Globalization, Pass-Through and Inflation Dynamic

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Motivation

- This paper investigates the "global-slack hypothesis", the extent to which inflation is more influenced by external conditions as a consequence of the globalization process.

- Globalization expands world trade. The increasing presence of foreign products in destination markets can change industry characteristics as the degree of competition and market concentration. Pricing strategies might be affected and thus the inflation dynamic.

Two channels under investigation. How can globalization change...:

1. ...the degree of pass-through, and therefore the sensitivity of prices of imported goods to external conditions (exchange rate, foreign marginal costs)?

2. ...the dynamic of domestic inflation, and therefore the sensitivity of prices to domestic and foreign marginal costs?

Findings

- Globalization should increase the degree of exchange-rate pass-through.
  - When the share of foreign firms in the domestic market increases, foreign firms face less competition for market shares coming from domestic firms. Foreign firms dominate the market and can pass-through more easily their costs into prices.
  - When the index of concentration in the market becomes low because more foreign firms enter, all firms become small and therefore behave as in a monopolistic-competitive market. Pass-through becomes unitary.
  - We find empirical evidence to support these theoretical results.

- Globalization steepens and shifts the Phillips curve.
  - An increase in the number of foreign firms in the market reduces the concentration in the industry and the steady-state mark up making prices more sensitive to domestic marginal costs.
  - The New-Keynesian Phillips curve is also influenced by the relative price (foreign-versus-domestic) on top of domestic real marginal costs. Relative price is a proxy for the market share.
  - "Global-slack hypothesis": a reduction in foreign prices puts downward pressure on domestic prices and shifts downward the AS equation.
  - The "global-slack" component depends on the share of foreign firms in the market and the degree of concentration in the industry.

Model

- Natural model to think about globalization is one in which firms compete for market shares through their pricing decision. (Dornbusch, 1987).

- Monopolistic competition (with isoelastic demand) would not work. Mark-ups are constant (in a flex-price model).

- A model in which firms are not small with respect to the market allows for time-varying mark-ups which depend on market shares and therefore on the relative marginal costs across firms with different technology or based in different markets.

- Two-country model, with multiple sectors, indexed by k. N differentiated goods in market h, N_h, produced by firms residing in h and N_f by firms residing in f.

- Optimal demand for a generic good i, in country h and sector k, is:

$$Y_i = (\frac{P_i}{P_k})^{-\sigma}(\frac{P_k}{P})^{-\theta}Y$$

where σ is the elasticity of substitution among varieties in sector k and θ is the elasticity of substitution across sectors.

$$P_k = (\sum_{i=1}^{N_h} P_i^{1-\sigma} + \sum_{j=1}^{N_f} P_j^{1-\sigma})^{\frac{1}{1-\sigma}}$$

where P_j denotes the price of a generic good j in the sector k, produced in country f.

- Following Dornbusch (1987), we assume that firms are not small with respect to their sector meaning that, in their pricing decisions, they internalize the fact that they can influence the sectoral price.

- The elasticity of demand of good i with respect to its price P_i is given by

$$\tilde{\sigma}_i \equiv \left| \frac{\partial Y_i}{\partial P_i} \frac{P_i}{Y_i} \right| = \sigma - (\sigma - \theta)\xi_i$$

where ξ_i identifies the market share of firm i in sector k given by

$$\xi_i \equiv \frac{P_i Y_i}{P_k Y_k} = \frac{P_i}{P_k} \frac{\partial P_k}{\partial P_i}.$$

- The elasticity of demand, $\tilde{\sigma}_i$, coincides with that of monopolistic competition under two cases:
  - When all firms are small, i.e. when their market share goes to zero, $\xi_i \longrightarrow 0$.
  - When $\theta = \sigma$; under this condition firms do not have leverage in affecting sectoral prices. The empirically-relevant case is one in which $\sigma > \theta$. Monopoly power rises with the market share.

Optimality conditions with flexible prices

Domestic firms:

$$P_{h,t} = \frac{\tilde{\sigma}_{h,t}}{\tilde{\sigma}_{h,t} - 1} \frac{W_t}{A_t},$$

Foreign Firms:

$$P_{f,t} = \frac{\tilde{\sigma}_{f,t}}{\tilde{\sigma}_{f,t} - 1} \frac{S_t W_t^*}{A_t^*}$$

where $\tilde{\sigma}_{h,t}$ and $\tilde{\sigma}_{f,t}$ are no longer constant and instead depend on market shares and therefore on prices.

