Monetary Policy and Trade in the Euro Area: The Effect of Market Concentration

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EEA 2025

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Motivation

- **Common currency, different prices;**
- Static price discrimination is well documented—*but how do common shocks affect it?*
- No exchange rates, yet competitive landscapes differ widely;
- Can those structural differences – productivity distributions, concentration – turn a common monetary policy shock into destination-specific price adjustments?

I will show that dynamic price discrimination signals a novel channel of heterogeneous monetary transmission.

This Paper

- Can common monetary policy shock induce **dynamic price discrimination?**
- Key finding:
  - French exporters adjust export prices differently across euro area destinations;
  - **Destinations' market concentration and productivity distribution matters**.
- To explain it: A **heterogeneous selection mechanism** could drive markup responses.

Develops a Melitz-Ottaviano New Keynesian model that explains aggregate dynamics.

Data

- **French Customs Data**: Monthly firm-to-firm export transactions by product and destination in the euro area. Customs Data Cleaning
- **Concentration and Productivity**: Amadeus and CompNet data for **country sector** TFP distributions and Herfindahl–Hirschman(HHI).
  Summary Stats Summary Stats Amadeus Foreign Exporters Description Country-Sector
- **Monetary Policy Shocks**: High-frequency shocks from Jarociński and Karadi (2020).
- Rich panel structure enables **destination-specific identification** of price responses.

HHI is positively correlated with TFP skewness Regression

Identification

Local projections: For seller i, buyer b, destination country c, industry n and product p:

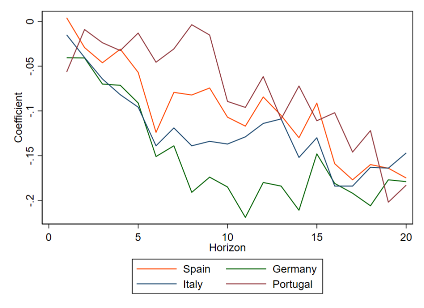
$$y^*_{i,b,p,t+h} = f_{i,h} + fP_{p,h} + fC_{b,h} + \sum_{c=1}^{C} \alpha_{c,h} \mathbf{I}[b \in C]\epsilon^m_t + \beta_h Conc_{c,n,t-12}\epsilon^m_t + \Gamma^h \Delta y_{i,B,p,t-1} + u_{i,t+h}$$

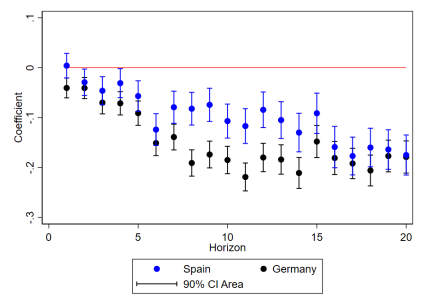
- $y^*_{i,b,p,t+h} = \frac{P_{i,j,t+h} - P_{i,j,t-1}}{P_{i,j,t-1}}$ is the cumulative price change ratio; Graph
- $fP_{p,h}$ is product fixed effects for each h;
- $f_{i,h}$ is seller fixed effects for each h;
- $fC_{i,h}$ is country fixed effects for each h;
- ϵ^m_t is the monetary policy shock (Karadi-Jarocinski); Data
- I indicator function for each country;
- $\Delta y_{i,t-1}$ is a lag of the dependent $\frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$

Results without the Concentration Term

$$y^*_{i,b,p,t+h} = f_{i,h} + fP_{p,h} + fC_{b,h} + \sum_{c=1}^{C} \alpha_{c,h} \mathbf{I}[b \in C]\epsilon^m_t + \Gamma^h \Delta y_{i,B,p,t-1} + u_{i,t+h}$$

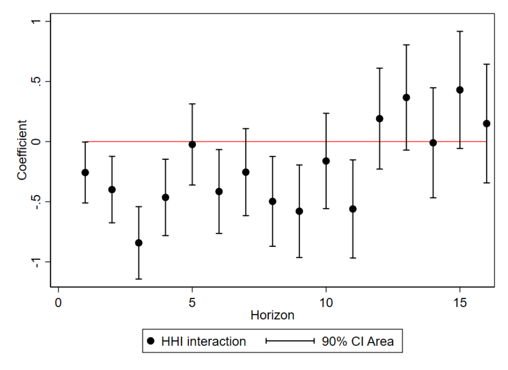
The coefficient for country - MP shock interaction through horizons after the shock:

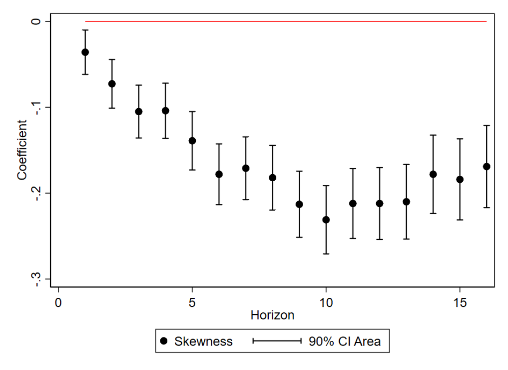




Significant differences in the price adjustment across countries. Back

Results-HHI & Skewness





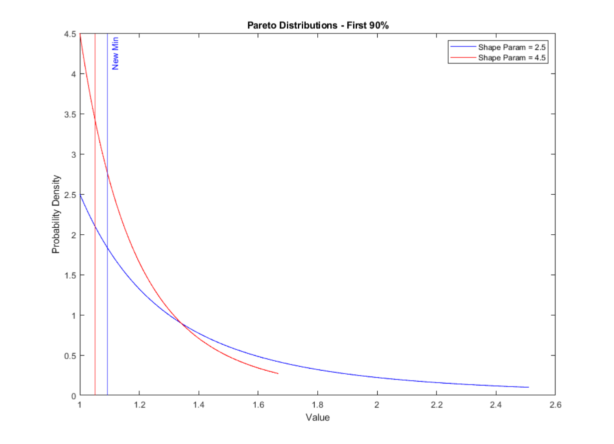
Higher HHI/skewness → Lower prices

Results

- **Dynamic Price Discrimination**: Stronger price adjustments in Core than Periphery.
  Peak Responses
- **TFP Skewness**: Higher skewness → larger exporter price changes after a shock.
- **HHI**: More concentrated destination markets → larger price response. Robust
- **Aggregate Trade Evidence**: Confirms micro-level patterns in macro-level unit values across countries. Results Core vs Periphery
- **Markup Adjustment:** Exporter X Product X Time interaction. Results

Pareto

Heterogeneous selection effect:



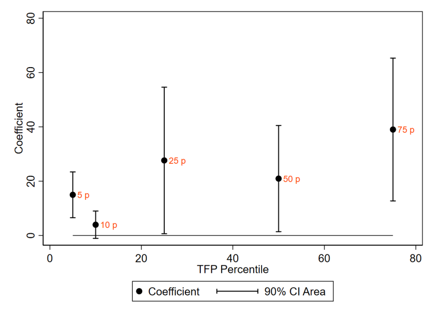
Distribution of the 90% of firms

Selection Mechanism

The selection effect is stronger in the more concentrated markets:

$$TFP_{p,cs,t+1} - TFP_{p,cs,t-1} = fC + fI + \epsilon_t^M + \beta_h Conc_{c,t-2}\epsilon_t^m + \sum_{l=1}^{L} X_{t-l} + u_{p,cs,t+h}$$

Where p is the percentile in the distribution and cs is the country sector.



TFP increase more in markets with higher concentration (higher skewness) Specifi Mechanism Shape

Preview of the model

Model with two-country Monetary Union à la Melitz-Ottaviano:

- Countries differ only in the skewness of the Productivity distribution ($\kappa_H \neq \kappa_F$)
- Monetary policy triggers the selection effect:
  - Lower demand leads to higher cut-off productivity;
  - Heterogeneous effect based on the skewness in the distribution;
  - As a result, cut-off moves differently across the two countries.

