

Frequently Asked Questions: Supervisory Methodologies in CCAR 2012

On March 21 and March 22, 2012, the Federal Reserve held five industry outreach calls to provide the bank holding companies (BHCs) that participated in CCAR 2012 with additional details on the methodologies used in CCAR to project supervisory estimates of losses related to residential mortgages, other consumer portfolios, wholesale portfolios, available-for-sale or held-to-maturity (AFS/HTM) securities, mortgage repurchase risk, and operational risk. The Frequently Asked Questions below are based on discussions during these industry outreach calls.

The Federal Reserve may adjust its supervisory models in the future based on its experience and external feedback.

A. General

1. *Did the Federal Reserve assess the accuracy of supervisory modeling techniques by performing any validation or back-testing?*

The Federal Reserve formed an independent model validation group to assess supervisory modeling techniques. The validation group focused on each model's conceptual underpinnings and reviewed modeling decisions and assumptions. Model reviewers were primarily composed of subject matter experts from the Federal Reserve's research divisions who were not involved in model development. To further ensure the independence of the model validation group, model reviewers reported to a different oversight group than model developers.

Supervisory model developers also performed a variety of tests of their models. These tests generally focused on the model subcomponents (e.g., default probability).

2. *How, if at all, were BHCs' own loss estimates used in developing supervisory estimates?*

While in some cases the Federal Reserve used the BHC-derived inputs (e.g., internal ratings for C&I and CRE loans and sensitivities for trading), individual loss estimates by BHC were not factored in any supervisory loss models.

3. *Was the industry information used as the basis for loss modeling calibrated to the recent performance of each firm?*

No. Federal Reserve-developed loss models were generally estimated using panel data, with no BHC fixed effects, because idiosyncratic factors that affected a BHC's past performance may not hold in a very stressful environment.

4. *Were any adjustments made to the modeled results?*

No adjustments, other than those based on actual items such as interim charge-offs and credit marks on purchase impaired loans, were made.

5. How was an individual BHC's proficiency with respect to loss mitigation taken into account?

No adjustments were made to modeled results based on qualitative factors such as the BHC's past experience with loss mitigation.

6. Did the Federal Reserve make any adjustments to the modeled results to account for timing of accounting loss realization?

Several supervisory loss models used an expected loss modeling framework, under which some of the future charge-offs were potentially brought forward. In those instances, no adjustments were made to projected losses to account for timing of accounting loss realization; however, the timing of loss recognition was explicitly factored into supervisory estimates of reserves.

7. In cases with missing or insufficient data provided by the BHCs, did the Federal Reserve make assumptions that may be construed as conservative?

As described in the CCAR 2012 Instructions, the Federal Reserve applied conservative assumptions to immaterial portfolios and to portfolios with missing or insufficient data elements.¹

BHCs with immaterial portfolios², which elected not to submit a relevant data schedule (submission was optional in these cases), received a loss rate that was at or near the 75th percentile of projected loss rates for the institutions reporting material portfolios.

The Federal Reserve made considerable efforts to validate BHC-reported data, and requested multiple resubmissions as needed. However, in certain instances, BHC-reported data were still not sufficient or were deemed unreliable to produce supervisory estimates. In such instances, the BHC received the 90th percentile or the highest loss rate projected among its peers, depending on the number of firms submitting the data.

For residential mortgages, where credit score or loan-to-value ratios were missing, the loss rates for the low credit score and high LTV buckets were assigned. For other types of loans, a conservative assumption was only applied to the risk segment with data integrity issues (e.g., credit score), and losses were estimated using the modeled parameters.³

¹ The CCAR Instructions were released on the Federal Reserve Board's public website on November 22, 2011. They are located at: www.federalreserve.gov/newsevents/press/bcreg/bcreg20111122d1.pdf.

² Immaterial portfolios are defined as those that represent less than 5 percent of Tier 1 capital or less than \$5 billion in balances on average for the preceding four quarters.

³ The method of applying conservative assumptions to certain risk segments was used only in cases in which the data integrity problem was isolated in such a way that the remainder of the portfolio could be readily modeled using the existing supervisory framework. Where the data integrity problems were more pervasive, the BHC's entire portfolio received the 90th percentile or highest loss rate among peers.

8. What average balances did the Federal Reserve use to project losses? How did the Federal Reserve project incremental balances?

The Federal Reserve used BHC-projected balances as reported on the FR Y-14A Summary schedule (Balance Sheet and Retail Balance Projections worksheets).⁴ Where applicable, incremental balances were calculated based on these projected balances.

9. How were risk-weighted assets calculated? Were risk-weighted assets adjusted for incremental losses?

The Federal Reserve used BHC-projected risk-weighted assets as reported on the FR Y-14A (Capital worksheet), and made no adjustment for incremental losses. Any incremental loan balance was assumed to have generally the same risk characteristics as existing loans.

10. Were loans that were held for sale or held for investment with the fair value option treated similarly to accrual loans? If not, how did the Federal Reserve project losses on those loans?

