MORTGAGE MARKET NOTE 12-02

20 Year vs. 30 Year Refinance Option

Under the changes to the Home Affordable Refinance Program (HARP)[1] announced late last year, borrowers with loan-to-value (LTV) ratios greater than 125% will now have the opportunity to refinance. In addition, these changes provided pricing incentives for borrowers to choose a shorter term mortgage.

This Mortgage Market Note provides a simple example to illustrate outcomes for underwater borrowers of choosing between two mortgage products:

- A 30 year fixed rate mortgage that will lower a borrower's monthly payment, but will extend the amount of time the borrower is underwater.
- A 20 year fixed rate mortgage that will not meaningfully lower a borrower's monthly payment, but will significantly reduce the amount of time the borrower is underwater.

In 2012, borrowers refinancing under HARP have been increasingly choosing shorter terms. The percentage of underwater HARP borrowers selecting a 15 or 20 year mortgage has increased from 10% in 2011 to 17% in the first six months of 2012.

Option 1 – Refinance into a 30 Year Mortgage

First we will consider the benefits to the borrower of refinancing into a new 30 year mortgage. The benefits to the borrower are:

- Lower monthly payment
- Reduction in finance cost

[1] www.fhfa.gov/webfiles/22721/HARP_release_102411_Final.pdf

The downside of refinancing into a new 30 year mortgage is that the borrower will be underwater for a longer period of time relative to the original mortgage.

The assumptions used for this analysis are displayed below. The borrower started with a $200,000 mortgage with a 360 month term (30 years). The borrower has made $10,000 in principal payments reducing the mortgage balance to $190,000. However, property values have declined such that the current LTV is 130%. The borrower refinances into a new 30 year mortgage and rolls $4,000 in closing costs into the new mortgage balance, raising the mortgage balance to $194,000. Adding the closing costs to the new mortgage balance increases the LTV to 133%.

Original Mortgage Assumptions	
Original Mortgage Balance	$200,000
Original Mortgage Term	360
Current Mortgage Balance	$190,000
Current LTV	130%

Refinanced Mortgage Assumptions	
Closing Costs included in Mortgage Balance	$4,000
Refinanced Mortgage Balance	$194,000
LTV of Refinanced Mortgage	133%
Refinanced Mortgage Term	360

Table 1 shows the change in monthly payment given different assumptions[2] for the original and refinanced interest rate. For example, if the rate on the original mortgage is 6%, the monthly payment would be $1,199. If the rate on the refinanced mortgage is 4.5%, the monthly payment would be $983. The difference between these two payments is -$216 (highlighted in yellow) – indicating that the borrower will save $216 per month on their mortgage payment with the refinanced mortgage.

[2] The assumed rates in this table are intended to cover a range of scenarios – they do not necessarily represent what a specific lender will offer a specific borrower.

Table 1: Change in Payment Original Mortgage vs. 30 Year Refinance							
				Refinanced Mortgage			
	Remaining Term	Rate	Payment	4.0% $926	4.5% $983	5.0% $1,041	5.5% $1,102
Original Mortgage	322	5.0%	$1,074	($147)	($91)	($32)	$28
	318	5.5%	$1,136	($209)	($153)	($94)	($34)
	315	6.0%	$1,199	($273)	($216)	($158)	($98)
	311	6.5%	$1,264	($338)	($281)	($223)	($163)
	308	7.0%	$1,331	($404)	($348)	($289)	($229)
	304	7.5%	$1,398	($472)	($415)	($357)	($297)
	299	8.0%	$1,468	($541)	($485)	($426)	($366)
	295	8.5%	$1,538	($612)	($555)	($496)	($436)

Next, consider the amount of time it will take the borrower to pay down the mortgage balance such that it equals the property value (LTV = 100%; meaning that the borrower is no longer underwater)[3]. Table 2 shows the difference in time (months) for the borrower to reach 100% LTV. For example, if the rate on the original mortgage is 6%, the mortgage will pay down to 100% LTV in 127 months. If the rate on the refinanced mortgage is 4.5%, the mortgage will pay down to 100% LTV in 143 months. The difference between these two is 16 months (highlighted in yellow) – indicating it will take the borrower 16 months longer to achieve a 100% LTV with the refinanced mortgage as opposed to staying with the original mortgage. Note that refinancing into a 30 year mortgage will increase the time to amortize to 100% LTV across all but two scenarios.

