

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  $s_t$

$$\frac{ds_t}{s_t} = \mu_t dt + \sigma_s dW_{st}$$

# The Model Mechanism

Empirical fact: fast decline but slow recovery of aggregate investment

- Irreversibility → two regions: investing and inaction
- Learning public signal → amplification of inaction region through increasing option value of waiting

- Negative signal in expansion

→  $\left\{ \begin{array}{l} \textit{decline} \text{ in investment demand} \\ \textit{increase} \text{ in option value of waiting} \end{array} \right\} \rightarrow \text{steep decline}$

- Positive signal in recession

→  $\left\{ \begin{array}{l} \textit{increase} \text{ in investment demand} \\ \textit{increase} \text{ in option value of waiting} \end{array} \right\} \rightarrow \text{sluggish increase}$

# 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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# Calibration: Firmlevel Investment Dynamics

Firm level investment: volatile, persistent, and lumpy

	Data
Volatility	0.22
Autocorrelation	0.36
Inaction rate %	2.63
Negative IK %	3.71
Positive Spike%	20.23
Negative Spike%	0.00

## Calibration: Irreversibility

- Does irreversibility capture the firm level investment dynamics?

	Data	Irreversibility
Volatility	0.22	0.36
Autocorrelation	0.36	<b>-0.04</b>
Inaction rate %	2.63	<b>7.85</b>
Negative IK %	3.71	0.00
Positive Spike%	20.23	<b>5.25</b>
Negative Spike%	0.00	0.00

- 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?

	Aggregate IK	Irreversibility
Volatility	0.01	<b>0.04</b>
Autocorrelation	0.71	0.56
Skewness	0.007	0.21
Excess Kurtosis	-0.715	<b>0.70</b>

- However, irreversibility alone: too volatile and excess kurtosis

# General Equilibrium vs. Partial Equilibrium

- Can PE results on aggregate investment survive in GE?
- Not necessarily. Micro-frictions irrelevant in GE: Thomas (2002); Khan and Thomas (2009)
- 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)

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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?
  - CAPX+Sale of Capital; Doms and Dunne (1998), Davis and Haltiwanger (1992), Caballero, Engel, and Haltiwanger (1995), Cooper and Haltiwanger (2006)

# Conclusion

An interesting paper on nonlinearity in aggregate investment dynamics

Calibration needs more robustness check