Federal Reserve CCAR Residential Mortgage Stress Testing Model Evolution

Comprehensive Analysis of Changes Since CCAR 2019

2019-2025

*Model Validation Assessment Report*

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# Executive Summary

Since the 2019 CCAR methodology baseline, the Federal Reserve's residential mortgage stress testing models have maintained remarkable stability in their core framework while implementing targeted adjustments for unprecedented economic conditions. The most significant finding is that **the fundamental expected-loss modeling architecture has remained unchanged**, with the Federal Reserve explicitly stating in 2025 that it opted to use "largely identical models" to facilitate upcoming transparency improvements (Federal Reserve, 2025).

The COVID-19 pandemic prompted the most substantial adjustments in the models' recent history. In 2021, the Federal Reserve standardized the calculation of payment status for first-lien mortgages in forbearance to address inconsistent reporting practices across firms, resulting in higher projected losses (Federal Reserve, 2021a). By 2022, as banking conditions stabilized, all pandemic-related adjustments except one were removed, with the final adjustment eliminated by 2023 (Federal Reserve, 2023). The implementation of the Current Expected Credit Loss (CECL) accounting standard was strategically deferred, with the Federal Reserve maintaining its pre-CECL framework through 2021 and extending this approach through 2024 to reduce uncertainty during the pandemic recovery.

# Core Modeling Framework Remains Stable Across All Products

The Federal Reserve's residential mortgage suite encompasses **first-lien mortgages, HELOCs, and HELOANs**, all operating under a consistent expected-loss framework expressed as Loss(t) = PD(t) × LGD(t) × EAD(t). This framework has remained unchanged from 2019 through 2025 (Federal Reserve, 2020; Federal Reserve, 2025).

## Probability of Default Models Maintain Competing Risks Structure

The PD models employ a **system of five binomial logit equations** generating quarterly default probabilities conditional on payment status. Two equations capture transitions from current status to impaired or paid-off states, while three equations model transitions from impaired status. The competing risks framework simultaneously models default and prepayment as terminal states from which loans cannot transition (Federal Reserve, 2021b).

Key variables driving PD models have remained constant:

* Credit score
* Interest rate type (fixed or adjustable)
* Loan-to-value ratio at origination
* Payment status based on days past due
* House Price Index
* Mortgage rates
* Treasury yields (10-year and 3-month)
* Unemployment rate

Geographic granularity operates at state and county levels for unemployment and house price projections (Federal Reserve, 2023).

## Loss Given Default Employs Two-Stage Approach

The LGD framework uses a two-model approach unchanged since 2019. The **liquidation timeline model** projects time between default and property liquidation using loan characteristics and macroeconomic variables. The **loss severity model** then estimates losses based on the projected timeline, with separate equations for prime, Alt-A, and subprime loans (Federal Reserve, 2021b).

For home equity products, the LGD calculation specifically accounts for senior lien positions: "The net recovery after senior-lien payout is calculated as the proceeds from the liquidation sale net of foreclosure costs, less the balance of any senior liens and of unpaid accrued interest on this loan" (Federal Reserve, 2023, p. 45).

# HELOC Models Feature Specialized Treatment

HELOCs receive distinct modeling treatment reflecting their revolving credit nature. The **utilization rate** (unpaid balance divided by original credit limit) serves as a critical PD model variable for HELOCs but not HELOANs. Exposure at Default calculations differ markedly: for open HELOCs still in their draw period, EAD equals the higher of unpaid principal balance or original credit limit, while closed or end-of-draw HELOCs use only the unpaid balance (Federal Reserve, 2021b).

The models explicitly capture **end-of-draw period effects**. When HELOCs reach the end of their draw period, requiring principal repayment or conversion to fully amortizing loans, the PD model assumes higher default and payoff rates due to increased payment requirements. This sophisticated treatment has remained consistent throughout 2019-2025 (Federal Reserve, 2023).

# COVID-19 Prompted Targeted but Temporary Adjustments

The pandemic's impact on mortgage markets necessitated specific model adjustments, particularly for forbearance programs. In December 2020 and throughout 2021, the Federal Reserve adjusted payment status calculations for first-lien mortgages in forbearance to standardize reporting across firms. According to the 2021 methodology: "This adjustment results in higher projected losses than if the model were run without the adjustment" (Federal Reserve, 2021a, p. 32).

By June 2022, the Federal Reserve noted that "banking conditions have stabilized and the macroeconomic outlook has improved," leading to removal of all but one pandemic adjustment (Federal Reserve, 2022, p. 18). The final assessment in 2023 confirmed: "The uncertainty associated with the pandemic, the path of the economy, and the associated government responses had largely dissipated" (Federal Reserve, 2023, p. 12).

# Technical Refinements Focused on Risk Sensitivity

Minor technical refinements occurred throughout the period. In 2019, the Federal Reserve made refinements to first- and second-lien mortgage models that "collectively resulted in a minimal change in post-stress capital ratios with no material impacts on any disclosed firm" (Federal Reserve, 2019, p. 48).

