Measuring Macroprudential Risk: Financial Fragility Indexes

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Dodd-Frank: Financial Stability Oversight Council is in charge of “identifying threats to the financial stability of the United States”

Financial fragility:
- Micro:
  - the liability and/or asset side of the balance sheet (on- and off-balance) are highly sensitive to changes in interest rate, income, amortization rate, etc.
  - high expected reliance on refinancing sources (high refinancing risk) and/or asset liquidation at rising prices (high liquidity risk)
- Macro: risk of financial instability

Financial instability:
- an economic state in which financial problems tend to affect employment and price stability.
- Ultimately financial instability manifests itself through debt-deflation processes
Conceptualizing Financial Fragility

- Evolutionary View: Financial fragility emerges during long periods of economic stability (possibly recording minor recessions).
- Imperfection View: Financial fragility is due to market imperfections and individual imperfections.
Imperfection View: Implications for Empirical Analysis

- Detect the occurrence of financial crises by using leading indicators that are supposed to reflect fragility:
  - Rising default rates
  - Rapid growth of credit
  - Decline in GDP growth
  - Rising real interest rate
  - Growing government deficit
  - Decline in business profit

Problem: up to the Great recession default rate were low, profit and net worth were rising.
Evolutionary View: Implications for Empirical Analysis

- Evolutionary view: Detecting change in funding practices and asset positions is important. The quality of indebtedness matters. What does it entail?
  - Checking underwriting procedures: collateral-based vs. income-based lending
  - Checking amount of refinancing, especially cash-out refinance
  - Checking cash-flow: operational net cash inflows relative to cash outflows induced by (on- and off-) balance sheet liabilities
Evolutionary View: Implications for Empirical Analysis

- Evolutionary view: Detecting changes in funding practices and asset positions is crucial. This is different from:
  - Detecting bubbles: Emergence of dangerous funding practices may become apparent independently (and usually before) bubbles (prime mortgage finance since 2001 at least)
  - Detecting financial crises: Financial fragility emerges long before crises occur
  - Detecting fraud: Perfectly legal funding processes may be highly dangerous (especially if fully collateral based).
  - Detecting if a business is profitable: highly profitable businesses involved in Ponzi finance are extremely fragile.

⇒ Rising profits of firms, rising net wealth of households, and declining default rates are not necessarily signs of strength.
⇒ Government deficit is not necessarily a weakness.
Theoretical foundation: Minsky’s Hedge, Speculative, Ponzi finance

- **Hedge:**
  - Cash flow aspect: \( E(\text{income}) > E(\text{debt service}) \)
  - Balance sheet aspect: No expected position-making operations (refinancing, asset liquidation) to generate cash inflow.

- **Speculative**
  - Cash flow aspect: \( E(\text{income}) > E(\text{interest service}) \)
  - Balance sheet aspect: expect position-making operations to be stable relative to outstanding debt

- **Ponzi:**
  - Cash flow aspect: \( E(\text{income}) < E(\text{debt service}) \)
  - Balance sheet aspect: expected position-making operations to grow relative to outstanding debt

\[
E(CF_{PM}) = \Delta L_R + \Delta P_A Q_A > 0 \text{ and } \Delta(E(CF_{PM})/L) > 0
\]
Bubble and Financial Fragility

- Ponzi finance is different from bubble: no assumption is made about the correctness of the valuation of assets, just need rising asset prices (net worth)
- The concept of bubble is a complementary element to judge the risk of financial instability:
  - Bubbles funded through Ponzi finance: will create a lot of financial instability
  - Bubbles not funded through Ponzi finance: not too much of a worry (when asset prices go down there is a limited risk of debt deflation).

However, the concept of bubble is of limited usefulness because financial instability may rise and be high without any bubble: central concern is funding methods.
Financial Stability Index

- **Datasets:**
  - **BEA: National Product and Income Accounts:**
    - Net operating surplus of corporations
    - Interest receipts of corporations
    - Interest payments of corporations
  - **Federal Reserve Board:**
    - Flow of Funds Accounts:
      - Outstanding total liabilities
      - Amount of short-term liabilities
      - Amount cash and liquid assets
      - Net worth
    - Household Finance
      - Mortgage financial obligation ratio
      - Debt service ratio
      - Consumer credit (total and revolving)
  - **Federal Housing Finance Agency**
    - Proportion of cash-out refinancing loans amount refinance loans.
  - **Standard and Poors**
    - S&P/Case-Shiller Home Price Indices
Household Financial Fragility

- Two indexes:
  - Overall household sector
  - Funding of homeownership

**Overall Index** is constructed as followed:

\[ I_H = 0.1D_L + 0.1D_{NW} + 0.25D_{DSR} + 0.25D_{MLR} + 0.15D_{COR} + 0.15D_{RCD} \]

L: Total outstanding liabilities
NW: net worth
DSR: debt service ratio
MLR: monetary instruments relative to outstanding liabilities
COR: proportion of cash-out refinancing mortgage loans in mortgage refinancing loans
Household Financial Fragility

- With $I_H \in [0, 1]$ and $D_X$ a dummy variable for variable $X$ defined as followed for all variables except MLR:

$$
D_X = \begin{cases} 
1 & \text{if } g_{X_t} > g_{X_t-1} > 0 \\
0.9 & \text{if } g_{X_t} > 0 \\
0 & \text{if } g_{X_t} = 0 \\
-0.9 & \text{if } g_{X_t} < 0 \\
-1 & \text{if } g_{X_t} < g_{X_t-1} < 0 
\end{cases}
$$

- For MLR we have:

$$
D_{MLR} = \begin{cases} 
1 & \text{if } g_{MLR_t} < g_{MLR_{t-1}} < 0 \\
0.9 & \text{if } g_{MLR_t} < 0 \\
0 & \text{if } g_{MLR_t} = 0 \\
-0.9 & \text{if } g_{MLR_t} > 0 \\
-1 & \text{if } g_{MLR_t} > g_{MLR_{t-1}} > 0 
\end{cases}
$$
For housing finance financial fragility index we have:

\[ I_{HHF} = 0.1D_L + 0.1D_P + 0.2D_{COR} + 0.3D_{MOR} + 0.3D_{MMR} \]

L: Home mortgage of households,
P: home price index
COR: proportion of cash out refinance
MOR: mortgage financial obligation ratio
MMR: the ratio of monetary assets to mortgage debt
OVERALL HOUSEHOLD FINANCIAL FRAGILITY INDEX
Homeownership Financial Fragility Index
The same index is used for the financial and nonfinancial sector

\[ I = 0.125D_L + 0.125D_{NW} + 0.3D_{ISR} + 0.3D_{MLR} + 0.15D_{ST} \]

L: Total outstanding liabilities
NW: net worth
ISR: interest service ratio (lacking principal servicing data)
MLR: monetary instruments relative to outstanding liabilities
ST: proportion of short-term liabilities

\[ ISR = \text{Monetary interest paid}/(\text{Net operating surplus} + \text{interest receipts}) \]
Nonfinancial nonfarm corporate
Financial Business

[Chart showing financial data with dates from 1954Q1 to 2002Q4 and values ranging from -1 to 1]
Conclusion

- Index is not built to fine tune the economy
- Index is not meant to forecast the timing and size of financial crises.
- Index is meant to be used for regulatory and supervisory purpose: Low default rate, High profitability, and rising net worth are not necessarily signs of financial health

=> macroeconomic financial fragility (financial instability risk, i.e. macroprudential risk) grows during periods of stability.