

COMMUNITY BANK STRESS TEST MANUAL

by

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This manual has been updated to reflect the use of 2016 bank data in the stress test.

This manual explains how any U.S. community bank can utilize the freely available resources that I have developed to build a customized macro stress testing model. The purpose of the model is to assess the bank's ability to withstand a severe and prolonged period of high credit losses. The base model groups banks by geography and subjects them to high chargeoff rates based on actual loss history between 2008 and 2012. Although U.S. community banks (with less than \$10 billion in assets) are not specifically required by regulators to run macro stress tests, those with high levels of commercial real estate lending are required to stress-test their portfolios. In addition, the banking industry has evolved quickly since 2009 to incorporate stress-testing as a routine part of risk management. The resources presented here allow community banks to quickly and costlessly adopt macro stress testing as part of their risk-management toolkit.

These resources were originally developed as a service to Arkansas community banks, but I have expanded the scope in the hope that they will benefit all U.S. community banks.

© Copyright - Timothy J. Yeager, 2017. This manual and the two accompanying spreadsheets may be freely downloaded from <http://finance-dev2.uark.edu/community-bank-stress-test.php> Reference to the model should be cited as Yeager, T.J. (2016) Community Bank Stress Test Model.

I. Getting Started

You should have downloaded [three files from this web page](#). If not, download the files before proceeding.

1. The first (pdf) file, the one you are now reading, is “Community Bank Stress Test Manual.pdf.” It provides the instructions to build a community bank stress test specific to your bank.
2. The second (Excel) file is “Generate Your Bank Stress Test.xlsm.” This is a macro-enabled file that will allow you to run a stress test specific to your bank beginning with the year 2016 financial data. You will use this file to transfer key data to another Excel spreadsheet file to build your own stress-test model.
3. The third (Excel) file is “My Bank Stress Test Template.xlsx. This is the file that you will use to customize and run your bank-specific stress test.

II. Running the 2016 Stress Test for Your Bank

Open the file “Generate Your Bank Stress Test.xlsm” file. With this file, it is possible to run a stress test for any US community bank beginning with 2016 as Year 0 (Y0). Enable the worksheet to run the macros—don’t worry, the file will not harm your computer. Click on the “Inputs” worksheet. As in Exhibit 1, you will see year-end 2016 call report information for the fictitious myCommunityBank with FDIC Cert #1. Click on the “Run Stress Test” button at the top of the worksheet.

myCommunityBank			
Call Report Date: Year 0 of Simulation		Metropolitan Statistical Area	
Year:	2016	myMSA	
Quarter:	4		
Cert	COHORT	PCTL Loss Rate	Asset Growth Rate
1	MSA	90%	3.0%
Enter dollar amounts as year-to-date			
Commercial Real Estate	Loan Amount (\$000s)	Annual Interest rate (%)	YTD net losses (\$000s)
MULTIFAM	57,296	3.50%	69
NFR-Other	143,979	3.50%	755
NFR-Owner Occupied	178,590	3.50%	154
FARM	0	3.50%	0
CLD-Other	36,299	3.50%	113
CLD-Residential	7,875	3.50%	33
Other Loans & Securities	Asset Amount (\$000s)	Annual Interest rate (%)	YTD net losses (\$000s)
Mortgages	198,888	6.33%	1,639
Consumer	233,220	2.74%	437
Commercial & Industrial	70,071	2.99%	2
Agricultural	0	2.99%	0
Other Loans	7,453	6.33%	0
Securities	217,572	2.44%	
Federal Funds Sold	0	0.03%	
Interest Bearing Balances	6,215	0.02%	

You will see the stress test input box appear as in Exhibit 2.

