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North America

Mortgage Credit Weekly

CRT Spreads, Liquidity, and G-Fee Estimates

- **Determinants of CRT Spreads** — We look at structural, collateral, and market factors that impact CRT back-pay spreads, in order to determine relative value beyond just cheap and rich on an OAS basis.
- **CRT Liquidity Update** — We update our liquidity measures for the CRT market to determine how liquidity conditions fared during the recent market volatility and increased supply. It's interesting that more senior bonds showed worse liquidity.
- **Refining Market Implied G-Fee** — We refine our way of estimating a market-implied GSE guarantee fee by reviewing pricing data on credit risk transfer (CRT) deals.

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CRT Spreads, Liquidity, & G-Fee Estimates

Sparks of Mortgage Credit Issuance

Some ABS-15G filings came through this week which breathes some life into issuance. There was one from Freddie Mac's first senior/sub risk transfer deal (FWLS 2016-SC01) for 2016. There was also a filing for the next CHASE 2016-2 portfolio risk transfer transaction, and the 55% conforming balance deal will likely to be similar to the first one (click here for a description). Redwood also filed for their second 2016 deal yesterday. Also, FirstKey filed for a deal under the TPMT shelf on Wednesday.

Finally, in single family rental space, Progress Residential expressed their intention to call a deal (PROG 2014-SFR1, which matures in October) by using some of the proceeds of a new deal (2016-SFR1). They may have to pay the yield maintenance/spread premium, which amounts to a couple months of interest, according to rating agency reports and our quick look at Intex. Generally speaking, this is a positive for spreads in a sector that has struggled to grow.

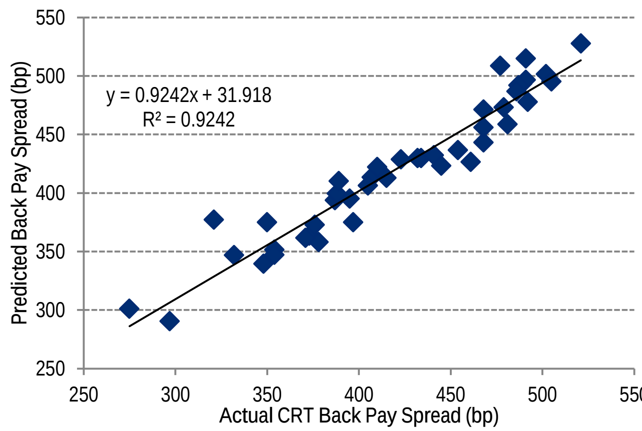
Determinants of CRT Spreads

From time to time, clients have requested a framework to look at CRT spreads, beyond just looking at one OAS number and doing a rich-cheap analysis. Most market participants look at technical factors as well as correlation with other asset classes to form a generic view on spreads. This week, we take a stab at this by analyzing the determinants of back-pay spreads by first running a cross-sectional regression vs. deal specific factors, market pricing, structural factors as well as collateral characteristics. Then, we run a time-series regression of daily aggregate back-pay spreads vs. explanatory variables to explain the macro credit risk sentiment.

Cross-Sectional Regression of Back Pay Spreads

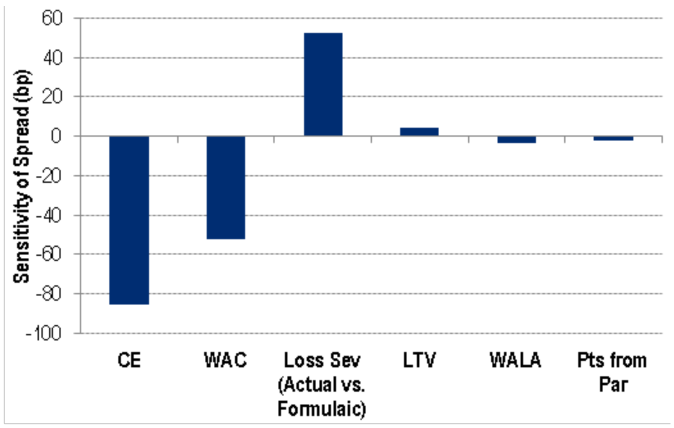
We look at the spreads for all the STACR/CAS back-pay bonds (pricing as of June end) and create dummy variables for loss severity (actual vs. formulaic), vintage (seasoned vs. more recent), shelf (STACR vs. CAS) and LTV (high vs. low). The other explanatory variables we employ are the points from par that the back-pay was trading at along with structural considerations like the credit support and the cumulative defaults needed for the back-pay bond to take a write-down. Finally, we also use collateral characteristics like WAC, WALA, LTV, FICO and loan size – we look at the average as well as the standard deviation of these characteristics. We run a regression of the option-adjusted spread from our default model against the independent variables mentioned above.

Figure 1. Predicted vs. Actual CRT Back-Pay Spread (as of June end)



Source: Citi Research, Bloomberg, Intex, The Yield Book

Figure 2. Sensitivities of the CRT Back-Pay Spread To Explanatory Variables (Significant at 95% confidence)



Source: Citi Research, Bloomberg, Intex, The Yield Book

Back pay spreads show the highest sensitivity to CE, actual vs. formulaic loss as well as WAC.

At a 95% confidence level, we find the dummy variable for loss severity (Actual loss vs. formulaic), points from par on the bond price, CE, WAC, WALA and LTV to be significant. Figure 1 shows the back-pay spreads predicted by the regression against the actual spreads. Figure 2 shows the sensitivities of the spreads to the independent variables that were significant. The regression is suggesting that back-pay spreads on actual loss severity deals are ~50bp wider than the older deals with formulaic losses. An increase in credit support by 1 point for a back-pay bond translates to an 85bp tightening in the spread. An increase in the average collateral WAC by 1 point (and hence higher prepays) translates to a ~50bp tightening in the back pay spread.

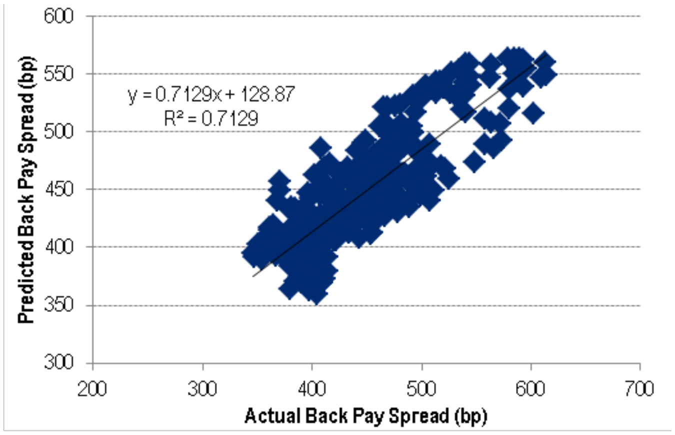
The sensitivities of the back-pay spread to the average LTV, WALA of the collateral as well as the points from par on the bond price are significantly lower. An increase in average collateral LTV by 1 point translates to a widening of ~4bp in the back-pay spread while an increase in seasoning by 1 more month results in spreads tightening by ~3bp. Finally, a price of 1 point over par translates to the back pay spread being tighter by ~2bp.

