

The Bubble Dilemma: Asset Prices in Historical Perspective

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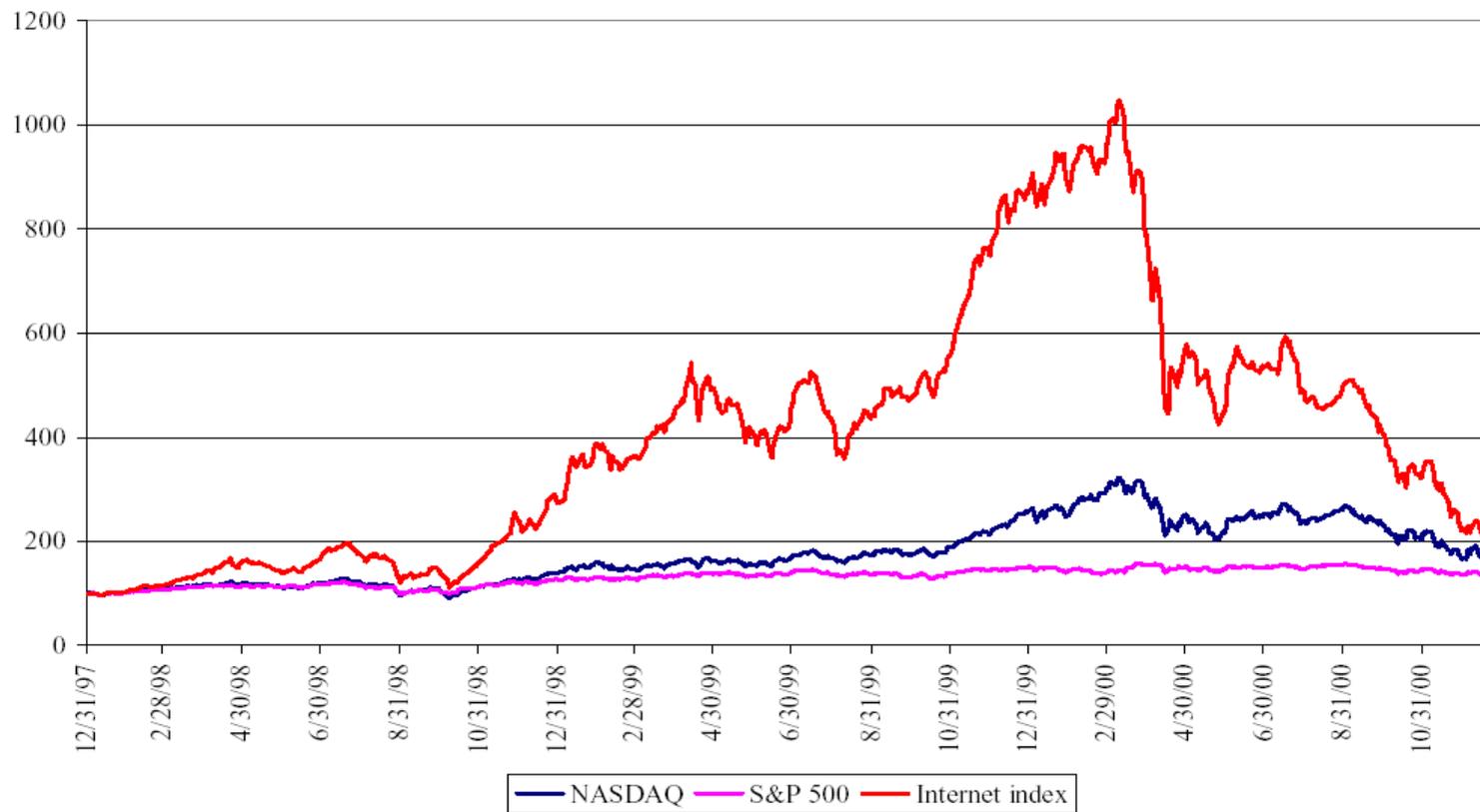


Structure

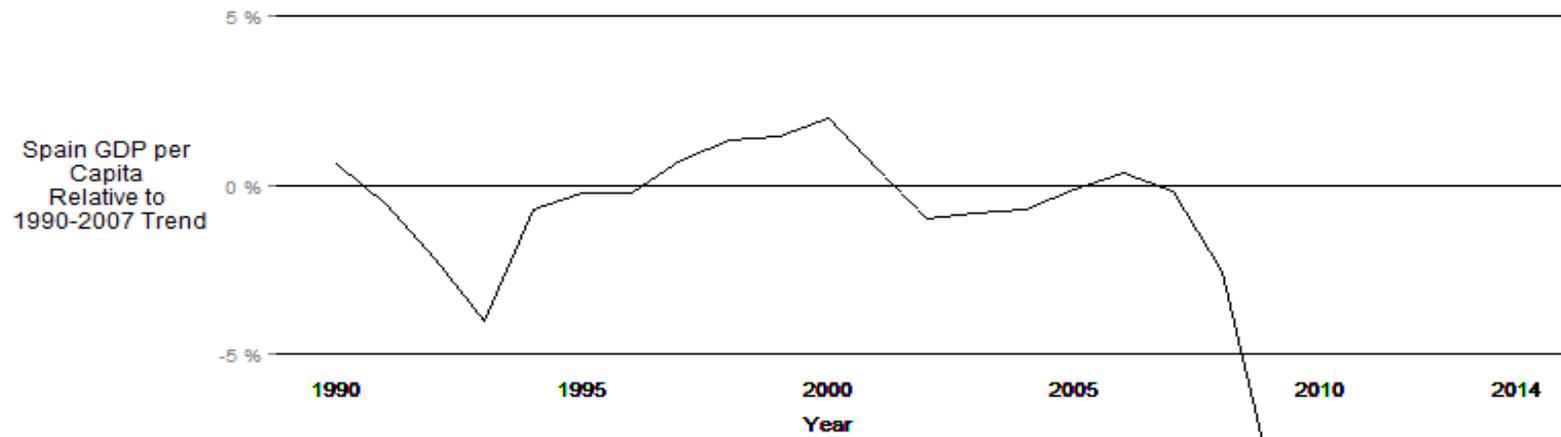
- ★ What the he^{**} is a “bubble”? Two examples
- ★ Where they come from
- ★ What to do about them

Bubbles can be dramatic

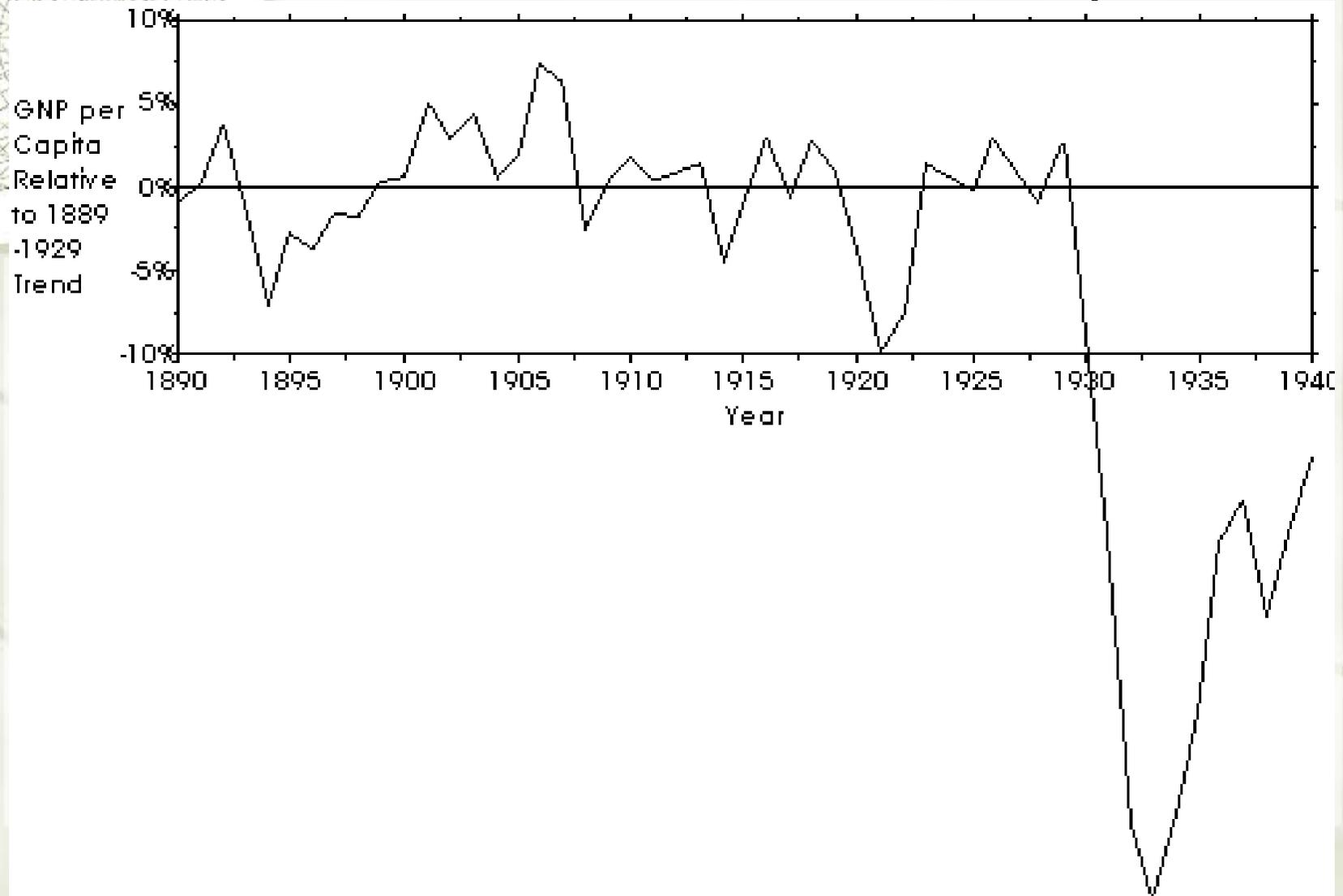
Figure 1
Returns on: equally weighted internet index, S&P 500, NASDAQ



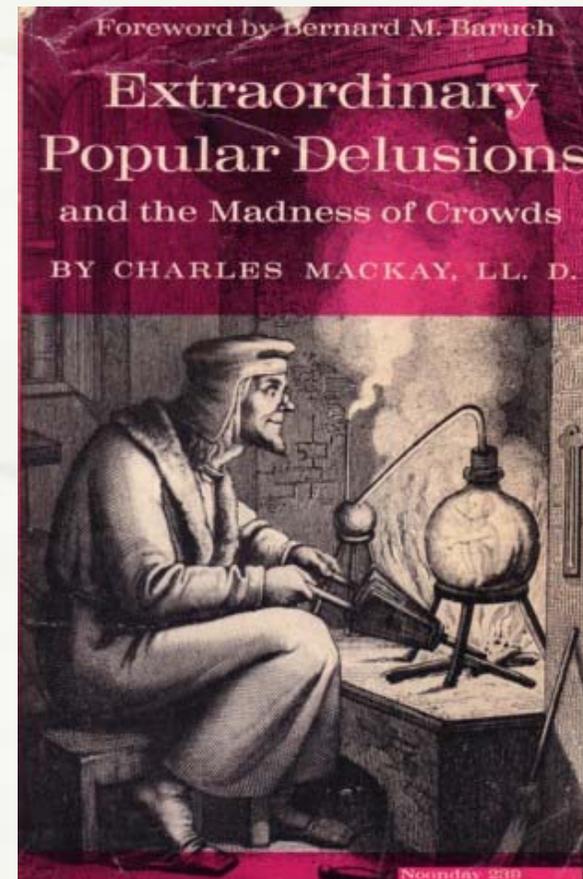
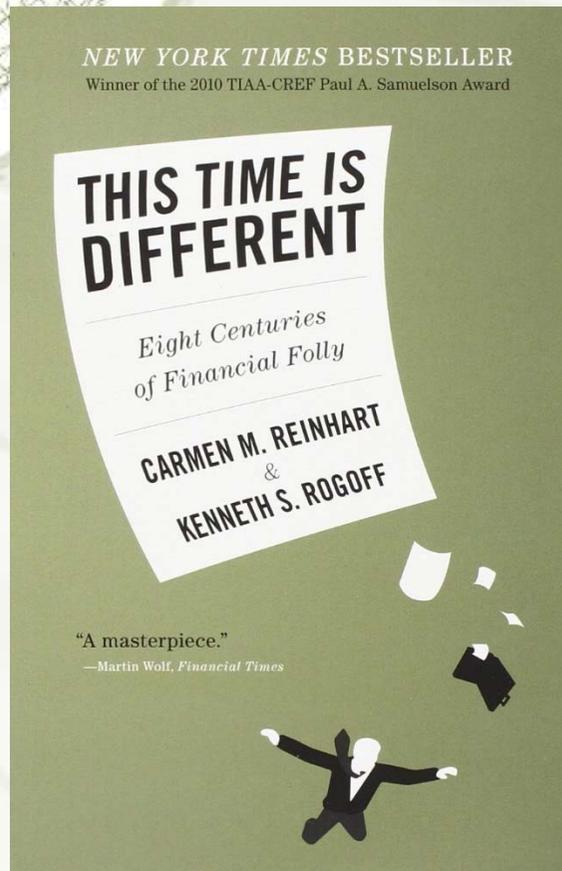
And can have dire consequences

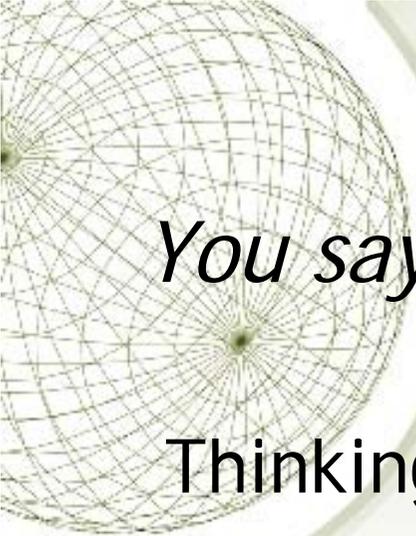


And can have dire consequences



One type of approach

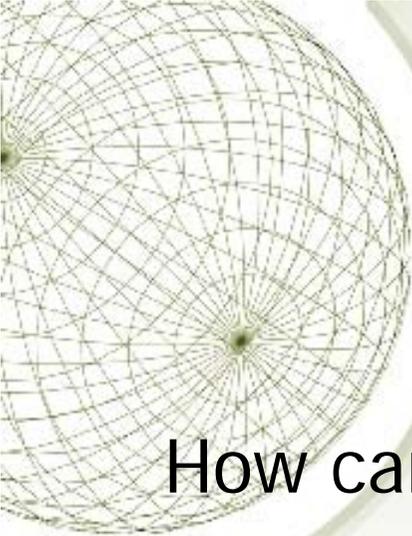




You say “bubble”; I say “useless theorist”

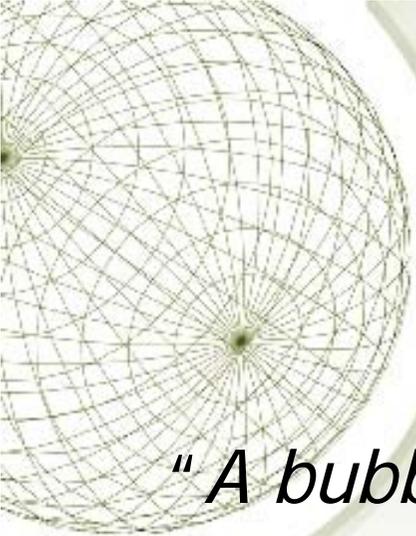
Thinking about bubbles

- ✦ 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



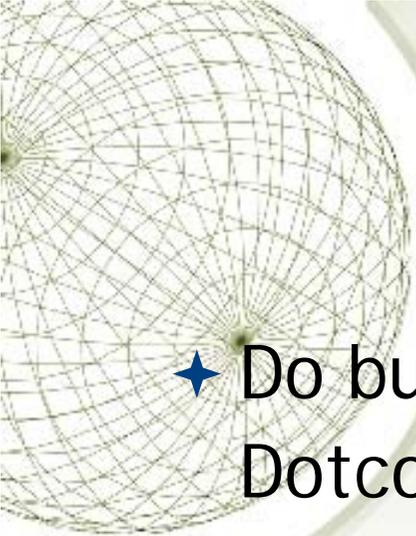
How can we sensibly talk about bubbles?

- ★ “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



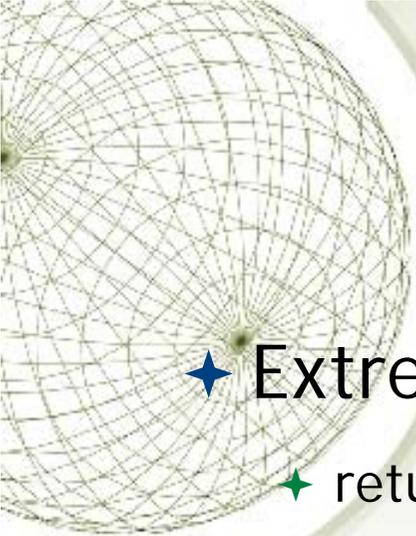
"A bubble may be defined loosely as a sharp rise the price of an asset ..., with the initial rise generating expectations of further rises and attracting new buyers - generally speculators interested in profits from trading in the asset rather than its use or earning capacity."

