PRODUCTIVITY, BUSINESS DYNAMICS AND POLICY IN AN ERA OF DIGITAL TRANSFORMATION

Chiara Criscuolo

OECD

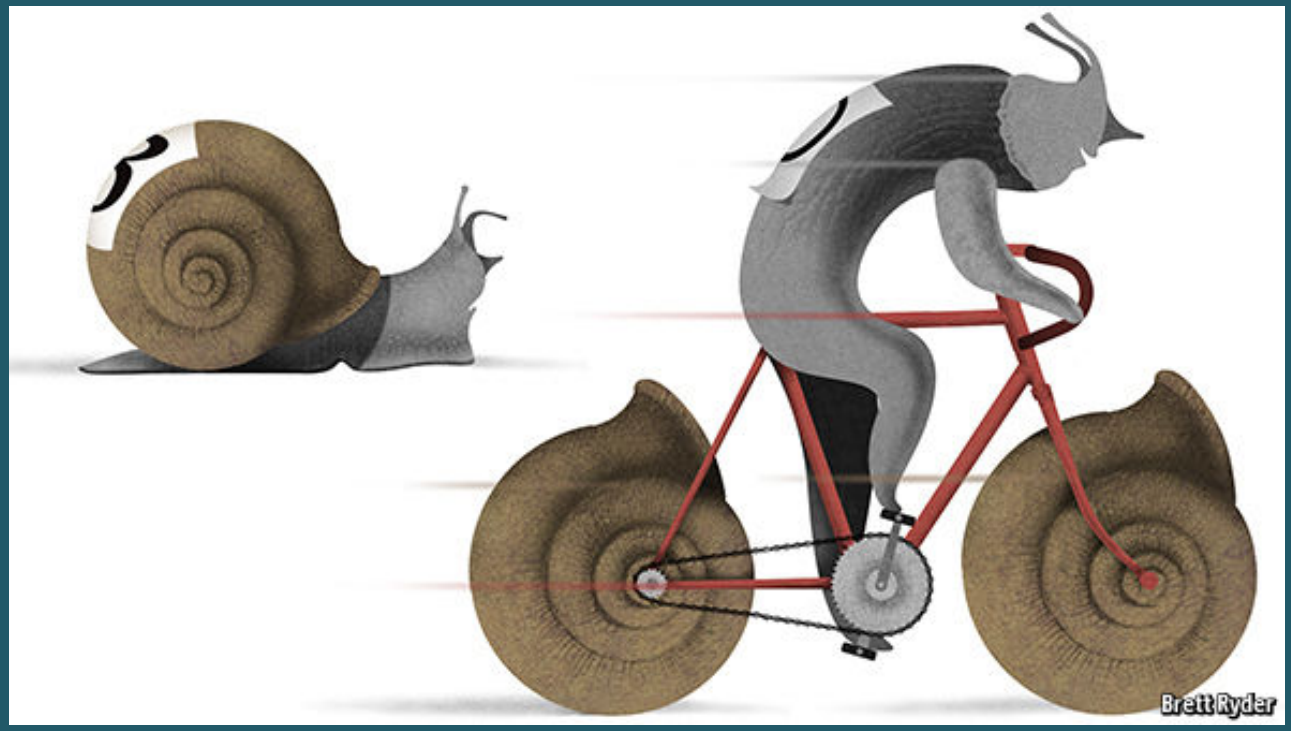
Conference of the National Productivity Board

Lisbon, 29 March 2019

BETTER POLICIES FOR BETTER LIVES

The Digital transformation paradox?

- New version of Solow's productivity paradox? Why do we see digital everywhere, but not (yet) in the productivity statistics?
- Is this what we see?
  - Do we see "digital" everywhere?
  - What do we see happening in markets?
    - Leaders "doing well", but
    - laggards not keeping pace and increasingly so,
    - a slowdown in business dynamics and
    - possible changes in business environment
- Policy holds the key
  - It can help smooth out the transition to a digital economy
  - Maintain a level playing field
  - double dividends →
    - digitalisation, productivity growth and inequality

