

Lecture notes on risk management, public policy, and the financial system

Financial imbalances and financial crises

Allan M. Malz

Columbia University

Defining financial crises

Causes of financial crises

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Historical experience and typology of crises

The credit crunch

Causes of financial crises

Macroeconomic causes of crises

Financial imbalances

Reaching for yield

Endogeneity

The long history of crises

- Very old phenomenon, dates back at least to late medieval era, origins of deposit banking
- Disparate phenomenon, different features central in different crises
- Some major crises before the Great Depression:
 - 1343** Collapse of several Florentine banks on failure of England to repay war-finance debt
 - 1763** Widespread failures of Dutch, German banks following end of Seven Years War and war boom
 - 1825** Bank of England suffers gold drain, widespread bank failures, stock and bond declines following credit expansion
 - 1837** Widespread suspension of specie payments by, failures of U.S. banks, sharp recession
 - 1873** Failure of Jay Cooke bank, followed by widespread bank failures, stock crashes in many countries, “Long Depression”
 - 1907** Exposure of losses by some banks leads to widespread runs and stock market declines

Typical features of financial crises

Credit contraction: sudden pervasive withdrawal of credit

International dimension: crisis affects a number of countries, abrupt changes in exchange rates or capital flows, transmitted via trade and finance

Bankruptcies in private and public sector, financial firm failures

Liquidity contraction: Sudden increase in demand for, narrowing of palette of liquid assets

Runs and panics: investors demand instant return of short-term capital from financial firms, **flight to quality** or **safety**

Impairment of market functioning and contraction of markets

Economic activity falls rapidly, recessions/depression generally unusually long and severe

Asset prices display extreme volatility; **market crashes**, other unusual behavior

Types of financial crises

- Each a unique historical event → quantitative treatment of financial crises difficult
 - Including systematic identification and dating (onset and end of crisis), classification
- Typical classification, based on triggering events and focal point of impact:
 - Banking crises:** widespread bank failures, triggered by market or other event igniting fears of loan losses
 - Banking panics less frequent since advent of (→) deposit insurance
 - Debt crises:** event or fear of large or widespread default
 - External debt crises:** debt vis-à-vis foreign residents, more frequent since end of fixed exchange-rate regime
 - Sovereign debt or fiscal crises:** default on public debt
 - Currency crises:** large devaluation of local currency, often following failure of peg

Financial crises are rarely purely of one type

- Increasing frequency of crises in postwar era
- Banking crises often associated with sovereign debt crises
 - Governments frequently explicit or implicit guarantors of banks via deposit insurance, bailouts
 - (→) **Doom loop**: banks large holders of sovereign debt, mutual exposure of banks and sovereigns
 - International exposure if external sovereign
- Crises often currency/balance of payments focused
 - Currency crises generally associated with other major financial and economic disturbances
- Many crises combine all types

Major postwar financial crises

Collapse of Bretton Woods 1968-1971, at beginning of 1970's stagflation

1987 stock market crash 20 percent 1-day decline but little lasting effect

Japan crisis in 1989 preceded by rapid rise in stock, land prices, followed by protracted recession

European Monetary System of 1992-1993, largest speculative attack on fixed exchange rates

S&L crisis of early 1980's, gambling for resurrection

Mexico default 1994-1995, fixed exchange rates, short-term foreign exchange borrowing

Asian crisis 1997-1998, fixed exchange rates, short-term foreign exchange borrowing

