THE BEST VERSUS THE REST: DIVERGENCE ACROSS FIRMS, THE GLOBAL PRODUCTIVITY SLOWDOWN AND THE ROLE OF PUBLIC POLICY

Peter Gal
OECD | Economics Department

Based on joint work with
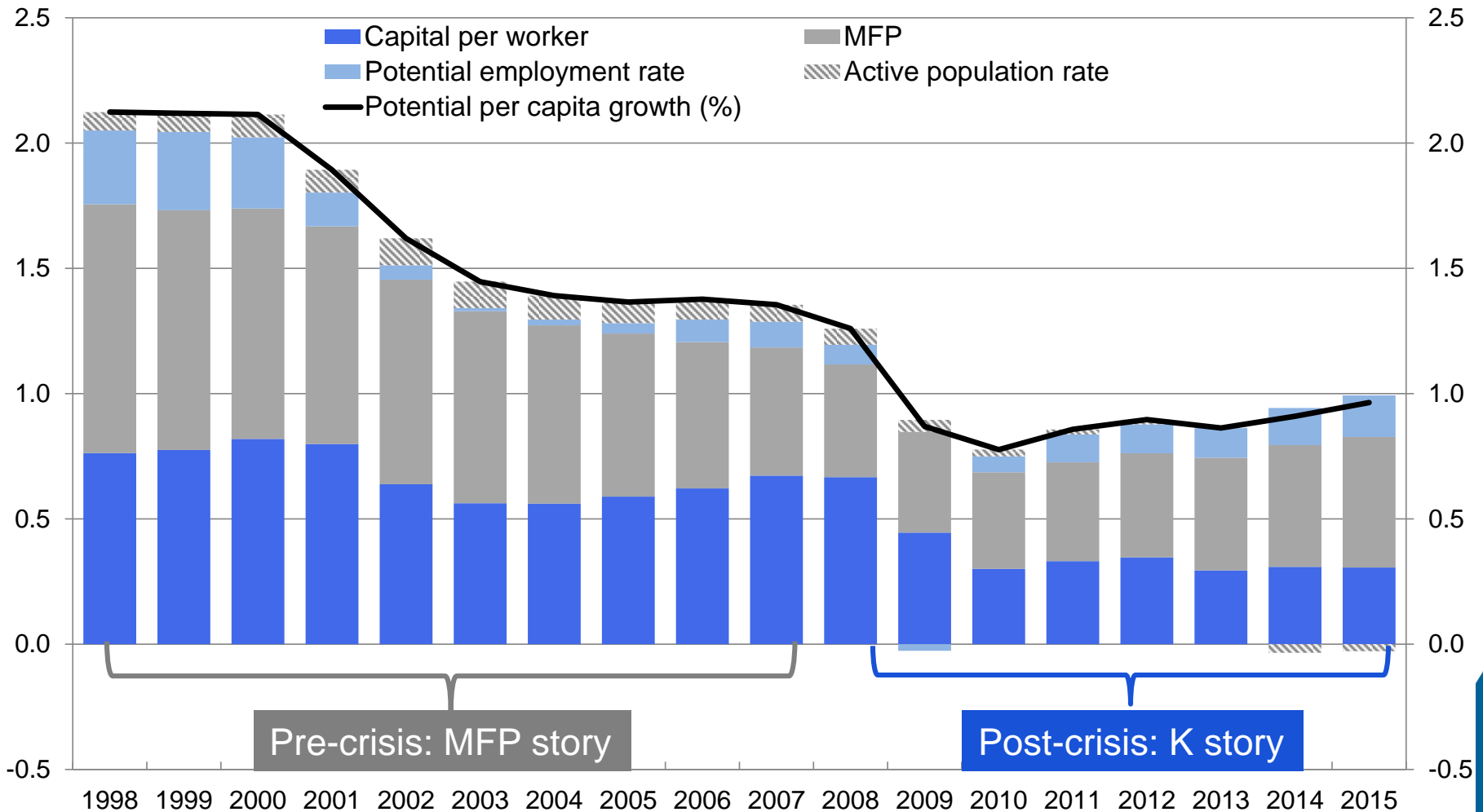*Dan Andrews and Chiara Criscuolo*

Groningen Growth and Development Centre
25th Anniversary Conference
June 2017

GLOBAL FORUM ON PRODUCTIVITY

OECD
BETTER POLICIES FOR BETTER LIVES

Weak labour productivity underpins the collapse in OECD potential growth

Contribution to potential per capita output growth

Source: OECD Economic Outlook 2016, Volume 1.

Our contribution: bring more micro evidence to a largely macro debate

Key findings:

1. Productivity at Global Frontier remained robust but **laggard** firms increasingly **fell behind**.

2. Some **explanations**:

   1. "Winner takes all" dynamics
   2. Stalling diffusion of technologies
   3. Market dynamism fell

   Capabilities?

   Incentives?

3. **Policy** weakness amplified MFP divergence and hence the productivity slowdown

DATA AND MEASUREMENT

Data and measurement

- **Data: Orbis**
  - Balance sheets and income statements from BvD
  - 24 OECD countries, 1997-2014
  - Both manufacturing and services
  - Large and small firms (we restrict to 20+ employees)

- Measuring **productivity**
  - Labour producivity (deflated, PPP converted at industry level)
  - MFP (prod.fn. estimation based Wooldridge + markup correction)

- Measuring the **Global Frontier** ("top 5%")
  - Set of best-performing productivity outcomes within industries
  - Schumpeterian growth → most innovative firms change over time
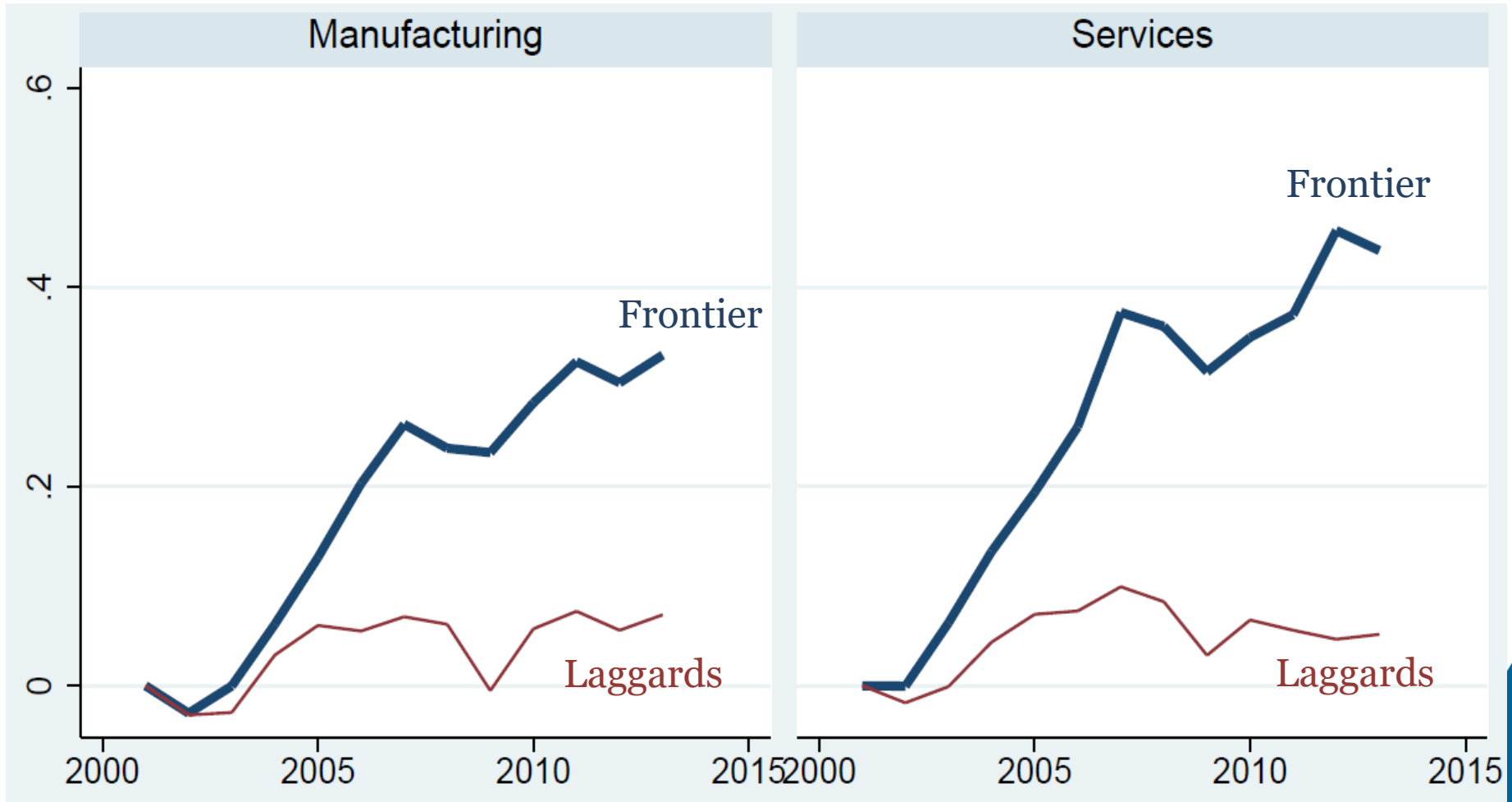
PRODUCTIVITY DIVERGENCE:
THE FINDINGS

