embedded in our existing market.

Ignoring the extension risk does not make it go away.

ANNEX 1: System Open Market Account - MBS Settled Holdings: 12/30/2009 ($ thousands)												
Term	Agency	Coupon	Jan Price	Sprd	OAD	Current Face	January	February	March	Total Position	Duration (MMs)	
30yr	FHLMC	4	96.66	4.06	6.54	51,410,643.7	400,000			51,810,644	32,751	40,663
		4.5	99.94	3.28	4.86	152,836,054.5	8,350,000	7,400,000	270,000	168,856,055	82,013	110,751
		5	102.72	2.78	3.61	83,202,225.3	15,675,000	9,825,000	2,975,000	111,677,225	41,412	63,809
		5.5	104.94	2.22	2.42	9,307,073.9	900,000	2,250,000	300	12,457,374	3,164	5,801
		6	106.19	1.25	1.65	632,858.5				632,859	111	168
		6.5	107.38	1.19	1.75	869,196.3				869,196	163	222
	FHLMC Total					**298,258,052.2**	**25,325,000**	**19,475,000**	**3,245,300**	**346,303,352**	**159,613**	**221,414**
	FNMA	3.5	92.79	4.25	8.47	239,494.0				239,494	188	189
		4	96.84	4.06	6.54	95,778,373.5	2,400,000	300,000		98,478,374	62,372	77,369
		4.5	100.00	3.16	4.89	204,896,010.3	7,925,000	6,900,000	3,225,000	222,946,010	109,021	140,735
		5	102.79	2.79	3.57	87,194,010.7	20,650,000	5,100,000	2,350,000	115,294,011	42,307	66,056
		5.5	104.84	2.06	2.42	88,829,449.4	23,575,000	9,400,000		121,804,449	30,904	52,531
		6	106.13	1.28	1.65	10,990,991.3	3,225,000	850,000	500,000	15,565,991	2,726	4,233
		6.5	107.25	1.13	1.75	1,554,444.3				1,554,444	292	375
	FNMA Total					**489,482,773.5**	**57,775,000**	**22,550,000**	**6,075,000**	**575,882,774**	**247,810**	**341,488**
	GNMA I	4	96.84	4.47	6.4	4,802,585.1				4,802,585	2,977	4,158
		4.5	100.28	3.44	4.72	39,747,541.1	4,250,000			43,997,541	20,825	30,355
		5	103.03	2.75	3.32	18,206,209.4	1,200,000			19,406,209	6,638	10,997
		5.5	104.94	1.91	2	1,535,508.9	125,000			1,660,509	349	666
		6	105.88	0.94	1.15	376,683.3				376,683	46	75
	GNMA I Total					**64,668,527.8**	**5,575,000**			**70,243,528**	**30,834**	**46,250**
	GNMA II	4	96.69	4.50	6.32	768,383.9				768,384	470	669
		4.5	100.13	3.44	4.7	22,357,899.0				22,357,899	10,521	15,390
		5	102.94	2.81	3.33	2,115,873.0				2,115,873	725	1,225
		5.5	105.00	2.06							-	-
		6	106.13	1.13	1.08	62,352.9				62,353	7	15
	GNMA II Total					**25,304,508.8**				**25,304,509**	**11,723**	**17,299**
15yr	FHLMC	4	100.75	2.75	3.47	4,278,496.2				4,278,496	1,496	2,371
		4.5	102.88	2.13	2.72	1,875,706.6				1,875,707	525	820
		5	104.66	1.78	2.07	146,288.2				146,288	32	55
		5.5	106.00	1.34	1.75	68,918.2				68,918	13	20
	FHLMC Total					**6,369,409.2**				**6,369,409**	**2,065**	**3,265**
	FNMA	3.5	98.03	3.25	4.48	145,462.3				145,462	64	93
		4	100.75	2.72	3.47	12,731,462.3	1,450,000			14,181,462	4,958	7,769
		4.5	103.00	2.25	2.72	9,155,464.3	1,250,000			10,405,464	2,915	4,823
		5	104.69	1.69	2.07	32,044.4				32,044	7	11
	FNMA Total					**22,064,433.3**	**2,700,000**			**24,764,433**	**7,944**	**12,696**
Other	FHLMC	4	100.75	2.75	3.47	655.8				656	0	0
		4.5	102.88	2.13	2.72	94,457.3				94,457	26	41
		5	104.66	1.78	2.07	202,625.2				202,625	44	76
		5.5	106.00	1.34	1.75	4,674.0				4,674	1	1
		6	107.13	1.13							-	-
		6.5	108.25	1.13	1.75	29,696.4				29,696	6	7
	FHLMC Total					**332,108.7**				**332,109**	**77**	**126**
	FNMA	4	100.75	2.75	3.47	1,036,083.9				1,036,084	362	574
		4.5	102.88	2.13	2.72	577,641.3				577,641	162	253
		5	104.66	1.78	2.07	45,638.0				45,638	10	17
		5.5	106.00	1.34	1.75	23,548.1				23,548	4	7
		6	107.13	1.13	1.75	81,394.5				81,395	15	20
		6.5	108.25	1.13	1.75	12,789.9				12,790	2	3
	FNMA Total					**1,777,095.7**				**1,777,096**	**556**	**873**
Grand Total						**908,256,909.2**	**91,375,000**	**42,025,000**	**9,320,300**	**1,050,977,209**	**460,622**	**643,411**