How Steep is the Phillips Curve in Developing Economies? A Sufficient Statistics Approach and Estimates for India

Juan Herreño, Noémie Pinardon-Touati, and Malte Thie

Discussion by Kunal Sangani

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3. Much more slack in labor / input markets? No... and this is the one that matters!
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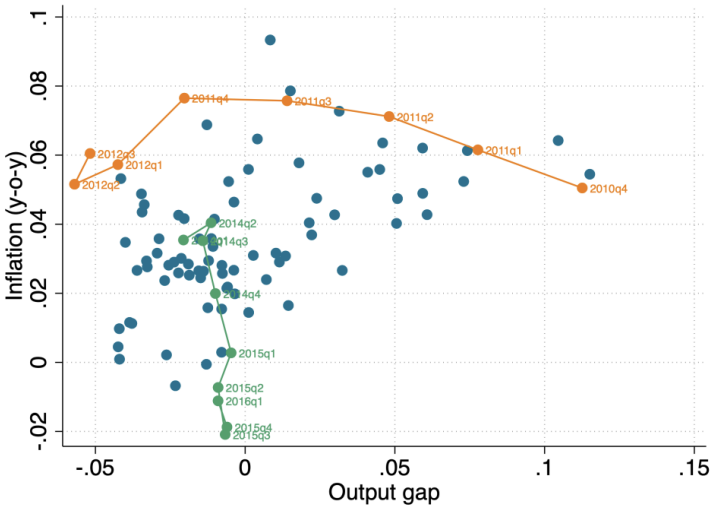
How to estimate the Phillips curve?

1. Using aggregate time series data.

2. Using structural parameters.
   (E.g., labor supply elasticity, returns to scale, frequency of price adjustment, input-output linkages.)

3. Using cross-sectional variation.

How to estimate the Phillips curve? Time series



- Using aggregate time series data?
- Confounding shifts in inflation expectations, supply conditions.

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← This paper: A few sufficient statistics, each identified with cross-sectional variation

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Decomposition

- Output-based Phillips curve decomposition:

$$\kappa_y = \frac{\partial \log P}{\partial \log Y} = \underbrace{\frac{\partial \log P}{\partial \log MC}}_{\kappa_{mc}} \underbrace{\frac{\partial \log MC}{\partial \log Y}}_{\Omega}.$$

- Marginal-cost based Phillips curve:

$$\kappa_{mc} = \frac{\partial \log P}{\partial \log MC} \approx \underbrace{\frac{\partial \log P}{\partial \log p^{\text{flex}}}}_{\varphi} \underbrace{\frac{\partial \log p^{\text{flex}}}{\partial \log MC}}_{\omega}.$$

- Marginal costs depend on scale of production and factor prices, $MC = mc(y, \boldsymbol{w})$.

$$\Omega = \frac{\partial \log MC}{\partial \log Y} = \underbrace{\frac{\partial \log mc(y, \boldsymbol{w})}{\partial \log y}}_{\substack{\text{Returns to scale} \\ \text{for individual firms}}} + \underbrace{\sum_f \frac{\partial \log mc(y, \boldsymbol{w})}{\partial \log w_f} \frac{\partial \log w_f}{\partial \log Y}}_{\text{Effects on factor prices}}.$$

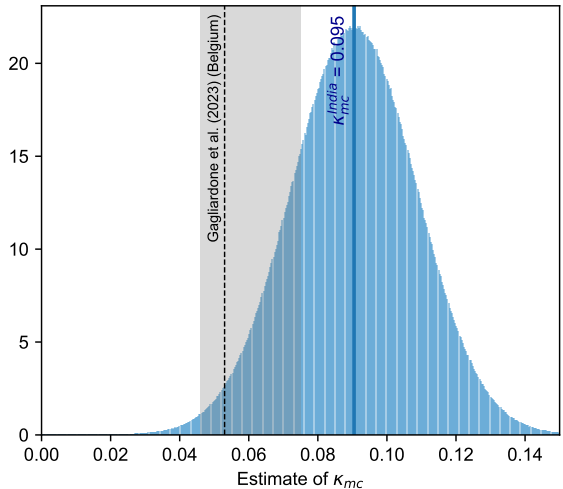
Decomposition

Parameter			Relevant moment	Estimate (s.e.) [range]
κ_y	κ_{mc}	φ	Share of firms with rigid prices	0.09 / year $[0.05, 0.28]$
		ω	Pass-through of identified, idiosyncratic cost shocks	0.214 (0.043)
			Persistence of cost shocks	0.80 $[0.75, 0.90]$
	Ω	Firms	$d \log mc / d \log y$ from identified demand shocks	0.168 (0.076)
		Region / industry	$d \log MC / d \log Y$ from identified demand shocks	0.583 (0.144) 0.703 (0.310)

- Putting it all together, at quarterly horizon: $\kappa_{mc} = 0.095$, $\kappa_y = 0.066$.
- Each of φ, ω, and Ω are huge measurement efforts!

