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**Import penetration, intermediate inputs and
productivity**

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Introduction

- Productivity gains are at the heart of the EU strategy for Growth and Jobs
- A vast body of theoretical and empirical literature points to a positive relationship between trade openness and productivity
 - At the country level: Ales and Glaeser (1999), Frankel and Romer (1999), Alesina, Spolaore, and Wacziarg (2000), Alcalà and Ciccone (2004), even after controlling for institutional quality and geographic variables
 - At the industry level: Trefler (2004) and Shor (2004), in both a context of developed (NAFTA) and developing country (Brazil)
 - At the firm level: Tybout and Westbrook (1995), Krishna and Mitra (1998), Pavcnik (2002), Fernandes (2003), Topalova (2004), Bernard, Jensen and Schott (2006), ...
- And yet the relationship between productivity and trade openness is, more often than not, perceived as negative, periodically leading to protectionist calls throughout the EU member States

Aim & Relevance

- To assess the relationship between trade openness and firm-level productivity in the context of an European country (Italy)
- The considered period of analysis (1996-2004) encompasses the Euro effect and the entry of China into global trade
- The paper explores both the “horizontal” channel (within-industry) through which the trade shock affects productivity via a competition effect, and the “vertical” channel (across-industry), i.e. the growing effects of trade in the up-stream industries on productivity (Amiti and Konings, 2007)
- The horizontal and vertical effects are also disentangled across different countries of origins: Italian trade flows with World, EU-15, USA, New Member States, BRICs and China are explored

Overview of main results

- ✓ Using firm level data we provide robust evidence that import penetration positively matters for productivity
- ✓ The effect is however differentiated between horizontal and vertical indicators:
 - an increase at the margin in the import penetration ratio of the same industry from the World would result in a productivity increase of limited magnitude, around 0.5%
 - an increase in the import penetration ratio in the up-stream industries would instead increase the productivity of the average firm by some 9.8%
- ✓ The exact estimate of these results changes when considering the impact of trade openness with respect to different countries or group of countries trading with Italy:
 - the EU Single Market (trade with EU-15) effect is in line with the coefficient of World trade on Italian firms' productivity
 - the effect of further Chinese trade competition is positive but half the World one
- ✓ Not every firm benefits equally from these effects: different firms' characteristics matter in influencing the firms' productivity response to the trade shock

Data sources

- Trade data from Eurostat COMEXT at the CN-8 digit (product-level data, with breakdown by country of origin / destination), then converted into NACE3 data
- Production data from Eurostat PRODCOM, at the same level of disaggregation
- An initial sample of 61,335 firms, observed from 1996 to 2003, and accounting for 73% of total manufacturing value added and 54% of manufacturing employment (with respect to data from the 2001 Industrial Census)
- 28,076 Italian manufacturing firms for which observations are available for all the variable of interests for at least one year, after cleaning for outliers: 34.6% of Italian manufacturing value added & 25.8% of manufacturing employment in 2001

Descriptive statistics and sample validation

The sample has been validated by comparing it with official Census data along three dimensions:

Spatial distribution across regions: correlation = 0.96***

Activity distribution across industries: correlation = 0.71***

Size distribution

	Sample 2001		Census 2001		Firm coverage
	Firms (A)	Freq. (%) (B)	Firms (C)	Freq. (%) (D)	
size					(A)/(C)
1-9	3,196	11.4%	447,859	82.5%	0.7%
10-19	3,926	14.0%	55,553	10.2%	7.1%
20-49	5,145	18.3%	27,075	5.0%	19.0%
50-249	3,653	13.0%	10,872	2.0%	33.6%
249-	644	2.3%	1,517	0.3%	42.5%
N/A	11,512	41.0%			
Total	28,076	100.0%	542,876	100.0%	5.2%