Exhibit 2. Stress Test Dialog Box

Community Bank Stress Test Inputs

1. Enter FDIC CERT Number: 1

BANK NAME	myCommunityBank
STATE	OH
RURAL/METRO	MSA
CBSA	myMSA

2. Select geographical cohort used to compute loan chargeoff rates

	Number in cohort
<input type="radio"/> CBSA: all community banks in your Core Based Statistical Area	9
<input type="radio"/> RURAL: all community banks in your state headquartered in rural areas (not in MSAs)	77
<input checked="" type="radio"/> MSA: all community banks in your state with headquarters in MSAs	69
<input type="radio"/> STATE: all community banks in your state	146

3. Chargeoff rate loss percentile (default=90%): 90 %

4. Annual asset growth rate (%): 3 %

Optional:

- ☐ Securities gains are recurring (as opposed to one-time)
- ☐ Dividend payments are fixed dollar amount (as opposed to % of income)

Proceed **Cancel**

There are four key inputs required to run your community banks' initial stress test.

1. *Enter the FDIC cert number.* The information box on the top right of the dialog box will update to reflect the bank's name, state, the rural/metro status of the bank's headquarters, and the Core Based Statistical Area (CBSA) of the headquarters.
2. *Select the geographic cohort to use to compute loan chargeoff rates.* This is the group of banks that are used to compute chargeoff rates that may be likely to replicate your bank's losses under an adverse 5-year horizon such as the one experience between 2008 and 2012. The choices are
 - a. CBSA, which includes all community banks in your CBSA. A CBSA is a combination of counties that can be a Micropolitan or Metropolitan area. Micropolitan areas are rural; Metropolitan areas are urban.
 - b. RURAL, which includes all community banks in your state headquartered in rural areas.
 - c. MSA, which includes all community banks in your state headquartered in an MSA.
 - d. STATE, which includes all community banks headquartered in your state.

A minimum of 20 community banks in your cohort are required each year between 2008 and 2012 to produce statistically reliable loan loss rates. A particular cohort is unavailable (grayed out) if fewer than 20 banks are available. For example, the CBSA option is unavailable for myCommunityBank because an average of nine community banks existed in that CBSA during those years.

If the CBSA option is available to click, that may be the most appropriate selection for your bank because the banks in your CBSA are likely to be in the closest competition with your bank in your market, and the chargeoff rates of these banks during the 2008-2012 period reflect realistic representations for how high your bank's chargeoffs could rise in a severely adverse scenario. If CBSA is unavailable, the next best selection may be RURAL if your bank is headquartered in a rural area; and MSA, if your bank is headquartered in an MSA. If an insufficient number of community banks exist in your state to select the rural or MSA cohort, the remaining option is to select all community banks headquartered in your state.

Because myCommunityBank is in an MSA and CBSA is grayed out for an insufficient number of banks, we select the MSA option.

3. *Chargeoff rate loss percentile.* By clicking the spinner, you can raise or lower the percentile of the cohort's chargeoff rates by 5 percentage point increments. The maximum loss percentile (and the default value) is 90% and the minimum is 50%. A value of 90% means that the chargeoff rates for each of your bank's loan types for years one through five (Y1-Y5) will equal the 90th percentile chargeoff rates of all the banks in your cohort for the years 2008 through 2012, respectively. A value of 50% means that the chargeoff rates will be at the median values of the banks in your cohort. Higher values produce more severe stress tests.
4. *Annual asset growth rate.* The final key input to run the stress test is your bank's average annual growth rate through the simulation's five-year horizon. The growth rate can range from 0% to 20%, and the default value is 3%. You should choose the value that reflects a realistic annual growth rate of your bank's assets during an adverse scenario.
5. *Optional inputs.* By default, any securities gains earned by your bank are assumed to be one-time gains. If they are recurring, select the checkbox. In addition, dividend payments are assumed to be a fixed proportion of the bank's net income. If instead, dividends are likely to be a fixed dollar payment (even under adverse conditions), select that checkbox.