Time-Series Regression of Aggregate Back-Pay Spreads

Back-pay spreads most sensitive to 10-yr Treasury and HY at an aggregate level.

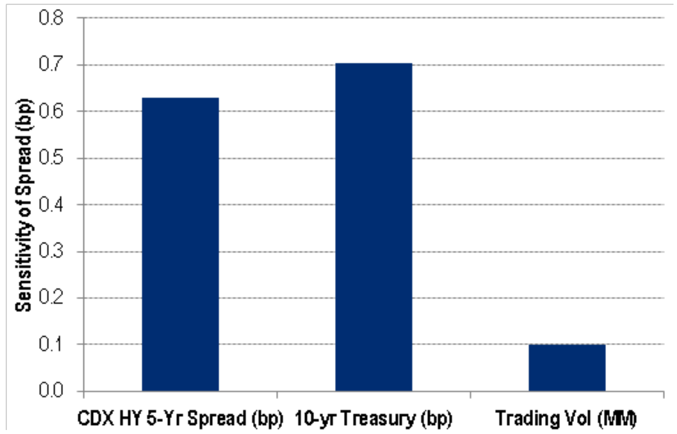
Next, we run a regression on a daily time series of aggregate back-pay spreads (since Jan 2015), based on FINRA TRACE data vs. daily time series of CDX HY 5-yr spreads (to capture macro credit risk sentiment), 2-month lagged 10-yr treasury rates (to capture prepayment) and trading volume of the back pays. The R-squared of this regression is 71% and all three explanatory variables are significant at the 95% confidence level. As expected, the sensitivity of the back pay spread is high to the CDX HY 5-yr spread, 0.63bp wider for a 1bp widening in CDX HY. The sensitivity to the 10-yr treasury rate is 0.70bp. Increase in trading volume of 1MM translates to a 0.10bp widening of the back pay spread.

Figure 3. Predicted vs. Actual Aggregate Back Pay Spread (daily time series since Jan 2015)



Source: Citi Research, Bloomberg, Intex, The Yield Book

Figure 4. Sensitivities of Aggregate Back Pay Spread To Explanatory Variables



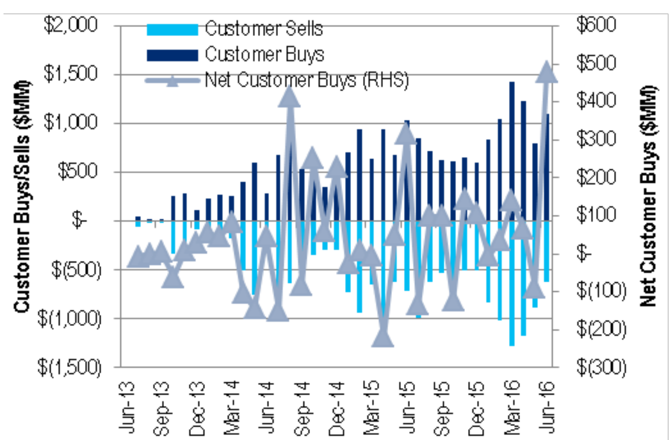
Source: Citi Research, Bloomberg, Intex, The Yield Book

This is our first take at using explanatory variables based on collateral, structure and deal specific factors (cross-sectional) as well as macro credit risk sentiment (time-series) to determine the back-pay spread. We will be fine tuning our analysis to come up with more robust estimates of the determinants and their spread sensitivities and extending this to the other CRT tranches.

CRT Liquidity Update

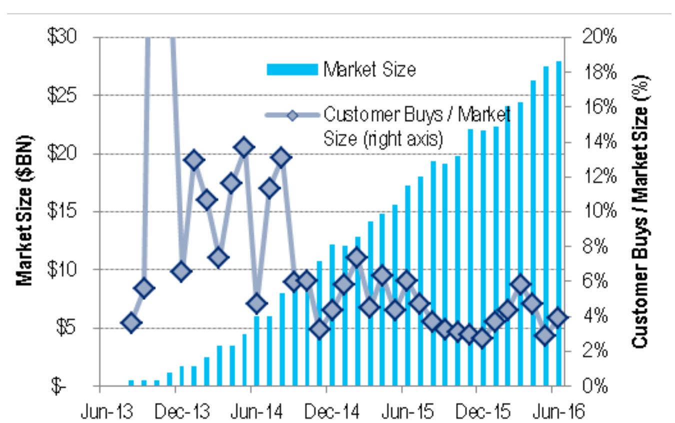
Back in April, we discussed liquidity conditions in the CRT market, and cited liquidity conditions in the market as a potential cause of the outsized vulnerability of spreads to financial market conditions. Since then, indications of how this trend has developed have been relatively mixed: on one hand front-pay bonds have recently outperformed IG corporates and trading volumes showed relative resilience to the impact of Brexit (see here), but on the other hand net investor positioning has been volatile and turnover rates have been declining (Figure 5, Figure 6). As such, we refresh our common liquidity metrics to see if any further information about the state of CRT market liquidity can be gleaned.

Figure 5. Customers Whip-Sawed Positioning in May & June



Source: FINRA TRACE, Citi Research

Figure 6. Turnover Rates Have Been Trending Downward



Source: FINRA TRACE, Citi Research

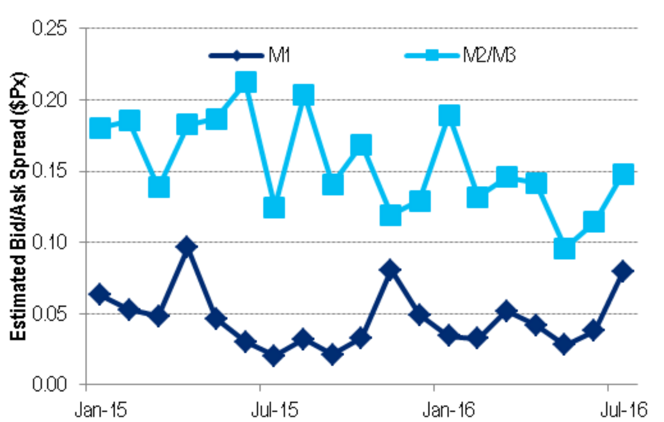
Overall, bid-ask spreads have been on a declining trend for back-pay bonds and stable for front-pay bonds (Figure 7), though both bond types experience an increase in the cost of liquidity around periods where spreads are widening dramatically, such as September 2015 and February 2016. Part of this can be explained by a decline in average trade size during downturn periods, especially in front –pays (Figure 11). We find that the cost of liquidity has been ordinal across lot sizes (Figure 12), and markets temporarily shifting to periods with higher odd-lot volumes will naturally feature higher average liquidity costs.

