Sticky Discount Rates

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NBER Corporate Finance Fall 2026

This Project Skillfully Covers a Lot of Ground

Provides **rich details** on discount rate updating and exploits their firm-level database of reported discount rates to study **aggregate fluctuations** in inflation and the cost of capital.

Documents **stickiness**, i.e., imperfect passthrough of inflation variation to nominal discount rates, as well as tightly-linked micro-level **investment patterns**.

Embeds the mechanism in **a rich investment model** with aggregate shocks, showing that the monetary transmission mechanism changes meaningfully.

I Like this Paper. A Lot.

In the macro investment literature, **we've been obsessed** with investment's sensitivity to cyclical shocks for three decades.

We've had truly glorious fights which sometimes centered on **PE vs GE** divides and **nonlinearity**, ...

sometimes on **exotic new shocks** or **financial frictions**, ...

sometimes on **adjustment cost functional forms**, ...

and, every now and then when we've been lucky, on **the data**.

This paper skillfully touches those debates. But it's also the first **novel adjustment friction** I've seen in years which I suspect is both **true** and **quantitatively important.**

A Discussant-y Model with Firm Heterogeneity

Sticky Discount Rates and Misallocation

The Nature of Discount Rate Stickiness

Micro vs Macro Identification

A Discussant-y Version of Their Model to Explore Numerically

I built a discrete-time version of their model

- focused on **real interest rate shocks** rather than nominal shocks,
- with **added** persistent micro profitability shocks,
- **maintained** capital adjustment costs,
- **maintained** Calvo or probabilistic reset of discount rates
- but **without** reset probability heterogeneity,

and I solved this model numerically in **partial equilibrium** with a loose, illustrative calibration.

The Gory Details[1]

Second Stage: investment under any given discount rate $\tilde{R}^d$

$$V^i(z,k|\tilde{R}^d) = \max_{k'}\left\{d(z,k,k') + \frac{1}{\tilde{R}^d}\mathbb{E}\left[V^i(z',k'|\tilde{R}^d)|z\right]\right\} \to k'(z,k|\tilde{R}^d) \quad \forall \tilde{R}^d$$

$$d(z,k,k') = zk^\alpha n^\nu - wn - k' + (1-\delta)k - AC_k(k,k')$$

$$AC_k(k,k') = \frac{\gamma_k}{2}\left(\frac{k'-(1-\delta)k}{k} - \delta\right)^2 k$$

$$\log z' = \rho_z \log z + \sigma_z \varepsilon'_z, \quad \varepsilon_z \sim N(0,1)$$

First Stage: can update discount rate R^d with probability θ_R

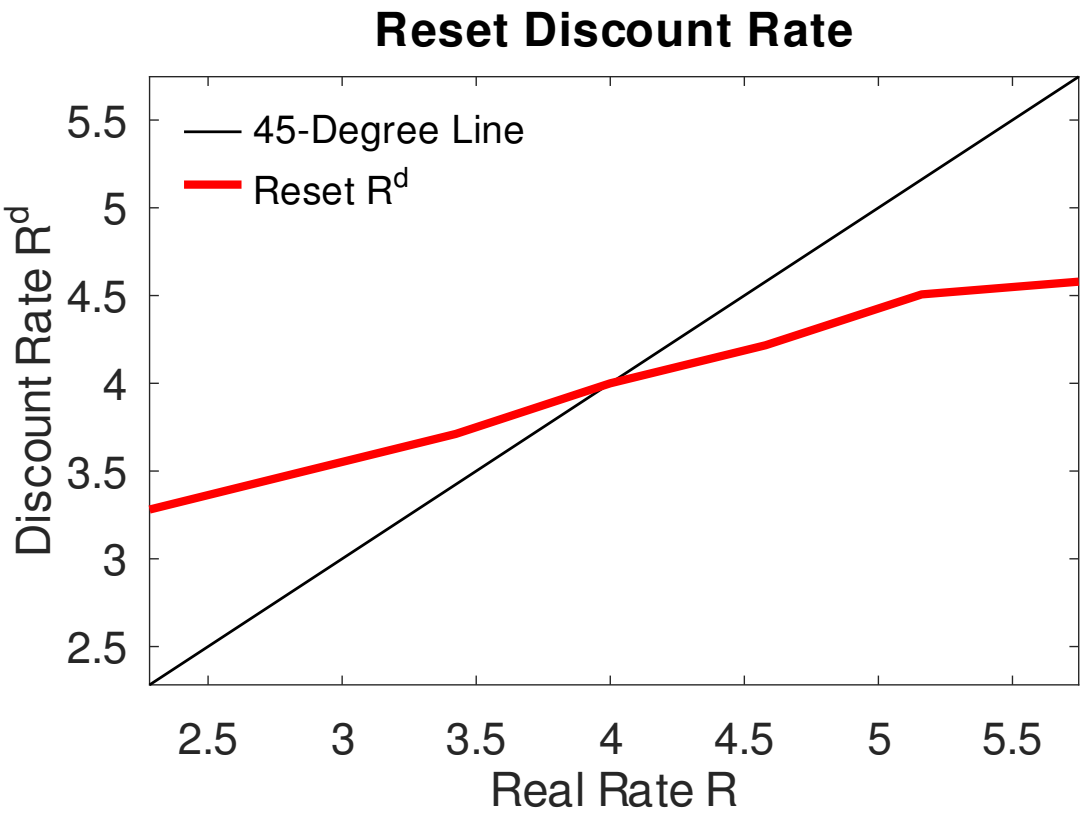
$$V^m(z,k,R^d_{-1},R) = \theta_R \max_{R^d} W(z,k,R^d,R) + (1-\theta_R)W(z,k,R^d_{-1},R)$$

