Sectoral Phillips Curves and the Aggregate Phillips Curve:

Results Available Upon Request

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Appendix 1: Derivation of the model with marginal costs following an AR(2)

The full model of (sectoral) inflation rests on the following system

$$\begin{aligned} \hat{\pi}_{j,t} &= \lambda_j^b \ \hat{\pi}_{j,t-1} + \lambda_j^f \ E_t \hat{\pi}_{j,t+1} + \theta_j \ \hat{s}_{j,t}^{avg} + \varepsilon_{j,t}^{\pi} \\ \hat{s}_{j,t}^{avg} &= \rho_{1j} \ \hat{s}_{j,t-1}^{avg} + \rho_{2j} \ \hat{s}_{j,t-2}^{avg} + u_{j,t}. \end{aligned}$$

Using the companion form of the second equation, we have

$$\begin{aligned} \pi_{j,t} &= \lambda_j^b \ \hat{\pi}_{j,t-1} + \lambda_j^f \ E_t \hat{\pi}_{j,t+1} + \begin{pmatrix} \theta_j & 0 \end{pmatrix} \begin{pmatrix} \hat{s}_{j,t}^{avg} \\ \hat{s}_{j,t-1}^{avg} \end{pmatrix} + \varepsilon_{j,t}^{\pi} \\ \begin{pmatrix} \hat{s}_{j,t}^{avg} \\ \hat{s}_{j,t-1}^{avg} \end{pmatrix} &= \Lambda_j \begin{pmatrix} \hat{s}_{j,t}^{avg} \\ \hat{s}_{j,t-1}^{avg} \end{pmatrix} + \begin{pmatrix} u_{j,t} \\ 0 \end{pmatrix} \end{aligned}$$

where

$$\Lambda_j = \begin{pmatrix} \rho_{1j} & \rho_{2j} \\ 1 & 0 \end{pmatrix}.$$

Determining the roots of the characteristic equation, we have

$$\hat{\pi}_{j,t} = \delta_{1j} \hat{\pi}_{j,t-1} + \frac{1}{\delta_{2j} \lambda_j^f} \begin{pmatrix} \theta_j & 0 \end{pmatrix} \left(I_2 - \delta_{2j}^{-1} \Lambda_j \right)^{-1} \begin{pmatrix} \hat{s}_{j,t}^{avg} \\ \hat{s}_{j,t-1}^{avg} \end{pmatrix} + \tilde{\varepsilon}_{j,t}^{\pi}$$

where

$$\delta_{1j} = \frac{1 - \sqrt{1 - 4\lambda_j^f \lambda_j^b}}{2\lambda_j^f} \qquad \text{and} \qquad \delta_{2j} = \frac{1 + \sqrt{1 - 4\lambda_j^f \lambda_j^b}}{2\lambda_j^f}.$$

It is straightforward to show that the sectoral reduced-form can be expressed as

$$\hat{\pi}_{j,t} = \delta_{1j} \hat{\pi}_{j,t-1} + \phi_{1j} \hat{s}_{j,t}^{avg} + \phi_{2j} \hat{s}_{j,t-1}^{avg} + \tilde{\varepsilon}_{j,t}^{\pi}$$

where

$$\begin{aligned}
\phi_{1j} &= \frac{\theta_j}{\Delta_j \delta_{2j} \lambda_j^f} \\
\phi_{2j} &= \phi_{1j} \frac{\rho_{2j}}{\delta_{2j}} \\
\Delta_j &= 1 - \frac{\rho_{1j}}{\delta_{2j}} - \frac{\rho_{2j}}{\delta_{2j}^2}.
\end{aligned}$$

Appendix 2: Sectoral Phillips Curves with Common Correlated Effects

With common correlated effects, the model in equation (9) can be rewritten:

$$\begin{aligned} \hat{\pi}_{j,t} &= \delta_{1j}\hat{\pi}_{j,t-1} + \phi_{1j}h_j\hat{s}^{avg}_{j,t} + \phi_{2j}h_j\hat{s}^{avg}_{j,t-1} + f_t'\ \gamma_{\pi,j} + \bar{\varepsilon}^{\pi}_{j,t} \\ \hat{s}^{avg}_{j,t} &= \rho_{1j}\ \hat{s}^{avg}_{j,t-1} + \rho_{2j}\ \hat{s}^{avg}_{j,t-2} + f_t'\ \gamma_{s,j} + \bar{u}_{j,t}, \end{aligned} \tag{1}$$

where $f_t = (\bar{\pi}_t, \bar{\pi}_{t-1}, \bar{s}_t, \bar{s}_{t-1}, \bar{s}_{t-2})'$, $\bar{x}_t$ is the cross-sectional average of $\hat{x}_{j,t}$, and $\bar{\varepsilon}^{\pi}_{j,t}$ (respectively $\bar{u}_{j,t}$) denotes an independent and identically distributed shock to inflation (respectively real marginal costs) in sector j.