In a log-linear approximation we get:

$$\hat{P}_{h,t} = \frac{\kappa s_f}{1+\kappa}(\hat{W}_t^* + \hat{S}_t - \hat{A}_t^*) + \frac{1+\kappa(1-s_f)}{1+\kappa}(\hat{W}_t - \hat{A}_t),$$

$$\hat{P}_{f,t} = \frac{\kappa s_h}{1+\kappa}(\hat{W}_t - \hat{A}_t) + \frac{1+\kappa(1-s_h)}{1+\kappa}(\hat{W}_t^* + \hat{S}_t - \hat{A}_t^*).$$

where

$$\kappa \equiv \frac{\sigma-1}{\bar{\sigma}-1}\frac{\sigma-\theta}{\bar{\sigma}}\frac{1}{N}$$

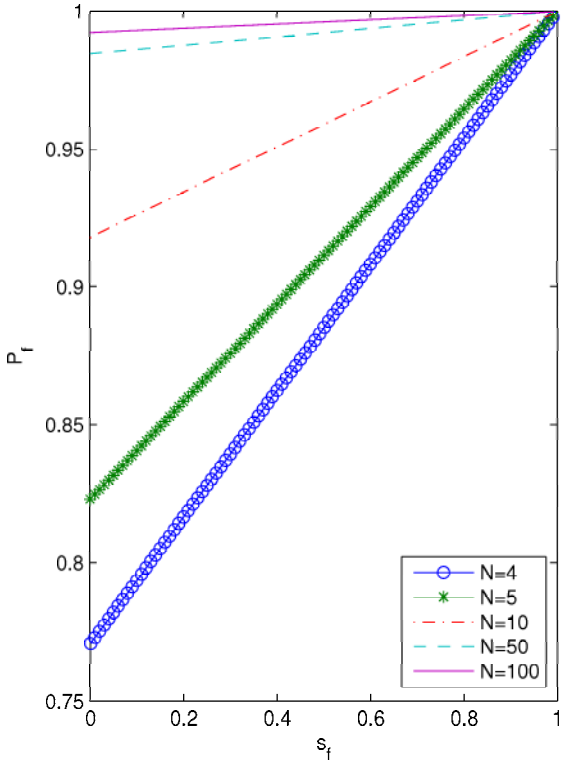
with $\bar{\sigma} \equiv \sigma - (\sigma-\theta)/N$, $s_h = N_h/N$ and $s_f = N_f/N$.

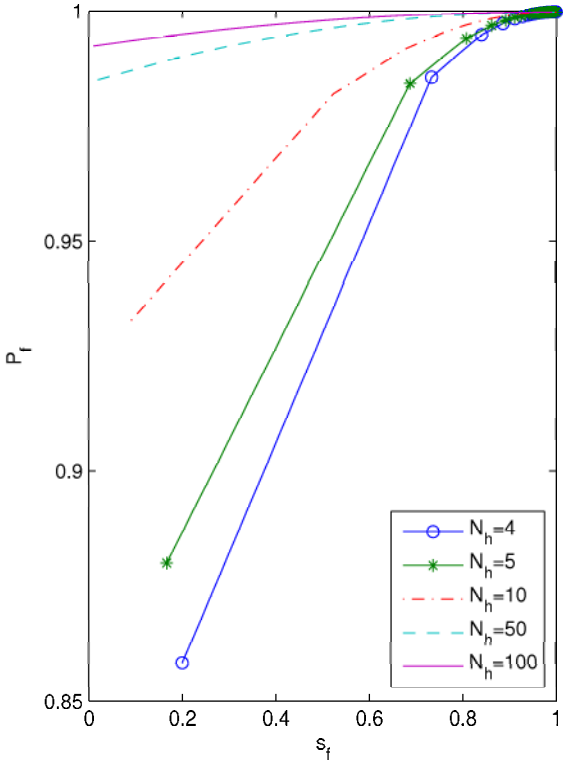
Implications:

