Anomalies

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NBER
November 5, 2004
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:

\[ E_t[M_{t+1} r^I_{t+1}] = 1 \]

where

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

- With constant return to scale,

\[ r^S_{t+1} = r^I_{t+1} \]
Surprise! **Characteristics** are sufficient statistics of expected returns.

\[
\begin{align*}
r_{ft} + \beta_{Mt} \lambda_{Mt} &= E_t[r_{t+1}^S] &= E_t[r_{t+1}^I]
\end{align*}
\]

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

Understanding anomalies amounts to signing

\[
\frac{\partial E_t[r_{t+1}^I]}{\partial (\text{Anomaly variables})}
\]
A downward-sloping investment-demand function — Cochrane (1991)

Titman, Wei, and Xie (2003)
The value anomaly:

$$1 + a \frac{I_t}{K_t} = \frac{q_t}{Q_t} = \text{Marginal Benefit of Investment}$$

Marginal Cost of Investment

Marginal Benefit of Investment

Market-to-Book

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

\[ \text{Outside Equity + Operating Profits} = \text{Investment + Adjustment Costs} \]

The Sources of Funds = The Uses of Funds

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

Issuing firms invest more —
Loughran and Ritter (1997)

Issuing firms

Nonissuing firms
The payout anomaly:

\[
\text{Operating Profits} = \text{Payout} + \text{Investment} + \text{Adjustment Costs}
\]

The Sources of Funds = The Uses of Funds

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

High payout firms invest less

High payout firms

Low payout firms
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

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

Marginal Product of Capital

Average Product of Capital

Profitability

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

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

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

Earnings surprise and profitability are both scaled earnings:

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

**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 $\neq$ 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.