Financial Crisis and Financial Reform

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Analysis and Applications:
A Conference in Honor of Elias M. Stein

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Overview

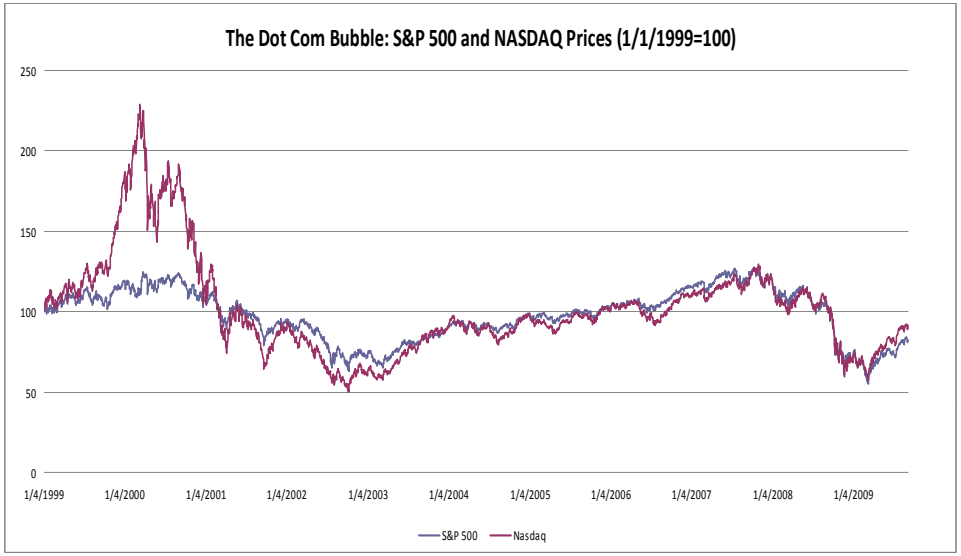
- How did we get into this mess?
- Short-run fire fighting.
- Long-run reform.
- An aside on mathematical and statistical modeling in finance.

How Did We Get Here? A Tale of Two Bubbles

- The dot-com bubble.
  - Huge loss of stock-market value, real economy gets off pretty light.
- The subprime/housing bubble.
  - Smaller aggregate losses, much bigger problems for real economy.
  - And it could have been worse.
- Why? Leverage. Subprime bubble involved much more borrowed money.
  - Households buying houses with little money down; financing consumption with home equity lines of credit.
  - Banks and other financial institutions with highly levered capital structures: lots of short-term debt, little equity.

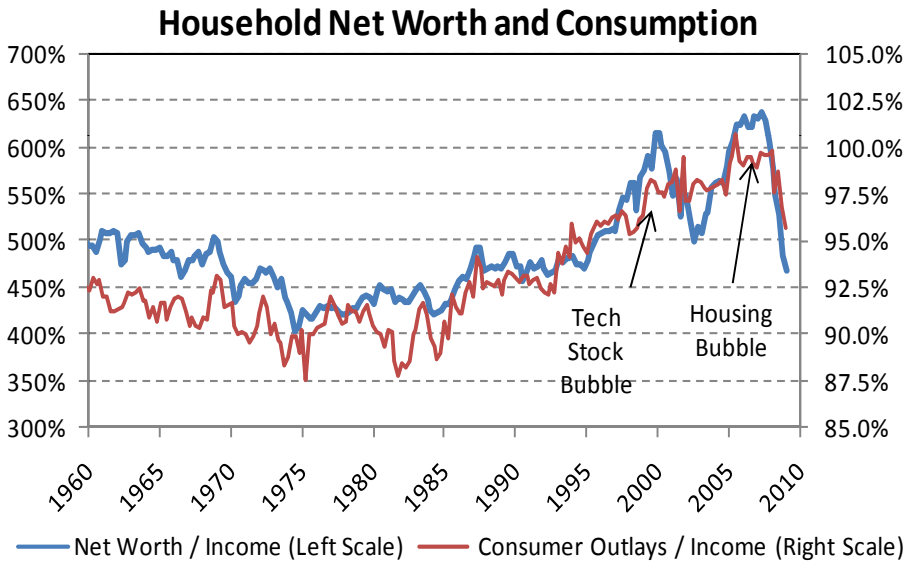
The Dot-Com Bubble

- NASDAQ index peaks on March 10, 2000.
  - $5 trillion of market value lost in tech companies alone by October 2002.
- Poster child for the bubble: Pets.com. "Because pets can't drive."
  - Founded 1998.
  - IPO in Feb. 2000.
  - Revenues of $619K first fiscal year (not a typo).
  - Peak market cap of over $1B (also not a typo).
  - Folds in Nov. 2000.



Macro Fallout from Dot-Com Bubble

- Brief and mild recession from March 01-Nov 01.
- Unemployment rate goes from 4.3% in March 01 to 5.7% in Dec 01.
- Consumption not much affected by large stock market wealth losses.
  - Contrast to what happens later with housing wealth.
  - Houses make better collateral than dot-com stocks: can borrow against them to finance consumption.



