Spending Allocation under Nominal Uncertainty: A Model of Effective Price Rigidity

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The Paper in a Nutshell

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⋆ A demand-driven mechanism of **aggregate** countercyclical markups...

...with fixed (but increasing with Hs' unc.) firm-level markups.

Related Literature

- **Consumers' search in GE**: Coibion, Gorodnichenko, and Hong (AER, 2015); Kaplan and Menzio (JPE,2016)
  - Them: real determinants (unemployment) of search cost;
  - Us: real search cost are fixed, nominal shocks influence exp. payoffs;
- **Extensive margins**: Phelps and Winter (1970), Rotemberg and Woodford (1999), Paciello, Pozzi, and Trachter (IER, 2019), Michelacci, Paciello, Pozzi (2020) - No nominal uncertainty;
- **Learning from Prices (IO)**: Fishman (QJE, 1996), Benabou and Gertner (REStud,1993), Janssen and Shelegia (AER, 2015) - No heterogeneous costs of search, infinite demand elasticity;
- **Learning from Prices - Uncertainty (Macro)**:Lucas (AER, 1972), Amador and Weill (JPE, 2010), Gaballo (REStud, 2018), Chahrour and Gaballo (REStud, forth.) - Learning from competitive prices: no signaling power;
- **Households' uncertainty**: Angeletos and La' O (JPE, 2020); Farhi and Werning (AER, 2019); Gabaix (AER, 2020); McKay, Nakamura and Steinsson (AER, 2016) etc... + Mackowiak and Wiederholt (ReStud, 2015) - Non-neutrality relies anyway on firms' rigidity.

Outline

- Model
- Demand-Driven Business Cycles
  - Aggregate Counter-Cyclical Markup
  - Firm-level Markups: A-cyclical but Endogenous to Hs' Uncertainty
  - Welfare
- Empirics: a test of inflation-driven shopping reallocation
- Extensions
  - Households' vs Local Firms' Uncertainty
  - Targeted Communication
  - Local Varieties
  - Firms' Common Uncertainty (sticky prices)

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Elements of the model

- Two markets for goods: local (markups > 0) and competitive (no markups)
- Hs exert shopping effort to buy in competitive markets
  - drive to distant locations (Walmart vs local Safeway)
  - search info about local markets on temporary sale
  - search info to arbitrage across shops for different varieties
  - behavioral/psycological, shopping habits
- Local productivity blurs the correlation of local prices with aggregate nominal shocks
- When deciding on shopping effort Hs forecast inflation with local prices
  $\rightarrow$ firms set prices without any friction

Model: Households

Household $i \in [0,1]$ on island $j \in [0,1]$:

$$E\left[\sum_{\tau=t}^{\infty} \beta^{\tau-t} \left(\frac{c_{ij\tau}^{1-\frac{1}{\gamma}}}{1-\frac{1}{\gamma}} - \varphi \ell_{ij\tau} - \psi_{ij}\, s_{ijt} \right) \Big| \Omega^u_{i,j,t} \right] \tag{1}$$

with shopping effort cost ψ_{ij}, with $s_{ijt} \in \{0,1\}$.

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with shopping effort cost ψ_{ij}, with $s_{ijt} \in \{0,1\}$. Her budget set is:

$$c_{ijt}\, \mathcal{P}(s_{ijt}) + R_t^{-1} b_{ijt} = W_t \ell_{ijt} + b_{ijt-1} - T_t \quad (2)$$

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where ψ_{ij} is distributed as in a generalized Pareto

$$G(\psi) = 1 - \kappa\left(1 - \frac{\psi}{\Psi}\right)^{\frac{\lambda}{\gamma-1}},$$

with $\kappa > 0, \lambda > 0$, and $\Psi = \frac{\varphi^{\gamma-1}}{\gamma-1}$ with support

$$[\underline{\psi}, +\infty] \text{ with } \gamma \le 1 \qquad\qquad [\underline{\psi}, \Psi + \underline{\psi}] \text{ with } \gamma > 1$$

where $\underline{\psi}$ such that $G(\underline{\psi}) = 0$.

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Model: Timing

Shocks and prices
P_t and p_{jt} realize

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Stage 1,

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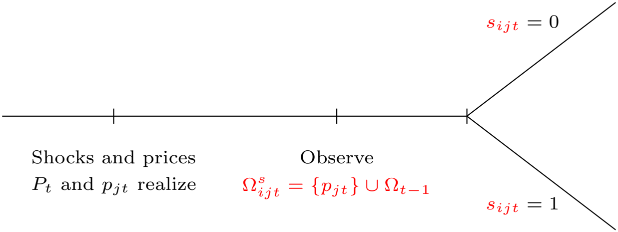
Observe
$\Omega^s_{ijt} = \{p_{jt}\} \cup \Omega_{t-1}$