$$W(z,k,\tilde{R}^d,R) = d(z,k,k'(z,k|\tilde{R}^d)) + \frac{1}{R}\mathbb{E}\left[V^m(z',k'(z,k|\tilde{R}^d),\tilde{R}^d,R')|z,R\right] \quad \forall \tilde{R}^d$$

$$\log\left(\frac{R'}{\bar{R}}\right) = \rho_R \log\left(\frac{R}{\bar{R}}\right) + \sigma_R \varepsilon'_R, \quad \varepsilon'_R \sim N(0,1)$$

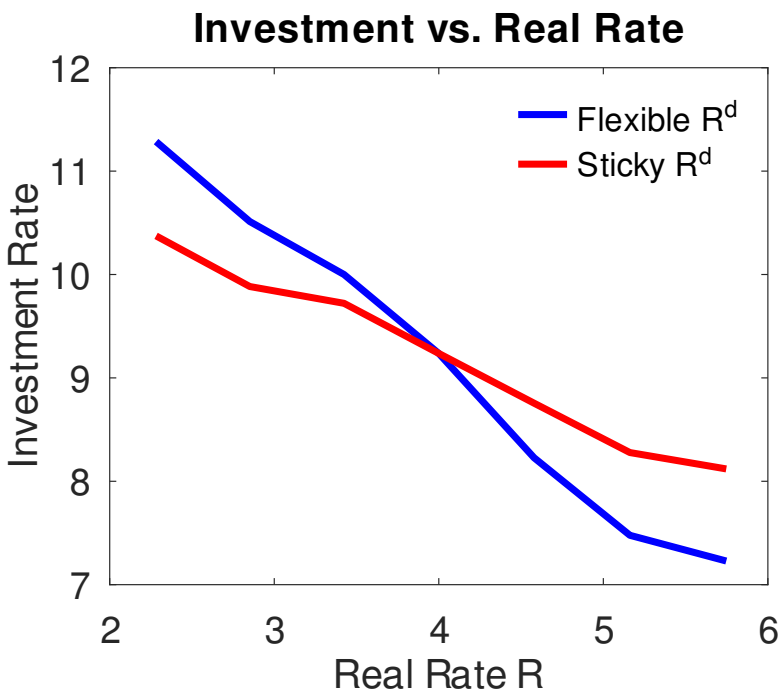
[1] I use $\alpha = 0.25$, $\nu = 0.5$, $w \approx 1$, $\delta = 0.1$, $\gamma_k \approx 1.5$, $\rho_z = 0.8$, $\sigma_z = 0.15$, $\bar{R} = 1.04$, $\rho_R \approx 0.75$, $\sigma_R \approx 0.005$, $\theta_R \approx 0.6$, motivated loosely by firm investment volatility and real interest rate dynamics. I solve a discretized version numerically.

