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WORKING PAPERS

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Carlo Altomonte
Alessandro Barattieri
Armando Rungi

23 / 2008

Import penetration, intermediate inputs and productivity: evidence from Italian firms

Carlo Altomonte* (Bocconi U. & FEEM)
Alessandro Barattieri (Boston College)
Armando Rungi (ISLA-Bocconi U.)

January 15, 2008

Abstract

We test the impact of import penetration on the productivity of a sample of roughly 35,000 Italian manufacturing firms operating in the period 1996-2003, considering the impact on productivity of both import penetration in the same industry and import penetration in the up-stream industries. We find that import penetration has a positive effect on productivity, but the effects are three times as large for import penetration in up-stream industries. Trade-related variables do not account however for the bulk of variation in individual firms' TFP.

JEL classification:
Keywords: import penetration, intermediate inputs, productivity

* *Corresponding author*: IEP-Università Bocconi, Via Gobbi, 5, I-20136 Milan. (T)+39.02.5836.5405; (F)+39.02.5836.5439; carlo.altomonte@unibocconi.it

1 Introduction

When analyzing the performance of European economies in the last decade, most analyses (e.g. Sapir et al., 2004) agree in identifying the sluggish growth of European productivity as a major contributing factor to the low potential growth rate of the EU economy. As a result, the need for productivity gains sits nowadays high in the agenda of policymakers.

To this extent, much emphasis has been put forward by the European institutions on the relations between productivity gains and a deepening of the process of economic integration via a better working of the EU Single Market, as well as its extension to third countries in order to achieve wider open markets and regulatory convergence (European Commission, 2007). Strangely enough, however, in the national debates the relationship between productivity and trade openness is, more often than not, perceived as a negative one, periodically leading to protectionist calls throughout the EU member States.

And yet, a vast body of theoretical and empirical literature points to a positive relationship between trade openness and productivity. In particular, from a theoretical point of view, several channels might explain a positive effect of trade and trade liberalization on productivity. An increased product market competition, for instance, may stimulate firms to reduce their x-inefficiences or even lead the less productive firms to leave the market (Melitz, 2003 and Melitz and Ottaviano, 2005). Other important channels might be the increased availability of foreign (possibly better) intermediate inputs that can also stimulate technological innovation (see for example Grossman and Helpman, 1991) and possible scale effects due to the greater market size (Krugman and Helpman, 1985).

As for the empirical contributions, the cross-country studies of Ades and Glaeser (1999), Frankel and Romer (1999), and Alesina, Spolaore, and Wacziarg (2000) all found significant effects of trade on growth and productivity[1]. The finding is also confirmed in industry studies such as Trefler (2004), who finds an increase by 14% in labour productivity in those Canadian and US industries with highest output tariff cuts. In a developing country context, Shor (2004) analyzes tariffs for a sample of Brazilian industries, showing that input tariffs have a negative effect on productivity. At the firm-level, Tybout and Westbrook (1995), Krishna and Mitra (1998), Pavcnick (2002), Fernandes (2003) and Topalova (2004), all find positive effects of trade on firm-level productivity.

All the previously quoted studies, however, explore the "horizontal" channels through which the trade shock affects productivity, i.e. all those channels captured by *within-industry* measures of integration (such as import penetration in the same industry or output tariff reductions). As a result, the economic nature of the effects explored deals essentially with

[1]These studies have been criticised by Rodrik (2000) and Rodriguez and Rodrik (2001), on the grounds that that once institutional quality and geographic variables are taken into account the positive effect of trade on productivity disappears. In a recent study, however, Alcalà and Ciccone (2004) find a positive impact of real openness on productivity for 138 countries, even after controlling for institutional quality and geographic variables, when real openness is employed.

productivity gains led by competition effect. On the other hand, it might be interesting to explore also "vertical" channels, i.e. all those channels captured by *across-industry* measures of integration such as imported input, input tariffs or import penetration in the up-stream industries, especially in light of the recent trends showing that international trade in components is growing faster than trade in final goods (Hummels et al., 2001).

As a result, a growing literature has started to explore this second class of channels, which might yield a richer set of predictions on the relationship between trade flows and productivity gains. In particular, Amiti and Konings (2007) consider the impact of both output and input tariffs on productivity for a sample of Indonesian firms, concluding that a 10% reduction in output tariffs would increase productivity by 1%, while a 10% reduction in input tariffs would increase TFP by 3% on average, and by 11% in input-importing firms.

The present paper is related to this last strand of literature, since it aims at understanding whether import penetration matters for the productivity of local firms, and whether the impact is different when considering trade measures within or across (up-stream) industries and across different countries of origin of the imports. In particular, the exercise is carried out on a sample of roughly 35,000 Italian manufacturing firms operating in the period 1996-2003. The choice of Italy is driven by the peculiar behavior of the country in the considered period: according to the OECD Factbook 2006, in fact, Italy is the only country among those surveyed which has displayed a negative average growth rate of its multi-factor productivity in the period 1996-2003 (-0.3 per cent), while at the same time experiencing an increasing trade openness[2]. As such, the country consistutes an interesting case of analysis, since we can exclude a possible spurious correlation between increasing trade flows and productivity.

Anticipating our main result, we find that import penetration positively matters for productivity, with an effect which is however differentiatied if considering within vs. across-industries (vertical) indicators. In particular, the marginal effect of an increase in the World import penetration ratio of the same industry would result in a productivity increase for Italian firms of limited magnitude (around 0.5%), while an increase in the World import penetration ratio in the vertical industries would instead increase the productivity of the average Italian firm by some 9.8%. The order of magnitude of these results is consistent with the one obtained by Amiti and Konings (2007), although our results vary when considering the impact of trade openness with respect to different countries or group of countries trading with Italy, or different trade penetration indicators.

The paper contributes to the literature in a number of ways. To the best of our knowledge, this is the first paper to consider in a core European country (Italy) both the "horizontal" and "vertical" channels through which economic integration might affect productivity. We employ a broad range of trade indicators, including a modified version, applied to the im-

[2]In a very detailed study Daveri and Lasinio (2006) find that the current stagnation of the Italian economy is mainly a labour productivity problem, mostly driven by a decline in total factor productivity (TFP), especially in manufacturing sectors.

port case, of the intensive and extensive margins calculated following Hummels and Klenow (2002), allowing the margins to vary across different countries of source and destination, and linking them to productivity. We have decided not to employ tariffs to gauge the effect of trade integration, since tariffs in the case of Italy do not exist with respect to the main trading partners (other EU countries) while tariffs towards non-European countries are jointly decided at the European level, and can thus be influenced by a number of factors such to make them endogenous to productivity (Karacaovali, 2006); moreover, MFN tariffs are imperfect indicators of the effective protection, because they are rarely the true tariffs applied. Finally, we build the import penetration indexes for the up-stream industries using time-varying technology coefficients retrieved from Input-Output tables, thus directly observing the linkages across sectors in every considered year.

The structure of the paper is as follows. Section two provides description and discussion of data used in the analysis, providing a picture of Italian imports through several measures of trade openness. Section three is devoted to introduce first our semi-parametric econometric estimation of total factor productivity, then to report estimates on linkages between productivity and the several measures of openness we use. Section four discusses the main results obtained and the relative robustness checks. Section five concludes.

2 Data description

2.1 The sample of italian manufacturing firms

A commercial dataset called AIDA, collected by the Bureau van Dijk, was used in order to retrieve balance sheet data relative to sales, value added, net tangible fixed assets, number of employees and ownership structure of the Italian manufacturing firms. The total sample was made up by 61,335 firms. Taking 2001 as the reference year and comparing sample data with the official Industrial Census of that year, these firms accounted for the 73% of total manufacturing value added and 54% of manufacturing employment. However, due to the quality of data, extensive data cleaning had been necessary. We adopted a two-stage data cleaning procedure. First, we dropped all those firms reporting negative values of any of the considered variables. Second, in order to get rid of outliers, we computed the growth rates of each variable and dropped all firms reporting growth rates smaller than the 1st or greater than the 99th percentiles of the relevant distribution. The resulting sample is constituted of 34,385 firms, representing the 40.7% of total manufacturing value added and 31.7% of manufacturing employment in 2001.

To validate our sample, we compared it with official data along three dimensions: geographical location, industrial activity and firms' size. Table 1 reports the geographical distribution of the firms in our sample. The number for each region ranges from 55 (Aosta Valley) to more than 10,000 (Lombardy). The correlation between the distribution of our

sample and the distribution of the 2001 Census is 0.96 and significant at the 1 per cent level.

[Table 1 about here]

As for the distribution across industries, Table 2 shows how the number of firms for each NACE2-digits sector ranges from 119 in the case of sector 23 ("Manufacture of coke, refined petroleum products and nuclear fuel") to more than 5,000 firms in sector 29 ("Machinery and equipment"). Again, the correlation with the Census data is pretty good (0.71) and significant.