The 2022 cycle saw enhancements to **Fair-Value Option and Held-for-Sale retail loan models**, incorporating measures of interest rate duration for residential mortgages to improve risk sensitivity. Hedge accounting was enhanced to separately project gains and losses for hedges on loans measured at amortized cost (Federal Reserve, 2022).

# Prepayment Modeling Maintains Competing Risks Framework

The competing risks framework for modeling prepayment versus default has remained structurally unchanged since 2019. The framework generates transition probabilities expressed as Pr(Tr(i,t+1)|S(i,t)) = f(X(i,t), Z(t)), where loan and borrower characteristics interact with macroeconomic scenario variables (Federal Reserve, 2021b).

Interest rate sensitivity remains the **primary driver of prepayment risk**, with models capturing the negative convexity relationship where mortgage servicing asset values decrease faster in declining rate environments than they rise when rates increase. The Federal Reserve's analysis showed a 100 basis point yield curve decrease causes approximately 27% decrease in servicing values, while an equivalent increase yields only 19% value appreciation (Federal Reserve, 2016).

# Cash Flow Estimation Methodologies

The Federal Reserve's approach to cash flow estimation for residential mortgages incorporates both interest income and principal repayment projections. Net interest income calculations account for the contractual interest rates on mortgages, adjusted for prepayment expectations under different rate scenarios (Federal Reserve, 2021b).

For HELOCs, cash flow projections specifically model draw behavior during the revolving period and the conversion to amortizing payments at end-of-draw. The utilization assumptions interact with macroeconomic scenarios, with stressed conditions typically showing increased draws followed by elevated defaults when repayment begins (Federal Reserve, 2023).

# 2024-2025 Marks Strategic Pause Before Transparency Overhaul

The Federal Reserve made an explicit decision to maintain model stability for 2024-2025. According to the 2025 methodology: "In light of the upcoming process through which the Board will seek broad feedback on the stress test models and scenarios, the Board has opted to use largely identical models to those used during the 2024 stress test for the 2025 stress test" (Federal Reserve, 2025, p. 8).

This pause precedes planned transparency improvements including:

* **Public disclosure of all stress test models**
* **Public comment periods on scenarios before finalization**
* **Implementation of two-year results averaging to reduce volatility**

Notably, the Federal Reserve released corrected 2024 results in June 2025 addressing "modest errors in the loss projections for corporate and first-lien mortgage loans," though aggregate capital impacts were immaterial (Federal Reserve, 2025).

# Model Governance Evolution

The supervisory framework transitioned from the Model Oversight Group to the **Stress Test Oversight Committee (STOC)** in 2020, with the Supervisory Stress Test Model Governance Committee providing enhanced Board communication. The independent System Model Validation group continues annual validation of all supervisory models, composed of dedicated staff not involved in model development (Federal Reserve, 2022).

Data sources remained consistent throughout, primarily relying on **FR Y-14M monthly regulatory filings** for loan-level data. Model estimation uses industry-wide loan-level data from bank portfolios and mortgage originators, with LGD models leveraging commercially available datasets of agency and private-label mortgage-backed securities (Federal Reserve, 2021b).

# Scenario Severity Drives Loss Variation More Than Model Changes

Loss rate variations across years primarily reflected scenario severity rather than model modifications. First-lien mortgage portfolio loss rates ranged from 1.3% in 2022's less severe scenario to 2.7% in 2023's more stringent conditions, dropping to 1.9% for 2025 with house price declines moderating from 36% to 33%. HELOC and junior lien loss rates showed similar patterns at 3.4% for 2025 (Federal Reserve, 2021c; Federal Reserve, 2022; Federal Reserve, 2023; Federal Reserve, 2025).

**Key Finding:** The Federal Reserve's approach demonstrates methodical model risk management, maintaining framework stability while making targeted adjustments for extraordinary circumstances. The current pause in model evolution positions the system for comprehensive transparency improvements while ensuring consistent, reliable stress testing during the transition period.

# Conclusion

The evolution of Federal Reserve CCAR residential mortgage stress testing models from 2019 to 2025 reveals a deliberate balance between stability and adaptability. While the core expected-loss framework has remained remarkably consistent across first-lien mortgages, HELOCs, and HELOANs, the Federal Reserve demonstrated flexibility in addressing unprecedented pandemic conditions through temporary adjustments.

The strategic pause in model changes for 2024-2025, combined with planned transparency improvements, signals a new phase in supervisory stress testing. As the Federal Reserve prepares to implement public model disclosure and stakeholder feedback mechanisms, the residential mortgage models stand as a testament to the effectiveness of maintaining methodological consistency while adapting to evolving market conditions.

For model validators, this analysis underscores the importance of understanding not just current methodologies but their evolution over time. The stability of core frameworks provides reliable benchmarks for validation activities, while the targeted adjustments highlight areas requiring enhanced scrutiny during periods of market stress.

# References

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