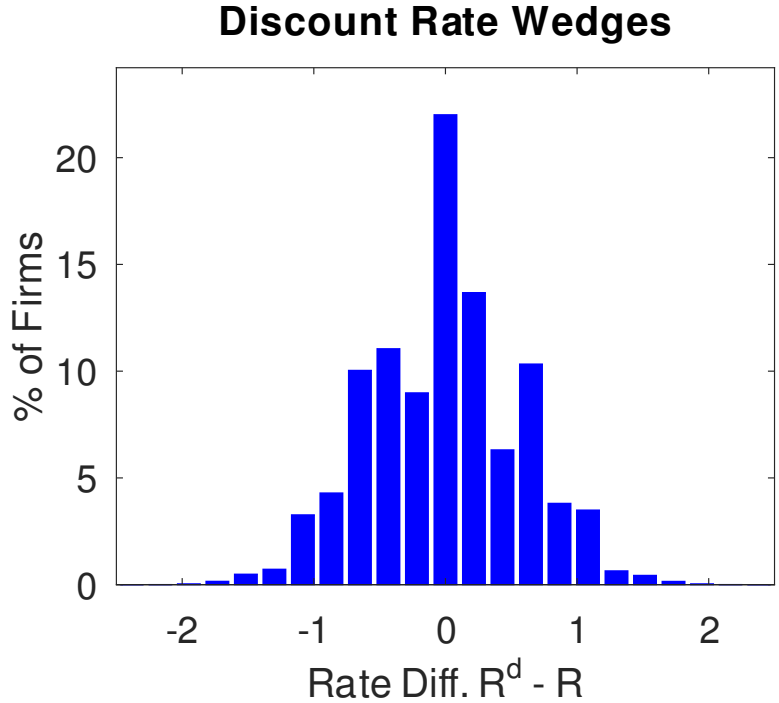
Discount Rates are Indeed Sticky



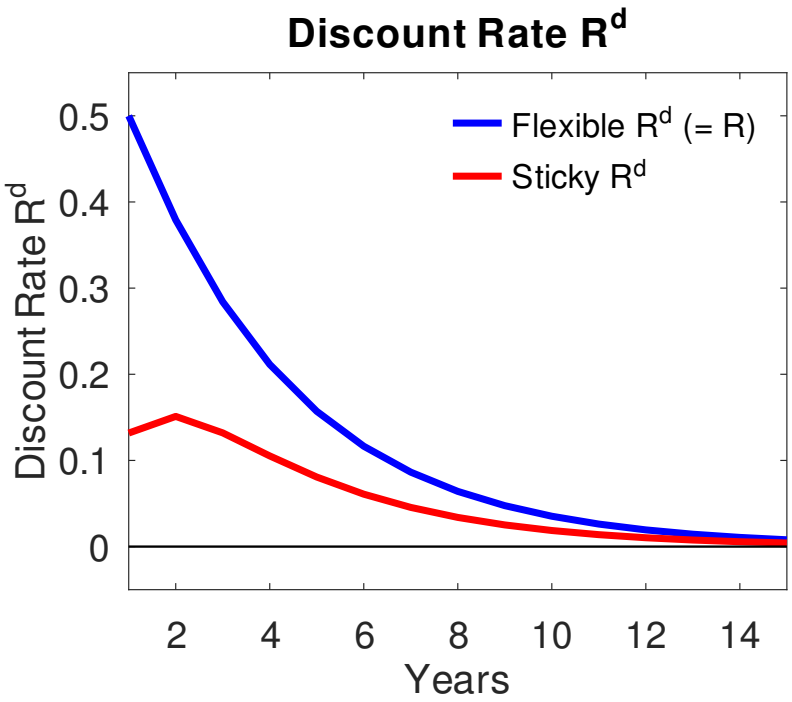
The reset rule is flatter than the identity line because firms are forward-looking and anticipate their decisions will be fixed for a while.

