An Institutional Theory of Momentum and Reversal

Dimitri Vayanos
LSE, CEPR and NBER

Paul Woolley
LSE

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1. Introduction

• Momentum during tech run-up in late 1990s:
  – Good performance by tech stocks
    ⇒ Underperformance by value funds.
    ⇒ Flows out of value funds and into growth funds.
  – Gradual flows (e.g., contracts)
    ⇒ Gradual run-up of tech stocks, and overvaluation.
This Paper

• Cross-sectional asset pricing under delegated portfolio management.

• Main assumptions:
  – Investors can invest through index fund and active fund.
  – “Ability” of active manager is time-varying
    ⇒ Flows in and out of active fund.
Results

- Momentum and reversal.
  - Fund flows amplify price effects of cashflow shocks.

- Comovement.
  - Fund flows transmit cashflow shocks to unrelated assets.
  - Positive comovement for assets that are both overweighed by active fund or both underweighed.
  - Negative comovement between an overweighed and an underweighed asset.
Results (cont’d)

• Expected returns priced by two factors.

• Risk premium of second factor: severity of mispricings.
  – Depends on manager’s concern with commercial risk.
  – Time-varying.
Related Literature

• Behavioral theories of momentum.

• Limits to arbitrage and delegated portfolio management.
1. Introduction

Roadmap

- Introduction. ✓
- Model.
- Symmetric information.
- Asymmetric information.
- Asymmetric information and gradual flows. (Incomplete)
2. Model

- Continuous time $t \in [0, \infty)$.
- Exogenous riskless rate $r$.
- $N$ risky stocks (industries, asset classes).
  - Supply of one share. (Normalization)
  - Endogenous prices $S_t \equiv (S_{1t}, \ldots, S_{Nt})'$. 
- Cumulative dividends $D_t \equiv (D_{1t}, \ldots, D_{Nt})'$ follow
  \[ ddD_t = F_t dt + \sigma dB_t^D. \]
- Drift $F_t \equiv (F_{1t}, \ldots, F_{Nt})'$ follows
  \[ df_t = \kappa(\bar{F} - F_t) dt + \phi \sigma dB_t^F. \]
- $(B_t^D, B_t^F)$: Independent $d$-dimensional Brownian motions.
- Proportional diffusion matrices ($\phi$ scalar).
- $\Sigma \equiv \sigma \sigma'$. 

**Dividends**
Residual Supply

- \( 1 - \theta_n \) shares of stock \( n \) held by exogenous agents who do not trade.
- \( \theta \equiv (\theta_1, \ldots, \theta_N) \): residual-supply portfolio.
- \( 1 \equiv (1, \ldots, 1) \): market portfolio.
- \((\theta, 1)\) not proportional \(\Rightarrow\) Benefit of investing in active fund.
  - High \( \theta_n \) stocks: Low demand, active overweighs.
  - Low \( \theta_n \) stocks: High demand, active underweighs.
Investor

- Can invest in riskless asset and two stock-only funds.
  - Index fund. Market portfolio.
  - Active fund. Portfolio determined by manager.
- Holds \((x_t, y_t)\) shares of index and active fund.
- Maximizes expected utility of intertemporal consumption

\[-E \int_0^\infty \exp(-\alpha c_t - \beta t)dt.\]
Manager

- Chooses active portfolio.
- Can invest personal wealth in riskless asset and active fund.
  - Pins down manager’s objective.
  - Manager acts as trading counterparty to investor.
- Holds $\bar{y}_t$ shares of active fund.
- Maximizes expected utility of intertemporal consumption

$$ -E \int_0^\infty \exp(-\bar{\alpha}\bar{c}_t - \beta t) dt. $$
2. Model

**Cost of Active Management**

- Return of active fund to investor is net of a cost.
  - Managerial perks.
  - Reduced form for managerial ability.
- Flow cost is $C_t y_t$, where
  $$dC_t = k(\bar{C} - C_t)dt + sdB^C_t,$$
- $B^C_t$: Brownian motion independent of $(B^D_t, B^F_t)$. 
Managerial Benefits

- Manager benefits from investor’s participation in fund.
  - Perks, fees.
- Flow benefit is $By_t$.
-Normalization: $y_t + \bar{y}_t = 1$. 
Summary Flowchart

Investor

Cost $C_t$

Active Fund

Benefit $B$

Manager

Buy-and-Hold Investors

Index Fund

Stocks
3. Symmetric Information

- Cost $C_t$ observable by both investor and manager.

- In equilibrium,
  - Stock prices are
    \[ S_t = \frac{\bar{F}}{r} + \frac{F_t - \bar{F}}{r + \kappa} - (a_0 + a_1 C_t). \]
  - Investor’s holding of active fund is
    \[ y_t = b_0 - b_1 C_t. \]
Equilibrium for $C_t = 0$

- Investor holds zero shares in index fund and
  
  $$y_t = \frac{\bar{\alpha}}{\alpha + \bar{\alpha}}$$

  shares in active fund.

- Expected returns are
  
  $$E_t(dR_t) = \frac{r\alpha\bar{\alpha}}{\alpha + \bar{\alpha}} Cov_t(dR_t, \theta dR_t sol).$$

  Covariance with residual-supply portfolio.
3. Symmetric Information

Equilibrium for Stochastic $C_t$

- Following increase in $C_t$, investor
  - Sells slice of residual-supply portfolio $\theta$.
  - Maintains constant overall index exposure.

