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Sarah BEN YAHMED
Sciences Po
Univ. Aix-Marseille

Sean DOUGHERTY
Paris School of Economics
OECD Economics Dept.

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Import Competition, Domestic Regulation and Firm-Level Productivity Growth in the OECD

Sarra BEN YAHMED* Sean DOUGHERTY†

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Abstract

This paper examines how import penetration affects firms' productivity growth taking into account the heterogeneity in firms' distance to the efficiency frontier and country differences in product market regulation. Using firm-level data for a substantial number of OECD countries from the late 1990s to late 2000s, the analysis reveals non-linear effects of both sectoral import penetration and *de jure* product market regulation measures depending on firms' positions along the global distribution of productivity levels. A magnifying effect is found between import penetration and domestic barriers to entry, conditional on a firm's distance to the technological frontier. The heterogeneous effects of international competition and domestic product market regulation on firm-level productivity growth are consistent with a neo-Schumpeterian view of trade and regulation. Close to the technology frontier, import competition has a strongly positive effect on firm-level productivity growth, with stringent domestic regulation reducing this effect substantially. However, far from the frontier, neither import competition nor its interaction with domestic regulation has a statistically significant effect on firm-level productivity growth. The results also suggest that insufficient attention has been made in the trade literature to within-firm productivity growth.

Keywords: Firm productivity growth, behind-the-border regulatory barriers, product market regulation, import competition, international trade.

JEL Classification Numbers: F1, K2, L2, L5, O1

*Sciences Po and GREQAM, Université Aix-Marseille, e-mail:*sarra.ben-yahmed@univ-amu.fr*

†OECD Economics Department and the Paris School of Economics (Centre d'Economie de la Sorbonne–Paris 1), e-mail: *sean.dougherty@oecd.org*

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1 Introduction

Globalization has dramatically reduced "explicit" barriers to international trade in OECD as well as non-OECD countries over recent decades. These tariff-type barriers have fallen far enough in manufacturing that they likely no longer represent a major obstacle to goods exporting and importing (Bouët *et al.*, 2008). Institutional limits on protection that prevent countries from raising tariffs even in times of economic crisis have so far proven effective in preventing a bout of defensive, or retaliatory, anti-trade measures, even in the context of the panic-inducing Great Recession that we have just experienced. Nevertheless, behind-the-border regulation still remains quite stringent in many economies (OECD, 2011), representing an important opportunity for further trade liberalization.

Stringent regulation of domestic product markets obstructs firm entry, operation and exit, thereby limiting competition, which can reduce firms' ability and incentives to improve their productivity. However, the mechanisms that cause weak competition to hamper productivity are not fully understood. In their recent review of endogenous growth theory, Aghion and Howitt (2009) argue that there is a U-shaped relationship between the degree of competition and productivity, where firms closer to the global technological frontier face stronger incentives to innovate in order to overcome the potential threat of new entrants. Near the frontier, stringent regulation reduces neck-to-neck competition and innovation, harming firm productivity. In contrast, farther from the frontier, Schumpeter (Mark II)-type effects dominate and firms face discouragement, making innovation and productivity growth less likely, regardless of regulation.

While new trade theory also considers heterogeneity in firm technological efficiency, it takes a different perspective, with most theoretical papers viewing firms' productivity levels as given and then investigating how productivity changes in the aftermath of trade liberalization. Various models featuring heterogeneous firms, notably Melitz's (2003), posit that trade liberalization yields entry and exit dynamics that reallocate market shares from low-productivity firms to higher productivity firms that compete in international markets. Bernard *et al.* (2007) show how this process can help strengthen comparative advantage through creative destruction, though in neither case do the dynamics come about through *intra*-firm productivity dynamics. Melitz and Ottaviano (2008) highlight the pro-competitive effect of trade taking into account market size. They show that sectoral productivity can be enhanced through increasing toughness of import competition, implying the potential for dynamic gains from policy reform.

This paper builds on the intuition of new trade models on the pro-competitive effect of trade along with the prediction of endogenous growth models where the effect of competition and regulation on firm productivity depends on firms' efficiency levels. It takes a difference-in-differences approach that uses the insights from the new trade literature to identify the empirical effects of import competition and anti-competitive domestic regulation on productivity at the firm level, also incorporating distance-to-technological frontier effects. In so doing, it develops new evidence in support of both sets of theories, suggesting that (i) trade models could be enriched by incorporating a distance-to-frontier and intra-firm productivity dimension, and (ii) distance-to-frontier ideas could be further enriched by examining their interactions with trade, helping to better explain the underlying mechanisms.

Beyond these general insights, several important findings stand out:

- Stronger competition, in the form of higher import penetration, is associated with higher firm-level productivity growth close to the technological (measured in terms of productivity levels) frontier, an effect that remains robust even when estimated in lags, though it varies when the smallest firms are over-sampled in the dataset. The main result is consistent with the predictions of the Aghion endogenous growth model as well as the Melitz and Ottaviano framework, though the latter would not have predicted a differential firm-level effect vis-à-vis the technology frontier.

- Close to the technology frontier, anti-competitive product market regulation substantially reduces the scope for TFP improvements spurred by import competition; far from the frontier, the interaction between regulation and foreign competition is not statistically significant. The effect of product market regulation depends on the sectoral trade orientation; more precisely, stringent product market regulation is found to damage the scope for productivity growth at least in part by reducing the competition-enhancing effect of import competition on top firms.

- The productivity-enhancing effect of import competition and the mitigating effect of product market regulation are robust to the inclusion of a Herfindahl index that captures the market shares concentration across firms, controls for the stringency of upstream regulation, as well as country-time fixed effects and industry fixed effects that capture respectively country specific policies or macroeconomic shocks and time-invariant industry-specific characteristics such as the intensity of ICT use.

In order to examine these questions, a large-scale firm database (Amadeus) is examined that covers close to half of the OECD member countries, which is then re-weighted to be representative of the actual size distribution of firms in the whole population, and matched with regulation and trade datasets. This firm data is sufficient to allow for the measurement of robust productivity measures that take account of potential simultaneity biases. Unique OECD indexes of product market regulation are used to measure *de jure* regulatory settings, at the country level and across time. International trade data are matched with production data, to generate measures of import penetration at the detailed industry level.

While there is previous evidence on the effect of domestic regulation on productivity, these studies have in general not examined their interaction with trade. A number of empirical studies, particularly those of the OECD (2003, 2006, 2011), have found distortionary effects of indicators of product and labor market regulation on overall productivity outcomes. For instance, Arnold *et al.* (2010) look at the effect of product market regulation on firm-level productivity – through the ICT channel – and find supportive evidence of distance-to-frontier effects. At the industry level, Bourlès *et al.* look at the effect of upstream product market regulation on sector-level productivity, and they also find distance-to-frontier effects. Conway *et al.* found similar sectoral effects for broader market regulation, while Nicoletti and Scarpetta (2003) found related, yet inverted, effects with respect to the distance-to-frontier.

