Xaos - Chaos → Deterministic

- Edward Lorenz MIT 1950s

"Sensitive Dependence on Initial Conditions" 18.72239 / 18.7223 → 20° → 2-3 days

Logistic Map

Robert May (1976)

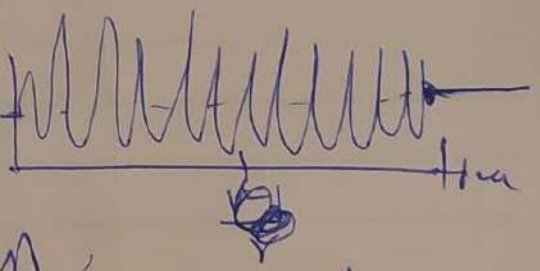
$$X_{t+1} = r \cdot X_t (1 - X_t) \qquad X_t : [0,1]$$

$r \rightarrow 0,1 \rightarrow X = 0$

$\rightarrow 1,2 \rightarrow \frac{r-1}{r}$

$\rightarrow 2,3 \rightarrow \frac{r-1}{r}$

$\rightarrow 3,\ 1+\sqrt{6} \simeq 3.45$



$X_0 = 0.46$

$r = 4.000000012$

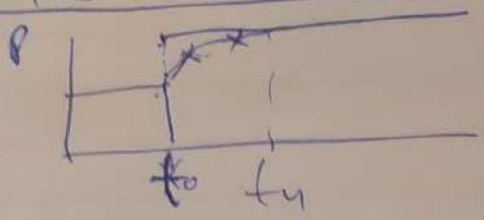
3

Bifurcation

Lyapunov Exponent

$\lambda > 0$

The Efficiant Market Hypothesis (EMH)



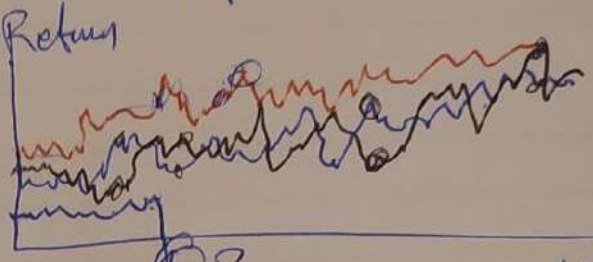
Fama-French (2012)

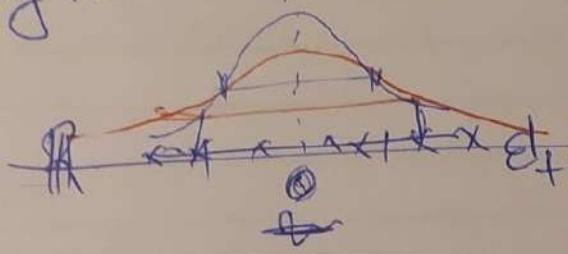
$$Z_{t+1} = X_{t+1} - E_t(X_{t+1}/I_t) > 0$$

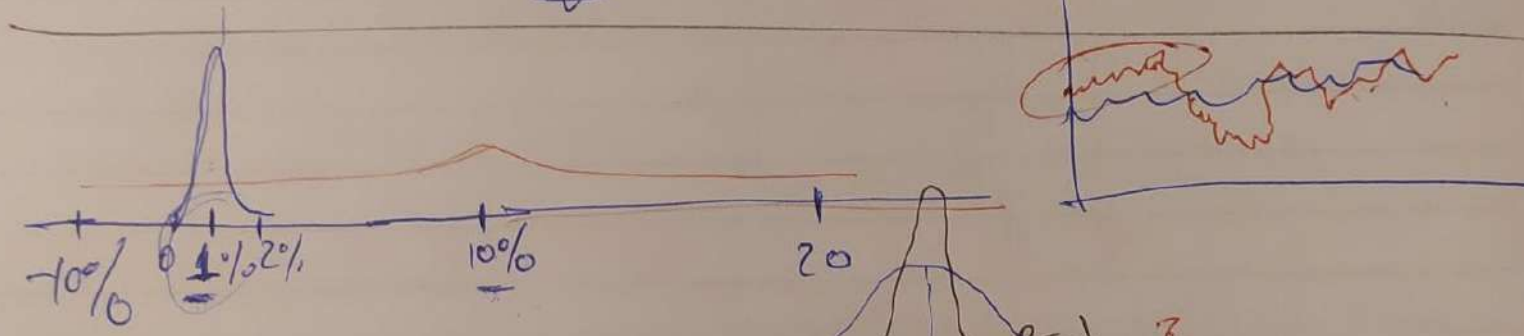
EMH: $E_t(Z_{t+1}/I_t) = \phi$, $Cov(Z_t, Z_{t\pm k}) = 0$ $\forall k$

+5% +8% +15%
−8% −15%

Consistently beat the market







FX: USD/EUR → RW

RWD?

$E_t(R)$

$$X_{t+1} = \mu + X_t + \varepsilon_{t+1}$$

$\sigma^2 = 1$

$\sigma = 5$