Journal of Monetary Economics 65 (2014) 36–53

Contents lists available at ScienceDirect

Journal of Monetary Economics

journal homepage: www.elsevier.com/locate/jme

Testing macroprudential stress tests: The risk of regulatory risk weights ☆

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ARTICLE INFO

Article history:
Received 1 February 2014
Received in revised form
22 April 2014
Accepted 24 April 2014
Available online 9 May 2014

Keywords:
Macroprudential regulation
Stress test
Systemic risk
Risk-weighted assets

ABSTRACT

We compare the capital shortfall measured by regulatory stress tests, to that of a benchmark methodology — the “V-Lab stress test” — that employs only publicly available market data. We find that when capital shortfalls are measured relative to *risk-weighted assets*, the ranking of financial institutions is not well correlated to the ranking of the V-Lab stress test, whereas rank correlations increase when required capitalization is a function of *total assets*. We show that the risk measures used in risk-weighted assets are cross-sectionally uncorrelated with market measures of risk, as they do not account for the “risk that risk will change.” Furthermore, the banks that appeared to be best capitalized relative to risk-weighted assets were no better than the rest when the European economy deteriorated into the sovereign debt crisis in 2011.

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1. Introduction

Since the financial crisis of 2007–2009, macroprudential stress tests have become a standard tool that regulators use to assess the resilience of financial systems. Macro stress tests have been designed to assist and facilitate macroprudential regulation, which essentially aims at preventing the costs of the financial sector's distress spreading to the real economy (Borio and Drehmann, 2009; Hirtle et al., 2009; Acharya et al., 2010; Hanson et al., 2011). Acharya et al. (2010) argue that such spillovers from the financial sector to the real economy arise when the financial sector as a whole is undercapitalized, limiting its capacity to intermediate industrial firms' functions. As part of the regulatory toolkit, macro stress tests should contain such (systemic risk) externalities by ensuring that the financial sector is sufficiently capitalized to continue financial intermediation in a severe economic downturn.

To simulate a severe economic downturn, regulators define a hypothetical stress scenario by specifying shocks to different macroeconomic and financial variables. The adverse scenario is translated into losses to assets on the balance sheet of banks using models that capture the sensitivity of banks' exposures to the stress scenario. These losses are assumed to be first borne by equity capital. The required capitalization of a bank is assessed using measures (the capital ratios) of the financial performance of the bank after application of the stress test model.

The current approach to assessing capital requirements is strongly dependent on the regulatory capital ratios defined under Basel Accords. The capital ratio of a bank is usually defined as the ratio of a measure of its equity to a measure of its

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☆ Prepared for the Carnegie Rochester Conference on Public Policy, November 15–16, 2013.

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http://dx.doi.org/10.1016/j.jmoneco.2014.04.014
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assets. A regulatory capital ratio usually employs book value of equity and *risk-weighted assets*, where individual asset holdings are multiplied by corresponding regulatory "risk weights." The regulatory capital ratios in stress tests help regulators determine which banks fail the test under the stress scenario and what supervisory or recapitalization actions should be undertaken to address this failure.

An annual supervisory stress test of the financial sector in the United States has become a requirement with the implementation of Dodd–Frank Wall Street Reform and Consumer Protection Act (Pub.L. 111–203, H.R. 4173) of 2010. Macroprudential stress tests have also been used by U.S. and European regulators to restore market confidence in financial sectors during an economic crisis. As a response to the recent financial crisis, the 2009 U.S. stress test led to a substantial recapitalization of the financial sector in the U.S. In Europe, the 2011 stress test also served as a crisis management tool during the European sovereign debt crisis. The European exercise lacked credibility in this role (Greenlaw et al., 2012), however, due largely to the absence of a clear recapitalization plan for banks failing the stress test.