Losses on loans held for sale or held for investment with the fair value option (fair value loans) were separately projected using the balance reported by each BHC. Fair value loans were subject to the global market shock and losses were recognized in the first quarter of the nine-quarter projection horizon, consistent with the treatment of other mark-to-market assets. Those losses were reported as Other Losses.

11. How, if at all, did the Federal Reserve account for changes in underwriting policies?

Supervisory loss estimates accounted for variations in underwriting standards reflected in the BHC's portfolio composition as of September 30, 2011. In general, the risk distributions of the portfolios were assumed to be static over the projection horizon and new business was not deemed to be of better or worse quality.

12. Where, if at all, did the Federal Reserve use local-level macroeconomic projections? How were those projections derived?

State-level unemployment rates and local-level house prices were used for some retail portfolios and securitized obligations (e.g., non-agency residential mortgage-backed securities). Local-level macroeconomic variables were projected based on their historical covariance with national variables.

13. Does the Federal Reserve plan on revising the FR Y-14 data schedules to capture additional risk drivers to use in supervisory models?

The Federal Reserve may propose revisions to the FR Y-14 data schedules and instructions in the future based on its experience and any comments on the data schedules.

⁴ www.federalreserve.gov/reportforms/formsreview/FRY14A_20120118_f.pdf

B. Domestic Residential Mortgages (Accrual Book)

14. *What modeling framework did the Federal Reserve use to project losses on residential mortgages?*

The supervisory models used to estimate mortgage loan losses were expected loss models. Those models estimated losses as a function of the quarterly probability of default (PD), loss given default (LGD) and exposure at default (EAD).

15. *How were PDs on residential mortgages estimated? What were the key risk drivers?*

Broadly speaking, the PDs were estimated within a “competing risk” model framework where default and prepayment probabilities were simultaneously estimated. More specifically, the probability of default was modeled as a four-state system where the probability of transition from one state to another was separately estimated. The four states were current, impaired (90 to 179 days delinquent), paid off, and defaulted (more than 180 days delinquent or defaulted).

The key risk drivers included the original interest rate margin or spread relative to a reference rate (e.g., 30-year Treasury yield), borrower original credit score, origination vintage, current loan-to-value or combined loan-to-value ratio, delinquency history, and economic conditions. For home equity loans and lines of credit, the origination channel and lien position were also considered.

Key macroeconomic drivers included the change or level of the state-level unemployment rate, changes in the county-level house price index (HPI), and market interest rates.

16. *How was LGD projected for first-lien mortgages?*

LGD for first-lien mortgages was estimated based on total estimated costs, estimated timeline from delinquency to termination, and estimated timeline from default to other real estate owned (OREO) on portfolio loans.

Total costs, which included collateral loss and other costs associated with foreclosure and asset disposition, were projected using the industry data as of September 30, 2011, and were a function of the timeline from delinquency to termination, local house price changes, and other variables. Separate models were estimated for prime, subprime, and Alt-A loans (as defined in the industry data used to estimate the model). The estimated costs were then assigned to each loan segment based on the composition of loans in that segment.

A separate timeline model that projected the time from default to OREO on portfolio loans was calibrated using the industry data. Estimated total costs were partitioned, based on the estimated timeline into (1) LGD for loan loss calculation, and (2) OREO expenses that flow through pre-provision net revenue (PPNR).

All costs up to foreclosure were allocated to LGD, and costs incurred after foreclosure, including further decline in property values, were allocated to OREO expenses for the fraction of time in OREO over the projection horizon. OREO expenses after December 31, 2013, were not included in supervisory estimates.

17. How was LGD projected for home equity?

The assumed LGD aligned with industry-reported Basel II loss given default by PD range as reported. The PD-weighted average LGD was about 95 percent.

18. How did the Federal Reserve factor recoveries into the LGD analysis? Was it included and was the vintage of the loss (not origination) factored into recovery calculation?

The mortgage LGD model estimated losses net of recovery in relation to changes in HPI, and other variables. The vintage of loss was factored into the timeline model.

19. What factor did the Federal Reserve use to estimate the drawdown on unused commitment lines for home equity lines of credit? Were any qualitative factors such as line suspension practice considered?

The home equity lines were assumed to be fully drawn at default. The assumption was applied consistently to all firms, and no adjustments were made based on qualitative considerations.

20. Did the Federal Reserve consider any changes to underwriting policies that might not be reflected in the historical loss data used in its model development?

The Federal Reserve generally assumed that newly originated loans had the same risk characteristics as the existing portfolios. Once the effect of seasoning was taken into account, projected losses on newly originated residential mortgages were mostly immaterial.

21. How was insurance treated in the loss projections? Did the Federal Reserve assume the counterparties would fail to meet their obligations?

The Federal Reserve did not collect data on private mortgage insurance (PMI) in connection with CCAR 2012, and, therefore, did not incorporate mortgage insurance into LGD models. Industry data suggest that insurance coverage on portfolio loans is infrequent and cancellation or nullification of guarantees was a common occurrence during the recent downturn.

