The OFR Financial Stability Monitor

Financial Research Advisory Committee Meeting
July 20, 2017

Executive Summary

As part of its mandate to develop and maintain metrics for risks to financial stability, the OFR created the Financial Stability Monitor (FSM), a heat map of key data on financial stability risks. We update and publish the FSM twice each year.

After several years of use and feedback from the advisory committee and other stakeholders, we propose a set of improvements to the Financial Stability Monitor.

The improved monitor answers the following questions:
- where do the data signal potential vulnerabilities in the U.S. financial system?
- how do today's vulnerability levels compare to their historical range?

Why A Heat Map? Overview of the Current FSM

Monitoring risks across the system requires a large body of data.

As a starting point, the FSM summarizes and visualizes 62 key indicators of risk.

Its stated purpose is to display a snapshot of weaknesses in the financial system.

The indicators are organized into five categories of risk, and 18 subcategories (see the FSM below).

The tool color-codes each data point based on its position within a multi-cycle range (15-25 years, depending on data availability).

The color-coding allows the user to quickly identify areas where risk indicators are high relative to recent history, or where they are increasing.

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Why Change the Heat Map?

Purpose
- The current statement of purpose may overstate the capability of a purely data-based tool.

Categories and Indicators
- The current indicator set co-mingles stress measures and vulnerability measures.
- Solvency/leverage risk in financial institutions warrants its own category of indicators.

Methodology (Appendix A summarizes our proposed methodology.)
- The use of statistical tests to select and weight indicators favors coincident indicators over early-warning indicators.
- The current methodology is skewed by extreme values, which can reduce the early-warning power of this tool.

Updating
- Key stakeholders have requested updates to the heat map more frequently.

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Why Change the Heat Map? Purpose

Previously, the advisory committee provided the feedback that this kind of tool cannot provide final conclusions about financial stability.

Taking that feedback, we plan to narrow the purpose and focus of this tool.

We propose to focus the Heat Map exclusively on measuring vulnerabilities, and to use a separate tool—the OFR Financial Stress Index—to measure and monitor stress.

In order to clarify the objective of this tool and its limits, we propose the following statement of purpose:

A tool to provide early warning signals of potential financial system vulnerabilities that merit investigation. The tool is based on data, not the OFR's assessment, and it does not comprehensively measure risks or provide conclusions about financial stability. The OFR provides such conclusions in its annual Financial Stability Report.

Why Change the Heat Map? Indicators

We selected a new set of indicators using the following process.

- We documented more than 200 potential quantitative indicators of financial stability risk identified in academic literature, used in official sector monitoring, or proposed by experts.

- From that master set, we selected 68 final indicators using the following criteria:
    - measures a U.S. financial system vulnerability (including vulnerabilities to the U.S. that emanate from abroad);
    - sufficient data to establish a multi-cycle distribution;
    - stationary mean or trend;
    - timeliness of signal;
    - coverage of six risk categories and key subcategories identified in the academic literature;
    - coverage of major components of the U.S. financial system.

Appendix B documents our proposed set of indicators.

Why Change the Heat Map? Initial Results

The initial results of our proposed improvements are positive.

The new results provide timely signals of escalating vulnerabilities before the financial crisis. We see this in the following categories:

- Market Risk
- Credit Risk
- Funding/Liquidity Risk
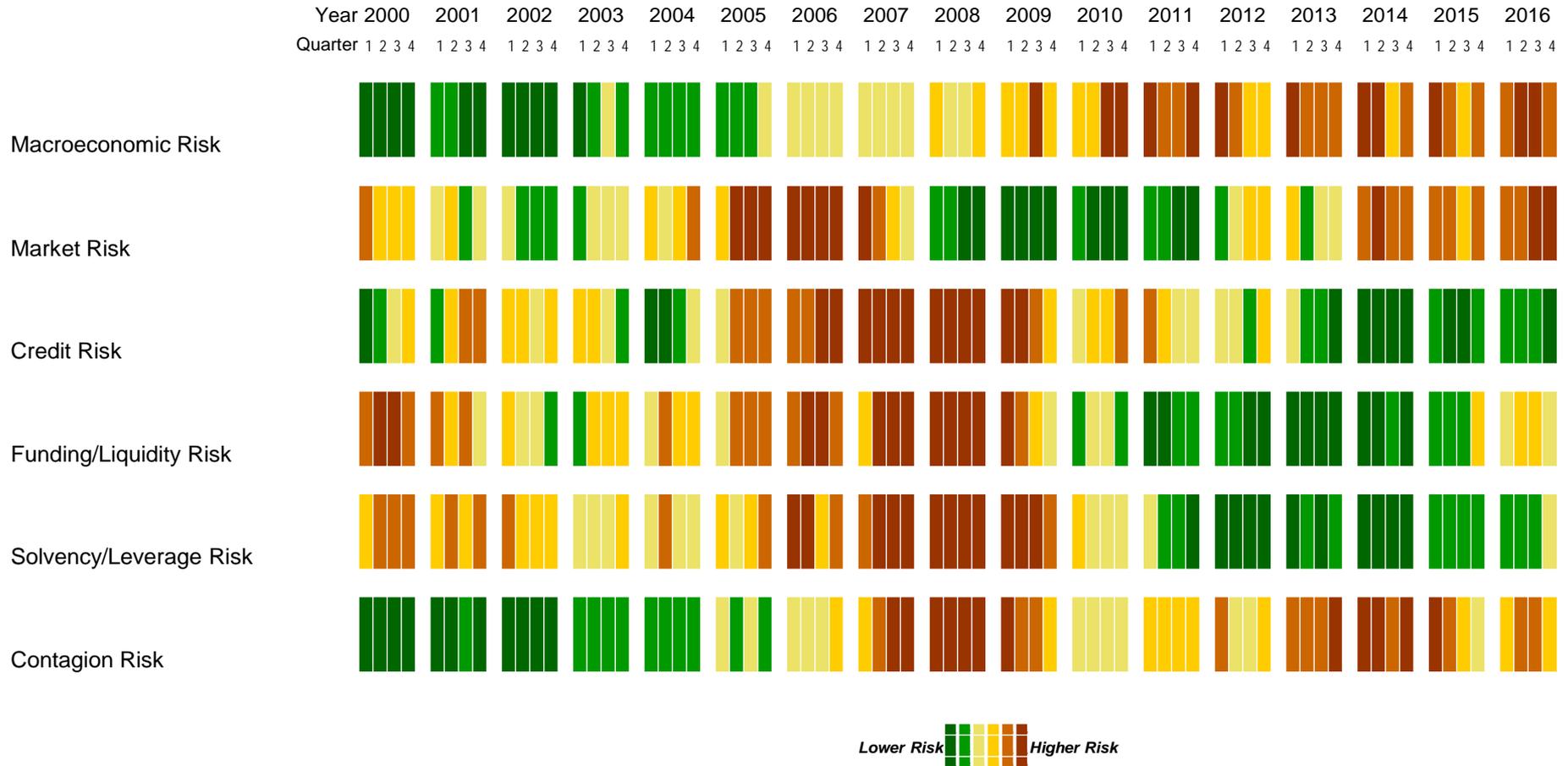- Solvency/Leverage Risk

We find that our proposed changes do improve the early warning signaling of the tool, as intended.

The following slides report the new and original results at the category level.

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New Results

Original Results

Questions for Discussion

- Does the statement of purpose on Slide 4 clarify the scope and limitations of this kind of tool?

- Guided by the indicator criteria on Slide 5, do you recommend that we consider additional indicators?

Appendix A: Methodology

We considered two simple classes of methods to score the risk in each observation:
- scoring based on deviations from mean;
- scoring based on ordinal ranking.

We also considered two broad approaches to translate the risk-scores into colors:
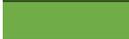- colors represent equal shares of the historical distribution;
- colors represent different shares of the historical distribution, calibrated or based on judgment.

We evaluated the various combinations of these approaches based on three criteria:
1. timely warning of past instability;
2. sufficient variation over time to make early warning signals credible;
3. simplicity/ease of interpretation.

We found that several combinations of these approaches perform well on criteria 1 and 2. We selected the simplest combination among them, to optimize criterion 3: scoring based on ordinal ranking; colors represent equal shares of the historical distribution (see table).

Heat Map Color Thresholds

Color	Observations
	0th < x <= 16.6 percentile
	16.6 < x <= 33.3 percentile
	33.3 < x <= 50 percentile
	50 < x <= 66.6 percentile
	66.6 < x <= 83.3 percentile
	83.3 < x <= 100 percentile

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Appendix A: Methodology

To summarize the information from the 68 indicators, we aggregate them into subcategory and category scores.

We considered four approaches to aggregation:
1. Arithmetic Mean;
2. Root Square Mean;
3. Geometric Mean;
4. Arithmetic Mean plus Standard Deviation.

We evaluated these approaches based on the three criteria discussed on slide 10, and an additional criterion important for aggregation: accounting for the center of the sample as well is dispersion within it.