[Table 2 about here]

As far as firms' size is concerned, Table 3 shows the distribution across the size classes adopted by the Italian National Institute of Statistics. Firm size is measured by employment. Looking at firms for which employment data in 2001 is available, there is a fair representation of micro firms (11.2%). Clearly, the third column shows how this sample under-represents micro-firms, which in Italy account for more than 80% of total firms. This (relative) over-representation of large firms is clearly a drawback that must be taken in mind along all the analysis. However, since micro firms are not obliged to report balance sheet data, it is almost impossible to obtain otherwise these latter on a regular basis and we have to cope with an (albeit moderate) "size bias" of the sample.

[Table 3 about here]

The last relevant feature retrieved from our data is the firm ownership structure, which for each firm we were able to identify in 2004. Hence, we classified as foreign (FORMNE) those firms with a direct foreign participation greater than 10%, while we considered as domestic MNEs (DOMMNE) all those firms with participation abroad greater than 10% in 2004. We have got a total of 453 foreign firms and 1,365 domestic multinationals in our sample[3].

Table 4 shows some descriptive statistics of the sample. Panel A shows the descriptive statistics for the values of the different variables whereas panel B reports the information on growth rates.

[Table 4 about here]

[3]Note that we are dealing with the ownership data of the last available year, which prevents us from capturing any possible change of status in the period considered (as for example due to M&A operations). Although foreign ownership is not the main object of our analysis, this caveat should be taken in mind when discussing our results.

2.2 An analysis of Italian imports

Information on trade flows and production by industry has been retrieved by EUROSTAT. Values of imports and exports of the manufacturing sector were collected at a detailed product level according to the CN 8-digit classification used for custom purposes, for the period 1996-2004 and for different countries of origin/destination. The data were then reclassified at the 4-digit NACE rev. 1.1 level, using the relative correspondence tables provided by EUROSTAT. The product-level data, coupled with a geographical breakdown, allowed us to draw a detailed picture of the changing pattern of Italian imports in a relevant period. Data on production were collected using the EUROSTAT PRODCOM database, also at a 8-digit product classification, whose codes were once again reclassified within NACE industries as for the trade flows.

First of all, looking at basic figures, openness on the import side has rapidly increased in the considered period, in Italy as in other European countries. Graph 1 simply reports a standard import intensity index, which weights import flows with industry production. If we consider both imports from world and if we differentiate them by import origin we acknowledge a rising pattern in Italy.

[Graph 1 about here]

In order to correct the general rising trend for world imports and to differentiate it by industry, we used a simple ratio IMP_sh_{zjt} which is the share of industry j imports from the partner z (in this case the world) at time t on total Italian imports (from the same partner world) at time t:

$$IMP\_sh_{zjt} = \frac{IMP_{zjt}}{IMP_{zt}} \tag{1}$$

where IMP_{zjt} are the imports from partner z in industry j in year t.

Table 5 reports the dynamics of these shares at NACE 2-digit industry level. At this level of aggregation, the wearing apparel industry (NACE 18) together with communication equipment (NACE 32), motor vehicles (NACE 34) and other transportation equipment show a clear rising share. Motor vehicles alone account for 14.5% of manufacturing imports in 2004, but the first sector still remains the chemical one, with 16.3%. Two of the sectors which instead reports neatly declining figures are food (NACE 15) and office machinery (NACE 30).

[Table 5 about here]

We have next decomposed the Italian import shares by an intensive and an extensive margin of trade, following Hummels and Klenow (2002). The intensive margin (Int_mar_{zjt}) measures the intensity of imports from a given partner z on the products s imported within industry j; the extensive margin (Ext_mar_{zjt}) catches the contribution of the same set of

products imported from partner z in industry j to the variety of products imported by Italy from the world. Both indexes are thus bounded between 0 and 1.

In particular, Int_mar_{zjt} is calculated as:

$$Int\_mar_{zjt} = \frac{IMP_{zjt}}{\sum_{r\ if\ r \neq z} \sum_{s\ \epsilon\ IMP_{zjt}} IMP_{rst}} \tag{2}$$

whereas Ext_mar_{zjt} is computed as:

$$Ext\_mar_{zjt} = \frac{\sum_{r\ if\ r \neq z} \sum_{s\ \epsilon\ IMP_{zjt}} IMP_{rst}}{IMP_{Wjt}} \tag{3}$$

where IMP_{Wjt} are imports from partner z in industry j in year t. Clearly, decomposing by trade margins excludes the option of considering world as a partner, given the peculiar method of calculation which takes total trade as a benchmark. At the same time, however, every country-specific intensive margin multiplied by its own extensive margin reproduces the import shares of that country for each j sector with respect to total Italian imports in the same sector, i.e. IMP_{zjt}/IMP_{Wjt}.

Intensive and extensive import margins for Italy are then differentiated by a number of representative partners: the European countries before the enlargement (EU-15), USA, the new member states of the European Union (NMS), the so-called BRICs (Brazil, Russia, India and China as new emerging markets) and China alone. Graph 2 and Graph 3 report the time trends of intensive and extensive margins for the average of the considered industries by partner.

[Graph 2 and 3 about here]

As it is possible to see, there are structural differences in the exposure to international trade flows. First, considering the European Union (EU 15) before the enlargement as a partner, both intensive and extensive margins reached high average ratios for all manufacturing industries, in line with the high level of economic integration of Italy with the Union. In some cases, where extensive ratios equal one, it means that Italy is importing all the existing varieties in the considered industries from the European partners. From United States (US), instead, many varieties are imported (relatively high extensive margin) but the intensity of trade is in general rather low and comparable with figures of the New Member States (NMS) after the enlargement. The latter trade shares are anyway rising within the considered period, while US ones are more stable.

Tables 6 and Table 7 summarize trade margins by industry, taking averages over time. For example, given the products which Italy imports from the US in the food industry (NACE15), over the period considered these products account on average for some 2.6% of total Italian imports of the same products within the industry (the intensive margin reported in Table 5). At the same time, these products cover some 43% of all varieties imported by

Italy in the food industry (the extensive margin reported in Table 6). As such, the total import share of US imports in the food industry with respect to Italian world imports is around 1.1%.

Intensive margins for China alone are considerably high for some sectors (e.g. NACE18 - wearing apparel; NACE19 - leather luggage and footwear) but extensive margins, reflecting the extent of traded varieties, are in general less relevant, i.e. the opposite of the US, a country from which Italy tends to import a relatively large number of varieties but without significant intensity. Figures for the group of BRICs (Brazil, Russia, India and China) show a wide range of imported goods, even if single countries are individually more specialized. These four countries taken together matter more than US in terms of import intensity when this latter is measured by intensive margins.

[Table 6 and 7 about here]

Finally, we have weighted the trade penetration of a given industry with its own local production level in the country, in order to take into account the increasing opportunities for international fragmentation of production structurally boosting trade flows. We have thus introduced a measure of horizontal import penetration and vertical import penetration, H_imp_{zjt} and V_imp_{zjt} respectively, from country z in industry j at time t. The horizontal penetration is calculated as:

$$H\_imp_{zjt} = \frac{IMP_{zjt}}{IMP_{zjt} + PROD_{jt} - EXP_{zjt}} \tag{4}$$

where EXP_{zjt} are the exports of Italy to country z in industry j in year t, while $PROD_{jt}$ is the national output of industry j in year t.

The measure of the vertical import penetration, V_imp_{zjt} takes into account the linkages present in the up-stream industries. Following Smarzynska (2004), who has used a similar indicator in order to measure "vertical" FDI presence, the index is computed as the weighted average of the up-stream industries' horizontal import penetration ratios using as weights the time-varying input-output coefficients retrieved from the Italian Input-Output matrix, which distinguishes between general figures for intermediates and specific amounts of imports used by economic activities for production purposes[4].

$$V\_imp_{zjt} = \sum_{k \; if \; k \neq j} a_{kjt} \cdot H\_imp_{zkt} \tag{5}$$

[4]In order to check whether the latter display a clear time-trend, we have checked the correlation between the 1996 and the 2003 input-output coefficients, which turned out to be very high and significant. However, a process of technological change is in some cases quite relevant, with differences in coefficients ranging from -15% (the weight of sector 23 - petroleum products - as input of itself) to +12% (the weight of sector 34 - motor vehicles - as input of itself).

where a_{kjt} is the weight of industry k as input of industry j at time t.

Table 8 presents simple descriptive statistics[5] on horizontal import penetration ratios taking the whole world as a partner. Heterogeneity is significant among industriesm with the index ranging from a 1.06 of average import penetration ratio registered by NACE industry 30 (office machinery and computers) to the 0.05 of NACE industry 22 (publishing and printing). As for the evolution over time of the import penetration ratios, Graph 4 reports the dynamics for different industries. Also in this case we find a lot of trend heterogeneity, with an upward trend in some industries (e.g. textiles - 17 or wearing apparel - 18), stability in others (wood -20; motor vehicles - 34), or a decreasing trend (pulp and paper - 21; basic metals - 27). Heterogeneity through time further increases if one looks at 4-digit industries.

