By order of the Board of Governors of the Federal Reserve System, December 7, 2017.

Ann E. Misback,

Secretary of the Board.

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FEDERAL RESERVE SYSTEM

12 CFR Chapter II

[Docket No. OP–1586]

Enhanced Disclosure of the Models Used in the Federal Reserve's Supervisory Stress Test

AGENCY: Board of Governors of the Federal Reserve System (Board).

ACTION: Notification with request for public comment.

SUMMARY: The Board is inviting comment on an enhanced disclosure of the models used in the Federal Reserve's supervisory stress test conducted under the Board's Regulation YY pursuant to the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) and the Board's capital plan rule.

DATES: Comments must be received by January 22, 2018.

ADDRESSES: You may submit comments, identified by Docket No. OP–1586 by any of the following methods:

- *Agency website: http://www.federalreserve.gov.* Follow the instructions for submitting comments at *http://www.federalreserve.gov/generalinfo/foia/ProposedRegs.aspx.*
- *Federal eRulemaking Portal: http://www.regulations.gov.* Follow the instructions for submitting comments.
- *Email: regs.comments@federalreserve.gov.* Include the docket number and RIN number in the subject line of the message.
- *Fax:* (202) 452–2819 or (202) 452–3102.
- *Mail:* Ann Misback, Secretary, Board of Governors of the Federal Reserve System, 20th Street and Constitution Avenue NW, Washington, DC 20551.

All public comments will be made available on the Board's website at *http://www.federalreserve.gov/generalinfo/foia/ProposedRegs.aspx* as submitted, unless modified for technical reasons. Accordingly, your comments will not be edited to remove any identifying or contact information. Public comments may also be viewed electronically or in paper form in Room 3515, 1801 K St. NW (between 18th and 19th Streets NW), Washington, DC 20006 between 9:00 a.m. and 5:00 p.m. on weekdays. For security reasons, the Board requires that visitors make an appointment to inspect comments. You may do so by calling (202) 452–3684. Upon arrival, visitors will be required to present valid government-issued photo identification and to submit to security screening in order to inspect and photocopy comments.

FOR FURTHER INFORMATION CONTACT: Lisa Ryu, Associate Director, (202) 263–4833, Kathleen Johnson, Assistant Director, (202) 452–3644, Robert Sarama, Manager (202) 973–7436, Division of Supervision and Regulation; Benjamin W. McDonough, Assistant General Counsel, (202) 452–2036, or Julie Anthony, Counsel, (202) 475–6682, Legal Division, Board of Governors of the Federal Reserve System, 20th Street and Constitution Avenue NW, Washington, DC 20551. Users of Telecommunication Device for Deaf (TDD) only, call (202) 263–4869.

SUPPLEMENTARY INFORMATION:

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I. Overview

Each year the Federal Reserve publicly discloses the results of the supervisory stress test.[1] The disclosures include revenues, expenses, losses, pre-tax net income, and capital ratios that would result under two sets of adverse economic and financial conditions. As part of the disclosures, the Federal Reserve also describes the broad framework and methodology used in the supervisory stress test, including information about the models used to estimate the revenues, losses, and capital ratios in the stress test. The annual disclosures of both the stress test results and supervisory model framework and methodology represent a significant increase in the public transparency of large bank supervision in the U.S.[2] Indeed, prior to the first supervisory stress test in 2009, many analysts and institutions cautioned against these disclosures, arguing that releasing bank-specific loss estimates to the public would be destabilizing. However, experience to date has shown the opposite to be true—disclosing these details to the public has garnered public and market confidence in the process.

The Federal Reserve routinely reviews its stress testing and capital planning programs, and during those reviews the Federal Reserve has received feedback regarding the transparency of the supervisory stress test models.[3] Some of those providing feedback requested more detail on modeling methodologies with a focus on year-over-year changes in the supervisory models.[4] Others, however, cautioned against disclosing too much information about the supervisory models because doing so could permit firms to reverse-engineer the stress test.

The Federal Reserve recognizes that disclosing additional information about supervisory models and methodologies has significant public benefits, and is committed to finding ways to further increase the transparency of the supervisory stress test. More detailed disclosures could further enhance the credibility of the stress test by providing the public with information on the fundamental soundness of the models and their alignment with best modeling practices. These disclosures would also facilitate comments on the models from the public, including academic experts. These comments could lead to improvements, particularly in the data most useful to understanding the risks of particular loan types. More detailed disclosures could also help the public understand and interpret the results of the stress test, furthering the goal of maintaining market and public confidence in the U.S. financial system. Finally, more detailed disclosures of how the Federal Reserve's models assign losses to particular positions

[1] *See,* for example, Dodd-Frank Act Stress Test 2017: Supervisory Stress Test Methodology and Results, June 2017 and Comprehensive Capital Analysis and Review 2017: Assessment Framework and Results, June 2017.

[2] In addition to those public disclosures, the Federal Reserve has published detailed information about its scenario design framework and annual letters detailing material model changes. The Federal Reserve also hosts an annual symposium in which supervisors and financial industry practitioners share best practices in modeling, model risk management, and governance.

[3] During a review that began in 2015, the Federal Reserve received feedback from senior management at firms subject to the Board's capital plan rule, debt and equity market analysts, representatives from public interest groups, and academics in the fields of economics and finance. That review also included an internal assessment.