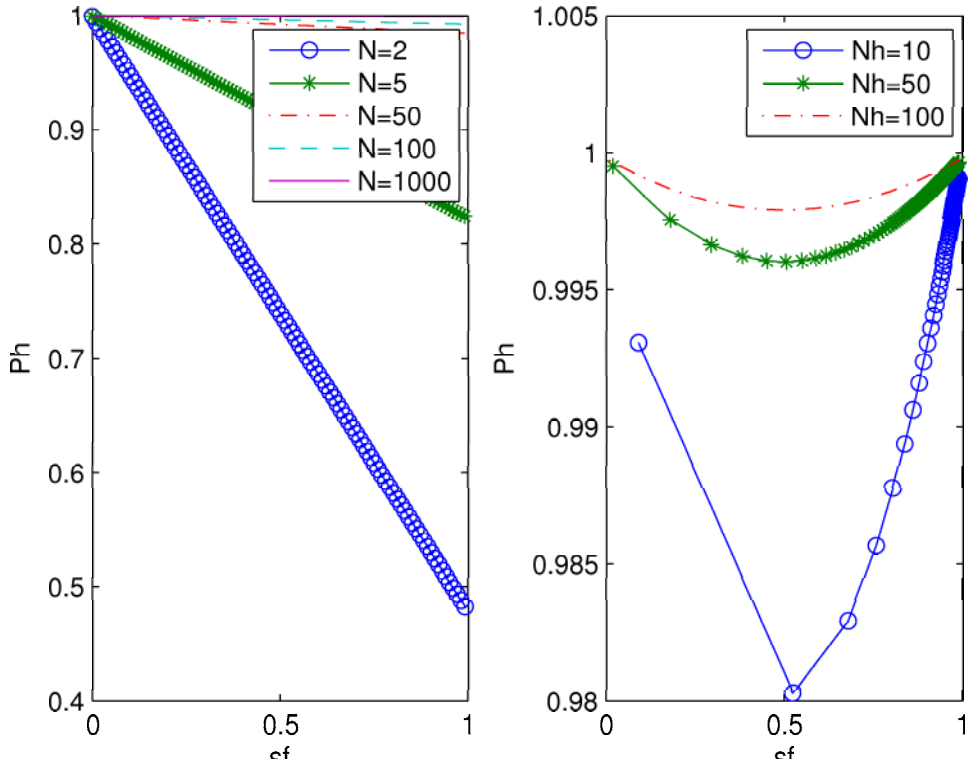
- Domestic and foreign prices in the home market are a weighted average of domestic and foreign marginal costs.

- Global-slack hypothesis: domestic prices depend on foreign marginal costs. The more, the higher is the fraction of foreign firms in the market (for given size N)

- Globalization should increase the pass-through. Pass-through of foreign costs or the exchange rate into import prices depends as well on the degree of competition. Pass-through is increasing in the number and share of foreign products in the domestic market. It is unitary when one of the following condition is met*: 1)* $\sigma = \theta$; 2) $N \to \infty$; 3) $s_h = 0$.


1
0.95
0.9
0.85
0.8
0.75
P_f
0
0.2
0.4
0.6
0.8
1
s_f
N=4
N=5
N=10
N=50
N=100


1
0.95
0.9
0.85
P_f
0
0.2
0.4
0.6
0.8
1
s_f
N_h=4
N_h=5
N_h=10
N_h=50
N_h=100


N=2
N=5
N=50
N=100
N=1000
Ph
sf
1
0.9
0.8
0.7
0.6
0.5
0.4
0
0.5
1
Nh=10
Nh=50
Nh=100
Ph
sf
1.005
1
0.995
0.99
0.985
0.98
0
0.5
1

Inflation dynamic

- Canonical New-Keynesian model implies the following AS equation

$$\pi_{h,t} = k \cdot mc_t + \beta E_t \pi_{h,t+1}.$$

  One issue of investigation has been the extent to which globalization can change the slope of the curve (See Sbordone, 2007)

- In an open economy, marginal costs are not just a function of the domestic output gap

$$\pi_{h,t} = k \cdot [y_{h,t} - (1-n)\psi(\hat{P}_{f,t} - \hat{P}_{h,t})] + \beta E_t \pi_{h,t+1},$$

  but also of the relative price. Foreign slack can be important. However, it works counter-intuitively.

- Our model instead implies variation in the mark-up due to changes in the market share

$$\pi_{h,t} = k \cdot mc_t + \frac{\sigma - \theta}{\bar{\sigma}} \frac{1}{N} \cdot \hat{\xi}_{h,t} + \beta E_t \pi_{h,t+1},$$

and therefore in the relative prices

$$\pi_{h,t} = k \cdot \left[mc_t + \kappa s_f (\hat{P}_{f,t} - \hat{P}_{h,t}) \right] + \beta E_t \pi_{h,t+1}.$$

- Relative-price channel now goes in the right direction, a fall in foreign prices puts downward pressure on domestic inflation for given marginal costs. (see Gust et al., 2008, with Kymball's preferences)

- The additional channel disappears
  - when *all* firms become small in size (N goes to infinity implying κ goes to zero), nesting the monopolistic-competitive market,
  - or when the share of foreign firms is small (s_f goes to zero),
  - or in the particular case in which $\sigma = \theta$, implying also that κ goes to zero.

- Steepening of the Phillips curve: an increase in N_f, rises N and, for given N_h, implies an increase in the slope of the Phillips curve. Hence, on the one side, globalization implies that prices become more sensitive to variations in the marginal costs as $\bar{\sigma}$ increases.

- Starting from a low share of foreign firms in the market, globalization makes the AS equation more dependent on foreign conditions, the 'foreign slack'.