An alternative approach for measuring the financial performance of a bank under stress is presented in Acharya et al. (2010, 2012) and Brownlees and Engle (2011). The proposed measure (*SRISK*) represents the expected amount of capital an institution would need to raise during an economic crisis to restore a target capital ratio. The crisis or stress scenario is defined by a 40% drop in the market equity index over six months. In these market conditions, *SRISK* is based on the assumption that the book value of the debt of the bank will remain constant, while its market capitalization will decrease by its expected six-month return conditional on the stress scenario, estimated from a bivariate model of the bank and the market returns. As the stress is on the market value of equity, this methodology — called "V-Lab stress test" — can be viewed as a mark-to-market stress test. The results of this benchmark for macroprudential stress tests are updated weekly on the Volatility Laboratory (V-Lab) website.[1]

The V-Lab stress tests have the advantage that they are inexpensive and non-invasive, as they require only publicly available data. They can show time series variations in financial sector capitalization. However, they do not show anything on financial institutions that are not traded and they do not reveal information on the weaknesses of financial institutions. The regulatory stress tests have large supervisory data requirements that provide sensitive information and are expensive to collect, analyze and maintain. The creation of scenarios for the tests is essentially a surprise to the sector as otherwise it will distort investment decisions. Thus the time series of regulatory stress tests is unlikely to reveal changes in bank capitalization. Fortunately, regulators can use more than one measure of financial health and it is our goal in this research to show the relationships between the outcomes and the benefits of combining these approaches.

In this paper, we compare the outcomes of stress tests performed by U.S. and European regulators to this benchmark methodology. Stress tests usually disclose two types of performance measures: the projected losses of a bank under the stress scenario and its required capitalization (measured by a capital ratio or a capital shortfall estimate) once these losses are taken into account. In addition, the average risk weight of a bank (the ratio of its risk-weighted assets to total assets) in the supervisory stress test is considered as a measure of the bank's asset risk under the stress scenario. We compare this risk measure with a market measure of asset risk implied by the V-Lab methodology, in particular to the "V-Lab risk weight," which assumes that banks whose market capitalization is predicted to shrink the most in the V-Lab scenario are the riskiest. The V-Lab risk weight is calculated in a top-down manner at the level of the entire bank, rather than bottom-up (i.e., asset by asset), as in the Basel risk-weighted approach.

Our comparisons reveal the following interesting results. First, the required capitalization in the V-Lab stress test appears always to be larger than in regulatory stress tests, but this contrast appears to be extreme in Europe, reflecting the low number of banks failing the supervisory stress test. As regulatory stress tests and the V-Lab stress tests identify vulnerable banks in a period of economic stress, the ranking of bank vulnerability in the scenarios should, however, be closely related even if the magnitude of the vulnerability is greater in the V-Lab stress test. Similarly, regulatory stress tests and V-Lab stress tests should identify vulnerable banks when there is a realized period of stress. We illustrate this using the 2011 European stress test, which was followed by a global downturn. For this stress test, we compare the outcomes of the regulatory stress test and the V-Lab stress test to realized outcomes of banks during the six months following the stress test disclosure.

We find that the average regulatory risk weight of stress tests is uncorrelated with the V-Lab risk weight. In the 2011 European stress test, the average risk weight of European banks appears completely unconnected with their actual risk (measured by their realized volatility) during the six months following the disclosure of the results of the stress test. Furthermore, we show that Basel risk standards provide no incentives for banks to diversify as regulatory risk weights (derived in a bottom-up manner) ignore the subadditivity feature of portfolio risk. As a result, banks have an incentive to concentrate their holdings on low risk-weight assets and hence to diversify less.[2] The underestimation of risk weights in turn leads to excessive leverage when there is no regulatory constraint on the leverage ratio.

Second, we consider an alternative definition of capital adequacy in stress tests based on the simple leverage ratio, defined as the ratio of book equity to total (un-weighted) assets. When capital adequacy is a function of *risk-weighted assets* in regulatory stress tests, the ranking of financial institutions by capital shortfalls deviates considerably from rankings using

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[1] http://vlab.stern.nyu.edu/.

[2] Empirical evidence that European banks took advantage of regulatory risk weights by concentrating on zero-risk weight sovereign debt exposures of the southern European periphery can be found in Acharya and Steffen (2013).

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