Table 4: Descriptive statistics

(A)					
Variable	Obs	Mean	Std. Dev	Min	Max
PROD_DEFL	182149	1.29E+07	7.31E+07	204.2953	5.40E+09
Y_DEFL	182149	1.25E+07	7.16E+07	198.023	5.35E+09
VA_DEFL	182149	3154958	1.59E+07	10.49453	1.11E+09
M_DEFL	151898	7022838	4.95E+07	1.87991	4.98E+09
K_DEFL	182149	2669538	1.91E+07	4.735422	1.85E+09
L	178420	62.57517	357.8281	1	103761
(B)					
Variable	Obs	Mean	Std. Dev	Min	Max
DPROD	141528	0.083077	0.194417	-0.44328	1.980081
DY	141528	0.084328	0.203545	-0.47451	1.993963
DVA	141528	0.070475	0.248729	-0.62854	1.997875
DM	141528	0.0742	0.274415	-0.62274	1.999147
DK	141528	0.075576	0.341839	-0.67925	1.999518
DL	141528	0.069498	0.283197	-0.81667	1.982955

Trade measures: Intensive and Extensive Margins

The measure follows Hummels and Klenow (NBER, 2002 and AER, 2004)

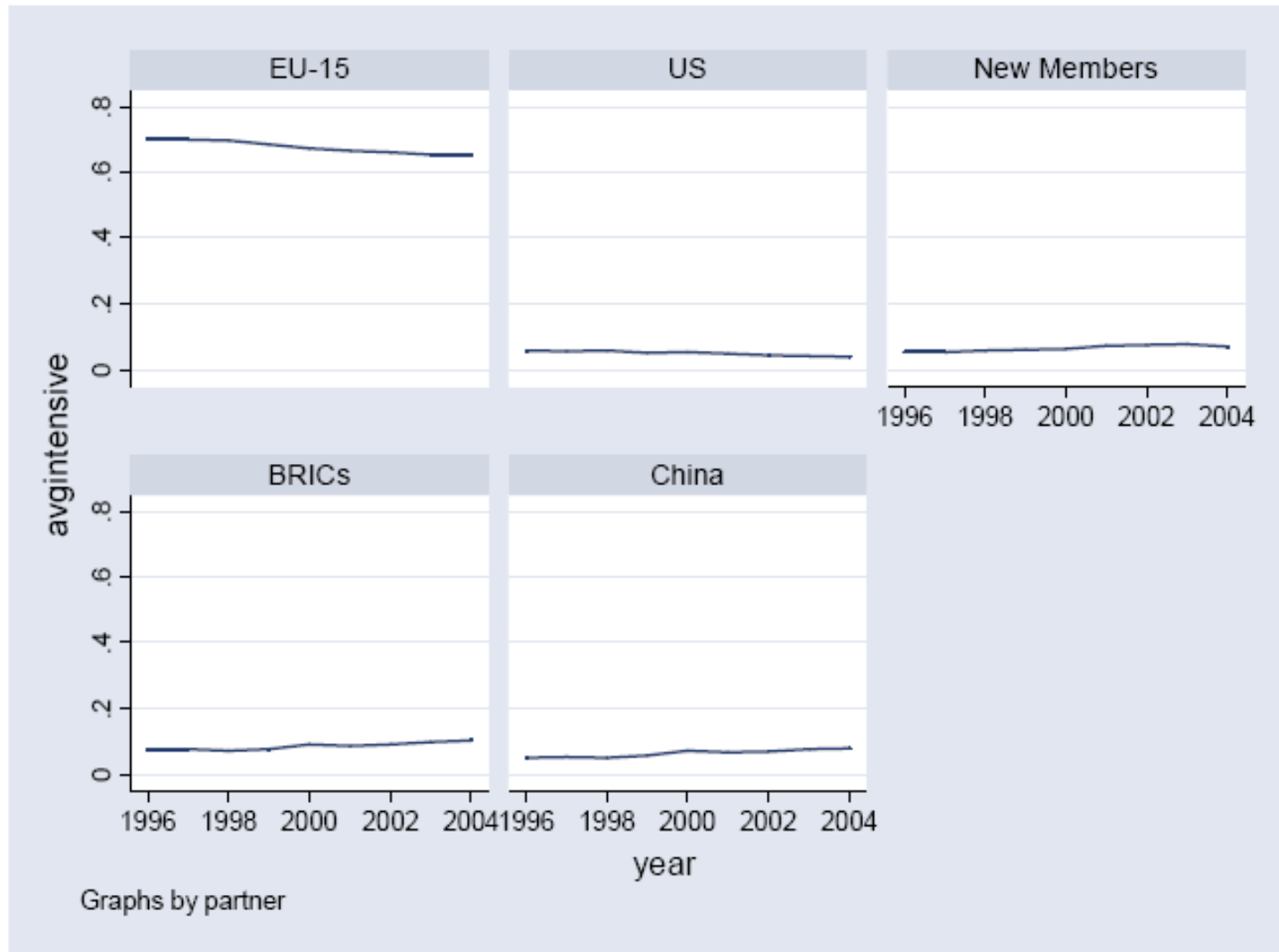
$$Int_mar_{zjt} = \frac{IMP_{zjt}}{\sum_{r \text{ if } r \neq z} \sum_{s \in IMP_{sjt}} IMP_{rst}}$$

