

# Refi Plus™ and HARP Performance Insights

## Summary

Fannie Mae's Connecticut Avenue Securities® (CAS) and Credit Insurance Risk Transfer™ (CIRT™) programs have transferred credit risk on newly acquired loans to private investors since 2013. As part of our ongoing capital management efforts, we expect to transfer credit risk on other parts of our portfolio. In November 2019, Fannie Mae will issue the first CAS transaction referencing loans that were acquired as part of the Refi Plus program. The Refi Plus program includes but is not limited to the Home Affordable Refinance Program, or HARP. CAS 2019-HRP1 will reference a pool of seasoned Refi Plus loans acquired between April 2009 and October 2012. In this commentary, we provide an overview of the Refi Plus program, analyze the profile of loans acquired through this program, and review their performance in order to provide insights that may help investors evaluate these transactions.

## Key Takeaways

- Loans that took advantage of the Refi Plus program have recovered a significant amount of equity since the financial crisis, resulting in strong credit performance and improved refinancing potential.
- The prepayment behavior of 2009-2012 Refi Plus has been similar to 2009-2012 non-Refi Plus loans and significantly more stable than more recent originations, adjusted for rate incentive.
- We can use the Fannie Mae Single-Family Loan Performance primary and HARP datasets to model the default performance of Refi Plus loans. After adjusting for their risk attributes, 2009-2012 Refi Plus loans exhibit approximately 20 percent unexplained underperformance in default rates.
- Loss severities for 2009-2012 Refi Plus loans are similar to those of 2009-2012 non-Refi Plus loans after considering the presence (or lack) of mortgage insurance (MI).
- An alternative approach may be to frame loss expectations in the context of historical vintages, given that cumulative delinquencies for the Refi Plus cohort have converged to the 2002-2003 vintages.
- Default expectations should be adjusted for seasoning and performance, as we would expect performing loans with significant seasoning to have a very low propensity to default going forward. Applying this methodology to CAS 2019-HRP1 generates expected losses in the range of 5-9 basis points and stress losses in the range of 10-19 basis points.

Loans that took advantage of the Refi Plus program have recovered a significant amount of equity since the financial crisis, resulting in strong credit performance and improved refinancing potential.



## Overview of Refi Plus Program

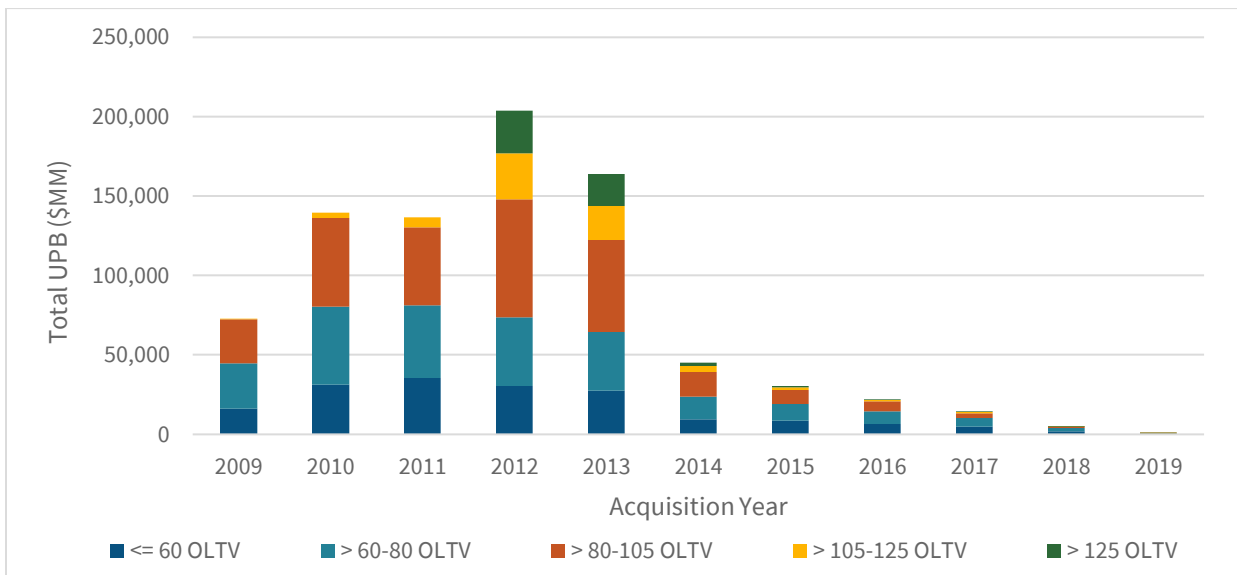
Fannie Mae’s Refi Plus program was launched in 2009. The program was introduced to enable borrowers whose loans were owned by Fannie Mae to efficiently refinance into improved loan terms such as a lower rate, a shorter term, or a more stable product. Refi Plus offered increased underwriting efficiencies, attractive pricing, and flexible MI requirements. Lenders benefited from relief from certain representations and warranties, while Fannie Mae could further reduce its credit risk by enabling existing Fannie Mae borrowers to refinance into more favorable terms.

The Federal Housing Finance Agency (FHFA) introduced the Home Affordable Refinance Program, or HARP, in 2009. HARP was designed for the segment of borrowers during the financial crisis that demonstrated continued ability and willingness to make their mortgage payments but were unable to take advantage of the low prevailing market interest rates to refinance due to low or negative equity. HARP was offered by Fannie Mae as a subset of its broader Refi Plus initiative and provided expanded refinance opportunities for eligible loans with LTV ratios of greater than 80 percent and initially up to 105 percent. HARP eligibility expanded over time in order to support more borrowers and later in 2009, the LTV maximum was increased to 125 percent. In late 2011, HARP 2.0 was introduced, which removed the LTV maximum, relaxed performance criteria, provided additional flexibilities for loans with existing MI, and allowed borrowers to more easily refinance with a different servicer. For more details on program eligibility, please see the Appendix.

Fannie Mae’s Refi Plus program, along with FHFA’s HARP, was retired in December 2018 (with deliveries allowed through September 2019). Fannie Mae through FHFA then introduced a new program, the high LTV refinance option, a permanent refinance offering aimed at performing borrowers whose LTV ratios exceed our standard limits for limited cash-out refinances.

Between 2009 and 2019, Fannie Mae’s Refi Plus initiative including HARP enabled 4.6 million homeowners to take advantage of refinances to improve their financial situation. During this period, Fannie Mae acquired \$834 billion of Refi Plus loans, 66 percent of which were acquired between 2009 and 2012. Approximately half of aggregate Refi Plus acquisitions were classified as HARP loans, having an LTV greater than 80 percent (see **Exhibit 1** below). The majority of HARP loans were acquired in 2012-13 after HARP 2.0 enhancements went into effect. In this commentary, we will use the term Refi Plus to refer to the broader initiative, which includes HARP, unless otherwise indicated.

**Exhibit 1: Refi Plus Acquisition Volumes by Original LTV Band**



Note: LTV band determined by the LTV ratio of Refi Plus loan, not the original loan being refinanced. In cases where Refi Plus loans were not required to submit an updated appraisal, the LTV ratio for Refi Plus loans is derived from the property value submitted by the lender.



## Credit Profile of Refi Plus Acquisitions

Unlike loan modification programs aimed at borrowers in default or in imminent danger of default, Refi Plus was targeted at borrowers who were current on their mortgage payments at the time of refinance. Correspondingly, Refi Plus acquisitions generally exhibited strong credit scores, averaging 740 FICO (see **Exhibit 2** below). Approximately 85 percent of overall Refi Plus volumes had a FICO of at least 680. Loans were required to have a strong payment history in order to take advantage of the Refi Plus program, typically resulting in improved credit scores. In addition, borrowers that refinanced through Refi Plus demonstrated a certain level of financial savvy, responsiveness to solicitation, and confidence in their financial status to re-commit to their mortgage obligation.

We can observe the impact of the changes to the HARP program over time in the credit profile beginning in 2012. Weighted average LTV increased by approximately 20 percentage points in the peak HARP vintages, and the credit score distribution experienced a modest shift lower. Refi Plus volumes dropped off significantly after 2013, although loans continued to trickle in through 2019. Loans that were acquired in later years exhibited weaker characteristics, as borrower credit may have been damaged during the financial crisis and borrowers that did not take advantage of the program immediately may reflect adverse selection.

On average, borrowers taking advantage of the Refi Plus program benefited from a note rate reduction of 1.61 percent.

