Predicting the Unpredictable:
Theory and Policy in the Presence of Asset Bubbles

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We are at a "Who Knew" moment in economics:
1. Who knew a recession would begin in late 2006?
2. Who knew how serious it would be?
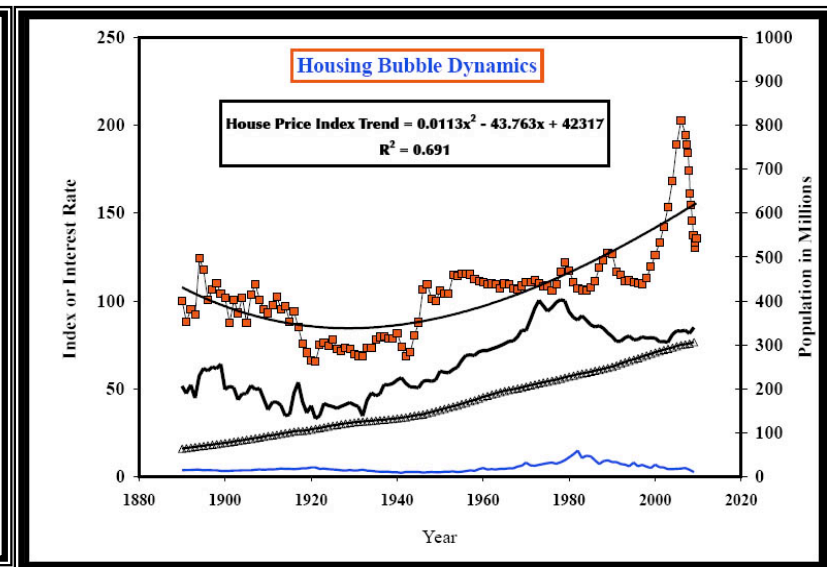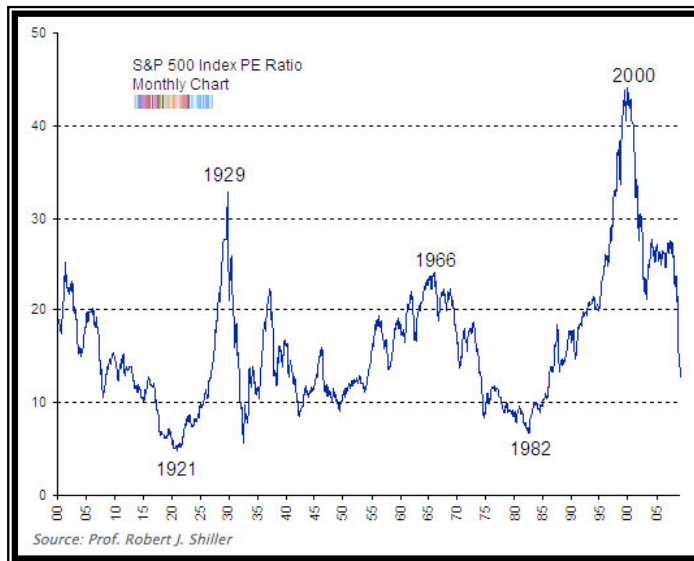3. Who knew what kind of policy responses would be needed?

The Short Answer: "Mostly 'No'"

Prior to 2007, few individuals correctly identified a recession in the making. Some names come to mind in this regard, e.g. Robert Shiller, Nouriel Roubini, and Andrew Lo, among others. Yet cautionary predictions were largely ignored in policy circles, whether in the Federal Reserve, Congress, or among the States. Moreover, ratings agencies seemed largely unaware of the rising level of risk, and investors continued to take on increasingly exotic products such as collateralized debt obligations (CDO's) and credit default swaps (CDS's). Since traditional warning signs such as consumer inflation were not on the horizon, few thought that the collapse of asset bubbles in housing or equities could precipitate a major downturn, the likes of which the U.S. had not confronted since the 1930's.