We selected approach 4: Arithmetic Mean plus Standard Deviation. Unlike the other approaches, it accounts for the center of the sample and for dispersion within it—an important property to avoid diluting the signals from divergent indicators.

Proposed Indicators - Macroeconomic Risk

Subcategory/Indicator	Notes	Data Frequency
Inflation risk		
U.S. core PCE inflation	Measured as absolute distance from 2 percent.	monthly
U.S. 5y consumer inflation expectations	Consumer-expected average rate over next five years, measured as absolute distance from 2 percent.	monthly
Fiscal risk		
U.S. federal government fiscal balance/GDP		quarterly
U.S. federal government debt/GDP		quarterly
U.S. federal government interest/revenues		quarterly
External balance risk		
U.S. current account balance/GDP		quarterly
U.S. net international investment position/GDP		quarterly
U.S. gross international investment liabilities/GDP		quarterly

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Appendix B: Proposed Indicators

Proposed Indicators - Market Risk

Subcategory/Indicator	Notes	Data Frequency
Valuations/risk premiums		
U.S. equity valuations: S&P500 CAPE	CAPE is the ratio of the monthly S&P 500 price level to trailing ten-year average earnings (inflation adjusted).	monthly
U.S. Treasury ten-year term premium (ACM model)	Adrian-Crump- Moench model	daily
U.S. corporate bond option-adjusted spread		daily
U.S. municipal bond option-adjusted spread (A-rated index)		daily
Fannie Mae/Freddie Mac 30-year MBS option-adjusted spread		daily
U.S. house price/rent ratio		quarterly
U.S. house price/income ratio		quarterly
U.S. CRE capitalization rate (weighted average)	Weighted average of CRE capitalization rates for the multifamily, industrial, office, retail, and hotel markets. Weighted by market capitalization.	monthly
Financial risk taking/appetite		
North America Investor Confidence Index (State Street)		monthly
U.S. bond investor duration proxy (Barclays Aggregate)		daily
U.S. equity market option-implied volatility (VIX)		daily
U.S. Treasury option-implied volatility (MOVE)		daily

Appendix B: Proposed Indicators

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Proposed Indicators - Credit Risk

Subcategory/Indicator	Notes	Data Frequency
Household credit risk		
U.S. consumer debt/disposable income (aggregate)	Consumer debt is non-mortgage household debt.	quarterly
U.S. consumer debt/GDP growth (aggregate)	Consumer debt is non-mortgage household debt.	quarterly
U.S. consumer debt service ratio (aggregate)	Consumer debt is non-mortgage household debt.	quarterly
U.S. residential mortgage debt/disposable income (aggregate)		quarterly
U.S. residential mortgage debt/GDP growth (aggregate)		quarterly
U.S. residential mortgage debt service ratio (aggregate)		quarterly
Nonfinancial business credit risk		
U.S. nonfinancial business debt/GDP (aggregate)		quarterly
U.S. nonfinancial business debt/GDP growth (aggregate)		quarterly
U.S. nonfinancial business gross debt/assets ratio (median)	Four-quarter moving average.	quarterly
U.S. nonfinancial business gross debt/earnings ratio (median)	Four-quarter moving average. Earnings measured as EBITDA.	quarterly
U.S. nonfinancial business interest coverage ratio (median)	Four-quarter moving average. Earnings measured as EBITDA.	quarterly
Real economy borrowing levels and terms		
U.S. real economy credit/GDP gap	Measured as gap from observed nonfinancial private debt/GDP to estimated long-term trend in that ratio.	quarterly
U.S. household net borrowing rate (aggregate)	Net borrowing is net investment less net saving.	quarterly
U.S. nonfinancial business net borrowing rate (aggregate)	Net borrowing calculated as net investment less net saving.	quarterly
Share of U.S. banks tightening business lending standards	As reported in Senior Loan Officer Opinion Survey. Business lending is defined as commercial and industrial loans.	quarterly

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Proposed Indicators - Credit Risk

Subcategory/Indicator	Notes	Data Frequency
Average FICO score of new residential mortgages		quarterly