### Exhibit 2: Credit Profile of Refi Plus Acquisitions by Vintage

Refi Plus Vintage	Loans ('000)	UPB (\$MM)	Factor	WAvg Rate Change	WAvg FICO	< 620 FICO	620-680 FICO	680-740 FICO	> 740 FICO	WAvg OLTV	<= 80 OLTV	> 80 OLTV
2009	332	72,534	0.1	-1.14%	757	1%	4%	24%	71%	74	62%	38%
2010	660	139,538	0.2	-1.16%	754	2%	6%	24%	68%	75	58%	42%
2011	733	136,794	0.2	-1.30%	753	2%	7%	25%	67%	74	59%	41%
2012	1,117	203,659	0.4	-1.81%	744	3%	10%	26%	60%	93	36%	64%
2013	1,018	163,906	0.5	-2.07%	728	6%	16%	29%	49%	90	39%	61%
2014	302	45,049	0.5	-1.65%	711	10%	22%	29%	39%	80	52%	48%
2015	198	30,383	0.6	-1.83%	716	9%	21%	28%	42%	74	63%	37%
2016	141	22,099	0.7	-2.07%	712	9%	23%	30%	38%	72	67%	33%
2017	92	14,083	0.8	-1.93%	709	10%	23%	32%	35%	69	72%	28%
2018	35	5,033	0.9	-1.59%	705	11%	24%	32%	34%	67	77%	23%
2019	4	644	1.0	-1.19%	706	11%	22%	31%	35%	62	83%	17%
Grand Total	4,633	833,722	0.4	-1.61%	740	4%	11%	26%	58%	82	50%	50%

Note: Loan characteristics including FICO and LTV ratio are shown for Refi Plus loan at acquisition, not for the original loan. Rate change is calculated as the difference between the note rate on the Refi Plus loan and the original loan.

Comparing the credit profile of the Refi Plus ex-HARP population to the HARP population (see **Exhibit 3** below), we find that leverage is the primary differentiating feature. As expected, the weighted average LTV of this population is 40 percentage points higher than Refi Plus ex-HARP given that HARP is the subset of Refi Plus with an LTV ratio greater than 80 percent at the time of refinancing. Correspondingly, the HARP population has a larger average loan size, as well as a higher weighted average debt-to-income (DTI) ratio. The credit profile of the HARP cohort is marginally weaker with a weighted average FICO that is 13 points lower than the Refi Plus ex-HARP cohort and a slightly higher share of loans with FICO less than 680.



**Exhibit 3: Credit Profile Comparison Between Refi Plus ex-HARP and HARP**

	<b>Refi Plus ex-HARP</b>	<b>HARP Only</b>	<b>All</b>
Orig UPB (\$MM)	416,492	417,230	833,722
Loan Count ('000)	2,562	2,071	4,633
WAvg Orig Loan Size	\$162,588	\$201,474	\$179,971
WAvg Note Rate	4.29%	4.41%	4.35%
WAvg OLTV	61	103	82
WAvg CLTV	67	108	87
WAvg FICO	747	734	740
WAvg DTI	36	40	0
% Cash-out	32%	30%	31%
% Investor	9%	12%	11%
% FICO < 680	13%	18%	15%
% OLTV > 80	0%	100%	50%
% OLTV > 125	0%	12%	6%
% DTI > 45	27%	33%	30%
WAvg Risk Layers	0.95	1.04	0.99

*Note: We identify four potential risk layers. Risk layers are defined as cash-out (original loan prior to Refi Plus), investor, FICO < 680, and single borrower. Debt-to-income (DTI) ratio is shown for the original loan prior to Refi Plus.*

From a geographic standpoint, the highest share of Refi Plus acquisitions was concentrated in California at almost 20 percent, as seen in **Exhibit 4** below. California had the largest volume of mortgages, as well as some of the most significant home price depreciation (HPD) in the country. New York and Texas, which experienced relatively lower HPD, have a higher representation in Refi Plus ex-HARP volumes, while Florida, which experienced severe HPD, represents a high share of HARP volumes.

**Exhibit 4: Geographic Concentration of Refi Plus Acquisitions**

<b>Rank</b>	<b>Refi Plus ex-HARP</b>	<b>HARP</b>	<b>Total</b>
1	CA - 18.2%	CA - 17.5%	CA - 17.8%
2	NY - 6.0%	FL - 8.7%	FL - 6.4%
3	TX - 5.8%	IL - 6.0%	IL - 5.1%
4	IL - 4.2%	MI - 4.7%	NY - 4.5%
5	FL - 4.1%	WA - 4.7%	WA - 4.3%
Top 5	38.3%	41.6%	38.1%

*Note: Geographic concentration is determined using acquisition UPB.*

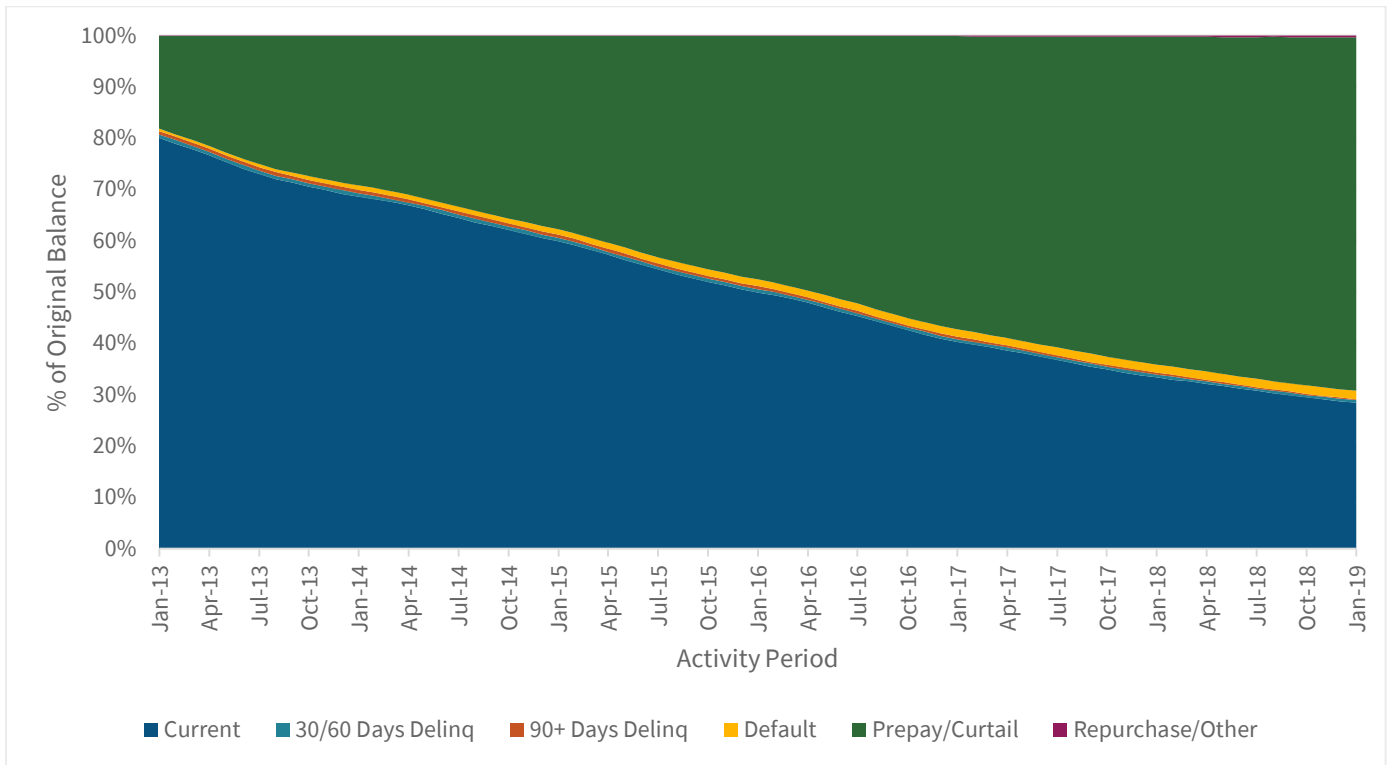


## Performance of Refi Plus Acquisitions

With over 10 years of performance on the earliest cohort of Refi Plus loans, we can take stock of trends observed in the data. To align with the acquisition period referenced in our forthcoming CAS transaction, we focus the remainder of this analysis on Refi Plus loans from the 2009-2012 vintages<sup>1</sup>. This population covers 66 percent of overall Refi Plus volumes.

As seen in **Exhibit 5** below, the 2009-2012 cohort has paid down at a relatively consistent rate since acquisition with a remaining factor of 25 percent. Less than 2 percent of the original cohort has defaulted, while less than 1 percent remains active and delinquent today.