Preview of the model

Model with two-country Monetary Union à la Melitz-Ottaviano:

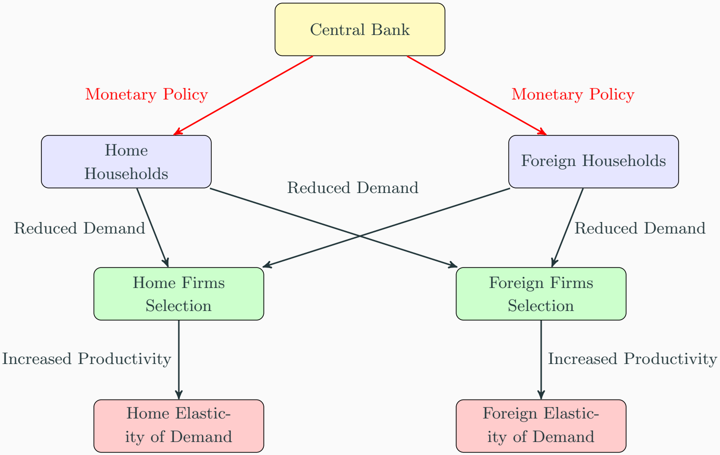
- Countries differ only in the skewness of the Productivity distribution ($\kappa_H \neq \kappa_F$)
- Monetary policy triggers the selection effect:
- Endogenous elasticity of demand:
  - Endogenous and heterogeneous markups;
  - Selection mechanism leads to a change in the elasticity;
  - Heterogeneous elasticity movements through heterogeneous selection effect;
  - As a result, there will be a heterogeneous markup adjustment.

Preview of the model

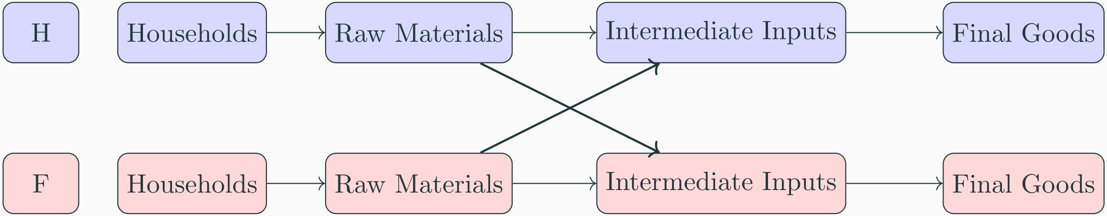
Model with two-country Monetary Union à la Melitz-Ottaviano:

- Countries differ only in the skewness of the Productivity distribution ($\kappa_H \neq \kappa_F$)
- Monetary policy triggers the selection effect:
- Endogenous elasticity of demand:
- **It will replicate the dynamics observed, additionally:**
  - Interdependencies and trade can explain the magnitude of the dynamics;
  - For example, small open economy devalues the role of concentration;
  - Heterogeneous responses also in output, prices, and trade.

Economy


Central Bank
Monetary Policy
Monetary Policy
Home Households
Foreign Households
Reduced Demand
Reduced Demand
Reduced Demand
Home Firms Selection
Foreign Firms Selection
Increased Productivity
Increased Productivity
Home Elasticity of Demand
Foreign Elasticity of Demand

Production


H
Households
Raw Materials
Intermediate Inputs
Final Goods
F
Households
Raw Materials
Intermediate Inputs
Final Goods

Model Overview

- Households: Quasi-linear preferences leading to endogenous elasticity of demand.

  Households Elasticity

- Raw materials: Producing inputs using labor. Wage rigidity enters here.

- Intermediate input: Uses raw materials from both countries with an elasticity.

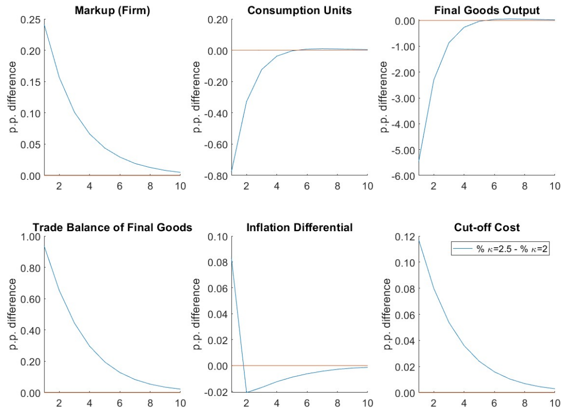
  Intermediate Input

Final Goods

- Heterogenous prices and markups across firms and destinations. Price and Quantity Trade Prices Trade
- Pareto distribution for the productivity. Pareto
- Free entry condition with domestic and foreign profits. Selection Selection log

Common monetary policy and debt elastic interest rate. Monetary Policy Summary

Simulation - Two Country MU



Responses on a 10 b.p. monetary policy shock. The values are the difference between the Home and Foreign (concentrated market) percentage change from the steady state.

Additional | New Calibration Results | All Responses | Small Open Economy | Steady State | Uniqueness

Empirics

Model shows that for higher TFP skewness (lower κ):

- Markup decreases more (as seen before);
- Cut-off Productivity increases more (as seen before);
- Producer price decreases more; Empirical Results
- Trade balance decreases; Empirical Results
- Output decreases less. Empirical Results

Conclusions

The skewness of the TFP distribution can explain part of the heterogeneous monetary policy transmission through:

- Heterogeneous selection effect on firms;
- Heterogeneous movement of competition and price adjustment.

A two-country MU model with selection mechanism and trade dynamics:

- Replicates the empirical evidence;
- Provides insights on heterogeneous movements on output, trade and prices.

This raises implications for optimum currency area theory and the role of firm concentration and trade.

Appendix

Customs Data

I use **monthly French data on customs** as in Bergounhon et al. (2018):

- Transactions made (exports);
- From firm to firm;
- Information on quantities/units and value;
- TFP/Competition parameters for each destination;
- Use of a categorical variable proxy to size and productivity;
- Firms export to at least 5 out of the 7 destinations;
- I focus on the biggest exporters.

Main goal: to see how prices change after an MP shock and how the change depends on the destinations' productivity distribution values. Back

Cleaning

Product codes do not contain homogeneous goods:

- Check firm-product transactions with extreme prices.
- Drop product codes where less than 85 % of the observations have extreme prices.
- Alternatively 95%

Drop observations where the price change is more than 200 % and lower than -66 %. Back

Summary Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
TFP Mean	998	5.822	4.476	1.759	36.82
TFP Skewness	998	1.196	0.621	-0.857	4.278
TFP Scale	998	2.283	1.156	0.765	10.63
TFP Shape	998	1.785	0.734	0.437	4.984

Summary Statistics for the productivity parameters from Compnet

Variable	Obs	Mean	Std. dev.	Min	Max
HHI Revenue	1,712	0.0442	0.0600	0.000811	0.548
HHI VA	1,712	0.0410	0.0536	0.000652	0.423
HHI Revenue Mean	1,724	0.0460	0.0607	0.00133	0.437
HHI VA Mean	1,724	0.0422	0.0522	0.00112	0.311

Summary Statistics for the concentration parameters from Compnet

Back

Summary Statistics Amadeus

Percentiles	Shape	Scale
1%	0.2411368	0.0623969
5%	0.6691915	1.972184
10%	1.344294	4.111791
25%	1.855894	6.970936
50%	2.468457	22.88199
75%	2.863277	96.18256
90%	3.463891	191.765
95%	3.798515	359.9561
99%	4.775873	600.516

Summary Statistics for Shape and Scale parameters from Amadeus Back

Foreign Exporters

All the variables are created by using domestic firms distributions. Can they say something about the imported competition?

- I use bilateral trade flows from Prodcom.
- I generate an HHI for countries imports:

$$\frac{\sum_{ij} Import_{i,j}^2}{Totimports_{j,t}^2}$$

- Test if this type of HHI is related to the domestic variables.

I find that skewness and HHI are positively correlated to the import HHI. Back

Back to Markup

Results

Regression Results

	(1)	(2)
VARIABLES	HHI IMP	HHI IMP
HHI Revenue	0.0432***	0.0516***
	(0.00296)	(0.00321)
Constant	0.0149***	0.0125***
	(0.000185)	(0.000588)
Observations	1,207	1,207
Industry FE	No	Yes
R-squared	0.151	0.178

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Firms distribution

For **production concentration** in manufacturing sectors (yearly frequencies):

- Country-sector specific;
- Sources: Compnet and Orbis;
- Concentration (Herfindahl–Hirschman Index);
- Mean and skewness of TFP distribution;
- By assuming Pareto distribution, the shape and scale parameters; Pareto
- The shape parameter is associated with the inverse of skewness and HHI.

