

# ***Development aspects of an artificial stock market***

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# Stylized facts

## Statistical properties exhibited by financial time-series

### **Unit-root property:**

if  $x(t) = \log p(t)$  where  $p(t)$  is price of an asset at  $t$ , then for the model  $x(t) = a x(t-1) + \varepsilon(t)$ , where  $\varepsilon(t)$  represents a stationary stochastic increment, the null hypothesis of  $a = 1$  can not be rejected, i.e., stock price is a *random walk* (Dickey-Fuller test, 1979).

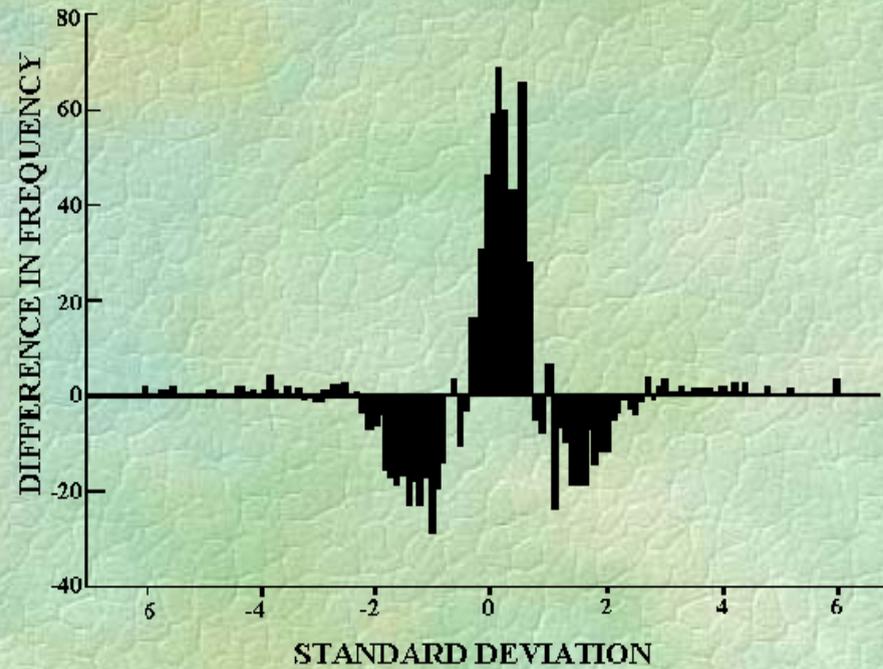
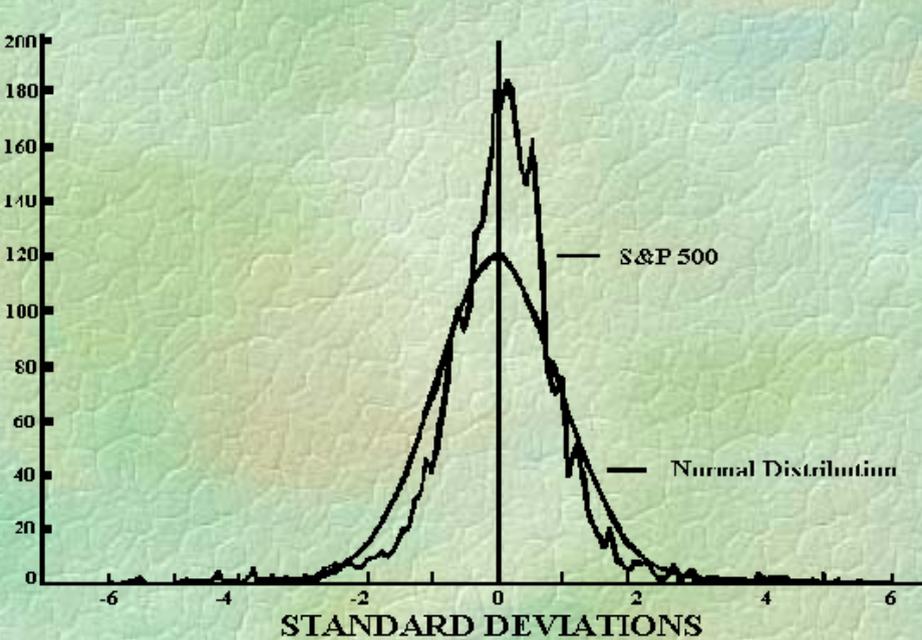
### **Fat tails phenomenon:**

empirical studies show that the estimated probability distribution function of returns (percentage of price's variation) at weekly, daily and higher frequencies exhibits leptokurtosis (more probability in the tails and in the center of the distribution than the standard Gaussian distribution).