[Table 8 and Graph 4 about here]

Table 9 reports the relevant descriptive statistics on vertical import-penetration indexes at 2-digit level of aggregation, revealing again a significant heterogeneity. The industry with the highest up-stream ratio is NACE industry 30 (office machinery and computers) while the one with the lowest value is NACE 20 (wood products).

[Table 9 and Graph 5 about here]

The extent of heterogeneity among industries is depicted in Graph 5 showing the evolution of vertical penetration ratios, mainly different from the corresponding horizontal figures plotted in Graph 4.

Disentangling import penetration ratios by country of origin of imports, Table 10 and Graph 6 show how average vertical import penetration ratios have rapidly grown for the period of concern if we look at emerging economies (BRICs or China alone), and found a renewed upward trend after 2000 in the case of the New Member States. United States count more for horizontal trade than for vertical trade and horizontal ratios are on average decreasing, a trend which is opposite to the one recorded for the New EU Members, BRICs and China.

[Table 10 and Graph 6 about here]

We now move to gauge the impact on Italian firms productivity of these different indicators of Italy's exposure to trade flows.

[5]Variables in Table 8 are summarized at the 2-digit level of aggregation, whereas the actual horizontal import penetration ratios used in the dataset are at a 4-digit level of disaggregation. Vertical penetration ratios can be instead calculated only at 2-digit level because this is the only available disaggregation for Imput-Output technology as provided by ISTAT

3 Econometric model

In order to calculate total factor productivity (TFP), we start from a standard Cobb-Douglas production function

$$Y_{it} = AK_{it}^{\beta_k} L_{it}^{\beta_l} \tag{6}$$

where Y_{it} is a measure of production (in our case value added), K and L are the capital and labour inputs and β_k and β_l the inputs coefficients. A is total factor productivity (TFP). Since our aim is to verify in which way TFP is affected by import penetration, the first step of the analysis is to obtain an unbiased estimate of total factor productivity.

3.1 Productivity estimation

Log-linearizing (6) one yields:

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \eta_{it} \tag{7}$$

where η_{it} is TFP, our variable of interest. In order to have a consistent OLS estimator of our production function, and thus extract TFP as the residual, we need however η_{it} (the error term) to be uncorrelated with both k_{it} and l_{it} (the regressors). However, as pointed out by Griliches and Mareisse (1995), profit-maximizing firms immediately adjust their inputs each time they observe a productivity shock, which makes input levels correlated with the same shocks. Since productivity shocks are unobserved to the econometrician, they enter in the error term of the regression. Hence, inputs turn out to be correlated with the error term, and thus OLS estimates of production functions are problematic.

Olley and Pakes (OP, 1996) and Levinsohn and Petrin (LP, 2003) have developed two similar semi-parametric estimation procedures to overcome this problem. Both techniques suppose that the productivity term η can be decomposed into two terms, so that eq(7) becomes:

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \varpi_{it} + \varepsilon_{it} \tag{8}$$

where ϖ_{it} is a productivity shock observed by the firm (but not by the econometrician) that is able to change the input choices while ε_{it} is a white noise uncorrelated to inputs. The key point in both the OP and the LP estimators is to "turn unobservables into observables", namely to find an observable proxy for the productivity term ϖ_{it}. In particular, the OP methodology uses investment as proxy while the LP methodology uses material costs. Herein after, we present results following the OP methodology as a baseline, and the LP one as a robustness check.

We have estimated separate production functions for each NACE2-digits sector. All our variables are deflated using 2-digit price deflators. The deflator for capital, following Smarzynska (2004), is the simple average of five industries capital deflators[6]. Table 11 shows

[6]NACE sectors 29 "Manufacture of machinery and equipment n.e.c."; 30, "Manufacture of office machinery

the results obtained for the coefficients using the different techniques previously described. In particular, it is worth noting the expected upward bias of the OLS labour coefficients with respect to the OP or the LP estimates. As for the capital coefficients, OP coefficients are usually higher than OLS ones, while LP capital coefficients seem to be sistematically lower[7].

[Table 11 about here]

Using OP estimates as our baseline model, we report in Graph 7 the evolution of an aggregate TFP index[8] that shows a declining trend for our sample of firms, particularly from 2000 to 2003, consistently with the results of the previously cited OECD data on the evolution of the Italian productivity in the period considered. Graph 8 disentangles the evolution of the TFP index according to its geographical and industrial dimensions

[Graph 7 and 8 about here]

As for the geographical heterogeneity of the TFP evolution, in Graph 9 we report the break-down for the different regions. While many of the southern regions display a declining path, the majority of the northern regions are characterised by an almost flat path, with a little decrease in productivity from 2000 to 2003 and some signs of recovery in 2004[9].

[Graph 9 about here]

3.2 Italian imports and productivity

The estimation strategy has been composed by three steps. First, once having obtained reliable TFP estimates, we have tested the relation of import shares of eq (1) from world with firm-level productivity by industry according to the following econometric model:

$$tfp_{ijt} = \alpha_0 + \alpha_1 IMP\_sh_{zjt} + \gamma_i + \theta_j + \delta_t + \epsilon_{ijt} \tag{9}$$

where tfp_{ijt} is the log-productivity of firm i operating in industry j at time t while γ_i, θ_j and δ_t are respectively firm, industry and time fixed effects. IMP_{zjt} is considered taking world as a partner. The same specification has been conducted with IMP_sh_{Wjt} lagged one period

Differentiating import shares by the intensive (Int_mar_{zjt}) and extensive (Ext_mar_{zjt})

and computers"; 31,"Manufacture of electrical machinery and apparatus " ; 34, "Manufacture of motor vehicles, trailers and semi-trailers"; 35, "Manufacture of other transport equipment".

[7]The negative OP capital coefficients for industry 22 "Publishing, printing and reproduction of recorded media" and 23 "Manufacture of coke, refined petroleum products and nuclear fuel" might be due to the small number of observations in these industries.

[8]The index has been computed as the ratio between the yearly unweighted average of the firm level TFP and its initial (1996) value.

[9]The path displayed by the Aosta Valley region might be due to the small number of observations

margins of trade according to eq(2) and eq(3), we have introduced a different econometric model:

$$tfp_{ijt} = \alpha_0 + \alpha_1 Int\_mar_{zjt} + \alpha_2 Ext\_mar_{zjt} + \gamma_i + \theta_j + \delta_t + \epsilon_{ijt} \tag{10}$$

Finally, weighting trade of an industry with its own demand in order to take into account the increasing availability of intermediates from abroad, we have introduced a third econometric model:

$$tfp_{ijt} = \alpha_0 + \alpha_1 H\_imp_{zjt} + \alpha_2 V\_imp_{zjt} + \gamma_i + \delta_t + \epsilon_{ijt} \tag{11}$$

where the log-productivity is tested against the measure of horizontal import penetration H_imp_{zjt} of eq(4) and vertical import penetration V_imp_{zjt} of eq(5) with firm and time fixed effects.

4 Results

4.1 Main Results

Table 12a and 12b contain the main results of the analysis, obtained from the estimation of eqs(9, 10, 11). The Breusch-Pagan test rejected the Pooled OLS as a possible estimator, while the Hausman test identified fixed effect estimator preferable in this case to the alternative random effect estimator. The first two columns of Table 12a report the estimates[10] using import shares by industry from world, with the second one which lags import shares by one period to control for potential endogeneity of trade measures. In the latter case a greater openness seems to affect productivity at industry-level with a 1.21% increase at the margin.

In the following columns we report the results for the (lagged) intensive and extensive margins of trade. The intensive margin is in general associated to a negative effect on productivity, likely to arise due to the enhanced intra-industry competition implied by considering the imports belonging to the precise and detailed economic activity of a single firm. The only exception are trade flows with the New Members of European Union, where the effects of offshoring activities might be picked up. The effects of extensive margins, within the same industries, are on average not significant for firm productivity if we consider imports from the EU-15 or the BRICs. The signs are instead significant when considering imports from USA and New EU Members. An increased number of varieties from US, probably substitutes of domestic ones, has a negative effect on productivity, whereas new varieties coming from New Members have a positive effect on firm performance, once again a hint consistent with the presence of intra-industry offshoring.

[10]Hereafter, when estimation strategy implies the using of a log-level functional form with a ratio as independent variable, recovered semielasticities are used to compute marginal effects, which are then reported as estimates.

