# Anatomy of the Phillips Curve: Micro Evidence and Macro Implications

Discussion

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# Phillips Curve

- New Keynesian formalization

$$\pi_t = \beta E_t \pi_{t+1} + \kappa (y_t - y_t^n) + \nu_t$$

- Drivers of inflation
  - Inflation expectations $E_t \pi_{t+1}$
  - Output / unemployment gap $u_t - u_t^n$
  - Supply shocks $\nu_t$

- Objects of interest:
  - "Slope" coefficient $\kappa$—how much does fall in unemployment increase inflation?
  - "Expectations" coefficient $\beta$—how forward looking is inflation?

# What Did We Know Before GGLT?

1. **Slope coefficient $\kappa$**
   - Growing consensus pre pandemic that $\kappa$ is low
     (Stock & Watson 2018; Hazell, Herreno, Nakamura & Steinsson 2022)
   - Perhaps not after pandemic (Benigno & Eggertsson 2023)

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2. **Expectations coefficient $\beta$**—no consensus

   *"Identification of the NKPC is too weak ... we think it will be more fruitful to explore fundamentally new sources of identification, such as* ***micro/sectoral data****"*

   — Mavroeidis, Plagborg-Moeller & Stock (2014)

   - Main issue is **weak instruments** in time series
   - "Holy grail" of Phillips Curve estimation going back to Phelps & Friedman ...

# This Paper

GGLT ask:

*What can we learn about the* ***aggregate*** *Phillips Curve from* ***microdata****?*

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GGLT ask:

*What can we learn about the **aggregate** Phillips Curve from **microdata**?*

Answer: **a tremendous amount!**

# Outline of the Discussion

- Summarize the paper

- Main comments
  1. Powerful framework for estimating $\beta$
  2. How to think about identification with persistent firm level demand shocks?
  3. Price stickiness vs. inflation inertia

# Approach—Theory

- GGLT show in a Calvo model w/ strategic complementarity in price setting

$$p_{ft} = (1-\theta)(1-\beta\theta)\sum_{\tau=0}^{\infty}(\beta\theta)^{\tau}\left((1-\Omega)\,mc^{n}_{ft+\tau} + \Omega p^{-f}_{it+\tau}\right) + \theta p_{f,t-1} + \varepsilon_{ft}$$

  - $p_{ft}$ = firm price
  - $1-\theta$ = frequency of price change
  - $\beta$ = discount factor
  - $\Omega$ = strategic complementarity
  - $mc_{ft}$ = firm level marginal cost
  - $p^{-f}_{it+\tau}$ = competitor price index
  - $\varepsilon_{ft}$ = other factors affecting firm prices—**idiosyncratic demand shocks**

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- Implies aggregate Phillips Curve

$$\pi_t = \beta E_t \pi_{t+1} + \lambda\left(mc_t - mc^{n}_t\right) \quad \lambda \equiv (1-\theta)(1-\beta\theta)(1-\Omega)/\theta$$

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→ Estimate Phillips Curve parameters **using microdata!**

- **General result**: mapping holds w/ oligopoly, menu costs, decreasing returns etc
- Marginal cost is "sufficient statistic" for many factors (wage rigidity, energy etc)

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- **Calibrate** $\beta$, **estimate** $\theta$ and $\Omega$

- Instrument for $mc_{ft}$ and $p_{i,t+\tau}$ with lags, add industry-time FEs
  - Identification assumption: lagged $mc$ orthogonal to $\varepsilon_{ft}$

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$$\pi_t = \beta E_t \pi_{t+1} + \lambda \left(mc_t - mc_t^n\right)$$
$$\approx \beta E_t \pi_{t+1} + \kappa \left(y_t - y_t^n\right)$$

- $\lambda$ is high!
- But additional evidence that $\kappa$ is low

$$\kappa \approx \lambda \varphi \quad \left(mc_t - mc_t^n\right) \approx \varphi \left(y_t - y_t^n\right)$$

# Implications

1. Discipline future models
   - Flat Phillips curve mostly **not** due to nominal price rigidity
   - Due to "real rigidity" or nominal wage rigidity
2. Propagation of supply vs. demand shocks
   - Supply shocks (e.g. oil) affect $mc_t$ directly, big effects on $\pi_t$ due to high $\lambda$
   - "Demand shocks" have smaller effects on $\pi_t$, due to low $\varphi$

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**Main Comment #1**: this is a great framework to estimate $\beta$!

- Powerful micro variation to overcome "weak instruments" in time series
- Recall main estimating equation calibrates $\beta = 0.99$

$$p_{ft} = (1-\theta)(1-\beta\theta)\sum_{\tau=0}^{\infty}(\beta\theta)^{\tau}\left((1-\Omega)\, mc^{n}_{ft+\tau} + \Omega p^{-f}_{it+\tau}\right) + \theta p_{f,t-1} + \varepsilon_{ft}$$

- Future work: estimate $\beta$, potentially calibrate $\theta$ from prob. of price change
- **No consensus on value of $\beta$ ("holy grail")**

→ Authors well positioned to make another important contribution

# Comment #2: Identification

- Main estimating equation

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- Plausible alternative instruments:
  1. Foreign components of marginal costs orthogonal to domestic demand (Amiti, Itskokhi & Konings 2017)
  2. Shift share instrument for $mc_{ft}$—oil shock is partial step in this direction

# Comment #3: Inflation Inertia vs. Nominal Rigidity

- Model of GGLT23

$$\pi_t = \beta E_t \pi_{t+1} + \lambda (mc_t - mc_t^n)$$

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→ Heuristically: regressing $p_{ft}$ on $p_{f,t-1}$ w/ instruments identifies nominal rigidity $\theta$

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- *How about Gali & Gertler '99?*

$$\pi_t = \beta E_t \pi_{t+1} + \lambda \left( mc_t - mc_t^n \right) + \gamma \pi_{t-1}$$

  - Very different aggregate dynamics (e.g. "sacrifice ratio" of disinflation is higher)

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- If GG99 model is true: regressing $p_{ft}$ on $p_{f,t-1}$ identifies mix of $\lambda$ and $\gamma$
  - **Can authors rule out GG99 model in favor of GGLT23?**

# Conclusion

- Great paper
  - General and tractable modelling
  - Careful empirical work
  - Important results
- Comments:
  1. More exciting work to be done with estimating $\beta$
  2. Useful to know more about identification
  3. Inflation inertia vs. nominal rigidity