Information Percolation, Momentum, and Reversal

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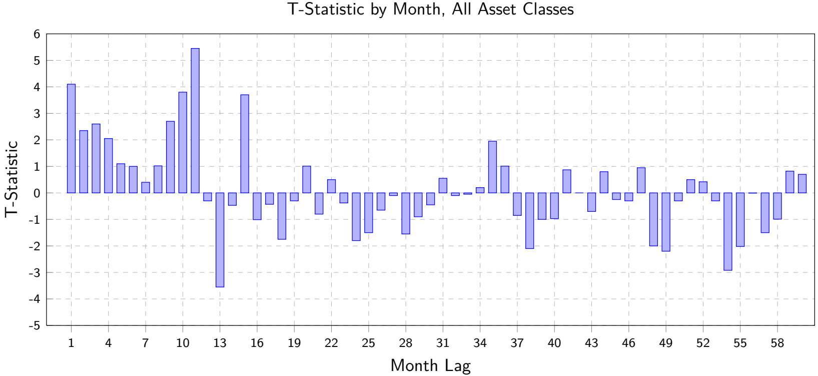
Time-Series Momentum and Reversal: Evidence



Source: Moskowitz, Ooi, and Pedersen (2012)

Behavioral Theories of Momentum and Reversal

	Momentum	**Reversal**
Barberis, Shleifer, and Vishny (1998)	Conservatism (underreaction)	Representativeness heuristic (overreaction)
Daniel, Hirshleifer, and Subrahmanyam (1998)	Biased self-attribution (continuing overreaction)	Overconfidence (overreaction)
Hong and Stein (1999)	Newswatchers (underreaction)	Momentum Traders (overreaction)

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Challenges (Moskowitz, Ooi, and Pedersen, 2012):

- Markets vary widely in terms of type of investors, yet the pattern of returns is the same
- No apparent link between measures of investor sentiment and time series momentum

A Rational Theory of Momentum and Reversal

- An equilibrium model with multiple agents
  - Momentum traders
  - Contrarians

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- Momentum trading is profitable and yet momentum persists
- Rumor spreads can generate reversals (overreaction)

Information Percolation in Centralized Markets

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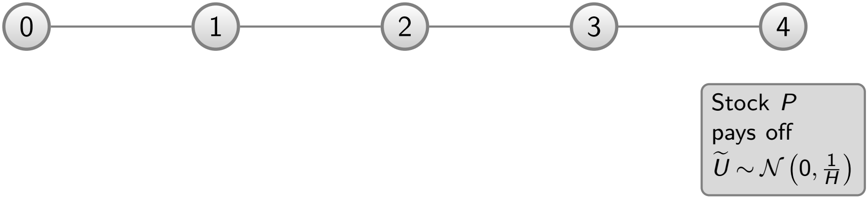

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There is a continuum $i \in [0,1]$ of investors with CARA$= \frac{1}{\gamma}$ utility

Each i gets a private signal $\widetilde{Z}_0^i = \widetilde{U} + \widetilde{\epsilon}_0^i$

$\widetilde{\epsilon}_0^i \sim \mathcal{N}\left(0, \frac{1}{S}\right)$

Stock P pays off $\widetilde{U} \sim \mathcal{N}\left(0, \frac{1}{H}\right)$

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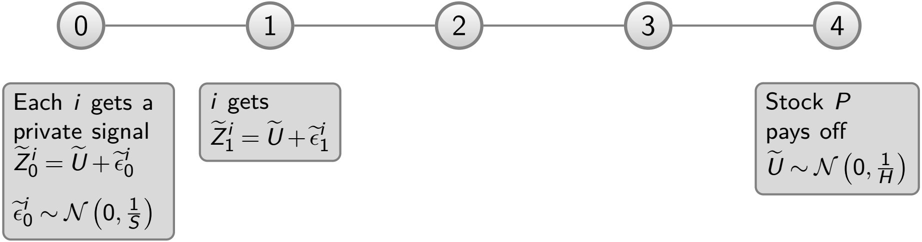

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1: i gets $\widetilde{Z}_1^i = \widetilde{U} + \widetilde{\epsilon}_1^i$

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0	1	2	3	4
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Noisy supply $\widetilde{X}_t \sim \mathcal{N}(0, \frac{1}{\Phi})$

