

Online Appendix to Has the Euro Shrunk the Band? Price Convergence in a Currency Union

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1 Asymmetric Thresholds

In this section I outline how the empirical strategy differ when I assume that the thresholds for the bands of inaction are asymmetric. Let c_{ij}^g be the threshold of the band of inaction for shipping good g from i to j . I estimate c_{ij}^g by maximum likelihood using the following TAR model:

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$$\Delta x_{ijt}^g = \begin{cases} \lambda_{ij}^{g,out}(x_{ij,t-1}^g - c_{ji}^g) + e_{ijt}^{g,out} & \text{if } x_{ij,t-1}^g > c_{ji}^g \\ \lambda_{ij}^{g,in} x_{ij,t-1}^g + e_{ijt}^{g,in} & \text{if } c_{ji}^g \geq x_{ij,t-1}^g \geq -c_{ij}^g \\ \lambda_{ij}^{g,out}(x_{ij,t-1}^g + c_{ij}^g) + e_{ijt}^{g,out} & \text{if } -c_{ij}^g > x_{ij,t-1}^g \end{cases} \quad (1)$$

where $e_{ijt}^{g,out} \sim N(0, \sigma_{ij}^{g,out2})$, $e_{ijt}^{g,in} \sim N(0, \sigma_{ij}^{g,in2})$ and $\lambda_{ij}^{g,in} = 0$. The estimation algorithm is identical to the baseline case, except that now we need to run a grid search for both c_{ji}^g and c_{ij}^g , which makes the algorithm much slower.

Using the estimated bands of inaction, I run the following regression:

$$b_{ij}^g = \beta_0 + \beta_1 \text{Euro}_{ij} + \beta_2 \tau_{ij} + \beta_3 \sigma(s_{ij}) + \beta_4 \text{Expenditures}_{ij} + e_g + \epsilon_{ij}^g \quad (2)$$

where $b_{ij}^g = (c_{ij}^g + c_{ji}^g)/2$, and the other variables have the same interpretation as the baseline case.

Column (1) in table 1 shows the results from the baseline regression. The coefficient on the Euro dummy is negative and statistically significant and the magnitude of its coefficient, as well those of other variables, are close to the baseline specification with symmetric thresholds. Results are robust when I restrict the sample to countries belonging to the EU, Schengen Area or both.

Table 1: The Euro Shrunk the Band

	(All)	(EU)	(Sch.)	(EU+Sch.)
Euro	-0.013*** (0.002)	-0.009*** (0.002)	-0.007*** (0.002)	-0.009*** (0.002)
Log(Distance)	0.013*** (0.002)	0.005*** (0.002)	0.013*** (0.002)	0.009*** (0.002)
Common Border	0.014*** (0.004)	0.001 (0.003)	0.009** (0.004)	0.005* (0.003)
Common Language	-0.006 (0.004)	-0.003 (0.004)	-0.000 (0.004)	-0.005* (0.003)
Island	0.026*** (0.003)	0.017*** (0.002)	0.016*** (0.004)	0.000 (0.003)
Landlocked	-0.004 (0.003)	-0.001 (0.002)	-0.015*** (0.002)	-0.007*** (0.002)
$\sigma(s_{ij})$	0.143*** (0.016)	0.068*** (0.014)	0.313*** (0.020)	0.137*** (0.017)
Log(Expenditures)	-0.002*** (0.001)	0.001** (0.000)	-0.001 (0.001)	-0.001** (0.000)
R^2	0.32	0.18	0.48	0.17
# Observations	9158	7182	5700	4389

Results from OLS of equation (2). Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product Fixed Effects. Sample: tradable four-digit COICOP goods.

2 Sample of three-digit COICOP goods

This section replicates the estimation procedure and the econometric analysis using of the paper using more aggregated Harmonized Index of Consumer Prices. In particular I use data on 38 COICOP three-digit goods (20 of which are tradable). Table 2 provides the list of goods used.

I estimate the bands of inaction c_{ij}^g for all goods and country pairs following the same algorithm described in the paper. The average threshold of the bands of inaction is 6.3%. At the good level, Household appliances have the lowest threshold (5%), while Tobacco have the highest(10%). Figure 1 shows the average threshold of the bands by good. Among country pairs in the EMU is 4.4%, while among country pairs with different currencies is 7%. Figure 2 shows how a common currency affects the average thresholds by good.

Table 3 shows the results from the baseline regression. Country pairs that share a common currency exhibit thresholds of the bands of inaction that are 20% smaller than the average band. In this case, the coefficient on Expenditures is negative but not significant, while the other variables have similar coefficients to the main results shown in the paper. Table 4 shows the results from restricting the sample to country pairs in the EU, Schengen Area or both. Table 5 shows the results from using the entry in the EMU by Cyprus, Malta, Slovakia and Slovenia. The coefficient are similar to those estimated with the four-digit COICOP sample, although it loses significance in the last specification.

