Slow to Hire, Quick to Fire: Employment Dynamics with Asymmetric Responses to News

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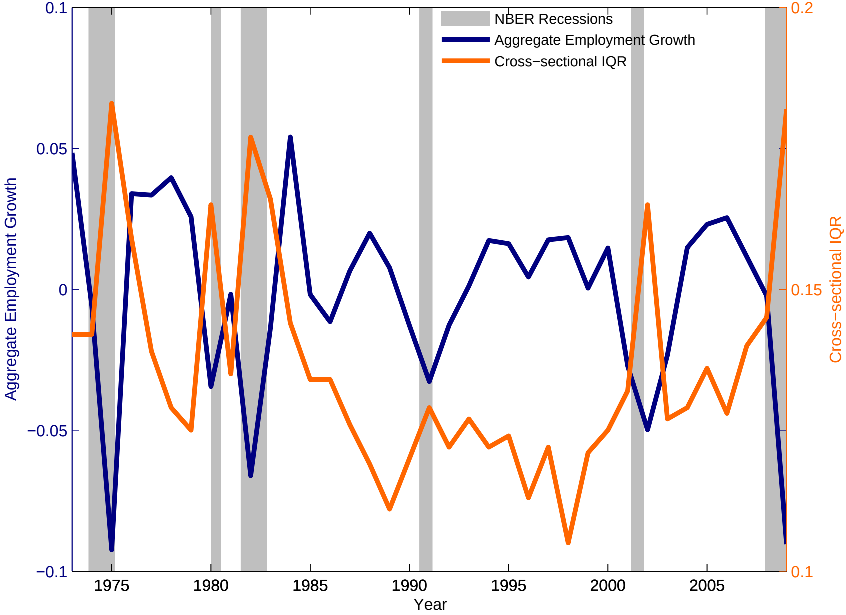
Motivation

- Cyclical changes in employment growth distributions
  - aggregate: conditional aggregate volatility
  - firm level: cross-sectional dispersion

US employment growth



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- This paper: asymmetric responses to news
  - generate *simultaneous* changes in volatility and dispersion from symmetric and homoskedastic shocks
- Plan for the talk
  - explain basic mechanism for countercyclical volatility and dispersion
  - use establishment-level & aggregate data to test other implications

Key mechanism

Model ingredients

1. Firms choose labor given dispersed noisy signals about future profits
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  - lower mean signal $\rightarrow$ strong decrease in aggregate employment
  - higher cross-sectional dispersion

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- Model predictions for employment growth
  1. time series: countercyclical aggregate volatility and negative skewness
  2. cross-section: countercyclical dispersion and negative skewness

A simple model

- Continuum of firms
  - beginning of period: get signal about future profits & choose net hiring
  - end of period: TFP realized
- Firm i's log productivity and signal:

$$z_t^i = a_t + b_t^i - \frac{1}{2}\left(\sigma_a^2 + \sigma_b^2\right)$$

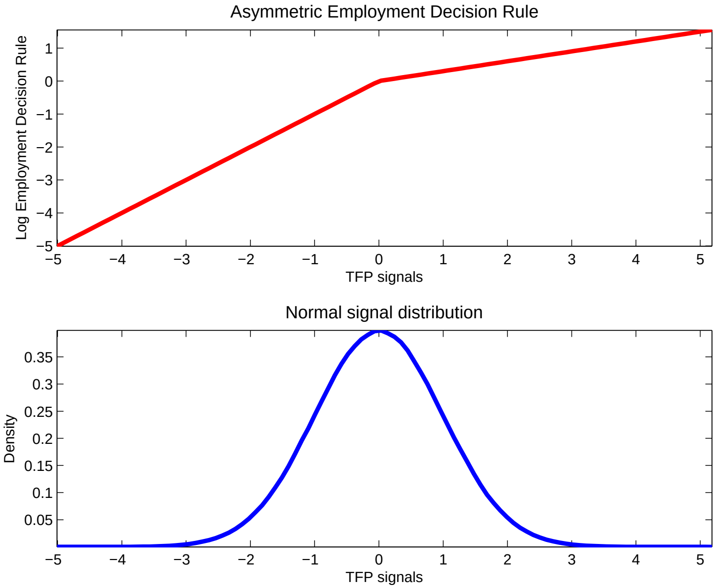
- Dispersed noisy signals

$$s_t^i = z_t^i + \sigma_\varepsilon \varepsilon_t^i$$

- Decision rule for net hiring $n_t^i \equiv \Delta \log L_t^i$

$$n_t^i = \gamma_t^* s_t^i; \quad \gamma_t^* = \begin{cases} \overline{\gamma} & \text{if } s_t^i < 0 \\ \underline{\gamma} & \text{if } s_t^i \geq 0 \end{cases}$$

