

MODELING METHODOLOGY

Estimating Commercial Real Estate (CRE) Stressed Loss Measures Under Federal Reserve 2016 Comprehensive Capital Analysis and Review (CCAR) Scenarios

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Abstract

The Comprehensive Capital Analysis and Review (CCAR) program is an annual capital adequacy exercise conducted under the requirements of the Dodd-Frank Wall Street Reform and Consumer Protection Act rules. For the 2016 CCAR program, the Federal Reserve published three macroeconomic and financial scenarios to be used in the stress testing of 33 CCAR financial institutions. In this study, we analyze 26 of these financial institutions, with a total of more than \$695 billion in exposure to commercial real estate loans, using Moody's CMM Stress Testing framework.

This report describes how we derive credit loss estimates for the CRE loan portfolios held by CCAR firms. Our analysis estimates that the expected nine-quarter, cumulative CRE portfolio loss through the first quarter of 2018 is 5.1% under the CCAR 2016 Severely Adverse Scenario. The primary factor behind the lower loss estimate compared to last year's stressed scenario is that CRE market conditions continued to improve during the past five quarters. From Q3 2014–Q4 2015, the commercial real estate price index increased by 11.6%, which substantially lowered average LTV and improved DSCR for the typical CRE loan portfolio.

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1. Introduction

1.1 Context

The Comprehensive Capital Analysis and Review (CCAR) is an annual exercise conducted under the Dodd-Frank Wall Street Reform and Consumer Protection Act rules. CCAR's goal is to ensure that the largest financial institutions have: a) robust and forward-looking capital planning processes that account for their unique risks, and b) adequate capital to continue operations during times of economic and financial stress. As part of CCAR, the Federal Reserve evaluates institutions' capital adequacy, internal capital adequacy assessment processes, and capital distribution plans, such as dividend payments or stock repurchases. On the other hand, the Dodd-Frank Act Stress Test (DFAST) is a distinct regulatory tool that differs from CCAR. DFAST requires the Federal Reserve to conduct forward-looking stress tests for financial companies regulated by the Fed to help ensure institutions have sufficient capital in order to absorb losses and support operations during adverse economic conditions. Currently, while only 33 firms participate in CCAR, the DFAST requirements apply to a broader range of companies, including bank holding companies, savings and loan companies, state member banks with total assets greater than the \$10 billion, and non-bank financial firms designated by the Financial Stability Oversight Council for supervision by the Federal Reserve.

Although CCAR and DFAST are distinct exercises, the Federal Reserve deems capital planning and stress tests complementary in nature, as they frequently rely upon similar processes, data, supervisory exercises, and requirements. The Fed coordinates these processes in order to reduce duplicative requirements and to minimize burdens. As such, the Fed uses the same CCAR scenarios and assumptions the bank holding companies (BHC) are required to use under the DFAST rules, in order to project revenues, losses, net income, and *pro forma* capital ratios.¹ Consequently, in the discussions of scenario-based credit loss estimates throughout this paper, there is practically no difference between whether or not they are CCAR scenarios or stressed scenarios under the DFAST rules, because they are the same within the regulatory setting.

For the 2016 CCAR program, the Federal Reserve published three macroeconomic and financial scenarios to be used in stress testing the 33 CCAR financial institutions.² The three scenarios include Baseline, Adverse, and Severely Adverse Scenarios. While acknowledging that the Baseline Scenario represents the expectation of private sector forecasters,³ the Fed has also made it clear that the Adverse and Severely Adverse Scenarios are not forecasts, but rather hypothetical scenarios designed to assess the strength and resilience of CCAR firms during stressful economic and financial environments.⁴ For each scenario, a BHC must conduct an assessment of the expected uses and sources of capital over the planning horizon.

An important part of a BHC's submission is the estimates of projected losses by asset classes in each of scenarios; the main objective of this study focuses on credit loss estimates for commercial real estate (CRE) loans.

Key Fed guidelines relevant for our exercise, either current or previously published:

- » Loans held in accrual portfolios: "The losses to be estimated for loans held in accrual portfolios in this exercise are generally credit losses due to failure to pay obligations (cash flow losses) ..."
- » Loan-loss estimates: "BHCs should describe the underlying models and methods used to project loan losses, and provide background on the derivation of estimated losses... Hypothetical behavioral responses by BHC management should not be considered as mitigating factors for the purposes of this analysis."

¹ See "2016 Supervisory Scenarios for Annual Stress Tests Required under the Dodd-Frank Act Stress Testing Rules and the Capital Plan Rule," published by the Federal Reserve January 28, 2016.

² The 33 bank holding companies participating in the 2016 CCAR: Ally Financial Inc.; American Express Company; BancWest Corporation; Bank of America Corporation; The Bank of New York Mellon Corporation; BB&T Corporation; BBVA Compass Bancshares, Inc.; BMO Financial Corp.; Capital One Financial Corporation; Citigroup Inc.; Citizens Financial Group, Inc.; Comerica Incorporated; Deutsche Bank Trust Corporation; Discover Financial Services; Fifth Third Bancorp; The Goldman Sachs Group, Inc.; HSBC North America Holdings Incorporated; Huntington Bancshares Incorporated; JPMorgan Chase & Co.; Keycorp; M&T Bank Corporation; Morgan Stanley; MUFG Americas Holdings Corporation; Northern Trust Corporation; The PNC Financial Services Group, Inc.; Regions Financial Corporation; Santander Holdings USA, Inc.; State Street Corporation; SunTrust Banks, Inc.; TD Group US Holdings LLC; U.S. Bancorp; Wells Fargo & Company; and Zions Bancorporation.

³ For the CCAR 2016 Baseline Scenario, the Fed comments that "... The baseline scenario follows a similar profile to the average projections from a survey of economic forecasters... The baseline outlook for U.S. real activity, inflation, and interest rates is similar to the January 2016 consensus projections from Blue Chip Economic Indicators. This scenario does not represent the forecast of the Federal Reserve."

⁴ See various press releases by the Federal Reserve, for example, January 28, 2016: <https://www.federalreserve.gov/newsevents/press/bcreg/20160128a.htm>. Note, the Fed developed scenarios in consultation with the Federal Deposit Insurance Corporation (FDIC) and the Office of the Comptroller of the Currency (OCC), and both will use the same scenarios as the Fed during the upcoming stress testing cycle for their supervised institutions.

- » Allowance for loan losses: "BHCs should estimate the portion of the current allowance for loan losses available to absorb credit losses on the loan portfolio for each quarter under each scenario, while maintaining an adequate allowance along the scenario path and at the end of the scenario horizon."
- » Declines in real estate prices: "Declines in aggregate U.S. commercial and residential real estate prices should be assumed to be concentrated in regions that have experienced rapid price gains over the past several years."
- » Credit losses on CRE loans: "Domestically, credit losses on commercial real estate loans backing commercial mortgage-backed securities are greater than would be expected, given the general economic and financial stress in the scenario, prompting widespread investor pull-back."

This paper describes how Moody's Analytics' analysis derives credit loss estimates for the CRE loan portfolios held by CCAR firms. Throughout the study, we rely heavily upon Moody's Commercial Mortgage Metrics (CMM), a credit risk measurement model developed and marketed by Moody's Analytics.

1.2 Composition of CRE Portfolios Held by CCAR Banks

Our current analysis focuses on 26 of 33 major CCAR banks: those with more than \$4 billion in CRE loans on their balance sheets.

Table 1 CRE HOLDINGS OF THE 26 CCAR BANKS AS OF DECEMBER 31, 2015 (\$,000)

Financial Institution	Construction Loans	Non-farm, Non-residential Loans	Multifamily Residential Loans	Total Commercial Real Estate Loans
Bank of America, National Assn.	9,568,000	56,975,000	6,535,000	73,078,000
Bank of the West	1,630,926	10,858,321	1,193,315	13,682,562
BMO Harris Bank National Assn.	1,665,178	6,174,194	645,749	8,485,121
Branch Banking and Trust Company	5,621,076	26,295,609	3,354,539	35,271,224
Capital One, National Assn.	2,425,419	16,186,241	9,608,673	28,220,333
Citibank, National Assn.	2,388,000	6,744,000	2,881,000	12,013,000
Citizens Bank, National Assn.	1,297,704	7,161,603	558,178	9,017,485
Comerica Bank	2,348,180	7,596,560	868,565	10,813,305
Compass Bank	2,353,983	8,649,985	1,803,553	12,807,521
Fifth Third Bank	3,666,825	6,352,442	337,490	10,356,757
HSBC Bank USA, National Assn.	1,331,504	7,552,722	2,967,814	11,852,040
JPMorgan Chase Bank, National Assn.	6,137,000	29,298,000	58,834,000	94,269,000
KeyBank National Assn.	1,056,600	6,033,209	2,319,236	9,409,045
M&T Bank	5,322,210	19,584,935	4,148,990	29,056,135
Morgan Stanley Bank, National Assn	84,000	8,810,000	17,000	8,911,000
MUFG Union Bank, National Assn.	2,296,991	10,148,222	4,100,068	16,545,281
PNC Bank, National Assn.	7,884,047	23,187,513	4,353,852	35,425,412
Regions Bank	3,621,599	10,502,258	1,053,248	15,177,105
Santander Bank	1,665,037	7,000,822	9,411,560	18,077,419
SunTrust Bank	3,066,062	12,841,055	998,140	16,905,257
TD Bank, National Assn.	2,399,598	19,014,745	2,442,793	23,857,136
The Huntington National Bank	1,150,708	5,928,831	595,957	7,675,496
The Northern Trust Company	515,971	3,089,510	770,079	4,375,560
U.S. Bank National Association	10,332,380	23,964,161	4,212,064	38,508,605
Wells Fargo Bank, National Assn.	21,575,000	96,486,000	16,032,000	134,093,000
Zions First National Bank	2,494,810	13,241,225	1,808,946	17,544,981
26 CCAR Banks Total	103,898,808	449,677,163	141,851,809	695,427,780

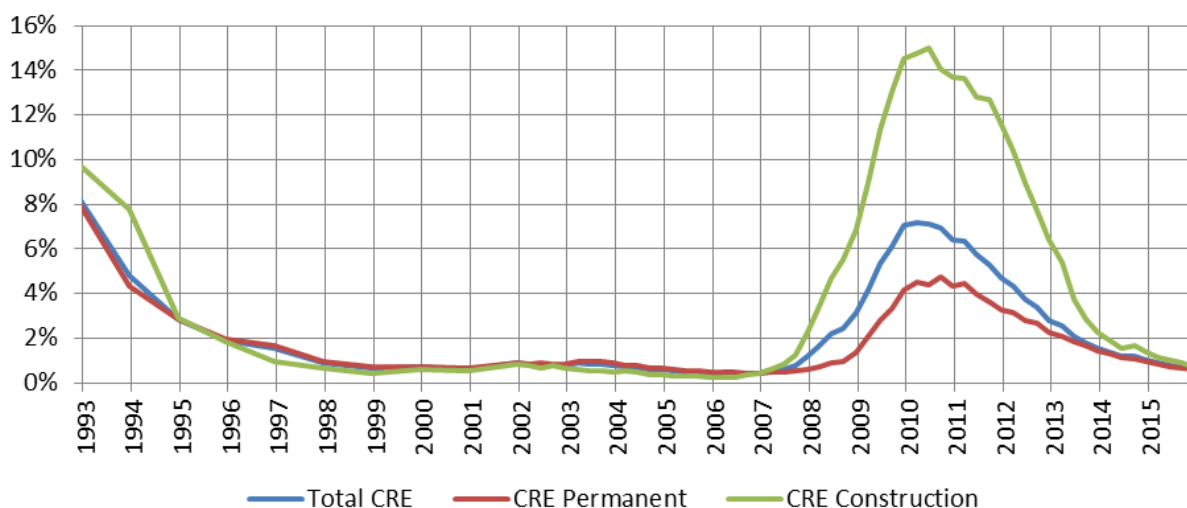
Banks hold two types of commercial real estate loans: permanent and construction. Permanent loans are loans backed by existing commercial properties, such as apartments, office buildings, retail stores, hotels, etc., while construction loans are loans for commercial properties under construction. Banks must report their CRE holdings to regulators, including the FDIC and the Federal Reserve. Reported data are publicly available.⁵ For reporting purposes, permanent loans are reported in two parts; Non-farm, Non-residential, and Multi-family Residential. Table 1 summarizes the CRE holdings of the 26 CCAR banks as of December 31, 2015 from data obtained from the FDIC.

Compared to the CRE holdings of the 22 CCAR banks in 2014, total CRE portfolio size increased by 24.6%. As of 4Q2015, the construction sector continued its increasing trend, which began in 2013, rising by 28.8% to \$103.9 billion. The 26 CCAR banks also added \$34.5 billion of multifamily residential loans, which suggests a significant increase in demand for these loans. The rising composition of construction loans reflects banks' willingness to take on more risk and participate in the broader economic recovery, after pulling back construction lending programs since the housing/financial crisis.