- In sectors with low degree of concentration, the relative-price channel is less important and a further increase in the presence of foreign products makes it smaller.

Eexchange-rate pass-through under sticky prices

- Price stickiness and strategic pricing interact in explaining the dynamic of exchange-rate pass-through.

$$\hat{P}_{f,t} = \lambda \hat{P}_{f,t-1} + \lambda E_t \sum_{j=0}^{\infty} (\beta\lambda)^j \left[\frac{(\bar{\sigma}-1)}{\chi^*} (\hat{W}^*_{t+j} + \hat{S}_{t+j}) + \frac{\sigma - \theta}{\bar{\sigma}} \frac{1}{N} \frac{1}{\chi^*} \hat{\xi}_{f,t+j} \right],$$

- Even if foreign prices are perfectly flexible, sticky domestic prices imply imperfect short- and long-run pass-through (short lower than long) contrary to the implication of a standard monopolistic competition model.

- Dynamic of market share influences the short and long-run pass-through.

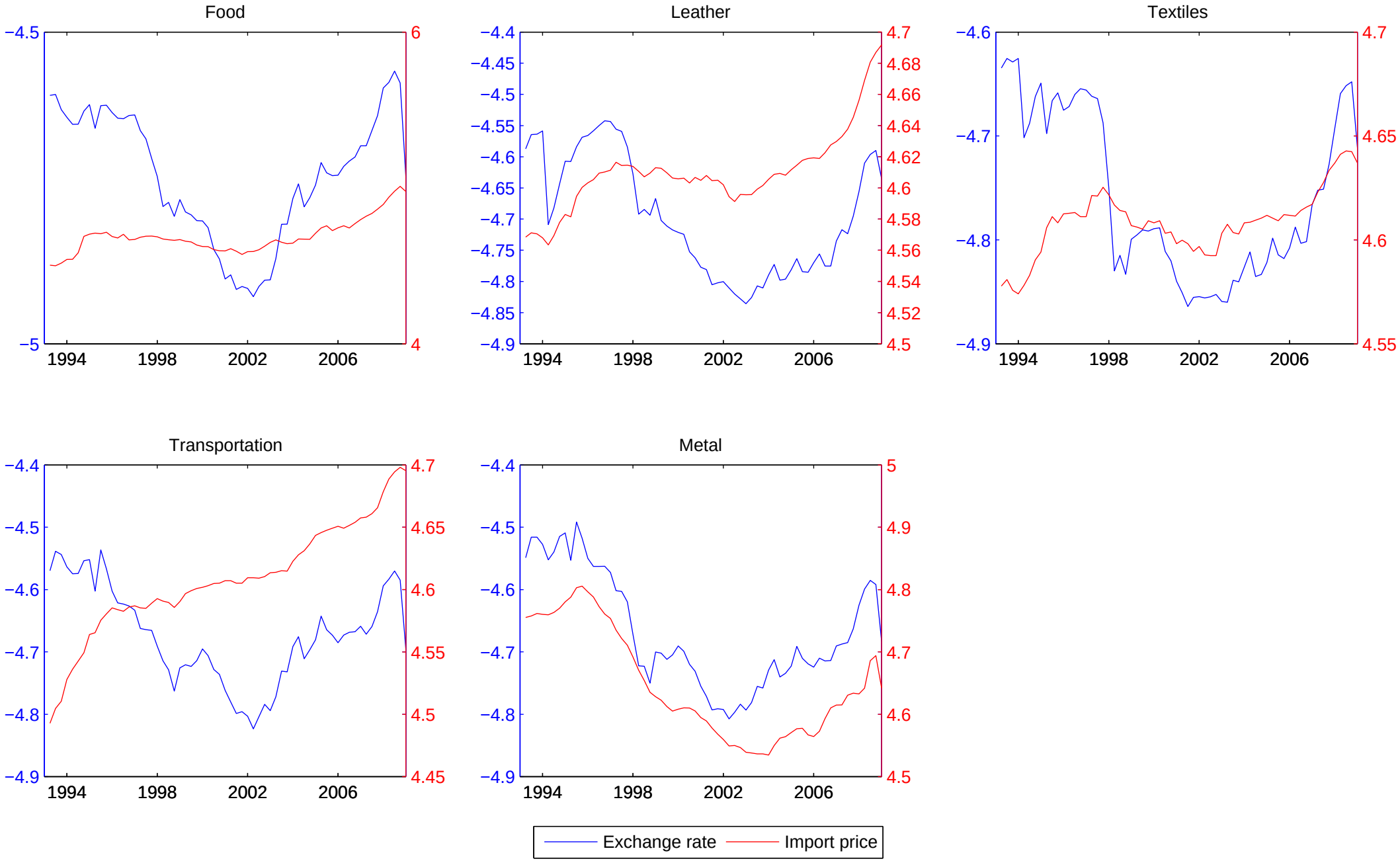
- The degree of pass-through is:
  - decreasing with the degree of price stickiness of foreign firms;
  - is increasing with the share of foreign firms in the domestic market.

