Hedge Funds and the Technology Bubble

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Introduction

Underlying Theory

Different views:

- Stock prices increase when driven by irrational investor euphoria (Schiller 2000)
- Efficient Market Hypothesis argues rational investors will exploit mispricing and correct it
- Limits to Arbitrage suggest noise traders, agency problems, and synchronization risk may constrain arbitrageurs to correct mispricing.
- Rational investors ride the bubbles for a while and have destabilizing effect

Introduction

Overview

- Find whether sophisticated speculators help correct Technology bubble
- Look directly at hedge fund holdings
- Hedge Funds anticipated price peak, captured upturn, and avoided downturn
- No evidence hedge funds exerted correcting force on prices
- Does not appear aversion to arbitrage risk and frictions explain why funds didn't correct

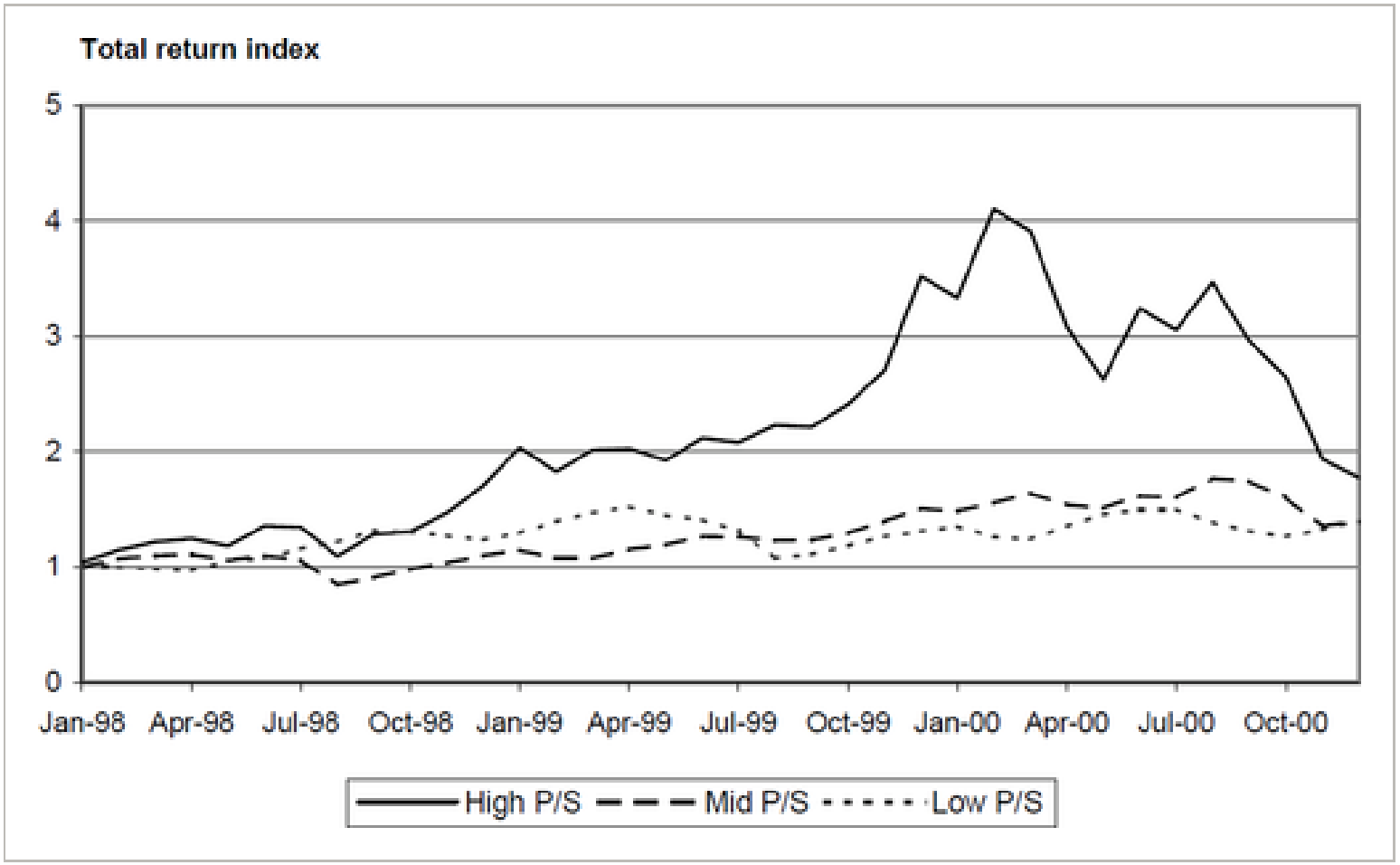
Data

Defining the Bubble Segment

- Look for stocks that were most likely to be overvalued during bubble
  - Use price to sales ratio
- Use monthly stock returns from 1998 to 2000
- Sort stocks into quintiles based on highest P/S ratio

Data

Defining the Bubble Segment



Data

Hedge Fund Holdings

- Spectrum Database by Thomson Financial
  - Based on 13F filings with SEC
  - Track positions in individual stocks at a quarterly frequency
- Use hedge fund returns to back out short positions indirectly
- Identify Hedge Funds using *Money Manager Directory*
- Look up each manager by name in Thomson
  - 71 managers

Data

Hedge Fund Holdings

- Reporting entity is institution, not the fund
- Check firm status as investment advisor with SEC
  - Signals non-hedge status: exclude
- In Form ADV, require 50% of clients are:
  - Other pooled investment vehicles
  - high net worth individuals
- Cuts managers down to 53

Data

Table I
Summary Statistics