The latter finding is an indication of the need to control the trade flows with respect to local production, since important phenomena of offshoring might affect the index and its relationship to productivity. To this extent, Column 1 of Table 12b presents the results of the model using import penetration indexes from the entire world. As clearly shown in eqs(4, 5), both horizontal and vertical ratios take into account production and exports, weighing detailed import flows by domestic demand. As it can be seen from estimates, then, horizontal import penetration ratios display a positive and significant coefficient, revealing however a quite small effect in absolute value. A unit increase in horizontal import penetrations, *ceteris paribus*, would result in an increase of productivity of around 0.5% at the margin. Also the coefficient attached to the import penetration in the up-stream industries is positive and statistically significant. However, most notably, its absolute value is sensibly higher: an increase in the "vertical" import penetration would result, *ceteris paribus*, in an increase of productivity by 9.8% at the margin.

Columns 2 to 6 report the results obtained running the same specification over the same group of countries of the previous specification. In Column 2 we explicitly test for the effects of the EU single market, limiting the calculation of import penetration indexes to the EU-15 countries. As it can be seen, both trade measures are positively and significantly associated to productivity gains, with the coefficient of horizontal import penetration once again smaller as when world trade is considered. In Column 3 we repeat the same exercise considering the Italian trade with the United States. Surprisingly, the latter analysis reveals that an increase in horizontal import penetration from the US is not significantly associated with an increase in productivity of Italian firms. Having conducted the same specification on a more aggregate level of import penetration (3-digit level) we found even a negative impact, maybe coming back to the result previously decribed in the case of extensive margins, where new varieties are suspected to be substitutes and in competition with domestic ones. Even US vertical import penetration does not display influence on TFP. Moving to the impact of Italian trade with the New Member States (Column 4), the results are in line with the ones obtained at the world level, and the same is true when considering trade with BRICs (Column 5). Concentrating on the impact of Chinese competition (Column 6), we can also see that trade with China eventually has a positive effect on the productivity of the Italian firms both if we consider the industry to which a firm belongs and if we consider the advantages coming from trade in intermediates. Even if this finding is not surprising for economists, it often is not so straightforward for policy-makers.

[Table 12a about here]

[Table 12b about here]

In Table 13 we analyse in more details our findings, interacting the trade measures with some characteristics of firms, in particular a dummy signalling whether the Italian firm

is controlled by a multinational group (FOR_MNE), or whether the same domestic firm is a parent company with a participation abroad (DOM_MNE)[11]. All these firm-level characteristics seem to be positively correlated with productivity. In particular, Column 1 shows how foreign affiliates display a productivity which is around 23% higher than the average firm, while Italian firms with participations abroad seem, on average, to be 19% more productive than the other firms, in line with the results of a vast literature on the productivity premia attributable to international firms.

When we interact these firm characteristics with our trade penetration measures, we find that foreign affiliates seem to take relatively less advantage than the average domestic firms from an increase in world trade penetration (Column 2), a clear indication that FDI in Italy tend to follow a market-seeking attitude, substituting trade with local presence. A similar finding is obtained for the Italian firms with a participation abroad (Column 3), a finding consistent with the fact that multinational groups in general tend to exploit different trade channels than the average domestic firm. Interestingly enough, however, when interacting the FOR or DOM dummies with the trade penetration within the EU-15 countries (Column 4 and 5), we have found that both domestic and foreign multinational firms operating in Italy do seem to benefit relatively more from horizontal penetration from other EU countries with respect to the average firm. The latter finding is again consistent with the idea that the advantages of market integration in Europe tend to be accrued relatively more by larger, international firms.

[Table 13 about here]

4.2 Robustness checks

In order to verify the accurateness of these results we performed some robustness checks. First, we employed different measures of productivity. Columns 1 and 2 of Table 14 report the results obtained when using alternatively the TFP obtained using, respectively, OLS estimates of the production function coefficients and labour productivity, measured as value added per employee. The results are qualitatively the same, with only a slight different in the point estimates with respect to Column 1 of Table 12b, our benchmark specification.

[Table 14 and 15 about here]

Columns 3 to 5 in Table 14 report a second set of robustness checks, running the specification in first differences for all the previously discussed productivity measures, thus wiping out unobserved firm heterogeneity[12]. Even through such a more demanding specification,

[11] In this case, we introduce in the specification industry fixed effects, since firm effects are now captured by the FOR and DOM dummies.

[12] If firm-specific fixed effects are spuriously correlated with other covariates, the latter might lead to potentially inconsistent estimates.

the results are virtually unchanged, with only the effect of horizontal import penetration slightly less significant.

Another concern is related to the time-varying nature of the I-O import coefficients used to build the vertical import penetration ratio variable, since the latter might be endogenous to trade shocks and productivity[13]. To this extent, Column 1 of Table 15 reports the results that are obtained using the I-O import coefficients of 1996 (i.e. the starting period of our sample). The results obtained are almost identical, with only slight changes in the point estimates.

In Column 2 of Table 15 we have tested whether the results change using a different aggregation for our horizontal trade measure (at NACE2 rather than NACE4), since the lack of observation at this finer industry level might induce a systematic bias in our estimates. In Column 3 we report the results recalculating instead the trade penetration index excluding exports, i.e. bounding the index between 0 and 1, to test for the sensitivity of our coefficients. The results are qualitatively the same, with some slight differences in the point estimates. However, our main result of a large difference in the impact of the two import penetration indexes on productivity in favor of the vertical one is not altered.

Finally, as for trade orientation, we have controlled for a potential bias induced by technology gap among trade partners weighing import penetrations (both horizontal and vertical ones) by a country index based on yearly GERD (Gross Expenditure on Reasearch and Development) taking US as benchmark. These indexes, interacted with import penetrations, should allow us to catch the distance to technology frontier. Point estimates of horizontal penetrations in Table 16 are very similar to those in Table 12b, whereas coefficients for vertical penetrations are slightly lower but maintain significance and order of magnitude, from EU15 to China.

[Table 16 about here]

5 Conclusions

We have tested the impact of import penetration and trade margins on productivity using a sample of roughly 35,000 Italian manufacturing firms operating in the period 1996-2003. After considering the different impact of trade intensity and trade variety on productivity, in line with the approach of the most recent literature, we have considered the effect of both import penetration in the same industry (competition-led productivity gain) and of import penetration in the up-stream industries (to gauge the productivity gain led by better input availability). After having obtained unbiased productivity measures through the Olley and Pakes (1996) semiparametric estimation, we have regressed Total Factor Productivity on the two import penetration ratios, controlling for fixed characteristics.

[13]It could be the case that a trade shock which increases productivity in an upstream industry leads over time to a more intensive use of inputs from the same industry.

Three main results emerged from this analysis. First, we find that import penetration positively matters for productivity, with an effect which is however differentiatied if considering within vs. across-industries (vertical) indicators. In particular, an increase in the import penetration ratio of the same industry would result in a productivity increase that ranges from 0.5% to 0.8% according to the TFP measure and the econometric specification. An increase of the import penetration ratio in the up-stream industries would instead increase average productivity by 9% to 12%. Second, both foreign firms and domestic firms participating in international networks are on average more productive than the other firms. The productivity premium of foreign firms ranges from 14% to 48% while the one of international domestic firms ranges from 10.1% to 41% according to the TFP measure and the econometric specification. We also find, however, that import penetration alone does not explain much of the individual variance in TFP levels, which is clearly (and not surprisingly) linked also to other relevant factors.

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Table 1: Geographical distribution of firms

Regione	Freq.	Percent
Abruzzo	602	1.75
Basilicata	121	0.35
Calabria	177	0.51
Campania	1,350	3.93
Emilia-Romagna	4,299	12.5
Friuli	1,048	3.05
Lazio	1,255	3.65
Liguria	409	1.19
Lombardia	10,415	30.29
Marche	1,258	3.66
Molise	65	0.19
Piemonte	2,956	8.6
Puglia	881	2.56
Sardegna	208	0.6
Sicilia	590	1.72
Toscana	2,729	7.94
Trentino-Alto Adige	486	1.41
Umbria	430	1.25
Valle d'Aosta	55	0.16
Veneto	5,051	14.69
Total	**34,385**	**100**

Table 2: Activity distribution of firms

CODE	NACE_DESCRIPTION	Freq.	Percent
15	Manufacture of food products and beverages	3,251	9.45
17	Manufacture of textiles	2,047	5.95
18	Manufacture of wearing apparel; dressing and dyeing of fur	1,437	4.18
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	1,470	4.28
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and..	1,086	3.16
21	Manufacture of pulp, paper and paper products	845	2.46
22	Publishing, printing and reproduction of recorded media	1,533	4.46
23	Manufacture of coke, refined petroleum products and nuclear fuel	119	0.35
24	Manufacture of chemicals and chemical products	1,511	4.39
25	Manufacture of rubber and plastic products	2,219	6.45
26	Manufacture of other non-metallic mineral products	2,278	6.62
27	Manufacture of basic metals	1,030	3
28	Manufacture of fabricated metal products, except machinery and equipment	3,530	10.27
29	Manufacture of machinery and equipment n.e.c.	5,171	15.04
30	Manufacture of office machinery and computers	234	0.68
31	Manufacture of electrical machinery and apparatus n.e.c.	1,599	4.65
32	Manufacture of radio, television and communication equipment and apparatus	490	1.43
33	Manufacture of medical, precision and optical instruments, watches and clocks	749	2.18
34	Manufacture of motor vehicles, trailers and semi-trailers	558	1.62
35	Manufacture of other transport equipment	447	1.3
36	Manufacture of furniture; manufacturing n.e.c.	2,781	8.09
	Total	**34,385**	**100**