More aggregate empirical work has used less detailed indicators of institutional and policy settings to examine the role of institutions in mediating the role of trade in affecting overall growth and productivity outcomes. Cross-country studies include Dollar and Kraay (2003), Rodrick *et al.* (2004), Alcalá and Ciccone (2004), and Freund and Bolaky (2008), who have tried to disentangle the respective roles of institutions and trade for growth at the country level. On balance, the evidence appears to suggest that institutions have a more fundamental role, as they complement trade liberalization, and strengthen the long-term effects of trade on growth, by enhancing the role of comparative advantage. However, the types of policies and reforms that may drive productivity in this context are still not clear from this literature.[1]

Research at the level of the firm seems more promising to reveal the underlying mechanics of how policies may work through trade to affect productivity and growth outcomes. Firm-level analysis has revealed a substantial role for product market regulation in affecting the margins of firm exit and entry as well as reallocation of productivity across firms (e.g., Bartelsman *et al.* (2009)). However, this work does not explicitly consider how international trade may drive and/or reinforce these margins.

There have been a series of country-specific firm-level studies that have identified substantial roles for international trade (not behind-the-border) regulation specifically in affecting firm entry/exit and reallocative margins, for Chile (Pavcnik, 2002; Bas and Ledezma, 2010), Columbia (Fernandez, 2007), France (Bas and Strauss-Kahn, 2011), India (Topalova, 2004; Goldberg *et al.*, 2010), Indonesia (Amiti and Konings, 2007) and the UK (Aghion *et al.*, 2009). Several of these studies show that reductions in import barriers can help to boost within-firm productivity (Amiti and Konings, 2007; Bas and Ledezma, 2010; Goldberg *et al.*, 2010).

However, these single-country studies do not address behind-the-border regulation, which varies principally *across* countries.[2] We thus contribute to the literature – addressing the questions raised above – by estimating productivity growth equations, at the firm level, where exposure to international markets and to domestic regulation both interact. The paper finds that their effect can be non-linear and depends on the characteristics of heterogeneous firms – especially their distance to the global technological frontier. Moreover, the scope for this type of behind-the-border reform appears to be vast.

The paper proceeds as follows. The second section describes the data and sampling frame, the construction of productivity, import penetration and domestic regulation measures. The third section motivates the empirical approach, and examines the effects of import penetration and domestic regulation on firm-level productivity growth. The fourth section concludes.

[1] One promising approach from a related literature uses incomplete contract theory to examine the effect of overall institutional quality on the organization of trade. Studies following this approach include Acemoglu *et al.* (2007), who find an important role of contracting institutions leading to strengthened comparative advantage.

[2] Although not focused on productivity, Crozet *et al.* (2012) take an innovative approach to addressing the effect of different countries' domestic regulations on services trade, using bilateral export data from French firms. The study finds strong detrimental effects of purely domestic regulations on both the extensive and intensive export margins of the firms – with domestic regulations being even more damaging for trade than explicit international trade barriers.

2 Data and measurement

In order to investigate the questions raised above, firm-level data are used to compute productivity measures, sectoral trade data are used to measure foreign competition, and restrictive regulation is measured using the OECD's economy-wide indexes of product market regulation.

2.1 Firm-level data: Amadeus

Firm level data are used based on company reports included in the Amadeus database compiled by the Bureau van Dijk. This database covers European OECD countries over the time period 1995–2005. The countries with sufficient numbers of firms for our use are Belgium, the Czech Republic, Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Poland, Portugal, Spain, Sweden and the United Kingdom. The data for Greece are not used since they lack wage and materials data. While all the countries included are OECD members, the former transition economies of Central and Eastern Europe are likely to have a wider dispersion of productivity across firms than the other countries as a result of their one-time structural transitions.

Data are cleaned for potential outliers that we identify by several criteria. First, firms with negative values for any variable entering the production function – operating revenue or value added, wages, capital stock, material inputs – or with depreciation higher than net capital stock are eliminated from the sample. Firms that report extreme year-to-year variation in ratios between production function variables and extreme reversals in one of these variables are not retained, either. Finally, outliers have been removed by eliminating the top and bottom one percent of the productivity distribution and subsequently re-estimating productivity without these extreme observations. The productivity estimation is described in more detail below.

Sectoral coverage includes all tradable goods and services, including mining, all of manufacturing (ISIC 15 to 37), electricity, utilities (ISIC 40, 51, 52), transport and communications (ISIC 60 to 64), business activities as R&D, advertising (ISIC 71 to 74) and recreational and cultural activities (ISIC 92). Consolidated accounts in the Amadeus dataset are dropped, which avoids problems of double-counting.

2.2 Sampling frame

The Amadeus data are broadly representative of the business sectors of OECD countries, since they include virtually all public companies, and as such are a fair representation of larger companies. However, smaller firms are underrepresented, since they typically do not report balance sheet information publicly. In addition, not all firms in the Amadeus data report information on all production function variables. The remaining sample used in this study includes only firms for which TFP estimates could be obtained.

In order to ensure that the sample of firms is as representative as possible of the population distribution of firms across size classes, sectors and countries, a re-sampling procedure was applied (see Schwellnus and Arnold, 2008). First, population weights for every size-sector-country strata were calculated from the OECD Structural Demographic Business Statistics (SDBS) database for the year 2000. Second, random draws with replacement from each size-sector-country strata in the TFP sample were taken until the weight of each strata corresponds to its population weight.[3]

This method resulted in a sample that is representative of the population distribution along the dimensions of employment size, sector and country. The sample size is then set to 139,065 firms (drawn from a set of 79,513 real firms) which results in 831,187 firm-year observations. While this method yields a more representative sample in the year 2000, it may also increase measurement error since 'successful' smaller firms are over-sampled. As a result, the resampled dataset may be less representative as the time period shifts away from the year 2000 since normally such firms have high rates of entry and exit. Thus, both the non-resampled and the resampled data are considered in the basic specifications in order to ensure robustness.

2.3 Estimation of Total Factor Productivity

Our productivity variable, total factor productivity (TFP), measures the firm-level efficiency in the use of all inputs. We calculate TFP as the residual from the estimation of a logarithmic

[3] The re-sampling procedure is restricted to firms with at least 20 employees since the coverage below this threshold is unsatisfactory. The firm size classes used for resampling (from SDBS) are: 20-49; 50-99; 100-499; 500 or more employees.