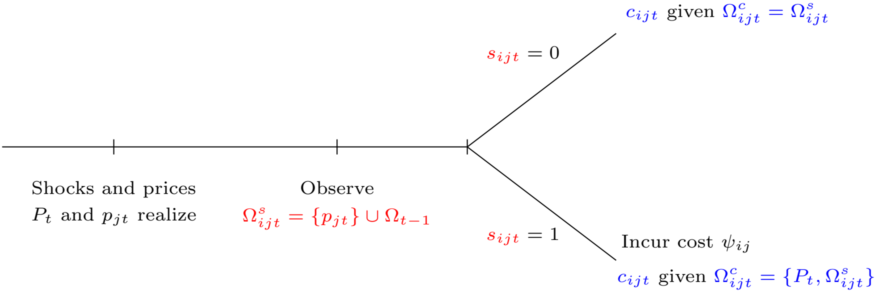
Model: Timing

Stage 1,



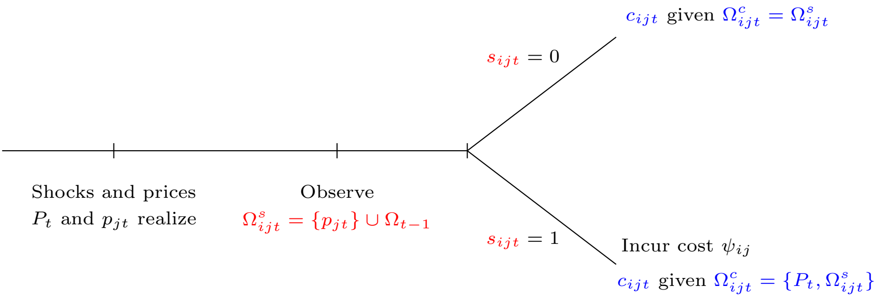
Model: Timing

Stage 1, Stage 2,



Model: Timing

Stage 1, Stage 2, Stage 3



$\{\ell_{ijt}, b_{ijt}\}$ in centralized markets $\Rightarrow$ full info $\Omega_t = \{P_t, \Omega_{t-1}\}$.

Model: Firms

- *Distant* competitive firms : linear technology in labor, thus

$$P_t = W_t \tag{3}$$

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$$P_t = W_t \tag{3}$$

- *Local* heterogeneous monopolist : maximize real profits under full info

$$\max_{p_{jt}} \left\{ \underbrace{\mathcal{N}(p_{jt})\,\mathcal{C}(p_{jt})}_{D(p_{jt})} \left(\frac{p_{jt}}{W_t} - z_{jt} \right) \right\} \tag{4}$$

where :

- $\ln z_{jt} \sim N(z, \sigma_z)$ are i.i.d. productivity shocks
- $\mathcal{N}(p_{jt}) \subset (0,1)$ is the mass of agents buying local
- $\mathcal{C}(p_{jt})$ denotes individual local consumption

Model: Aggrgeate Shocks and Monetary Policy

- $\Pi_t \equiv P_t/P_{t-1} = W_t/W_{t-1}$, because of (**??**).

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- Monetary Policy implements a standard Taylor rule

$$R_t = \beta^{-1} \left(\Pi_t \, e^{-\pi_t^w} \right)^{\phi} \tag{5}$$

setting T_t accordingly, with $\phi > 1$, where $\pi_t^w \sim N(0, \sigma_{\pi^w}^2)$ represents a stochastic inflation target.

Equilibrium Definition

Definition

Given the past price level and inflation $\{P_{t-1}, \Pi_{t-1}\}$ and a distribution of bond holdings $\{b_{ijt-1}\}_{i,j\in[0,1]\times[0,1]}$, the realizations of aggregate and idiosyncratic shocks, π_t and $\{z_{jt}\}_{j\in[0,1]}$ respectively, a *log-normal equilibrium* is a collection of log-normally distributed prices $\{P_t, W_t, R_t, \{p_{jt}\}_{j\in[0,1]}\}$, and quantities $\{s_{ijt}, c_{ijt}, b_{ijt}, \ell_{ijt}\}_{i,j\in[0,1]\times[0,1]}$ at time t such that:

- in each island j, each household i chooses $\{s_{ijt}, c_{ijt}, b_{ijt}, \ell_{ijt}\}$ to maximize the expected utility (**??**) subject to the sequence of budget constraints in (**??**);
- s_{ijt} and c_{ijt} are chosen first, according to the infromation sets Ω^s_{ijt} and Ω^c_{ijt} respectively, b_{ijt} and ℓ_{ijt} are chosen at the end of the period under perfect information;
- in each island j, p_{jt} solves the firm problem in (**??**);
- W_t and P_t are determined, respectively, by equations (**??**) and (**??**);
- R_t and T_t guarantee the equilibrium in the bond market, consistently with the monetary policy rule in (**??**);
- $\int s_{ijt} di > 0$ holds almost surely in all islands.

A non-trivial fixed point: demand elasticity along extensive margins influence pricing, in turn pricing influences shopping choices by affecting Hs' expectations on p_{jt}/P_t.

Markets open sequentially. At time t, H chooses:

STAGE 1 $s_{ijt} = 0$ iff:

$$E\left[V_{jt}(\psi_{ij};0) - V_{jt}(\psi_{ij};1) \mid \{p_{jt}\}\right] \geq 0.$$

i.e. iff $\psi_{ij} > \hat{\psi}_{jt}$, with $\hat{\psi}_{jt}$ being an equilibrium object.

