Do Product Market Regulations in Upstream Sectors Curb Productivity Growth? Panel Data Evidence for OECD Countries

by

Renaud Bourlès\textsuperscript{a}, Gilbert Cette\textsuperscript{b}, Jimmy Lopez\textsuperscript{c}, Jacques Mairesse\textsuperscript{d} \& Giuseppe Nicoletti\textsuperscript{e}

\textsuperscript{a} Ecole Centrale Marseille, GREQAM-IDEP
\textsuperscript{b} Banque de France, Université de la Méditerranée (DEFI)
\textsuperscript{c} Banque de France
\textsuperscript{d} CREST-INSEE
\textsuperscript{e} OECD Economics Department
Motivation

• **Competition is an important determinant of productivity growth:**
  – According to neo-Schumpeterian theory, the link between competition and productivity growth relies on incentives to escape peer pressure and reap temporary rents by improving efficiency through innovation/adoption/imitation (escape competition/entry effect)
  – This effect depends on distance to frontier (far from it, the negative Schumpeterian/discouragement effect can dominate)

• **Most of previous research (theory and empirics),**
  – Focuses on competitive conditions within each sector (or market)
Motivation

• **However,** focusing on within-sector competition misses part of the story:
  1. Rents from efficiency gains (i.e. incentives to improve productivity) are also reduced by lack of competition in (upstream) sectors producing intermediate inputs, because upstream market power is used to appropriate part of downstream rents

  2. Barriers to competition upstream also generate less entry and weaker competition (i.e. disincentives to improve productivity) downstream, e.g. low variety of banking services or poor distribution channels

• **Moreover,** since peer pressure and the benefits of escaping entry and competition are higher when competitive pressures downstream are strong and firms compete neck-and-neck
  – lack of competition upstream may reduce incentives to improve downstream productivity more markedly when average distance to frontier is short and markets are integrated
Purpose and findings of paper

- Look at the influence of upstream competition for productivity outcomes in downstream sectors
  - Explain theoretically this link within a simple neo-Schumpeterian model
  - Examine empirically this link using industry-level/cross-country panel data and proxying upstream competition with the OECD indicators of sectoral product market regulation, focusing on non-manufacturing
  - Account for differential effects of competition with distance to frontier

- Main findings:
  - Anticompetitive regulations upstream curb significantly MFP growth in downstream sectors
  - Effects are strongest over past 15 years and close to global technological frontier
  - Aligning upstream regulations on best practice could result in over 1 percentage point acceleration in yearly MFP growth in some countries
Related previous empirical research

• Focus mainly on direct effects of lack of competition in a market on its own productivity performance
  – Using cross-country data: Conway et al. 2005; Aghion et al. 2009

• Only few papers accounting for indirect effect of lack of upstream competition:
  – in firm-level single country panels: Arnold et al. (2006); Forlani (2010)
  – in static (country/industry) cross sections: Allegra et al., 2004; Faini et al., 2006; Barone and Cingano, 2008
  – in cross-country/industry panels: Conway et al. 2005;

• Our main contributions
  – Focus squarely on this link (abstract from direct effects)
  – Formalize link in endogenous growth framework
  – Explicitly test link using ECM approach accounting for distance to frontier
Outline

1. The channels: from upstream competition to downstream productivity
2. Empirical specification: technology diffusion/neo-Schumpeterian model
3. The data: productivity, anticompetitive regulations, upstream regulatory burdens
4. Main empirical results
5. Economic significance of estimates: policy simulations
6. Robustness checks
7. Conclusion
The channels

Neo-Schumpeterian growth framework (Aghion et al. 1997):

• Technology leaders and followers – downstream firms produce using intermediate goods –
  positive competition/innovation link if neck-and-neck/close to frontier prevail

Extensions:
• Imperfections in markets for intermediate goods (upstream)
  – Suppliers are difficult/costly to find
  – Suppliers have bargaining power

• Free entry (upon securing supplier) on downstream markets, i.e. endogenous n. of firms

Main implications:
• By reducing search costs and bargaining power of suppliers upstream competition alters
  downstream incentives to seek efficiency improvements:
  – Lower search costs eases entry of new firms downstream raising neck-and-neck competitive pressures
  – Lower bargaining power reduces appropriation of downstream innovation rents by suppliers
  – With more neck-and-neck pressures and lower expected rent sharing downstream incentives to seek
    efficiency improvements increase

Note:
• To simplify, catch-up rate is exogenous: no inverted-U curve as market structure changes, but
  competition effects still non-linear with distance to frontier (stronger close to frontier)
Empirical specification