22. For the mortgage loss models, were the weights (sensitivities) associated with macroeconomic variables empirically derived? If so, which variables were most significant in the loss estimation process?

Yes, the weighted were empirically derived. The estimated models were sensitive to changes in unemployment rates and HPI, both directly and through the impact of house prices on the ratio of loan balance to projected house value. All of these effects were strongly significant in each of the first-lien and home equity models.

23. How were loan modifications dealt with in the mortgage loss modeling framework?

The effects of loan modifications and evolving modification practices were captured in the supervisory first-lien mortgage model through the default probability of re-performing loans (loans that had cured from delinquency). The default probability of re-performing loans has improved (lower probabilities) in recent periods, reflecting the effects of evolving loan modification practices. Robustness analysis showed that separating modified loans from other re-performing loans did not materially increase the explanatory power of the model.

In the home equity model, modified loans were not separately modeled. Rather, they were included as a subset of all loans that were ever 90 or more days delinquent.

Loan modifications subsequent to default (beyond 180 days delinquent) were not independently factored into the loss severity calculation for first-lien mortgages.

24. How was the quality of loan origination (documentation level or appraisal quality) considered? How were the original underwriting criteria, including the origination channel for loans, considered?

Unobserved loan quality was captured primarily through vintage effects. The loan level first-lien mortgage and home equity models incorporated other potential indicators of quality such as origination spread or margin and an indicator for the broker/wholesale channel.

The loan origination channel was directly factored into the home equity model, but not into the first-lien mortgage model.

25. Did the valuation on the existing non-performing loans incorporate changes in housing prices between the most recent charge-off date and the assumed resolution date? Did you use the HPI at the national level or at the local level?

The valuation incorporated ongoing changes in housing prices, and the model used HPI at the county level.

26. Was the lien position in HELOCS considered in the transition modeling?

Yes, lien position was a variable in the HELOC delinquency and default model.

27. How was the effect of brokered loans and higher original loan-to-value (LTV) ratios on private-label mortgage-backed securities adjusted for before applying LGDs to bank portfolios?

The original LTV ratio was incorporated directly into the loss given default model but the origination channel was not. In addition, the model controlled for various risk characteristics including original credit score and credit quality segment (prime, alt-A, and subprime).

28. Were performance and loss assumptions on residential mortgage loans modeled differently based on loan purpose (primary home, investment property, second home, land, etc.)?

Yes, the estimated first-lien mortgage delinquency and default transition models controlled for loan purpose.

29. When was the total economic loss for residential loan portfolios recognized?

All losses not attributable to time in OREO were assumed to be fully written down at the time of default (180-days past due), for all defaults projected to occur during the nine-quarters. The projected loss incorporated the projected house price path. The OREO portion was assigned to PPNR if the loan was predicted to enter OREO during the nine-quarter period of the stress test.

C. Domestic Credit Cards (Accrual Book)

30. *What kind of modeling framework did the Federal Reserve use to project losses on credit cards?*

Losses on domestic credit cards were estimated using an expected loss modeling framework.

31. *Will the Federal Reserve provide more detail on the PD model and data used?*

The PDs for credit cards were estimated using a competing risk model framework that estimates the transition probabilities within a three-by-three transition matrix conditional on macroeconomic variables, credit score of the borrower, age of the account, and product characteristics such as line size and utilization rate. The three states were “current,” “delinquent,” and “default,” where defaults were defined as being 90 days or more delinquent.

The models were estimated using a random sample of an industry account-level consumer credit database, spanning from the second quarter of 2006 to the second quarter of 2011.

32. *How was LGD on credit cards estimated?*

The model used the average LGD during the 2008 to 2009 period, based on pooled data submitted by BHCs. The LGD was calculated separately for bank cards and charge cards and then applied consistently to each BHC’s credit card portfolio.

33. *How was EAD on credit cards estimated?*

Based on pooled data from January 31, 2007 to September 30, 2011, the model measured the change in account balances for each possible transition state in PD model over a six-month window and estimated EAD by segment such as vintage and line size.

34. *At what level of segmentation was the macroeconomic modeling applied (e.g., payment status, geography, vintage, credit line, and borrower credit score)?*

The PD model was estimated at the loan level and the LGD and EAD models were estimated at the segment level. Loan-level PDs were aggregated into segment buckets to produce segment-level PDs. The granularity of the segmentation buckets used was analogous to that defined in the FR Y-14Q U.S. Bank and Charge Card Schedule.

35. *Was any consideration given to addressing the change in correlations between losses and macroeconomic variables over time?*

The PD model was estimated on a sample spanning the second quarter of 2006 to the second quarter of 2011. Throughout the model development process, particular attention was given to ensure stability of the estimated parameters across time and robustness of the parameter estimates to minor model specification choices.

36. *Line suspension strategy was not mentioned as a point of specific BHC data for bank card. Was that factored into the analysis?*

Line suspension and other management strategies were assumed to affect EADs as they did during the January 31, 2007 to September 30, 2011 period.