We should note at the outset that even the few who predicted a recession, perhaps even fewer were able to tell in advance how serious it would be, or what kind of policy responses would be needed to bring the economy back to sustainable full-employment levels.
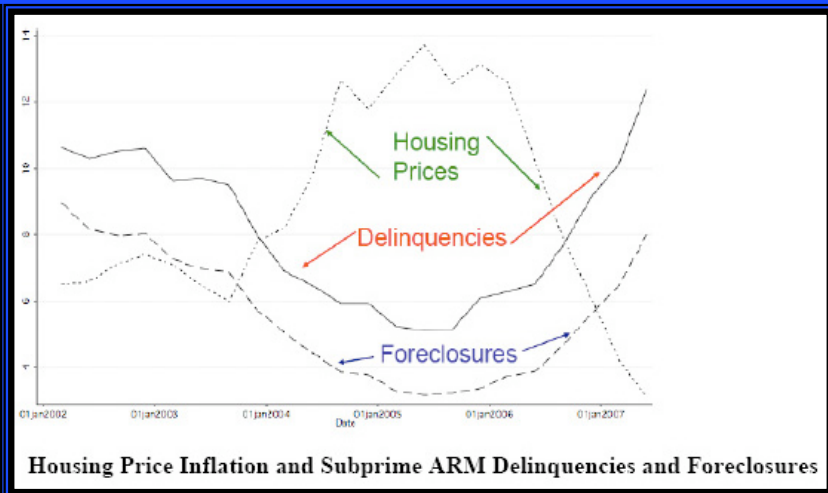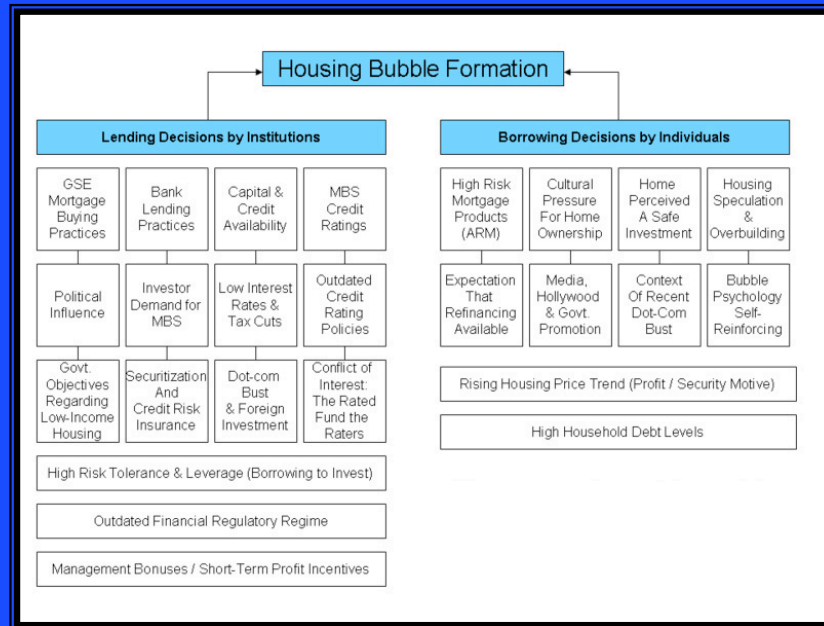
Signs of Risk in a Changing Economy

Evidence of Asset Bubbles:

S&P 500 Index PE Ratio
Monthly Chart

1929

2000

1966

1921

1982

Source: Prof. Robert J. Shiller

Housing Bubble Dynamics

House Price Index Trend = 0.0113x² - 43.763x + 42317

$R^2 = 0.691$

Index or Interest Rate

Population in Millions

Year

Asset bubbles consist of rising prices in such areas as stocks, housing, and primary commodities such as gold and silver that are unsustainable relative to historical norms. Individuals have underlying time preferences that may be similar to prevailing interest rates. If not, individuals will seek, and take the corresponding risks, of alternative asset investments rather than rely on bank time deposits, cd's or even the stock market. Lacking transparent and symmetric information, individuals thus help to creating and drive asset bubbles. When one is in a bubble it becomes obvious all too often only in hindsight after asset values have fallen dramatically in a return to levels more consistent with historical norms. What is often difficult to reconcile is exactly what is an "historical norm"

Signs of Risk in a Changing Economy

1. Expanding housing subsidies fuel the sub-prime market

Housing Bubble Formation

Lending Decisions by Institutions

GSE Mortgage Buying Practices	Bank Lending Practices	Capital & Credit Availability	MBS Credit Ratings
Political Influence	Investor Demand for MBS	Low Interest Rates & Tax Cuts	Outdated Credit Rating Policies
Govt. Objectives Regarding Low-Income Housing	Securitization And Credit Risk Insurance	Dot-com Bust & Foreign Investment	Conflict of Interest: The Rated Fund the Raters

High Risk Tolerance & Leverage (Borrowing to Invest)

Outdated Financial Regulatory Regime

Management Bonuses / Short-Term Profit Incentives

Borrowing Decisions by Individuals

High Risk Mortgage Products (ARM)	Cultural Pressure For Home Ownership	Home Perceived A Safe Investment	Housing Speculation & Overbuilding
Expectation That Refinancing Available	Media, Hollywood & Govt. Promotion	Context Of Recent Dot-Com Bust	Bubble Psychology Self-Reinforcing

