“Sectoral Price Data and Models of Price Setting”

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Objectives of the paper:

- Establish stylized facts about the dynamics of sectoral prices by estimating a statistical model
- Contrast the predictions of the rational-inattention pricing model with those of the Calvo and sticky-information models.

Statistical Model

$$\pi_{nt} = \pi_{nt}^A + \pi_{nt}^S$$

$$\pi_{nt}^A = a_n(L)u_t$$

$$\pi_{nt}^S = b_n(L)\nu_{nt}$$

$u_t \sim N(0,1)$: "aggregate shock"

$\nu_{nt} \sim N(0,1)$: pairwise independent, independent of u_t, "sector-specific shock"

Stylized Fact (1)

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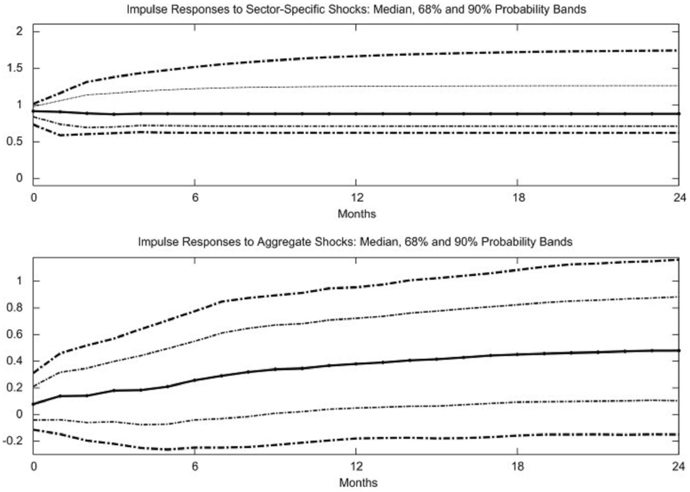

Stylized Fact (2)

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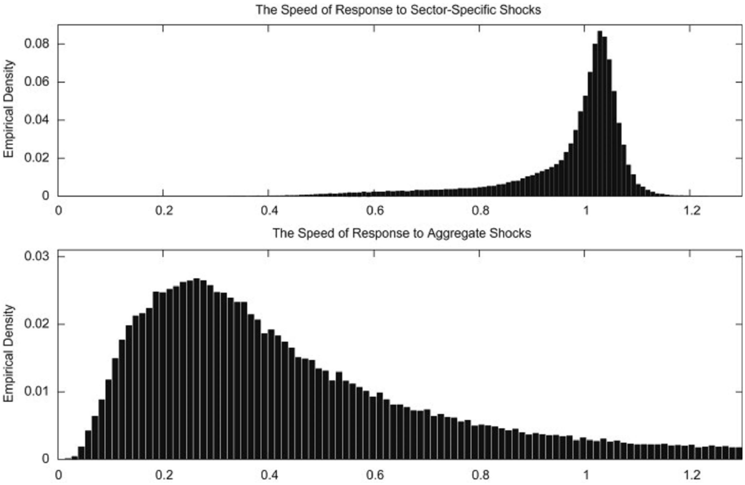


Stylized Fact (3)

$$corr\big(\text{the speed of price response in sector n to a shock of type K}, std(\pi_{nt}^{K})\big) > 0$$

for K = A and S

(FYI: $std(\pi_{nt}^{S}) >> std(\pi_{nt}^{A})$ for most sectors)

Model: Environment

- Discrete Time, Infinite Horizon.
- A continuum of sectors of mass one, indexed by $n \in [0, 1]$.
- Within each sector, a continuum of firms of mass one, indexed by $i \in [0, 1]$.

Model: Firms

- A partial equilibrium model of firms
- $C_{int} = (\frac{P_{int}}{P_{nt}})^{-\theta}(\frac{P_{nt}}{P_t})^{-\eta}C_t$, ($\theta > 1$ and $\eta > 1$)
- $Y_{int} = Z_{nt}L_{int}^{\alpha}$, ($\alpha \in (0,1]$) and $Y_{int} = C_{int}$
- C_t and Z_{nt} are exogenous.
- $\bar{p}_{int}$: (log of) profit-maximizing price implied by C_t and Z_{nt}
- $\bar{p}_{int} = \bar{p}_{int}^{A} + \bar{p}_{int}^{S}$

Model: Firms

- At $t = 0$, firm chooses precision of $\{s_{int}\}_{t=0}^{\infty}$ ("signal")
- At each $t \geq 1$, firm chooses p_{int} to minimize $E[\Pi(\bar{p}_{int}) - \Pi(p_{int})|s_{in}^t]$
- $E[\Pi(\bar{p}_{int}) - \Pi(p_{int})|s_{in}^t] \cong ... = const. * E[(\bar{p}_{int} - p_{int})^2|s_{in}^t]$
- $p_{int} = E[\bar{p}_{int}|s_{in}^t]$