*-- Charles Kindleberger, *The New Palgrave**



Structure

- ★ 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

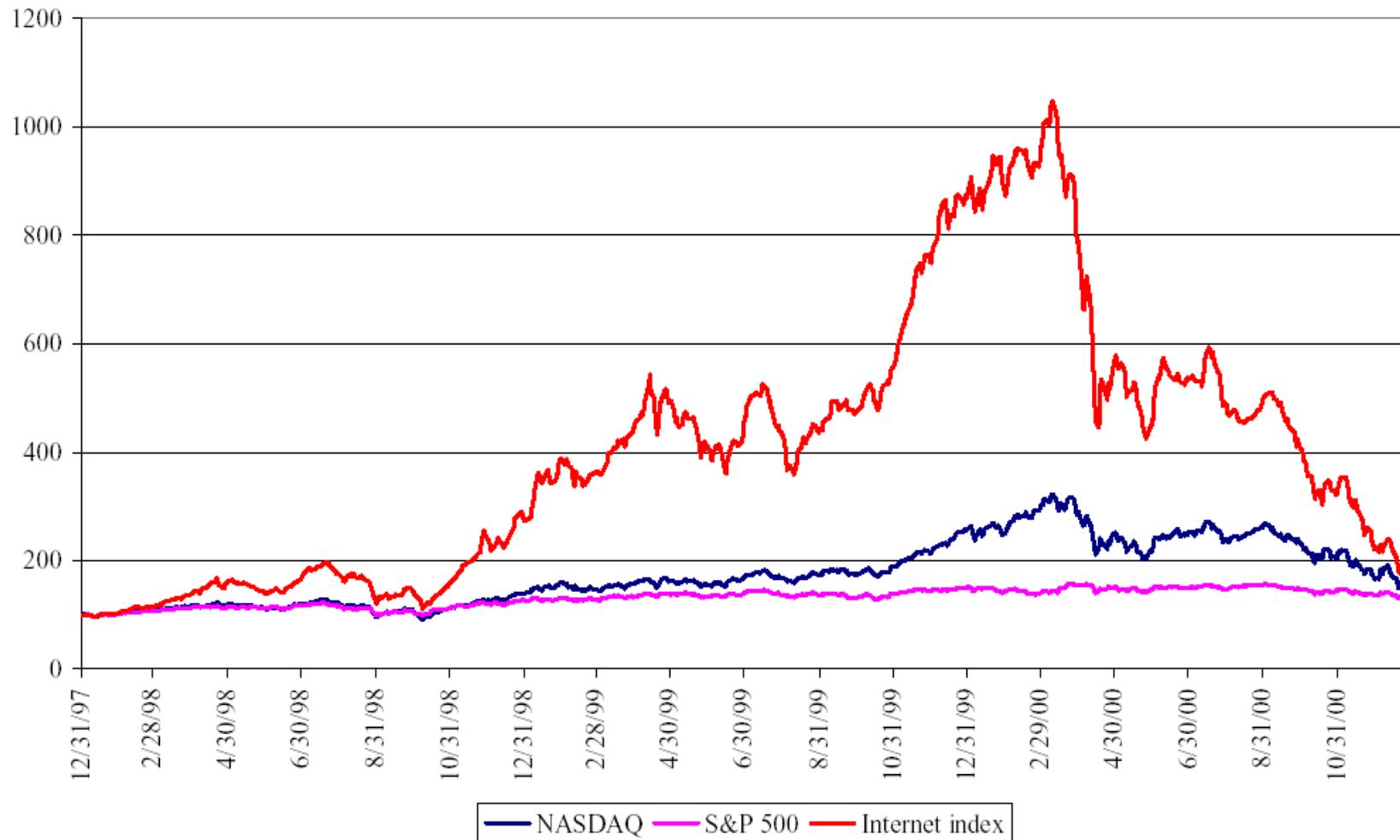
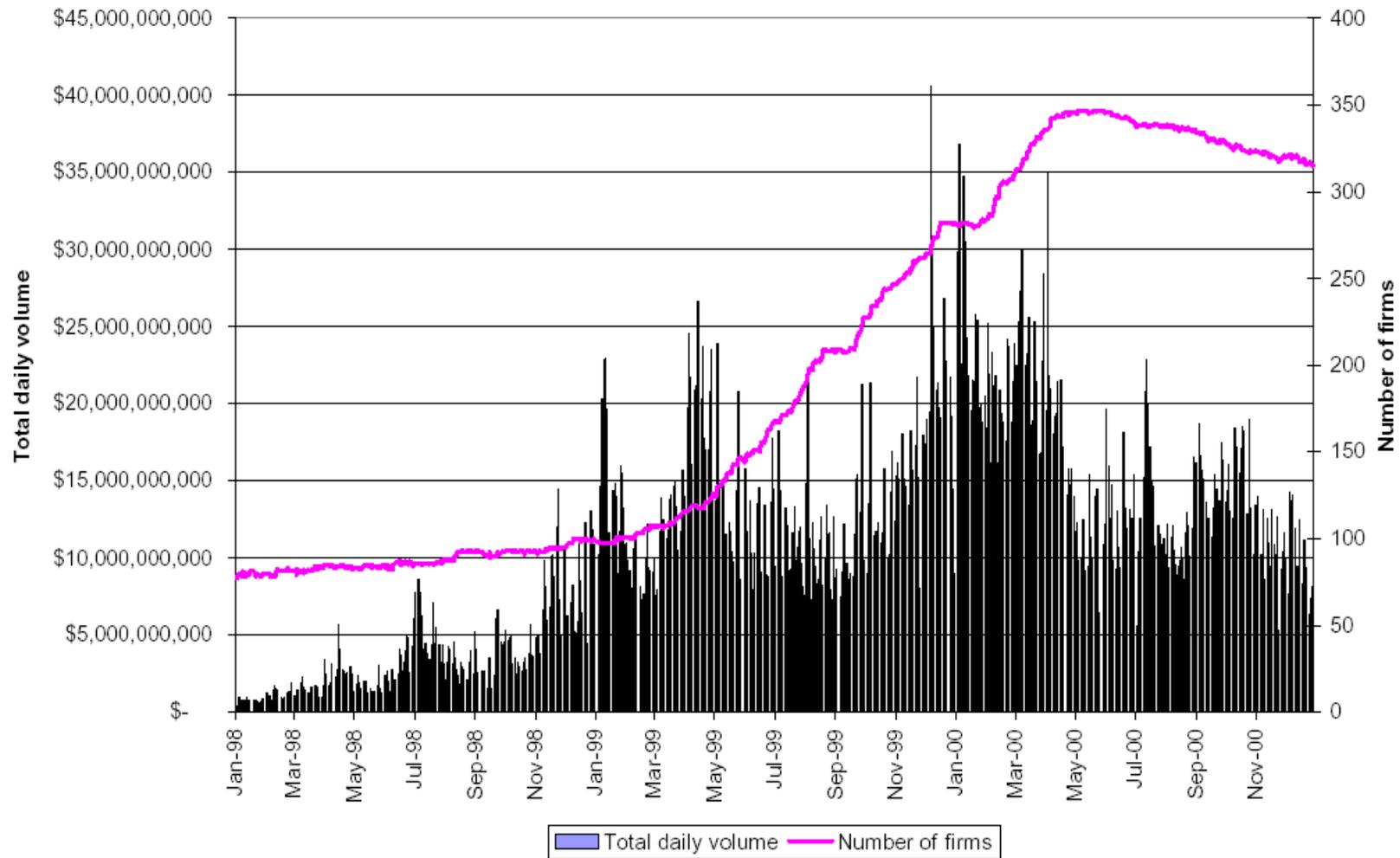
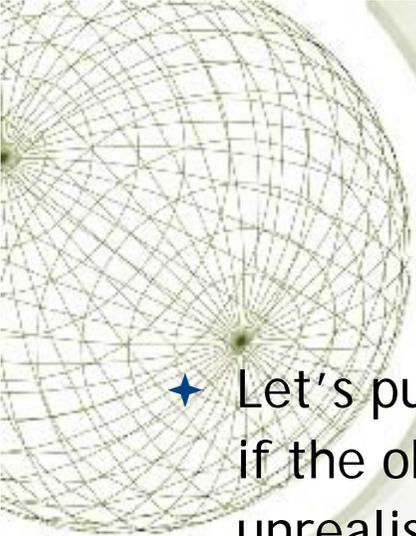


Figure 2
Total daily volume and number of- Internet firms

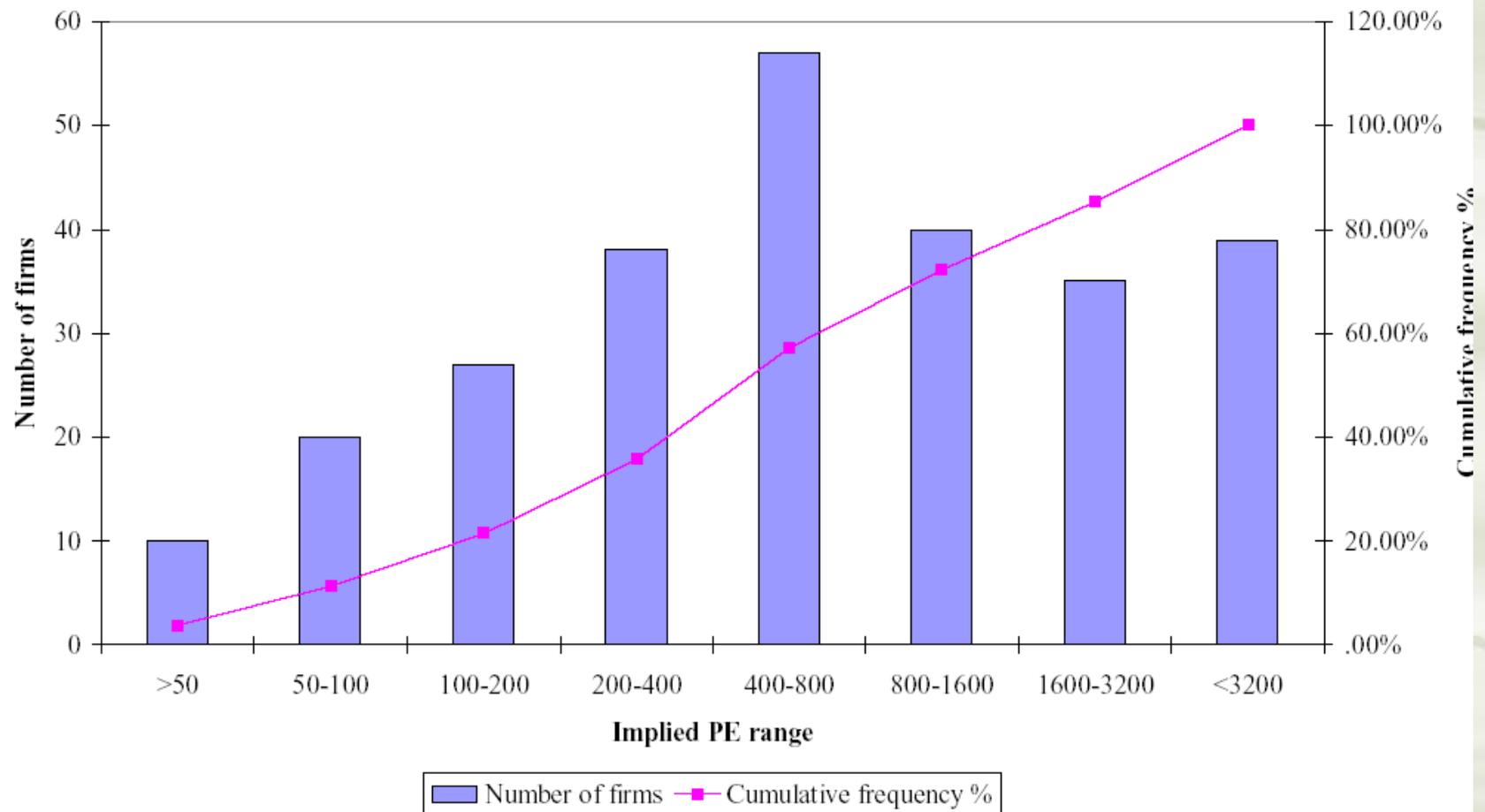




Valuing Nasdaq

- ★ 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.

$$P/E = \left(\frac{1+r^*}{1+r} \right)^T P/E^{OLD}$$

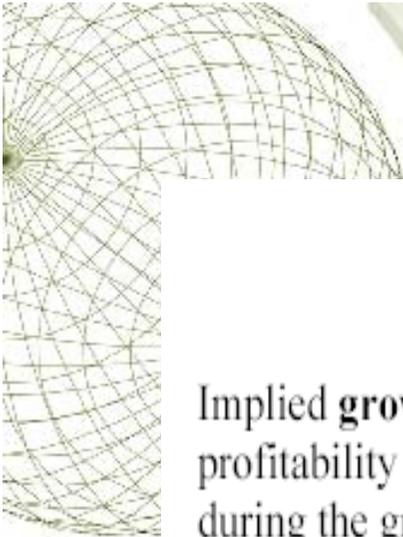
- ★ Then stock value
- ★ Since firms have negative earnings, use imputation - assume that firms are already as profitable as old-economy equivalents

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)

Years	Terminal P/E levels				
	10	15	20	25	30
10	50.7%	44.7%	40.6%	37.5%	35.0%
15	31.5%	28.0%	25.5%	23.7%	22.2%
20	22.8%	20.3%	18.6%	17.3%	16.2%
25	17.8%	15.9%	14.6%	13.6%	12.8%
30	14.7%	13.1%	12.0%	11.2%	10.5%

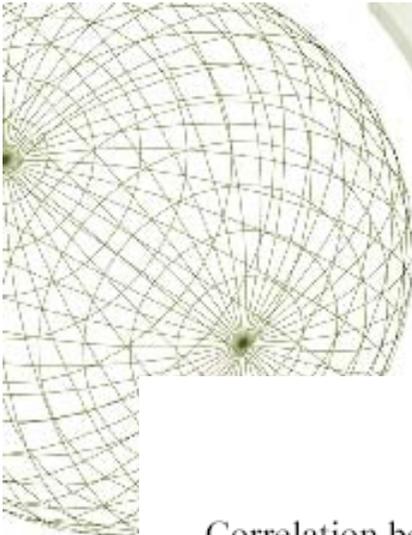


Panel B

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.

Years	Terminal P/E levels				
	10	15	20	25	30
10	74.8%	67.9%	63.1%	59.5%	56.6%
15	52.5%	48.4%	45.6%	43.5%	41.7%
20	42.4%	39.6%	37.6%	36.0%	34.8%
25	36.7%	34.5%	32.9%	31.8%	30.8%
30	33.0%	31.2%	30.0%	29.0%	28.2%



Panel B

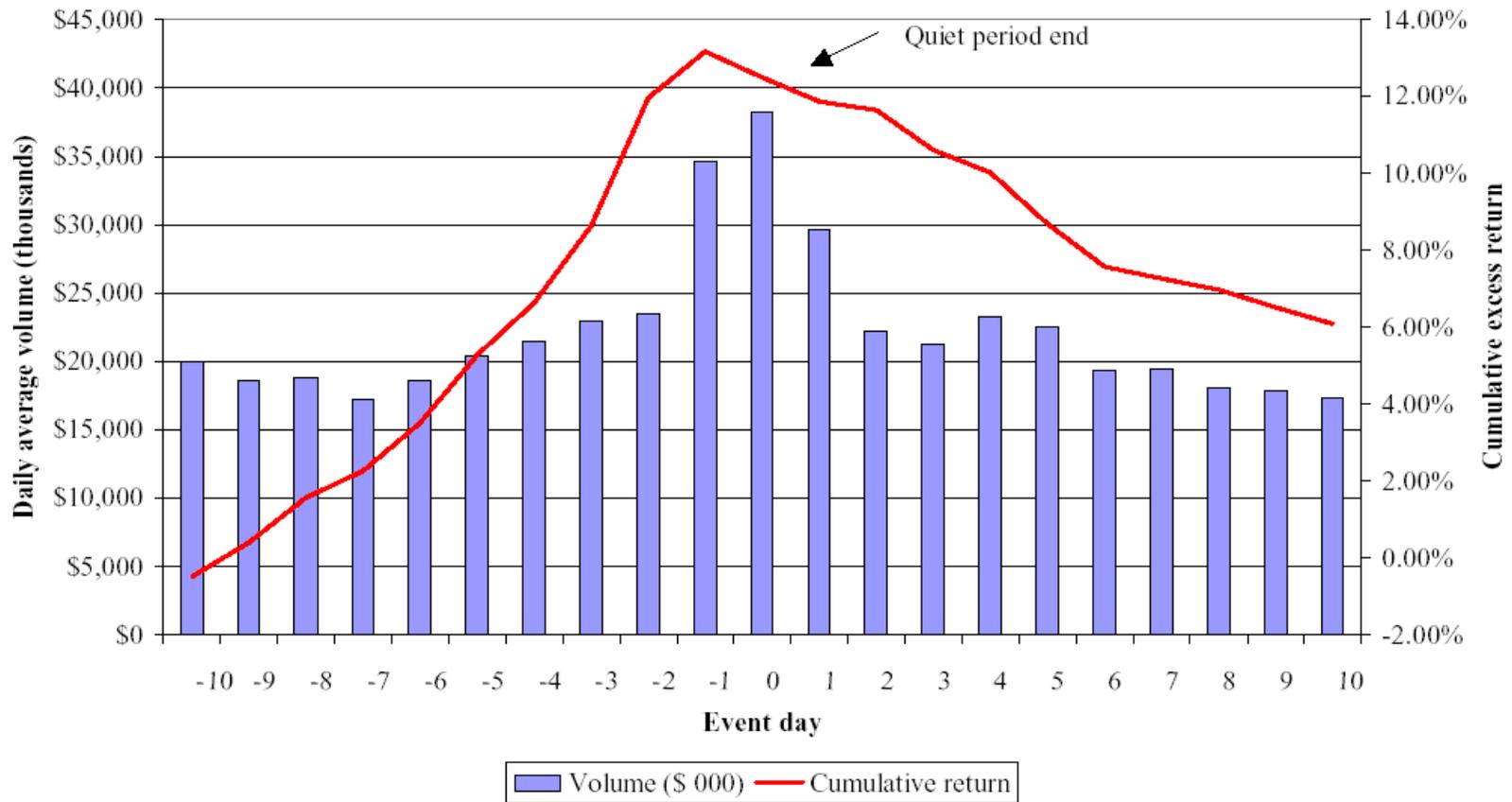
Correlation between various measures of short interest and firm characteristics for 273 internet firms as February 2000. Age is the number of months since the IPO until February 2000. Implied P/E is the stock price scaled by steady state earnings (current revenues*profit margins of comparable old economy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