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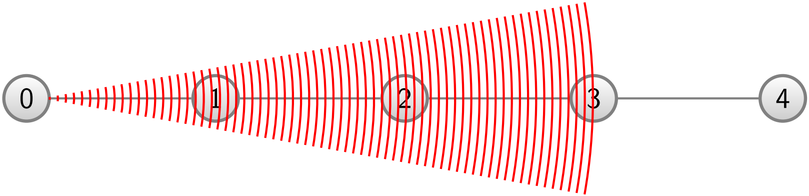

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$$\mu_t(n) = \text{probability density function over the number of signals}$$

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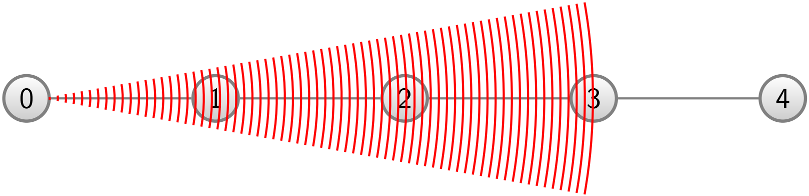

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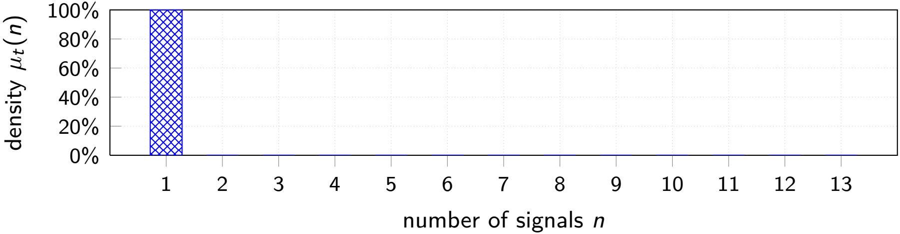

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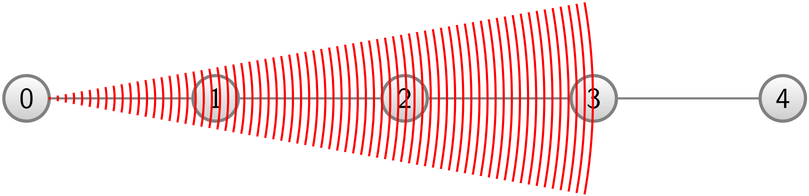

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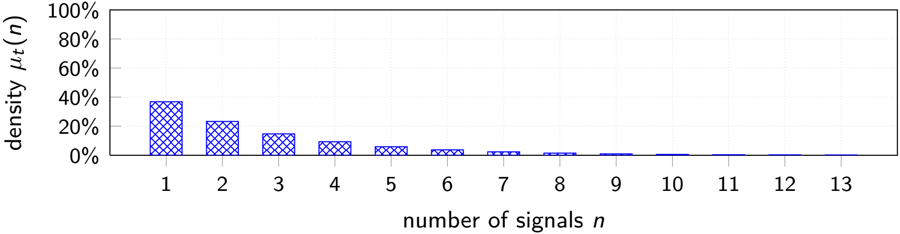

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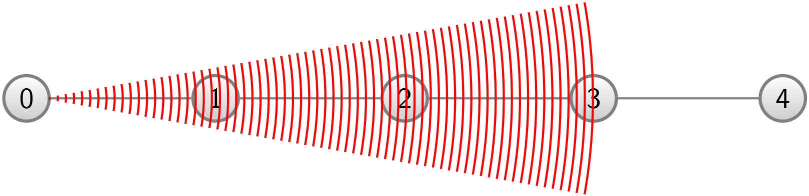

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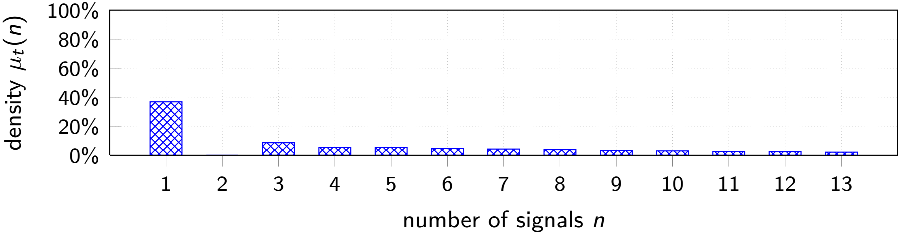
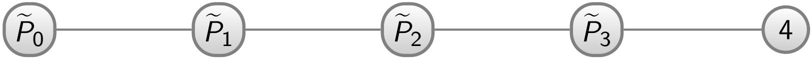