Global financial crisis 2008-2011 (?), extreme leverage, liquidity crunch

Covid-19 pandemic 2020-?, extreme supply and demand shock, liquidity crunch

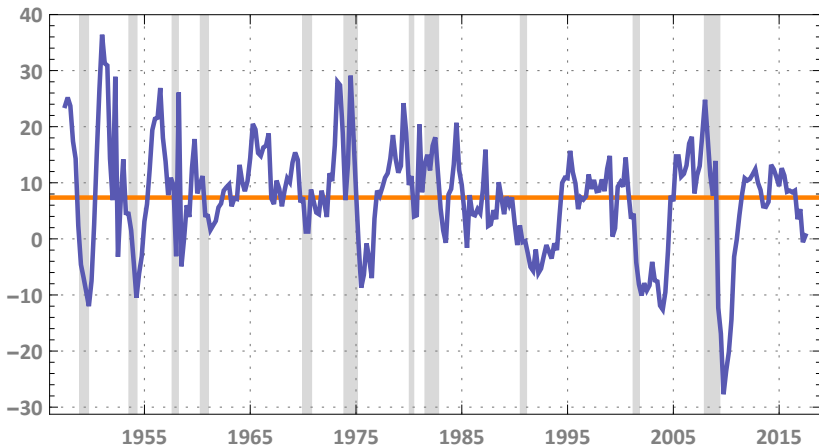
Credit contraction in financial crises

- Credit *growth* during expansions generally gradual; credit *contractions* are quite abrupt
 - → “Credit crunch”: **lending** or **credit transmission channel** of financial crises to real economy
- Non-price balance-sheet constraints: intermediaries can't fund, or seek to deleverage and preserve capital (“capital crunch”)
- Often also reduction in broader money supply aggregates/velocity, even if central bank keeps monetary base steady
- Contraction of securities markets
- → Debt overhang

Debt overhang in crises

- Bad consequences of high leverage once crisis hits
- Leverage reduces incentives by firm owners to invest, since returns raise value of debt→deepens recession
- →Banks with high leverage can't/reluctant to raise new equity capital
 - Banks continued dividend payments in spite of losses mid-2007 to mid-2008

Growth rate of U.S. bank lending 1947–2015



Annualized growth rate of C&I loans of all commercial banks, seasonally adjusted, percent, quarterly. Vertically shaded intervals denote NBER recessions. *Source:* Federal Reserve Board, H.8 data release.

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Monetary policy and crises

- Unevenly distributed across countries
 - Evidence of causal role poor/politically-driven regulatory environment
- Too-high monetary/credit expansion, too-low interest rates→unsustainable growth
 - Inflation, balance of payments deficits
- Traditional approach: monetary and fiscal policy, business cycles
- Limited scope for finance in contemporary macroeconomic theories
- Goals/objective function: growth/employment vs. price stability

Background of the crisis: competing narratives

- Low real interest rates
- Low inflation deceptive? Inflation targeting
- Why were interest rates so low?
 - Feeding a boom, rates below natural
 - Global savings glut: current account deficit and the “conundrum”
- Leverage
 - Excessive dependence on short-term debt
 - How encouraged by public policy? E.g. keep MMMF yields positive to maintain market for bank paper

How do low interest rates manifest themselves?

- Rising credit aggregates
- Unsustainable debt relative to income
- Rising asset prices
- Credit spreads, implied and realized volatility, and other evidence of risk premiums low
- Reaching for yield: institutional investors, return hurdles
- May occur during periods of stable prices and employment
- Imbalances then put an end to period of stable prices and employment
- →International dimension

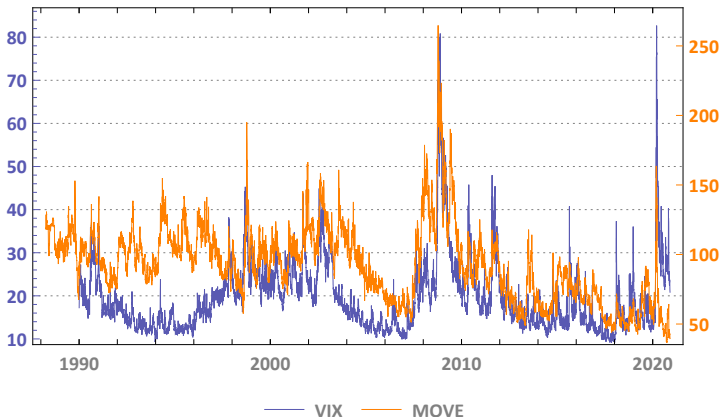
Paradox of volatility

- Volatility low when risk-taking high
 - Low volatility *encourages* risk-taking, boom phase of boom-bust cycle
 - →Current monetary policy: market volatility a substitute for Fed policy normalization
- Thus volatility low when financial imbalances building
- →Unusually low volatility a warning signal financial imbalances may be building
- Policy can encourage build ups
 - Low rates cited as cause of reaching for yield, as paradox of volatility suggests

