Can Supply Shocks Be Inflationary with a Flat Phillips Curve?

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Introduction

- Two facts:
  1. **The Phillips curve (PC) is very flat**
     (Housing bubble, Great Recession, QE 1, 2, 3, 4, ...)
     (Del Negro et al. 2020; Hazell et al. 2020)
  2. **Supply shocks are inflationary**
     (1970s, now)
     (Kaenzig 2021; Bunn, Anayi, Bloom et al. 2022)

- Standard models can't account for these two facts
  - Flat PC $\Longrightarrow$ no inflation from supply shocks

- Shortcoming of Calvo, Taylor, Rotemberg, Menu Costs
  - NK model: unreasonable rise in costs (500% for 1% inflation)

What Do We Propose in This Paper?

- Data want a model where:
  1. prices are sticky when demand shifts
  2. prices are flexible when supply shifts

  $\longrightarrow$ shock dependence

- Contribution:
  Microfoundation for shock-dependent pricing friction

- Strategic interaction between firms and consumers:
  1. Firms able to pass on cost increases to consumers
  2. But they avoid increasing prices when demand increases
     Intuition: The 'undue increase in profits' problem

Idea for Shock-Dependent Microfoundation

- Firms have superior information about shocks
  - Some consumers are uninformed
  - Firms set a price
- Leads to strategic firm-consumer interaction
  (Hall & Hitch 1939; Okun 1981; Kahnemann et al. 1986; Greenwald & Stiglitz 1989; Blinder 1991; Rotemberg 2005; Nakamura & Steinsson 2011)
- **Firm incentives** are the source of the pricing friction

Demand Shock

- A discount factor shock
  - Changes aggregate nominal demand
- Firm is superiorly informed, some consumers uninformed
  - Issue: Firm has incentive to stimulate demand
    Price as "suggestion" of how much to spend
- Question: Can flexible prices be a PBE?
  - RESULT: If many consumers uninformed, not an equilibrium
  - Reason: Price increases are not credible
    $\Longrightarrow$ **strategic friction and stickiness**
  - Cutoff of price adjustment: fraction of informed
    (same as L'HUILLIER (2020), L'HUILLIER AND ZAME (2022))

Supply Shock

- A shock to firms' costs
- Same information structure
  - Notice: Shock not payoff-relevant to consumers!
    Firm cannot stimulate demand by raising the price
    No incentive to stimulate demand
- Question: Can flexible prices be a PBE?
  - Yes, for any amount of information among consumers
  - Reason: Price increases are credible
    Lead to lower demand, but necessary due to higher costs
    Higher price maximizes profits
    $\Longrightarrow$ **no strategic friction, flexible prices**