**Exhibit 5: Evolution of 2009-2012 Refi Plus Population**

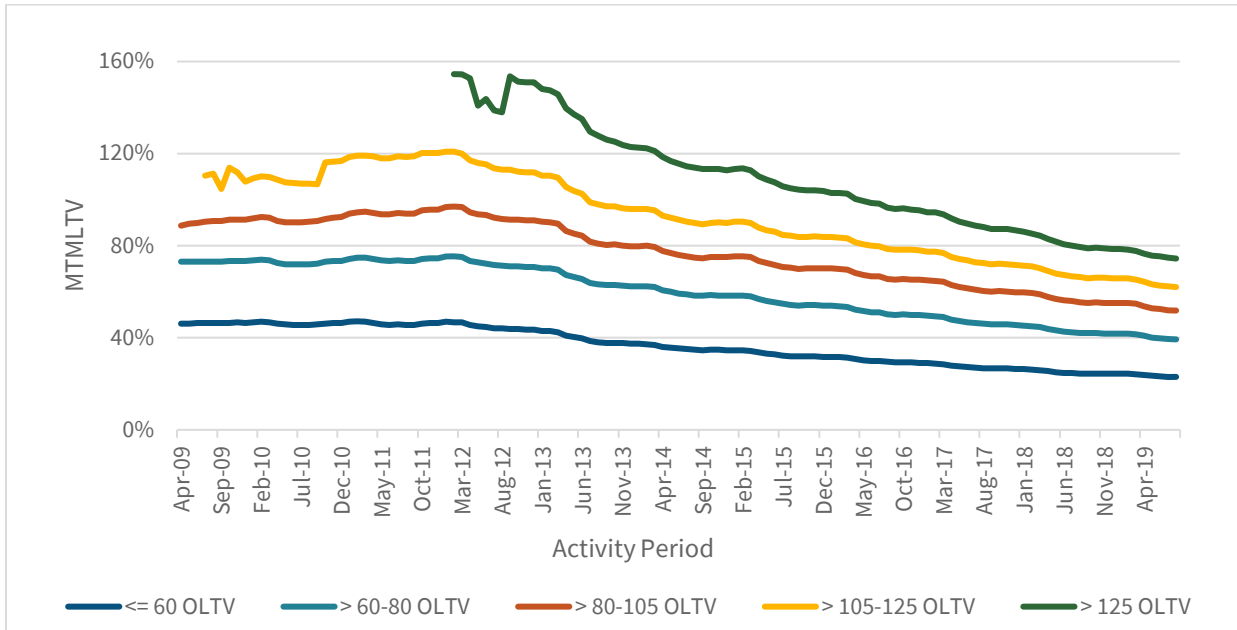


After troughing in 2012, national home prices have rebounded meaningfully and today exceed their 2007 peak by roughly 20 percent. As a result, Refi Plus borrowers have experienced significant home price appreciation (HPA) that has improved their equity position, even if they were initially underwater on their mortgage. In **Exhibit 6** below, we plot the evolution of mark-to-market LTV (MTMLTV) by original LTV band for the 2009-2012 Refi Plus population over time. MTMLTV is calculated by marking the property value of the Refi Plus loan to market using Fannie Mae’s zip-level home price index.

<sup>1</sup> Note that this cohort does not align perfectly with the CAS 2019-HRP1 deal, which references Apr 2009-Oct 2012 acquisitions.



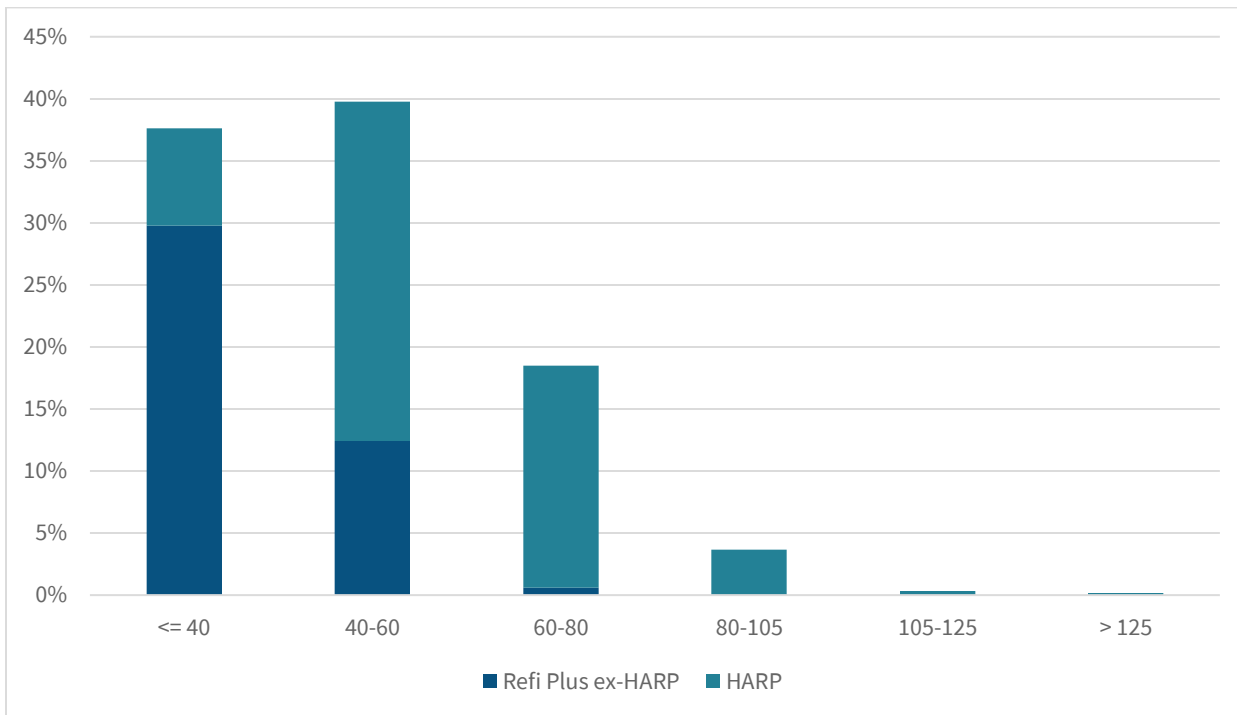
**Exhibit 6: Evolution of 2009-2012 Refi Plus Population MTMLTV by OLV Band**



Note: MTMLTV is calculated by marking to market the property value using Fannie Mae's zip-level home price index.

Today, 99 percent of active 2009-2012 Refi Plus ex-HARP loans have an MTMLTV ratio less than or equal to 60 percent and 93 percent of active 2009-2012 HARP loans have an MTMLTV ratio less than or equal to 80 percent, as seen in **Exhibit 7** below. The weighted average MTMLTV for the 2009-2012 cohort overall is 47 percent based on Fannie Mae's zip-level home price index.

**Exhibit 7: MTMLTV Distribution of 2009-2012 Refi Plus Today**

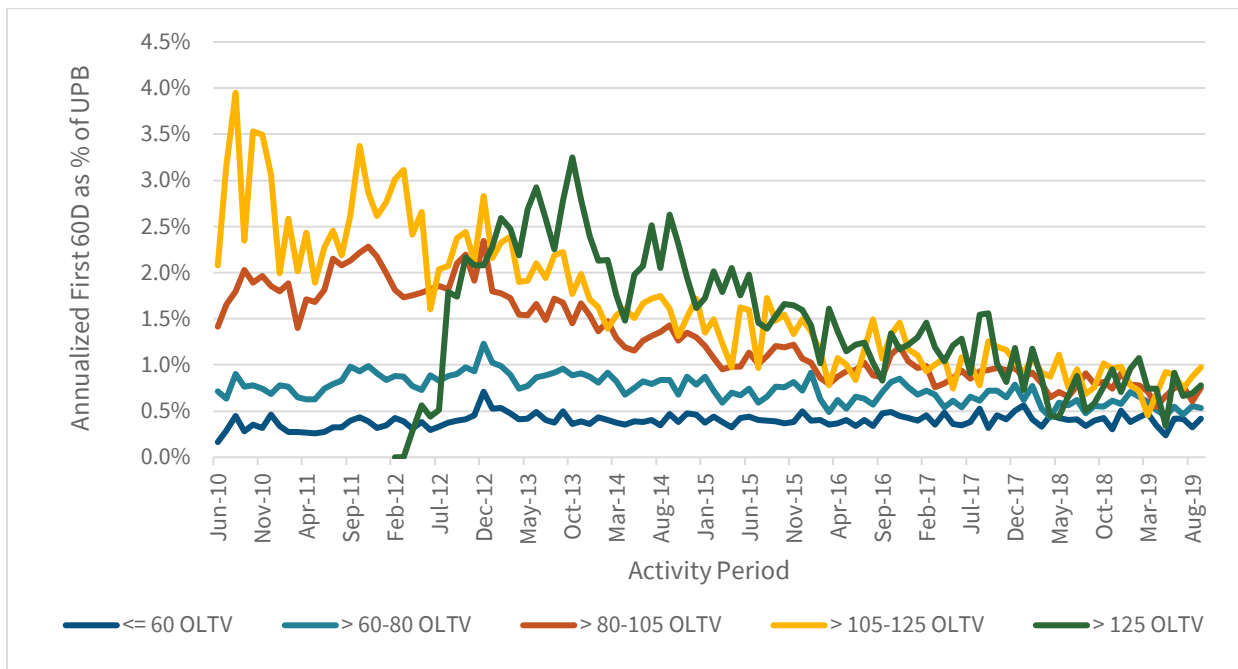


Note: MTMLTV is calculated by marking to market the property value using Fannie Mae's zip-level home price index.



The recovered home equity, as well as general macroeconomic strength, have resulted in improving credit performance in this population. In **Exhibit 8** below, we show the annualized share of the 2009-2012 Refi Plus population that is rolling to 60-day delinquency for the first time by original LTV band. Initially, we observed significant stratification between LTV bands, as borrowers with low or no equity became delinquent at a faster pace than borrowers with more equity. With HPA and macroeconomic stabilization, the pace of rolls into 60-day delinquency for the first time has declined significantly and converged across LTV bands. With equity build-up and credit burnout, the performance of the outstanding population of Refi Plus is exhibiting continued improvement.