1.3 CRE Loan Performance Status

Corresponding to the economic recovery underway, commercial real estate markets have improved during the last couple of years. As a result, the credit performance of banks' CRE portfolios has improved across both construction and permanent loans, as shown in Figure 1. The total nonaccrual rate of all CRE loans is 0.6%, as of fourth quarter of 2015, about half of the 1.2% nonaccrual rate last year and about 8.3% of the 7.2% nonaccrual rate reached at the end of 2009.

Figure 1 Non-accrual rates of total CRE holdings of the 26 CCAR Banks.



CRE loan portfolio improvement is visible for individual CCAR banks as well over the past three years, as seen in Figure 2. This change stems from the fact that CRE markets have improved for most parts of the country, and financial institutions have also been more stringent with new CRE loan originations when compared to the pre-financial crisis era. Also, new originations during the last year or two have not yet reached the peak default seasoning curve. Additionally, with time, legacy bad loans from the last cycle have been worked out or liquidated, and older, lower quality loans are maturing or amortizing themselves.

⁵ FDIC data downloadable from <http://www2.fdic.gov/sdi/main.asp>, and the Fed's data downloadable from http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm.

Figure 2 Non-accrual rates of the total CRE holdings of the 26 CCAR Banks in recent quarters, using FDIC data.

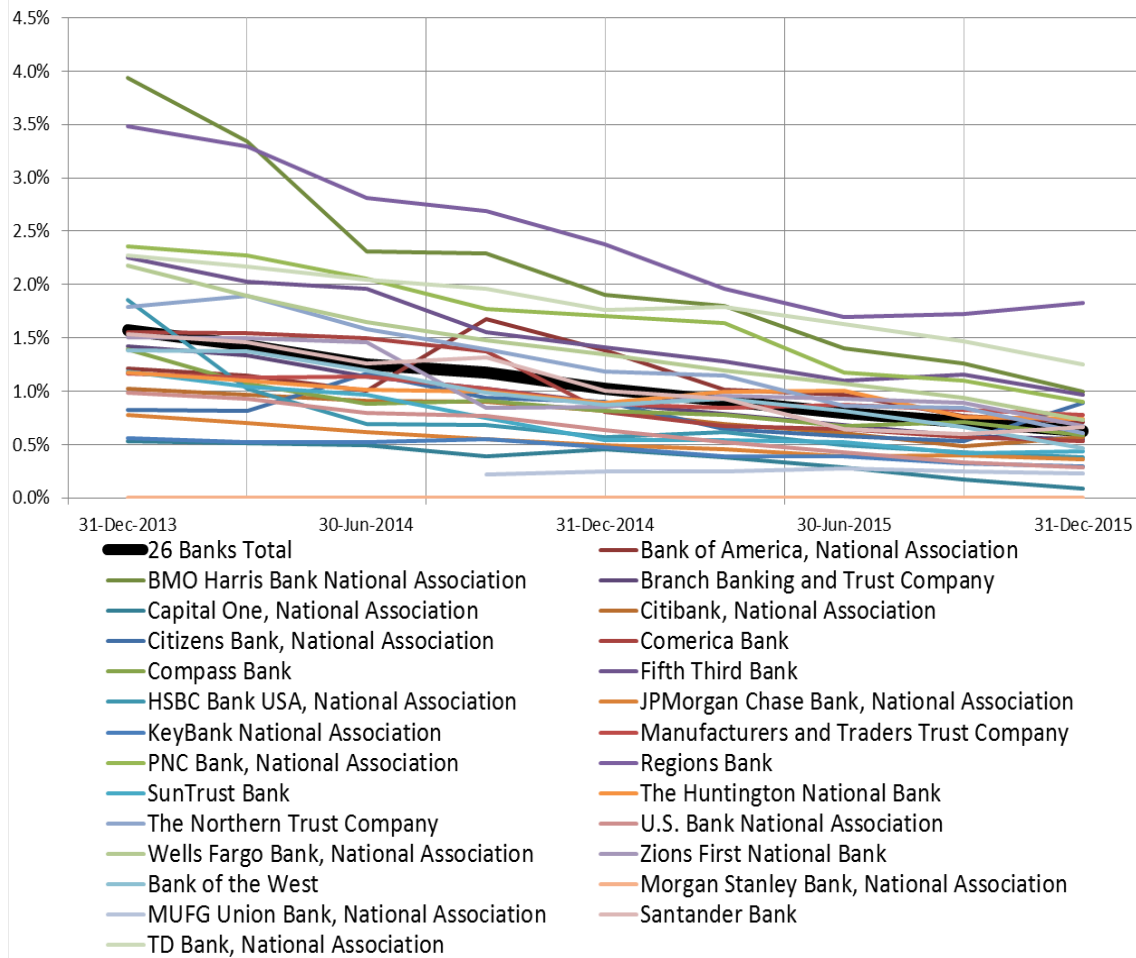
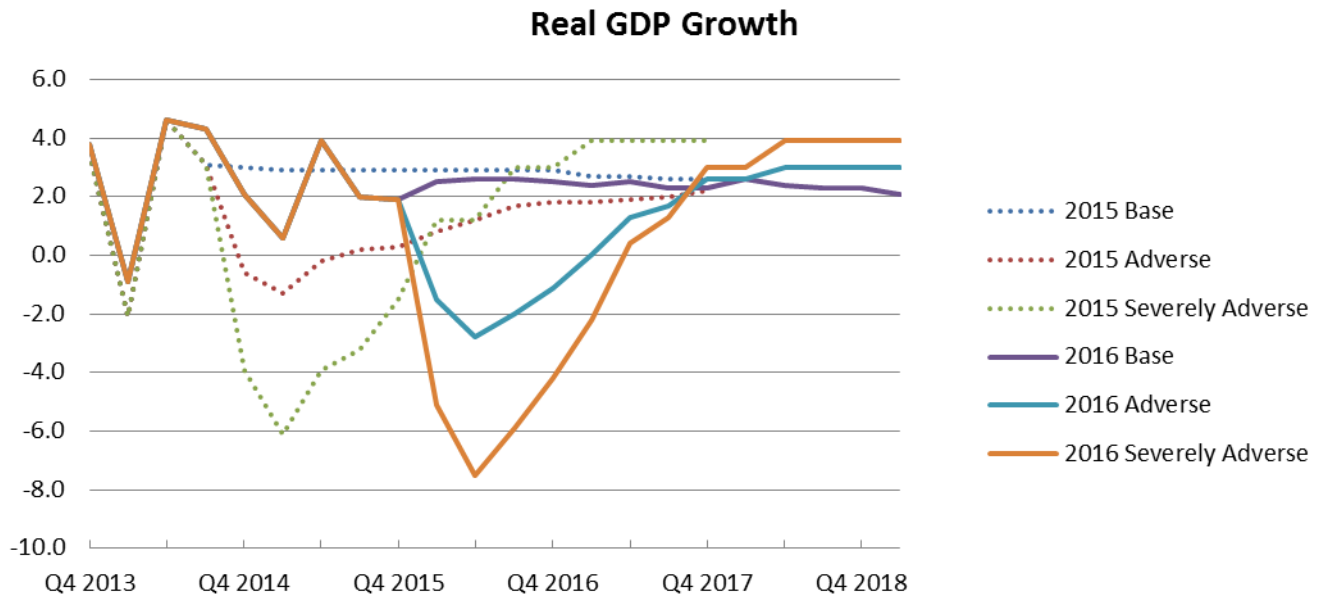


Figure 2 shows that, for all the major banks, CRE non-accrual rates continue to fall. The four quarter, average non-accrual rates are also lower at present, compared to what they were a year ago, for all the major banks. We observe similar patterns with charge-off rates as well.

1.4 CCAR 2016 Scenarios and the CCAR 2015 Scenarios

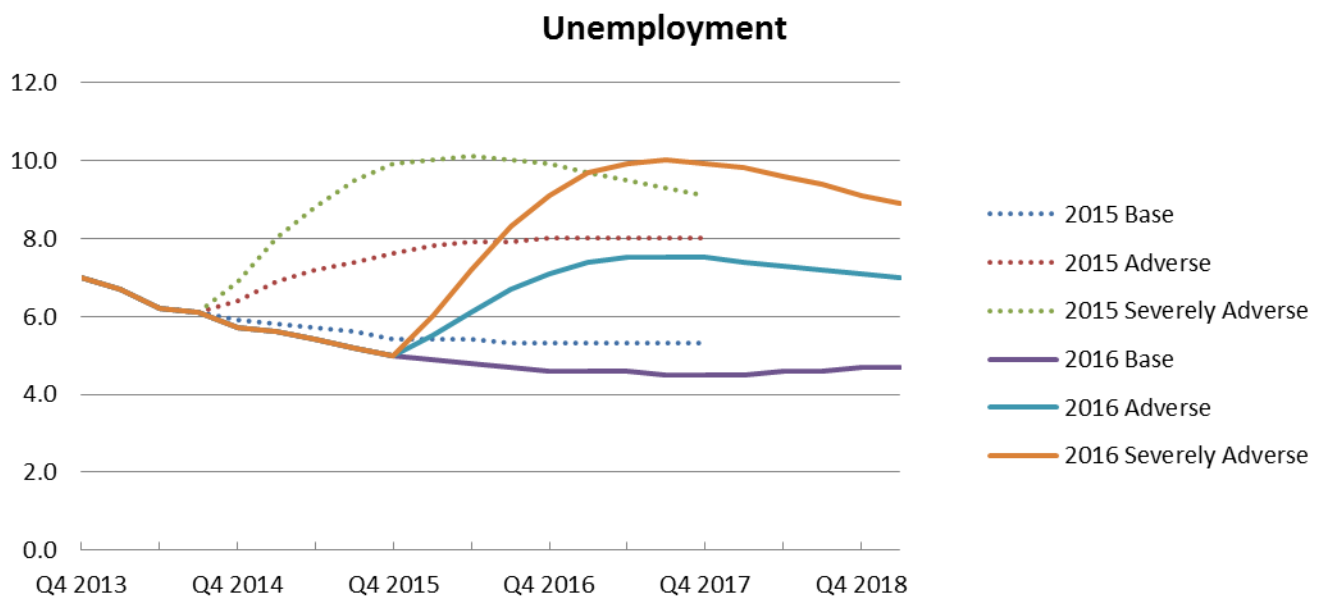
Similar to CCAR 2015, for the 2016 CCAR program, the Federal Reserve presents three macroeconomic scenarios: the Baseline Scenario, the Adverse Scenario, and the Severely Adverse Scenario. While the Baseline Scenario reflects the Federal Reserve's interpretation of market expectations, the other scenarios are constructed as hypothetical scenarios for stress testing purposes. The CCAR 2016 Severely Adverse Scenario is comparable to the CCAR 2015 Severely Adverse Scenario, in terms of the decline in Real GDP, increase in unemployment, etc., and other macroeconomic factors, as shown in the following graphs and in Appendix A.

Figure 3 Real GDP growth under the CCAR 2015 and CCAR 2016 Scenarios.



For the 2016 Baseline Scenario, real GDP grows at an average rate of 2.5% per year, slightly lower than last year's projection. Real GDP declines from the first quarter of 2016 to the recession trough in the first quarter of 2017 for the Moderate Recession Scenario. In the Severely Adverse Scenario, real GDP growth rate falls to -7.5% during the second quarter of 2016, and the real GDP level is approximately 6.3% below the pre-recession peak when reaching the trough during the first quarter of 2017.