- Globalization should increase the degree of pass-through for given degree of nominal rigidity and more when the degree of rigidity is lower.

Empirical Analysis on Pass-Through

- Empirical analysis on the effects of globalization on the exchange-rate pass-through using manufacturing data on US

- 5 manufacturing sectors considered: 1) vegetables and prepared food, 2) leather and footwear, 3) textiles and textile articles, 4) vehicles, vessels and associated transport equipment, and 5) base metals and machinery. Data are quarterly from 1993 to 2008.


Food
−4.5
−5
6
4
1994
1998
2002
2006
Leather
−4.4
−4.45
−4.5
−4.55
−4.6
−4.65
−4.7
−4.75
−4.8
−4.85
−4.9
4.7
4.68
4.66
4.64
4.62
4.6
4.58
4.56
4.54
4.52
4.5
1994
1998
2002
2006
Textiles
−4.6
−4.7
−4.8
−4.9
4.7
4.65
4.6
4.55
1994
1998
2002
2006
Transportation
−4.4
−4.5
−4.6
−4.7
−4.8
−4.9
4.7
4.65
4.6
4.55
4.5
4.45
1994
1998
2002
2006
Metal
−4.4
−4.5
−4.6
−4.7
−4.8
−4.9
5
4.9
4.8
4.7
4.6
4.5
1994
1998
2002
2006
Exchange rate
Import price

	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
$1993-2000$	-0.30	-0.19	-0.10	-0.59	0.77
$2001-2008$	2.35	0.57	0.26	1.05	0.59

Table 1: Ratio between the log-change in import price and the log-change in the real exchange rate ($\Delta p/\Delta q$) computed on the intervals 1993-2000 and 2001-2008 for the five sectors considered: 1) vegetables and prepared food, 2) leather and footwear, 3) textiles and textile articles, 4) vehicles, vessels and associated transport equipment, and 5) base metals and machinery.

Test the following linear models

$$\Delta p_{k,t} = c_k + \sum_{j=0}^{m} \beta_{k,j} \Delta q_{k,t-j} + \varepsilon_{k,t} \tag{1}$$

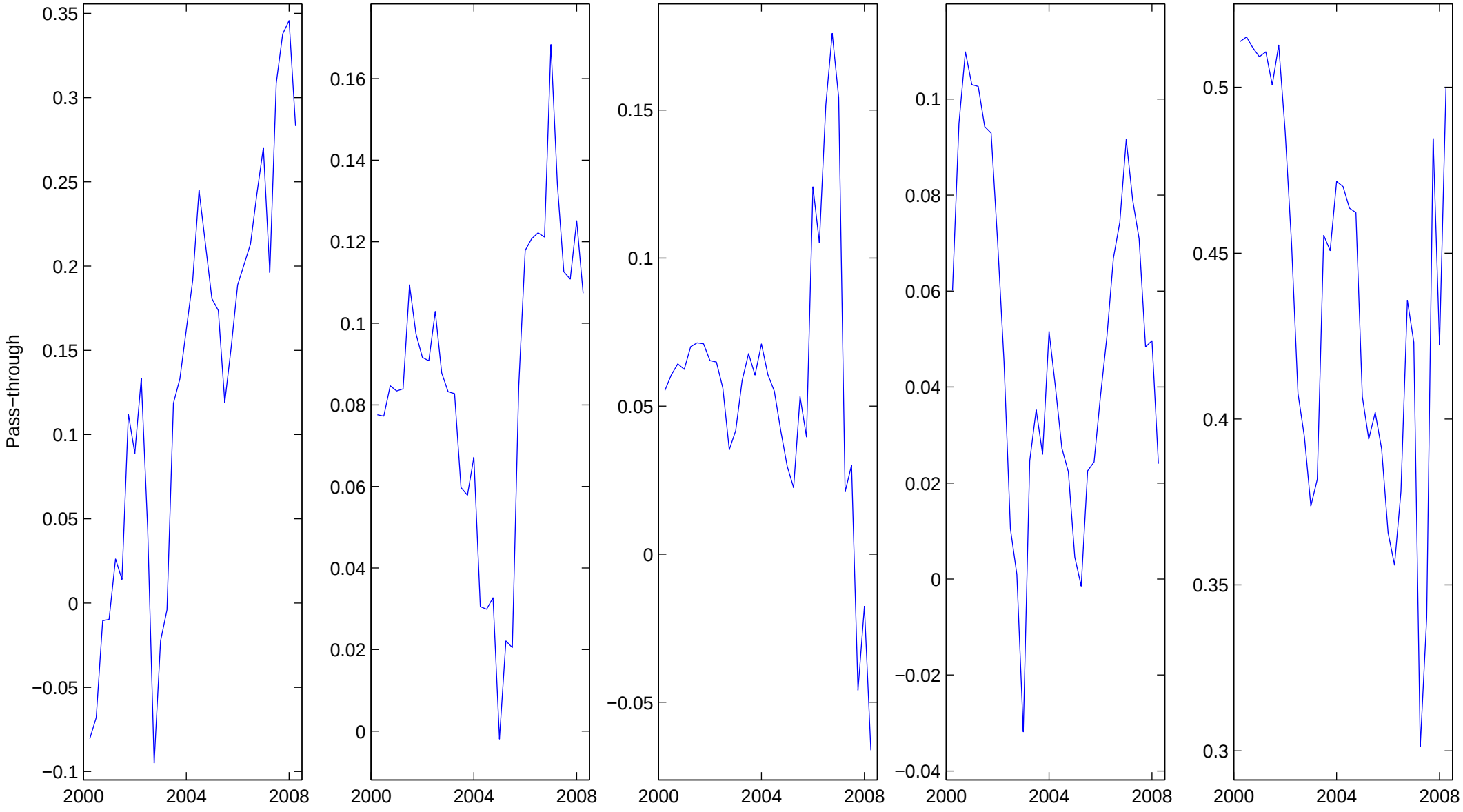
$$\Delta p_{k,t} = c_k + \gamma_k \Delta p_{k,t-1} + \sum_{j=0}^{m} \beta_{k,j} \Delta q_{k,t-j} + \varepsilon_{k,t}, \tag{2}$$