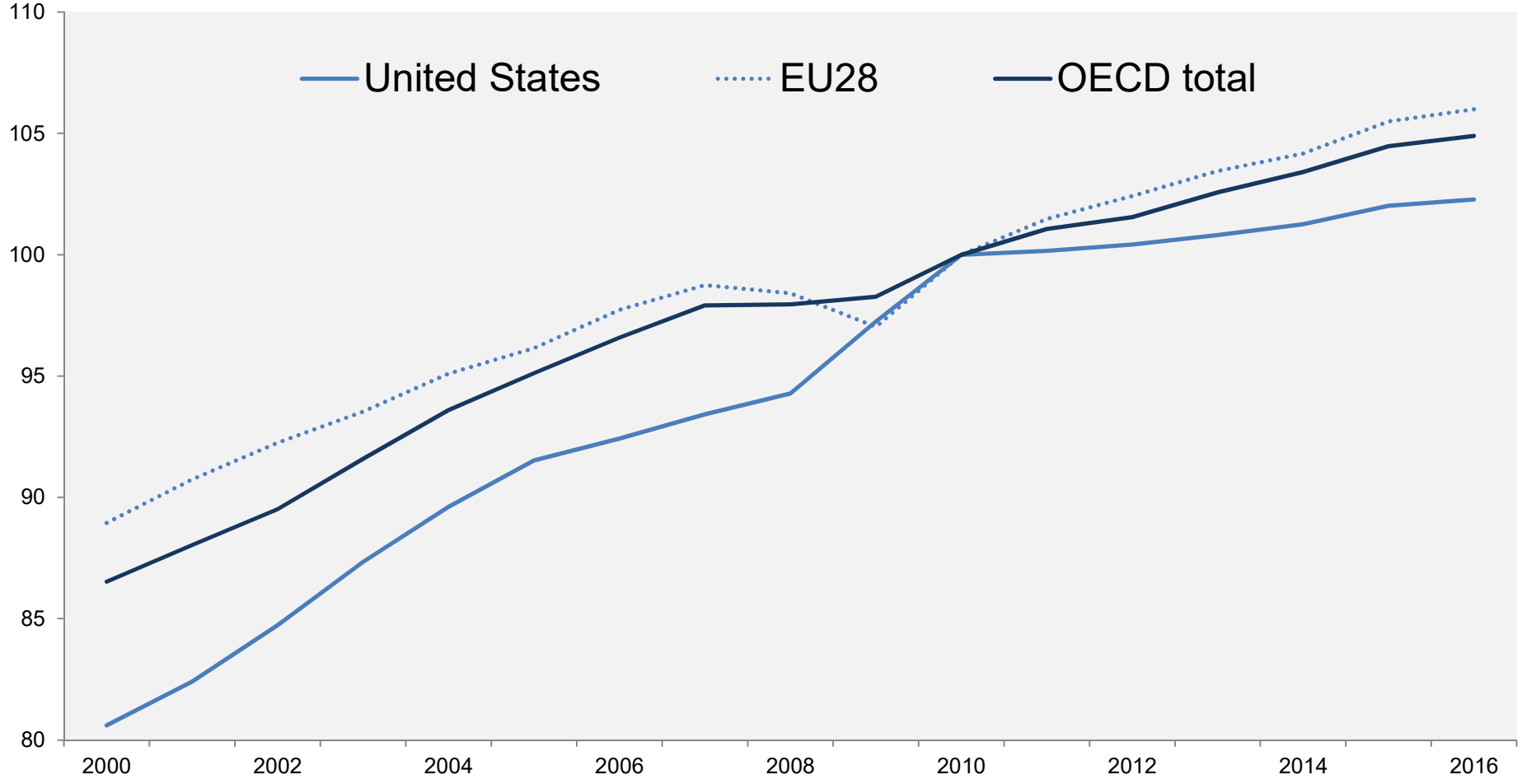


PRODUCTIVITY AND BUSINESS DYNAMICS IN THE NEW MILLENIUM

A STORY OF LEADERS AND LAGGARDS

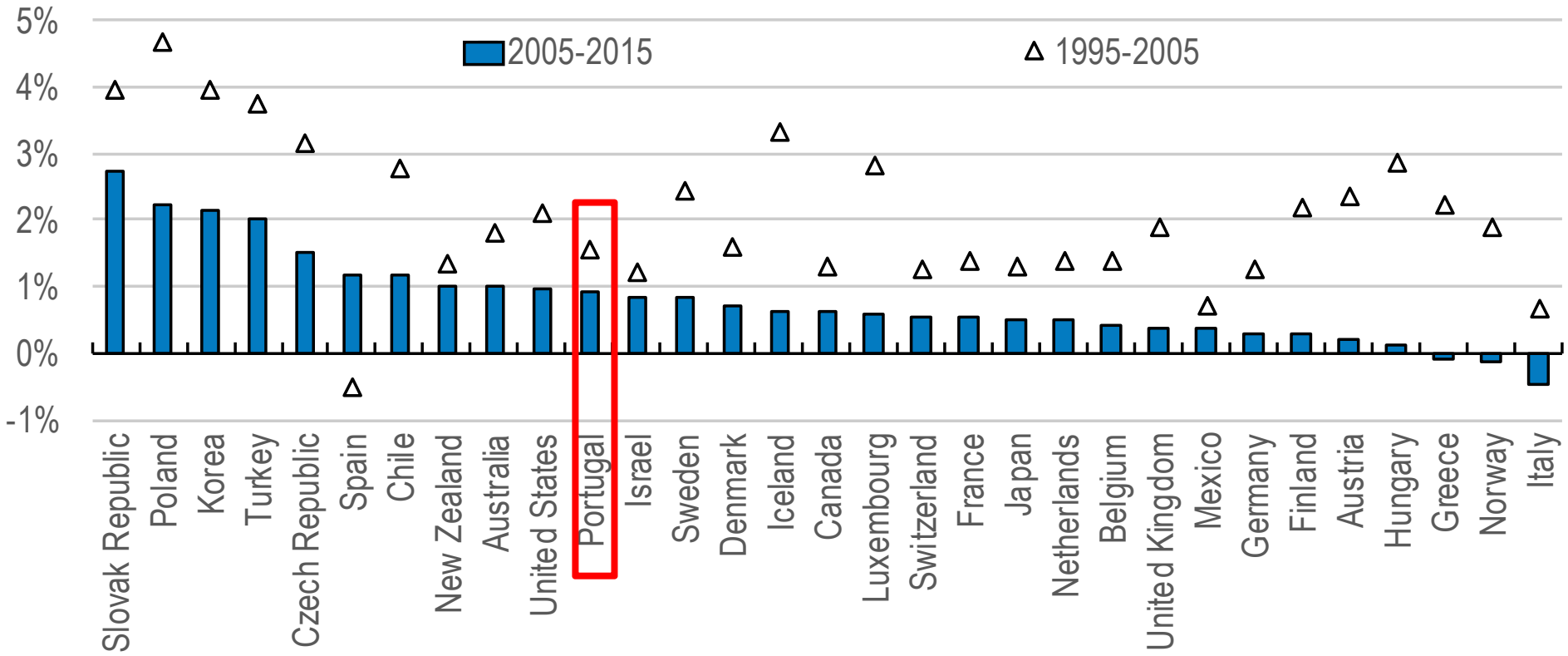
The Productivity Slowdown

Real growth in GDP per hour worked[(1)], 2000-2016
Index 2010 = 100



Source: OECD, Productivity database, October 2018.

…and this is true also for Portugal



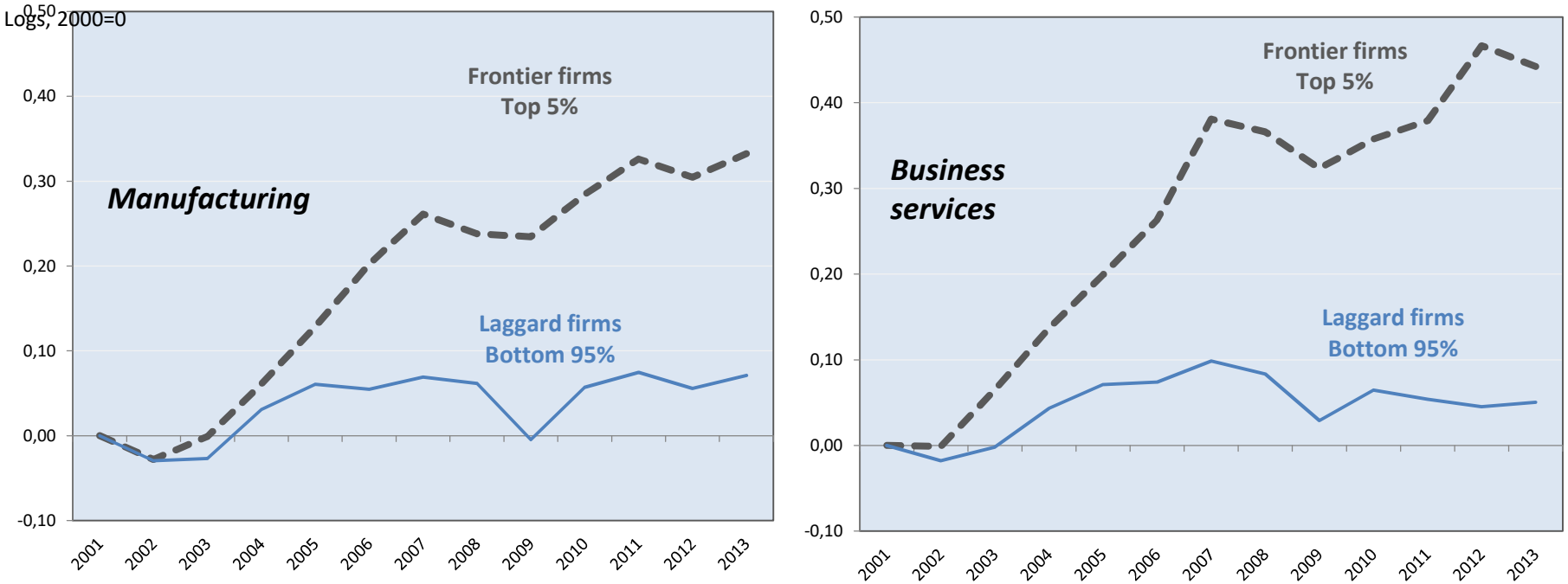
Source: OECD calculations based on OECD Economic Outlook No 103 database (May 2018).

Notes: Labour productivity is defined as real GDP divided by total employment in the economy.

…and divergence

Dispersion in multifactor productivity (MFP) has widened

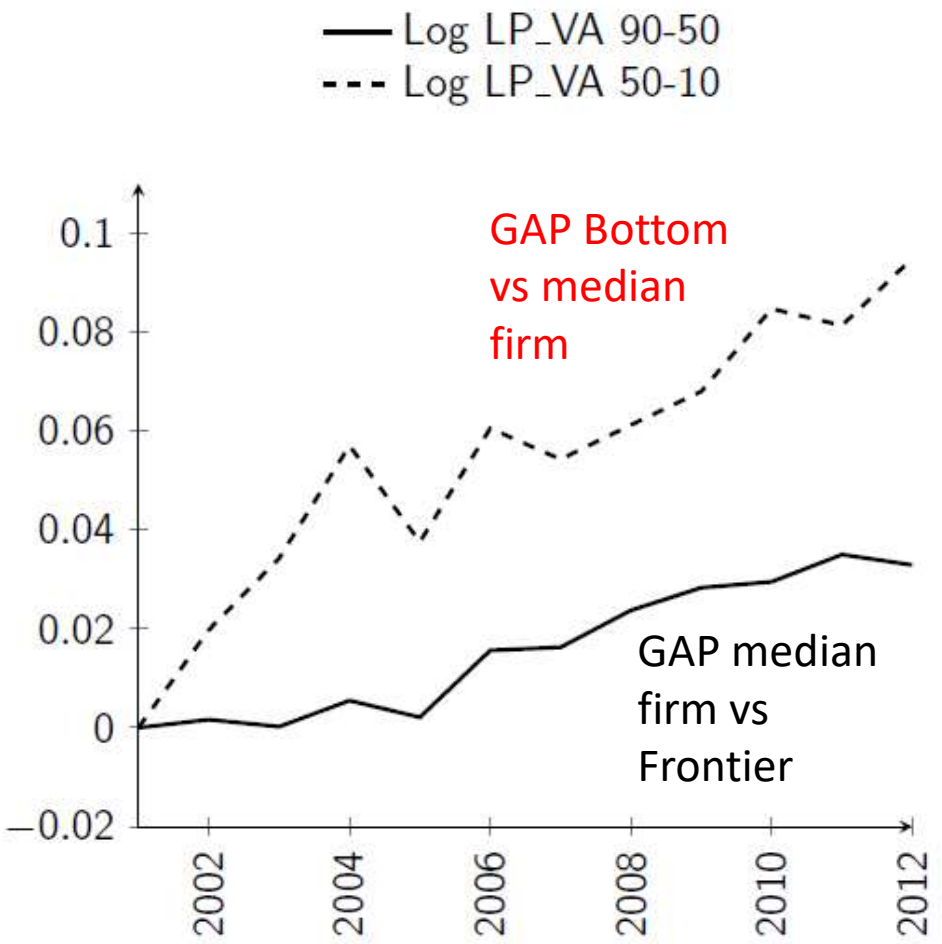
Evolution of MFP of frontier and other firms, 2001-13
(cross-firm, cross-sector averages)



Source: Andrews et al. (2016)