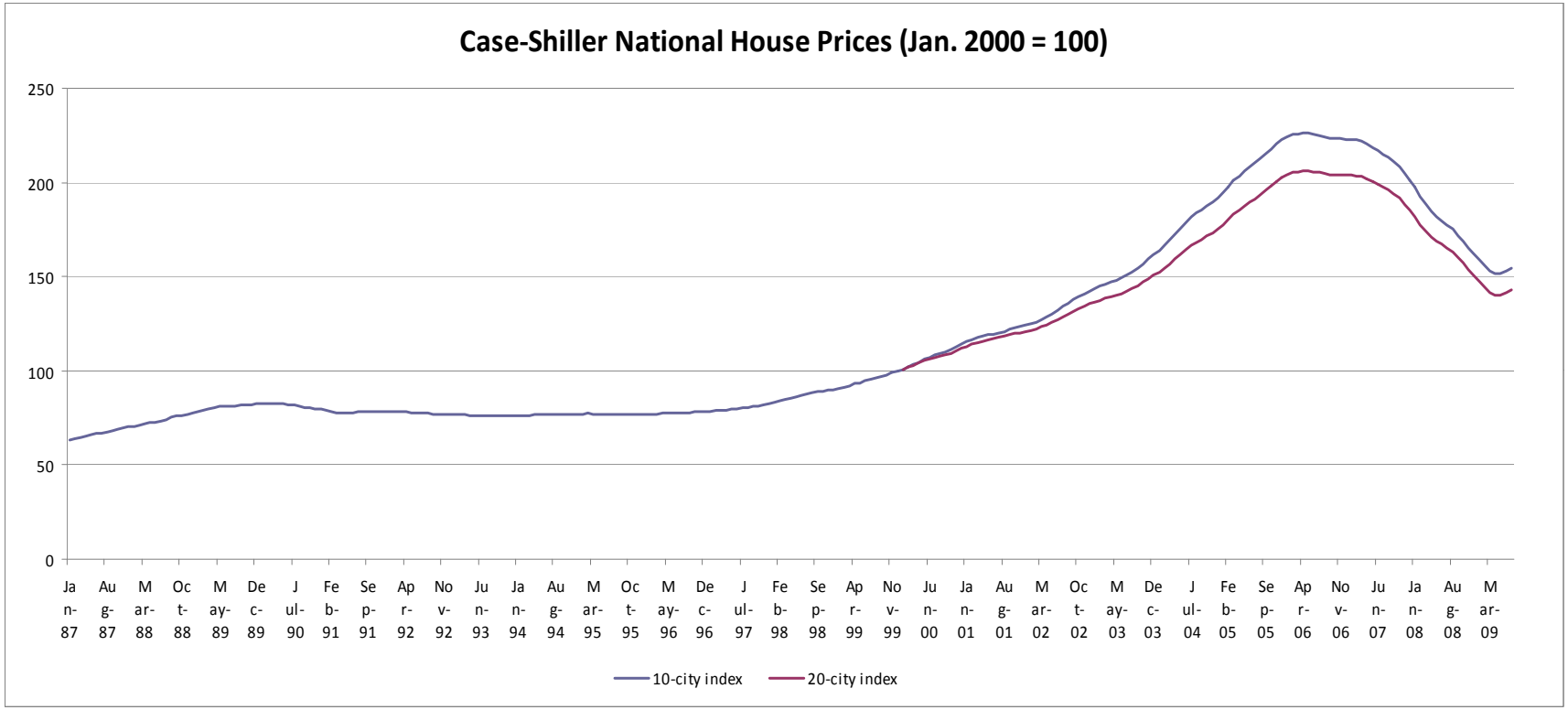
Dot-Com Losses Were Broadly Spread

- Dot-com stocks were largely owned by unleveraged investors.
  - Households, mutual funds, pension funds.
- To put $5T stock-market loss in perspective, note that as of 2009Q3:
  - Total household assets = $67T.
    - Tangible assets (mostly housing) = $23T.
    - Financial assets = $44T.
  - Liabilities (mostly mortgages) = $14T.
  - So household net worth = $53T.