Cobb-Douglas production function of the form:

$$\ln y_{isct} = \alpha_{sc} \ln l_{isct} + \beta_{sc} \ln k_{isct} + \epsilon_{isct} \tag{1}$$

where the subscripts stand for the firm i from country c operating in sector s at time t. The dependent variable of the production function is the firm's value-added (y). The production factors are labor (l) and capital (k). When value-added was not available, it was imputed as the residual between operating revenue and material inputs. Labor inputs are measured using the total wage bill, while net capital stocks were used to measure capital input. Nominal values are deflated using sector-specific price indexes, with the exception of capital stocks that have been deflated using deflators for gross fixed capital formation. The production function is estimated at the sector-country level sc, in order to avoid strong assumptions on the homogeneity of production technologies across sectors and OECD countries. The residuals ϵ_{isct} represent plant-specific efficiency in the year t.

The ideal measure of TFP would be in volume terms, "physical TFP". However, given the available data, we use a "revenue-based TFP". The pluses and minuses of using various measures are discussed in Foster *et al.* (2008). In most business micro data sets like Amadeus, establishment-level prices are unobserved. Thus, establishment output is measured as revenue divided by a common industry-level deflator. This method embodies within-industry price differences in output and productivity measures. Difficulties arise when prices reflect idiosyncratic demand shifts, demographic characteristics or market power variation rather than differences in quality or production efficiency.[4] For instance, a firm sheltered from competition because of some regulatory barriers may set high prices and according to a "revenue-based TFP" it may look more efficient than a firm in a more deregulated environment even if their efficiency levels are similar. Since we cannot implement the Foster *et al.* treatment, firm fixed effects are considered as controls for time-invariant characteristics that may determine firm-level prices.[5]

[4]Note that an important advantage of using a revenue-based TFP measures is that if we observe positive effects of competition-related measures on TFP growth, the result is not subject to concerns about markups being conflated, since markups would reduce TFP growth, thus implicitly the efficiency effects must be dominating.

[5]Estimates of the main analytical results using firm-level fixed effects are shown in the Annex, Table A.1. These estimates use the balanced panel dataset, where there are sufficient repeated observations to carry them out, and show that the baseline results are robust to firm fixed effects. This estimate also addresses concerns about the use of a Cobb-Douglas production function, if the underlying production function departs from constant returns to scale. In addition, (insignificant) firm size dummies were used in alternative specifications, and these did not affect the results.

We now turn to the endogeneity issue. Estimation of Equation (1) by OLS can lead to biased estimates as inputs in the production function are likely to be related to the residuals. Let us decompose the residuals as follows:

$$\epsilon_{isct} = \omega_{isct} + u_{isct} \tag{2}$$

Equation (2) decomposes firm efficiency into a part that is predictable by the firm ω_{isct}, though not observable in the data, and a part due to a productivity shock that can be forecast neither by the firm nor by the econometrician.

Firms choose their input on the basis of their knowledge of their environment and own efficiency ω_{isct}. Hence, if firms that anticipate high efficiency level hire more workers and invest more, OLS estimates will be biased upward. The endogeneity of input choices is well known in the literature. Consistent productivity estimates are obtained using the semi-parametric estimation techniques of Olley and Pakes (1996) or Levinsohn and Petrin (2003). These methods correct for simultaneity biases. To carry out such estimations, we need data on investment for the former and intermediate inputs for the latter in order to proxy firm's private knowledge of its efficiency.

Our preferred TFP estimates are those from the Levinsohn and Petrin (LP) method, which uses information on materials to correct for simultaneity biases. We do not use the Olley and Pakes technique, as their method requires primary information on investment to proxy for unobserved productivity shocks, while prior information on investment is not provided in Amadeus. Although we could create an investment measure using the perpetual inventory equation, we do not follow this path because of a high probability of measurement errors in capital depreciation.

Hence, we compute firm-level TFP by using intermediate inputs m to capture variation in firms' prediction of their efficiency ω:

$$\omega_{isct} = f(m_{isct}, k_{isct})$$

Introducing this function into Equation equation:prodfn, we now have:

$$\ln Y_{isct} = \alpha_{sc} \ln l_{isct} + \beta_{sc} \ln k_{isct} + f(m_{isct}, k_{isct}) + u_{isct} \tag{3}$$

The variation in inputs is now not related with the error term u_{isct} so that we have consistent estimates of the parameters. We compute each firm's TFP as the residual from an estimate of

Equation (3). At this stage, firms' TFP values are not yet comparable across sectors and countries.

Following Pavcnik (2002) and Fernandez (2007), we construct a TFP index to deal with the comparability issue. The TFP index is based on the LP estimates and is constructed in two steps. First, for each 4-digit sector s and country c, we construct a reference hypothetical plant that has mean output and input levels calculated over the whole period. We compute the TFP of this reference plant as:

$$\widehat{A}_{sc}^{ref} = \overline{Y}_{sc} - \widehat{\alpha}_{sc}\overline{L}_{sc} - \widehat{\beta}_{sc}\overline{K}_{sc} \tag{4}$$

where $\widehat{\alpha}_{sc}$ and $\widehat{\beta}_{sc}$ are the estimates obtained from the regression estimate of Equation (3).

Second, we obtain plant i's *productivity index* at time t by subtracting the reference plant productivity A^{ref} from plant i's productivity as estimated in Equation (4):

$$A_{isct} = Y_{isct} - \widehat{\alpha}_{sc}L_{isct} - \widehat{\beta}_{sc}K_{isct} - \widehat{A}_{sc}^{ref} \tag{5}$$

This index number methodology follows Aw *et al.* (2001) and Caves and Tretheway (1980). The relative TFP measure obtained ensures comparability across industries and countries.

Table 1: Summary statistics – Firm TFP growth

Country	Standard deviation	10th percentile	mean	median	90th percentile
All	2.87	-1.24	-.01	.01	1.28
BEL	4.09	-1.76	0	0	1.79
CZE	1.78	-.84	.09	.01	1.03
DEU	10.83	-1.7	.41	0	2.5
DNK	6.72	-.72	.14	.01	1.17
ESP	2.01	-1.01	.01	0	1.04
FIN	2.1	-1.3	.04	.01	1.46
FRA	1.2	-.63	.06	.03	.76
GBR	4.17	-1.64	-.05	-.02	1.53
ITA	2.3	-1.55	.01	.01	1.56
NLD	3.51	-1.83	.14	0	2.54
NOR	2.01	-1.12	.06	.04	1.35
POL	4.32	-1.75	.47	.05	3.13
PRT	2.15	-1.02	.07	.01	1.36
SWE	6.43	-4.16	-.45	-.03	3.4

Source: Authors' calculations based on Amadeus database. Not resampled dataset.

