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Does the Dodd-Frank Act Stress Test improve bank equity risk and liquidity risk?

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ABSTRACT

This paper attempts to fill the gap in the existing literature on stress tests by investigating the effects of the Dodd-Frank Act Stress Tests (DFAST) on bank equity risk and core deposits. The former signals future cash flows while the latter acts as a buffer for banks when market liquidity becomes scarce. Using a difference in difference model for the period 2013-2018, I find that the implementation of the DFAST reduces bank equity risk and increases the amount of core deposits held at the stress-tested banks. The findings show that the stress tests fulfill their primary goal of improving banks' risk exposure and liquidity management, thereby promoting sound financial conditions in the banking industry.

Keywords: Stress Test, Liquidity Risk, Banking, Financial Markets.
JEL Classification: C55, C58, E44, E51, G21, G32

1.0 Introduction

The financial crisis of 2008 raised attention to the catastrophic consequences of systemic risk in the financial sector. Prominent banks had become "too big to fail," imposing severe risk in the financial sector and the whole economy as a result. In response to the crisis, Congress passed the Dodd-Frank Wall Street Reform and Consumer Protection Act (hereby the Dodd-Frank Act) in 2010, offering substantial changes in regulation and supervision of financial institutions. Starting from 2013, banks with total consolidated assets of more than $10 billion are required to conduct an annual stress test given by the Federal Reserve. The purpose of the Dodd-Frank Act stress tests (DFAST) is to gauge if banks have enough capital to survive unfavorable economic conditions while still being able to provide credit to the economy. The results of the stress tests are released in June each year to the public, providing transparent information about prominent banks in the U.S.

This paper attempts to fill the gap in the existing literature on stress tests by investigating the effects of the DFAST on bank equity risk and core deposits. Constructed from stock returns, equity risk reflects volatility in a bank's stock price, signaling its future cash flows and credit conditions (Rego, Billet and Morgan, 2009). Core deposits, on the other hand, are a stable source of financing for banks especially during a crisis when market liquidity dries up (Cornett et al., 2011). The two measures indicate a bank' financial heath and its ability to weather adversities. Hence, is important to study whether or not the implementation of the DFAST improves bank equity risk and core deposits, promoting a sound banking system in the U.S. as a result. To the best of my knowledge, no research has been done on this topic. Existing papers in the related literature have paid considerable attention to the effects of stress tests on bank lending and the reactions of financial markets to the tests. For the former, most studies found that the DFAST decrease credit supply and raise interest rates on business loans (Acharyam, Berger and Roman, 2018; Cortés et al., 2020; Chen et al., 2017). For the latter, the majority of studies concluded that the disclosure of the test results improves asymmetric information and

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opaqueness in financial markets (Acharyam, Berger and Roman, 2018; Cortés et al., 2020; Acharya, Engle and Pierret, 2014).

To analyze the effect of the stress test on bank equity risk, I construct the variable using stock returns. In detail, bank daily stock returns are regressed on daily market returns. Equity risk is then calculated as the standard deviation of error terms. By construction, equity risk is the idiosyncratic risk, reflecting the performance of individual banks. Moving to the impact on core deposits, I build the series using data from the Call Report. Finally, a standard difference in difference (DID) model is used to study the effects of the stress tests on bank equity risk and core deposits.

I find that banks participating in the stress tests experience less equity risk, implying less volatility in their capital and future cash flows. The tests, therefore, achieve their main objective of creating a safer and more stable banking system. Moreover, I find that the DFAST have a positive and significant effect on the core deposits of tested banks. By holding more deposits, those banks have a greater ability to survive unfavorable economic circumstances. The results of this paper offer an important policy implication on the ongoing debate on whether or not the government should lift its regulations on big banks. Since mandatory stress tests on major banks are proven to be effective in maintaining the health of the banking industry, the government should continue its monitoring role in the industry to prevent another catastrophic "too big to fail" event.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 introduces the DFAST. Section 4 discusses the model and data. Section 5 reports the results. Section 6 concludes.

