The impact of ESG on MBS performance and prepayment

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The incorporation of sustainability and social responsibility measures into investment practices has often been handled separately from traditional financial assessment; however, in this publication we demonstrate that ESG considerations can provide significant value when integrated into workflows.

Last year, Yield Book introduced a quantitative-based methodology for agency residential mortgage-backed security (RMBS) assets, producing ESG-focused metrics that analyzed and measured entities' Responsible Lending and Responsible Servicing behaviors and applying this at a security level. Market participants can use this information to identify mortgage pools that meet certain criteria. In this paper we show that the same information correlates to investment performance.

This publication focuses on prepayment behavior across the dimension of these socially oriented lending and servicing traits. We present the results through several common visualizations, including a correlation study, S-curves, weighted average loan age (WALA) ramps and a total return analysis. Our goal is to assist investors in identifying mortgage-backed security (MBS) pools that contain loans originated or serviced along commonly accepted social criteria and to support investment decisions with the benefit of observing prior results.

The study includes performance and prepayment information for each individual ESG metric, as well as aggregated loan attributes outside of ESG.

Our research highlights significant dispersion in the prepayment behavior of ESG cohorts and cannot be attributed to other collateral characteristics typically used in prepayment models. We find that investing based on Yield Book's ESG metrics generally leads to better financial performance and, in most cases, ESG MBS cohorts are observed to prepay more slowly.

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Yield Book's ESG Metric Methodology overview

Last year, Yield Book launched a set of ESG metrics intended to facilitate detection of negative and positive behaviors in a servicing and lending context based on loan-level data; a summary of each metric is given below. We then investigate these metrics' connection to financial performance.

For additional information on our Sustainable Investment Analytics solutions, please visit [Sustainable Investment Analytics | Yield Book]

Responsible servicing

Responsible behavior in a servicing context is the practice of extending fair and reasonable terms to borrowers during the servicing process. To facilitate the measurement of – and to highlight the extent of – potentially predatory practices within a deal or market segment, we have developed quantitative-based metrics.

Responsible delinquency policy

Positive behaviors can be observed when the servicer actively attempts to seek modification with the borrower to prevent foreclosure and other routes such as default and buyout, particularly prior to legally enforced deadlines. This measure shows servicers' willingness to provide positive outcomes for the borrower by helping them avoid incurring further debt or losing their home.

Relative default rate

Foreclosure is the ultimate worst outcome for both the borrower and the servicer. It is a costly legal process usually avoided by the servicer and becomes a major credit issue for the borrower; however, a relatively high value in combination with other characteristics could also indicate an unwillingness to engage in alternative options for the borrower.

Loan churn

Loan churn is understood to be the process of encouraging borrowers to refinance repeatedly in a short timeframe following the origination of their loan with little benefit to the borrower, with the servicer benefiting from these administrative fees at each refinance.

Responsible Lending

Responsible behavior in a lending context is the practice of extending fair and reasonable terms to borrowers during the loan origination process. To facilitate the measurement of – and to highlight the extent of – potentially predatory practices within a deal or market segment, we have developed quantitative-based metrics.

Outsized rates

This metric provides a measure of a lender's overall deviation from the population for the interest rates extended to borrowers. We developed a benchmark for prediction of spread at origination (SATO) given input characteristics at each point in time, based on a linear regression model to obtain coefficients of the various inputs across loan-level data from 2010-2021. Each lender's distribution is then compared to the population through a density comparison.

Early pay default risk

A mortgage loan is considered to have substantial early payment default risk (EPDR) if it displays delinquency above a threshold period within a relatively short timeframe following loan origination. While this can occur even with the involved parties acting responsibly during loan origination, prevalence of early delinquency situations in recently originated loans for a specific lender's production highlights a potential inclination towards predatory behavior.

Irresponsible lending

Irresponsible lending, a predatory behavior on the part of the lender, is defined by the consistent offering of loans to borrowers with high-risk credentials. This can result in the borrower facing default risks, falling behind on existing commitments and experiencing financial hardship. This behavior expressed in regard to loans with poor credit is identified by looking at the consistent extension of credit to high-risk borrowers relative to other lenders within either a deal or market segment, in combination with default rates. We note that lending to risky borrowers is not predatory – this is of course required for healthily functioning markets – but is an issue to be highlighted if it occurs consistently and over a long period.

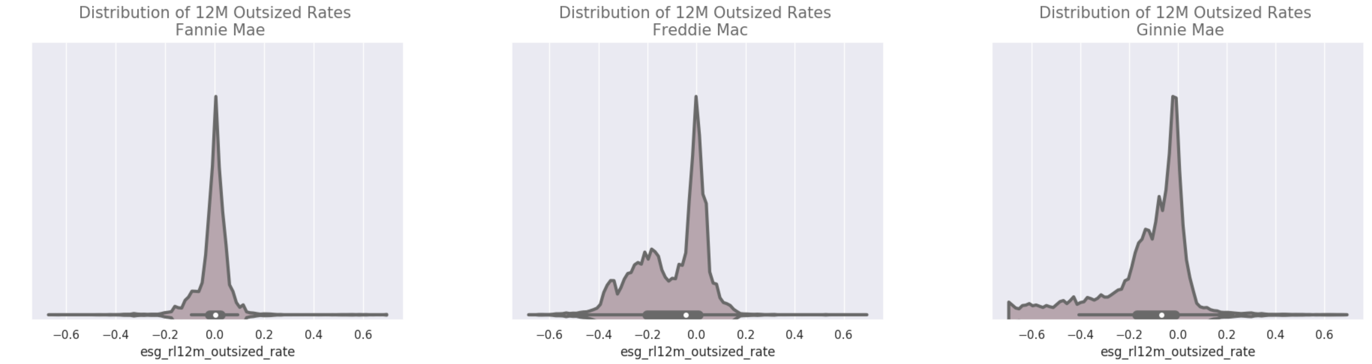
We focus on the 12 months averaged pool-level versions of the metrics for this analysis.

ESG metric distributions

Figures 1 and 2 below show the distribution of pool-level metrics across all three agencies: GNMA, FNMA and FHLMC. Distributions are shown via violin plots demonstrating both summary statistics (first quartile, median, third quartile) and the kernel density of the values for each of the metrics.

Figure 1. Distributions of responsible lending scores

Figure 1a. Outsized rates (OR)



The distributions of early pay default risk seen below clearly visualize the different collateral credit quality and lending practices for FNMA and FHLMC vs GNMA.

Figure 1b. Early pay default risk (EPDR)

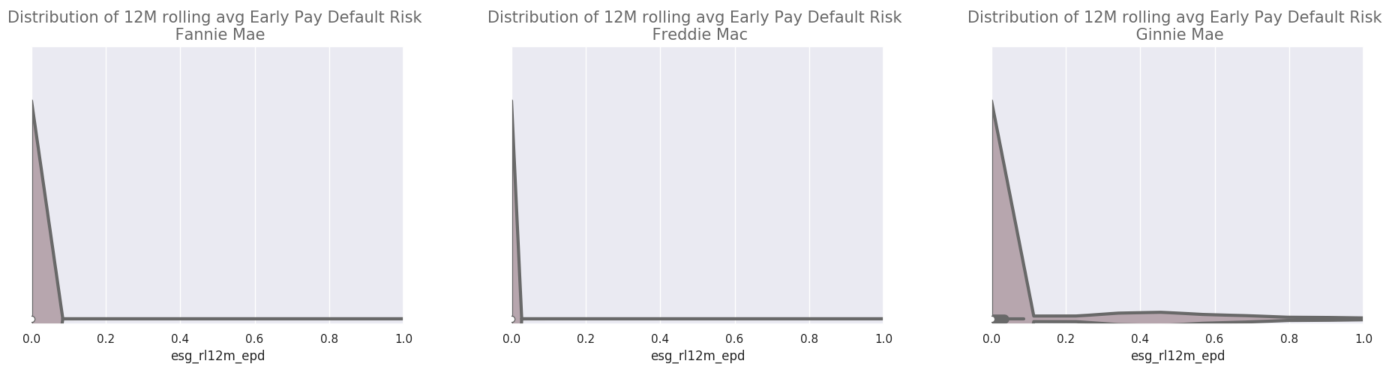
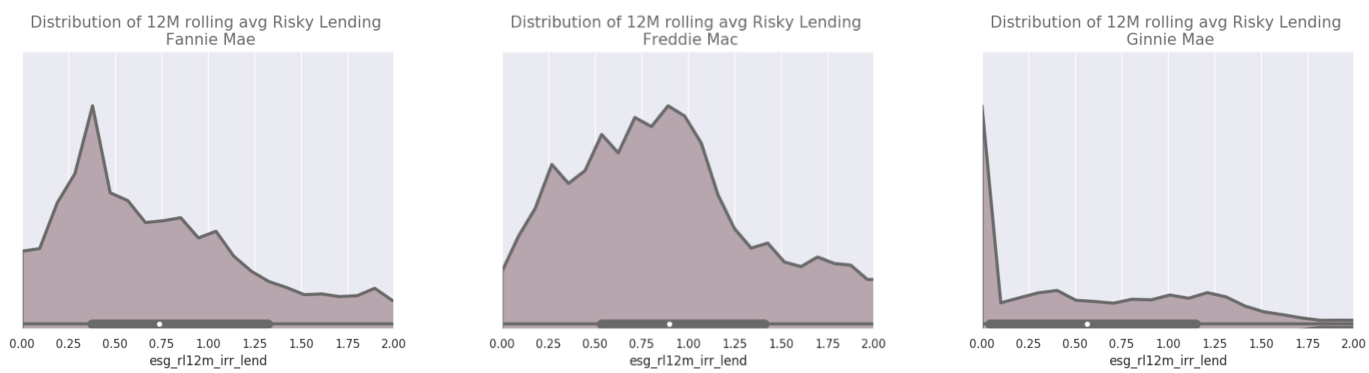