We then compute firms' TFP growth rates as the log difference: $\Delta A_{isct} = lnA_{isct} - lnA_{isct-1}$. Summary statistics for firm's TFP growth are shown in Table 1. It displays the standard variation, the mean, median, the 10th and 90th percentiles of firm's TFP growth for each country. It shows that there is a wide variation in ΔA_{isct} both within and across countries.

2.4 Trade openness

To capture the pro-competitive impact of trade we construct a proxy for foreign competition which is import penetration. Trade data come from the Comtrade database. By combining it with detailed production data from OECD Structural Demographic Business Statistics (SDBS) database, we compute different openness measures at the 4-digit sectoral level. Import penetration is constructed in the following way for each sector, country and year:

$$IP_{sct} = \frac{M_{sct}}{Q_{sct} + M_{sct} - X_{sct}}$$

where M_{sct} is total imports of good s to country c in year t. Q_{sct} is the production of good s while X_{sct} is the exports of good s from country c to its trade partners in year t.

Summary statistics for the import penetration measure across countries are shown in Table 2. This table displays the median, the 25th and 75th percentiles of import penetration. There is considerable variation in import penetration across country and time, and these differences persist even within narrowly defined sectors.

Table 2: Summary statistics – Import penetration

	1996			2005		
Country	25th percentile	median	75th percentile	25th percentile	median	75th percentile
All	.17	.43	.75	.23	.55	.87
BEL	.36	.7	1.26	.42	.88	1.57
CZE	.05	.35	.61	.25	.61	1.02
DEU	.02	.2	.64	.2	.41	.87
DNK	.32	.59	.86	.4	.76	1.22
ESP	.13	.29	.55	.17	.46	.68
FIN	.16	.47	.67	.18	.49	.82
FRA	.17	.37	.54	.23	.48	.7
GBR	.17	.4	.61	.24	.54	.78
GRC	.06	.26	.63	.3	.58	.82
ITA	.12	.22	.37	.14	.31	.5
NLD	.42	.96	1.41	.4	.84	1.73
NOR	.36	.62	.82	.3	.62	.91
POL	.02	.25	.44	.16	.55	.75
PRT	.15	.41	.72	.23	.49	.76
SWE	.21	.51	.84	.27	.55	.93

Source: Authors' calculations based on Comtrade and OECD SDBS databases.

2.5 Regulation and market structure measures

The primary measure of regulation is the OECD product market regulation indicators of *de jure* anti-competitive regulations, focusing on the vintages which coincide with the coverage of the Amadeus data. These include the 1998 and 2003 data updates, the settings for which are assumed to be unchanged for the immediately following years, preceeding the most recent 2008 data update. These indicators include both domestic as well as international barriers; only the domestic barriers are used here, specifically the grouping 'barriers to entrepreneurship', which covers sub-indicators for administrative burdens on startups, regulatory and administrative opacity and sectoral barriers to competition. Each of the low-level indicators are based on a scoring of regulatory data on a 0 to 6 scale reflecting the extent to which the regulations inhibit competition (see Wölfl *et al.*, 2009).

A Herfindahl index of firm concentration at the four-digit level using the Amadeus firm database is used to control for the extent of *de facto* competition from domestic firms. It is calculated in the standard way, based on the sum of the square revenue market shares of each firm in an industry, so that it ranges between $1/n$ and 1 where n is the number of firms. The OECD 'Regimpact' measure, which assesses the industry-specific knock-on effects of anti-competitive regulation in seven network sectors is also used in robustness checks to control for the extent of upstream regulation.[6]

Table 3 displays some summary statistics for the main measures of domestic competition. Though there has been convergence in these measures over time, a wide variation is still observed across countries.

3 Empirical analysis of firm-level productivity

3.1 The effect of competition

Competition may stem from both foreign as well as domestic sources, which we take into account by differentiating the two. Our methodology assumes that increased import shares are equivalent to an increase in competition within a narrowly defined industry and that this increase is exogenous to the productivity growth of an individual firm. Several studies document that increased imports amount to tougher competition: for instance, Katics and Petersen (1994) find that it is associated

[6] These indicators are calculated using a bottom-up approach in which regulatory data are quantified and aggregated to into summary indicators by sector using weights from I/O tables.

Table 3: Summary statistics – Market structure and domestic regulation

		‘Barriers to entrepreneurship’ Index			
Country	Standard deviation	10th percentile	mean	median	90th percentile
All	.6	1.45	2.23	2.39	3.05
BEL	.22	1.88	2.16	2.33	2.33
CZE	.08	2.09	2.13	2.09	2.27
DEU	.24	1.83	2.05	1.83	2.31
DNK	.17	1.42	1.52	1.42	1.82
ESP	.35	1.63	2.17	2.39	2.39
FIN	.49	1.42	2.01	2.41	2.41
FRA	.62	1.79	2.55	3.05	3.05
GBR	.23	.95	1.29	1.45	1.45
ITA	.54	1.58	2.38	2.74	2.74
NLD	.13	1.78	1.93	2.05	2.05
NOR	.21	1.33	1.45	1.33	1.83
POL	.28	3.15	3.42	3.15	3.72
PRT	.25	1.57	2.02	2.16	2.16
SWE	.48	1.15	1.69	2.11	2.11
		Herfindahl Index			
Country	Standard deviation	10th percentile	mean	median	90th percentile
All	.08	0	.05	.02	.12
BEL	.12	.01	.09	.04	.23
CZE	.11	.01	.09	.06	.22
DEU	.2	.04	.22	.16	.45
DNK	.11	.02	.11	.08	.21
ESP	.07	0	.03	.01	.07
FIN	.13	.02	.11	.06	.25
FRA	.07	0	.04	.02	.1
GBR	.09	.01	.08	.04	.18
ITA	.06	0	.03	.01	.08
NLD	.21	.05	.23	.15	.53
NOR	.09	0	.05	.03	.09
POL	.13	.02	.1	.05	.25
PRT	.21	.06	.22	.15	.51
SWE	.09	.01	.07	.03	.17

Source: ‘Barriers to entrepreneurship’ is sourced from the OECD Regulatory database. The Herfindahl Index is based on author’s calculations using the Amadeus database.

with reduced price-cost margins using industry-level data for the United States. Recent empirical studies, including Aghion *et al.* (2009), Bas and Strauss-Kahn (2011), Fernandez (2007) and Pavcnik (2002), use import shares as measures of competition from trade, while Kletzer (2002) discusses assumptions necessary for this approach to be valid. Using a more structural approach, Chen *et al.* (2009) find that import penetration has a boosting effect on industry average productivity, supporting the pro-competitive effect of trade predicted by the theoretical model of Melitz and Ottaviano (2008).

