

# Supervisory Stress Tests, Model Risk, and Model Disclosure: Lessons from OFHEO

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Federal Reserve Bank of Atlanta

Financial Markets Conference

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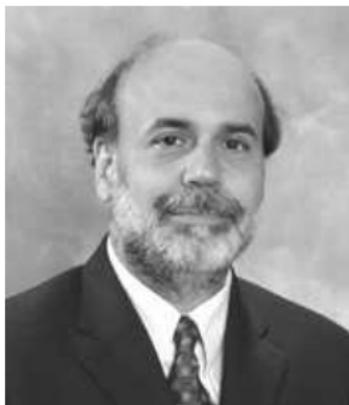
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# Motivation

- In the aftermath of the 2008 financial crisis and Great Recession, stress tests have become a primary tool for macro prudential risk management.
- U.S. started this trend with its 2009 Supervisory Capital Assessment Program (SCAP) which targeted its 19 largest banking organizations.
  - SCAP was used as a confidence building tool at the time.
- In 2010, the Federal Reserve introduced an annual Comprehensive Capital Assessment and Review (CCAR).
  - Stress testing framework to evaluate capital planning processes and capital adequacy at banking organizations with total assets > \$100 billion.
  - Capital adequacy: Post-stress ratio of common equity to risk-weighted assets > 5%.