2.0 Stress Test related literature

A number of studies have been done on the effects of stress tests on the banking industry. The first strand of the literature focuses on how stress tests affect banks' risk management, mainly credit risk and liquidity risk. Acharyam, Berger and Roman (2018) investigate whether stress tests reduce loan supply to large corporates and increase loan prices to risky borrowers. A difference in difference model is applied to estimate the effects of stress tests on the amount of loans and price of loans to large businesses. They find that due to the implementation of stress tests, credit supply to large corporates is negatively affected, especially to risky borrowers. Their finding is consistent with the Risk Management Hypothesis, under which banks decrease lending to risky borrowers to reduce credit risk.

Cortés et al. (2020) examine the consequences of stress tests on lending to small businesses. They calculate the stress-test exposure, which is the difference between the starting value of the capital ratio at the beginning of the test and the minimum capital ratio projected by the severely adverse scenario. The result is that stress tests decrease credit supply to all small businesses with a larger effect on risky borrowers. Additionally, due to stress tests, small businesses experience higher interest rates on loans. Calem, Correa, and Lee (2020) provide similar evidence in the market for jumbo mortgages as the share of jumbo mortgage originations and approval rates decline at stress-tested banks. Basett and Berrospide (2017) study the impact of stress tests on loan growth rate. They construct a stress test measure, which is the difference between the minimum capital ratios in the supervisory and the bank holding companies' (BHCs) own stress tests. The result is that stress tests do not have any significant effect on the growth rate of loans. Similarly, Chen et al. (2017) show a sharp decline in lending at the largest banks who participate in the stress tests. Cappelletti, Fernandes, Marques (2019) use a difference in difference estimator and find that European banks respond to the stress tests by reducing their lending and risk taking to households and corporates.

Another strand of the literature pays attention to the reactions of financial markets to the release of the stress test results. Goldstein and Leitner (2018) develop a theoretical model to study if disclosing stress test results is optimal for financial markets. They find that during normal times no disclosure is optimal as too much information destroys risk-sharing opportunities. However, during bad times partial disclosure is optimal since it helps prevent a market turmoil. The closest paper to mine is the study of Peristian et al. (2014). They use standard event study techniques to assess the impact of stress tests on banks' daily stock returns. The event is the release of the first stress test results in 2009. Average cumulative abnormal returns (CAR) of each bank's stocks is calculated over three days: day before the event, event day, and day after the event. For 18 stress-tested banks, the authors separate them into two groups: passing the test and not passing the test. For the latter group, capital gap is calculated as the difference between the projected capital level obtained from the stress test under the adverse scenario minus the standard capital ratio determined by supervisors for each bank.

Peristian et al. (2014) find that larger capital gaps result in more negative abnormal returns for banks. The finding suggests that stress tests are informative to investors and help mitigate bank's opacity. Petrella and Resti (2013) confirm the results found in Peristian et al. (2014) for European Union stress tests. Cappelletti, Fernandes, Marques (2019) state that the disclosure of the stress test results reinforces the supervisory and market discipline. Additionally, Sahin, Haan, Neretina (2020) suggest that the publication of stress test results decreases U.S. banks' systemic risk. Fernandes, Igan and Pinheiro (2020), on the hand, apply the event study techniques but find that public disclosure of stress tests does not improve information asymmetry and uncertainty in financial markets.

In this paper, I contribute to the literature by addressing the effects of DFA stress tests on bank equity risk and core deposits using a difference in difference model.