Rising Housing Price Trend (Profit / Security Motive)

High Household Debt Levels

Housing Price Inflation and Subprime ARM Delinquencies and Foreclosures

The goal of broad-based home ownership. This has been an underlying goal of every US administration since the Great Depression of the 1930s. In the quest fo an "ownership society", Congress has adopted any number of incentives and rules in support of this goal on the assumption that a more stable and prosperous society would result. Home ownership rates, which rose from 64 to 68 percent in the past five years, have been driven not just by low interest rates. They also have been driven by government-sponsored public financing entities (I.e., GSE's) such as Fannie Mae (1938), Ginnie Mae (1968), and Freddie Mac (1970). These institutions were pressured by the Clinton and George W. Bush administrations to promote an "ownership society" in housing. Fannie Mae and Freddie Mac used relaxed accounting standards to issue mortgage-backed securities to fuel more housing construction and purchases.By 2007, Fannie Mae and Freddie Mac were becoming insolvent and needed infusions of Federal money to keep issuing mortgage-backed securities, thus feeding further pricing speculation.

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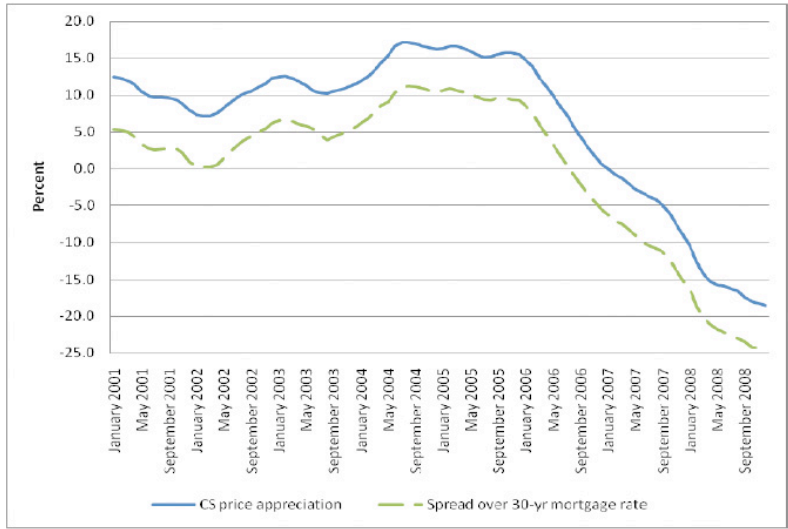
S&P/Case-Shiller US home price appreciation and its spread over the 30-year conventional mortgage rate, 2001-2008. Source: Standard & Poor's, http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_csmahp/2,3,4,0,0,0,0,0,0,0,0,0,0,0,0,0.html; and Board of Governors of the Federal Reserve System, 30-year conventional mortgage interest rate series.

Annual growth of US households' debt and mortgages. Source: Board of Governores of the Federal Reserve System, *Flow of Funds Accounts of the United States*.

Signs of Risk in a Changing Economy

2. Derivative Contracts Do Not Address Systemic Risks

UNDERLYING	CONTRACT TYPES				
	Exchange-traded futures	Exchange-traded options	OTC swap	OTC forward	OTC option
Equity	DJIA Index future Single-stock future	Option on DJIA Index future Single-share option	Equity swap	Back-to-back Repurchase agreement	Stock option Warrant Turbo warrant
Interest rate	Eurodollar future Euribor future	Option on Eurodollar future Option on Euribor future	Interest rate swap	Forward rate agreement	Interest rate cap and floor Swaption Basis swap Bond option
Credit	Bond future	Option on Bond future	Credit default swap Total return swap	Repurchase agreement	Credit default option
Foreign exchange	Currency future	Option on currency future	Currency swap	Currency forward	Currency option
Commodity	WTI crude oil futures	Weather derivatives	Commodity swap	Iron ore forward contract	Gold option