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STAGE 2 Consumption c_{ijt}:

$$c_{ijt}^{-\frac{1}{\gamma}} = \varphi\, E\left[\frac{\mathcal{P}(s_{ijt})}{W_t} \,\middle|\, \{\mathcal{P}(s_{ijt}), p_{jt}\}\right].$$

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STAGE 3 Labor ℓ_{ijt} and Bonds b_{ijt}:

$$1 = \beta\, R_t\, E_t\left[\frac{W_t}{W_{t+1}} \,\middle|\, \{\mathcal{P}(s_{ijt}), p_{jt}, W_t,\, R_t\}\right].$$

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Monetary Policy implies

$$\pi_t = \frac{1}{\phi} E_t\left[\pi_{t+1} | \{\mathcal{P}(s_{ijt}), p_{jt}, W_t,\ R_t\}\right] + \pi_t^w$$

and finally

$$\pi_t = \pi_t^w$$

as $[\{\mathcal{P}(s_{ijt}), p_{jt}, W_t,\ R_t\}]$ does not contain info about π_{t+1}^w.

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$\star$ the mass of households purchasing in island j is given by

$$\mathcal{N}_{jt}(p_{jt}) = \kappa^{\frac{\lambda}{\gamma-1}}\, e^{-\lambda\left(\ln p_{jt} - E\left[\ln P_t \,|\, \Omega^s_{jt}\right] + \frac{1}{2}\mathcal{S}\right)},$$

with $\hat{\psi}_{jt} = \frac{\Psi}{\kappa}[1 - e^{(1-\gamma)\left(\ln p_{jt} - E\left[\ln P_t \,|\, \Omega^s_{jt}\right] + \frac{1}{2}\mathcal{S}\right)}] \geq 0$ for any j almost surely;

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$\star$ the consumption of household i initially matched to a island j is

$$c_{ijt} = \begin{cases} \mathcal{C}_{jt}(p_{jt}) \equiv C^*\, e^{-\gamma\left(\ln p_{jt} - E\left[\ln W_t \,|\, \Omega^s_{jt}\right] + \frac{1}{2}\mathcal{S}\right)} & \text{if } \psi_{ij} > \hat{\psi}_{jt} \\ C^* \equiv \varphi^{-\gamma} & \text{otherwise} \end{cases};$$

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$\star$ the optimal price posted by the monopolistic firm in island j is

$$p_{jt} = \underbrace{\frac{(\gamma+\lambda)(1-\omega)}{(\gamma+\lambda)(1-\omega)-1}}_{\mu} \times \frac{W_t}{z_{jt}},$$

provided z is suff. large relative to σ_z, and $(\gamma+\lambda)(1-\omega) > 1$.

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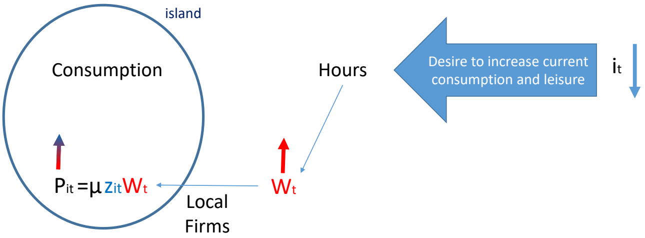

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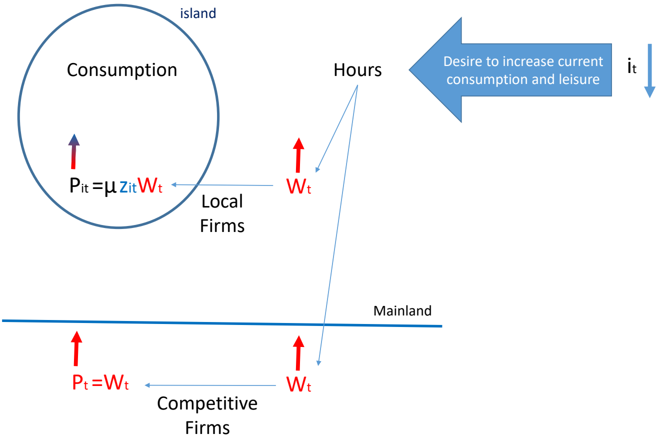

Two types of firms: local (high markup) and competitive (low/no-markup)

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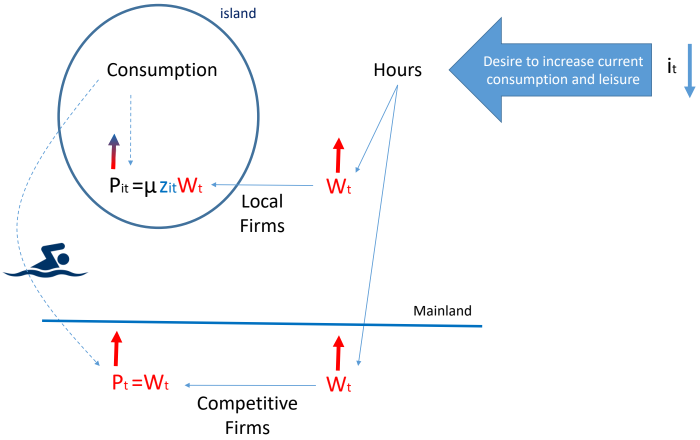

Two types of firms: local (high markup) and competitive (low/no-markup)

Real rigidity: Shopping costs individual-specific effort.