The intensive margin measures the intensity of imports from a given partner z on the set of products s imported within industry j at time t .

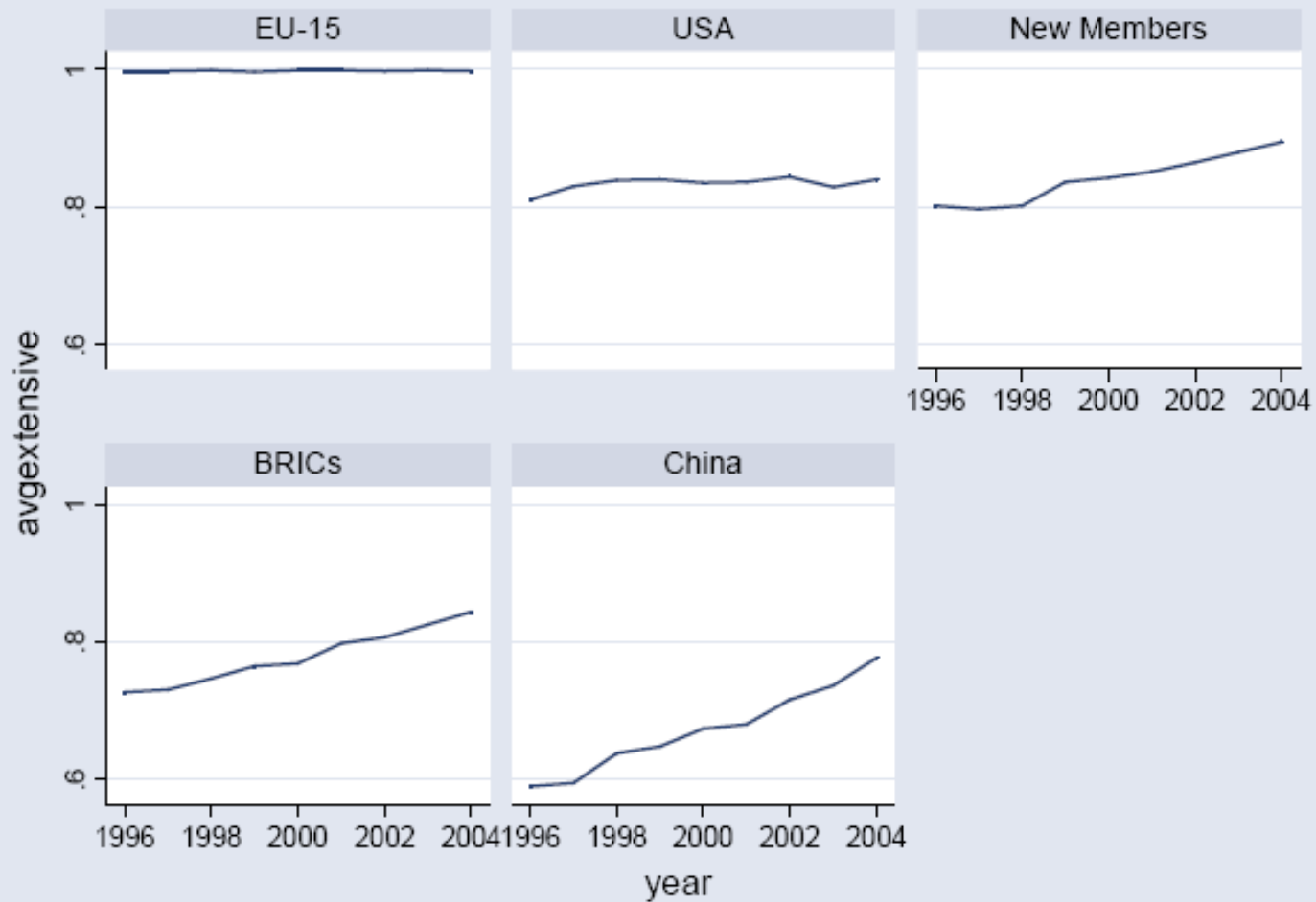
$$Ext_mar_{zjt} = \frac{\sum_{r \text{ if } r \neq z} \sum_{s \in IMP_{sjt}} IMP_{rst}}{IMP_{Wjt}}$$