Figure 1c. Risky lending (RL)



Source: Yield Book

Figure 2. Distributions of responsible servicing scores

Figure 2a. Loan churn (LC)

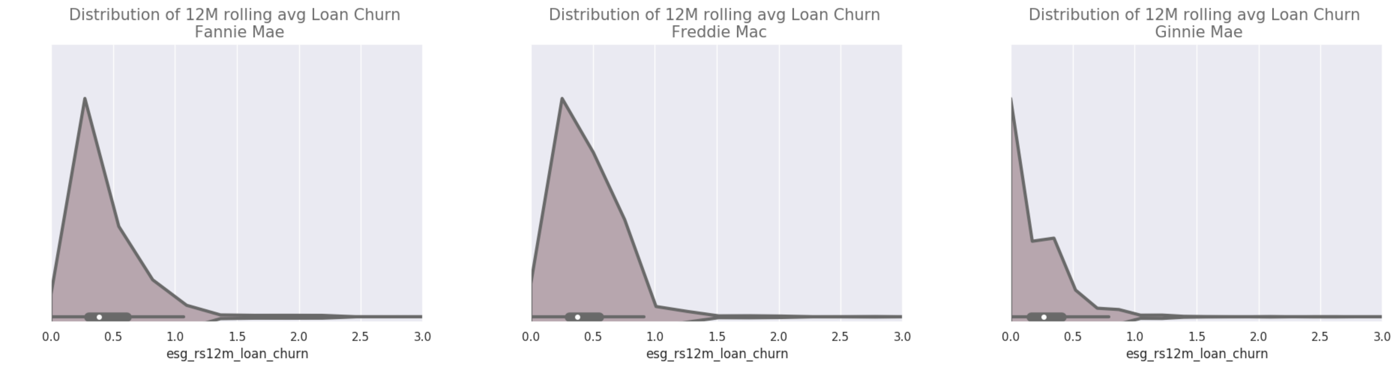
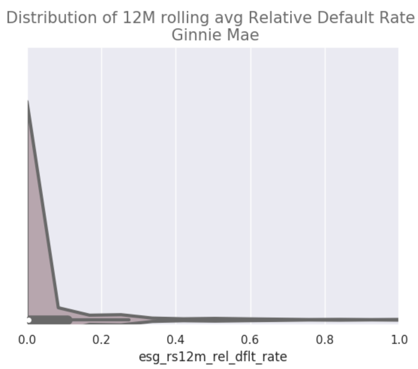
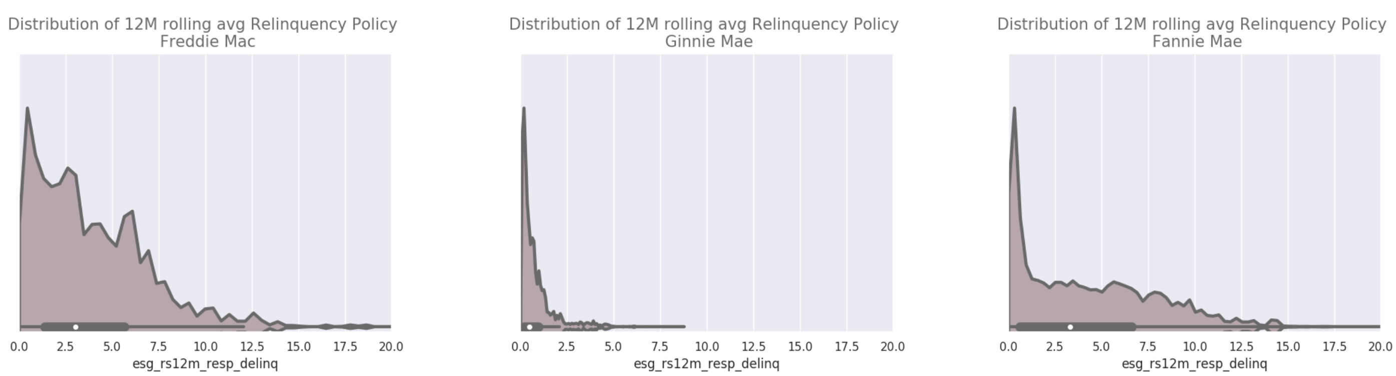


Figure 2b. Relative default rate (RDR)



On the delinquency policy charts below, we see again the different servicing practices of government-sponsored enterprises vs GNMA. For this metric, higher values indicate more responsible practices.

Figure 2c. Delinquency policy (DP)



Source: Yield Book

Total return analysis

The charts in Figures 3 and 4 show the moving time window of two months' total returns on the investment for the universe of FNMA mortgage pools.

The results in Tables 1 and 2 show total return for two-month periods assuming various risk-free rates. The investment universe is segmented into two sub-cohorts (low and high) for each ESG metric. The sub-cohorts are split at the weighted average value of the pool-level metrics (weighted by the current balance of the pool).

On the responsible lending side, the charts and more detailed data in Table 1 show that investing in cohorts with lower EDPR scores or lower risky lending scores on average produce higher total returns. Since the higher outsized rate score is indicative of higher loan rates, investing in those cohorts predicably produces higher returns.

Figure 3: Total return graphs by ESG RL cohorts (with 0.1 risk-free rate)

Figure 3a: Total return graph outsized rates (OR)

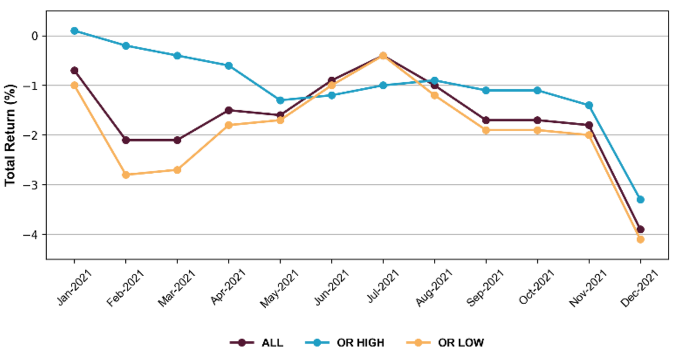


Figure 3b: Total return graph early pay default risk (EPDR)

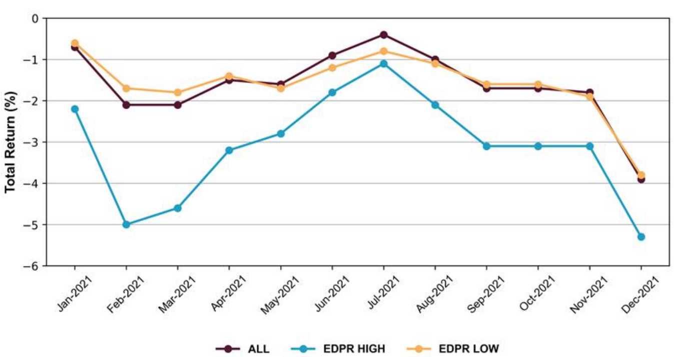


Figure 3c: Total return graph risky lending (RL)