Table 3: Size distribution of firms

	Sample 2001		Census 2001		
size	Freq.	Percent	Freq.	Percent	Firm coverage
1-9	3,844	11.2%	447,859	82.5%	0.9%
10-19	4,881	14.2%	55,553	10.2%	8.8%
20-49	6,646	19.3%	27,075	5.0%	24.5%
50-249	4,641	13.5%	10,872	2.0%	42.7%
249-	809	2.4%	1,517	0.3%	53.3%
N/A	13,564	39.4%			2.5%
TOTAL	**34,385**	**100.0%**	**542,876**	**100.0%**	**6.3%**

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	7022836	4.95E+07	1.87991	4.98E+09
K_DEFL	182149	2669536	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	141526	0.063077	0.194417	-0.44328	1.980081
DY	141526	0.064328	0.203545	-0.47451	1.993963
DVA	141526	0.070475	0.248729	-0.62854	1.997875
DM	141526	0.0742	0.274415	-0.62274	1.999147
DK	141526	0.075576	0.341839	-0.67925	1.999518
DL	141526	0.069498	0.263197	-0.81667	1.982955

Table 5: Import shares by sector

NACE 2-digit	1996	1997	1998	1999	2000	2001	2002	2003	2004
15	0.098	0.091	0.085	0.080	0.073	0.077	0.077	0.080	0.077
16	0.007	0.006	0.006	0.007	0.006	0.006	0.006	0.006	0.006
17	0.035	0.037	0.036	0.033	0.033	0.034	0.032	0.031	0.030
18	0.025	0.026	0.027	0.026	0.026	0.028	0.031	0.032	0.032
19	0.024	0.025	0.024	0.022	0.025	0.029	0.029	0.029	0.026
20	0.016	0.016	0.016	0.017	0.016	0.015	0.015	0.016	0.015
21	0.028	0.027	0.027	0.027	0.029	0.027	0.026	0.025	0.023
22	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
23	0.029	0.024	0.016	0.017	0.025	0.021	0.023	0.022	0.020
24	0.162	0.161	0.156	0.155	0.152	0.153	0.159	0.163	0.163
25	0.026	0.025	0.026	0.027	0.025	0.025	0.025	0.026	0.026
26	0.015	0.014	0.014	0.014	0.013	0.013	0.013	0.013	0.013
27	0.107	0.109	0.109	0.093	0.103	0.097	0.091	0.091	0.107
28	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019
29	0.091	0.086	0.093	0.096	0.093	0.093	0.094	0.091	0.089
30	0.042	0.040	0.041	0.044	0.042	0.039	0.037	0.034	0.033
31	0.034	0.034	0.035	0.035	0.035	0.036	0.033	0.034	0.033
32	0.050	0.054	0.055	0.057	0.064	0.058	0.052	0.051	0.059
33	0.034	0.034	0.034	0.036	0.036	0.036	0.036	0.034	0.034
34	0.116	0.128	0.134	0.143	0.130	0.136	0.145	0.150	0.145
35	0.018	0.018	0.026	0.028	0.031	0.034	0.033	0.029	0.026
36	0.018	0.019	0.019	0.020	0.020	0.019	0.019	0.019	0.020
Total	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Table 6: Intensive margins

	EU15		United States		New EU Members		BRIC		CHINA	
NACE2	average	standard deviation	average	standard deviation	average	standard deviation	average	standard deviation	average	standard deviation
15	0.84789	*0.00608*	0.02629	*0.00832*	0.02783	*0.00399*	0.09244	*0.01007*	0.03758	*0.00641*
17	0.43773	*0.06410*	0.01954	*0.00489*	0.13514	*0.03014*	0.13469	*0.01827*	0.09635	*0.01308*
18	0.25307	*0.02814*	0.00796	*0.00189*	0.21376	*0.02893*	0.23413	*0.02491*	0.15868	*0.03371*
19	0.21269	*0.01592*	0.01573	*0.00221*	0.24636	*0.01789*	0.20228	*0.01542*	0.12426	*0.00873*
20	0.55726	*0.00969*	0.03159	*0.00615*	0.17257	*0.01746*	0.07317	*0.00539*	0.04765	*0.00432*
21	0.80738	*0.01948*	0.02775	*0.00319*	0.05785	*0.01876*	0.05507	*0.00492*	0.02921	*0.00597*
22	0.75116	*0.01581*	0.05243	*0.00997*	0.02055	*0.01162*	0.04329	*0.00928*	0.04197	*0.00787*
23	0.28063	*0.05372*	0.08275	*0.02646*	0.02461	*0.01678*	0.14292	*0.02909*	0.03035	*0.01571*
24	0.79704	*0.00288*	0.05368	*0.00512*	0.02357	*0.00210*	0.02292	*0.00384*	0.01736	*0.00463*
25	0.70467	*0.01566*	0.04073	*0.00671*	0.03662	*0.01020*	0.07761	*0.00757*	0.07181	*0.00581*
26	0.68246	*0.05214*	0.01801	*0.00283*	0.09183	*0.02589*	0.12432	*0.03972*	0.07709	*0.03166*
27	0.66631	*0.03194*	0.02452	*0.00566*	0.07514	*0.00956*	0.08196	*0.00804*	0.02241	*0.00642*
28	0.69485	*0.03637*	0.03549	*0.01856*	0.09101	*0.01698*	0.06507	*0.02384*	0.05127	*0.01707*
29	0.69919	*0.01425*	0.07649	*0.01244*	0.03765	*0.00839*	0.03829	*0.01658*	0.03213	*0.01540*
30	0.77743	*0.02665*	0.05417	*0.01993*	0.01381	*0.00739*	0.03768	*0.01501*	0.03735	*0.01527*
31	0.67918	*0.02259*	0.07018	*0.01145*	0.04739	*0.01065*	0.07287	*0.01714*	0.06696	*0.01510*
32	0.72572	*0.03247*	0.06708	*0.01999*	0.03214	*0.00982*	0.03059	*0.01064*	0.02689	*0.01010*
33	0.62696	*0.01311*	0.16247	*0.01372*	0.02027	*0.00922*	0.04521	*0.01661*	0.04338	*0.01628*
34	0.81867	*0.02869*	0.02868	*0.00299*	0.06688	*0.01133*	0.01941	*0.00565*	0.00587	*0.00309*
35	0.47781	*0.08808*	0.12154	*0.02124*	0.07931	*0.04108*	0.09951	*0.04594*	0.08364	*0.04407*
36	0.51961	*0.04345*	0.03578	*0.00573*	0.07721	*0.01095*	0.15168	*0.02881*	0.13490	*0.02528*

Table 7: Extensive margins

	EU15		United States		New EU Members		BRIC		CHINA	
nace2	average	standard deviation	average	standard deviation	average	standard deviation	average	standard deviation	average	standard deviation
15	0.99965	*0.00026*	0.42962	*0.02605*	0.54999	*0.09425*	0.39401	*0.03930*	0.29922	*0.05338*
17	0.99994	*0.00003*	0.82722	*0.01495*	0.93941	*0.02264*	0.92896	*0.03366*	0.84641	*0.06309*
18	0.99999	*0.00002*	0.96153	*0.00927*	0.99556	*0.00189*	0.99732	*0.00237*	0.99129	*0.00787*
19	0.99980	*0.00037*	0.94415	*0.02423*	0.98951	*0.00751*	0.99250	*0.00377*	0.96266	*0.01540*
20	0.99974	*0.00021*	0.81916	*0.04269*	0.97201	*0.00722*	0.88583	*0.06785*	0.57634	*0.09331*
21	0.99998	*0.00003*	0.88211	*0.04543*	0.94600	*0.02151*	0.77774	*0.06497*	0.70564	*0.06599*
22	0.99993	*0.00020*	0.98022	*0.01468*	0.95142	*0.02009*	0.93907	*0.02283*	0.91678	*0.03475*
23	0.99276	*0.00988*	0.47456	*0.15479*	0.78982	*0.10308*	0.70455	*0.09639*	0.04658	*0.04628*
24	0.99914	*0.00056*	0.93914	*0.00503*	0.87133	*0.02365*	0.77777	*0.06601*	0.61510	*0.08938*
25	0.99994	*0.00016*	0.97982	*0.00694*	0.94575	*0.03538*	0.91083	*0.02635*	0.87081	*0.04414*
26	0.99999	*0.00002*	0.74721	*0.04365*	0.90270	*0.05176*	0.79533	*0.09722*	0.74444	*0.11662*
27	0.99878	*0.00110*	0.66247	*0.03088*	0.82152	*0.05608*	0.76959	*0.06133*	0.42854	*0.10954*
28	1.00000	*0.00000*	0.93818	*0.01763*	0.97119	*0.01173*	0.87477	*0.07797*	0.85489	*0.07725*
29	0.99938	*0.00114*	0.93885	*0.00683*	0.91097	*0.01803*	0.84428	*0.04768*	0.75272	*0.07571*
30	1.00000	*0.00000*	0.99271	*0.00685*	0.96829	*0.01641*	0.97840	*0.01441*	0.97375	*0.01624*
31	0.99998	*0.00002*	0.98971	*0.00343*	0.92966	*0.01958*	0.94785	*0.01180*	0.93060	*0.01979*
32	1.00000	*0.00000*	0.99072	*0.00683*	0.85427	*0.08429*	0.88938	*0.09384*	0.86970	*0.10391*
33	0.99989	*0.00016*	0.98763	*0.00619*	0.88593	*0.04072*	0.92315	*0.02445*	0.84647	*0.05924*
34	0.99998	*0.00005*	0.86372	*0.02969*	0.96480	*0.02465*	0.85327	*0.04237*	0.74138	*0.05798*
35	0.89678	*0.04526*	0.73640	*0.07238*	0.74252	*0.08171*	0.62091	*0.09328*	0.49261	*0.10951*
36	1.00000	*0.00000*	0.96630	*0.01483*	0.90741	*0.04668*	0.96701	*0.01171*	0.91246	*0.06232*