The Subprime/Housing Bubble

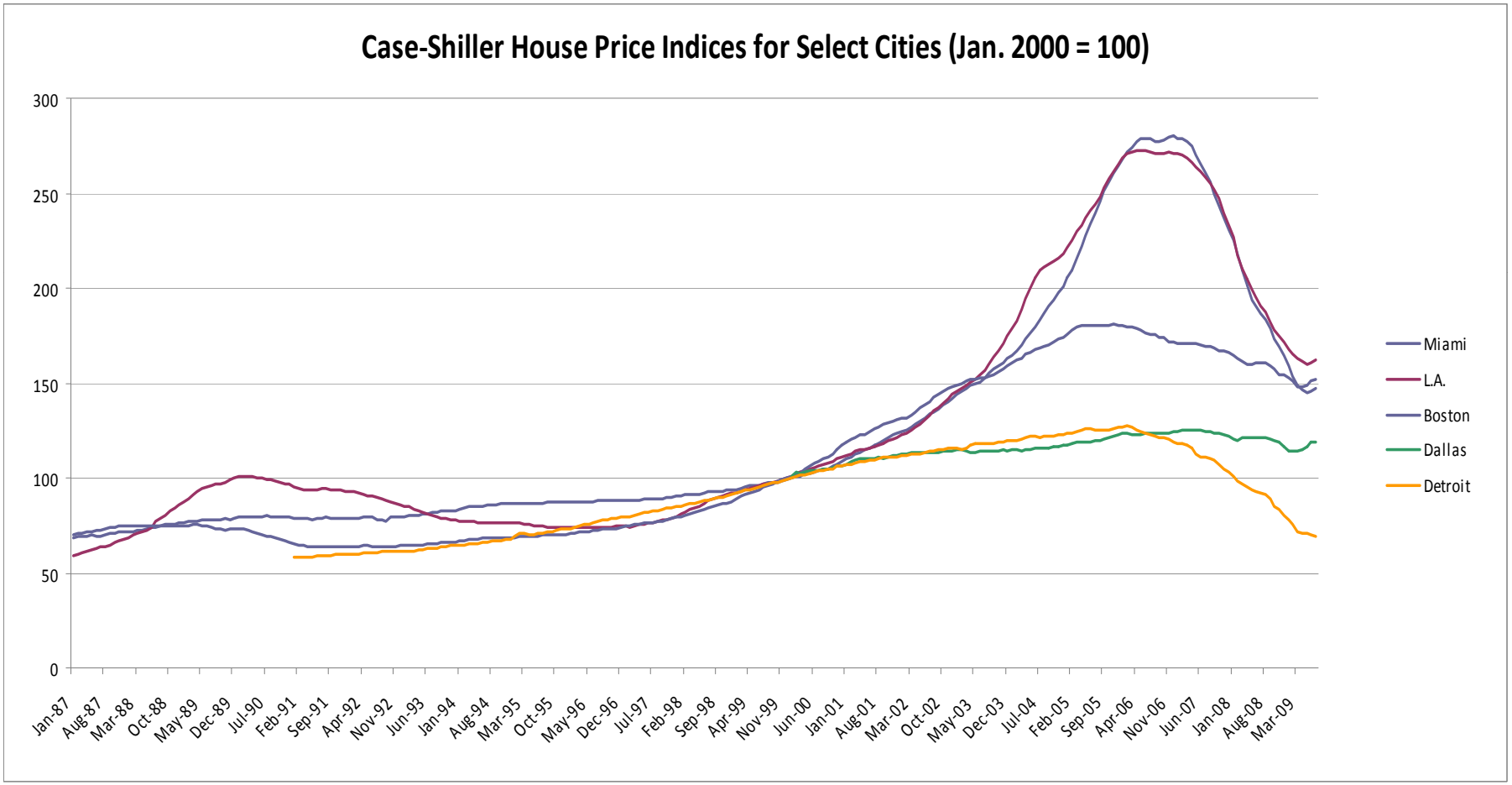
	Total Mortgage Originations (Billions)	Subprime Originations (Billions)	Subprime Share in Total Originations (% of dollar value)	Subprime Mortgage Backed Securities (Billions)	Percent Subprime Securitized (% of dollar value)
2001	$2 ,215	$190	8.6%	$95	**50.4%**
2002	$2,885	$231	8.0%	$121	**52.7%**
2003	$3,945	$335	8.5%	$202	**60.5%**
2004	$2,920	$540	18.5%	$401	**74.3%**
2005	$3,120	$625	20.0%	$507	**81.2%**
2006	$2,980	$600	20.1%	$483	**80.5%**

Evolution of House Prices



- According to Case-Shiller 20-city index, biggest years of boom were:
  - 2002: +12.2%
  - 2003: +11.4%
  - 2004: +16.2%
  - 2005: +15.5%

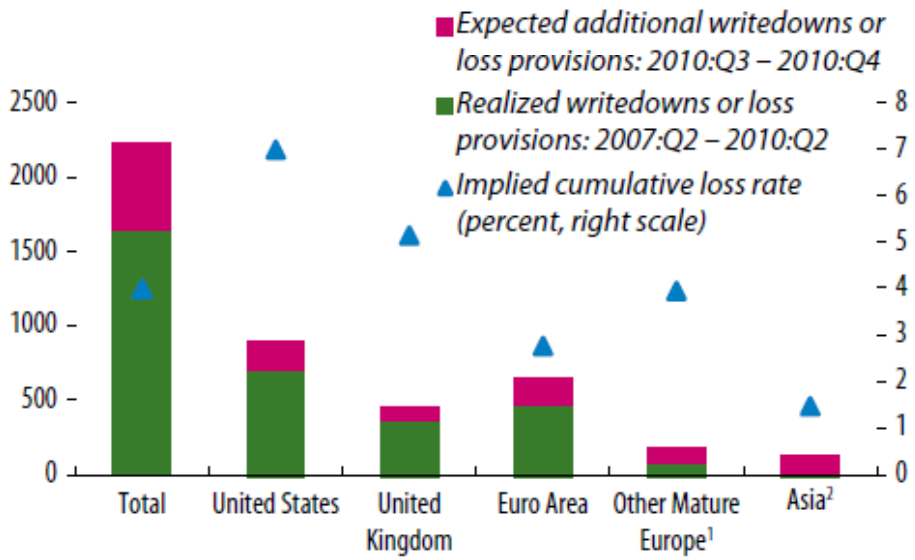
Heterogeneity Across Cities



Subprime Losses Will be Smaller

- As of October 2010, IMF estimates that:
  - Total global writedowns over 2007-2010 period will total $2.2T.
  - Of which, approx $1.0T will hit U.S. financial institutions.