	Short interest/shares outstanding	Rebate rate	Age	Implied PE
Short interest/shares outstanding	1.000	-0.431 ^a	0.252 ^a	-0.045
Rebate rate on shorts %	-0.431 ^a	1.000	0.082	-0.161 ^a
Age	0.252 ^a	0.082	1.000	-0.092
Implied PE	-0.045	-0.161 ^a	-0.092	1.000

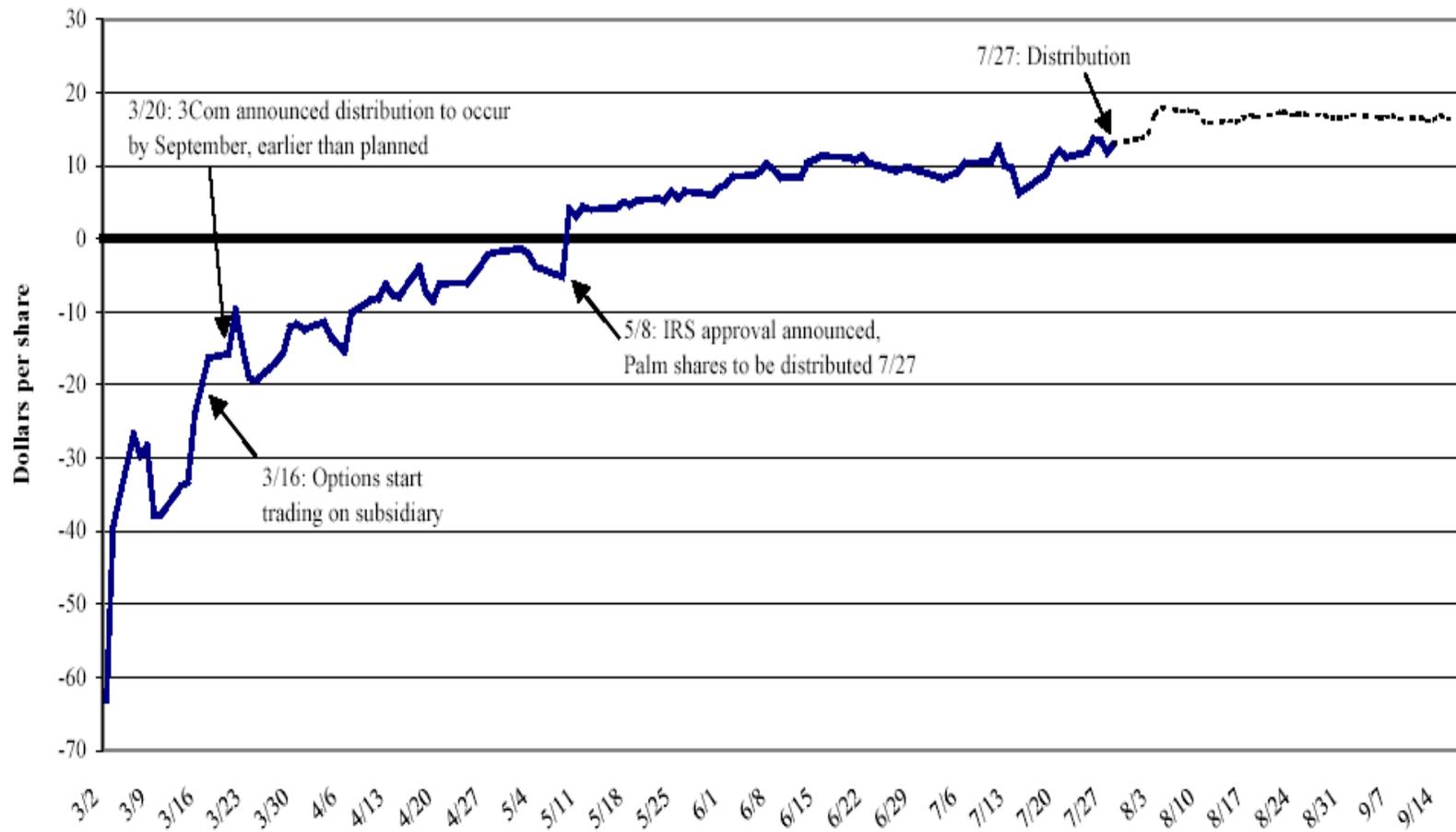
^a - Significant at the 1% level

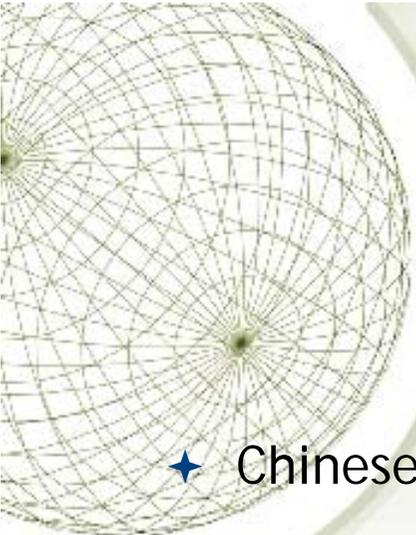
^b - Significant at the 5% level

Figure 5
Volume and returns relative to quiet period end
Internet firms 1/1998-2/2000



3Com/Palm Stub 3/2/00 - 9/18/00





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

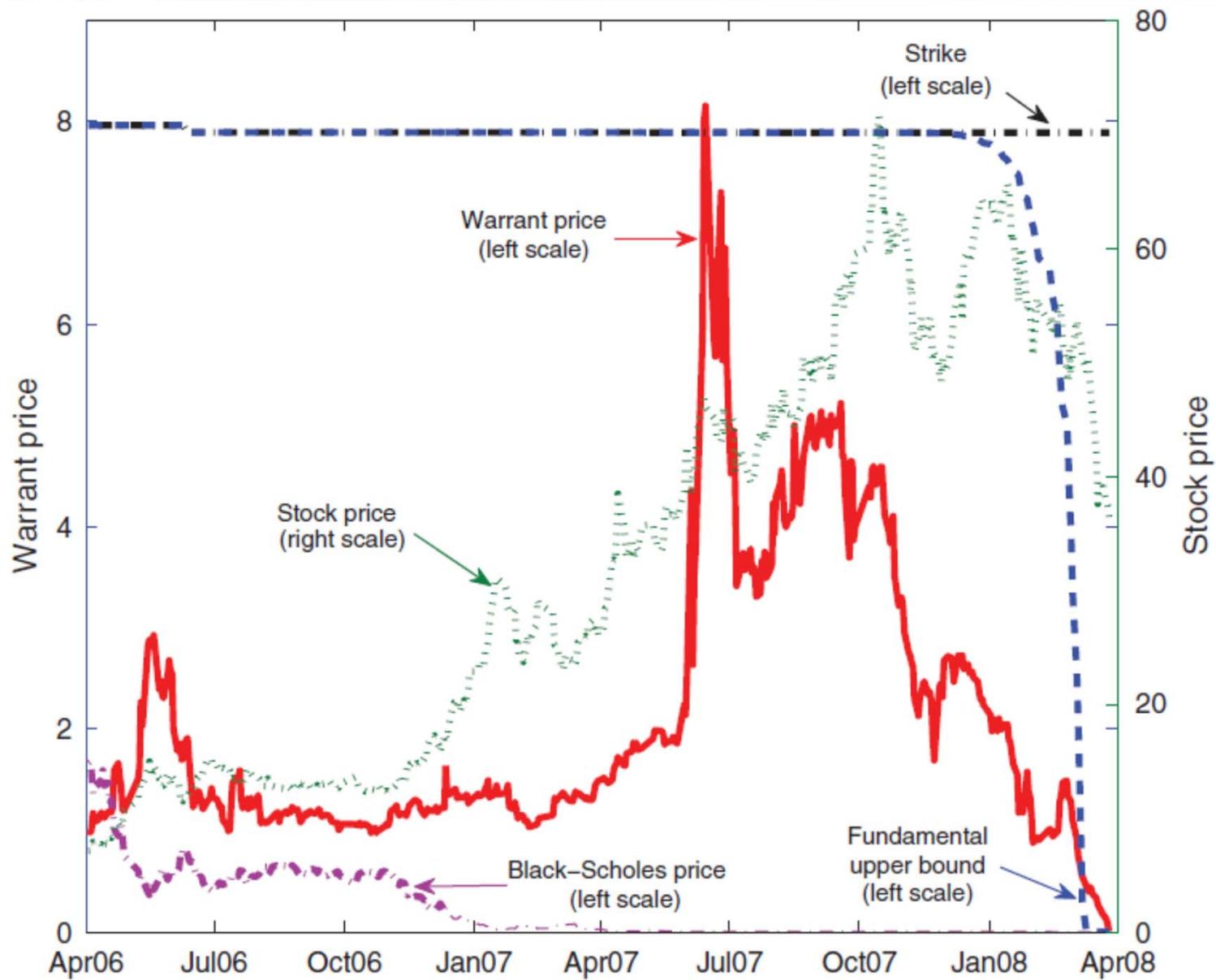
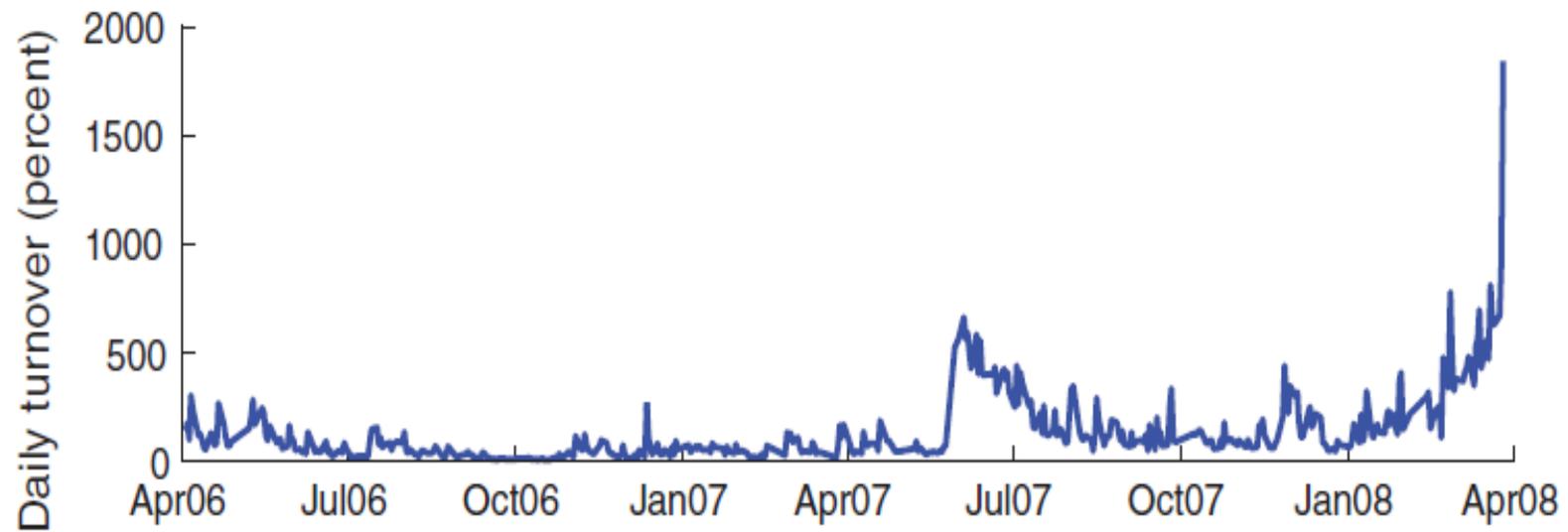
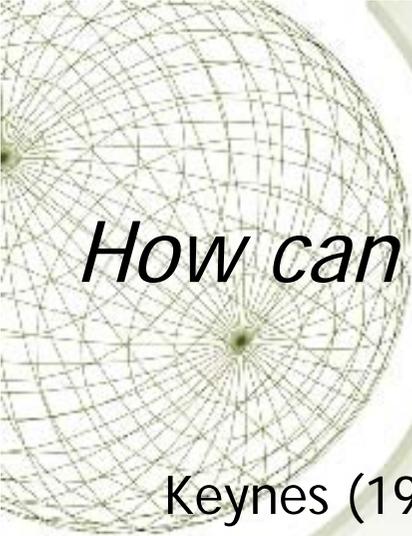


FIGURE 1. PRICES OF WULIANG PUT WARRANT

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."

Brunnermeier and Nagel - what did the hedge funds do?

Year	Qtr. Of Mgrs.	Number of Mgrs.	Stock Holdings	No. of Stocks	Portfolio	Agg. Stock Holdings (\$ mill)
			per Mgr.	per Mgr.	Turnover	
			Mean (\$ mill)	Mean	Mean (ann.)	
1998	1	35	1280	150		44,794
	2	42	1053	113	1.02	44,234
	3	42	728	71	0.83	30,594
	4	41	925	66	1.16	37,912
1999	1	39	1070	74	0.98	41,742
	2	42	995	75	1.12	41,807
	3	43	927	69	1.28	39,879
	4	44	1136	83	1.02	49,981
2000	1	43	1138	85	1.33	48,933
	2	44	772	67	1.19	33,988
	3	45	861	80	1.21	38,747
	4	48	812	100	1.06	38,989

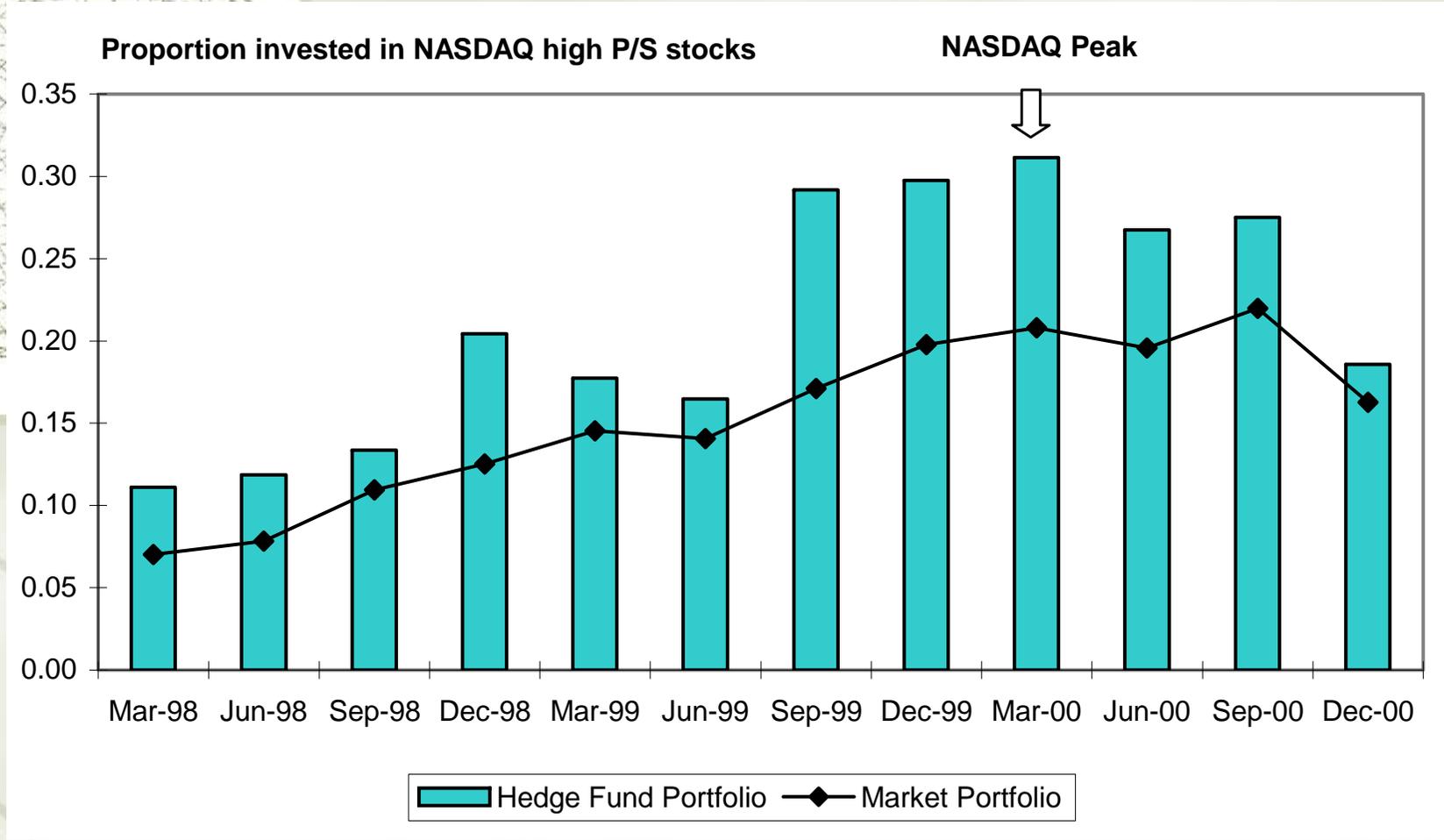


Figure 2: Weight of NASDAQ technology stocks (high P/S) in aggregate hedge fund portfolio versus weight in market portfolio



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)

