



# Asset Price Bubbles

Sarah Van der Elst & Luke  
Guerrero



# Agenda

Rational Models

Behavioral Models

Bubbles through History

Monetary Authority Intervention

# Introduction

- Bubble is deviation of market price from asset's fundamental value
- It's very difficult to determine when you're in one
- Early literature focused on models where all agents were rational yet bubbles persisted
- New literature relaxes rationality constraint
  - Helps to explain initiation, burst, and lack of arbitrage negation

# Hazards of Betting on Bubbles

- Short positions are costly
  - Potentially unlimited loss
  - Risk of premature call of borrowed asset
  - Interest on margin accounts
- Vilification by
  - Press
  - Governments
  - Companies
- Thus a persistent overvaluation is more likely than an undervaluation

# Foundations of Bubbles

- News moves the price of an asset up or down
- Feedback traders buy or sell with respect to past pricing patterns
- Current price does not reflect the current valuation
- Price goes beyond justified valuation
- Risk of short selling will allow positive bubble to persist and grow

$$P_t > E_t \left[ \sum_{\tau=t+1}^{\infty} \frac{CF_{\tau}}{(1+r)^{\tau-t}} \right],$$

$$P_t > E_t \left[ \sum_{\tau=t+1}^{\infty} \frac{CF_{\tau}}{(1+r_f)^{\tau-t}} \right].$$

# More Contributions to Bubbles

- Limited liability compensation structure
- Information intermediaries are not paid by investors and thus do not always report negative information
- High trading volumes likely to capture on current reactionary trading

# Rational Models

- When all agents are perfectly rational and all information is common knowledge, bubble can exist for an infinitely-lived asset if the rate of growth is equal to the discount rate

$$P_t = P_t^{fair} + B_t.$$

$$P_t = E_t \left[ \sum_{\tau=t+1}^{\infty} \frac{CF_{\tau}}{(1+r)^{\tau-t}} \right] + \lim_{T \rightarrow \infty} E_t \left[ \frac{B_T}{(1+r)^{T-t}} \right].$$

# Rational Models

- Bubble grows at rate  $r_B$  such that  $B_T = B_t(1+r_B)^{T-t}$ 
  - If  $r_B < r$  then the present value of the bubble is zero and it cannot exist
  - If  $r_B > r$  then the present value of the bubble is infinite and it cannot exist
- Implies that bubbles cannot exist when there is an upper bound on asset price
  - Substitute goods have upper bounds
  - If required ROR exceeds growth rate of the economy
- If asset is not infinitely-lived, then the bubble will burst at the end of the asset's life  $T$ , then  $T-1$ , then  $T-2$  etc.



# Rational Bubbles

- Bubble is not a function of time but rather a function of fundamentals
  - Investor is bad at forecasting Future CFs
  - Valuation relies too much on current CFs

$$B(CF_t) = cCF_t^\lambda$$

$$B_{t+1} = B_t(1 + r).$$

$$B_{t+1} = cCF_{t+1}^\lambda = cCF_t(1 + g)^\lambda$$

$$1 + r = (1 + g)^\lambda.$$

# Rational Bubbles

$$P_t^{fair} = \frac{CF_t(1+g)}{r-g}.$$

$$P_t = \frac{CF_t(1+g)}{r-g} + cCF_t^\lambda.$$

$$\frac{P_t}{CF_t} = c_0 + cCF_t^{\lambda-1} + \eta_t,$$

- Using the Gordon Growth Model
- Leads to model of price to cash flow
- Error term captures a shock to the demand for a stock that is not related to the fundamentals

# Rational Bubbles

- P/CF should be constant over time, and thus the last two term should be zero
- Data from S&P 500 suggests an increasing ration
  - Reject the no bubble hypothesis
- Froot and Obstfeld used dividends in place of cash flows
  - <50% of index value as of 1988 was a result of the **non-bubble component**
- Implies stocks are more volatile than dividends and prices overreact to dividend changes

$$\frac{P_t}{CF_t} = c_0 + cCF_t^{\lambda-1} + \eta_t,$$

# The New Generation of Rational Models

- Investigate role of:
  - Incentives
  - Market Frictions
  - Non Standard Preferences
- Herding of investment decision
- Limited Liability induces bubble riding
- Perverse incentives of disseminators of information