[3] Property values are assumed to be constant.

Table 2: Change in Months to Amortize to 100% LTV Original Mortgage vs. 30 Year Refinance							
				Refinanced Mortgage			
	Remaining Term	Rate	Months to 100% LTV	4.0%	4.5%	5.0%	5.5%
				136	143	149	156
Original Mortgage	322	5.0%	121	15	22	28	35
	318	5.5%	124	12	19	25	32
	315	6.0%	127	9	16	22	29
	311	6.5%	130	6	13	19	26
	308	7.0%	132	4	11	17	24
	304	7.5%	134	2	9	15	22
	299	8.0%	136	0	7	13	20
	295	8.5%	137	(1)	6	12	19

Finally, Table 3 shows the refinance savings of the refinanced mortgage versus the original mortgage. In this analysis we compare the discounted after-tax cash flows of the two options, assuming the borrower stays in the home for ten years.[4,5] We assume the borrower has a marginal tax rate of 28% and we discount the cash flows using the after-tax rate on the refinanced mortgage. The table shows the refinance savings under different interest rate assumptions. For example, if the rate on the original mortgage is 6% and the rate on the refinanced mortgage is 4.5%, the borrower will save $11,929 (highlighted in yellow with the refinanced mortgage as opposed to staying with the original mortgage.

[4] For a detailed discussion of the methodology used here see: Tai, Lawrence S. and Przasnyski, Zbigniew (2000). Calculating Refinance Strategies Precisely. *Journal of Financial and Strategic Decisions, Volume 13 Number 3*, 9-21.

[5] This analysis only considers the net present value of the cash flows. A fuller analysis would also include the difference in the value of the in-the-money refinance option that is given up and the new out-of-the-money option that is acquired. For a description, see: Agarwal, Driscol and Laibson (2008). Optimal Mortgage Refinancing: A Closed Form Solution. Electronic copy available at: http://ssrn.com/abstract=1010702.

Table 3: Refinance Savings Original Mortgage vs. 30 Year Refinance						
			Refinanced Mortgage			
	Remaining Term	Rate	4.0%	4.5%	5.0%	5.5%
Original Mortgage	322	5.0%	($6,695)	($1,261)	$4,000	$9,092
	318	5.5%	($12,122)	($6,573)	($1,200)	$4,000
	315	6.0%	($17,592)	($11,929)	($6,447)	($1,139)
	311	6.5%	($23,097)	($17,323)	($11,732)	($6,318)
	308	7.0%	($28,632)	($22,747)	($17,049)	($11,531)
	304	7.5%	($34,189)	($28,196)	($22,392)	($16,771)
	299	8.0%	($39,761)	($33,662)	($27,754)	($22,032)
	295	8.5%	($45,343)	($39,139)	($33,130)	($27,309)

In summary, underwater borrowers who refinance into a 30 year mortgage can expect a lower monthly payment and lower finance costs. However, they will increase the amount of time they are underwater.

Option 2 – Refinance into a 20 Year Mortgage

Now we will consider the benefits to the borrower of refinancing into a new 20 year mortgage. The benefits to the borrower are:

- Significant decrease in the amount of time the property is underwater
- Reduction in finance costs

The downside of refinancing into a 20 year mortgage is that the borrower is unlikely to see a reduction in their monthly payment relative the original mortgage and may see an increase in their monthly payment.

The assumptions used for this analysis are displayed below. All of the assumptions for the Original Mortgage are identical to Option 1. The assumptions for the refinanced mortgage are also the same except the term is 240 months (20 years).