• Embed the upstream competition/downstream growth link into neo-Schumpeterian technology diffusion ECM model (Acemoglu et al. 2006; Aghion and Howitt, 2006):
  – Productivity growth depends on both local innovation efforts (fraction of innovation at frontier) and technology adoption from abroad
  – Relative size of two effects depends on distance to frontier (catch up process)
  – Effect of upstream competition depends on intensity in use of upstream intermediate products
  – Effects of competition depend on distance to frontier (escape vs discouragement effects)
Empirical specification

- Productivity is an ADL(1,1) process co-integrated with productivity at frontier (Griffith et al. 2006):

\[
\ln MFP_{icst} = \alpha_0 \ln MFP_{icst-1} + \alpha_1 \ln MFP_{F cst} + \alpha_2 \ln MFP_{F cst-1} + \varepsilon_{icst}
\]

- With LR homogeneity and lack of upstream competition (REG) effects, ECM representation is:

\[
\Delta \ln \left( MFP_{cs,t} \right) = \alpha_1 \Delta \ln \left( MFP_{Fs,t} \right) + (1 - \alpha_0) \left( gap_{cs,t-1} \right) + \\
+ \alpha_3 \left( REG_{cs,t-1} \right) + \alpha_4 \left( gap_{cs,t-1} \right) \left( REG_{cs,t-1} \right) + \gamma_{c,t} + \gamma_s + \varepsilon_{cs,t}
\]

with \( gap_{cs,t} = \ln \left( \frac{MFP_{Fs,t}}{MFP_{cs,t}} \right) \) and centered gap and REG variables

- Effect of REG for a given gap: \( \alpha_3 + \alpha_4 \times gap_{cs,t-1} \)
Model properties

1. $\Delta \ln MFP$, REG and distance to frontier

$\alpha_3 < 0$ and $\alpha_4 > 0 \rightarrow$ neg. effects of reg. decreasing with gap
$\rightarrow$ neo-Schumpeterian effect

2. $\Delta \ln MFP$ and distance to frontier

$0 < \alpha_0 < 1$ and $\alpha_4 > 0 \rightarrow$ catch up process

3. REG and steady state MFP gap

$$\text{gap}_{cs} = \frac{1}{(1 - \alpha_0 + \alpha_4 \cdot \text{REG}_{cs})} \left[ -\alpha_3 (\text{REG}_{cs} - \text{REG}_{F_s}) - (\gamma_c - \gamma_F) \right]$$

$\rightarrow$ no absolute convergence (depends inter alia on REG)

4. REG and steady state growth

$$\Delta \ln \text{MFP}_{F_s,t} = \frac{\alpha_3}{1 - \alpha_1} \text{REG}_{F_s,t-1} + \frac{\gamma_s + \gamma_{F,t}}{1 - \alpha_1}$$
Proxying upstream competition

• **Three main criteria:**
  ✓ Account for trickle down effects of upstream competition
  ✓ Minimize endogeneity issues
  ✓ Provide link with policies affecting competition: OECD non-
    manufacturing regulation data (NMR)

• **The “Regulatory burden” indicator (**REG**):**

\[
REG_{cs,t} = \sum_{k=1}^{K} NMR_{c,t}^{k} \ast \frac{input_{s,T_0}^{k}}{output_{s,T_0}^{k}} = \sum_{k=1}^{K} NMR_{c,t}^{k} \ast \omega_{T_0}^{ks}
\]

where \( K = 6 \) non-manuf. sectors; \( T_0 = 2000 \); \( \omega \) from US I-O table; k≠s

• **“Best policy practice” is defined for each year \( t \) and sector \( s \) as the** **REG** **resulting from the average of the three smallest values of the** **NMR** **in each upstream sector**
“Regulatory burden” indicator
Proxying productivity

• **Multifactor productivity growth:**

\[ \Delta \ln MFP_{cs,t} = \Delta \ln VA_{cs,t} - \alpha_s \cdot \Delta \ln L_{cs,t} - (1 - \alpha_s) \cdot \Delta \ln K_{cs,t} \]

*where*

• \( VA \): value added in constant $US PPP price
• \( L \): total number of employees
• \( K \): capital stock in constant $US PPP price
• \( \alpha_s \): sector sample average of labor cost share

• **Multifactor productivity levels and distance to frontier:**

• Compute for base year (2000) and extend using growth
• Frontier is highest MFP in each country/sector/year (cleaned)
• Distance measured by \textit{gap} variable
Data: Distance to leader

Country occurrence as frontier (% in total number occurrence 430)
Sample

- **4629 obs. in cleaned unbalanced panel**
  - Eliminate outlier MFP
  - Avoid spurious changes in leader due to data availability

- **23 years: 1985 – 2007**

- **15 countries**
  
  AUS, AUT, BEL, CAN, DNK, FIN, FRA, GER, GRC, ITA, NLD, NOR, SPA, SWE, USA

- **20 manufacturing and market service sectors**
  - 6 “upstream”: energy, retail, transport, communication, financial services, business services
Results