Slope accounting: κ_{mc} in India vs. Belgium

- κ_{mc}: Estimate frequency of price adjustment, pass-through of identified cost shocks.



Parameter	Belgium	India	
Rigid prices / year	0.25	0.09	
φ	0.124	0.378	3.0x
Returns to scale	0.97	0.86	
Desired pass-through of idiosyncratic costs	0.428	-	
ω	0.428	0.251	0.6x
κ_{mc}	0.053	0.095	1.8x

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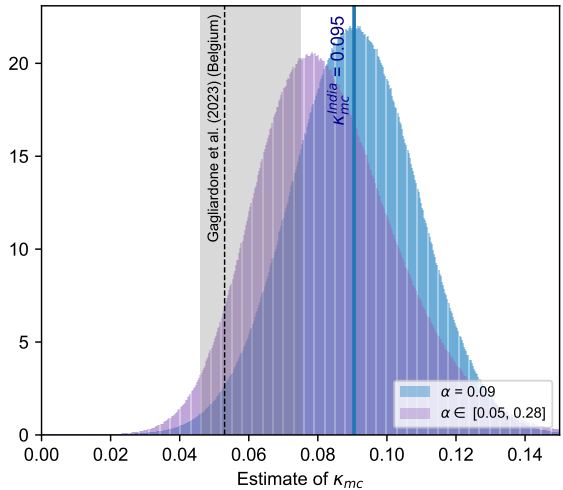

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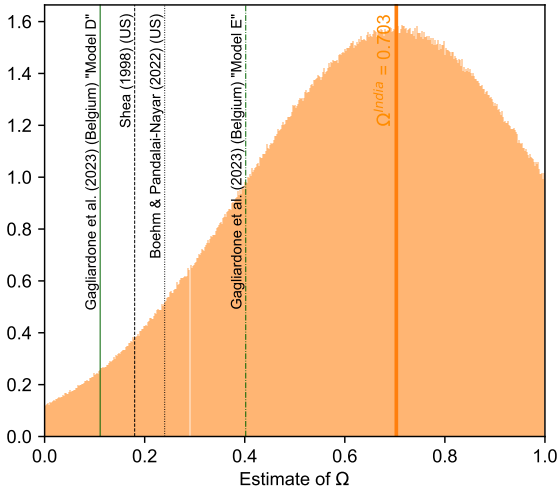
Slope accounting: Ω and κ_y in India vs. Belgium

- Ω: Estimate response of industry costs to identified demand shocks.



Parameter	Belgium	India	
$d \log mc / d \log y$	0.03	0.168	
$d \log MC / d \log Y$	0.111	0.703	
Ω	0.111	0.703	6.3x
κ_{mc} (from last slide)	0.053	0.095	1.8x
κ_y	0.006	0.066	**11x**

Slope accounting: Taking stock

- Manufacturing Phillips curve in developing economy (India) steeper slope than advanced (Belgium, US). $\kappa_y = 0.066$ vs. 0.006–0.021.
  - Tempting to compare to Hazell, Herreño, Nakamura and Steinsson (2022), who estimate $\kappa_u = 0.0062$ for nontradables.
  - Or Egger, Haushofer, Miguel, Niehaus, and Walker (2022), who estimate $\kappa \approx 0$ in Kenya.

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- Partly due to more flexible prices...
- Lion's share due to inelasticity of inputs / labor. (Prior-shifting results!)

TABLE E.10. Coefficients for input-level prices

	Industry (1)	District (2)	Max (3)
Labor	0.29***	0.78***	0.78
Material (non-energy)	0.51***	0.42***	0.51
Energy	-0.03	-0.18	-0.03

Reactions

1. Understanding the inelasticity of labor supply.

2. Inflation–output tradeoff and output volatility.

Reactions: 1. Inelastic input supply

- Surprising result on the inelasticity of inputs, especially labor.
  - Aside: Price response of materials means we may want to model input–output explicitly.
- Egger et al. (2022), Walker et al. (2024) evidence of elastic labor supply and slack in nontradables sector in Kenya (largely retail / food).
- Why might labor supply for manufacturing industries be more inelastic?
  - Frictions to reallocation of workers across industries and regions?
  - Labor in elastic supply, but skills in inelastic supply?
  - Which elasticity is relevant for aggregate Phillips curve?

