Investment-Based Momentum Profits

Laura Xiaolei Liu\textsuperscript{1} \quad Lu Zhang\textsuperscript{2}

\textsuperscript{1}Hong Kong University of Science and Technology

\textsuperscript{2}Ohio State University
and NBER

University of Cincinnati
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Theme

Investment-based momentum profits

Use neoclassical theory of investment to explain momentum profits
Outline

Key Results

The Model of the Firms

Econometric Design

Additional Results
Outline

Key Results

The Model of the Firms

Econometric Design

Additional Results
Key Results
10 momentum deciles, the CAPM and the Fama-French model
Key Results

10 momentum deciles, the standard consumption-CAPM and the investment model
Key Results

9 size and momentum portfolios, the CAPM and the Fama-French model
Key Results

9 size and momentum portfolios, the consumption-CAPM and the investment model

![Graph showing average realized returns vs. average predicted returns for small-winner and big-loser portfolios. The graph is divided into two quadrants with the x-axis representing average realized returns and the y-axis representing average predicted returns. The small-winner portfolio is represented by points above the 45-degree line, while the big-loser portfolio is represented by points below the line. The points for both portfolios are scattered across the graph, indicating a correlation between realized and predicted returns.]
Key Results

9 age and momentum portfolios, the CAPM and the Fama-French model

Diagram showing average realized returns versus average predicted returns for Young-winner and Young-loser portfolios.
Key Results

9 age and momentum portfolios, the consumption-CAPM and the investment model
Key Results

9 volume and momentum portfolios, the CAPM and the Fama-French model

[Graphs showing average realized returns vs. average predicted returns for different portfolios, indicating performance patterns.]
Key Results

9 volume and momentum portfolios, the consumption-CAPM and the investment model
Key Results

9 stock return volatility and momentum portfolios, the CAPM and the Fama-French model

[Graphs showing average realized returns vs. average predicted returns, with markers for High-loser and Middle-winner]
Key Results

9 stock return volatility and momentum portfolios, the consumption-CAPM and the investment model
Key Results

9 cash flow volatility and momentum portfolios, the CAPM and the Fama-French model.
Key Results

9 cash flow volatility and momentum portfolios, the consumption-CAPM and the investment model.
Key Results

5 industry momentum quintiles, the CAPM and the Fama-French model
Key Results
5 industry momentum quintiles, the consumption-CAPM and the investment model

Average realized returns versus Average predicted returns for winners and losers.
Outline

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The Model of the Firms

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The Model

The investment-based expected return model as in Liu, Whited, and Zhang (2009)

Operating profits, $\Pi(K_{it}, X_{it})$, with

$$\frac{\partial \Pi(K_{it}, X_{it})}{\partial K_{it}} = \kappa \frac{Y_{it}}{K_{it}}$$

with $Y_{it} = \text{Sales}$

Capital evolves as:

$$K_{it+1} = I_{it} + (1 - \delta_{it})K_{it}$$

Convex adjustment costs:

$$\Phi(I_{it}, K_{it}) = \frac{a}{2} \left( \frac{I_{it}}{K_{it}} \right)^2 K_{it}$$
The Model

Value maximization

One-period debt, $B_{it+1}$, with corporate bond return $r_{it+1}^B$

Payout, $D_{it}$, defined as:

$$(1 - \tau_t)[\Pi(K_{it}, X_{it}) - \Phi(l_{it}, K_{it})] - l_{it} + B_{it+1} - r_{it}^B B_{it} + \tau_t \delta_{it} K_{it} + \tau_t (r_{it}^B - 1) B_{it}$$

The cum-dividend market value of the equity:

$$V_{it} \equiv \max_{\{l_{it+s}, K_{it+s+1}, B_{it+s+1}\}_{s=0}^\infty} E_t \left[ \sum_{s=0}^{\infty} M_{t+s} D_{it+s} \right]$$

in which $M_{t+1}$ is the SDF, correlated with $X_{it+1}$
The Model

The investment return

\[ E_t[M_{t+1}r_{it+1}] = 1, \text{ in which } r_{it+1} \text{ is the investment return:} \]

\[ r_{it+1} = \left[ \begin{array}{c}
(1 - \tau_{t+1}) \left[ \kappa \frac{Y_{it+1}}{K_{it+1}} + \frac{a}{2} \left( \frac{l_{it+1}}{K_{it+1}} \right)^2 \right] \\
+ \tau_{t+1} \delta_{it+1} + (1 - \delta_{it+1}) \left[ 1 + (1 - \tau_{t+1})a \left( \frac{l_{it+1}}{K_{it+1}} \right) \right] \\
1 + (1 - \tau_t) \left( \frac{l_{it}}{K_{it}} \right) \end{array} \right] \]

Marginal benefit of investment at time \( t+1 \)

Marginal product plus economy of scale (net of taxes)

Expected continuation value

Marginal cost of investment at time \( t \)
The Model

The weighted average cost of capital

\[ E_t \left[ M_{t+1} r_{it+1}^{Ba} \right] = 1, \text{ with } r_{it+1}^{Ba} = (1 - \tau_{t+1}) r_{it+1}^B + \tau_{t+1} \]

Let \( P_{it} \equiv V_{it} - D_{it} \) and \( r_{it+1}^S \equiv (P_{it+1} + D_{it+1})/P_{it} \)