The extensive margin catches the contribution of the set of products s imported from partner z in industry j to the whole set of products imported by Italy from the rest of the world at time t .

Average Intensive Margins by Partner



Average Extensive Margins by Partner



Graphs by partner

Trade measures: Horizontal and Vertical Import Penetration

We have weighted the trade penetration of a given industry with its own local production level in the country and the ensuing exports, in order to take into account the increasing opportunities for international fragmentation of production structurally boosting trade flows.

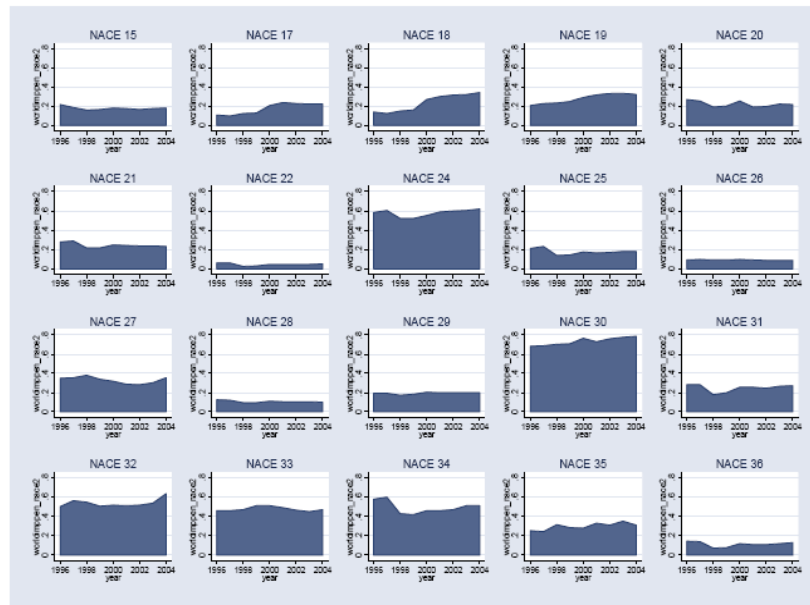
IMP_{zjt} is the (H: horizontal; V: vertical) import penetration index from country z and industry j at time t , calculated as follows:

