The Bubble Dilemma: Asset Prices in Historical Perspective

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What the he** is a “bubble“? Two examples

Where they come from

What to do about them
Bubbles can be dramatic

Figure 1
Returns on: equally weighted internet index, S&P 500, NASDAQ
And can have dire consequences
And can have dire consequences
One type of approach
You say “bubble”; I say “useless theorist”

Thinking about bubbles

- Easy to define theoretically - almost impossible to pin down cleanly empirically

- Observed: asset price (someone actually paid that)

- Prediction of the model, based on fundamentals

- Bubble $b = \text{asset price} - \text{prediction}$

- $b$ could be a bubble OR it could be a sign of a bad model
How can we sensibly talk about bubbles?

- “Stacking the odds”: be as optimistic as possible about fundamentals. If anything is left, let’s call the residual “a bubble”

- Behavioral diagnosis: derive predictions about what investors should do during bubbles, then compare to see if actual patterns are in line with these predictions
“A bubble may be defined loosely as a sharp rise in the price of an asset ..., with the initial rise generating expectations of further rises and attracting new buyers - generally speculators interested in profits from trading in the asset rather than its use or earning capacity.”

-- Charles Kindleberger, *The New Palgrave*
Do bubbles exist? Evidence from China and the Dotcom mania

How can they persist?

A bit of theory

What to (not) do about them

Lessons from 1927

Some experimental evidence

Conclusions for policy (and investors)
Key Bubble Characteristics

- Extreme valuation
  - returns
  - M/B
- Co-movement of valuation and volume
- Low profitability
- Valuation errors
  - 3Com case
  - Chinese warrants
- Extreme volatility
Figure 1
Returns on: equally weighted internet index, S&P 500, NASDAQ
Figure 2
Total daily volume and number of Internet firms
Valuing Nasdaq

- Let’s push traditional valuation models as far as possible - and if the observed valuations can only be matched with wildly unrealistic assumptions, it’s a bubble
- Were marginal investors too optimistic?
  - Use first day, end of quiet period to examine holdings of investors
  - Use retail as a proxy for optimists
- Why did the pessimists fail to matter?
  - Evidence on price of shorting
- Why the eventual collapse?
  - Lock-ups - marginal investor shifts
Figure 4
Histogram and cumulative frequency implied PE ratios of internet firms at the end of 1999
Valuation

- $r^*$ supernormal profits, $r$ normal profits, supernormal profits accumulate for $T$ periods.
- Then stock value
- Since firms have negative earnings, use imputation - assume that firms are already as profitable as old-economy equivalents

Panel A

Implied excess return on capital

Implied excess return on capital $(1+R^*)/(1+R)$ for internet firms as of 12/1999, assuming they already have profitability of comparable established industry, (i.e., P/E of 605)

<table>
<thead>
<tr>
<th>Years</th>
<th>Terminal P/E levels</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td>50.7%</td>
<td>44.7%</td>
<td>40.6%</td>
<td>37.5%</td>
<td>35.0%</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>31.5%</td>
<td>28.0%</td>
<td>25.5%</td>
<td>23.7%</td>
<td>22.2%</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>22.8%</td>
<td>20.3%</td>
<td>18.6%</td>
<td>17.3%</td>
<td>16.2%</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>17.8%</td>
<td>15.9%</td>
<td>14.6%</td>
<td>13.6%</td>
<td>12.8%</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>14.7%</td>
<td>13.1%</td>
<td>12.0%</td>
<td>11.2%</td>
<td>10.5%</td>
</tr>
</tbody>
</table>
Panel B

Implied excess return on capital

Implied growth rates $g$ for internet firms as of 12/1999. Assuming they already have profitability of comparable established industry, (i.e., P/E of 605), and that WACC=16% during the growth period.