Finally, table 6 presents the results with the unbalanced panel of goods. Table 7 shows the effect of the euro on the autoregressive coefficient outside the band of inaction, the variance of relative price and their change. Table 8 shows that the euro does not affect the bands of inaction for non tradable goods. In table 9 I add to the baseline regression the volatility of prices and their changes.

2.1 Goods and Country Details

Table 2: Tradable and Non Tradable three-digit COICOP

Tradable		Non tradable	
Code	Description	Code	Description
CP011	Food	CP041	Rentals
CP012	Non-alcoholic beverages	CP043	Repair of dwelling
CP021	Alcoholic beverages	CP044	Services to dwelling
CP022	Tobacco	CP045	Electricity and gas
CP031	Clothing	CP062	Out-patient services
CP032	Footwear	CP063	Hospital
CP051	Furniture	CP073	Transport Services
CP052	Household Textiles	CP081	Postal Services
CP053	Household Appliances	CP094	Cultural services
CP054	Glassware and tableware	CP095	Books
CP055	Tools for house	CP096	Package Holidays
CP056	Goods for household maintenance	CP111	Catering Services
CP061	Medical products	CP112	Accommodation services
CP071	Vehicles	CP121	Personal Care
CP072	Transport Equipment	CP124	Social Protection
CP082-083	Telephones	CP125	Insurance
CP091	Audio-visual equipment	CP126	Financial services
CP092	Durables for recreation	CP127	Other services
CP093	Recreational items		
CP123	Personal effects		

2.2 Descriptive Results

Figure 1: Average commodity point ($100 * c_{ij}^g$) by three-digit tradable COICOP good

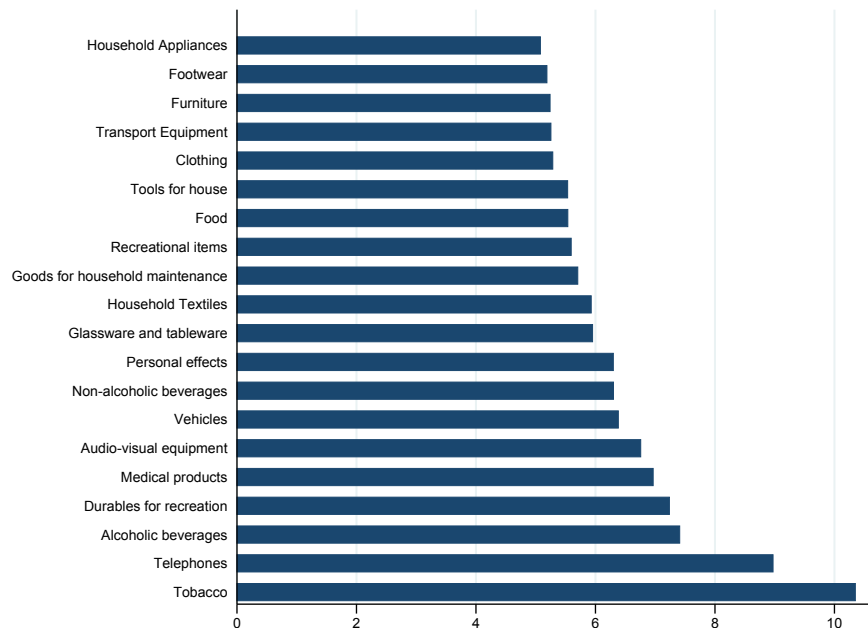
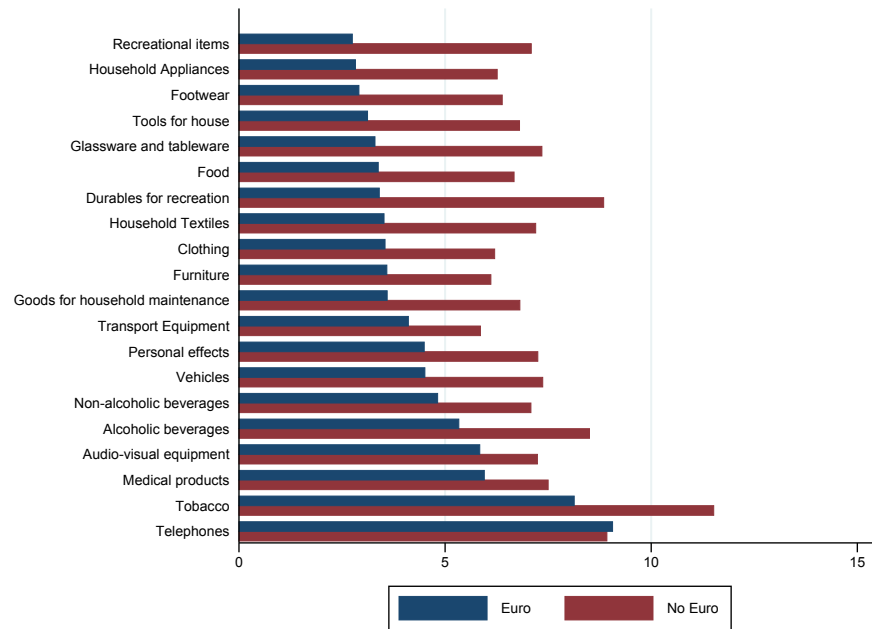