Equilibrium Prices and Optimal Trading Strategies



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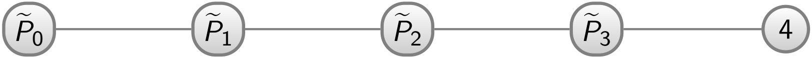

$$\widetilde{P}_t = \frac{K_t - H}{K_t}\widetilde{U} - \sum_{j=0}^{t} \frac{1+\gamma^2 S\Omega_j \Phi}{\gamma K_t}\widetilde{X}_j$$

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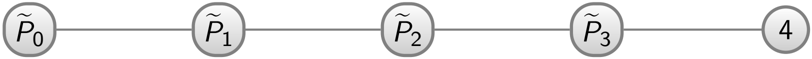

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marginal info advantage

cummulative info advantage

$$\widetilde{D}_t^i - \widetilde{D}_{t-1}^i = \gamma\left[\left(S\Omega_t + a_t^i\right)\left(\widetilde{Z}_t^i - \widetilde{P}_{t-1}\right) - \left(\frac{K_t}{1+\gamma^2 S\Phi\Omega_t} + A_t^i\right)\left(\widetilde{P}_t - \widetilde{P}_{t-1}\right)\right]$$

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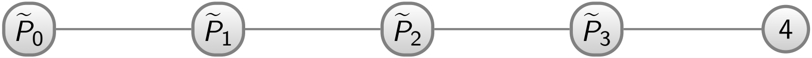

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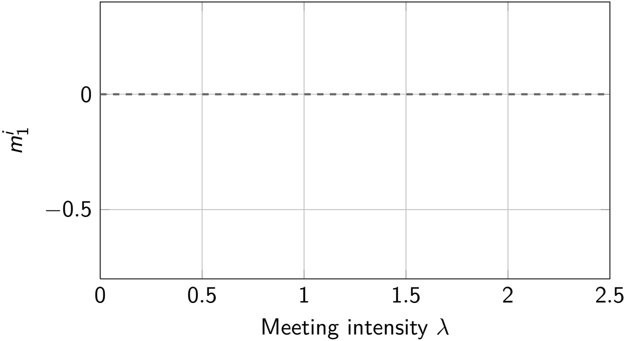
$$\mathbb{E}\left[\widetilde{D}_t^i - \widetilde{D}_{t-1}^i \middle| \widetilde{P}_t - \widetilde{P}_{t-1} \right] = m_t^i \left(\widetilde{P}_t - \widetilde{P}_{t-1} \right)$$

Momentum and Momentum Trading



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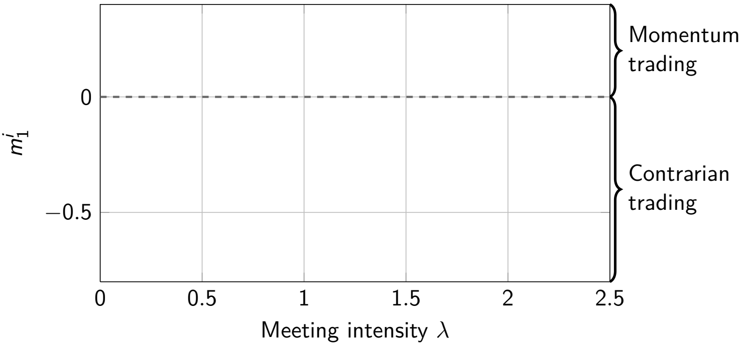

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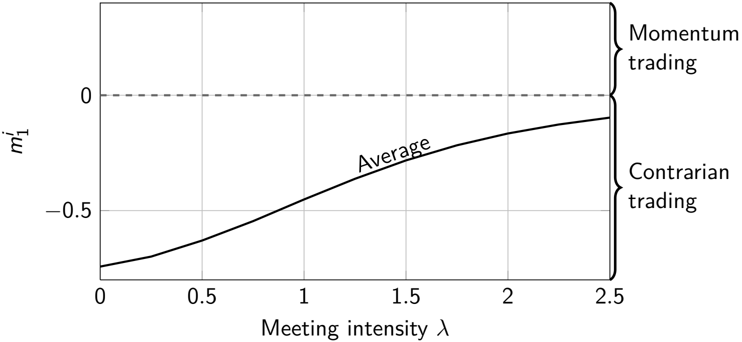