<table>
<thead>
<tr>
<th>Years</th>
<th>Terminal P/E levels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>74.8%</td>
</tr>
<tr>
<td>15</td>
<td>52.5%</td>
</tr>
<tr>
<td>20</td>
<td>42.4%</td>
</tr>
<tr>
<td>25</td>
<td>36.7%</td>
</tr>
<tr>
<td>30</td>
<td>33.0%</td>
</tr>
</tbody>
</table>
Panel B

Correlation between various measures of short interest and firm characteristics for 273 internet firms as February 2000. Age is the number of months since the IPO until February 2000. Implied P/E is the stock price scaled by steady state earnings (current revenues/profit margins of comparable old economy margins).

<table>
<thead>
<tr>
<th>Short interest/shares outstanding</th>
<th>Rebate rate</th>
<th>Age</th>
<th>Implied PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short interest/shares outstanding</td>
<td>1.000</td>
<td>-0.431&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.252&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Rebate rate on shorts %</td>
<td>-0.431&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.000</td>
<td>0.082</td>
</tr>
<tr>
<td>Age</td>
<td>0.252&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.082</td>
<td>1.000</td>
</tr>
<tr>
<td>Implied PE</td>
<td>-0.045</td>
<td>-0.161&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.092</td>
</tr>
</tbody>
</table>

<sup>a</sup> - Significant at the 1% level

<sup>b</sup> - Significant at the 5% level
Figure 5
Volume and returns relative to quiet period end
3Com/Palm Stub
3/2/00 - 9/18/00

3/20: 3Com announced distribution to occur by September, earlier than planned.

5/8: IRS approval announced, Palm shares to be distributed 7/27.

3/16: Options start trading on subsidiary.

7/27: Distribution.
Xiong and Yu - Chinese warrant bubble

- Chinese stocks only allowed to fall by 10% a day
- Warrants with N days of trading left, with strikes far from current price
- Because of maximum movement per day, stock CANNOT reach strike price
- Nonetheless, traded (massively) at positive prices
Figure 1. Prices of WuLiang Put Warrant
Massive turnover
How can bubbles develop in the first place?

Keynes (1936):

“It might have been supposed that competition between expert professionals, possessing judgment and knowledge beyond that of the average private investor, would correct the vagaries of the ignorant individual left to himself.”

Fama (1966):

“If there are many sophisticated traders in the market, they may cause these “bubbles” to burst before they really get under way.”
<table>
<thead>
<tr>
<th>Year</th>
<th>Qtr. Of Mgrs.</th>
<th>Number of Mgrs.</th>
<th>Stock Holdings per Mgr. Mean ($ mill)</th>
<th>No. of Stocks per Mgr. Mean</th>
<th>Portfolio Turnover Mean (ann.)</th>
<th>Agg. Stock Holdings ($ mill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>1</td>
<td>35</td>
<td>1280</td>
<td>150</td>
<td>1.02</td>
<td>44,794</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>42</td>
<td>1053</td>
<td>113</td>
<td>44,234</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>42</td>
<td>728</td>
<td>71</td>
<td>0.83</td>
<td>30,594</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>41</td>
<td>925</td>
<td>66</td>
<td>1.16</td>
<td>37,912</td>
</tr>
<tr>
<td>1999</td>
<td>1</td>
<td>39</td>
<td>1070</td>
<td>74</td>
<td>0.98</td>
<td>41,742</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>42</td>
<td>995</td>
<td>75</td>
<td>1.12</td>
<td>41,807</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>43</td>
<td>927</td>
<td>69</td>
<td>1.28</td>
<td>39,879</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>44</td>
<td>1136</td>
<td>83</td>
<td>1.02</td>
<td>49,981</td>
</tr>
<tr>
<td>2000</td>
<td>1</td>
<td>43</td>
<td>1138</td>
<td>85</td>
<td>1.33</td>
<td>48,933</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>44</td>
<td>772</td>
<td>67</td>
<td>1.19</td>
<td>33,988</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>45</td>
<td>861</td>
<td>80</td>
<td>1.21</td>
<td>38,747</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>48</td>
<td>812</td>
<td>100</td>
<td>1.06</td>
<td>38,989</td>
</tr>
</tbody>
</table>
Figure 2: Weight of NASDAQ technology stocks (high P/S) in aggregate hedge fund portfolio versus weight in market portfolio.
Stock Holdings of Individual Hedge Funds

- How did individual hedge fund managers trade?
- Five managers with largest stock holdings
- Are differences in positions associated with differences in flows?
- Two important examples: Quantum Fund (Soros) and Jaguar Fund (Tiger)
Fig. 4a: Weight of technology stocks in hedge fund portfolios versus weight in market portfolio
Fig. 4b: Funds flows, three-month moving average
Not all stocks crashed at the same time

Did Hedge Funds anticipate price peaks?