$$\Delta_y p_{k,t} = c_k + \beta_k \Delta_y q_{k,t} + \varepsilon_{k,t} \tag{3}$$

$$\Delta_{2y} p_{k,t} = c_k + \beta_k \Delta_{2y} q_{k,t} + \varepsilon_{k,t} \tag{4}$$

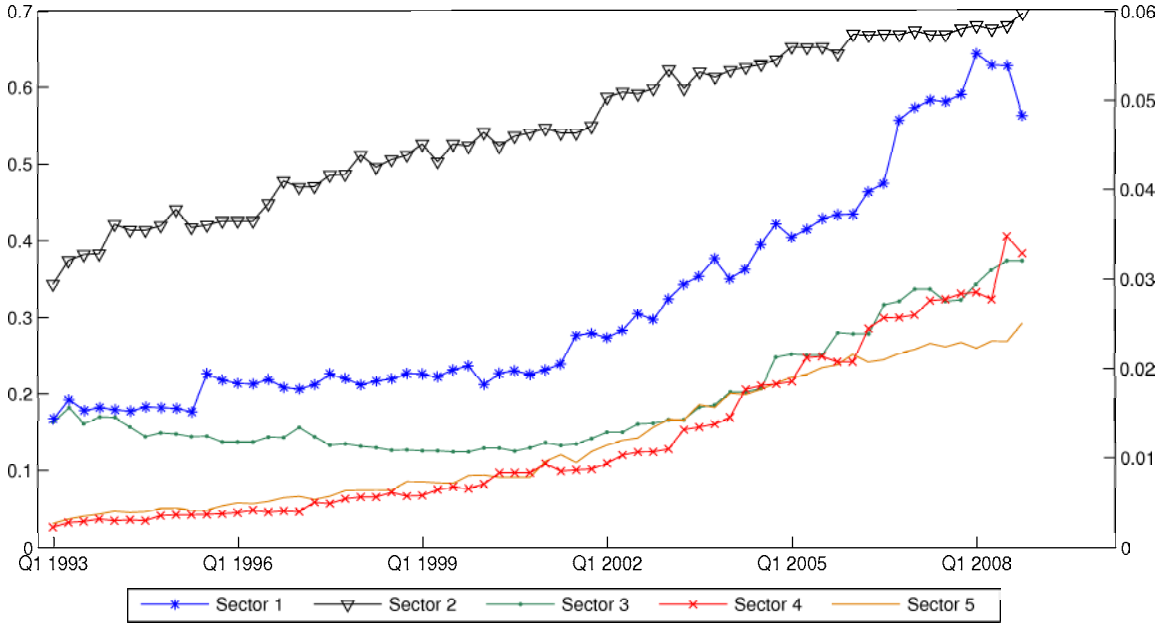
	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
Model (A)	0.497***	0.192***	0.081**	0.130***	0.669***
Until 2001 Q1	0.259	0.158***	0.124**	0.153**	0.631***
After 2001 Q1	0.483**	0.290***	0.059	0.159***	0.645***
Model (B)	0.540**	0.201***	0.083*	0.080**	0.711***
Until 2001 Q1	0.168	0.147***	0.115	0.108*	0.840*
After 2001 Q1	0.560	0.288***	0.042	0.103***	0.699***
Model (C)	0.409***	0.154***	0.076***	0.086***	0.439***
Model (D)	0.554***	0.164***	0.095***	0.087***	0.630***