# Herding

- Important mechanism for sustaining and propagating bubbles
- DeMarzo, Kaniel, Kremer
  - Keeping up with the Joneses and relative wealth
- Scharfstein and Stein
  - First mover always mimics second mover
  - Signals and the labor market: smart and dumb
- Shiller
  - Compelling private information of peers and costs of investigation
- Lux
  - Costs of being wrong with everyone vs. wrong alone
- Media

# Limited Liability

- Positive gains with limited fallout
- Allen and Gorton
  - Unskilled vs. Skilled managers
  - Pool in equilibrium as long as profit is made
- Allen and Gale
  - Borrowers obtain investment capital from banks
  - Downside risk limited
  - Keep all profit
  - Convex payoff structure encourages riding bubbles

# Perverse Incentives

- Equity Analysts
  - Fear negative coverage will shut them out from management
  - Ignoring of “chinese wall”
  - Sell-side analysts get a fraction of commission
    - Easier to issue buy recommendations than sell recommendations
- Ratings Agencies
  - Paid by subject firm
  - More interested in short-term profit than long-term reputation
  - Subject firm may walk across the street

# Behavioral Models

- At least one groups of agents is assumed to be irrational
- Models separated into four categories



# Differences of Opinion and Short Sale Constraints

- Boundedly rational or Dogmatic investors will not take into account peers
  - Leads to a price too high or too low compared to fair market
  - Resolved with relaxation of short sale constraint or agreement
- Agents will pay premium over valuations today with expectation of selling at an even higher price tomorrow
- Chen, Hong and Stein
  - Stocks are more likely to be overvalued when owned by few firms
- Diether, Malloy and Scherbina
  - High forecast dispersion typically means overpriced
- Both confirm model assumptions

# Feedback Trading

- Good news encourages investors which encourages investors
- Shiller shows that news media engages in vicious cycle
  - Much more attention to internet than non-internet during dot com bubble
- Gives bubbles the flavor of a Ponzi Scheme
  - Early investors gain more than latecomers
- Hong and Stein
  - News Watchers and Momentum Traders

# Biased Self-Attribution

- Consider signals that confirm their beliefs
- Dismiss signals that contradict their beliefs
- Daniel, Hirshleifer, and Subrahmanyam
  - Investors arrive at conclusion by hearing noisy private signal
  - Public signal agrees with conclusion but is almost pure noise
  - Investors take public signal seriously and adjust valuation upward
- Public signals often lead to movement in direction of private signals

# Representativeness Heuristic

- Deviation from optimal Bayesian information processing
- Too often change model based on “strong” news
- Do not change model enough based on “routine” news
  - Conservatism bias
- Barberis, Shleifer and Vishny
  - Random walk vs. mean-reversion vs. trends
  - Mistake a pattern between the latter two and extrapolate future data
  - Ignore low unconditional probability of continued success until signals point to reversion

# Behavioral Models

- The behavioral view of bubbles finds support in experimental studies
  - Artificial markets with finitely-lived assets
  - Price bubbles arise frequently
- The presence of bubbles is often attributed to the lack of common knowledge of rationality among traders
  - Traders expect bubbles to arise because they believe that other traders may be irrational
  - Optimistic media stories and analyst reports may help create bubbles
    - Not because investors believe these views but because the optimistic stories may indicate the existence of other investors who do

# How are Bubbles Initiated?

- Rational models say that bubbles exist when asset starts trading
- Behavioral models say bubbles are result of signal analysis
- Historically sensible stories
  - Dot com: Improved tech would improve global productivity
  - Land: Growing population + Scarce Supply
  - 2008: Securitization supposedly would deal with idiosyncratic risk
- Increase in credit availability
- Hong, Scheinkman and Xiong:
  - Two technological investors model