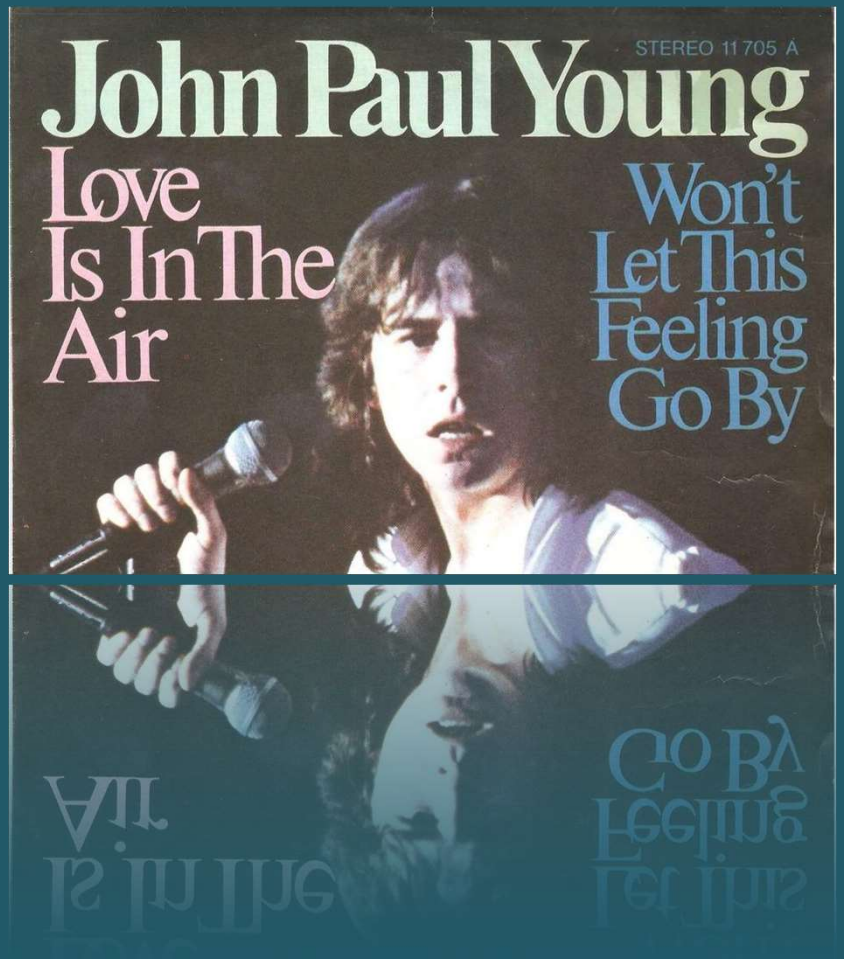
Are digital technologies a cause or an explanation of rising dispersion?
What role for structural policies?

The bottom seems to struggle to keep up



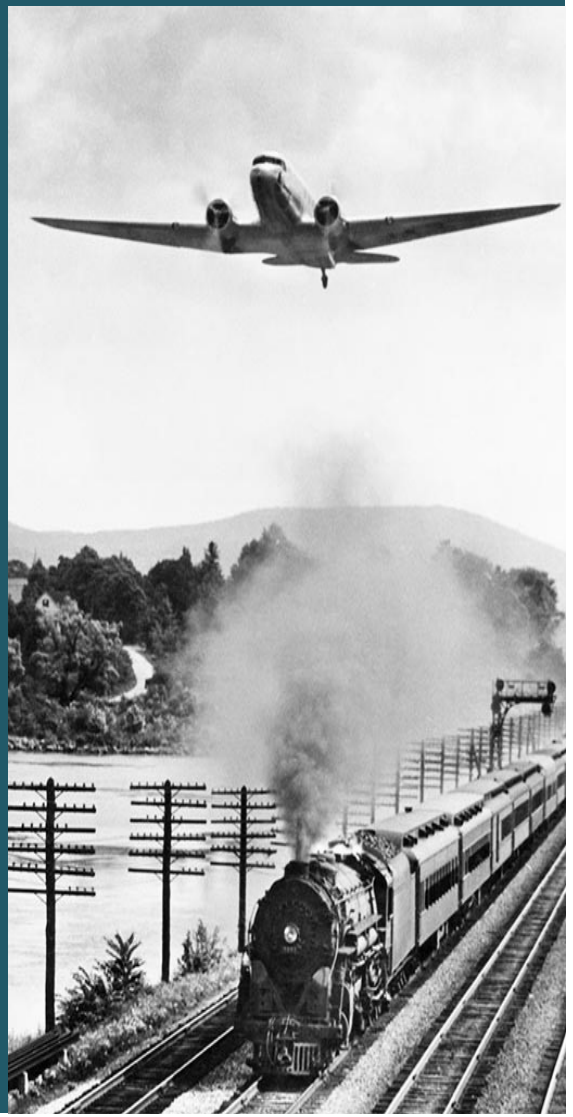
Source: Berlingieri et al., 2017 based on OECD MultiProd project, March 2017.

Note: The figure plots the estimated year dummies of a regression of log-productivity dispersion (labour productivity , LP, on the left, and multifactor productivity à la Wooldridge, MFP_W, on the right), respectively, at the top (90th and 50th percentiles ratio, solid line) and at the bottom (50th and 10th percentiles ratio, dashed line) within country-sector pairs, using data from the following countries: AUS, AUT, BEL, CHL, DNK, FIN, FRA, HUN, ITA, JPN, NLD, NOR, NZL, SWE. The graphs can be interpreted as the cumulated growth rates of dispersion at the top and the bottom of the distribution within each country and sector over the period. For instance, in 2012 LP dispersion in manufacturing is roughly 3% higher than in 2001 for the top, and 10% for the bottom.



DIGITAL IN THE AIR?

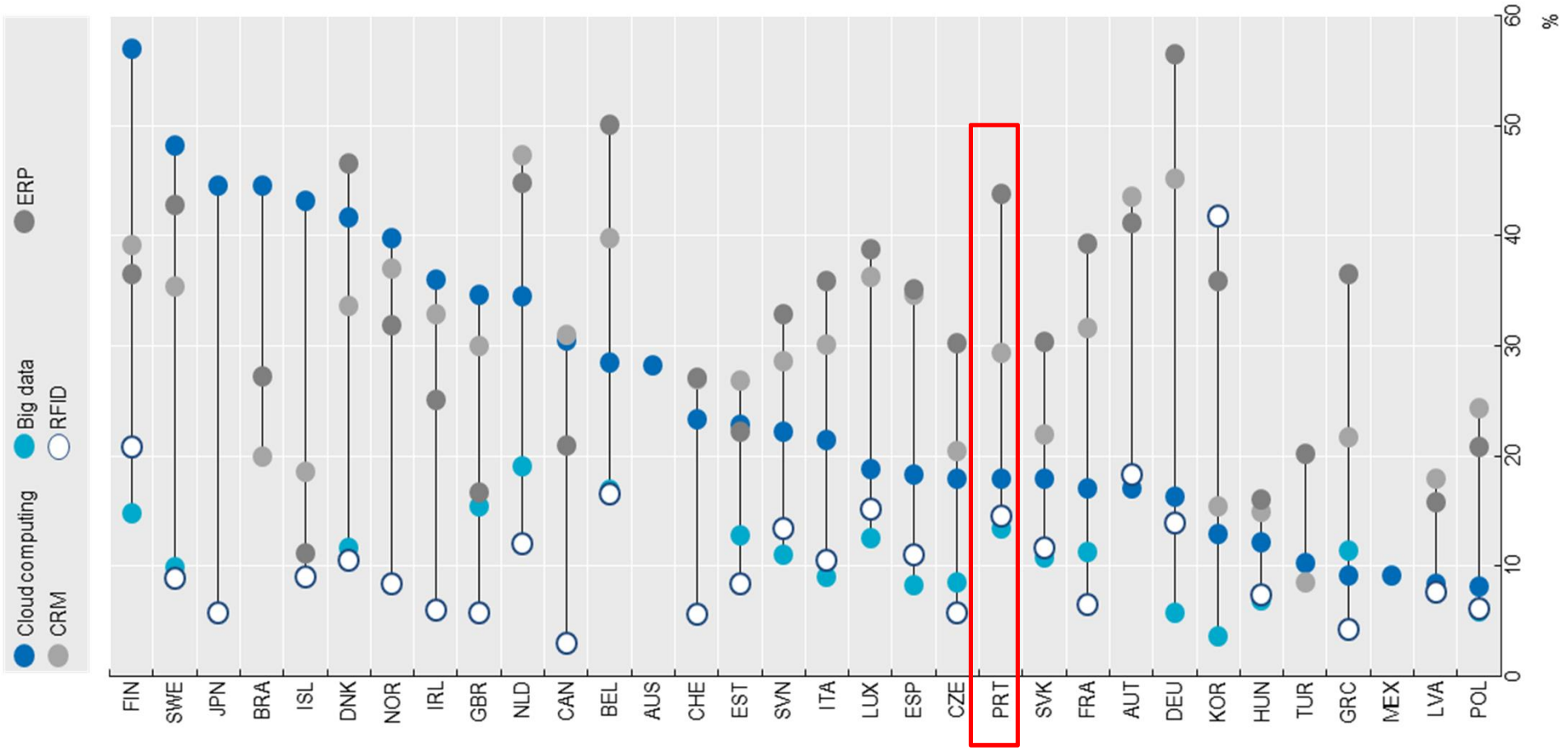
...NOT EVERYWHERE...