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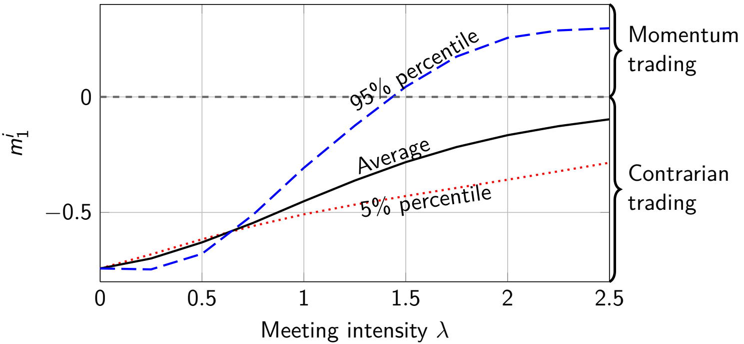

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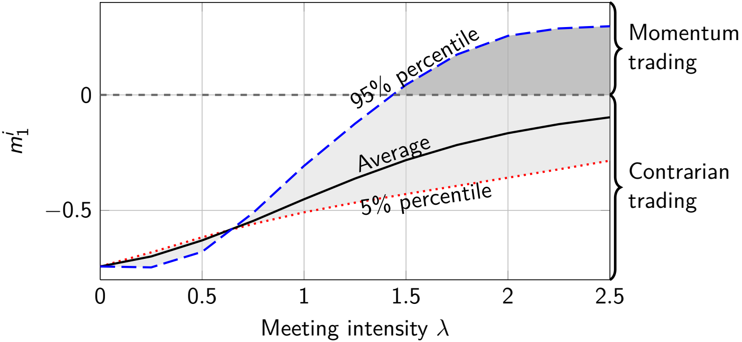

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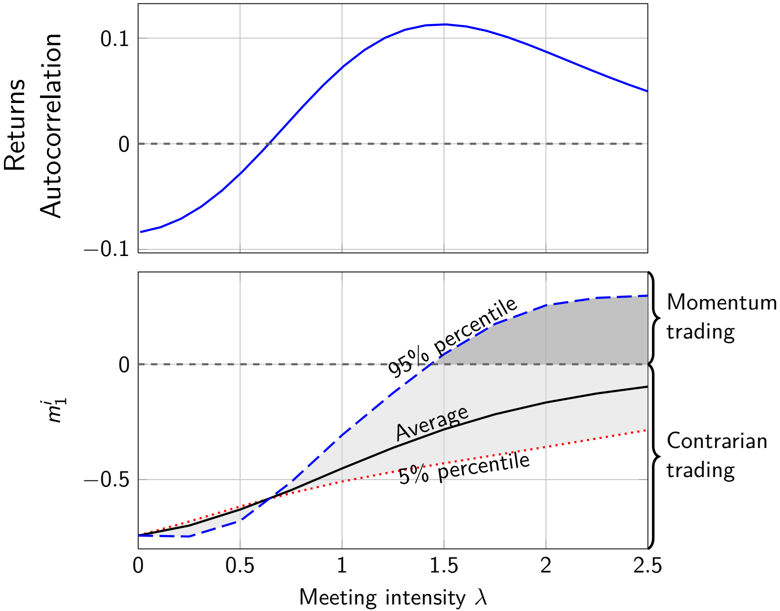
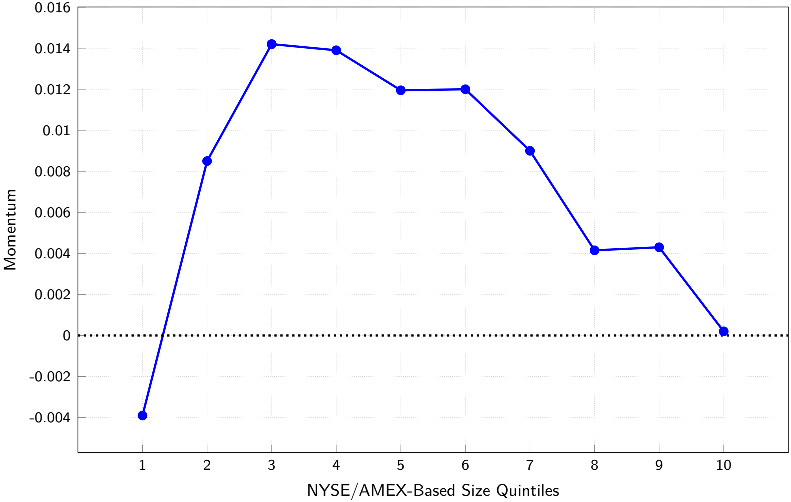