The total sample comprises 53 hedge fund managers that existed prior to 1998 for which we have CDA/Spectrum data, and that satisfy the inclusion criteria described in the text. The number of managers in the first column refers to those with a valid 13F filing in the given quarter. Stock holdings per manager denotes the sum of the market value of all stocks held by the manager at the end of the quarter. Portfolio turnover is defined as the minimum of the absolute values of buys and sells during a quarter t divided by total holdings, where buys, sells, and holdings are measured with end-of-quarter $t-1$ prices. Means, medians, and cross-sectional semi-interquartile ranges (s.i.q.r., one-half the difference between the 75^{th} and 25^{th} percentile) for portfolio turnover are annualized.

			Stock Holdings per Manager			Number of Stocks per Manager			Portfolio Turnover			Stock Holdings
Year	Qtr.	Number of Mgrs.	Mean ($ mill)	Median ($ mill)	S.i.q.r. ($ mill)	Mean	Median	S.i.q.r.	Mean (ann.)	Median (ann.)	S.i.q.r. (ann.)	Aggregate ($ mill)
1998	1	35	1,280	295	755	150	56	77				44,794
	2	42	1,053	231	445	113	50	49	1.02	0.94	0.34	44,234
	3	42	728	145	364	71	44	30	0.83	0.57	0.40	30,594
	4	41	925	178	417	66	39	36	1.16	1.05	0.58	37,912
1999	1	39	1,070	216	538	74	47	39	0.98	0.84	0.55	41,742
	2	42	995	211	382	75	48	38	1.12	1.12	0.50	41,807
	3	43	927	244	426	69	37	42	1.28	1.32	0.46	39,879
	4	44	1,136	270	615	83	46	41	1.02	0.95	0.51	49,981
2000	1	43	1,138	316	792	85	39	49	1.33	1.12	0.71	48,933
	2	44	772	246	383	67	37	41	1.19	0.99	0.75	33,988
	3	45	861	269	413	80	37	34	1.21	1.22	0.63	38,747
	4	48	812	190	427	100	45	37	1.06	0.77	0.70	38,989

Data

Important Note

- Hedge Funds in this sample hold 0.3% of outstanding equity
- Dwarfed by other institutional investors
- Then, this paper is NOT looking at causal links between hedge fund holdings and price changes.
- Interest is in trading behavior of "rational" investors in a bubble

Did Hedge Funds Trade against the Bubble?