Significant differences across countries and technologies

Diffusion of ICT tools and activities in enterprises, by technology, 2016

As a percentage of enterprises with ten or more persons employed

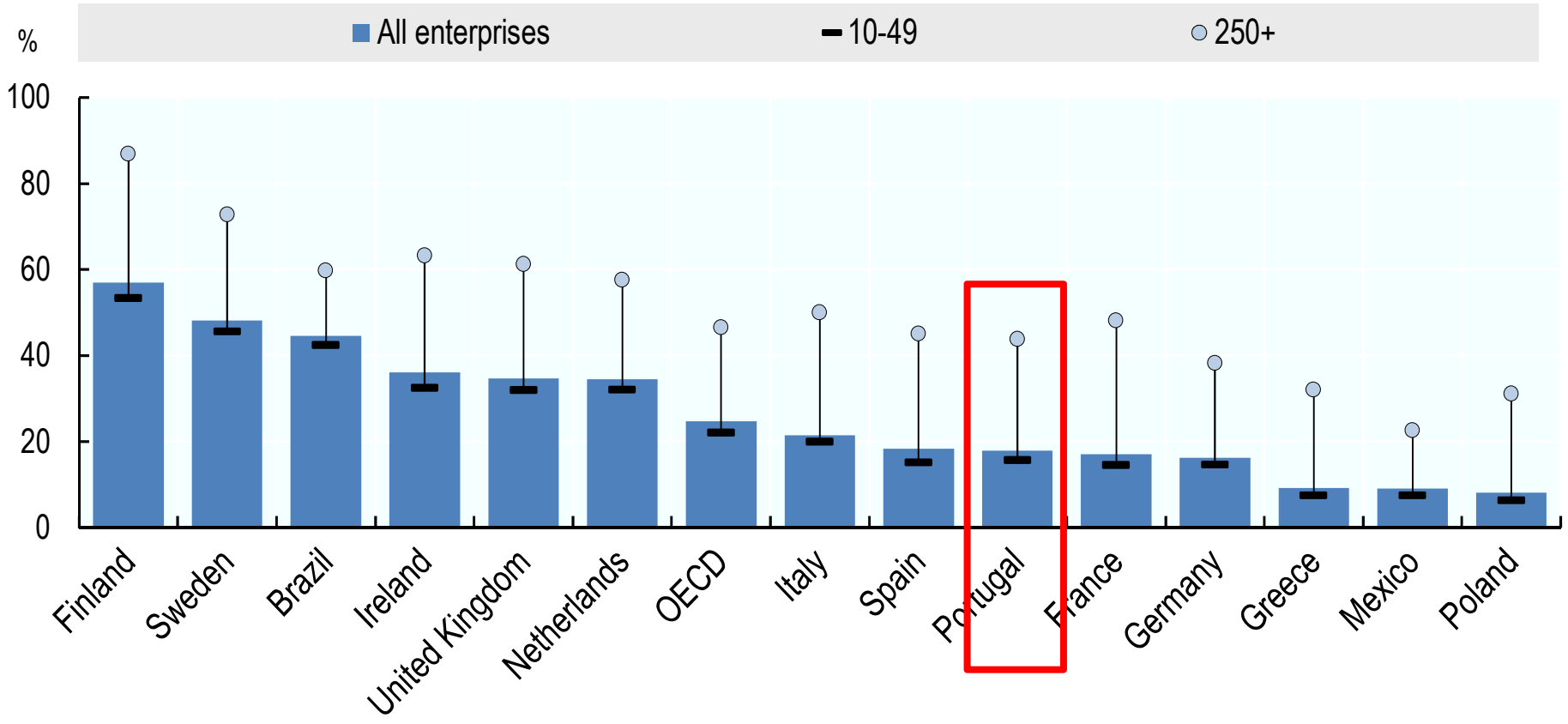


Source: OECD Science, Technology and Industry Scoreboard 2017,

… and **SMEs are often lagging**, even in technologies well suited to them

Enterprises using cloud computing services, by firm size, 2016

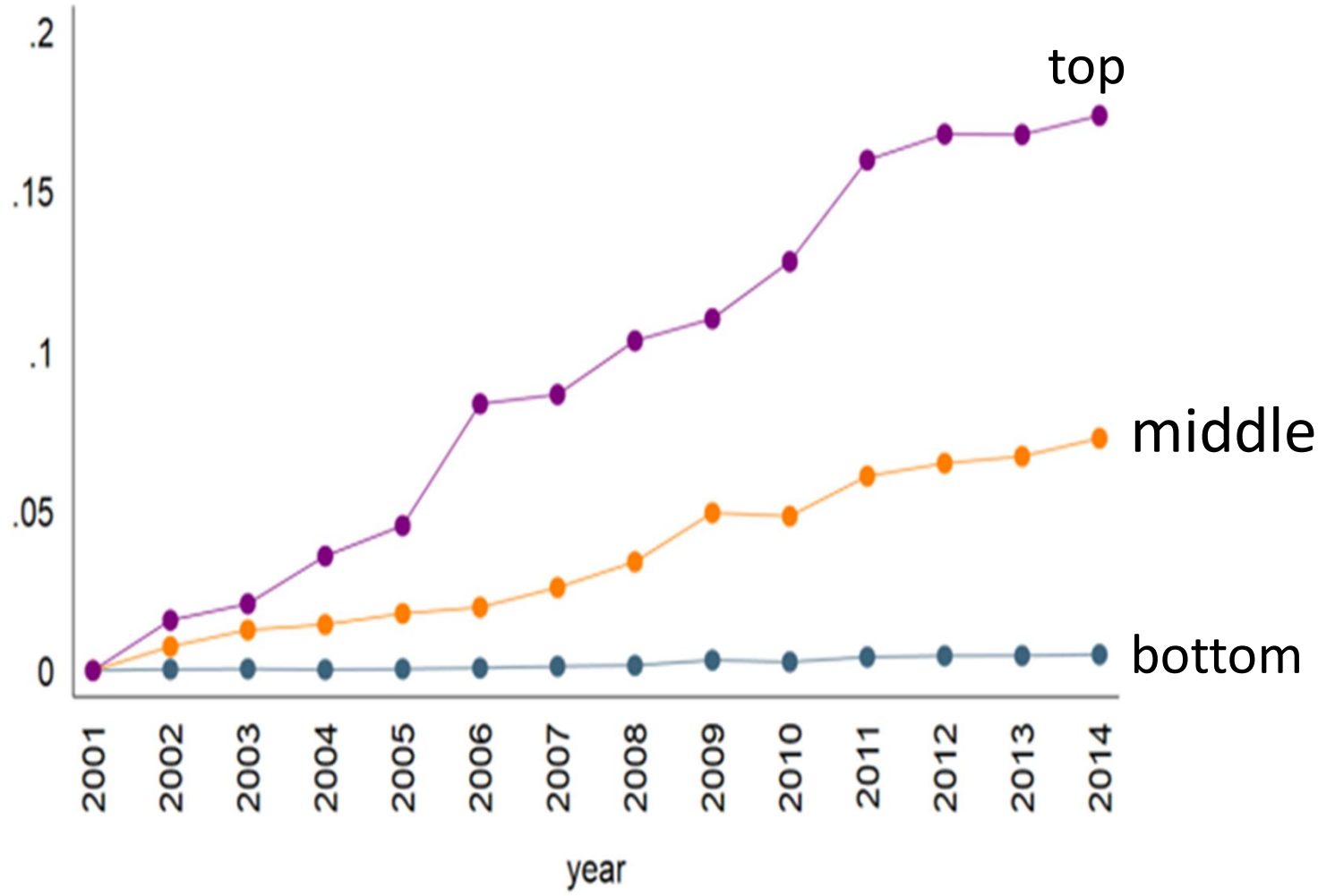
As a percentage of enterprises in each employment size class



Source: OECD Digital Economy Outlook 2017, StatLink: http://dx.doi.org/10.1787/888933585495

WHAT'S HAPPENING TO THE BUSINESS ENVIRONMENT?

Rising mark-ups pushed by the top…especially in digital setors

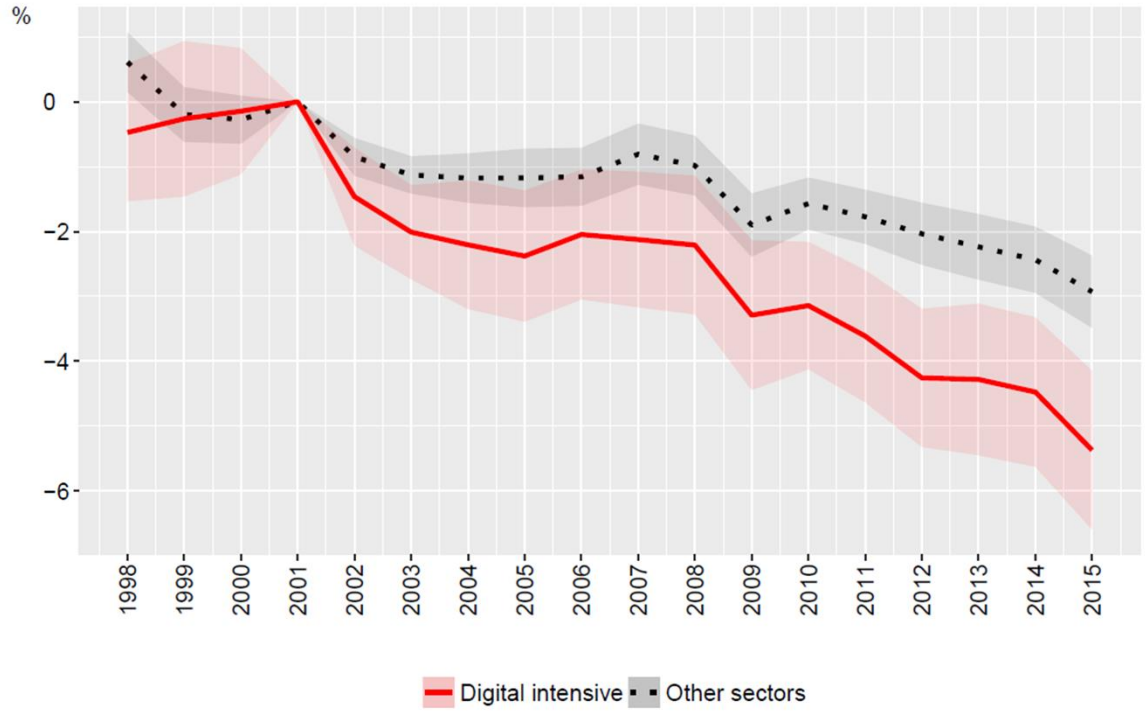


- *Within* the **year 2-digit industry** averaged across sectors;
- Dynamics not due to a particular country. But stronger in digital intensive sectors