[4] Some of the comments in favor of additional disclosure included requests that the Federal Reserve provide additional information to firms only, without making the additional disclosures public. Doing so would be contrary to the Federal Reserve's established practice of not disclosing information related to the stress test to firms if that information is not also publicly disclosed.

could help those financial institutions that are subject to the stress test understand the capital implications of changes to their business activities, such as acquiring or selling a portfolio of assets.

The Federal Reserve also believes there are material risks associated with fully disclosing the models to the firms subject to the supervisory stress test. One implication of releasing all details of the models is that firms could conceivably use them to make modifications to their businesses that change the results of the stress test without changing the risks they face. In the presence of such behavior, the stress test could give a misleading picture of the actual vulnerabilities faced by firms. Further, such behavior could increase correlations in asset holdings among the largest banks, making the financial system more vulnerable to adverse financial shocks.[5] Another implication is that full model disclosure could incent banks to simply use models similar to the Federal Reserve's, rather than build their own capacity to identify, measure, and manage risk. That convergence to the Federal Reserve's model would create a ''model monoculture,'' in which all firms have similar internal stress testing models which may miss key idiosyncratic risks faced by the firms.[6]

In the next section of the paper, three proposed enhancements to the supervisory stress test model disclosures are described, with an example of the enhanced disclosure for the Federal Reserve's corporate loan loss model. If the proposed enhancements were implemented, the Federal Reserve would expect to publish the enhanced disclosures in the first quarter of each year, starting with selected loan portfolios in 2018. The Federal Reserve expects that the annual disclosure would reflect any updates to supervisory models, for applicable portfolios, in a given year, but would be based on data and scenarios from the prior year.

The proposed enhancements are designed to balance the costs and benefits discussed above in a way that would further enhance the public's understanding of the supervisory stress test models without undermining the effectiveness of the stress test as a supervisory tool.

II. Description of Enhanced Model Disclosure

The proposed enhanced disclosures have three components: (1) Enhanced descriptions of supervisory models, including key variables; (2) modeled loss rates on loans grouped by important risk characteristics and summary statistics associated with the loans in each group; and, (3) portfolios of hypothetical loans and the estimated loss rates associated with the loans in each portfolio.[7]

Collectively, the additional information is designed to facilitate the public's ability to understand the workings of the models and provide meaningful feedback.

A. Enhanced Description of Models

The Federal Reserve currently discloses descriptions of the supervisory stress test models in an appendix in the annual Dodd-Frank Act supervisory stress test methodology and results document. For each modeling area, the appendix includes a description of the structure of the model, key features, and the most important explanatory variables in the model.

The proposed enhanced descriptions of the models would expand these descriptions in two ways. First, they would provide more detailed information about the structure of the models. For example, the existing disclosure for corporate loans explains that the model estimates expected losses using models of probability of default (PD), loss given default (LGD), and exposure at default (EAD). It further explains that PDs are projected using a series of equations fitted to the historical relationship between changes in the PD and macroeconomic variables, including growth in real gross domestic product, changes in the unemployment rate, and changes in the spread on BBB-rated corporate bonds. The proposed enhanced model description would include certain important equations that characterize aspects of the model. Second, the proposed enhanced descriptions would include a table that contains a list of the key loan characteristics and macroeconomic variables that influence the results of a given model. The table would show the relevant variables for each component of the model (*e.g.,* PD, LGD, EAD), and information about the source of the variables (see Table 1).

B. Modeled Loss Rates on Pools of Loans

The proposed enhanced disclosure would include estimated loss rates for groups of loans with distinct characteristics. Those loss rates would allow the public to directly see how the supervisory models treat specific assets under stress. The corporate loan example included below illustrates how this new loss rate disclosure could operate in practice. The modeled loss rates are reported for eight groups of loans that have combinations of three loan characteristics: sector (financial and nonfinancial), security status (secured and unsecured), and rating class (investment grade and non-investment grade). The average (mean) estimated loss rate and 25th and 75th percentiles of the estimated loan-level loss rates are presented for each group of loans. By presenting the modeled loss rates in ranges as well as the average for each group, the disclosure highlights that loans within the same group may have different loss rates because of differences in other risk characteristics. For example, nonfinancial sector loans would include loans to companies in a range of sectors, which may have different sensitivities to the macroeconomic environment associated with any given scenario.

To shed more light on the degree of heterogeneity of loans within a given group, the enhanced disclosure could also include summary statistics associated with the loans in each group. Combined, the modeled loss rates and summary statistics would allow a firm to compare the characteristics of its own portfolio to those of the aggregate portfolio for all firms subject to the stress test and to better understand differences in loss rates between the two. The modeled loss rates could be reported for both the supervisory adverse and supervisory severely adverse scenarios, which would help to illustrate the effect of variation in macroeconomic conditions on modeled loss rates.

C. Portfolios of Hypothetical Loans and Associated Loss Rates

Publishing portfolios of hypothetical loans is another way to enhance transparency. This approach would allow outside parties to use their own suites of models to estimate losses on the portfolios and compare loss rates across different models.

The portfolios the Federal Reserve may publish for certain asset classes could comprise three sets of hypothetical loans designed to mimic the characteristics of the actual loans reported by firms participating in the

[5] For example, if firms were to deem a specific asset as more advantageous to hold based on the particulars of the supervisory models, were an exogenous shock to occur to that specific asset class, the firms' losses would be magnified because they held correlated assets.