Implied volatility and variance premium

- Implied and realized asset return volatility extremely low
- Variance risk premium:
 - Difference between implied volatility and expected volatility
 - Reward to supplying protection against volatility
- Variance premium also at low level:
 - Jan. 1990 to onset of crisis end-Feb. 2007: about 4.25 percent
 - Late Sep. 2011 to date: about 2.75 percentage

Equity and swaption implied volatility 1989–2020



CBOE Volatility Index (VIX): weighted average of prices of options on the S&P 500 Index with approximately 1 month to expiry and with a range of strike prices, daily, 02Jan1990 to 31Aug2020. Merrill Lynch Option Volatility Estimate (MOVE) Index: index of implied normal volatilities of at-the-money options with approximately 1 month to expiry on U.S. Treasury notes and bonds, daily, 04Apr1988 to 28Aug2020. *Source:* Bloomberg LP.

Reaching for yield and the Great Moderation

- Rajan (2006) thesis: intermediary/manager behavior when interest rates low
 - Aggressive allocation shifts to riskier bonds and alternatives rather than leverage
 - Variable asset returns, but fixed liabilities
 - Make up risk-free rate shortfall via expected return and premium on market (especially duration) and credit risks
 - Riskier assets rather than leverage
 - Imperfect discernment of risk by standard measurement techniques
- Hard to define, even harder to identify
- Market conditions
 - Low absolute level of yields
 - Spread compression, curve flattening
 - Low volatility, stable → **paradox of volatility**

Reaching for yield behaviors: examples

- Higher-yielding securities with given credit rating
- Add duration risk
- Lower credit rating/quality
- Higher-risk asset class, e.g. whole loans, structured products, equity, alternatives
- Non price features, e.g. cov-lite
- Closely related: discerning between authentic alpha and priced factors (e.g. liquid alternatives)
- Rewarded by market through asset flows?
- **Example:** insurance companies
 - Invest premiums to generate income to fund future claims
 - Add duration risk, lower credit rating/quality, allocate to private equity

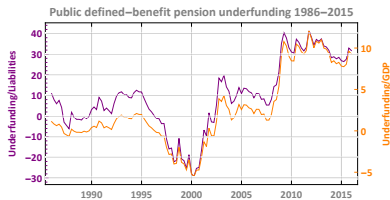
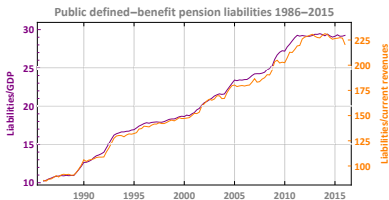
Reaching for yield and intermediary type

- Focus on unlevered, esp. institutional investors
- Banks also suffering from net interest margin compression
 - Endeavoring to shift to fee income, but regulatory and competitive pressures
- Insurance companies
 - Need net income, annuities/fixed-rate with obligations
- Pension/retirement plans
 - Pension liabilities
 - Asset returns may not match
 - Public-sector (but not private): vast underfunding problem
- Bond mutual funds: higher yielding bonds than benchmarks
- Institutional prime MMMFs: wholesale funding, flows highly sensitive to relative performance

Reaching for yield behaviors: examples

- Higher-yielding securities with given credit rating
- Add duration risk
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- Higher-risk asset class, e.g. whole loans, structured products, equity, alternatives
- Non price features, e.g. “cov-lite” loans
- Closely related: discerning between authentic alpha and priced factors (e.g. liquid alternatives)
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Public pension plan underfunding 1986–2015