Hiring decision rule



Average employment growth

- Average over strong negative and weak positive responses

$$\overline{n}_t = \int n_t^i di = \int_{-\infty}^{0} \overline{\gamma} s_t^i f(s_t^i) ds_t^i + \int_0^{\infty} \underline{\gamma} s_t^i f(s_t^i) ds_t^i$$
$$= \overline{\gamma} \mathcal{M}^- E[s_t^i | s_t^i < 0] + \underline{\gamma}(1 - \mathcal{M}^-) E[s_t^i | s_t^i > 0]$$

$$s_t^i \sim N\left(a_t + b_t^i - \frac{1}{2}\left(\sigma_a^2 + \sigma_b^2\right), \sigma_b^2 + \sigma_\varepsilon^2\right)$$

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- Effects of changes in aggregate component of TFP
  - if $a_t \Downarrow$, more firms respond strongly to the bad s_t^i, so $\overline{n}_t \Downarrow$ by more
  - if $a_t \Uparrow$, more firms respond weakly to the good s_t^i, so $\overline{n}_t \Uparrow$ by less

$\Longrightarrow$ **negative skewness in time-series** of aggregate $\overline{n}_t$
$\Longrightarrow$ **countercyclical aggregate volatility clustering**: aggregate $\overline{n}_t$ more volatile in periods of negative a_t

Cross-sectional dispersion

- Cross-sectional quartiles of n_t^i monotonic in those of TFP signals

$$Q_3^n = c\gamma^*(Q_3^s)Q_3^s; \qquad Q_1^n = c\gamma^*(Q_1^s)Q_1^s$$

$$Q_3^s = E(s^i) + 0.67\sqrt{Var(s^i)}; \quad Q_1^s = E(s^i) - 0.67\sqrt{Var(s^i)}$$

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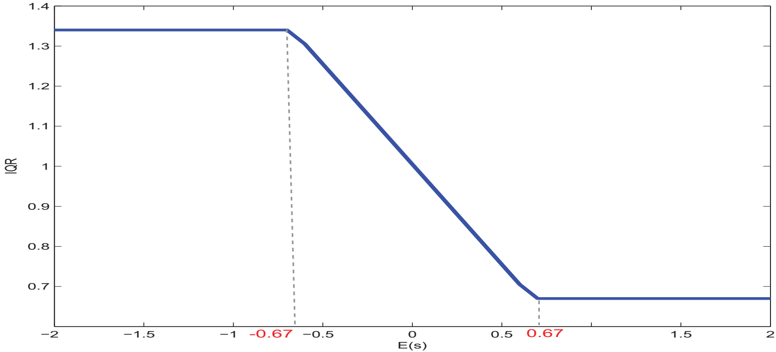
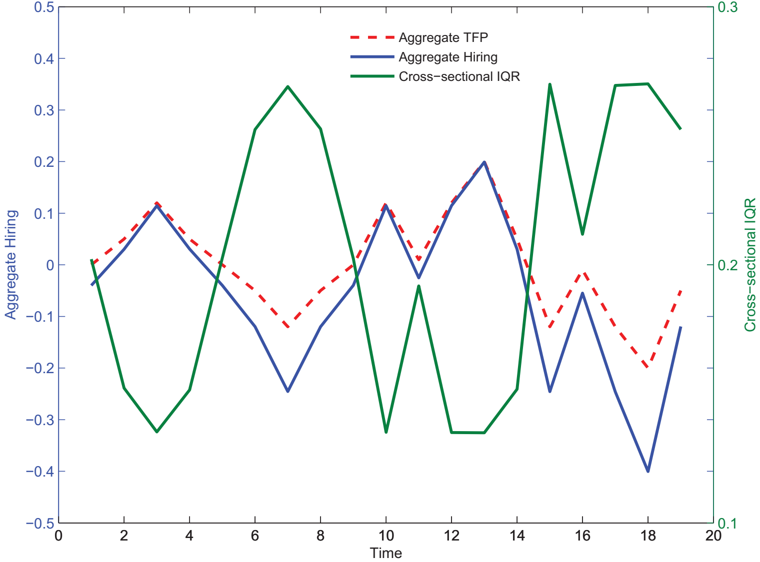
- Interquartile range $IQR \equiv Q_3^n - Q_1^n$ **countercyclical**