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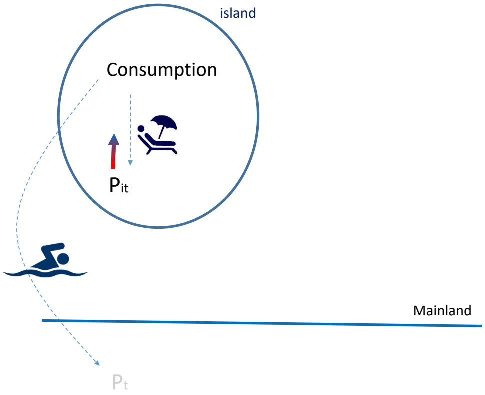

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Info rigidity: Shopping choice conditional to local prices only.

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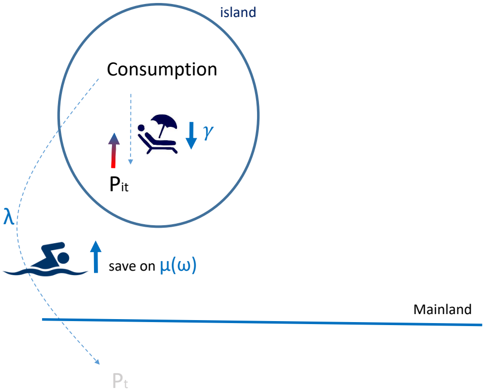

Conditional to an aggregate nominal shock:

- swimmers: ↑ consumption due to ↓ markup ⇒ ***effective* price rigidity**

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Demand-Driven Business Cycle Fluctuations

Agg. consumption (switchers + non-switchers) of agents type j:

$$C_{jt} - C^* = \underbrace{\mathcal{N}(p_{jt})}_{\substack{\text{mass of local buyers} \\ \downarrow \text{ with } P_t \\ \text{less positive}}} \times \underbrace{(\mathcal{C}(p_{jt}) - C^*)}_{\substack{\text{local consumption loss} \\ \downarrow \text{ with } P_t \\ \text{more negative}}}$$

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In particular:

$$\ln C_t - \ln \bar{C} \approx [\lambda\, \mu(\omega)^\gamma - \lambda - \gamma]\, \bar{\alpha}\, (1-\omega)\, \pi_t,$$

with $\bar{\alpha}$ denoting the steady state share of expenditure in the local market, and $\bar{C}$ steady state aggregate consumption.

Demand-Driven Business Cycle Fluctuations

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$$C_{jt} - C^* = \underbrace{\mathcal{N}(p_{jt})}_{\substack{\text{mass of local buyers} \\ \downarrow \text{ with } P_t \\ \text{less positive}}} \times \underbrace{(\mathcal{C}(p_{jt}) - C^*)}_{\substack{\text{local consumption loss} \\ \downarrow \text{ with } P_t \\ \text{more negative}}}$$

In particular:

$$\ln C_t - \ln \bar{C} \approx [\lambda\, \mu(\omega)^\gamma - \lambda - \gamma]\, \bar{\alpha}\, (1-\omega)\, \pi_t,$$

with $\bar{\alpha}$ denoting the steady state share of expenditure in the local market, and $\bar{C}$ steady state aggregate consumption.

⋆ N.B.: With $\lambda = 0$ the comovement would be negative!

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- This is why firms must be bad compared to Hs in the NK framework.

Aggregate Countercyclical Markup

The effective average markup:

$$\mathcal{M}_t^{eff} \equiv \frac{P_t^{eff}}{W_t} = 1 + \alpha_t \, (\mu - 1) \, ,$$

where α_t denotes the market share of local sellers and is given by

$$\alpha_t = \frac{\bar{\mathcal{N}} \, \bar{\mathcal{C}} \, e^{-(\lambda+\gamma)\,(1-\omega)\pi_t}}{1 - \bar{\mathcal{N}} \, e^{-\lambda\,(1-\omega)\pi_t} + \bar{\mathcal{N}} \, \bar{\mathcal{C}} \, e^{-(\lambda+\gamma)\,(1-\omega)\pi_t}}.$$

where $\bar{\mathcal{C}}$, $\bar{\mathcal{N}}$ denote steady states values.

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where $\bar{\mathcal{C}}$, $\bar{\mathcal{N}}$ denote steady states values.

α_t co-moves negatively with π_t, in fact:

$$\ln \alpha_t - \ln \bar{\alpha} \approx - \left[\bar{\alpha} \, \lambda \, \mu^{\gamma} + (1 - \bar{\alpha}) \, (\gamma + \lambda) \right] \, (1 - \omega) \pi_t$$

where $\bar{\alpha}$ is the value of α_t at $\pi_t = 0$.

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The aggregate markup is countercyclical.

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The aggregate markup is countercyclical.

Let us now turn to how ω shapes μ

Learning from Prices and Local Markups

$\rightarrow$ ω denotes the elasticity of Hs' inflation exp. w.r.t. local prices.

$$E[\pi_t \,|\, \Omega_t^s] = \underbrace{\frac{\sigma_z^{-2}}{\sigma_\pi^{-2} + \sigma_z^{-2}}}_{\omega} \left(\ln p_{jt} \,-\, E[\ln p_{jt} | \Omega_{t-1}] \right).$$