# Housing Price Bubbles

- Brunnermeier and Julliard
  - Money illusions and the housing market
  - Real vs. Nominal
  - Falling expected inflation will push up prices of housing market

$$V_t = E_t \left[ \sum_{\tau=t+1}^{\infty} \frac{Rent_{\tau}}{(1 + r_{\tau}^{real})^{\tau}} \right]$$

$$V / Rent = \frac{1}{r^{real}}$$

$$V / Rent = \frac{1}{r^{nom}}$$

$$r^{nom} = r^{real} + inflation$$

# Why do Bubbles Burst or Deflate

- Scherbina agrees with Model 1
  - Bubble ends when consensus is reached
- Ofek and Richardson
  - Bubble ends when short sale constraint is relaxed
  - Morgan stanley index fell 1030 to 430 in March and April of 2000
    - 300 Billion in dot com shares were unlocked in the lead up
- Model 2
  - When capital flow changes
    - Tightening of credit in Japan in 1999
- Model 3 and 4
  - When positive sentiment is reversed: 1929 “Strong” signal on Real Estate
- Attack by Arbitrage



# Trading Volume

- Bubbles are accompanied by abnormally high trading volumes
- No-Trade Theorem
  - Broken by liquidity seekers due to exogenous shocks
- Model 2
  - Low -> high -> low
- Model 1
  - Baker and Stein extend
    - In good times, optimistic traders create high volume
    - In poor times, short sale constraint limits trade volumes
- Model 3 and 4 do not address trading volume
  - Behavioral biases aggregated to level of representative agent

# Why are Bubbles not Arbitraged Away

- Rational arbitrageurs may amplify rather than eliminate
  - Increase price of holding short position and fulfilling margins
  - Fundamentals could change
- Cryptic information
  - Experienced traders can interpret
  - Increases price of trading
    - Eliminate or greatly reduce arbitrage profit potential
- Sequential awareness and lack of coordination
- Optimal choice becomes riding bubble for a while before deciding to attack it
  - Hedge funds in 2000

# Bubbles in Experimental Settings

- Smith, Suchanek and Williams
  - Endowment and investment experiment
  - Bubbles appear in 14 of 22 experiments
- Relevant to real markets
  - Initially low price created expectation of future gain
  - Adding  $\frac{1}{3}$  “experienced” traders to the game lowered instances of bubbles dramatically
  - Lack of certainty of other traders opinions
    - No divergent information released
- In the market, prevalence of experience leads to few asset pricing bubbles

# Efficient Market Hypothesis

- Investors act on information without delay
- No arbitrage opportunities are possible
- Stock prices reflect best estimates possible regarding future prospects of each company
- Stock markets give correct signals to capital markets to guide efficient allocation of capital
- Doesn't assert that current stock prices will prove to have been correct when viewed in hindsight

# Financial Markets in Capitalist Economies

- Efficiently-priced financial markets are essential for smooth functioning of capitalist economies
- Common stocks: permanent capital for businesses and financial investment instruments that can be converted to cash quickly
- Important in capital resource allocation among competing uses

# Tulipmania

- Dutch nonfatal virus infected bulbs
- Prices reached a peak in early 1637
  - Semper Augustus
  - Variety status become widely known
- Negative feedback loop: bulb price deflation
- Rational vs. Irrational
  - Garber: Rare bulb prices still commanded high price after collapse of bulb prices, bubble more likely in common bulbs
  - Twenty-fold increase in prices hard to explain
  - Limited economic distress afterwards

# The Mississippi Bubble

- John Law
- 1717, control over trade between France and its Louisiana and Canadian colonies
  - 1719 control over trade with China and East Indies
  - 1720 Europe's most successful conglomerate
- Minted new coins and collected most French Taxes
- Financed by issuing shares
  - King was principal shareholder
- Stock prices began to fall in 1720, returned to pre-bubble price by 1721
  - Company tried to give investors paper money instead of paying off in gold coins
  - Exchange of shares for paper money caused runaway inflation
  - Monetization of shares and purposeful monetary deflation