Source: Calligaris, Criscuolo and Marcolin, 2018 “Mark-ups in digital era”

But business dynamism is declining …especially in digital intensive sectors

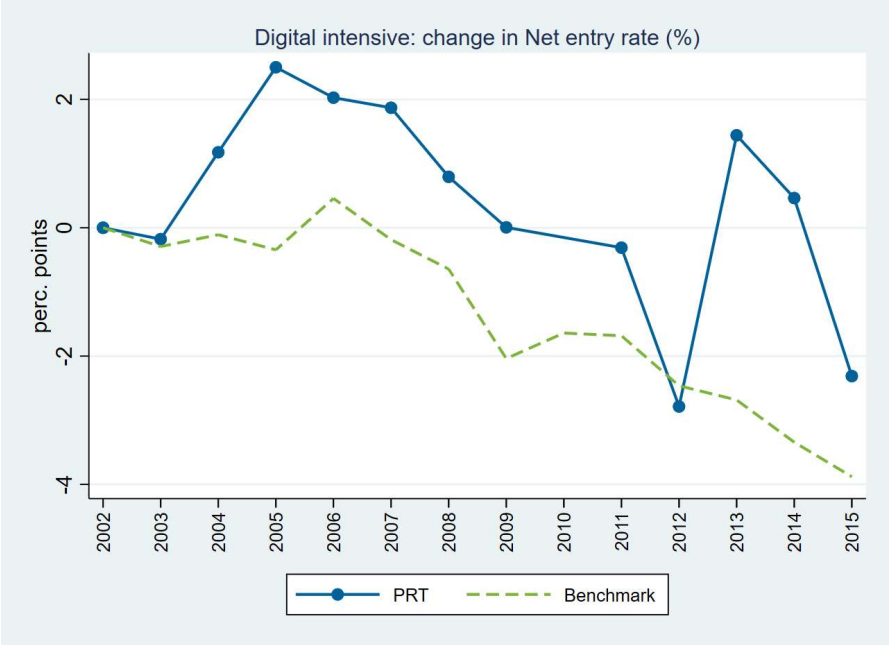
Entry rates

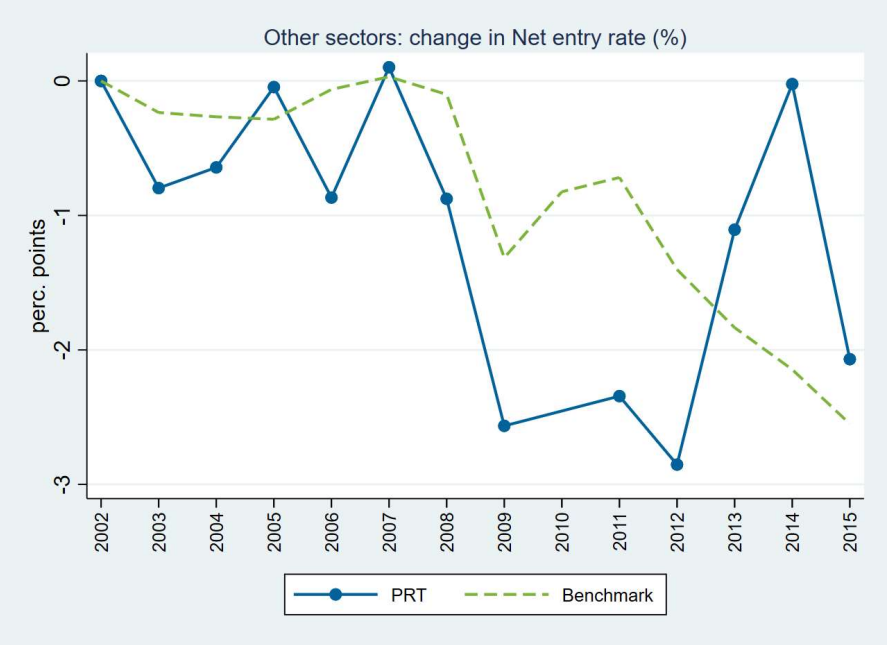


Source: Calvino and Criscuolo, 2018 “Business Dynamics and Digitalisation” based on OECD DynEmp3 database, August 2018.

…and Portugal seems no different

Net entry rate: changes over time, digital intensive vs. other sectors





Source: OECD DynEmp3 database, March 2019

WHAT CAN POLICY DO? STIMULATING BUSINESS DYNAMICS AND ADOPTION

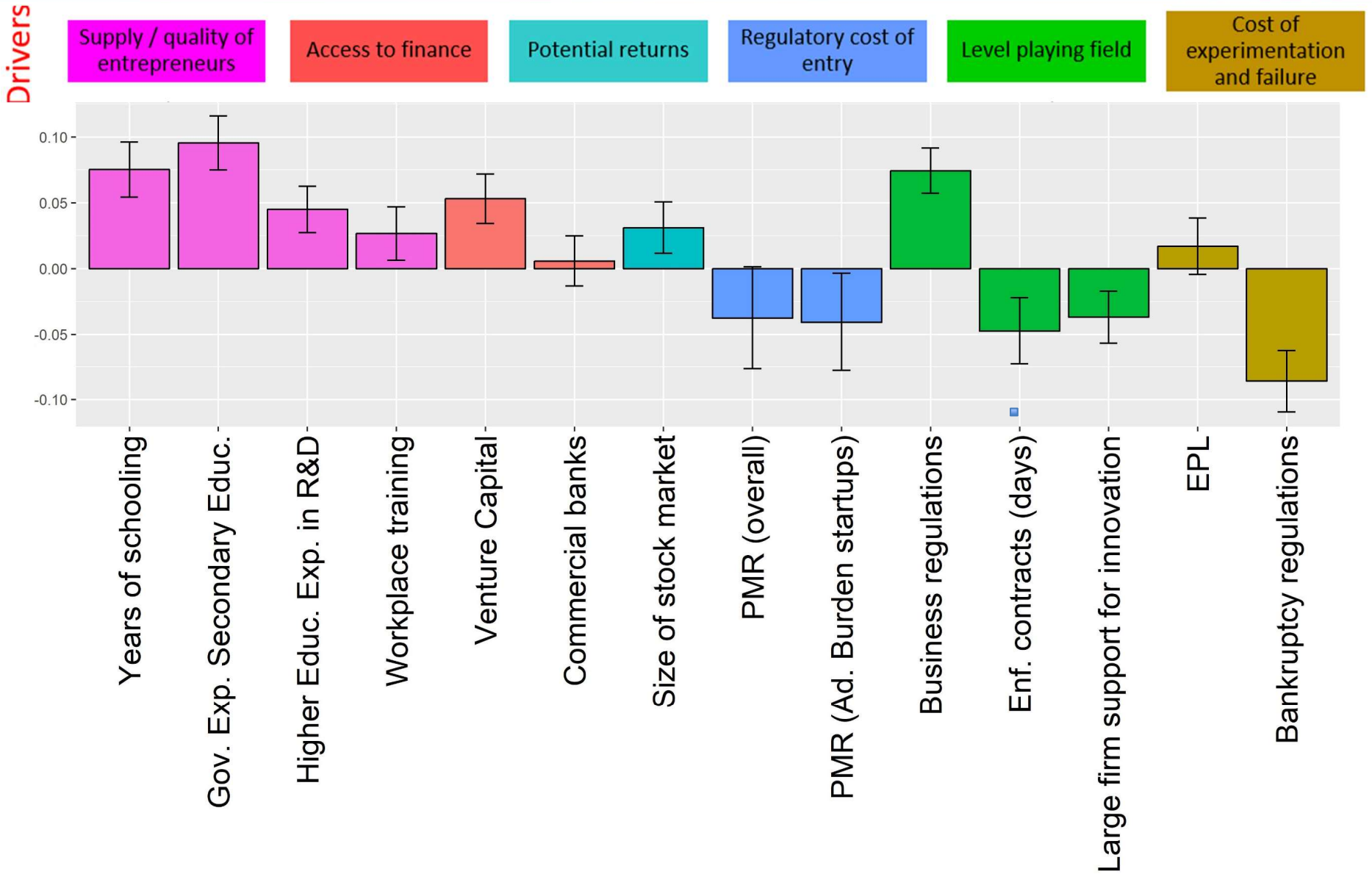
Digitalisation raises a number of challenges…

1. Digital adoption boosts productivity, but…
2. … changes in the business environment raise challenges for laggards and new entrants…

3. … and the productivity gains from higher adoption are stronger for **high productive firms** likely reflecting their higher complementary intangible assets and wider scope for reorganising production

→ **Challenges for policies: digitalisation can increase productivity dispersion and affect jobs, but needs complementary investments and a level playing field**

Policies can help sustain entry rates



Source: Calvino and Criscuolo, 2018 "Business Dynamics and Digitalisation" based on OECD DynEmp3 database, August 2018.