We continue to find it interesting that M1 liquidity is more sensitive to credit headwinds than back-pay liquidity.

Additionally, because open-end mutual funds can be viewed as more liquidity sensitive, we postulate that it could be pull-back from these real money investors that cause lower levels of block trading and higher average liquidity costs. Because real money investors such as these are major investors in front-pay bonds, it makes sense that M1 liquidity is the most sensitive in a sell-off, despite being less credit levered. It could also be due to the fact that this is more of a buy-and-hold sector and secondary trading is quite thin.

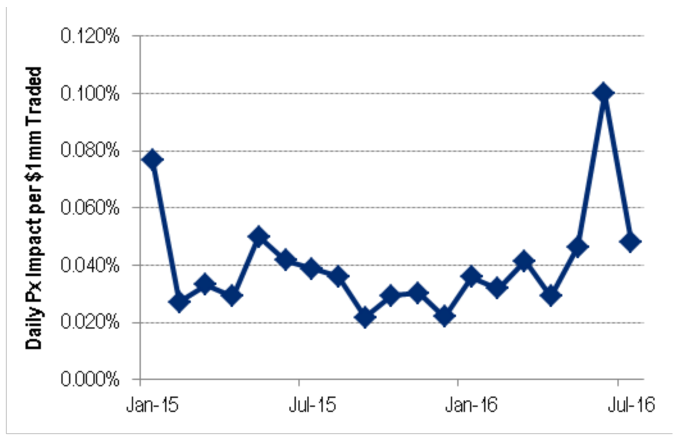
Lastly, we looked at the Amihud measure, which estimates the absolute price impact in percentage terms per million dollars of daily trading volume. As can be seen, the price impact of trading has been relatively stable until spiking in June (Figure 8). So far in July, the impact appears to have reverted to a more normal level. We believe the whip-saw from customers' heavy net-selling to heavy net-buying on lower trading volume from May to June may have played a role in this effect, as well as several new deals being brought to the market during the period. Overall, our outlook for CRT market liquidity is stable for back-pays and constructive for front-pays.

Figure 7. Thompson-Waller Estimate of Bid/Ask Spread



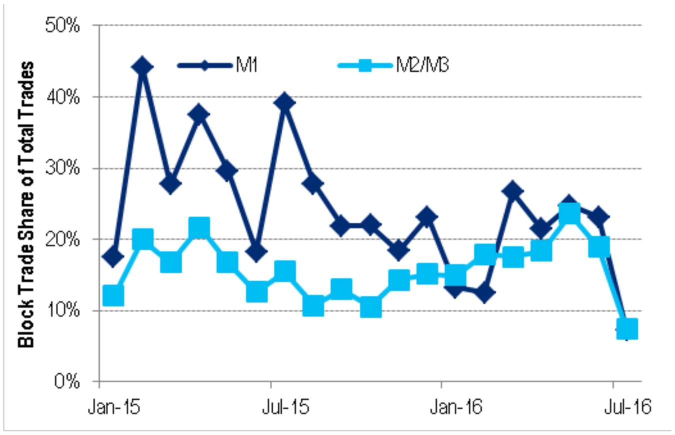
Source: FINRA TRACE, Citi Research

Figure 8. Amihud Measure of Price Impact



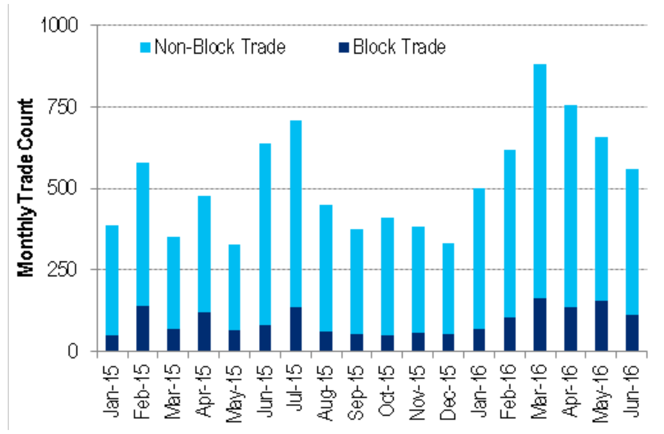
Source: FINRA TRACE, Citi Research

Figure 9. Block Trade Share of Trading Volume, by Bond Type



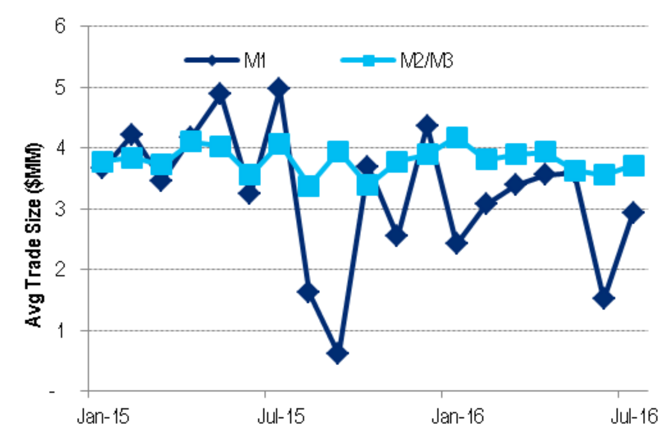
Source: FINRA TRACE, Citi Research

Figure 10. Count of Block and Non-Block Trades



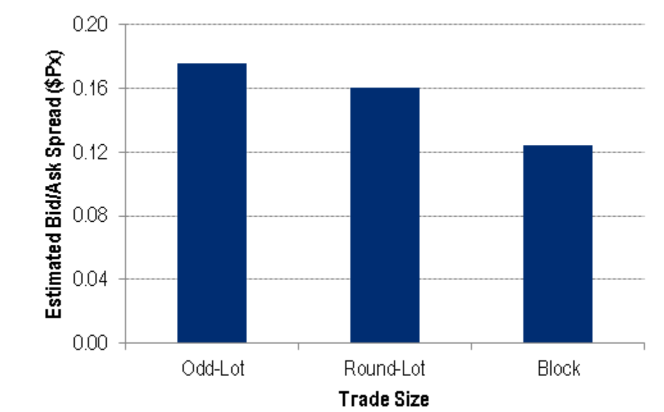
Source: FINRA TRACE, Citi Research

Figure 11. Average Trade Size, by Bond Type



Source: FINRA TRACE, Citi Research

Figure 12. Overall Bid/Ask Spread, by Trade Size



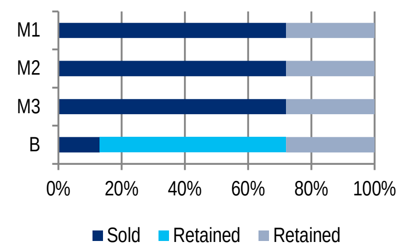
Source: FINRA TRACE, Citi Research

Refining Market Implied G-Fees

We have previously made attempts at estimating what the credit risk transfer (CRT) market is telling us about guarantee fees charged by Fannie Mae and Freddie Mac (click here for our primer). Given the FHFA recently highlighted that their estimate of market-implied g-fees are in the area of 53–70bps[1], we thought we would circle back through our methodology. In this article, we refine our approach, start to take more factors into account, and stabilize the results between issuers.