Table III
Distribution of Price Peaks of NASDAQ Technology (High P/S) stocks

<table>
<thead>
<tr>
<th>Year</th>
<th>Quarter</th>
<th>Number of Peaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>1</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>207</td>
</tr>
<tr>
<td>2000</td>
<td>1</td>
<td>285</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>198</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>49</td>
</tr>
</tbody>
</table>
Figure 5. Average share of outstanding equity held by hedge funds around price peaks of individual stocks
Figure 6: Performance of a copycat fund that replicates hedge fund holdings in the NASDAQ high P/S segment
# Table V

Quarterly Abnormal Returns, Copycat Portfolio

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Quarters after 13F</th>
<th>Mean</th>
<th>t-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>High P/S NASDAQ stocks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Technology Segment)</td>
<td>1</td>
<td>4.51</td>
<td>1.87</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.71</td>
<td>2.02</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.39</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1.01</td>
<td>0.77</td>
</tr>
<tr>
<td>Other NASDAQ stocks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.55</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.36</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-1.64</td>
<td>-1.12</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>-0.89</td>
<td>-0.55</td>
</tr>
<tr>
<td>NYSE/AMEX stocks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.24</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.25</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.32</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>-0.48</td>
<td>-0.45</td>
</tr>
</tbody>
</table>
“The moral of this story is that irrational market can kill you ... Julian said ‘This is irrational and I won’t play’ and they carried him out feet first. Druckenmiller said ‘This is irrational and I will play’ and they carried him out feet first.”

Quote of a financial analyst, New York Times, April 29, 2000
Conclusions

- Hedge Funds were “riding” the bubble
- Short-sales constraints and “arbitrage” risks are not sufficient to explain this behavior
- Timing bets of hedge funds were well placed. Outperformance.
- Suggests predictable investor sentiment. Riding the bubble for a while may have been a rational strategy

⇒ Presence of sophisticated investors need not help to contain bubbles in the short-run
The South Sea Bubble

- South Sea Company
- East India Company
- Bank of England
Historical background

- South sea company founded in 1711
  - Purpose: to trade with Spanish America (Treaty of Utrecht 1713)
  - Finance government debt
  - Trade never amounts to much (a number of slave ships etc.); in 1718, ships and assets seized by Spain
- 1719: successful exchange of lottery tickets from 1710 (government debt) for company shares
  - Lower interest rate - debt becomes more liquid
  - Financed by new share issue; profit for company
  - Higher market value of debt for creditors
- 1720: offer to exchange most of remaining government debt
  - Total remaining debt: approx. 50 million pounds
  - 18.3 held by Bank of England, East India Company, and South Sea Company
  - 16.5 redeemable, privately held debt
  - 15 irredeemable [long: 72-87 years maturity, short: 22 years]
Historical background - 2

- Debt exchange agreed with Treasury December 1719
  - Government will pay 5% until 1727 and 4% thereafter
- Bank of England starts to bid for contract, January-February 1720
  - Initial offer South Sea Company: 3 million pounds for the debt conversion privilege
  - Final offer: 7.5 million
- Parliament (and the Court) bribed February-March 1720
  - Total expense: probably around 1.3 million pounds
  - Shares "sold" to politicians, mistresses of the King, ministers [with no cash changing hands], often below market price - similar to granting a free option to them
Some difficulties in determining underlying value

- *Flying Post* from April 9th, 1720
  - with the share price of South Sea stock at £300, its intrinsic value would be £448
  - at £600, it would be worth £880
  - the higher the price, the more cheaply bondholders could be bought out, and the higher the value of shares

- Garber (2000): "the episode is readily understandable as a case of speculators working on the basis of the best economic analysis available and pushing prices along by their changing view of market fundamentals."
The sign of the golden bottle and Sir Richard Hoare
Hoare's holdings and South Sea prices