Overall, higher concentration → higher share of very productive firms. Back

Country-Sector Data

I use monthly country and country-sector-specific data of 7 euro-area countries on:

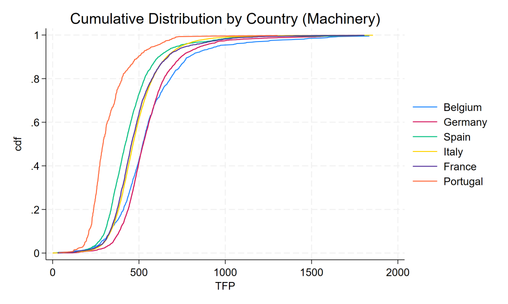
- Industrial Production ;
- Intra-Euro Trade data (Eurostat);
- Harmonized Consumer Price Index;
- Stock Price index.

For productivity (yearly frequencies):

- Compnet and Amadeus;
- Mean and skewness of TFP;
- Competition (HHI);
- By assuming Pareto distribution the shape and scale parameters. Pareto Back

Pareto Distribution

- Pareto captures better the right tail of the distribution;
- Pareto is highly tractable;
- **Density of unproductive firms always higher in the less concentrated distributions.**



Back

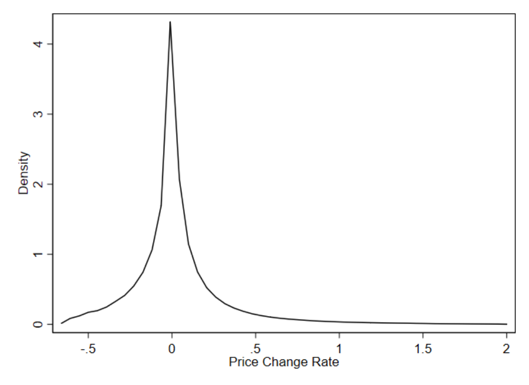
HHI and TFP

HHI and TFP

	(1)	(2)	(3)	(4)
TFP Skewness	0.006***	0.009***	0.004*	0.007***
	(0.0018)	(0.0018)	(0.0020)	(0.0020)
Constant	0.028***	0.045***	0.016***	0.055***
	(0.0019)	(0.0034)	(0.0034)	(0.0033)
Observations	1,570	1,570	1,570	1,570
R-squared	0.006	0.151	0.292	0.462
Country	No	Yes	No	Yes
Industry	No	No	Yes	Yes

Higher HHI is associated with higher TFP Skewness Back

Price Change Rate



Density distribution of Price Change Rate

Back

Monetary Policy

Use of **Karadi-Jarocinski** monetary policy shocks :

- Pure monetary policy shock;
- Disentangle information channel;
- In the 3-month frequencies I use the sum;
- I also include the information shock in the control variable (3-month).

Back

Peak Responses to Productivity Parameters

$$y^*_{i,b,p,t+h} = f_{i,h} + fP_{p,h} + fC_{b,h} + \sum_{c=1}^{C} \alpha c, h\mathbf{I}[Z \in C]\epsilon_t^m + \beta_h Conc_{c,n,t-12}\epsilon_t^m + \Gamma^h \Delta y_{i,B,p,t-1} + u_{i,t+h}$$

Variables for $\text{Prod}_{t-12}(1\ s.d.)$	Setup 1	Setup 2	Setup 3	Setup 4
Shape (Amadeus)	1.1 p.p			
Scale (Amadeus)	-0.2 p.p			
Shape (Compnet)		0.8 p.p		
Scale (Compnet)		0.42 p.p		
Skewness (Compnet)			-1.43 p.p	
Mean (Compnet)			2.4 p.p	
HHI revenue based				-0.5 p.p

Peak responses related to the concentration/productivity parameters for the biggest French exporters in a monetary policy shock of 10 basis points. Back

Aggregate Trade Flows

	UV change								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
HHI Rev#MP Shock	-3.472***	-4.211***	-2.879***						
	(0.520)	(0.568)	(0.617)						
HHI Rev#Inf Shock	0.562	-1.425***	0.315						
	(0.428)	(0.469)	(0.493)						
MP Shock	-0.605***			-1.739***			-1.319***		
	(0.0263)			(0.0732)			(0.0867)		
Inf Shock	-1.133***			-1.874***			-1.610***		
	(0.0267)			(0.0773)			(0.0948)		
TFP Shape (Amadeus)#MP Shock				0.112***	0.131***	0.0524*			
				(0.0238)	(0.0253)	(0.0314)			
TFP Min (Amadeus)#MP Shock				0.00039***	0.00044***	0.00011			
				(0.000136)	(0.000138)	(0.000652)			
TFP Shape (Amadeus)#Inf Shock				0.0656***	0.0809***	0.0608*			
				(0.0249)	(0.0267)	(0.0331)			
TFP Min (Amadeus)#Inf Shock				-0.00018	-0.00013	-0.00005			
				(0.000146)	(0.000147)	(0.000670)			
TFP Shape (Compnet)#MP Shock							0.396***	0.158**	0.317***
							(0.0461)	(0.0622)	(0.0527)
TFP Min (Compnet)#MP Shock							-0.122***	-0.0441**	-0.153***
							(0.0119)	(0.0204)	(0.0132)
TFP Shape (Compnet)#Inf Shock							0.242***	0.120*	0.326***
							(0.0503)	(0.0687)	(0.0570)
TFP Min (Compnet)#Inf Shock							-0.0968***	-0.0708***	-0.107***
							(0.0127)	(0.0214)	(0.0140)
Observations	477,888	477,888	477,888	475,614	475,614	475,614	332,551	332,551	332,551
R-squared	0.042	0.045	0.043	0.049	0.049	0.050	0.051	0.053	0.053
Country Interactions	No	Yes	No	No	Yes	No	No	Yes	No
Industry Interactions	No	No	Yes	No	No	Yes	No	No	Yes

Aggregate unit value change one year after a monetary policy shock Back

Core vs Periphery

	Unit Value change
MP shock	-1.498***
	(0.0220)
Inf shock	-1.921***
	(0.0241)
Periphery# MP shock	0.0960***
	(0.0357)
Periphery# Inf shock	0.185***
	(0.0378)
Constant	0.148***
	(0.00121)
Observations	967,761
R-squared	0.046

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Aggregate unit value change one year after a monetary policy shock Back

Robustness Checks

Alternative variables:

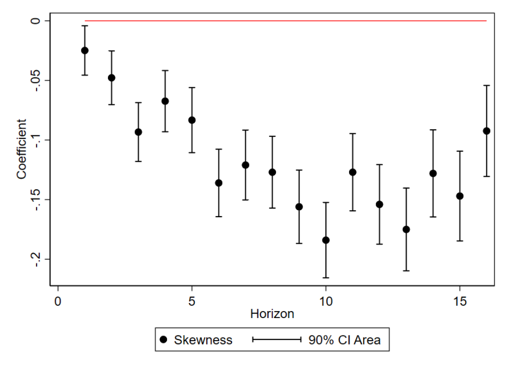
- Time invariant HHI; Results
- Time invariant Skewness; Results
- Time invariant Pareto; Results Scale
- Time variant Pareto.