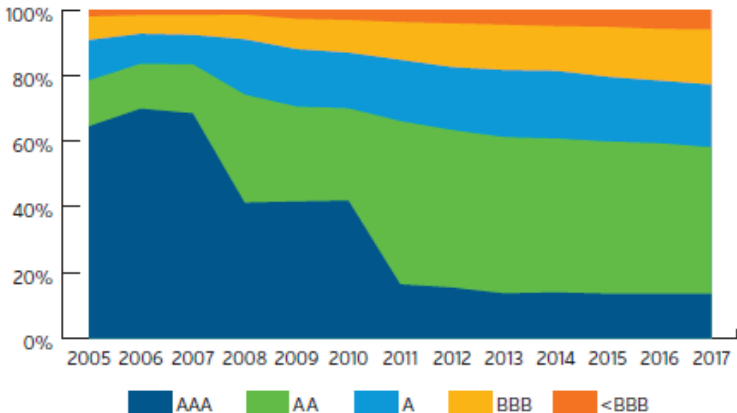


Left panel: Ratio of accrued state and local government defined benefit pension entitlements to GDP (purple plot, left axis), and to state and local government current receipts (orange plot, right axis). Right panel: Ratio of defined benefit pension plan entitlements unfunded by assets to total entitlements (purple plot, left axis), and to GDP (orange plot, right axis). Percent, quarterly, Q4 1984 through Q3 2013. Negative values indicate overfunding. *Source:* Federal Reserve Board, Financial Accounts of the United States (Z.1), Table L.120.b, lines 16 and 18, Table F.107, line 1, Table F.2, line 1.

Incentive and regulatory causes

- Corporate governance issues on the buy side
- Do institutional investors take too much risk, and, if so, what incentivizes them to do so?
- Agency problems: buy-side managers don't bear tail risks
 - Analogous to conflict of interest between equity owners and creditors
 - Capital Decimation Partners (Lo)
- Problem not unique to reach for yield: “we have to put our money to work”
 - An unsolved crisis mystery: why the demand for AAA subprime?
 - Institutional investor demand, not issuer pays the source of high ratings
- Capital standards for insurance: NAIC, Solvency II
 - High capital charges for common stock, little differentiation of common vs. alternatives

U.S. insurance company credit allocation 2007–2017



Source: NEAM, S&P Global Market Intelligence, Reuters, ICE BAML Global Index System, Bloomberg

Credit rating shares (percent of par) of fixed-income investments of U.S. property-casualty insurance companies. Source: New England Asset Management, *Perspectives*, 27Nov2018, Chart 17, retrieved from <https://www.neamgroup.com/insights/2016-investment-highlights>.

Resolving the paradoxes seems risky

- How will the tension between reaching for yield and risk aversion be resolved?
 - Contradictory evidence is disturbing: resolved smoothly or disruptively?
 - Low liquidity, but not much demanded or needed right now
- An eerie parallel: the dots plot
 - Market estimates of future interest rates persistently and quite drastically lower than Federal Reserve's
- Market doesn't appear able to withstand large shocks
- Potential sources
 - Policy normalization
 - Problems in a number of specific large countries
 - Conflict risks

Why are crises so severe?

- Understanding severity and speed with which crises develop
- Crisis-related recessions/depressions more severe than typical business-cycle troughs
- One framework of analysis: distinction between **triggers** and **propagation mechanisms** of crises
- Are crisis triggers large or small events?
 - If relatively small and initial impact not widespread, focus on propagation mechanisms to explain severity→**contagion**
 - If triggers relatively large or widespread, focus on sources of **common shocks**
 - “Popcorn” vs. “domino” approach (E. Lazear)—and perhaps “asteroids” as well

Common shocks and propagation of crises

- **Common shocks** hit intermediaries/countries
- **Examples:**
 - Widespread bad underwriting or sudden declines in prices of widely-held assets
 - Impact of sudden tightening of credit constraints/rationing
 - A controversial example: was not bailing out Lehman a policy error? Was uncertainty regarding policy a common shock?

