The Great Divorce Between Investment and Profitability

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Motivation

Firm investment and profitability are related to cross-sectional returns

- **high-investment** firms have **low** expected returns
  - Titman, Wei, and Xie (2004), Cooper, Gulen, and Schill (2008), Xing (2008) ...

- **high-profitability** firms have **high** expected returns
  - Novy-Marx (2013), Ball et.al. (2015), Ball et.al. (2016) ...

Theories tend to explain the two premia separately

- examine investment and expected returns keeping profitability constant
  - Fama and French (2015), Hou, Xue, and Zhang (2015)

Recent empirical work suggests that the premia are due to data snooping

- investment and profitability premia are only significant in recent decades
  - Linnainmaa and Roberts (2018)
**This paper**

- Document novel facts about the relation between firm investment and profitability in two episodes of the U.S. stock market history

- Shed light on the common component of investment premium and profitability premium

- Explain the “rise” of investment and profitability premia
PREVIEW OF MAIN FINDINGS

   - opposite cross-sectional correlation between investment and profitability
   - opposite correlation between CMA and RMW factors
PREVIEW OF MAIN FINDINGS

   ▶ opposite cross-sectional correlation between investment and profitability
   ▶ opposite correlation between CMA and RMW factors

2. Differences largely due to entry of firms with high cash flow duration
PREVIEW OF MAIN FINDINGS

   - opposite cross-sectional correlation between investment and profitability
   - opposite correlation between CMA and RMW factors

2. Differences largely due to entry of firms with high cash flow duration

3. New listing of high-duration firms boosts up investment and profitability premia because of duration premium
### Investment and Profitability Factors

<table>
<thead>
<tr>
<th>Year</th>
<th>CMA (L−H Investment)</th>
<th>RMW (H−L Profitability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1940</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1950</td>
<td></td>
<td></td>
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<tr>
<td>1960</td>
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<tr>
<td>1970</td>
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<td>1980</td>
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<td>2000</td>
<td></td>
<td></td>
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<tr>
<td>2010</td>
<td></td>
<td></td>
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<tr>
<td>2020</td>
<td></td>
<td></td>
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</tbody>
</table>

- 10-year moving average of investment and profitability factors
- Pre 1980: $corr(RMW, CMA) < 0$, RMW and CMA averages are not significant
- Post 1980: $corr(RMW, CMA) > 0$, RMW and CMA averages are both significant
The cross-sectional correlation between investment and profitability in each year

- Pre 1980: $corr(inv, prof) > 0$ in most years
- Post 1980: $corr(inv, prof) < 0$ in most years
RISE OF LOW-PROFIT AND HIGH-INVESTMENT FIRMS
Fact 1: different landscape of public firms in early and later periods
Fact 1: different landscape of public firms in early and later periods

Next: Which firms caused the differences between the two periods?
DECOMPOSING INV-PROF RELATION

What drives the change in the sign of $\text{corr}(\text{inv}, \text{prof})$?

- Incumbents change investment policy, or
- Change in composition of firms due to entry & exit

Decomposition of the cross-sectional correlation:

$$\text{corr}(u_{j,t}, i_{j,t}) = \frac{\text{cov}(u_{j} + \tilde{u}_{j,t}, i_{j} + \tilde{i}_{j,t})}{\sigma_{u}(t)\sigma_{i}(t)}$$

$$= \frac{\text{cov}(u_{j}, i_{j})}{\sigma_{u}(t)\sigma_{i}(t)}$$

Between-firm component

Within-firm component
## Counterfactual Analysis

What happens if we exclude new listing firms in the later period?

\[
Inv_{f,t} = \beta Prof_{f,t} + FE_t + \epsilon_{f,t}
\]

<table>
<thead>
<tr>
<th></th>
<th>Later Periods (1979-2017)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All (1)</td>
</tr>
<tr>
<td>Profitability</td>
<td>-0.15*** (0.03)</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td>Yr</td>
</tr>
<tr>
<td>Observations</td>
<td>111,234</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.04</td>
</tr>
</tbody>
</table>
**Counterfactual Analysis**

Do not see similar impact if we exclude new listing firms in early period

\[ Inv_{f,t} = \beta Prof_{f,t} + FE_t + \epsilon_{f,t} \]

<table>
<thead>
<tr>
<th></th>
<th>Early Periods (1963-1978)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All (1)</td>
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<tr>
<td>Profitability</td>
<td>0.22***</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
</tr>
<tr>
<td>Fixed Effects</td>
<td>Yr</td>
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<td>Observations</td>
<td>26,298</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.06</td>
</tr>
</tbody>
</table>
Investment and Profitability of New Firms