Relation Between Size and Momentum



Source: Hong, Lim, and Stein (2000)

Market Learning and Momentum

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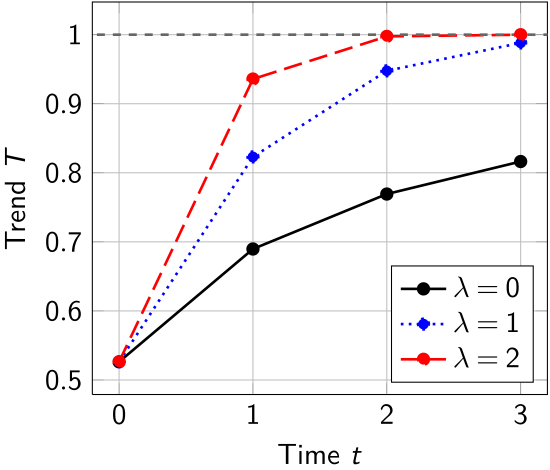

Momentum Profits

$$\text{Momentum Profits } = \mathbb{E}\left[\sum_{t=1}^{3}\left(\mathbf{1}_{\Delta\widetilde{P}_t>0}-\mathbf{1}_{\Delta\widetilde{P}_t<0}\right)\Delta\widetilde{P}_{t+1}\right]$$

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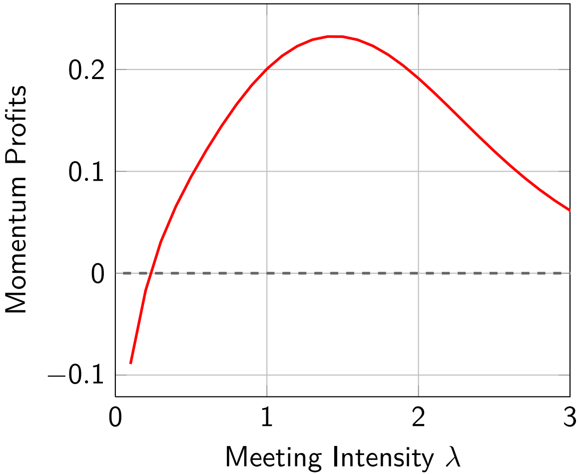
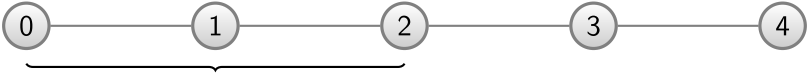


Rumors, Price Overshooting, and Reversals



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$$\widetilde{V} \sim \mathcal{N}\left(0, \frac{1}{\nu}\right)$$

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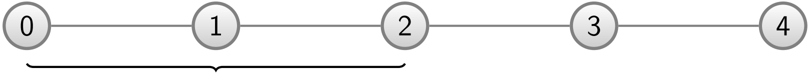

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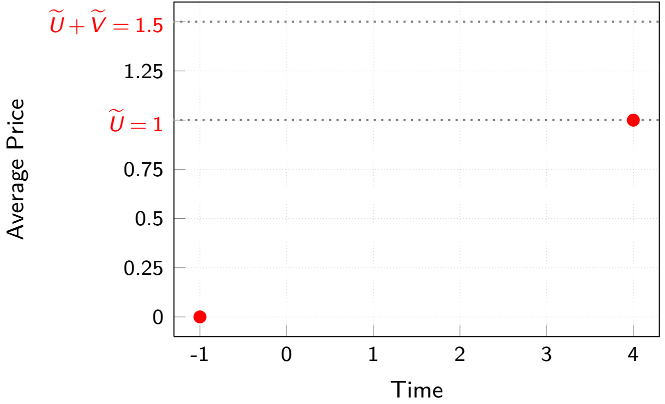