To capture domestic competition, different measures have been proposed in the literature, such as price-cost margins and concentration indexes. Both measures have substantial flaws. First, they do not allow the effect of foreign competition to be distinguished from the effect of domestic competition. Secondly, while both sources of competition are supposed to put a downward pressure on price-cost margins, it is not clear that higher concentration indexes indicate lower competitive forces. Indeed, pressures from abroad may lead to exit of domestic firms, resulting in a small number of national firms operating, and a more concentrated domestic sector. While we control for concentration, we believe that the two sub-indexes of product market regulation that we use, namely barriers to entrepreneurship and burdens on startups, capture more accurately domestic competitive pressures, as they are direct measures of barriers to market entry.

Aghion *et al.* (2009) exploit several policy reforms that influenced the competitive environment in Europe, namely the European Single Market Program and industry specific reforms imposed by the Monopolies and Mergers Commission. They claim that those experiments enable them to identify the causal impact of competition on innovation. The perspective of this paper is similar; it makes the most of a country-specific product market regulation (PMR) index that captures various product market reforms that took place in OECD countries between 1998 and 2008. The product market regulation index captures various policies with different treatment intensity across countries and time.

Our empirical analysis highlights that the effect of foreign competition varies with the local stringency of product market regulation. Theoretical predictions on the interaction between trade and product market regulation are ambiguous though. On one hand, PMR and openness can go in the same direction and have a positive additive effect by demanding further productivity improvements. While foreign exposure reduces rents and demand stronger competitiveness to survive, this pro-competitive effect can be higher in countries with stringent regulation protecting incumbents as it creates new incentives to upgrade the production technology. On the other hand, rigidities can impede reallocation, innovation and firm adjustments, reducing the ability to react quickly to new competitive pressures.

3.2 Empirical specification: difference-in-differences

We relate firm-level TFP growth to domestic and foreign competition as well as domestic regulation in the following way:

$$\Delta A_{isct} = \beta_0 + \beta_1 IP_{sct} + \beta_2 IP_{sct} \times PMR_{ct} + \beta_3 X_{isct} + \gamma_s + D_{ct} + \epsilon_{isct} \qquad (6)$$

where ΔA_{isct} is the productivity growth of firm i that belongs to sector s and country c, IP_{sct} is the level of import penetration in sector s for country c in year t, PMR_{ct} is the level of product market regulation in country c and year t. One issue is that productivity growth can vary across firms because of sectoral features that have nothing to do with competitive pressures. To avoid any spurious correlation due to industry characteristics, sector fixed effects γ_s are included. They capture time-invariant characteristics that, for example, shape the potential for technological upgrading. It is also very likely that TFP growth is influenced by other institutional determinants or policies that do not affect competition. Country-time fixed effects D_{ct} are added to deal with this type of correlation. The country-time fixed effects also address country macroeconomic shock common to all sectors. X_{isct} is a set of control variables that vary across firms and time such as the size of the firm or across sectors s, country c and time t such as the level of concentration or the impact of regulation in services sectors on the manufacturing sector under study.

Equation (6) enables us to understand first how firm-level TFP growth depends on foreign competition (β_1), and second, how the effect of foreign competition varies with the regulation of the product market (β_2). Since we control for industry and country-time fixed effects, this specification identifies the effect of foreign competition through differential evolution of the import penetration across industries (industry-time variation).

Models of endogenous growth, considering the existence of technological flows between firms across all countries, dwell on the role played by the pool of highly innovative firms in driving productivity growth of incumbent firms. Productivity growth of followers depends on the productivity growth of the global technological frontier. Adding productivity growth of the frontier firms (top 1 percent in levels), we estimate:

$$\Delta A_{isct} = \beta_0 + \alpha \Delta A_{st}^{front} + \beta_1 IP_{sct} + \beta_2 IP_{sct} \times PMR_{ct} + \beta_3 X_{isct} + \gamma_s + D_{ct} + \epsilon_{isct} \qquad (7)$$

where ΔA_{st}^{front} is the frontier's productivity growth. We compute the productivity level of the industry-year specific frontier A_{st}^{front} by taking the average productivity level of the top 1 percent of firms across all countries: it is thus a global frontier which is consistent with our cross-country empirical strategy.[7]

3.3 The importance of the firm's distance to the frontier

We allow for a non-monotonic effect of competition according to the heterogeneity of firms. The position on the firm in the productivity distribution is determined specific to its industry, with the right tail of the distribution representing the technological or productivity frontier. Is the positive escape-competition effect conditional on the distance of the firm to its industry frontier? The rationale behind this question is the following: the closer firms are to the frontier, the stronger the escape-competition effect on TFP growth tends to be. In other words, the pro-competitive effect of trade displays a boosting effect for firms with relatively high level of productivity. On the other hand, for laggard firms, an increase of competition due to the entry of foreign products on their market has a depressing effect because they are too far from the frontier to cope with it.

To capture the size of the technology gap among firms in an open-economy setting, we compare each firm's productivity to the median productivity of the the same sector and year. We then divide firms into two groups: a group of firms that are above the median level of TFP – those closer to the global TFP frontier – and a group of firms that have a TFP level below the median of their industry – who have a larger technological gap. To evaluate the differential impact of foreign competition and product market regulation according to firm heterogeneity in technology gap, we estimate Equations (6) and (7) separately for the two sub-samples.

3.4 The issue of reverse causality

Foreign competition is proxied by import penetration. It is possible that a bias exists because of reverse causality between firm productivity and trade orientation of the firm's sector. Foreign firms are able to enter more heavily a market if domestic firms are not efficient, leaving the competitive advantage to trade partners. This implies a negative correlation between productivity and import shares. However, this relation should be weak in our specification as we regress firm level produc-

[7]As a robustness check, we also compute the productivity frontier using the average of the top 5% of firms.

Table 4: Impact of import penetration and PMR on firms' TFP growth
Not resampled data set

PMR variable	**Barriers to entrepreneurship**					
	(1)	(2)	(3)	(4)	(5)	(6)
	All firms	Close to the frontier	Far from the frontier	All firms	Close to the frontier	Far from the frontier
IP	0.173**	0.542**	0.019	0.175**	0.445**	0.011
	(0.084)	(0.215)	(0.031)	(0.076)	(0.201)	(0.028)
IP×PMR	-0.094**	-0.292**	-0.008	-0.128***	-0.303***	0.032
	(0.043)	(0.114)	(0.016)	(0.046)	(0.102)	(0.029)
Herf				0.021	0.132	0.317***
				(0.221)	(0.377)	(0.098)
IP×Herf				0.134**	0.275*	-0.130**
				(0.066)	(0.165)	(0.060)
Constant	0.373	1.004	-0.381***	0.384	0.988	-0.454***
	(0.758)	(1.012)	(0.060)	(0.752)	(0.996)	(0.068)
Observations	455,491	234,361	221,130	455,491	234,361	221,130
R-squared	0.024	0.033	0.033	0.024	0.033	0.033
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1

tivity on sectoral import shares. We also consider that the reverse causality issue is less acute when we look at TFP growth compared to productivity levels. Finally, this could bias us away from finding a productivity-enhancing effect of import competition. In spite of this, our results indicate a positive relationship between productivity growth of the top firms and import penetration, which strengthens our confidence in the findings.