Endogeneity

- **Endogeneity:** focus on internal amplification, self-reinforcing mechanisms
 - Internal forces as well as external shocks important
 - Loops: Market prices determined not only by fundamentals, but by reactions of market participants to price levels/changes
 - Amplification via leverage, market institutions
- **Multiple equilibria** and **sunspots:** redemption decisions taken individually but with a collective outcome
- **Externalities:** one firm's actions imposes costs on others
- Self-propagating mechanisms, build-up of financial imbalances
- Synchronous/homogenous investor behavior rather than offsetting randomness
- Related concept: **procyclicality** of the financial system
 - Tendency for financial variables to vary with real variables so as to increase amplitude of business cycle

Contagion and interconnectedness

Interconnectedness: “dominoes” metaphor of propagation

- Motivation for Dodd-Frank OTC derivatives **clearing mandate**
- Two types of interconnectedness:

Asset interconnectedness: lenders harmed by loan and counterparty losses, default in turn to their lenders

Liability interconnectedness: rapid unwinds by borrowers forced into → **fire sales**

Contagion: sudden shifts in beliefs, fear of problems at *other* market participants

- **Information-insensitive** liabilities become **information-sensitive**
- The Tylenol effect: where are the toxic assets? → reluctance to lend, runs and run-like behaviors
- Where is my rehypothecated collateral?
- Who is too dependent of short-term financing?
- My suddenly information-sensitive short-term assets make it impossible to sell, use them as collateral, so I can no longer fund myself → run on me

Self-reinforcing mechanisms in crises

Balance sheet mechanisms: diminution of capital, “involuntary” increase in leverage

Collateral devaluation: margin calls, reduced range of acceptable collateral

- Tylenol effect: collateral pool supporting securitizations contain toxic assets
- Leads to fire sales as market participants can't maintain positions → “**run on repo**”

Risk triggers include

Option hedging: sellers of puts hedge price declines by increasing short positions

Stop-loss orders activated on price declines

VaR limits: increase in volatility induces unwinding to remain within limits, exacerbated by similarity of models (→ capital standards)

Accounting triggers: mark-to-market (MTM) accounting rules said to exacerbate crises

Net worth and asset price declines

- Impact of market and credit losses
 - Prior to crisis: diminution of equity increases moral hazard, incentives to “gambling for redemption,” e.g. U.S. savings and loan crisis
 - At onset of crisis: fire sales
- Impact of market-driven changes in leverage
 - During the upturn: increases in asset values→strengthening of balance sheet→increased risk taking
 - During the downturn: inverse behavior, amplified by desire to preserve credit ratings
- Minimum capital and credit rating requirements drive leverage impact

Mark-to-market accounting and financial crises

- The putative mechanism: MTM for banks induces loss, reduction of book and regulatory capital (→procyclicality)
- Fire sales further reduce MTM values, become contagion mechanism to other banks
 - But bank may sell assets with gains to shore up capital
- Impact of MTM for banks' regulatory capital limited
 - Most assets in banking book (held to maturity), only permanent impairments enter capital
 - Losses on available for sale securities enter OTTI, but not capital
- Not marking to market exacerbates asymmetric information problem
 - Tradeoff of value of transparency vs. harm of procyclicality
- Can be addressed through higher and anticyclical capital
- Empirical evidence difficult to interpret (causality, incremental impact of MTM) and mixed

Are crises inevitable?

- **Post-Keynesians:** crises inherent and inevitable in market economy
- Modern macroeconomics, e.g. Keynesian fine-tuning, monetarist critique of 1929 Fed: crises avoidable, occur due to policy errors

Minsky model or **Financial Instability Hypothesis:** three stages of the financial cycle or firm financing models

- Crises and instability inherent in capitalist system
- Stability leads to complacency and increased debt, risk-taking (→paradox of volatility)

Hedge finance: debt can be repaid out of the cash flows of the borrower

- Debt does not need to be rolled over or refinanced

Speculative finance: firm can pay interest but not principal out of cash flows

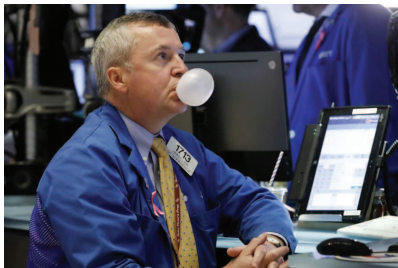
- Firm must refinance or sell investment at a higher price to remain solvent