Appendix 3: Robustness - Sectoral Estimates

- Table A1: Sectoral Phillips Curves with GMM;
- Table A2: Sectoral Phillips Curves with Common Correlated Effect.

Table A1: Sectoral Phillips Curves with GMM

Industries	Agri.	Food	Cons.	Car	Equip.	Interm.	Energy	Const.	Trade	Transp.	Fin.	Real Estate	Business	Pers. Serv.	Educ. & Health	Govt
Reduced Form - Equation (??)																
λ^b	0.498***	0.000	0.153*	0.291***	0.302***	0.338***	0.000	0.414***	0.387***	0.000	0.484***	0.493***	0.000	0.120*	0.482***	0.484***
	(0.028)	(0.385)	(0.085)	(0.079)	(0.090)	(0.052)	(0.057)	(0.024)	(0.052)	(0.117)	(0.030)	(0.064)	(0.168)	(0.070)	(0.012)	(0.009)
λ^f	0.501***	0.999***	0.632***	0.540***	0.697***	0.648***	0.693***	0.515***	0.572***	0.974***	0.515***	0.507***	0.999***	0.879***	0.501***	0.516***
	(0.047)	(0.385)	(0.094)	(0.197)	(0.131)	(0.130)	(0.104)	(0.042)	(0.124)	(0.262)	(0.054)	(0.081)	(0.374)	(0.118)	(0.019)	(0.012)
θ	0.934	2.551*	0.801**	0.020	0.189	0.033	7.460***	0.134	0.143	0.229	0.207	0.023	0.195	0.253	0.028	0.022*
	(0.905)	(1.426)	(0.346)	(0.037)	(0.214)	(0.177)	(2.299)	(0.115)	(0.308)	(1.486)	(0.219)	(1.148)	(1.295)	(0.384)	(0.045)	(0.0012)
Structural Estimates																
ω	0.237***	0.000	0.120**	0.463***	0.238**	0.393*	0.016*	0.427***	0.371***	0.005	0.417***	0.671	0.000	0.762	0.647***	0.659***
	(0.114)	(0.047)	(0.048)	(0.108)	(0.105)	(0.214)	(0.009)	(0.087)	(0.123)	(0.103)	(0.121)	(0.459)	(0.088)	(0.878)	(0.133)	(0.046)
α	0.239***	0.232*	0.349***	0.782***	0.558***	0.754*	0.093***	0.529***	0.545*	0.623	0.448***	0.698	0.649	0.579***	0.678***	0.709***
	(0.124)	(0.123)	(0.072)	(0.230)	(0.162)	(0.451)	(0.022)	(0.123)	(0.327)	(0.964)	(0.151)	(0..457)	(0.906)	(0.215)	(0.161)	(0.055)
Duration	1.314***	1.304***	1.535***	4.589	2.262**	4.059***	1.102***	2.125***	2.201	2.650	1.812***	3.310	2.851	2.378***	3.108*	3.439***
	(0.215)	(0.210)	(0.174)	(4.848)	(0.828)	(0.674)	(0.026)	(0.554)	(1.636)	(6.776)	(0.475)	(5.103)	(7.368)	(1.219)	(1.557)	(0.654)