D. Domestic Auto Loans (Accrual Book)

37. *What kind of modeling framework did the Federal Reserve use to project losses on domestic auto loans?*

Losses on domestic auto loans were estimated using an expected loss modeling framework.

38. *Will the Federal Reserve provide more detail on the PD model and data used?*

The estimated PD model was a survival model with two transition equations: current to default, and delinquent to default. The model was estimated using a random sample of auto trade line data from a large panel of credit bureau data spanning from June 30, 2004 through June 30, 2011.

The most important risk drivers in the estimated model were the credit score, delinquency history, loan age, and macroeconomic variables including changes in the unemployment rate and changes in house prices.

39. *How was LGD on domestic auto loans estimated?*

The LGD on domestic auto loans was estimated using pooled data. The model conditioned the LGD on changes in the unemployment rate.

40. *How was EAD on domestic auto loans estimated?*

The estimated EAD model was based on trade line data, and captures the average amortization at different timelines for each risk segment. The estimated EAD model was not a function of macroeconomic variables.

41. *How were losses projected for each BHC's portfolio?*

Because industry data that were used to estimate the PD and EAD model lacked some key risk attributes (e.g., loan-to-value ratio), a separate model that related actual net losses to predicted net losses and loan-to-value ratio was used to estimate losses. The model was estimated using pooled data spanning from January 31, 2008 through September 30, 2011. Finally, losses for each BHC were projected using the BHC's September 30, 2011 portfolio risk characteristics, model parameters, and the path of macroeconomic variables in the supervisory stress scenario.

42. *Was consideration given to including a used car price index?*

The key macro drivers in the model were changes in the unemployment rate and changes in house prices. An auto price index was not used in the auto loan model.

43. Did only some or all transitions in the transition models include macro variables?

All of the transitions in the estimated models were functions of the macroeconomic variables and were conditional on other risk drivers.

E. Other consumer loans (Accrual Book)

44. Can the Federal Reserve provide more detail on the modeling assumptions and data used?

The other retail portfolios included U.S. other consumer, U.S. small business, small business and corporate card loans, student loans, and international retail loans. These portfolios were not amenable to the expected loss model approach given their small sizes and data limitations.

The other retail suite of models used pooled data spanning January 31, 2007 through September 30, 2011. The product level models were defined as a system of equations characterizing the delinquency rate, default rate, and net charge-off rate. Those rates were simultaneously estimated and modeled as a function of static portfolio characteristics, the rate in the previous delinquency state, and macroeconomic variables.

Projected loss rates were generated for each BHC by seeding the system of equations with risk characteristics of the BHC's loan portfolio as of September 30, 2011 and lagged (actual) values of delinquency, default, and net charge-off rates. The equations were then rolled forward over the stress scenario horizon to produce projected loss rates.

45. What specific assumptions were applied to other consumer loans?

For government-guaranteed student loans, a monthly PD of 1.5 percent and LGD of 3 percent were assumed.

Non-purpose securities-based loans received an annual loss rate of 25 basis points.

For international portfolio models, credit score equivalents were used when available and deemed appropriate. Geographic differences between BHC portfolios accounted for some of the cross-sectional variation in projected loss rates. In certain instances, where the data availability precluded estimating a separate international model, projected loss rates on domestic portfolio were applied to international portfolios.

46. What were the macroeconomic assumptions outside of the Euro area, the United Kingdom, developing Asia, and Japan? For example, what was the scenario for Latin America?

There were some cases in which a perfect mapping between the geography associated with the scenario variables and the geography segments collected in the data schedules did not exist. The macroeconomic scenario for Developing Asia and Japan aligned with the Asia Pacific geography region; the scenario for Europe and the U.K. aligned with the Europe, Middle East, and Africa geography; and, the U.S. macro scenario was used for the rest of the world, including Latin America.

F. Commercial and Industrial (C&I) Loans (Accrual Book)

47. *What modeling framework was used to project losses on Commercial and Industrial (C&I) loans?*

The supervisory models in this area used an expected loss framework. The same general methodology was applied to the C&I (large corporate loans) and the Other Loan categories. The principal risk parameters in these models were PD, LGD, and EAD, with definitions similar to those in the Federal Reserve's Basel II regulatory capital framework.

As noted above, loans to small businesses that were underwritten based on credit scores were modeled using the modeling framework for other consumer loans, not C&I.

48. *How was PD estimated for C&I loans?*

The probabilities of default conditional on the supervisory stress scenario were estimated as follows.

First, each BHC's internal ratings as reported by the BHC were mapped to external scales using the "concordance tables" received from each BHC through the ongoing supervisory process, and then mapped into six risk buckets.⁵ A consistent definition of default was used to create a seventh bucket (default). This concordance mapping was used to assign a rating bucket that remained constant over the stress period.

Second, the model translated changes in key macro-economic variables to quarterly changes in expected default probabilities (EDFs). For this model, the spread on BBB/Baa-rated corporate bonds and the VIX index of market volatility⁶ best explained changes in historically observed EDFs over time. These variables acted as leading indicators of economic change, and they were applied without lags. The model was separately estimated using more than 15 years of data for each combination of credit quality bucket and industry, as well as for U.S. and non-U.S. borrowers.