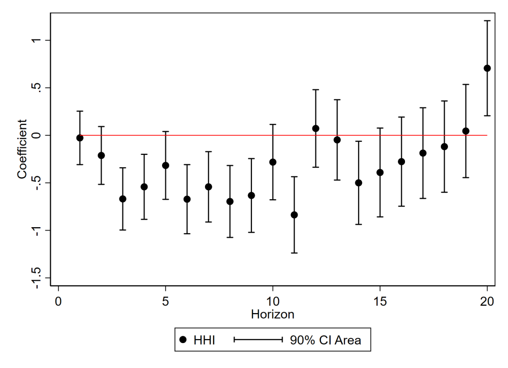
Alternative specifications:

- Less restrictive cleaning; Results
- Lower frequency (3 month). Results

Back

Time Invariant Skewness and HHI



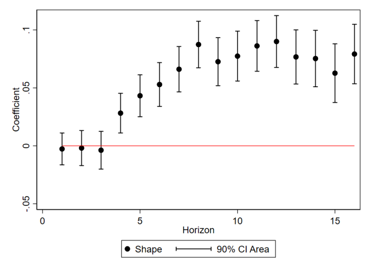


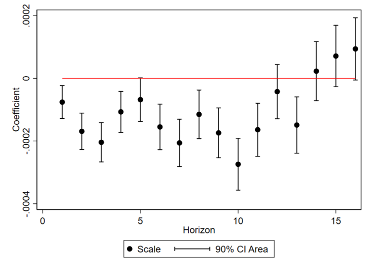
Higher TFP Skewness → Lower prices Back

Time Invariant Pareto

$$y^*_{i,b,p,t+h} = f_{i,h} + fP_{p,h} + fC_{b,h} + \sum_{c=1}^{C} \alpha_{c,h} \mathbf{I}[b \in C]\epsilon_t^m + \beta_h Conc_{c,n,t-12}\epsilon_t^m + \Gamma^h \Delta y_{i,B,p,t-1} + u_{i,t+h}$$

The coefficient for Shape(left figure) and Scale (right figure) - MP shock interaction:

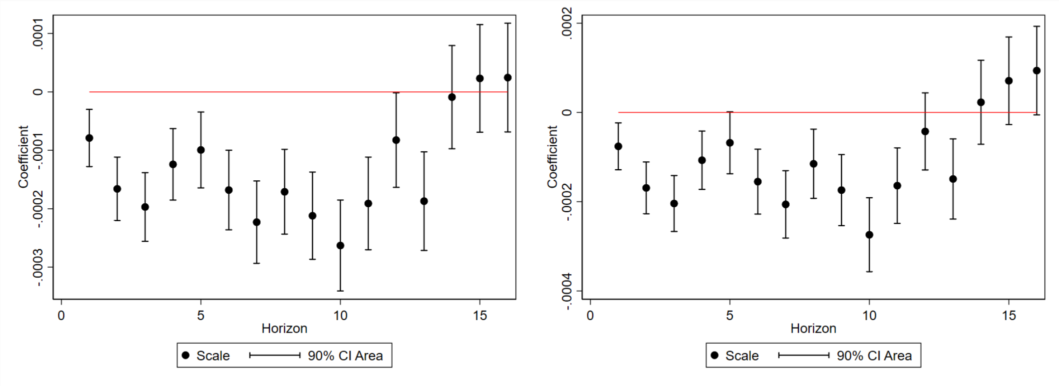




Interaction of Shape and Scale with MP shock:

higher concentration → lower prices. Back

Scale Variable



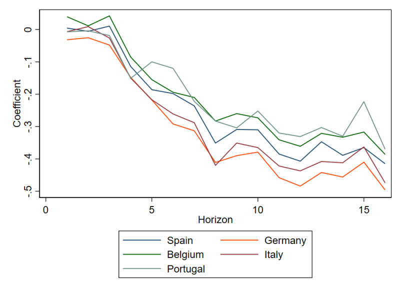
(a) Scale **(b)** Scale (largest exporters)

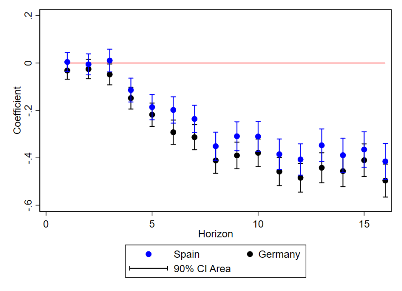
Interaction of Pareto Scale and MP shock Back

Results with the Concentration Term

$$y^{*}_{i,b,p,t+h} = f_{i,h} + fP_{p,h} + fC_{b,h} + \sum_{c=1}^{C} \alpha_{c,h} \mathbf{I}[b \in C]\epsilon_t^m + \beta_h Conc_{c,n,t-12}\epsilon_t^m + \Gamma^h \Delta y_{i,B,p,t-1} + u_{i,t+h}$$

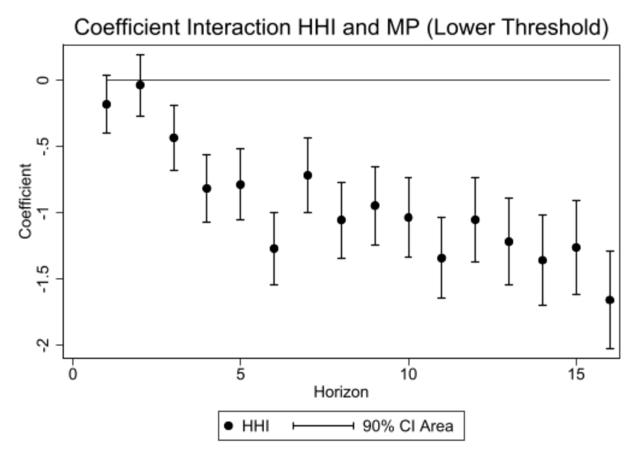
The coefficient for country - MP shock interaction through horizons:





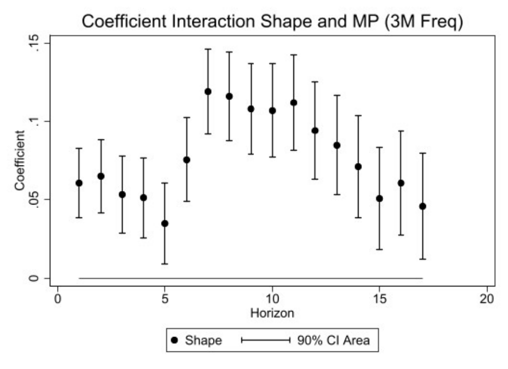
By adding the concentration variables: no significant differences across countries.

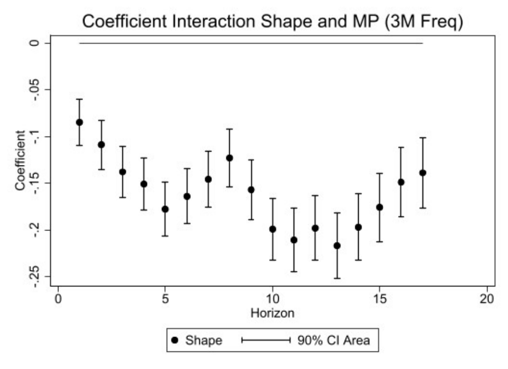
Lower Threshold



Higher HHI → Lower prices Back

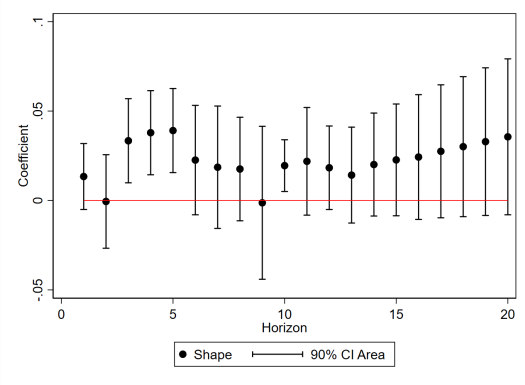
3M Freq



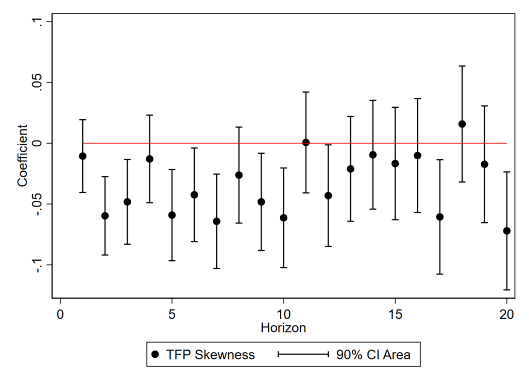


Higher skewness → Lower prices Back

Country-Product-Shock Interaction



(a) TFP Shape (Amadeus)



(b) TFP Skewness (Compnet)

Role of the Shape and Skewness of the productivity distribution Back

Saturated Regression

Triple interactions by focusing on big firms :

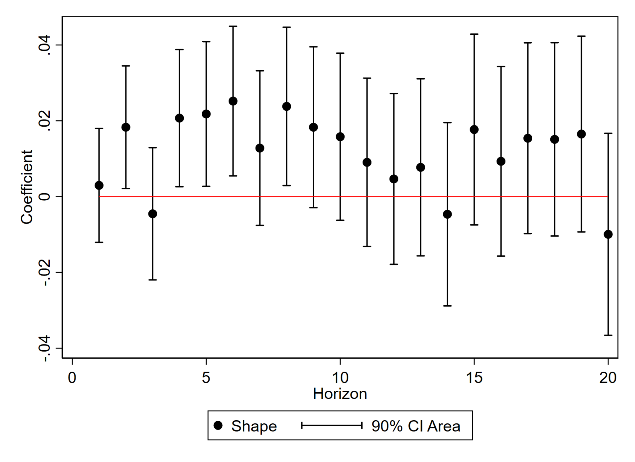
- HHI Results
- TFP skewness Results
- And more “homogeneous” products: TFP shape Results

For the composition effects:

- Big firms that are consistently in the data.
- Only firms that export to at least 4 destinations in that year.
- Consequently transaction before the shock.
- Attrition per horizon 2% to 3%.