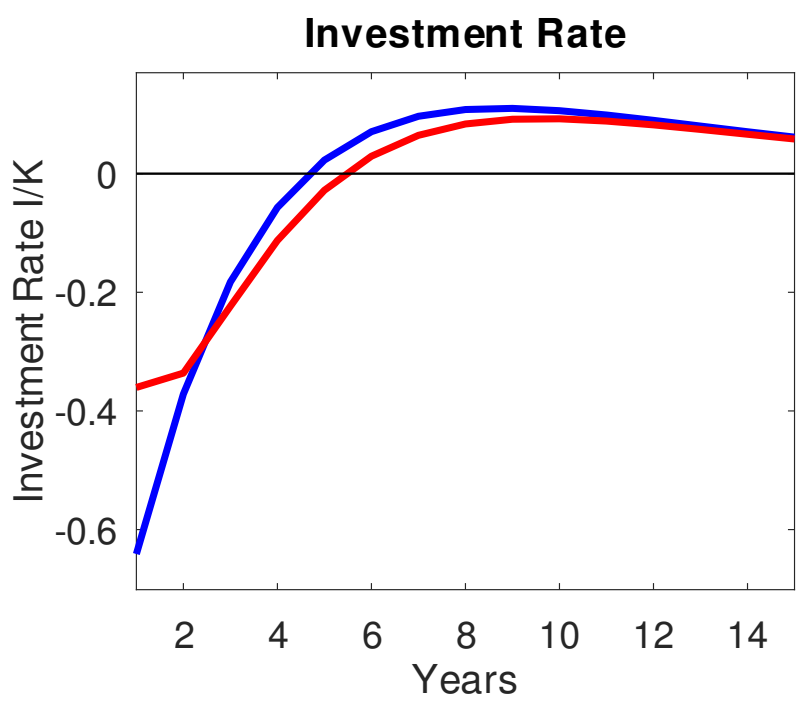
Investment Sensitivity Declines, Discount Rate Dispersion Exists





Sticky Discount Rates Dampen Macro Interest Rate Shocks





In summary...

...everything works exactly as advertised. I'd expect nothing less from this talented group of researchers.

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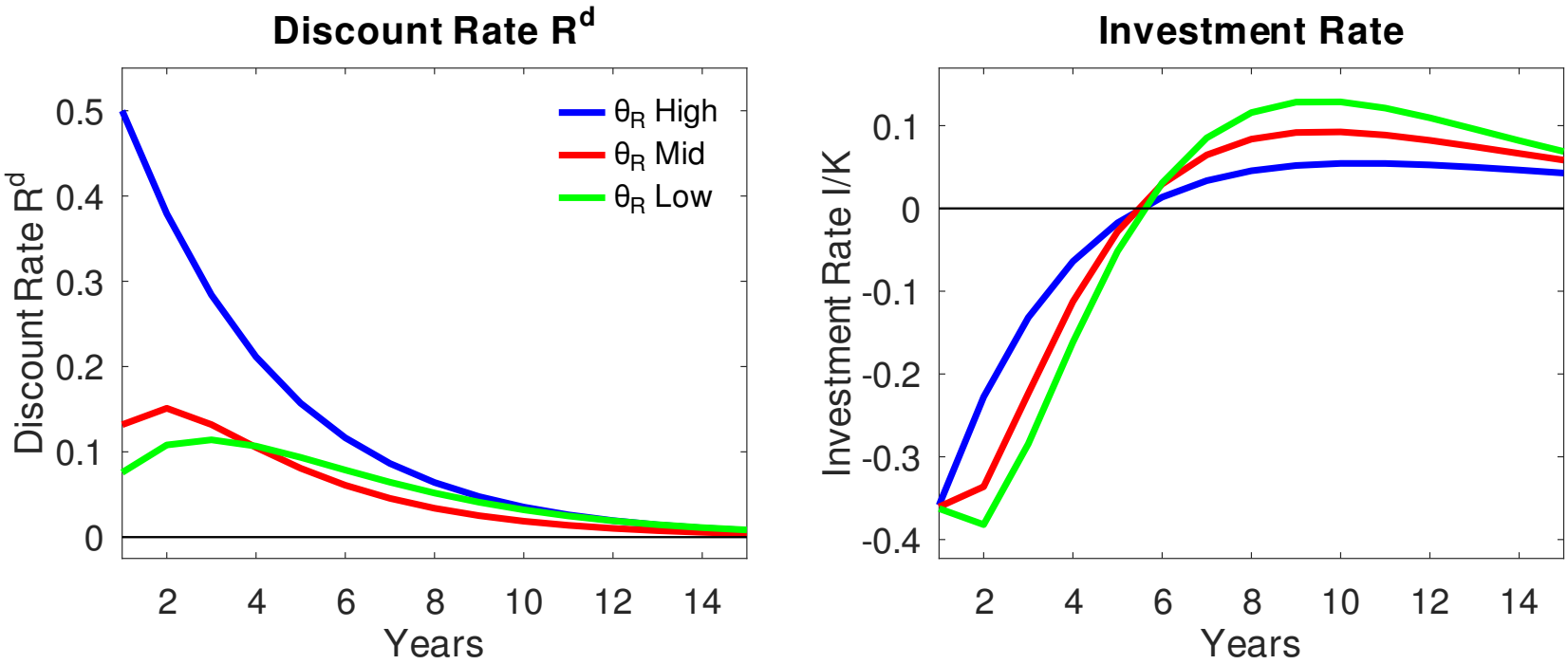
Two Ways to Dampen Capital Sensitivity to Macro Shocks