# The Mississippi Bubble

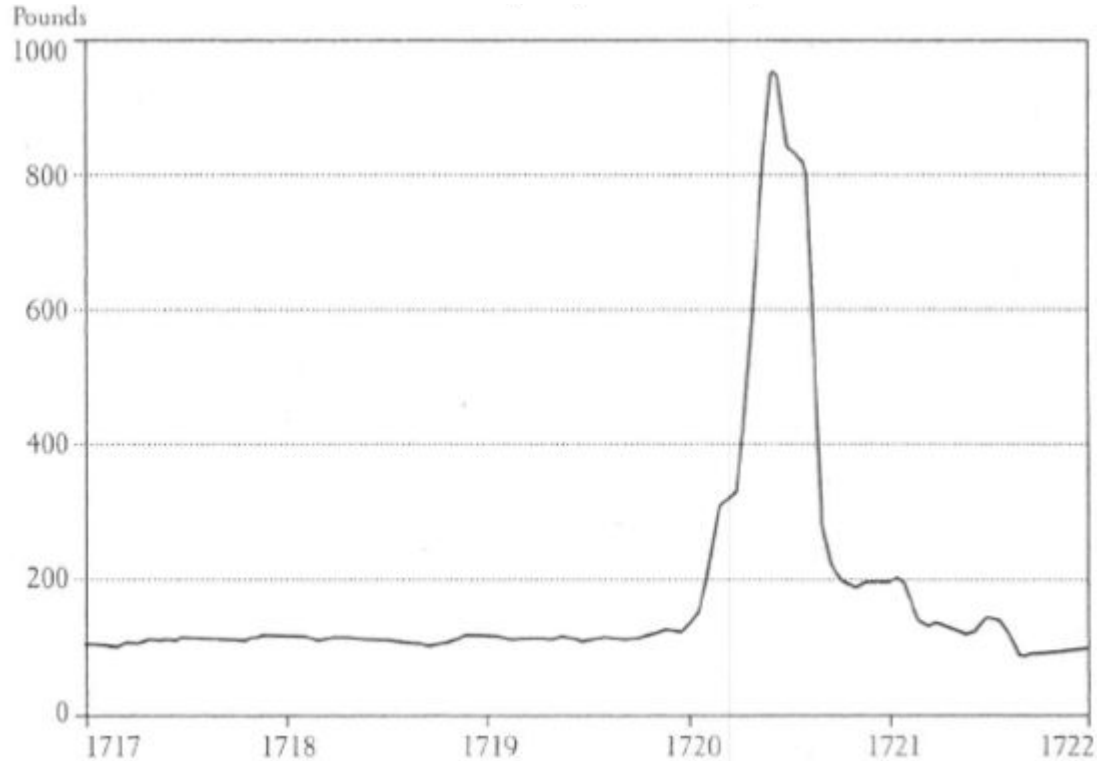
- Law's theory was plausible
- Downward slide of share price can be explained by radical shifts in monetary policy and connection of share price to Banque Royale note emission
- Law's fall from power and accession of his enemies
- Just because expansion never materialized doesn't mean it's a bubble
  - Investors couldn't know idea was flawed until experiment was run
  - Garber: can explain according to fundamentals, investor confidence



# The South Sea Bubble

- England, 18th Century
- Large holding of British government debt
  - Expanded shares to finance purchase of debt
- Monopoly over trade to South Seas
- Speculative craze about the potential profits to be made from trade with new world
- Speculation spread from one stock to other enterprises
- Liquidity crisis

# South Sea Company Stock Price, 1717-1722



# U.S. Stock Market Bubble and Crash, 1928-1932

- March 1928-September 1929 market percentage increase equaled that of 1923 to 1928
- September 5: “Babson Break”
- Fisher: “Permanently high plateau”
- October 21: record volume of sales on exchange and price decline
- Black Thursday and Market Crash