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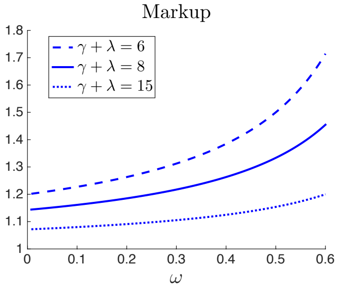
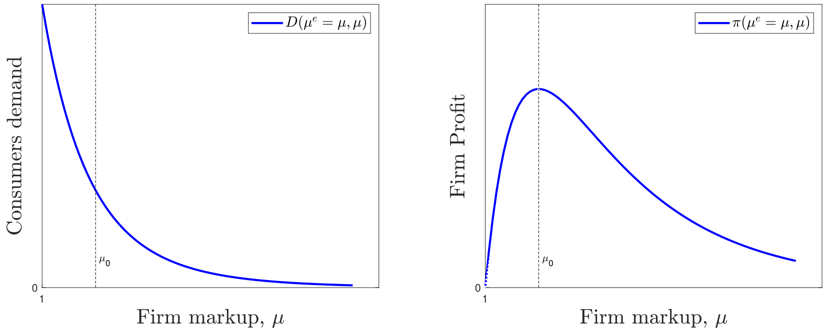


The optimal markup set by firm j is endogenous but time/state-invariant:

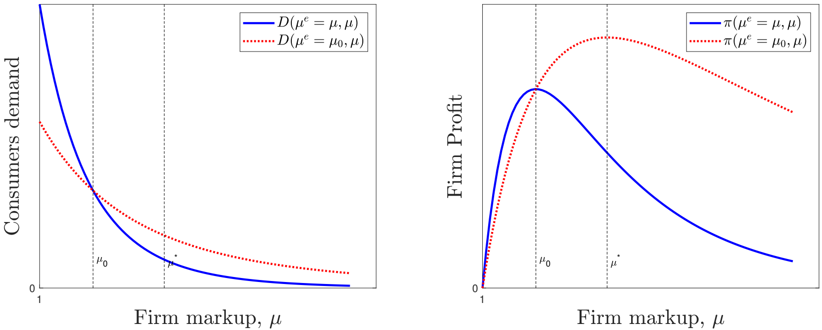
$$\mu(\omega) = \begin{cases} \frac{(\gamma+\lambda)(1-\omega)}{(\gamma+\lambda)(1-\omega)-1} & \text{with} \quad \omega < \frac{\gamma+\lambda-1}{\gamma+\lambda}, \\ +\infty & \text{with} \quad \omega \geq \frac{\gamma+\lambda-1}{\gamma+\lambda}, \end{cases}$$

Confusion and discretion in pricing



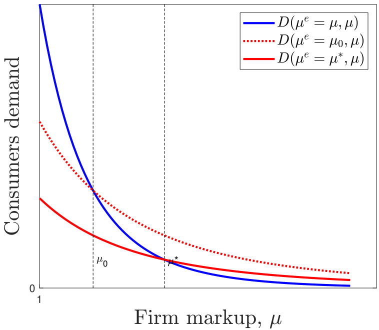
Without any signaling power we have the standard firm problem.

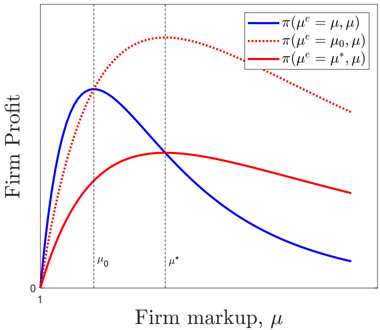
Confusion and discretion in pricing



Signalling power induces firms to increase their markups.

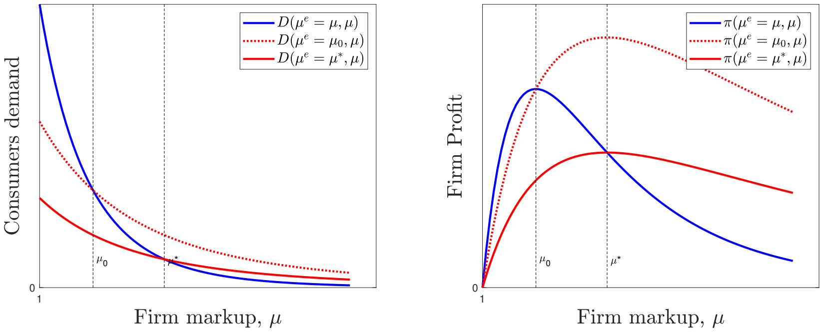
Confusion and discretion in pricing





However, as Hs anticipate μ^*, their demand shifts down!

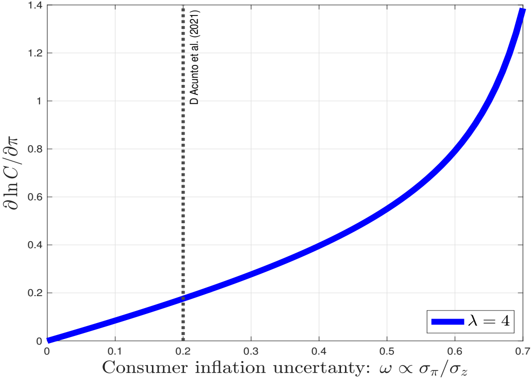
Confusion and discretion in pricing



Signaling power creates a commitment problem, hurting firms' profits.