**Exhibit 8: Annualized First 60-Day Delinquency as % of Current UPB by OLTV Band**

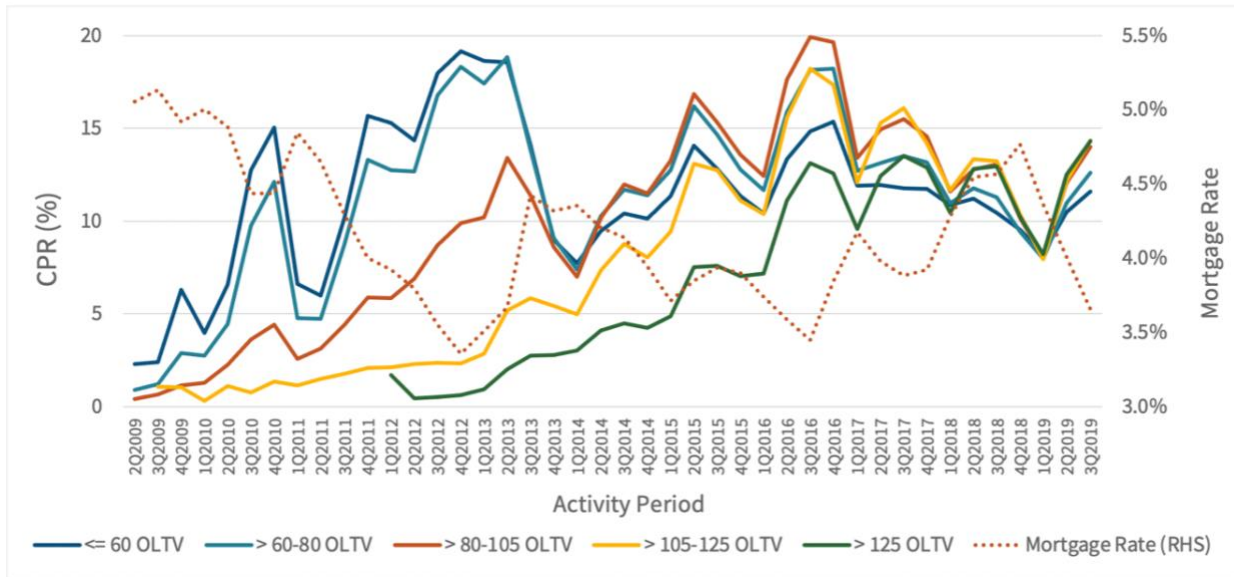


Note: Excludes loans located in hurricane-affected areas.

As their equity position has improved, Refi Plus borrowers have also been able to take advantage of new refinancing opportunities. Initially, we can see significant stratification between LTV bands in responsiveness to rate rallies. When rates fell by roughly 170 basis points beginning in 2011, borrowers that had an LTV less than or equal to 80 percent exhibited voluntary prepayments in the high teens, while more levered borrowers exhibited a weaker response (see **Exhibit 9** below). More recently, the response from borrowers that started out with a lower LTV ratio has been more muted due to burnout. However, refinancings from borrowers that were originally underwater have picked up.

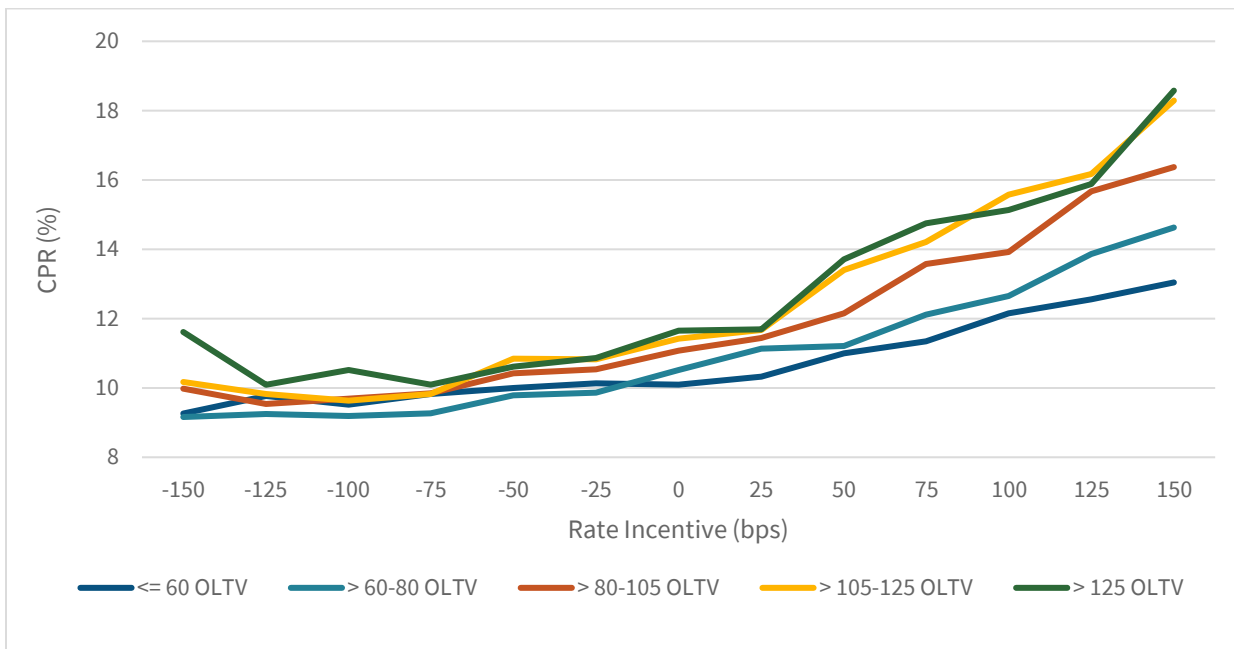


**Exhibit 9: 2009-2012 Refi Plus Prepayments by OLV Band**



**Exhibit 10** below illustrates the sensitivity of 2009-2012 Refi Plus borrowers by original LTV band to rate incentives since 2018. Loans that had an original LTV less than or equal to 80 percent have a flatter s-curve, while loans that had an original LTV above 80 percent exhibit more pronounced convexity.

**Exhibit 10: Prepayment S-Curves by OLV Band Since 2018**



Note: Shown for activity periods beginning in Jan-2018.





## Relative Performance of Refi Plus Loans

In this section, we analyze publicly available sources of loan performance data to inform our expectations for the future performance of the Refi Plus cohort. We use the Fannie Mae Historical Single-Family Loan Performance dataset (the “historical dataset”) for loan-level data of a subset of non-Refi Plus acquisitions, as well as the corresponding subset of HARP mortgages from the addendum to the primary dataset. We begin by analyzing defaults, provide insights into loss severities, and end with an evaluation of prepayment behavior.

## Credit Performance Relative to Benchmarks

We can think of the Refi Plus cohort as two separate populations: (1) Refi Plus loans with an OLV ratio less than or equal to 80 percent and (2) HARP loans, which are Refi Plus loans with an OLV ratio greater than 80 percent. As discussed below, we use the primary dataset to analyze the former and the HARP addendum to analyze the latter.

We begin by comparing the profile of Refi Plus ex-HARP loans with the profile of non-Refi Plus loans having an OLV ratio less than or equal to 80 percent. The post-crisis non-Refi Plus vintages are among the cleanest originations in history. As seen in **Exhibit 11** below, the Refi Plus ex-HARP cohort is weaker across all dimensions except weighted average OLV. The difference between these cohorts widens with the implementation of the second phase of Refi Plus, beginning in early 2012. In particular, the Refi Plus ex-HARP cohort exhibits lower FICO scores and concentration in the FICO tail. In addition, the Refi Plus ex-HARP cohort has a higher concentration of loans with CLTV greater than 90.