Figure 2: Average commodity point ($100 * c_{ij}^g$) by three-digit tradable COICOP good



2.3 Regression Tables

Table 3: The Euro Shrunk the Band

	(1)	(2)	(3)	(4)	(5)
Euro	-0.030*** (0.003)	-0.031*** (0.002)	-0.015*** (0.002)	-0.015*** (0.002)	-0.013*** (0.002)
Log(Distance)		0.015*** (0.003)	0.010*** (0.002)	0.009*** (0.002)	0.008*** (0.002)
Common Border		0.014*** (0.005)	0.010** (0.004)	0.011*** (0.004)	0.009** (0.004)
Common Language		0.000 (0.004)	-0.003 (0.004)	-0.003 (0.004)	-0.005 (0.004)
Island		0.030*** (0.004)	0.028*** (0.003)	0.027*** (0.003)	0.027*** (0.003)
Landlocked		0.004 (0.003)	0.001 (0.003)	0.001 (0.003)	0.000 (0.003)
$\sigma(s_{ij})$			0.124*** (0.012)	0.124*** (0.012)	0.100*** (0.013)
Log(Expenditures)				-0.001 (0.001)	-0.001 (0.001)
European Union					-0.015*** (0.004)
R^2	0.12	0.23	0.31	0.31	0.32
# Observations	8928	8928	8928	8928	8928

Results from OLS. Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product Fixed Effects. Sample: tradable three-digit COICOP goods.

Table 4: The Euro Shrunk the Band

	(UE)	(Sch.)	(UE+Sch.)	(UE+Sch.+Border)
Euro	-0.010*** (0.002)	-0.007*** (0.002)	-0.007*** (0.002)	-0.014** (0.007)
Log(Distance)	0.003 (0.002)	0.011*** (0.002)	0.008*** (0.002)	0.004 (0.004)
Common Border	-0.001 (0.004)	0.009** (0.004)	0.007 (0.004)	
Common Language	-0.002 (0.004)	0.000 (0.003)	-0.003 (0.003)	-0.004 (0.007)
Island	0.020*** (0.003)	0.005 (0.004)	-0.002 (0.003)	
Landlocked	0.003 (0.002)	-0.010*** (0.002)	-0.005*** (0.002)	0.003 (0.004)
$\sigma(s_{ij})$	0.095*** (0.018)	0.295*** (0.023)	0.202*** (0.020)	0.209** (0.088)
Log(Expenditures)	0.002*** (0.001)	-0.001* (0.001)	-0.001* (0.000)	0.001 (0.001)
R^2	0.18	0.46	0.20	0.34
# Observations	6804	5400	4158	540

Results from OLS. Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product Fixed Effects. Sample: tradable three-digit COICOP goods.

Table 5: The Euro Shrunk the Band

	(1)	(2)	(3)
Euro	-0.280** (0.120)	-0.280** (0.120)	-0.185 (0.158)
Good FE	Yes	Yes	Yes
Country i FE	No	Yes	Yes
Pair in EU and Schengen	No	No	Yes
R^2	0.04	0.11	0.12
# Observations	1761	1761	972

Results from OLS. Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product and country switching fixed effects. Sample: tradable three-digit COICOP goods.