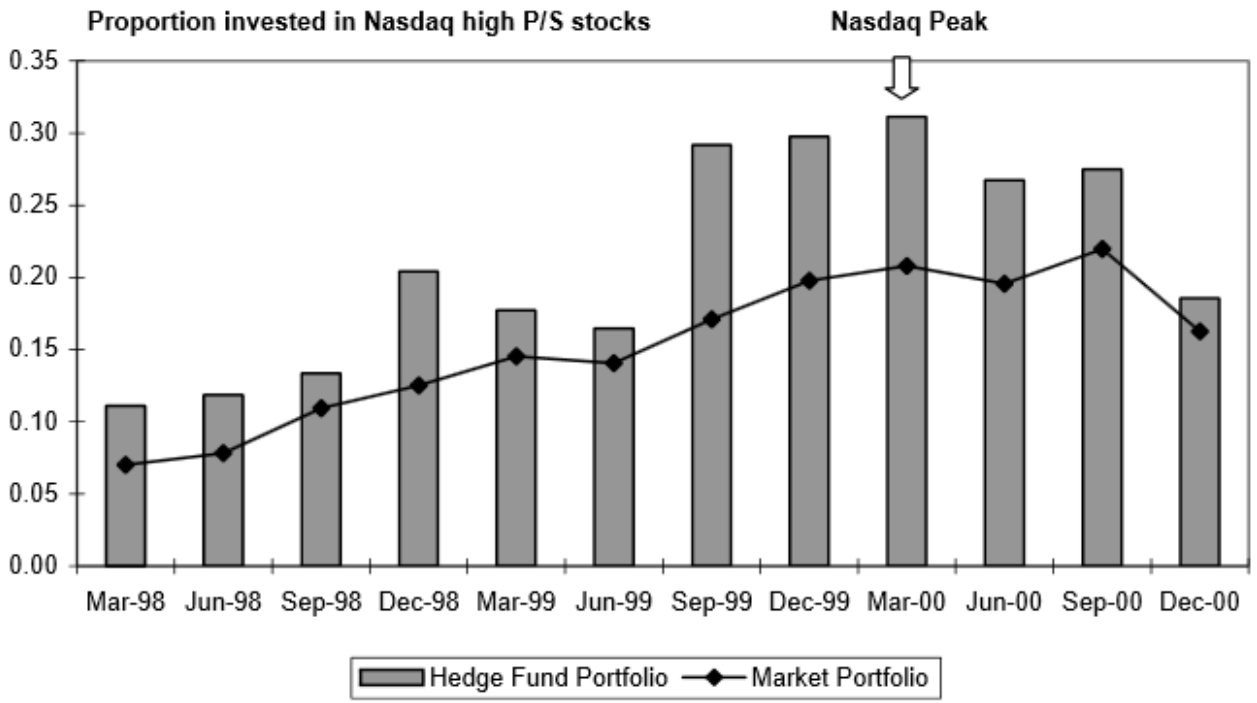


Figure 2. Weight of Nasdaq technology stocks (high P/S) in aggregate hedge fund portfolio versus weight in market portfolio. At the end of each quarter, we compute the weight, in terms of market value, of high P/S quintile Nasdaq stocks in the overall stock portfolio of hedge funds, given their reported holdings on form 13F. For comparison, we also report the value-weight of high P/S stocks in the market portfolio (all stocks on CRSP).

Did Hedge Funds Trade against the Bubble?

Could preferential IPO allocations explain?

- Investors given shares of "hot" IPOs on first day of trading and selling them after (flipping)
- In exchange, Investment Bank increases trading commissions
- Could not see clearly in data
- Separating newly listed items on CRSP in data do not appear to deviate from overall analysis

Return Regressions

Look at two asset classes: market portfolio return R_m and portfolio of technology stock returns R_T. Manager will allocate b fraction of portfolio to the market and reallocate g of total portfolio value from market to technology stocks. Let R_t be:

$$R_t = (b - g)R_{Mt} + gR_{Tt} + e_t$$

Return Regressions

Now, want to look at ratio of hedge fund long and short positions compared with the market. The net investment in technology stocks as a proportion of the total portfolio is $(b - g)m_T + g$ and the net investment in stocks overall is b. Then, the ratio is:

$$w_T = m_T + \frac{g}{b}(1 - m_T)$$

Return Regressions

$$w_T = m_T + \frac{g}{b}(1 - m_T)$$

Long only fund means $b = 1$ and $g = 0$. Need to recover b and g and do so in the following regression:

$$R_t = \alpha + \beta R_{Mt} + \gamma(R_{Tt} - R_{Mt}) + \epsilon_t$$

with $\beta = b$ and $\gamma = g$

Call $(R_{Tt} - R_{Mt})$ the *TECH* factor.