We have at least two ways to dampen the responsiveness of capital investment to macroeconomic shocks, namely

1. **sticky** R^d governed by the reset probability θ_R or
2. **frictional** k governed by the adjustment cost γ_k.

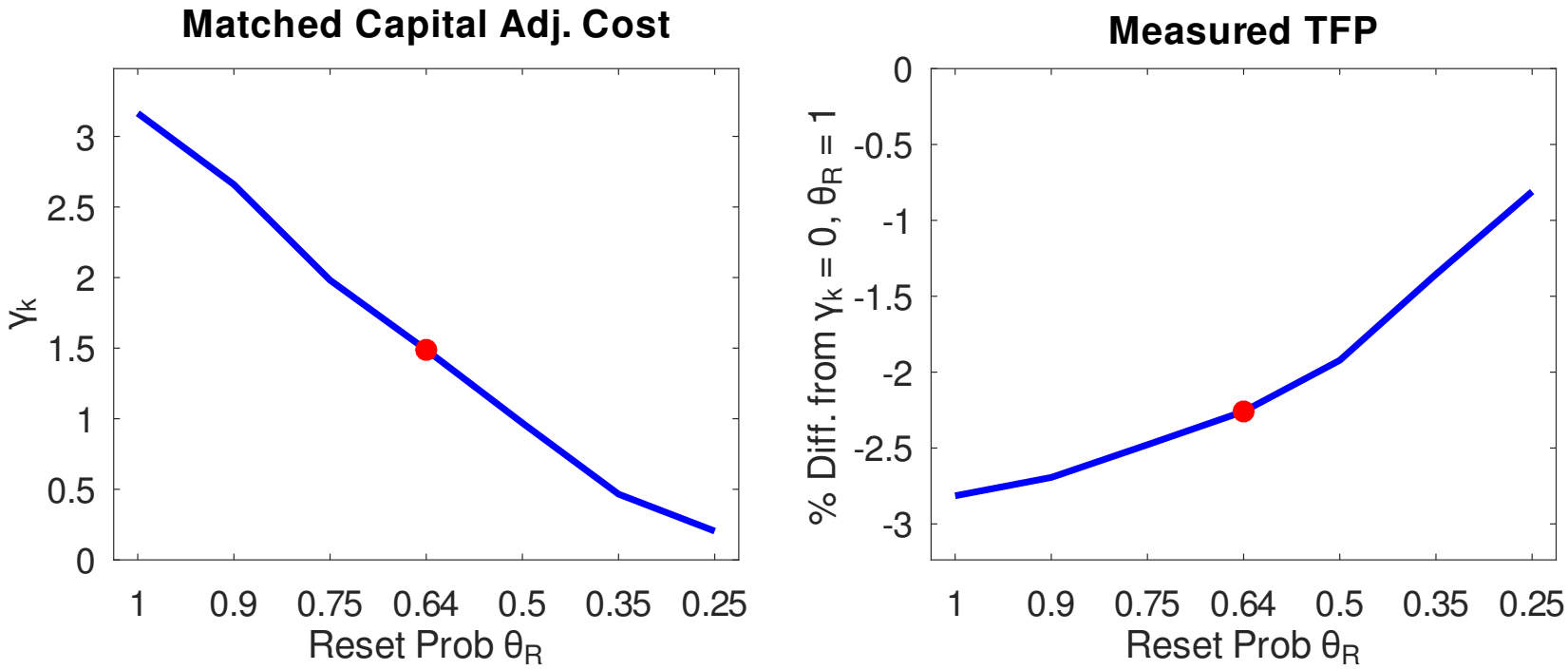
Does the split across the two sources of sluggishness matter?

Different Mixes of Stickiness in R^d vs k, Same Aggregate Effect



I choose different reset probabilities θ_R and re-calibrate γ_k to match the same aggregate investment rate response on impact from before.

