Discussion:
Corporate Investment Over Uncertain Business Cycles
by Dangl and Wu

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Summary of the Paper

Learning and irreversibility help explain nonlinearity in aggregate investment.
Outline

1 Model
2 Calibration
3 Empirical facts
Model: Key Ingredients

- A partial equilibrium model with heterogeneous firms
- Investment is irreversible
- The growth rate of aggregate demand is uncertain and persistent
- Learning through observing profits and a public signal $s_t$

$$\frac{d s_t}{s_t} = \mu_t dt + \sigma_s dW_{st}$$
The Model Mechanism

Empirical fact: fast decline but slow recovery of aggregate investment

- Irreversibility $\rightarrow$ two regions: investing and inaction

- Learning public signal $\rightarrow$ amplification of inaction region through increasing option value of waiting

- Negative signal in expansion

\[
\begin{align*}
&\rightarrow \left\{ \begin{array}{l}
decline \text{ in investment demand} \\
increase \text{ in option value of waiting} \\
\end{array} \right\} \rightarrow \text{steep decline}
\end{align*}
\]

- Positive signal in recession

\[
\begin{align*}
&\rightarrow \left\{ \begin{array}{l}
increase \text{ in investment demand} \\
increase \text{ in option value of waiting} \\
\end{array} \right\} \rightarrow \text{sluggish increase}
\end{align*}
\]
Calibration: Identification of the public signal

- The model: high conditional volatility of public signal help with asymmetric aggregate investment

- How do we identify the public signal in the data?

- The calibration of the conditional volatility of public signal $\sigma_s = 25\%$
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Firm level investment: volatile, persistent, and lumpy

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility</td>
<td>0.22</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>0.36</td>
</tr>
<tr>
<td>Inaction rate %</td>
<td>2.63</td>
</tr>
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<td>Negative IK %</td>
<td>3.71</td>
</tr>
<tr>
<td>Positive Spike%</td>
<td>20.23</td>
</tr>
<tr>
<td>Negative Spike%</td>
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Calibration: Irreversibility

- Does irreversibility capture the firm level investment dynamics?

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<tr>
<td>Autocorrelation</td>
<td>0.36</td>
<td>-0.04</td>
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<tr>
<td>Inaction rate %</td>
<td>2.63</td>
<td>7.85</td>
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<tr>
<td>Negative IK %</td>
<td>3.71</td>
<td>0.00</td>
</tr>
<tr>
<td>Positive Spike%</td>
<td>20.23</td>
<td>5.25</td>
</tr>
<tr>
<td>Negative Spike%</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

- However, irreversibility alone: less persistent, too volatile, and too many inactions.

- Needs both convex and nonconvex costs
Calibration: Aggregate Investment Dynamics

Does irreversibility capture the aggregate investment dynamics?

<table>
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<th>Irreversibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility</td>
<td>0.01</td>
<td>0.04</td>
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<tr>
<td>Autocorrelation</td>
<td>0.71</td>
<td>0.56</td>
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<tr>
<td>Skewness</td>
<td>0.007</td>
<td>0.21</td>
</tr>
<tr>
<td>Excess Kurtosis</td>
<td>-0.715</td>
<td>0.70</td>
</tr>
</tbody>
</table>

However, irreversibility alone: too volatile and excess kurtosis
General Equilibrium vs. Partial Equilibrium

Can PE results on aggregate investment survive in GE?


Crucially, GE price movement dampen investment demand such that aggregate investment non-linearity generated in PE will disappear in GE.

Suggestion: Pseudo GE effect in Bloom (2009)
General Equilibrium vs. Partial Equilibrium

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Empirical Facts

- Aggregate investment nonlinearity
  - Caballero and Engel (1999); Kashyap and Gourio (2005); Khan and Thomas (2008); Bachman, Caballero, and Engel (2011); Favilukis and Lin (2012)

- Aggregate investment vs. average investment

- Gross investment vs. capital growth (net investment)
  - What if depreciation rate is time-varying in reality?
Conclusion

An interesting paper on nonlinearity in aggregate investment dynamics

Calibration needs more robustness check