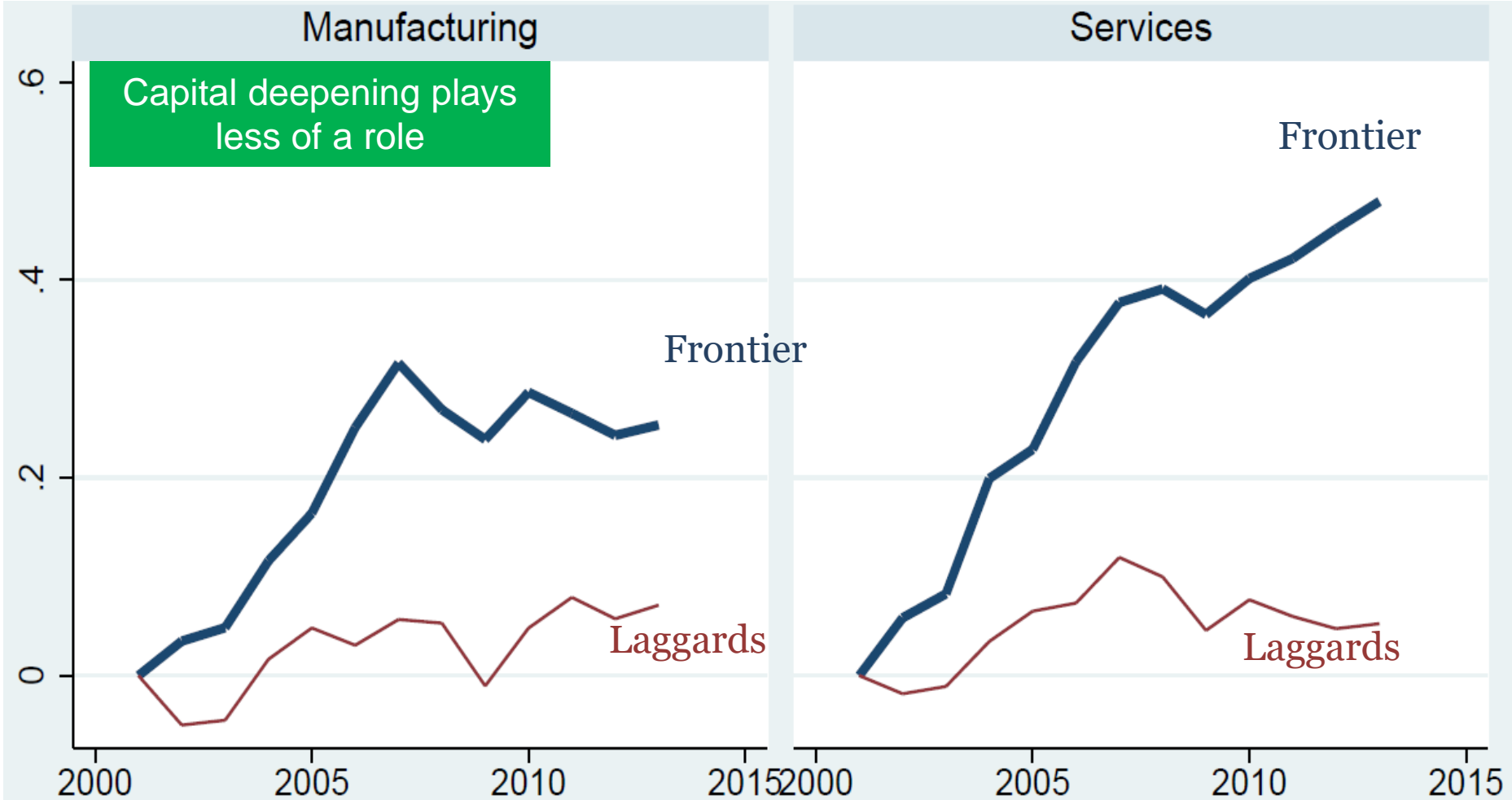# Rising labour productivity gap between global frontier and laggards

Average of labour productivity across each 2-digit sector (log, 2001=0)
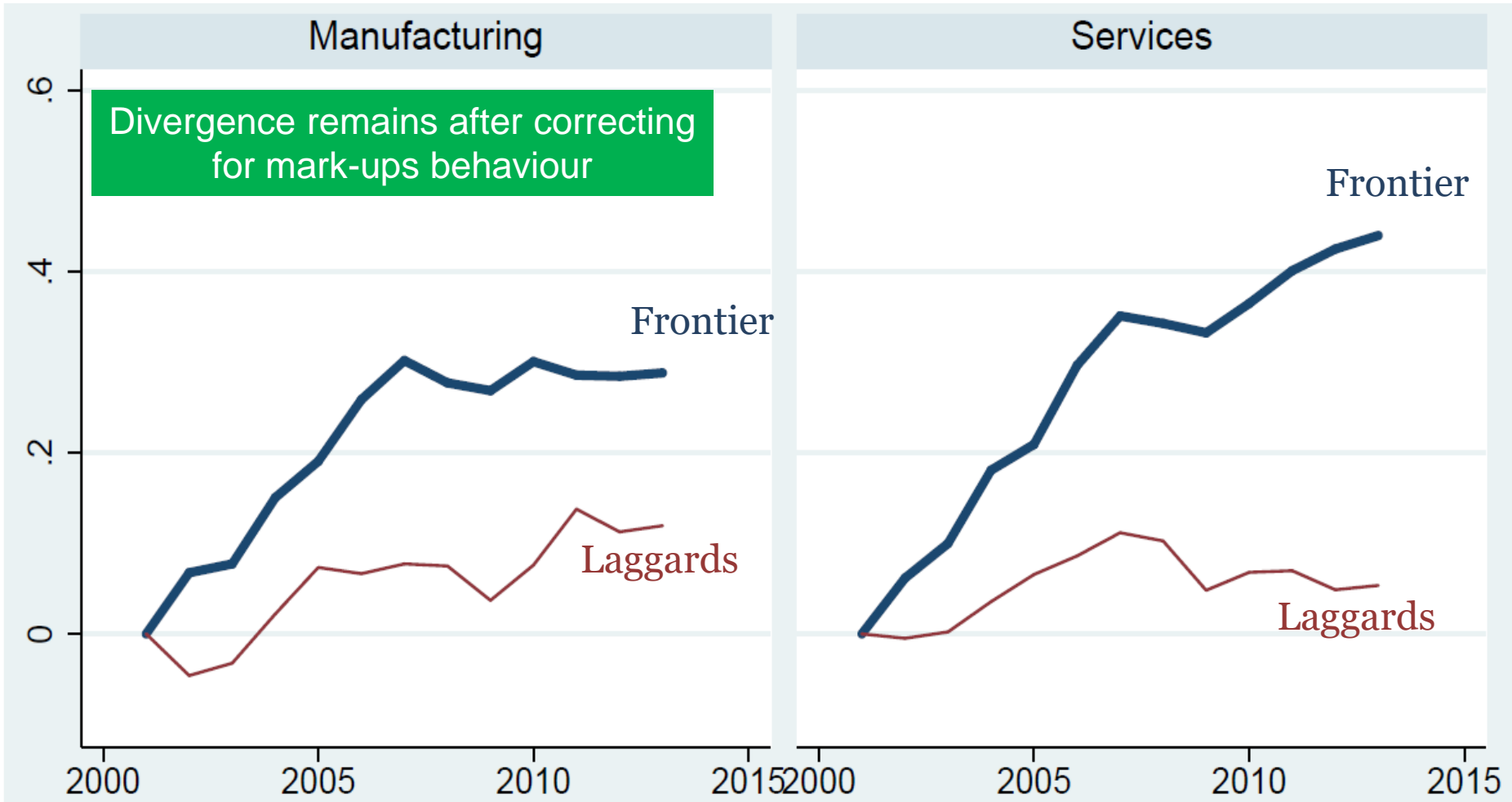
... largely reflects MFP divergence

Average of MFPR across each 2-digit sector (log, 2001=0)