### **Volatility clustering:**

volatility is a measure of the amplitude of price fluctuations, over a given time interval. Localized bursts of volatility can be identified.

# Fat Tails in S&P 500 at 5 days

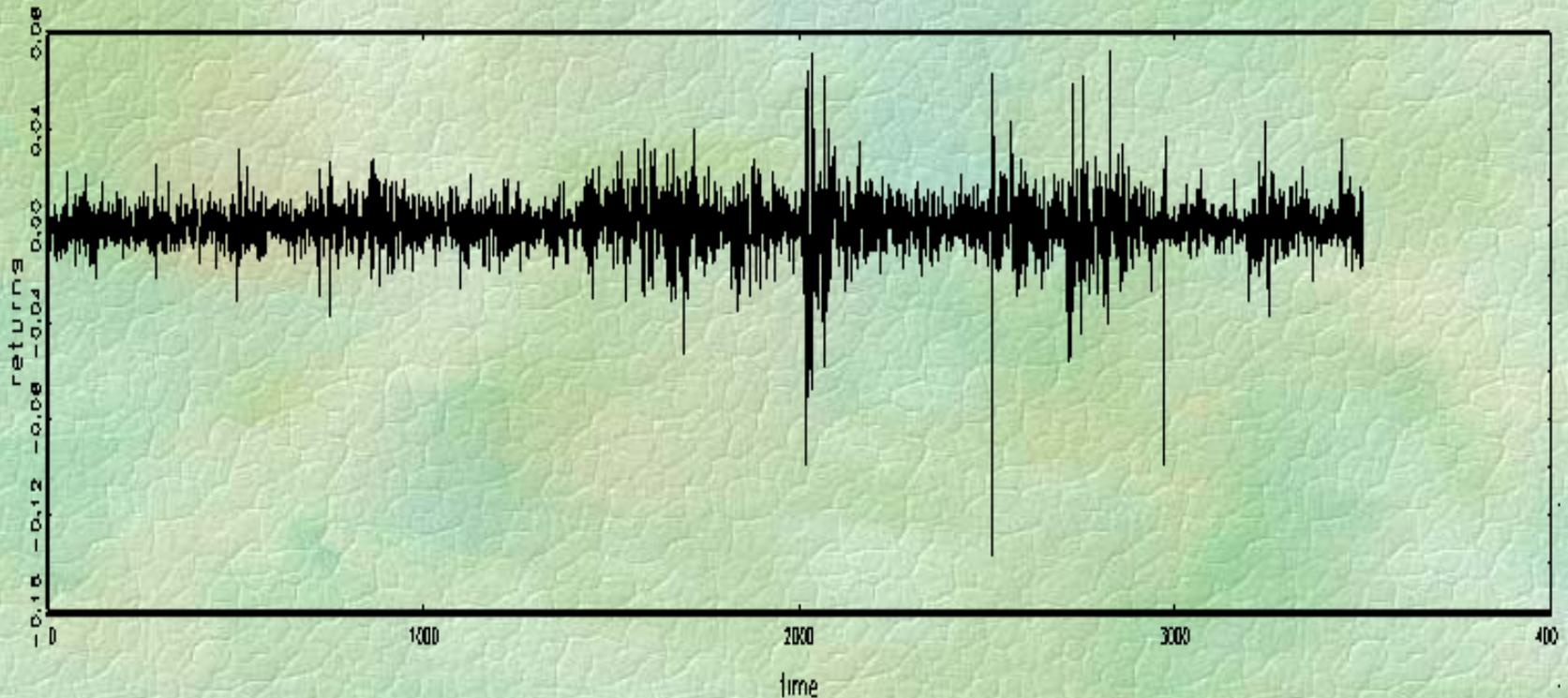


January 1928 – December 1989

# Volatility clustering

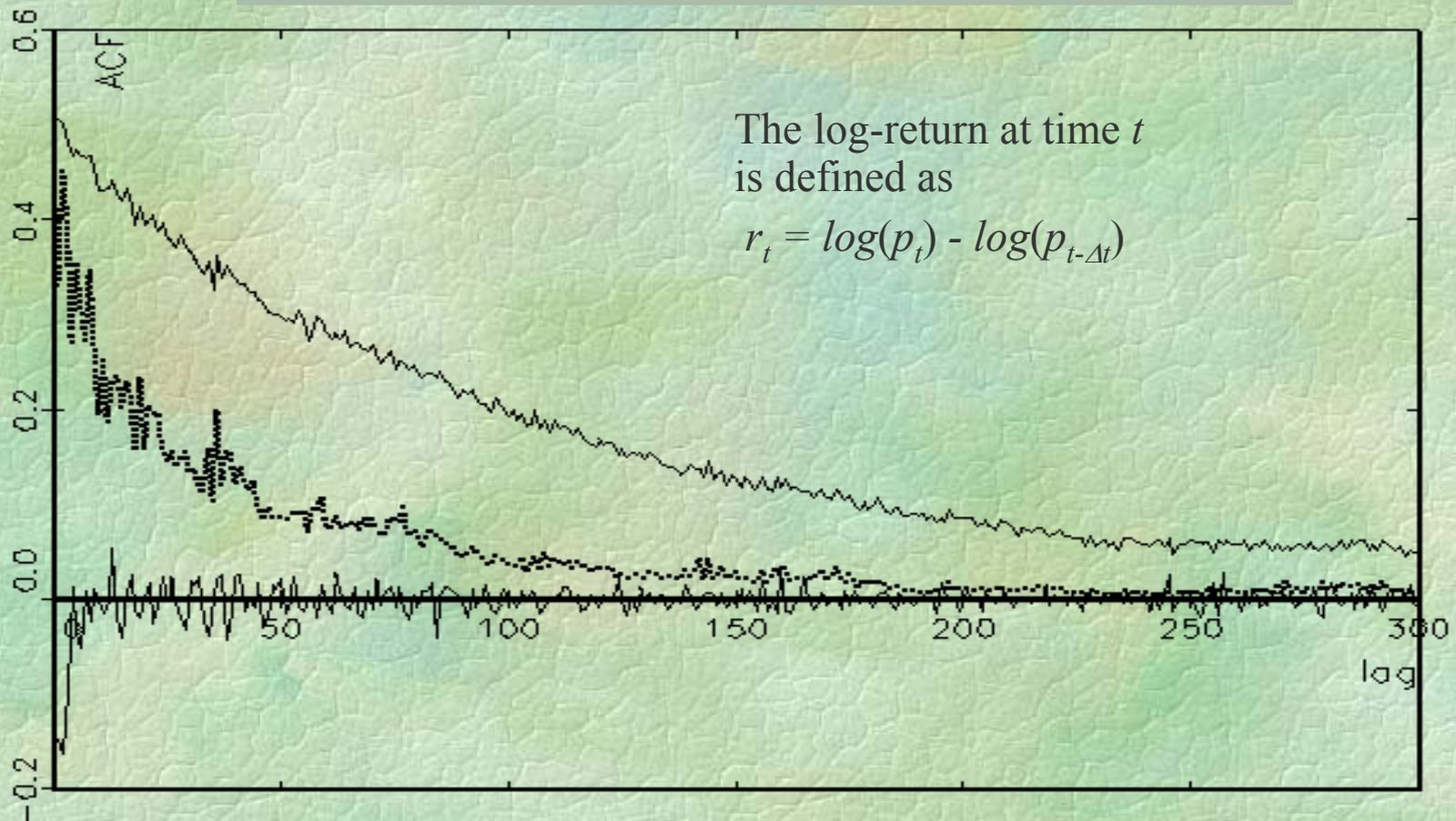
- Price variations are characterized by period of calm followed by period of turbulence