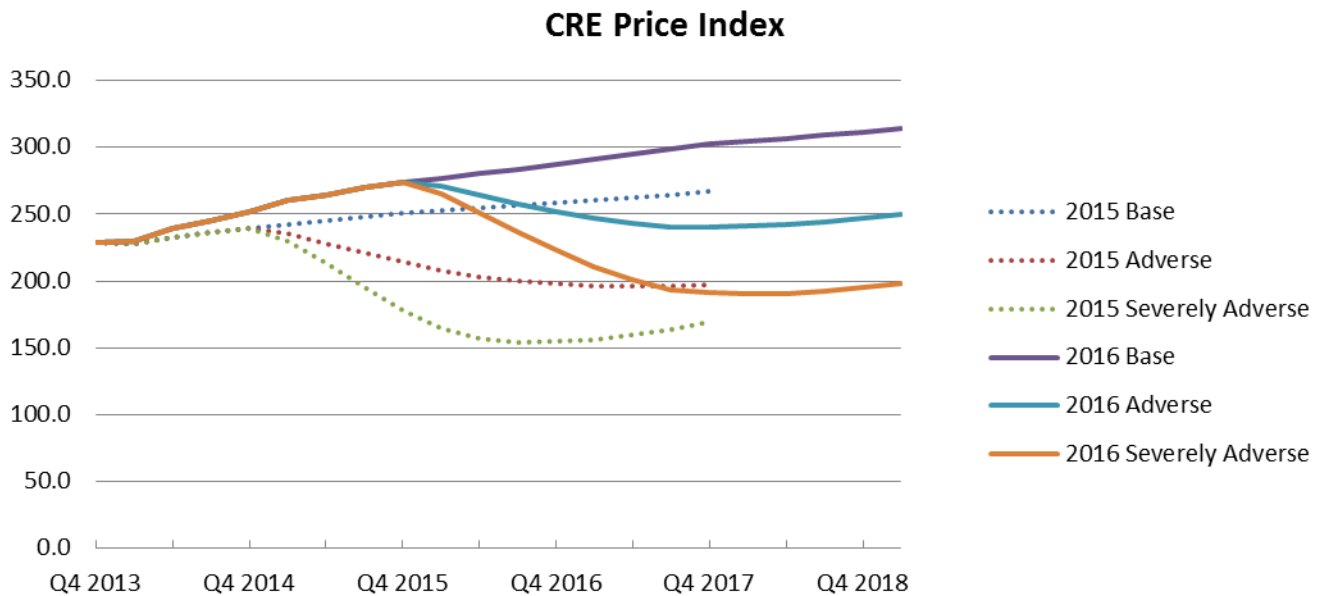
Figure 4 Unemployment rates under the CCAR 2015 and CCAR 2016 Scenarios.



Unemployment rate fell more than projected to five percent by the end of 2015. In the Baseline Scenario, unemployment rate declines to 4.5% in 2017 and remains at that level. The rise in unemployment rate in the Adverse Scenario this year is comparable to

that of last year. Unemployment rate in the 2016 Severely Adverse Scenario reaches the same peak of 10% as in the 2015 Severely Adverse Scenario, but it begins from a lower starting rate, which reflects a more severe economic downturn.

Figure 5 CRE Price Index under the CCAR 2015 and CCAR 2016 Scenarios.



The commercial real estate price Index continued to outperform the market forecast in CCAR 2015's Baseline Scenario. From Q3 2014–Q4 2015, the Fed's CRE price index has increased by 11.6%.⁶ CRE price continues rising, with an annual average rate of 4.3% in the Baseline Scenario, and it falls approximately by 12% and 30%, respectively, in the Adverse and Severely Adverse Scenarios. The magnitudes of CRE price decline in this year's stress scenarios are similar to those of last year, despite beginning from a more elevated level.

As shown in the previous figures, the economy improved during the past year. The CCAR 2016 Baseline Scenario's forecasts suggest that the economy is expected to keep improving. Overall, the increase in unemployment rate and declines in real GDP growth and CRE price index under the Severely Adverse Scenario this year are comparable to last year.

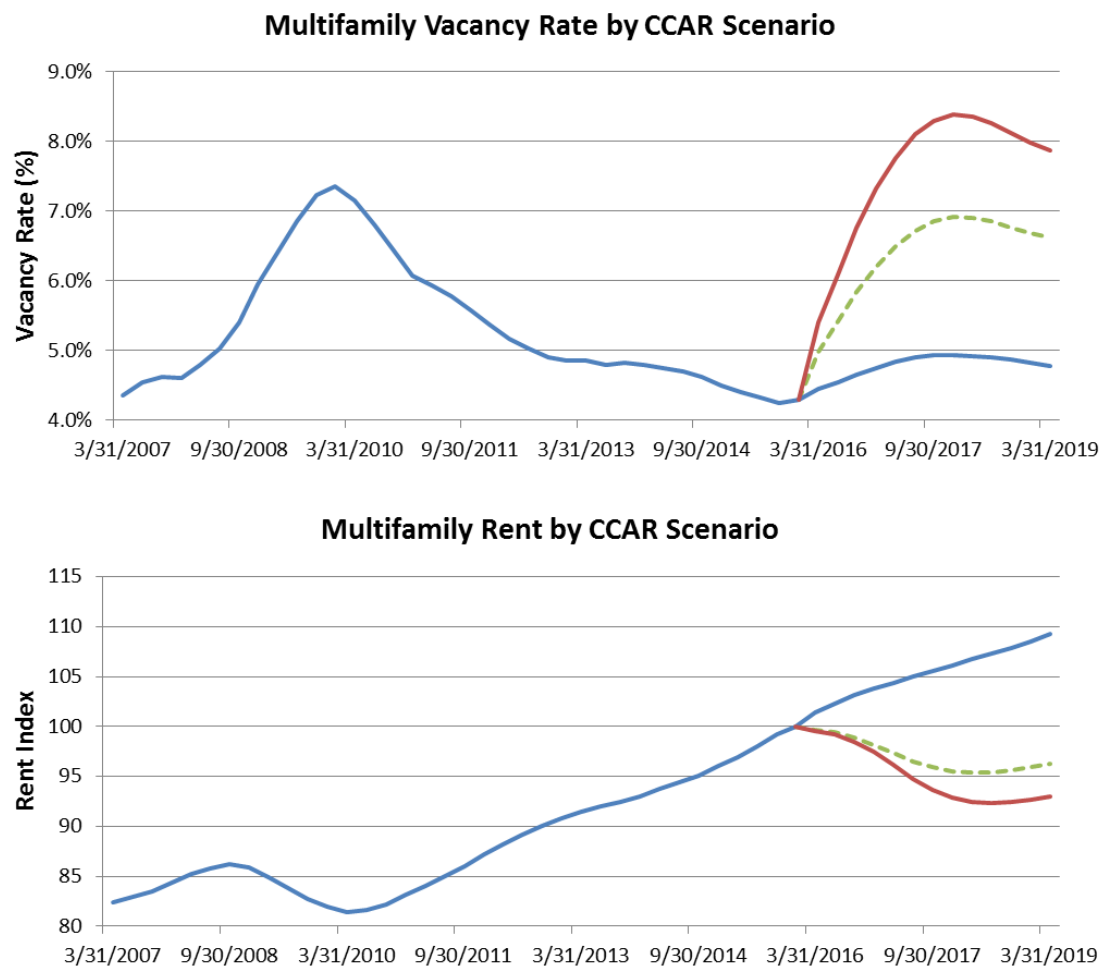
⁶ Moody's/RCA Commercial Property Price Index indicates even greater price appreciation of 16.8% for the same period.

2. Translating CCAR Scenarios into Specific CRE Scenarios

The Fed's CCAR guideline only describes the macroeconomic and financial variables in the scenarios. As described in our earlier papers,⁷ Moody's Analytics has developed a proprietary methodology for translating the macroeconomic scenarios into market factors specific to the CRE industry: vacancy rates, rental growth rates, NOI growth rates, and cap rates. The following graphs present the forecasted national average vacancy rates, rental growth rates, and NOI growth rates for Multifamily and Office properties for the three 2016 CCAR scenarios.

The following graphs indicate that the stress to the CRE industry resulting from the Fed's Severely Adverse Scenario is comparable to the stress seen during 2008–2009's Great Recession. Multifamily and Office vacancy rates are projected to increase by a similar magnitude over the Severely Adverse Scenario as they did during the recent Great Recession. Similarly, the decrease in rent and NOI estimated for the Multifamily and Office properties over the Severely Adverse Scenario compares to the decrease in the respective rent and NOI observed during the Great Recession. It is also worth noting that CRE market conditions improved in almost every aspect from Q3 2014–Q4 2015. In addition to the rapid CRE price gains discussed earlier, the vacancy rate continued declining toward levels seen before the Great Recession. Net operating income grew by 4.8% for Multifamily and by 8.8% for Office through the past five quarters, which improved the Debt Service Coverage Ratio (DSCR) for typical CRE portfolios.

Figure 6 Multifamily property vacancy rates, rent, and NOI index by CCAR Scenario.



⁷ See Chen and Cai (2011), Chen, Cai, and Zhang (2011) and Chen, Cai, and Watugala (2013).

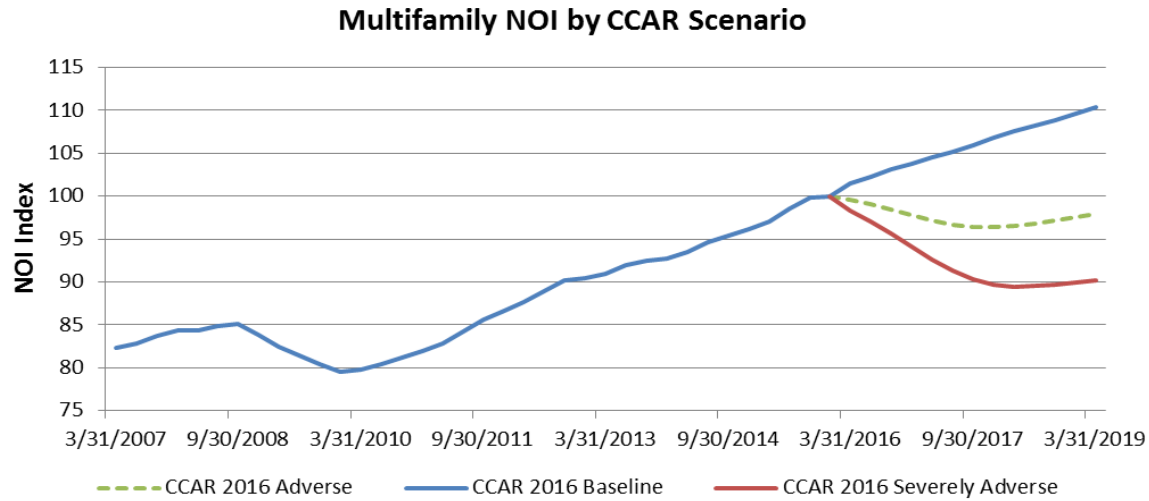
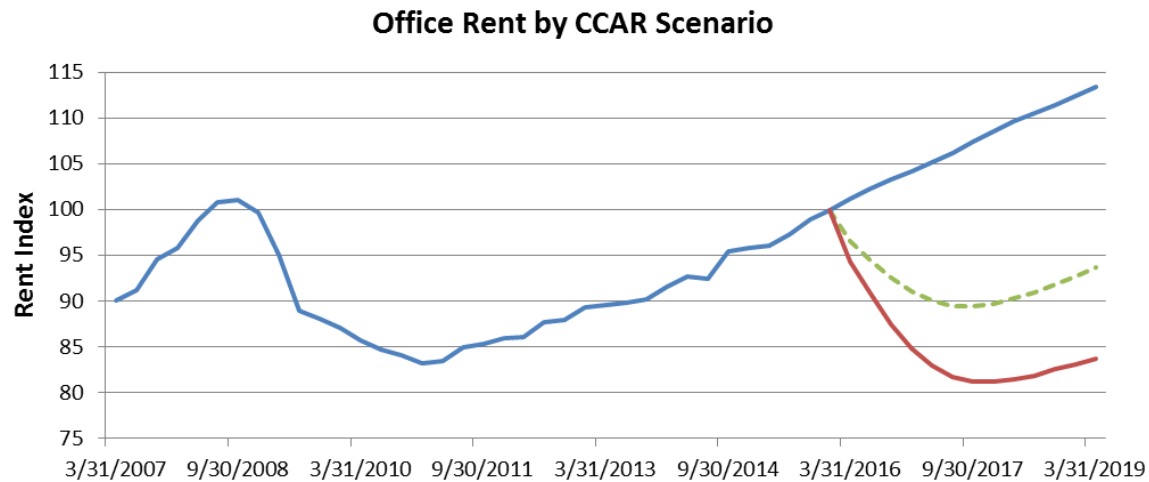
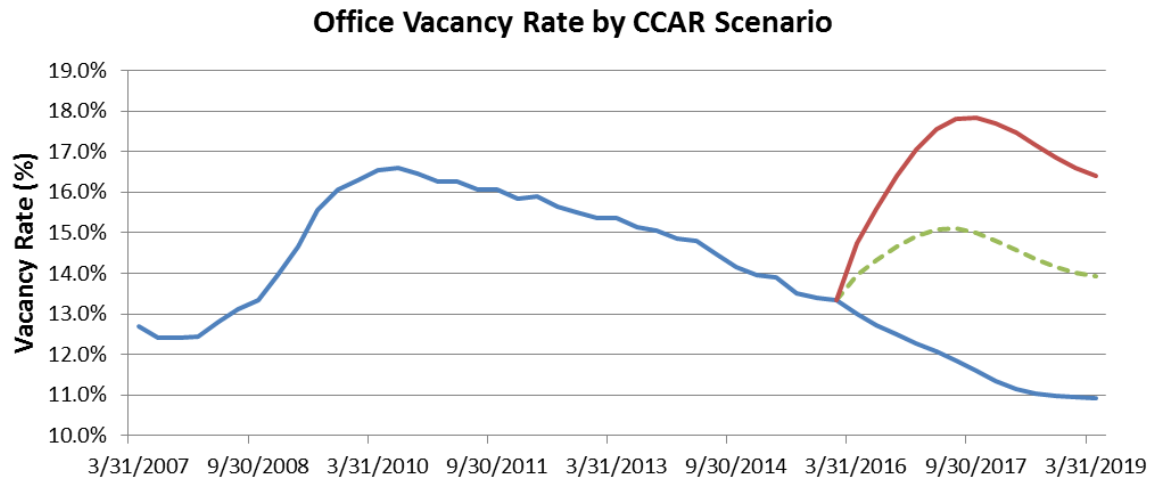
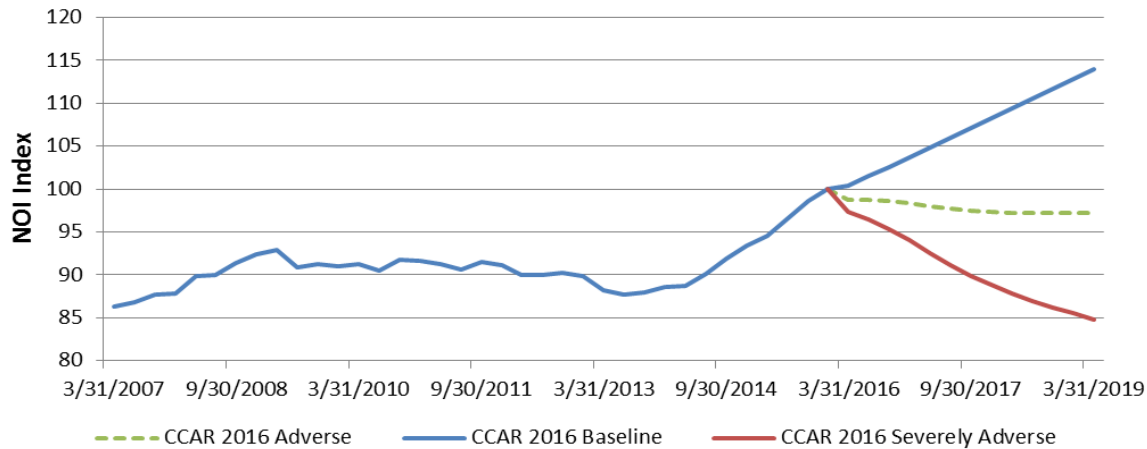