Figure 1.12. Bank Writedowns or Loss Provisions by Region
(In billions of U.S. dollars unless indicated)



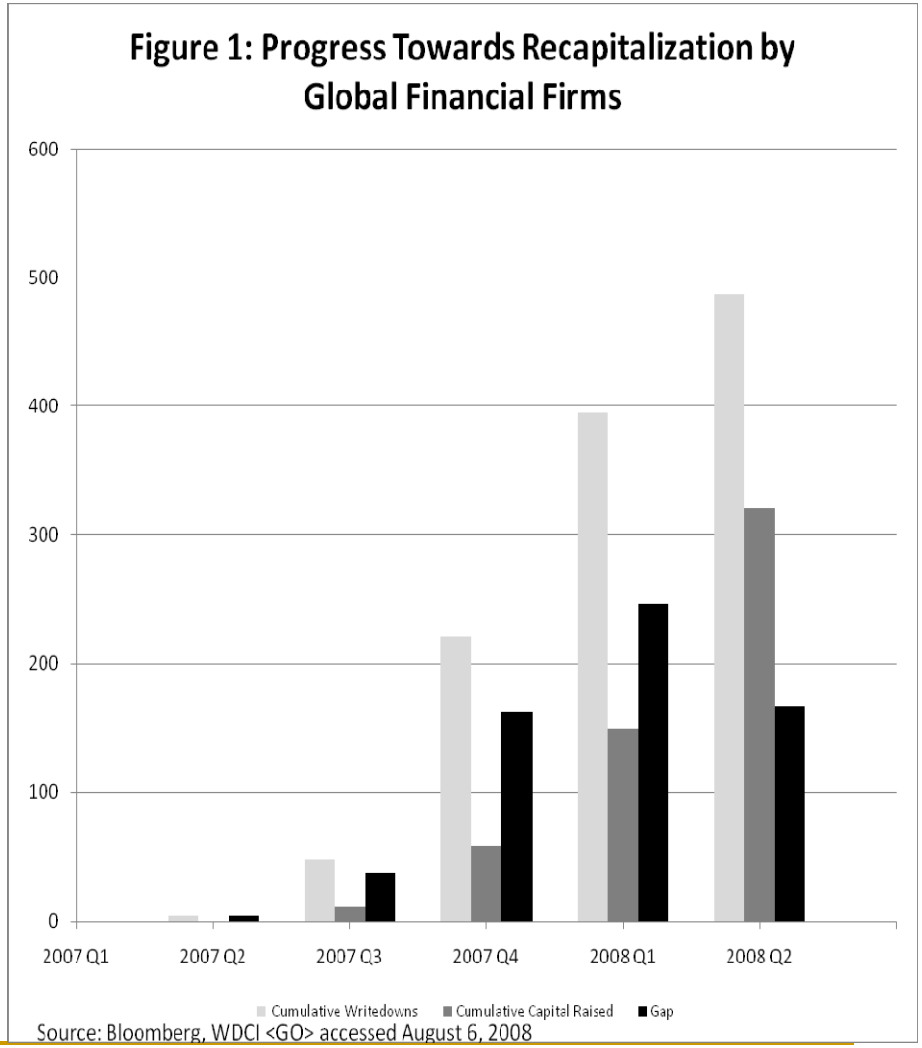
But Subprime Losses Are Concentrated in Highly Levered Institutions

Approximate Financial Structure of U.S. Banking System:

- Assets = $15.0T
- Liabilities = $13.6T
  - Deposits = $8.5T
  - Other short-term borrowing = $3.2T
  - Long-term debt = $1.9T
- Equity capital = $1.4T.
- Equity is less than 10% of assets.
- Leverage effect: if value of assets falls by only 5% ($750B), over 50% of bank equity is wiped out.
- And banks' ability to lend is constrained by their equity capital.
  - Due to regulatory capital requirements.
  - And their own internal risk controls.

So Why Don't Banks Raise New Equity?

- They do—but left to their own devices, not nearly enough.
  - As crisis unfolds, bank capital raising not sufficient to make up for *realized* losses. To say nothing of anticipated future losses.
  - As a result, banks forced to contract their assets.
  - Results: credit crunch, fire sales of distressed assets.
  - Costs of these not fully internalized by banks doing the shrinking.



The Debt Overhang Problem

- Bank initially has assets = 100; debt = 90; equity = 10.
- Assets then fall in value and become riskier: with 80% prob, assets will pay off 95; with 20% prob assets will pay off 80.
  - Expected value of assets now = 92.
  - Value of equity = .80*5 = 4. Equity only gets paid in good state.
  - Value of debt = .80*90 + .20*80 = 88. Debt takes hit in bad state.
- Suppose bank raises 5 of new equity, keeps it all in cash. Now with 80% prob, assets pay off 100; with 20% prob pay off 85.
  - Value of equity = .80*10 = 8. Total equity value up by 4.
  - Value of debt = .80*90 + .20*85 = 89. Total debt value up by 1.
- Bottom line: equity investors get hurt. Put in 5, but only net 4.
- Why? Debt holders at front of line, siphon off some of the value.
- Impaired debt acts as a tax on new money contributed by equity.