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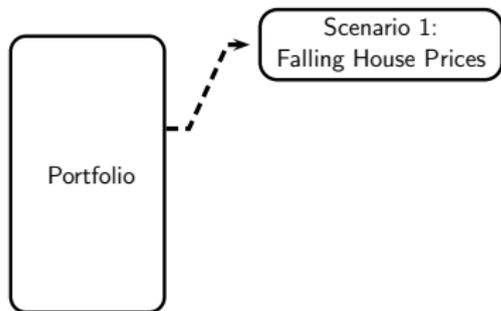
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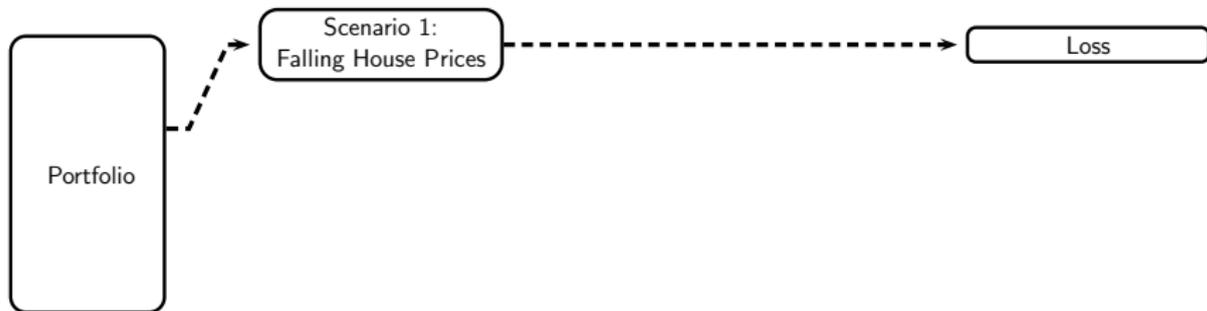
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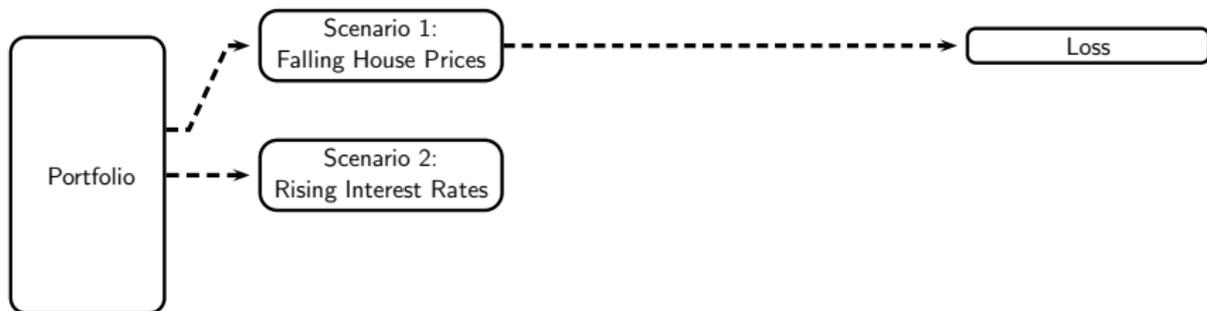
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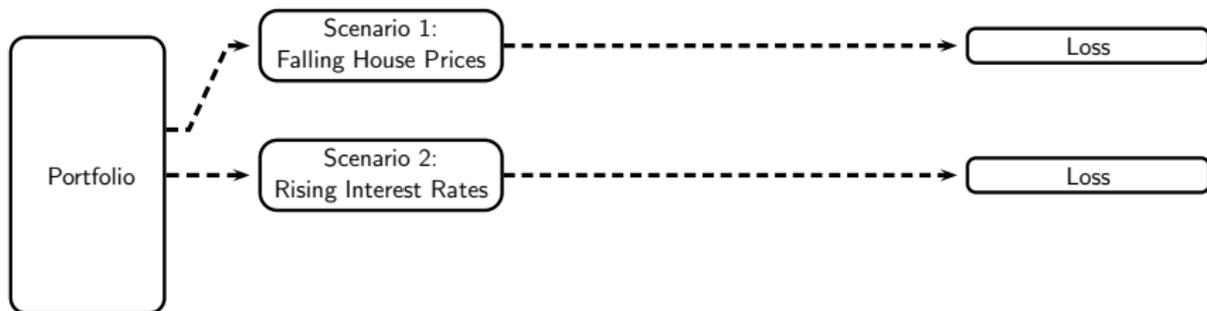
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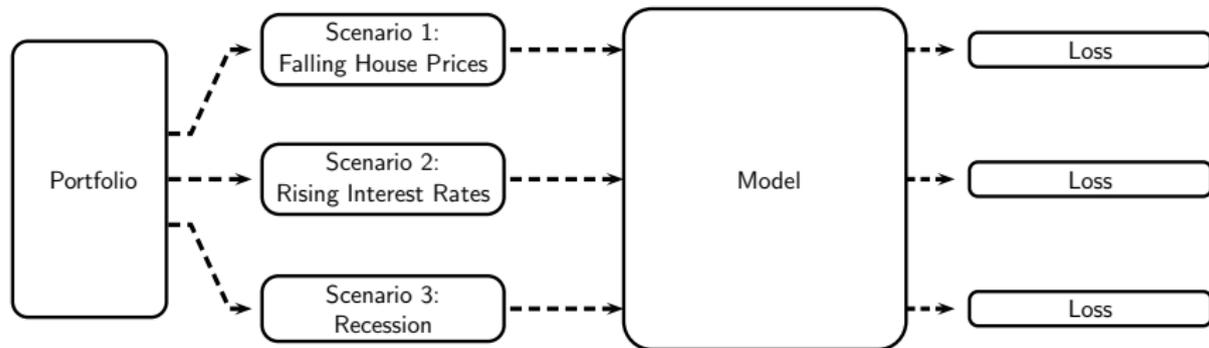
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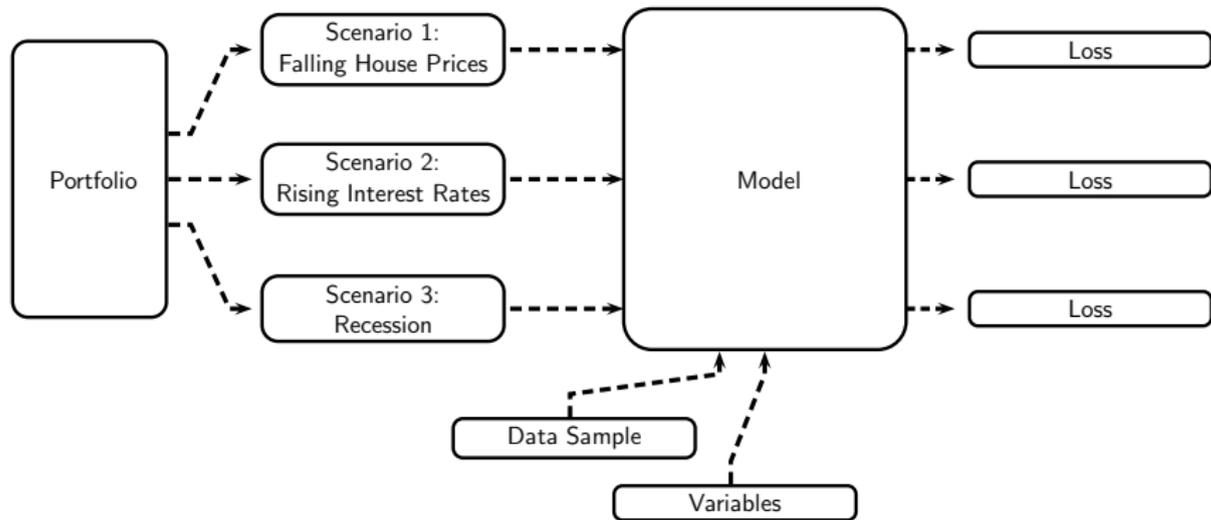
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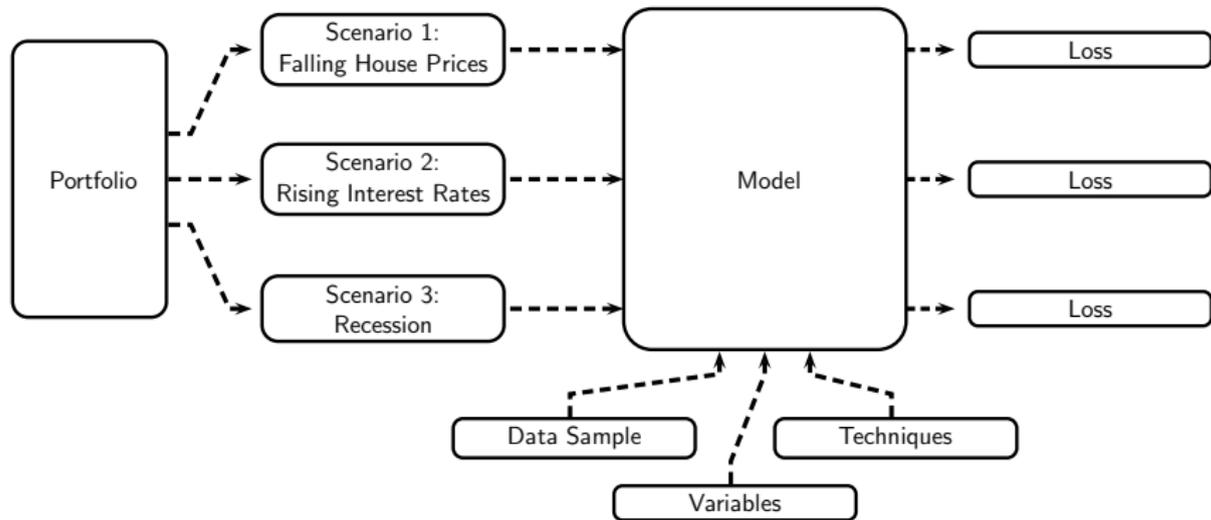
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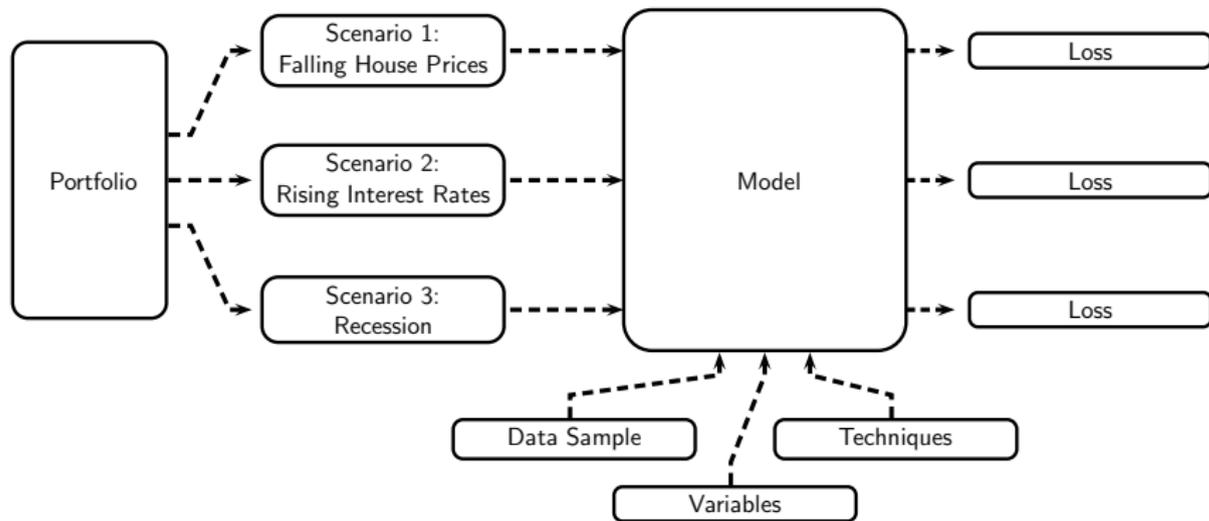