Ponzi finance: even interest cannot be paid out of cash flows

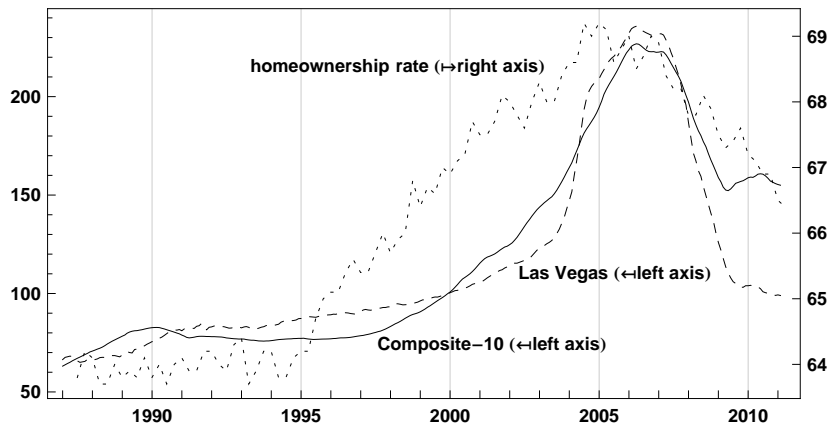
- Further borrowing needed to service existing debt(→bubbles)

Bubbles

- Asset prices become detached from fundamentals and trade on expected future capital gains
- Controversies:
 - Can/do bubbles exist?
Compatibility with rational maximizing behavior
 - Identification
 - Policy vis-à-vis bubbles → “lean or clean”
- Models of rational bubbles → multiple equilibria



U.S. house prices and homeownership 1987–2011

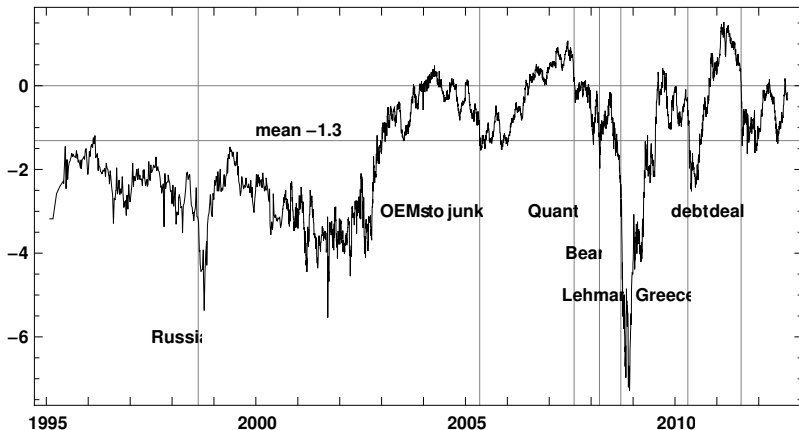


Solid line: S&P/Case-Shiller 10-City Composite Home Price Index. Dotted line: S&P/Case-Shiller Home Price Index for Las Vegas. Dashed line (right axis): U.S. Census Bureau estimate of U.S. homeownership rates. House price data monthly, Jan. 1987–Feb. 2011; homeownership rates quarterly 1987–Q1 2011.

Liquidity risk and fragility of the financial system

- Interactions between funding and market liquidity
- Can be distinguished analytically but not in practice
- Lack of funding liquidity → forced sales, lack of a two-way market, redeemable capital
- Lack of market liquidity → margin calls, reluctance to fund
- Example: convertible bonds
 - Strategy of buying converts and hedging option → long gamma returns
 - Embedded option generally cheap, but requires leverage (economies of scale)
 - Tail risk: converts cheapen sharply on withdrawal of leverage and capital redemption

Convertible bond cheapness 1995–2011



Difference between theoretical and market prices of convertible bonds, weekly through 1997 and daily through 06Sep2012, in percent. The theoretical price is the value of the replicating portfolio, taking the credit, risk-free rates, and the embedded option into account. *Sources:* Bank of America, Barclays Bank.