Manufacturing

Capital deepening plays less of a role

Frontier

Laggards

Services

Frontier

Laggards

... which may reflect "technological" divergence

Average of mark-up adjusted MFPR across each 2-digit sector (log, 2001=0)
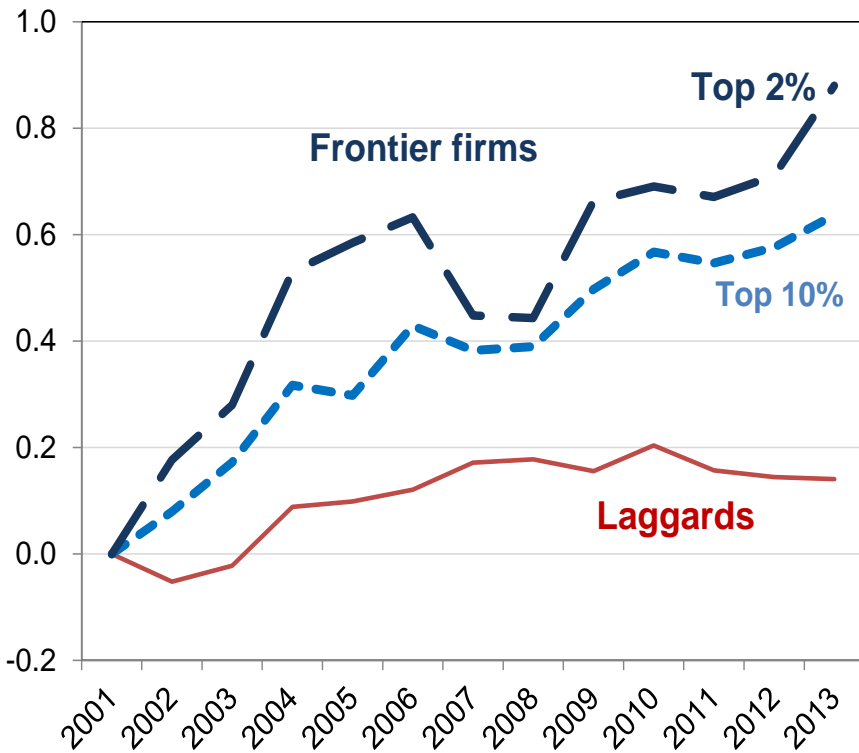
PRODUCTIVITY DIVERGENCE: *POTENTIAL DRIVERS*
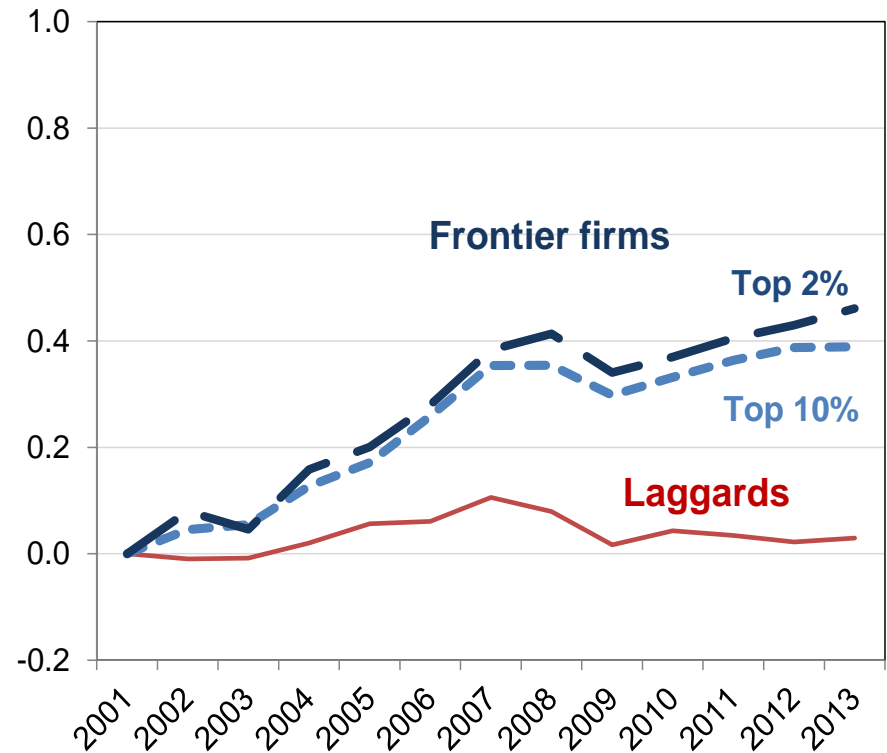
Diverging capabilities?
" Winner takes all" at the frontier?

MFPR divergence

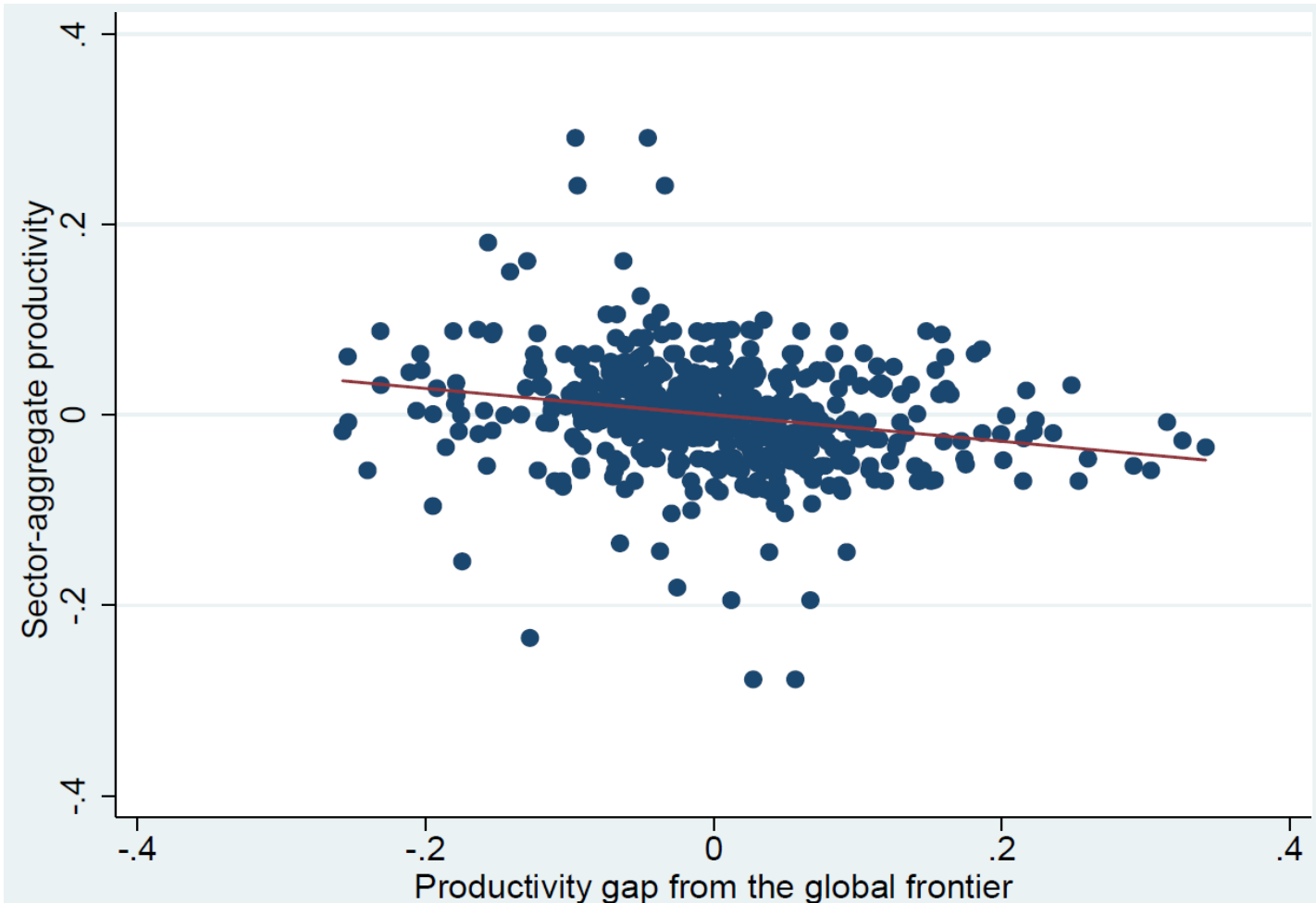ICT-intensive services

Non ICT-intensive services

But more MFP divergence across firms ~ worse aggregate performance

Residual aggregate MFP and the MFPR gap at the industry level; 1998-2007
Data averaged across 12 OECD countries and purged of industry and year fixed effects

Lack of capabilities?
Catch-up of laggards weakening

Estimated convergence parameter from a neo-Schumpeterian model
Dotted line: 95% confidence intervals