[1] http://www.fhfa.gov/AboutUs/Reports/ReportDocuments/CRT-Progress-Report-6292016.pdf

Figure 13. STACR 2016-DNA3



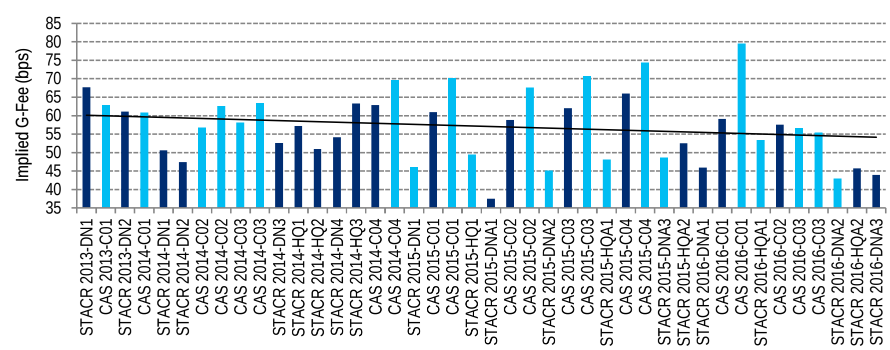
Source: Freddie Mac, Citi Research

The Old Approach

Figure 14 below highlights the results of our old method for determining what the market is telling us guarantee fees should be. Without going into too much detail, we took primary issuance spreads and layered on a couple more assumptions to fill in the blanks where market pricing was not available. For example, if a first loss piece was not priced, we assumed a multiple which essentially wrote off that piece over time. We also added in extra amounts for operational costs, the payroll tax surcharge, and another return on capital assumption if the issuer did not sell up to 5% losses in a given deal.

You can see the results are lumpy, both over time and between issuers (shaded differently below). Some of this had to do with our methodology briefly mentioned above. While one issuer started selling first loss pieces, we continued to penalize another by effectively writing off the whole first loss position. Furthermore, when first loss pieces are sold, issuers have not sold a proportional amount relative to the rest of the capital structure. For example, GSEs have usually retained only ~5–8% of M1/M2/M3 bonds while retaining more than 50% of the first loss position. So if an issuer were to sell the same proportional amount of first loss bonds, the extra supply would theoretically force spreads wider. Figure 13 shows how STACR 16-DNA3 issuer retention on each horizontal slice was ~28% while the retention on the first loss was ~87%. In a recent instant poll in our weekly (click here for a copy), most investors felt that first loss bonds should price 100–300bps wider if a proportional size were transferred. These are some of the factors we try to correct for below.

Figure 14. The Old Way: Inconsistent Over Time and Between Issuers



Source: Fannie Mae, Freddie Mac, Citi Research

Correcting for Some Factors

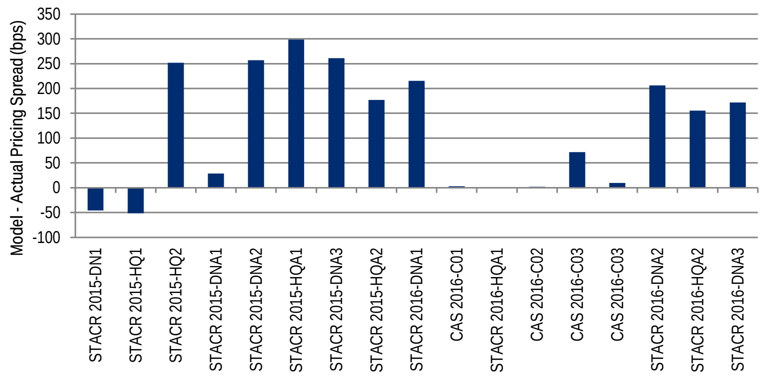
Now that we have a fair amount of primary issuance observations for first loss bonds, we can start to correct spreads for the disproportional retention and also try to figure out where a first loss bond would price if none were sold. To achieve this, we performed a simple regression to approximate first loss bond spreads. Factors taken into account include collateral characteristics such as weighted average coupon (WAC), weighted average loan age (WALA), loan-to-value ratio (LTV), bond thickness in the capital structure, % retained by the issuer, and high yield corporate spreads at the time.

First Application: First Loss Pricing

The first application of the resulting analysis is to see how much wider bonds would price if issuers were to sell off a proportional amount of the first loss position. Figure 15 takes the resulting regression equation and simply dials the % retained back to 5%, recalculates the first loss spreads, and shows how much wider bonds should price based on our estimates. Generally speaking, first loss bonds should price 150–300 bps wider, but the timing of deal pricing matters. This roughly matches up with our recent poll.

It was interesting to see how bonds priced from Feb to Apr 2016 appear to be fair based on collateral, structure, and market conditions at the time. The only bonds that look to have priced too cheap were the first two back in Jan and Feb 2015, respectively, and this is half expected with anything new.