Industry-adjusted profitability

Year


Industry-adjusted investment

Year


▶ Newly listed firms since 1980 features low profitability and high investment
Fact 2: decoupling between investment and profitability is largely due to entry of low-profit and high-investment firms
Fact 2: decoupling between investment and profitability is largely due to entry of low-profit and high-investment firms

Next: How does this affect investment and profitability premia?
A SIMPLE THEORETICAL FRAMEWORK

We propose a framework featuring two types of firms

1. Classic firms
   ▶ Discount rate is $r_s$
   ▶ Profitability process
   \[ \frac{du_t}{u_t} = \sigma dB_t \]
   ▶ Optimal investment
   \[ i_c(u_t) = \frac{1}{c(r_s + \delta)} u_t \]

2. Boom firms
   ▶ Discount rate is $r_l$
   ▶ Profitability process
   \[ \frac{du_t}{u_t} = \sigma dB_t + (e^{Z_t} - 1)dN_t \leftarrow \text{jump process} \]
   ▶ Optimal investment
   \[ i_b(u_t) = \frac{1}{c(r_l + \delta - \lambda \mu z)} u_t \]

Key assumption:
▶ Investors charge lower discount rate for longer-term cash flows $\rightarrow r_s < r_l$ (Duration Premium)

van Binsbergen et al. (2012), van Binsbergen and Koijen (2017), Dechow et al. (2014), Weber (2018), Chen and Li (2018), Goncalves (2020), Gormsen and Lazarus (2020) ...
INTUITION FROM THE FRAMEWORK

Classic: $i_c(u_t) = \frac{1}{c(r_s+\delta)} u_t$

Boom: $i_b(u_t) = \frac{1}{c(r_l+\delta-\lambda\mu_z)} u_t$
INTUITION FROM THE FRAMEWORK

Classic: \( i_c(u_t) = \frac{1}{c(r_s + \delta)} u_t \)

Boom: \( i_b(u_t) = \frac{1}{c(r_l + \delta - \lambda \mu_z)} u_t \)

- Investment and profitability are positively related within a firm.
INTUITION FROM THE FRAMEWORK

Classic:  \( i_c(u) = \frac{1}{c(r_s + \delta)} u \)  

Boom:  \( i_b(u) = \frac{1}{c(r_l + \delta - \lambda \mu_z)} u \)

- investment and profitability are positively related within a firm
- boom firms may invest more than classic firms despite having lower current profitability, leading to negative cross-sectional relation
**Data consistent with model intuition**

\[ Inv_{f,t} = \beta Prof_{f,t} + FE_t + \epsilon_{f,t} \]

<table>
<thead>
<tr>
<th></th>
<th>Early Period</th>
<th></th>
<th>Later Period</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>baseline (1)</td>
<td>ctrl. duration (2)</td>
<td>firm FE (3)</td>
<td>baseline (4)</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.22***</td>
<td>0.30***</td>
<td>0.21***</td>
<td>-0.15***</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Observations</td>
<td>26,298</td>
<td>25,978</td>
<td>25,809</td>
<td>111,234</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
<td>0.06</td>
<td>0.17</td>
<td>0.17</td>
<td>0.04</td>
</tr>
</tbody>
</table>
INVESTMENT AND PROFITABILITY PREMIA

- In this framework, cross-section of returns is fully characterized by the “duration premium” \( r_s - r_l \) across classic and boom firms.
- In aggregate, the mass of boom firms is tilted towards lower current profitability.
  - Profitability premium (RMW)
    \[ r_R - r_W = \xi (r_s - r_l), \]
- The mass of boom firms is tilted towards higher investment rate.
  - Investment premium (CMA)
    \[ r_C - r_A = \psi (r_s - r_l), \]
How does firm duration look like during the two periods in the data?