Original Mortgage Assumptions	
Original Mortgage Balance	$200,000
Original Mortgage Term	360
Current Mortgage Balance	$190,000
Current LTV	130%

Refinanced Mortgage Assumptions	
Closing Costs included in Mortgage Balance	$4,000
Refinanced Mortgage Balance	$194,000
LTV of Refinanced Mortgage	133%
Refinanced Mortgage Term	240

Similar to Table 1, Table 4 shows the change in monthly payment given different assumptions for the original and refinanced interest rate. Again, if the rate on the original mortgage is 6%, the monthly payment would be $1,199. If the rate on the refinanced mortgage is 4.25%, the monthly payment would be $1,201. The difference between these two payments is $2 (highlighted in yellow) – indicating the borrower's payment will increase $2 per month. **NOTE:** The rates for the refinanced mortgage in this table are 0.25% lower than the rates used for the refinanced mortgage in Option 1, to reflect the fact that rates on 20 year mortgages are typically 0.25% lower than rates on otherwise identical 30 year mortgages.

Table 4: Change in Payment
Original Mortgage vs. 20 Year Refinance

				Refinanced Mortgage			
	Remaining Term	Rate		3.75%	4.25%	4.75%	5.25%
			Payment	$1,150	$1,201	$1,254	$1,307
Original Mortgage	322	5.0%	$1,074	$77	$128	$180	$234
	318	5.5%	$1,136	$15	$66	$118	$172
	315	6.0%	$1,199	($49)	$2	$55	$108
	311	6.5%	$1,264	($114)	($63)	($10)	$43
	308	7.0%	$1,331	($180)	($129)	($77)	($23)
	304	7.5%	$1,398	($248)	($197)	($145)	($91)
	299	8.0%	$1,468	($317)	($266)	($214)	($160)
	295	8.5%	$1,538	($388)	($337)	($284)	($231)

Similar to Table 2, Table 5 shows the difference in time (months) for the borrower to reach 100% LTV. Again, if the rate on the original

mortgage is 6%, the mortgage will pay down to 100% LTV in 127 months. If the rate on the refinanced mortgage is 4.25%, the mortgage will pay down to 100% LTV in 81 months. The difference between these two is -46 months (highlighted in yellow) – indicating that it will take the borrower 46 fewer months to achieve a 100% LTV with the refinanced mortgage as opposed to staying with the original mortgage. Note that across all assumed interest rates, refinancing into a 20 year mortgage will significantly decrease the time to amortize to 100% LTV.

Table 5: Change in Time to Amortize to 100% LTV
Original Mortgage vs. 20 Year Refinance

				Refinanced Mortgage			
	Remaining Term	Rate	Months to 100% LTV	3.75%	4.25%	4.75%	5.25%
				78	81	84	87
Original Mortgage	322	5.0%	121	(43)	(40)	(37)	(34)
	318	5.5%	124	(46)	(43)	(40)	(37)
	315	6.0%	127	(49)	(46)	(43)	(40)
	311	6.5%	130	(52)	(49)	(46)	(43)
	308	7.0%	132	(54)	(51)	(48)	(45)
	304	7.5%	134	(56)	(53)	(50)	(47)
	299	8.0%	136	(58)	(55)	(52)	(49)
	295	8.5%	137	(59)	(56)	(53)	(50)

And finally, similar to Table 3, Table 6 shows the refinance savings over a ten year horizon of a 20 year refinanced mortgage relative to the original mortgage under different interest rate assumptions. For example, if the rate on the original mortgage is 6% and the rate on the refinanced mortgage is 4.25%, the borrower will save $14,737 (highlighted in yellow) in finance costs with the refinanced mortgage as opposed to staying with the original mortgage.