$\Rightarrow$ Sells slice of flow portfolio

$$p_f \equiv \theta - \frac{1\Sigma\theta'}{1\Sigma1'}1.$$  

- Long positions in $p_f$: High $\theta_n$, active overweighs.
- Short positions in $p_f$: Low $\theta_n$, active underweighs.
Expected Returns

- Expected returns are
  
  $$E_t(dR_t) = \Lambda_1 \text{Cov}_t(dR_t, \mathbf{1}dR_t) + \Lambda_2t \text{Cov}_t(dR_t, pf dR_t).$$

- Two-factor model: market, flow portfolio $pf$.

- Factor risk premium $\Lambda_{2t}$: severity of mispricings relative to market CAPM.
  - Undervaluation of stocks covarying positively with $pf$.
  - Overvaluation of stocks covarying negatively with $pf$. 
3. Symmetric Information

Expected Returns (cont’d)

- Factor risk premium $\Lambda_{2t}$ increases in
  - Cost $C_t$. (Outflows from active fund increase mispricings.)
    - Stocks covarying positively with $p_f$ become more undervalued.
    - Stocks covarying negatively with $p_f$ become more overvalued.
  - Managerial benefits $B$. (Concern with commercial risk makes manager less willing to trade against mispricings.)
Comovement

- Covariance matrix of returns is
  \[ g\Sigma + k_s\Sigma p_f' p_f \Sigma, \quad g, k_s > 0. \]

- \( g\Sigma \): Fundamental covariance. Driven purely by cashflows.

- \( k_s\Sigma p_f' p_f \Sigma \): Non-fundamental covariance. Added effect of fund flows.
  - Consider two stocks covarying positively with \( p_f \).
  - \( C_t \uparrow \Rightarrow \text{Outflows from active fund} \Rightarrow \text{Both stocks } \downarrow \).
4. Asymmetric Information

- Cost $C_t$ observable only by manager.
- In equilibrium,
  - Investor believes that $C_t$ is normal with mean $\hat{C}_t$.
  - Stock prices are
    \[
    S_t = \frac{\bar{F}}{r} + \frac{F_t - \bar{F}}{r + \kappa} - (a_0 + a_1 \hat{C}_t + a_2 C_t).
    \]
  - Investor’s holding of active fund is
    \[
    y_t = b_0 - b_1 \hat{C}_t.
    \]
Investor’s Inference

- Learn about $C_t$ by observing
  - Net return of active fund $\equiv \theta ddD_t - C_t dt$.
  - Price of active fund $\equiv \theta S_t$.
    ($S_t$ informative about $\frac{F_t}{r+\kappa} - a_2 C_t \equiv \hat{S}_t$.)
  - Return of index fund $\equiv 1dD_t$.
  - Price of index fund $= 1S_t$.

- Optimal inference yields benchmarking on index.
4. Asymmetric Information

Dynamics of $\hat{C}_t$

- Kalman filtering:

$$d\hat{C}_t = -\beta_1 \left\{ p_f \left[ dD_t - E_t(dD_t) \right] - (C_t - \hat{C}_t)dt \right\}$$

$$- \beta_2 p_f \left[ d\hat{S}_t - E_t(d\hat{S}_t) \right] + \kappa (\bar{C} - \hat{C}_t)dt,$$

for $\beta_1, \beta_2 > 0$.

- Following a stock’s positive cashflow news,
  - $\hat{C}_t \downarrow$ if stock’s weight in $p_f$ is $> 0$ (active overweigh).
  - $\hat{C}_t \uparrow$ if stock’s weight in $p_f$ is $< 0$ (active underweigh).
Momentum

• Positive cashflow news by a stock.
  – Stock’s weight in $p_f$ is $> 0 \Rightarrow \hat{C}_t \downarrow \Rightarrow$ Inflows into active fund $\Rightarrow$ Stock ↑.
  – Stock’s weight in $p_f$ is $< 0 \Rightarrow \hat{C}_t \uparrow \Rightarrow$ Outflows from active fund $\Rightarrow$ Stock ↑.

• Fund flows amplify price effects of cashflow shocks.

• Momentum is instantaneous.
4. Asymmetric Information

Comovement

- Covariance matrix of returns is

\[ g \Sigma + k_a \sum p'_f p_f \Sigma, \quad g, k_a > 0. \]

- Compared to symmetric information,
  - Fundamental covariance is identical.
  - Non-fundamental covariance is scalar multiple.

- Yet, non-fundamental covariance includes cashflow effects!
Consider two stocks covarying positively with $p_f$.

- $\hat{C}_t \uparrow \Rightarrow$ Outflows from active fund $\Rightarrow$ Stocks $\downarrow$. (DR,DR)
- Negative cashflow news by one stock $\Rightarrow$ Outflows from active fund $\Rightarrow$ Other stock $\downarrow$. (CF,DR)

Consistent with Anton and Polk (2008).
Symmetric vs. Asymmetric Information

- (CF, DR) only under asymmetric information.
- (DR, DR) weaker under asymmetric information.
  - $\hat{C}_t$ varies less than $C_t$.
- Non-fundamental covariance is larger under asymmetric information. ($k_a > k_s$)
- Stocks’ volatility is larger under asymmetric information.
Investor incurs flow cost $\psi \left( \frac{dy_t}{dt} \right)^2$ to change active-fund holding.

Conjecture equilibrium in which stock prices are

$$S_t = \frac{\bar{F}}{r} + \frac{F_t - \bar{F}}{r + \kappa} - \left( a_0 + a_1 \hat{C}_t + a_2 C_t + a_3 y_t \right).$$

Momentum is gradual.

TBD.
• Empirical counterpart of flow portfolio?
  – Value-growth?

• Empirical counterpart of two-factor model? Of time-varying premium on second factor?

• Correlation between momentum and value?
6. Conclusion

- Cross-sectional asset pricing under delegated portfolio management.
- Momentum/reversal, flow-driven comovement.
- Tractable, linear framework.