- Early period characterized by absence of high-duration firms
- Later period characterized by presence of high-duration firms
## Duration Premium

- Monthly average returns of portfolios sorted on duration

<table>
<thead>
<tr>
<th></th>
<th>Sorted by duration</th>
<th>Sorted by duration within size group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td><strong>Early period</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dur</strong></td>
<td>15.83</td>
<td>17.01</td>
</tr>
<tr>
<td><strong>Ret</strong></td>
<td>0.59**</td>
<td>0.81**</td>
</tr>
<tr>
<td><strong>SE</strong></td>
<td>(0.29)</td>
<td>(0.38)</td>
</tr>
<tr>
<td><strong>Later period</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dur</strong></td>
<td>15.28</td>
<td>19.08</td>
</tr>
<tr>
<td><strong>Ret</strong></td>
<td>0.94***</td>
<td>1.21***</td>
</tr>
<tr>
<td><strong>SE</strong></td>
<td>(0.24)</td>
<td>(0.32)</td>
</tr>
</tbody>
</table>

- Little variation in duration and expected returns in early period
- High-duration firms in later period have lower expected returns
Countries with higher $\text{Corr}(\text{CMA}, \text{RMW})$ also tend to have higher long-term investments in the private market, proxied by Venture Capital (Gompers & Lerner (2001))
CONCLUSION

- Two periods in the U.S. stock market over the last century exhibit completely different joint distributions of investment and profitability

- Our analysis
  - reveals several novel facts about what is different before and after 1980
  - suggests that investors’ tolerance for long-duration cash flows (“duration premium”) is an important driver for understanding cross-sectional stock returns
Two periods in the U.S. stock market over the last century exhibit completely different joint distributions of investment and profitability.

Our analysis reveals several novel facts about what is different before and after 1980.

Suggests that investors’ tolerance for long-duration cash flows (“duration premium”) is an important driver for understanding cross-sectional stock returns.

Several important questions remain:

- Why investors charge low discount rate for long-duration cash flows?
- What caused the influx of high-duration firms into the stock market after 1980?
Panel A: Manufacturing

Panel B: Transportation

Panel C: Wholesale & Retail

Panel D: Service & Finance
Panel A: NASDAQ firms

Panel B: NYSE&Amex firms

Panel C: Small cap firms

Panel D: Large cap firms

Panel E: Growth firms

Panel F: Value firms
The parameter values are:

\[ r_s = 0.16, \quad r_l = 0.03, \quad \delta = 0.1, \quad c = 4, \quad \phi = 0.75, \quad \sigma = 0.04, \quad u_0 = 0.2, \quad \lambda = 0.01. \]

Z has a normal distribution with mean \( \mu_z = 0.15 \) and \( \sigma_z = 0.1 \). We simulate 1,000,000 firms and use \( \tau = 10 \) and \( m_c = m_b = 0.5 \). The correlation between \( i \) and \( u \) is -28%. The model implied values are \( q = 2.026 \) and \( \overline{q} = 1.714 \) satisfying the negative covariance condition \( q > \overline{q} \).
- Estimate realized cash flows for each firm
  (Clean Surplus Accounting)
  \[ CF_{i,t+s} = BV_{i,t+s-1} \left( \text{ROE}_{i,t+s} - \Delta BV_{i,t+s} \right) \]

- Estimate an *ex-post* duration for each firm
  (Dechow, Sloan, and Soliman (2004) and Weber (2018))
  \[ Dur_{i,t} = \frac{\sum_{s=1}^{T} s \times CF_{i,t+s} / (1 + r)^s}{P_{i,t}} + \left( T + \frac{1 + r}{r} \right) \frac{P_{i,t} - \sum_{s=1}^{T} CF_{i,t+s} / (1 + r)^s}{P_{i,t}} \]

- Estimate *ex-ante* duration for each firm using projection
  (Da (2009) and Hou, Mo, Xue, and Zhang (2018))
  \[ \log(Dur_{i,t}) = \alpha_t + \beta_{1,t} \log(ME_{i,t}) + \beta_{2,t} \text{ROE}_{i,t} + \beta_{3,t} \Delta BV_{i,t} + \varepsilon_{i,t} \]
  \[ E_t[\log(Dur_{i,t})] = \overline{\alpha}_t + \overline{\beta}_{1,t} \log(ME_{i,t}) + \overline{\beta}_{2,t} \text{ROE}_{i,t} + \overline{\beta}_{3,t} \Delta BV_{i,t} \]

- \( T = 10 \) years, \( r = 0.12 \)
Institutional investors targeting venture capital funds

Institutional investors targeting long-duration stocks
Examples of boom firms

“Because of our emphasis on the long term, we may make decisions and weigh tradeoffs differently than some companies. [...] We will continue to make investment decisions in light of long-term market leadership considerations rather than short-term profitability considerations”

— Jeffrey P. Bezos, “Amazon.com 1997 Letter to Shareholders” (page 1)