

Martingale Model

- The martingale property:

$$E(p_{t+1}|\Omega_t) = p_t$$

- If prices follow a martingale then returns are a fair game.
- Rearrange the equation:

$$E(p_{t+1}|\Omega_t) - p_t = 0 \quad E(p_{t+1} - p_t|\Omega_t) = 0$$
$$E\left(\frac{p_{t+1} - p_t}{p_t}|\Omega_t\right) \equiv E(r_{t+1}|\Omega_t) = 0$$

- Which is a fair game (expected value is zero).
- Since returns are always positive, we use sub-martingale instead:

$$E(p_{t+1}|\Omega_t) = p_t(1 + \mu)$$
$$E\left(\frac{p_{t+1} - p_t}{p_t}|\Omega_t\right) \equiv E(r_{t+1}|\Omega_t) = \mu$$

Martingale property means that a return at one date gives no information about the return at any other date..

Returns should not be serially correlated (**Zero correlation supports EMH**)

Implications of EMH

1. **Information search is pointless** - Why would we spend time and valuable resources looking for inefficiency. This is irrational and irrationality indicates stock market inefficiency.
2. **Active or Passive Portfolio Management** - The EMH implies that professional portfolio managers have no informational advantages over other investors.
3. **Resource allocation** - If asset prices are mispriced then incorrect signals are sent to the market. Cash may flow into over-valued (invested) activities

Major issues in evaluating the EMH

1. **The magnitude issue** - Small opportunities will exist to make Significant profits, even if prices are very close to the true value. Professional analysis may be worthwhile even for a very small % increase in portfolio performance. This may not be detectable by statistical analysis but may still represent a significant return.
2. **The selection bias issue** - Tests of the EMH based on published investment strategies ("tips") will likely show that these strategies are worthless. Truly profitable strategies or "tips" would not be publicised. Published techniques may not work but effective private techniques may exist.