A: MFPR
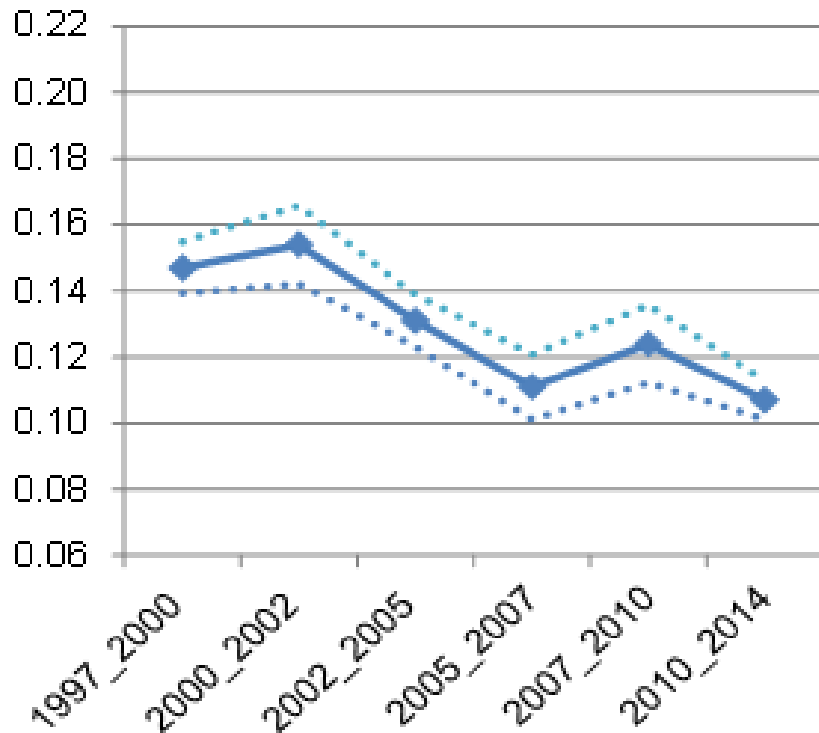
B: Mark-up adjusted MFPR
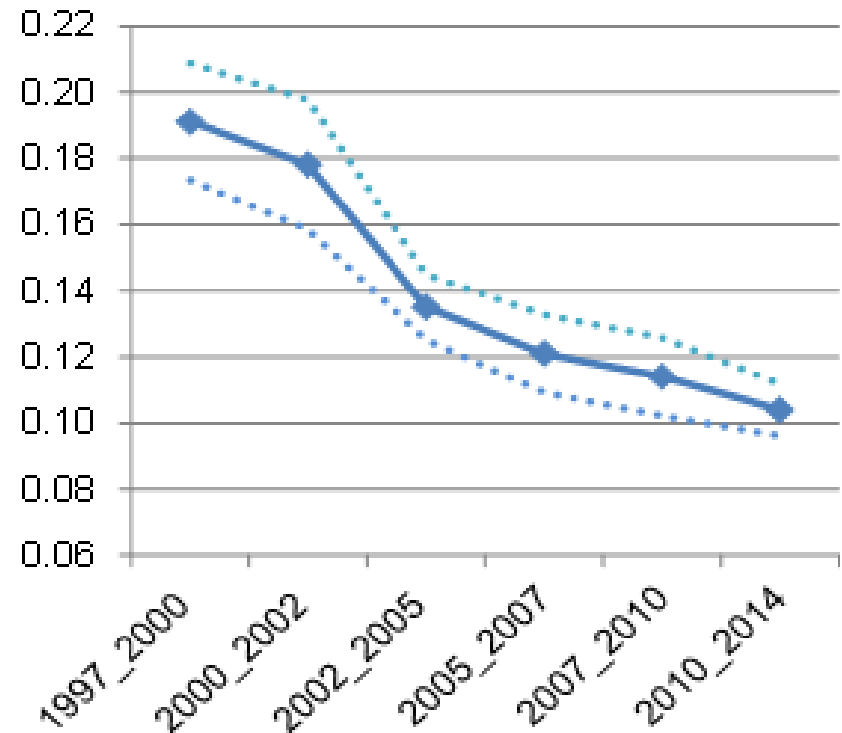
$$\Delta \ln A_{icst} = \delta_1 \Delta \ln A_{Fcst} + \delta_2 gap_{icst-1} + \sum_j \delta_3^j gap_{icst-1} * D_t^j + \sum_j \delta_4^j X_{isct}^j + \delta_s + \delta_{ct} + \varepsilon_{icst}$$

Lack of capabilities?
Harder to reach frontier as it's more entrenched

Proportion of frontier firms in time *t* according to their frontier status in *t-2*

Manufacturing

Services

From top 20%

From top 10%

From top 5%

Lack of incentives?
Signs of weakening market contestability

Share of firms
Percent

Young firms (0-5 years)

Mature firms (6-10 years)

Non-viable old firms (older than 10 years)

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
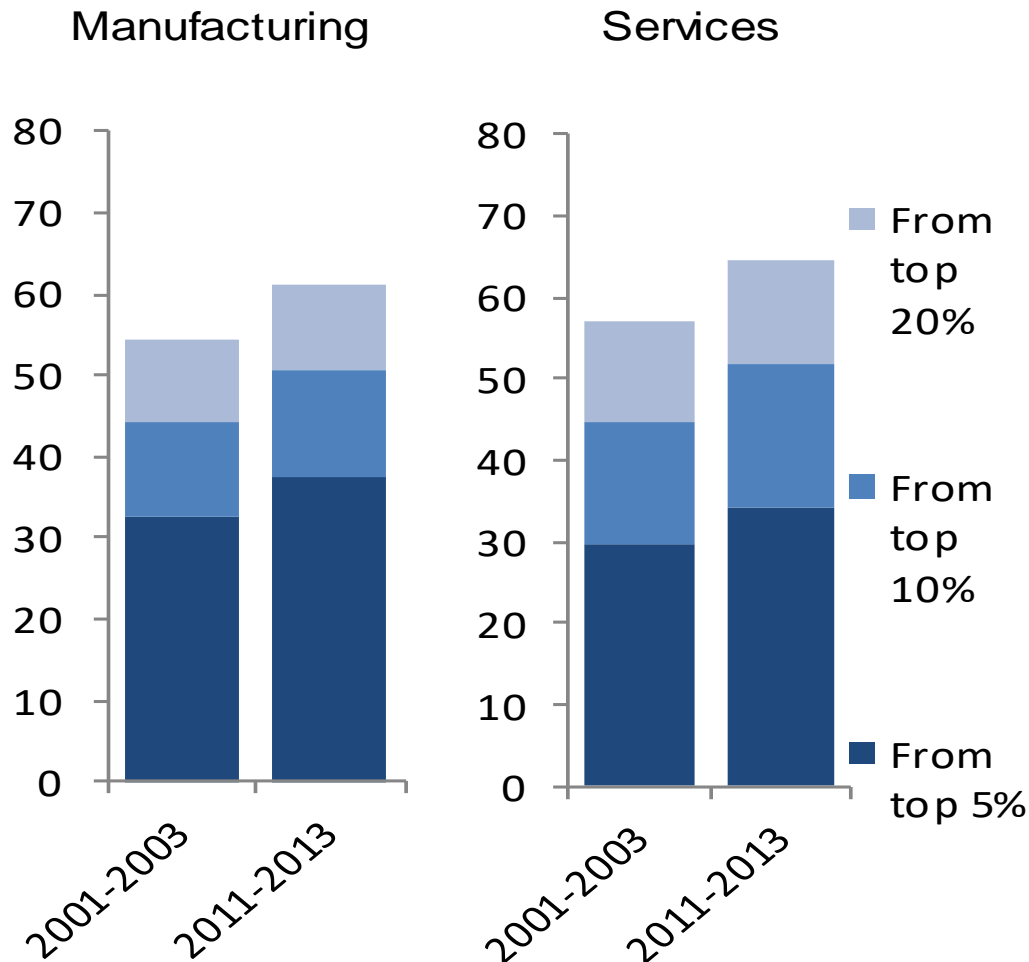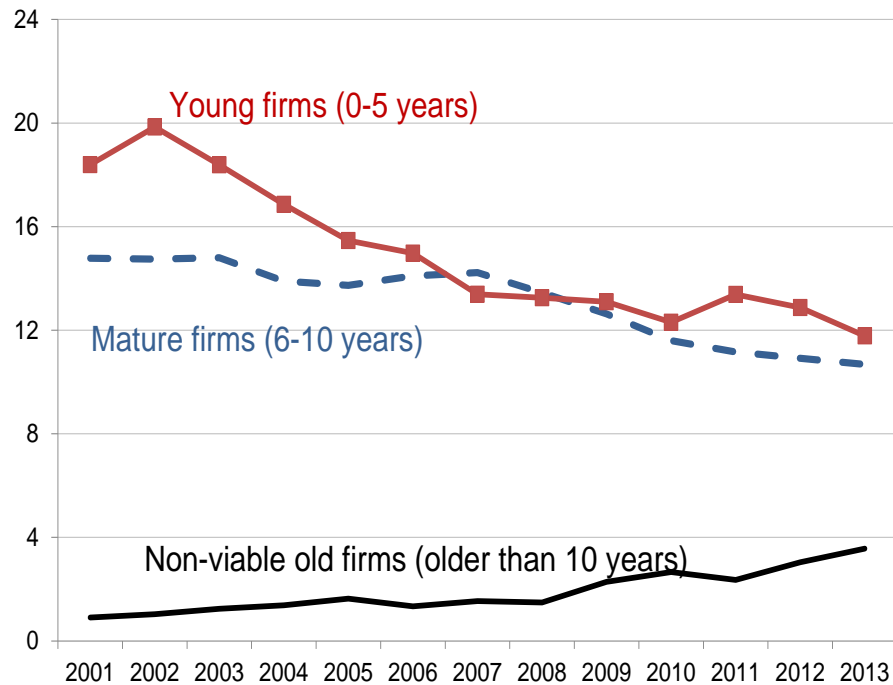
Declining firm turnover: fewer young firms, while marginal firms increasingly survive.

