Trade in goods, globalized production structure and inflationary dynamics: Cross country evidences

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Question?

…role nature of trade plays in influencing domestic prices?

pricing strategies: LCP-PCP

Open Economy New Keynesian Phillips Curve:

- ✓ Domestic factors (inflation, output gap)
- ✓ External or global factors

This paper:

- ✓ Trade in goods … substitute goods (consumption goods)
- ✓ Globalized production structure…trade in complement goods (intermediate goods)
- ✓ Financial integration…interest rate difference
- ✓ Panel fixed effect model (34 OECD countries, 1990-2014)

Answer… **Yes.**

Trade openness in consumption and intermediate goods have opposing impacts on domestic inflation dynamics.

Trade openness

...lowers inflation

Romer (1993), Lane (1997), Gruben and McLeod (2004), Bowdler and Nunziata (2006), Borio and Filardo (2007), Bowdler (2009)..

...increases inflation

Deniels et al. (2005), Narayan, et al. (2011)

…no systematic relationship..

Temple (2002), Ball (2003), Sachside et al. (2003), Alfaro (2005), Wu and Lin (2007), Ghosh (2014)..

… trade and financial openness lowers inflation

Razin and Loungani, 2007; Badinger, 2009; Bianchi and Civelli, 2014

Theoretical Background

- Gali and Monacellie (2005)
  - Trade openness and financial openness
    - imported goods in utility function… consumption goods trade
- Wong and Eng (2010)
  - globalized production structure and financial openness
    - imported goods in production function… intermediate goods trade
- *This paper*
  - Gali and Monacellie (2005)+Wong and Eng (2010)

- *CPI inflation*

$$\pi_t = \pi_{Ht} + \alpha \Delta s_t \qquad (1)$$

  - $\alpha \in [0,1]$ index of openness (share of imported goods in consumption),
  - π_t CPI inflation (domestic + imported goods)
  - π_{Ht} the rate of change in the index of domestic goods prices
  - $s_t (= p_{Ft} - p_{Ht})$ effective terms of trade,
    - p_{Ft} and p_{Ht} log of foreign and home goods price indexes.

- *Dynamics of domestic inflation in terms of real marginal costs* mc_t

$$\pi_{Ht} = \beta E\{\pi_{Ht+1}\} + \lambda mc_t, \qquad (2)$$

Substitute Eq. 2 in 1 and using $\pi_{Ht+1} = \pi_{t+1} - \alpha \Delta s_{t+1}$

- *Dynamics of CPI inflation with external factors_1*

$$\pi_t = \beta E\{\pi_{t+1}\} + \lambda mc_t + \alpha(\Delta s_t - \beta \Delta s_{t+1}) \qquad (3)$$

Theoretical Background: Wong and Eng(2010)

- *Real marginal cost for a firm producing at **nth** stage of a globalized production process*

$$mc_{nt} = \sigma\, p'_{nt} + (1-\sigma) w_{nt} - a_{nt} \qquad (4)$$

- p'_{nt} log of the PPI for intermediate input,
- w_{nt} log of the cost of labor,
- a_{nt} log of the state of technology for stage n production,
- σ the share of intermediate input use in production.

- *PPI inflation for intermediate inputs*

$$p'_{nt} = (1-\kappa) p'_{Hnt} + \kappa p'_{Fnt} \qquad (5)$$

- $\kappa \in [0,1]$ extent of globalization in production structure
- p'_{Hnt} and p'_{Fnt} log of the price of domestic and foreign intermediate inputs.