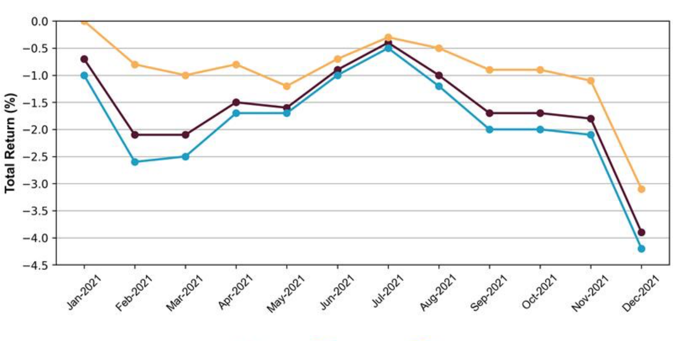


Table 1: Total return by ESG RL cohorts

		Total return for the two months period												
Risk free rate (%)	Cohort type	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Avg
0.1	ALL	-0.73%	-1.40%	0.02%	0.65%	-0.11%	0.64%	0.48%	-0.59%	-0.64%	-0.01%	-0.15%	-2.06%	-0.33%
0.1	EPDR HIGH	-2.17%	-2.80%	0.34%	1.47%	0.36%	1.03%	0.64%	-1.02%	-0.99%	0.03%	0.04%	-2.22%	-0.44%
0.1	EPDR LOW	-0.58%	-1.15%	-0.06%	0.41%	-0.29%	0.47%	0.39%	-0.34%	-0.42%	-0.04%	-0.30%	-1.92%	-0.32%
0.1	RL HIGH	-0.98%	-1.62%	0.09%	0.82%	-0.02%	0.70%	0.50%	-0.69%	-0.75%	-0.01%	-0.12%	-2.09%	-0.35%
0.1	RL LOW	-0.03%	-0.76%	-0.20%	0.19%	-0.37%	0.49%	0.40%	-0.27%	-0.34%	-0.01%	-0.25%	-1.98%	-0.26%
0.1	OR HIGH	0.13%	-0.31%	-0.23%	-0.22%	-0.69%	0.09%	0.26%	0.01%	-0.16%	0.01%	-0.34%	-1.90%	-0.28%
0.1	OR LOW	-1.02%	-1.74%	0.09%	0.89%	0.03%	0.77%	0.53%	-0.71%	-0.75%	-0.02%	-0.10%	-2.11%	-0.34%
1.0	ALL	-0.72%	-1.39%	0.02%	0.66%	-0.11%	0.65%	0.49%	-0.58%	-0.64%	-0.01%	-0.15%	-2.06%	-0.32%
1.0	EPDR HIGH	-2.17%	-2.80%	0.34%	1.48%	0.36%	1.03%	0.65%	-1.01%	-0.99%	0.03%	0.04%	-2.21%	-0.44%
1.0	EPDR LOW	-0.57%	-1.15%	-0.05%	0.42%	-0.28%	0.48%	0.40%	-0.33%	-0.41%	-0.03%	-0.30%	-1.92%	-0.31%
1.0	RL HIGH	-0.97%	-1.61%	0.10%	0.82%	-0.02%	0.70%	0.51%	-0.69%	-0.74%	-0.01%	-0.12%	-2.08%	-0.34%
1.0	RL LOW	-0.02%	-0.76%	-0.19%	0.20%	-0.36%	0.50%	0.41%	-0.27%	-0.33%	0.00%	-0.24%	-1.97%	-0.25%
1.0	OR HIGH	0.14%	-0.30%	-0.22%	-0.21%	-0.68%	0.10%	0.27%	0.02%	-0.15%	0.01%	-0.34%	-1.90%	-0.27%
1.0	OR LOW	-1.01%	-1.73%	0.10%	0.89%	0.04%	0.78%	0.53%	-0.71%	-0.74%	-0.01%	-0.10%	-2.10%	-0.34%
2.0	ALL	-0.71%	-1.39%	0.03%	0.67%	-0.10%	0.66%	0.49%	-0.58%	-0.63%	0.00%	-0.14%	-2.05%	-0.31%
2.0	EPDR HIGH	-2.17%	-2.80%	0.34%	1.48%	0.36%	1.03%	0.65%	-1.01%	-0.98%	0.04%	0.04%	-2.21%	-0.44%
2.0	EPDR LOW	-0.56%	-1.15%	-0.04%	0.43%	-0.27%	0.49%	0.41%	-0.33%	-0.40%	-0.03%	-0.29%	-1.91%	-0.30%
2.0	RL HIGH	-0.96%	-1.61%	0.11%	0.83%	-0.01%	0.71%	0.52%	-0.68%	-0.73%	0.00%	-0.11%	-2.08%	-0.34%
2.0	RL LOW	-0.01%	-0.75%	-0.18%	0.21%	-0.35%	0.50%	0.42%	-0.26%	-0.33%	0.00%	-0.24%	-1.97%	-0.25%
2.0	OR HIGH	0.15%	-0.30%	-0.21%	-0.19%	-0.67%	0.11%	0.28%	0.03%	-0.14%	0.02%	-0.33%	-1.89%	-0.26%
2.0	OR LOW	-1.00%	-1.73%	0.10%	0.90%	0.04%	0.78%	0.54%	-0.70%	-0.74%	-0.01%	-0.09%	-2.10%	-0.33%
3.0	ALL	-0.70%	-1.38%	0.04%	0.67%	-0.09%	0.66%	0.50%	-0.57%	-0.62%	0.01%	-0.14%	-2.05%	-0.31%
3.0	EPDR HIGH	-2.17%	-2.80%	0.35%	1.48%	0.37%	1.04%	0.65%	-1.01%	-0.98%	0.04%	0.05%	-2.21%	-0.43%
3.0	EPDR LOW	-0.55%	-1.14%	-0.02%	0.44%	-0.27%	0.49%	0.42%	-0.32%	-0.39%	-0.02%	-0.28%	-1.91%	-0.30%
3.0	RL HIGH	-0.95%	-1.61%	0.12%	0.83%	-0.01%	0.71%	0.52%	-0.68%	-0.73%	0.00%	-0.11%	-2.07%	-0.33%
3.0	RL LOW	0.01%	-0.75%	-0.17%	0.21%	-0.35%	0.51%	0.42%	-0.25%	-0.32%	0.01%	-0.23%	-1.96%	-0.24%
3.0	OR HIGH	0.17%	-0.29%	-0.20%	-0.18%	-0.66%	0.12%	0.29%	0.04%	-0.13%	0.03%	-0.32%	-1.89%	-0.25%
3.0	OR LOW	-0.99%	-1.73%	0.11%	0.91%	0.05%	0.79%	0.54%	-0.70%	-0.73%	0.00%	-0.09%	-2.09%	-0.33%
4.0	ALL	-0.68%	-1.38%	0.05%	0.68%	-0.09%	0.67%	0.50%	-0.56%	-0.62%	0.01%	-0.13%	-2.04%	-0.30%
4.0	EPDR HIGH	-2.17%	-2.80%	0.35%	1.48%	0.37%	1.04%	0.65%	-1.00%	-0.98%	0.04%	0.05%	-2.20%	-0.43%
4.0	EPDR LOW	-0.54%	-1.14%	-0.01%	0.45%	-0.26%	0.50%	0.43%	-0.31%	-0.38%	-0.01%	-0.28%	-1.90%	-0.29%
4.0	RL HIGH	-0.94%	-1.60%	0.13%	0.84%	0.00%	0.72%	0.53%	-0.67%	-0.72%	0.01%	-0.10%	-2.07%	-0.32%
4.0	RL LOW	0.02%	-0.75%	-0.16%	0.22%	-0.34%	0.52%	0.43%	-0.25%	-0.31%	0.01%	-0.23%	-1.96%	-0.23%
4.0	OR HIGH	0.18%	-0.29%	-0.18%	-0.17%	-0.65%	0.13%	0.30%	0.05%	-0.12%	0.04%	-0.32%	-1.88%	-0.24%
4.0	OR LOW	-0.98%	-1.72%	0.12%	0.91%	0.05%	0.79%	0.55%	-0.69%	-0.72%	0.01%	-0.08%	-2.09%	-0.32%
5.0	ALL	-0.67%	-1.38%	0.06%	0.69%	-0.08%	0.67%	0.51%	-0.56%	-0.61%	0.02%	-0.13%	-2.04%	-0.29%
5.0	EPDR HIGH	-2.16%	-2.80%	0.35%	1.48%	0.37%	1.04%	0.66%	-1.00%	-0.97%	0.04%	0.05%	-2.20%	-0.43%
5.0	EPDR LOW	-0.52%	-1.13%	0.00%	0.45%	-0.25%	0.51%	0.43%	-0.30%	-0.38%	0.00%	-0.27%	-1.89%	-0.28%
5.0	RL HIGH	-0.93%	-1.60%	0.14%	0.85%	0.01%	0.73%	0.53%	-0.66%	-0.71%	0.02%	-0.09%	-2.06%	-0.32%
5.0	RL LOW	0.03%	-0.74%	-0.15%	0.23%	-0.33%	0.52%	0.44%	-0.24%	-0.31%	0.02%	-0.22%	-1.95%	-0.22%
5.0	OR HIGH	0.19%	-0.28%	-0.17%	-0.16%	-0.64%	0.14%	0.31%	0.06%	-0.12%	0.04%	-0.31%	-1.87%	-0.23%
5.0	OR LOW	-0.97%	-1.72%	0.13%	0.92%	0.06%	0.80%	0.55%	-0.68%	-0.72%	0.01%	-0.08%	-2.08%	-0.32%

On the responsible servicing side, the charts and more detailed data in Table 2 show that investing in cohorts with lower loan churn scores also, on average, produce higher total returns.

Due to the agencies' disclosure content, there is no sufficient data available to complete a similar analysis for relative default rate scores and delinquency policy scores.

Figure 4: Total return graph by ESG RS cohorts loan churn (LC) (with 0.1 risk-free rate)

