Heterogeneous Technology and the Phillips Curve

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Introduction and Motivation

- Recent economic shocks (COVID-19, demand surge, supply disruptions) raised inflationary pressure.
- Traditional Phillips curve (PC) analysis is unstable due to varying slopes.
- Granular data enables improved aggregate inflation analysis.
- Chapter based on Aglio and Bartelsman (2025), extending CompNet (2023).

Introduction and Motivation

- Micro-theoretical foundations and novel statistical techniques to cluster firms according to technology and demand characteristics.
- We estimate supply curves and PC slopes for heterogeneous clusters of firms.
- Aggregate PC will become flatter with an increase in the number of technologically advanced firms or with a larger share of demand changes met by these firms.
- Theoretical and empirical framework to better understand how different demand and supply disturbances can lead to aggregate price pressure.

Key Intuition

- Firms' marginal cost curves vary with technology, influencing inflation-slack relationships.
- High-productivity firms absorb demand increases with lower price rises.
- Cost shocks have reduced impact when they affect low pass-through firms.

Data and Methodology

- Micro Data Infrastructure (MDI) used to access firm-level data.
    i. Prodcom, BR, BS, SBS.
    ii. Demand shocks from OECD Input-Output tables and Com-Trade.
    iii. Manufacturing firms in France, the Netherlands, and Slovenia.
- Clustering firms by technology and demand characteristics.
- Estimating supply and demand curves for each cluster.

Clustering Estimation

Supply Estimation $\rightarrow$ Firm Reassignment $\rightarrow$ Demand Estimation $\rightarrow$ Firm Reassignment $\rightarrow$ Convergence Check.

Supply Estimation[a]*:*

$$y_{it} = \alpha + \gamma_k k_{it} + \gamma_l l_{it} + \gamma_m m_{it} + \delta_t + \epsilon_{it}$$

Demand Estimation[b]*:*

$$dp_{it} = \beta_0 + \beta_{mc} dmc_{it} + \delta_t + \nu_{it}$$

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[a] y_{it}, k_{it}, l_{it}, and m_{it} are logs of real output (revenue deflated with the price index from Prodcom), real capital, full-time equivalent labour, and real material, respectively, for firm i in year t, and δ_t are time fixed effects.

[b] dp_{it} and dmc_{it} are the log change in price and the log change in marginal costs, respectively, for firm i in year t. Mrázová and Neary (2017) show that the cost pass-through is a function of demand elasticity and convexity in monopolistic competitive markets.

Cross-Country Results: Technology Clusters

Table 1: Firms' characteristics by technology cluster

France							
Technology cluster	N° firms	TFP	$\gamma_k + \gamma_l + \gamma_m$	Labour productivity	Size	Markup$_m$	Marginal costs
1	4593	1.47	0.91	90.0	8.3	1.20	2.39
2	14397	1.39	0.92	162.4	12.8	1.25	1.05
3	8442	1.68	0.94	219.2	19.7	1.38	0.73
4	3428	1.74	0.99	361.4	22.7	1.43	0.55
5	1371	2.32	1.05	812.4	24.9	1.82	0.27
Netherlands							
Technology cluster	N° firms	TFP	$\gamma_k + \gamma_l + \gamma_m$	Labour productivity	Size	Markup$_m$	Marginal costs
1	791	1.03	0.89	139.7	36.8	1.22	1.75
2	2634	1.43	0.90	244.7	47.2	1.15	0.99
3	988	1.72	0.87	387.6	47.5	1.31	0.74
4	416	1.80	0.93	411.62	47.8	1.60	0.62
5	286	1.74	1.04	1164.4	77.6	1.45	0.34
Slovenia							
Technology cluster	N° firms	TFP	$\gamma_k + \gamma_l + \gamma_m$	Labour productivity	Size	Markup$_m$	Marginal costs
1	773	1.33	1.02	70.8	4.6	1.08	1.15
2	594	1.65	1.04	116.7	4.9	1.25	0.77

Cross-Country Results: Demand Clusters

Table 2: Cost pass-through by demand cluster

France		
Demand cluster	N° firms	β_{mc}
1	7895	0.17
2	3169	0.83
3	21167	0.91
Netherlands		
Demand cluster	N° firms	β_{mc}
1	2004	0.11
2	2594	0.89
3	517	0.94
Slovenia		
Demand cluster	N° firms	β_{mc}
1	822	0.13
2	545	0.94

Cross-Country Results: Technology Clusters

- Higher technology firms have flatter marginal cost curves.