Illustrative time-series



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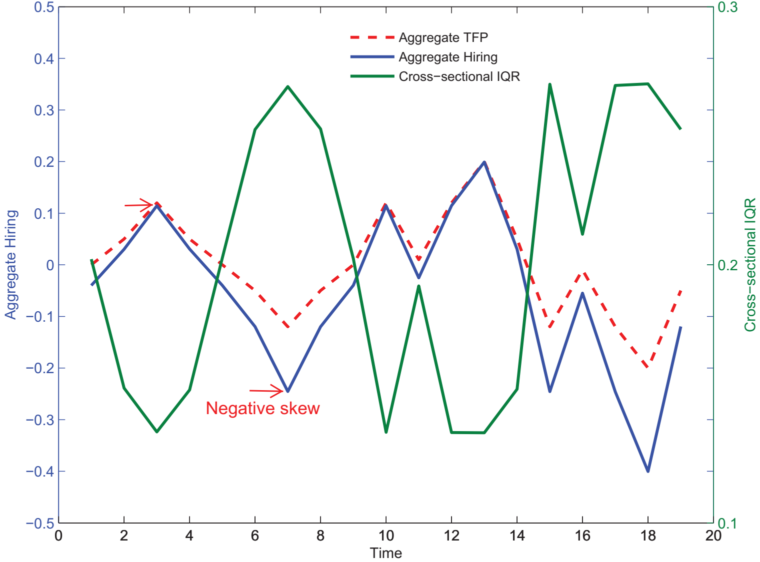

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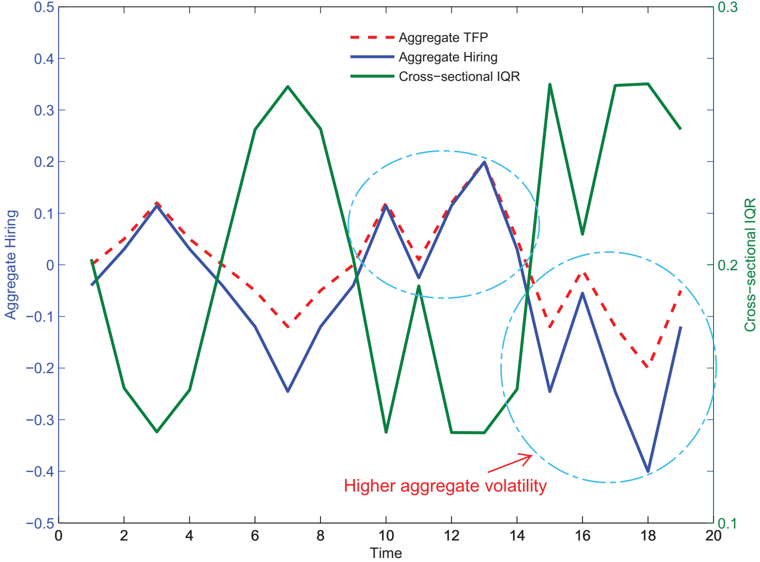

Data

- Census data on U.S. manufacturing establishments
- Annual data 1972-2009
  - 55k obs. per year; 2.1m total
- Employment: sum of production and non-production workers
  - other information: output, hours, capital, investment, industry, ...
- Here: Focus on employment changes: $n_t^i \equiv \Delta \log(Emp_t^i)$

Employment growth – aggregate and cross section

- Time-series skewness of *aggregate* employment growth:

$$Skewness_{Aggr} = \frac{\frac{1}{T}\sum_t^T (\overline{n}_t - \overline{n})^3}{Vol^{3/2}} = -1 \text{ in data}$$

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- Cross-sectional skewness across establishments

$$Skewness_t = \frac{\frac{1}{N}\sum_{i=1}^N (n_t^i - \overline{n}_t)^3}{Vol_t^{3/2}}$$

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- Cross-sectional dispersion across establishments.

$$IQR_t = Q_3(n_t^i) - Q_1(n_t^i)$$

  - Data: countercyclical *IQR*
  - average $= 13\%$, one quarter of the year in NBER recession it $\Uparrow$ to 17%
  - doubles in fully recessionary years