Policy Implications of Debt Overhang

- When a bank is in trouble and its debt is impaired, it will be reluctant to raise new equity capital.
  - Viewed as “dilutive” to stockholders because some of benefit of new money goes to making debt holders whole.
  - Even if, from a social perspective, new capital would be a good thing—would ease credit crunch problems, etc.
  - Since they don’t want to be forced by regulators to issue equity, banks will also be reluctant to fully disclose extent of their losses.
- What policymakers need to do:
  - Push hard for better disclosure of losses.
  - Compel banks to raise equity.
    - Private market is presumptive best option.
    - But if can’t raise enough in private market, may have to make government capital available as a backstop.

Short-Run Fire Fighting: A Sampler

- TARP
  - $245B invested in 700 banks starting Oct. 2008
  - $82B in auto companies.
- AIG bailout: $182B from Fed and Treasury.
- Fed programs: alphabet soup.
  - TAF, TALF, AMLF, CPFF, QE1, QE2.
  - Broad liquidity support to banks, asset-backed securities market, commercial paper market.
  - And large-scale purchases of mortgage-backed securities and longer-term Treasuries.
- Assorted other guarantees.
  - FDIC's TLGP program: guarantee new borrowings by banks.
- Takeover of Fannnie Mae and Freddie Mac.

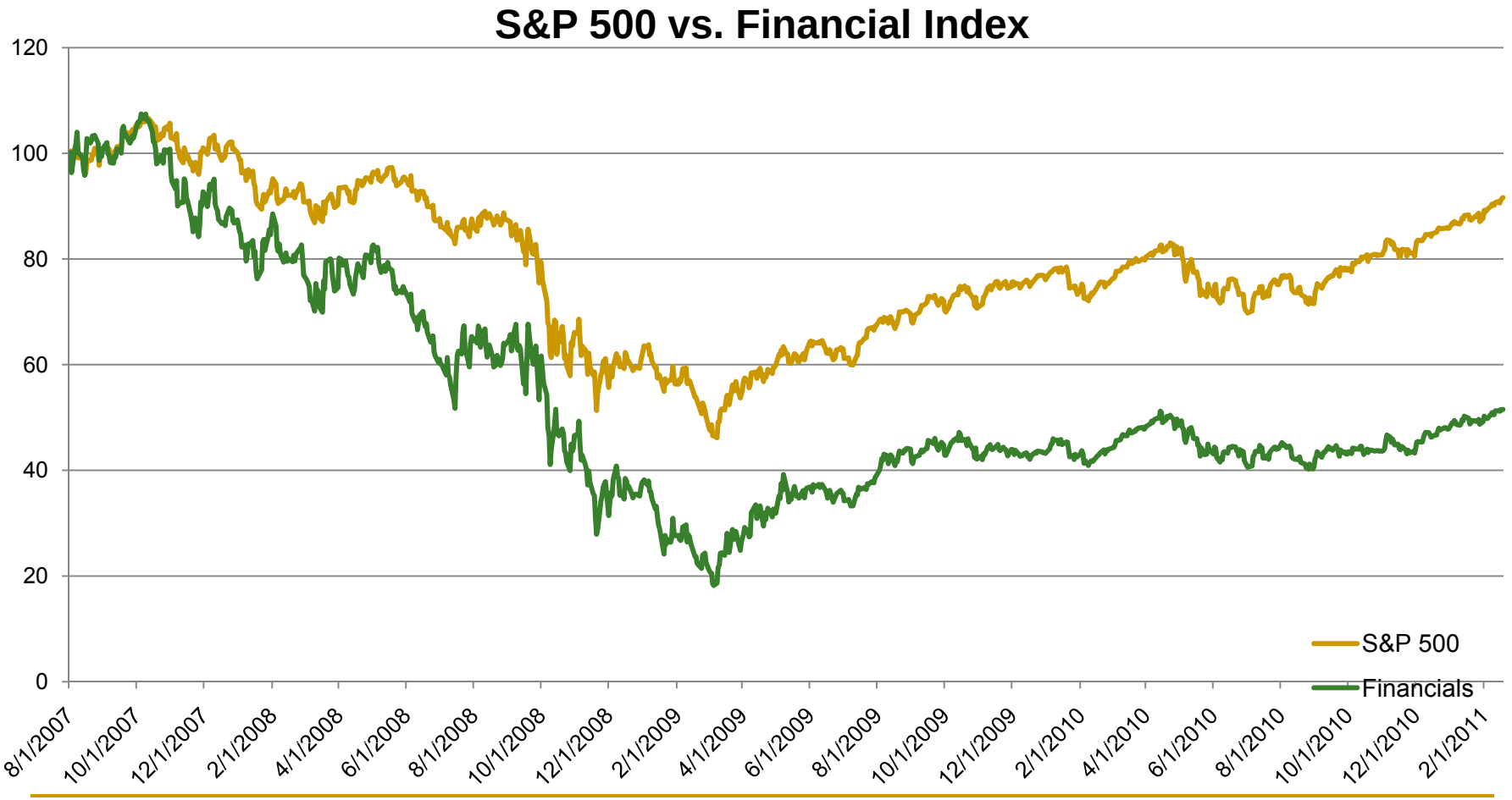
But What's the Diagnosis?