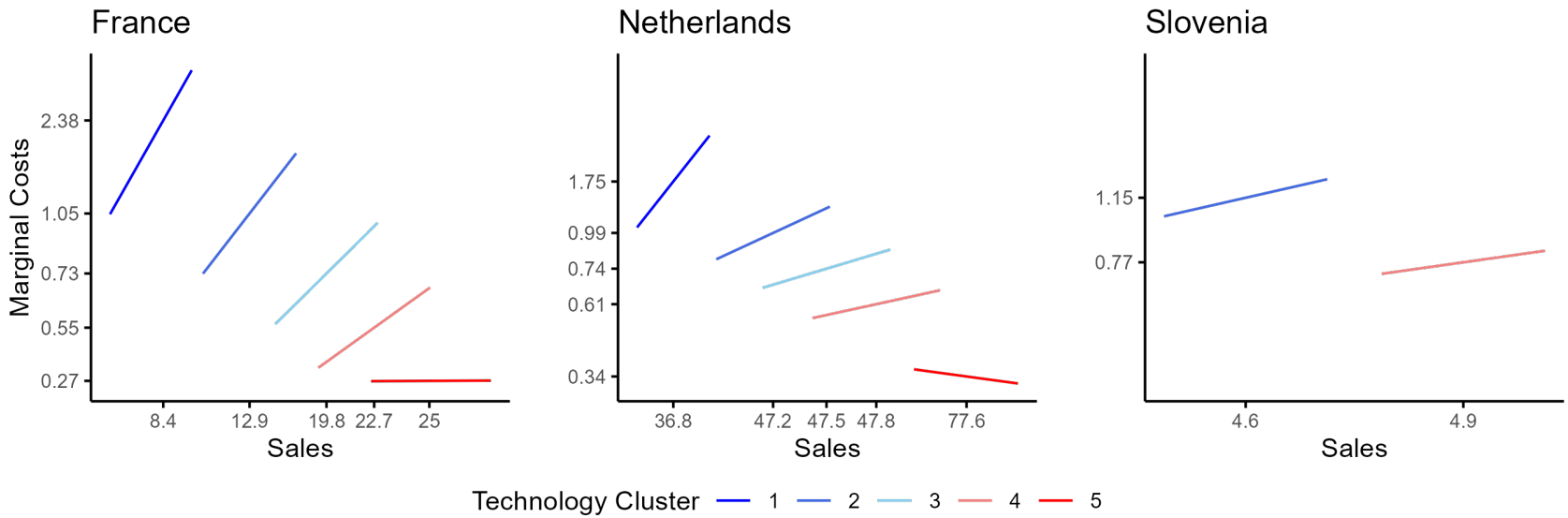

Figure 1: Supply curves by technology cluster

Phillips Curve Estimation

- Firms' pricing equation:

$$dp_{it} = \beta_1 dy_{it} * C + \beta_2 dp_{it}^{comp} * C + \beta_4 dp_{it-1} + \delta_{st} + \epsilon_{it}$$

- Higher technology firms show lower price increases in response to demand shocks.

