Do lower tariffs on foreign intermediate inputs raise productivity? 
Panel data evidence for OECD countries

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Motivation

Endogenous growth and trade literature

• **Foreign technology embodied in imported inputs enhance productivity and foster economic growth:** Ethier, 1979, 1982; Grossman-Helpman, 1991; Rivera-Batiz- Romer, 1991.

Motivation

Endogenous growth, competition and regulation

• Competitive pressures have non-linear effects on productivity gains and innovation: Aghion et al., 2005; 2006.

• Restrictions to competition curb productivity growth depending on distance to the technological frontier: Nicoletti and Scarpetta, 2003; Griffith et al., 2006, Bourles et al., 2010, Conway et al., 2006; Aghion et al., 2009, Arnold et al. 2010 - 2011.

What do we do?

Link the two strands of empirical endogenous growth literature to:

• Study how a specific type of upstream regulation affecting foreign intermediate goods affects productivity growth in downstream industries across countries.

• Identify the industries and countries that have benefited the most from input liberalization depending on their technological structure.
Main questions

• Does sheltering intermediate goods markets from foreign competition harm productivity downstream?

• What kind of input tariffs are most damaging for productivity growth?

• Does the foreign technology transfer-productivity link depend on distance to the technological frontier?

How do we do it?

• Relying on the link between upstream competition and downstream productivity in a neo-Schumpeterian framework

• Using industry/country data for 16 OECD countries and 10 manufacturing industries (1996-2007)

• Constructing input tariffs at the industry/country level using the MFN tariffs and IO tables for each country

• The identification strategy exploits changes in input tariffs across industries and countries over time and the relative productivity to the leading industry to explain productivity growth.
What do we find?

New evidence on the effects of tariffs on foreign inputs on economic growth:

• the average input tariff reduction between 1996-2007 across all countries-industries (1.3 p.p.) has boosted productivity growth by around 1 p.p. per year on average

• the effect is likely to be stronger for industry-country pairs that are close to the technological frontier (1.2 %) relative to those that are distant to it (0.9 %).

• cuts in tariffs for high-tech goods have benefited mostly and to a larger extent industries and countries that are closest to best practice

• results are robust to several sensitivity tests (IV, sample selection of countries and industries)

How do we explain these results?

• Escape competition effect: sectors-countries closer to the technological frontier operate in a competitive environment, and thereby, they obtain greater returns from input tariff cuts.

• Partly because a larger share of highly efficient firms in these industries are able to face the fixed costs involved in importing intermediate inputs from foreign firms, especially high-tech ones

• Confirm and extend previous results found by:
  - Bourles et al (2010) anticompetitive upstream regulations on intermediate goods curb MFP growth, more strongly so for industry-country pairs close to the frontier;
  - Bas and Causa (2012) using firm level data from China and studying input liberalization and product market deregulation
Analysis

• Data

• Econometric specification

• Baseline results

• Disentangling the channels

• Robustness checks

Data

• As in Bourlès et al. (2010), the MFP levels are calculated for a base year 2005 as:

\[ \ln(MFP_{c,t}) = \ln(VA_{c,t}) - a_i \ln(H_{c,t}) - (1 - a_i) \ln(K_{c,t}) \]

• and are extended over the sample period using data on MFP growth over the period 1996-2007

• The basic data is from OECD STAN industry statistics and OECD Productivity database by industry (PDBi)

• for 16 countries (EU and non-EU OECD) and 10 manufacturing industries over the period 1996-2007.
Input tariffs

• Most Favourite Nation (MFN) applied tariffs at the 2-digit industry level by each of the 16 countries covered in the sample from the WITS/TRAINS/WTO database for the period 1996-2007;

• Domestic input-output tables from the OECD for each country;

• For each country $c$, input tariffs for the manufacturing industry $i$ and year $t$, are computed as:

$$\tau_{input_{c,i,t}} = \sum_z \alpha_{c,i,z} \tau_{c,z,t}$$

• To disentangle the channels a set of high- and low-technology input tariffs is created based on the technology content of intermediate inputs using the classification of manufacturing industries from OECD (2005) based on direct and indirect indicators of technological intensity.