- *Log of the relative price of imported over domestic goods at the nth stage of production process,*

$$q_t = p'_{Fnt} - p'_{Hnt} \qquad (6)$$

  - *Substituting Eq. (6) in Eq. (5) and then to Eq. (4)*

- *Real marginal cost*

$$mc_{nt} = \sigma p'_{Hn-1t-1} + (1-\sigma)w_{nt} - a_{nt} + \sigma\kappa q_{t-1} \qquad (7)$$

  - Using income definition
    - $y_{nt} = \sigma p'_{Hn-1t-1} + (1-\sigma)w_{nt}$

Then $mc_{nt} = y_{nt} - a_{nt} + \sigma\kappa q_{t-1}$

- *At Nth final stage MC*

$$mc_t = y_t - a_t + \sigma\kappa q_{t-1} \qquad (8)$$

- *Substituting Eq. (8) in Eq. (3)*

- *CPI Inflation dynamics_2*

$$\pi_t = \beta E\{\pi_{t+1}\} + \lambda(y_t - a_t) + \lambda\sigma\kappa q_{t-1} + \alpha(\Delta s_t - \beta\Delta s_{t+1}) \qquad (9)$$

To introduce a parameter for financial integration

- *Uncovered interest rate parity*
  - $r_t - r_t^* = E_t\{\Delta e_{t+1}\}$, *where*

$$e_t = s_t - p_t^* + p_{H,t}, \qquad e_t : \text{nominal effective exchange rate}$$

Then

- $s_t - E_t\{s_{t+1}\} = (r_t^* - E_t\{\pi_{t+1}^*\}) - (r_t - E_t\{\pi_{H,t+1}\})$,

- *If perfect foresight assumption holds*

$$\Delta s_{t+1} = \tilde{r}_{t+1}^* - \tilde{r}_{t+1} \qquad (10)$$

- ***Inflation Dynamics _3***

$$\pi_t = \beta E\{\pi_{t+1}\} + \lambda(y_t - a_t) + \lambda\sigma\kappa q_{t-1} + \alpha\Delta s_t - \beta\alpha(\tilde{r}^*_{t+1} - \tilde{r}_{t+1})$$

(11)

- domestic factors : expected next period CPI inflation,
  domestic output gap

- external factors : - relative prices in intermediate goods (q_{t-1}) times the degree of vertically globalized production structure ($\sigma\kappa$),
  - relative prices in consumption goods (s_t) times degree of trade openness in consumption goods (α) ,
  - degree of openness in financial markets.

Empirical Analysis: Panel Fixed Effect Model

- $\pi_{it} = \theta + \varphi\, x_{it} + \phi y_{it} + \mu_i + \rho_t + \boldsymbol{u}_{it}$ (12)

  - φ parameter vectors for domestic factors,
  - ϕ parameter vector for external factors
  - u_{it} vector of idiosyncratic errors.
  - x_{it} includes stationary domestic variables
  - y_{it} includes of stationary external factors
  - μ_i country fixed effects
  - ρ_t country-specific time fixed effects (eliminated before the beginning of the empirical analysis)

Empirical strategy:

1. Estimate Eq. (12) by using data from 34 OECD countries for the period 1990-2013
2. Recursive Estimation
3. Sub-period estimation: 1990-2001 and 2002-2013
4. Additional regression analyses

Empirical Analysis: Data

- π_t : annual CPI inflation
- Output gap: log deviation of real GDP from a Hodrick-Prescott trend.

Trade openness:

- trade intensity in final goods : consumer goods imports + exports over GDP
- Production fragmentation: intermediate goods imports + exports over GDP

Financial openness:

- Short real interest rate difference.

world interest rate is approximated by the average of USA, Germany and Japan rates

In sensitivity Analysis:

1. *Geographic Regions*
2. *Relative prices in consumption and intermediate goods*
3. *De facto measure of financial openness: total foreign assets + liabilities over GDP*

Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
π	762	0.050	0.102	-0.045	1.052
gap	762	0.000	0.010	-0.029	0.029
TI^{total}	762	0.624	0.339	0.109	1.861
TI^{interm}	762	0.422	0.241	0.072	1.280
TI^{conm}	762	0.102	0.052	0.010	0.381
TOT^{total}	280	-0.017	0.044	-0.228	0.081
TOT^{intem}	280	-0.027	0.066	-0.223	0.120
TOT^{conm}	280	-0.009	0.049	-0.163	0.133
FO^{r_r*}	759	0.532	3.098	-21.779	35.118
$FO^{funflow}$	694	6.782	27.169	0.349	240.749