Return Regressions

- Run regression over monthly returns in sample period
- Returns net-of-fees.

Three Samples:

1. Five largest managers in terms of stock holdings - *Large*
2. Hedge fund style indexes with significant exposure to equity
3. Monthly return series on long-only copycat fund - 13f

Return Regressions

Index	Factor Loadings β	Factor Loadings γ	Adj. R^2	Implied Tech-Weight w_T
Panel A: Equal-weighted Index of Largest Funds in Our Sample (1998–2000)				
Large	0.42	0.17	0.56	0.49
	(3.51)	(2.51)		(0.08)
Panel B: HFR Hedge Fund Style Indexes (1998–2000)				
Equity-hedge	0.45	0.15	0.80	0.44
	(6.36)	(3.92)		(0.04)
Equity nonhedge	0.74	0.16	0.86	0.34
	(9.07)	(3.57)		(0.03)
Equity market-neutral	0.07	0.01	0.10	0.32
	(1.54)	(0.53)		(0.15)
Market timing	0.25	0.07	0.48	0.38
	(3.45)	(1.67)		(0.08)
Short-selling specialists	−1.00	−0.43	0.80	
	(−5.93)	(−4.57)		
Macro	0.13	0.09	0.34	0.70
	(1.84)	(2.13)		(0.21)
Sector technology	0.71	0.57	0.86	0.84
	(5.29)	(7.62)		(0.08)
Panel C: Aggregate Long Portfolio (As in Figure 2)				
13F	1.13	0.29	0.89	0.37
	(9.97)	(4.49)		(0.03)

Return Regressions

Results

- Panel A shows largest hedge fund managers had positive exposure to *TECH*
  - Higher than Figure 2 (20% there vs 49% here) due to shorting
- Panel B Short-selling specialists are only ones to have negative *TECH*
- Panel C reveals over weighted exposure is not limited to fifth P/S quintile

In short, accounting for short positions strengthens results - hedge funds offset market exposure, not technology exposure

Return Regressions

Previous modeling yielding average exposure over the sample. Would be interesting to look at model with time-varying coefficients:

Kalman Filter

$$R_t = \bar{\alpha} + \xi_{1t} + (\bar{\beta} + \xi_{2t})R_{Mt} + (\bar{\gamma} + \xi_{3t})(R_{Tt} - R_{Mt}) + \varepsilon_t. \tag{4}$$

Stochastic variation in regression coefficients is captured by the unobserved state vector ξ_t, for which we assume the following dynamics

$$\begin{pmatrix} \xi_{1t+1} \\ \xi_{2t+1} \\ \xi_{3t+1} \end{pmatrix} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & \phi & 0 \\ 0 & 0 & \phi \end{pmatrix} \begin{pmatrix} \xi_{1t} \\ \xi_{2t} \\ \xi_{3t} \end{pmatrix} + \begin{pmatrix} \eta_{1t+1} \\ \eta_{2t+1} \\ \eta_{3t+1} \end{pmatrix}, \tag{5}$$