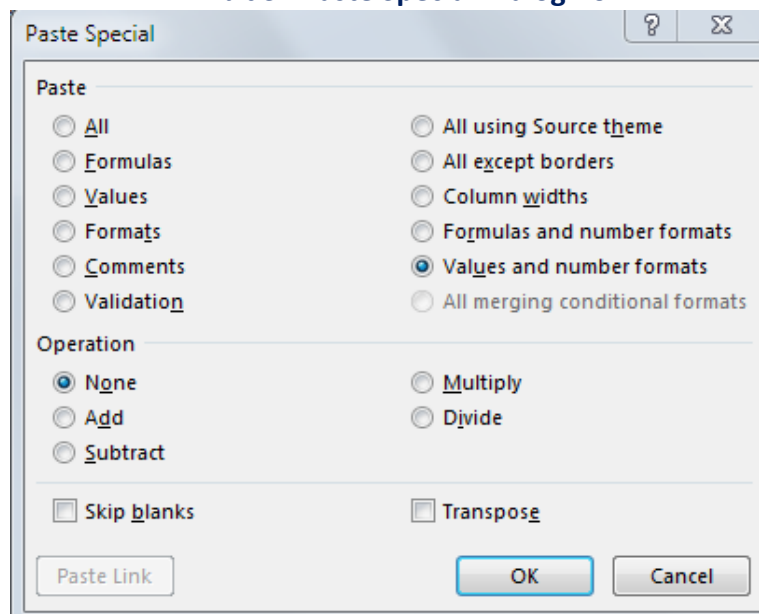
Once you have selected your bank's stress-test inputs, click the "Proceed" button. You will be taken to the "Results" worksheet, which contains the stress test report, which we discuss below. We emphasize that the stress test is not designed to forecast or predict any bank's *actual* performance. Rather, the results represent a realistic worst-case outcome based on the worst-case outcomes of banks in the cohort. Save the file to preserve your work. However, you can reproduce your results any time by opening the file and repeating the steps above.

III. Transferring data to your bank's stress test template

Now open the file called "My Bank Stress Test Template.xlsx." This is the Excel spreadsheet that you will use to run your bank's stress test over any time period that you wish using any chargeoff rates that you choose. The first task is transfer the relevant data values from the macro-enabled file to this file.

In the "Generate Your Bank Stress Test.xlsm" file, go to the ProjectedLossRates worksheet. This worksheet contains the projected chargeoff rates for Y1 through Y5 at the loss percentile you specified for your bank's cohort based on data from 2008 through 2012. In the myCommunityBank example, the loss percentile was 90% and the cohort was all the banks headquartered in MSAs in the state of Ohio. Copy the chargeoff rates from the "Generate...xlsm" file in Range (B3:F13), and paste them as values into the same Range on the ProjectedLossRates worksheet in the "My Bank Stress Test Template.xlsx" file. Exhibit 3 shows Excel's Paste Special dialog box available from the menu bar (or Ribbon). By clicking on the 'Values' or 'Values and number format's radio button, you will transfer only the values (and not the links) to the spreadsheet. These values will serve as the initial stressed chargeoff rates by loan type and year for your bank's stress test.

Exhibit 3. Paste Special Dialog Box



Now return to the Inputs worksheet in the "Generate Your Bank Stress Test.xlsm" file. Copy the shaded cells with your bank's call report data for year-end 2016 into the Inputs worksheet of the "My Bank Stress Test Template.xlsx" file. Once again, be sure to paste only the values so that you avoid embedding unwanted links and checkboxes into the file. The simplest approach is to copy and paste values for Range (B4:D25) first, then for Range (B28:B38).

Go to the Results worksheet in both of the open Excel files. You should see that the results are identical in both workbooks. If not, check that the asset growth rate value and the checked status of the two checkboxes are the same in both files. If the results are still different, repeat the steps above.

IV. Customizing your stress test model

Your “My Bank Stress Test Template.xlsx” file is now ready for use. In fact, you have already run one stress test based on the choices you selected in “Generate Your Bank Stress Test.xlsm” file. We are finished with that file and you are welcome to close it if you wish.

1. Base Year Updates

Updating your stress test model for a time period other than year-end 2016 is simple. On the Inputs worksheet, enter the call report values into the shaded boxes for the quarter you wish to use as Y0. The “DataSources” worksheet provides the call report variable names for each of the requested data values as taken from FFIEC Form 031. For example, the amount of multifamily commercial real estate loans to enter into Cell B10 comes from the call report variable RCFD1460. Note that the values to enter for banks using FFIEC Form 041 are slightly different.