MFPR relative to viable old firms
Log point differential

Mature firms (6-10 years)

Young firms (0-5 years)

Non-viable old firms (older than 10 years)

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
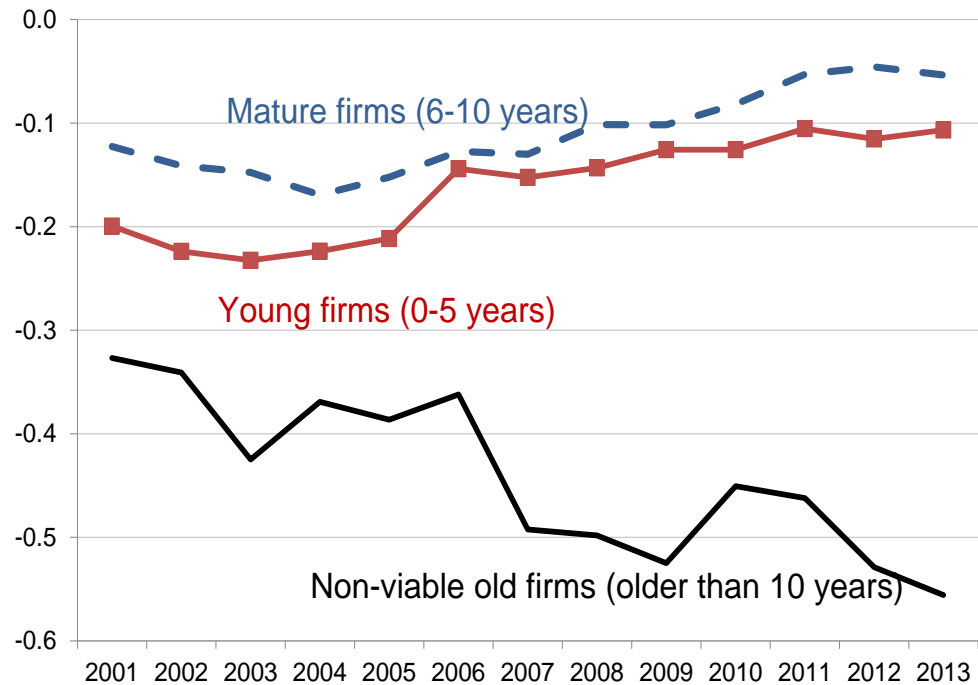
A higher productivity threshold for entry, while marginal firms survive despite a collapse in their MFPR

Notes: Non-viable old firms are those older than 10 years that record negative profits over at least two consecutive years. The omitted group are firms older than 10 years that do not record negative profits over at least two consecutive years (viable old firms).

PRODUCTIVITY DIVERGENCE:
ROLE OF POLICY

The pace of deregulation in services has slowed

The restrictiveness of product market regulations

A: Network industries

B: Professional Services
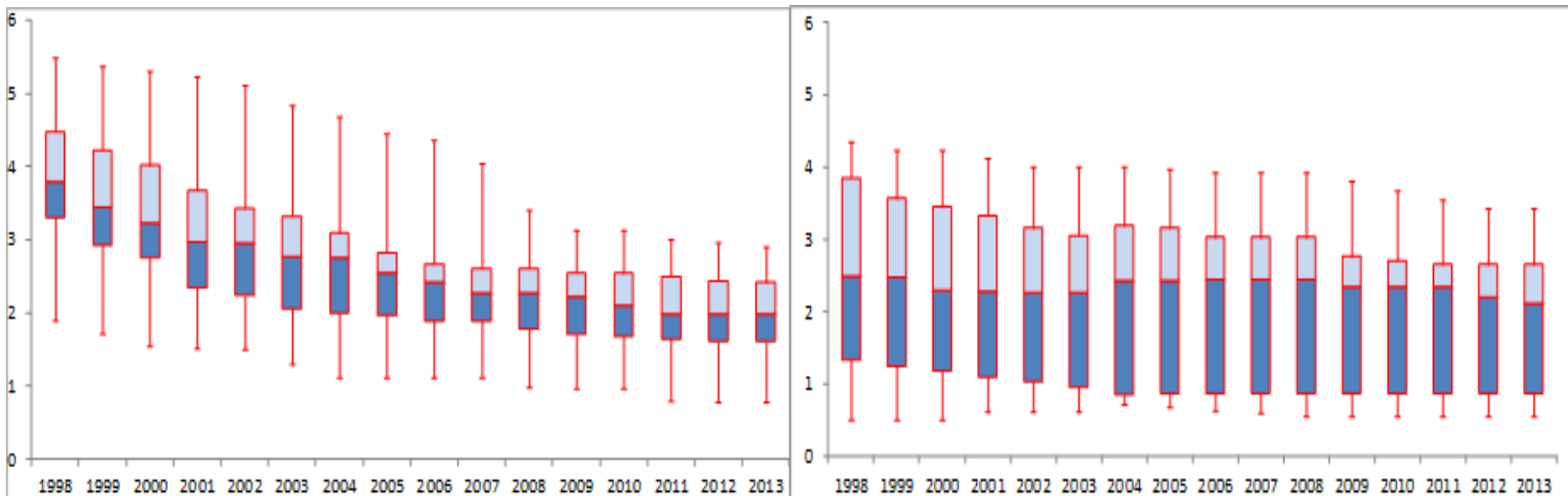
Notes: The horizontal line in the boxes represents the median, the upper and lower edges of each boxes reflect the 25th and 75th percentiles and the markers on the extremes denote the maximum and the minimum across countries.

Slower product market reform: a larger increase in the gap

Empirical approach:
country x industry x year level regressions

1. OLS of long differences:

$$\Delta^{ld} MFPgap_{s,c,t} = \beta_0 + \beta_1 \Delta^{ld} PMR_{s,c,t} + \beta_2 \Delta^{ld} E_{s,c,t} + \delta_c + \delta_s + \delta_t + \varepsilon_{s,c,t}$$

2. Instrumental variables of long differences:
   "Reform pressure" or "reform waves"

Slower product market reform: a larger increase in the gap

MFP divergence and product market regulation in services
Estimation method: five-year long differences (1998-2013)

	Y: Δ MFP gap		Y: Δ Mark-up corrected MFP gap	
	(1)	(2)	(3)	(4)
Δ Product Market Regulation$_{s,c,t}$	0.205***	0.231***	0.332***	0.311**
	(0.065)	(0.083)	(0.103)	(0.132)
Country fixed effects	YES	NO	YES	NO
Industry fixed effects	YES	YES	YES	YES
Year fixed effects	YES	NO	YES	NO
Country X year fixed effects	NO	YES	NO	YES
Observations	458	458	376	376
R-squared	0.201	0.323	0.327	0.463

Notes: Cluster robust standard errors (at the industry-year level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Both the MFP gap and the PMR indicator are measured in log terms. The MFP gap is calculated at the country-industry-year level, by taking the difference between the global frontier and the average of log productivity of non-frontier firms.

Slower product market reform: a larger increase in the gap

MFP divergence and product market regulation in services
Estimation method: IV (1998-2013)

	"Reform pressure"		"Reform waves"	
Δ Product Market Regulation$_{s,c,t}$	0.326**	0.338*	0.569***	0.676***
	(0.163)	(0.194)	(0.189)	(0.179)
Country fixed effects	YES	NO	YES	NO
Industry fixed effects	YES	YES	YES	YES
Year fixed effects	YES	NO	YES	NO
Country X year fixed effects	NO	YES	NO	YES
Observations	458	458	458	458
R-squared	0.193	0.318	0.125	0.235

Notes: Cluster robust standard errors (at the industry-year level) in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$ Both the MFP gap and the PMR indicator are measured in log terms. The MFP gap is calculated at the country-industry-year level, by taking the difference between the global frontier and the average of log productivity of non-frontier firms.