Preliminary evidence

\[ y = -0.236x - 0.0025 \]
## Main estimates

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in MFP in the technology leader&lt;sub&gt;t&lt;/sub&gt;</td>
<td>0.113***</td>
<td>0.114***</td>
<td>0.122***</td>
</tr>
<tr>
<td></td>
<td>[0.016]</td>
<td>[0.016]</td>
<td>[0.019]</td>
</tr>
<tr>
<td>Gap in MFP level&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.037***</td>
<td>0.041***</td>
<td>0.032***</td>
</tr>
<tr>
<td></td>
<td>[0.003]</td>
<td>[0.004]</td>
<td>[0.005]</td>
</tr>
<tr>
<td>Regulatory burden' indicators&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>-0.064</td>
<td>-0.067</td>
<td>-0.124**</td>
</tr>
<tr>
<td></td>
<td>[0.048]</td>
<td>[0.047]</td>
<td>[0.062]</td>
</tr>
<tr>
<td>Effect of gap on the regulation impact&lt;sub&gt;t-1&lt;/sub&gt;</td>
<td>0.240***</td>
<td>0.132**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[0.040]</td>
<td>[0.054]</td>
<td></td>
</tr>
<tr>
<td>Fixed effects:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time * Country</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tests of joint significance (p-values):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gap.&lt;sub&gt;1&lt;/sub&gt;=REG.&lt;sub&gt;1&lt;/sub&gt;=gap.&lt;sub&gt;1&lt;/sub&gt; * REG.&lt;sub&gt;1&lt;/sub&gt;=0</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>REG.&lt;sub&gt;1&lt;/sub&gt;=gap.&lt;sub&gt;1&lt;/sub&gt; * REG.&lt;sub&gt;1&lt;/sub&gt;=0</td>
<td>0.000</td>
<td>0.011</td>
<td></td>
</tr>
<tr>
<td>Ratio MFP&lt;sub&gt;F&lt;/sub&gt; on MFP above which REG.&lt;sub&gt;1&lt;/sub&gt; has a positive impact</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>2.123***</td>
<td>4.115*</td>
<td></td>
</tr>
<tr>
<td>Proportion of the sample above this threshold</td>
<td>13.22%</td>
<td>1.40%</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>4629</td>
<td>4629</td>
<td>2938</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.25</td>
<td>0.25</td>
<td>0.27</td>
</tr>
</tbody>
</table>
Main estimates

Graphic representation: 1985-2007

Regulation impact on TFP growth

-6%  -4%  -2%  0%  2%

p10 : 0.155 (85%)
p25 : 0.288 (75%)
p50 : 0.436 (64.7%)
p75 : 0.606 (54.6%)
p90 : 0.809 (44.5%)

p10 reg : 0.061
p50 reg : 0.150
p90 reg : 0.249
Main estimates

Economic significance
Implied MFP gains from reforms

• Proxying upstream competition with the OECD indicators makes it possible to link policies to MFP
• Different experiments are possible: simpler one is instantaneous alignment in 2000 on sectoral “best practice” observed in 2007
• Compute yearly and total gains in 2007 relative to baseline
• In each period $t$ two sources of changes in MFP:

  - Direct effect through $\left( \alpha_3 + \alpha_4 \cdot gap_{t-1} \right) \Delta REN$

  - Recursive effect through $\left( (1 - \alpha_0) + \alpha_4 \cdot REG^B_{t-1} \right) \Delta gap$

where $\Delta$ is relative to best practice $B$
MFP gains from reforms
Based on 1995-2007 estimates and 2000 national I-O tables

Cross-country differences in MFP gains depend on:
- excess upstream regulation relative to best practice
- intensity in use of regulated inputs
- distance to frontier
- industrial structure (aggregate MFP gain computed with sectoral VA shares)
Robustness

Estimates are robust to:

• Changes in country and sector coverage
• Changes in I-O matrices used to compute REG
• Using sectoral instead of aggregate PPP
• Changes in measurement of MFP (labour share, “structural” instead of observed MFP)
• Using labour productivity instead of MFP
• Excluding the six upstream sectors from sample

But are sensitive to price measurement in “electrical and optical equipment” sector in US
Conclusions

• Barriers to competition in upstream sectors curb MFP growth downstream, and more strongly so
  – closer to the technological frontier
  – over the past 15 years, when neck-and-neck competition increased due to globalization and ICT diffusion

• Potential MFP gains of policies reducing ‘regulatory burden’ are sizeable, and more so in countries
  – where excess burdens are high
  – and that are close to the technological frontier (e.g. ITA)

• Under realistic assumptions best practice reforms in Euro area in 2010 could imply an acceleration of (non-farm) business sector MFP by 1.1 percentage points relative to baseline over the following 5 years