# U.S. Stock Market Crash not a bubble?

- Bierman, Jr.: without perfect foresight, stocks were not obviously overpriced in 1929, because it appeared the economy would continue to prosper
- Optimism in stock market may have been justified had it not been for inappropriate monetary policies
  - Argues crash due to Federal Reserve Board's policy of raising interest rates and decline in money supply
- Malkiel: irrational speculative enthusiasm drove prices far above the value of their underlying assets

# Japanese Real Estate Stock Market Bubble of 1980s

- 1980s Japan asset prices rose rapidly
  - Japanese stocks: sold at 60x earnings, total market value of \$4 trillion, almost 1.5 value of all U.S. equities, and close to 45% world's equity-market capitalization
- Real estate boom, 1955-1990 value of real estate increased more than 75 times
  - In 1990, Japanese property appraised to be worth five times as much as all U.S. property
- Price inflation a social phenomenon
- Stock market integral to Japanese culture

# Japanese Stock-Market bubble



Japanese Stock Prices Relative to Book Values, 1980-2000

# Japanese Central Bank Response

- Japanese government believed that a dangerous bubble existed
- Bank of Japan believed easy credit and borrowing frenzy were underwriting rise in land and stock prices
- Central bank restricted credit and rose interest rates
- Sharp rise in interest rates in 1990 and market collapsed
- Weakened entire financial system and lead to severe recession

# The Internet Bubble

- Burst in March 2000, \$7 trillion of market value
- New technology and new business opportunity
- Large number of useful new technology startups but also considerable misallocation of resources
- Media contributed to excitement
- Lead to short, mild recession



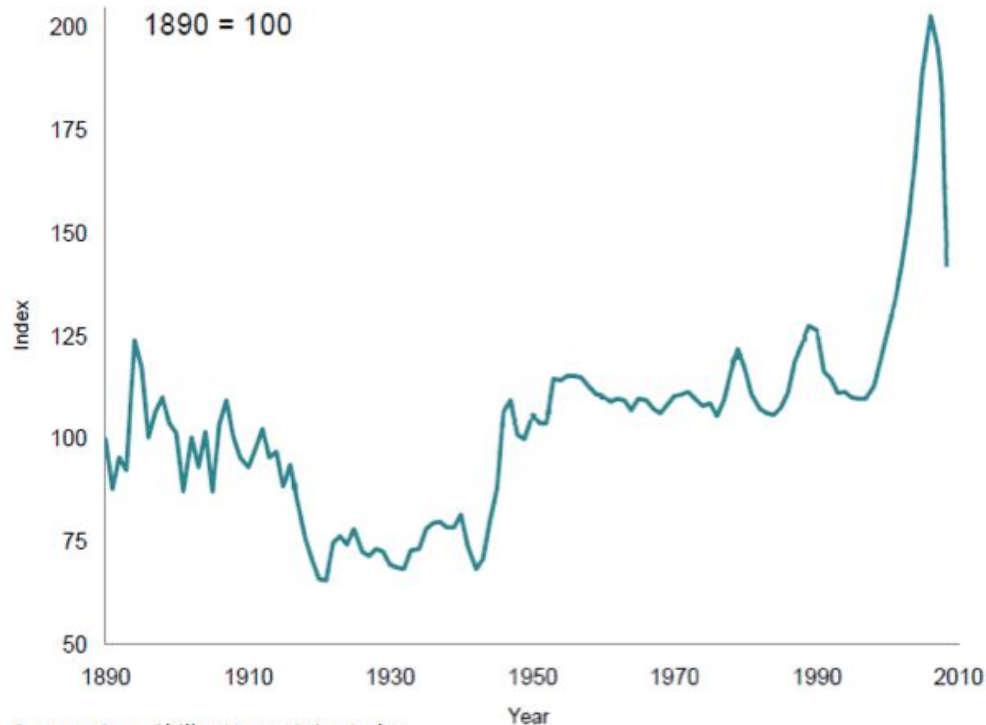
# Real Estate and Leverage Bubble of 2007