[6] *See,* Schuermann, T. (March 19, 2013). The Fed's Stress Tests Add Risk to the Financial System. *Wall Street Journal,* which highlights bank incentives to mimic Federal Reserve's stress test models.

[7] The second and third components would be provided for the models used to project losses on the most material loan portfolios.

stress test. The first set could be based on the full sample of loans observed in the data, the second could capture characteristics associated with lower-than-average risk loans, and the third could capture characteristics associated with higher-than-average risk loans. Importantly, those portfolios would not contain any individual firm's actual loan portfolio or any actual loans reported by firms, but rather would be portfolios of hypothetical loans designed to illustrate the effect of loan characteristics on estimated loss rates. The set of variables included for each portfolio would be designed such that the public could independently estimate loss rates for these portfolios, although this set would not necessarily include every variable that might be included in a loss model for the relevant loan type. The disclosure could also include the loss rates estimated by the supervisory models for each portfolio of hypothetical loans under the supervisory adverse and supervisory severely adverse scenarios.

D. Explanatory Notes on Enhanced Model Disclosures [8]

The proposed enhanced model disclosures described in this document focus on the design of and projections from particular models, whereas the current disclosures of supervisory stress test results include projections aggregated to the portfolio level that in most cases contain the outputs from multiple supervisory models. As such, the two different disclosures will not align exactly.

The proposed enhanced model disclosures would also differ from the current stress testing results disclosures in that they would not include accounting and other adjustments used to translate projected credit losses into net income. In the current supervisory stress test results disclosure, accounting adjustments are used to translate supervisory model estimates into provisions and other income or expense items needed to calculate stressed pre-tax net income. These adjustments often depend on factors that vary across participating banks, such as the write-down amounts on loans purchased with credit impairments.

III. Request for Comment

The Board requests comment on the proposed enhanced disclosure of the models used in the Federal Reserve's supervisory stress test. Where possible, commenters should provide both quantitative data and detailed analysis in their comments. Commenters should also explain the rationale for their suggestions. Specifically, feedback is requested on the following questions:

- Does the enhanced disclosure appropriately balance the benefits and costs of additional disclosure as outlined above?
- Would the enhanced disclosure allow the public, including academics, to comment on the soundness of the models and their alignment with best modeling practices?
- Are there specific ways the enhanced disclosures could be tailored to limit the potential for increased correlation of risks in the system?
- Are there additional disclosures that would be more helpful to the public without increasing the potential for increased correlation of risks in the system?

IV. Example of Enhanced Model Disclosure

This section contains an illustrative example of what an enhanced model disclosure could look like for the supervisory corporate loan model.

A. Enhanced Description of Models

Overview of Corporate Loan Model

Losses stemming from the default of corporate loans are projected using a model that assigns a specific loss amount to each corporate loan held by a firm subject to the supervisory stress test. The model projects losses as the product of three components: Probability of default (PD), loss given default (LGD), and exposure at default (EAD). The PD component measures the likelihood that a borrower will stop repaying the loan. The other two components capture the lender's loss on the loan if the borrower enters default. The LGD component measures the percent of the loan balance that the lender will not be able to recover after the loan defaults, and the EAD component measures the total expected outstanding balance on the loan at the time of default.

The model is estimated using historical data on corporate loan losses, loan characteristics, and economic conditions. Losses are projected using the estimated model, firm-reported loan characteristics, and economic conditions defined in the Federal Reserve's supervisory stress scenarios. Some of the key loan characteristics that affect projected losses include:

- The loan's credit rating;
- The industry of the borrower;
- The country in which the borrower is domiciled; and
- Whether or not the loan is secured.

The losses projected by the model for a given loan vary based on changes in the defined economic conditions over the nine quarters of the projection horizon. Those include:

- Growth in real gross domestic product (GDP);
- Changes in the unemployment rate; and
- Changes in the spread on BBB-rated loans relative to Treasuries.

Loan Coverage and Model Structure

Corporate loans modeled using the expected loss modeling framework described in this document consist of a number of different categories of loans, as defined by the Consolidated Financial Statements for Holding Companies—FR Y–9C report. The largest group of these loans includes commercial and industrial (C&I) loans with more than $1 million in committed balances that are ''graded'' using a firm's corporate rating process. The corporate loan model is designed to project quarterly losses on those loans over the projection horizon of each stress test scenario.

Expected loss (EL) is the product of the three components described above (PD, LGD, and EAD), and for loan *i* in quarter *t* of the projection horizon it can be expressed as: [9]

$$EL(i,t) = PD(i,t) * LGD(i,t) * EAD(i). \quad (1)$$

[8] This section highlights definitional differences between the proposed enhanced disclosures and the loss rate disclosures in the annual Dodd-Frank Act stress test methodology and results document. Those differences are intended to facilitate the stated goal of the proposed enhanced disclosure to illustrate more clearly how the Federal Reserve's models translate firms' portfolio characteristics and the scenarios into loss rates.

[9] For example, if the probability of default is 1 percent, the loss given default is 20 percent, and the expected outstanding balance at default is $1,000,000 the expected loss is: EL = 0.01*0.20*1,000,000 = $2,000.

Each of the three components is modeled separately. The three component models are described below.