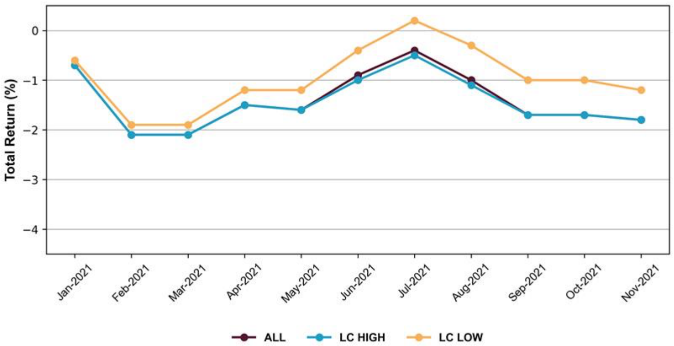


Table 2: Total return by RS ESG cohorts

		Total return for the two months period												
Rist free rate (%)	Cohort type	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Avg
0.1	ALL	-0.73%	-1.40%	0.02%	0.65%	-0.11%	0.64%	0.48%	-0.59%	-0.64%	-0.01%	-0.15%	-2.06%	-0.33%
0.1	LC HIGH	-0.73%	-1.40%	0.02%	0.65%	-0.12%	0.63%	0.45%	-0.60%	-0.56%	-0.01%	-0.09%	-2.02%	-0.32%
0.1	LC LOW	-0.58%	-1.34%	0.04%	0.68%	-0.02%	0.81%	0.63%	-0.53%	-0.68%	-0.01%	-0.16%	-2.06%	-0.27%
1.0	ALL	-0.72%	-1.39%	0.02%	0.66%	-0.11%	0.65%	0.49%	-0.58%	-0.64%	-0.01%	-0.15%	-2.06%	-0.32%
1.0	LC HIGH	-0.72%	-1.39%	0.02%	0.66%	-0.11%	0.64%	0.46%	-0.60%	-0.55%	-0.01%	-0.08%	-2.02%	-0.31%
1.0	LC LOW	-0.57%	-1.34%	0.04%	0.69%	-0.01%	0.81%	0.63%	-0.53%	-0.68%	-0.01%	-0.16%	-2.06%	-0.26%
2.0	ALL	-0.71%	-1.39%	0.03%	0.67%	-0.10%	0.66%	0.49%	-0.58%	-0.63%	0.00%	-0.14%	-2.05%	-0.31%
2.0	LC HIGH	-0.71%	-1.39%	0.03%	0.66%	-0.11%	0.64%	0.46%	-0.59%	-0.55%	0.00%	-0.08%	-2.01%	-0.30%
2.0	LC LOW	-0.56%	-1.34%	0.05%	0.69%	-0.01%	0.82%	0.63%	-0.52%	-0.67%	0.00%	-0.15%	-2.05%	-0.26%
3.0	ALL	-0.70%	-1.38%	0.04%	0.67%	-0.09%	0.66%	0.50%	-0.57%	-0.62%	0.01%	-0.14%	-2.05%	-0.31%
3.0	LC HIGH	-0.70%	-1.39%	0.04%	0.67%	-0.10%	0.65%	0.47%	-0.58%	-0.54%	0.01%	-0.07%	-2.01%	-0.30%
3.0	LC LOW	-0.55%	-1.34%	0.06%	0.70%	-0.01%	0.82%	0.64%	-0.52%	-0.67%	0.01%	-0.14%	-2.05%	-0.25%
4.0	ALL	-0.68%	-1.38%	0.05%	0.68%	-0.09%	0.67%	0.50%	-0.56%	-0.62%	0.01%	-0.13%	-2.04%	-0.30%
4.0	LC HIGH	-0.69%	-1.38%	0.05%	0.68%	-0.09%	0.66%	0.48%	-0.58%	-0.53%	0.01%	-0.07%	-2.00%	-0.29%
4.0	LC LOW	-0.55%	-1.33%	0.06%	0.70%	0.00%	0.83%	0.64%	-0.51%	-0.66%	0.01%	-0.14%	-2.04%	-0.25%
5.0	ALL	-0.67%	-1.38%	0.06%	0.69%	-0.08%	0.67%	0.51%	-0.56%	-0.61%	0.02%	-0.13%	-2.04%	-0.29%
5.0	LC HIGH	-0.68%	-1.38%	0.06%	0.69%	-0.09%	0.66%	0.48%	-0.57%	-0.52%	0.02%	-0.06%	-1.99%	-0.28%
5.0	LC LOW	-0.54%	-1.33%	0.07%	0.71%	0.00%	0.83%	0.65%	-0.51%	-0.66%	0.02%	-0.13%	-2.04%	-0.24%

S-curves and WALA ramps

In the charts that follow, we present side-by-side graphs for various combinations of agency and RL/RS metrics. Each row of graphs has an S-curve on the left and a WALA ramp on the right.

The **S-curves** graph prepayment rates based on interest rate incentive experienced for 30-year FRM MBS cohorts for 2021-2022 factor dates.

The **WALA ramps** plot prepayment seasoning for 30-year FRM MBS cohorts for 2021-2022 factor dates.

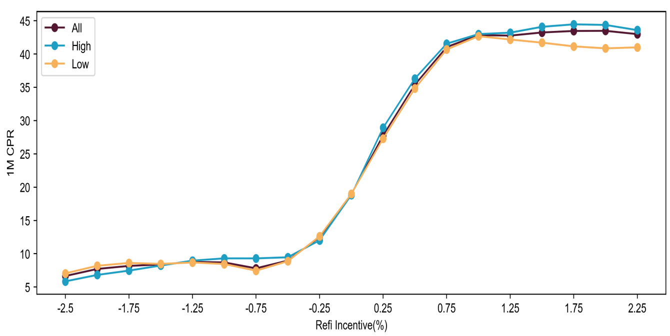
For each ESG metric, we have created two loan-level cohorts: high and low. The high cohort contains all loans with ESG scores above the balance weighted average of the ESG score. The low cohort is the complementary set. We could not produce graphs for all metrics because certain metrics highlight rare events and lack sufficient differentiation to create cohorts of adequate size – for example, EPDR events for FNMA loans.

Figure 5: Responsible lending metrics

For outsized rates, higher score cohorts (the part of the loan universe with the higher rates) predictably prepay faster, especially in GNMA space.

Figure 5a: Outsized rates (OR) FNMA

OR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	20.7174	41,713,317,702,815	169,840,271	318,431.86	21.16	74.19	752.12
High	26.0189	13,083,634,755,087	56,934,902	303,151.64	28.21	75.67	744.76
Low	18.2475	28,629,682,947,728	112,905,369	325,414.85	17.93	73.51	755.48



OR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	35.7814	17,491,064,889,689	89,717,973	261,875.71	42.73	77.19	742.27
High	37.2688	8,173,416,344,974	43,084,432	254,803.00	49.83	77.72	739.95
Low	34.4517	9,317,648,544,716	46,633,541	268,079.87	36.5	76.73	744.3

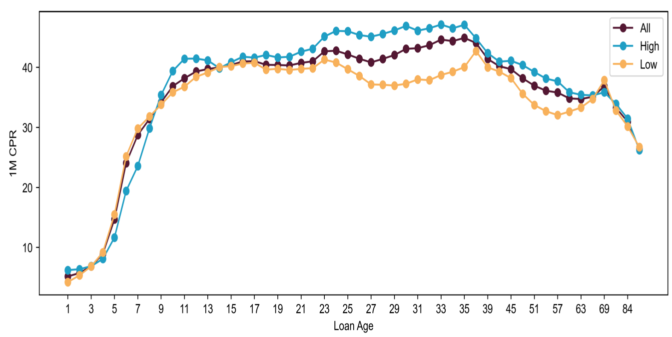
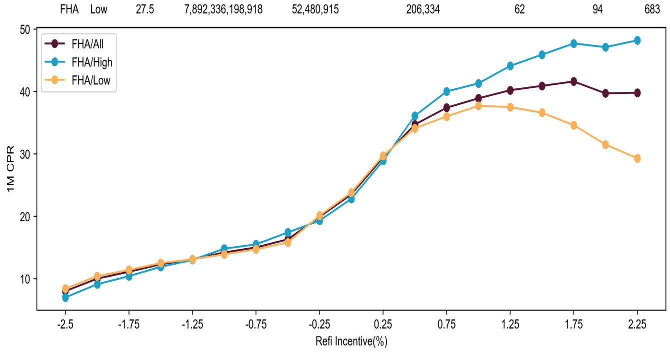


Figure 5b: Outsized rates (OR) GNMA FHA

Agency	OR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.0	12,369,983,261,361	78,057,891	212,771	52	94	680
FHA	High	34.1	4,477,647,062,444	25,576,976	224,119	36	95	673
FHA	Low	27.5	7,892,336,198,918	52,480,915	206,334	62	94	683



Agency	OR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.6	11,594,114,277,846	66,225,675	227,402	39	95	678
FHA	High	34.3	4,737,935,224,039	26,782,683	225,697	34	95	672
FHA	Low	28.0	6,856,179,053,807	39,442,992	228,580	42	94	681

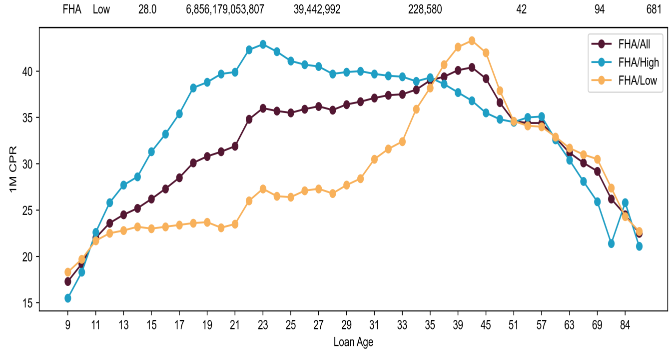
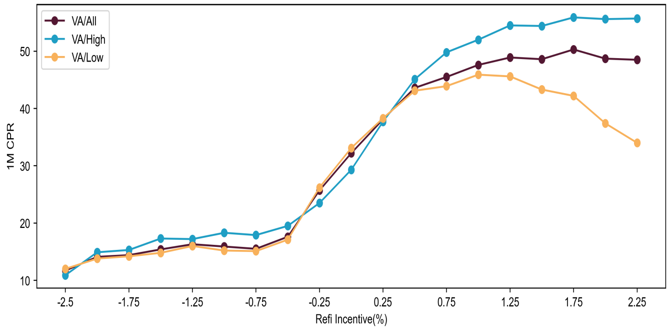
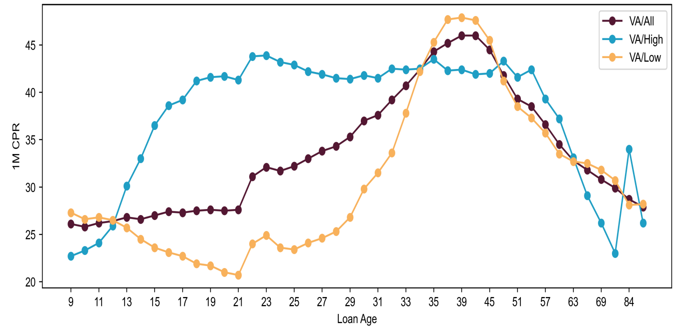


Figure 5c: Outsized rates (OR) GNMA VA

Agency	OR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	33.5	6,487,479,503,305	29,832,470	294,732	42	95	721
VA	High	38.9	1,751,734,198,694	7,890,567	288,847	33	96	714
VA	Low	31.4	4,735,745,304,611	21,941,903	296,909	46	94	724



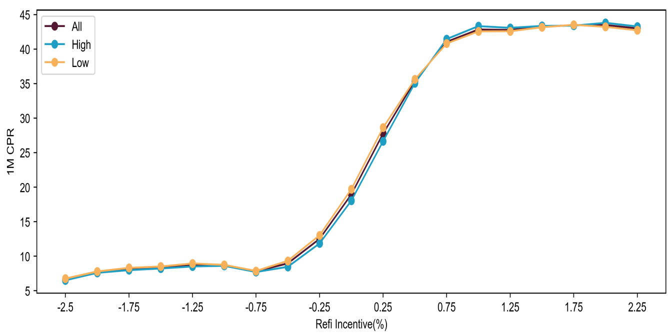
Agency	OR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	31.4	7,037,941,447,188	29,612,702	318,690	34	94	724
VA	High	36.9	1,943,602,273,705	8,479,134	301,140	30	95	715
VA	Low	29.2	5,094,339,173,482	21,133,568	325,386	36	94	727



The risky lending charts below show faster prepayment for GNMA high score cohorts. This effect is less pronounced for FNMA cohorts, which reflects known, inherent different characteristics of FNMA and GNMA collateral.