49. *What were the key risk drivers for C&I losses?*

The key risk drivers for C&I losses included internal ratings, industry, collateral, lien position, domicile, utilization, and macroeconomic conditions.

50. *How was LGD calculated for C&I loans?*

The LGD assumptions varied based on the BHC-reported lines of business (LOB), the presence of security, seniority, and the domicile of the borrower.

The LOBs, as defined in the BHC's normal course of business (as reported on FR Y-14Q), were mapped into a consistent set of generic LOBs. Examples of these generic LOBs included large

⁵ See "Comprehensive Capital Analysis and Review 2012: Methodology for Stress Scenario Projections," March 12, 2012, Appendix B (Models to Project Net Income and Stressed Capital).

⁶ Source: Chicago Board Options Exchange

corporate lending, middle market lending, asset based lending, wealth management and corporate cards. All the loans in that generic LOB received the same base-case LGD, which based on industry data, where available, and a horizontal view of BHCs' LGD parameters. For example, asset-based loans were assigned a lower LGD than corporate cards, all other factors being equal.

The base case LGD was adjusted by security, seniority, and domicile at the loan level. The adjustment for domicile was done using a published creditor-friendliness index. The loan was differentiated based on whether secured or not, but the characteristics of the collateral were not considered.

The LGD for an already-defaulted loan depended heavily on the level of existing ASC 310-10 reserves.

51. How was EAD estimated and what assumptions were used for LEQs (loan equivalency exposures)?

EAD was calculated as the sum of current outstanding exposure plus an estimate of future draws up to default on current committed but undrawn exposure. The estimate of future draws for defaulted exposures was loan equivalence, or LEQ.

LEQ was empirically derived based on historical Shared National Credit data and calculated by comparing the funded loan level at the date of default and the funded loan level one year earlier.

52. How was the relationship between historical realized default frequencies and market-implied projections validated for industries, credit quality segments, and countries?

The expected default frequencies (EDFs) used in the model were forward-looking measures that were calibrated using the large default database observed over an extended time period. In assessing the reasonableness of using EDFs as a proxy for PDs, particular attention was paid to EDFs as of 2008 and 2009 and actual defaults in 2009 and 2010.

The PD model estimated changes in EDFs as a function of changes in financial market variables included in the supervisory stress scenario by industry, credit quality segment and domicile. Those relationships were back-tested using out-of-period sample analysis.

53. How sensitive were projected losses to macroeconomic or financial market variables included in the supervisory stress scenario?

The sensitivity to macroeconomic or financial market variables varied by the borrower's credit quality and industry. Loans to different industries carrying the same external rating could see their EDF react differently to macro-economic stress. All else equal, portfolios that were more heavily concentrated in industries that have historically been most sensitive to the business cycle would have higher expected losses.

54. Was a different modeling approach used for the mid-market loan book?

No, the same modeling approach was used to project losses on the mid-market loan book. The risk characteristics of those loans were captured by data submitted by the BHCs (which included the ratings each BHC assigned to these credits), and the translation of the risk characteristics to loss experience was done in a consistent manner regardless of loan size.

55. Were C&I charge-offs assumed to occur instantly at default? If so, were the recovery portions of the loans also assumed to occur at default?

An expected loss approach was used to project losses on C&I loans. Similar to their definitions in the Basel II regulatory capital framework, the PD was a forward-looking estimate and the LGD represented the discounted present value of the total workout process. Thus, the default and recovery event were assumed to occur simultaneously.

Under the expected loss modeling framework, some of the future charge-offs were potentially brought forward. No adjustments were made to projected losses to account for timing of accounting loss realization. However, the timing of loss recognition was explicitly factored into supervisory estimates of reserves.

G. Commercial Real Estate (CRE) Loans (Accrual Book)

56. What methodology was used to project losses on CRE loans?

Losses on CRE loans were projected using a two-step approach. A riskiness index was first calculated using probit regressions, based on the characteristics of each loan as reported by the BHCs. The estimated index values were used to distribute the industry-wide losses estimated using a top-down regression model of charge-offs that conditions on macro factors.

57. How was the riskiness index estimated?

The characteristics used to estimate the riskiness index included property type, MSA level geography, vintage, recourse, and quantitative factors such as debt service coverage ratio (DSCR) and loan-to-value ratio (LTV). DSCR and LTV were adjusted to account for cross-collateralization.

The more the loan in question resembled the characteristics of criticized loans (internal ratings at or below the equivalent of CCC/Caa) based on this set of variables, the higher the score the loan received. For example, if the model suggested that criticized loans were more likely to have high LTVs or low DSCRs, then loans with higher LTVs or lower DSCRs would have higher scores than like loans with lower LTVs or higher DSCRs. Each loan's score was weighted by its committed balance to get a final index for each BHC.