Probability of Default

The PD model assumes that the probability that a loan defaults depends on macroeconomic factors, such as the unemployment rate. The model first calculates the loan's PD at the beginning of the projection horizon and then projects it forward using the estimated relationship between historical changes in PD and changes in the macroeconomic environment.[10]

Calculating the Initial PD: The initial PD, which is the PD at the beginning of the projection horizon (*i.e., PD(i,t=0)*), is calculated as the long-run average of daily expected default frequencies (EDFs). EDFs are measures of the probability of default based on a structural model that links the value of a firm to credit risk. The initial PD for publicly traded borrowers for which a CUSIP is available in the firm-reported data reflects a borrower-specific EDF. The initial PD for other borrowers is based on the average EDF for the industry and rating category group in which the borrower is classified. A borrower's industry category is directly observed in the firm-reported data, and the rating category is derived from the firm-reported internal credit rating for the borrower and a firm-reported table that maps the internal rating to a standardized rating scale.

Projecting the PD: The initial PDs are then projected over the projection horizon using equations fitted to the historical relationship between changes in the EDFs and changes in macroeconomic variables. The equations are estimated separately by borrower industry, rating category, and country of borrower domicile. The macroeconomic variables used to project changes in PDs over the projection horizon are GDP growth, changes in the unemployment rate, and changes in the spread on BBB-rated loans relative to Treasuries (BBB spread). GDP growth and the rate of unemployment reflect economy-wide changes in demand for goods and services which affect firms' probabilities of default, while the BBB spread represents factors that affect firms' profitability and investment opportunities, such as aggregate credit risk and the cost of borrowing.

For loan *i,* which is in country-industry group *j,* and rating category *k,* the change in PD from period *t*-1 to *t* is given by:

$$\Delta PD(i,t) = \alpha_j + \lambda_k + \sum_{m=1}^{M} \beta_{jk}(m) \times S(t,m) \qquad (2)$$

Where $\beta_{jk}(m)$ is the estimated sensitivity of the probability of default to macroeconomic factor *m,* for country-industry segment *j* and rating category *k,* and *S(t,m)* is macroeconomic factor *m* in period *t.*

Loss Given Default

Similar to the PD model, the LGD model first calculates the loan's LGD at the beginning of the projection horizon and then projects it forward using the estimated relationship between historical changes in LGD and changes in the macroeconomic environment.

Calculating the Initial LGD: Firm-reported data on line of business and whether the loan is secured or unsecured are used to set the initial LGD for performing loans. In cases in which the loan has already been identified as troubled, *i.e.,* the firm has already put aside a reserve to cover the expected loss, the initial LGD is based on the size of the reserve. Further adjustments are made to the initial LGDs of loans that are in default at inception.[11] For foreign loans, initial LGDs are also adjusted based on the country in which the obligor is domiciled, capturing differences in collateral recovery rates across countries.

Projecting LGD: The LGD is then projected forward by relating the change in the LGD to changes in the PD following Frye and Jacobs (2012).[12] Under that approach, changes in LGD are explicitly calculated as an increasing function of PD. Specifically, loan *i*'s LGD from period *t–1* to period *t* is given by:

$$LGD(i,t) = \frac{\Phi\left[\Phi^{-1}[PD(i,t)] - \Phi^{-1}[PD(i,t-1)] + \Phi^{-1}[PD(i,t-1) * LGD(i,t-1)]\right]}{PD(i,t)} \qquad (3)$$

Where $\Phi[\cdot]$ denotes the standard normal cumulative distribution function and $\Phi^{-1}[\cdot]$ is its inverse. LGD in period *t* depends on PD in period *t* and on PD and LGD in period *t*-1. If *PD(i,t) = PD(i,t-1),* then *LGD(i,t) = LGD(i,t-1).*

Exposure at Default

For closed-end loans, the EAD is the utilized exposure.

For lines of credit and other revolving commitments, the EAD equals the utilized exposure plus a portion of the unfunded commitment (*i.e.,* the difference between the committed exposure and utilized exposure), which reflects the amount that is likely to be drawn down by the borrower in the event of default. The amount that is likely to be drawn down is calibrated to the historical drawdown experience for defaulted U.S. syndicated revolving lines of credit that are in the Shared National Credit (SNC) database.[13]

Formally, the EAD for a line of credit or other revolving product *i* is set to:

[10] Loans that are 90 days past due, in non-accrual status, or that have a Financial Accounting Standards Board Accounting Standards Codification Subtopic 310–10 (ASC 310–10) reserve as of the reference date for the stress test are considered in default.

[11] Loans that are in default at inception of the stress period (*i.e.,* t=0) are assigned a PD of 100%, and a LGD using the ASC 310–10 reserves reported by the firm.

[12] *See,* Frye, J., & Jacobs Jr, M. (2012). Credit loss and systematic loss given default. The Journal of Credit Risk, 8(1), 109.

[13] SNC loans have commitments of greater than $20 million and are held by three or more regulated participating entities. For additional information, see ''Shared National Credit Program,'' Board of Governors of the Federal Reserve System, *www.federalreserve.gov/supervisionreg/snc.htm.*

$$EAD(i) = OB(i, t = 0) + LEQ * (CB(i, t = 0) - OB(i, t = 0)) \quad (4)$$

Where *LEQ* is the calibrated drawdown amount, *OB(i,t=0)* is the line's outstanding exposure at the start of the projection horizon, and *CB(i,t=0)* is the line's committed exposure at the start of the projection horizon.