Sticky R^d vs Misallocation



The mix of frictions matters. With more discount rate stickiness, i.e., lower θ_R, lower capital adjustment costs γ_k are required. The result is meaningfully lower micro misallocation, which is mostly driven by (large) micro profitability shocks.

In summary...

...this exciting new investment friction is not neutral with respect to our understanding of misallocation.

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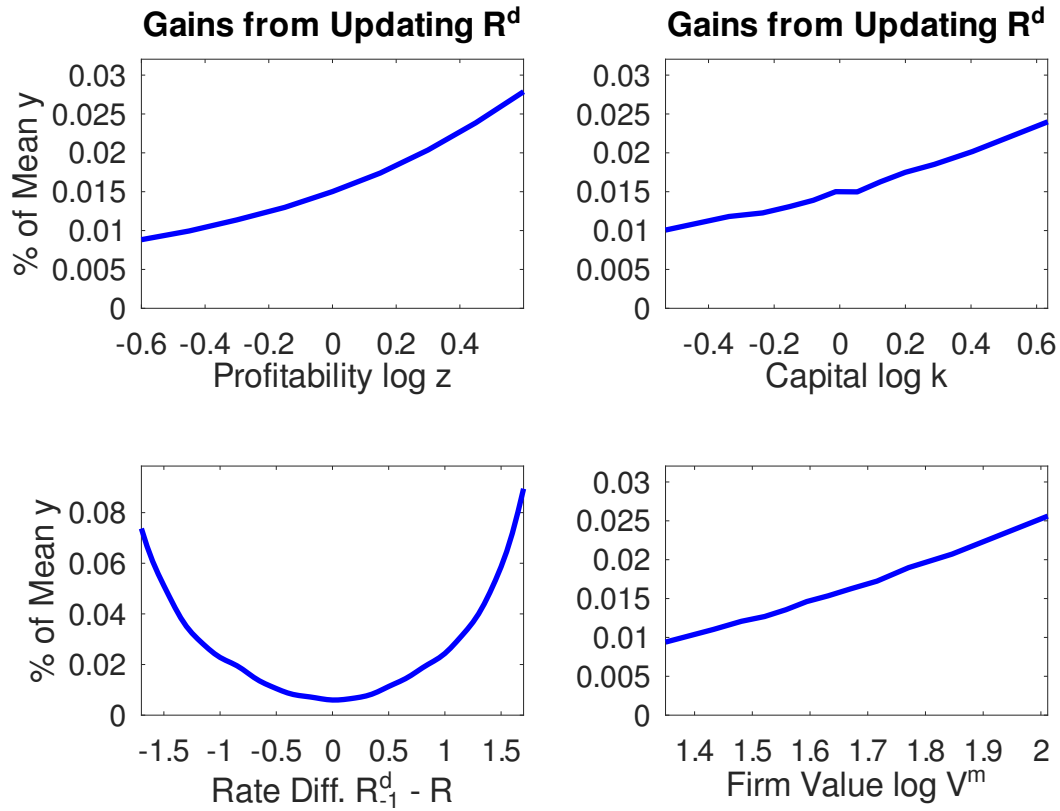
Three Decades of Nerd War

In the micro-macro New Keynesian pricing literature, we've been through decades of hard-fought debates about

1. **time-dependent** or Calvo-style adjustment frictions, e.g., this paper's fixed θ_R reset probability, versus
2. **state-dependent** adjustment frictions, e.g., a fixed adjustment cost $\gamma_R \mathbb{I}(R^d \neq R^d_{-1})k$.