Figure 7 Office property vacancy rates, rent, and NOI index by CCAR Scenario.

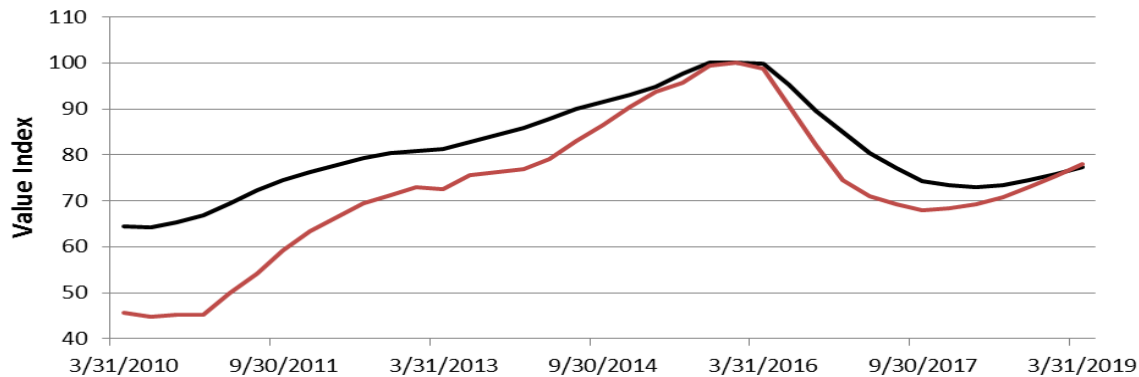


Office NOI by CCAR Scenario

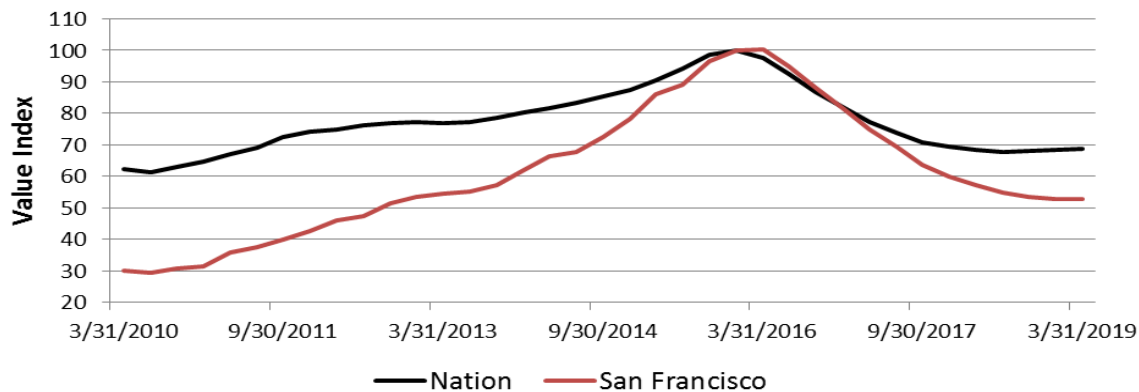


While following the general trend lines prescribed in the Fed's scenarios, our CRE price forecasts are also in-line with CCAR 2016 instructions of "Declines in aggregate U.S. commercial and residential real estate prices should be assumed to be concentrated in regions that have experienced rapid price gains over the past several years" We examine markets with significantly above average growth in CRE prices during the past few years and ensure they experience above average shocks during the CCAR Severely Adverse Scenario. The following charts depict examples of multifamily and office market projections under the CCAR 2016 Severely Adverse Scenario. Driven by very strong growth in the high-tech sector, San Francisco has seen much faster price appreciation than the national average since the recent financial crisis. Under the Severely Adverse Scenario, we project San Francisco will experience a rapid decline, where price decreases are more severe than the national average.

Multifamily Value Forecast for Severely Adverse Scenario



Office Value Value Forecast for Severely Adverse Scenario



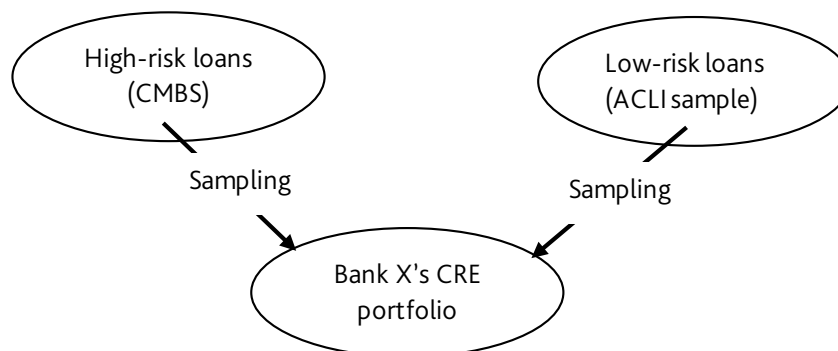
3. Major Banks Total Expected Loss in CRE Assets for CCAR 2016

3.1 Reconstructing a Bank's CRE Loan Portfolio

Aggregate statistics related to banks' loan portfolios, such as non-accrual rates, charge-off rates, 30-day delinquent rates, 90-day delinquent rates, etc., are available by asset class, including CRE. However, we have limited loan level details on an individual bank's holdings.⁸ Thus, we construct hypothetical portfolios for each bank, such that, each of the portfolios matches with the reported credit performance measures of the bank. It should be noted, we perform this process in such a way as to align the reported average measures of the banks with the average measures of the constructed portfolio. In constructing a loan portfolio that can be used for stress testing on CMM, we require loan-specific details such as geography, property type, and other financial information such as LTV, DSCR, coupon rate, etc. To this end, we simulate banks' CRE loans by referencing loans in the CMBS universe and the insurance sector.

In the commercial mortgage industry, three major sectors compete for CRE loan business: commercial banks, life insurance companies, and CMBS. At present, the risk profiles of the commercial banks' CRE loans fall in between that of life insurance companies and that of CMBS—life insurance companies are perceived to originate low-risk loans, and CMBS is the largest originator of high-risk loans,⁹ with commercial banks somewhere in the middle. Fortunately, loan-specific details are available in the CMBS universe, while average loan-specific details are available in the insurance space by originations,¹⁰ from which we can construct a portfolio representative of the insurance sector. Then, by appropriately sampling the detailed loans available in the CMBS and insurance spaces, we can simulate the CRE holdings of the major banks. As noted earlier, these portfolios will, by construction, match the reported average credit performance measures from which the sampling process was based upon.

Figure 8 Illustration of the sampling method used to construct Bank X's CRE portfolio.



The non-accrual rate of a particular bank is also a reflection of the quality of the holdings still performing. A bank currently demonstrating a high non-accrual rate would be expected to possess a lower quality portfolio, as it was the underlying portfolio that caused the loans now falling into the non-accrual state. As such, we use the average of the past four quarters reported non-accrual rates as a proxy measure for the quality of a bank's CRE holdings. This parameter is used to determine the ratio of which CMBS and ACLI portfolios' loans were sampled to construct the bank CRE portfolio of loans in performing status. The percentage of CMBS loans that account for an average bank's CRE portfolio is about 37%, based on the non-accrual rates as of December 31, 2015.

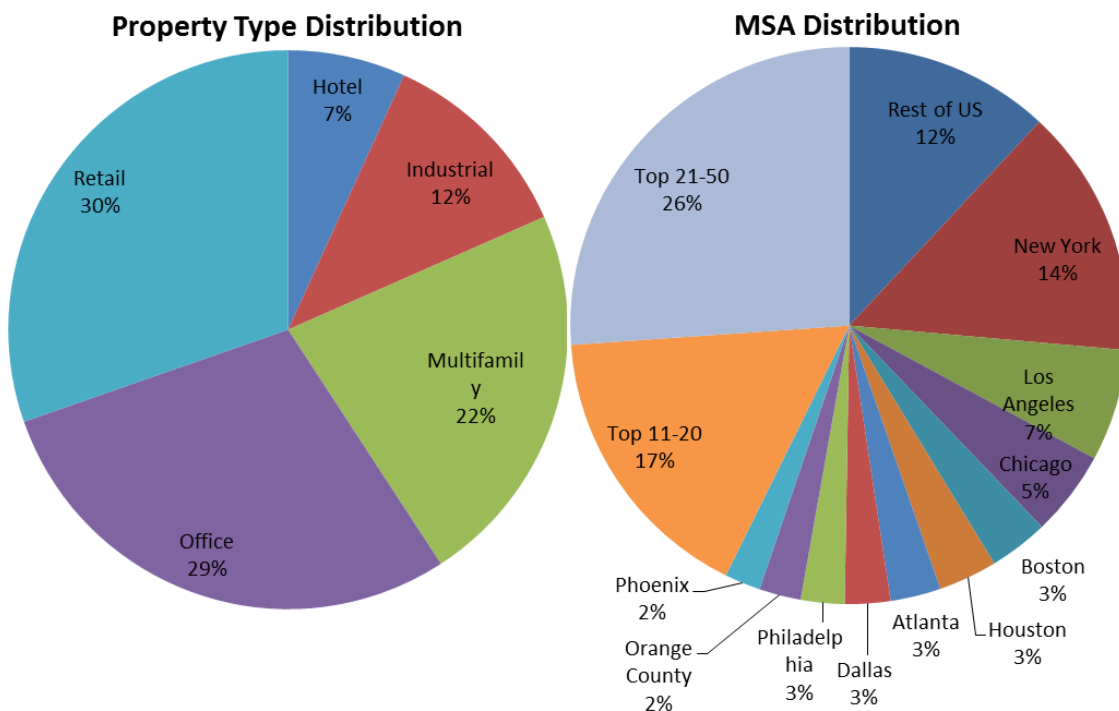
The simulated CRE portfolio, all banks included, is reasonably diversified across property type and geographic locations. Figure 9 shows summary statistics.

⁸ Moody's Analytics recently launched CRE Credit Research Database consortium. While there are a number of CCAR banks participating, we have not reached a conclusion regarding the robustness and accuracy of data contributions.

⁹ At least, historically speaking. The newer originations ("CMBS 2.0") reportedly have seen improved underwriting quality. We have yet to see enough actual credit performance data to confirm or reject this hypothesis.

¹⁰ Data published by American Council of Life Insurers (ACLI).

Figure 9 Property type and MSA distributions of an average CCAR bank's CRE portfolio.