3.5 Interpretation of results

The first set of results of the estimation of Equation equation:estbase are shown in Tables 4 and 5, while Tables 6, 7 and 8 provide robustness checks of the same equation. These results are based on the regression of firm-level productivity growth on import penetration (IP) and the interaction between import penetration and domestic regulation ($IP \times PMR$). Import penetration at the sectoral level (IP) is used to proxy foreign competition pressures, while the 'barriers to entrepreneurship' index is used to measure the stringency of domestic regulation (PMR). The same equations are also estimated with the control variables. The first set of results, Tables 4 through 7, use the 'barriers to entrepreneurship' index (PMR) contemporaneously and with lags,

Table 5: Lagged impact of import penetration and PMR on firms' TFP growth
Not resampled data set

PMR variable	**Barriers to entrepreneurship**					
	(1)	(2)	(3)	(4)	(5)	(6)
	All firms	Close to the frontier	Far from the frontier	All firms	Close to the frontier	Far from the frontier
IP_{t-1}	0.166*	0.518**	-0.039	0.135	0.419*	-0.012
	(0.100)	(0.222)	(0.071)	(0.096)	(0.249)	(0.071)
$\text{IP}\times\text{PMR}_{t-1}$	-0.088*	-0.281**	0.025	-0.108**	-0.268**	0.036
	(0.051)	(0.118)	(0.034)	(0.052)	(0.120)	(0.037)
Herf_{t-1}				-0.046	0.042	0.314***
				(0.230)	(0.408)	(0.088)
$\text{IP}\times\text{Herf}_{t-1}$				0.142**	0.168	-0.089
				(0.057)	(0.142)	(0.068)
Constant	0.380	0.908	-0.428***	0.408	0.907	-0.489***
	(0.731)	(0.942)	(0.088)	(0.731)	(0.940)	(0.093)
Observations	454,375	233,529	220,846	454,375	233,529	220,846
R-squared	0.022	0.030	0.033	0.022	0.030	0.033
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1

both with the default dataset (Tables 4 and 5) and the resampled dataset (Tables 6 and 7).

Overall, the results, which split the sample by distance to frontier, are highly consistent with our hypotheses, and are robust across specifications, including those that account for potential reverse causality (using lagged values of IP) and potential sampling bias (on the resampled dataset).

Changes in firm productivity are impacted by both the domestic institutional environment and the extent of openness to foreign markets. However, firms' responses to foreign competition are heterogeneous, even within narrowly defined sectors. The evolution of firm TFP growth depends remarkably on its position in the distribution of firm efficiency. Firms that are technologically advanced benefit from competitive pressure of foreign firms' entry into their domestic markets. This "escape competition effect" is only present for the most competitive firms, with foreign competition generally having no significant impact on firms that are at the bottom of the efficiency distribution.

The positive pro-competitive effect of trade on advanced firms has a different magnitude according to the extent of product market regulation in the country. The negative coefficient on the interaction term indicates that trade becomes more beneficial as market regulation becomes less stringent. The 'barriers to entrepreneurship' PMR index is used in the estimates shown in Tables

Table 6: Impact of import penetration and PMR on firms' TFP growth
Resampled data set

PMR variable	Barriers to entrepreneurship					
	(1)	(2)	(3)	(4)	(5)	(6)
	All firms	Close to the frontier	Far from the frontier	All firms	Close to the frontier	Far from the frontier
IP	-0.020	0.427**	-0.023	-0.005	0.409*	-0.002
	(0.204)	(0.213)	(0.075)	(0.207)	(0.213)	(0.080)
IP×PMR	0.007	-0.232**	0.008	0.002	-0.234**	0.009
	(0.105)	(0.114)	(0.037)	(0.105)	(0.115)	(0.039)
Herf				0.371	0.303	0.117
				(0.252)	(0.304)	(0.097)
IP×Herf				-0.010	0.036	-0.049
				(0.043)	(0.079)	(0.046)
Constant	-0.179*	-5.055***	0.073**	-0.295**	-5.174***	0.042
	(0.100)	(0.960)	(0.029)	(0.150)	(0.991)	(0.039)
Observations	348,007	162,479	164,429	348,007	162,479	164,429
R-squared	0.037	0.043	0.025	0.037	0.043	0.025
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Lagged impact of import penetration and PMR on firms' TFP growth
Resampled data set

PMR variable	Barriers to entrepreneurship					
	(1)	(2)	(3)	(4)	(5)	(6)
	All firms	Close to the frontier	Far from the frontier	All firms	Close to the frontier	Far from the frontier
IP_{t-1}	0.422**	0.718**	0.273*	0.400*	0.645**	0.339**
	(0.209)	(0.282)	(0.160)	(0.228)	(0.305)	(0.159)
$IP \times PMR_{t-1}$	-0.193*	-0.357***	-0.128*	-0.193*	-0.348**	-0.127*
	(0.099)	(0.134)	(0.076)	(0.099)	(0.135)	(0.076)
$Herf_{t-1}$				-0.024	-0.249	0.067
				(0.288)	(0.351)	(0.110)
$IP \times Herf_{t-1}$				0.051	0.302	-0.160
				(0.208)	(0.304)	(0.105)
Constant	-0.250***	-5.269***	-0.089***	-0.241**	-5.189***	-0.117***
	(0.062)	(0.832)	(0.018)	(0.115)	(0.854)	(0.035)
Observations	338,137	158,549	159,645	338,137	158,549	159,645
R-squared	0.039	0.043	0.028	0.039	0.043	0.028
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Impact of import penetration and PMR on firms' TFP growth
Not resampled data set

PMR variable	Burdens on startups					
	(1) All firms	(2) Close to the frontier	(3) Far from the frontier	(4) All firms	(5) Close to the frontier	(6) Far from the frontier
IP	0.075	0.189***	-0.039*	0.181**	0.122	0.071
	(0.050)	(0.073)	(0.023)	(0.072)	(0.113)	(0.070)
IP×PMR	-0.055*	-0.117***	0.032*	-0.079***	-0.113**	0.012
	(0.029)	(0.044)	(0.019)	(0.029)	(0.044)	(0.025)
Herf				-0.121	-0.035	0.422***
				(0.260)	(0.277)	(0.101)
IP×Herf				-0.141	0.130	-0.145*
				(0.086)	(0.159)	(0.078)
Constant	-0.042	-0.614	-0.481***	-0.017	-0.597	-0.561***
	(0.309)	(0.470)	(0.109)	(0.323)	(0.475)	(0.104)
Observations	417,389	237,355	160,651	417,389	237,355	160,651
R-squared	0.025	0.046	0.035	0.025	0.046	0.035
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1

4 through 7, which reflects anti-competitive measures such as entry barriers and administrative burdens that inhibit competition across sectors.