Table 2: Estimated pass-through coefficients for Sector 1 (vegetables and prepared food), Sector 2 (leather and footwear), Sector 3 (textiles and textile articles). Model (A) corresponds to equation (1), Model (B) corresponds to equation (2). Model (C) to the following equation $\Delta_y p_t = c + \beta_0 \Delta_y s_t + \varepsilon_t$ where Δ_y represents the one-year difference operator. Model (D) corresponds to the following equation $\Delta_{2y} p_t = c + \beta_0 \Delta_{2y} s_t + \varepsilon_t$ where Δ_{2y} represents the two-year difference operator. Stars denote significance level, ***=1%, **=5%, *=10%.


Pass−through
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
−0.05
−0.1
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.15
0.1
0.05
0
−0.05
0.1
0.08
0.06
0.04
0.02
0
−0.02
−0.04
0.5
0.45
0.4
0.35
0.3
2000
2004
2008

Understanding the pass-through coefficient

$$\begin{aligned} \Delta p_{k,t} &= c_k + \sum_{j=0}^{m} \alpha_{k,j} \Delta q_{k,t-j} + \varepsilon_{k,t}, \\ \alpha_{k,j} &= \alpha_{0,k,j} + \alpha_{1,k,j} HH_t + \alpha_{2,k,j} share_t. \end{aligned} \tag{5}$$


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.06
0.05
0.04
0.03
0.02
0.01
0
Q1 1993
Q1 1996
Q1 1999
Q1 2002
Q1 2005
Q1 2008
Sector 1
Sector 2
Sector 3
Sector 4
Sector 5

	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
c_k	0.006***	0.002***	0.001***	0.003***	-0.002
$\alpha_{0,k,0}$	3.155	5.182	-0.086	-0.148	4.560*
$\alpha_{1,k,0}$	-0.012	-0.029	0.0004	0.0002	-0.053*
$\alpha_{2,k,0}$	-2.296	-0.472	0.247	1.187	2.537**
$\alpha_{0,k1}$	3.387	-5.305	0.036	-0.186	0.413
$\alpha_{1,k,1}$	-0.019	0.029	0.0004	0.0002	-0.004
$\alpha_{2,k,1}$	24.787*	0.884***	-0.323	4.102	0.893

Table 4: Estimation of the non-linear model (5) for the five sectors considered: 1) vegetables and prepared food, 2) leather and footwear, 3) textiles and textile articles, 4) vehicles, vessels and associated transport equipment, and 5) base metals and machinery.

	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
c	-0.033***	0.012***	0.008***	0.022***	-0.008
$\alpha_{1,k,0}$	-4.567	3.294*	-0.156*	0.094	5.424***
$\alpha_{2,k,0}$	0.020	-0.019*	0.002***	0.000	-0.0572**
$\alpha_{3,k,0}$	14.95*	0.302	-0.609**	1.309	2.317*

Table 5: Estimation of the non-linear model (5) for the five sectors considered where $\Delta p_{k,t}$ and $\Delta q_{k,t}$ are computed on a two-year horizon: 1) vegetables and prepared food, 2) leather and footwear, 3) textiles and textile articles, 4) vehicles, vessels and associated transport equipment, and 5) base metals and machinery.

	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
1997	219.28	167.2	115.13	797.6	85.41
2002	229.22	163.6	185.48	526.9	92.15

Table 3: Herfindahl-Herschmann index of market concentration for the five sectors considered: 1) vegetables and prepared food, 2) leather and footwear, 3) textiles and textile articles, 4) vehicles, vessels and associated transport equipment, and 5) base metals and machinery.