58. How were the industry-wide loss rates estimated and spread to produce an individual BHC's projected loss rate?

The aggregate industry charge-off rate was estimated using a top-down regression model of charge-off rates, which conditions on macro factors. The top-down model was estimated

separately for each Y-9C category (multifamily, construction and land development, and nonfarm, non-residential) using a panel of Y-9C data. The panel started in 1991 and covered the 19 institutions subject to CCAR 2012.

Using the index score, the BHCs were distributed around the conditional expected mean loss rate from the top-down model. The distribution was designed to match the dispersion of BHC losses around the central tendency observed in past CRE downturns.

59. What data were used to calibrate the probit model—BHC data or CMBS?

The index was calibrated purely on bank loan data and does not use CMBS or other proxy data in its calculation.

60. How was DSCR estimated?

A uniform set of assumptions regarding interest rate and amortization for comparability purposes was applied to the cross-collateralized net operating income (NOI) to calculate the DSCR. A uniform 30-year amortization was used for all loans. The current interest rates for individual loans, as reported on the 14Q, were used.

61. How were criticized loans defined?

The BHCs' internal ratings were used to break the loans into two groups. The first group had an internal rating better than the equivalent of CCC/Caa. The second group had an internal rating at or below the equivalent of CCC/Caa. The method for this split was the same as the mapping procedure used for corporate loans. Generically, the first group of loans resembled "pass" credits and the second group of loans would primarily fall into the criticized categories.

62. How were the owner occupied non-farm, non-residential loans modeled?

Losses on the owner-occupied non-farm, non-residential loans were projected using the C&I model.

63. If the riskiness indicator was based on the characteristics of the market (geographic location), what level of geographic granularity was used?

Each property was mapped into one of roughly 52 metropolitan statistical areas (MSAs).

64. Was the change in the portfolio mix considered in the forecast of future losses?

The portfolio composition was assumed to remain constant over the projection horizon.

65. How did the strength of guarantors impact losses in the models?

The probit model used to generate the riskiness index incorporated BHC-reported data on the reliance on recourse to a third-party guarantor. However, the strength of individual guarantors was not considered in the model.

66. How were price forecasts generated at the MSA-level by property type?

MSA-level price forecasts by property type were not used in the probit model or top-down model.

H. AFS/HTM Securities

67. How were OTTI losses for securitized obligations estimated?

For securitized obligations, credit and prepayment models were used to estimate default, severity, and prepayment vectors on the underlying pool of collateral under the supervisory stress scenario. In most cases, these projections incorporated relatively detailed information on the underlying collateral characteristics for each individual security available through commercial databases that contain loan level collateral and security structure information. Default, severity, and prepayment vectors were projected using either econometric models developed by the Federal Reserve or commercially-available models. These vectors were then applied to a cash flow engine, which captured the structure of each security (for instance, tranche, subordination, and payment rules), to calculate the intrinsic value for that security. The intrinsic value was defined as the present value of the projected cash flows for a given tranche.

The estimated intrinsic value for structured products differed from the fair market value. In general, to be consistent across all institutions, the discount rate used was equal to the coupon rate for fixed rate bonds or the discount margin for floating rate assets.

Credit losses on structured products were determined in accordance with existing accounting guidance. If the projected intrinsic value was less than the amortized cost basis, then the security was considered to be other than temporarily impaired and OTTI was calculated as the difference between the amortized cost and the intrinsic value.

68. How were OTTI losses estimated for direct obligations?

For direct obligations, the model assessed the probability of default or severe credit deterioration for each security issuer or group of security issuers over the stress scenario horizon. In general, OTTI for direct obligations was estimated using models that related changes in expected default frequencies (EDFs) or in credit default swap (CDS) spreads to variables included in the supervisory stress scenario. A security was considered to be other than temporarily impaired if the projected value of the EDF or CDS spread crossed a pre-determined threshold level—generally the level consistent with a CCC/Caa rating—at any point during the stress scenario horizon. Loss given default on these securities was calculated based on historical data on bond recovery rates. OTTI was calculated as the difference between the bond's amortized cost and its projected value in the supervisory stress scenario.

69. How were OTTI losses projected for corporate debt?

Where firm-specific default frequencies were available, the projected value for corporate debt was estimated by first projecting obligor-level EDF changes to identify OTTI securities, and then applying the estimated loss given default based on historical recovery data.

Changes in obligor-level EDF were projected in three steps. First, quarterly changes in region-level EDFs were projected using a model that regresses changes in the average region-level EDF on the quarterly change in U.S. GDP and the change of the yield spread between Baa corporate bonds and the 10-year Treasury note. Second, obligor-level betas were estimated by regressing changes in each obligor's EDF against the corresponding region-level EDF changes. Finally, obligor-level betas were applied to projected changes in region-level EDFs to produce projections of obligor-level EDF changes.

If the projected EDF level at any quarterly node crossed a threshold consistent with a bond transitioning to a CCC/Caa rating, the bond was considered to be other-than-temporarily impaired in that quarter.