To more clearly delineate the effects of the measures, the 'burdens on startups' sub-indicator is used in Table 8. This indicator focuses more clearly on administrative burdens for new firms, including sector-specific burdens. Using this index, these results yield coefficient estimates that are qualitatively very similar to the estimates with the broader PMR 'barriers to entrepreneurship' index shown in the previous tables. The other two PMR sub-indicators of this index, 'regulatory and administrative opacity' and 'barriers to competition', show less significance.

Domestic competition may also vary within a country, across sectors. This may have an effect on firms' incentives to upgrade their technology. The level of competition within a sector can be proxied by the concentration level within a sector.[8] In concentrated sectors, firms are not forced to reduce prices and can make positive profits more easily. Hence low productivity firms can survive.

[8] We also use the *Regimpact* regulatory impact index to help control for pressures that may affect costs. Regimpact can control for the cost structure of intermediate inputs coming from upstream sectors. Robustness checks were run with all of the estimated equations, and the inclusion of *Regimpact* in the equations does not affect the interpretation of the estimates. Firms that are closer to the frontier are found to cope more easily with high regulation in upstream services sectors, and it has a damping effect on firms farther from the frontier.

Table 9: The impact of IP and PMR on firms' TFP growth, with frontier TFP growth
Not resampled data set

PMR variable	**Barriers to entrepreneurship**					
	(1) All firms	(2) Close to the frontier	(3) Far from the frontier	(4) All firms	(5) Close to the frontier	(6) Far from the frontier
ΔA^{front}	0.003***	0.005**	0.001*	0.003***	0.005**	0.001*
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
IP	0.172**	0.494**	-0.040	0.162*	0.382*	0.002
	(0.087)	(0.197)	(0.063)	(0.086)	(0.202)	(0.055)
IP×PMR	-0.092**	-0.265**	0.020	-0.102**	-0.252**	0.046
	(0.045)	(0.105)	(0.032)	(0.050)	(0.104)	(0.035)
Herf				0.160	0.239	0.346***
				(0.191)	(0.374)	(0.097)
IP×Herf				0.058	0.204	-0.164***
				(0.055)	(0.143)	(0.061)
Constant	-0.612***	-0.770**	-0.425***	-0.637***	-0.817**	-0.503***
	(0.191)	(0.350)	(0.092)	(0.206)	(0.393)	(0.102)
Observations	414,890	211,820	203,070	414,890	211,820	203,070
R-squared	0.032	0.042	0.031	0.032	0.043	0.031
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1

Our analysis suggests that the concentration level has a different impact on more advanced versus laggard firms, based on the raw dataset (Tables 4 and 5). While high concentration seems to allow less efficient firms to perform well, it is not a condition for high productivity firms whose TFP growth rates are not significantly affected by the concentration level. Such a concentration index is however an imperfect measure of competition as it does not capture the existence of entry threats. Moreover it focuses on a geographically limited definition of competition while European manufacturing sectors are open and some firms operate in international markets. Our favored measure of competition is the product market regulation index, as it can proxy unobservable entry threats as well as the existing regulatory scope that can be used to adjust to changes in market structure.

These results are robust to a number of alternative specifications, such as inclusion of the growth of the productivity frontier (Table 9, using Equation (7)) or the restriction of the sample to only surviving firms (Table 10). While these changes in specification have a slight impact on the results, they remain the same in sign, significance and roughly the same in magnitude, in these

Table 10: The impact of IP and PMR on surviving firms' TFP growth
Not resampled, balanced data set

PMR variable	**Barriers to entrepreneurship**					
	(1) All firms	(2) Close to the frontier	(3) Far from the frontier	(4) All firms	(5) Close to the frontier	(6) Far from the frontier
IP	0.212**	0.602***	-0.024	0.199*	0.571***	0.032
	(0.106)	(0.218)	(0.075)	(0.101)	(0.216)	(0.069)
IP×PMR	-0.114**	-0.323***	0.014	-0.119**	-0.319***	0.036
	(0.056)	(0.116)	(0.038)	(0.057)	(0.115)	(0.041)
Herf				-0.021	0.019	0.384***
				(0.268)	(0.441)	(0.120)
IP×Herf				0.048	0.056	-0.187**
				(0.065)	(0.111)	(0.077)
Constant	-0.688*	-0.945	-0.429***	-0.677*	-0.944	-0.525***
	(0.380)	(0.649)	(0.043)	(0.382)	(0.657)	(0.050)
Observations	230,267	125,647	104,620	230,267	125,647	104,620
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1

contemporaneous results. We have also checked for the inclusion of other controls at the firm level, such as an indicator of exit during the period, the size of the firm, which has no discernible effect on the main results.

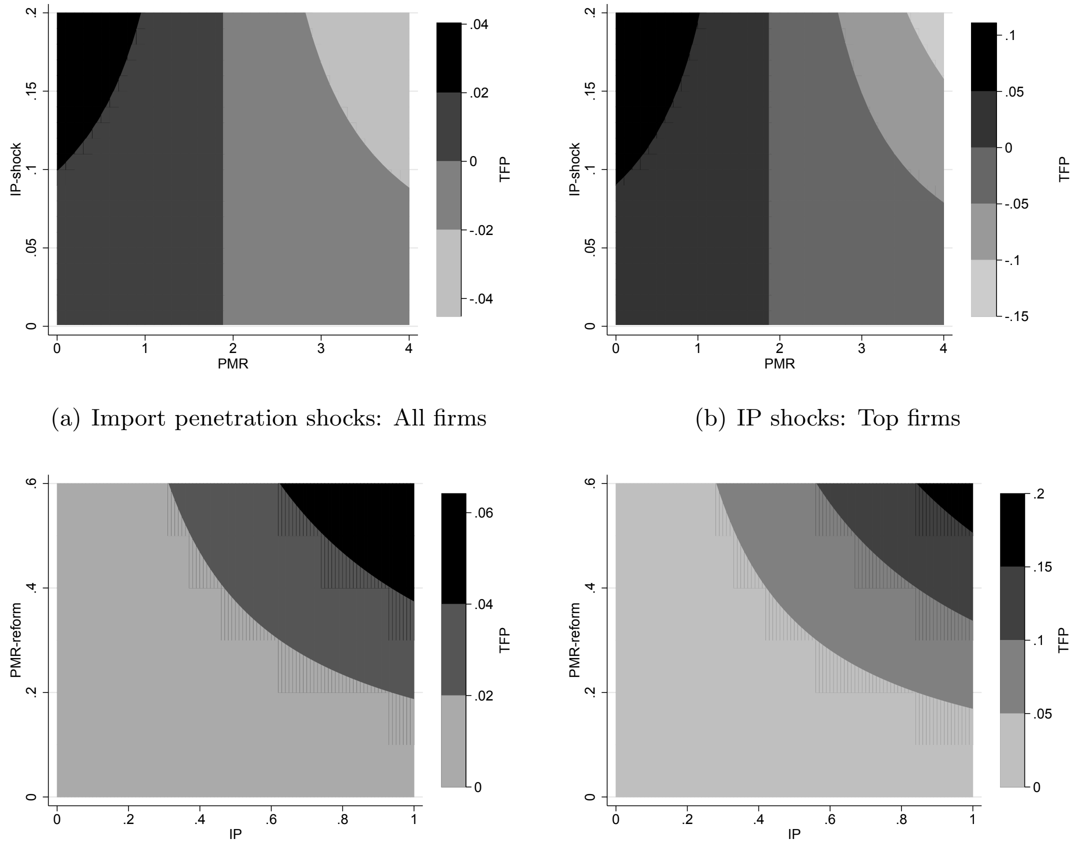
Inclusion of the direct effect of product market regulation has a somewhat larger effect on the results, which was expected as we include country fixed effect and year fixed effect separately to estimate the impact of country-wide PMR. Yet the results on our variables of principal interest, import penetration and its interaction with PMR remain qualitatively similar.