- Fundamental change in U.S. Banking system operation
  - Low interest rate post collapse of dot-com bubble
  - Two-tier securitization process: pooling mortgages into mortgage-backed securities (MBSs) and MBSs into collateralized debt obligations (CDOs) allowed investors to diversify away risk and lower mortgage rates
- Overstated benefits of cross-regional diversification
- Lower lending standards and Moral Hazard for lending institutions
- Bond rating agencies
- Government-sponsored enterprises securitized home loans and encouraged originators to make credit available to borrowers

# Real Estate and Leverage Bubble of 2007

- Increase in amount of funds lead to bubble in prices of single family houses
- Moral Hazard for borrowers: Low home equity created incentive for borrowers to walk away from house in event mortgage payments exceeded cost of renting elsewhere
- Sophisticated investors, successfully rode the bubble and switched to betting against it in time
- Rising prices accompanied by construction boom
- Financial Crisis Inquiry Commission: crisis could have been avoided if US government paid more attention to warning signs

# Housing Bubble in the United States



Source: Case-Shiller Home Price Index

# Bubbles and Economic Activity

- Bursting bubbles followed by disruptions in real economic activity
- Bubbles dangerous when associated with credit boom and widespread increases in leverage for consumers and financial institutions
- Positive Feedback followed by negative feedback
  - Increased demand for housing raises prices, which, encourages further mortgage lending
  - Price decline and individuals wealth declines and indebtedness may exceed value of houses

# Should Monetary Authorities Intervene?

- Asset price bubbles can occur with little or no general price inflation
- Greenspan: central bankers shouldn't react to asset-price bubbles but should be prepared to take vigorous action to offset economic dislocations that might follow
- Lansing and Taylor: monetary policy should react to anticipations of inflation and output gap and also asset prices
- Central bank advised to raise interest rates when prices above what are considered "warranted" levels

# Arguments Against Central Bank Intervention

- Bubbles aren't easily identifiable in advance (can even be difficult to identify ex post)
  - Argentine peso
  - Difficult to distinguish rising asset prices that result from technology shocks from those due to financial shocks
- If identifiable, how soon should preemptive action be taken?
  - Lags in operation of monetary policy may make it unlikely that effects take place in time
- Monetary policy is a blunt instrument, cannot be made to operate on a particular asset price that may be misaligned
- Hard to let out bubble gradually
- Bernanke and Gertler: reacting to stock prices instead of expectations of inflation and output gap results in inferior economic performance

# Selective Central Bank Policies

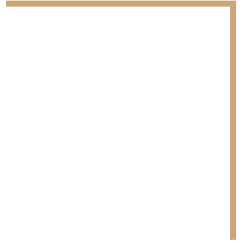
- Margin requirements, minimum equity that must be put up to finance stock-market purchases
  - Little evidence that this can be altered to successfully manipulate stock prices
  - Federal Reserve has expressed skepticism
- Tobin Tax: Transaction taxes on short-term speculative stock-market transactions
  - Proponents argue it could reduce volatility of stock prices
  - Could reduce liquidity, and possibly, increase volatility
  - May not work in an environment of global capital markets
  - May cause more problems than it would solve

# Other Suggestions to Prevent Future Bubbles

- Remove short sale restrictions
- Provide better financial education to reduce adverse influence of investor irrationality
- Mitigate limited liability incentive structure and expose all agents to the downside risk of a bubble



Questions?



# Bibliography

*Asset Price Bubbles: A Selective Survey, Anna Scherbina, IMF Working Paper, 2013*

*Bubbles in Asset Prices, Burton G. Malkiel, CEPS Working Paper, 2010*

*Famous First Bubbles, Peter M. Garber, The Journal of Economic Perspectives, 1990*