Big Bets

Gross market value of derivatives contracts outstanding, in trillions

$25
20
15
10
5
0

'99 '01 '03 '05 '07 '09

Note: Data are as of June of each year
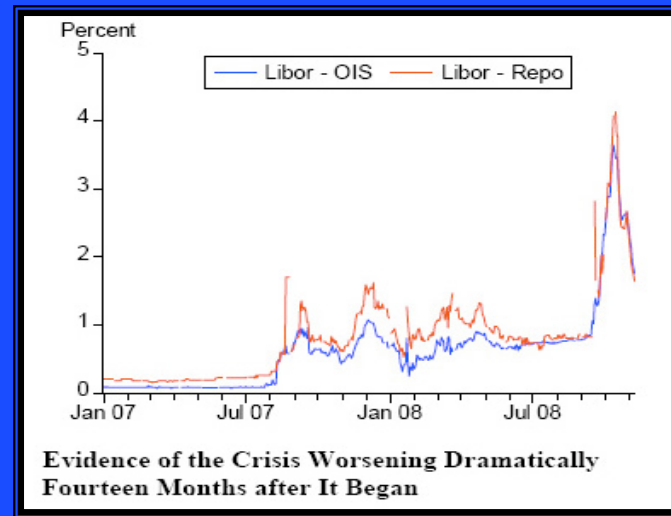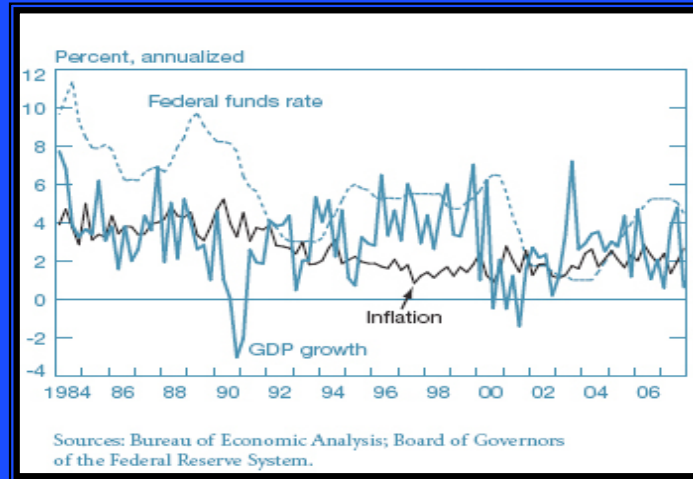Source: Bank for International Settlements

Signs of Risk in a Changing Economy

Financial Innovations to Manage Risk:

1. <u>Hedge Funds</u> (1966) - Limited Liability Partnerships exempted from the provisions of the 1933 Securities Act and the 1940 Investment Company Act, which restrict the operations of mutual funds and investment banks with respect to leverage and short-selling. Hedge funds have operated outside of any formal regulatory structure, even though some have been bailed out (e.g., the Federal Reserve bailout of Long Term Capital Management in 1999).

2. <u>Structured Investment Vehicles (SIV's)</u> (1988) - Created by Citibank, these are funds that borrow money by issuing short-term securities at low interest and then lend that money by buying long-term securities at higher interest, making profit from the difference. SIV's ceased to exist as of October 2008, with the onset of the latest recession. Also known in Europe as Special Purpose Entity (SPE).

3. <u>Mortgage-Backed Security</u> (MBS) - First used by the Government National Mortgage Association (Ginnie Mae, est. in 1968), in 1970, these consist of government backed securities issued on the basis of mortgages purchased from originators. These pass-throughs have been used by the Federal National Mortgage Association (FNMA, of Fannie Mae, est. in 1938), and by the Federal Home Loan Mortgage Corporation (Freddie Mac, est. 1970). During the latest recession, these institutions have some $14.6 trillion in U.S. mortgage debt outstanding. Mortgage-Backed Securities are also known as <u>Collateralized Debt Obligations</u> (CD0's). When Collateralized Debt Obligations are segmented into differing risk tranches (e.g., unsecured, mezzanine, senior secured), the groups derived from the original pool often are referred to as Derivatives, because their value derives from the value originating in the initial market mortgage pool.