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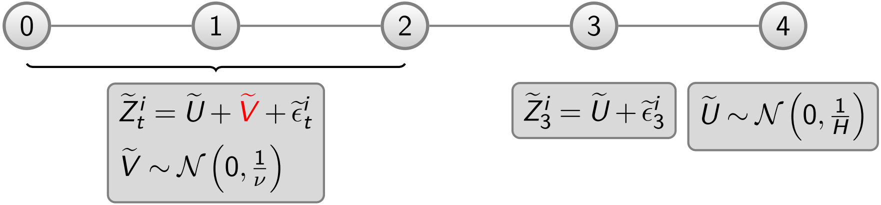

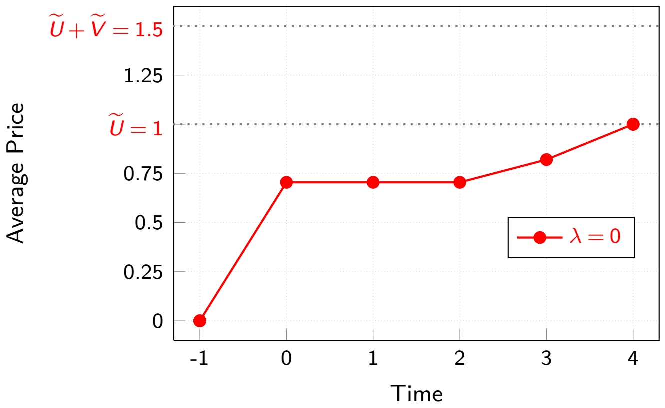

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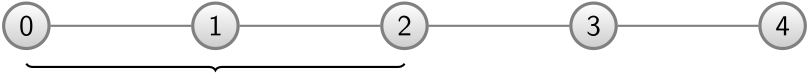

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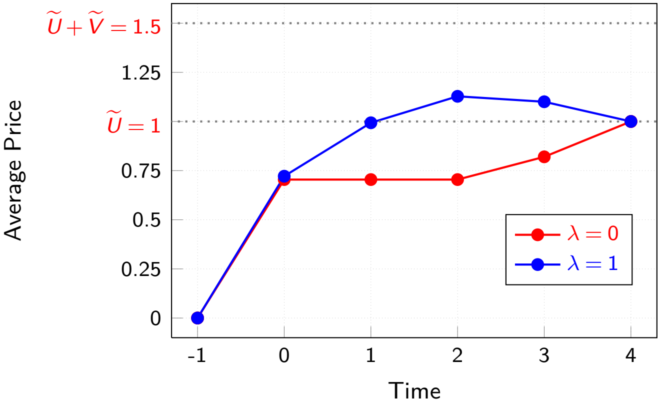

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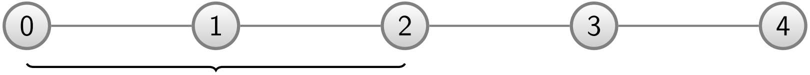

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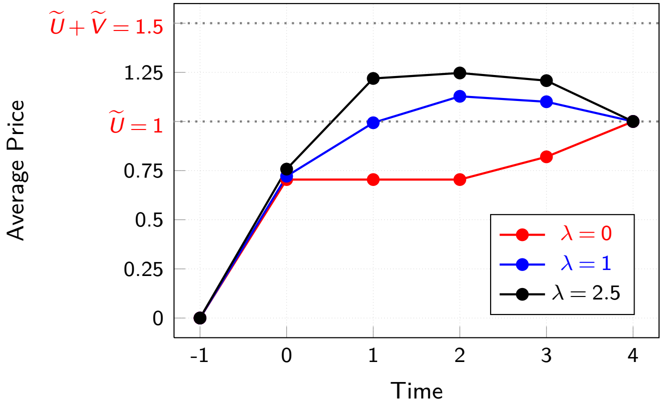