Summary

- The slowdown in aggregate productivity growth masks an **increasing divergence** between GF and laggard firms

- Technological and structural changes could
  - lead to "winner takes all" dynamics
  - make adoption more difficult
  - → Signs of declining **capacity** to catch up and use latest technologies

- But **incentives** seem to have weakened too:
  - Declining market contestability
  - Regulatory policy plays a role

THANK YOU

peter.gal@oecd.org

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ADDITIONAL SLIDES

The Global Frontier: Who are they?
Descriptives in brief

- Frontier firms have
  - larger market shares
  - higher capital intensity
  - higher wages
  - higher mark-ups
  - more patents

    … More so in services than in manuf.
- Productivity gap is also higher in services

- Frontier is composed of various countries

The globally most productive firms: *Who are they?*

A: Labour productivity based frontier definition

	Sector: manufacturing												Sector: services											
	Laggard firms			Frontier-firms			Difference		Laggard firms			Frontier-firms			Difference	
Variables	Mean	St.dev.	N	Mean	St.dev.	N			Mean	St.dev.	N	Mean	St.dev.	N		
Productivity	10.7	0.6	21,191	12.0	0.4	825	1.3	***	10.4	0.7	22,053	11.9	0.7	627	1.5	***
Employees	49.3	52.1	21,191	45.1	33.8	825	-4.2	***	59.5	156.6	22,053	38.0	24.8	627	-21.6	***
Capital-labour ratio[1]	86.1	115.3	21,191	274.5	425.5	825	188.4	***	76.4	214.0	22,053	677.5	2,071.1	627	601.1	***
Revenues[2]	11.8	21.6	21,191	39.0	58.8	825	27.3	***	14.8	54.0	22,053	57.9	133.0	627	43.1	***
Markup (log)	0.1	0.4	21,191	0.1	0.4	825	0.05	***	0.1	0.4	22,053	0.3	0.5	627	0.19	***
Wages[1]	34.2	16.7	21,191	54.6	20.1	825	20.4	***	34.5	16.7	22,053	56.6	23.4	627	22.1	***

B: MFPR based frontier definition

	Sector: manufacturing												Sector: services											
	Laggard firms			Frontier-firms			Difference		Laggard firms			Frontier-firms			Difference	
Variables	Mean	St.dev.	N	Mean	St.dev.	N			Mean	St.dev.	N	Mean	St.dev.	N		
Productivity	10.4	0.6	21,317	11.6	0.4	706	1.3	***	10.3	0.7	22,147	11.7	0.7	538	1.4	***
Employees	48.3	46.8	21,317	73.7	126.0	706	25.4	***	59.1	155.3	22,147	53.4	115.6	538	-5.6	
Capital-labour ratio[1]	89.3	125.1	21,317	214.3	406.0	706	125.1	***	81.1	245.5	22,147	579.6	2,131.7	538	498.5	***
Revenues[2]	11.5	19.9	21,317	50.5	74.1	706	39.0	***	14.4	40.1	22,147	80.2	268.0	538	65.7	***
Markup (log)	0.1	0.4	21,317	0.0	0.4	706	-0.02		0.1	0.4	22,147	0.2	0.5	538	0.12	***
Wages[1]	34.3	16.7	21,317	56.3	18.9	706	22.0	***	34.6	16.8	22,147	56.8	23.9	538	22.2	***

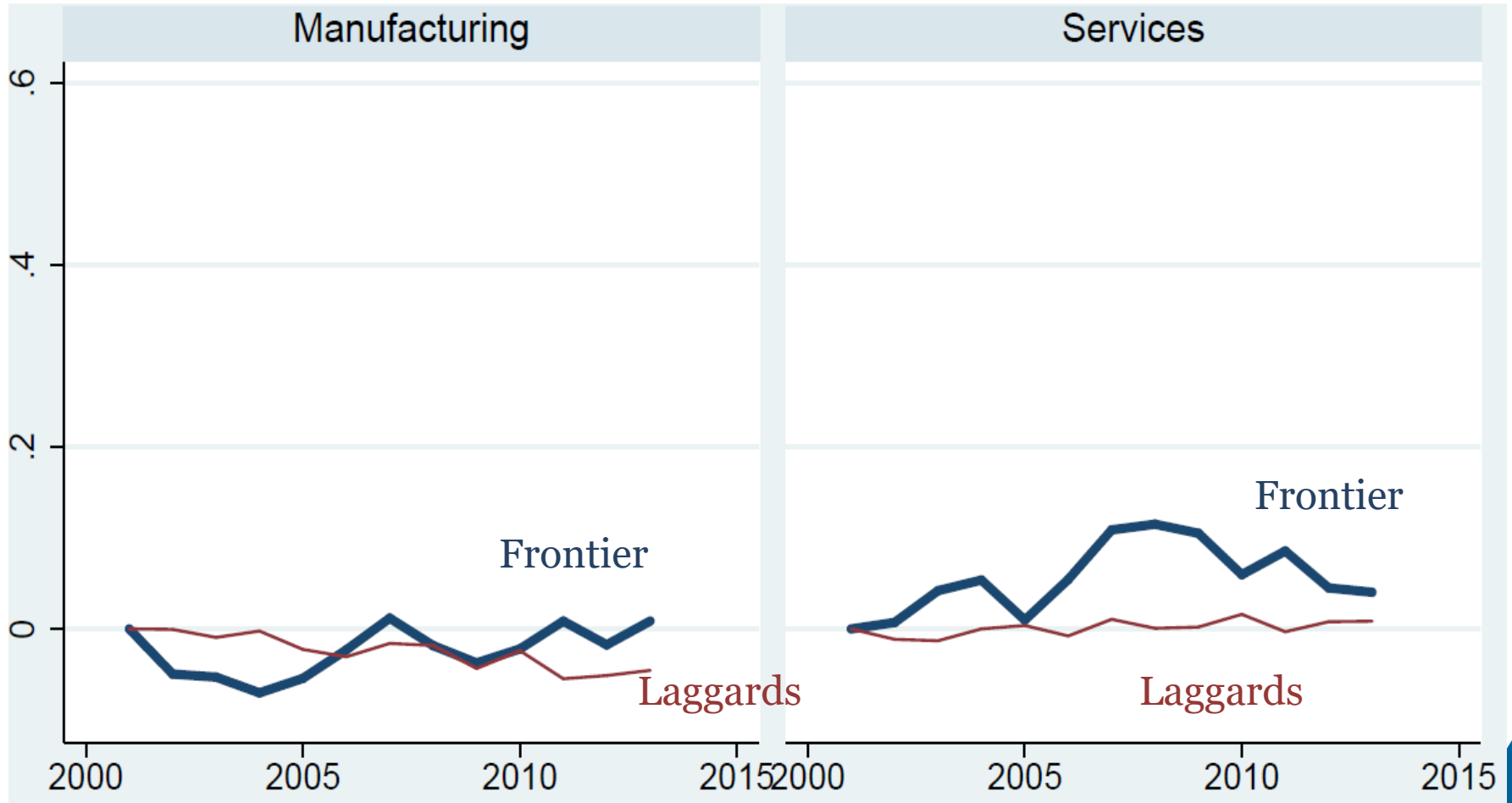# How much is it a capital deepening story?