4. <u>Derivatives</u> - Derivatives are financial contracts that derive their value from some other asset, index, event, value, or condition. Derivatives are considered to be risk-sharing instruments that operate as a form of insurance. Derivatives have largely been unregulated since their expansion in the United States, which started with the Chicago Mercantile Exchange in the 18th century and accelerated with the creation of the Chicago Board of Options Exchange in 1973. Derivative contracts typically are exchanged through two types of markets: 1. <u>Over the Counter (OTC) contracts</u> that are traded on formal exchanges; 2. <u>Exchange-traded derivatives (ETD)</u> that trade via specialized derivatives exchanges.
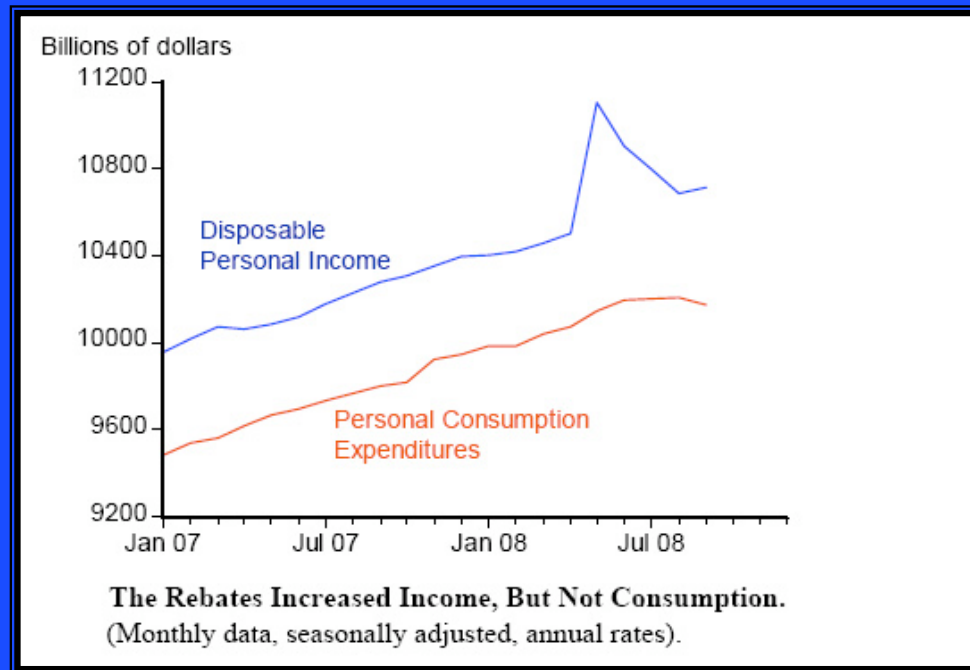
Signs of Risk in a Changing Economy

3. Classic Monetary Stimulus Falls Short

Percent, annualized

Federal funds rate

Inflation

GDP growth

Sources: Bureau of Economic Analysis; Board of Governors of the Federal Reserve System.

Libor OIS spread (3 month)

12 Sept 2008

9 Aug 2007

The Libor–OIS Spread During the First Year of the Crisis

Libor - OIS   Libor - Repo

Evidence of the Crisis Worsening Dramatically Fourteen Months after It Began

Signs of Risk in a Changing Economy

4. First-Round Fiscal Stimulus Falls Short

Billions of dollars

Disposable
Personal Income

Personal Consumption
Expenditures

The Rebates Increased Income, But Not Consumption.
(Monthly data, seasonally adjusted, annual rates).

Signs of Risk in a Changing Economy

5. Second-Round Fiscal Stimulus Runs Out of Steam

Table 1.

Estimated Macroeconomic Impact of the American Recovery and Reinvestment Act, 2009 to 2012

	Real Gross Domestic Product (Percent)		Unemployment Rate (Percentage points)		Employment (Millions of people)		Full-Time-Equivalent Employment (Millions)[a]	
	Low Estimate	High Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate
2009 (Calendar Year Quarter)								
Q1	0.1	0.1	*	*	*	*	*	0.1
Q2	0.9	1.5	-0.2	-0.3	0.3	0.5	0.5	0.8
Q3	1.3	2.7	-0.4	-0.7	0.7	1.3	1.0	1.9
Q4	1.5	3.5	-0.5	-1.1	1.0	2.1	1.4	3.0
2010 (Calendar Year Quarter)								
Q1	1.7	4.2	-0.7	-1.5	1.2	2.8	1.8	4.1
Q2	1.7	4.6	-0.8	-1.9	1.4	3.4	2.0	4.9
Q3	1.4	4.2	-0.8	-2.0	1.4	3.7	2.0	5.3
Q4	1.1	3.6	-0.7	-1.9	1.3	3.6	1.8	5.1
Calendar Year Average								
2009	1.0	2.0	-0.3	-0.5	0.5	1.0	0.7	1.4
2010	1.5	4.2	-0.7	-1.8	1.3	3.4	1.9	4.8
2011	0.7	2.2	-0.5	-1.4	0.9	2.6	1.2	3.6
2012	0.1	0.3	-0.1	-0.4	0.2	0.7	0.2	0.7

Source: Congressional Budget Office.

Note: * = Between -0.05 and 0.05.

a. A year of full-time-equivalent employment is 40 hours of employment per week for one year.