Policies can nurture capabilities and incentives for digital adoption…

Capabilities

- Complementary intangible and human capital:
  - Organisation and Management
  - Skilled workforce (IT but not only) and talent
- Good allocation of skills
- Digital Infrastructure (e.g. broadband)

Incentives

- Competitive markets
- Low trade barriers
- Low costs of adjustment

..and ensure that gains from digital adoption are widely shared

Closing the digital divide across firms and workers, preserving jobs is possible via:

1. **Roll-out of broadband** high-speed internet (key enabler)
2. Upgrading **ICT capabilities** via schooling, on and out of the job training, LL learning, e-government (complementarities)
3. Strengthening **market incentives** (competition, labour market flexibility) and fostering **business dynamism** (low administrative burdens, efficient regulation, trade openness, managerial talent)
4. Financing **risk** (government R&D, venture capital)

→ Large role for structural policies to diffuse adoption and boost productivity

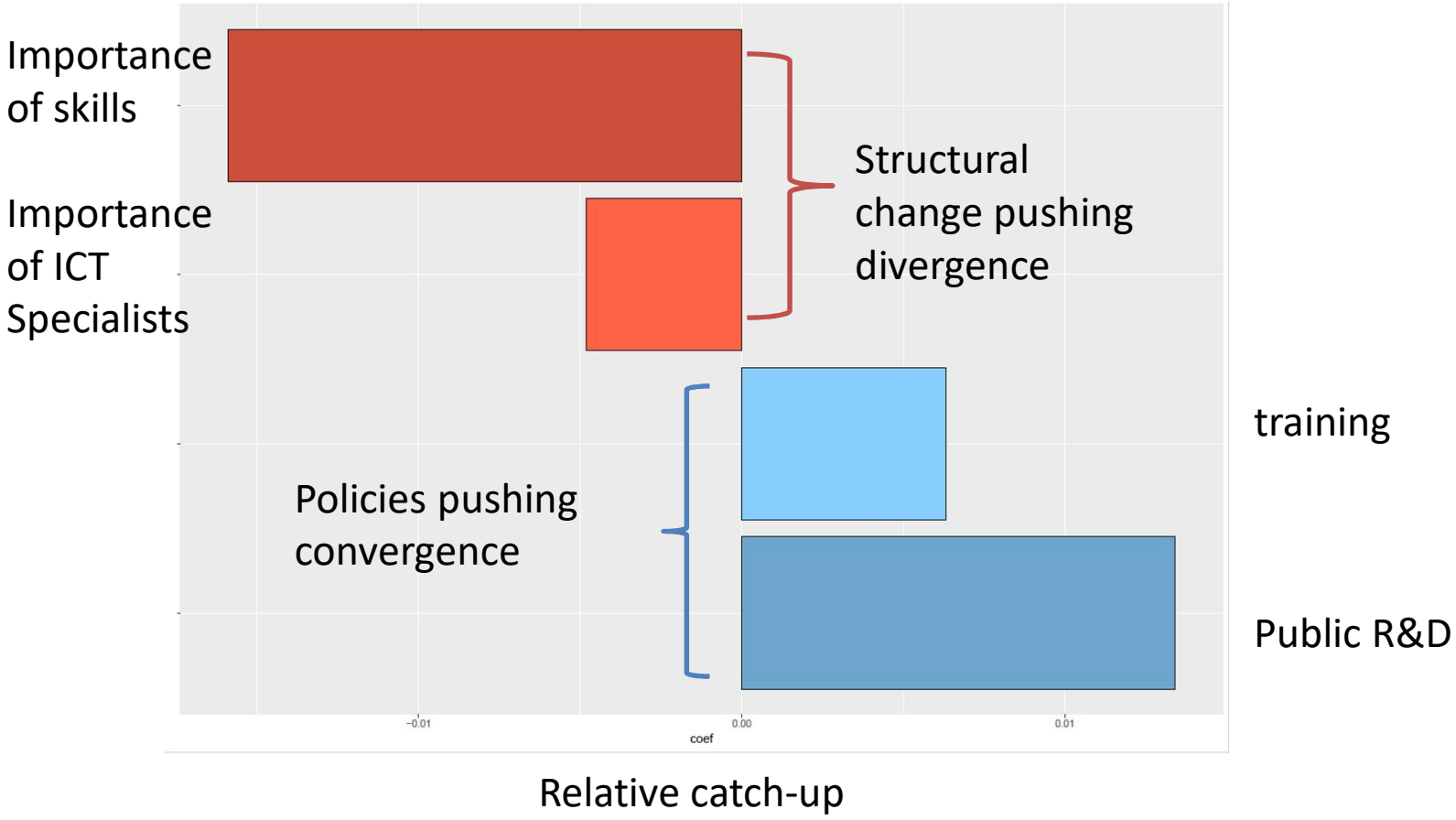
→ Package policies for best results!

→ Exploit double dividends

For more information:

Chiara.criscuolo@oecd.org

Structural change pushes divergences but which policies can help lift the bottom up? (graphics to improve)



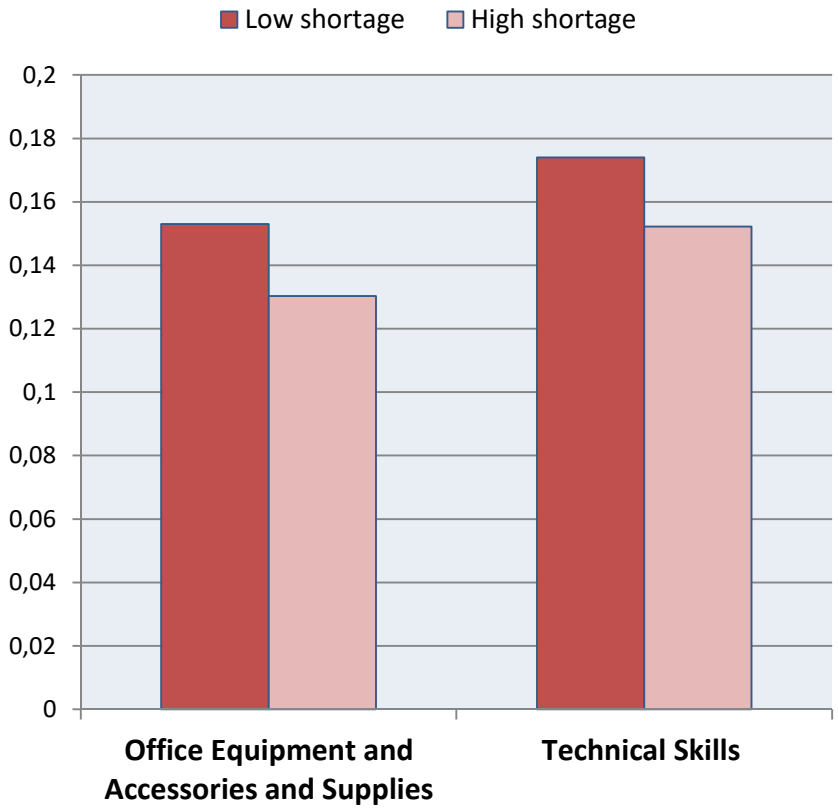
Note: The blue bar plots the estimated coefficients of the productivity-gap, and can be interpreted as the catch-up effect in sectors with average use of the specific X taken into account. The green bar is the catch-up in sectors with "high" share of the specific X, defined as sectors in which these variables are one standard deviation above the average (and it is the algebraic sum of the coefficient for gap and the interaction term). Countries included: AUS, AUT, BEL, CAN, CHL, FIN, FRA, HUN, IRL, ITA, NOR, PRT, SWE.