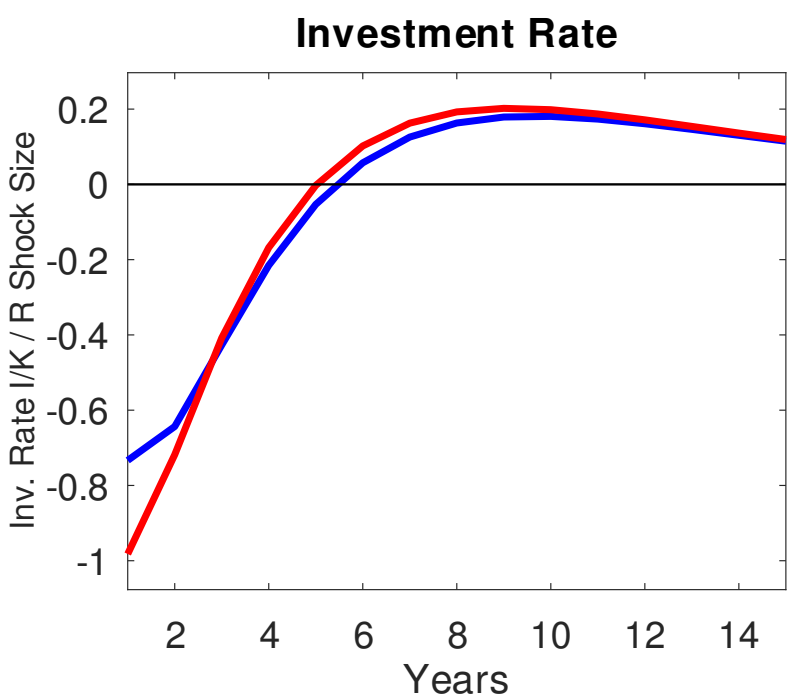
These authors are careful to document insensitivity of discount rate adjustment across aggregate inflation rates as in Calvo, and they offer a very nice, highly informed discussion of exactly this issue.

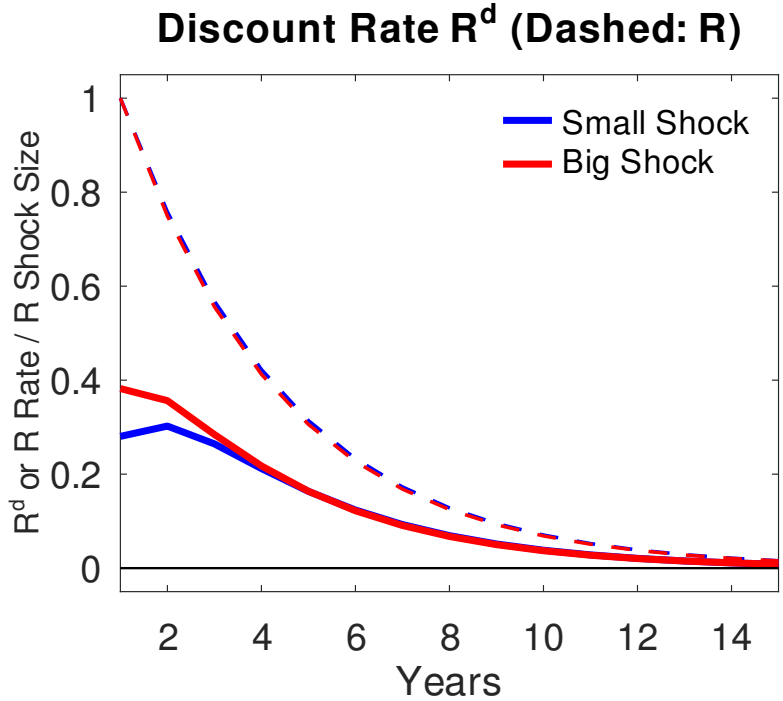
R^d Adjustment Incentives Do Vary a Lot in the Model



Larger firms and firms further away from target rates have larger incentives to update, which would create time variation in adjustment with state-dependent fixed adjustment costs.

Macro Nonlinearity is Possible with State-Dependent Frictions





With fixed adjustment costs for discount rates, more firms may adjust after big shocks, leading to aggregate nonlinearity.

In summary...

...the old adjustment friction debate is active here. The authors' empirical work suggesting adjustment insensitivity could imply that some underlying corporate finance frictions, e.g., asymmetric info, agency frictions, organizational hassle, etc., constrain adjustment.

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Since the Friction Mix Between θ_R vs γ_k Matters in the Model...