Justifying a Price Increase

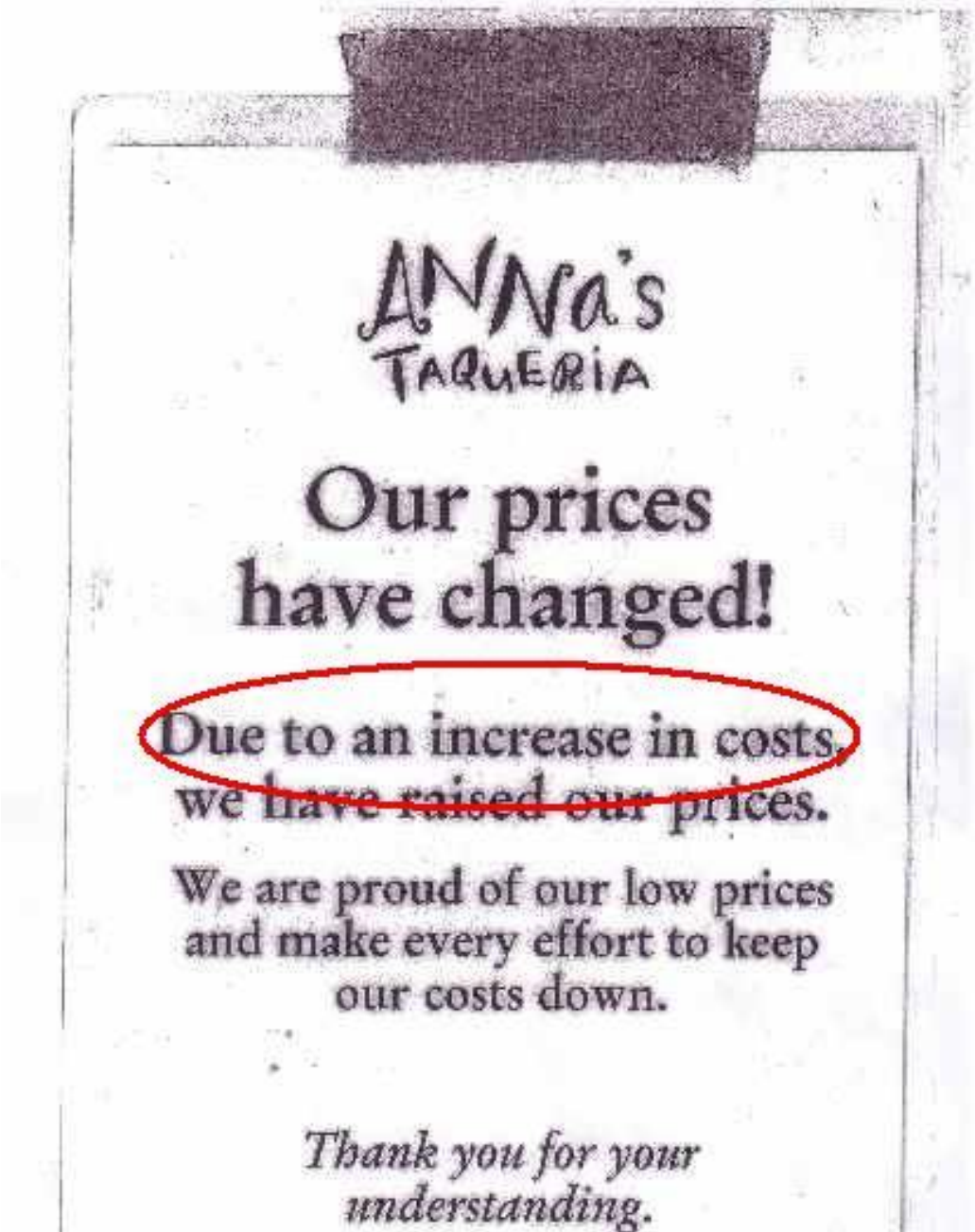


Illustration: Rescaling of Cost-Push Shocks

- NK Phillips curve

$$\widehat{\pi}_t = \beta \mathbb{E}_t[\widehat{\pi}_{t+1}] + \underbrace{\lambda \cdot e}_{\kappa} \widehat{x}_t + \lambda \widehat{\mu}_t$$

- Estimates for λ suggest pretty flat PC: $\lambda = 0.0020$
  (Del Negro et al. 2020; Hazell et al. 2020)

- Normalization $\nu_t \equiv \lambda \widehat{\mu}_t$:
  - For 1% inc. in $\widehat{\pi}_t$, need $\widehat{\mu}_t = 500\%$
    If ss. markup is 12.5%, desired markup increases to 75.0%.
    Mmmmh.

The Model

- Geography: unit mass of islands, and a mainland
- Two periods: the present (short run); the future (long run)
- Agents: households, firms, Central Bank (CB)
- Focus on the present:
  decentralized trading on the islands, sticky prices
  (Future: centralized trading in the mainland, flexible prices)

Presentation: partial equilibrium

Households

- Unit mass $j \in [0, 1]$ on each island, heterogenous information
- Problem:

$$\max \ \mathbb{E}_j \left[(c_j - c_j^2/2) + \beta\theta C_j \right]$$

$$\text{s.t.} \quad pc_j + QC_j = Income$$

  θ is demand shock

- Markets:
  - Good c on islands (decentralized): sticky or flex. prices p
  - Good C in mainland (centralized): numeraire good
    $Q = \frac{1}{1+i}$ is set by CB, Taylor rule

Demand Shock

$$\max \ \mathbb{E}_j \left[(c_j - c_j^2/2) + \beta\theta C_j \right]$$

- $\mathbb{E}[\theta] = 1$
- Changes in discount factor
  $\Longrightarrow$ determines natural rate i^*
- Allows for imperfect information

Firms and Supply Shock

- Each firm a monopolist on an island
- Marginal cost k (supply shock)
- Sets price p

Information

- Aggregate state: $s = \{\theta, k\}$
- Households:
  - On each island: fraction α informed, fraction $1 - \alpha$ uninformed
  - Distribution of α over islands: $F(\alpha)$
- Firms: informed

Demand Shocks Only

- State $s = \{\theta, k_0\}$, k_0 fixed

- DEFINE: Flex. price p_s: profit max. when θ is known
  Sticky price p_0: profit max. when no shock ($\theta = 1$)

Proposition

There is $\overline{\alpha}$ such that:

- *if $\alpha > \overline{\alpha}$: firms post the flexible price ($p = p_s$)*
- *if $\alpha \leq \overline{\alpha}$: firms post the sticky price ($p = p_0$)*

- Proof: $\overline{\alpha}$ obtained from firm's IC constraint.
  Intuition: For high enough fraction of informed consumers, the flexible price is credible and it maximizes profits.

Supply Shocks Only

- State $s = \{1, k\}$, θ fixed at 1
- DEFINE: Flexible price p_k when k is known ($p_k = \frac{1+k}{2}$)

Proposition

For any α, the flexible price p_k is consistent with a PBE.

- Proof: No firm IC constraint.
  Intuition: k is not payoff-relevant to consumers. No incentive to stimulate demand. Price increases are credible.