Figure 5d: Risky lending (RL) FNMA

IRR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	20.7174	41,713,317,702,815	169,840,271	318,431.86	21.16	74.19	752.12
High	19.7745	17,631,302,811,173	68,990,446	327,436.16	17.97	75.54	749.58
Low	21.3985	24,082,014,891,642	100,849,825	311,839.49	23.49	73.19	753.98



IRR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	35.7814	17,491,064,889,689	89,717,973	261,875.71	42.73	77.19	742.27
High	35.2723	6,694,712,411,719	32,826,168	275,256.30	35.37	78.33	736.83
Low	36.0951	10,796,352,477,970	56,891,805	253,578.54	47.3	76.49	745.63

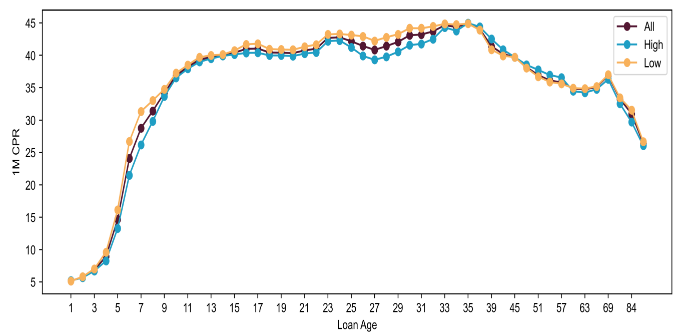
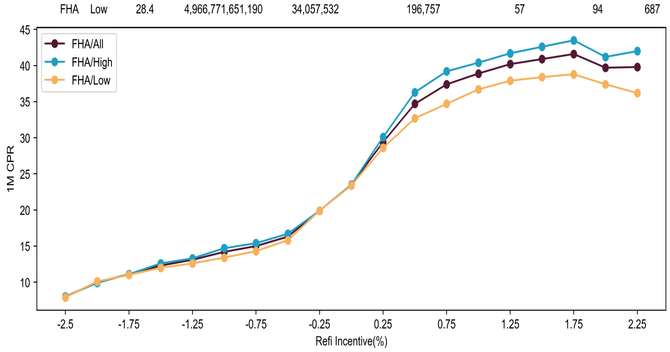


Figure 5e: Risky lending (RL) GNMA FHA

Agency	IRR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.0	12,369,983,261,361	78,057,891	212,771	52	94	679
FHA	High	31.0	7,403,211,610,171	44,000,359	223,515	49	94	675
FHA	Low	28.4	4,966,771,651,190	34,057,532	196,757	57	94	687



Agency	IRR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.6	11,594,114,277,846	66,225,675	227,402	39	95	678
FHA	High	31.5	7,126,610,362,688	38,682,056	236,917	38	95	673
FHA	Low	29.3	4,467,503,915,158	27,543,619	212,223	40	95	685

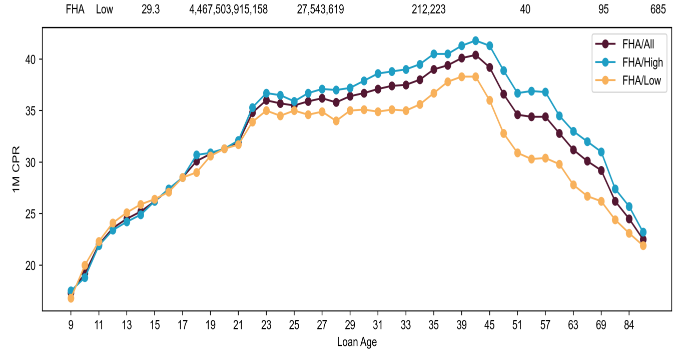
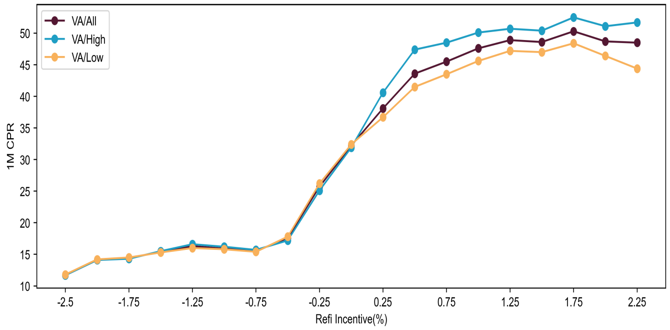


Figure 5f: Risky lending (RL) GNMA VA

Agency	IRR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	33.5	6,487,479,503,305	29,832,470	294,732	42	95	721
VA	High	35.6	2,614,584,176,719	12,009,567	299,753	43	96	711
VA	Low	32.1	3,872,895,326,586	17,822,903	291,343	41	94	728



Agency	IRR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	31.4	7,037,941,447,188	29,612,702	318,690	34	94	724
VA	High	33.4	2,844,066,944,171	11,916,255	326,811	35	95	714
VA	Low	30.0	4,193,874,503,016	17,696,447	313,183	34	94	731

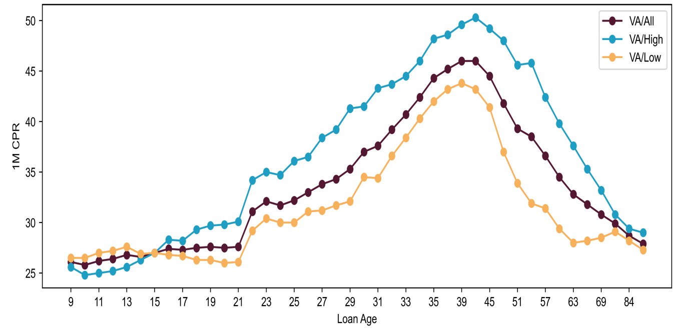
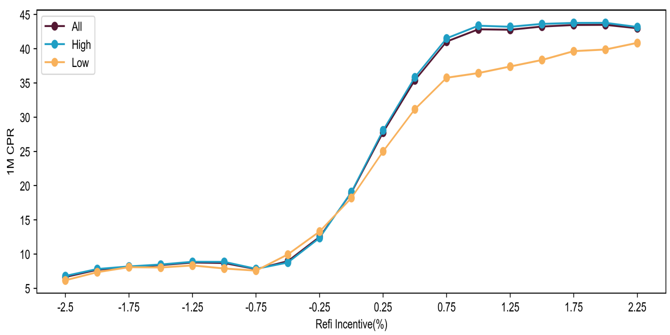


Figure 6: Responsible servicing metrics

In line with our expectations, the charts show that cohorts with higher loan churn and relative default rate scores prepay faster than the corresponding lower score cohorts.

Figure 6a: Loan churn (LC) FNMA

LC	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	20.7174	41,713,317,702,815	169,840,271	318,431.86	21.16	74.19	752.12
High	21.7106	35,511,686,794,144	142,932,373	320,930.74	21.16	74.26	752.09
Low	14.9287	6,201,630,908,671	26,907,898	304,122.79	21.14	73.77	752.27



LC	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	35.7814	17,491,064,889,689	89,717,973	261,875.71	42.73	77.19	742.27
High	36.3531	15,829,566,724,785	80,060,512	264,452.89	42.62	77.09	742.7
Low	30.0968	1,661,498,164,905	9,657,461	237,322.20	43.82	78.18	738.16

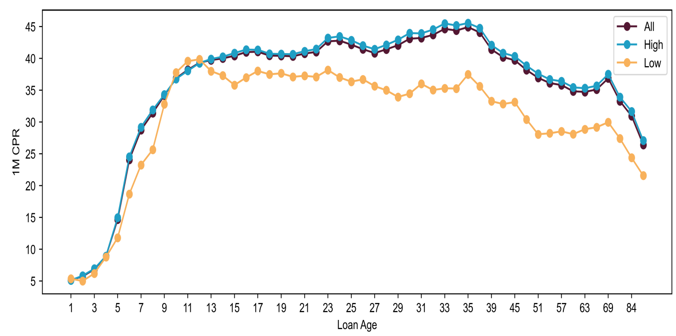
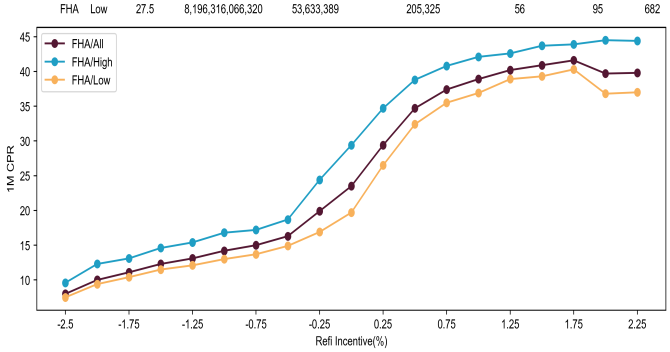


