Andreas Krause

Market efficiency

Definition of market efficiency

A market is efficient if prices include all relevant information

Weak form efficiency Prices reflect information from past prices

Semi-strong form efficiency Prices reflect all publicly available information

Strong form efficiency Prices reflect all available information, including private information

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Asset returns

- Asset values are derived from the future income they generate, discounted to the present value
- The future income is determined using the information available at the time
- $P_t = \sum_{\tau=0}^{+\infty} \frac{\mathsf{E}[D_{t+\tau}|\Omega_t]}{\rho^\tau} = D_t + \frac{\mathsf{E}[P_{t+1}|\Omega_t]}{\rho}$
- For short-term returns, we can neglect the future income and set $\mathsf{E}\left[d_{t+\tau}|\Omega_t\right] = 0$

$$\Rightarrow \rho = \frac{\mathsf{E}[P_{t+1}|\Omega_t]}{P_t} = \frac{\mathsf{E}[P_{t+2}|\Omega_{t+1}]}{P_{t+1}}$$

$$\Rightarrow \rho = \mathsf{E}\left[\frac{\mathsf{E}[P_{t+2}|\Omega_{t+1}]}{P_{t+1}}|\Omega_t\right] \approx \frac{\mathsf{E}[P_{t+2}|\Omega_t]}{\mathsf{E}[P_{t+1}|\Omega_t]} = \frac{\mathsf{E}[P_{t+2}|\Omega_t]}{\rho P_t}$$

$$\Rightarrow \rho^2 = \frac{\mathsf{E}[P_{t+2}|\Omega_t]}{P_t}$$

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Serial correlation of returns

- $\text{Cov}\left[\frac{\mathsf{E}[P_{t+1}|\Omega_t]}{P_t}, \frac{\mathsf{E}[P_{t+2}|\Omega_t]}{\mathsf{E}[P_{t+1}|\Omega_t]}\right] = \mathsf{E}\left[\frac{\mathsf{E}[P_{t+1}|\Omega_t]}{P_t}\frac{\mathsf{E}[P_{t+2}|\Omega_t]}{\mathsf{E}[P_{t+1}|\Omega_t]}\right] - \frac{\mathsf{E}[P_{t+1}|\Omega_t]}{P_t}\frac{\mathsf{E}[P_{t+2}|\Omega_t]}{\mathsf{E}[P_{t+1}|\Omega_t]}$

  $= \mathsf{E}\left[\frac{\mathsf{E}[P_{t+2}|\Omega_t]}{P_t}\right] - \frac{\mathsf{E}[P_{t+1}|\Omega_t]}{P_t}\frac{\mathsf{E}[P_{t+2}|\Omega_t]}{\mathsf{E}[P_{t+1}|\Omega_t]}$

  $= \rho^2 - \rho\rho = 0$

$\Rightarrow$ Returns are serially uncorrelated

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Random returns

- If returns are uncorrelated, they will fluctuate randomly around the expected return
- $\frac{P_{t+1}}{P_t} = \rho + \varepsilon_t$
- The error term will have a mean of 0 and a variance of σ_ε^2

$\Rightarrow$ $\mathrm{E}\left[\frac{P_{t+1}}{P_t}\right] = \rho$

$\mathrm{Var}\left[\frac{P_{t+1}}{P_t}\right] = \sigma_\varepsilon^2$

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Profitability of trading strategies

- If returns are unpredictable, then investors cannot make profits from any trading strategy
- In strong form efficient markets, even insiders could not make any profits
- In semi-strong form efficient markets, fundamental analysis of assets cannot lead to profits
- In weak form efficient markets, technical trading could not be profitable

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Andreas Krause
Department of Economics
University of Bath
Claverton Down
Bath BA2 7AY
United Kingdom

E-mail: mnsak@bath.ac.uk