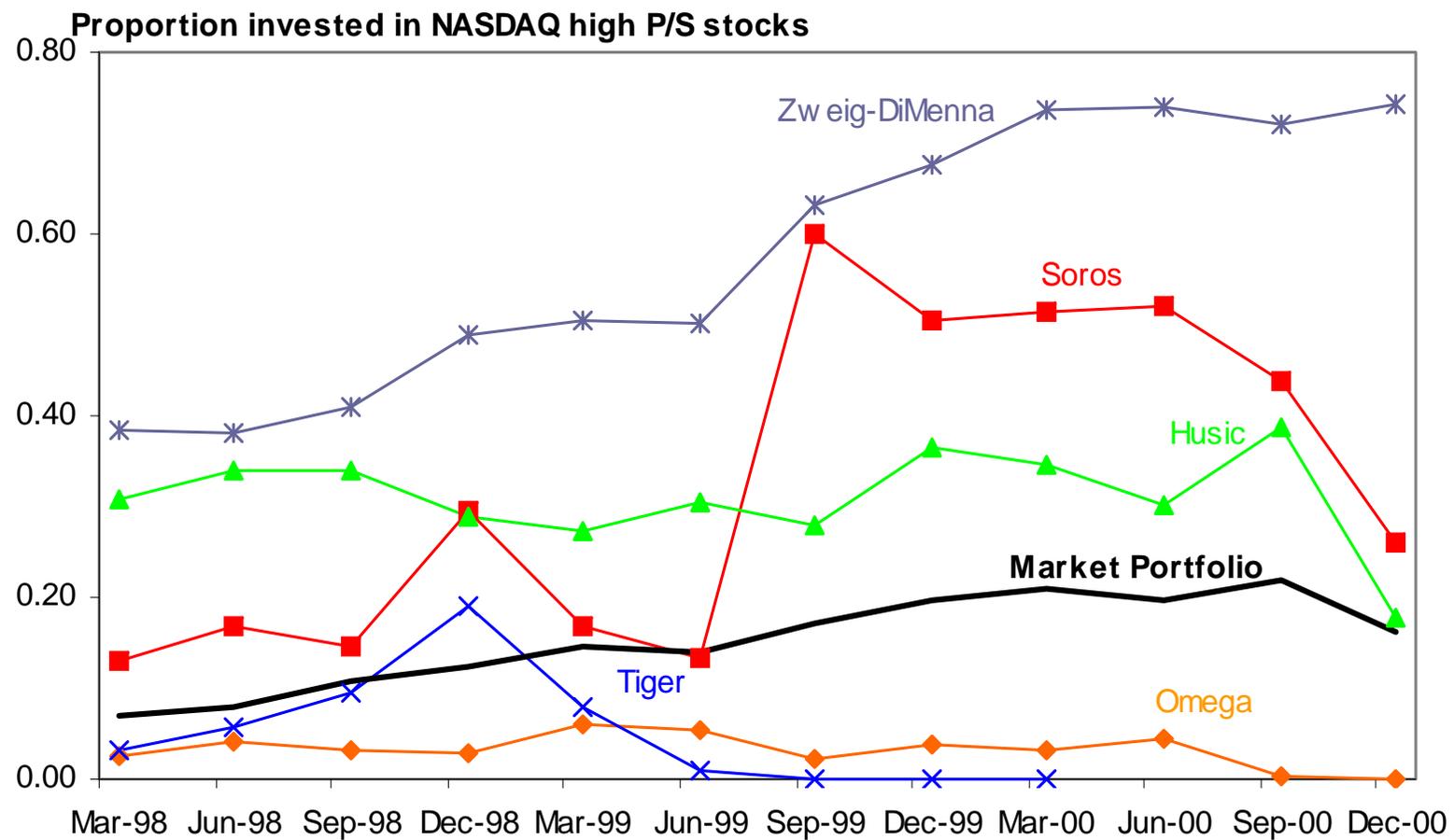


Fig. 4a: Weight of technology stocks in hedge fund portfolios versus weight in market portfolio

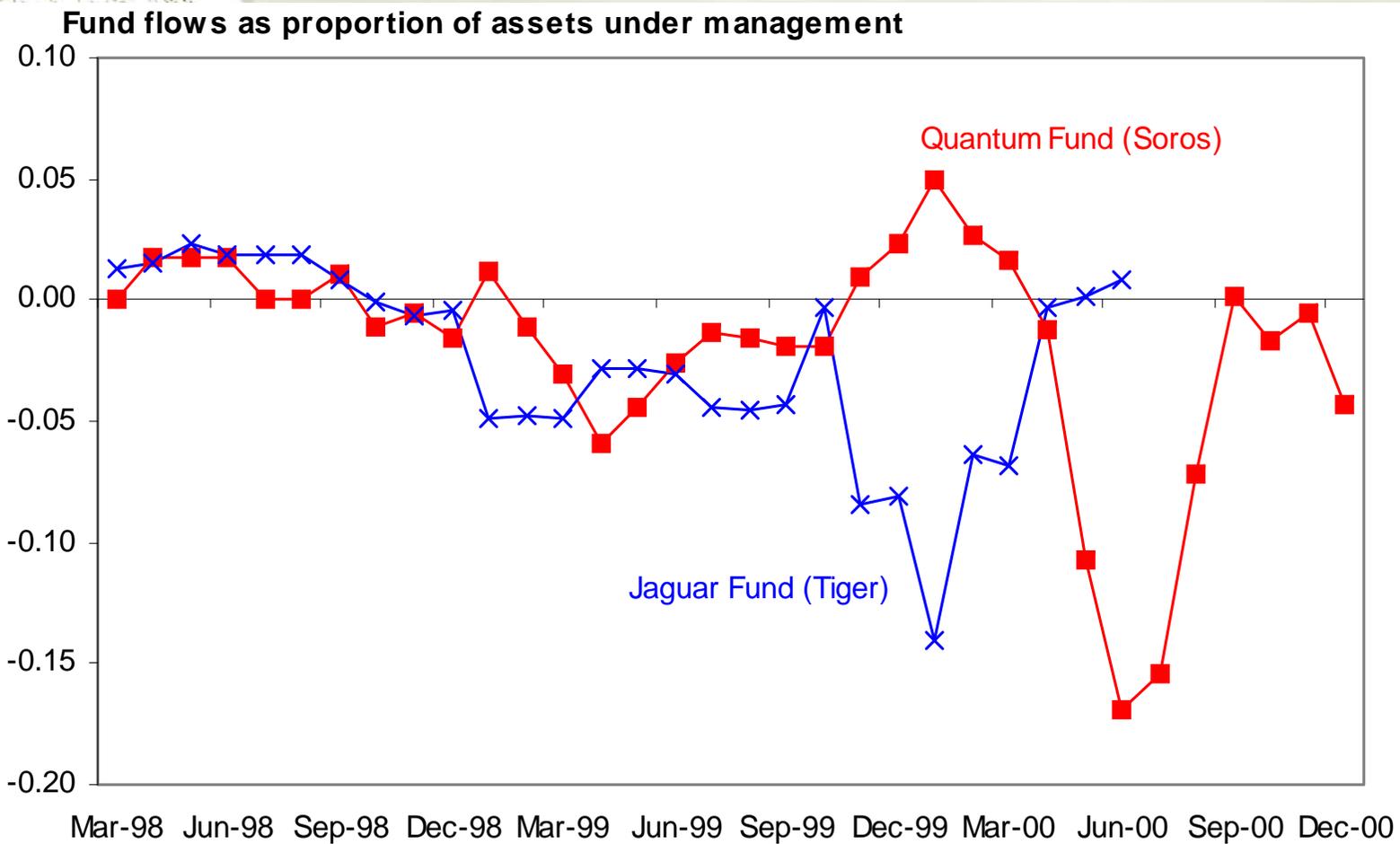


Fig. 4b: Funds flows, three-month moving average

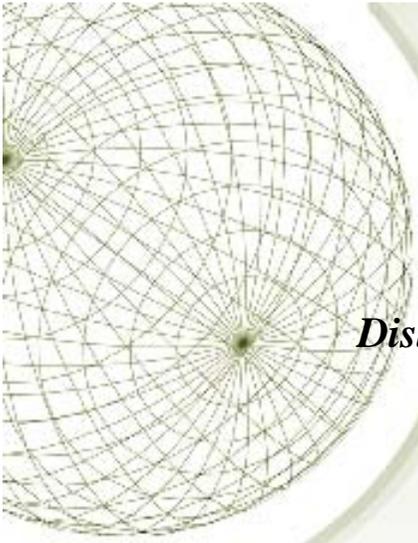


Table III
Distribution of Price Peaks of NASDAQ Technology (High P/S) stocks

Year	Quarter	Number of Peaks
1999	1	58
	2	86
	3	38
	4	207
2000	1	285
	2	98
	3	198
	4	49

- ✦ Not all stocks crashed at the same time
- ✦ Did Hedge Funds anticipate price peaks?

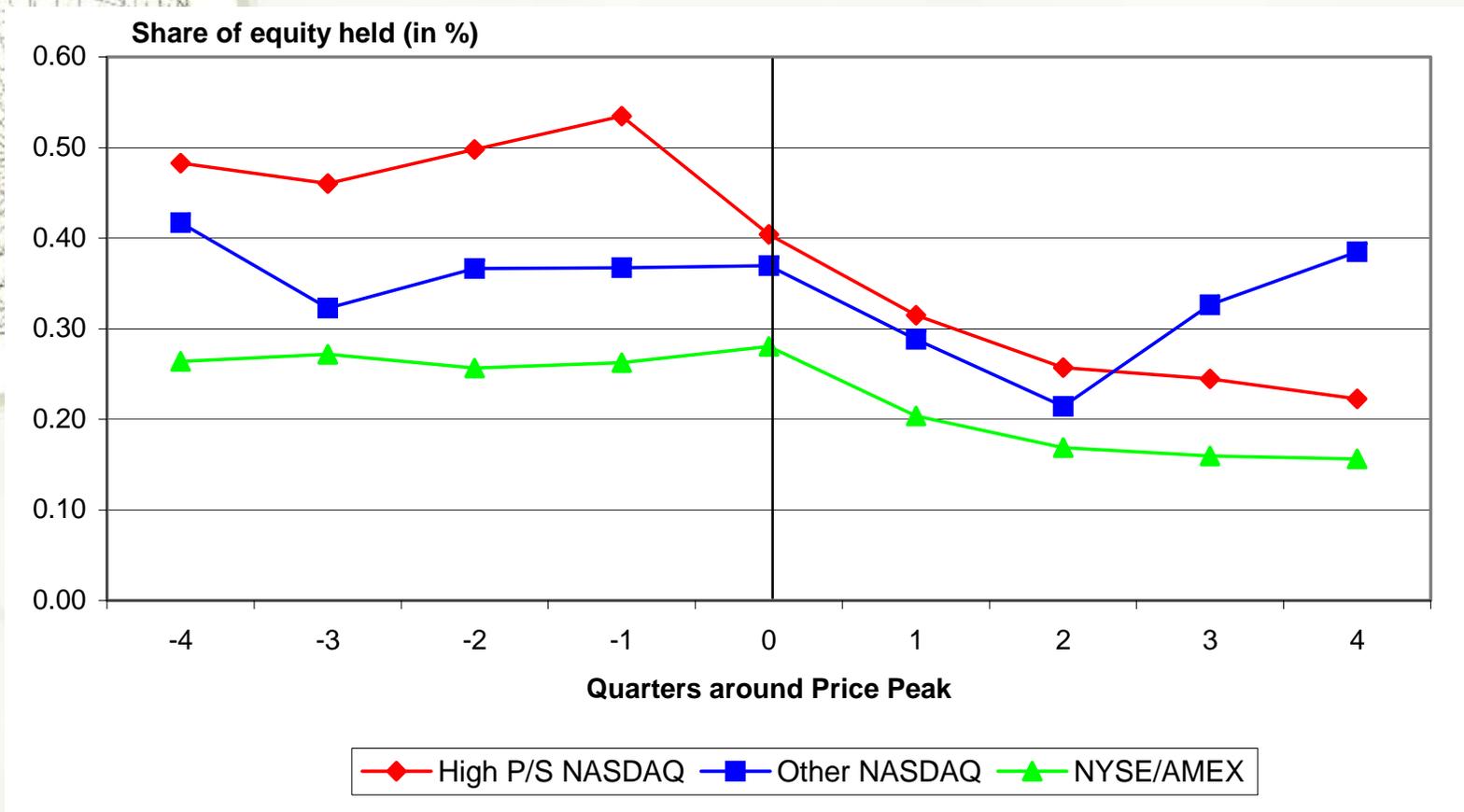


Figure 5. Average share of outstanding equity held by hedge funds around price peaks of individual stocks

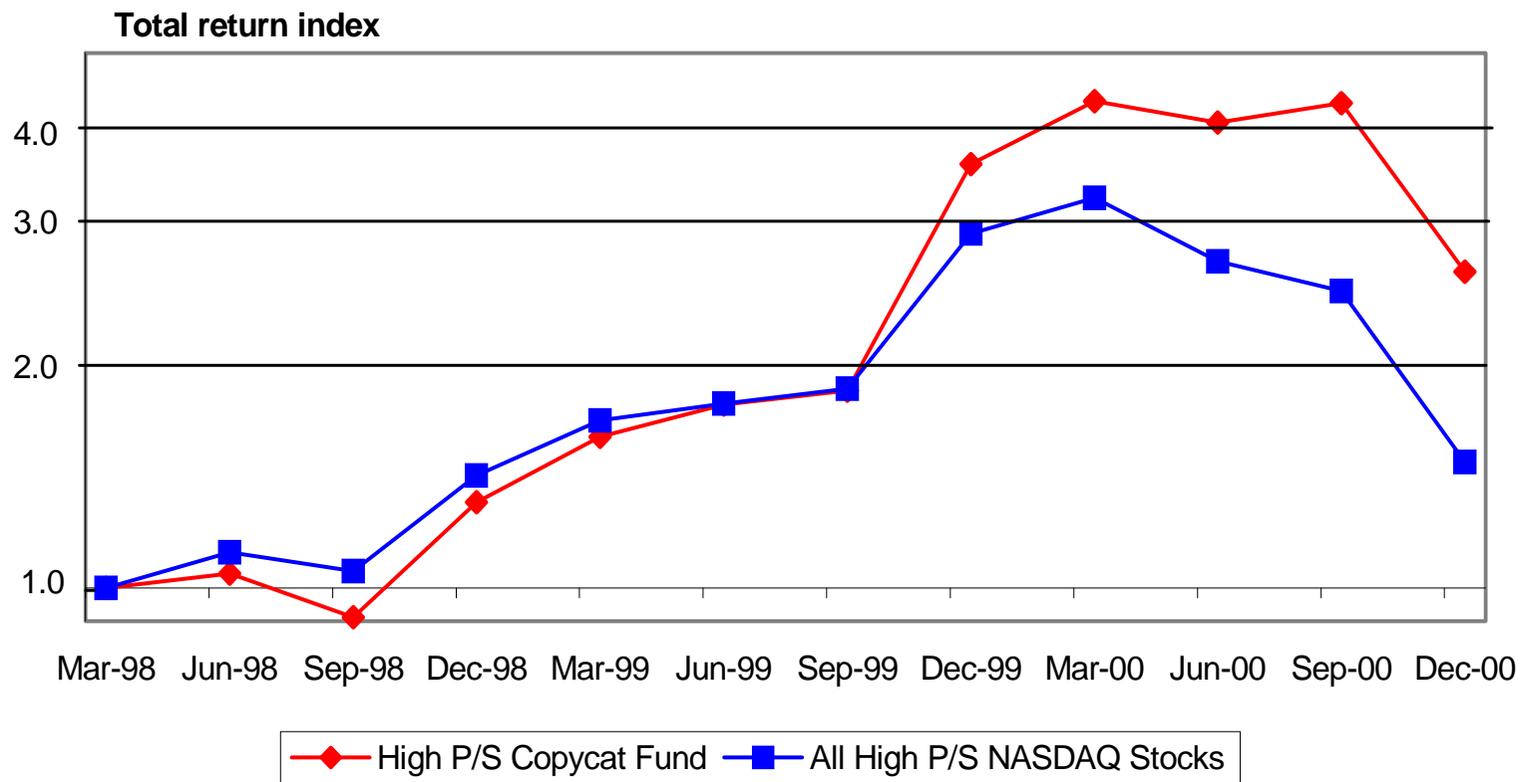


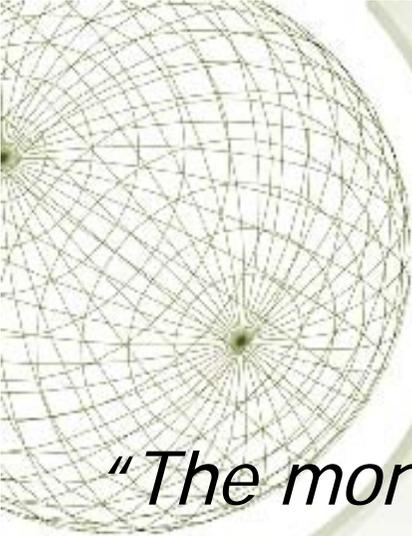
Figure 6: Performance of a copycat fund that replicates hedge fund holdings in the NASDAQ high P/S segment



Table V

Quarterly Abnormal Returns, Copycat Portfolio

<u>Market Segment</u>	<u>Quarters after 13F</u>	<u>Mean</u>	<u>t-statistic</u>
High P/S NASDAQ stocks (Technology Segment)	1	4.51	1.87
	2	2.71	2.02
	3	0.39	0.22
	4	1.01	0.77
Other NASDAQ stocks	1	0.55	0.58
	2	0.36	0.3
	3	-1.64	-1.12
	4	-0.89	-0.55
NYSE/AMEX stocks	1	0.24	0.31
	2	0.25	0.31
	3	0.32	0.3
	4	-0.48	-0.45