**Exhibit 11: Comparison of Refi Plus ex-HARP and Non-Refi Plus ≤ 80 OLV Populations**

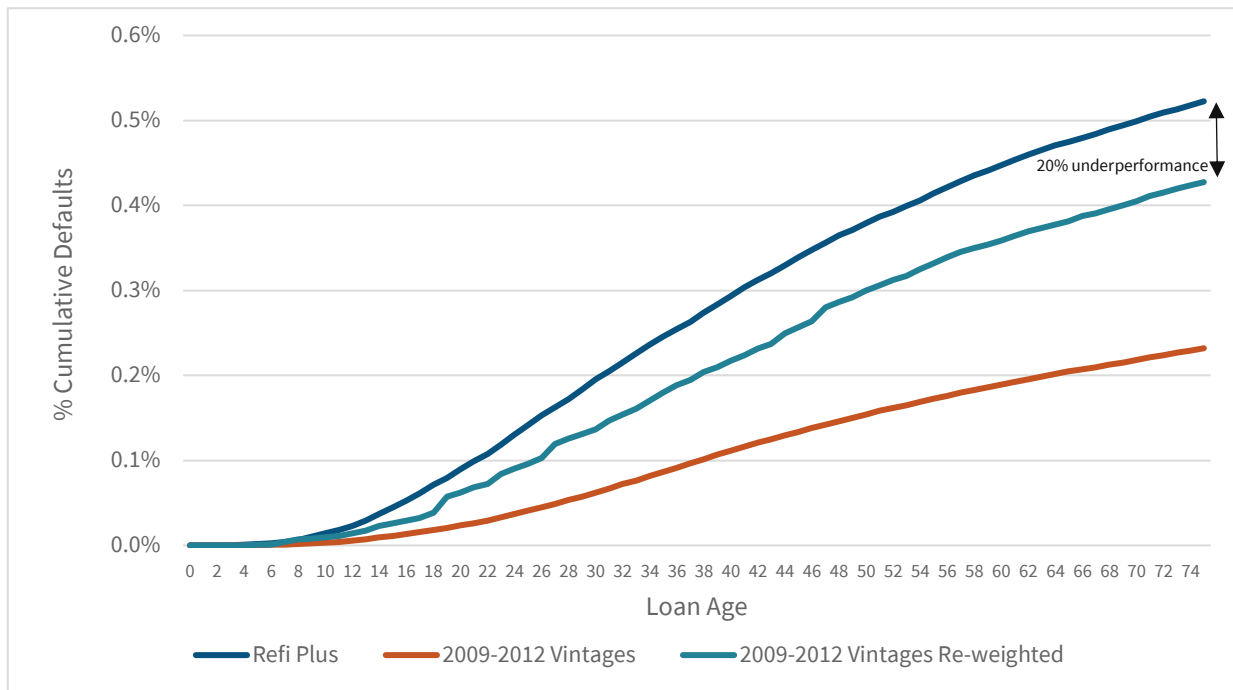
	Refi Plus ≤80 OLV	Non-Refi Plus ≤80 OLV	Difference between Refi Plus and Non-Refi Plus			
			2009	2010	2011	2012
Orig UPB (\$MM)	280,124	1,682,285	-428,164	-293,732	-247,641	-432,624
Loan Count ('000)	1,591	7,603	-1,918	-1,280	-1,040	-1,774
WAvg Note Rate	4.43	4.36	-0.08	0.07	0.13	0.20
% 30-yr Fixed Rate	59%	69%	-6%	-6%	-9%	-11%
WAvg OLV	62	65	-1	-3	-5	-4
WAvg CLTV	67	67	0	0	-1	1
WAvg FICO	758	765	0	-5	-7	-15
WAvg DTI	35	32	2	3	3	4
% Cash-out	31%	27%	-6%	2%	7%	10%
% Investor	6%	5%	-1%	0%	1%	3%
% FICO < 680	8%	4%	1%	3%	4%	8%
% CLTV > 90	7%	1%	3%	6%	7%	9%
% DTI > 45	25%	9%	8%	18%	18%	20%
WAvg Risk Layers	0.81	0.72	-0.08	0.04	0.13	0.22

Note: Risk layers are defined as cash-out (original loan prior to HARP), investor, FICO < 680, and single borrower. Debt-to-income (DTI) ratio is shown for the original loan prior to HARP.



Not surprisingly, cumulative default performance has been weaker for the Refi Plus cohort than for the non-Refi Plus cohort, as illustrated by the brown line relative to the green line in Exhibit 12 below. However, given the riskier profile of the Refi Plus cohort, we need to adjust performance for observable credit attributes; in this analysis, we use CLTV, FICO, and risk layer buckets. If we re-weight the performance of the Refi Plus cohort by the credit profile of the non-Refi Plus cohort, represented by the red line in **Exhibit 12** below, the performance gap narrows. On a risk-adjusted basis, we find that the Refi Plus cohort has performed approximately 20 percent worse than the non-Refi Plus cohort.

**Exhibit 12: Cumulative Default Performance for 2009-2012  $\leq$  80 OLV Refi Plus and Non-Refi Plus**



*Note: The Refi Plus cohort is limited to Refi Plus loans from 2009-2012 acquisition vintages having an OLV ratio less than or equal to 80 percent. The non-Refi Plus cohort is limited to 2009-2012 loans from the Fannie Mae historical dataset having an OLV ratio less than or equal to 80 percent. The Refi Plus cohort is re-weighted according to CLTV, FICO, and risk layer buckets. Risk layers are defined as cash-out (original loan), investor, and single borrower.*

Next, we can compare the profile and performance of the full 2009-2012 HARP population to the 2009-2012 HARP loans in the addendum to the historical dataset.

Following the announcement of the high LTV refinance option, Fannie Mae published an addendum to our historical dataset in Aug 2017 that captures the profile and performance details on the portion of loans included in the primary dataset that have refinanced through HARP. This dataset contained a subset of Fannie Mae HARP acquisitions – aligning with the corresponding loans in the primary dataset – and was meant to provide investors with insight into how the continuation of coverage on reference collateral that exercises the high LTV refinance option may affect credit performance.



In this section, we compare the profile and performance of the HARP loans included in the Loan Performance dataset with the overall population of HARP loans acquired by Fannie Mae. As a reminder, HARP is the subset of the Refi Plus population that had an LTV greater than 80 percent.

In **Exhibit 13** below, we compare the credit profile of the HARP population in the historical dataset with the full HARP population acquired by Fannie Mae. The two populations are very similar across most risk attributes, although the full HARP population is slightly riskier. In particular, the difference between the weighted average LTV of the two populations increases as HARP 2.0 goes into effect. This slight gap between the populations is also visible in the share of loans with CLTV greater than 90 percent. The weighted average FICO and share of loans with FICO less than 680 are roughly similar. The HARP loans in the historical dataset have a slightly higher share of cash-out loans, while the overall HARP population has a slightly higher share of investor loans.

**Exhibit 13: Comparison of Historical Dataset and Full HARP Populations**

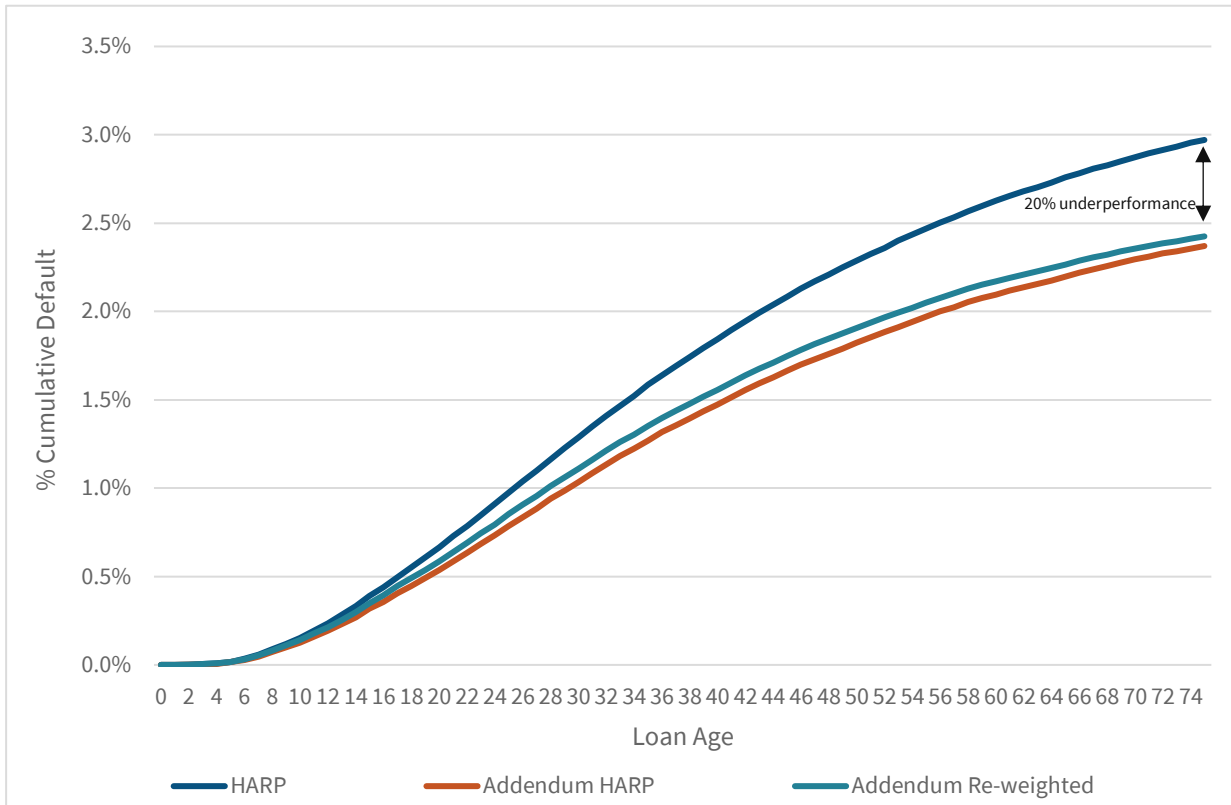
	Full HARP	Addendum HARP	Difference between Full HARP and Addendum HARP			
			2009	2010	2011	2012
Orig UPB (\$MM)	272,401	155,100	10,835	27,373	24,321	54,772
Loan Count ('000)	1,251	708	46	116	110	270
WAvg Note Rate	4.55	4.50	-0.01	0.07	0.05	0.05
% 30-year Fixed Rate	79%	79%	-2%	0%	2%	1%
WAvg OLTV	101	100	0	0	0	4
WAvg CLTV	106	103	1	1	1	4
WAvg FICO	743	742	2	-1	-1	1
WAvg DTI	39	39	0	0	1	1
% Cash-out	29%	33%	-4%	-4%	-3%	-5%
% Investor	9%	8%	0%	0%	1%	1%
% FICO < 680	12%	13%	-1%	0%	0%	-1%
% CLTV > 90	72%	69%	3%	3%	3%	3%
% DTI > 45	31%	30%	1%	1%	1%	1%
WAvg Risk Layers	0.91	0.92	-0.01	0.00	0.01	-0.03