In addition, all income and loan loss values are entered as year-to-date (YTD). The stress test automatically annualizes these values. Consequently, it is critical to ensure that you have entered the correct quarter into Cell B5 so that the spreadsheet annualizes the data correctly.

2. Projected loss rates updates

The PCTL Loss Rate value in Cell C7 on the Inputs worksheet has no effect on the chargeoff rates used in the stress test. This percentile value is for information purposes only. The actual chargeoff rates are listed in the ProjectedLossRates worksheet.

You may wish to update your bank’s projected loss rates for years 1 to 5 on the ProjectedLossRates worksheet. You can either enter the chargeoff rates directly into the worksheet, or you can re-run the stress test in the “Generate Your Bank Stress Test.xlsm” file, and choose a different cohort and/or percentile for the simulation. After running the simulation, copy the new chargeoff rates values into your workbook on the ProjectedLossRates worksheet.

V. Interpreting your stress test results

Once you have customized the data for the stress test, perhaps by using call report data from year-end 2015 and/or adjusting the projected loss rates, the Results worksheet will contain the output. Exhibit 4 represents the myCommunityBank stress test output using year-end 2016 as Year 0, a growth rate of 3%, a loss percentile of 90%, and the MSA cohort.

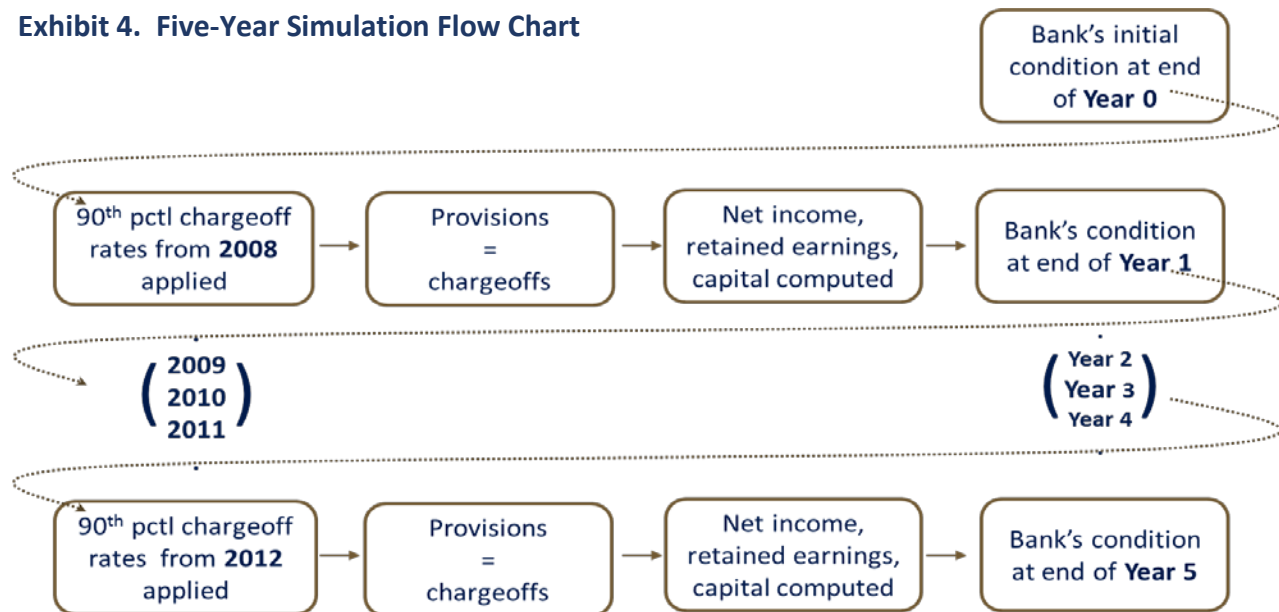
The stress test assumes that each community bank:

- maintains its initial Y0 asset composition except that charged off loans are not replaced;

- sets provision expense equal to net chargeoffs each year; and
- pays dividends equal to its initial dividend to net income ratio (or to its fixed dollar amount) if net income is positive, and \$0 if the bank suffers losses.