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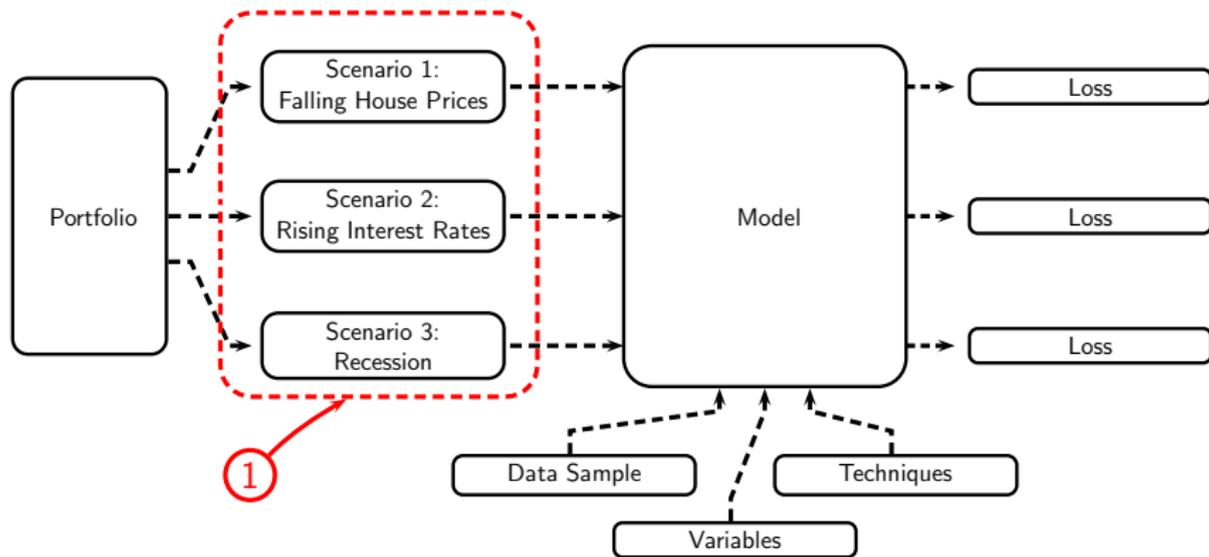
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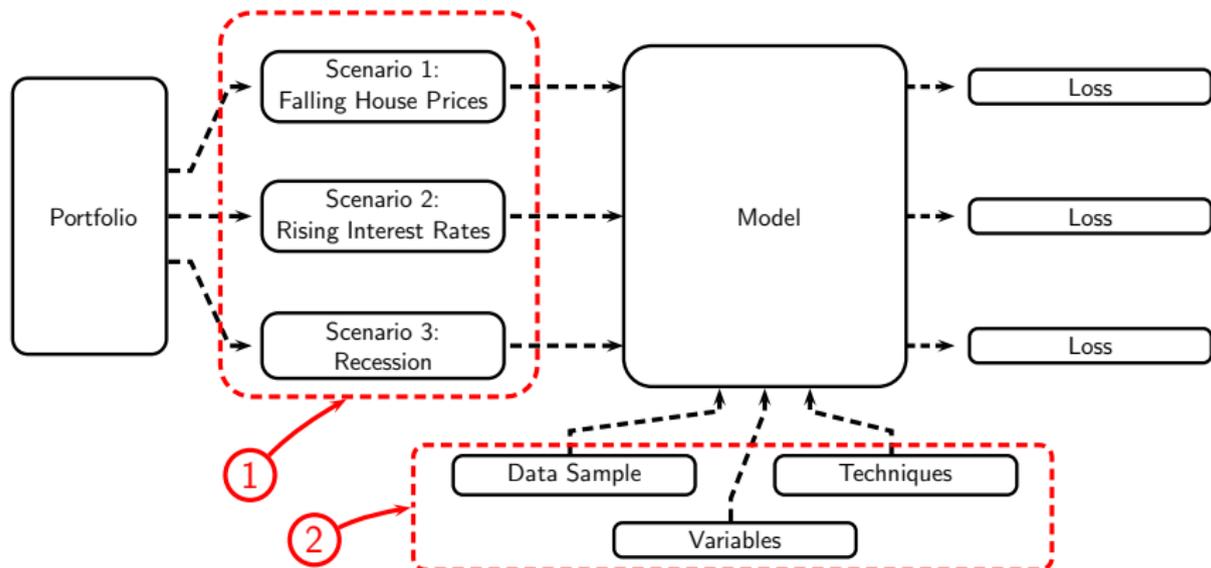
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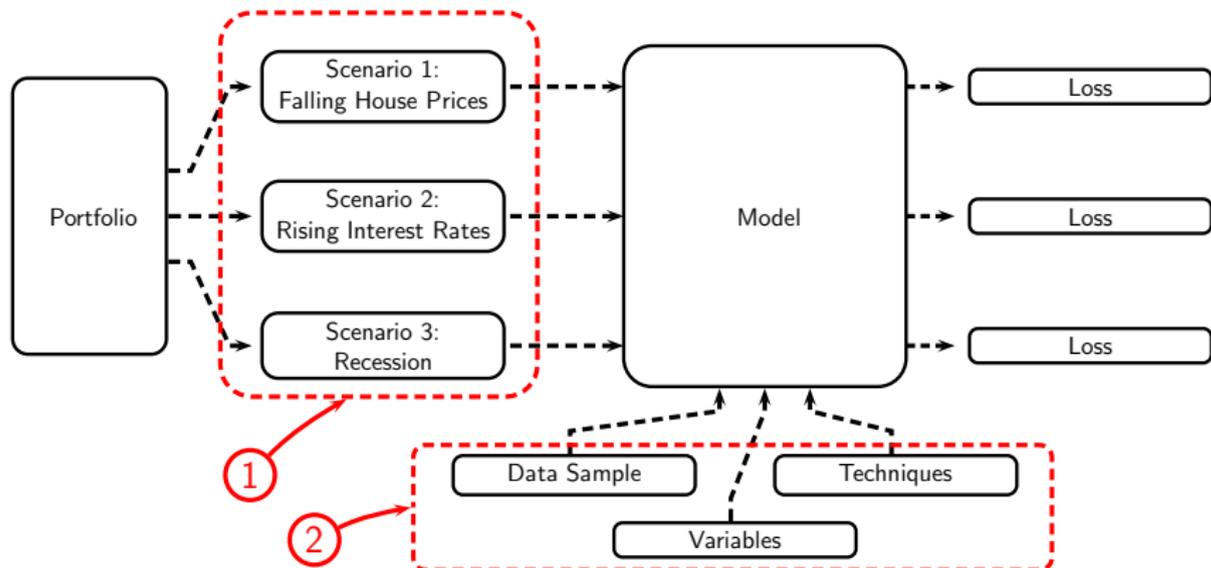
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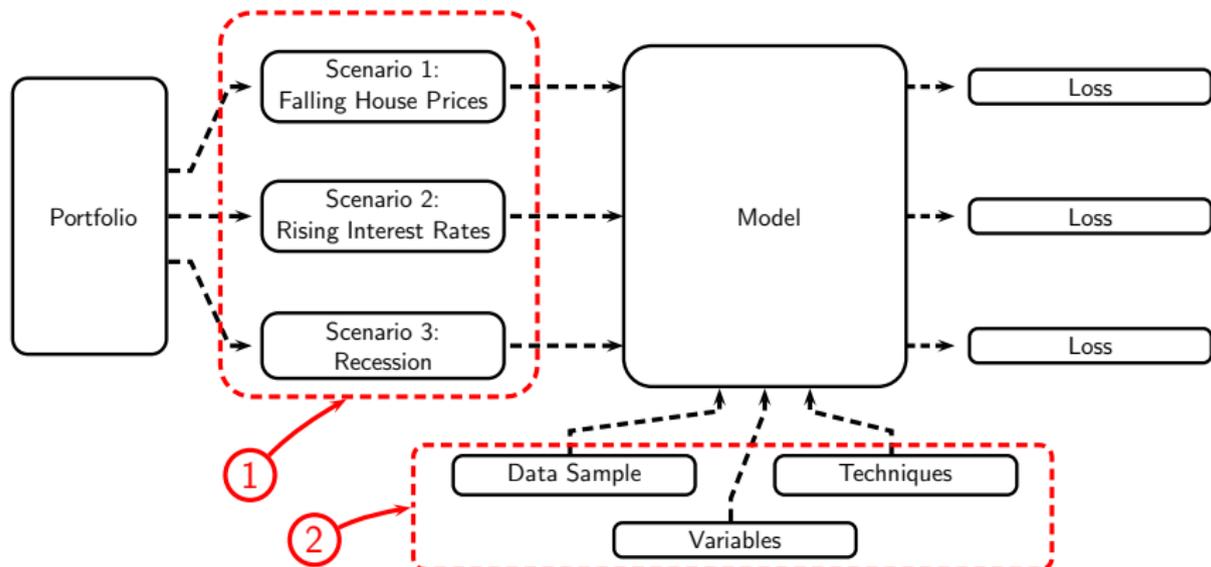
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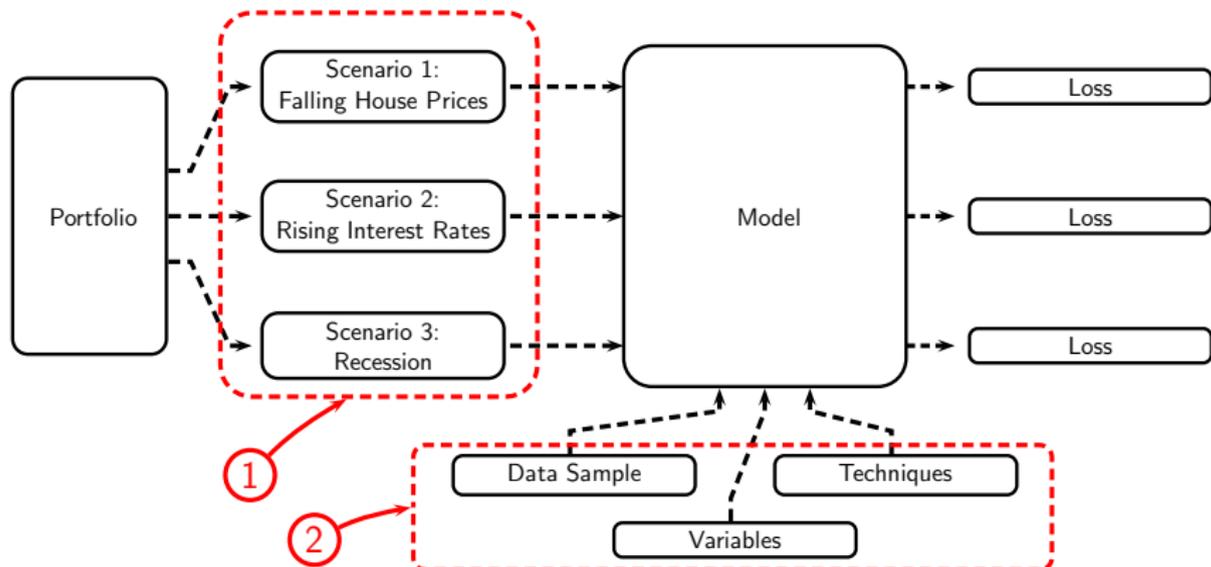
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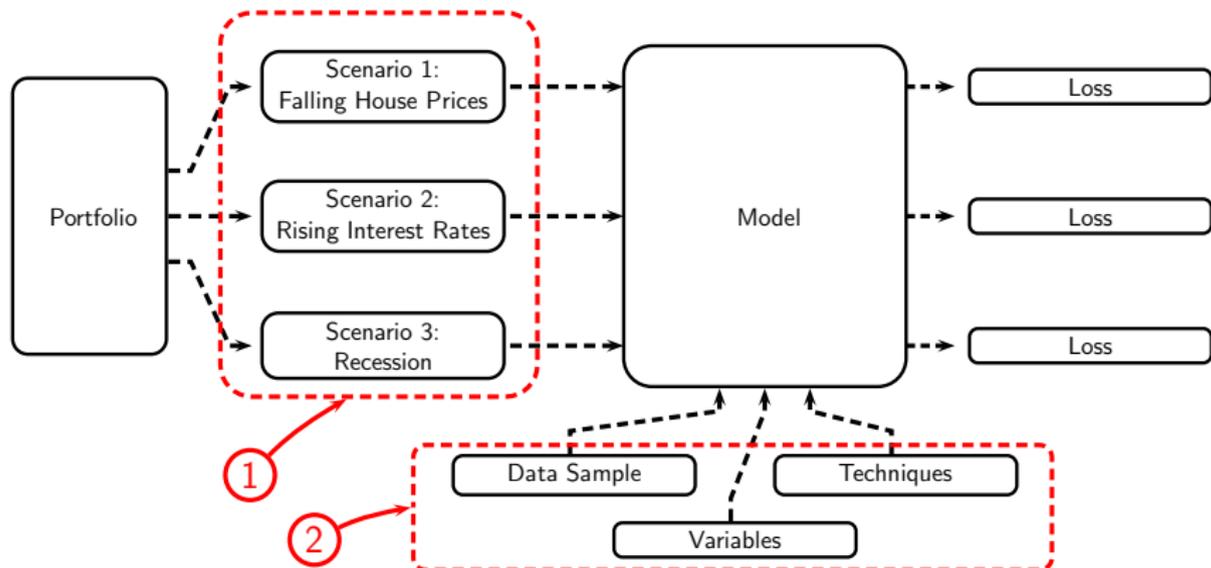
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- FNMA and FHLMC failed, costing taxpayers > \$100 billion.
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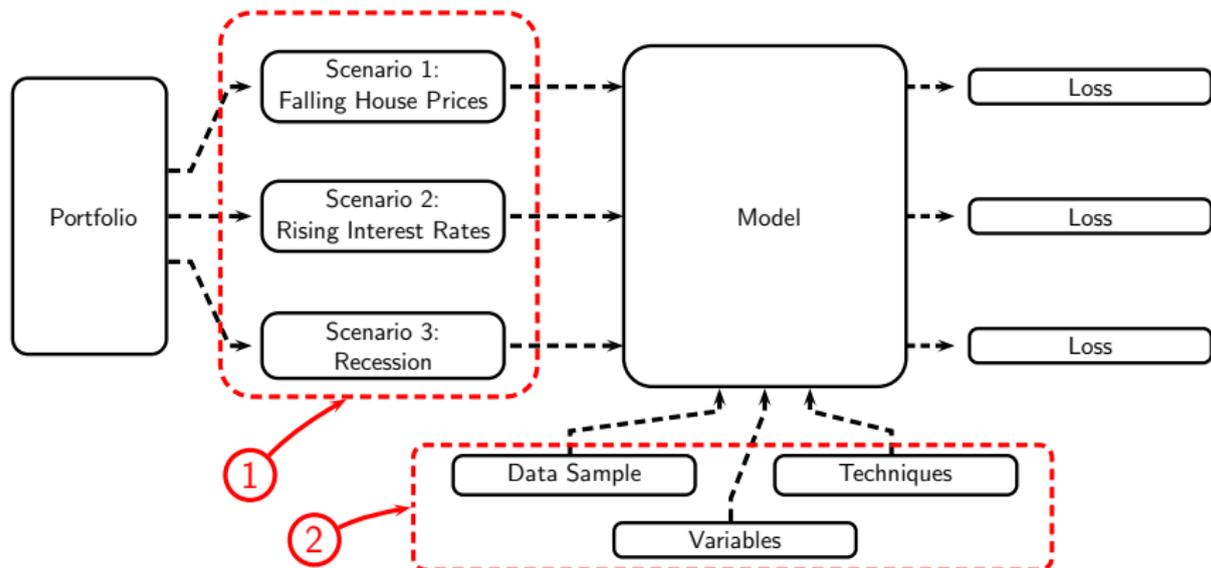