Table 6: Refinance Savings Original Mortgage vs. 20 Year Refinance						
			Refinanced Mortgage			
	Remaining Term	Rate	3.75%	4.25%	4.75%	5.25%
Original Mortgage	322	5.0%	($9,480)	($3,956)	$1,391	$6,567
	318	5.5%	($14,965)	($9,325)	($3,865)	$1,421
	315	6.0%	($20,493)	($14,737)	($9,166)	($3,771)
	311	6.5%	($26,056)	($20,187)	($14,505)	($9,003)
	308	7.0%	($31,647)	($25,666)	($19,875)	($14,268)
	304	7.5%	($37,259)	($31,168)	($25,270)	($19,559)
	299	8.0%	($42,885)	($36,687)	($30,684)	($24,870)
	295	8.5%	($48,521)	($42,216)	($36,110)	($30,196)

In summary, underwater borrowers who refinance into a 20 year mortgage will not achieve a large decline in their monthly payment, and may see an increase. However, they will lower their finance costs and decrease the amount of time they are underwater.

Comparison of the 20 and 30 Year Refinance

The prior two sections compared the 30 year and 20 year refinance options to not refinancing and continuing with the existing mortgage. This section will compare the 20 year and 30 year refinance options. Table 7 shows the difference in monthly payment between a 20 year mortgage and a 30 year mortgage, using the same assumptions described earlier. Again, the rates on the 20 year mortgage are 0.25% lower than the comparable rates on the 30 year mortgage, consistent with the fact that rates on 20 year mortgages are typically 0.25% lower than rates on 30 year mortgages. The data show that the monthly payments for the 20 year mortgages exceed the monthly payment for the 30 year mortgages by more than $200.

Table 7: Change in Payment 30 Year vs. 20 Year Refinance						
			30 Year Refinance			
	Rate		4.0%	4.5%	5.0%	5.5%
		Payment	$926	$983	$1,041	$1,102
20 Year Refi	3.75%	$1,150	$224			
	4.25%	$1,201		$218		
	4.75%	$1,254			$212	
	5.25%	$1,307				$206

Table 8 shows the difference in time (months) for the borrower to reach 100% LTV between a 20 year mortgage and a 30 year mortgage, using the same assumptions described earlier. The data show that refinancing into a 20 year mortgage will reduce the amount of time the borrower is underwater by 58 – 69 months (nearly 5-6 years) depending on the interest rate.

Table 8: Change in Time to Amortize to 100% LTV 30 Year vs. 20 Year Refinance						
			30 Year Refinance			
	Rate		4.0%	4.5%	5.0%	5.5%
		Months to 100% LTV	136	143	149	156
20 Year Refi	3.75%	78	(58)			
	4.25%	81		(62)		
	4.75%	84			(65)	
	5.25%	87				(69)

Table 9 shows the difference in refinance savings between a 20 year mortgage and a 30 year mortgage, using the same assumptions described earlier. The data show that refinancing into a 20 year mortgage will always reduce finance costs relative to a 30 year mortgage, though the amount is relatively small given a 10 year holding period.

Table 9: Difference in Refinance Savings Over a 10 Year Horizon 20 Year vs. 30 Year Refinance					
		Refinanced Mortgage			
	Rate	20 Year (3.75%) - 30 Year (4%)	20 Year (4.25%) - 30 Year (4.5%)	20 Year (4.75%) - 30 Year (5%)	20 Year (5.25%) - 30 Year (5.5%)
Original Mortgage	5.0%	($2,785)	($2,695)	($2,609)	($2,525)
	5.5%	($2,843)	($2,752)	($2,664)	($2,579)
	6.0%	($2,901)	($2,808)	($2,719)	($2,632)
	6.5%	($2,958)	($2,864)	($2,773)	($2,685)
	7.0%	($3,014)	($2,919)	($2,826)	($2,737)
	7.5%	($3,070)	($2,973)	($2,879)	($2,788)
	8.0%	($3,124)	($3,025)	($2,930)	($2,838)
	8.5%	($3,177)	($3,077)	($2,981)	($2,887)

Conclusion

The examples in the Mortgage Market Note show that underwater borrowers who refinance into a 30 year mortgage can improve their monthly cash flow, but at the cost of extending the time period that they are underwater. Alternatively, the borrower can refinance into a 20 year mortgage with little change in their monthly cash flow, but with the benefit of significantly reducing the time period they are underwater and lowering their finance costs.