Return Regressions

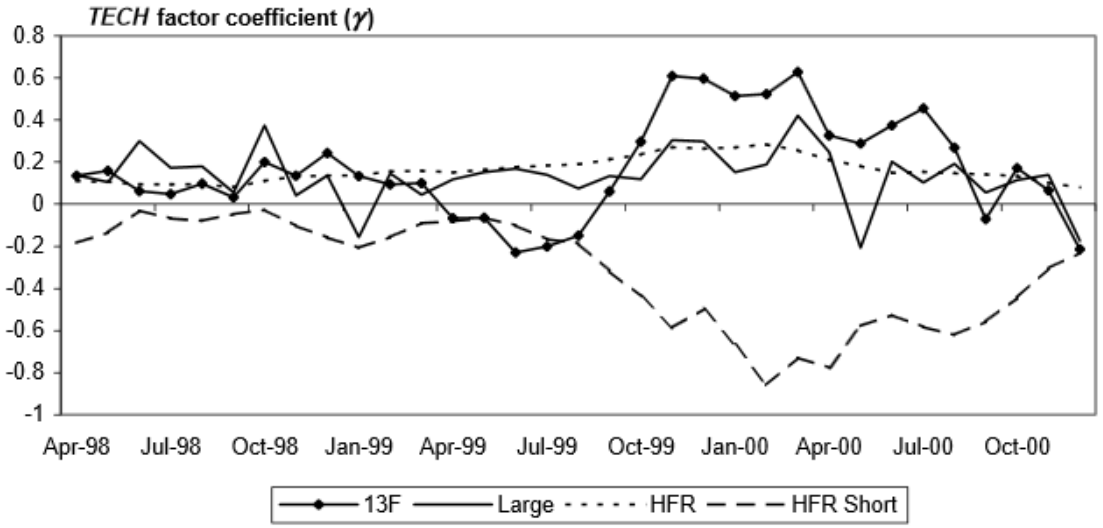


Figure 3. Exposure of hedge funds to the technology segment: Smoothed Kalman filter estimates. Time-series regressions of monthly hedge fund return indexes on R_M, the CRSP value-weighted NYSE/AMEX/Nasdaq market index, and the *TECH* factor, which is the Nasdaq high P/S portfolio return R_T minus the market return, are run like in Table II, but allowing for stochastically time-varying regression slopes, estimated via Kalman filtering and smoothing. Dependent variables are *13F*, the return on the portfolio of aggregate long holdings of all hedge funds from our 13F filings data; *Large*, an equal-weighted average of returns on five funds managed by the five largest managers in our sample; and *HFR*, which is an equal-weighted average across all HFR style indexes examined in Table II, with the exception of short-selling specialists (*HFR Short*), which are considered separately. The figure shows the estimated coefficients (γ) on the *TECH* factor.

Did Hedge Funds Time Their Exposure to Individual Stocks?

- It appears hedge funds did ride the bubble
  - But did they do so deliberately?
- Hedge Funds did not exit tech stocks aggressively during the bubble
  - Seems plausible that they were in it for the ride

Hedge Fund Holdings around Stock Price Peaks

- Look at price peaks of individual stocks
- For each stock, get proportion of outstanding shares that is held by the hedge funds
- Align quarterly series of hedge funds holdings in event time (price peak)
- Take value-weighted average across high P/S Nasdaq stocks, other Nasdaq, and NYSE/AMEX stocks