Figure 6b: Loan churn (LC) GNMA FHA

Agency	LC	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.0	12,369,983,261,361	78,057,891	212,771	52	94	679
FHA	High	34.7	4,173,667,195,041	24,424,502	227,395	45	93	674
FHA	Low	27.5	8,196,316,066,320	53,633,389	205,325	56	95	682



Agency	LC	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.6	11,594,114,277,846	66,225,675	227,402	39	95	678
FHA	High	35.0	4,119,837,263,865	22,786,508	236,211	37	93	673
FHA	Low	28.1	7,474,277,013,981	43,439,167	222,546	40	95	680

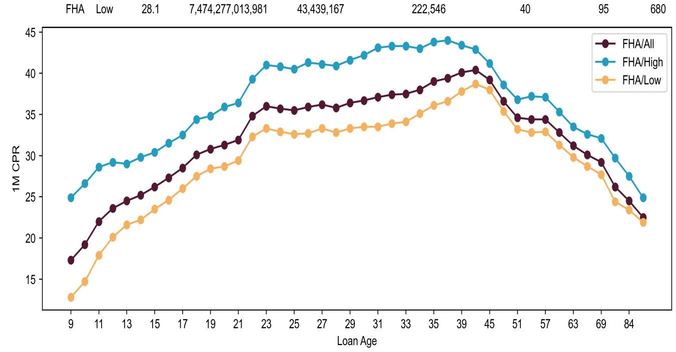
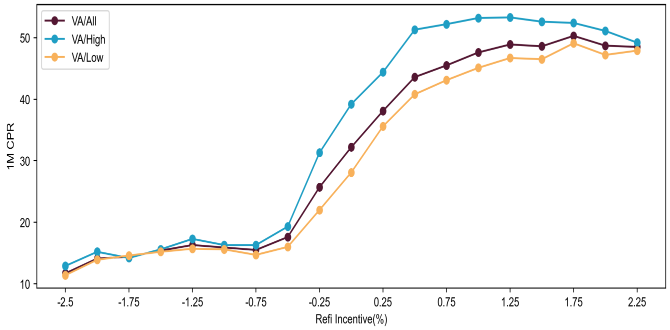


Figure 6b: Loan churn (LC) GNMA VA

Agency	LC	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	33.5	6,487,479,503,305	29,832,470	294,732	42	95	721
VA	High	36.7	2,086,161,162,163	8,928,276	317,542	34	93	720
VA	Low	32.0	4,401,318,341,142	20,904,194	283,920	46	96	722



Agency	LC	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	31.4	7,037,941,447,188	29,612,702	318,690	34	94	724
VA	High	34.9	2,258,978,830,885	9,180,184	331,851	30	92	721
VA	Low	29.7	4,778,962,616,303	20,432,518	312,469	36	95	725

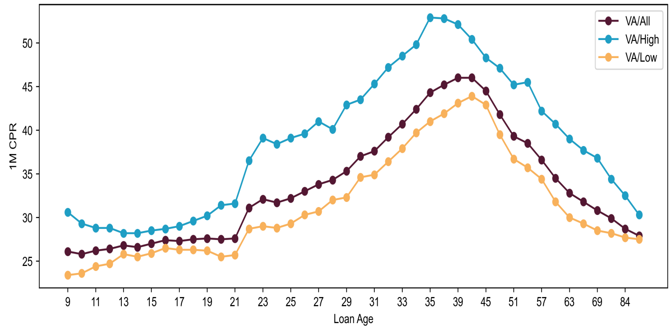
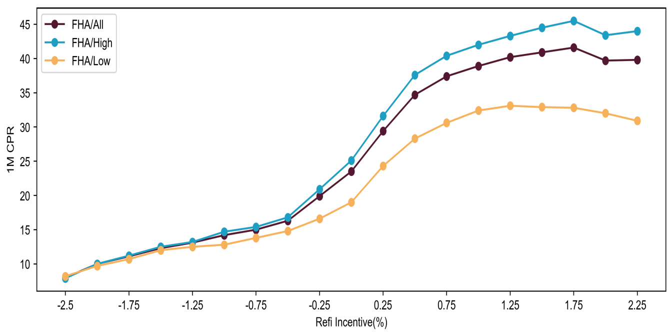


Figure 6c: Relative default rate (RDR) GNMA FHA

Agency	RDR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.0	12,369,983,261,361	78,057,891	212,771	52	94	680
FHA	High	31.6	8,708,614,085,587	50,432,168	226,542	46	95	676
FHA	Low	25.8	3,661,369,175,775	27,625,723	180,017	68	94	687



Agency	RDR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	29.1	13,632,335,573,084	88,681,389	212,591	54	94	678
FHA	High	30.6	9,618,524,652,250	56,682,428	227,458	46	94	676
FHA	Low	25.3	4,013,810,920,834	31,998,961	176,962	72	94	685

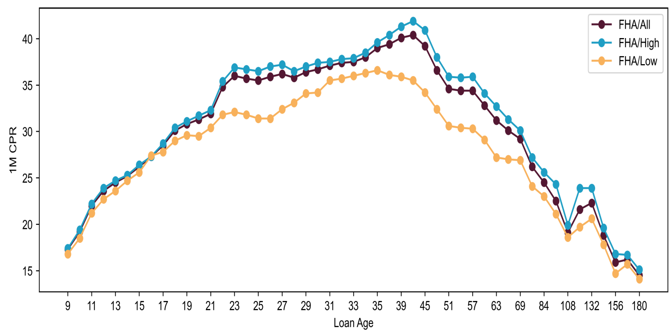
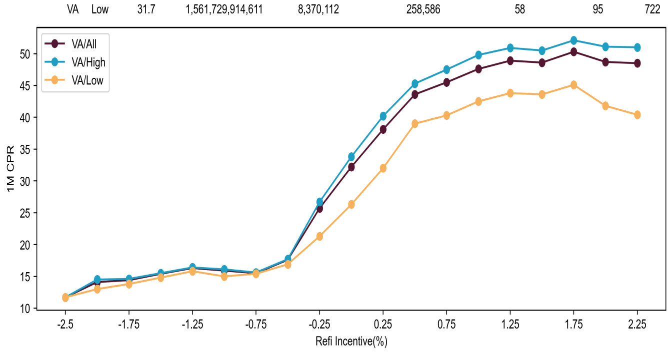


Figure 6c: Relative default rate (RDR) GNMA VA

Agency	RDR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	33.5	6,487,479,503,305	29,832,470	294,732	42	95	721
VA	High	34.1	4,925,749,588,694	21,462,358	306,192	37	95	721
VA	Low	31.7	1,561,729,914,611	8,370,112	258,586	58	95	722



Agency	RDR	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	30.8	7,491,533,317,830	33,763,519	309,023	40	94	723
VA	High	31.0	5,792,338,138,867	24,464,502	322,433	35	94	724
VA	Low	30.2	1,699,195,178,963	9,299,017	263,307	58	95	722

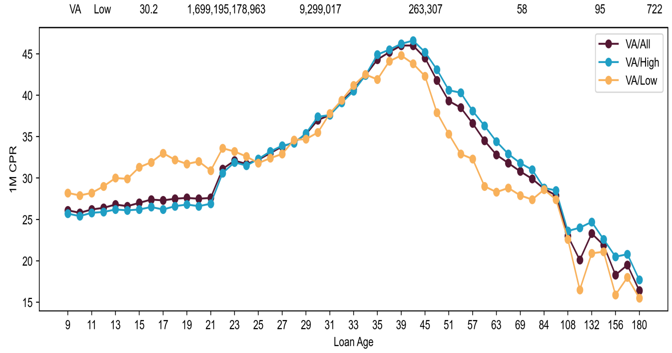
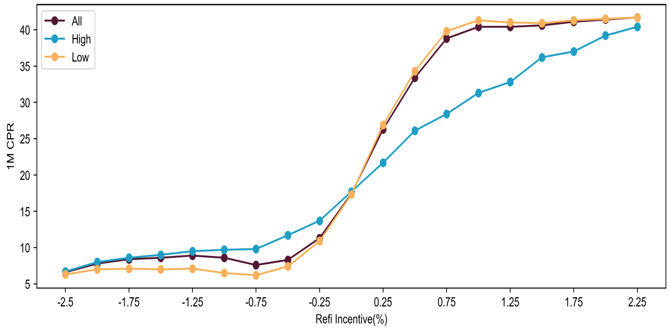


Figure 6c: Delinquency policy (DP) FNMA

DP	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	19.8	50,594,098,400,070	217,885,179	309,247	28	74	752
High	11.5	16,439,528,618,173	73,114,244	303,115	32	75	749
Low	23.6	34,154,569,781,897	144,770,935	312,198	25	74	753

DP	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
All	18.6	56,028,508,136,368	237,110,479	313,677	27	74	753
High	10.0	21,112,966,994,567	89,214,633	315,221	29	74	752
Low	23.4	34,915,541,141,802	147,895,846	312,744	25	74	753