$$H_imp_{zjt} = \frac{IMP_{zjt}}{IMP_{zjt} + PROD_{jt} - EXP_{zjt}}$$

$$V_imp_{zjt} = \sum_{k \text{ if } k \neq j} a_{kjt} \cdot H_imp_{zkt}$$

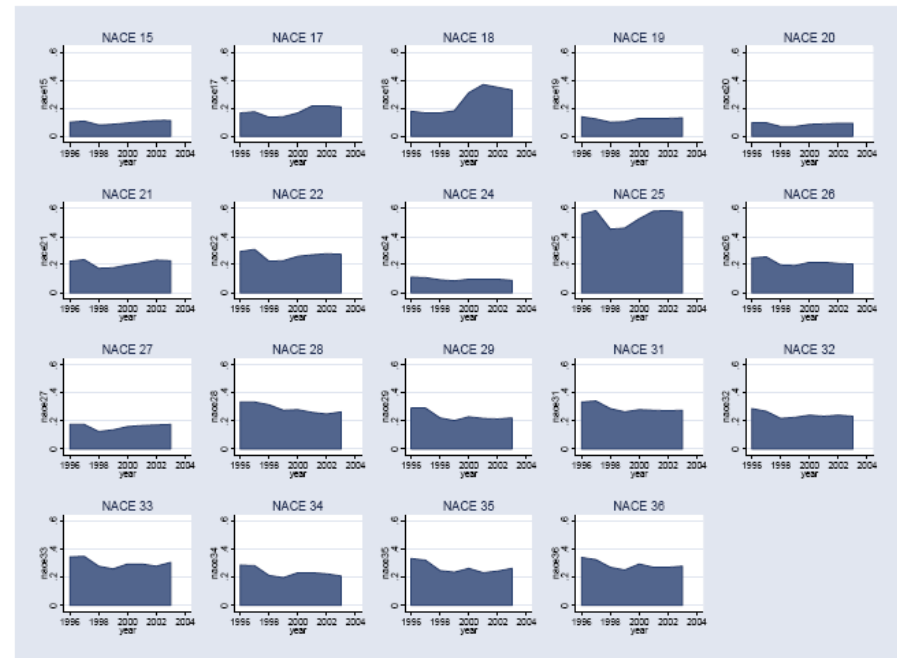
where a_{kjt} are the time-varying input/output coefficients

Import Penetration Indexes by Industry



Average Horizontal Penetration Index = 28.3%

Average Vertical Penetration Index = 24.4%



Average Vertical Import Penetration Indexes by Partner



Econometric model I

First, in order to gauge a more and very general impact of trade openness on productivity, we have estimated at the industry level the following relationship:

$$tfp_{ijt} = \alpha_0 + \alpha_1 IMP_sh_{zjt} + \gamma_i + \theta_j + \delta_t + \epsilon_{ijt}$$

where tfp_{ijt} is the total factor productivity of firm i operating in industry j at time t .

IMP_sh_{zjt} is the import share from country z (*world*) and industry j at time t calculated as follows:

$$IMP_sh_{zjt} = \frac{IMP_{zjt}}{IMP_{zt}}$$

Econometric model II

Then, in order to gauge the impact of trade diversity on productivity, we have estimated at the firm level the following relationship:

$$tfp_{ijt} = \alpha_0 + \alpha_1 Int_mar_{zjt} + \alpha_2 Ext_mar_{zjt} + \gamma_i + \theta_j + \delta_t + \epsilon_{ijt}$$

where tfp_{ijt} is the total factor productivity of firm i operating in industry j at time t .