For standby letters of credit and trade finance credits, EADs are conservatively assumed to equal the total commitment, since typically these types of credits are fully drawn when they enter default status.

TABLE 1—LIST OF KEY VARIABLES IN THE CORPORATE LOAN MODELS AND SOURCES OF VARIABLES

Variable	Description	Variable type	Source
PD model [1]			
U.S. BBB corporate yield spread	The difference between quarterly average of the yield on 10-year BBB corporate bonds and quarterly average of the yield on 10-year U.S. Treasury bonds.	Macroeconomic	FR supervisory scenarios.
U.S. Real GDP growth	Percent change in real gross domestic product in chained dollars, expressed at annualized rate.	Macroeconomic	FR supervisory scenarios.
U.S. unemployment rate	Quarterly average of seasonally-adjusted monthly data for the unemployment rate of civilian, non-institutional population of age 16 years and older.	Macroeconomic	FR supervisory scenarios.
Country	The two letter country code for the country in which the obligor is headquartered.	Loan/borrower characteristic.	FR Y–14.
Industry of obligor	Numeric code that describes the primary business activity of the obligor.	Loan/borrower characteristic.	FR Y–14.
Internal obligor rating	The obligor rating grade from the reporting entity's internal risk rating system.	Loan/borrower characteristic.	FR Y–14.
LGD model			
Country	The two letter country code for the country in which the obligor is headquartered.	Loan/borrower characteristic.	FR Y–14.
Lien position	The type of lien. Options include first lien senior, second lien, senior unsecured, or contractually subordinated.	Loan/borrower characteristic.	FR Y–14.
Line of business	The name of the internal line of business that originated the credit facility using the institution's own department descriptions.	Loan/borrower characteristic.	FR Y–14.
Type of facility	The type of credit facility. Potential types are defined in the FR Y–14Q H.1 corporate schedule.	Loan/borrower characteristic.	FR Y–14.
EAD model			
Committed exposure amount	The current dollar amount the obligor is legally allowed to borrow according to the credit agreement.	Loan/borrower characteristic.	FR Y–14.
Type of facility	The type of credit facility. Potential types are defined in the FR Y–14Q H.1 corporate schedule.	Loan/borrower characteristic.	FR Y–14
Utilized exposure amount	The current dollar amount the obligor has drawn which has not been repaid, net of any charge-offs, ASC 310–30 (originally issued as SOP 03–03) adjustments, or fair value adjustments taken by the reporting institution, but gross of ASC 310–10 reserve amounts.	Loan/borrower characteristic.	FR Y–14.

[1] Other variables used to calculate initial loan status include days past due, non-accrual date, and ASC 310–10 amount.

B. Modeled Loss Rates on Pools of Loans

The output of the corporate loan model is the expected loss on each loan. As described above, estimated corporate loan loss rates depend on a number of variables. This section groups loans according to three of the most important variables in the model: Sector (financial and nonfinancial), security status (secured and unsecured), and rating class (investment grade and non-investment grade).[14] Categorizing corporate loans reported on schedule H.1 of the FR Y–14Q report as of the fourth quarter of 2016 by sector, security status, and rating class results in eight groups of loans: [15]

- Financial, secured, investment grade
- Financial, secured, non-investment grade
- Financial, unsecured, investment grade
- Financial, unsecured, non-investment grade
- Nonfinancial, secured, investment grade
- Nonfinancial, secured, non-investment grade
- Nonfinancial, unsecured, investment grade
- Nonfinancial, unsecured, non-investment grade.

The remainder of this section reports summary statistics and modeled loss rates for these eight groups of corporate loans.

Table 2 reports summary statistics for the eight groups of loans. The summary statistics cover a wide set of variables

[14] Financial loans have a NAICS category (''naics_two_digit_cat'') of 52; all other loans are marked nonfinancial. Secured loans are defined as loans with lien positions (''lien_position_cat'') marked as ''first-lien senior''; all other loans are marked as unsecured. Investment grade loans are defined as loans with a credit rating (''rating'') higher than and including BBB; all other loans are marked as non-investment grade.

[15] The set of loans on which loss rates are calculated excludes loans held for sale or accounted for under the fair value option, loan observations missing data fields used in the model, lines of credit that were undrawn as of 2016:Q4, and other types of loans that are not modeled using the corporate loan model (*e.g.,* loans to financial depositories).

that capture important characteristics of the loans and borrowers in the set of loans.

Tables 3 and 4 show the modeled loss rates for the eight groups of loans for the DFAST 2017 supervisory severely adverse and supervisory adverse scenarios, respectively. Each entry in the table shows the average (mean) estimated loss rate for the loans in one of the eight groups, as well as the 25th and 75th percentiles of the estimated loss rates.

Certain groups of loans generally have wider ranges of losses than other groups. Although the loans are grouped according to the most important characteristics in the model, other loan characteristics in the model also affect loss rates, albeit in more limited manner. Differences in these other characteristics within each loan group are responsible for the range of loss rates shown in the tables. Greater variation in these other characteristics within a group will generally lead to larger ranges of loss rates. For example, among secured, non-investment grade loans, the loss rates shown in Table 3 range from 8.7 to 12.1 for financial firms, but range from 2.7 to 9.8 for nonfinancial firms, which include a wider variety of industries. Secured, non-investment grade loans to nonfinancial firms are predominantly loans to firms in the manufacturing, transportation, and technology sectors, but also include loans to firms in other sectors like education and utilities (Table 2).