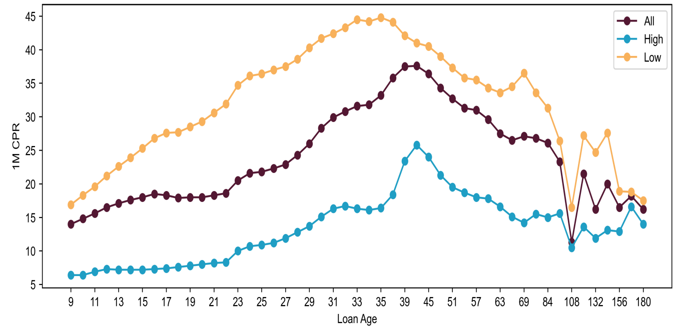
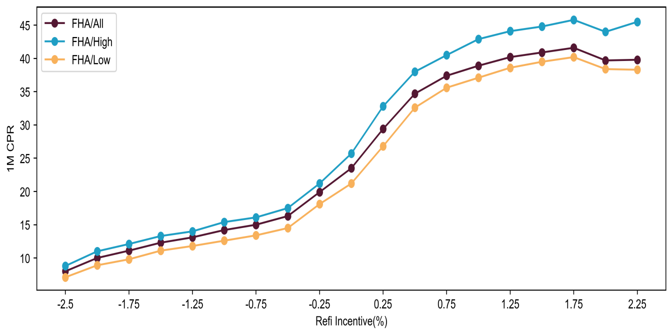


Figure 6c: Delinquency policy (DP) GNMA FHA

Agency	DP	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	30.0	12,369,983,261,361	78,057,891	212,771	52	94	679
FHA	High	29.3	4,953,487,924,805	28,995,047	225,587	46	94	679
FHA	Low	30.4	7,416,495,336,556	49,062,844	204,212	56	95	680

Agency	DP	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
FHA	All	29.1	13,632,335,573,084	88,681,389	212,591	54	94	678
FHA	High	28.2	5,403,332,399,961	31,811,595	227,770	46	94	678
FHA	Low	29.7	8,229,003,173,123	56,869,794	202,624	59	94	678



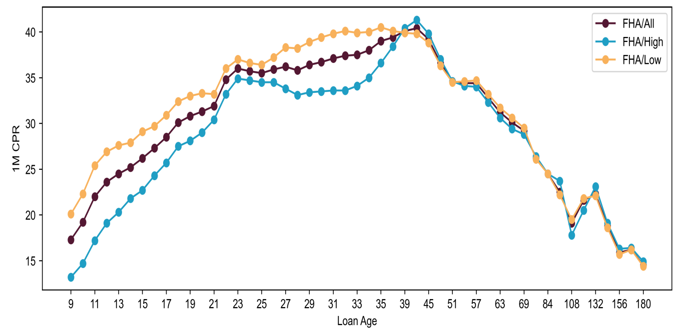
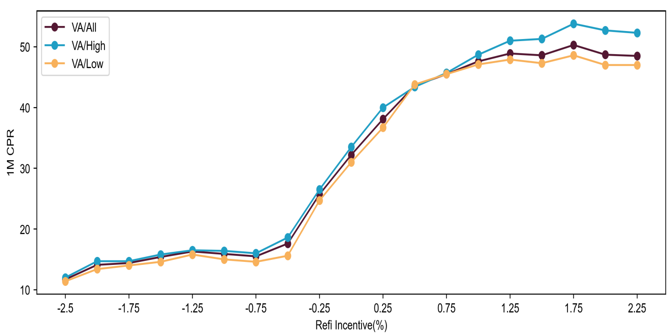
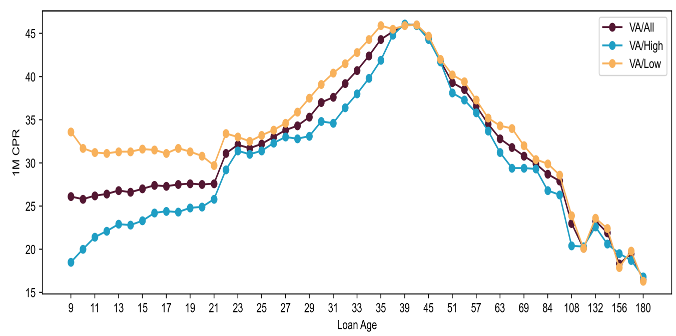


Figure 6c: Delinquency policy (DP) GNMA VA

Agency	DP	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	33.5	6,487,479,503,305	29,832,470	294,732	42	95	721
VA	High	30.7	3,098,518,124,812	13,387,816	309,735	36	94	725
VA	Low	36.0	3,388,961,378,493	16,444,654	281,014	48	95	718

Agency	DP	1M CPR	Total Curr Balance	Loan Count	WA Curr Balance	WA Loan Age	WA Orig LTV	WA FICO
VA	All	30.8	7,491,533,317,830	33,763,519	309,023	40	94	723
VA	High	27.9	3,624,819,226,861	15,150,545	324,350	34	93	727
VA	Low	33.4	3,866,714,090,970	18,612,974	294,654	46	95	720





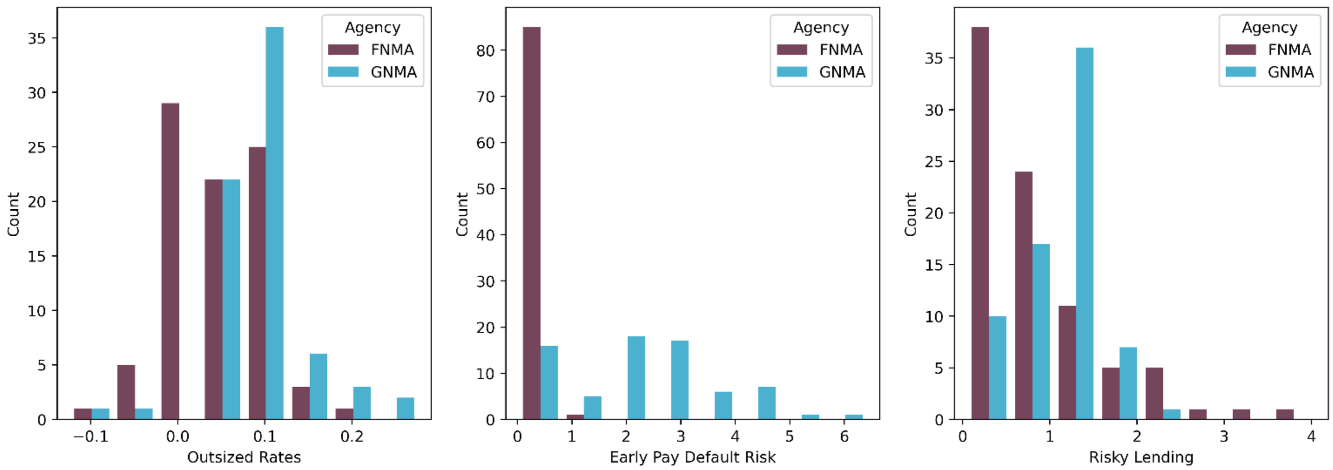
For the delinquency policy metric, a higher score means that servicers do a better job of mitigating borrower delinquency and avoiding foreclosures. Consequently, the seasoning charts show that high-score cohorts prepay more slowly than lower-score cohorts for both GNMA and FNMA, with the effect being more pronounced for FNMA.

Metric distribution and CPR regression by entity

Responsible lending metrics

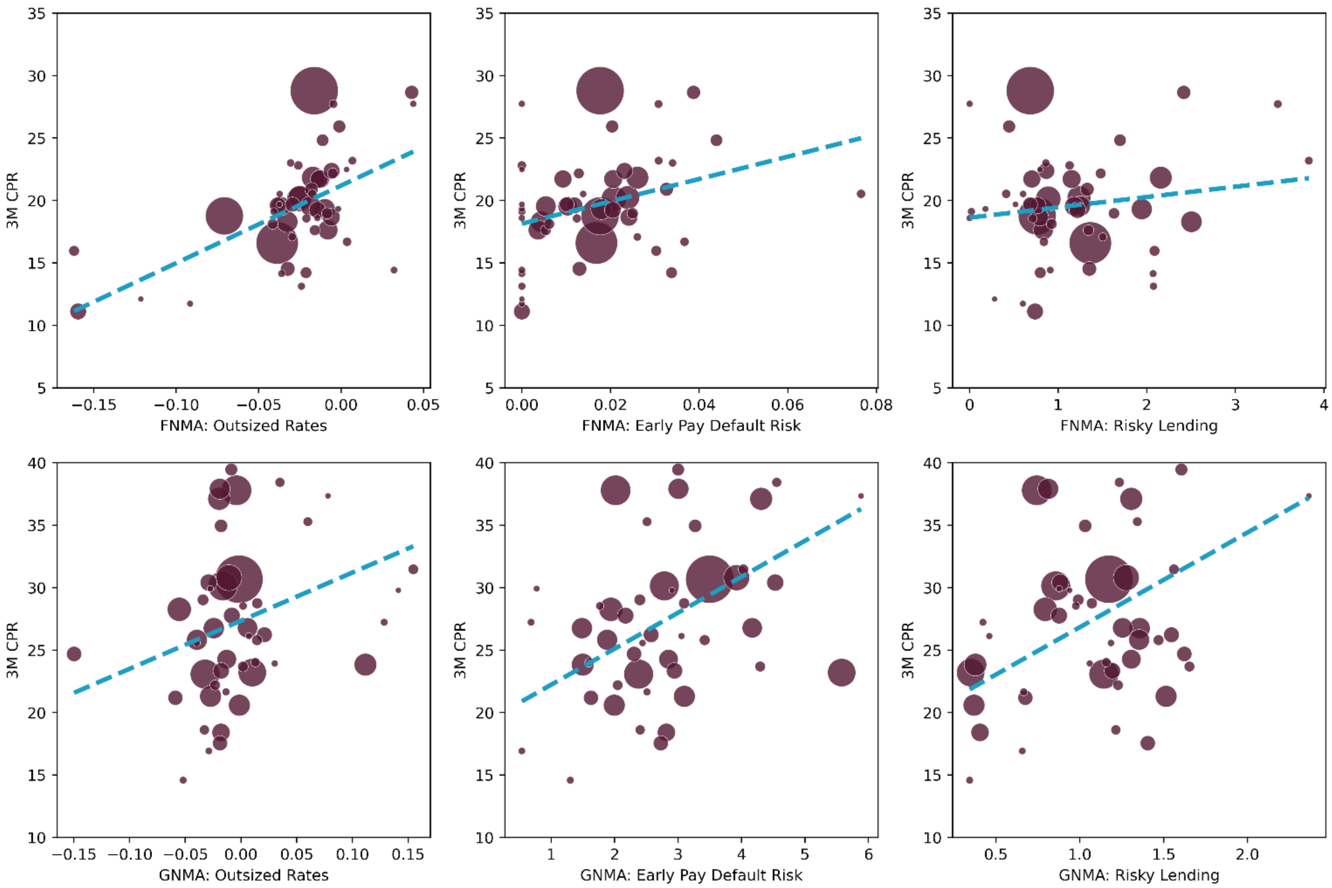
We present individual 12-month weighted average metric scores from the selected top lenders as of December 2020 below. Due to broader underwriting guidelines, the distribution for GNMA lenders is more right-skewed than the corresponding distributions for FMNA and FHLMC.