In addition, the (90th percentile) chargeoff rates between 2008 and 2012 derived from the bank's cohort are used to project your bank's chargeoff rates during the five-year stress test horizon. The flow chart in Exhibit 4 illustrates the logical progression of the simulation.

Exhibit 4. Five-Year Simulation Flow Chart



Stress test results appear in the Results worksheet in the report titled “myCommunityBank Stress Test Results,” and the balance sheet, income statement, and chargeoff rates are illustrated in Exhibit 5. We emphasize key patterns in the results to enhance your intuition about the model's logic.

- First, the initial balance sheet and chargeoffs in Y0 should exactly match your call report data. For example, myCommunityBank at year-end 2016 has (in \$000s) \$1,235,679 in assets, \$933,671 in loans, \$128,988 in equity, and \$3,202 in net chargeoffs.
- Second, the income statement should closely approximate your bank's actual reported income. The results may not match exactly because interest income is estimated based upon the yields and loan amounts entered in the Inputs worksheet. Consequently, net income and ROA may be slightly higher or lower than reported ROA.
- Third, the annualized net chargeoff to loan ratios in Y1 through Y5 equal the projected chargeoff rates listed in the ProjectedLossRates worksheet. These chargeoff rates are the critical inputs of the model, and they should reflect realistic values for your bank. Recall that projected chargeoff rates by loan type for myCommunityBank came from the 90th

percentile chargeoff rates between 2008 and 2012 for all banks headquartered in MSAs in Ohio. If the values obtained from the “Generate Your Bank Stress Test.xlsm” file are not representative of a reasonable severely adverse scenario, you should change them to reflect more appropriate worst-case chargeoff rates.

Exhibit 5. Partial Stress Test Results

my Community Bank Stress Test Results						
Cert: 1	Metropolitan Statistical Area:					my MSA
Loan Loss Cohort:	MSA	Percentile Loss Rate:		90%	Growth rate:	3.0%
Balance Sheet (\$000s)	Y0	Y1	Y2	Y3	Y4	Y5
Interest Bearing Balances	6,215	6,401	6,593	6,791	6,995	7,205
Federal Funds Sold	0	0	0	0	0	0
Securities	217,572	224,099	230,822	237,747	244,879	252,226
Total Loans	933,671	950,895	960,139	968,103	978,733	992,484
LLR	17,416	17,737	17,910	18,058	18,257	18,513
Net Loans	916,255	933,157	942,229	950,045	960,477	973,971
Total Earning Assets	1,140,042	1,163,658	1,179,645	1,194,583	1,212,351	1,233,402
Non-Earning Assets	95,637	97,618	98,959	100,212	101,703	103,469
Total Assets	1,235,679	1,261,276	1,278,604	1,294,795	1,314,054	1,336,870
Liabilities	1,106,691	1,131,300	1,151,342	1,171,143	1,192,279	1,215,042
Equity	128,988	129,976	127,263	123,652	121,775	121,828
Net Chargeoffs (annualized in \$000s)	Y0	Y1	Y2	Y3	Y4	Y5
Net chargeoffs	3,202	10,787	19,282	20,840	18,413	15,611
Income Statement (annualized in \$000s)	Y0	Y1	Y2	Y3	Y4	Y5
Interest income	41,718	42,591	43,218	43,766	44,394	45,167
Interest expense	4,789	4,888	4,955	5,018	5,093	5,181
Net Interest Income	36,929	37,703	38,263	38,748	39,301	39,986
Noninterest expense	35,090	35,817	36,309	36,769	37,316	37,964
Noninterest income	12,999	13,268	13,451	13,621	13,823	14,064
Provision	3,113	11,108	19,455	20,989	18,611	15,868
Securities & Extraordinary gains	-5	0	0	0	0	0
Operating income	11,720	4,046	-4,050	-5,389	-2,802	218
Taxes	3,379	1,335	-1,337	-1,778	-925	72
Net income	8,341	2,711	-2,714	-3,610	-1,877	146
Dividend Payout	5,300	1,723	0	0	0	93
Retained Earnings	3,041	988	-2,714	-3,610	-1,877	53
Annualized Net Chargeoffs to Loans (%)	Y0	Y1	Y2	Y3	Y4	Y5
Commercial Real Estate	0.27%	0.73%	1.54%	1.79%	2.16%	1.16%
Multifamily	0.12%	0.77%	0.59%	0.84%	3.30%	0.68%
NFR-Other	0.52%	0.25%	2.66%	1.85%	1.56%	1.22%
NFR-OwnerOccupied	0.09%	1.25%	0.99%	1.26%	0.97%	0.91%
Farm	0.00%	0.00%	0.00%	0.00%	0.02%	0.00%
CLD-Other	0.31%	0.00%	1.25%	5.70%	8.00%	3.14%
CLD-Residential	0.42%	0.34%	0.60%	0.00%	3.17%	0.32%
Residential Mortgages	0.82%	0.63%	0.78%	1.39%	1.26%	0.98%
Consumer	0.19%	1.95%	3.38%	3.00%	1.86%	2.64%
Commercial & Industrial	0.00%	1.95%	3.44%	3.52%	1.86%	1.99%
Agriculture	0.00%	0.66%	0.36%	0.09%	0.02%	0.05%
Other Loans	0.00%	3.49%	1.88%	1.24%	1.66%	3.32%
Net chargeoffs to total loans	0.34%	1.13%	2.01%	2.15%	1.88%	1.57%