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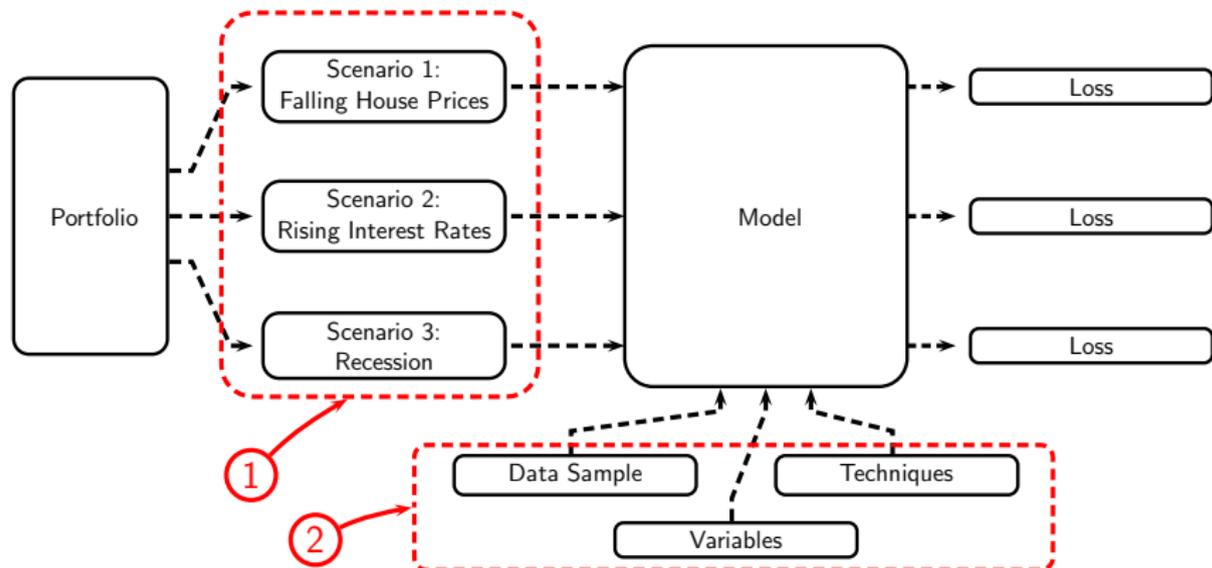
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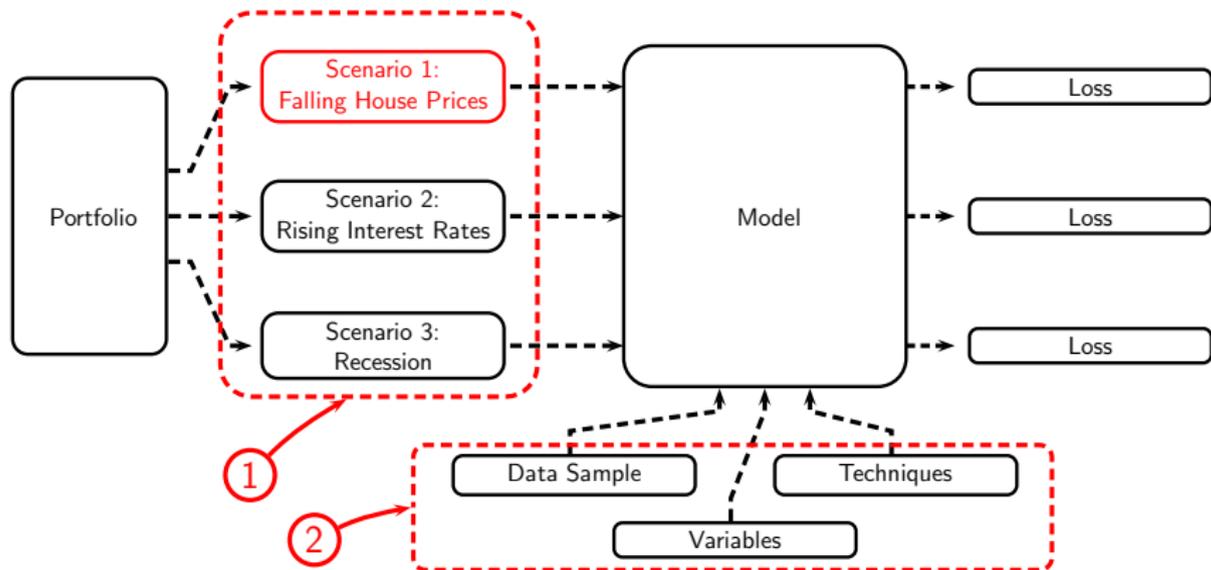
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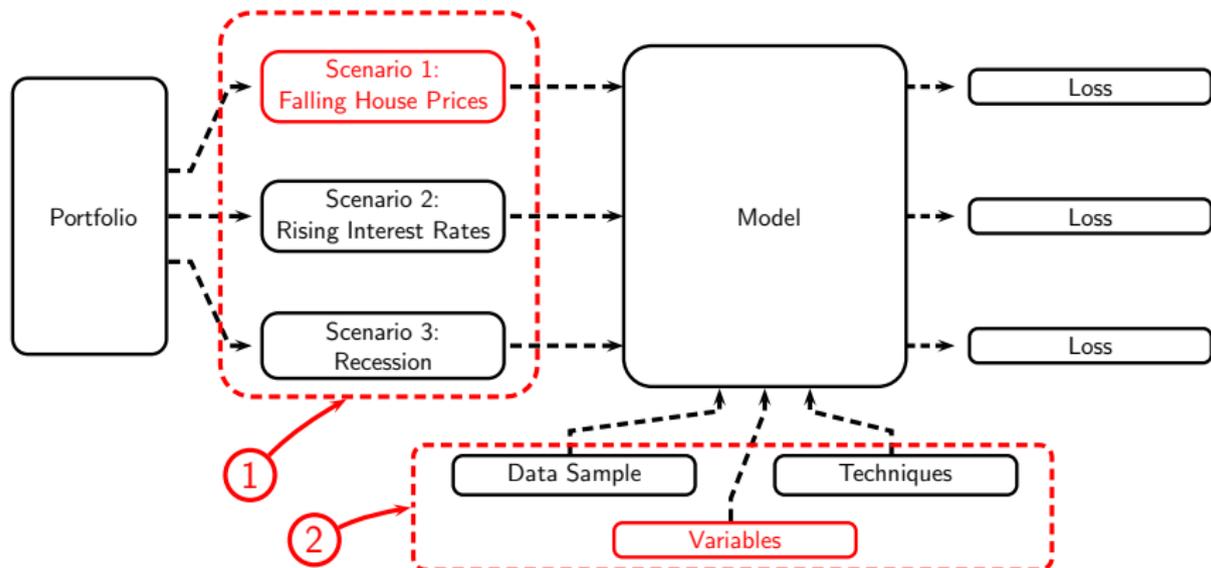
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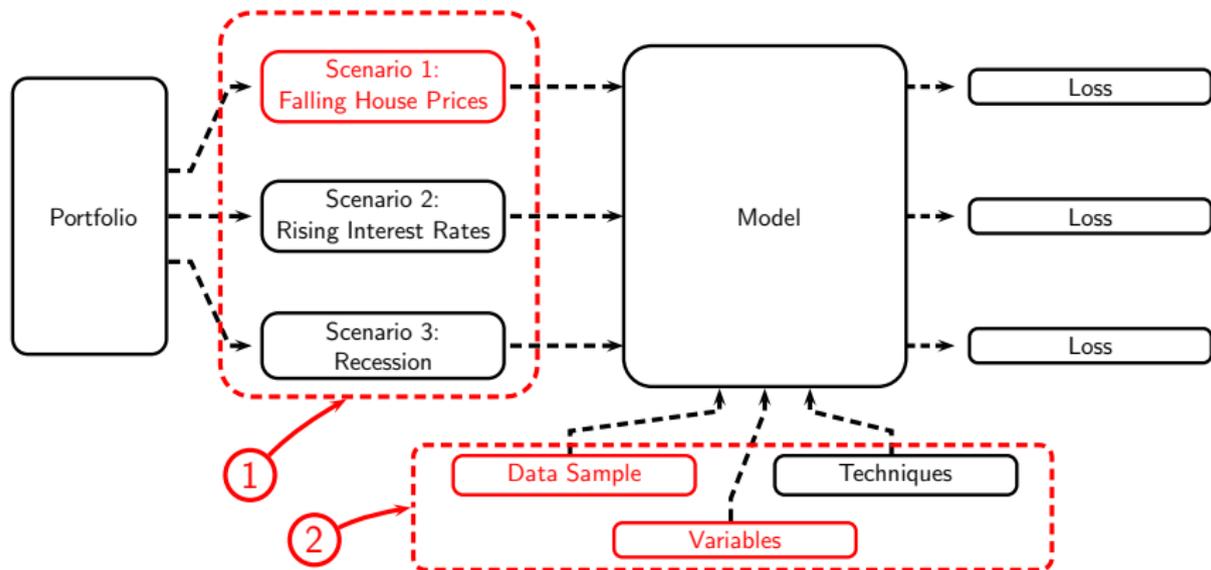
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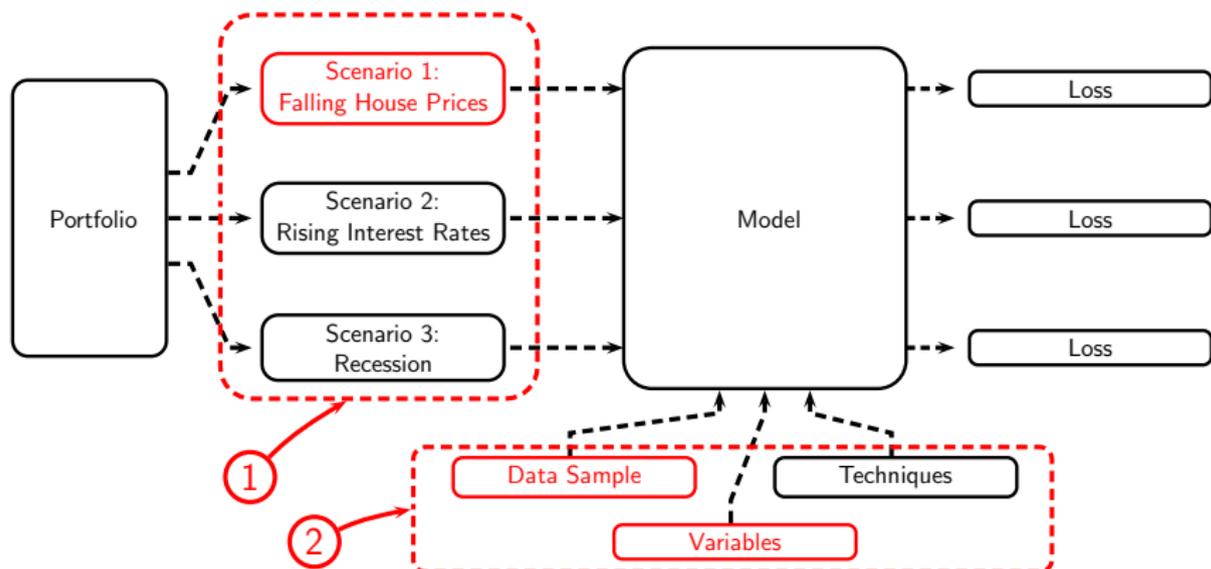
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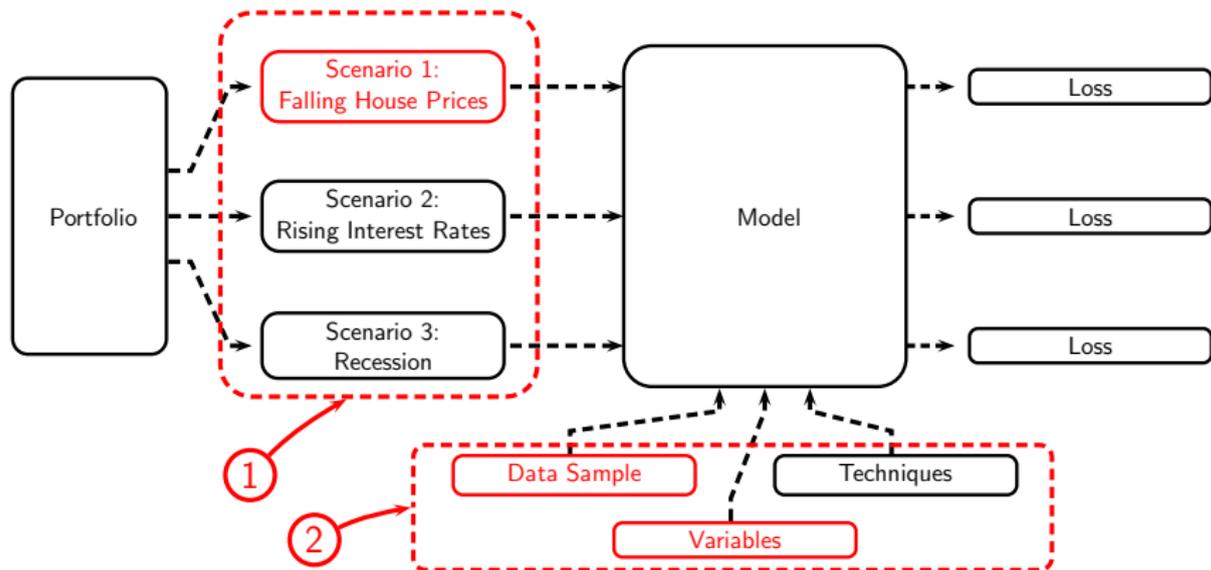
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  - Risk-based requirement produced by OFHEO and based on a stress test.
  - Capital requirement =  $\max[2.5\%, \text{RBC from stress test}]$