Table 8: Import penetration ratios

nace2	Description	mean	standard deviation	1996	2003
15	Manufacture of food products and beverages	0.21072	0.02208	0.26231	0.20867
17	Manufacture of textiles	0.30323	0.14595	0.15319	0.42259
18	Manufacture of wearing apparel; dressing and dyeing of fur	0.44077	0.22894	0.22886	0.69184
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.89717	0.18940	0.74593	1.03761
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and..	0.25011	0.03790	0.30941	0.24571
21	Manufacture of pulp, paper and paper products	0.30107	0.03713	0.35220	0.29016
22	Publishing, printing and reproduction of recorded media	0.05051	0.01512	0.07464	0.04900
24	Manufacture of chemicals and chemical products	0.92891	0.10171	0.91582	1.02942
25	Manufacture of rubber and plastic products	0.26906	0.07459	0.35094	0.27090
26	Manufacture of other non-metallic mineral products	0.13378	0.01059	0.14060	0.11507
27	Manufacture of basic metals	0.44606	0.06029	0.51042	0.39553
28	Manufacture of fabricated metal products, except machinery and equipment	0.15642	0.02810	0.21059	0.14311
29	Manufacture of machinery and equipment n.e.c.	0.42364	0.06984	0.52519	0.41584
30	Manufacture of office machinery and computers	1.06182	0.06773	1.21683	1.02502
31	Manufacture of electrical machinery and apparatus n.e.c.	0.35810	0.07404	0.45735	0.38642
32	Manufacture of radio, television and communication equipment and apparatus	0.77910	0.04084	0.76118	0.77389
33	Manufacture of medical, precision and optical instruments, watches and clocks	0.76831	0.03694	0.77798	0.71595
34	Manufacture of motor vehicles, trailers and semi-trailers	0.81593	0.24934	1.30709	0.77380
35	Manufacture of other transport equipment	0.54493	0.08704	0.55319	0.62923
36	Manufacture of furniture; manufacturing n.e.c.	0.25170	0.14391	0.56380	0.20893

Table 9: Vertical import penetration ratios

nace2	Description	mean	standard deviation	1996	2003
15	Manufacture of food products and beverages	0.10188	0.01115	0.10316	0.11449
17	Manufacture of textiles	0.17997	0.03037	0.16769	0.20976
18	Manufacture of wearing apparel; dressing and dyeing of fur	0.25825	0.08437	0.17988	0.33053
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.12439	0.01298	0.14101	0.13184
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and..	0.08870	0.01018	0.09892	0.09395
21	Manufacture of pulp, paper and paper products	0.21076	0.02351	0.22458	0.22781
22	Publishing, printing and reproduction of recorded media	0.26820	0.02743	0.29601	0.27489
24	Manufacture of chemicals and chemical products	0.09767	0.00873	0.11280	0.08973
25	Manufacture of rubber and plastic products	0.54098	0.05172	0.55677	0.57737
26	Manufacture of other non-metallic mineral products	0.21873	0.02085	0.24756	0.20672
27	Manufacture of basic metals	0.16248	0.01794	0.17786	0.17581
28	Manufacture of fabricated metal products, except machinery and equipment	0.29018	0.03173	0.33481	0.26494
29	Manufacture of machinery and equipment n.e.c.	0.23700	0.03322	0.29347	0.22450
30	Manufacture of office machinery and computers	0.58794	0.03829	0.59389	0.59440
31	Manufacture of electrical machinery and apparatus n.e.c.	0.29286	0.02707	0.33572	0.27868
32	Manufacture of radio, television and communication equipment and apparatus	0.24443	0.02160	0.28820	0.23334
33	Manufacture of medical, precision and optical instruments, watches and clocks	0.30140	0.02987	0.34542	0.30577
34	Manufacture of motor vehicles, trailers and semi-trailers	0.23606	0.03009	0.28587	0.21065
35	Manufacture of other transport equipment	0.26871	0.03608	0.33456	0.26523
36	Manufacture of furniture; manufacturing n.e.c.	0.28856	0.02829	0.34026	0.27956

Table 10: Average vertical and horizontal import penetration by partner

All sectors (average)	Horiz.	Vertical	Horiz.	Vertical	Horiz.	Vertical
	mean		1996		2004	2003
World	28.35%	24.46%	29.27%	25.96%	29.61%	26.97%
UE-15	20.81%	15.72%	22.54%	16.87%	20.98%	16.83%
USA	3.23%	1.57%	4.07%	1.72%	2.75%	1.55%
NMS	2.97%	4.49%	2.75%	4.32%	3.59%	4.92%
BRICs	3.96%	1.22%	3.32%	1.02%	4.82%	1.77%
China	3.03%	0.69%	2.80%	0.48%	4.66%	1.13%

Table 11: Estimated coefficients of productivity

NACE2	B_OLS_k	B_OP_k	B_LP_k	B_OLS_l	B_OP_l	B_LP_l
15	0.199286	0.1849	0.0908	0.807484	0.7669	0.7302
17	0.156383	0.2947	0.0911	0.767666	0.7646	0.6793
18	0.14598	0.1008	0.0817	0.785492	0.7606	0.6884
19	0.156995	0.2617	0.0607	0.772181	0.7706	0.6835
20	0.151688	0.2615	0.084	0.758334	0.7279	0.6773
21	0.163492	0.0124	0.059	0.829653	0.8149	0.7079
22	0.100989	-0.1478	0.0879	0.875345	0.8492	0.791
23	0.237177	-0.2347	0.1991	0.82989	0.6974	0.6793
24	0.125747	0.039	0.0475	0.880446	0.8631	0.7011
25	0.164333	0.1867	0.0977	0.807254	0.7641	0.7019
26	0.19005	0.2926	0.0837	0.795313	0.7589	0.7078
27	0.179544	0.2456	0.0982	0.809779	0.7515	0.7328
28	0.150927	0.1866	0.0687	0.805118	0.7702	0.7393
29	0.146798	0.1816	0.1125	0.82128	0.7957	0.7085
30	0.142311	0.1768	0.1554	0.806228	0.789	0.7742
31	0.146407	0.1709	0.0987	0.79652	0.7665	0.6984
32	0.129786	0.0636	0.0968	0.858254	0.8232	0.7427
33	0.131017	0.0884	0.0619	0.815538	0.7442	0.6917
34	0.126878	0.2201	0.0592	0.875367	0.8229	0.7351
35	0.17106	0.1074	0.0929	0.813883	0.816	0.7493
36	0.127275	0.1333	0.0693	0.806038	0.8168	0.6938

Table 12a: Import shares, intensive and extensive margins, trade orientation and productivity

Dep var: ln(TFP) OP	World	World	EU-15	USA	NMS	BRICs	China
Import shares	.0273***						
	(.0056)						
Lagged import shares		.0121*					
Lagged intensive_margin			-.0733***	-.0043*	.0207***	-.0171***	-.0094***
			(.0169)	(.0024)	(.0030)	(.0033)	(.0026)
Lagged extensive_margin			.0486	-.0299***	.0200**	.0119	-.0007
			(.0603)	(.0084)	(.0089)	(.007)	(.0062)
Constant	9.19***	9.20***	9.22***	9.25***	9.18***	9.22***	9.22***
	(.007)	(.006)	(.061)	(.010)	(.009)	(.008)	(.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