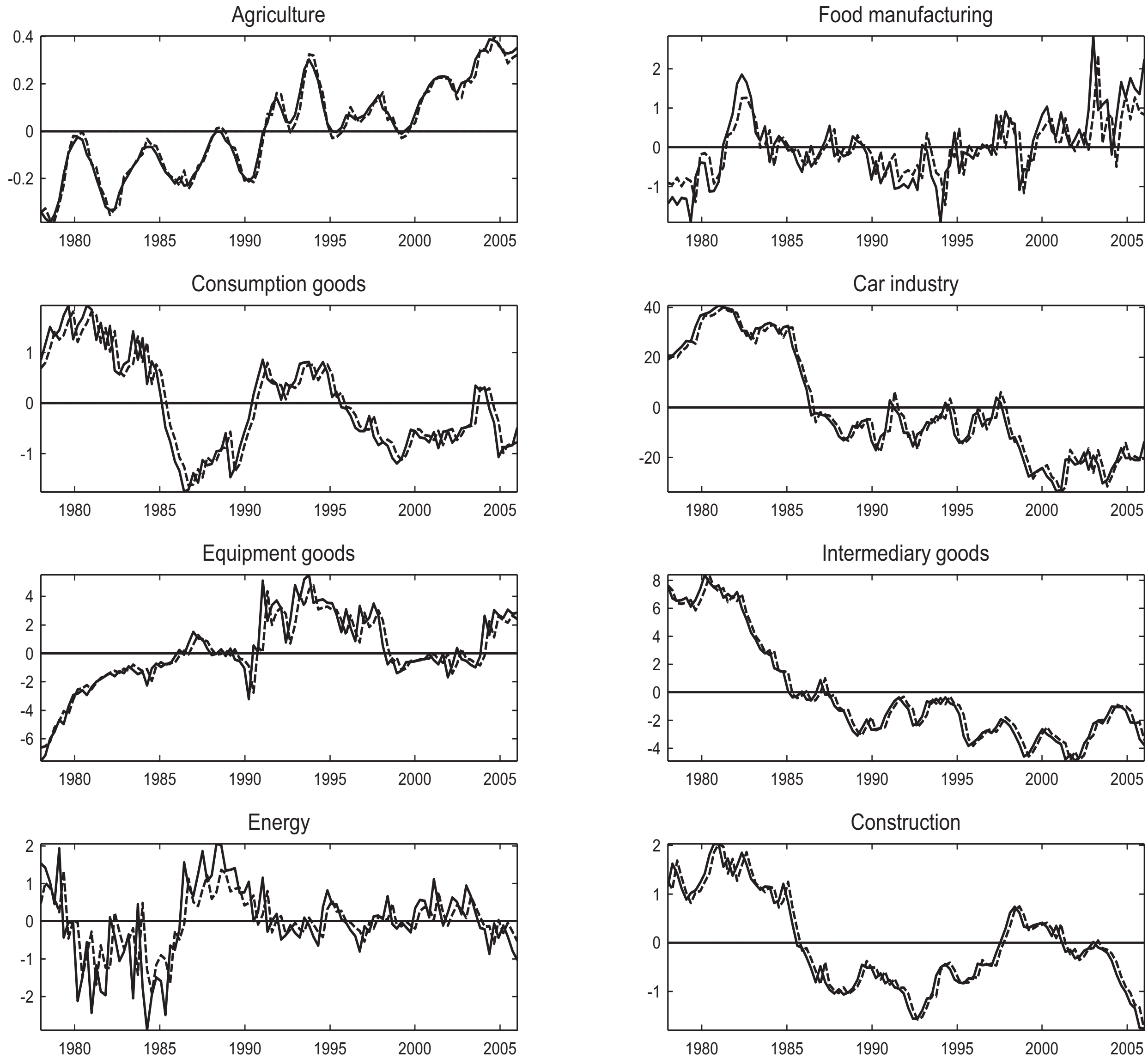
Note: Standard deviation in parentheses. The estimates are obtained using the generalized method of moments.