Figure 15. First Loss Bonds Would Price Wider if Retention Proportional To More Senior Bonds

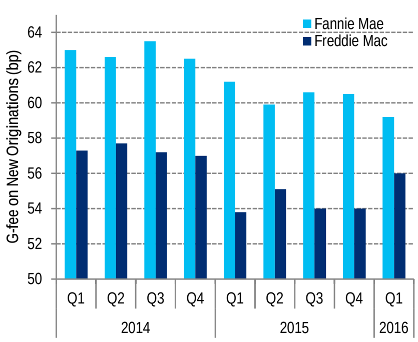


Source: Fannie Mae, Freddie Mac, Yield Book, Citi Research

Analysis Provides More Stable Results

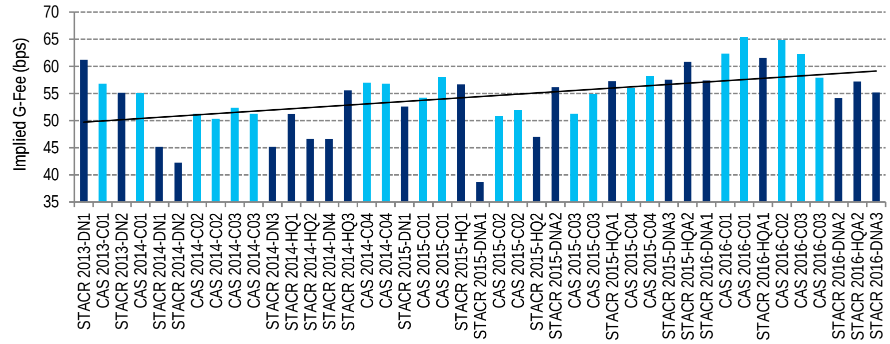
The second application is to recalculate our market-implied g-fees using our adjusted first loss spreads as well as estimates of first loss spreads where no piece was sold. Spreads are then all weighted by balance and average life, and all of the other assumptions are applied as before. Figure 17 highlights the deal-by-deal results. You can see the differences over time and between issuer are now smaller. There are certainly some outliers (e.g. STACR 15-DNA1 which contained more seasoned loans than the others), but is for the most part much more stable than before. Another point of note is that market is telling us g-fees are currently in the ~55bps area, at the tight end of the FHFA's estimates and slightly tighter than what the GSEs are currently charging (Figure 16). It also better captures the spread widening and subsequent tightening that happened over the last nine months.

Figure 16. Current G-Fees on New Business



Source: Fannie Mae, Freddie Mac, Citi Research

Figure 17. Current Implied G-Fees Appear to Be ~55bps



Source: Fannie Mae, Freddie Mac, Yield Book, Citi Research

Good Barometer for Issuance

We don’t think a significant tightening in implied fees will spark a flurry of issuance from the GSEs. We do feel, however, that issuance could certainly slow down if the market-implied levels gap wider and challenge the economics of risk transfer. So in that sense this is a good barometer for issuance going forward.

Speaking of Issuance…

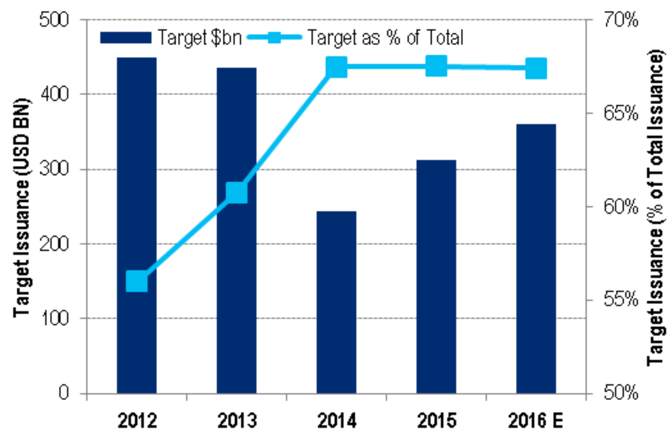
In light of the current interest rate environment, we also wanted to take this time to update our issuance expectations for CRT. The FHFA scorecard for 2016 mandates the GSEs to transfer credit risk on at least 90% of UPB of newly acquired single-family mortgages in non-HARP loans with fixed rate terms greater than 20 years and LTV above 60%.

Projected 2016 H2 STACR/CAS Issuance of ~$10BN

Figure 18 and Figure 19 show the target issuance for Fannie Mae and Freddie Mac for non-HARP loans with fixed rate terms greater than 20 years and LTV above 60%. Using our Agency MBS Strategy team’s issuance projections for the remainder of 2016, the charts also show projected target issuance for 2016 assuming the same % of total issuance as what we have seen year to date in 2016.

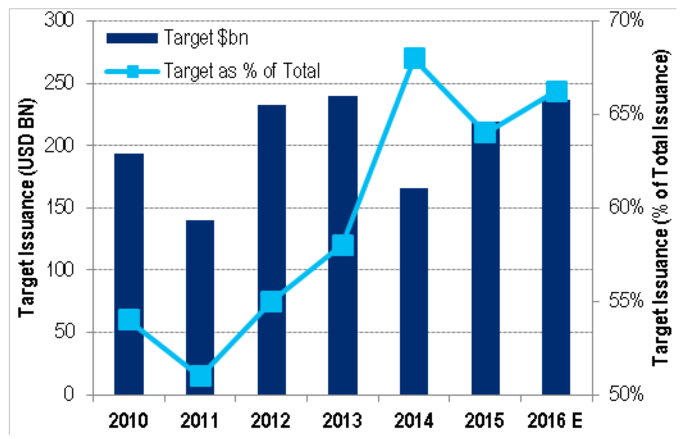
We take 90% of the target issuance, assume the GSEs sell the same approximate thickness of credit (e.g. STACR sells ~5.5%, CAS sells ~4%), that they retain 5% per current practice, and sell the remaining to securities and mortgage insurance with a 85/15 split. Based on this, we estimate STACR/CAS issuance for the remainder of 2016 of ~$11.5BN, roughly split 50% between STACR and CAS. However, based on the STACR/CAS issuance calendars of the GSEs, there will be 5 CAS and 3 STACR deals for the remainder of 2016. Hence, it is unlikely that Freddie would be able to issue over $5.5BN in just 3 deals. After taking this factor into account and any lag associated with STACR/CAS issuance from the target issuance of Agency MBS, we estimate ~$10BN of STACR/CAS issuance for the remainder of 2016. Despite slower than expected issuance over the winter due to broader market volatility, we expect a pickup through the end of the year to match up with our estimates from December (click here for a copy).