3.2 Stress Testing the Constructed Bank Portfolios

Employing a similar process used in estimating the total expected loss for CMBS and the insurance space (explained in Appendix B), we estimate the total expected loss for the selected major banks for the various CCAR 2016 scenarios. Public filings of these banks also provide information on the share of construction loans in their CRE portfolio, including non-accruals in construction loans and permanent loans. We use such information to create bank-specific construction and permanent CRE portfolios, to be modeled accordingly. Using the constructed bank portfolios, the first step estimates the total expected loss attributable to the current CRE loans of the bank.¹¹ Table 2 summarizes the results for the average bank portfolio in the analysis.

Having estimated the total loss contributed by currently performing loans, the next step estimates the total loss resulting from loans in non-accrual status. Using the bank's latest published non-accrual rates data obtained from the FDIC, LGDs from the CMM Stress Testing runs, and appropriately assumed roll rates, we calculate the loss attributable to loans currently in non-accrual states.

The following figures show the quarterly expected loss for the average bank through three CCAR 2016 scenarios. Expected loss fluctuates with CRE market conditions. Specifically, the expected loss decreases as value of commercial real estate appreciates in the Baseline Scenario. When CRE price encounters significant downward pressure, expected loss of bank's CRE portfolio rises to 0.25% under the Adverse Scenario and to 0.87% under the Severely Adverse Scenario during the first quarter 2017. As property value gradually rises during the last several quarters of the stress scenarios, expected loss decreases accordingly.

¹¹ This is effectively the accrual portion of a bank's portfolio, as reported by the Federal Reserve and the FDIC.

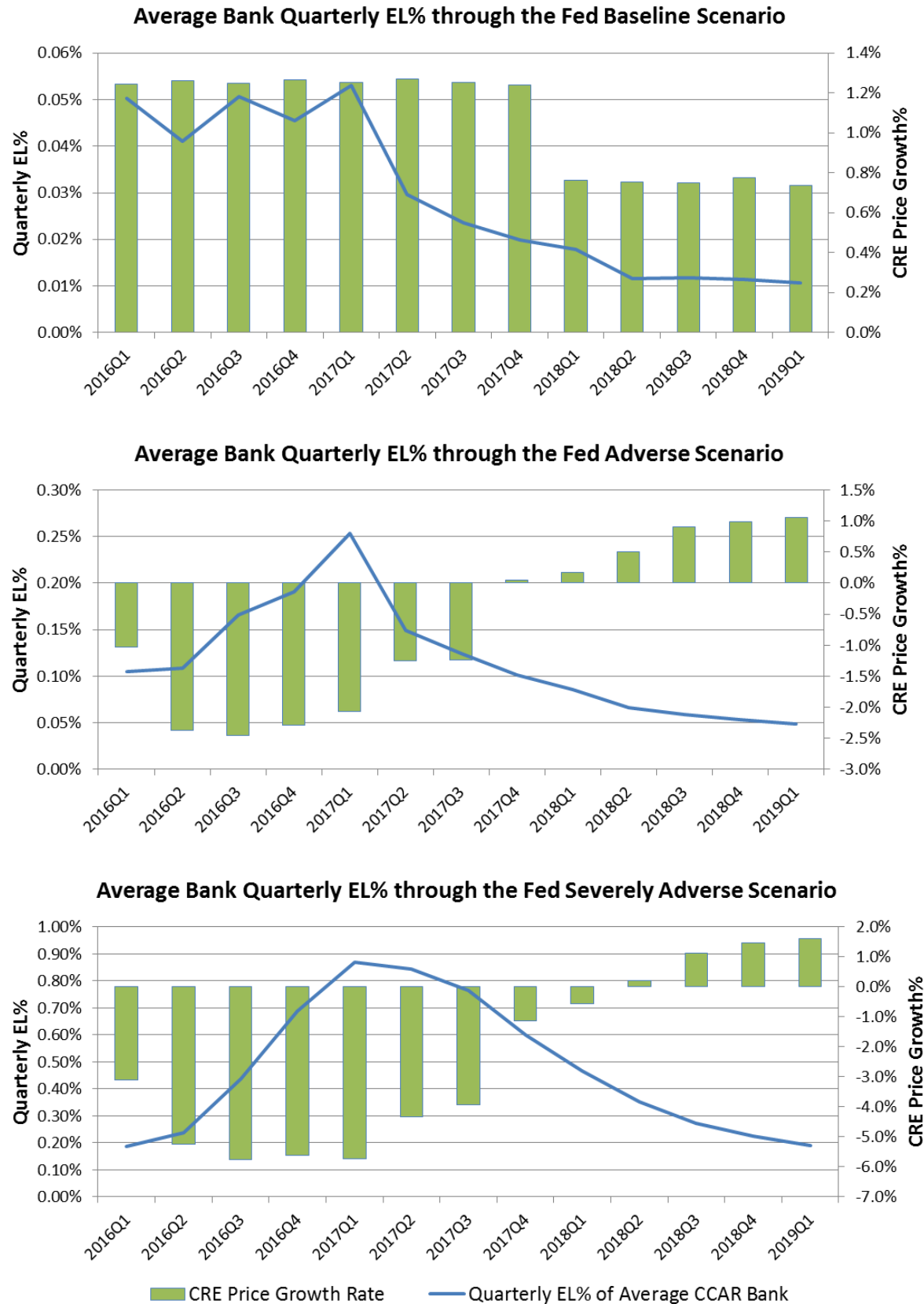


Table 2 presents the total expected loss for an average bank through the three CCAR 2016 scenarios.¹² For the 26 major banks selected for our CCAR 2016 stress testing analysis, the expected loss from their CRE portfolios after nine quarters under the Severely Adverse Scenario is 5.1%, while, after thirteen quarters, we expect the loss to increase to 6.1%. In the Baseline Scenario, the expected loss is 0.3% and 0.4% at the end of nine and thirteen quarters, respectively.

Table 2 TOTAL EXPECTED LOSS FROM AN AVERAGE CCAR BANK'S CRE PORTFOLIO FOR CCAR 2016 SCENARIOS

26 CCAR Banks	Portfolio Composition %	Fed Baseline		Fed Adverse		Fed Severely Adverse	
		Q9 ('18Q1)	Q13 ('19Q1)	Q9 ('18Q1)	Q13 ('19Q1)	Q9 ('18Q1)	Q13 ('19Q1)
Permanent Performing	84.45%	0.24%	0.28%	0.77%	0.92%	2.54%	3.10%
Construction Performing	14.93%	0.29%	0.34%	3.31%	3.97%	17.83%	21.65%
Permanent Non-accrual	0.52%	14.24%	14.24%	21.49%	21.49%	41.90%	41.90%
Construction Non-accrual	0.10%	14.24%	14.24%	26.18%	26.18%	64.68%	64.68%
CRE Total	100.00%	0.33%	0.38%	1.28%	1.51%	5.09%	6.13%

¹² CCAR guidelines require that institutions estimate the expected loss through the first quarter of 2018 (nine quarters (Q9) from 2015Q4) and make provisions for an additional year, through to the first quarter of 2019 (thirteen quarters (Q13) from 2015Q4). For CCAR stress testing purposes, as we are concerned with the results at Q9 and Q13, the tables and charts in this paper present those results.

4. Concluding Remarks

Table 3 summarizes the average expected loss, given the CCAR 2016 scenarios for the 26 CCAR banks selected for our analysis.

Table 3 26 BANKS' TOTAL EXPECTED LOSS BY CCAR 2016 SCENARIO

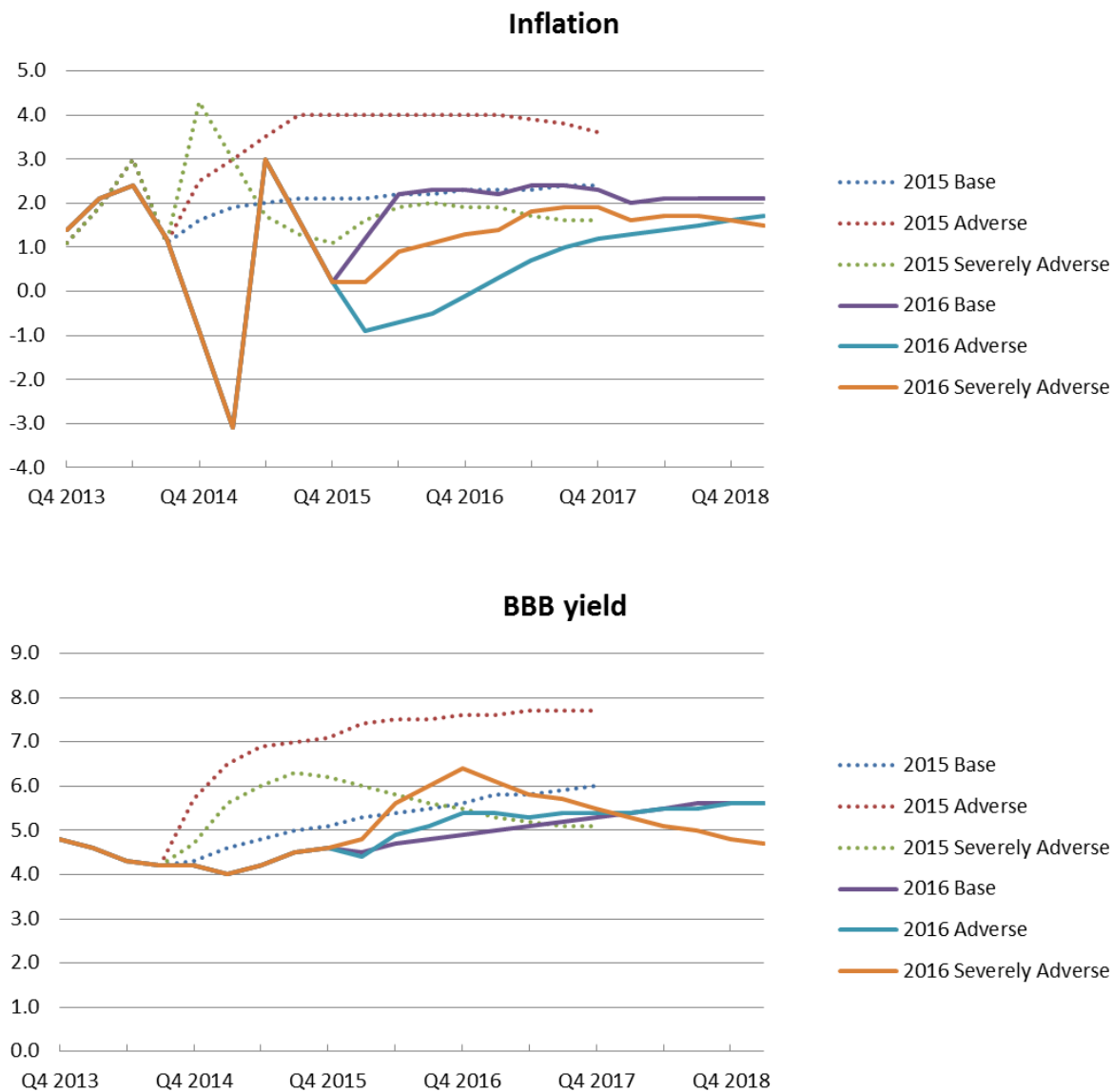
CCAR 2016 Scenario	9-quarter Expected CRE Loss	13-quarter Expected CRE Loss
Fed Baseline	0.3%	0.4%
Fed Adverse	1.3%	1.5%
Fed Severely Adverse	5.1%	6.1%

The nine-quarter expected losses estimated under all three scenarios for CCAR 2016 are slightly lower than the corresponding figures from the CCAR 2015 analysis. This finding is the cumulative result of several factors. Improvement in the underlying commercial real estate markets during the past five quarters is the primary factor leading to lower expected loss for this year. From Q3 2014–Q4 2015, commercial real estate price index increased by 11.6%, which has substantially lowered average LTV and improved DSCR for a typical CRE loan portfolio. Additionally, CCAR 2016's Severely Adverse Scenario features a path of negative yields for short-term U.S. treasury securities. Low or negative interest rates will reduce the borrowing cost of many floating rate loans in a typical commercial bank's portfolio, which partially offsets the downward pressure from commercial property price decline under the Severely Adverse Scenario. Overall, our analysis points to slightly lower expected losses under the Severely Adverse Scenario for CCAR 2016, relative to the corresponding CCAR 2015 analysis.