- Central question for fire-fighting strategy: is it primarily a solvency problem, or a fire-sales/liquidity problem?
- Solvency: bank assets are worth less than liabilities. Need to plug the hole.
  - Ideally, by having banks raise new equity.
  - Government capital as a last resort.
- Liquidity/fire sales: Asset prices are below hold-to-maturity values due to forced selling.
  - Lender-of-last-resort policies, guarantees can be a win-win here.

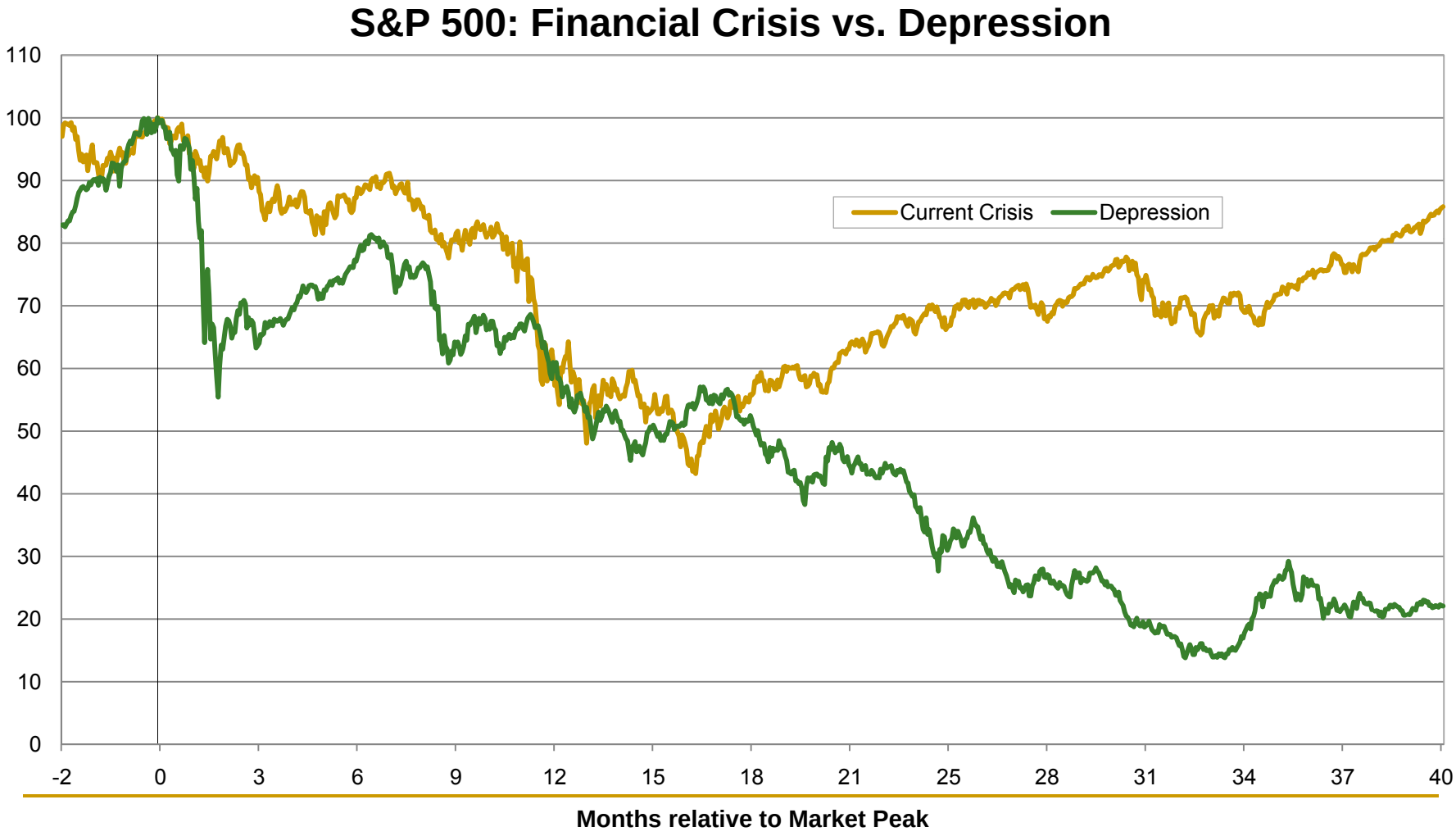
Treating Solvency: The Stress Tests

- Bank regulators to examine 19 largest bank holding cos; test ability to withstand adverse economic scenario.
  - Those with insufficient capital to be required to raise it.
- May 7 2009: Results released: overall losses of 19 banks for 2009-2010 estimated as $600B.
  - 9 of 19 have enough capital to absorb losses.
  - Other 10 are told they need to raise a total of $75B.
- In weeks after stress tests, banks raise over $60B of new equity. Total is $140B within a year.
  - Belying widely-held views that private equity-raising of this magnitude would be impossible for such a troubled sector.