*Note: Risk layers are defined as cash-out (original loan prior to HARP), investor, FICO < 680, and single borrower. Debt-to-income (DTI) ratio is shown for the original loan prior to HARP.*

We compare the cumulative default performance of these two populations in **Exhibit 14** below and find that the full HARP cohort (in brown) exhibits weaker performance than the HARP cohort in the addendum to the historical dataset (in green). When we re-weight the performance of the full HARP cohort (in red), we find that very little of this performance differential is attributable to observable characteristics. The roughly 20 percent underperformance of the full HARP cohort is unexplainable by differences in credit profile. The most likely driver of this underperformance is the selection criteria used to include loans in the primary dataset, which is limited to fixed-rate, fully amortizing, full documentation mortgage loans only. Because the purpose of the dataset is to enable market participants to analyze the performance of newly originated loans, certain types of mortgage loans with features that are generally no longer eligible for sale to Fannie Mae have been excluded from the dataset.



## Exhibit 14: Cumulative Default Performance for 2009-2012 HARP Cohorts



Note: The HARP cohort is limited to Refi Plus loans from 2009-2012 acquisition vintages having an OLV ratio greater than 80 percent. The addendum HARP cohort is limited to 2009-2012 loans from the Fannie Mae historical dataset addendum having an OLV ratio greater than 80 percent. The HARP cohort is re-weighted according to CLTV, FICO, and risk layer buckets. Risk layers are defined as cash-out (original loan), investor, and single borrower.

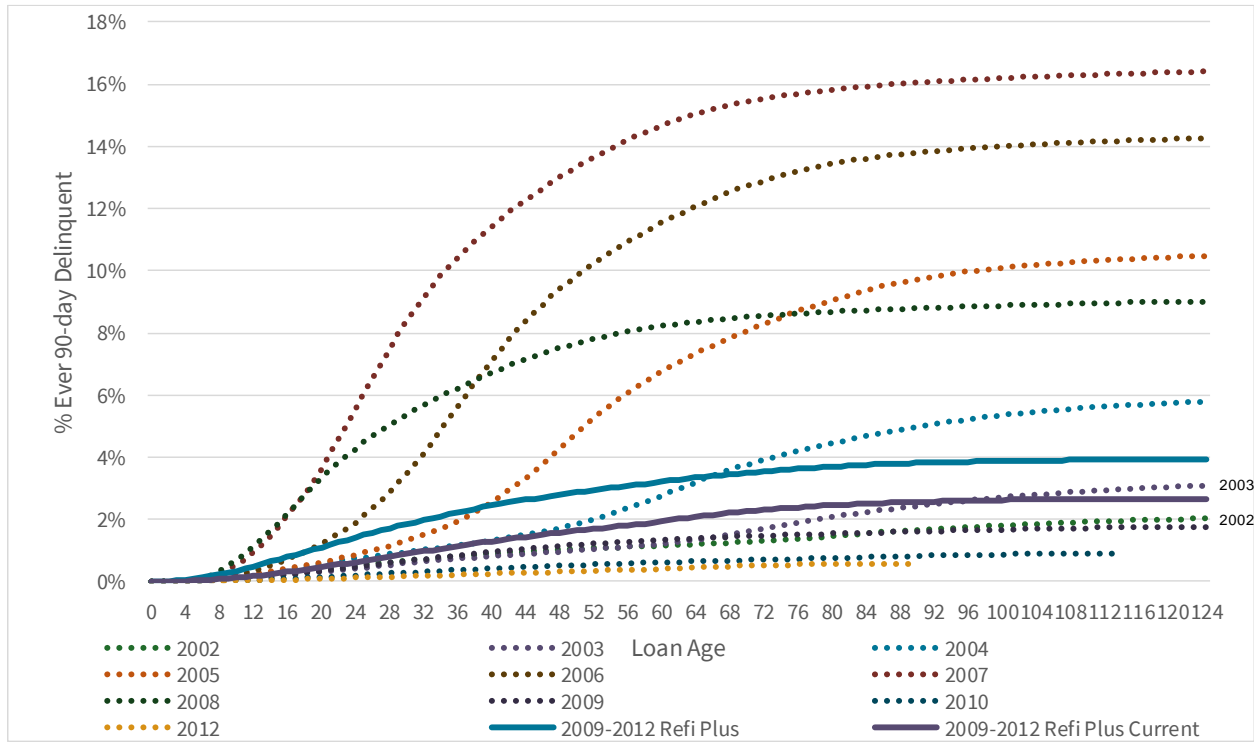
Using this insight, investors may consider analyzing Refi Plus collateral using default models calibrated to the historical dataset, applying a scalar to adjust for the 20 percent residual underperformance, and adjusting for the seasoning of the collateral, as discussed below.

## Benchmarking Performance Expectations

We can also frame our performance expectations for the Refi Plus cohort in the context of historical vintages. In **Exhibit 15** below, we compare the cumulative delinquency performance of the Refi Plus cohort to historical vintages by seasoning. This entire Refi Plus cohort is shown in teal, while the subset of Refi Plus loans that is active and current today is shown in purple in Exhibit 15 below. We can observe that the pace of transitions to delinquency for both populations accelerated as market conditions deteriorated in the first 24 months but plateaued thereafter. As seen in Exhibit 15 below, the share of the Refi Plus population that is active and current today (solid purple line) that has ever gone 90 days delinquent is between those of the 2002 and 2003 vintages.



**Exhibit 15: Ever 90-day Delinquencies as a % of Original Balance**



Note: The 2009-2012 Refi Plus Current cohort refers to Refi Plus loans originated between 2009-2012 that are still active and current as of the most recent activity period, while the 2009-2012 Refi Plus cohort refers to all Refi Plus loans originated between 2009-2012 (including those that have prepaid or defaulted).

**Box 1. Illustrative Methodology for Benchmarking Refi Plus Loss Expectations**

1. **Select comparable historical vintage(s):** Identify historical vintage(s) whose credit performance and remaining factor are comparable to the relevant Refi Plus cohort.
2. **Calculate defaults:** Calculate lifetime defaults for the comparable historical vintage(s).
3. **Apply seasoning adjustment:** Isolate the portion of lifetime defaults for the comparable historical vintage(s) that occurred up through the level of seasoning of the Refi Plus cohort. Haircut lifetime defaults in Step 2 by this amount.
4. **Apply performance adjustment:** Determine what portion of lifetime defaults from Step 2 were attributable to loans that meet deal performance eligibility criteria at various levels of seasoning. Haircut adjusted defaults from Step 3 by this amount.
5. **Apply loss severity:** Apply expected loss severity to adjusted defaults from Step 4 to calculate expected loss.



Given their comparable performance, one potential approach to estimating expected and stress losses for the 2009-2012 Refi Plus loans is to use the 2002 and 2003 vintages as a benchmark. A high-level summary of the methodology we use below is shown in Box 1 above.

- 1. Comparative vintage defaults:** The 2002 vintage has experienced 78 basis points of default. The 2003 vintage has experienced 113 basis points of default. On average, these two vintages have experienced 100 basis points of default.
- 2. Seasoning adjustment:** Given that the 2009-2012 Refi Plus cohort is seasoned and that our objective is to project defaults on the population that is outstanding today, we need to adjust the lifetime defaults above for the portion that had occurred through a comparable level of seasoning. We believe that this methodology is reasonable given that the 2002-2003 vintages have a similar factor on a seasoning-adjusted basis as the Refi Plus cohort.
  - **Expected:** The weighted average seasoning of the 2009-2012 Refi Plus cohort is 97 months. As illustrated by the shaded box in Exhibit 16 below, of the 100 basis points of lifetime defaults on the 2002-2003 vintages, roughly 55 percent had occurred by 97 months of seasoning. The remaining 45 percent of lifetime defaults occurred thereafter. If we assume that the Refi Plus cohort will exhibit the same seasoning ramp, 45 percent remaining defaults would produce 45 basis points of expected incremental default on this population.
  - **Stress:** The least seasoned loans from the 2009-2012 Refi Plus cohort are aged 85 months. Roughly 45 percent of 2002 and 2003 vintage cumulative defaults occurred by 85 months of seasoning, and the remaining 55 percent occurred thereafter. If we assume that in a stress scenario, the entire Refi Plus cohort will behave like the least seasoned loans, 55 percent remaining defaults would produce 55 basis points of expected default.
- 3. Performance adjustment:** The contribution to lifetime defaults of loans that meet the performance eligibility criteria for our CAS 2019-HRP1 transaction has been low.
  - **Expected:** Continuing with our methodology of using the weighted average pool seasoning to benchmark a potential expected scenario, we see in **Exhibit 16** below that loans with 97 months of seasoning and which also meet the CAS 2019-HRP1 performance criteria contributed roughly 20 percent of lifetime defaults. As expected, once we apply payment criteria to the loans, the default expectations drop significantly. In this scenario, the performance-adjusted pool contribution of 20 percent of lifetime defaults is a little less than half of the 45 percent of remaining lifetime defaults.
  - **Stress:** Using the minimum seasoning as a potential stress scenario, we see that loans from the 2002 and 2003 vintages with 85 months of seasoning that meet the performance criteria for CAS 2019-HRP1 contributed only 30 percent of lifetime defaults. This represents slightly more than half of the 55 percent of remaining lifetime defaults for the overall vintage.