Model: $\{\bar{p}_{int}\}_{t=0}^{\infty}$ and $\{s_{int}\}_{t=0}^{\infty}$

$$\bar{p}_{int} = \bar{p}_{int}^{A} + \bar{p}_{int}^{S}$$

$$\begin{pmatrix} \bar{p}_{int}^{A} \\ \bar{p}_{int}^{S} \end{pmatrix} = \begin{pmatrix} \bar{p}_{int-1}^{A} \\ \bar{p}_{int-1}^{S} \end{pmatrix} + \begin{pmatrix} \sigma_A u_t \\ \sigma_S \nu_{nt} \end{pmatrix}$$

$$u_t \sim N(0,1) \;\; \& \;\; \nu_{nt} \sim N(0,1)$$

u_t, independent of ν_{nt} for all n and s

$$s_{int} = \begin{pmatrix} s_{int}^{A} \\ s_{int}^{S} \end{pmatrix} = \begin{pmatrix} \bar{p}_{int}^{A} \\ \bar{p}_{int}^{S} \end{pmatrix} + \begin{pmatrix} \sigma_\epsilon \epsilon_{int} \\ \sigma_\psi \psi_{int} \end{pmatrix}$$

$$\epsilon_{int} \sim N(0,1) \;\; \& \;\; \psi_{int} \sim N(0,1)$$

ϵ_{int}, independent of ψ_{jms} for all j, m, s

Model: Firm's Problem at $t = 0$

$$\min_{(\sigma_\epsilon, \sigma_\psi) \in \mathbb{R}^2_+} \quad E[\sum_{t=1}^{\infty} \beta^t (p_{int} - \bar{p}_{int})^2]$$

subject to

(i) $\{\bar{p}_{int}\}_{t=0}^{\infty}$, $\{s_{int}\}_{t=0}^{\infty}$

(ii) $p_{int} = E[\bar{p}_{int} | s_{in}^t] \quad \forall \quad t \geq 1$

(iii) $\underbrace{H(\bar{p}_{int}^A | s_{in}^{t-1}) - H(\bar{p}_{int}^A | s_{in}^t)}_{\kappa_A} + \underbrace{H(\bar{p}_{int}^S | s_{in}^{t-1}) - H(\bar{p}_{int}^S | s_{in}^t)}_{\kappa_S} \leq \kappa$ for all $t = 1, 2, \ldots$

(iv) s_{in0} satisfies $Var\left(\left(\begin{array}{c} \bar{p}_{in1}^A \\ \bar{p}_{in1}^S \end{array} \right) | s_{in0} \right) = \lim_{t \to \infty} Var\left(\left(\begin{array}{c} \bar{p}_{int}^A \\ \bar{p}_{int}^S \end{array} \right) | s_{int-1} \right)$

Model: Characterizing the Solution

Can rewrite the firm's problem as

$$\min_{(\kappa_A,\kappa_S)\in\mathbb{R}^2_+} \quad \frac{\beta}{1-\beta}\left(\frac{\sigma_A^2}{2^{2\kappa^A}-1}+\frac{\sigma_S^2}{2^{2\kappa^S}-1}\right)$$

$$\text{s.t. } \kappa_A+\kappa_S \le \kappa$$

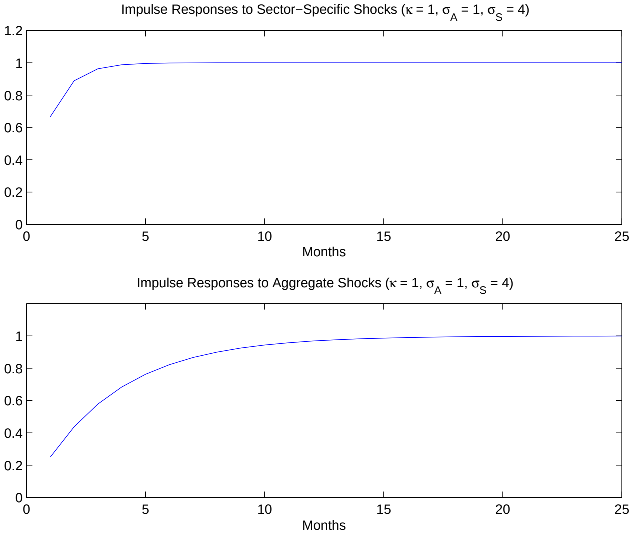
$$\Rightarrow \frac{2^{\kappa_S}-2^{-\kappa_S}}{2^{\kappa_A}-2^{-\kappa_A}}=\frac{\sigma_S}{\sigma_A}$$

Model: Characterizing the Solution

$$\left.\begin{array}{r}\sigma_S > \sigma_A \Rightarrow \kappa_S > \kappa_A \\ \bar{p}_{nt} - p_{nt} = \sum_{j=0}^{\infty}[(\frac{1}{2^{2\kappa_A}})^{j+1}\sigma_A u_{t-j}] + \sum_{j=0}^{\infty}[(\frac{1}{2^{2\kappa_S}})^{j+1}\sigma_S \nu_{t-j}]\end{array}\right\} \Rightarrow \text{stylized facts (1) and (3)}$$

speed of response to a shock of type K as a function of σ_K is concave for k = S and A $\Rightarrow$ stylized fact (2)

Model: Predicting Stylized Fact (1)



Model: Predicting Stylized Fact (2)