Proposed Indicators - Solvency/Leverage Risk

Subcategory/Indicator	Notes	Data Frequency
Financial institution solvency		
U.S. bank holding company risk-based capital (median)	Tier 1 capital divided by risk-weighted assets.	quarterly
U.S. bank holding company risk-based capital (aggregate)	Tier 1 capital divided by risk-weighted assets.	quarterly
U.S. commercial bank risk-based capital (median)	Tier 1 capital divided by risk-weighted assets.	quarterly
U.S. commercial bank risk-based capital (aggregate)	Tier 1 capital divided by risk-weighted assets.	quarterly
Financial institution leverage		
U.S. bank holding company tangible equity/tangible assets (median)	Tangible equity divided by tangible assets.	quarterly
U.S. bank holding company tangible equity/tangible assets (aggregate)	Tangible equity divided by tangible assets.	quarterly
U.S. commercial bank tangible equity/tangible assets (median)	Tangible equity divided by tangible assets.	quarterly
U.S. commercial bank tangible equity/tangible assets (aggregate)	Tangible equity divided by tangible assets.	quarterly
U.S. life insurer assets/equity (median)	Includes only publicly traded insurers, GAAP accounting.	quarterly
U.S. non-life insurer assets/equity (median)	Includes only publicly traded insurers, GAAP accounting.	quarterly

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Appendix B: Proposed Indicators

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Proposed Indicators - Funding/Liquidity Risk

Subcategory/Indicator	Notes	Data Frequency
Funding risk		
Three-month Ted Spread	Spread between three-month U.S. dollar LIBOR and three-month U.S. Treasury bills.	daily
Three-month financial CP spread to three-month Treasury Bill rate	Spread between 90-day financial firm commercial paper rate and three-month U.S. Treasury bill rate.	daily
Cross-currency basis swap spreads (EUR-USD, JPY-USD)	Average absolute value of one-year swaps: EUR-USD, JPY-USD)	daily
Trading liquidity risk		
Net dealer position in U.S. Treasuries/U.S. Treasuries held by public		quarterly
Net dealer position in U.S. agency-backed bonds/U.S. agency-backed bonds outstanding		quarterly
U.S. Treasury bond trading turnover (average)	Turnover measures trading volume/tradeable securities outstanding.	quarterly
U.S. equity trading turnover (average)	Turnover measures trading volume/tradeable securities outstanding.	quarterly
Financial institution liquidity risk		
U.S. commercial bank loans/deposits (median)		quarterly
U.S. commercial bank loans/deposits (aggregate)		quarterly
U.S. bank holding company wholesale funding (median)	Nondeposit Liabilities/Total Liabilities	quarterly
U.S. bank holding company wholesale funding (aggregate)	Nondeposit Liabilities/Total Liabilities	quarterly
U.S. bank holding company net stable funding ratio proxy (median)	Measure derived from *Fire-Sale Spillovers and Systemic Risk, Fernando Duarte and Thomas M. Eisenbach, Federal Reserve Bank of New York Staff Reports, no. 645 October 2013* and *How Useful Is Basel III's Liquidity Coverage Ratio? Evidence From US Bank Holding Companies, Brian Du, California State University, European Financial Management.*	quarterly

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Proposed Indicators - Funding/Liquidity Risk

Subcategory/Indicator	Notes	Data Frequency
U.S. bank holding company net stable funding ratio proxy (aggregate)	Measure derived from *Fire-Sale Spillovers and Systemic Risk, Fernando Duarte and Thomas M. Eisenbach, Federal Reserve Bank of New York Staff Reports, no. 645 October 2013* and *How Useful Is Basel III's Liquidity Coverage Ratio? Evidence From US Bank Holding Companies, Brian Du, California State University, European Financial Management.*	quarterly

Proposed Indicators - Contagion Risk

Subcategory/Indicator	Notes	Data Frequency
Cross-institution contagion risk		
Asset fire sale risk in top 100 U.S. BHCs	Estimates the share of equity capital lost due to fire sale spillovers following for an indicative one percent decline in all asset prices. Aggregate for largest 100 U.S. bank holding companies, by assets. Measure derived from *Fire-Sale Spillovers and Systemic Risk, Fernando Duarte and Thomas M. Eisenbach, Federal Reserve Bank of New York Staff Reports, no. 645 October 2013.*	quarterly
Systemic risk contribution of top 175 U.S. financial institutions (SRISK)	Series reports the sum of positive SRISK values for top 175 U.S. financial institutions.	monthly
Financial sector concentration risk		
Bank holding company concentration (Herfindahl Index)		quarterly
Life insurance industry concentration (Herfindahl Index)		quarterly
Mutual fund industry concentration (Herfindahl Index)		quarterly
Transmission risk to real economy		
Total U.S. private financial liabilities/GDP		quarterly
Narrow U.S. private financial liabilities/GDP	Narrow financial liabilities includes deposits, money market fund shares, and debt obligations.	quarterly
Cross-border contagion risk		
U.S. gross international investment assets/GDP		quarterly
U.S. bank cross-border claims/GDP	Total cross-border claims. Immediate counterparty basis.	quarterly

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