The relatively low contribution of these loans to lifetime defaults may justify scaling expected and stress losses down by the same amount, or roughly 50 percent.
- 4. Loss severity:** Applying a loss severity of 20 percent to the expected defaults above results in approximately 5 basis points of loss, or up to 9 basis points if we omit the 50 percent performance criteria benefit. Similarly, applying a loss severity of 35 percent to the stress defaults above results in approximately 10-19 basis points of loss, or up to 19 basis points if we omit the 50 percent performance criteria benefit. We discuss loss severity benchmarks in further detail below.

## Box 2. Illustrative Methodology for Benchmarking Refi Plus Loss Expectations

### Expected Loss

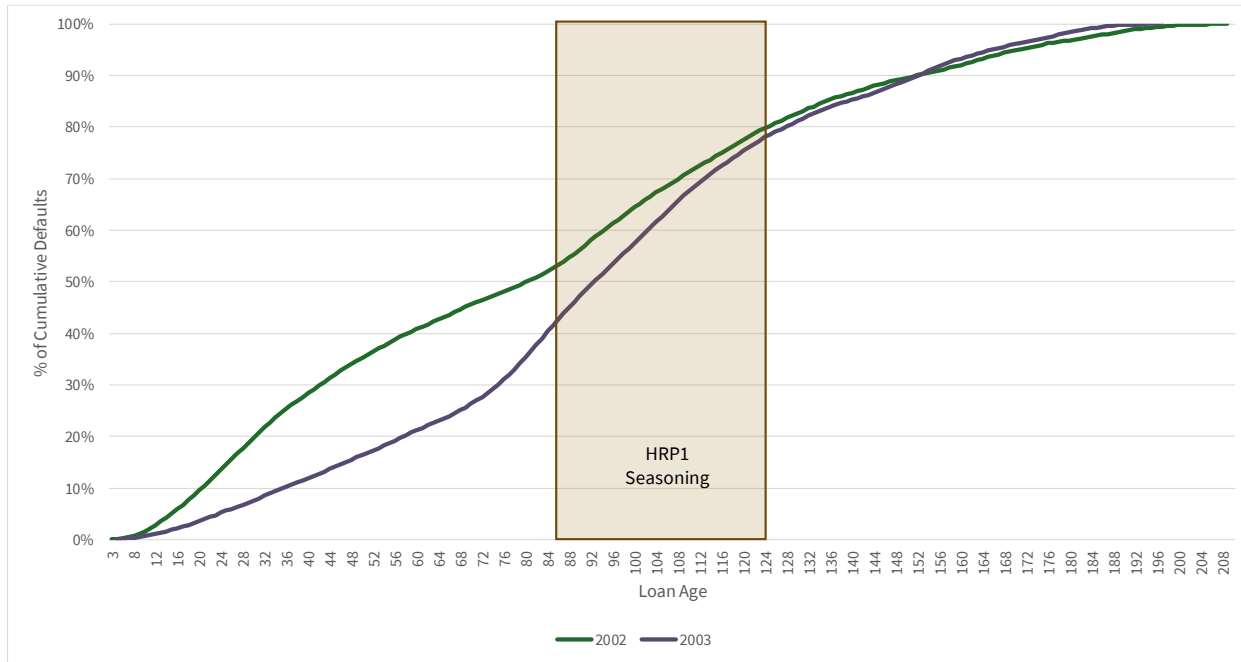
$$= \text{Expected Lifetime Defaults} \times \text{Seasoning Haircut} \times \text{Performance Haircut} \times \text{Expected Loss Severity}$$

### Stress Loss

$$= \text{Stress Lifetime Defaults} \times \text{Seasoning Haircut} \times \text{Performance Haircut} \times \text{Stress Loss Severity}$$



### Exhibit 16: Percent of Cumulative Defaults by Loan Seasoning



The *active* and *current* Refi Plus cohort continued to make payments on their original loan as financial conditions deteriorated, recommitted to their mortgage by refinancing through the program, weathered continued home price depreciation through the trough, and remained in the same home and Refi Plus loan through today. As a result, our expectation of additional defaults from this population in the current macroeconomic environment is extremely low.

### Exhibit 17: Contribution to Cumulative Defaults by Loans that Meet Eligibility Criteria

Loan Age	Vintage	
	2002	2003
72	35%	41%
84	24%	28%
96	17%	18%
108	11%	10%
120	7%	6%
132	5%	4%

*Note: We show the share of cumulative defaults from the 2002 and 2003 vintage that is attributable to loans that met our CAS 2019- HRP1 performance eligibility criteria at each level of seasoning. We apply the following inclusion criteria based on performance: (1) loans that have an MTMLTV ratio less than 40 percent and are current at the beginning of each of the above calendar years and (2) loans that have an MTMLTV ratio greater than or equal to 40 percent, have no 30-day delinquencies in the prior three months, and have no more than one 30-day delinquency in the prior twelve months are deemed to satisfy the eligibility criteria. For example, loans from the 2002 vintage that met the 2019-HRP1 performance eligibility criteria at 84 months of seasoning contributed 24 percent of lifetime defaults for that vintage.*



## Loss Severities

Although the Refi Plus program eased appraisal requirements, loss severities for the 2009-2012 Refi Plus cohort look very similar to those of 2009-2012 non-Refi Plus loans after considering the presence (or lack) of MI, as seen in **Exhibit 18** below. Unlike the non-Refi Plus population, most of the Refi Plus loans with an original LTV ratio greater than 80 that defaulted did not have MI. This outcome was primarily due to the original (pre-Refi Plus) loan having had an LTV ratio less than or equal to 80 percent (and thus, not required to acquire MI on the Refi Plus loan despite home price depreciation). The severity differential between defaulted loans with and without MI is approximately 15-20 percentage points.

**Exhibit 18: Components of Loss Severity for 2009-2012 Refi Plus/Non-Refi Plus Loans**

	Refi Plus				Non-Refi Plus			
	<= 60 OLTV	> 60-80 OLTV	> 80-105 OLTV No MI	> 80-105 OLTV MI	<= 60 OLTV	> 60-80 OLTV	> 80-105 OLTV No MI	> 80-105 OLTV MI
Default UPB (\$MM)	137	1,225	4,331	832	363	3,635	7	1,277
% of Default UPB								
Delinquent Interest	9%	8%	7%	7%	10%	9%	7%	7%
Foreclosure	5%	3%	2%	3%	5%	3%	4%	3%
Property Preservation	3%	3%	2%	3%	4%	3%	4%	3%
Asset Recovery	1%	1%	1%	1%	0%	1%	1%	1%
Associated Taxes	5%	3%	2%	2%	5%	3%	3%	2%
Miscellaneous	1%	1%	0%	1%	1%	1%	1%	1%
Total Costs	123%	119%	115%	116%	126%	120%	119%	117%
Sales Proceeds	98%	84%	77%	72%	96%	80%	80%	76%
Credit Enhancement	0%	0%	0%	24%	0%	0%	0%	20%
Repurchase Proceeds	1%	1%	1%	1%	2%	5%	1%	3%
Other Proceeds	3%	1%	1%	1%	3%	2%	1%	1%
Total Proceeds	102%	86%	79%	97%	101%	86%	83%	101%
% Severity	22%	33%	36%	18%	25%	34%	36%	16%

Note: The maximum LTV ratio for non-Refi Plus loans is 97 percent.

Interestingly, we do not see a material deterioration in loss severity as the original LTV ratio of the Refi Plus population increases. As seen in **Exhibit 19** below, the loss severity for the 105-125 LTV and greater than 125 LTV populations with and without MI are roughly in line with their counterparts with 80-105 LTV in **Exhibit 18** above.

**Exhibit 19: Components of Loss Severity for 2009-2012 Refi Plus, LTV Greater than 105 Percent**

	> 105-125 OLTV		> 125 OLTV	
	No MI	MI	No MI	MI
Default UPB (\$MM)	749	545	611	515
% of Default UPB				
Delinquent Interest	5%	6%	4%	4%
Foreclosure	2%	2%	2%	2%
Property Preservation	2%	2%	2%	2%
Asset Recovery	1%	1%	1%	1%
Associated Taxes	2%	2%	1%	1%
Miscellaneous	0%	1%	0%	1%
Total Costs	112%	113%	111%	111%
Sales Proceeds	76%	70%	75%	66%
Credit Enhancement	0%	25%	0%	25%
Repurchase Proceeds	0%	0%	0%	0%
Other Proceeds	1%	1%	1%	1%
Total Proceeds	77%	97%	76%	92%
% Severity	34%	16%	35%	19%

Taking a look at the same defaulted Refi Plus population by MTMLTV bucket (**Exhibit 20** below), we observe an intuitive, positively sloped relationship between MTMLTV and loss severity. The severity gap between defaulted loans with and without MI also increases with MTMLTV.