TABLE 2—SUMMARY STATISTICS OF SELECTED VARIABLES IN THE CORPORATE LOAN DATA GROUPED BY LOAN AND BORROWER CHARACTERISTICS [1]

[Percent, except as noted]

Variables	Non-investment grade				Investment grade			
	Nonfinancial sector		Financial sector		Nonfinancial sector		Financial sector	
	Unsecured	Secured	Unsecured	Secured	Unsecured	Secured	Unsecured	Secured
Number of loans (thousands)	15.60	101.80	1.28	8.20	21.34	52.80	2.11	5.91
Facility type, share of utilized balance								
Revolving	37.14	41.52	33.37	45.28	32.27	37.17	51.78	71.39
Term loan	45.06	40.33	34.08	20.83	44.48	42.20	35.54	14.57
Other	17.80	18.15	32.55	33.89	23.25	20.63	12.67	14.04
Credit rating, share of utilized balance								
AAA	0.00	0.00	0.00	0.00	1.22	0.92	3.36	4.89
AA	0.00	0.00	0.00	0.00	6.55	7.17	12.12	11.05
A	0.00	0.00	0.00	0.00	22.23	23.63	25.16	39.80
BBB	0.00	0.00	0.00	0.00	70.00	68.28	59.35	44.26
BB	80.06	76.66	88.97	81.82	0.00	0.00	0.00	0.00
B	19.63	22.28	10.89	18.05	0.00	0.00	0.00	0.00
CCC or below	0.31	1.07	0.14	0.13	0.00	0.00	0.00	0.00
Lien position, share of utilized balance								
First-lien senior	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
Senior unsecured	95.10	0.00	98.51	0.00	98.26	0.00	98.75	0.00
Other	4.90	0.00	1.49	0.00	1.74	0.00	1.25	0.00
Interest rate variability, share of utilized balance								
Fixed	23.04	14.45	13.11	6.17	24.93	27.97	17.69	6.92
Floating	71.61	79.99	81.29	88.65	68.75	68.72	77.52	90.21
Mixed	5.33	5.54	5.59	5.15	6.22	2.74	4.73	2.74
Industry, share of utilized balance [2]								
Agriculture, fishing, and hunting	0.66	1.50	0.00	0.00	0.28	0.50	0.00	0.00
Natural resources, utilities, and construction	13.02	7.92	0.00	0.00	8.89	5.21	0.00	0.00
Manufacturing	25.70	18.82	0.00	0.00	28.19	13.73	0.00	0.00
Trade and transportation	28.30	32.57	0.00	0.00	15.95	29.17	0.00	0.00
Technological and business services	22.28	22.18	0.00	0.00	28.91	19.54	0.00	0.00
Finance and insurance	0.00	0.00	100.00	100.00	0.00	0.00	100.00	100.00
Education, health care, and social assistance	3.76	6.45	0.00	0.00	8.08	13.84	0.00	0.00
Entertainment and lodging	2.46	6.06	0.00	0.00	2.13	4.39	0.00	0.00
Other services	3.82	4.49	0.00	0.00	7.57	13.62	0.00	0.00
Guarantor flag, share of utilized balance								
Full guarantee	41.24	41.83	42.22	29.09	30.23	29.95	42.22	12.02

TABLE 2—SUMMARY STATISTICS OF SELECTED VARIABLES IN THE CORPORATE LOAN DATA GROUPED BY LOAN AND BORROWER CHARACTERISTICS [1]—Continued

[Percent, except as noted]

Variables	Non-investment grade				Investment grade			
	Nonfinancial sector		Financial sector		Nonfinancial sector		Financial sector	
	Unsecured	Secured	Unsecured	Secured	Unsecured	Secured	Unsecured	Secured
U.S. government guarantee	5.03	0.18	0.23	0.03	0.52	0.26	0.00	0.00
Partial guarantee	2.62	4.23	3.09	3.28	1.77	2.41	3.86	4.99
No guarantee	51.11	53.74	54.47	67.60	67.49	67.31	53.92	82.99
Domestic obligor, share of utilized balance	63.53	91.35	65.10	72.29	71.58	91.46	65.93	81.37
Remaining maturity, average in months [3 4]	38.34	48.44	28.95	23.89	38.26	57.59	38.55	30.44
Interest rate, average in percent [4]	2.77	3.24	2.36	2.68	2.17	2.48	2.26	2.32
Committed exposure, average in millions of dollars	15.24	8.32	25.22	17.43	24.79	10.81	43.24	57.37
Utilized exposure, average in millions of dollars	10.89	6.17	19.89	14.17	16.46	8.35	28.36	39.64

[1] The set of loans presented in this table excludes loans held for sale or accounted for under the fair value option, loan observations missing data fields used in the model, lines of credit that were undrawn as of 2016:Q4, and other types of loans that are not modeled using the corporate loan model (*e.g.,* loans to financial depositories).

[2] Industries are collapsed using the first digit of the NAICS 2007 code, except for finance and insurance.

[3] Maturity excludes demand loans.

[4] Averages for remaining maturity and interest rate are weighted by utilized exposure.