Table A2: Sectoral Phillips Curves with Common Correlated Effect

Industries	Agr.	Food	Cons.	Car	Equip.	Interm.	Energy	Const.	Trade	Transp.	Fin.	R. Estate	Business	Pers. Serv.	Educ. & Health	Govt
	Reduced Form - Equation (2)															
δ_1	0.776***	0.002	0.453***	0.213***	0.054	0.361***	0.003	0.370***	0.468***	0.001	0.485***	0.580***	0.001	0.313***	0.665***	0.795***
	(0.062)	(0.084)	(0.091)	(0.086)	(0.083)	(0.071)	(0.046)	(0.081)	(0.076)	(0.041)	(0.073)	(0.076)	(0.078)	(0.081)	(0.074)	(0.059)
ϕ_1	27.131**	1.716*	0.357	0.569*	0.348	0.908**	4.541***	0.908	2.042***	0.001	2.645**	7.645	0.001	0.001	0.765**	0.004
	(11.138)	(1.032)	(0.722)	(0.290)	(0.311)	(0.362)	(1.703)	(0.837)	(0.811)	(0.077)	(1.246)	(15.57)	(0.009)	(0.013)	(0.307)	(0.059)
ϕ_2	−17.68**	0.057	0.015	0.029	0.032	−0.097	1.004**	−0.191	−0.484*	−0.001	−1.465**	−5.473	0.001	−0.001	0.146*	0.001
	(7.327)	(0.138)	(0.041)	(0.048)	(0.037)	(0.082)	(0.404)	(0.192)	(0.264)	(0.002)	(0.704)	(11.17)	(0.003)	(0.003)	(0.079)	(0.013)
ρ_1	1.586***	0.852***	0.866***	0.832***	0.846***	1.053***	0.427***	1.157***	1.123***	0.609***	1.504***	1.648***	0.520***	1.118***	0.729***	0.727***
	(0.059)	(0.097)	(0.092)	(0.088)	(0.086)	(0.079)	(0.008)	(0.081)	(0.082)	(0.078)	(0.062)	(0.069)	(0.069)	(0.092)	(0.099)	(0.096)
ρ_2	−0.675***	0.034	0.044	0.051	0.093	−0.108	0.223	−0.213***	−0.240***	−0.026	−0.561***	−0.729***	0.275***	−0.184**	0.193*	0.216**
	(0.053)	(0.098)	(0.094)	(0.085)	(0.081)	(0.076)	(0.057)	(0.079)	(0.076)	(0.040)	(0.056)	(0.068)	(0.066)	(0.095)	(0.100)	(0.099)
	Reduced Form - Equation (??)															
λ^b	0.441***	0.002	0.313***	0.175***	0.051	0.267***	0.003	0.271***	0.320***	0.001	0.328***	0.369***	0.001	0.239***	0.402***	0.445***
	(0.022)	(0.083)	(0.043)	(0.059)	(0.075)	(0.039)	(0.046)	(0.044)	(0.036)	(0.041)	(0.034)	(0.031)	(0.077)	(0.047)	(0.027)	(0.019)
λ^f	0.554***	0.989***	0.682***	0.817***	0.940***	0.728***	0.987***	0.724***	0.675***	0.989***	0.667***	0.626***	0.989***	0.756***	0.595***	0.553***
	(0.021)	(0.082)	(0.043)	(0.058)	(0.074)	(0.038)	(0.045)	(0.043)	(0.035)	(0.039)	(0.033)	(0.031)	(0.076)	(0.046)	(0.027)	(0.018)
θ	1.533*	0.211	0.025	0.060	0.024	0.043	1.619*	0.043	0.177*	0.001	0.112	0.413	0.000	0.001	0.042*	0.001
	(0.801)	(0.222)	(0.058)	(0.046)	(0.028)	(0.034)	(0.952)	(0.052)	(0.101)	(0.003)	(0.084)	(0.871)	(0.002)	(0.001)	(0.022)	(0.002)
	Structural Estimates															
ω	0.156***	0.001	0.359***	0.159*	0.046	0.273***	0.001	0.280***	0.262***	0.001	0.302***	0.239	0.001	0.313***	0.465***	0.772***
	(0.047)	(0.053)	(0.102)	(0.064)	(0.071)	(0.055)	(0.015)	(0.068)	(0.052)	(0.040)	(0.052)	(0.188)	(0.075)	(0.089)	(0.067)	(0.019)
α	0.198***	0.636***	0.793***	0.749***	0.855***	0.756***	0.301***	0.756***	0.559***	0.999***	0.620***	0.409	0.999***	0.999***	0.694***	0.970***
	(0.064)	(0.146)	(0.207)	(0.084)	(0.084)	(0.082)	(0.075)	(0.127)	(0.097)	(0.272)	(0.106)	(0.322)	(0.174)	(0.122)	(0.071)	(0.236)
Duration	1.247***	2.750**	4.819***	3.991**	6.888*	4.098***	1.432***	4.104*	2.267***	-	2.628***	1.692*	-	-	3.272***	33.286
	(0.099)	(1.105)	(0.316)	(1.332)	(3.994)	(1..369)	(0.038)	(2.137)	(0.496)		(0.729)	(0.923)			(0.766)	(262.52)