Figure 18. Fannie Mae Target Issuance



Source: Citi Research, Fannie Mae

Figure 19. Freddie Mac Target Issuance



Source: Citi Research, Freddie Mac

Market Snapshot

Figure 20. Cash Price Snapshot

Product	Vintage	Tranche	Now	Last Week	Change	Last Month	Change	Jan-13	Change	YTM
Prime	2005	P/T	H90	H90	0.0	H90	0.0	H90	(10.0)	4.75%
		SuperSenior	L100	L100	0.0	L100	0.0	100A	(10.0)	4.75%
	2006	P/T	H90	H90	0.0	H90	0.0	M/H90	(10.0)	4.75%
		SuperSenior	H90	H90	0.0	H90	0.0	H90	(10.5)	4.75%
	2007	P/T	M/H90	M/H90	0.0	M/H90	0.0	M90	(10.0)	4.75%
		SuperSenior	H90	H90	0.0	H90	0.0	M/H90	(10.0)	4.75%
Alt-A	2005	P/T	M/H80	M/H80	0.0	M/H80	0.0	M80	(10.0)	5.00%
		SuperSenior	H80	H80	0.0	H80	0.0	M80	(10.0)	5.00%
	2006	P/T	H70	H70	0.0	H70	0.0	H70	(10.0)	5.00%
		SuperSenior	H70	H70	0.0	H70	0.0	H70	(10.0)	5.00%
	2007	P/T	H50	H50	0.0	H50	0.0	H50	(10.0)	5.00%
		SuperSenior	L70	L70	0.0	L70	0.0	H60	(10.0)	5.00%
Option ARM	Seasoned	SSNR	M70	M70	0.0	M70	0.0	M60	3.0	4.50%
		SN Mezz	M40	M40	0.0	M40	0.0	H30	2.5	5.25%
		Jr Mezz	30A	30A	0.0	30A	0.0	L20	1.5	6.00%
	2007	SSNR	L70	L70	0.0	L70	0.0	M60	3.0	5.00%
		SN Mezz	H30	H30	0.0	H30	0.0	H20	2.5	5.75%
		Jr Mezz	H20	H20	0.0	H20	0.0	H10	2.5	6.75%
Subprime	2006	3rd Pay	H50	H50	0.0	H50	0.0	M/H40	8.5	5.50%
		LCF	H50	H50	0.0	H50	0.0	M/H40	8.5	5.50%
	2007	3rd Pay	L50	L50	0.0	L50	0.0	M40s	7.0	5.50%
		LCF	L50	L50	0.0	L50	0.0	M40s	7.0	5.50%

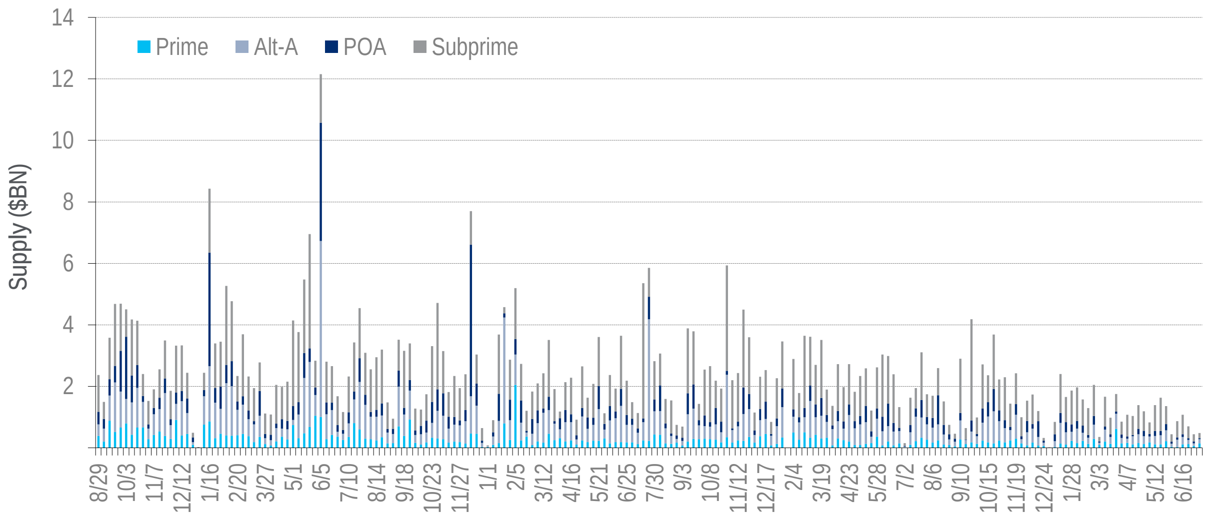
Source: Citi Research

Figure 21. Synthetic Price Snapshot

Index	Sub-Index	Tranche	Now	Last Week	Change	Last Month	Change	Jan-13	Change	YTM (100% Margin)	YTM (15% Margin)
ABX	ABX 07-2	Pen AAA	74.75	74.75	0.00	74.75	0.00	53.93	20.82	3.51%	11.45%
		AAA	66.5	66.50	0.00	66.50	0.00	49.05	17.45	4.52%	15.07%
	ABX 07-1	Pen AAA	80.25	80.25	0.00	80.25	0.00	64.23	16.02	2.65%	6.86%
		AAA	75.33	75.33	0.00	75.33	0.00	50.96	24.37	1.89%	0.00%
	ABX 06-2	Pen AAA	87.83	87.83	0.00	87.83	0.00	80.52	7.31	2.27%	5.76%
		AAA	82	82.00	0.00	82.00	0.00	67.29	14.71	3.51%	12.55%
	ABX 06-1	AAA	97.75	97.75	0.00	97.75	0.00	96.14	1.61	1.00%	0.00%
		AA	80.92	80.92	0.00	80.92	0.00	64.84	16.08	4.30%	17.24%
PrimeX	FRM.1		110.25	110.25	0.00	110.25	0.00	110.23	0.02		
	FRM.2		103.25	103.25	0.00	103.25	0.00	103.43	(0.18)		
	ARM.1		110.25	110.25	0.00	110.25	0.00	109.92	0.33		
	ARM.2		103.13	103.13	0.00	103.13	0.00	102.09	1.04		