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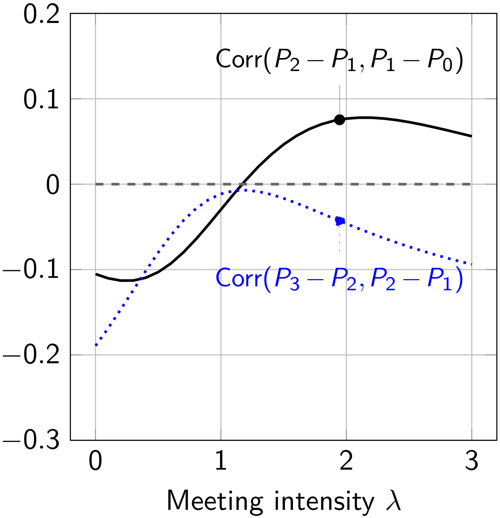
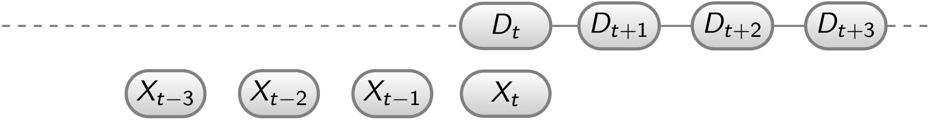


The Intuition is Robust to a "Steady State" World



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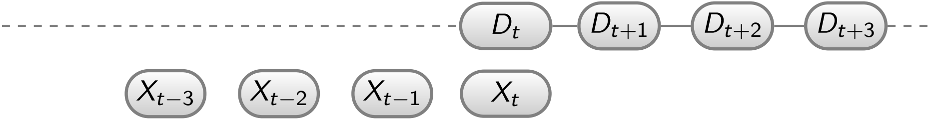

$$P_t = -b_3 X_{t-3} - b_2 X_{t-2} - b_1 X_{t-1} - b_0 X_t + a_0 D_t + a_1 D_{t+1} + a_2 D_{t+2} + a_3 D_{t+3}$$

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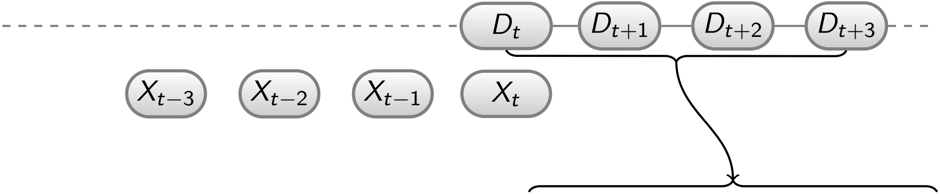

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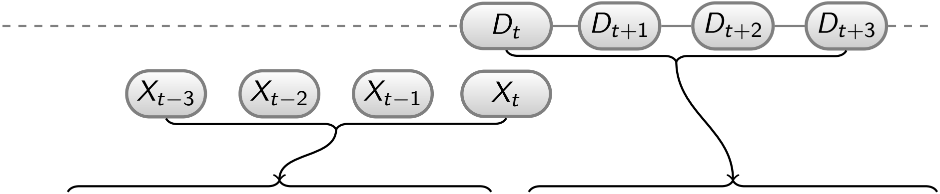

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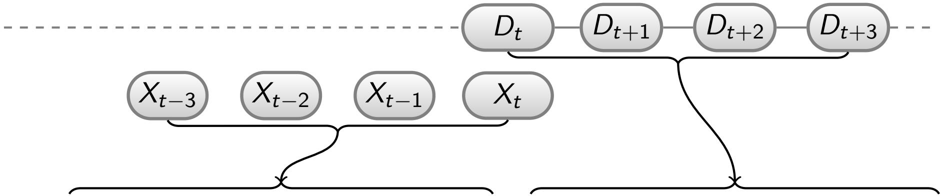

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- $\mathrm{Cov}(P_{t+2} - P_{t+1}, P_{t+1} - P_t)$ is generally amplified by information percolation
- For some calibrations, $\mathrm{Cov}(P_{t+2} - P_{t+1}, P_{t+1} - P_t)$ can turn from negative (reversals) to positive (momentum)
- Intuition about momentum/contrarian trading holds in this case as well

Further Questions

- **Multiple asset setting** (Moskowitz, Ooi, and Pedersen (2012) show that correlations of time series momentum strategies across asset classes are larger than the correlations of the asset classes themselves)
- **Endogenous meeting intensity** (explaining momentum in response to fundamental impulses such as earnings announcements or analysts' forecast revisions)
- **Truth telling, influence of an investor on others** (talking about winners or losers, thought contagion)

References I

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