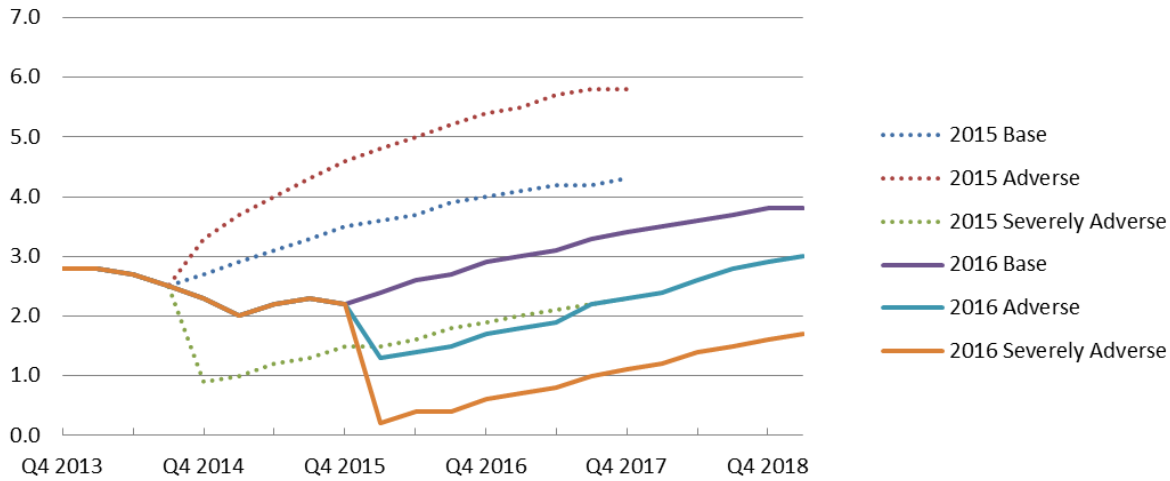
Appendix A CCAR 2016 Scenarios and the CCAR 2015 Scenarios

The figures below compare some of the key macroeconomic variables published by the Fed under the CCAR 2015 and CCAR 2016 scenarios.

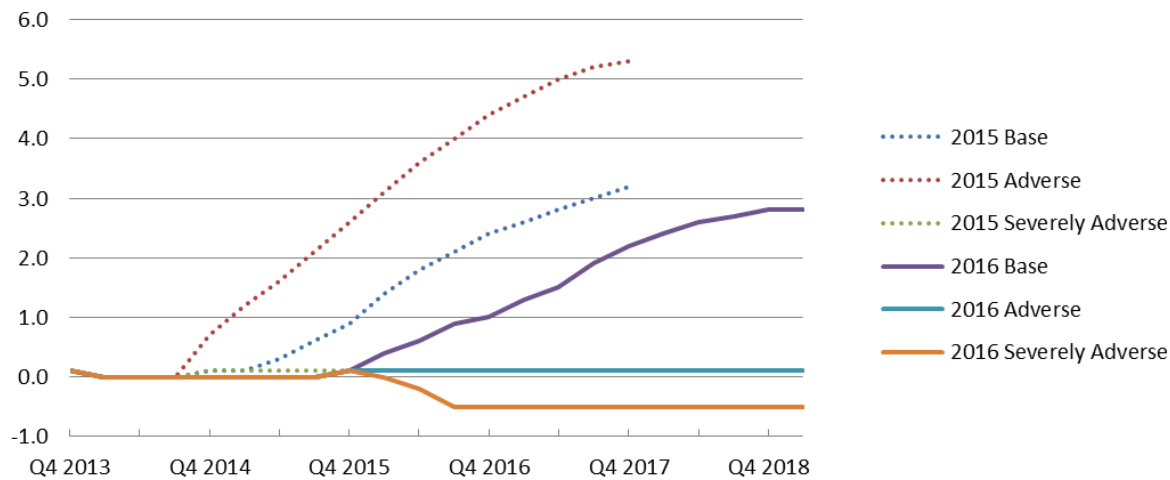
Figure 10 CCAR 2016 and CCAR 2015 scenario comparisons.



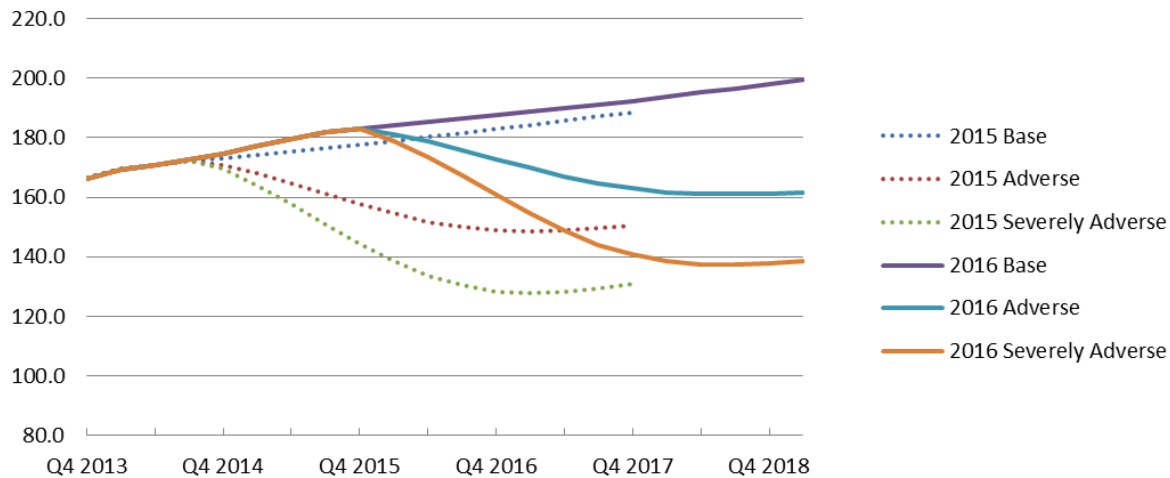
10-Y Treasury



3-mo Treasury



House Price Index



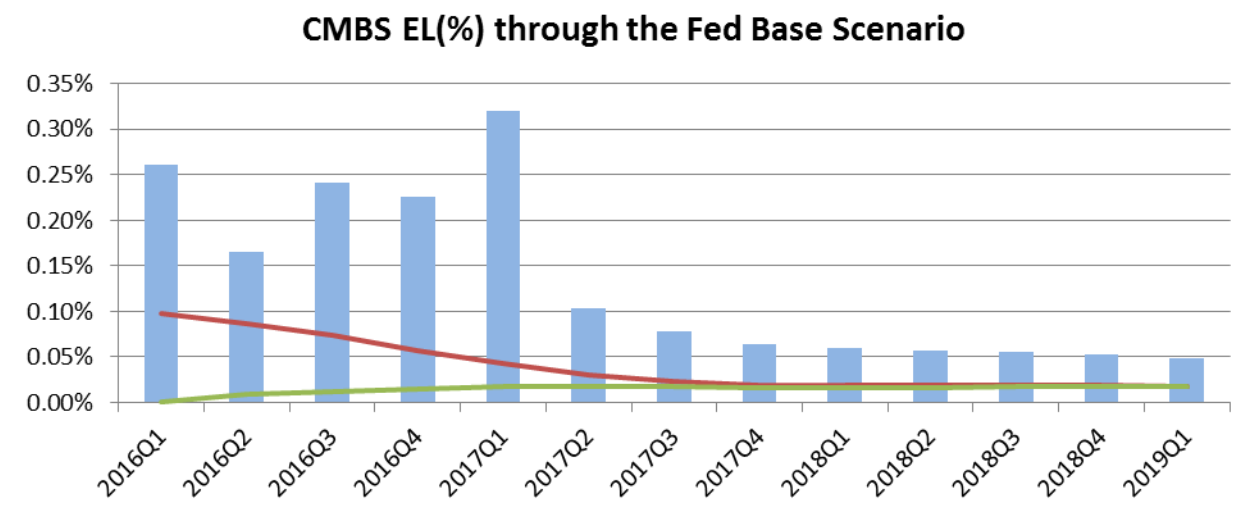
Appendix B Stress Testing the CMBS and Insurance Portfolios

Total Expected Loss from Performing (Non-delinquent and Accrual) Loans

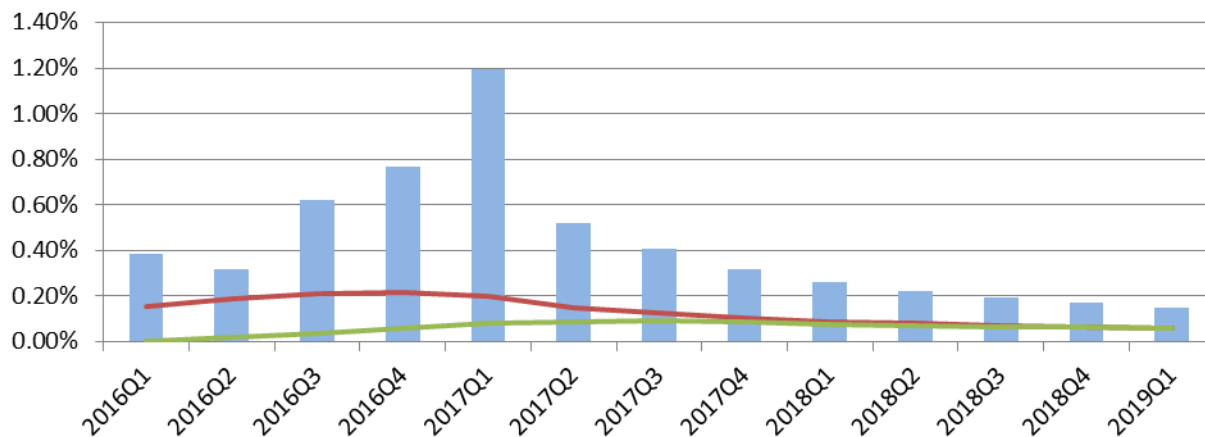
As explained earlier, we use loans from the CMBS and life insurance portfolios to simulate banks' portfolios. We explain the CCAR stress testing process here for the CMBS and insurance portfolios, which, in turn, guide the process for the bank portfolios.

We first run the CMBS and insurance portfolios' performing loans through the CMM. This analysis calculates the term risk and maturity risk of the current loans from the existing CMBS and insurance universe. However, this process ignores the risk associated with new loan originations during the stress period. It is advised that the stress testing process keeps the exposure at default (EAD) when estimating the total risk. Thus, using the CMM Stress Testing outputs, we generate risk measures for the portfolios, assuming the size of the portfolio remains constant through the stress horizon. We achieve this goal by assuming that during every quarter new loan originations equal the amount of loans that mature or amortize during that quarter. Using the quarterly default risk estimates obtained for the existing portfolio via the CMM Stress Testing process, appropriately adjusted default risks are assigned to the new originations. For a given portfolio, credit risk incurs from default during the term of the loan (term risk) and default at maturity (maturity risk) when the remaining principal is to be paid. The following figures show the term and maturity expected losses, as well as the expected loss from new loan originations, for the currently-performing portion of CMBS and ACLI sample through the various stress horizons. Given the large proportions of 2005–2007 vintages set to mature during the next few years, the CMBS maturity risk is projected to be higher than term risk under all three scenarios, with the most critical period being 2016–2017, corresponding to the maturing 2006–2007 vintages.

Figure 11 CMBS (Annualized) Term EL, Maturity EL, and EL from New Originations under CCAR 2016 Scenarios.