Reactions: 1. Inelastic input supply

- Given surprising result, worthwhile to also consider more mundane reasons.
- Estimate specification:

$$\underbrace{\Delta \log C_{it}}_{\substack{\Delta \text{ industry } i\text{'s} \\ \text{variable costs}}} = \Omega \underbrace{\Delta \log Y_{it}}_{\substack{\Delta \text{ industry } i\text{'s} \\ \text{real output}}} + \underbrace{\delta_t}_{\substack{\text{Time} \\ \text{FEs}}} + \varepsilon_{it},$$

  using demand shock instrument for $\Delta \log Y_{it}$.

- Concern: Demand shock may also change product mix, e.g., to higher quality.
- $\Delta \log C_{it}$ in part reflects shift to higher quality inputs, more expensive labor.
- Solutions: “cost index” rather than costs; industry FEs to absorb secular trends.

Reactions: 2. Inflation–output tradeoff and volatility

- In New Keynesian model, welfare losses are

$$\mathscr{L} \approx -\sum_{t=0}^{\infty} \beta^t \left(\Omega x_t^2 + \frac{\theta}{\kappa_{mc}} \pi_t^2 \right),$$

where π_t is inflation, $x_t = y_t - y_t^e$ is log output deviation from efficient level.

  - Elasticity of marginal cost to output Ω gives distortion in labor vs. leisure.
  - Slope of marginal cost-Phillips curve κ_{mc} determines price dispersion, and elasticity of substitution θ maps to misallocation cost.

Reactions: 2. Inflation–output tradeoff and volatility

- Suppose planner minimizes per-period loss facing supply shocks (Gali 2008, Ch. 5):

$$\min \kappa_y x_t^2 + \theta \pi_t^2,$$

s.t. Phillips curve,

$$\pi_t = \kappa_y x_t + \beta \pi_{t+1} + \underbrace{\kappa_y (y_t^e - y_t^n)}_{\text{Cost-push supply shocks}} .$$

- Optimal discretionary policy "leans against the wind,"

$$x_t = -\theta \pi_t = -\frac{\theta \kappa_y}{\theta \kappa_y + (1 - \beta \rho_u)} (y_t^e - y_t^n),$$

where ρ_u is the persistence of the cost-push shock.

  - Higher slope of Phillips curve κ_y implies more movement in x_t, π_t given same shock.

Reactions: 2. Inflation–output tradeoff and volatility

- If we only have supply shocks, volatility of output gap is:

$$Var(x_t) = \left(\frac{\theta \kappa_y}{\theta \kappa_y + (1 - \beta \rho_u)} \right)^2 Var(y_t^e - y_t^n),$$

- For $\kappa_y = 0.066$ vs. 0.006 (India vs. Belgium), given same shocks:
  - If $\rho_u = 0.7$, std(x_t) is 5.8x higher in India than Belgium. If $\rho_u = 0.2$, 8.1x higher.
- For $\kappa_y = 0.066$ vs. 0.021,
  - If $\rho_u = 0.7$, std(x_t) is 2.0x higher in India than Belgium. If $\rho_u = 0.2$, 2.5x higher.
- If Phillips curve is 11x steeper, may need to believe less volatile supply shocks in India than in Belgium or US.

Conclusion

- Big question, and extensive, careful empirical work to answer it.
- Authors blend two approaches: combine multiple sufficient statistics, each identified with cross-sectional variation.
- Benefits for model flexibility + interpretability ("slope accounting").
  - Can be sensitive to measurement error in multiple statistics.
  - Difference in marginal cost elasticity Ω is the next puzzle.
- Highly recommend!

Lewis (1954)

- Lewis in *"Economic Development with Unlimited Supplies of Labour"* (1954):

  The classics, from Smith to Marx, all assumed, or argued, that an unlimited supply of labour was available at subsistence wages. [....] [This assumption] is obviously not true of the United Kingdom, or of North West Europe. It is not true either of some of the countries usually now lumped together as under-developed; for example there is an acute shortage of male labour in some parts of Africa and of Latin America. On the other hand it is the obviously relevant assumption for the economies of Egypt, of India, or of Jamaica.