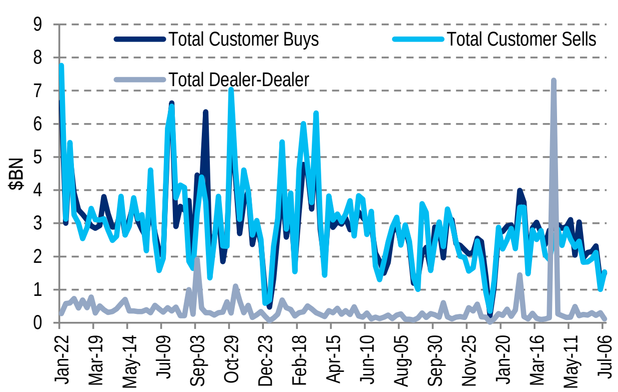
Source: Citi Research

Figure 22. BWIC Volume by Product



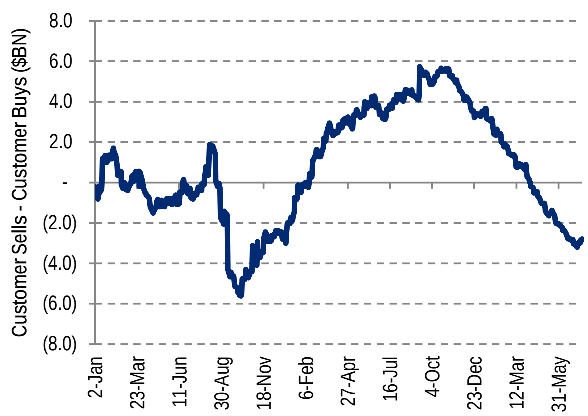
Source: Citi Research

Figure 23. Trading Volume By Type, Weekly, Year-to-Date



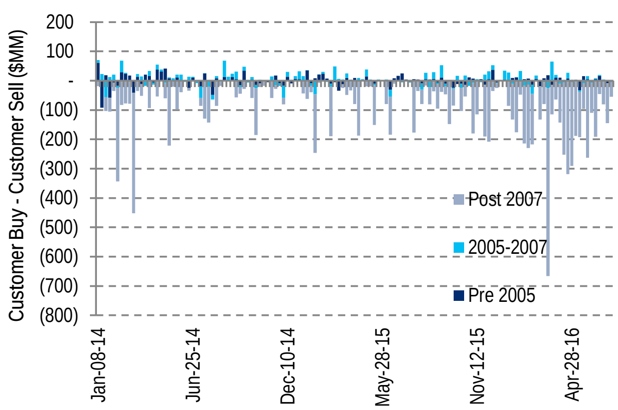
Source: Citi Research, FINRA

Figure 24. Change in Dealer Inventory Since Jan '14



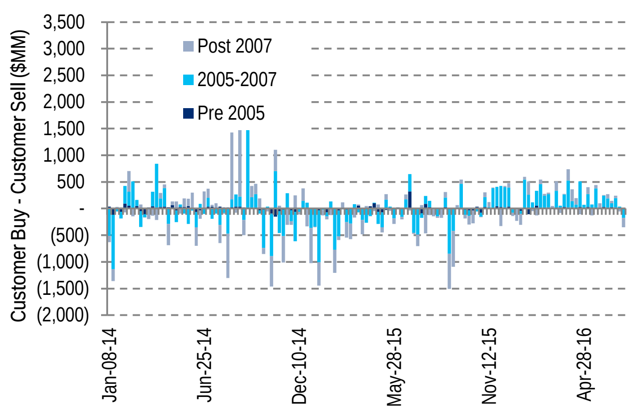
Source: Citi Research, FINRA

Figure 25. Net Customer Holdings By Vintage, Investment Grade



Source: Citi Research, FINRA

Figure 26. Net Customer Holdings By Vintage, Non-Investment Grade



Source: Citi Research, FINRA

Figure 27. Default Model Report

																				Model Projections(%CB)							
																				Base Scenario				Stress Scenario			
																		To Date(%OB)		2 Yr		Life		2 Yr		Life	
ISSUE YEAR	AMT OUT ($BB)	FACTOR	WALA	LOAN SIZE($K)	FICO	%INV	ORIG LTV	CURR LTV	60++ DQ(%)	Mods (%)	IO (%)	%in IO prd	Not DQ in 2Yr(%)	LAST 3 MONTH VPR	CDR	LS	Advrate	Cum Def	Cum Loss	Cum Def	Cum Loss	Cum Def	Cum Loss	Cum Def	Cum Loss	Cum Def	Cum Loss
Prime FIX																											
2004	1.8	0.07	146	243	722	13.0	70.6	44.0	9.5	13.7	1.5	0.0	82.88	15.5	1.6	33.9	76.4	1.5	0.5	3.7	0.2	9.2	0.4	5.4	0.3	12.6	0.5
2005	6.1	0.12	129	387	726	5.8	73.9	63.6	11.1	22.4	17.4	0.0	80.58	18.1	3.4	40.1	73.7	6.3	2.4	4.3	0.8	9.9	1.4	6.0	1.1	13.9	2.0
2006	8.8	0.15	117	437	726	5.6	76.8	75.4	13.8	31.1	32.5	22.6	77.53	15.9	4.1	45.5	70.5	10.8	4.7	5.8	2.0	12.8	3.3	8.1	2.6	18.6	4.7
2007	12.5	0.17	107	473	729	4.9	79.5	78.0	14.3	31.9	39.1	38.9	77.23	14.3	4.7	48.0	74.0	13.2	5.9	6.4	2.2	14.3	3.6	8.9	2.9	20.9	5.1
Total	**29.2**	**0.15**	**117**	**419**	**727**	**5.8**	**77.0**	**72.1**	**13.2**	**28.6**	**30.3**	**23.5**	**78.37**	**15.7**	**4.1**	**44.7**	**73.1**	**10.3**	**4.5**	**5.6**	**1.7**	**12.6**	**2.9**	**7.8**	**2.3**	**18.2**	**4.1**
Prime ARM																											
2004	7.9	0.08	141	295	729	11.5	72.8	49.7	7.0	8.9	74.0	0.0	88.29	14.7	1.7	32.5	74.3	3.0	1.0	2.9	0.7	7.9	1.4	4.7	1.0	11.9	2.0
2005	14.6	0.15	131	386	733	10.7	74.3	61.5	7.3	13.4	81.1	0.0	88.10	14.5	1.8	36.9	76.5	7.7	2.9	3.2	1.0	8.2	2.0	4.9	1.3	12.3	2.7
2006	11.6	0.18	120	455	730	10.4	75.6	73.3	9.3	19.9	90.9	20.9	85.56	14.7	2.6	45.7	75.8	15.4	6.7	4.5	1.8	12.2	4.0	7.0	2.6	17.9	5.7
2007	13.1	0.22	114	539	729	10.2	75.6	72.4	10.8	27.7	88.7	42.7	83.15	11.1	2.4	47.4	72.6	16.8	7.6	5.5	2.1	16.3	4.9	8.6	3.0	23.2	6.8
Total	**47.2**	**0.16**	**125**	**413**	**730**	**10.6**	**74.7**	**65.4**	**8.7**	**18.2**	**84.4**	**17.0**	**86.14**	**13.6**	**2.1**	**41.2**	**74.9**	**11.3**	**4.8**	**4.1**	**1.4**	**11.4**	**3.2**	**6.4**	**2.0**	**16.7**	**4.5**
Alt-A FIX																											
2003	2.9	0.07	153	100	711	30.6	73.9	42.1	10.0	16.6	1.6	0.0	81.80	12.0	1.6	60.5	74.5	2.7	1.1	3.3	0.9	11.1	2.1	4.5	1.1	13.8	2.7
2004	6.2	0.12	141	115	708	31.5	75.7	51.6	12.3	17.4	6.0	0.0	79.12	11.1	2.7	53.9	80.3	4.9	2.1	4.6	1.8	14.6	4.3	6.3	2.3	18.7	5.5
2005	20.3	0.20	129	169	709	19.2	76.8	66.8	15.1	26.0	28.3	0.0	74.67	11.9	4.2	58.0	72.8	12.9	6.6	5.7	2.6	16.4	6.2	7.5	3.4	21.6	8.1
2006	25.1	0.23	118	205	701	17.1	78.9	77.2	20.8	38.8	35.1	24.6	66.72	8.8	5.4	67.9	63.7	25.5	14.7	8.9	4.8	26.4	11.8	11.7	6.0	34.7	15.2
2007	19.9	0.28	108	254	703	13.9	78.3	76.6	21.2	42.9	41.6	41.0	66.05	8.5	5.1	65.0	69.2	27.6	15.7	9.0	4.7	26.7	11.5	12.0	6.0	35.4	14.9
Total	**74.4**	**0.22**	**122**	**184**	**705**	**18.5**	**77.7**	**70.7**	**18.2**	**33.8**	**31.2**	**19.3**	**70.33**	**9.9**	**4.6**	**63.0**	**69.5**	**20.0**	**11.2**	**7.5**	**3.8**	**22.2**	**9.2**	**9.9**	**4.8**	**29.1**	**11.9**