Table 12b: Import penetration, trade orientation and productivity

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

Table 13: Import penetration, firm characteristics and productivity

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

***,**,* Statistically significant at 1%, 5%, 10% respectively
FE (within) estimator.

Table 14: Alternative productivity estimates – World Import Penetration

Dep var:	ln(TFP) OLS	ln(lab_prod)	Δln(TFP) OP	Δln(TFP) OLS	Δln(lab_prod)
Horizontal_imp_pen	.008*** (.002)	.005*** (.003)			
Vertical_imp_pen	.122*** (.011)	.121*** (.011)			
Δ Horizontal_imp_pen			.003 (.002)	.004* (.002)	.004 (.003)
Δ Vertical_imp_pen			.093*** (.013)	.095*** (.013)	.114*** (.014)
Constant	9.52*** (.018)	10.58*** (.012)	.031*** (.003)	.030*** (.004)	.032*** (.004)
Firm fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Observations	158,983	161,343	114,231	114,231	114,231

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

Table 15: Robustness and sensitivity analysis – World Import Penetration

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

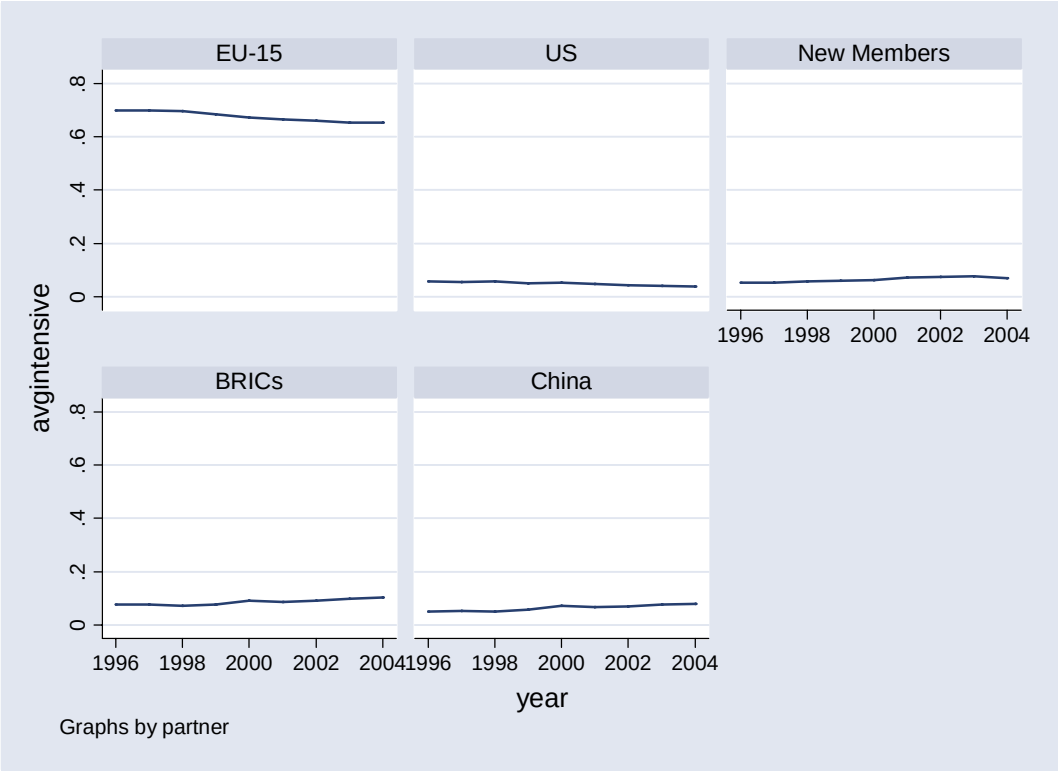
***,**,* Statistically significant at 1%, 5%, 10% respectively
FE (within) estimator. Standard errors clustered at firm level

Table 16: Robustness and sensitivity analysis - Technology gap, trade orientation and productivity

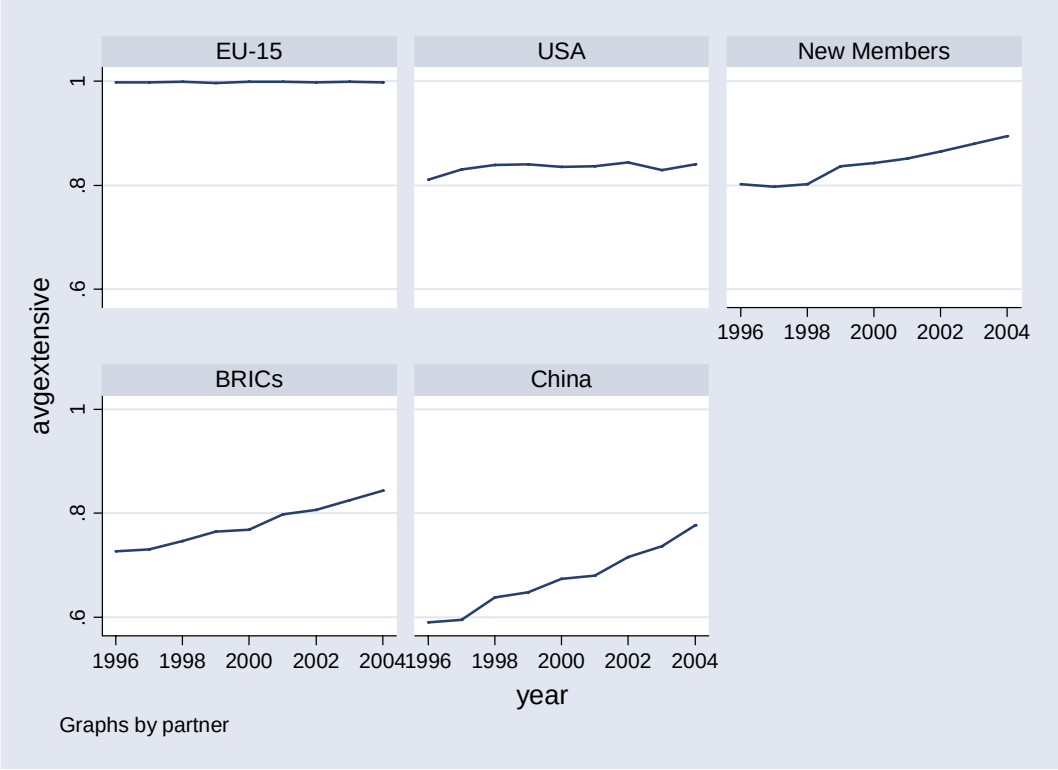
Dep var: ln(TFP) OP	EU-15	NMS	BRICs	China
GERD_hor_import_pen	.0019**	.0002	.0017**	.0027**
	(.0005)	(.0001)	(.0008)	(.0009)
GERD_vert_import_pen	.0841***	.0593**	.0703***	.0290***
	(.060)	(.0063)	(.0069)	(.007)
Constant	9.07***	9.12***	9.12***	9.16***
	(.011)	(.007)	(.005)	(.003)
Firm fixed effects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

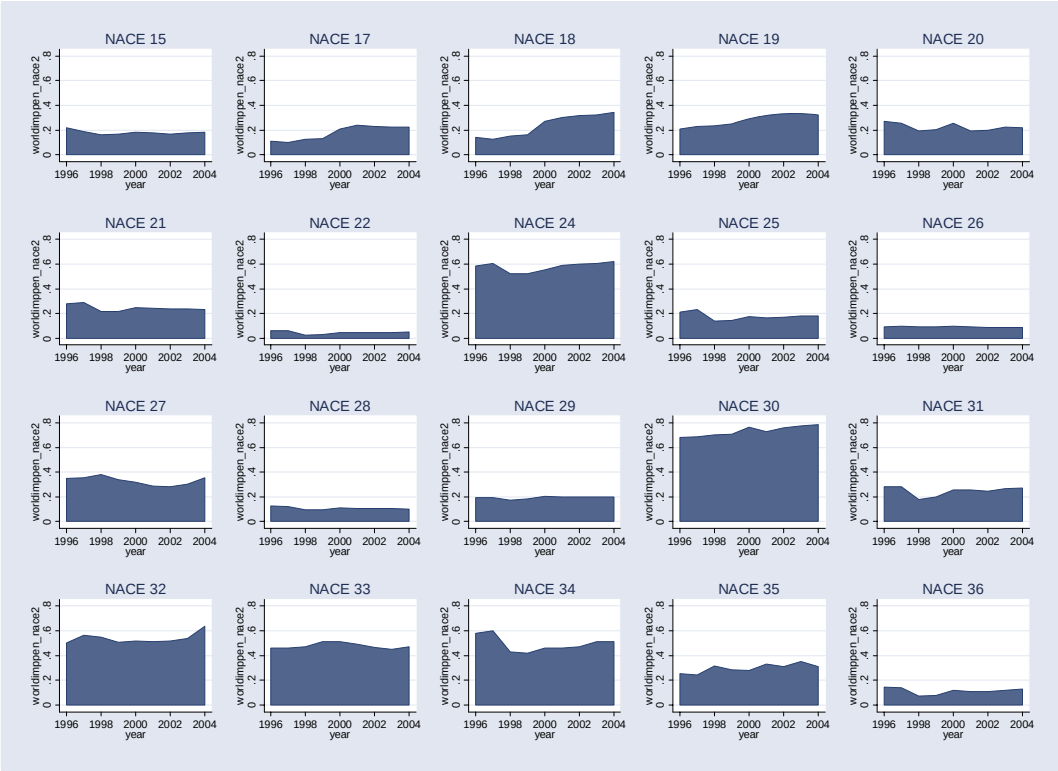
Graph 2: Average intensive margins by partner