Empirical approach

• Using the neo-Schumpeterian growth framework (Aghion and Howitt, 1998)

• The MFP is assumed to follow an error correction model (ECM) of the form:

$$\ln A_{cit} = a_1 \ln A_{pit} + \text{gap}_{cit-1} + \text{input}_{cit-1} + \text{input}_{cit-1} \times \text{gap}_{cit-1} + \text{Z}_{cit-1} + \epsilon_i + \epsilon_{cit}$$

• Productivity gap measures how far each country lags behind the frontier country in each industry:

$$\text{gap}_{cit} = \ln (\text{MFP}_{pit} / \text{MFP}_{cit})$$

• $\beta_2 + \beta_3 \times \text{gap}$ is the coefficient of interest.

• Control variables: import flows and output tariffs by industry and country.
Baseline results

Dependent variable: Growth in multi-factor productivity (MFP)

<table>
<thead>
<tr>
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<th>(2)</th>
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</thead>
<tbody>
<tr>
<td>Input tariffs(t-1)</td>
<td>-0.779***</td>
<td>-0.783***</td>
<td>-0.849***</td>
<td>-1.320***</td>
<td>-1.290**</td>
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<td>(0.255)</td>
<td>(0.249)</td>
<td>(0.249)</td>
<td>(0.511)</td>
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<tr>
<td>Gap in MFP levels(t-1)</td>
<td>0.064***</td>
<td>0.073***</td>
<td>0.072***</td>
<td>0.077***</td>
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<td>(0.008)</td>
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<tr>
<td>Effect of gap on the input tariffs(t-1)</td>
<td>1.468***</td>
<td>1.446***</td>
<td>1.122***</td>
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<tr>
<td></td>
<td>(0.462)</td>
<td>(0.462)</td>
<td>(0.475)</td>
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<tr>
<td>Change in imports</td>
<td>0.021</td>
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<tr>
<td></td>
<td>(0.018)</td>
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<tr>
<td>Output tariffs(t-1)</td>
<td>0.333</td>
<td>0.330</td>
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<tr>
<td></td>
<td>(0.309)</td>
<td>(0.308)</td>
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<tr>
<td>Change in MFP in the technology leader</td>
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<tr>
<td></td>
<td>0.036***</td>
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<tr>
<td>(0.013)</td>
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</table>

Tests of joint significance (p-values)

| Gap(t-1) = Input tariffs(t-1) = Gap(t-1) * Input tariffs(t-1) | 0.000 | 0.000 | 0.000 |
| Input tariffs(t-1) = Gap(t-1) * Input tariffs(t-1) | 0.000 | 0.003 | 0.003 |

Proportion of observations of the sample above which input tariffs have a negative impact: 95.0% 98.9% 98.1%

Proportion of observations of the sample above which input tariffs have a positive impact: 5.0% 1.1% 1.9%

Input tariffs impact on MFP growth

- The impact of input tariff on MFP growth depends on the gap.
- The slope flattens out more as input tariff decline;
- For the average gap (0.39) and average input tariff (3%), the effect of eliminating input tariff in all sectors is to increase MFP growth by 2.6 percent per year.
### Channels