3.0 The Dodd-Frank Act Stress Tests

The DFA requires the Federal Reserve to conduct annual stress tests on state nonmember banks and state savings associations whose total consolidated assets are more than $10 billion. The test is designed to assess how well large banks in the economy would absorb potential losses under unfavorable economic conditions, while still having the ability to fulfill their debt obligations and continue to lend to households and businesses. The stress test started with 18 BHCs and increased to 35 BHCs in 2018. Participants of the test include domestic as well as foreign-owned banks in the U.S. Table 1 lists the BHCs included in the stress tests from 2008 to 2018. On the test, the Federal Reserve designs three hypothetical economic scenarios: baseline, adverse, and severely adverse. Each scenario includes 28 variables capturing economic activities in the economy, such as real gross domestic products (GDP), asset prices, interest rates, and U.S./foreign currency exchange rates. To consider the integration of the global economy, economic variables in the Euro area, the United Kingdom, Japan, and developing Asia are included as well.

3.1 The adverse scenario

The U.S. economy experiences a moderate recession in which real GDP decreases by 2 percent, the unemployment rate increases by 7 percent. In addition, the recession is accompanied by higher long-term interest rates, steeper yield curves in the U.S. and all other countries in the sample. Asset prices fall by nearly 40 percent and volatility rises in the equity market. In the housing market, house prices decline by 12 percent, and real estate prices fall by 15 percent. Global demand decreases, leading to a lower rate of inflation in all foreign countries. The U.S. dollar appreciates against the euro, the pound, the currencies of developing Asia, whereas it depreciates against the yen. The U.S. economy recovers after four quarters in this scenario.

3.2 The severely adverse scenario

The global economy is in a severe recession. The U.S. economy experiences a 6 percent decrease in real GDP, 10 percent increase in unemployment rate. Asset prices drop by 50 percent. House prices and real estate prices fall by 25 percent and 35 percent, respectively. This scenario is also featured by a sharper increase in long-term interest rates and a steeper yield curve compared to the adverse scenario. Exchange rates of the U.S. dollar and other foreign currencies move in the same directions yet with a larger magnitude in relation with the adverse scenario. The recession lasts for four quarters.

3.3 Analytical framework and models

The effects of the adverse and severely adverse scenarios on the regulatory capital ratios of all participating BHCs are estimated. The Federal Reserve predicts changes in the balance sheet, risk-weighted assets (RWAs), net income, and resulting capital of the BHCs due to changes in economic conditions under each scenario. To get the projection of net income, BHCs' revenues, expenses, and losses of loans are estimated. Two methods are applied to measure losses on loan portfolio. The first method calculates the default probabilities on loans, losses given default, and exposure at default under the macroeconomic conditions in each hypothetical scenario. The expected losses are the product of these components.

The second method uses the history of how net charge-offs on loans behave as the macroeconomic and financial environment changes. The projected impact of the scenarios on the balance sheet growth is obtained using a common framework, which incorporates historical data on bank balance sheets from the Federal Reserve. BHCs subject to the stress test are required to submit data on their balance sheets, loans, and securities material information for all portfolios through the Capital Assessment and Stress Testing (FR Y-14A/Q/M) by the end of the prior year to the release of the test results. Five regulatory capital measures in the stress test are the common equity tier 1, tier 1 risk-based capital, total risk-based capital, tier 1 leverage, and supplementary leverage ratios. The projections of loan losses, revenue, net income, and capital measures are reported for the two scenarios, adverse and severely adverse. To pass the test, BHCs have to meet the minimum requirements of all five capital ratios.

4.0 Data and model specification

4.1 Data

To examine the effects of DFAST on bank equity risk, I select a sample of 100 largest publicly traded banks in the U.S. based on their consolidated assets at the beginning of each year from 2008 to 2018. All the Dodd-Frank stress-tested banks during this time period are included in the sample. There are a couple of reasons for choosing large banks. First, all the stress-tested banks are the largest in the U.S. Thus, comparing them to the next largest ones provides the most accurate estimate of the effect of the tests. Second, daily stock returns of large banks are available and reliable given the trade frequency.

After selecting the top 100 banks, I exclude banks that participated in a merger or acquisition (M&A) during the year of the deal. Speculation about M&A deals can potentially generate a great amount of stock volatility for acquirers and targets that is unrelated to banks' basic risks, such as liquidity risk and credit risk, and the implementation of the stress tests. Quarterly data on banks are downloaded from the Call Reports. Data on banks' daily stock returns and market returns are obtained from the Center for Research in Security Prices (CRSP) database. Table 2 summarizes the statistics for all variables included in the regression.