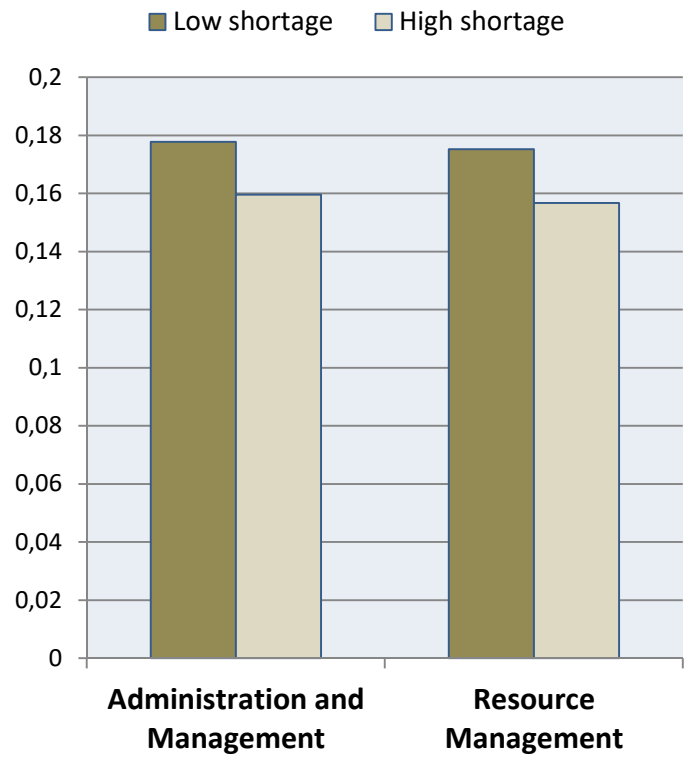
Considerable scope for public policy to affect aggregate productivity through:

- specific policies to increase the diffusion of knowledge (e.g. policies in IP rights, mobility of workers, etc.)
- policies targeted to increase the absorptive capacity of laggards (e.g., policies undertaking R&D and export, sustaining entrepreneurial managerial capital, increasing skills at all levels of the workforce)

Digital adoption and skills are complementary

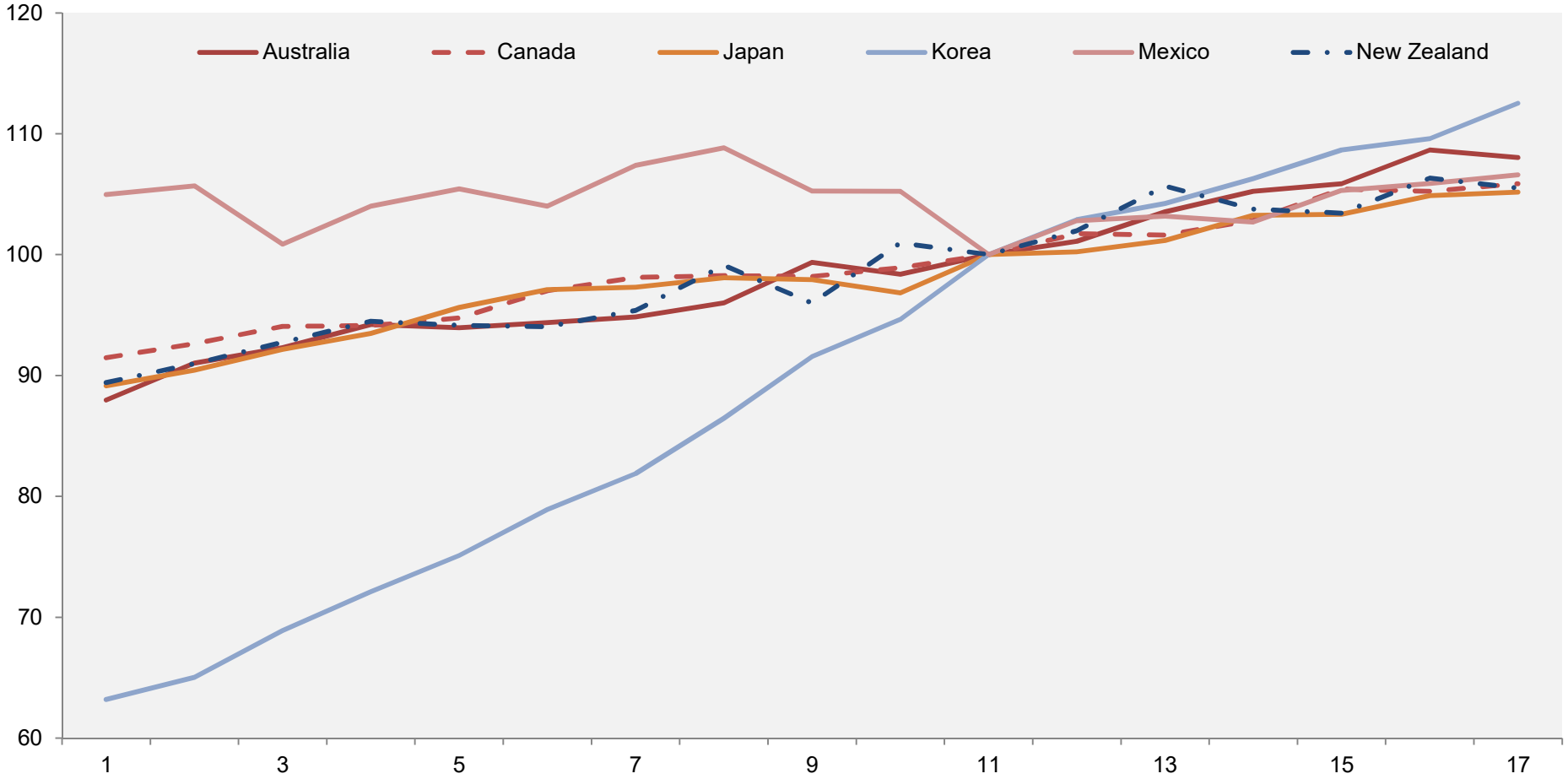
The effects of specific skill shortages on the returns from digitalisation





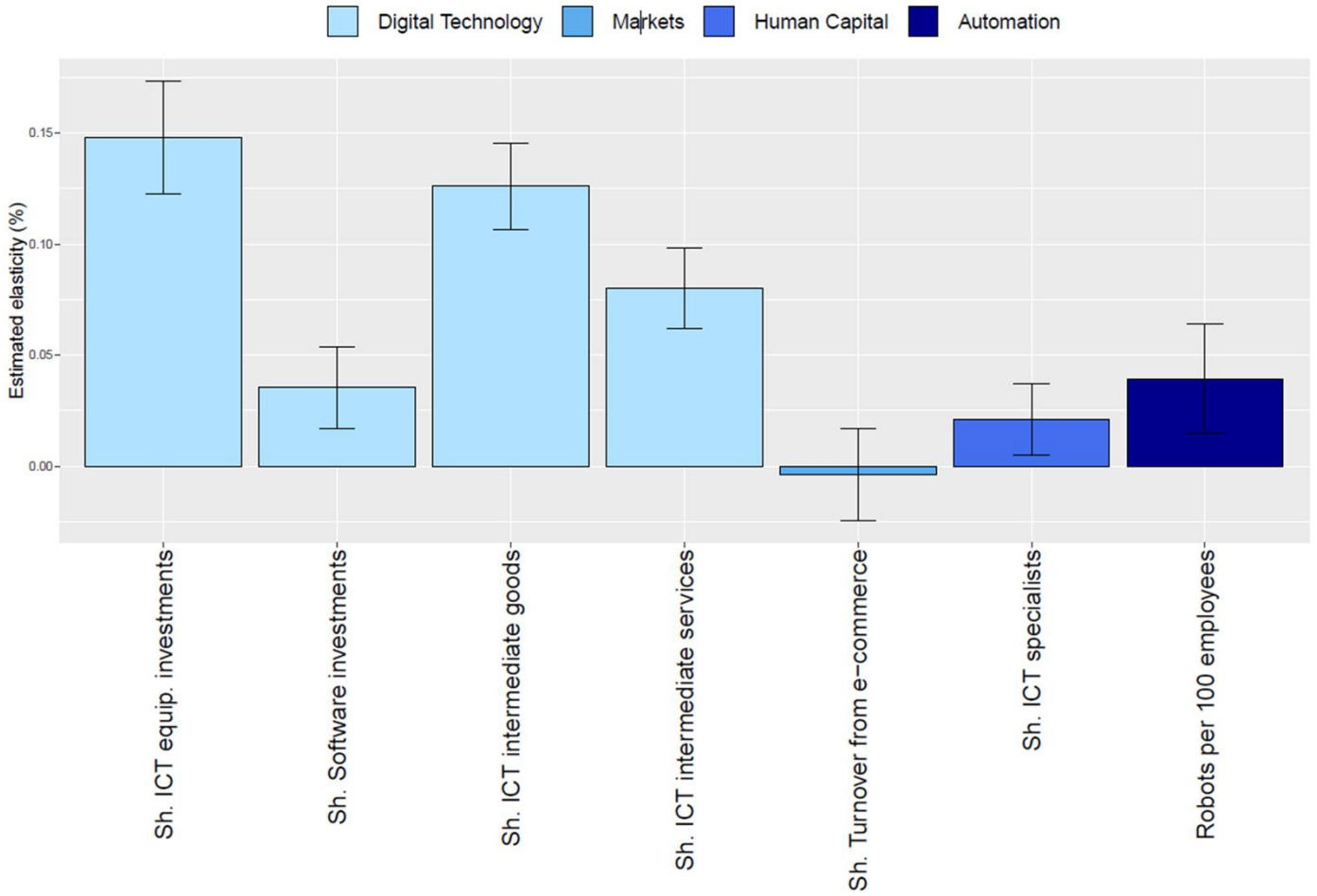
Source: Gal et al. (2018) , Digitalisation and productivity: In search of the Holy Grail

Productivity slowdown is a common feature of OECD economies (back up slide)