Demand-Driven Business Cycle Fluctuations

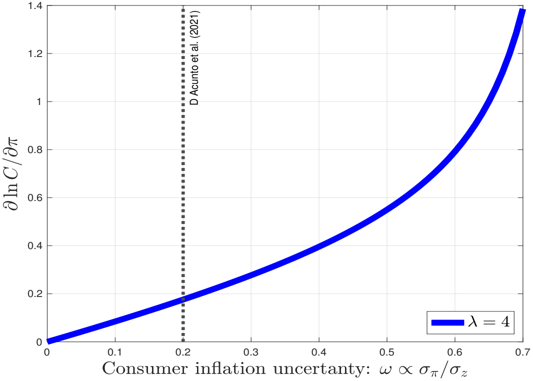
Figure: The consumption-inflation comovement



dashed : $(\gamma = 1, \omega = 0) \Rightarrow [\lambda\, \mu(\omega)^{\gamma} - \lambda - \gamma] = 0$

Demand-Driven Business Cycle Fluctuations

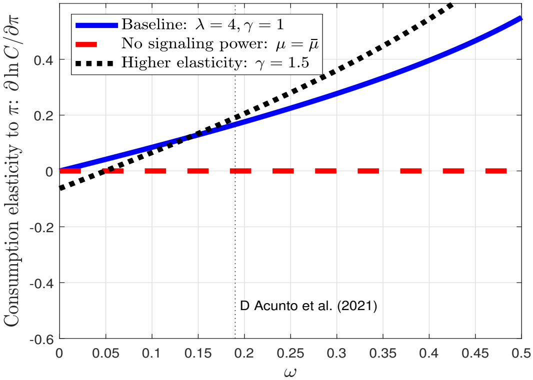
Figure: The consumption-inflation comovement



$$\text{solid : } (\gamma = 1, \omega > 0) \Rightarrow [\lambda\, \mu(\omega)^\gamma - \lambda - \gamma] > 0$$

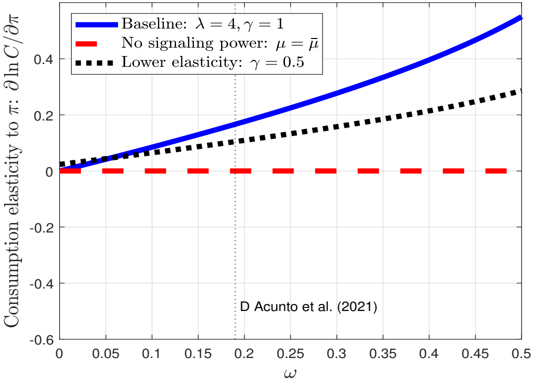
Demand-Driven Business Cycle Fluctuations

Figure: The consumption-inflation comovement



$$\text{dotted}: \; (\gamma = 1.5, \omega > \bar{\omega}) \Rightarrow [\lambda\, \mu(\omega)^{\gamma} - \lambda - \gamma] > 0$$

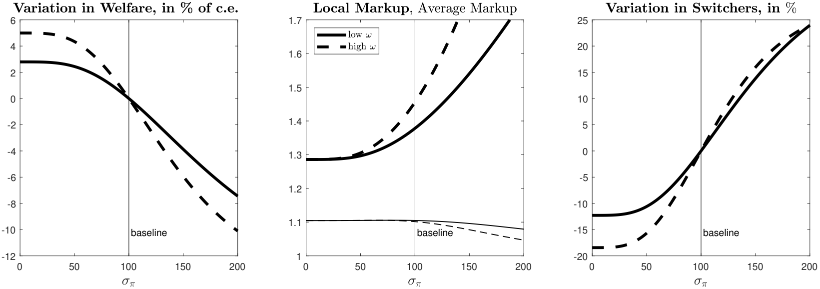
FIGURE: The consumption-inflation comovement



$$\text{dotted}: \ (\gamma = 0.5, \omega \geq 0) \Rightarrow [\lambda \, \mu(\omega)^{\gamma} - \lambda - \gamma] > 0$$

Welfare and Policies of Uncertainty Reduction

$$\uparrow \text{inflation volatility} \quad \Rightarrow \quad \uparrow \omega = \frac{1}{1+\frac{\sigma_z^2}{\sigma_\pi^2}} \quad \Rightarrow \quad \uparrow \mu$$



Note: The figure shows how welfare varies with σ_π^2. The vertical dotted line corresponds to the baseline value of $\sigma_\pi = 0.35\%$. Welfare is calculated in equivalent consumption growth with respect to baseline consumption. We fixed $\gamma = .5, \lambda = 4$ and $\varphi = 1$. Calibration is such that at baseline, $\rho = 0.1$ and $\omega = 0.29$ for the dashed line and $\omega = 0.19$ for the solid line.

Outline

- Model
- Demand-Driven Business Cycles
  - Aggregate Counter-Cyclical Markup
  - Firm-level Markups: A-cyclical but Endogenous to Hs' Uncertainty
  - Welfare
- Empirics: a test of inflation-driven shopping reallocation
- Extensions
  - Households' vs Local Firms' Uncertainty
  - Targeted Communication
  - Local Varieties
  - Firms' Common Uncertainty (sticky prices)

Empirics: Effective vs Posted Inflation

- **effective inflation**: π_t^{eff} effective per unit price
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- **inflation gap** $\pi_t^{eff} - \pi_t^{pos}$ from spending reallocation
  - covariance with inflation: 0 in NK fig NK;
  - $\neq 0$ in our model

$$\pi_t^{eff} - \pi_t^{pos} \approx -\bar{\alpha}\,(\mu - 1)\,\underbrace{\left[\bar{\alpha}\,\lambda\,\mu^{\gamma} + (1-\bar{\alpha})\,(\lambda+\gamma)\right]}_{\log \alpha_t - \log \bar{\alpha}}\,(1-\omega)\,\pi_t.$$

  - < 0 if households less informed than firms

Data

- Information Resources Inc. ("IRI"), weekly price and quantity information 2001-2011 on items (UPC $\times$ Store $\times$ Market).