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- GSEs subject to *both* minimum leverage and risk-based capital requirement:
  - Minimum leverage requirement set in statute at 2.5% for balance sheet assets (plus 0.45% for off-balance sheet liabilities).
  - Risk-based requirement produced by OFHEO and based on a stress test.
  - Capital requirement =  $\max[2.5\%, \text{RBC from stress test}]$
- Stress test largely developed by OFHEO, but constrained in some important ways by the enabling statute.
  - Overall treatment of credit, market, and operational risks.
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- Simulated 10 years of adverse economic conditions on Fannie Maes and Freddie Macs existing assets, liabilities, and off-balance sheet obligations.
  - Assumed no new business.
- Stress applied via house prices and interest rates.
- House price scenario derived from “benchmark loss experience”.
  - Based on worst cumulative credit losses originated during a period of two consecutive years in contiguous states with at least five percent of the population.
  - AR + LA + MS + OK = ALMO during 1983-1984. 10-year default rate = 14.9%
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- Joint estimation of default and prepayment using a multinomial logit model.
- Defined default as having occurred when a loan *terminated* with a loss. In such cases, default was recorded as having occurred as of the last mortgage payment.
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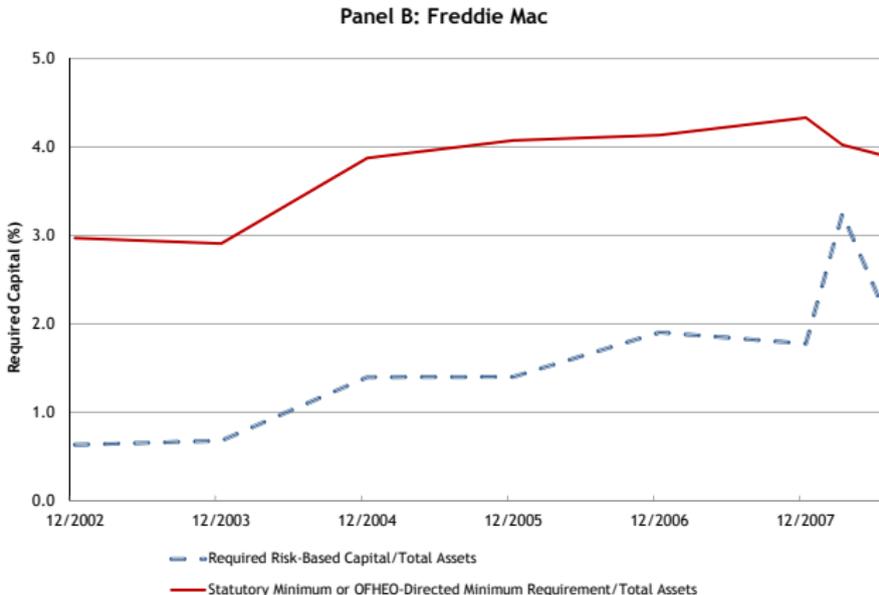
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# OFHEO Stress Test