Figure 7: Histogram of RL ESG scores by lender



We plot three-month prepayment speeds (3m CPR) against each ESG metric by lender. In the analysis, we include loans originated in 2020 by the selected top sellers. Three-month CPR is calculated as of December 2021. The size of each circle represents the outstanding balance of the lender.

Figure 8: Correlation of CPR to RL ESG metrics FNMA and GNMA



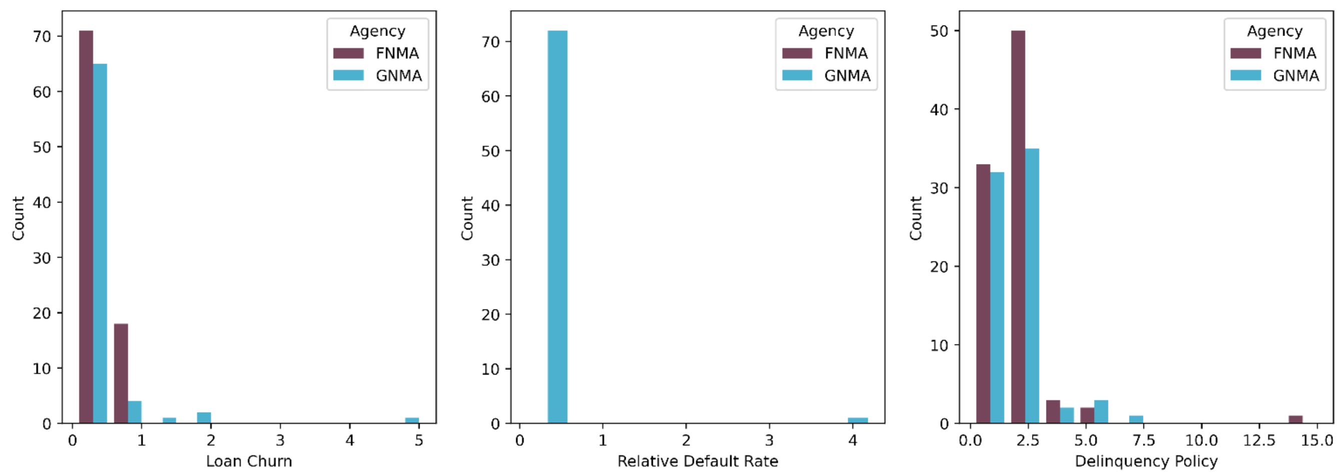
For outsized rates, a high score indicates the loan was made by a lender who systematically originates loans with rates higher than can be explained by the loan's characteristics and the prevailing market rate. The results above align with our hypothesis that loans with high outsized rates should prepay faster.

In the coming months, we want to extend this analysis to include a study of the involuntary vs. voluntary prepayment speeds for ESG cohorts for all agencies.

Responsible lending metrics

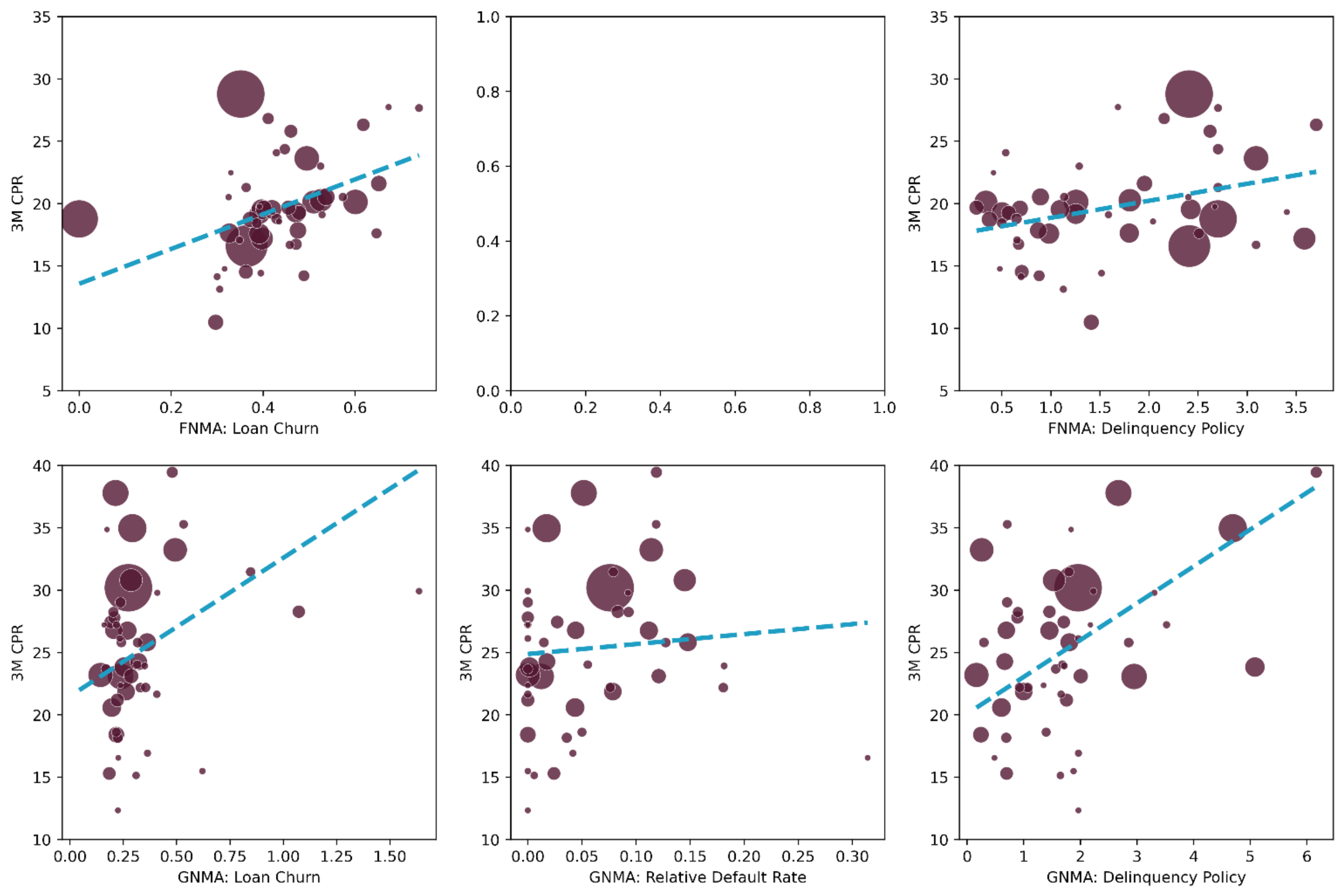
We show individual 12-month weighted average metric scores from the selected top servicers as of December 2021 below.

Figure 9: Histogram of RS ESG scores by lender



We plot three-month prepayment speeds (3m CPR) against each ESG metric by servicer. In the analysis, we include loans originated in 2021 by the selected top servicers. 3m CPR is calculated as of December 2021. The size of each circle represents the outstanding balance of the servicer.

Figure 10: Correlation of CPR to RS ESG metrics FNMA and GNMA



For loan churn, a higher score means the servicers are actively encouraging borrowers to refinance repeatedly. This will naturally drive up the prepayment speed.

Conclusion

In summary, our findings indicate three critical outcomes:

- Four out of the five ESG metrics used in the prepayment study demonstrated consistent behavior in terms of relative prepayment speeds for high and low ESG cohorts. The fifth metric, delinquency policy, followed our expectations for the seasoning curve and only slightly deviated from the other ESG cohorts at the higher incentive rates end of the S-curve.
- In the total return study, three out of the four ESG metrics showed higher average returns during the period under consideration. The only easily explainable exception was the outsized rates metric.
- The correlation of speeds vs ESG metrics study also demonstrated stable and consistent non-negative correlations.

These results suggest that the use of Yield Book-developed ESG scoring metrics would not only enable responsible investing but could also enhance the performance of MBS portfolio.

About Yield Book

Yield Book is a trusted and authoritative source for fixed income analytics that enables market makers and institutional investors to perform complex analysis of their portfolios, benchmarks, trading decisions, historical performance, and risk. Yield Book products offer analytical insight into an extensive range of financial products in the fixed income space including governments, agencies, corporates, high yield, emerging markets, mortgages, ABS, CMBS, CMOs, CLOs, and derivatives. The platform utilizes dedicated centralized servers that help ensure reliable, prompt data delivery. Yield Book forms part of London Stock Exchange Group's Data and Analytics Division.

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