- Fourth, between Y1 and Y5, provision expense in a given year equals chargeoffs in that year plus a buffer to account for loan growth. For example, myCommunityBank is projected to have \$10,787 chargeoffs in Y1. Provision expense is allocated to replenish those chargeoffs and to account for the loan growth of 1.84%, which keeps the ratio of loan loss reserves (LLR) to total loans unchanged throughout the simulation.
- Fifth, dividend payments are computed to equal the Y0 ratio of dividends to net income. (If the “Dividends are fixed dollar amount each period as opposed to percent of income” checkbox is checked, then dividend payments equal the initial Y0 dollar amount.) If net income is negative, then dividends are set to \$0. myCommunityBank has an initial dividend payout of 64%, but when net income is negative in years two through four, no dividends are paid.

The critical stress-test results are the five-year projections of ROA and equity to assets, found in the Profitability and Capital section of the report and listed in Exhibit 6. For this bank, the equity to asset ratio is projected to decline from 10.44% in Y0 to 9.11% in Y5. The capital declines because ROA is negative in years two through four. Nevertheless, myCommunityBank has sufficient capital to weather this severely adverse scenario. In general, an equity ratio less than 6% would signal that the bank has a capital level that is becoming uncomfortably low. An equity ratio less than 2% signals that a bank is on the verge of failure.

my Community Bank Stress Test Results						
1						
2	Cert: 1	Metropolitan Statistical Area:				my MSA
3	Loan Loss Cohort:	MSA	Percentile Loss Rate:		Growth rate:	3.0%
49	Profitability and Capital (%)	Y0	Y1	Y2	Y3	Y4
50	ROA (annualized)	0.68%	0.21%	-0.21%	-0.28%	-0.14%
51	ROE (annualized)	6.47%	2.09%	-2.13%	-2.92%	-1.54%
52	Equity to assets	10.44%	10.31%	9.95%	9.55%	9.27%
						9.11%

A series of charts are also available to assess your bank’s stress-test performance. Click on the ROA, ROE, Capital, Net Chargeoffs, Chargeoffs by Loan Category, and Chargeoffs by CRE Category to view the different charts.

VI. Summary

This manual plus the two Excel spreadsheet files contain the tools necessary for your community bank to quickly build a unique, customizable stress test model. The stress test is designed to assess the ability of your bank’s current capital to withstand a severely adverse shock to loan chargeoffs, and to incorporate a macro stress test into your risk-management toolkit.