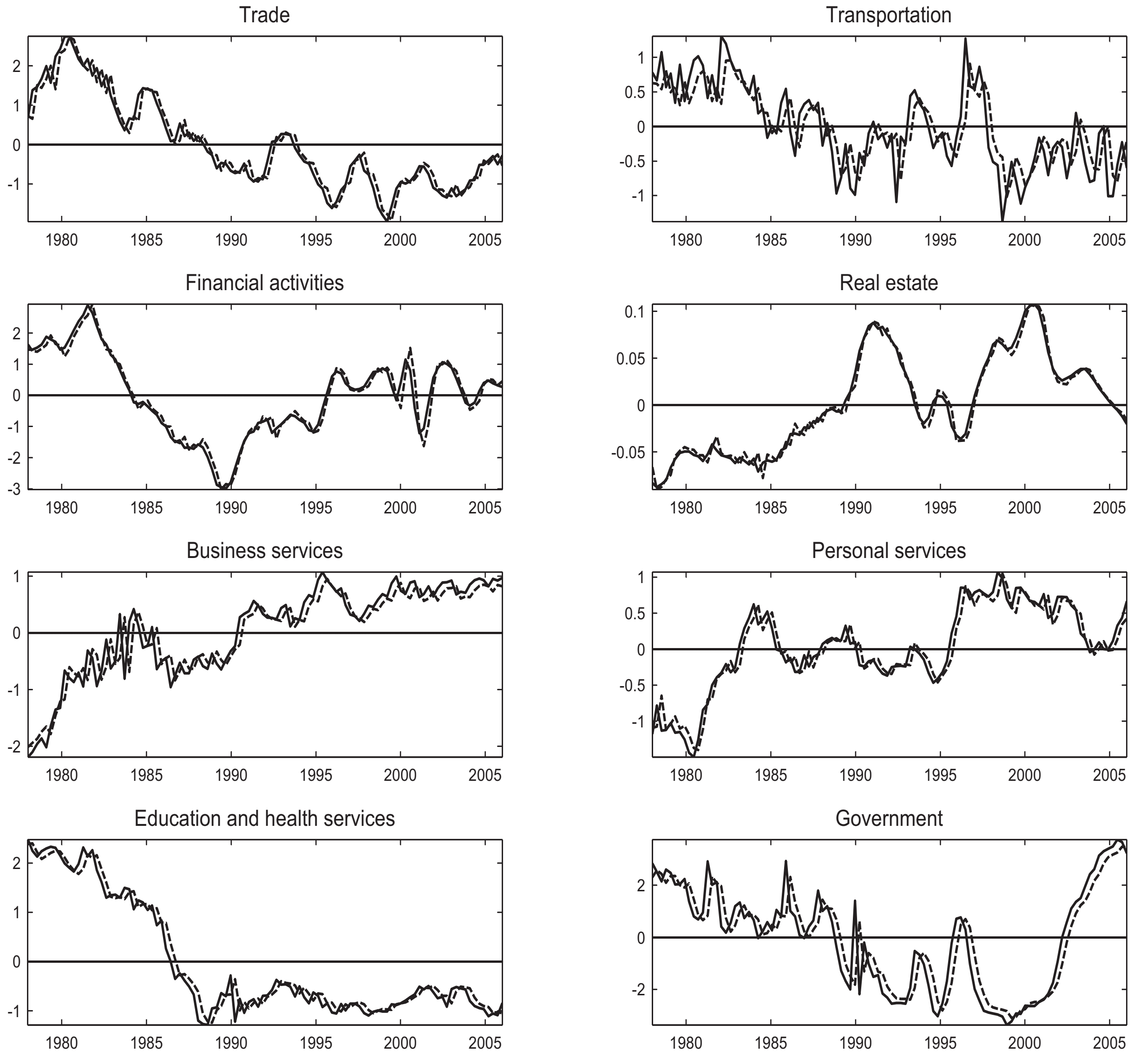
Note: Standard deviation in parentheses. Marginal costs follow an autoregressive process of order two. The estimates are obtained using a Maximum Likelihood procedure, including Common Correlated Effects. The structural estimates are inferred from reduced form coefficients using a Delta method.

Figure 1: Real Marginal Cost and AR(2)



Note: The plain line denotes observed marginal costs and the dotted line is the fitted AR(2).

Figure 1 (continued): Real Marginal Cost and AR(2)



Note: The plain line denotes observed marginal costs and the dotted line is the fitted AR(2).