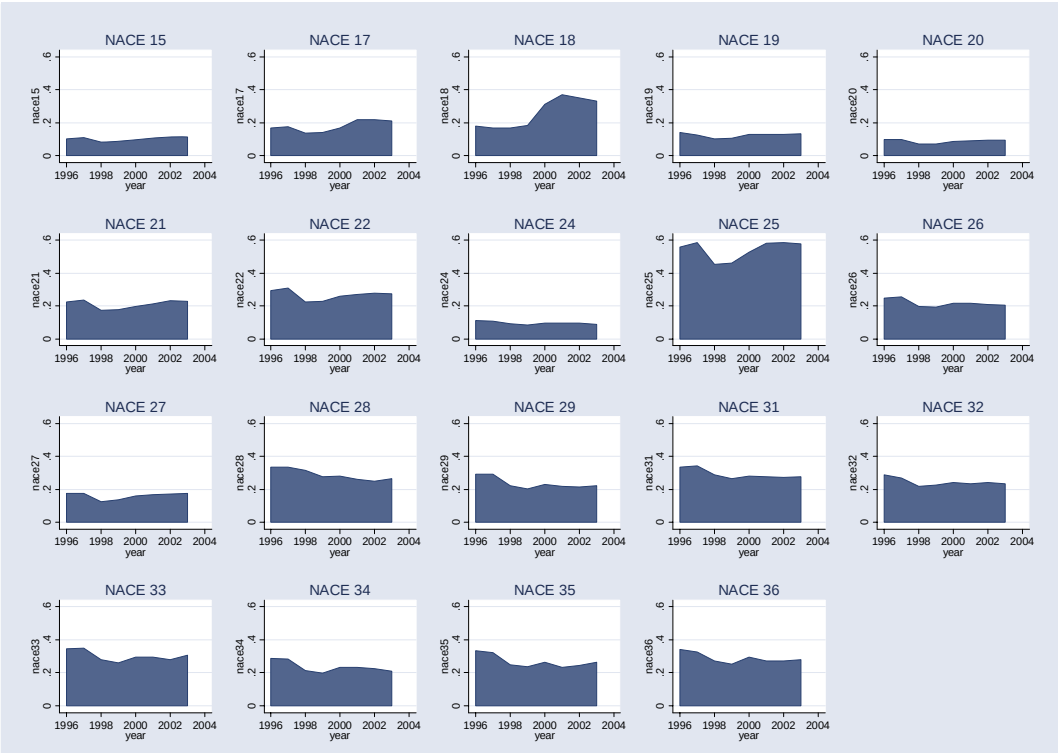
Graph 3: Average extensive margins by partner



Graph 4: Average import penetration ratios

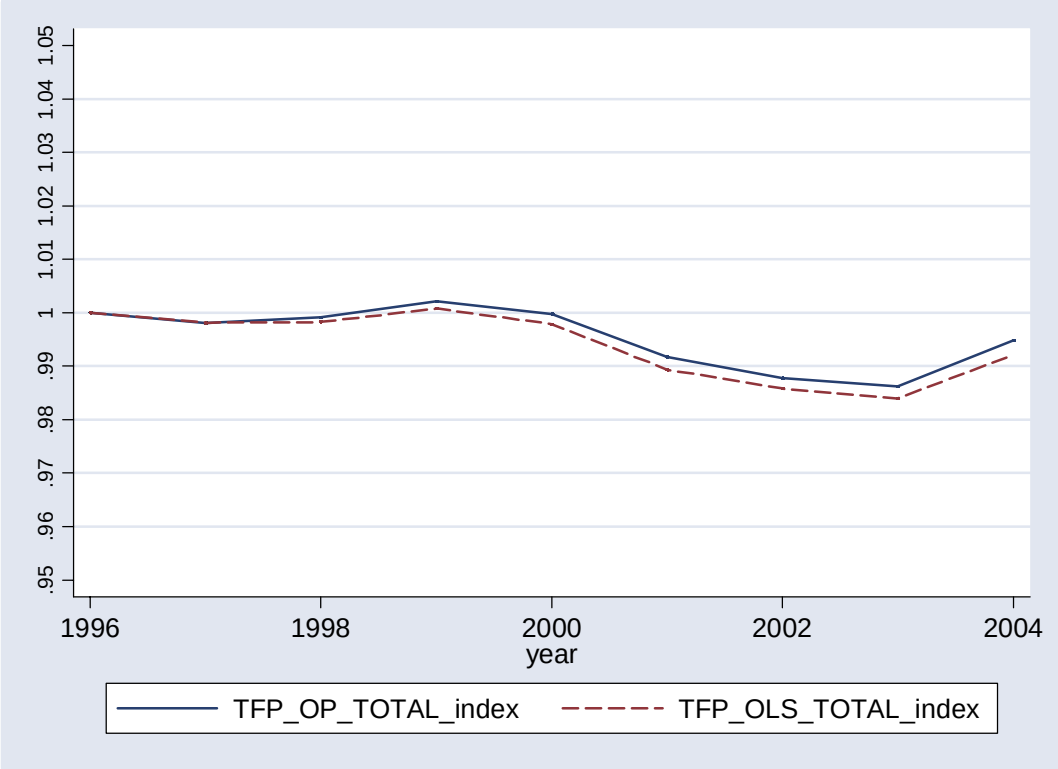


Graph 5: Vertical import penetration ratios

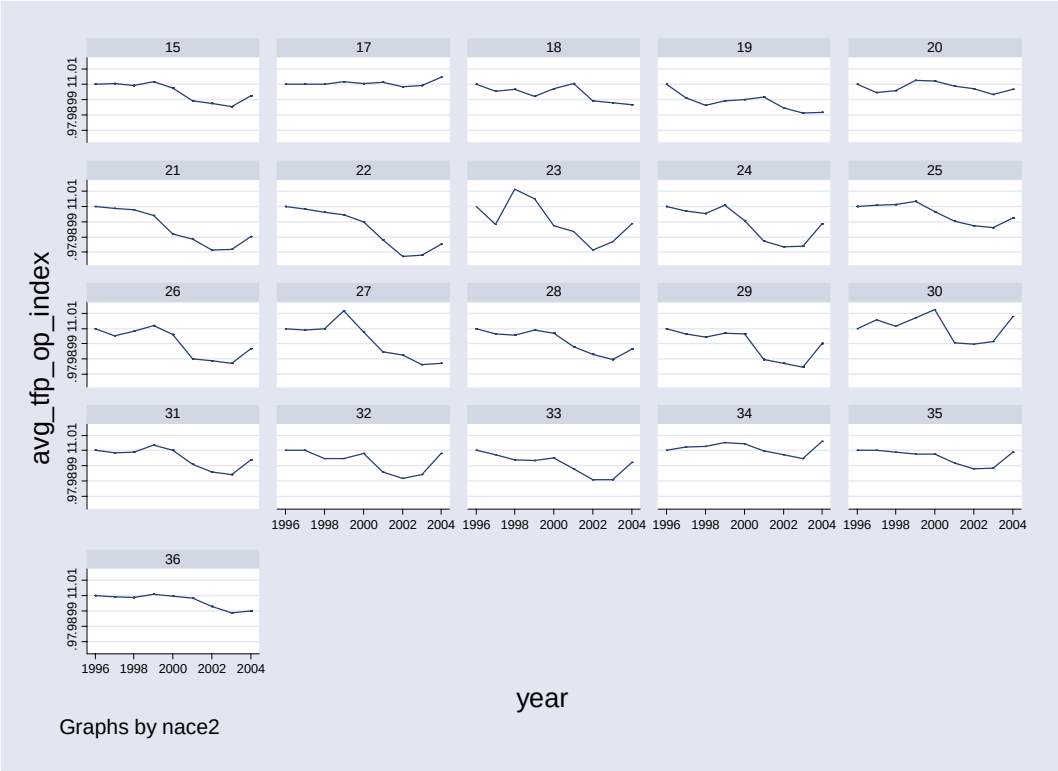


Graph 6: Average vertical import penetration by partner

Graph 7: Average TFP



Graph 8: Average TFP by industry



Graph 9: Average TFP by region