Anomalies

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Many anomalies are *qualitatively* consistent with efficient markets.
Outline

- Anomalies
- Methodology
- Intuition
- Empirical implications
Anomalies

- The value anomaly
- The investment anomaly
- The payout anomaly
- The SEO anomaly
- The expected-profitability anomaly
- The profitability anomaly
- The post-earnings-announcement drift
Methodology

- Production-based asset pricing — Cochrane (1991)

- From the stochastic Euler equation:

\[ E_t[M_{t+1}r_{t+1}^I] = 1 \]

where

\[ r_{t+1}^I \equiv \frac{\text{MPK}_{t+1} + \frac{a}{2} \left( \frac{I_{t+1}}{K_{t+1}} \right)^2 + (1 - \delta) \left[ 1 + a \left( \frac{I_{t+1}}{K_{t+1}} \right) \right]}{1 + a \left( \frac{I_t}{K_t} \right)} \]

- With constant return to scale,

\[ r_{t+1}^S = r_{t+1}^I \]
Surprise! **Characteristics** are sufficient statistics of expected returns.

\[ r_{ft} + \beta_M t \lambda_M t = E_t[r_{t+1}^S] = E_t[r_{t+1}^I] \]

- Consumption-based asset pricing
- Production-based asset pricing

Understanding anomalies amounts to signing

\[
\frac{\partial E_t[r_{t+1}^I]}{\partial (\text{Anomaly variables})}
\]
Intuition: The Investment Anomalies

- A downward-sloping investment-demand function — Cochrane (1991)

\[ E_t[r_{t+1}] \]

Titman, Wei, and Xie (2003)

Low \( \frac{I_t}{K_t} \) firms

High \( \frac{I_t}{K_t} \) firms
The value anomaly:

\[ 1 + a \frac{I_t}{K_t} = \underbrace{\text{Marginal Cost of Investment}}_{\text{Marginal Benefit of Investment}} = \underbrace{q_t}_{\text{Market–to–Book}} = \underbrace{Q_t}_{\text{ }} \]

\[ E_t[r_{t+1}] \]

Growth firms invest more —
Fama and French (1995)
The SEO anomaly:

\[
\begin{align*}
\text{Outside Equity} + \text{Operating Profits} &= \text{Investment} + \text{Adjustment Costs} \\
\text{The Sources of Funds} &= \text{The Uses of Funds}
\end{align*}
\]

\[
\mathbb{E}_t[r_{t+1}]
\]

Issuing firms invest more —
Loughran and Ritter (1997)
The payout anomaly:

\[
\begin{align*}
\text{Operating Profits} & = \text{Payout} + \text{Investment} + \text{Adjustment Costs} \\
\text{The Sources of Funds} & = \text{The Uses of Funds}
\end{align*}
\]

\[\mathbb{E}_t[r_{t+1}]\]

High payout firms invest less

High payout firms

Low payout firms

\[\frac{I_t}{K_t}\]
Interactive, second-order effects:

- the value anomaly is stronger in small firms;
- the SEO anomaly is stronger in small firms;
- the payout anomaly is stronger in value firms.

With quadratic adjustment costs, the investment-demand function is convex:

\[
\frac{\partial^2 E_t[r_{t+1}]}{\partial (I_t/K_t)^2} > 0
\]

By the chain rule, the convexity manifests itself as the second-order effects.
Intuition: The Earnings Anomalies

- Operating Profits = Earnings + Depreciation

\[
\text{MPK}_{t+1} = \frac{\Pi_{t+1}}{K_{t+1}} = \frac{N_{t+1}}{K_{t+1}} + \delta
\]

\[
\text{Marginal Product of Capital} = \text{Average Product of Capital} = \text{Profitability}
\]

\[
E_t[r_{t+1}] = \frac{\text{MPK}_{t+1} + \frac{a}{2} \left( \frac{I_{t+1}}{K_{t+1}} \right)^2 + (1 - \delta) \left[ 1 + a \left( \frac{I_{t+1}}{K_{t+1}} \right) \right]}{1 + a \left( \frac{I_t}{K_t} \right)}
\]

\[
\Rightarrow \frac{\partial E_t[r_{t+1}]}{\partial E_t[N_{t+1}/K_{t+1}]} = \frac{K_{t+1}}{P_t} > 0; \quad \text{and decreasing in } P_t
\]
Profitability is highly persistent — Fama and French (1995, 2000, 2004):

\[
\text{Profitability} \uparrow \implies \text{Expected profitability} \uparrow \implies \text{Expected return} \uparrow
\]

Earnings surprise and profitability are both scaled earnings:

\[
\text{Earnings surprise} \uparrow \implies \text{profitability} \uparrow \implies \text{Expected return} \uparrow
\]

**Caution:** Is earnings surprise a strong, positive predictor of future profitability?
Empirical Implications

- Popular empirical models: The beta- and SDF-representation.

- The investment-return equation as a new empirical asset pricing model:

  $$E \left[ (r_{t+1}^S - r_{t+1}^I) \otimes Z_t \right] = 0$$

  implicit in the aggregate-level results of Cochrane (1991)

- Rationality ≠ only covariances matter.
Conclusion

- *Production-based asset pricing* can qualitatively explain many anomalies.

- *Production-based asset pricing* provides a new asset pricing test.

- *Production-based asset pricing* uses characteristics, not covariances.
Limitations/Future Work

- Estimate and test whether the model can explain the anomalies quantitatively.