Table 1.

List of participants in DFA Stress Tests between 20013-2018.

BHC Name	2013	2014	2015	2016	2017	2018
Ally	1	1	1	1	1	1
American Express	1	1	1	1	1	1
Banc West	0	0	0	1	1	0
Bank of America	1	1	1	1	1	1
Bank of NY-Mellon	1	1	1	1	1	1
BB&T	1	1	1	1	1	1
BBVA	0	1	1	1	1	1
BMO	0	1	1	1	1	1
Capital One	1	1	1	1	1	1
CIT	0	0	0	1	1	0
Citigroup	1	1	1	1	1	1
Citizens	0	1	1	1	1	1
Comerica	0	1	1	1	1	0
DBTC	0	0	0	1	1	1
Deutsche Bank Trust Corporation	0	0	1	1	0	0
Discover	0	1	1	1	1	1
Fifth Third	1	1	1	1	1	1
Goldman Sachs	1	1	1	1	1	1
HSBC	0	1	1	1	1	1
Huntington	0	1	1	1	1	1
JPMorgan Chase	1	1	1	1	1	1
KeyCorp	1	1	1	1	1	1
M&T	0	1	1	1	1	1
Morgan Stanley	1	1	1	1	1	1
MUFG Americas	0	1	1	1	1	1
Northern Trust	0	1	1	1	1	1
PNC	1	1	1	1	1	1
Regions	1	1	1	1	1	1
Santander	0	1	1	1	1	1
State Street	1	1	1	1	1	1
SunTrust	1	1	1	1	1	1
TD Group	0	0	0	1	1	1
U.S. Bancorp	1	1	1	1	1	1
Wells Fargo	1	1	1	1	1	1
Zions	0	1	1	1	1	0

Table 2.

Data description.

Variable	Observations	Mean	Standard Deviation
Equity Risk	3832	0.02	0.02
Stress-Tested Bank × Time	3870	0.18	0.38
Log (Assets)	3870	7.54	0.93
Liquid Assets	3870	0.02	0.19
Illiquid Assets	3870	0.67	0.22
Credit	3870	0.64	0.22
Deposits	3870	0.61	0.19
Commitment Ratio	3870	0.21	0.22
Equity Capital	3870	0.13	0.13

4.2 Model specification

I apply a difference in difference (DID) model to examine the effects of the DFAST on bank equity risk. This approach is widely used in the recent banking literature (Duchin and Sosyura, 2014; Berger, Roman, et al.,

2017, Acharya, Berger, and Roman, 2018) to study the impact of policy changes on banks' performances. The treated group is the equity risk of all BHCs that are subject to the DFAST, and the control group is the equity risk of remaining banks in the selected 100 banks. The following regression for equity risk of bank i at time t is estimated:

$$Risk_{it} = \beta_0 + \beta_1 \times Stress\ Tested\ Bank_i \times Time + \beta_2 \log(Assets) + \beta_3\ Liquid\ Assets + \beta_4\ Illiquid\ Assets + \beta_5\ Credit + \beta_6\ Deposits + \beta_7\ Committment\ Ratio + \beta_8\ Equity\ Capital + \beta_9\ Bank\ FE + \beta_{10} Quarter\ FE + \varepsilon_{it} \quad (1)$$

4.3 Dependent variable: Bank equity risk

A bank's daily stock returns, R_{it}, are regressed on daily market returns, S&P 500 index, as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (2)$$

Thus, the residuals are given by:

$$\widehat{\varepsilon_{it}} = R_{it} - \left(\widehat{\alpha_i} + \widehat{\beta_i} R_{mt}\right) \quad (3)$$

Next, the standard deviation of the residuals is calculated. It is a bank's idiosyncratic equity risk, which is used as the measure of bank equity risk in this paper. A bank's quarterly equity risk is the simple average of its daily risk.