**Dependent variable:** Growth in multi-factor productivity (MFP)

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<tr>
<td>Change in MFP in the technology leader</td>
<td>0.043***</td>
<td>0.036***</td>
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<td>Gap in MFP levels(t-1)</td>
<td>0.063***</td>
<td>0.073***</td>
<td>0.078***</td>
<td></td>
</tr>
<tr>
<td>Input tariffs HT (t-1)</td>
<td>-1.159**</td>
<td>-1.286**</td>
<td>-1.344**</td>
<td></td>
</tr>
<tr>
<td>Input tariffs LT (t-1)</td>
<td>-1.455***</td>
<td>-1.396**</td>
<td>-1.386**</td>
<td></td>
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<tr>
<td>Effect of gap on the input tariffs HT(t-1)</td>
<td>1.552***</td>
<td>1.257**</td>
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</tr>
<tr>
<td>Effect of gap on the input tariffs LT (t-1)</td>
<td>1.385***</td>
<td>1.019**</td>
<td></td>
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</tr>
<tr>
<td>Output tariffs(t-1)</td>
<td>0.400</td>
<td>0.345</td>
<td>0.395</td>
<td>0.354</td>
</tr>
<tr>
<td>Change in imports</td>
<td>0.022</td>
<td>0.021</td>
<td>0.020</td>
<td>0.019</td>
</tr>
</tbody>
</table>

**Fixed effects:**
- Time * Country: Yes
- Industry: Yes

**Observations:** 1585

**R-squared:** 0.316

**Tests of joint significance (p-values):**

- Input tariffs HT(t-1) + Gap(t-1) * Input tariffs HT(t-1) = 0.745
- Input tariffs LT(t-1) + Gap(t-1) * Input tariffs LT(t-1) = 0.597

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### Heterogeneous effects of technological tariffs

Far away from the frontier = distance above median gap. Close to the frontier = distance below the median gap

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<tr>
<td>Distance above median Gap * input tariffs HT(t-1)</td>
<td>-0.356</td>
<td>-0.350</td>
<td>-0.354</td>
<td>-0.892</td>
</tr>
<tr>
<td>Distance below median Gap * input tariffs HT(t-1)</td>
<td>-0.993**</td>
<td>-0.955**</td>
<td>-0.959**</td>
<td>-1.466**</td>
</tr>
<tr>
<td>Distance above median Gap * input tariffs LT(t-1)</td>
<td>-0.874***</td>
<td>-0.890***</td>
<td>-0.879***</td>
<td>-1.533**</td>
</tr>
<tr>
<td>Distance below median Gap * input tariffs LT(t-1)</td>
<td>-0.880***</td>
<td>-0.863***</td>
<td>-0.849***</td>
<td>-1.485**</td>
</tr>
<tr>
<td>Distance above median Gap</td>
<td>0.021***</td>
<td>0.021***</td>
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<td>0.021***</td>
</tr>
<tr>
<td>Output tariffs(t-1)</td>
<td>0.017</td>
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<td>Change in imports</td>
<td>0.019</td>
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<td>0.017</td>
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<td>0.017</td>
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</tr>
</tbody>
</table>

**Fixed effects:**
- Time * Country: Yes
- Industry: Yes

**R-squared:** 0.322

**Tests of joint significance (p-values):**

- Distance below median Gap * input tariffs HT(t-1) = 0.793
- Distance below median Gap * input tariffs LT(t-1) = 0.965
- Distance above median Gap * input tariffs HT(t-1) = 0.214
- Distance above median Gap * input tariffs LT(t-1) = 0.133

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No difference between impact of HT and LT tariffs due to composition effect

HT tariffs hurt only most productive firms
Sensitivity tests

- **Endogeneity issues:** Instruments: level of input and output tariffs in 1996 as well as the change in imports in 1996 (Amiti and Konings, AER, 2007).

- **Persistence effects:** from the previous results, we expect the effect of input tariff cuts to be stronger for industries with previously higher levels of MFP.

- **Sample selection:**
  - Countries
  - Industries

Conclusions

New evidence on the effects of imported inputs on productivity growth:

- Input-trade liberalization generally boosts productivity by widening the range of available intermediate inputs and enabling tech transfer

- This effect differs across countries within an industry according to the distance to the technological frontier

- Countries closer to frontier gain greater returns from liberalization, probably due to a stronger escape competition effect

- While tariff cuts on low-tech products benefit all producers, cuts in high-tech products benefit particularly the most efficient ones

- Further work at firm level is needed to confirm and deepen understanding of these industry-level results
Thanks