LGD was calculated using a model that regressed the recovery data on the spread on BBB/Baa-rated corporate bonds and a term spread. Projected LGD varied over the time horizon and was differentiated based on bond seniority.

OTTI was calculated as the difference between the bond's amortized cost and its projected value under the supervisory stress scenario.

70. How were OTTI losses projected for municipal bonds?

Each obligor was assigned to one of three risk categories (Categories 1, 2, and 3) based on the inherent risk characteristics of different municipal bond types.

The lowest risk category, Category 1, included municipal bond types where the issuers have sovereign powers to raise taxes or revenue (e.g., states) and/or those that are monopoly providers of essential services such as water systems and electric systems. Category 2 included municipal bond types for which repayment is highly reliant on consumer demand for the service provided, such as toll roads, private colleges, and universities. Category 3 included municipal bond types where the credit risk is more similar to that of corporate credits, such as hospitals.

The default rates varied by risk category. For example, default rates for Category 1 bonds were based on historical default rates observed for general obligation bonds. Default rates for Category 3 bonds were more akin to corporate bond default experience.

A uniform LGD assumption based on historical recovery rates was applied to produce the projected value. OTTI was calculated as the difference between the bond's amortized cost and its projected value under the supervisory stress scenario.

71. What LGD assumptions were used for direct obligations (e.g., corporate bonds)?

For corporate bonds, LGD was calculated by regressing recovery data on the BBB/Baa spread on corporate bonds and a term spread. LGD varied over the time horizon and was differentiated based on bond seniority.

For sovereign bonds, severity was in line with the historical weighted average LGD observed across defaulted sovereign obligors.

72. How were international AFS securities treated relative to domestic securities? Were international locally denominated currency securities stressed for a credit component?

Currency was not an input into the corporate and sovereign bond models. The general methodology for domestic and international securities was the same for corporate bonds.

73. Were credit migration and its effect on cumulative PD estimates included in the default loss projections for the planning period?

A credit rating migration model was not used for corporate and sovereign bonds.

74. How did the Federal Reserve consider unrealized gains or losses in the context of Tier 1 capital?

Only credit OTTI losses impacted post-stress capital ratios.

I. Mortgage Repurchase Risk

75. How were losses on mortgages sold with representations and warranties projected?

The Federal Reserve used a two-step process to project mortgage repurchase losses on loans sold with potential liability associated with representations and warranties. First, credit losses on those loans were projected; second, a “putback” rate was applied to these losses to estimate potential putback losses from contractual repurchase, settlement, or adverse litigation outcome.

76. What data did the Federal Reserve use to project credit losses?

Credit losses were projected using historical industry data for agency loans (i.e., loans sold to Fannie, Freddie or guaranteed by the FHA) and private label securities (PLS). Specifically, for private label securities and whole loans, proxy deals for each BHC were selected from the industry database based on the dealer, issuer, and originator information contained in the database. For loans sold to government-sponsored enterprises (GSEs), a random sample was selected from the industry database.

Credit losses for each BHC were projected using data on loans sold with representations and warranties that the BHC reported on the FR Y-14A Mortgage Repurchase worksheet of the Summary schedule.

77. How did the Federal Reserve project credit losses for each BHC?

Each BHC’s credit losses on PLS and whole loans had two components. First, historical loss rates by vintage and BHC were applied to the unpaid principal balance (UPB) of the run-off portfolio reported to estimate realized losses. Second, future credit losses were projected by applying the loss rates by vintage and BHC to outstanding UPB reported by the BHCs.

For GSE loans, the industry average loss rates were first adjusted by the delinquency data reported by the BHCs and then the adjusted loss rates were applied to the outstanding balance reported to project credit losses for each BHC.

78. What putback rate assumptions did the Federal Reserve use?

The putback rates applied to PLS and whole loans were based on industry settlement activity and varied by vintage and the relative contractual strength of the representations and warranties made by the BHCs.

For GSE loans, the putback rates were based on historical data. The putback rates for post-2008 vintages were adjusted downward to account for better origination controls on more recent vintages and for the expected decline in the rate at which defaulted loans would be successfully put back as the loans season.

79. Were any adjustments made to modeled loss rates?

For GSE loans, projected industry average loss rates were scaled by the 90+ days past due delinquency rates reported by the BHC in third quarter 2011 to account for differences in performance across BHCs.

The supervisory estimates include a majority but not all of projected lifetime putback losses. It was assumed that some projected losses would occur outside the projection horizon.

80. Please elaborate on what was meant by 'adjustments for supervisory assessments of BHC-specific risk' in the methodology white paper.

Through the supervisory process, the Federal Reserve had previously collected information about the representations and warranties associated with the loans sold by a subset of the CCAR BHCs. This information was used to make assessments about the overall strength of the representations and warranties and to derive putback rate assumptions that correspond to these assessments.

81. Please discuss how government guaranteed loans, such as FHA/GNMA loans, were analyzed for the mortgage putback analysis?