3.6 Effects on productivity

What is the economic significance of the results just discussed? Taking our preferred equation estimates from Table 4, the effects of changes in import penetration and product market reform can be simulated for within-firm productivity growth, among the relatively large firms in our dataset. Given the difference-in-differences specification of the estimation equation, we therefore focus on conditional shocks. A qualitative visualization of these simulations is shown in Figure 1.

Increases in import penetration (*IP*) only boost firm TFP growth if PMR is sufficiently low, below a certain threshold (Figure 1, Panel A) equivalent to the median PMR setting at the end

Figure 1: Estimated within-firm TFP growth effects under conditional IP and PMR shocks



(a) Import penetration shocks: All firms

(b) IP shocks: Top firms

(c) Product market reform shocks: All firms

(d) PMR shocks: Top firms

Source: Simulations based on equation estimates from Table 4, columns 2 and 3.

of the period studied. If PMR is higher than this threshold, an increase in IP (*i.e.* international competition) has a perverse impact on TFP, leading to negative TFP growth through discouragement. This effect arises from an even larger-magnitude effect on the firms in the upper half of the productivity distribution (Panel B). To take a particular example, for firms in the United Kingdom, the country with the lowest PMR, an increase in import penetration of 10 percentage points would raise firm TFP growth by approximately 1.0% per year on average, or 2.7% for the firms in the upper half of the productivity distribution. Yet for countries (primarily in earlier time periods) with higher PMR settings, the effect is essentially reversed.

A similar simulation can be carried out for a range of PMR reforms taking varying levels of import penetration as given (Figure 1, Panels C and D). Product market regulatory reforms unambiguously boost productivity growth; however, their effects are magnified considerably when import penetration is higher. For instance, a PMR reform of 10% of the median setting would boost within-firm productivity growth by 0.5% in a sector at the 25th percentile of import penetration, and by 2.3% in a sector at the 75th percentile. Again, the impact is driven by firms in the upper half of the productivity distribution, where productivity growth is boosted by 1.4% and 6.3%, respectively. For firms in the lower half of the productivity distribution, the impact of PMR reform through this channel is negligible. Countries with a large share of high-productivity firms will thus benefit much more from PMR reforms.

4 Conclusion

This paper offers a new assessment of the effect of import penetration on firm-level productivity growth, taking into account heterogeneity in distance to the technological frontier and country differences in product market regulation. Our results show that firms in sectors with higher import penetration have higher TFP growth only if the firms are close to their sectoral technology frontier. Only the most productive firms enjoy an increase in productivity when foreign competitors' pressure is high. This result illustrates that in order to understand firms' TFP growth, it is important to combine explanations based on the pro-competitive effect of trade with a "Schumpeterian" distance-to-the-frontier mechanism, an area that theoretical trade models have overlooked to date.

The pro-competitive effect of international trade depends on domestic product market regulation as measured by the OECD's Product Market Regulation (PMR) index. Our results indicate that, at the top of the productivity distribution, the positive effect of foreign competition is inhibited for firms operating in a country with stringent regulation such as higher barriers to entry. Domestic and foreign competitive pressures are found to be complementarity: firms' incentives or abilities to improve their productivity to cope with foreign competition are stronger in countries with lower levels of PMR. As for firms at the bottom of the productivity distribution, foreign competition does not have a significant within-firm benefit on their efficiency – irrespective of the regulatory environment – though it may faciliate their demise, whereby they relinquish their market share to more productive firms.

Future work in this area could go beyond this paper in a number of respects. First, if firm-level trade information were available in a multi-country dataset, both the extensive and intensive margins could be examined, since their impact on competition likely differs. Second, instrumentation of import penetration would make the results for the measure more robust. Third, once a longer time series of domestic regulation indicators is available, further analysis would be worthwhile.

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A Annex

Table A.1: The impact of IP and PMR on surviving firms' TFP growth
With firm fixed effects – Not resampled, balanced data set

PMR variable	Barriers to entrepreneurship					
	(1) All firms	(2) Close to the frontier	(3) Far from the frontier	(4) All firms	(5) Close to the frontier	(6) Far from the frontier
IP	0.310**	0.567*	0.094	0.306**	0.513*	0.100*
	(0.131)	(0.312)	(0.063)	(0.130)	(0.311)	(0.059)
IP×PMR	-0.168**	-0.307*	-0.052	-0.190**	-0.312*	-0.021
	(0.069)	(0.166)	(0.033)	(0.080)	(0.168)	(0.047)
Herf				-0.070	0.165	0.050
				(0.443)	(0.835)	(0.112)
IP×Herf				0.096	0.149	-0.121*
				(0.086)	(0.153)	(0.070)
Constant	0.102***	0.353***	-0.139***	0.120***	0.358***	-0.162***
	(0.023)	(0.046)	(0.012)	(0.036)	(0.062)	(0.019)
Observations	230,708	125,978	104,730	230,708	125,978	104,730
R-squared	0.036	0.046	0.006	0.036	0.046	0.006
Number of IDs	34,071	25,210	22,054	34,071	25,210	22,054
Firm FE	YES	YES	YES	YES	YES	YES
Country-Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses, clustered standard errors by country and sector.
*** p<0.01, ** p<0.05, * p<0.1