CMBS EL(%) through the Fed Adverse Scenario



CMBS EL(%) through the Fed Severe Scenario

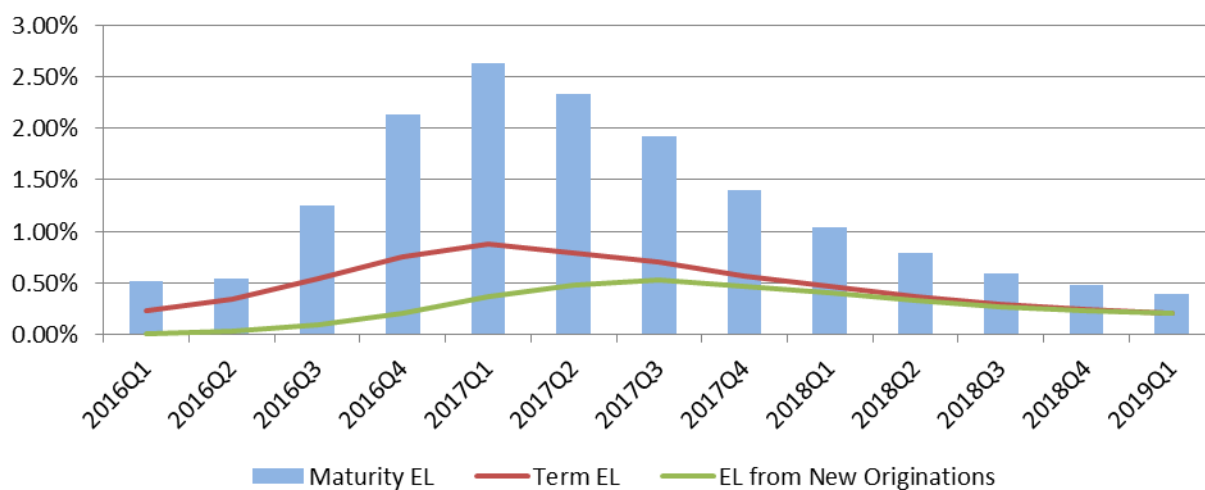
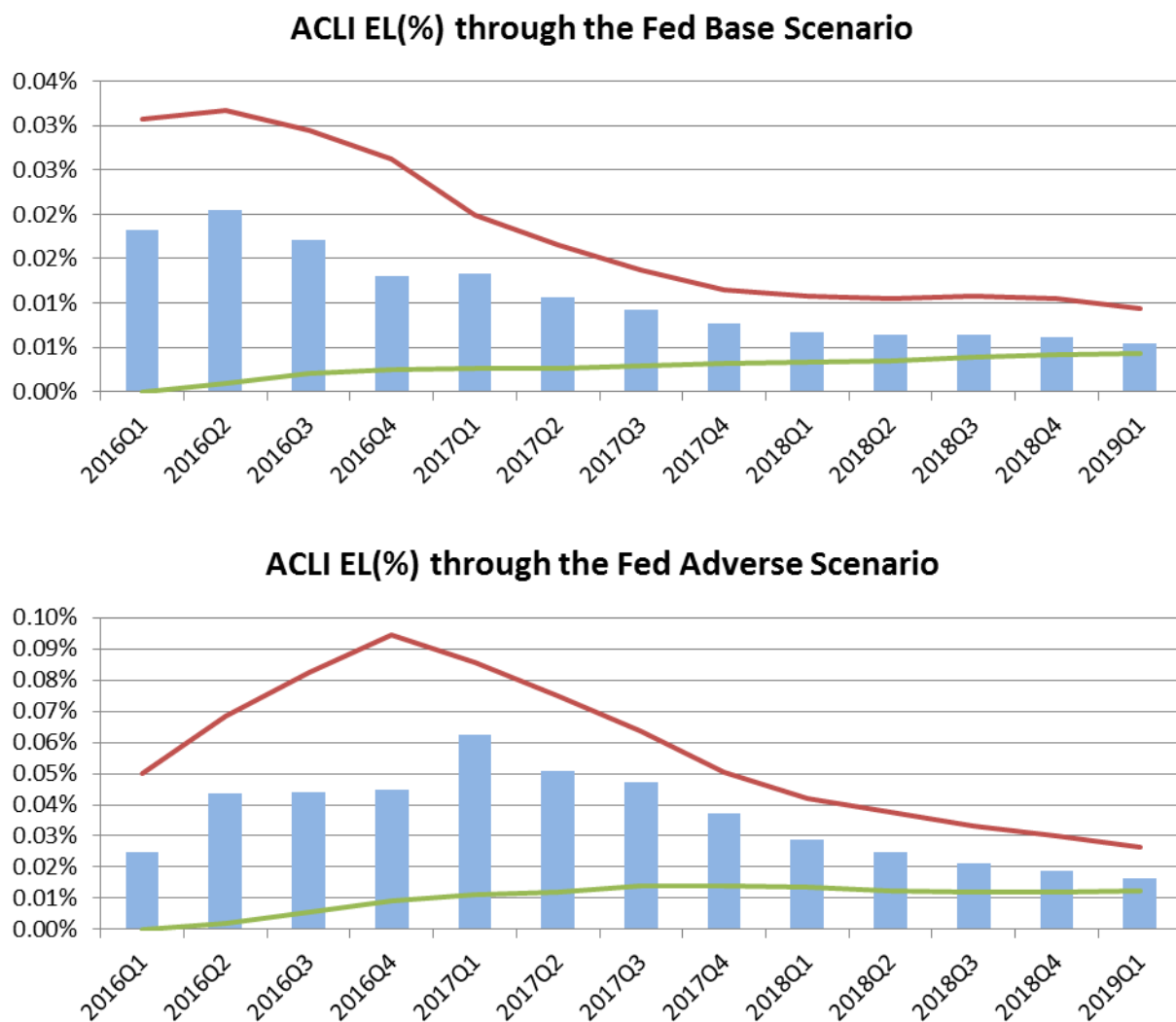
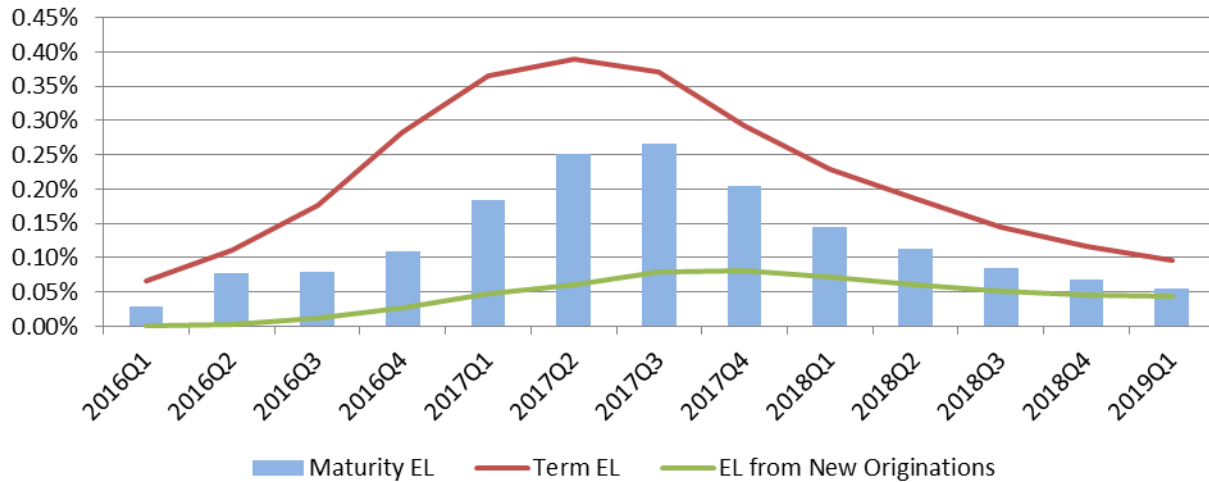


Figure 12 ACLI (Annualized) Term EL, Maturity EL, and EL from New Originations under CCAR 2016 Scenarios.



ACLI EL(%) through the Fed Severe Scenario



Total Expected Loss from Non-performing (Non-accrual or Delinquent) Loans

Having estimated the total loss contributed by currently performing loans, the next step estimates the total loss resulting from loans currently delinquent.¹³ Data on the delinquency rates of the ACLI and CMBS portfolio are available. In the earlier step, via the CMM Stress Testing run, we obtain the loss given default (LGD) for the existing portfolios for each of the stress scenarios. Using the resulting LGDs from the previous analysis and the appropriately assumed roll rates,¹⁴ we find the loss attributable to currently delinquent loans. Table 4 presents the total expected loss from the CMBS and insurance space for the various CCAR 2016 scenarios.

Table 4 TOTAL EXPECTED LOSS FROM THE CMBS AND INSURANCE SPACE FROM CCAR 2016

CCAR 2016 Scenario	Quarter from 2015Q4	CMBS			ACLI		
		Performing Loans %	Non-accrual %	Total %	Performing Loans %	Non-accrual %	Total %
		95.2%	4.8%	100%	99.96%	0.04%	100%
Fed Baseline	Q9	0.5%	14.7%	0.8%	0.1%	14.0%	0.1%
Fed Adverse	Q9	1.7%	22.5%	2.1%	0.3%	20.9%	0.3%
Fed Severely Adverse	Q9	5.4%	44.9%	6.1%	1.0%	40.1%	1.0%
Fed Baseline	Q13	0.6%	14.7%	0.9%	0.1%	14.0%	0.1%
Fed Adverse	Q13	2.0%	22.5%	2.4%	0.3%	20.9%	0.4%
Fed Severely Adverse	Q13	6.5%	44.9%	7.1%	1.3%	40.1%	1.3%

The expected losses for both CMBS and ACLI under all three scenarios for CCAR 2016 are lower than the corresponding figures of the CCAR 2015 analysis, which is mainly attributable to improving portfolio quality. During the past year, many of the lower quality loans that originated prior to the financial crisis which were of lower credit quality matured, while new originations generally show better quality. More importantly, improvements in commercial real estate market conditions has pushed DSCR and LTV in a favorable direction. For instance, comparing CMBS portfolios as of 2014 and 2015, DSCRs improved overall, with a median increase

¹³ In the case of the bank portfolios, we have their non-accrual rates, treated similarly.

¹⁴ Roll rate is the fraction of delinquent loans that will end in (roll into) default.

of 0.12. Rapid CRE price gains during the past five quarters lead to the general decline of LTVs. In particular, we see a significantly smaller proportion of assets with negative or near-negative equity in the CMBS universe: at the end of 2015 there were 2.1% of loans estimated to have LTV of 90% and above, compared to 10.6% just a year ago.

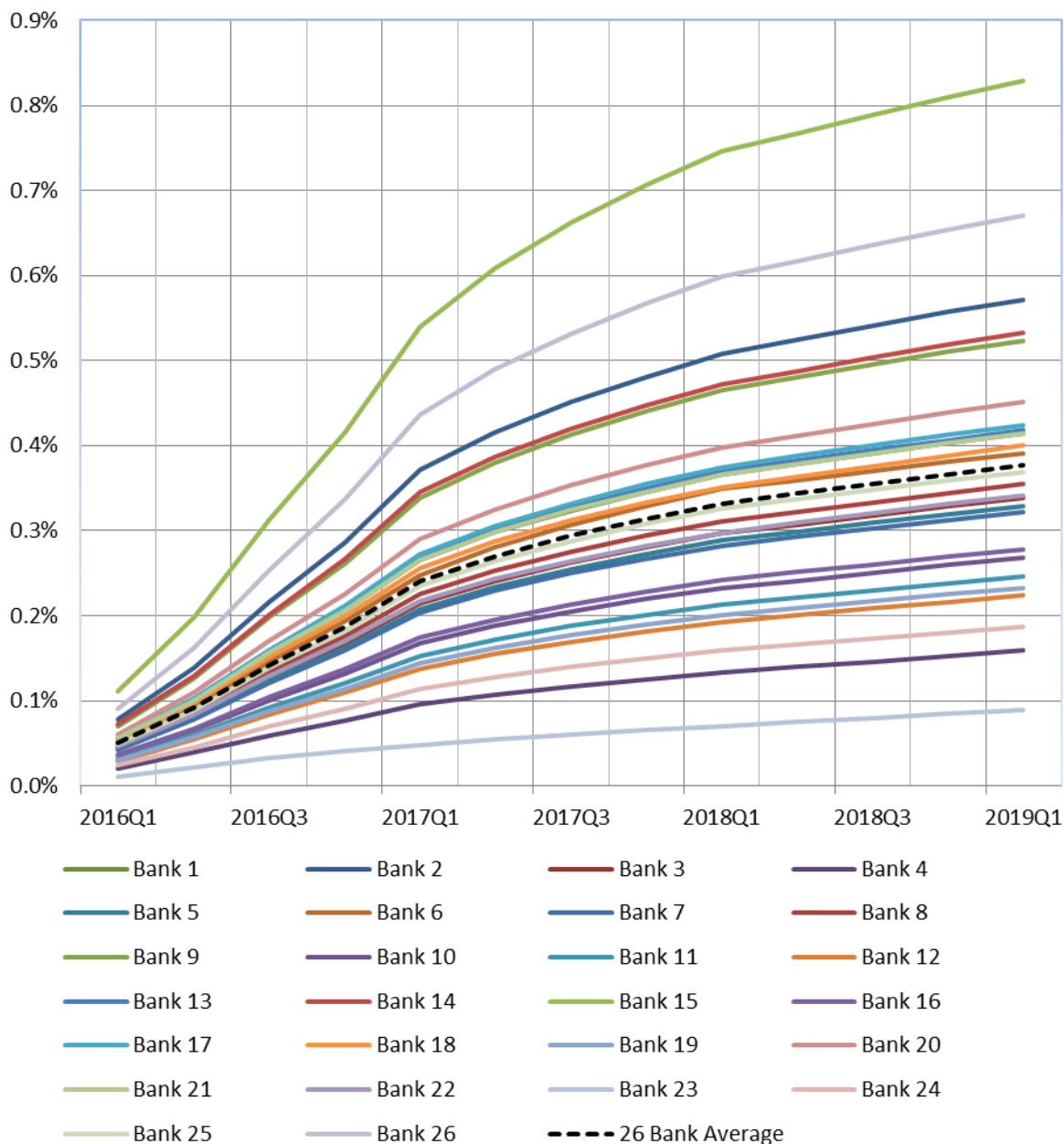
Table 5 COMPARISONS OF DSCR AND LTV BETWEEN CMBS PORTFOLIOS AS OF 2014 AND 2015