Micro-level evidence

- Time-series skewness of *individual* establishment

$$Skewness^i = \frac{\frac{1}{T^i}\sum_t^{T^i}(n_t^i - \overline{n}^i)^3}{(Volatility^i)^{\frac{3}{2}}}$$

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  - Data: on average establishment growth is negatively skewed over time

$$\frac{1}{N}\sum_{i=1}^{N} Skewness^i = -0.5$$

  - no evidence of time-series skewness in individual TFP innovations ω_t^i

Table: Time-series volatility and skewness of a typical establishment

	Variable		
Skewness	$d\log(TFP_t^i)$	ω_t^i	n_t^i
Unweighted	-0.05	-0.02	-0.18
Employment-weighted	-0.12	-0.04	-0.50

Empirical test for asymmetric responses

- Model-based test: does establishment's employment growth respond asymmetrically to signals about future shocks?
- Estimate establishment-level TFP z_t^i and recover TFP innovations ω_t^i
- Current unobserved signals show up in average future innovations

$$n_t^i = \alpha + \beta_{pos}\omega_{t+1}^i + \beta_{neg}\omega_{t+1}^i \mathbb{1}\{\omega_{t+1}^i < 0\} + \theta X_t^i + c^i + y_t + \epsilon_t^i$$

  - Estimates: $\widehat{\beta}_{pos} = +0.025^{***}$ $\widehat{\beta}_{neg} = +0.099^{***}$
    A typical *positive* TFP shock increases employment by 0.5%.
    A typical *negative* TFP shock decreases employment by 2.5%.

- Could it be frictions? Hiring/firing cost?
  $\Rightarrow$ evidence on hiring frictions suggests only small role Hiring cost

Model candidates for asymmetry

1. Physical adjustment cost
2. Information processing
   - firm decision makers are ambiguous about quality of signals:

$$s_t^i = z_t^i + \sigma_{\varepsilon,t}\varepsilon_t^i; \quad \sigma_{\varepsilon,t} \in [\underline{\sigma}_\varepsilon, \overline{\sigma}_\varepsilon]$$

   - hiring decision based on 'worst case' expected profits
   - expected profits depend on signal's precision
   - worst-case precision: high for bad news, low for good news

$$n_t^i = \gamma_t^* s_t^i; \qquad \gamma_t^* \equiv \frac{var(z_t^i)}{var(z_t^i) + \left(\sigma_{\varepsilon,t}^*\right)^2} = \begin{cases} \overline{\gamma} & \text{if } s_t^i < 0 \\ \underline{\gamma} & \text{if } s_t^i \geq 0 \end{cases}$$

- How to distinguish?:
  - proxies for physical adjustment cost
  - asset prices: ambiguity implies predictable excess returns

Conclusion

- Objective: endogenous joint changes in distributions
  - volatility and skewness in aggregate and firm-level employment growth
  - from symmetric and homoskedastic shocks
  - model of asymmetric decision rules
- Key mechanism
  - firms receive dispersed noisy signals
  - firms optimally respond more to bad than to good signals
- The asymmetric response generates:
  - countercyclical aggregate and cross-section
  - negative skewness in the time-series and cross-section
  - model's key properties consistent with micro and macro data

Appendix: Asymmetric responses & hiring costs

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Sample	ASM
Firms w/ pos. shock	$+0.5\%^{***}$
	(0.1%)
Firms w/ pos. shock & hiring constraint	
Firms w/ neg. shock	$-2.5\%^{***}$
	(0.3%)
N	1,416k

Back to Estimates

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$$n_t^i = \alpha + \beta_{pos}\omega_{t+1}^i + \beta_{cstr}\omega_{t+1}^i \mathbb{1}\{\omega_{t+1}^i > 0\} + \beta_{neg}\omega_{t+1}^i \mathbb{1}\{\omega_{t+1}^i < 0\} + \ldots$$

Sample	ASM	PCU
Firms w/ pos. shock	$+0.5\%^{***}$	$+0.7\%^{***}$
	(0.1%)	(0.2%)
Firms w/ pos. shock & hiring constraint		-0.2%
		(0.4%)
Firms w/ neg. shock	$-2.5\%^{***}$	$-2.8\%^{***}$
	(0.3%)	(0.8%)
N	1,416k	116k

Back to Estimates