- Risk-based capital requirement from stress test *never* binding – even in beginning of 2008!



# Timeline of the OFHEO Stress Test

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1996	First Notice of Proposed Rulemaking
1999	Second Notice of Proposed Rulemaking
2001	Final Rule Announced
2002	Stiglitz, Orszag and Orszag conclude that stress test means that risk of insolvency of GSEs is "effectively zero."
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# This Paper

- Figure out why OFHEO stress test failed in identifying the sensitivity of the GSEs' portfolios to the dramatic decline in house prices.
- Focus on single-family, 30-year, FRMs (they account for the vast majority of loans guaranteed by the GSEs).
- Evaluate model performance during the housing bust.
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- Data used to estimate original OFHEO model, proprietary GSE data from 1979–1999.
- We use loan-level data from Lender Processing Services (LPS).
  - Servicer-provided data that currently accounts for 75-80% of active mortgages.
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Year	Avg. LTV Ratio (%)		Avg. UPB (\$)		Avg. Interest Rate (%)	
	OFHEO	LPS	OFHEO	LPS	OFHEO	LPS
1995	80.1	79.5	101,518	101,393	8.1	8.6
1996	79.1	77.3	105,059	107,358	8.0	8.1
1997	78.1	78.5	111,398	115,546	7.8	8.0
1998	76.2	78.0	122,646	129,966	7.1	7.1
1999	77.6	76.8	123,600	128,224	7.4	7.2
2000	78.9	77.9	128,041	137,490	8.2	8.1
2001	76.2	74.9	145,435	148,313	7.1	7.1
2002	74.3	74.2	153,982	155,927	6.7	6.7
2003	72.2	72.4	162,743	160,537	5.9	5.9
2004	74.4	70.8	162,513	161,472	6.0	6.0
2005	73.8	72.4	175,886	164,631	6.0	6.1

# Model Analysis

- Focus on quarterly 1-step ahead forecasts of 30-year FRM default and prepayments based on OFHEO model parameters using LPS data.
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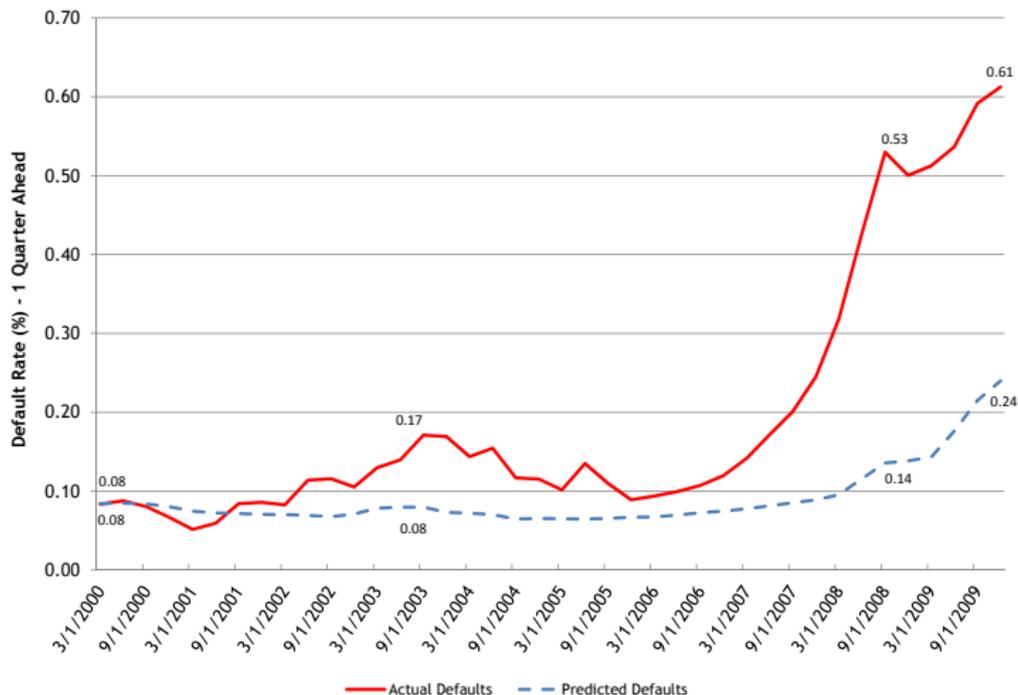
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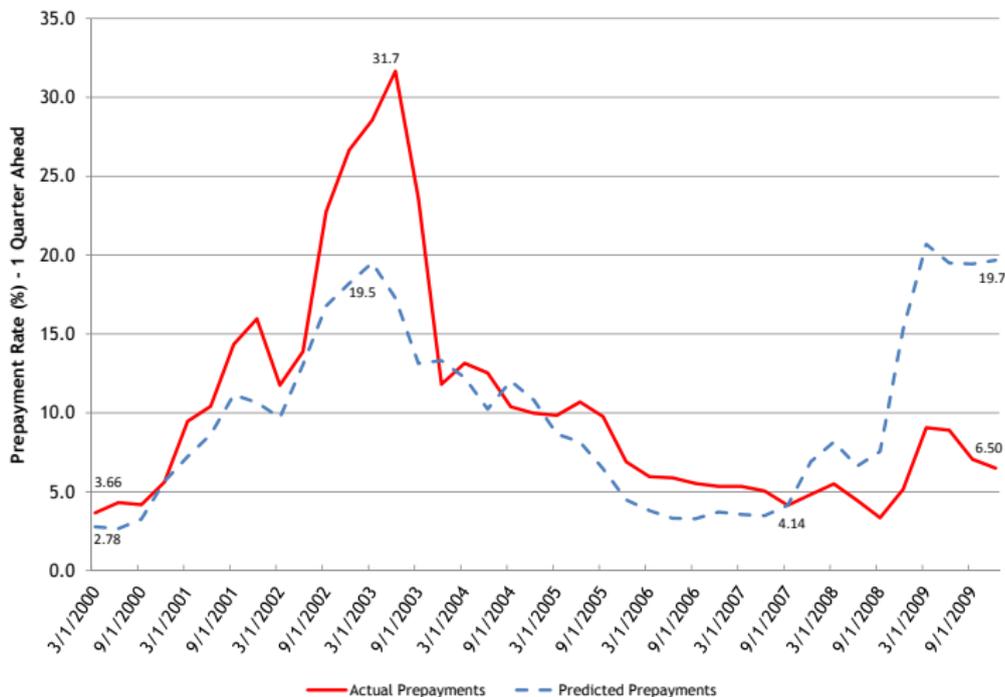
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## ● Default Forecasts (1-Quarter Ahead)



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## ● Prepayment Forecasts (1-Quarter Ahead)