Hedge Fund Holdings around Stock Price Peaks

Result

- Greater holdings before price peak
- Appears there was success in timing

Hedge Fund Holdings around Stock Price Peaks

Figure 5

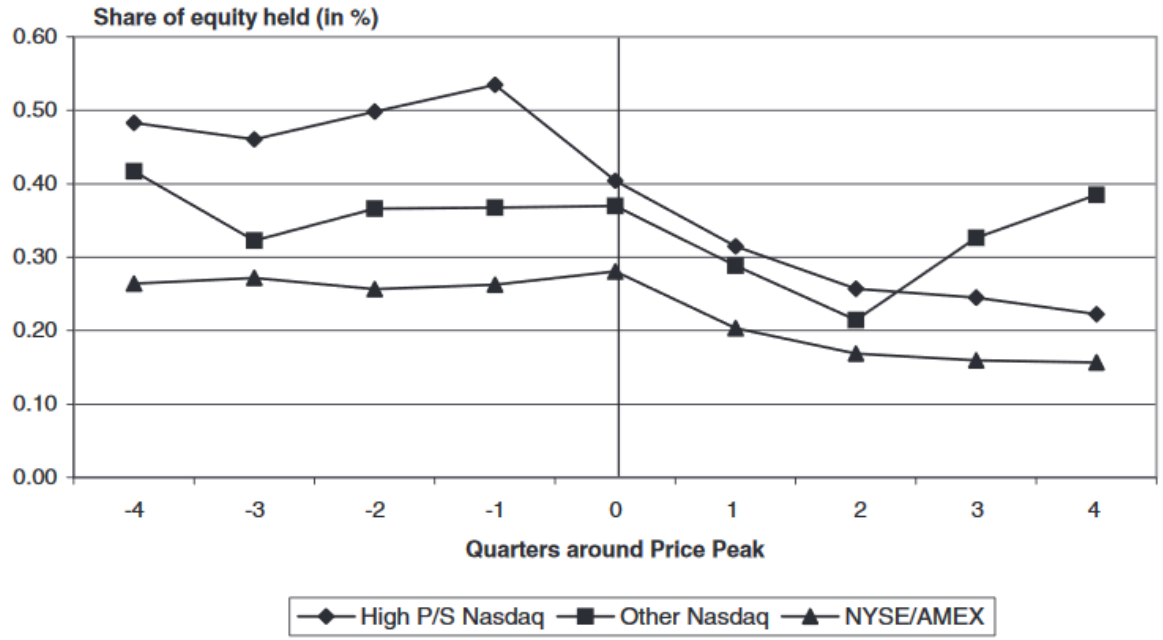


Figure 5. Average share of outstanding equity held by hedge funds around price peaks of individual stocks. For each stock, we construct a quarterly total return index from 1998 to 2000, from which we determine each stock's price peak during this period. Each quarter, we also calculate the proportion of outstanding shares that is held by hedge funds. For stocks with peaks in 1999 or 2000, we align these time-series of holdings in event time (value-weighted), where the price peak is the event-time quarter 0. We then average hedge fund holdings in event time across all stocks in the sample. The figure presents these event-time averages for three different samples of stocks: Stocks in the high P/S quintile of the Nasdaq, other Nasdaq stocks, and NYSE/AMEX stocks.

Characteristic Adjusted Performance

Result

- Recreate "copycat" hedge portfolios and compare them against benchmark portfolios
- Tech stocks held by hedge funds performed much better