Financial Markets Have Rallied Strongly Since Stress Tests



Some Perspective: This Crisis vs. Great Depression



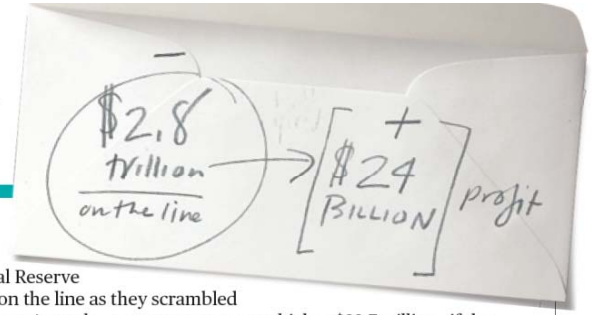
Stress Tests: Evaluation

- Clearly a success: overarching goal was infusion of new private equity, and this was met beyond expectations.
- Reasons for the success?
  - Credibility of tests: market reassured that potential losses not worse, and that most banks were in better shape than feared.
    - Detailed disclosure of loss estimates at bank and loan category level a big plus.
  - Bank stocks buoyed by fact that government would not be nationalizing a large chunk of the sector.
    - Note positive spiral: confidence→higher stock prices→easier to raise private equity→less need for government capital.
  - Executive compensation restrictions make bank CEOs eager to avoid taking government capital. Willing to raise private equity even if this dilutes their shareholders.

Ultimate Costs to Taxpayers

- Treasury had by March 2011 recouped $250B of the total $245B TARP investment in banks.
  - All the original TARP 9 are fully out.
  - Treasury expects to net +$20B from banks, including dividends and proceeds from warrants.
- Remaining exposures:
  - AIG, car companies (Treasury now owns shares).
  - Not to mention Fannie and Freddie (though this is not TARP).
- Does this mean it was mainly a liquidity crisis, and solvency fears were overblown?
  - My take: solvency problem was real, though smaller than feared. But absolutely critical to treat aggressively for solvency early on.

Bloomberg Businessweek®



Back of the Envelope

Accounting for the Bailout

At the height of the financial crisis, the Federal Reserve and the Treasury had more than $2.8 trillion on the line as they scrambled to prevent a financial meltdown. The government's total exposure was an even higher $23.7 trillion–if the U.S. were forced to make good on all promises, including guaranteeing Fannie Mae and Freddie Mac, says the special inspector general for the Troubled Asset Relief Program. The rescue efforts are now on track to turn a profit of about $24 billion, according to Treasury's Mar. 30 projections. —*Rebecca Christie*

Troubled Asset Relief Program

COMMITTED: $700 BN

BOTTOM LINE: $28.1 BN LOSS

The $700 billion Troubled Asset Relief Program was the primary bailout vehicle for both the Bush and Obama Administrations. Treasury expects bank capital injections to turn a profit once the government exits all bank investments. It projects losses to come from housing and auto industry assistance.

BANKS

Treasury injected $245 BN into about 700 banks. Already it has collected $251 BN from repayments, dividends, and warrant sales. Combined with two smaller bank programs, Treasury is on track to reap a $19.7BN PROFIT including $12 BN from Citigroup and $1.4 BN from Goldman Sachs Group.

AIG

Insurance giant American International Group got Fed and Treasury bailouts of $182 BN

Of that, about $68 BN came from TARP, and that portion is expected to generate an $8 BN LOSS

Treasury also got $20 BN worth of AIG stock—based on the shares' Nov. 30, 2010, market value—from the Fed as part of a December restructuring that boosted Treasury's ownership stake to 92% from 79.9 percent. Treasury says the U.S. may come out about $12 billion ahead once it sells those shares.

AUTOS

Treasury put about $82 BN into General Motors, Chrysler, and both their financing arms and suppliers. It projects a ~~$14.8BN~~ LOSS

HOUSING

Treasury has set aside $45.6 BN to help distressed homeowners stay in their homes and doesn't expect to get any of that back.

CREDIT MARKETS

Direct purchases of troubled assets from banks' frozen balance sheets—TARP's original intent—turned out to be minor. Still, Treasury expects a $500 MN gain on the Public-Private Investment Program and similar efforts.

Federal Reserve Programs

COMMITTED: $1.7 TN

BOTTOM LINE: $110 BN PROFIT

The Fed's wide array of programs to prop up the financial system will generate $110 billion for taxpayers, Treasury says. The programs include Fannie Mae and Freddie Mac debt purchases, a commercial paper funding facility, purchases of asset-backed bonds, dollar swaps with other central banks, and the AIG bailout.

Mortgage-Backed Security Purchases

COMMITTED: $225 BN

BOTTOM LINE: $13.5BN PROFIT

Treasury purchased mortgage-backed securities in 2008 and 2009. It expects to sell them over the next year at a profit.

Money-Market Mutual Funds

COMMITTED: $50 BN

BOTTOM LINE: $1.2 BN PROFIT

After investors began fleeing money-market mutual funds, regulators scrambled to backstop the $3.3 trillion industry. Treasury committed $50 billion to a government insurance program that collected $1.2 billion in premiums. It never had to cover any losses.

Fannie Mae and Freddie Mac

COMMITTED: $154 BN

BOTTOM LINE: $73BN LOSS

Fannie and Freddie are operating with an unlimited federal government lifeline. So far they have received about $154 billion and paid about $20 billion in dividends, for a net drawdown of $134 billion.

Federal Deposit Insurance Corp.

The FDIC guaranteed $350 billion in corporate debt and $834.5 billion in business checking accounts through programs that Treasury projects will break even. The FDIC is now running a surplus, with $10 billion in premiums offsetting $2.4 billion in claims to date.