Legislative stumbling over the Troubled Asset Relief Program of 2008 (TARP), the Economic Stimulus Act of 2008 (ESA) and the Economic Recovery and Reinvestment Act of 2009 (ARRA) illustrate just how little was known to work in a climate of deeply divided opinion over the need for monetary or fiscal policy intervention. It also reflects much academic debate over why markets in the aggregate seemed to be failing in the first place.
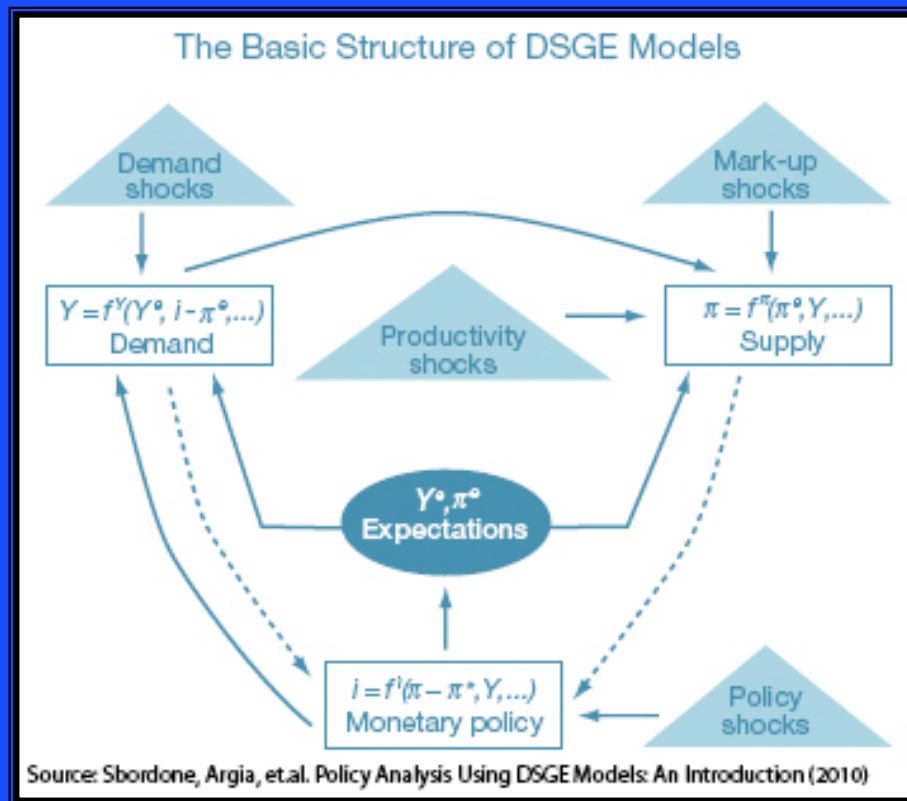
Economic Theory and Its Counter-Factuals

It is reasonable to ask why so few predicted a recession and why weren't markets reflecting an imminent downturn? In turn, why were economic models coming up so short of the task at hand?

Whether in economics or finance, the benchmark reference is the competitive economy consisting of self-interested utility maximizing consumers and profit-maximizing firms. Competitive markets are characterized as incorporating all relevant information in the allocation of resources, a process in which both product and input prices adjust accordingly. The finance counterpart is the efficient market hypothesis, in which all relevant information is incorporated into asset prices.

In the real and financial sectors, as long as competitive conditions prevail, there is no presumptive basis for market failure, and thus for government intervention. Only a set of simplified rules that address externalities, distributive justice, and sustainable growth monetary policy are seen as justified, with the notion that macroeconomic failures are at most an anomaly. As long as the above conditions were true, the need for government intervention would be minimal.

The difficulty with the above framework is that government already has intervened in substantial ways, thus complicating the extent to which one could reasonably expect some market-driven self-adjusting process in which prices reach an efficient equilibrium. Moreover, markets may be less than competitive, the entry barriers to which often reflect some less than thorough appreciation of the extent of government barriers to entry.

Econometric models rely on past behavior to predict future conditions. They cover a broad range of detail, but form the basis for most forecasts of future activity. We have come a long way in recent years in the evolution of econometric models, with macro models now often dominated initially by CGE formulations, and more recently by a DSGE framework that spells out the underlying micro-foundations of agents.