Alt-A ARM																											
2003	0.8	0.06	152	265	710	17.0	72.3	43.3	10.3	12.9	64.6	0.0	83.35	8.8	1.4	51.8	77.3	1.9	0.6	4.7	0.5	11.1	0.9	5.2	0.5	13.2	1.0
2004	6.9	0.09	140	214	711	23.1	79.9	59.3	11.7	20.1	74.1	0.0	79.27	10.0	3.2	36.8	63.1	6.9	2.6	6.0	1.8	16.1	4.0	6.8	2.0	19.4	4.5
2005	20.0	0.17	129	246	713	20.2	81.8	75.2	15.3	25.7	87.6	0.0	75.54	9.5	4.4	47.5	62.8	20.4	10.0	7.4	3.3	20.7	7.4	8.4	3.6	24.9	8.7
2006	23.7	0.20	118	296	709	16.7	83.3	85.7	18.2	38.2	89.1	51.0	70.96	6.9	5.0	59.2	51.1	36.8	20.4	9.6	4.9	28.6	11.8	11.3	5.6	34.9	14.1
2007	16.8	0.25	109	382	711	15.3	81.7	82.0	18.7	40.8	89.8	76.6	70.17	6.8	4.4	59.9	52.5	40.5	22.2	9.5	4.5	27.7	10.3	11.1	5.1	33.9	12.1
Total	**68.2**	**0.19**	**122**	**283**	**711**	**18.0**	**82.0**	**78.6**	**16.7**	**33.0**	**87.0**	**36.6**	**73.09**	**8.0**	**4.5**	**53.6**	**56.4**	**29.5**	**15.8**	**8.5**	**4.0**	**24.6**	**9.3**	**9.9**	**4.4**	**29.9**	**10.9**
Option ARM																											
2004	1.6	0.06	139	277	705	13.3	74.4	57.1	15.2	30.6	0.0	0.0	74.50	7.4	4.1	53.8	74.0	6.4	2.9	6.1	2.3	17.3	5.2	6.9	2.6	21.2	6.3
2005	15.5	0.13	129	331	699	15.0	76.3	70.4	20.1	39.7	0.0	0.0	68.47	6.0	5.4	55.4	59.2	21.2	11.3	8.9	4.4	23.0	9.5	10.1	4.8	28.3	11.4
2006	28.1	0.21	117	340	703	15.3	79.2	82.6	24.6	50.9	3.4	2.7	62.79	3.9	5.8	61.2	46.7	44.6	26.4	12.4	6.9	33.4	16.8	14.1	7.7	41.3	20.4
2007	22.7	0.29	108	359	709	14.2	78.7	81.4	23.4	50.9	31.7	29.6	64.86	3.7	5.9	66.9	44.8	49.8	29.8	11.7	6.6	32.8	16.8	13.4	7.4	40.6	20.3
Total	**67.9**	**0.21**	**117**	**342**	**704**	**14.8**	**78.3**	**78.8**	**23.0**	**47.9**	**12.0**	**11.0**	**65.05**	**4.4**	**5.7**	**61.6**	**49.6**	**40.1**	**23.5**	**11.2**	**6.1**	**30.5**	**14.9**	**12.8**	**6.8**	**37.6**	**18.0**
Subprime																											
2003	7.0	0.04	156	83	618	6.6	80.8	52.1	16.0	44.5	0.8	0.2	71.08	7.1	2.7	73.9	51.2	7.0	3.4	6.4	4.4	20.9	12.1	7.6	5.1	25.2	14.5
2004	19.6	0.06	142	109	626	6.5	81.3	59.6	18.5	52.4	5.6	0.1	67.48	6.2	3.6	73.4	53.0	9.1	5.2	7.4	5.0	24.1	13.7	8.6	5.7	29.1	16.5
2005	45.1	0.11	129	134	624	5.5	84.1	73.5	23.4	66.6	19.8	0.0	61.04	4.5	5.2	74.7	47.6	21.9	13.7	9.3	6.6	31.0	18.5	10.7	7.4	36.9	21.9
2006	78.0	0.18	118	144	623	4.9	85.3	83.1	26.2	73.1	16.1	1.3	57.75	3.8	6.4	81.3	48.8	41.5	29.4	10.9	8.4	37.9	25.2	12.5	9.5	45.2	29.9
2007	49.9	0.28	110	164	619	4.8	83.6	81.2	26.6	74.6	12.9	2.1	56.59	3.1	6.1	83.1	43.3	44.3	32.4	10.9	8.3	37.4	24.5	12.5	9.4	44.8	29.1
Total	**199.6**	**0.17**	**122**	**138**	**622**	**5.2**	**84.0**	**77.1**	**24.6**	**69.0**	**14.6**	**1.1**	**59.62**	**4.2**	**5.6**	**79.2**	**47.7**	**33.4**	**23.3**	**10.1**	**7.5**	**34.3**	**21.9**	**11.5**	**8.5**	**41.0**	**26.1**

-%OBand %CBstand for percent of original balance and percent of current balance respectively. Loss as a%OB= Loss to date + factor * (Loss as a %CB).
-The Base Scenario assumes that home prices rise 5% in the 1st year and 2nd year, and then increase by 3% per year, while unemployment goes to 5.1% by Q4 2016.
-The Stress Scenario assumes that home prices drop 4% in the 1st year, 1% in the 2nd year, remain flat in the 3rd year, and then increase by 3% per year, while unemployment peaks at 11% in 1 year.
-Cum Defaults and Cum Losses Include Losses arising from Loan Modifications as well.
-For details on our Model, refer to the white paper on our Loss Severity model, "A Loss Severity Model for Residential Mortgages," January, 2008 and Default Model , "Modeling of Mortgage Defaults," January, 2008.

Source: Citi Research, as of April 25th, 2016

Appendix A-1

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