“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,

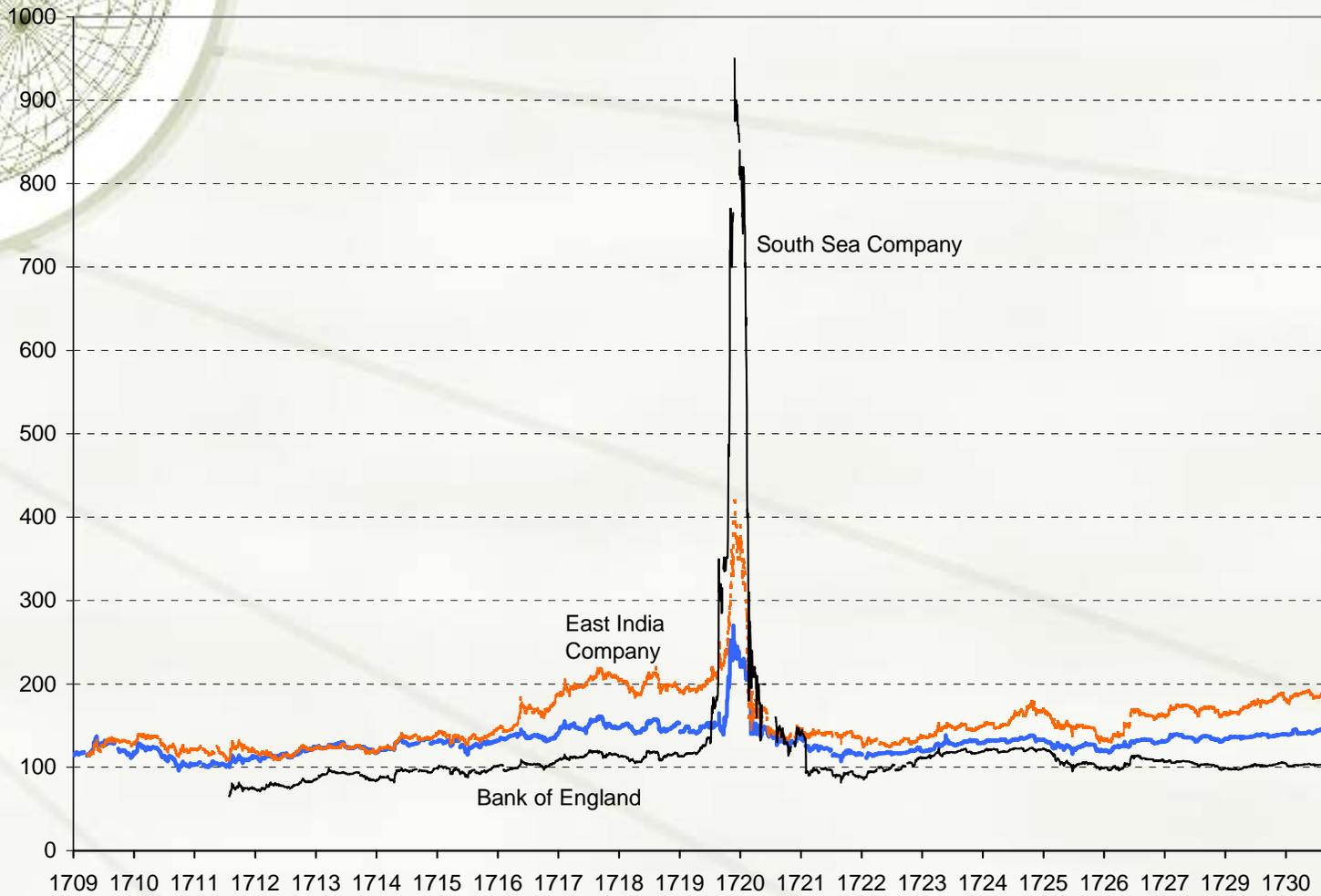
New York Times, April 29, 2000



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





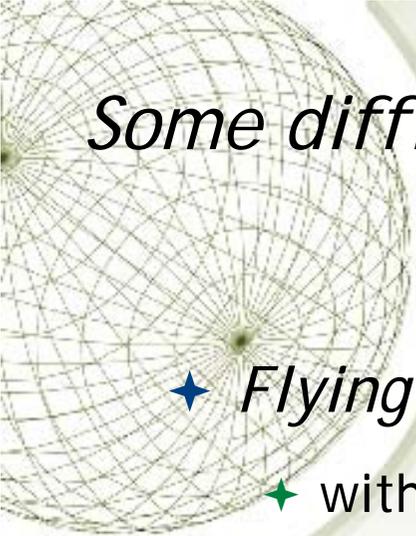
Historical background

- ◆ 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



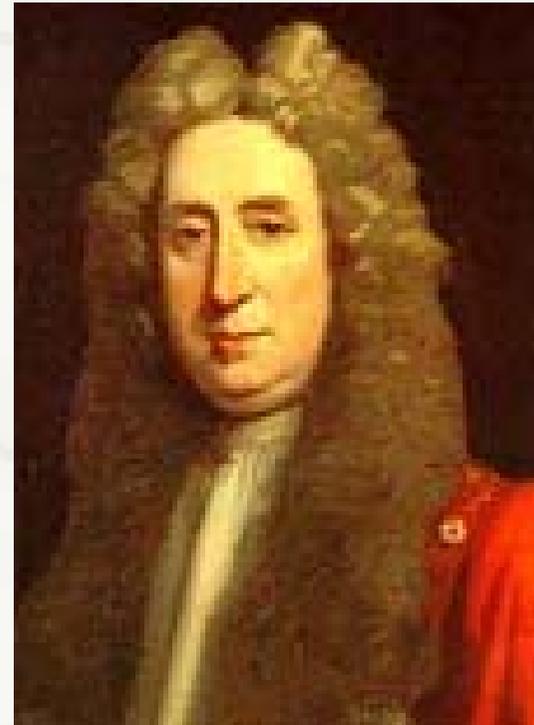
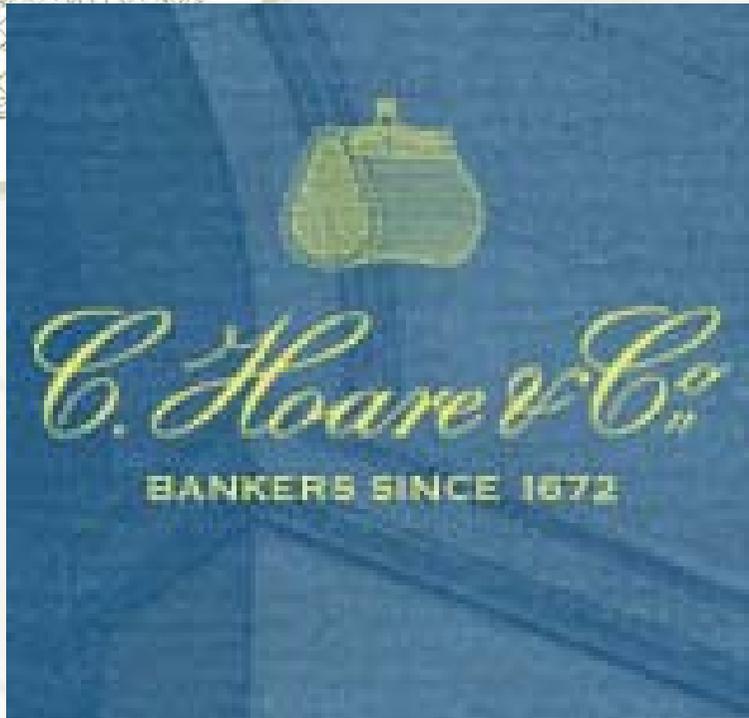
Some difficulties in determining underlying value

- ★ *Flying Post* from April 9th, 1720

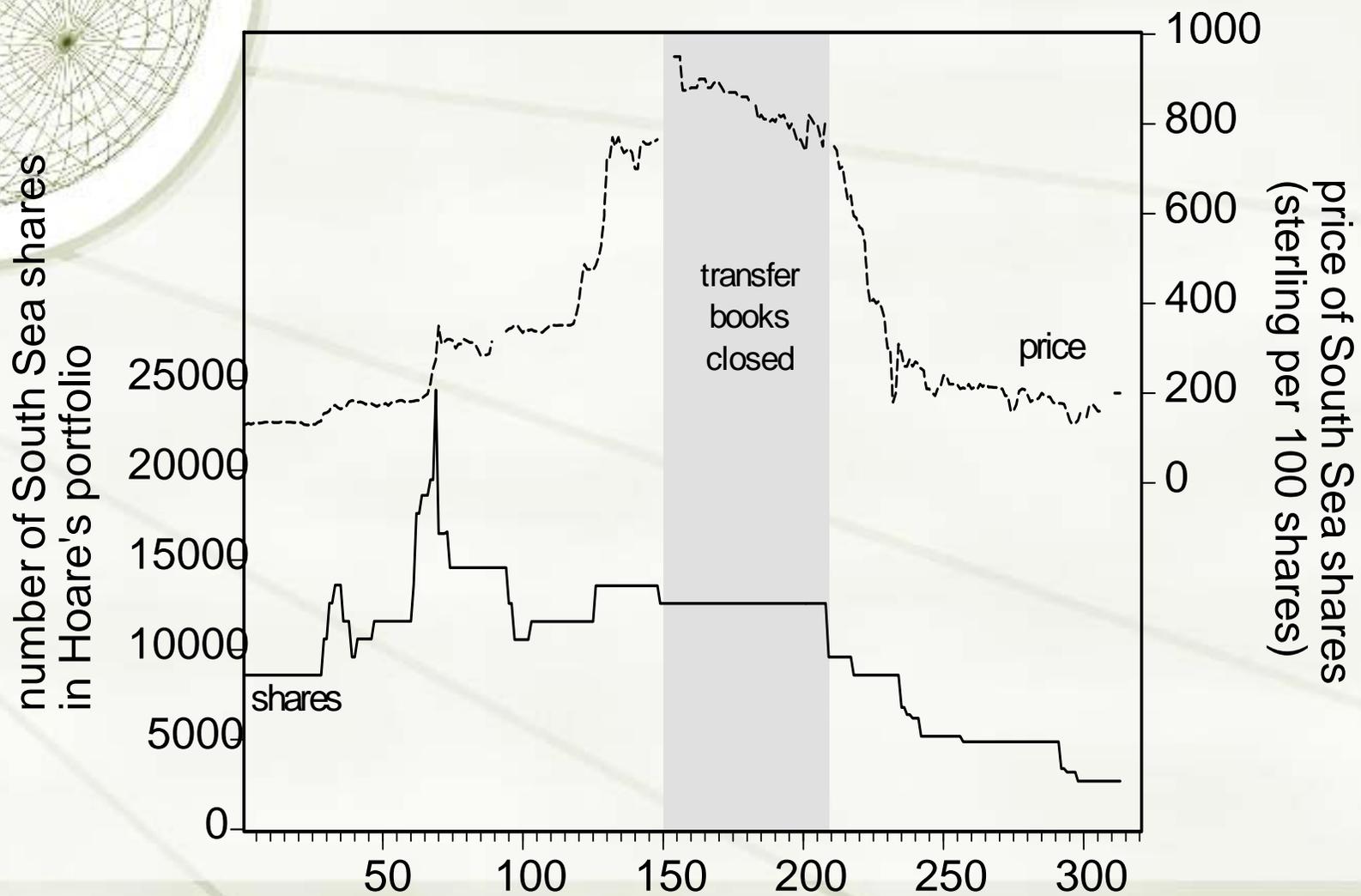
- ★ with the share price of South Sea stock at £300, its intrinsic value would be £448
- ★ at £600, it would be worth £880
- ★ the higher the price, the more cheaply bondholders could be bought out, and the higher the value of shares

- ★ 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.*"

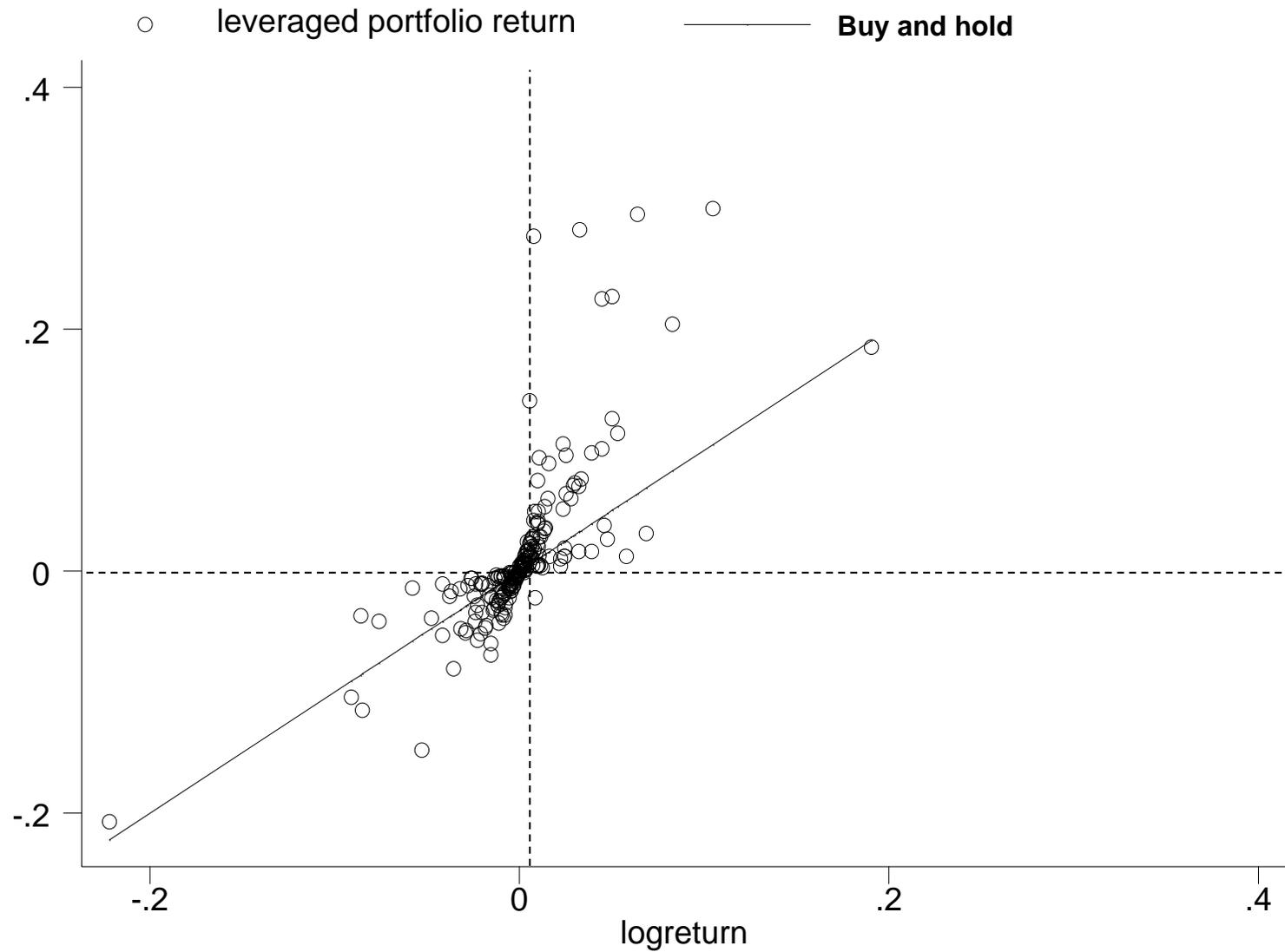
The sign of the golden bottle and Sir Richard Hoare

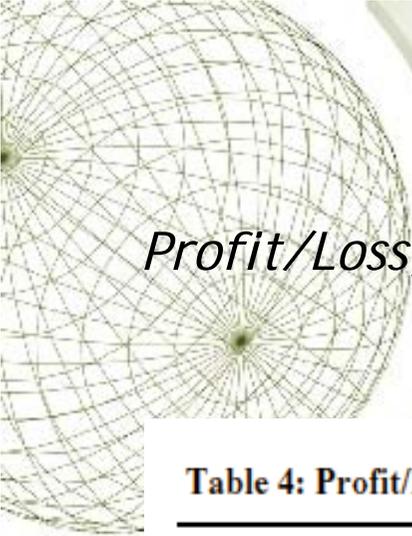


Hoare's holdings and South Sea prices



Hoare's daily return vs. the return on South Sea stock





Profit/Loss, from 6 months prior to market peak to 6 months after

Table 4: Profit/Loss on South Sea stock, from 6 months before market peak to 6 months thereafter

Strategy	Log returns	Standard deviation of daily log returns
Momentum	-0.446	0.043
Buy-and-hold	0.445	0.063
Hoare's Unleveraged	0.708	0.027
Hoare's Leveraged	2.055	0.054