2.3.1 Robustness

Table 6: The Euro Shrunk the Band

	(1)	(2)	(3)	(4)	(5)
Euro	-0.029*** (0.003)	-0.030*** (0.003)	-0.014*** (0.002)	-0.014*** (0.002)	-0.011*** (0.002)
Log(Distance)		0.015*** (0.003)	0.010*** (0.002)	0.009*** (0.002)	0.008*** (0.002)
Common Border		0.015*** (0.005)	0.011*** (0.004)	0.011*** (0.004)	0.010** (0.004)
Common Language		-0.001 (0.004)	-0.005 (0.004)	-0.005 (0.004)	-0.007* (0.004)
Island		0.030*** (0.004)	0.028*** (0.003)	0.027*** (0.003)	0.027*** (0.003)
Landlocked		0.005* (0.003)	0.002 (0.003)	0.001 (0.003)	0.001 (0.003)
$\sigma(s_{ij})$			0.129*** (0.012)	0.129*** (0.012)	0.107*** (0.013)
Log(Expenditures)				-0.001* (0.001)	-0.001 (0.001)
European Union					-0.015*** (0.004)
R^2	0.12	0.22	0.30	0.30	0.31
# Observations	9828	9828	9828	9828	9828

Results from OLS. Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product Fixed Effects. Sample: tradable three-digit COICOP goods. Unbalanced panel.

Table 7: The Euro Shrunk other variables too

	$\lambda_{ij}^{g,out}$	$\sigma(x_{ijt}^g)$	$\sigma(\Delta x_{ijt}^g)$
Euro	-0.087*** (0.012)	-0.002*** (0.000)	0.011 (0.009)
Log(Distance)	-0.030*** (0.009)	0.001*** (0.000)	0.040*** (0.008)
Common Border	-0.025 (0.025)	0.002*** (0.000)	0.036** (0.015)
Common Language	-0.115*** (0.030)	-0.001** (0.001)	0.014 (0.022)
Island	0.046*** (0.010)	0.004*** (0.000)	0.054*** (0.011)
Landlocked	-0.015 (0.011)	-0.001* (0.000)	-0.023** (0.010)
$\sigma(s_{ij})$	0.220*** (0.045)	0.022*** (0.002)	0.361*** (0.045)
Log(Expenditures)	0.003* (0.002)	-0.000*** (0.000)	-0.012*** (0.002)
European Union	0.147*** (0.016)	-0.001*** (0.000)	-0.097*** (0.015)
R^2	0.19	0.51	0.46
# Observations	8928	8928	8928

Results from OLS. Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product Fixed Effects. Sample: tradable three-digit COICOP goods.

Table 8: The Euro Did Not Shrink the Band of Non-Tradable Goods

	(All)	(EU)
Euro	0.002 (0.003)	0.004 (0.003)
Log(Distance)	-0.001 (0.003)	-0.002 (0.003)
Common Border	-0.001 (0.006)	-0.003 (0.007)
Common Language	-0.015*** (0.005)	-0.017*** (0.006)
Island	0.018*** (0.004)	0.020*** (0.004)
Landlocked	0.006 (0.003)	0.008** (0.004)
$\sigma(s_{ij})$	0.125*** (0.014)	0.140*** (0.025)
Log(Expenditures)	-0.002*** (0.001)	-0.001* (0.001)
European Union	0.001 (0.004)	
R^2	0.16	0.16
# Observations	4464	3402

Results from OLS. Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product Fixed Effects. Sample: non tradable three-digit COICOP goods.

Table 9: The Euro Shrunk the Band

	Tradable		Non Tradable	
	(1)	(2)	(1)	(2)
Euro	-0.003** (0.001)	-0.013*** (0.002)	0.004 (0.002)	0.002 (0.003)
Log(Distance)	0.003** (0.001)	0.006*** (0.002)	-0.005*** (0.002)	-0.002 (0.003)
Common Border	0.003 (0.003)	0.008** (0.004)	-0.009** (0.005)	-0.003 (0.006)
Common Language	-0.000 (0.003)	-0.006 (0.004)	-0.004 (0.004)	-0.014*** (0.005)
Island	0.009*** (0.002)	0.025*** (0.003)	-0.003 (0.003)	0.014*** (0.004)
Landlocked	0.003* (0.002)	0.001 (0.003)	0.004 (0.003)	0.008** (0.004)
$\sigma(s_{ij})$	0.008 (0.008)	0.088*** (0.012)	-0.006 (0.011)	0.098*** (0.013)
Log(Expenditures)	0.000 (0.000)	-0.000 (0.001)	0.001** (0.001)	-0.001 (0.001)
European Union	-0.009*** (0.002)	-0.012*** (0.003)	0.004 (0.003)	0.006 (0.004)
$\sigma(x_{ijt}^g)$	4.154*** (0.214)		3.550*** (0.171)	
$\sigma(\Delta x_{ijt}^g)$		3.435*** (0.590)		6.028*** (1.130)
R^2	0.51	0.33	0.41	0.18
# Observations	8928	8928	4464	4464

Results from OLS. Robust std. error in parenthesis. Cluster: country pair. ***: significant at 99%, ** at 95%, * at 90%. Product Fixed Effects. Sample: tradable three-digit COICOP goods. Unbalanced panel.