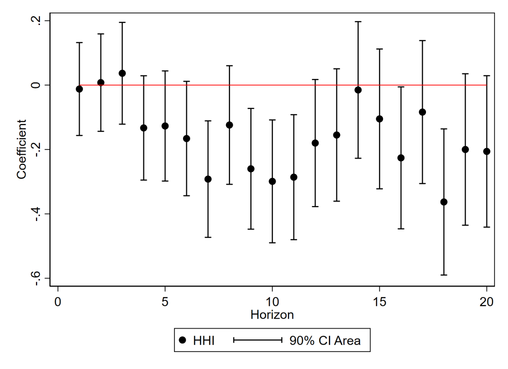
Back

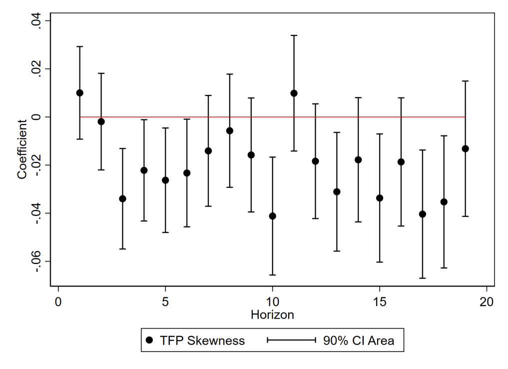
Country-Product-Month



Lower Shape → Lower prices Back

Country-Product-Month





Higher skewness → Lower prices Back

Specification

$$TFP_{p,cs,t+1} - TFP_{p,cs,t-1} = fC_{t+h} + fI_{t+h} + \epsilon_t^M + \beta_h Prod_{t-12}\epsilon_t^m + \sum_{l=1}^{L} X_{t-l} + u_{p,cs,t+h}$$

The dependent variable is the change of TFP of the specific percentile of the TFP distribution one year after the shock:

- Annual frequencies;
- CPI and IP as control variables;
- Country and Industry fixed effects.

Back

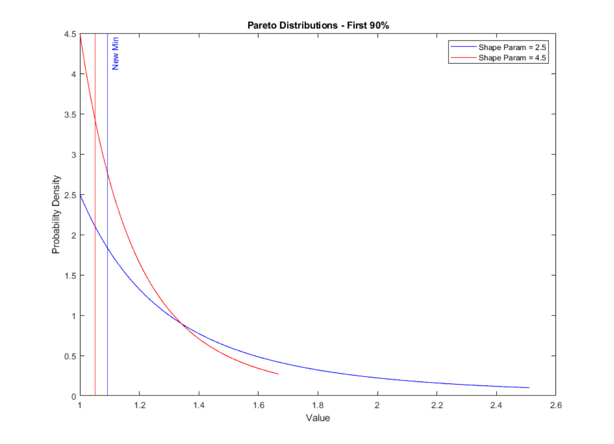
Mechanism

Assuming a **Pareto distribution** with different shape parameters:

- A lower shape is associated with a higher density to the right part;
- But lower density to the left.

Pareto

Heterogeneous selection effect:



Distribution of the 90% of firms

Mechanism

Assuming a **Pareto distribution** with different shape parameters:

- A lower shape leads to a higher density to the right;
- But lower density to the left.

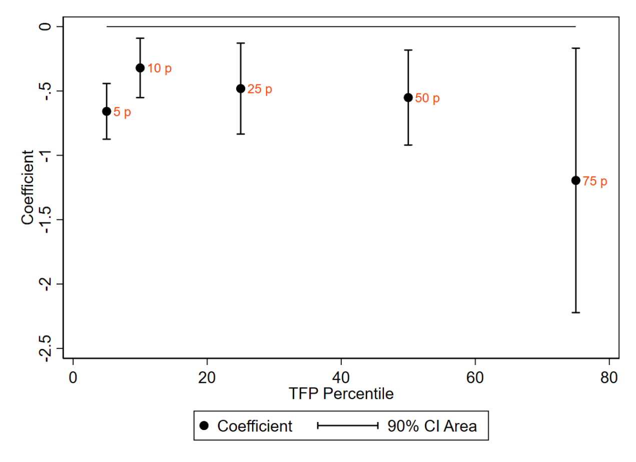
A **symmetric negative demand shock**:

- Leads to the exit of unproductive firms;
- But since different densities, in lower shape, the cutoff increases more;
- Can this lead to a temporal higher competition?
- If yes, survivors set a lower markup and price;
- Additional effects on production, inflation, and trade.

If there is a **higher competition** → **also the exporters from other countries** face it.

Back

Selection Effect - HHI



Higher Shape → Lower TFP after shock Back

Literature

Monetary Policy and Monetary Union:

- Gali-Monacelli (2008) and Benigno (2004) optimal monetary policy MU;
- Cacciatore et al.(2016) market deregulation in monetary union.

→ Asymmetric price adjustment and selection mechanism.

Monetary Policy and Firm Heterogeneity:

- Bilbiie, Ghironi and Melitz (2012, 2007), Bergin and Corsetti (2008), Colciago and Silvestrini (2022): Extensive margin in business cycles;
- Ghironi and Melitz (2005, 2007): Trade and monetary policy.

→ Intensive margin and productivity movements.

Literature II

Trade:

- Melitz and Ottaviano (2008) build a trade model where monopoly power matters;
- Goldberg and Verboven (2001), Fontaine et al. (2020): Price discrimination in EMU.

$\rightarrow$ Trade and price discrimination due to monetary policy.

Back

Households

I use the quasi-linear preferences as in Ottaviano (2011) Households:

$$U = \alpha \int_{i\in\Omega} c_i^c di - \frac{1}{2}\gamma \int_{i\in\Omega} (c_i^c)^2 di - \frac{1}{2}\eta \Big(\int_{i\in\Omega} c_i^c di \Big)^2 - \frac{N_t^{1+\phi}}{1+\phi}$$

- c_i^c is the consumption of the final good variety i of consumer c;
- N_t is labor supply;
- α, γ, η represent the substitution between differentiated varieties.

- Deviating from CES $\rightarrow$ endogenous markup/ elasticity of demand;
- Decrease of **demand** $\rightarrow$ **change in markups**; Elasticity
- Productivity cut-off to enter the market.

Back

Households II

By solving with a budget constraint:

$$\int_{i\in\Omega} p_{i,t}c^c_{i,t}di + V_tB_t \leq N_tW_t + B_{t-1} + \int_{i\in\Omega}\Gamma_t(i)$$

where $p_{i,t}$ is the price of the variety i, V_t is the price of the riskless bond B_t and $\Gamma_t(i)$ the dividend from firm.

By taking the FOCs:

$$\lambda_t p_{i,t} = \alpha - \gamma c^c_{i,t} - \eta C^c_t$$

$$\lambda_t = \beta E_t i_t \lambda_{t+1}$$

where λ_t is the "shadow price" of the budget constraint and C^c_t is the aggregate consumption of consumer c. Back

Households III

By integrating both sides and using the previous equation:

$$c_{i,t}^{c} = \frac{\alpha}{\gamma + \eta O_t} - \frac{\lambda_t p_{i,t}}{\gamma} + \frac{\lambda_t \eta O_t \bar{P}_t}{\gamma(\gamma + \eta O_t)}$$

where O_t is the number of firms operating and $\bar{P}_t = \int_{i \in \Omega} P_{i,t}$ is the average price of products.