TABLE 3—PROJECTED AVERAGE LOAN LOSS RATES AND 25TH AND 75TH PERCENTILE RANGES BY LOAN AND BORROWER CHARACTERISTICS, 2017:Q1–2019:Q1, DFAST 2017 SEVERELY ADVERSE SCENARIO

Sector	Security status	Rating class	Loss rates (percent)
Financial	Secured	Investment grade	2.5 [1.6 to 3.3].
Financial	Secured	Non-investment grade	10.4 [8.7 to 12.1].
Financial	Unsecured	Investment grade	3.3 [1.9 to 5.3].
Financial	Unsecured	Non-investment grade	12.6 [8.3 to 17.0].
Nonfinancial	Secured	Investment grade	0.8 [0.3 to 1.0].
Nonfinancial	Secured	Non-investment grade	5.4 [2.7 to 9.8].
Nonfinancial	Unsecured	Investment grade	1.2 [0.5 to 1.7].
Nonfinancial	Unsecured	Non-investment grade	6.0 [3.6 to 11.7].

Note: Loan-level loss rates are calculated as cumulative nine-quarter losses on a given loan divided by initial utilized balance on that loan. Average loss rates reported in the table are the average of the loan-level loss rates weighted by initial utilized balances. The set of loans on which loss rates are calculated excludes loans held for sale or accounted for under the fair value option, loan observations missing data fields used in the model, lines of credit that were undrawn as of 2016:Q4, and other types of loans that are not modeled using the corporate loan model (*e.g.*, loans to financial depositories).

TABLE 4—PROJECTED AVERAGE LOAN LOSS RATES AND 25TH AND 75TH PERCENTILE RANGES BY LOAN AND BORROWER CHARACTERISTICS, 2017:Q1–2019:Q1, DFAST 2017 ADVERSE SCENARIO

Sector	Security status	Rating class	Loss rates (percent)
Financial	Secured	Investment grade	1.5 [1.0 to 2.0].
Financial	Secured	Non-investment grade	5.9 [4.7 to 6.7].
Financial	Unsecured	Investment grade	2.0 [1.2 to 3.3].
Financial	Unsecured	Non-investment grade	7.3 [4.7 to 9.8].
Nonfinancial	Secured	Investment grade	0.5 [0.2 to 0.6].
Nonfinancial	Secured	Non-investment grade	3.2 [1.6 to 5.8].
Nonfinancial	Unsecured	Investment grade	0.8 [0.4 to 1.1].
Nonfinancial	Unsecured	Non-investment grade	3.7 [2.1 to 7.1].

Note: Loan-level loss rates are calculated as cumulative nine-quarter losses on a given loan divided by initial utilized balance on that loan. Average loss rates reported in the table are the average of the loan-level loss rates weighted by initial utilized balances. The set of loans on which loss rates are calculated excludes loans held for sale or accounted for under the fair value option, loan observations missing data fields used in the model, lines of credit that were undrawn as of 2016:Q4, and other types of loans that are not modeled using the corporate loan model (*e.g.*, loans to financial depositories).

C. Portfolios of Hypothetical Loans and Associated Loss Rates

The effect of borrower and loan characteristics on the losses estimated by the corporate loan model can also be illustrated by the differences in the estimated loss rate on specific sets of hypothetical loans. This section contains descriptive statistics from three portfolios of hypothetical loans (Table 6) and the modeled loss rates for the three portfolios under the DFAST 2017 supervisory adverse and supervisory severely adverse scenarios (Table 7).

The portfolios of hypothetical loans are designed to have characteristics similar to the actual loans reported in schedule H.1 of the FR Y–14Q report. Three portfolios containing 200 loans each are provided, and they are designed to capture characteristics associated with:

1. Typical set of loans reported in the FR Y–14Q;

2. Higher-than-average-risk loans (in this case, non-investment grade loans); and,

3. Lower-than-average-risk loans (in this case, investment grade loans).

The portfolios of hypothetical loans include 12 variables that describe characteristics of corporate loans that are generally used to estimate corporate loan losses (Table 5).[16]

Table 6 contains summary statistics for the portfolios of hypothetical loans in the same format as Table 2. The portfolios of hypothetical loans are constructed to capture characteristics of certain sets of loans, but are not fully representative of the population of loans reported in Table 2. Table 7 contains the loss rates for the portfolios of hypothetical loans calculated under the DFAST 2017 supervisory severely adverse and supervisory adverse scenarios. The rank ordering of the loss rates is consistent with the ranges of loss rates reported in Tables 3 and 4. The portfolio of higher-risk loans has higher loss rates under both the severely adverse and adverse scenarios and is also more sensitive to changes in macroeconomic conditions (loss rate of 7.2 percent in the severely adverse scenario and 4.2 percent in the adverse scenario) than the portfolio of typical loans (loss rate of 5.4 percent in the severely adverse scenario and 3.2 percent in the adverse scenario). Conversely, the portfolio of lower-risk loans has lower losses under both scenarios, and is less sensitive to changes in macroeconomic conditions (loss rate of 1.8 percent in the severely adverse scenario and 1.1 percent in the adverse scenario).