Empirical Analysis on the AS equation

Equation to be tested

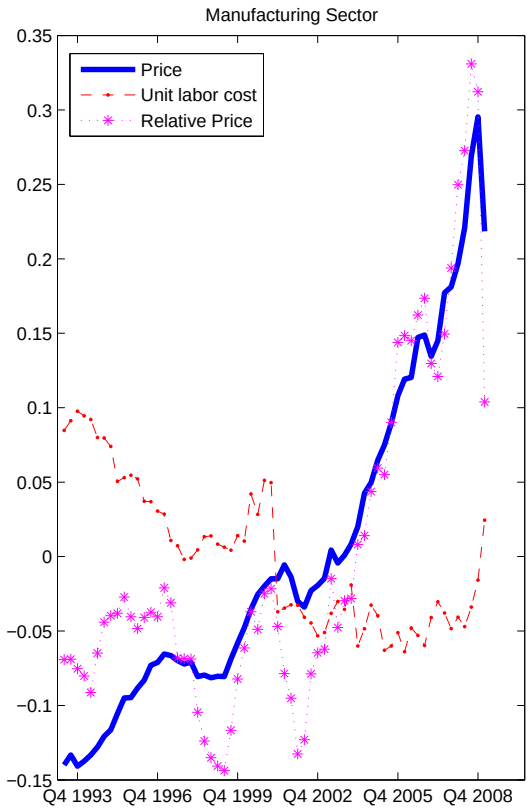
$$\pi_{h,t} = k \cdot \left[mc_t + \kappa s_f (\hat{P}_{f,t} - \hat{P}_{h,t}) \right] + \beta E_t \pi_{h,t+1},$$

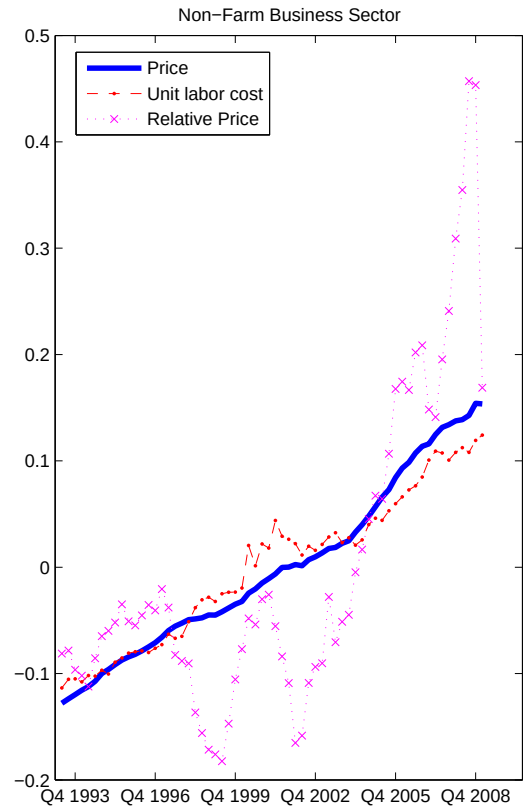
which can be written as

$$\begin{aligned} (\hat{P}_{h,t} - ulc_t) \;\; = \;\; & \phi_1 (\hat{P}_{h,t-1} - ulc_{t-1}) - \Delta ulc_t + \\ & (1-\phi_1) E_t \left\{ \sum_{T=t}^{\infty} (\beta\phi_1)^{(T-t)} [\Delta ulc_T + \omega \cdot pr_T] \right\}, \end{aligned}$$

where $\omega = \kappa s_f$ and ϕ_1 is a function of k and β.

- Estimation strategy: find k and ω which minimize deviations of $(\hat{P}_{h,t} - ulc_t)$ between data and model.


Manufacturing Sector
Price
Unit labor cost
Relative Price
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
Q4 1993
Q4 1996
Q4 1999
Q4 2002
Q4 2005
Q4 2008


Non−Farm Business Sector
Price
Unit labor cost
Relative Price
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
Q4 1993
Q4 1996
Q4 1999
Q4 2002
Q4 2005
Q4 2008

	Manufacturing sector		Non-farm business sector	
	(1)	(2)	(3)	(4)
		Full Sample 1993-2008		
k	0.000	0.025	0.010	0.057
	(0.024)	(0.069)	(0.048)	(0.131)
ω	0	0.32*	0	0.04
		(0.19)		(0.032)
		Sample 1993-2000		
k	0.001	0.001	0.024	0.019
	(0.0116)	(0.0202)	(0.0471)	(0.0523)
ω	0	0.25	0	0.05
		(4.21)		(0.148)
		Sample 2001-2008		
k	0.002	0.1	0.02	0.087
	(0.0275)	(0.2429)	(0.1098)	(0.2969)
ω	0	0.37**	0	0.05*
		(0.1507)		(0.0295)

Conclusion

- Globalization, meaning a larger fraction of foreign products in destination markets, can have important effects on the inflation dynamic of a country and in particular on the degree of exchange-rate pass-through and the slope/position of the AS equation.

- We find evidence that the pass-through has increased in the most recent years and that the relative-price channel is relevant in explaining the domestic inflation dynamic.