The investment return is the weighted average of stock and after-tax bond returns:

\[ r_{it+1}^I = w_{it} r_{it+1}^{Ba} + (1 - w_{it}) r_{it+1}^S \]

in which \( w_{it} \equiv B_{it+1}/(P_{it} + B_{it+1}) \) is market leverage
Outline

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The levered investment return:

\[ r_{iw}^{lw} \equiv \frac{r_{it+1} - w_{it} r_{it+1}^{Ba}}{1 - w_{it}} \]

Expected stock returns = expected levered investment returns?

\[ E \left[ r_{it+1}^{S} - r_{it+1}^{lw} \right] = 0 \]
The expected return error (alpha) is defined as:

$$\alpha_i^q \equiv E_T \left[ r_{it+1}^S - r_{it+1}^{lw} \right]$$

- Construct a $\chi^2$ test based on these alphas
- Compare the alphas with those obtained from traditional asset pricing models
Econometric Design
Testing portfolios

- 10 (6/1/6) momentum deciles
- 9 size and momentum portfolios
- 9 age and momentum portfolios
- 9 trading volume and momentum portfolios
- 9 stock return volatility and momentum portfolios
- 9 cash flow volatility and momentum portfolios
- 5 industry momentum portfolios
Econometric Design
Measurement

- $K_{it}$: gross property, plant, and equipment
- $l_{it}$: capital expenditure minus sales of property, plant, and equipment
- $Y_{it}$: sales
- $B_{it}$: total long-term debt
- $P_{it}$: market value of common equity
- $\delta_{it}$: the amount of depreciation divided by capital
- $r_{it+1}^B$: impute bond ratings, assign corporate bond returns of a given rating to all firms with the same rating
- $\tau_t$: statutory tax rate of corporate income
Outline

Key Results

The Model of the Firms

Econometric Design

Additional Results
Empirical Results
Point estimates and tests of overidentification

<table>
<thead>
<tr>
<th></th>
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<th>Return volatility and momentum</th>
<th>Industry momentum</th>
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Empirical Results
Alphas for 10 momentum deciles

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Empirical Results
Alphas for 9 age and momentum portfolios

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Empirical Results
Alphas for 9 stock return volatility and momentum portfolios

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# Empirical Results

Alphas for 5 industry momentum quintiles

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<td>3.7</td>
<td>6.8</td>
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<td>0.0</td>
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<tr>
<td>$\alpha^q$</td>
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<td>−0.5</td>
<td>0.3</td>
<td>0.6</td>
<td>0.5</td>
<td>0.2</td>
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Sources of cross-sectional variations of expected stock returns:

$Y_{it+1}/K_{it+1}, l_{it+1}/l_{it}, w_{it}, l_{it}/K_{it};$ also $\delta_{it+1}$ and $r_{it+1}^B$

$$r_{it+1}^L = \frac{(1 - \tau_{t+1}) \left( \kappa \frac{Y_{it+1}}{K_{it+1}} + \frac{a}{2} \left( \frac{l_{it+1}}{K_{it+1}} \right)^2 \right) + \tau_{t+1} \delta_{it+1} + (1 - \delta_{it+1}) \left[ 1 + (1 - \tau_{t+1})a \left( \frac{l_{it+1}}{K_{it+1}} \right) \right]}{1 + (1 - \tau_{t})a \left( \frac{l_{it}}{K_{it}} \right)}$$

$$r_{it+1}^S = \frac{r_{it+1}^L - w_{it}r_{it+1}^B}{1 - w_{it}}$$
Empirical Results

Expected return determinants, 10 momentum deciles

<table>
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<tr>
<th></th>
<th>Loser</th>
<th>5</th>
<th>Winner</th>
<th>W−L</th>
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<tr>
<td>$(I_{it+1}/K_{it+1})/(I_{it}/K_{it})$</td>
<td>0.85</td>
<td>1.00</td>
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<tr>
<td>$Y_{it+1}/K_{it+1}$</td>
<td>1.57</td>
<td>1.45</td>
<td>1.92</td>
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<tr>
<td>$\delta_{it+1}$</td>
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<td>$w_{it}$</td>
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<td>$r_{it+1}$</td>
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Empirical Results
Accounting for momentum profits, 10 momentum deciles

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<td>3.99</td>
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<td>1.92</td>
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<td>$q_{it+1}/q_{it}$</td>
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<td>$Y_{it+1}/K_{it+1}$</td>
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<td>$w_{it}$</td>
<td>−3.72</td>
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<td>−3.23</td>
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The results largely similar for the other sets of testing portfolios
Related Literature
Investment-based momentum profits

Momentum profits:
▶ Jegadeesh and Titman (1993); Rouwenhorst (1998); Moskowitz and Grinblatt (1999); Lee and Swaminathan (2000); Jiang, Lee, and Zhang (2005); Zhang (2006)

Behavioral finance:
▶ Barberis, Shleifer, and Vishny (1998); Daniel, Hirshleifer, and Subrahmanyam (1998); Hong and Stein (1999)

Real options explanations:
▶ Johnson (2002); Sagi and Seasholes (2007)
Summary

Investment-based momentum profits

Momentum profits are potentially consistent with value maximization of firms