4.4 Explanatory variables

$Stress\ Tested\ Bank_i \times Time$ is the main variable of interest. Stress-Test Bank is a dummy variable, which is equal to one if the bank is required to take the DFAST and zero otherwise. Time is a dummy equal to one in 2013-2018, the period after the implementation of the stress tests, and zero otherwise. I expect the coefficient of the interaction term, β_1, to be negative. Stress tests provide investors with transparent information about the health of participating banks, improving the incomplete information problem. As a result, the introduction of the DFAST should reduce banks' stock volatility or equity risk. *Log (Assets)* is expected to have a negative effect on bank equity risk as banks with more assets signal positive future earnings and their ability to weather adversaries.

Next, three measures of bank liquidity risk management, including *Liquid Assets* and *Deposits*, should negatively impact bank equity risk. They act as buffers to prevent banks from facing a liquidity crisis and provide a stable source of financing during a crisis. *Commitment Ratio*, on the other hand, exposes banks more to liquidity risk. Banks with many unused loan commitments might experience an unexpected increase in demand for loans by many borrowers simultaneously, especially during a crisis when the availability of liquidity market dries up. Banks with more illiquid assets should experience more equity risk since illiquid assets are more difficult to convert into cash, sending a negative signal about a bank's solvency. Thus, β_4 is expected to be positive.

5.0 Empirical results

Table 3 reports the results of the DFAST on bank equity risk. The sign of the estimate of the interaction term $Stress\ Tested\ Bank_i \times Time$ is negative as expected. Banks subject to the stress tests experience less equity risk. This finding is consistent with the literature (Peristian et al., 2014; Petrella and Resti, 2013). The stress tests require banks to hold an adequate ratio of capital in order to survive adverse economic circumstances. Stress-tested banks appear safer and more transparent to investors given that the results of the stress tests are publicly available. As a result, the banks' stock volatility or equity risk decreases.

Table 3.

Effects of DFA Stress Tests on Bank Equity Risk.

Variable	Estimate
Stress-Tested Bank x Time	-0.01***
Log(Assets)	-0.01***
Liquid Assets	-0.00
Illiquid Assets	-0.01*
Credit	0.01
Deposits	-0.06***
Commitment Ratio	0.01
Equity Capital	-0.03***

Notes: ***, **, * denote significance at the 1% level, 5% level, 10 % level, respectively.

Table 4.
Effects of DFA Stress Tests on Core Deposits.

Variable	Estimate
Stress-Tested Bank x Time	0.09***
Log(Assets)	0.03
Liquid Assets	0.13
Illiquid Assets	0.23***
Credit	-0.04
Commitment Ratio	-0.00
Equity Capital	0.04

Notes: ***, **, * denote significance at the 1% level, 5% level, 10% level, respectively.

Table 5.
Effects of DFA Stress Tests on Liquid Assets.

Variable	Estimate
Stress-Tested Bank x Time	0.00 Log(Assets)
	-0.03***
Deposits	0.10*
Illiquid Assets	-0.67***
Credit	-0.18***
Commitment Ratio	-0.09*
Equity Capital	-0.08**

Notes: ***, **, * denote significance at the 1% level, 5% level, 10% level, respectively.

Moreover, the effect of the stress tests on bank equity risk is significant at one percent level. Assets also have a negative influence on bank equity risk as predicted. Banks with more assets possess less equity risk. Liquid assets, on the other hand, does not significantly affect bank equity risk. The finding implies that holding more liquid assets might help with managing liquidity risk but not equity risk. Strikingly, the effect of illiquid assets on bank equity risk is negative and significant. This result can be explained by the fact that illiquid signal strong future earnings for banks. Banks with a large amount of loans and mortgage-backed securities have high potential earnings. Thus, the volatility of stock returns is less. Credit and commitment ratio both have insignificant impacts on bank equity risk. Having many unused loan commitments might expose banks to more liquidity risk, not equity risk. Lastly, banks holding more equity capital enjoys less equity risk. Equity capital is the margin by which creditors will be covered if a bank's assets were liquidated. Thus, investors treat equity capital as one of the leading indicators of a bank's safety. When equity capital increases, investors consider the bank less risky, resulting in less volatility in stock returns.