There is a choke price, for which $q_{i,t} = 0$:

$$p_{i,t} \leq \frac{\frac{\alpha}{\lambda_t}\gamma + \eta O_t \bar{P}_t}{\gamma + \eta O_t} = PM_t$$

By using the relationship of the PM we have the demand equation:

$$p_{i,t} = PM_t - \frac{\gamma}{\lambda L} c_{i,t}$$

The last relationships:

$$\lambda_t W_t = N_t^{\phi} \quad \& \quad V_t = \beta E_t \left(\frac{\lambda_{t+1}}{\lambda_t} \right)$$

Back

Elasticity

The elasticity of demand in home market:

$$\epsilon_{H,i} = \frac{dq_i}{dp_i}\frac{p_i}{q_i} = \left(\frac{Pmax(v^H_{H,t})}{p_{i,t}} - 1\right)^{-1}$$

Where $p_{i,t}$ is the price of the specific variety/firm, $Pmax$ is the maximum price a firm can set (a proxy for competition), while $v^H_{H,t}$ is the cut-off cost in the home market.

- $Pmax$ depends negatively on the cut-off productivity;
- A contractionary MP shock triggers the Selection mechanism but cut-off productivity increases more in the more concentrated market;
- Higher productivity → higher elasticity of demand → lower markups.

Therefore, heterogeneous selection effect → heterogeneous markup adjustment. Back

Back to Households

Intermediate input and Raw materials

Intermediate input firms use raw materials from both countries:

$$I_{H,t}^{W} = (\alpha^{1-\rho} {M_{H,t}^{H}}^{\rho} + (1-\alpha)^{1-\rho} {M_{H,t}^{F}}^{\rho})^{\frac{1}{\rho}}$$

Where M_H^H is the use of domestic raw materials and M_H^F is the use of foreign materials.

The price of input depends on the price of domestic PM_t^H and foreign raw materials PM_t^F and it includes an iceberg cost:

$$P_{H,t}^{I} = (\alpha({}_{H,t}^{F})^{\frac{\rho}{\rho-1}} + (1-\alpha) P {M_{H,t}^{H}}^{\frac{\rho}{\rho-1}})^{\frac{\rho-1}{\rho}}$$

Raw Materials are produced by using labor:

$$M_{j,t} = A_t N_{j,t}^{1-\alpha}$$

Wage rigidities that do not affect the markups :

$$log(W_t) - log(W_{t-1}) = \beta E_t(log(W_{t+1}) - log(W_t)) + \frac{\mu(1-\beta(1-\mu))}{1-\mu}(log(N^{\phi}) - log(W_t \lambda_t))$$

Back

Trade Effect

By solving for $\bar{v}_H^H$:

$$\hat{v}_{H,t}^H \approx -\frac{A_H}{\kappa_H + 2}\left(\hat{\lambda}_{H,t} + \hat{P}_{H,t}^I\right)$$

$$-B_H\left[\hat{P}_{F,t}^I\left(1 + B_F - \frac{A_F}{\kappa_F + 2}\right) - \hat{P}_{H,t}^I\left(1 + B_F\right)\right.$$

$$\left.+\hat{\lambda}_{H,t}\left(\frac{1}{\kappa_H + 2} + \frac{B_F}{(\kappa_F + 2)}\right) - \hat{\lambda}_{F,t}\left(\frac{1}{\kappa_H + 2} + \frac{1}{\kappa_F + 2}\right)\right]$$

The foreign effect:

- $\hat{\lambda_H} \uparrow \longrightarrow v_{H,t}^{\hat{H}} \downarrow$: A fall in Home demand $\longrightarrow$ decrease of cut-off cost;
- $\hat{\lambda_F} \uparrow \longrightarrow v_{H,t}^{\hat{H}} \uparrow$: A fall in Foreign demand $\longrightarrow$ increase of cut-off cost;
- $P_{H,t}^{\hat{I}} \uparrow \longrightarrow v_{H,t}^{\hat{H}} \uparrow$: An increase in Home input prices $\longrightarrow$ increase of cut-off cost;
- $P_{F,t}^{\hat{I}} \uparrow \longrightarrow v_{H,t}^{\hat{H}} \uparrow$: An increase in Foreign input prices $\longrightarrow$ decrease of cut-off cost;

Given that $\frac{B_H}{A_H} > \frac{B_F}{A_F}$, the foreign effect is more important when κ is higher. Back

Price & Quantity of Final Good

Similarly with Melitz-Ottaviano, the final domestic good firms (superscript **H**) set at the home market (subscript **H**):

$$Production : q^H_{H,i,t} = \frac{\lambda_{H,t} P^I_{H,t}}{\gamma}(v^H_{H,t} - v^H_{i,t})$$

$$Price : p^H_{H,i,t} = \frac{P^I_{H,t}}{2}(v^H_{H,t} + v^H_{i,t})$$

$$Markups : \mu^H_{H,i,t} = \frac{P^I_{H,t}}{2}(v^H_{H,t} - v^H_{i,t})$$

Where λ_t is the Lagrangian multiplier, $v^H_{i,t}$ is the cost of a firm i, $v^H_{H,t}$ is the cut-off cost of **the destination market**, $\mu_{i,t}$ is the markup of each firm and $P^I_{H,t}$ is the price of the intermediate input at the domestic market.

→ More productive firms have lower prices but higher mark-ups and production. Back

Firms-Trade

When trading to the foreign market, each domestic firm faces an iceberg cost $\tau > 1$:

$$Price : p^{H}_{i,F,t} = \frac{\tau P^{I}_{H,t}}{2}\left(\frac{P^{I}_{F,t} v^{F}_{F,t}}{\tau P^{I}_{H,t}} + v^{H}_{i,t}\right)$$

$$Production : q^{H}_{i,F,t} = \frac{\tau \lambda_{H,t} P^{I}_{H,t}}{2\gamma}\left(\frac{P^{I}_{F,t} v^{F}_{F,t}}{\tau P^{I}_{H,t}} - v^{H}_{i,t}\right)$$

$$Markups : \mu^{H}_{i,F,t} = \frac{\tau P^{I}_{H,t}}{2}\left(\frac{P^{I}_{F,t} v^{F}_{F,t}}{\tau P^{I}_{H,t}} - v^{H}_{i,t}\right)$$

The exporter has to take into account the cut-off cost of the foreign market.

The cut-off cost of exporting:

$$v^{H}_{F,t} = \frac{P^{I}_{F,t} v^{F}_{F,t}}{\tau P^{I}_{H,t}}$$

Back

Trade

The trade balance of the Final goods:

$$TB_t = O^H_{F,t}\frac{\lambda_{F,t}(P^I_{F,t}\upsilon^H_{F,t})^2}{4\gamma(\kappa_H+2)} - O^F_{H,t}\frac{\lambda_{H,t}(P^I_{H,t}\upsilon^F_{H,t})^2}{4\gamma(\kappa_F+2)}$$

Where $O^H_{F,t}$ is the number of exporters from Home to Foreign and $O^F_{H,t}$ the exporters from Foreign to Home. By using the cumulative density function, the number of exporters are:

$$O^H_{F,t} = (\frac{\upsilon^H_{F,t}}{\upsilon^H_{H,t}})^{\kappa_H} O^H_{H,t}$$

$$O^F_{H,t} = (\frac{\upsilon^F_{H,t}}{\upsilon^F_{F,t}})^{\kappa_F} O^F_{F,t}$$

The different κ leads to different densities also to the right tail of the distribution $\rightarrow$ lower cut-off does not necessarily lead to more exporters. Back

Productivity Parametarization

Following the literature, I assume **Pareto distribution** for the productivity of firms:

$$G(v) = \left(\frac{v}{v^M}\right)^{\kappa}, c \in (0, v^M]$$

Where κ is the shape parameter of the Pareto productivity, and v^M is the maximum cost (related to scale).