Average capital deepening across each 2-digit sector (log, 2001=0)
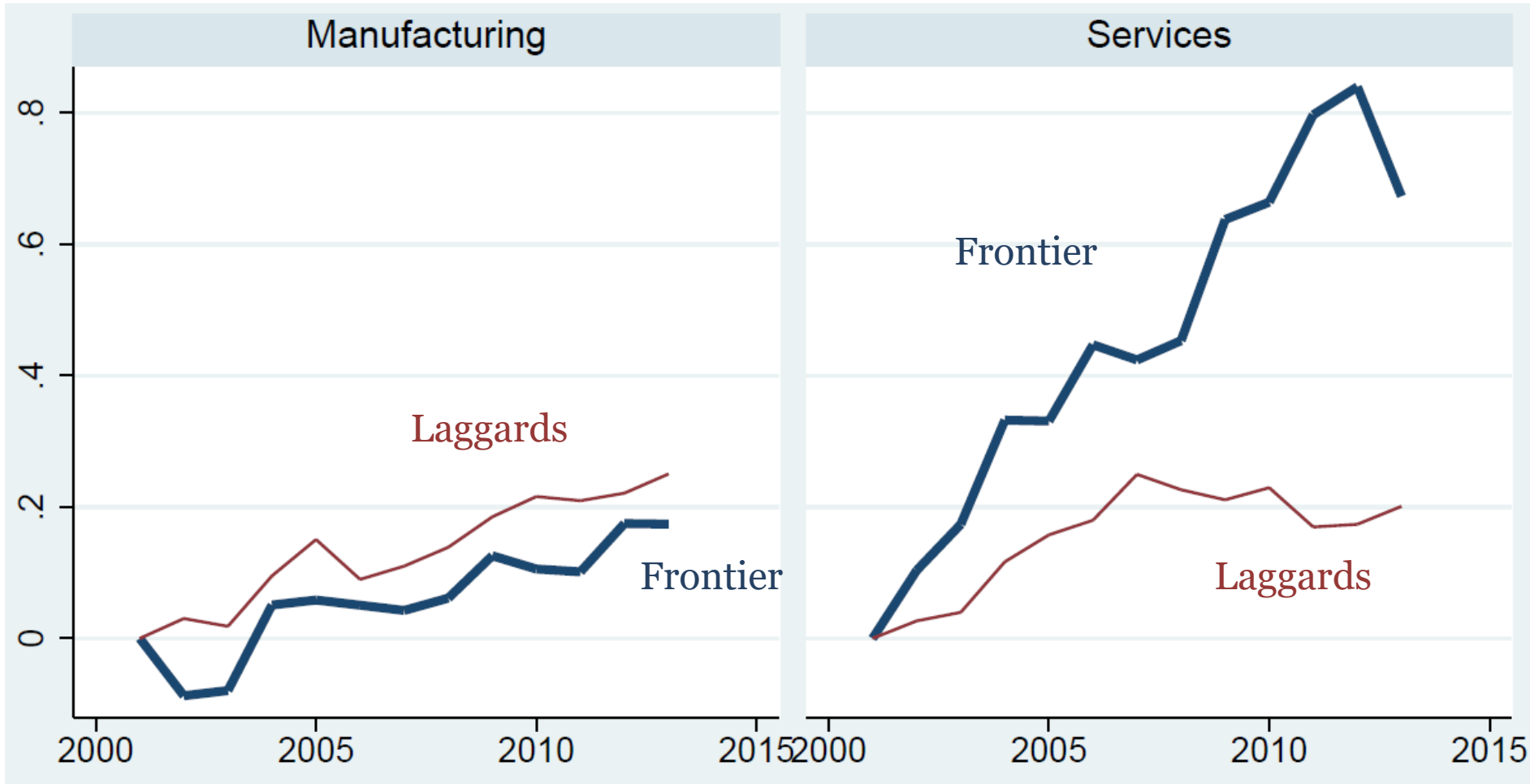
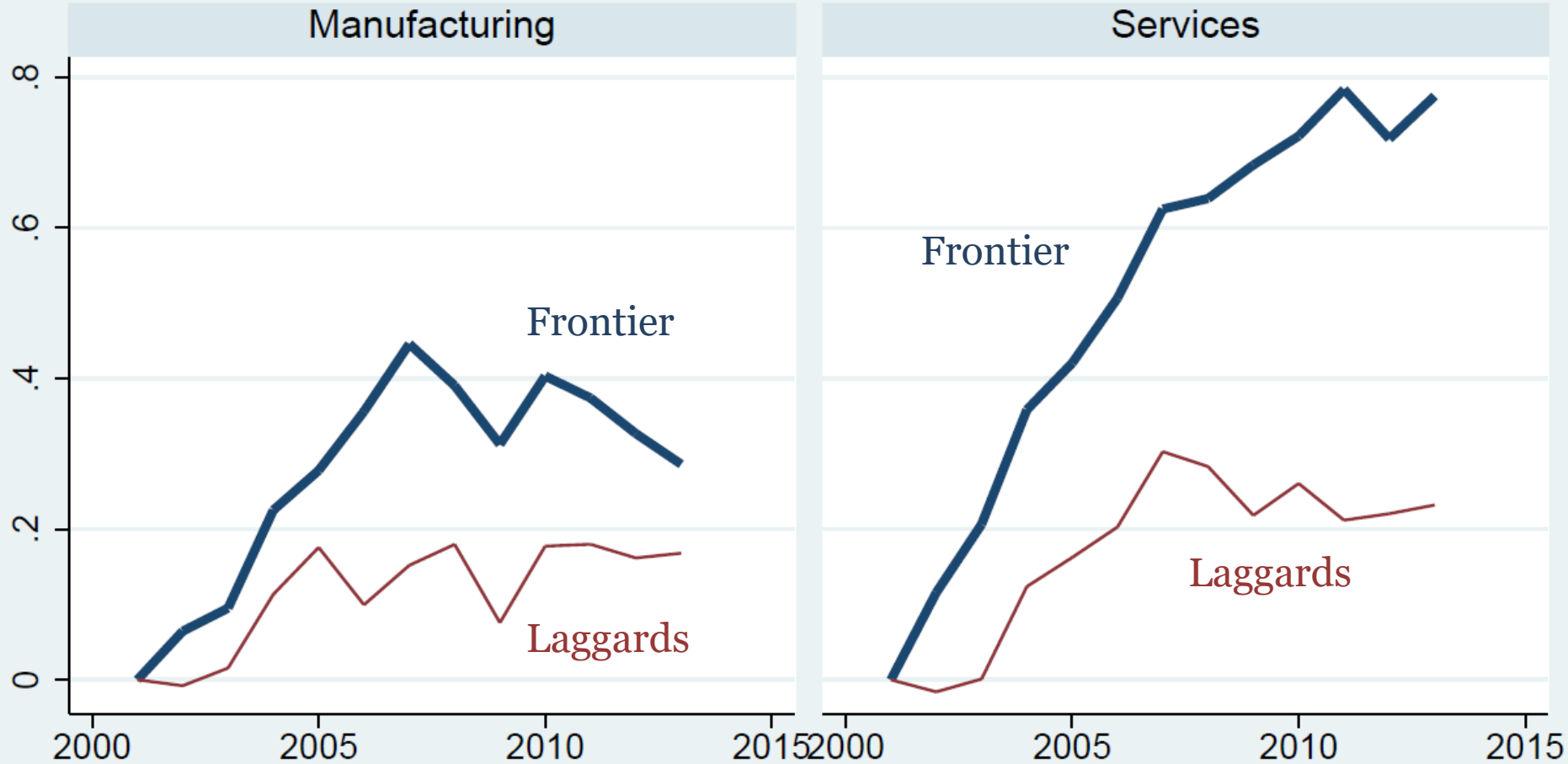# Mark-ups for frontier firms has grown in services but not in manufacturing

Average estimated mark-up across each 2-digit sector (log, 2001=0)

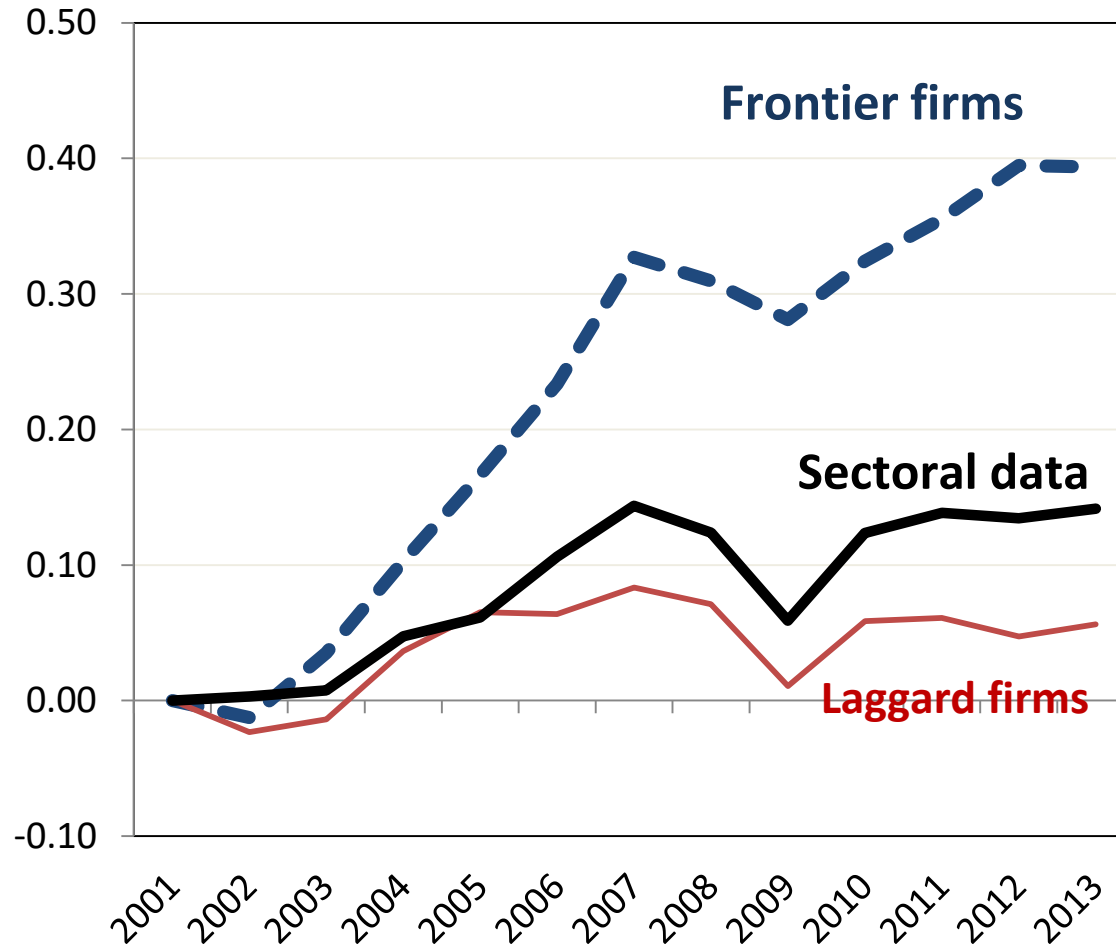# Frontier firms are *getting larger in terms of sales*

Average of log sales for global frontier firms and the rest
Based on top 5% of MFP; index, 2001=0