- Method: Coibion et al. (AER15), Gagnon et al. (AER17)

- Effective vs Posted price and inflation for UPC j in market m:

$$p_{mj,t}^{eff} = \frac{\sum_{s \in S_m} TR_{mjs,t}}{\sum_{s \in S_m} TQ_{mjs,t}} \implies \pi_{mj,t}^{eff} = \ln p_{mj,t}^{eff} - \ln p_{mj,t-1}^{eff}$$

$$p_{mj,t}^{pos} = \sum_{s \in S_m} \bar{w}_{msj} \frac{TR_{mjs,t}}{TQ_{mjs,t}} \implies \pi_{mj,t}^{pos} = \ln p_{mj,t}^{pos} - \ln p_{mj,t-1}^{pos}$$

- Average over j within category c and market m, monthly:

$$\pi_{mc,t}^{eff} = \frac{1}{J} \sum_{j \in c} \pi_{mj,t}^{eff} \quad \text{and} \quad \pi_{mc,t}^{pos} = \frac{1}{J} \sum_{j \in c} \pi_{mj,t}^{pos}$$

- Average over c within market m, monthly: $\pi_{m,t} = \frac{1}{N_c} \sum_{c \in S_m} \pi_{mc,t}^{pos}$.

Effective vs Posted Inflation

$\pi^{eff}_{m,t} - \pi^{pos}_{m,t}$	(1)	(2)	(3)	(4)	(5)
			CGH's sample		
Inflation, $\pi_{m,t}$	-0.22^{***}		-0.24^{***}		
	(0.060)		(0.06)		
Unemployment, $u_{m,t}$		-0.12^{***}	-0.14^{***}		
		(0.034)	(0.035)		
FFR shock, ϵ_t				0.04^{***}	0.04
				(0.007)	(0.064)
			GLSS's sample		
Inflation, $\pi_{m,t}$	-0.09^{***}		-0.09^{***}		
	(0.028)		(0.029)		
Unemployment, $u_{m,t}$		0.03	0.015		
		(0.032)	(0.033)		
FFR shock, ϵ_t				0.03^{***}	0.08^{**}
				(0.004)	(0.032)
Robust S.E.	Yes	Yes	Yes	Yes	Yes
Stratum F.E.	Yes	Yes	Yes	Yes	Yes
Month F.E.	Yes	Yes	Yes	No	No

Note: We regress the gap between paid and posted price inflation in each stratum on the market specific inflation rate in columns (1) and (3), on the market specific unemployment rate in columns (2) an (3), on the FFR shocks obtained from Agrippino et al. (2015, 2016, 2018) with the narrative method in column (4) and high frequency method in column (5).

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An extended info structure

⋆ Local firms' uncertainty about inflation innovations:

$$E[\pi_t \,|\, \Omega^f_{jt}] = \delta\,(\pi_t + u_{jt})$$

so that $p_{jt} = \mu\, e^{E\left[\ln W_t \,|\, \Omega^f_{jt}\right] + \frac{1}{2}\mathcal{V} - \ln z_{jt}}$;

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⋆ Households' expectations are expressed as

$$E[\pi_t \,|\, \Omega^s_{jt}] = \rho\,(\pi_t + \nu_{jt}) + \omega\,(\ln p_{jt} - E[\ln p_{jt} | \Omega_{t-1}]),$$

where $\nu_{jt} \sim N(0, \sigma^2_\nu)$ and $u_{jt} \sim N(0, \sigma^2_u)$ i.i.d.

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where $\nu_{jt} \sim N(0, \sigma^2_\nu)$ and $u_{jt} \sim N(0, \sigma^2_u)$ i.i.d.

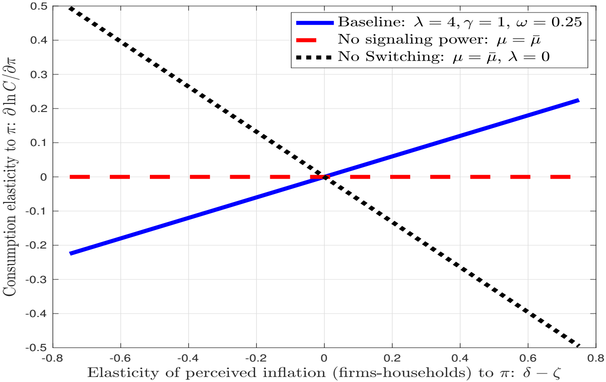
⋆ Households perceived real local price is

$$\int_0^1 \ln p_{jt} - E\left[\ln P_t \middle|\, \Omega^s_{jt}\right] dj = \ln \mu + \underbrace{(\delta - \zeta)}_{\text{info gap}}\,\pi_t.$$

where $\zeta \equiv \omega\delta + \rho$.