Results 1: Estimates of NKPC: 1990-2013

Indep. Var.: inflation , gap, trade intensity and interest rate difference

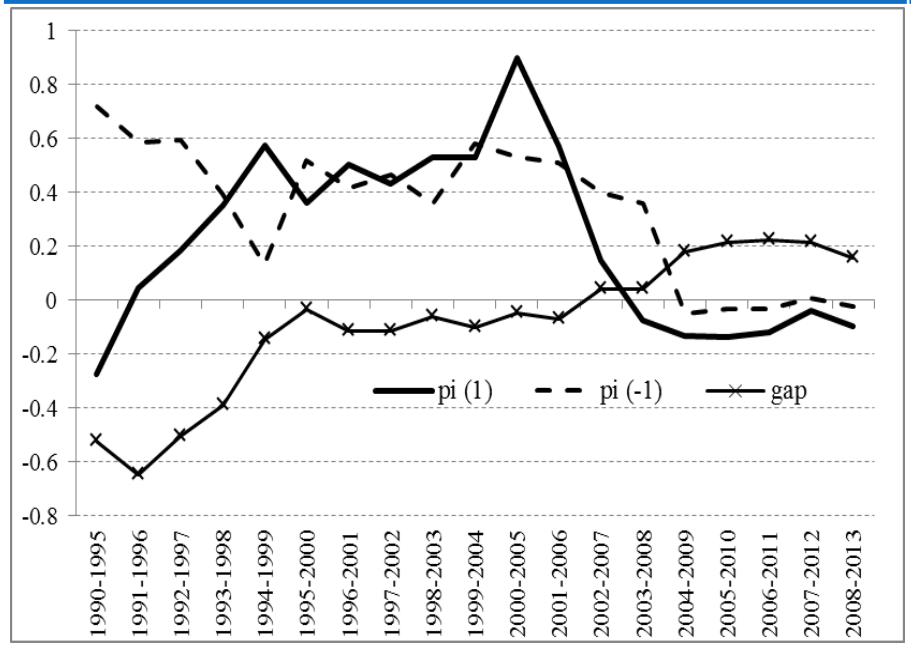
	Models									
	1		2		3		4		5	
π(1)	**0.92**	0.02	**0.51**	0.02	**0.51**	0.02	**0.51**	0.02	**0.50**	0.02
π(-1)			**0.48**	0.02	**0.49**	0.02	**0.49**	0.02	**0.50**	0.02
gap	-0.12	0.06	0.02	0.04	0.00	0.04	-0.01	0.04	0.00	0.05
TI^{total}					**0.02**	0.01				
TI^{interm}							**0.06**	0.02	**0.06**	0.02
TI^{conm}							-0.17	0.10	-0.16	0.10
FO^{r_r*}									**0.06**	0.03
No. of obs.	728		728		694		694		694	
No. of country	34		34		34		34		34	

Notes: Bold numbers denotes the coefficients significant at 5% level. Standard errors are reported next to the coefficients