Both Shocks

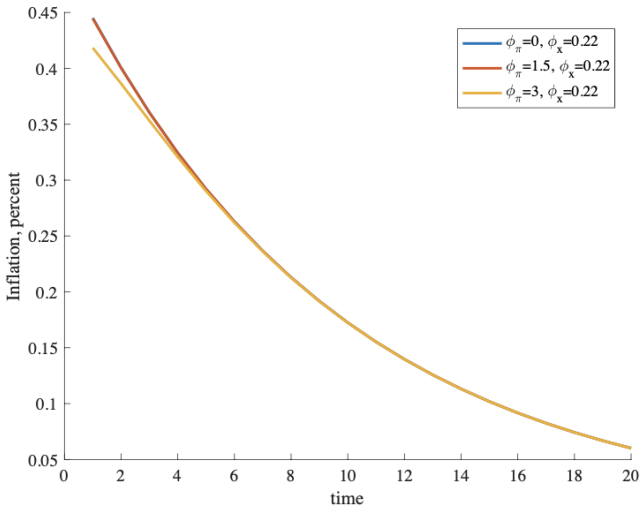
- State: $s = \{\theta, k\}$
- DEFINE: Price $p_{0k} = \frac{1+k}{2}$: demand-sticky but supply-flexible.

Proposition

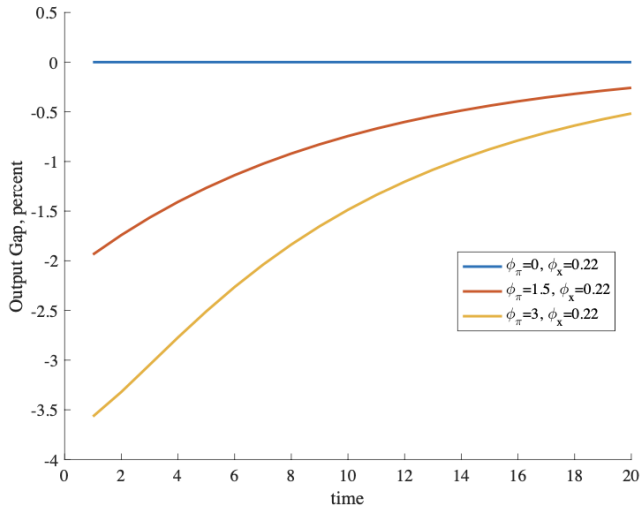
There is $\overline{\overline{\alpha}}$ such that if $\alpha \leq \overline{\overline{\alpha}}$, firms post price p_{0k}, and this is consistent with a PBE.

- The PC is flat, but it shifts with cost shocks.

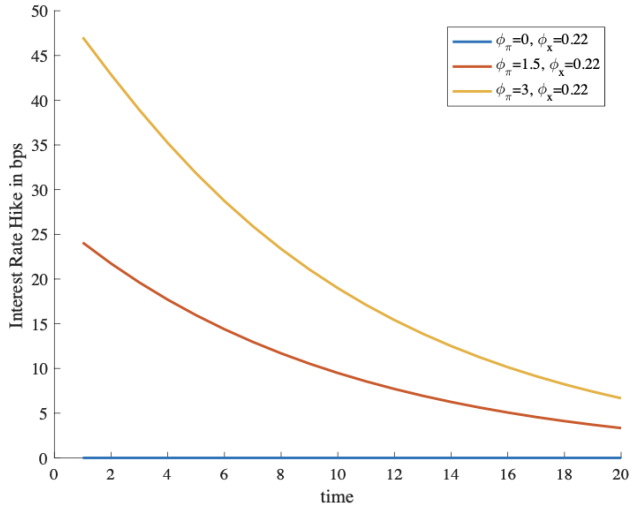
Aggregate Implications: Supply Shock



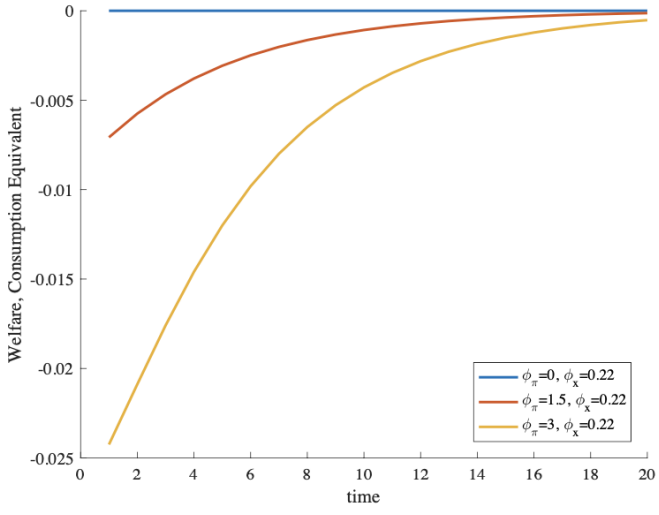
(a) Inflation



(b) Output Gap



(c) Interest Rate



(d) Welfare (CE)

Shock Dependence?

- Types of pricing frictions:
  1. Time dependent
  2. State dependent
  3. ... Shock dependent?

- Ours is one candidate microfoundation

- Demand Shocks $\Rightarrow$ Firm Incentives $\Rightarrow$ Strategic Friction
  $\Longrightarrow$ **stickiness**
  Supply Shocks $\Rightarrow$ Firm Incentives $\Rightarrow$ No Strategic Friction
  $\Longrightarrow$ **flexibility**