- Number of South Sea shares in Hoare's portfolio
- Price of South Sea shares (sterling per 100 shares)

Key:
- Transfer books closed
- Price
Hoare's daily return vs. the return on South Sea stock
Table 4: Profit/Loss on South Sea stock, from 6 months before market peak to 6 months thereafter

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Log returns</th>
<th>Standard deviation of daily log returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Momentum</td>
<td>-0.446</td>
<td>0.043</td>
</tr>
<tr>
<td>Buy-and-hold</td>
<td>0.445</td>
<td>0.063</td>
</tr>
<tr>
<td>Hoare's</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unleveraged</td>
<td>0.708</td>
<td>0.027</td>
</tr>
<tr>
<td>Leveraged</td>
<td>2.055</td>
<td>0.054</td>
</tr>
</tbody>
</table>

Profit/Loss, from 6 months prior to market peak to 6 months after
Figure 6: Performance of a copycat fund that replicates hedge fund holdings in the NASDAQ high P/S segment

From: Brunnermeier and Nagel 2003
Hoare's timing not perfect, but similar to hedge funds during the tech bubble
### Hoare's lending against South Sea stock

<table>
<thead>
<tr>
<th>Date</th>
<th>number of shares offered as security</th>
<th>loan value</th>
<th>£ lent per 100 par value</th>
<th>market price</th>
<th>discount</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.3.1719</td>
<td>1,300</td>
<td>1,400</td>
<td>107.7</td>
<td>109.5</td>
<td>-1.7%</td>
</tr>
<tr>
<td>2.4.1719</td>
<td>6,000</td>
<td>7,860</td>
<td>131.0</td>
<td>110.25</td>
<td>18.8%</td>
</tr>
<tr>
<td>26.2.1720</td>
<td>6,000</td>
<td>9,000</td>
<td>150.0</td>
<td>170.5</td>
<td>-12.0%</td>
</tr>
<tr>
<td>1.3.1720</td>
<td>600</td>
<td>900</td>
<td>150.0</td>
<td>177.5</td>
<td>-15.5%</td>
</tr>
<tr>
<td>7.3.1720</td>
<td>2,000</td>
<td>1,580</td>
<td>79.0</td>
<td>184.5</td>
<td>-57.2%</td>
</tr>
<tr>
<td>24.3.1720</td>
<td>1,500</td>
<td>2,700</td>
<td>180.0</td>
<td>310</td>
<td>-41.9%</td>
</tr>
<tr>
<td>27.10.1720</td>
<td>300</td>
<td>631</td>
<td>210.3</td>
<td>212</td>
<td>-0.8%</td>
</tr>
<tr>
<td>23/24.12.1720</td>
<td>3,000</td>
<td>1,400</td>
<td>146.0</td>
<td>160</td>
<td>-8.4%</td>
</tr>
</tbody>
</table>
“This comes to good Mr. Warner, to lett him know that I am allmost sure, I can mack an advantage by bying in the South Seas with the hundred and four score pounds is still in your hands... so I would bye as much as theat will bye today, and sell it out agane next week, for tho I have no oppinion of the South Sea to contineue in it I am almost certine thus to mack sum litell advantage to her that is good Mr. Warner’s reaell friend...”

-- Dutchess of Rutland, letter to her broker, March 1720
Conclusions

- Hoare's apparently thought South Sea stock was overpriced -- warnings about overvaluation available for a long time + Hoare's limits amount of lending against stock during the run-up in prices, suggesting that it doesn't expect the bubble to last

- Nonetheless, the bank did not attack the bubble, but maintained (or increased) its positions during the run-up of prices. Nonetheless did spectacularly well - much better than hedge funds in 1998-2001.

- Both Hoare's and the hedge funds were "riding bubbles" and making money - similar behavior across 280 years of history

- Why does this work in the first place? Why do sophisticated investors do the exact opposite of what Fama and Keynes expected?
Where do bubbles come from?