The Basic Structure of DSGE Models

Demand shocks

Mark-up shocks

$Y = f^Y(Y^\circ, i - \pi^\circ, ...)$
Demand

Productivity shocks

$\pi = f^\pi(\pi^\circ, Y, ...)$
Supply

Y°, π°
Expectations

$i = f^i(\pi - \pi^*, Y, ...)$
Monetary policy

Policy shocks

Source: Sbordone, Argia, et.al. Policy Analysis Using DSGE Models: An Introduction (2010)

DSGE models enable one to test counter-factual hypotheses such as whether an alternative policy choice at some moment in the past would have generated a less extreme outcome than the current subject of one's inquiry, as in a recession. Yet if econometric models are to be truly useful, they need to pass the *ex ante* test of anticipating more crisis-prone events before they happen, that is, they need out-of-sample predictive accuracy.

In financial modeling, one can rely in the first instance on economy-wide macro-models to derive general scenarios, from which one then can obtain alternative financial portfolio scenarios. These financial portfolios generally seek to maximize returns subject to some minimum level of risk, that is, to arrive at an efficient portfolio choice. Thus, financial institutions provide continuing reviews of investments as new information becomes available, and at the same time, conduct stress tests to determine how much of a portfolio is at risk of loss. As Yogi Berra once said, "It's hard to make predictions, especially about the future."

While financial institutions now routinely engage in stress-testing procedures to estimate how robust a portfolio is when some proportion of assets are at risk of default, these tools were already in use prior to the most recent recession, and largely to no avail because off-balance sheet mechanisms such as structured investment vehicles, or SIV's often hid the true level of risk from a firm's balance sheet. Hence the need for greater accounting transparency.

Is There a Black Swan in Your Future?
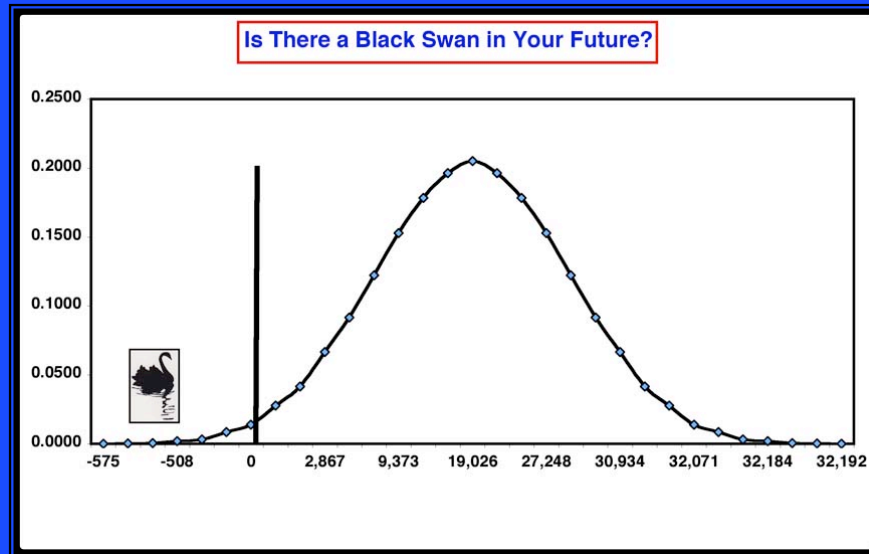
Whether one is conducting a stress-test of financial assets, or making some out-of-sample forecast, in almost all cases, the underlying econometric assumptions are built around normal distributions. Normal, or Gaussian, distributions assign low probabilities to extreme events, and rely on the corresponding expected value estimate of a particular outcome.

One problem with the Gaussian assumption is that a true distribution may not be normal. That is, we confront "fat tails" for otherwise seemingly low probability events. This makes seemingly rare events such as a black swan, more commonplace than our normality assumption would lead us to believe.

Fat tailed distributions carry a higher level of total risk than a normally distributed set of choices. We could note just how much in terms of absolute risk, as measured by a standard deviation, or relative risk, as measured by the coefficient of variation. In either case, economic agents in the real and financial sectors can make inefficient choices in the presence of such higher risk distributions. The question is whether government agents know any more than market-based information, and as such, could reduce the level of risk through some form of intervention.

Yet the problem of accurate forecasts is more complex than the problem of fat-tailed distributions. It is that for any given distribution, perceptions of risk shift in ways that are not easily captured in an econometric model. By this, we refer to insights provided from prospect theory.

Prospect theory has been around for thirty years and yet we have yet to find a way to meaningfully incorporate it into econometric models. One key premise behind prospect theory is that agents' perceptions of risk are anchored in recent events, with the result that informational myopia leads to choices that are, in hindsight, irrational.