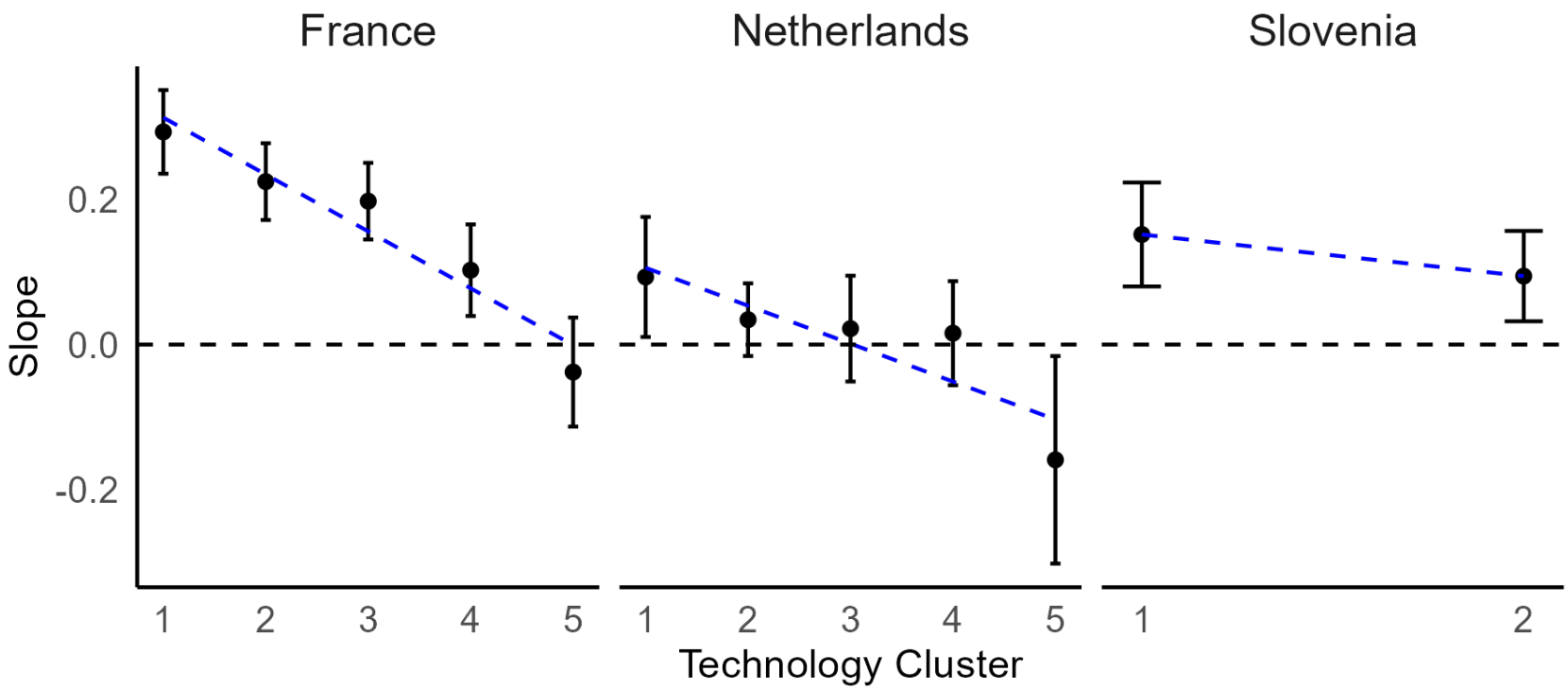

Figure 2: Slope of the Phillips curve by technology cluster

Conclusions

- Traditional PC estimates are unstable due to micro-level heterogeneity.
- Micro results show that there is considerable heterogeneity in the PC slope.
- Our clustering method provides a flexible way to capture the heterogeneity while aggregating the micro data into a limited number of sub-aggregates.
- Having estimates of how such heterogeneous clusters respond to shocks, together with information on the nature of shocks faced by each of the clusters, can lead to better and more timely macro forecasts.

Thank you for your kind attention

References I

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Loecker, J. D. and Warzynski, F. (2012). Markups and firm-level export status. *American Economic Review*, 102(6):2437–2471.

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Appendix: Demand - Technology Clusters

- Estimated distribution of demand and supply curves among clusters.