DAX - 1979-1983



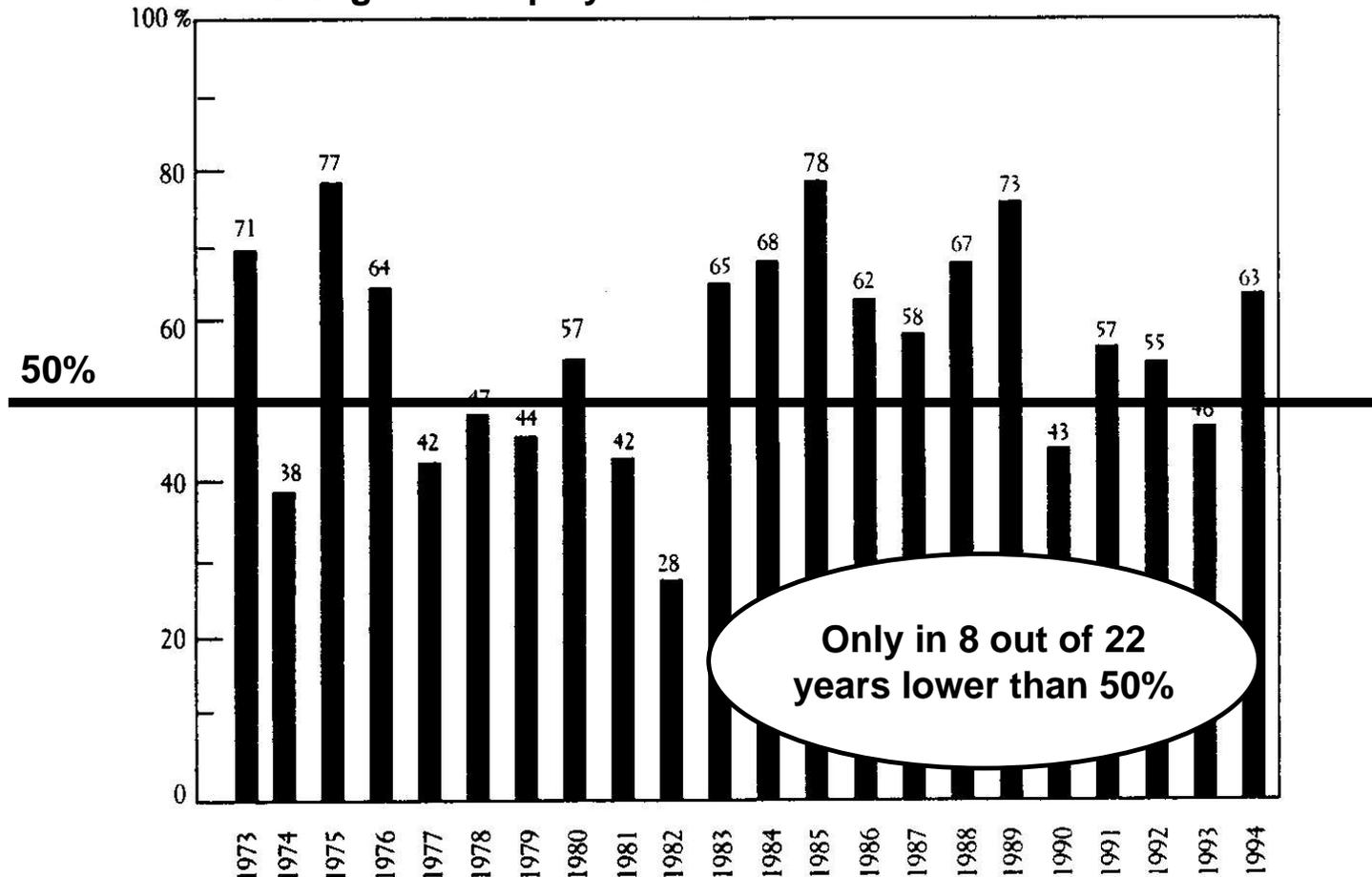
# Autocorrelations of log-returns

Autocorrelations of log-returns, module of log-return  
and square of log-returns



For the average fund, the odds of beating the market are less than even

### FUNDS UNDERPERFORMING WILSHIRE 5'000 INDEX Percent of total U.S. general equity funds



Source: Malkiel (1996), p. 215