Characteristic Adjusted Performance

Figure 6

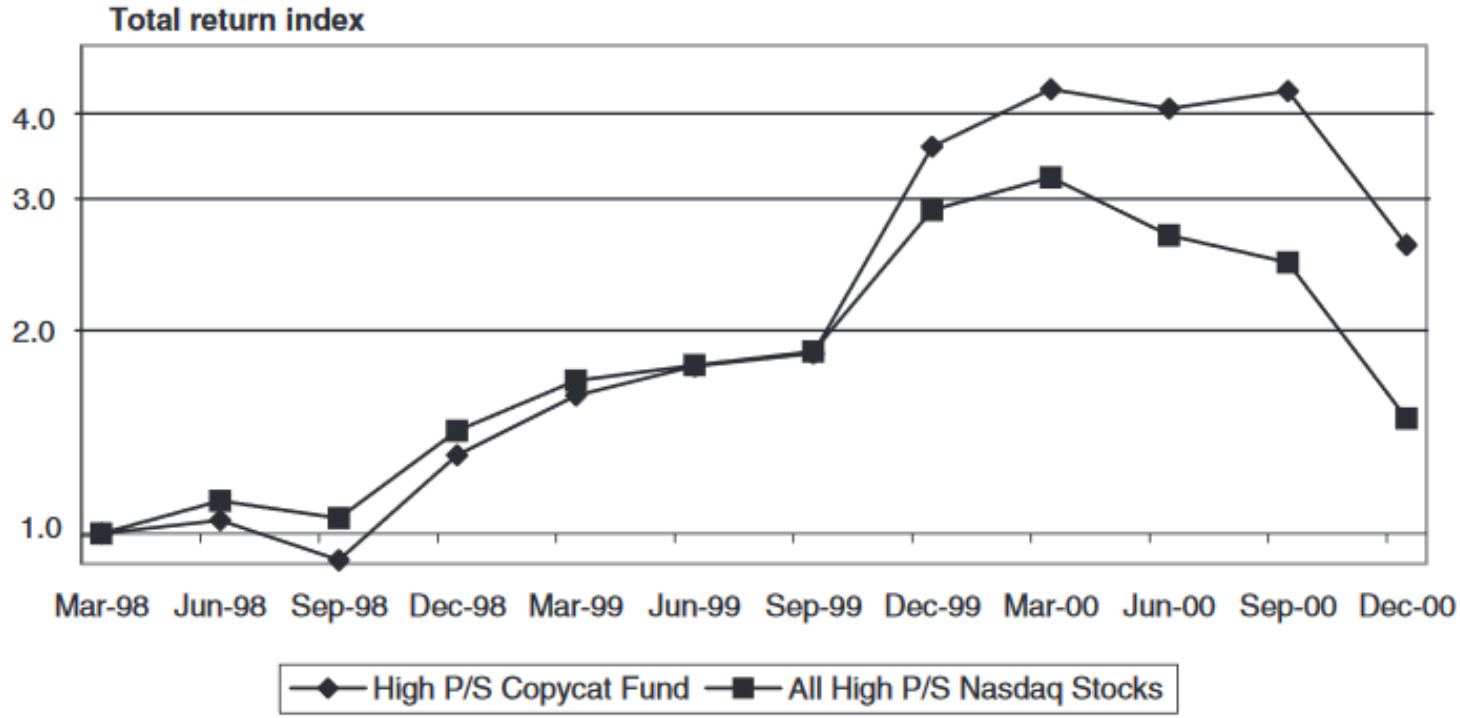


Figure 6. Performance of a copycat fund that replicates hedge fund holdings in the Nasdaq high P/S segment. At the end of each quarter, we form a portfolio that replicates aggregate hedge fund holdings in the Nasdaq high P/S segment as of that quarter-end. Stocks are held until the portfolio is rebalanced at the end of the next quarter. The figure shows the value-weighted buy-and-hold return on this portfolio and the portfolio of all high P/S Nasdaq stocks (log scale).

Characteristic Adjusted Performance

A more formal test

Following Daniel (1997), Chen, Jegadeesh, and Wermers (2000):

- Want to measure abnormal returns relative to benchmark returns
- Sort all Nasdaq stocks into quintiles based on size
- Subsort this group into P/S quintiles and then into past 6-month momentum quintiles.
- Repeat for NYSE/AMEX
- Generates 125 portfolios for each exchange
- Calculate abnormal return for each stock by subtracting return of its matched benchmark portfolio

Characteristic Adjusted Performance

Table IV

Market Segment	Qtrs. after 13F	Number of Stocks		Value in $bn.		Qtrly. Abnormal Returns: Copycat	
		Total	Copycat	Total	Copycat	Mean	*t*-Statistic
High P/S Nasdaq stocks	+1	720	320	2071	8.0	4.51	(1.87)
(Technology Segment)	+2					2.71	(2.02)
	+3					0.39	(0.22)
	+4					1.01	(0.77)
Other Nasdaq stocks	+1	3163	472	1236	4.1	0.55	(0.58)
	+2					0.36	(0.30)
	+3					−1.64	(−1.12)
	+4					−0.89	(−0.55)
NYSE/AMEX stocks	+1	2118	885	9891	25.0	0.24	(0.31)
	+2					0.25	(0.31)
	+3					0.32	(0.30)
	+4					−0.48	(−0.45)

Conclusion

- Efficient Market Hypothesis says rational investors prevent price bubbles by trading against mispricing
- This paper shows two points:
  1. Hedge Funds were riding technology bubble, not attacking it
  2. Hedge funds reduced holdings before prices collapsed - suggesting hedge funds knew these stocks were inflated.
- Suggests that Investor sentiment driving tech bubble was predictable to some extent
- Hedge funds seem to be a much smaller pool - were there other rational investors who could fill the role?
- Did hedge funds act similarly in other periods? Were there times they were wrong (a false bubble?)