TABLE 5—LIST OF VARIABLES INCLUDED IN PORTFOLIOS OF HYPOTHETICAL LOANS

Variable	Mnemonic	Description
Origination year	orig_year	Year loan was originated.
Type of facility	facility_type_cat	The type of credit facility. 1 is revolving; 5 is non-revolving; and 0 is other.
Lien position	lien_position_cat	The type of lien. 1 is first-lien senior; 2 is second-lien; 3 is senior unsecured; and, 4 is contractually subordinated.
Credit rating	rating	Credit rating of obligor. Categories include AAA, AA, A, BBB, BB, B, CCC, CC, C, and D.
Domestic flag	domestic_flag	Equal to 1 if obligor is domiciled in the U.S.
Industry code (2-digit)	naics_two_digit_cat	Two-digit industry code based on 2007 NAICS definitions.
Committed exposure amount	committed_exposure_amt	Committed exposure in dollars.
Utilized exposure amount	utilized_exposure_amt	Utilized exposure in dollars.
Interest rate	interest_rate	Interest rate on credit facility.
Interest rate variability	interest_rate_variability	Interest rate type. 0 is fully undrawn (interest rate not provided); 1 is fixed; 2 is floating; 3 is mixed.
Remaining maturity	term	Remaining term of the loan in months.
Guarantor flag	guarantor_flag	Indicates the type of guarantee of the guarantor. 1 is full guarantee; 2 is partial guarantee; 3 is U.S. government agency guarantee; 4 is no guarantee.

Note: Some of the variables included in the portfolios of hypothetical loans are presented in a more aggregated form than they are reported in the FR Y–14.

TABLE 6—SUMMARY STATISTICS OF SELECTED VARIABLES IN THE PORTFOLIOS OF HYPOTHETICAL LOANS

[Percent, except as noted]

Variables	Higher-risk	Lower-risk	Typical
Facility type, share of utilized balance			
Revolving	36.52	46.02	50.77
Term loan	42.67	39.97	33.32

[16] The sets of loans are available for download on the Federal Reserve's website: Higher-than-average-risk loans (*https://www.federalreserve.gov/newsevents/pressreleases/files/HigherRisk.csv*); typical-risk loans (*https://www.federalreserve.gov/newsevents/pressreleases/files/Typical.csv*); and lower-than-average-risk loans (*https://www.federalreserve.gov/newsevents/pressreleases/files/LowerRisk.csv*).

TABLE 6—SUMMARY STATISTICS OF SELECTED VARIABLES IN THE PORTFOLIOS OF HYPOTHETICAL LOANS—Continued

[Percent, except as noted]

Variables	Higher-risk	Lower-risk	Typical
Other	20.81	14.02	15.91
Credit rating, share of utilized balance			
AAA	0.00	0.00	0.45
AA	0.00	6.79	1.06
A	0.00	9.72	4.48
BBB	0.00	83.49	41.32
BB	78.68	0.00	40.91
B	20.85	0.00	10.57
CCC or below	0.47	0.00	1.21
Lien position, share of utilized balance			
First-lien senior	82.79	61.31	76.61
Senior unsecured	17.21	38.69	23.39
Other	0.00	0.00	0.00
Interest rate variability, share of utilized balance			
Fixed	16.26	26.36	11.72
Floating	83.44	71.99	86.04
Mixed	0.30	1.64	2.24
Industry, share of utilized balance [1]			
Agriculture, fishing, and hunting	0.42	0.00	0.16
Natural resources, utilities, and construction	10.71	9.34	4.03
Manufacturing	15.46	5.26	18.96
Trade and transportation	19.30	31.32	20.64
Technological and business services	26.36	11.52	13.74
Finance and insurance	16.36	15.51	20.15
Education, health care, and social assistance	6.40	7.67	7.05
Entertainment and lodging	1.96	1.66	1.52
Other services	3.03	17.73	13.75
Guarantor flag, share of utilized balance			
Full guarantee	41.61	50.93	32.40
U.S. government guarantee	1.50	0.00	0.38
Partial guarantee	1.57	0.06	2.15
No guarantee	55.32	49.01	65.08
Domestic obligor, share of utilized balance	93.88	82.34	94.64
Remaining maturity, average in months [2 3]	48.57	56.35	39.23
Interest rate, average in percentage [3]	3.33	2.75	2.87
Committed exposure, average in millions of dollars	7.87	17.94	17.47
Utilized exposure, average in millions of dollars	5.76	7.35	5.86

[1] Industries are collapsed using the first digit of the NAICS 2007 code, except for finance and insurance.
[2] Maturity excludes demand loans.
[3] Averages for remaining maturity and interest rate are weighted by utilized exposure.

TABLE 7—PROJECTED PORTFOLIO LOSS RATES, 2017:Q1–2019:Q1, DFAST 2017 SCENARIOS

[Percent]

Hypothetical portfolio	Scenario	
	Severely adverse	Adverse
Typical	5.4	3.2
Lower-risk	1.8	1.1
Higher-risk	7.2	4.2

Note: Portfolio loss rates are calculated as sum of the cumulative nine-quarter losses divided by sum of initial utilized balances.

By Order of the Board of Governors of the Federal Reserve System, December 7, 2017.

Ann E. Misback,

Secretary of the Board.

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA–2017–1184; Product Identifier 2017–CE–029–AD]

RIN 2120–AA64

Airworthiness Directives; Pacific Aerospace Limited Airplanes

AGENCY: Federal Aviation Administration (FAA), Department of Transportation (DOT).

ACTION: Notice of proposed rulemaking (NPRM).