Information gap

Figure: The consumption-inflation comovement and the information gap



Note: We set σ_z/σ_π so that $\omega = 0.25$ and κ so that $\bar{\alpha} = 0.66$ in all simulations. We report the elasticity of consumption to an inflation shock at different combinations of λ and γ, and for different values of $\delta - \zeta$ on the horizontal axis obtained either by varying δ and/or ρ. In the baseline specification we use $\lambda = 4$ and $\gamma = 1$ (solid blue line). The red dashed line plots a counterfactual where $\mu = (\lambda+\gamma)/(\lambda+\gamma-1)$. The black dotted line also sets $\lambda = 0$.

Local Varieties

c_{ijt} is an aggregate over the X varieties,

$$c_{ijt} = X \left(\frac{1}{X} \sum_{x=0}^{X} c_{xijt}^{\frac{\epsilon-1}{\epsilon}} \right)^{\frac{\epsilon}{\epsilon-1}}$$

with $\epsilon > 1$ being the elasticity of substitution across varieties, whose price is:

$$p_{jt} = \left(\frac{1}{X} \sum_{n=0}^{N} p_{xjt}^{1-\epsilon} \right)^{\frac{1}{1-\epsilon}} .$$

Each local firm $x \in \{1, 2, ..., X\}$ chooses the price p_{xjt} that maximizes profits

$$p_{xjt} = \text{argmax}_p \, \mathcal{N}_{jt}(p) \, \mathcal{D}_{xjt}(p) \left(\frac{p}{W_t} - z_{jt} \right)$$

with $\mathcal{D}_{xjt}(p) = \int c_{xijt} \, di = c_{ijt} \left(\frac{p}{p_{jt}} \right)^{-\epsilon} di.$

In equilibrium, $\mu = \frac{\xi}{\xi-1}$ where

$$\xi = \left(1 - \frac{1}{X} \right) \epsilon + \frac{1}{X} (\gamma + \lambda)(1 - \omega).$$

Conclusions

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A *pencil-and-hand* model where:

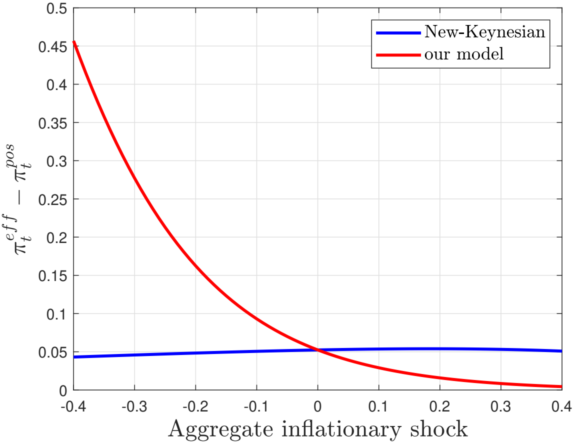
Demand-driven Countercyclical Aggregate Markup +

...but fixed firm-level markups!

Thanks

Appendix

R.3. The response of the inflation gap



With deflationary shocks consumers reallocate towards local markets to save shopping effort.

back

Micro-evidence on Markup Cyclicality

- **Macro models call for countercyclical markups**

  Bils, Klenow and Malin (2018): "Thus, countercyclical price markups deserve a central place in business-cycle research."

- **Micro evidence seems pointing towards a-cyclical markups**

  Anderson, Rebelo and Wong (2018): "markups are relatively stable over time and mildly procyclical";

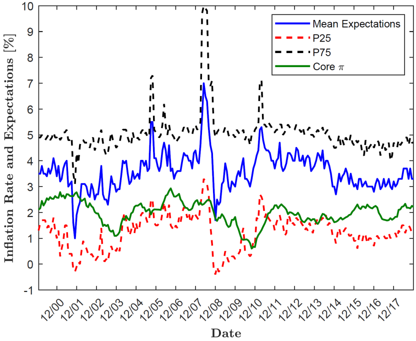
  Burstein, Carvalho and Grassi (2020): "exploiting different reduced-form measures of markup cyclicality, two researchers may arrive at opposing conclusions even within a single dataset."

Q: How to reconcile Macro call with Micro evidence?

back

How well households predict inflation?

Figure 5: **Inflation Expectations and Realized Core Inflation over Time**



Notes. This figure plots average inflation expectations over time from the Michigan Survey of Consumers together with the 25^{th} and 75^{th} percentiles as well as the realized core inflation rate for a sample period from January 2000 until December 2018.

Source: D'Acunto et al. (2019)

Three Facts on Expectations and Shopping

- **Shopping prices influence expectations**

  Expectation Survey Bank of England: first source of information

  D'Acunto, Malmendier, Ospina and Weber (2021): CPI Household ~ 0.2; CPI Frequency ~ 0.3

- **Arbitrage across shops: valuable but limited**

  Menzio and Kaplan (2016): visiting one additional store: $\sim -0.6\%$ Indiv-CPI; shopping concentrated: 2.3 shops visited on average per quarter

- **Expected[2] inflation less dispersed than experienced[1]**

  [1] Michigan Survey: inter. range 3.8%

  [2] Kaplan and Schulhofer-Wohl (2017): inter. range 7.3%

Q: how to reconcile the frictional household (micro) with output-inflation comovement (macro)?

back