- Allen and Gale (2000) assume the people who make investment decisions do so with borrowed money.
- Lenders cannot observe the riskiness of projects so there is an *agency problem*.
- Borrowers prefer risky projects because they receive the excess above debt payments.
- They bid the prices of risky projects above their fundamentals and there is a bubble.
- The more money and credit that is available the higher that prices are bid.
Two assets:

$t = 0  \quad \rightarrow \quad 1$

Safe asset price:  

- 1  \quad \rightarrow \quad 1.5
  (variable supply)

Risky asset price:  

- 1 unit  \quad \leftrightarrow \quad 6 \quad \rightarrow \quad \text{w. pr.} \quad 0.25
  (fixed supply)

- costs $\text{P} \quad 1 \quad \leftrightarrow \quad \text{“ “ 0.75}

ER = 2.25

All investors are risk neutral
The fundamental

- Investors have wealth 1 and invest own money
- Equating marginal returns

\[
\frac{2.25}{P_f} = \frac{1.5}{1}
\]

\[\Leftrightarrow\]

\[P_f = \frac{2.25}{1.5} = 1.5\]
Intermediated case

- Investors have no wealth of their own
- They can borrow 1 at date 0 and repay 1.33 at date 1 if they can
- Lenders can’t observe how loans are invested
Can $P = 1.5$ be equilibrium price?

Borrow 1 and invest in safe asset

$$R_{safe} = 1.5 - 1.33 = 0.17$$

Borrow 1 to buy $1/1.5$ units of risky asset

$$R_{risky} = 0.25 \times (1/1.5 \times 6 - 1.33) + 0.75 \times 0 = 0.67 > 0.17$$
What is the equilibrium $P$?

- Since risky asset is in fixed supply, $P$ will be bid up until returns are equated

$$0.25 \times \left( \frac{1}{P} \times 6 - 1.33 \right) + 0.75 \times 0 = 1.5 - 1.33 = 0.17$$

$P = 3$

- There’s a bubble since $P = 3 > P_F = 1.5$
The more risk there is the greater is the risk shifting and the larger the bubble.

Default and a financial crisis occurs in this model when the return on the risky asset is low.

The bank’s depositors bear the costs of the agency problem and this requires a “stupid bank” to close the model (not so popular < 2007; more appreciated today).

Metaphor for:
- Stock options-based compensation
- US housing
- Investors in the South Sea bubble
- Etc.
Structure

- What the he** is a “bubble“? Two examples
- Where they come from
- What to do about them
  - “Hands off and fix the mess”
  - Intervene to bring down bubbles
  - Macroprudential regulation to prevent their emergence
Policy Options for Central Banks

- general credit restriction, raising interest rates (historical examples: US 1929, Japan 1989)
- “open mouth” operations (Greenspan 1996)
- “surgical strike” - attempt to limit lending to stockmarket alone, higher lombard rates, punishment of banks that fail to curtail lending to the stockmarket, impose higher margin requirements etc. (US 1929, Germany 1927)
The Crash Nobody Knows About

- 13.5.1927 - Share prices on the Berlin exchange fell by 31.9%

- What happened?

- Reichsbank
  - Considered equities overvalued (political reasons)
  - Forced the banks to reduce margin loans by 25% by the next settlement date
  - Banks go public with this intervention (Thursday, 12.5.)
  - Next morning, prices plummet amid massive illiquidity
Three questions

- Why did the central bank intervene?
- Was there a bubble in the German stock market?
- Did the intervention have real effects?
What they were thinking

Dividend Yield and Stock Prices in Germany, 1925-30
“...speculation is primarily responsible for the extraordinary excesses in terms of equity valuations. ... in 1913 ... the yield of fixed securities quoted on the Berlin stock exchange was 4.5%. The [dividend] yield of shares was somewhat lower, 3.97%, since shares offer a speculative upside. The difference in yield between bonds and shares was a mere 0.5%. Today, we see bonds offering a yield of 7.12%, while shares (even if we look at the latest dividend figures) yield 3.44%. That not only means that today’s [dividend] yield is lower than in 1913, when we [the German people] were richer, but it also means that the difference in yields is more than 3.5% now...This proves how unhealthy current conditions are; everybody is buying shares because they think there will be future capital gains...”
The Age of Dr Mabuse
The Age of Dr Mabuse
“Everything is a gamble”
Was there a bubble?