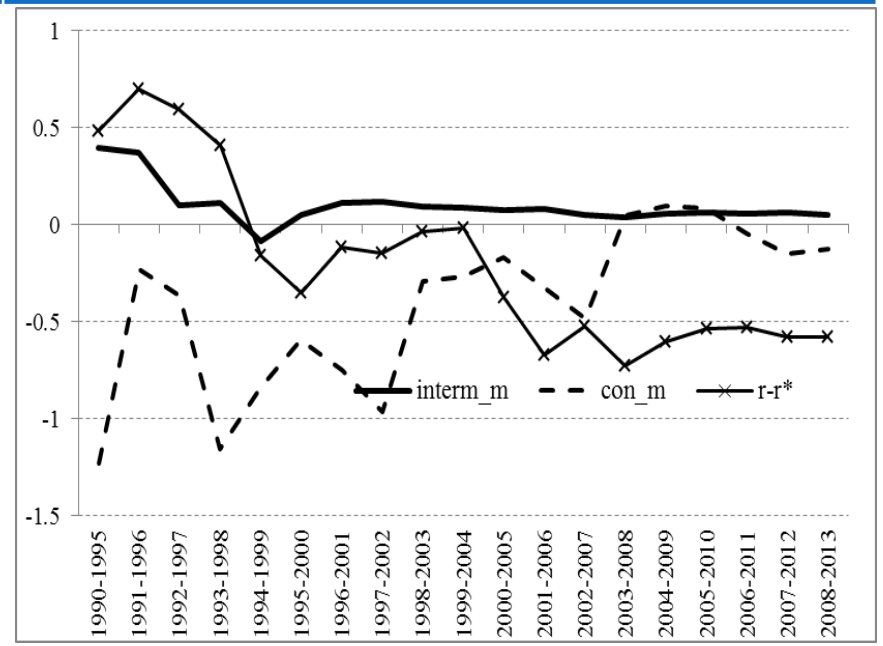
Results 2: Path of the Estimated Coefficients from Recursive Regression Analysis

Indep. Var.: inflation , gap, trade intensity and interest rate difference

a) Domestic factors



a) External factors



Results 3: Estimates of NKPC: 1990-2001; 2002-2013

Indep.var.: inflation, gap, trade intensity and interest rate difference

	1990-2001			2002-2013	
	6			7	
$\pi(1)$	**0.47**	0.04		**0.24**	0.05
$\pi(-1)$	**0.50**	0.05		**0.53**	0.02
gap	**-0.32**	0.11		**0.15**	0.03
TI^{interm}	**0.09**	0.04		**0.07**	0.01
TI^{conm}	-0.48	0.30		**-0.17**	0.08
FO^{r_r*}	**0.22**	0.06		**-0.53**	0.05
No. of obs	284			340	
No. of countries	34			34	

Notes: Bold numbers denotes the coefficients significant at 5% level. Standard errors are reported next to the coefficients

Results 4: Geographical Regions

Indep. Var.: inflation , gap, trade intensity and interest rate difference

	Europe		EU15		CEEC		America	
π(1)	**0.50**	0.03	**0.33**	0.04	**0.51**	0.05	**0.45**	0.09
π(-1)	**0.49**	0.03	**0.57**	0.03	**0.51**	0.05	**0.59**	0.07
gap	0.07	0.05	**0.17**	0.03	0.06	0.15	**-0.29**	0.15
TI^{interm}	0.05	0.02	**0.03**	0.01	0.06	0.05	**0.17**	0.08
TI^{conm}	-0.12	0.11	-0.09	0.06	-0.21	0.31	-0.52	0.50
$FO^{r\_r^*}$	**0.06**	0.04	**-0.18**	0.04	**0.16**	0.08	0.23	0.12
No. of obs	515		316		126		83	
	1990-2000							
π(1)	**0.48**	0.05	**0.31**	0.08	**0.42**	0.13	**0.43**	0.13
π(-1)	**0.48**	0.06	**0.65**	0.06	**0.43**	0.19	**0.65**	0.20
gap	-0.22	0.13	-0.01	0.05	-0.55	0.60	-0.62	0.33
TI^{interm}	0.06	0.04	0.02	0.03	0.19	0.15	**0.50**	0.21
TI^{conm}	-0.40	0.32	0.03	0.10	-3.68	2.22	**-5.25**	2.13
$FO^{r\_r^*}$	**0.22**	0.07	**-0.20**	0.05	0.29	0.22	**0.51**	0.25
No. of obs	239		151		49		39	
	2002-2013							
π(1)	**0.25**	0.05	**-0.14**	0.04	**0.26**	0.10	0.15	0.13
π(-1)	**0.55**	0.03	-0.07	0.05	**0.61**	0.04	0.08	0.12
gap	**0.15**	0.04	**0.20**	0.03	0.05	0.08	0.06	0.08
TI^{interm}	**0.07**	0.02	**0.06**	0.01	0.06	0.03	**0.18**	0.06
TI^{conm}	**-0.18**	0.09	**-0.17**	0.07	-0.17	0.15	0.38	0.34
$FO^{r\_r^*}$	**-0.57**	0.05	**-0.85**	0.06	**-0.79**	0.10	**-0.47**	0.13
No. of obs	312		180		84		48	
No of countries	26		15		7		4	