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DATA: U.S. TREASURY

Lessons for Financial Reform

- Hallmark of financial crises is not just asset overvaluation per se.
  - Rather, overvaluation accompanied by high leverage—with much of the debt typically being short-term in nature.
  - Real estate is often in the middle of things, because it makes such good collateral for borrowing.
- Much work to do on reforming financial regulation. But key is moderating financial-sector leverage.
  - Require banks to hold more capital in good times.
  - Constrain ratio of short-term bank debt to total debt.
  - Find ways to promote rapid recapitalization in bad times.
  - But be aware that stiffer regulation of banks will tend to drive financial intermediation into more lightly regulated "shadow banking" sector.

On the Perils of Mathematical and Statistical Modeling in Finance

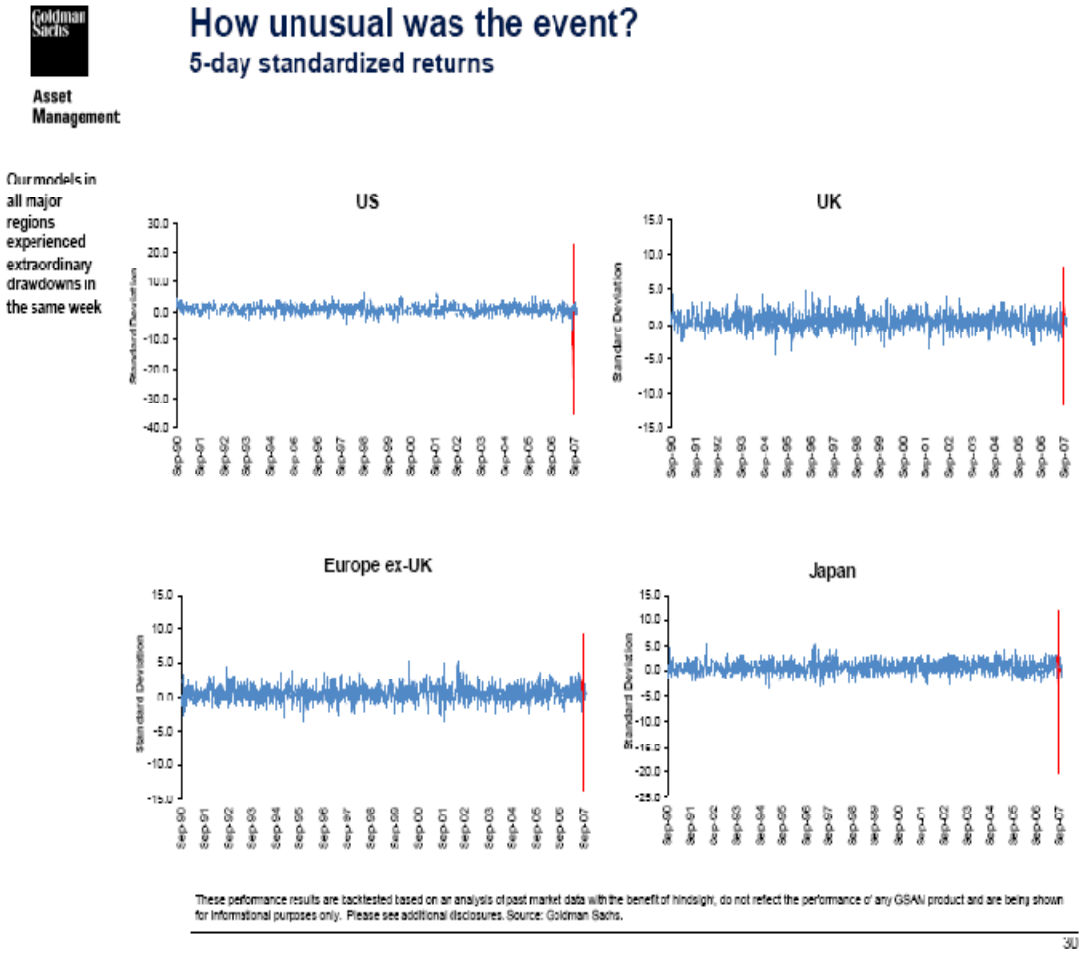
- Canonical problem: asset *i* follows an exogenous stochastic process given by:

$$\frac{dP_{it}}{P_{it}} = \alpha_{it}dt + \sigma_{it}dz_i$$

- You estimate the parameters, build a diversified portfolio to optimize ratio of mean to variance.
- Then you apply leverage. How much? Up to the point where your model tells you risk of ruin is only say 0.5%.
  - E.g., you can survive a 3-sigma event.

The Quant Debacle of August 2007

- In early August 07, quant equity hedge funds experienced negative returns on order of 30 to 40 standard deviations.
- That's pretty unlucky.



What Gives?

- Mistake is treating asset price processes as exogenous.
- If enough people believe assets are uncorrelated, and lever aggressively against that belief, *their actions change the equilibrium and invalidate the original data*.
  - In extremis, high leverage forces them to liquidate all their holdings together, driving correlations to one.
  - Not a problem that can be cured with more data or fancier analytics. Need to understand the economics.
- Moral applies broadly to model-based financial innovation.
  - E.g., the belief that house prices were historically stable and uncorrelated across regions led to innovations in subprime lending that were ultimately highly destabilizing.