# Model Analysis

- What if OFHEO had updated their model by simply re-estimating it with newer data?
  - Re-estimate OFHEO model with LPS data using 7-year rolling windows (also tried 3 year windows).
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- What if OFHEO had updated their model by including additional variables that have been found to be predictive of default rates?
  - More disaggregated house prices (county-level Corelogic indices)
  - FICO score at origination.
  - Documentation levels
  - Unemployment rates (county-level).
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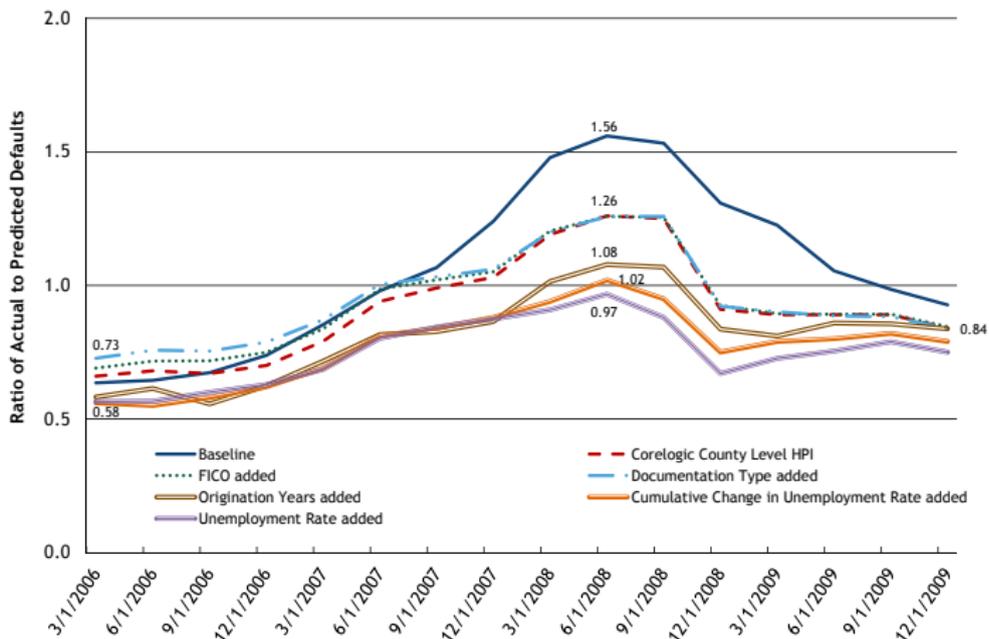
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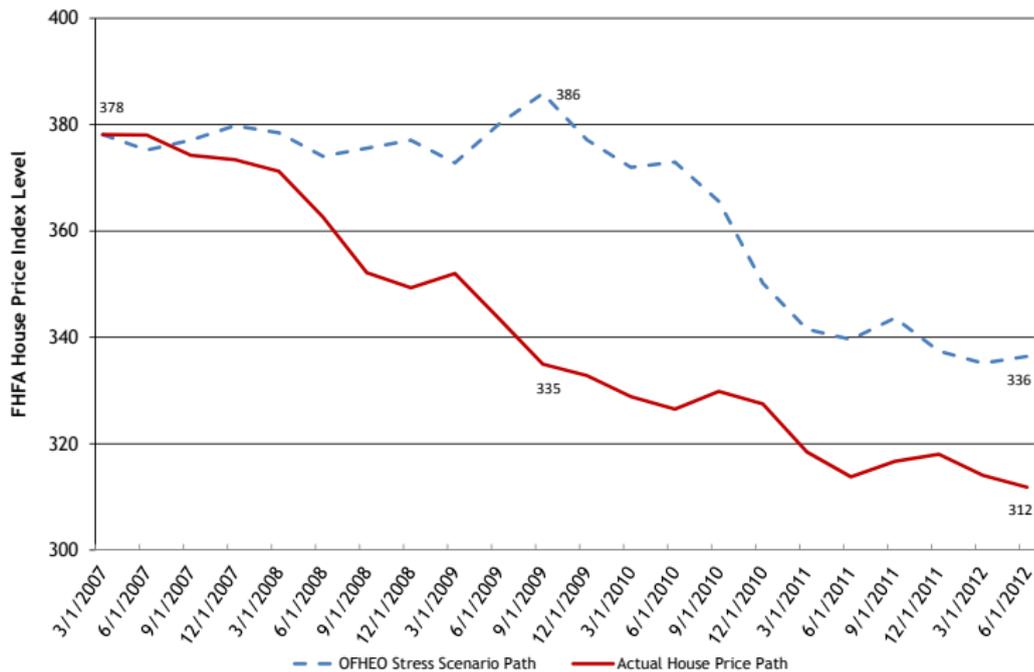
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  - Next 10 quarters, 13% decrease.

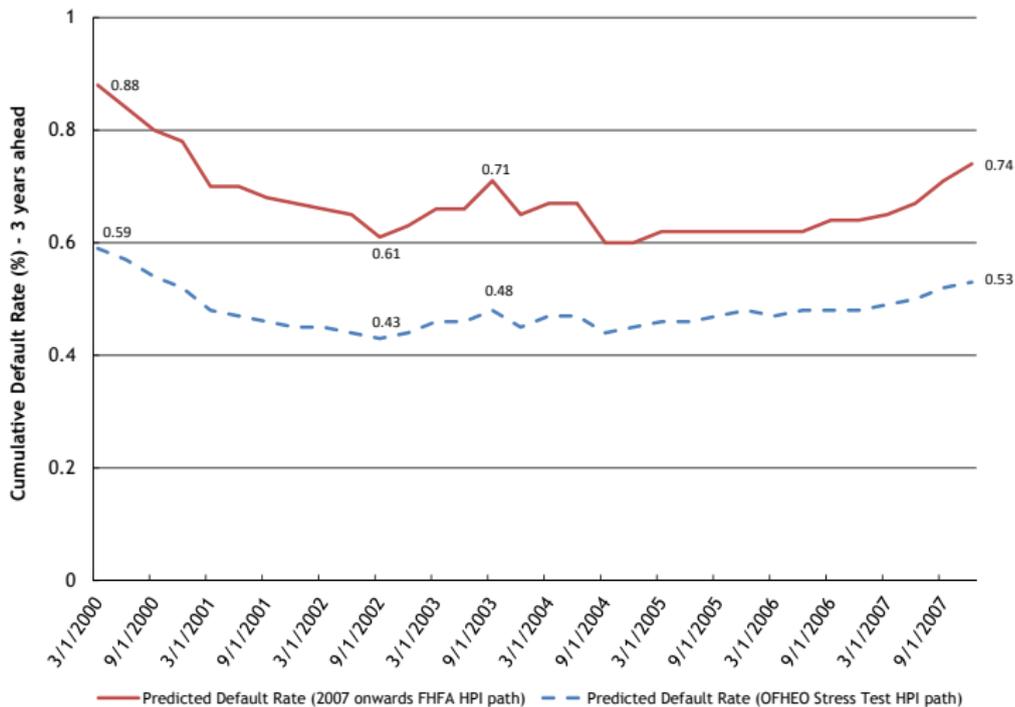
# Stress Scenario

- How stressful was the house price stress scenario used by OFHEO compared to what happened during the crisis?
- OFHEO house price stress scenario:
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# Concluding Remarks

- Stress testing can provide valuable insights regarding financial health and risk exposures of large institutions.
- However, stress tests, like any other forecasting exercise, are vulnerable to model risk.
- OFHEO experience is an unfortunate example of what can go wrong without appropriate model validation.
- Terrible forecasting performance of OFHEO mortgage default/prepayment model due to:
  - Failure to update parameter estimates.
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