For example, savings decisions are grounded in recent behavior, with more distant events essentially discounted. Such was the case, for example, with savings behavior in the 1920's, and which switched in the 1930's, and which was the basis for enacting Social Security in 1935. Had individuals known in the 1920's that equity valuations could precipitate a contractionary monetary policy by the Fed in the 1930's, they might have set aside a higher rate of savings. But they did not, and as unemployment reached 25 percent in 1933, the response was the New Deal. In short, even though the DSGE represents a useful starting point, we do not yet have a way of incorporating changing attitudes toward risk into useful predictions within macroeconomic models.

As a general proposition, experience tells us that government intervention, which can take a multitude of forms in terms of tax and spending incentives, typically does not reflect superior information to the market. Instead, it is reactive, and driven essentially by an effort to correct past events rather than ward off some future crisis. And in all too often instances, because it is informed by past events, it may create conditions of moral hazard in which future decisions lead agents to take on greater risk than a purely market driven context would warrant. What this implies is the need for financial and economic signals that could help agents make more rational decisions than they seem to do with the kind of herd behavior they so often display.

What Kinds of Reforms Are Needed?

Economic agents need clarity in making rational decisions. Because no action can eliminate risk, the best we can hope for is a set of tools that increase transparency, and in so doing, reduce the level of risk in the economy. Here is a short list for consideration:

1. Create clearinghouses for derivative transactions that can help markets price more efficiently the level of risk to which a given individual, firm, or institution is exposed.

2. Avoid "too big to fail" regulatory oversight measures that create moral hazard in which institutions take on excessive risks on the assumption that government will bail them out no matter what happens. This should be done in a coherent fashion in which we do not have a bailout of firms such as AIG while letting Lehman Brothers go under. All comparable agent environments should be subject to the same default probabilities that provide the necessary discipline for prudential investment choices.

3. Reduce artificial measures to subsidize housing, e.g. Fannie Mae and Freddie Mac in which they are required to create collateralized debt obligations that only add to aggregate risk, all with the seemingly innocent goal of universal housing ownership.

4. Establish truth-in-lending standards for unsecured debt that spell out the time frame to liquidate existing debt under various terms and conditions.

5. Undertake measures to bring the public deficit to historically manageable norms, consistent with the goal of sustainable non-inflationary full-employment over time. Proposals for a balanced budget amendment, pay-go standards, or various alternatives should be viewed through this perspective. While deficit spending should be kept as an option, use super-majorities or other rules to reinforce fiscal discipline in Congress, much as is the case now for state and local governments.

6. If *ex ante* information that is compelling and consistent regarding the existence of asset bubbles, instead of using interest-rate or open-market operations in response, have the Federal Reserve use its historical tools such as Regulation T and W to set credit margins at rates that are consistent with prudential risk choices and efficient pricing solutions in such markets as equities and housing.

What Kinds of Financial Reforms Are Under Consideration?

Financial Reform Legislative Proposals

	Proposed Provisions	Proposals eliminated
Derivatives	Requires insurance by a third-party clearinghouse and traded on public exchanges	A ban on Naked Credit-Default Swaps (i.e. they are still permitted)
Consumer Protection	Creates a federal regulator to write and enforce rules protecting consumers of financial products such as checking accounts, mortgages and payday loans.	"Plain Vanilla" loan option description for fixed-rate mortgages to borrowers
Financial Regulation	Creates a Federal Reserve regulatory council to lok for systemic risks and merges the Office of Thrift Supervision into the Office of the Comptroller of the Currency	Creation of a single regulatory agency (the Dodd proposal); This leaves in place the Comptroller, the Fed, F.D.I.C., the SEC, and the CFTC
"Too Big to Fail"	Authorizes regulators to impose restrictions on large, troubled financial companies; creates a proces for government ot liquidate falling companies at no cost to taxpayers, similar to the F.D.I.C. process for liquidating failed banks.	Limits on the largest financial companies to come under "too big to fail" provisions
Shareholder Protedtions	Requires companies to have executive compensation set by independent directors; gives shareholders a nonbinding vote on those decisions.	"Bonus taxation" on top earners
Proprietary Trading	One variation uses the Volcker Rule, which restricts banks from making "proprietary" investments that do not benefit clients, including in hedge funds and private equity funds. Most like to adversely affect Goldman Sachs which make much of their income from this type of activity.	Glass-Steagall Act of 1933 restoration (failed)
Investor Protections	Requires companies selling certain complex financial products, notably mortgage-backed securities, to retain a portion of the risk; allows investors to sue credit ratings	Separation of ratings agencies from banks who purchase the ratings on products they sell to

Source: *The New York Times* May 20, 2010

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