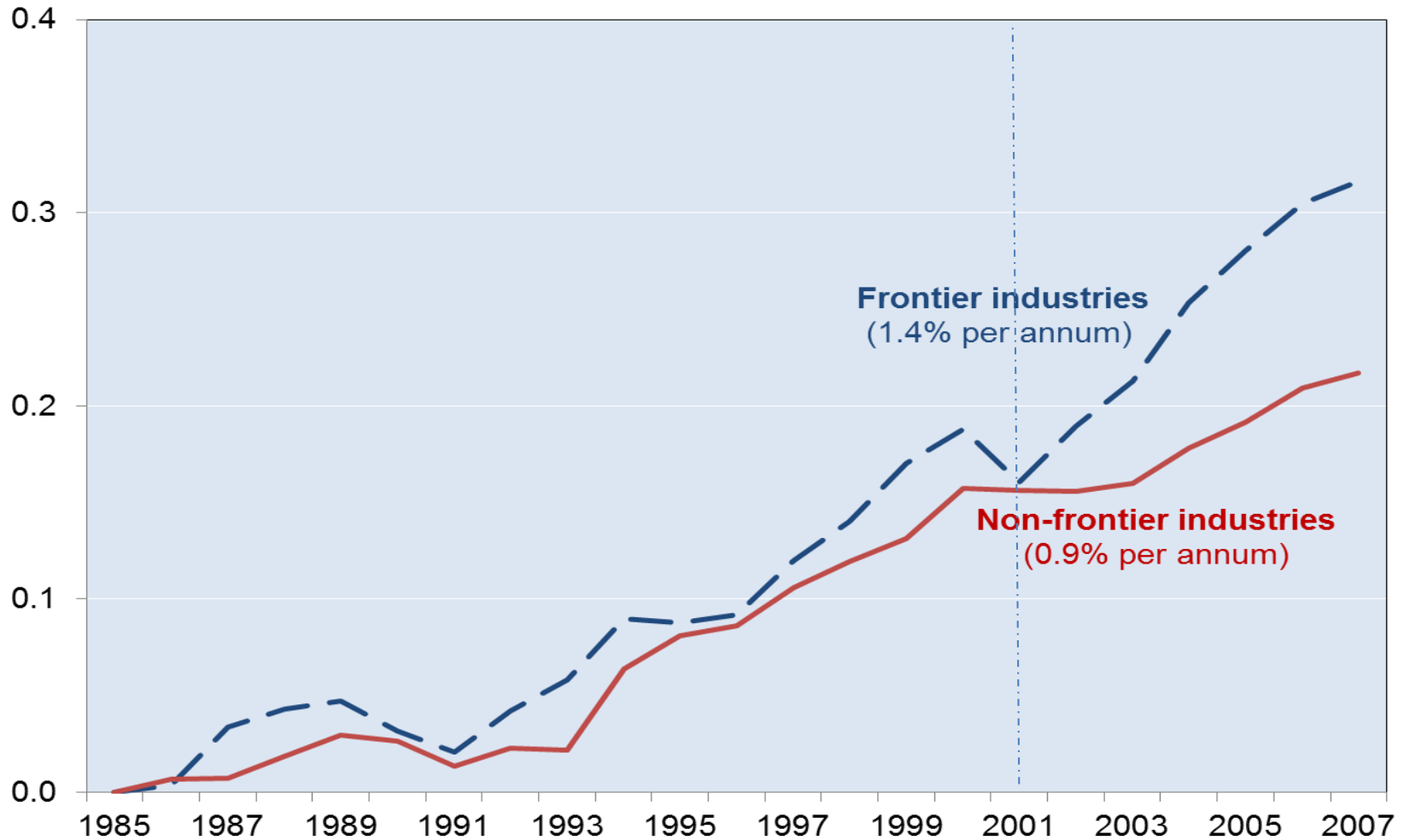# Firm-level patterns *vs* average industry level productivity

Labour Productivity in the Business Sector

Industry-level data show bigger divergence from early 2000s

Unweighted average of TFP in the non-farm business sector; index 1985=0

Frontier industries
(1.4% per annum)
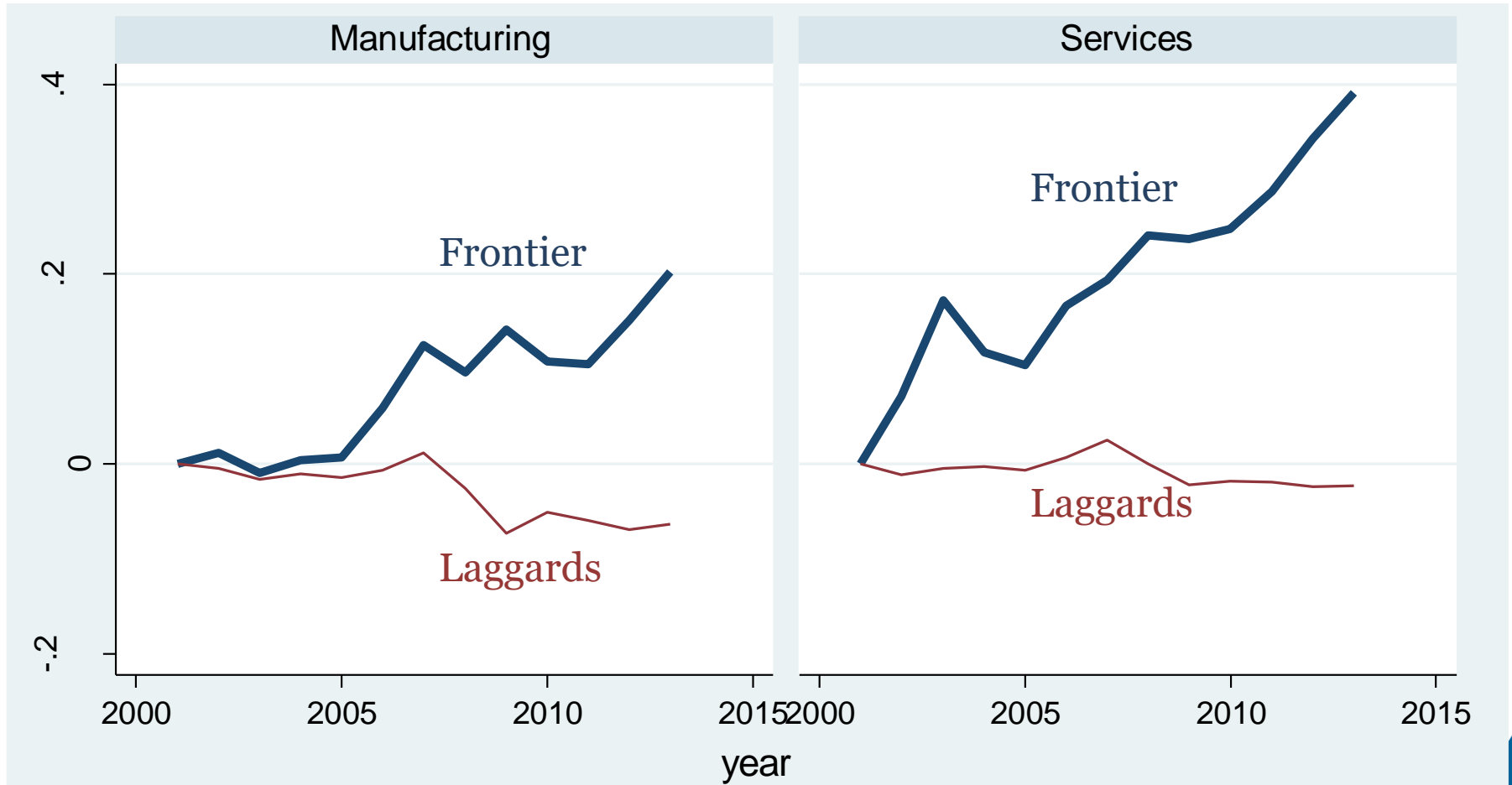
Non-frontier industries
(0.9% per annum)

Source: OECD calculations based on Bourles et al (2013) dataset.

Labour quality adjusted MFP also shows divergence

MFP estimation based on wagebill instead of employment

Productivity estimation (Wooldridge, 2009)

- Value added based production function, estimated separately for each industry:

$$y_{it} = \beta_K^j k_{it} + \beta_L^j l_{it} + \nu_{c,j} + \eta_{t,j} + \varepsilon_{it}$$

- Proxy *g(k,m)* (rich polynomial) for productivity and use GMM to control for endogeneity

$$y_{it}$$
$$= \beta_K^j k_{it} + \beta_L^j l_{it} + g(k_{it-1}, m_{it-1})$$
$$+ \nu_{c,j} + \eta_{t,j} + u_{it}$$

- Define MFP as residual:

$$MFP \qquad \hat{\beta}^j k \qquad \hat{\beta}^j l$$

Mark-up Correction

- $MFPR_{it}^c = MFPR_{it} - \log(\mu_{it})$,where the MFP values are measured in logs and μ denotes the estimated mark-up.

- $MFPR^c$ is purged from mark-up variations and hence is not influenced by market power changes under the assumptions:

  - At least one input of production is fully flexible

  - Firms minimize costs

$$\mu_{it} = \frac{P_{it}}{MC_{it}} = Output\ Elasticity_{ikt} / Output\ Share_{ikt} = \frac{\hat{\beta}_L^j}{ws_{it}}$$

- The labour coefficient is estimated using the GMM estimation method by Wooldridge (2009).

- The denominator is obtained by using a prediction of firm-level value added by a rich polynomial function of observable inputs in order to retain only the anticipated part of output developments.