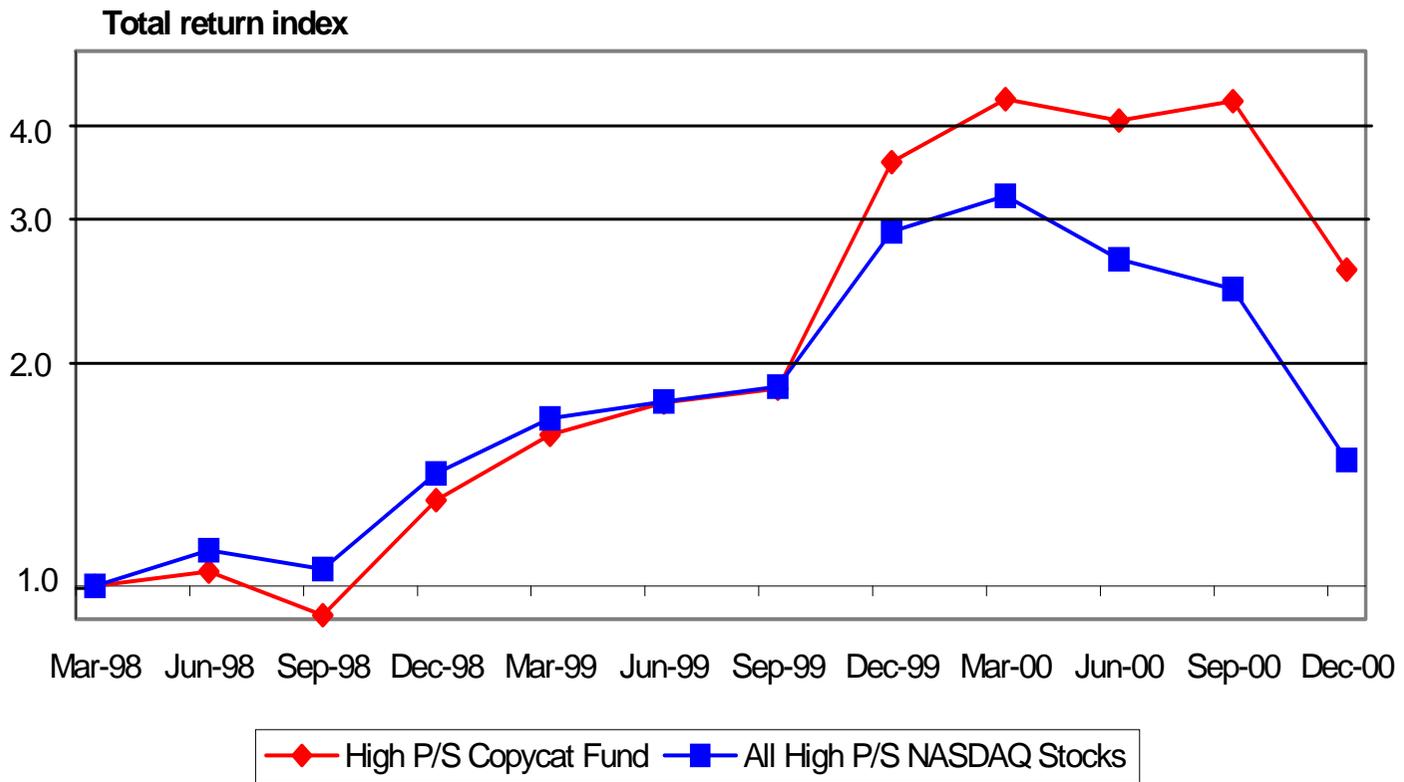
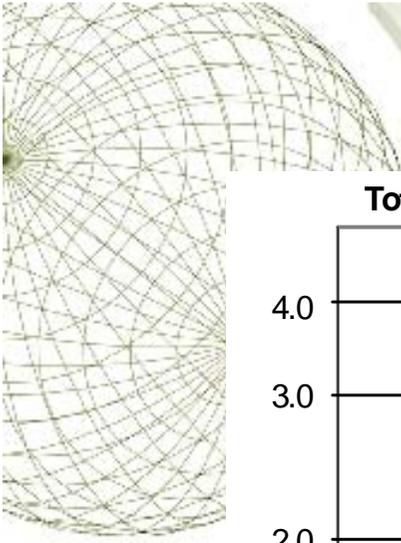
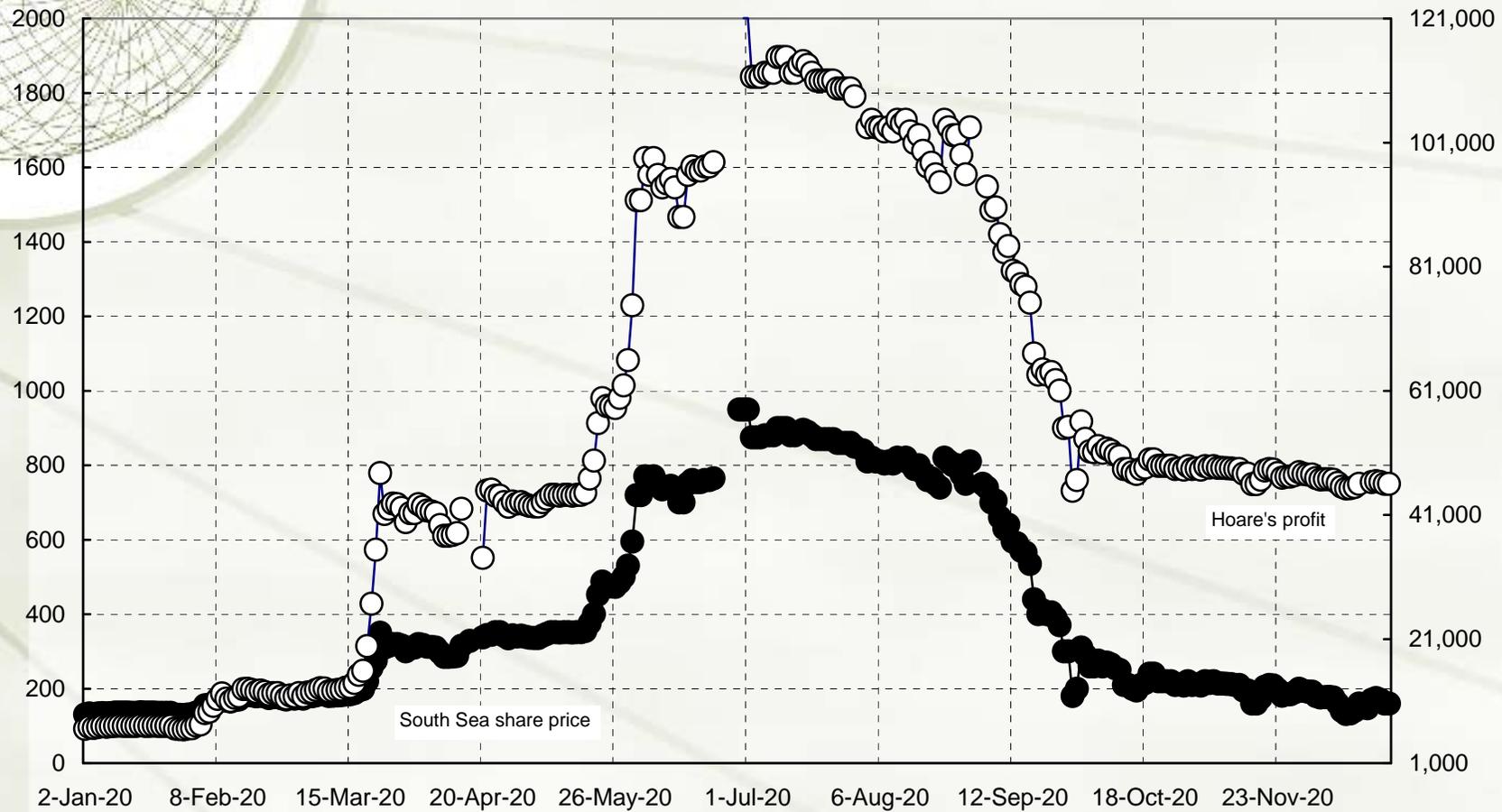
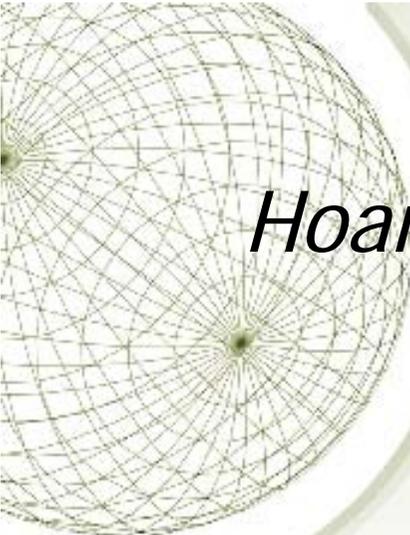


Figure 6: Performance of a copycat fund that replicates hedge fund holdings in the NASDAQ high P/S segment

From: Brunnermeier and Nagel 2003

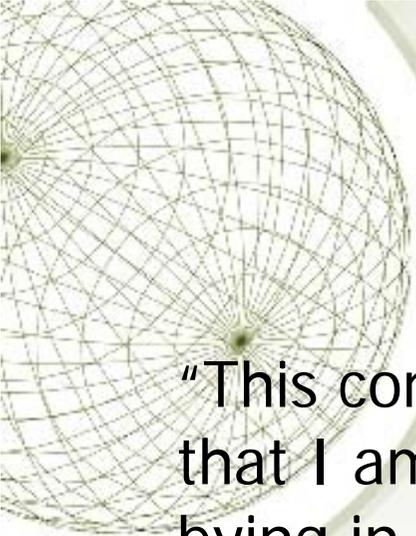
*Hoare's timing not perfect,
but similar to hedge funds during the tech bubble*





Hoare's lending against South Sea stock

Date	number of shares offered as security	loan value	£ lent per 100 par value	market price	discount
17.3.1719	1,300	1,400	107.7	109.5	-1.7%
2.4.1719	6,000	7,860	131.0	110.25	18.8%
26.2.1720	6,000	9,000	150.0	170.5	-12.0%
1.3.1720	600	900	150.0	177.5	-15.5%
7.3.1720	2,000	1,580	79.0	184.5	-57.2%
24.3.1720	1,500	2,700	180.0	310	-41.9%
27.10.1720	300	631	210.3	212	-0.8%
23/24.12.1720	3,000	1,400	146.0	160	-8.4%



Greater fools

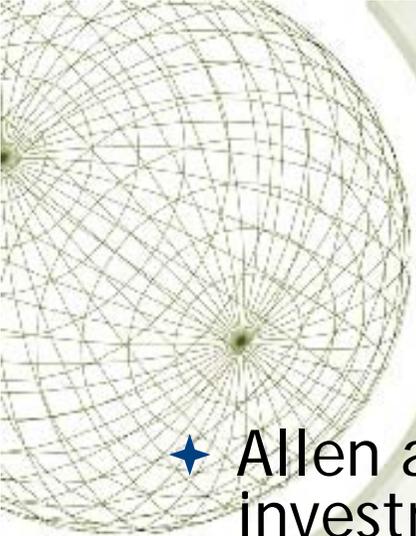
"This comes to good Mr. Warner, to lett him know that I am allmost sure, I can mack an advantage by bying in the South Seas with the hundred and four score pounds is still in your hands... so I would bye as much as theat will bye today, and sell it out agane next week, for tho I have no oppinion of the 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

The fundamental

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

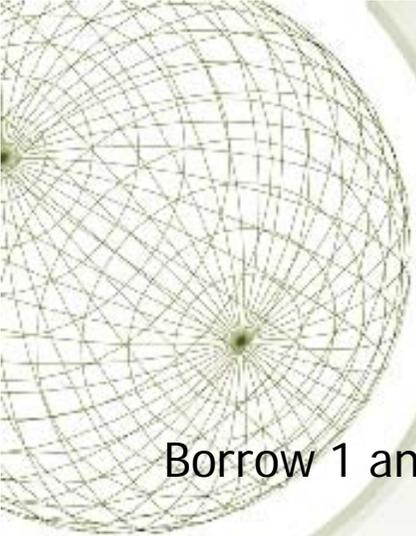
$$\frac{2.25}{P_f} = \frac{1.5}{1}$$

$$\Leftrightarrow P_f = \frac{2.25}{1.5} = 1.5$$



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



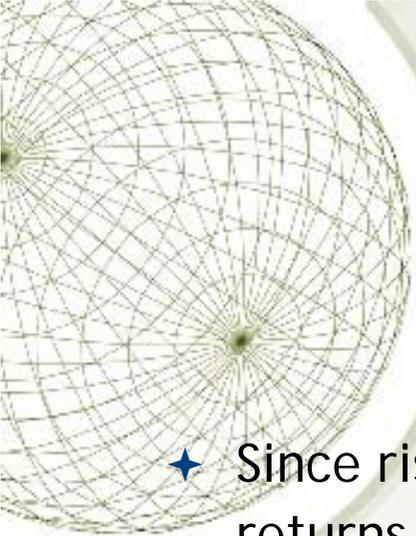
Can $P = 1.5$ be equilibrium price?

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

$$R_{risky} = 0.25 * (1/1.5 * 6 - 1.33) + 0.75 * 0 = 0.67 > 0.17$$



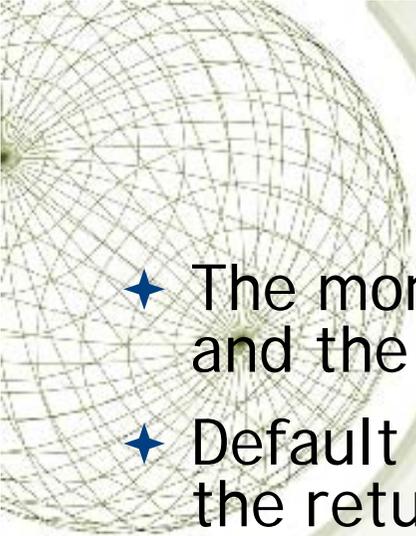
What is the equilibrium P?

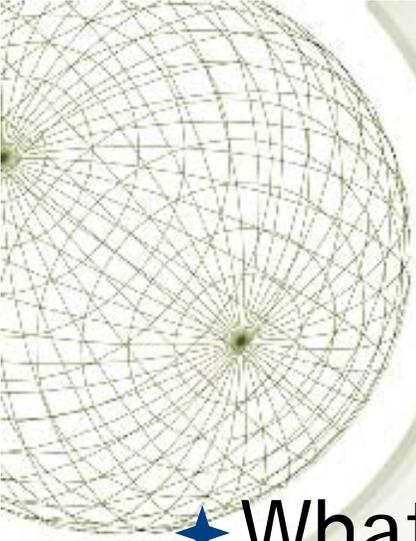
- ★ Since risky asset is in fixed supply, P will be bid up until returns are equated

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

$$P = 3$$

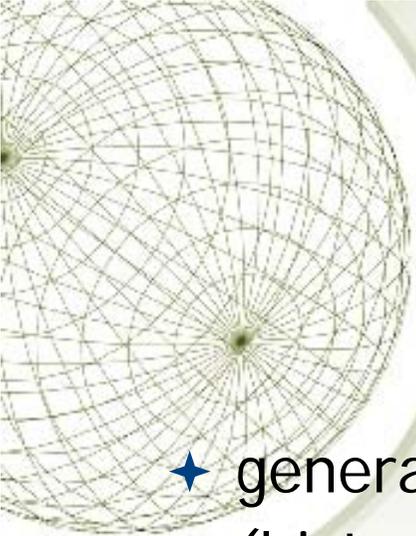
- ★ There's a bubble since $P = 3 > P_F = 1.5$

- 
- ★ 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.