Int_mar_{zjt} is the intensive margin country z and industry j at time t

Ext_mar_{zjt} is the intensive margin country z and industry j at time t calculated as before.

$$Int_mar_{zjt} = \frac{IMP_{zjt}}{\sum_{r \text{ if } r \neq z} \sum_{s \in IMP_{sjt}} IMP_{rst}}$$

$$Ext_mar_{zjt} = \frac{\sum_{r \text{ if } r \neq z} \sum_{s \in IMP_{sjt}} IMP_{rst}}{IMP_{Wjt}}$$

Econometric model III: main specification

Finally, in order to weight trade openness with the impact of trade intensity of local demand, we have estimated at the firm level the following relationship:

$$tfp_{ijt} = \alpha_0 + \alpha_1 H_imp_{zjt} + \alpha_2 V_imp_{zjt} + \gamma_i + \delta_t + \epsilon_{ijt}$$

where tfp_{ijt} is the total factor productivity of firm i operating in industry j at time t .

IMP_{zjt} is the (H: horizontal; V: vertical) import penetration index from country z and industry j at time t , calculated as follows:

$$H_imp_{zjt} = \frac{IMP_{zjt}}{IMP_{zjt} + PROD_{jt} - EXP_{zjt}}$$

$$V_imp_{zjt} = \sum_{k \text{ if } k \neq j} a_{kjt} \cdot H_imp_{zkt}$$

where a_{kjt} are the time-varying input/output coefficients

Results I & II – Marginal effects (log-level)

Dep var: ln(TFP) OP	World	World	EU-15	USA	NMS	BRICs	China
Import shares	.0273*** (.0056)						
Lagged import shares		.0121*					
Lag intensive_margin			-.0733*** (.0169)	-.0043* (.0024)	.0207*** (.0030)	-.0171*** (.0033)	-.0094*** (.0026)
Lag extensive_margin			.0486 (.0603)	-.0299*** (.0084)	.0200** (.0089)	.0119 (.007)	-.0007 (.0062)
Constant	9.19*** (.007)	9.20*** (.006)	9.22*** (.061)	9.25*** (.010)	9.18*** (.009)	9.22*** (.008)	9.22*** (.007)
Firm fixed effects	no	no	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	no	no	no	no	no
Time fixed effects	yes	yes	yes	yes	yes	yes	yes
Observations	149,444	138,484	149,444	146,785	147,760	146,494	144,377

***, **, * Statistically significant at 1%, 5%, 10% respectively
FE (within) estimator. Standard errors clustered at firm level

Baseline results – Marginal effects (log-level)

Dep var: ln(TFP) OP	World	EU-15	USA	NMS	BRICs	China
Lag_horiz_imp_pen	.0053*** (.0014)	.0019** (.0006)	-.0001 (.0000)	.0001 (.0003)	.0016** (.0008)	.0023** (.0009)
Lag_vert_imp_pen	.0980*** (.0095)	.0859*** (.0100)	.0095 (.0058)	.0692*** (.0067)	.0761*** (.0073)	.0494*** (.0054)
Constant	9.06*** (.013)	9.07*** (.012)	9.16*** (.007)	9.11*** (.007)	9.11*** (.006)	9.14*** (.005)
Firm fixed effects	yes	Yes	yes	yes	yes	yes
Time fixed effects	yes	Yes	yes	yes	yes	yes
Observations	161,343	161,343	161,343	161,343	161,343	161,343

***, **, * Statistically significant at 1%, 5%, 10% respectively
FE (within) estimator. Standard errors clustered at firm level

Firms' characteristics (average effects, log-log)

Dep var: ln(TFP) OP	World	World	World	EU-15	EU-15
Horizontal_imp_pen	.019*** (.004)	.019*** (.004)	.019*** (.004)	.024*** (.004)	.024*** (.004)
Vertical_imp_pen	.082*** (.011)	.084*** (.012)	.084*** (.012)	.072*** (.012)	.073*** (.012)
FOR_MNE	.233*** (.008)	.174*** (.029)		.190*** (.037)	
DOM_MNE	.188*** (.005)		.169*** (.017)		.171*** (.021)
Horizontal*FOR_MNE		-.001 (.008)		.016** (.008)	
Vertical*FOR_MNE		-.052*** (.016)		-.045*** (.016)	
Horizontal*DOM_MNE			-.008 (.004)		.012*** (.005)
Vertical*DOM_MNE			-.013 (.009)		-.025*** (.009)
Constant	9.33*** (.016)	9.34*** (.016)	9.34*** (.015)	9.39*** (.023)	9.38*** (.023)
Industry fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Observations	158,983	158,983	158,983	159,276	159,276