The two countries have only the shape parameter different:

- Home market: $\kappa_H = 2.5$ (non-concentrated market)
- Foreign market: $\kappa_F = 2$ (concentrated market)

Back

Entry

Firms exit in every period and enter if the expected profits are positive (Hopenhayn):

$$\pi_t^e = \underbrace{\int_0^{c_{H,t}^H} \pi_{i,t} dG(c)}_{\text{Domestic Profits}} + \underbrace{\int_0^{c_{F,t}^H} \pi_{F,i,t} dG(c)}_{\text{Export Profits}} - f_E P_{H,t}^I$$

The f_E is the fixed cost of inputs that each firm needs to pay to enter the market. By solving it:

$$v_{H,t}^H = \Big(\underbrace{f_E \frac{2\gamma(\kappa_H + 1)(\kappa_H + 2)(v^M)^{\kappa_H}}{\lambda_{H,t} P_{H,t}^I}}_{\text{Domestic Effect}} - \underbrace{\tau^2 \frac{\lambda_{F,t}}{\lambda_{H,t}} \big(\frac{(P_{F,t}^I)}{\tau(P_{H,t}^I)} v_{F,t}^H\big)^{\kappa_H + 2}}_{\text{Foreign Effect}}\Big)^{\frac{1}{\kappa_H + 2}}$$

The monetary policy triggers the selection mechanism through the wage rigidity and the change of $\lambda_{H,t}$. Back

Entry II

By log-linearizing the relationship around the steady-state:

$$\hat{v}_H^H \approx \underbrace{-\frac{A_H}{\kappa_H + 2}\left(\hat{\lambda}_{H,t} + \hat{P}^I_{H,t}\right)}_{\text{Domestic Effect}} \underbrace{-B_H\left[(\hat{P}^I_{F,t} - \hat{P}^I_{H,t}) + v^{\hat{F}}_{F,t} + \frac{1}{\kappa_H + 2}\left(\hat{\lambda}_{F,t} - \hat{\lambda}_{H,t}\right)\right]}_{\text{Foreign Effect}}$$

Where $A_H < A_F$ and $B_H > B_F$ are related to the steady state. Foreign effect Details

- Higher $\kappa \rightarrow$ lower decrease of v_H^H by domestic effect;
- Additional trade effect: higher $\kappa \rightarrow$ lower decrease of v_H^H;
- The trade effect leads to a stronger movement in the more concentrated economy.

Back

Trade Effect

Where:

$$A_H = \frac{f_E \frac{2\gamma(\kappa_H+1)(\kappa_H+2)(v_H^M)^{\kappa_H}}{\lambda_H^* P_H^*}}{v_H^{H*}} \qquad B_H = \frac{\tau^2 \frac{\lambda_F^*}{\lambda_H^*}\left(\frac{P_F^{I*}}{\tau P_H^{I*}}\right)^{\kappa_H+2}}{v_H^{H*}}$$

In the steady state of a two country model:

- Higher κ leads to lower λ^* and P^{I*}
- This overpass the positive effect on A_H

Back

Simulations

The model produces:

- Heterogeneous markup adjustment through heterogeneous selection effect;
- Decrease in number of firms/varieties (Extensive margin);
- Trade dynamics with extensive and intensive margin.

Matching with the evidence, higher concentration:

- Stronger price adjustment;
- BUT higher cut-off productivity!
- **Additionally:**
  - Higher output;
  - Lower trade balance of final goods.

Interdependencies and monetary union matters for the size of the dynamics.

Wholesale and Intermediate Inputs

Whole

I use the simple NK framework where *wholesale firms* use CES aggregator:

$$Y_t^w = (\int_0^1 (Y_{j,t}^I)^{\frac{\epsilon-1}{\epsilon}})^{\frac{\epsilon}{\epsilon-1}}$$

And the Price would be:

$$P_t^w = (\int_0^1 p_{j,t}^{1-\epsilon} dj)^{\frac{1}{1-\epsilon}}$$

While the Intermediate Inputs:

$$Y_{i,t}^I = A_t N_t$$

I introduce price rigidities by using Rotemberg pricing. Back

Monetary Policy

Common monetary policy:

$$1 + i_t = \frac{1}{\beta}(\beta(1 + i_{t-1}))^{\rho_i} \Pi_t^{\phi_\pi} (\frac{Q_t}{Q^s})^{\phi_Q} e^{(\nu_t)}$$

Where I use the same weight for both economies:

$$\Pi_t = (\Pi_{H,t} + \Pi_{F,t})/2 \quad Q_t = (Q_{H,t} + Q_{F,t})/2$$

For stationarity, following Schmitt-Grohé and Uribe (2003) I use a debt elastic interest rate:

$$i^*_{H,t} = i_t + \psi(e^{(\frac{d_{H,t}}{\bar{d}_{H,t}})} - 1)$$

Where ψ is a small parameter related to the debt premium (Net supply equal to 0). Back

Summary

The output of the economy, where O_t is the number of firms:

$$Q_t^H = O_{H,t}^H \frac{\lambda_{H,t}}{2\gamma(\kappa_H + 1)} P_{H,t}^I c_{H,t}^H + O_{F,t}^H \frac{1}{2\gamma(\kappa_H + 1)} \lambda_{F,t} P_{F,t}^I (c_{F,t}^F)$$

The consumption of the economy:

$$C_{H,t} = Q_{H,t} = O_{H,t}^H \frac{\lambda_{H,t} P_{H,t}^I c_{H,t}^d}{2\gamma(\kappa_H + 1)} + O_{H,t}^F \frac{\lambda_{H,t} P_{H,t}^I (c_{H,t}^H)}{2\gamma(\kappa_F + 1)}$$

The price index depends on the home prices and trade:

$$P_{H,t} = \frac{O_{H,t}^H \frac{\lambda_{H,t} (P_{H,t}^I c_{H,t}^H)^2}{4\gamma(\kappa_H + 2)} + O_{H,t}^F \frac{\lambda^H (P_{H,t}^I c_{H,t}^{H}{}^2)}{4\gamma(\kappa_F + 2)}}{C_{H,t}}$$

Back

Calibration

Parameter	Description	Value
f_E	Fixed entry cost	0.17
υ_H^M	Maximum potential cost	13.5
υ_F^M	Maximum potential cost	13.5
ϕ	Inverse Frisch elasticity	3
η	Preferences parameter	10
α	Preferences parameter	5
γ	Preferences parameter	11
A	Productivity of the intermediate input firms	1
L	Market size	1
κ_H	Shape parameter of Pareto distribution	2.5
κ_F	Shape parameter of Pareto distribution	2
α_N	Capital returns	0
τ	Iceberg cost	1.5
ϕ_π	Taylor rule (Inflation)	2
ϕ_y	Taylor rule (Output)	0.2
ϵ	Elasticity	6
β	Discount factor	0.99
ρ_ξ	AR(1) monetary policy shock	0.95
μ	Wage rigidity	0.25

Parameters, their descriptions, and values

Back

Simulation - Two Country MU

Variable	Description	$\kappa = 2.5$	$\kappa = 2$
Q_{ss}	Final Good Output	0.019	0.161
v^d_{ss}	Inverse Cut-Off Productivity	12.969	10.509
N_{ss}	Employment	0.591	0.662
C_{ss}	Consumption	0.079	0.101
I_{ss}	Intermediate input	0.178	1.049
O_{ss}	Number of Firms	1.288	1.685
P^W_{ss}	Price of Intermediate Input	1.308	1.370
P^M_{ss}	Price of Raw Materials	1	1.260
P_{ss}	Consumer Price Index	6.410	5.406
$P_{\max}$	Maximum Price	16.968	14.399
λ_{ss}	Langrangian Multiplier	0.247	0.276
W_{ss}	Wage	0.833	1.050
$\bar{P}_{ss}$	Average Price	14.231	12.013
$O^H_{H,ss}$	Domestic Firms	0.291	1.615
$O^H_{F,ss}$	Exporters	0.070	0.997
M_{ss}	Raw Materials	0.591	0.662
T_{ss}	Trade Balance (Final Goods)	-0.293	0.293
B_{ss}	Bond	0	0

Steady state of the two country model. Calibration Closed Economy Steady Closed Economy Uniqueness
New Calibration New Calibration Steady Back

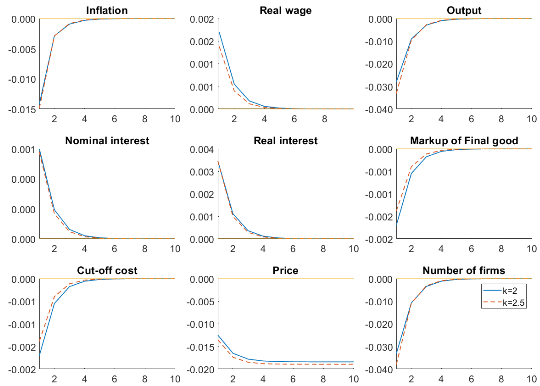
Closed Economy

Variable	Description	$\kappa = 2.5$	$\kappa = 2$
Q_{ss}	Final Good Output	0.064	0.076
v_{ss}^{d}	Inverse Cut-Off Productivity	13.268	12.207
N_{ss}	Employment	0.649	0.661
I_{ss}	Intermediate input	0.649	0.661
O_{ss}	Number of Firms	1.124	1.198
P^{W}	Price of Intermediate Input	1	1
$P_{\max}$	Maximum Price	13.268	12.207
λ	Langrangian Multiplier	0.328	0.346
W_{ss}	Wage	0.833	0.833
$\bar{P}$	Average Price	11.373	10.173

Comparison of Steady State Values for Different κ Values

Back

Closed Economy-Simulation



Responses for a 10 basis point shock in closed economy.