## Exhibit 20: Refi Plus Loss Severity by MTMLTV Bucket

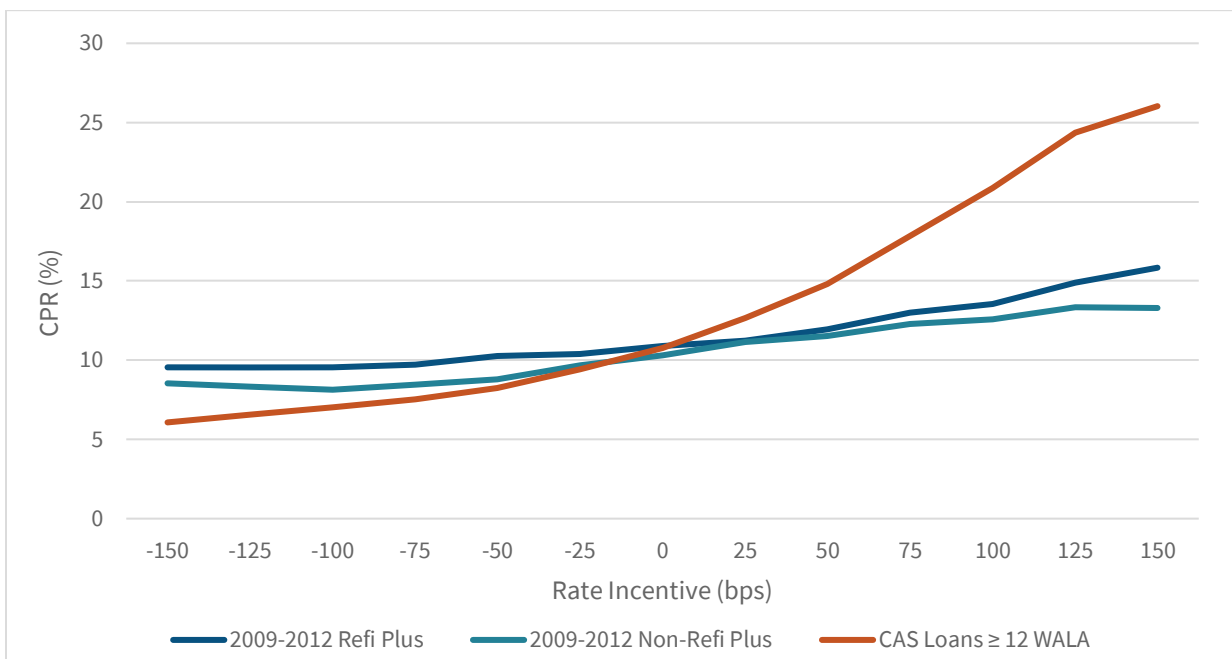
	No MI						MI				
	<= 40 MTMLTV	> 40-60 MTMLTV	> 60-80 MTMLTV	> 80-105 MTMLTV	> 105-125 MTMLTV	> 125 MTMLTV	> 40-60 MTMLTV	> 60-80 MTMLTV	> 80-105 MTMLTV	> 105-125 MTMLTV	> 125 MTMLTV
Default UPB (\$MM)	33	299	1,688	3,181	1,017	326	6	128	806	483	272
% of Defaults	0%	4%	20%	39%	12%	4%	0%	2%	10%	6%	3%
% of Default UPB											
Delinquent Interest	7%	9%	8%	7%	6%	5%	7%	7%	7%	6%	5%
Foreclosure	7%	5%	3%	2%	2%	2%	8%	4%	3%	2%	2%
Property Preservation	2%	3%	3%	2%	2%	2%	2%	3%	3%	2%	2%
Asset Recovery	0%	1%	1%	1%	1%	1%	0%	1%	1%	1%	1%
Associated Taxes	5%	4%	3%	2%	2%	1%	2%	3%	2%	2%	1%
Miscellaneous	1%	1%	1%	0%	0%	0%	1%	1%	1%	1%	1%
Total Costs	123%	122%	119%	115%	112%	111%	120%	119%	116%	114%	111%
Sales Proceeds	107%	97%	87%	77%	69%	61%	94%	82%	74%	67%	58%
Credit Enhancement	0%	0%	0%	0%	0%	0%	11%	20%	24%	26%	26%
Repurchase Proceeds	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%
Other Proceeds	6%	3%	1%	1%	0%	0%	1%	1%	1%	1%	1%
Total Proceeds	114%	101%	89%	79%	70%	62%	106%	104%	100%	94%	85%
% Severity	9%	21%	30%	36%	42%	49%	14%	15%	16%	20%	26%

Note: MTMLTV is calculated by marking to market the property value using Fannie Mae's zip-level home price index. Includes disposed loans with populated MTMLTV.

## Prepayments

Compared to 2009-2012 non-Refi Plus loans, 2009-2012 Refi Plus loans have displayed a similar prepayment profile in recent years, as seen in **Exhibit 21** below. Although we have observed burnout on the segment of Refi Plus borrowers that had lower LTV ratios at origination, prepayments on loans that were initially underwater have picked up. Relative to more recent originations, represented by the cohort of CAS borrowers with at least 12 months of seasoning, Refi Plus borrowers have exhibited a less negatively convex, more stable profile over the past two years.

## Exhibit 21: Prepayment S-curve for 2009-2012 Refi Plus and Non-Refi Plus Cohorts



Note: Shown for activity periods beginning in Jan-2018. CAS loans must have at least 12 months of seasoning.



## Conclusion

Fannie Mae’s Refi Plus program offered a simplified refinancing experience, enabling existing Fannie Mae borrowers to take advantage of market conditions to refinance into improved loan terms. Borrowers that took advantage of the Refi Plus program displayed a commitment to their mortgage obligation and a certain level of financial savvy. The borrowers in this cohort that remain outstanding today have recovered a significant amount of equity in their properties, resulting in benign credit performance and a stable prepayment behavior. As Fannie Mae prepares to transfer credit risk on its Refi Plus portfolio, market participants can use the historical datasets with appropriate adjustments to formulate expectations about how this cohort will perform.

## Appendix

### Summary of Refi Plus and HARP Program

	Pre-2012	Post-2012
<b>Eligibility</b>	<p><b>Original loan:</b> Originated on or before May 31, 2009 and owned or guaranteed by Fannie Mae</p> <p><b>New loan:</b> Application dates on or after Apr 1, 2009 and acquired by Fannie Mae on or after Apr 1, 2009</p>	<p><b>Original loan:</b> Originated on or before May 31, 2009 and owned or guaranteed by Fannie Mae</p> <p><b>New loan:</b> Application dates on or after Dec 1, 2011 and acquired by Fannie Mae on or after Jan 3, 2012</p>
<b>Number of Refi Plus/HARP Refinances Permitted</b>	Borrowers only allowed to refinance through Refi Plus/HARP once	Borrowers only allowed to refinance through Refi Plus/HARP once
<b>Minimum LTV ratio</b>	<p><b>HARP:</b> 80 LTV</p> <p><b>Non-HARP:</b> no minimum</p>	<p><b>HARP:</b> 80 LTV</p> <p><b>Non-HARP:</b> no minimum</p>
<b>Maximum LTV ratio</b>	<p><b>HARP:</b> 105 LTV through June 2009, 125 LTV thereafter</p> <p><b>Non-HARP:</b> 80 LTV</p>	<p><b>HARP:</b> no maximum</p> <p><b>Non-HARP:</b> 80 LTV</p>
<b>Performance Criteria</b>	No more than 1 x 30 in last 12 months, or if less than 12 months seasoned, since the note date	0 x 30 in last 6 months; no more than 1 x 30 in last 12 months, or if less than 12 months seasoned, since the note date
<b>Mortgage Insurance</b>	<ul style="list-style-type: none"> <li>• If the original loan was not required to have MI, the Refi Plus/HARP loan was not required to have MI</li> <li>• If the original loan had MI that has since been cancelled, the Refi Plus/HARP loan was not required to have MI</li> </ul>	<ul style="list-style-type: none"> <li>• If the original loan was not required to have MI, the Refi Plus/HARP loan was not required to have MI</li> <li>• If the original loan had MI that has since been cancelled, the Refi Plus/HARP loan was not required to have MI</li> <li>• If the original loan had MI, the lender must work with the MI provider to transfer coverage from the old loan to the new loan</li> </ul>



## Additional Resources

- Explore our suite of credit risk transfer vehicles via [Fannie Mae Credit Risk Transfer Programs](#)
- Download our [Single-Family Loan Performance Dataset](#)
- Take a deep-dive into our [Single-Family Credit Risk Management presentation](#)
- Sign up for [News and Commentary](#) or our free data analytics platform [Data Dynamics](#)

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