Results 5: NKPC Estimation with TOT, 2000-2013

Indep. Var.: inflation , gap, terms of trade and interest rate difference

	overall			EU15			CEEC	
π(1)	**0.11**	*0.05*		**-0.11**	*0.05*		0.21	*0.11*
π(-1)	**0.33**	*0.04*		-0.03	*0.05*		**0.49**	*0.09*
gap	**0.21**	*0.03*		**0.23**	*0.03*		0.15	*0.09*
TOT^{intem}	0.02	*0.01*		0.01	*0.01*		0.14	*0.08*
TOT^{conm}	0.00	*0.02*		0.02	*0.02*		0.03	*0.05*
FO^{r_r*}	**-0.52**	*0.06*		**-0.84**	*0.05*		**-0.48**	*0.14*
No. of obs.	260			195			65	
No. of country	20			15			5	

Notes: Bold numbers denotes the coefficients significant at 5% level. Standard errors are reported next to the coefficients

Results 5: NKPC Estimation with De facto measure of Fin. Openness

Indep. Var.: inflation, gap, trade intensity and financial openness

	All		Europe		Eu15		CEEC		America	
$\pi(1)$	**0.51**	*0.02*	**0.51**	*0.03*	**0.35**	*0.05*	**0.52**	*0.05*	**0.54**	*0.08*
$\pi(-1)$	**0.49**	*0.02*	**0.49**	*0.03*	**0.53**	*0.04*	**0.48**	*0.05*	**0.52**	*0.07*
gap	0.03	*0.09*	0.06	*0.05*	**0.17**	*0.04*	-0.02	*0.15*	**-0.55**	*-0.32*
TI^{interm}	**0.06**	*0.02*	**0.04**	*0.02*	**0.04**	*0.01*	0.06	*0.05*	**0.19**	*0.08*
TI^{conm}	-0.20	*0.11*	-0.17	*0.12*	-0.08	*0.07*	-0.31	*0.35*	-0.68	*0.70*
$FO^{funflow}$	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.01*	0.00	*0.01*
No. of obs.	660		501		301		121		79	
No. of country	34		26		15		7		4	

Notes: Bold numbers denotes the coefficients significant at 5% level. Standard errors are reported next to the coefficients

Results 5: NKPC Estimation with De facto measure of Fin. Openness, 1990-2001, 2002-2013

Indep. Var.: inflation, gap, trade intensity and financial openness

	1990-2000			2002-2013	
π(1)	**0.46**	*0.05*		0.01	*0.06*
π(-1)	**0.41**	*0.04*		**0.30**	*0.03*
gap	**0.40**	*0.11*		**0.22**	*0.04*
TI^{interm}	0.07	*0.04*		**0.08**	*0.02*
TI^{conm}	-0.44	*0.33*		-0.17	*0.10*
FO^{funflow}	0.00	*0.00*		0.00	*0.00*
No. of obs.	286			306	
No. of country	34			34	

Notes: Bold numbers denotes the coefficients significant at 5% level. Standard errors are reported next to the coefficients

Concluding Remarks

- External or global factors has become more relevant inflation drivers
- Nature of trade matters in detecting the appropriate impact of trade on inflation
  - Trade in consumption or substitute goods had decreasing effects on inflation
  - Production fragmentation approximated by trade in intermediate goods had increasing effects on inflation
- Financial integration increases or decreases inflation depending on the state of the financial conditions
- Globalization complicates the conduct of monetary policy
  - Heterogeneity in price setting mechanism
    - ….improve competitiveness in both consumption and intermediate goods market
  - Financial condition
    - Stability in financial markets

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Thanks!