Back

Uniqueness

About global uniqueness:

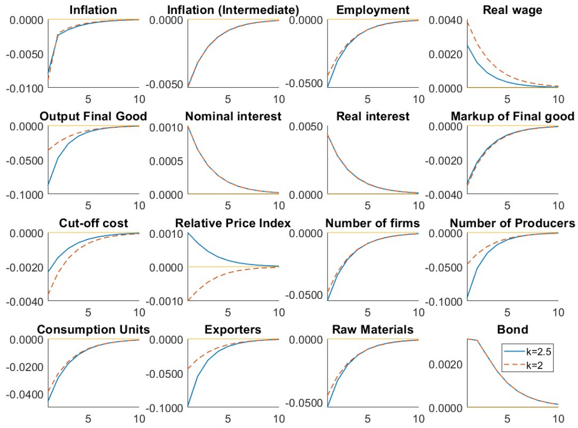
- Numerical with multiple initial guesses.
- closed or symmetric economy has a unique global solution.

About local uniqueness:

- Local uniqueness : Full rank of the Jacobian.
- Dynamic determinacy: BK test.

Back

Simulation - Two Country MU



Responses on a 10 b.p. monetary policy shock. Log deviations from the steady state Back.

New Calibration

Parameter	Description	Value	Source
f_E	Fixed entry cost	0.25	
v_H^M	Maximum potential cost	10	Normalized
v_F^M	Maximum potential cost	10	Normalized
ϕ	Inverse Frisch elasticity	3	Schmitt-Grohé and Uribe (2003)
η	Preferences parameter	1	Castillo-Martinez (2024)
α	Preferences parameter	9	
γ	Preferences parameter	11	Castillo-Martinez (2024)
κ_H	Shape parameter of Pareto distribution	2.5	Assumed
κ_F	Shape parameter of Pareto distribution	2.2	Assumed
τ	Iceberg cost	1.3	Ghironi and Melitz (2005)
ϵ	Elasticity of substitution (labor)	4.3	Galí and Monacelli (2016)
β	Discount factor	0.99	Schmitt-Grohé and Uribe (2003)
μ	Index of wage rigidity	0.2	Galí and Monacelli (2016)

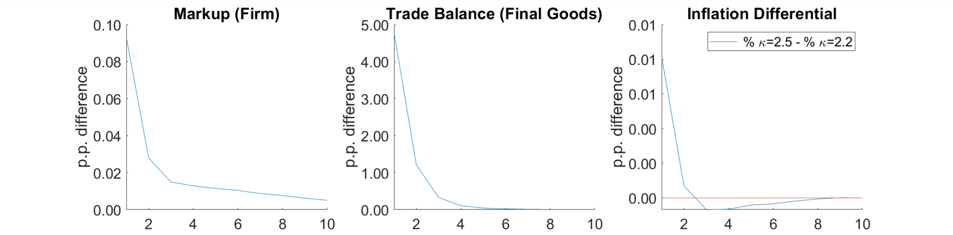
Parameters, their descriptions, and values Back

New Calibration Steady State

Variable	Description	$\kappa = 2.5$ (H)	$\kappa = 2.2$ (F)
Q_{ss}	Final good output	0.078	0.175
v_{ss}^{d}	Inverse cut-off productivity	9.612	8.317
N_{ss}	Employment	0.859	0.908
C_{ss}	Consumption	0.125	0.128
I_{ss}	Intermediate input	0.530	0.941
O_{ss}	Number of firms	1.132	1.125
P_{ss}^{W}	Price of intermediate input	1.000	1.000
P_{ss}^{M}	Price of raw materials	4.491	3.879
P_{ss}	Consumer price index	1.214	1.221
$P_{\max}$	Maximum price	11.668	10.155
λ_{ss}	Lagrangian multiplier	0.761	0.874
W_{ss}	Wage	0.833	0.858
$\bar{P}_{ss}$	Average price	9.926	8.586
$O_{H,ss}^{H}$	Domestic firms	0.591	0.973
$O_{F,ss}^{H}$	Exporters	0.151	0.541
M_{ss}	Raw materials	0.908	0.859
T_{ss}	Trade balance (final goods)	-0.177	0.177
B_{ss}	Bond	0.000	0.000

Steady state of the two–country model, updated with the new $\kappa = 2.5$ (H) and $\kappa = 2.2$ (F) values. Back

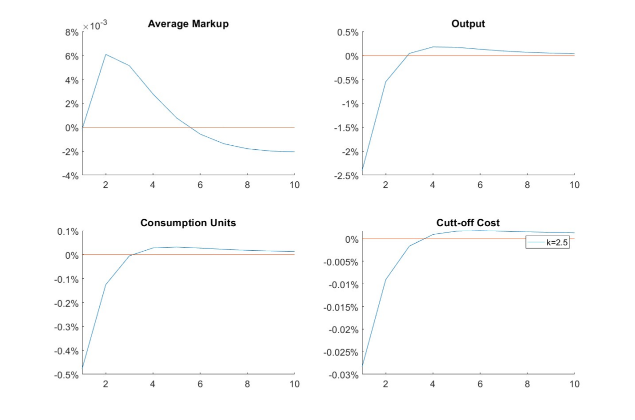
New Calibration Results



Responses for a 10 basis point shock in small open economy.

Back

Additional Results



Responses for a 10 basis point shock in small open economy.

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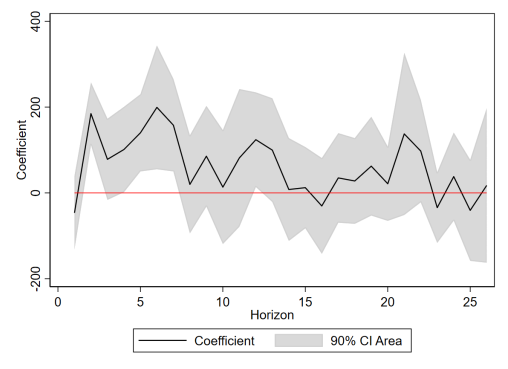
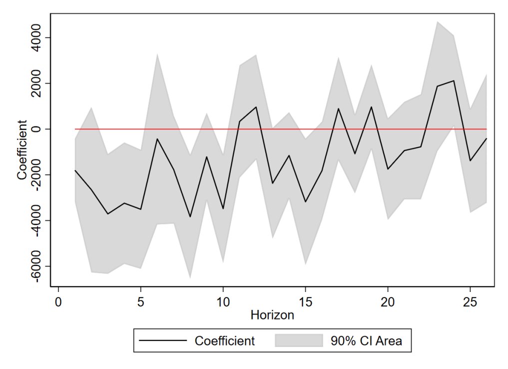
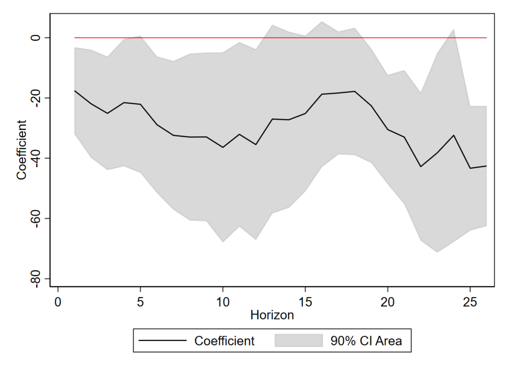
IP and Trade Balance





Higher skewness → Higher output and lower trade balance Back

PPI and Import Prices



Higher skewness → Lower import prices and PPI. Back