FHA/GNMA loans were treated similarly to Fannie Mae and Freddie Mac loans. This conservative assumption reflects that, under the supervisory stress scenario, putback behavior on these loans could be similar to what has been experienced on Fannie Mae and Freddie Mac loans. Recently, there has been increased scrutiny on FHA loan defects, as evidenced by the publication of an updated FHA rule that states that the Department of Housing and Urban Development shall be indemnified from an insurance claim on FHA-insured loans "if the mortgagee 'knew or should have known' that fraud or misrepresentation was involved."⁷

⁷ FHA Single Family Lender Insurance Process: Eligibility, Indemnification, and Termination (www.gpo.gov/fdsys/pkg/FR-2012-01-25/pdf/2012-1508.pdf)

82. Was there any consideration given to a company's willingness to litigate rather than accept the proposed level of losses?

Losses may occur due to contractual repurchases, settlements, or adverse litigation outcomes. The Federal Reserve's analysis estimated total losses in a stress scenario and, for the purposes of this exercise, losses did not depend on the exact manner in which the losses would be passed to the BHC.

83. How long did the Federal Reserve assume repurchase demands would persist from a particular vintage?

The Federal Reserve assumed that repurchase rates on defaulted loans for each vintage would not materially slow from observed historical rates under the supervisory stress scenario, with the exception of the adjustment to the post-2008 vintages discussed above. The assumption was partly supported by the recent FHFA report on Freddie Mac's repurchase review process that notes an increasing pressure for GSEs to review older loans that default.⁸

84. Did the Federal Reserve model the rate of expected correspondent buybacks?

The Federal Reserve loss estimation methodology did not distinguish between originated loans and purchased loans. However, to avoid potential double-counting of putback exposure related to whole loans sold to another CCAR BHC for inclusion in a PLS deal, the Federal Reserve adjusted PLS putback losses for all firms by an estimate of the amount of this overlap.

85. How were existing reserves for putback losses taken into account in the Federal Reserve's estimates?

For each BHC, the Federal Reserve subtracted from its estimate of putback losses any expenses for putback losses that the BHC had incorporated into its CCAR financial statements under the supervisory stress scenario. The netted expenses included: repurchase reserve as of third quarter 2011, provisions to the repurchase reserve over the nine projection quarters, litigation reserves as of third quarter 2011 that the BHC identified as being held specifically for putback issues, and provisions to the litigation reserve over the nine-quarter planning period that the BHC identified as being made specifically for putback issues.

⁸ www.fhfaig.gov/Content/Files/EVL-2011-006.pdf

J. Operational Risk

86. *What methodologies were used to project the frequency of operational risk losses conditional on the macroeconomic drivers? What was the magnitude of effect between each category of event and each driver?*

A panel regression was used to link the frequency of losses per event type to the risk drivers (both macroeconomic and firm specific). A number of firm-specific factors were also linked to macroeconomic factors through regression analysis providing a second, indirect, relationship between operational risk losses and the business cycle. Some of the firm-specific variables were used as proxies for the riskiness of the institutions, consistent with other available research on operational risk.

87. *How sensitive was event frequency to the macro variables?*

The effect of the macroeconomic environment on operational risk losses was captured statistically through panel regressions linking loss frequency and various firm specific and macroeconomic factors. Sensitivity to macroeconomic variables varied across operational loss categories, with the sensitivity being more pronounced for certain event types such as Clients, Products and Business Practices (CPBP) and Fraud and not being present for event types such as damage to physical assets.

88. *What operational risk indicators were used to estimate the frequency?*

Both firm specific (such as log of assets, stock beta, book-to-market ratios) and macroeconomic (such as capacity utilization as a proxy for GDP, unemployment) were used to project the frequency of operational loss events. In some instances, the impact of macroeconomic events was modeled indirectly through the firm-specific variables (using regression analysis).

89. *How was the expected severity estimate formulated?*

Loss severity was calculated as sample averages by event type for each BHC during a stressed period and was not conditional on macroeconomic variables included in the supervisory stress scenario.

90. *How did the Federal Reserve count the number of loss events (i.e., how was a loss defined and was the definition applied consistently across banks providing data to the Federal Reserve)?*

A consistent definition of loss was used across firms (aggregation of transactions at the event level was done when necessary). The timing of the losses was also consistently applied.

91. *Will the Federal Reserve make the operational risk database available to the BHCs?*

The Federal Reserve currently has no plan to make the operational risk database available to the BHCs.

92. What was the rationale for allocating projected aggregate operational losses using Tier 1 common capital?

Projected aggregate operational losses were allocated to each BHC using the ratio of the BHC's Tier 1 common capital to aggregate Tier 1 common capital (summed across 19 BHCs). The Federal Reserve views the relative size of Tier 1 common capital to be a reasonable proxy for the relative difference in BHC's inherent operational risk, and used it to apportion losses to each BHC given considerable variance observed in the length and breadth of data reported by the BHCs.

93. Did the Federal Reserve take into account any existing reserves, insurance coverage or other potential loss mitigation in the calculation of aggregate operational risk events?

Existing reserves for operational losses were assumed to remain constant over the projection horizon.