...let's pretend we measure everything perfectly and run some hypothetical regressions in the model of investment $\frac{i}{k}$ against

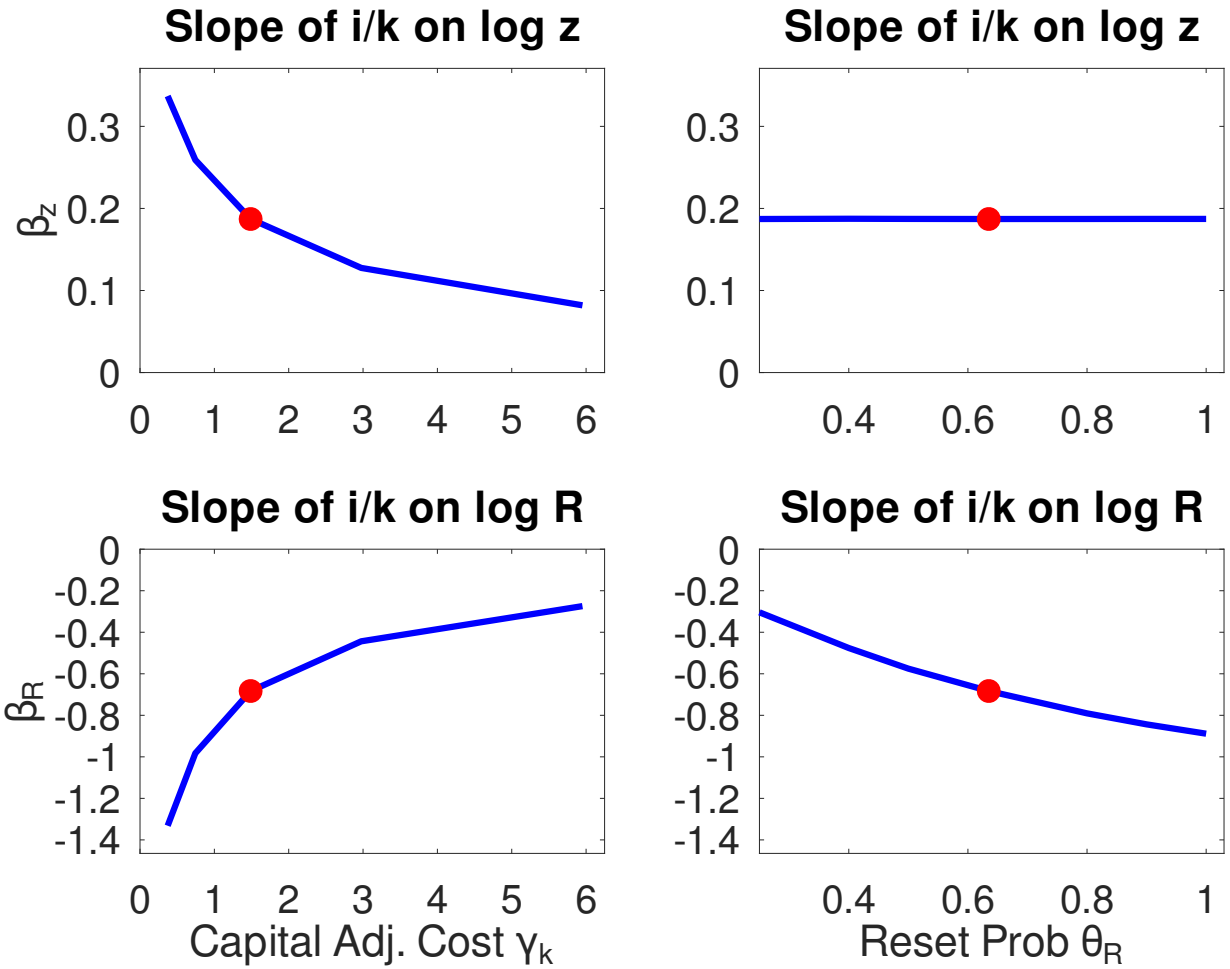
1. **micro-level profitability shocks** z

$$\frac{i}{k} = \alpha_z + \beta_z \log z + \epsilon_z,$$

2. and then **macro-level real interest rates** R

$$\frac{i}{k} = \alpha_R + \beta_R \log R + \epsilon_R.$$

γ_k Dampens Everything, θ_R Dampens only Macro Shocks



In summary...

...we'll likely need to commit the grave sin of relying at least in part on always complicated, sometimes endogenous, macro empirical variation to sort the two mechanisms out. But, on the other hand, we've got cool, tight new predictions to work with.

I Like this Paper. A Lot.

As I said at the start, I personally suspect this paper's mechanism is both **valid in reality** and **quantitatively important for our investment models**.

So, as a result, **I want more**. Looking forward, I'd like to start seeing the implications of this friction carried forward to our **traditional debates**, in models with rich heterogeneity, about

- the nature and size of **misallocation**,
- adjustment **incentives** and **costs**, and
- shock **identification**.

The authors are off to a **really great start** along that path.