FOR: affiliates of foreign MNEs

DOM: domestic MNEs

Robustness check: different productivity measures

Dep var:	ln(TFP) OLS	ln(lab_prod)	Δ ln(TFP) OP	Δ ln(TFP) OLS	Δ ln(lab_prod)
Horizontal_imp_pen	.008*** (.002)	.008*** (.003)			
Vertical_imp_pen	.122*** (.011)	.153*** (.012)			
Δ Horizontal_imp_pen			.003 (.002)	.004* (.002)	.004 (.003)
Δ Vertical_imp_pen			.093*** (.013)	.095*** (.013)	.114*** (.014)
Constant	9.52*** (.018)	11.01*** (.020)	.031*** (.003)	.030*** (.004)	.032*** (.004)
Firms fixed effects	yes	Yes	yes	Yes	yes
Time fixed effects	yes	Yes	yes	Yes	yes
Observations	158,983	158,983	114,231	114,231	114,231
***, **, * Statistically significant at 1%, 5%, 10% respectively FE (within) estimator. Standard errors clustered at firm level					

Robustness check: different trade penetration indexes

Dep var: ln(tfp) OP	Fixed I/O coeff	NACE2 Index	Bounded Index (0-1)
Horizontal_imp_pen	.0060*** (.0013)	.0219*** (.0044)	.0257** (.0077)
Vertical_imp_pen	.0905*** (.0096)	.0741*** (.0101)	.1519*** (.0163)
Constant	9.07*** (.011)	9.05*** (.011)	8.98*** (.019)
Firm fixed effects	yes	yes	yes
Time fixed effects	yes	yes	yes
Observations	161,343	164,678	159,441

***, **, * Statistically significant at 1%, 5%, 10% respectively
FE (within) estimator. Standard errors clustered at firm level

Robustness check: technology gap e trade orientation

In order to discount the impact of trade penetration as a source of relatively cheap inputs (thus linked to productivity via a cost rather than efficiency channel), we have weighted import penetrations (both horizontal and vertical) by each country's technological gap, a 0-1 index based on the ration of the country's yearly GERD (Gross Expenditure on Reasearch and Development) vs. the US one (index = 1)

Dep var: ln(TFP) OP	EU-15	NMS	BRICs	China
GERD_hor_import_pen	.0019** (.0005)	.0002 (.0001)	.0017** (.0008)	.0027** (.0009)
GERD_vert_import_pen	.0841*** (.060)	.0593** (.0063)	.0703*** (.0069)	.0290*** (.007)
Constant	9.07*** (.011)	9.12*** (.007)	9.12*** (.005)	9.16*** (.003)
Firm fixed effects	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes
Observations	161,343	161,343	161,343	161,343

***, **, * Statistically significant at 1%, 5%, 10% respectively
FE (within) estimator. Standard errors clustered at firm level

Conclusions and policy implications

- The paper revisits the relationship between trade openness and firm-level productivity in the context of a European country (Italy)
- We provide robust evidence that import penetration positively matters for productivity, with the effects systematically more pronounced for vertical measures (i.e. trade in intermediates) rather than horizontal ones (competition and imitation)
- Openness to China and other emerging economies does not seem to pose a threat, at least in terms of productivity gains, for Italian firms
- Foreign and Domestic multinational firms benefit more from the Single Market in terms of horizontal import penetration, while at the same time they exploit alternative channels for sourcing products
- How to enhance the gains from the Single Market:
 - increase the magnitude of the horizontal channel => competition policy
 - capitalise on the relevance of the vertical channel (*Technology is “in the air”*)
=> policies of technology adoption rather than technology development