German Share Price Index, 1900-32
### Monthly returns (in %) and volatility

<table>
<thead>
<tr>
<th>Length of period (months)</th>
<th>5 markets recovering from high inflation*</th>
<th>22 “re-emerging markets”**</th>
<th>Germany</th>
<th>Germany – period chosen to maximize returns***</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>6.6%</td>
<td></td>
<td>-0.8%</td>
<td>4.0%</td>
</tr>
<tr>
<td>24</td>
<td>4.2%</td>
<td>3.24</td>
<td>-0.7%</td>
<td>3.0%</td>
</tr>
<tr>
<td>36</td>
<td>3.4%</td>
<td>3.13</td>
<td>1.6%</td>
<td>3.3%</td>
</tr>
<tr>
<td>48</td>
<td>4.6%</td>
<td></td>
<td>1.1%</td>
<td>2.5%</td>
</tr>
<tr>
<td>60</td>
<td>1.8%</td>
<td>2.64</td>
<td>1.1%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

* The countries and the date of stabilization are Mexico 1987, Peru 1993, Poland 1991, Argentina 1991, Brazil 1994. Rates of return are from the S&P/IFC Emerging Markets Data-base except for Poland, where the FIBV statistics were used.

** Jorion and Goetzmann 1996.
where $P$ is the price, $D_0$ is dividend in the initial period, $g$ is the growth rate of dividends, and $i$ is the discount rate. From this we obtain:

$$
\frac{P}{i-g} = \frac{D_0(1+g)}{i-g}$$

$$
g = \frac{Pi - D}{D + P}
$$
Valuation Measures

- Actual rate of dividend growth, 1870-1913
- Actual rate of dividend growth, 1925-30
- Real return on gold-backed mortgage bonds + 3%
- Real return on shares, 1870-1913
“[i]ndustrial leaders declare that the restriction of bank credits not only will affect share prices adversely but also will handicap the industrial life of the country. It is pointed out that the reorganisation of Germany’s industries has not been finished and can be carried out successfully only if the Bourse is able to absorb the new shares which Germany’s industries will be obliged to market.”

-- Associate Press, Berlin correspondent
Stock Prices and Investment, 1925-39

- Stock price index
- Net investment
Real consequences

- US downturn starts in summer of 1929 with a fall in consumption
- German downturn starts in 1927 with a fall in investment
- Firms stop issuing equity - enter depression with high debt/equity ratios
- Banks hold many shares - their equity cushions suffer from the decline in share prices → less lending
New share issuance and real stock market index

new share issues

real stock market index

Reichsbank intervention
Three hypotheses to test

H.1. Bubbles are larger for assets with lottery characteristics

H.2. Bubbles are larger when traders borrow money

H.3. Bubbles are larger when traders cannot short sell

To test the hypotheses, authors conduct experiments where people trade two type of assets.
# Part 2: Set up of the experiments

## Experimenting with different market structures

<table>
<thead>
<tr>
<th>Three Different Market structures</th>
<th>Market 1</th>
<th>Market 2</th>
<th>Market 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can traders borrow money?</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Can traders shortsell assets?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Ackert et al.
No short sales, borrowing

Figure 2. Time Series of Median Transaction Prices, Lottery Asset, NSS/B Treatment
No short sales, NO borrowing
Short sales, No borrowing

FIGURE 5. Time Series of Median Transaction Prices, Standard Asset, SS/NB Treatment

[Graph showing time series of median transaction prices over 12 periods, with different lines representing different medians.]
Conclusions

- Bubbles are best defined by the motives of buyers, NOT arguments about fundamentals
- Some behavior is not fully compatible with investor rationality
- Investors may be better off going „crazy“ when everyone else is crazy, too
- Risk-shifting one important source of bubble formation [i.e. who is the equivalent of the foolish bank in Allen-Gale?]
- Costs of intervention potentially very high → calls for macroprudential regulation [experimental evidence]