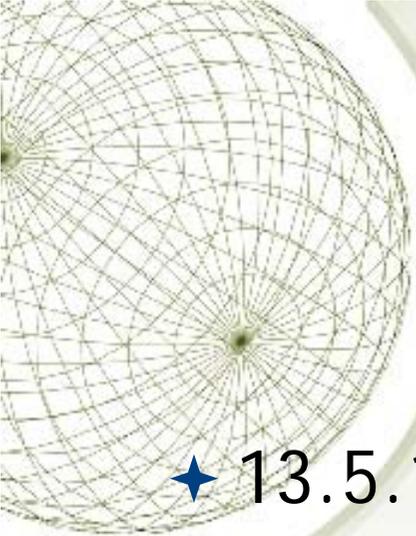
Structure

- ◆ 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



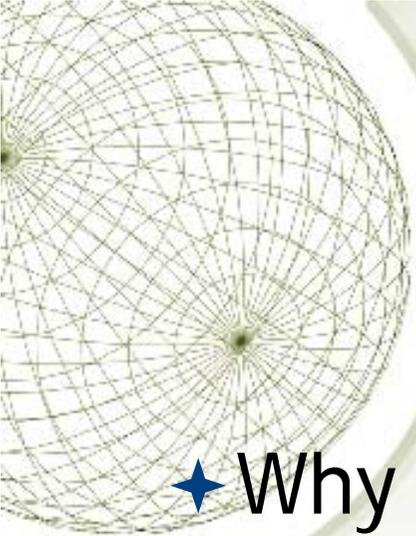
Policy Options for Central Banks

- ★ 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

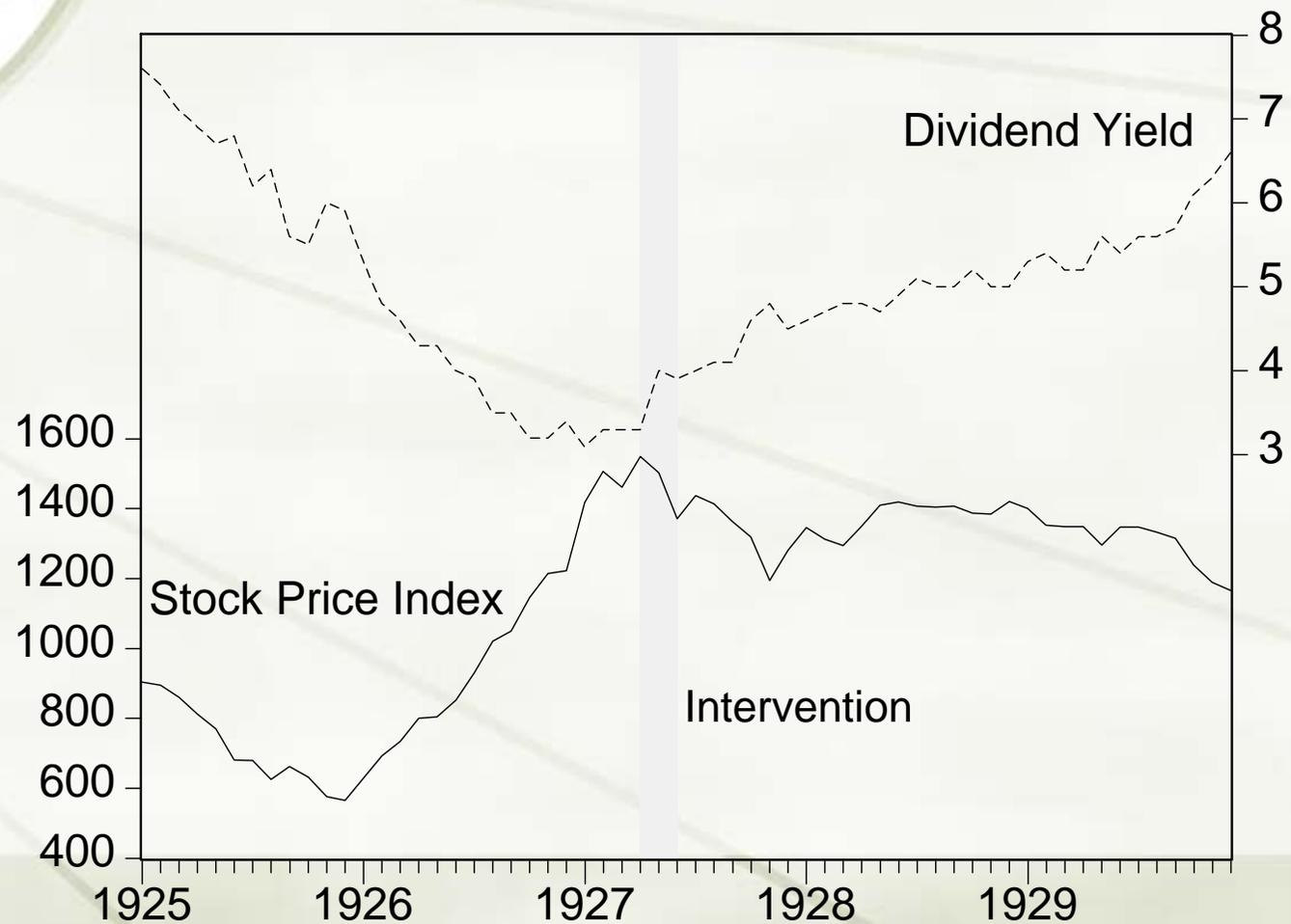


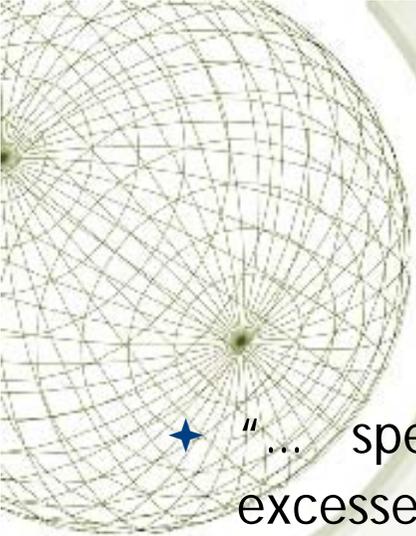
Three questions

- ★ 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

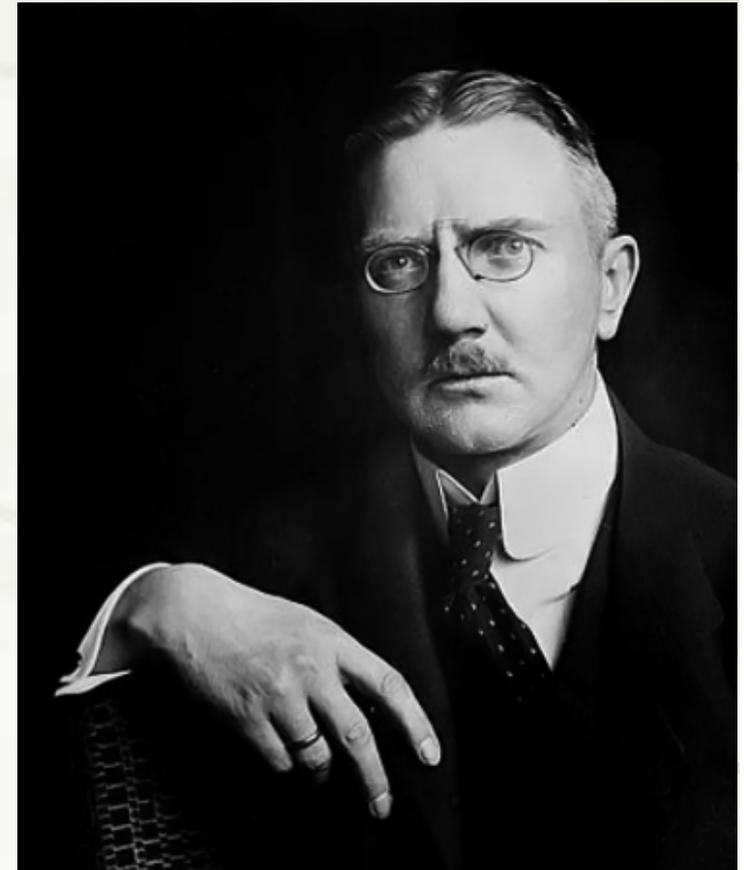
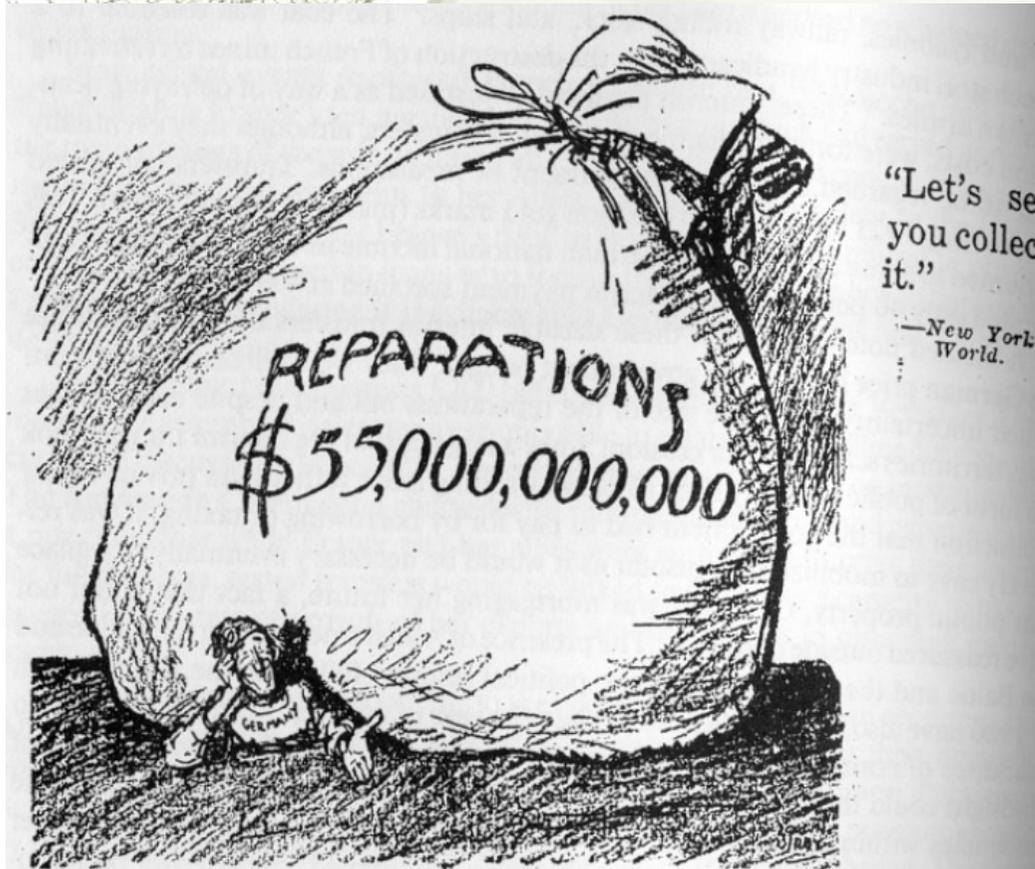




What they were thinking

★ "... 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** ..."

Context



The Age of Dr Mabuse



The Age of Dr Mabuse



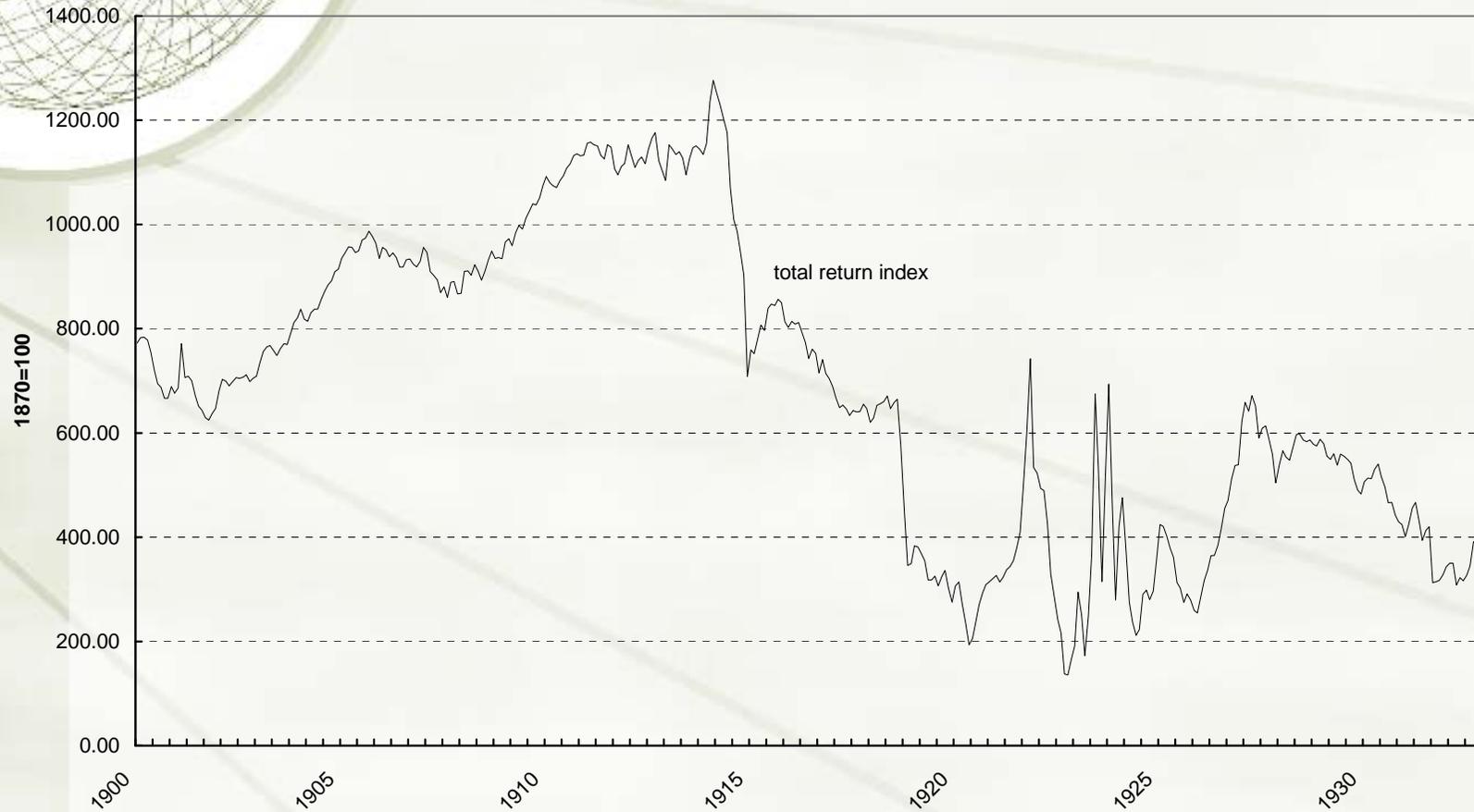


"Everything is a gamble"



Was there a bubble?

German Share Price Index, 1900-32

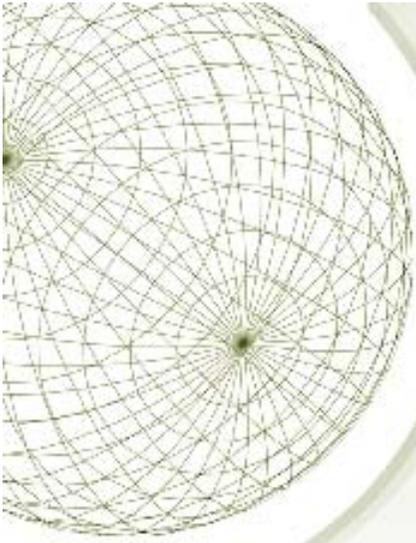


Monthly returns (in %) and volatility

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

Notes: * 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.

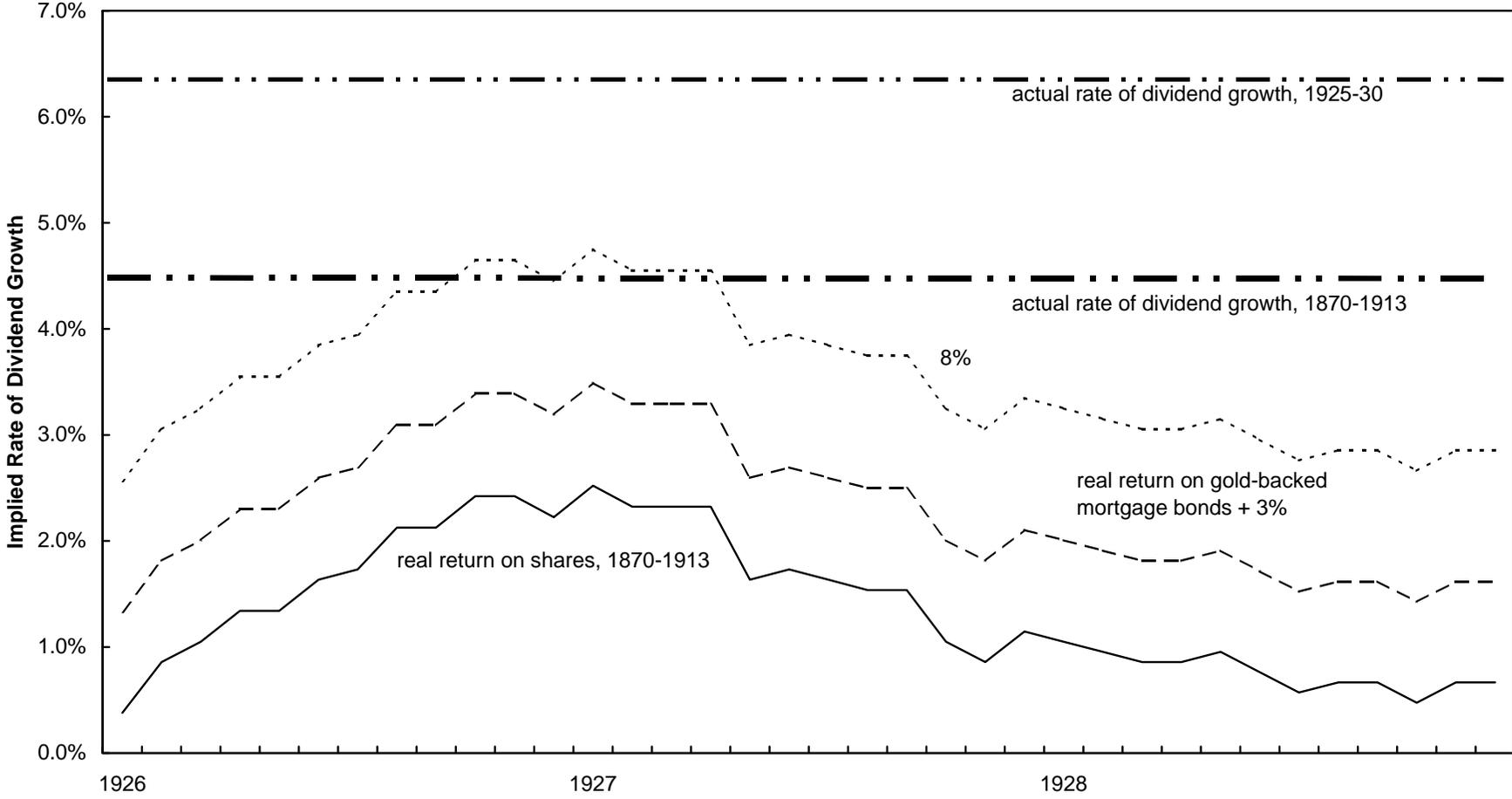


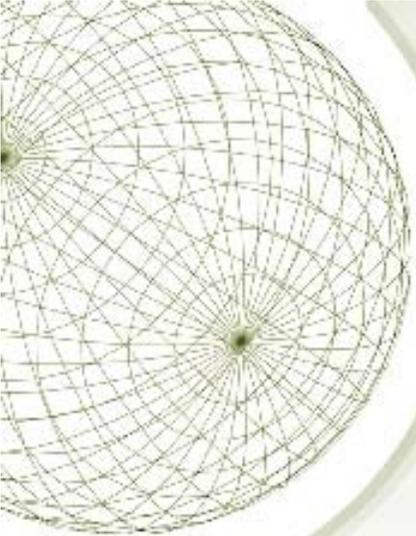
$$P = \frac{D_0(1+g)}{i-g}$$

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:

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

Valuation Measures



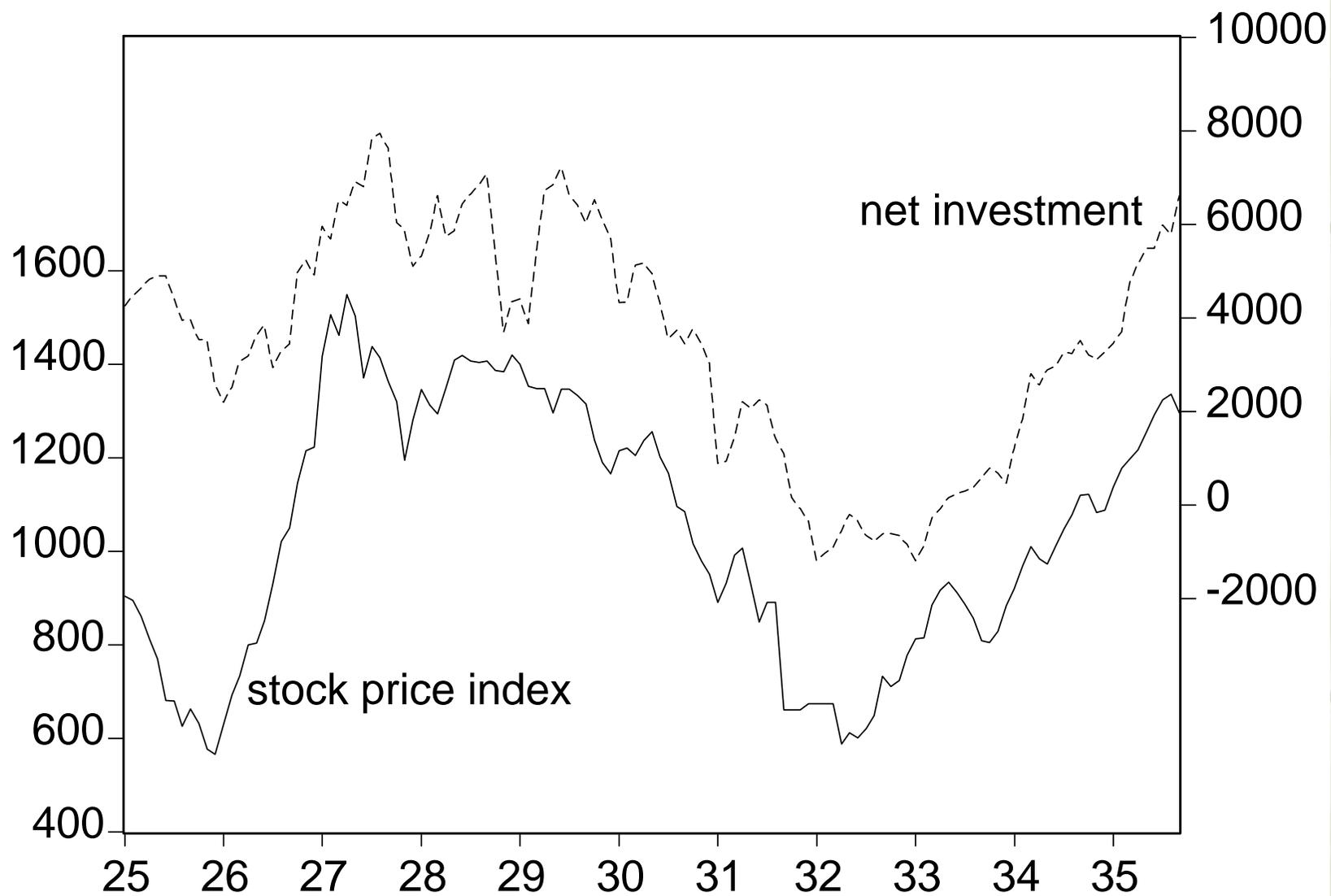


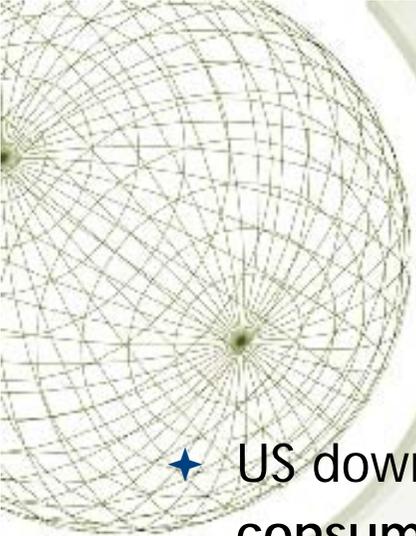
Real consequences

“[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

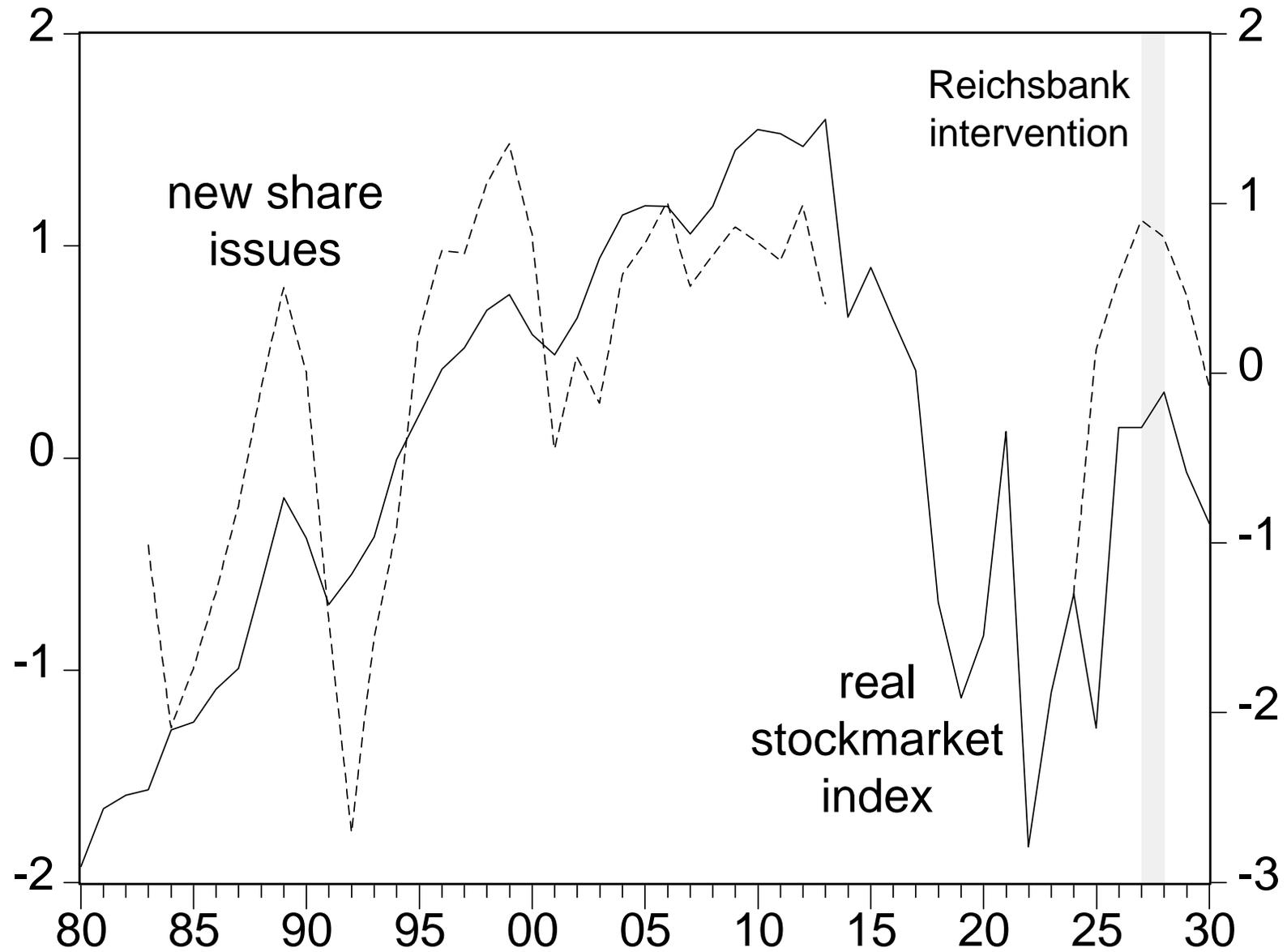


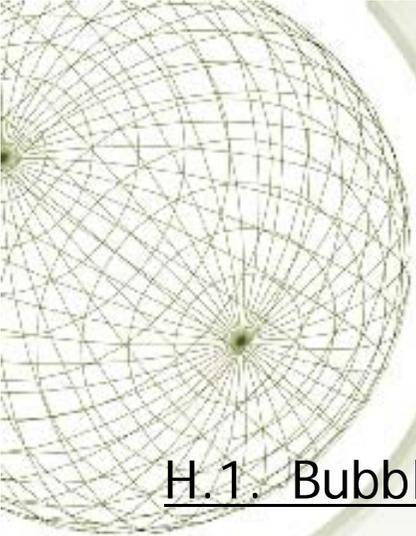


Real consequences

- ★ 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





Ackert et al. – experimental evidence on “Irrational Exuberance No More”

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

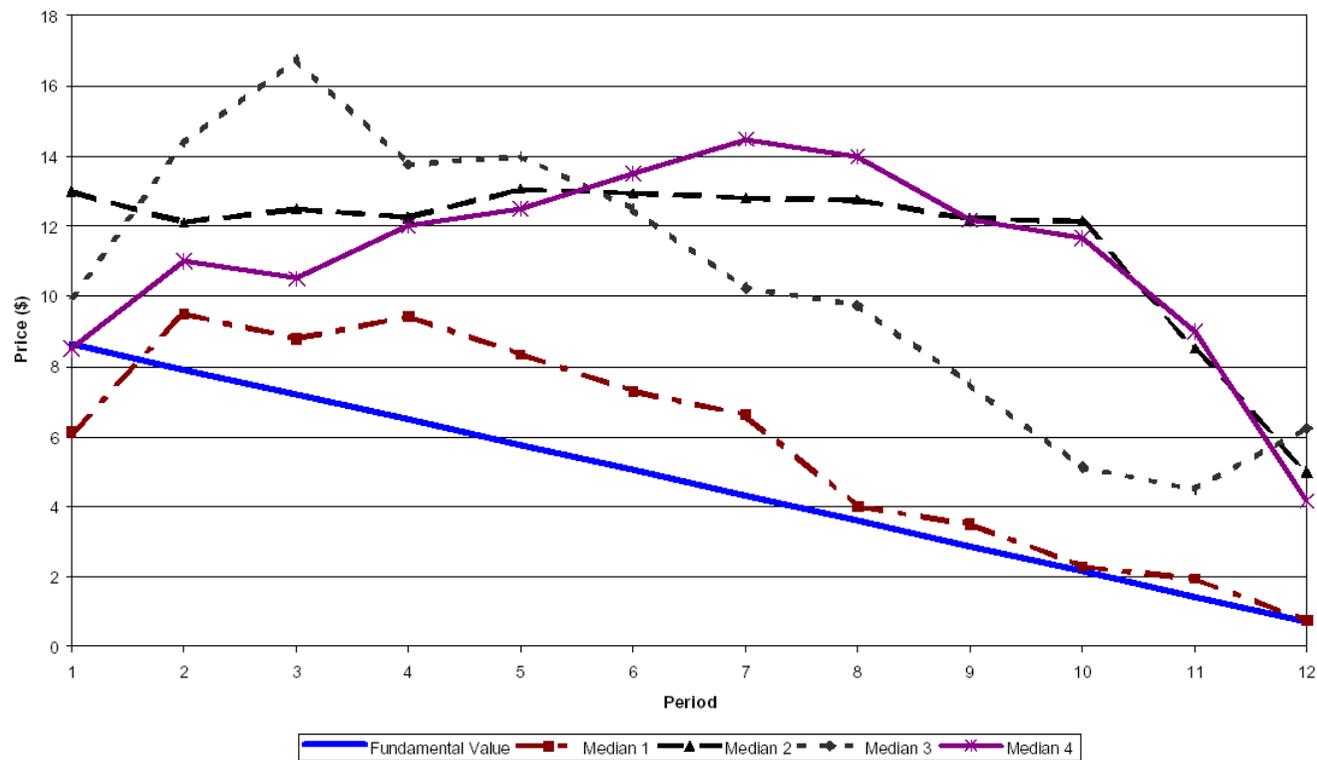
Experimenting with different market structures

Three Different Market structures

	Market 1	Market 2	Market 3
Can traders borrow money?	Yes	No	No
Can traders shortsell assets?	No	No	Yes

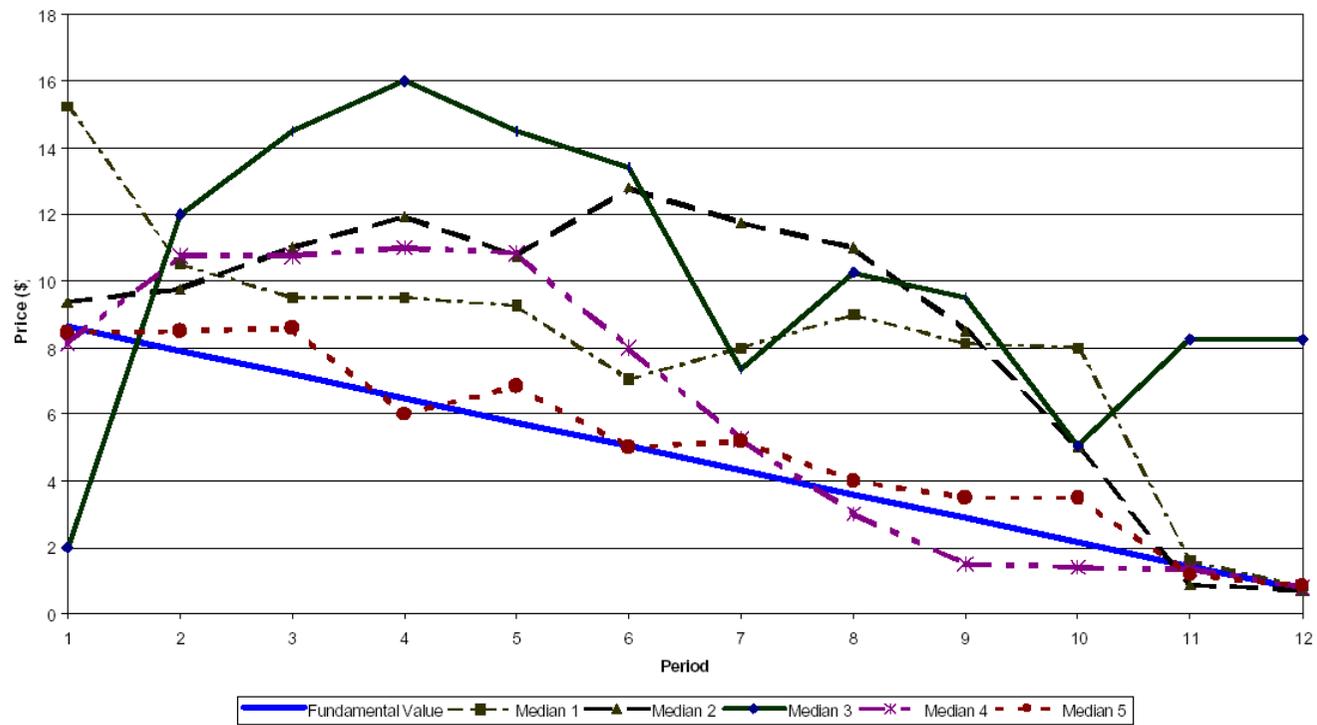
Ackert et al. No short sales, borrowing

FIGURE 2. Time Series of Median Transaction Prices, Lottery Asset, NSS/B Treatment



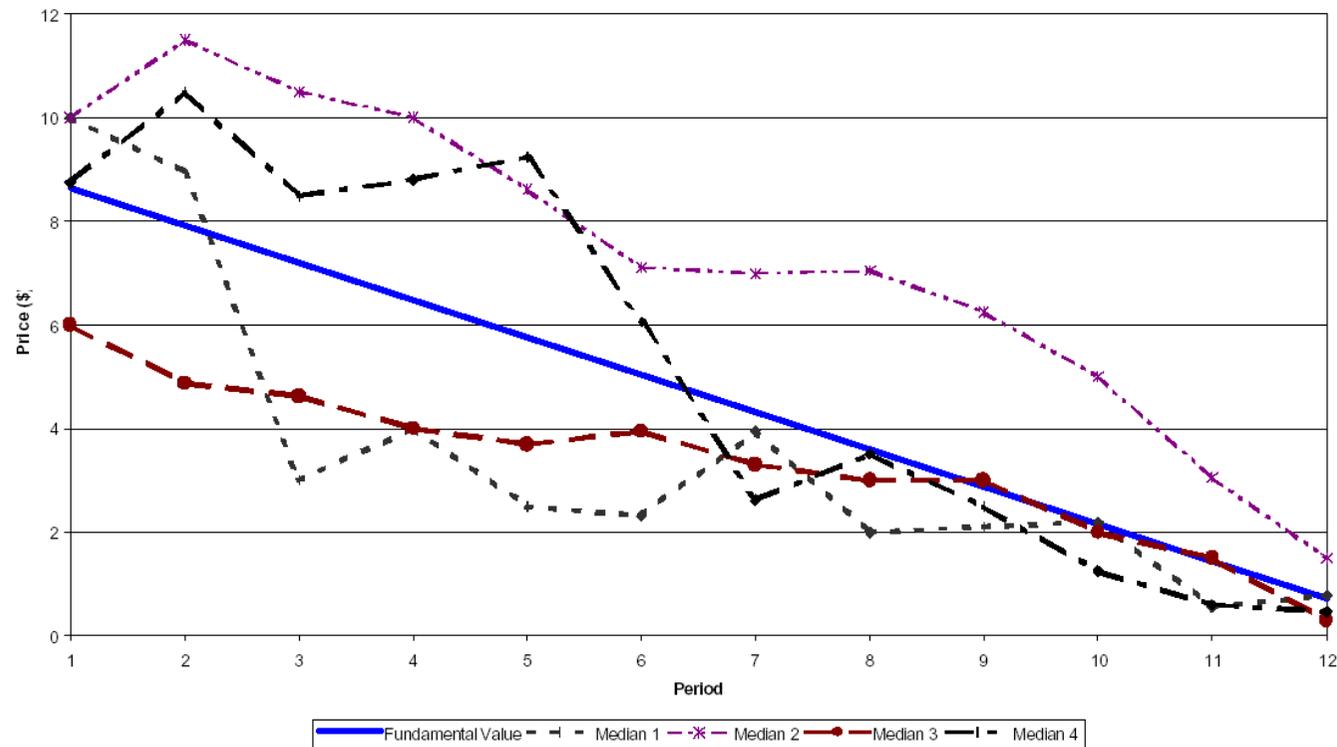
No short sales, NO borrowing

FIGURE 3. Time Series of Median Transaction Prices, Standard Asset, NSS/NB Treatment



Short sales, No borrowing

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



- 
- ✦ 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]

Conclusions