Percentile	DSCR			LTV		
	2014	2015	2015 vs. 2014	2014	2015	2015 vs. 2014
10%	1.05	1.12	0.07	31.8%	26.9%	-5.0%
25%	1.28	1.35	0.08	35.4%	40.8%	5.4%
50%	1.55	1.66	0.12	58.3%	51.5%	-6.8%
75%	1.91	2.07	0.16	72.2%	62.3%	-9.9%
90%	2.43	2.61	0.18	91.4%	71.4%	-20.0%

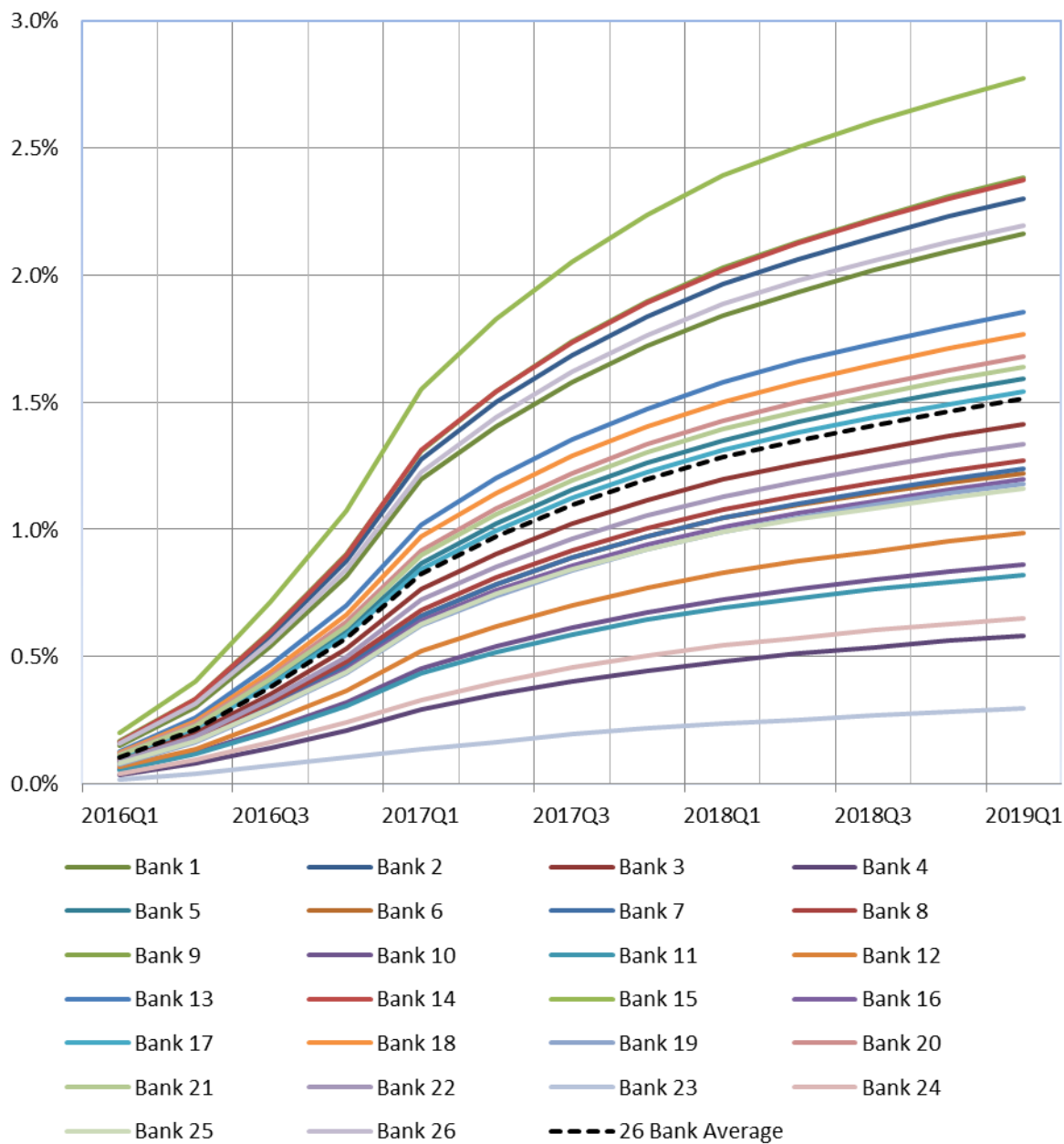
Appendix C Total Loss from Banks' CRE Portfolio, CCAR 2016

The following figures show details of total loss in the various categories, for each bank's CRE portfolios for the 2016 CCAR stress testing scenarios.

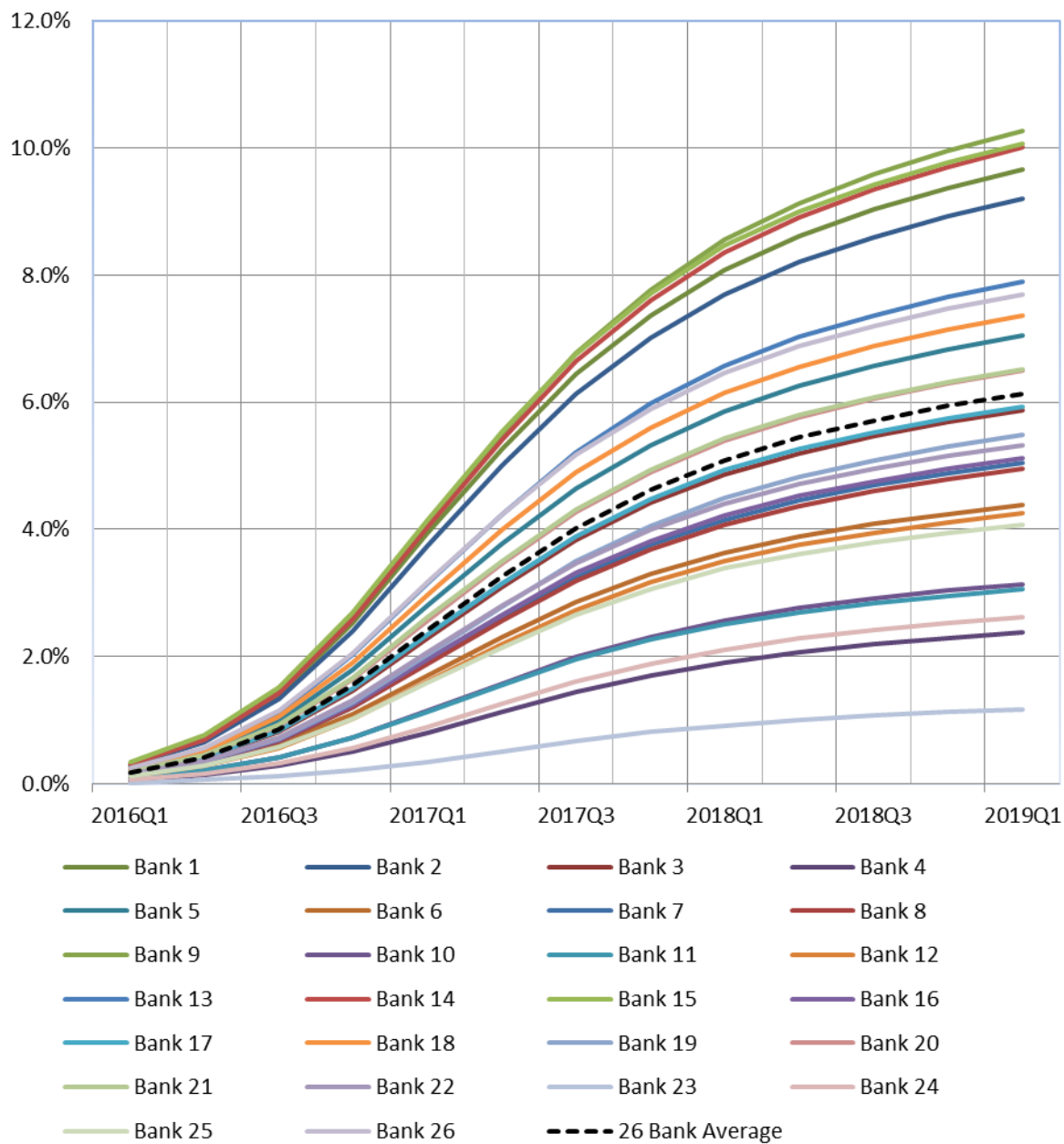
Bank Total EL% through the Fed Base Scenario



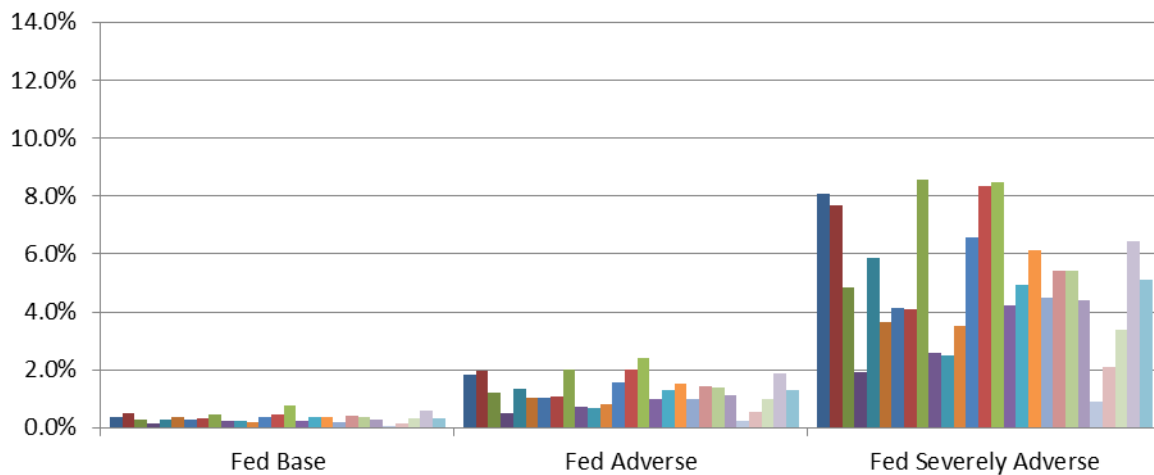
Bank Total EL% through the Fed Adverse Scenario



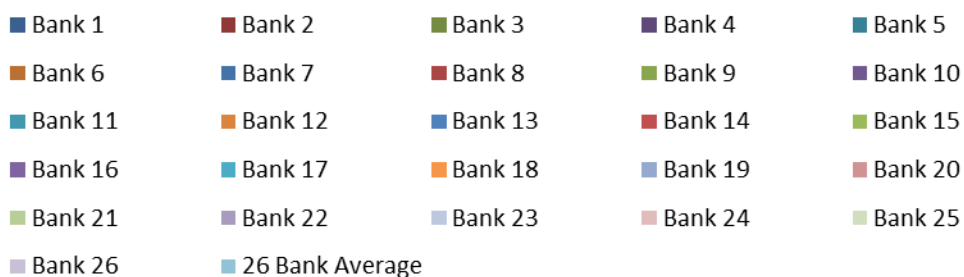
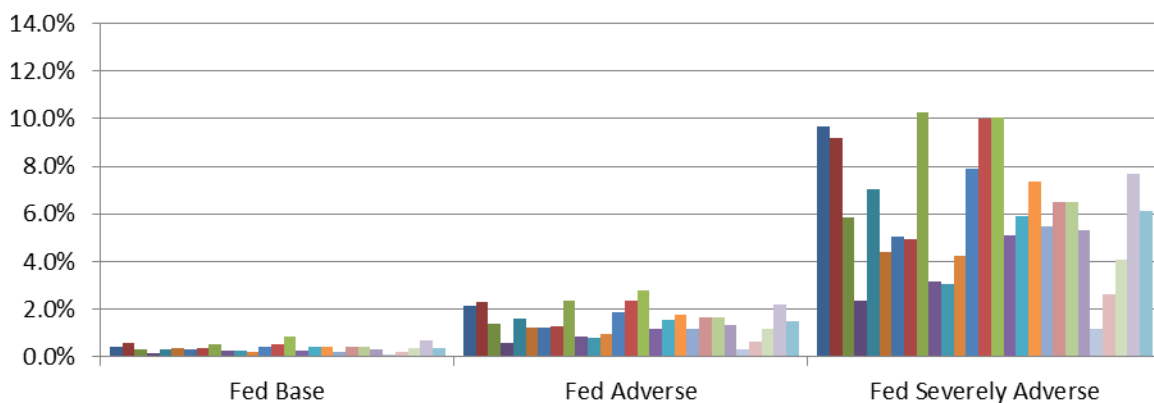
Bank Total EL% through the Fed Severe Scenario



Bank Total EL% by Scenario at Q9 for CRE



Bank Total EL% by Scenario at Q13 for CRE



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