Table 4 shows the estimates of the effects of the DFAST on core deposits. The stress tests have a significant and positive impact on deposits. Core deposits act as a buffer for banks when market liquidity becomes scarce. Thus, the tests encourage banks to hold more deposits to help them cope with unfavorable economic conditions that could lead to a liquidity crisis. Additionally, an increase in illiquid assets results in an increase in core deposits. As banks decide make more loans or invest in illiquid assets such as mortgage-back securities, they need to attract more deposits to finance these investments. Consider equity capital, I find that it positively affects deposits. Banks with more equity capital attract more deposits as they appear safer and more reliable to depositors. However, the effect is not significant. Finally, credit, commitment ratio, assets, and liquid assets do not have any significant influence on core deposits.

The results of the regression on liquid assets are presented in Table 5. The DFAST do not have any significant effect on the amount of liquid assets that banks hold. An increase in bank assets, however, decreases liquid assets. Besides minimizing liquidity risk, banks also seek high returns on their investments. Liquid assets normally offer low returns. Therefore, banks with plenty of assets are considered safe banks, and they tend to have fewer liquid assets. Deposits have a positive and significant effect on liquid assets. Banks with more deposits hold more liquid assets. Furthermore, illiquid assets negatively impact liquid assets as they are considered substitutes. Similarly, credit and commitment ratios reduce the amount of liquid assets since they both include illiquid assets. Finally, equity capital has a positive and significant influence on liquid assets. Bank equity capital and liquid assets are considered safety guards for banks against liquidity risk. Thus, banks with more capital are more willing to run down their other liquid buffer, liquid assets.

6.0 Conclusion

The financial crisis 2008 has put the banking industry on the spot light and posed the imminent need for new laws that could properly regulate banks, especially the "too big to fail" ones. The Dodd-Frank Act was passed in Congress in July 2010, providing a series of broad reforms in financial markets. This paper focuses on the Dodd-Frank Act stress test designed by the Federal Reserve to assess whether large BHCs have sufficient amount of capital to weather adverse economic conditions. Banks whose consolidated assets of more than 10 billion dollars are subject to the test. Banks are exposed to a number of risks, including credit risk, liquidity risk, equity risk, and market risk.

In this paper, I focus on the effect of the DFAST on bank equity risk. The public release of the stress test results provides investors and banks' stockholders more information about banks, affecting the volatility of their stock returns. To measure bank equity risk, I regress banks' daily stock returns on market returns. Bank equity risk is the standard deviation of the error terms of the regression. A difference in difference model is applied to study the impact of the implementation of the DFAST on bank equity risk.

The result is that the stress tests significantly help reduce bank equity risk. Moreover, I investigate if the stress tests improve banks' liquidity risk buffers, including deposits and liquid assets. Deposits are a stable source of funding for banks. Thus, banks with more deposits have a better chance of surviving unfavorable economic conditions. Liquid assets also measure the liquidity of a bank during a crisis. I find that the stress tests encourage banks to hold more core deposits. They, however, do not have any significant effect on liquid assets. The debates over the necessity of stress tests are current. Some economists and policymakers believe that the tests impose necessary regulations on banks and other financial institutions to improve transparency and safety in the banking industry and financial markets. Opponents of the tests argue that the policy burdens the banking sector with excessive rules and regulations, violating the free market principles, hurting economic growth as a result. My paper sheds some light on the effectiveness of the Dodd-Frank stress test on improving bank risks and liquidity risk management. It provides an important policy implication that the Dodd-Frank Act stress tests succeed in improving banks' risk exposure and management, facilitating sound financial conditions in the banking industry. Consequentially, stress tests are necessary to prevent the U.S. economy from another "too big to fail" catastrophe.

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