Higher entry rate in digital intensive sectors

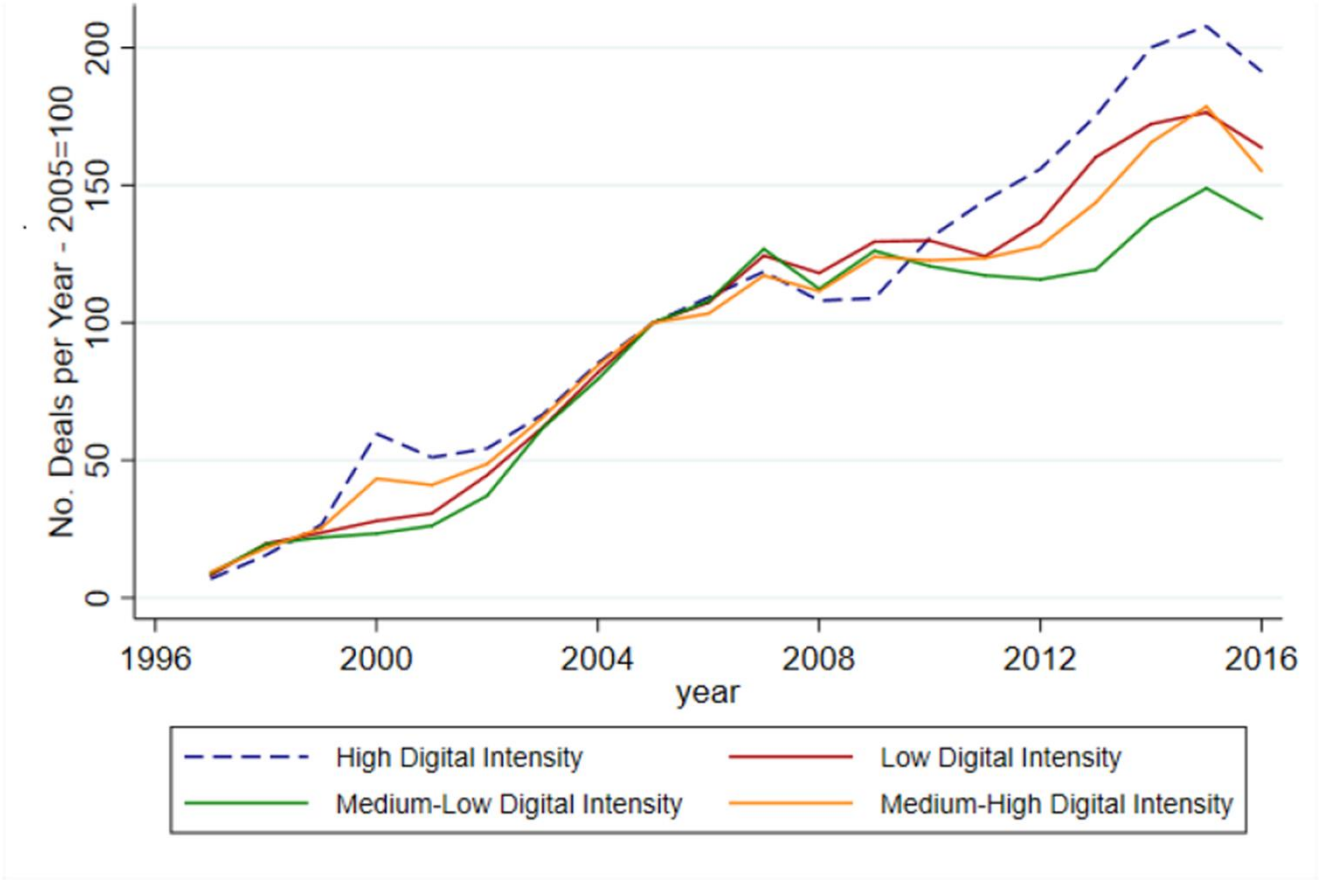
Digital intensive sectors are more “Entrepreneurial” for all but one facet of the digital transformation



Source: Calvino and Criscuolo, 2018 based on OECD DynEmp3 database, August 2018.

Increase in M&A

Number of M&As per Year by Digital Intensity of the Target Firm Industry

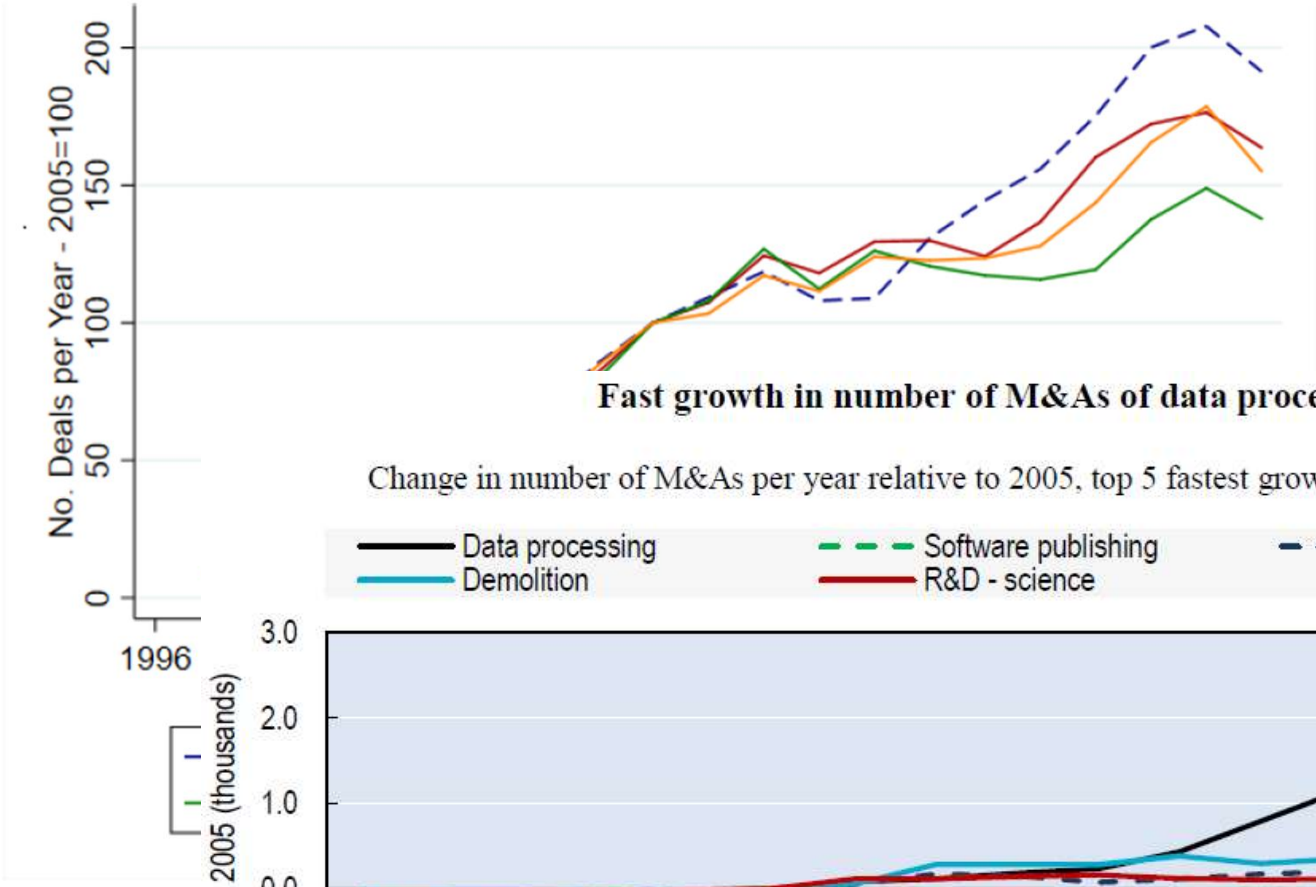


Note: The digital intensity of sectors is defined using the industry of the target firm and the STAN A38 global digital intensity indicator of 2013-15 constructed by (Calvino et al., 2017). The M&A data reflects the annual total number of acquisitions (i.e. result in a majority stake), purchasing minority stakes and issuing of new share capital involving target firms in the non-farm non-financial business sector (i.e. NACE rev.2 codes 10-82, excluding 64-66). Note M&A data has global coverage from 2003 onwards, statistics before that point should be interpreted cautiously.

Source: Zephyr M&A database.

Increase in M&A

Number of M&As per Year by Digital Intensity of the Target Firm Industry



Note: The digital inte
digital intensity indic
total number of acqui
capital involving tar
excluding 64-66). No
interpreted cautiously
Source: Zephyr M&A

Fast growth in number of M&As of data processing targets

Change in number of M&As per year relative to 2005, top 5 fastest growing 3-digit sectors

Note: Industry reflects the primary NACE rev.2 industry of the target firm. Show for the top 5 3 digit industries with the fastest growth in number of deals over 2005-2016.
Source: BvD Zephyr M&A Database.

Increased Divergence and Policy response

- Lift the bottom up:
  - Increase laggards' absorptive capacity and capacity to adopt successfully:
    - Technological via Innovation policies (R&D tax credit and grants appropriately designed); and with university collaborations
    - Organisational and Managerial capabilities
    - Information and benchmarking
    - Skills: at all level of the workforce (supply of skill, life-long learning and on the work training)

- Let the bottom scale-up smoothly:
  - Young firms start at the bottom,
    - ensure access to financing; little red tape; level playing field and access/connection to global markets
    - Help build capability to innovate e.g. accelerators and university collaboration; procurement policies

- Allow for diffusion of ideas and knowledge:
  - Design of IP rights
  - Mobility of workers: non compete clauses; housing policies; hiring and firing costs
  - Migration policies (Kerr, 2018)

Capabilities and incentives are key

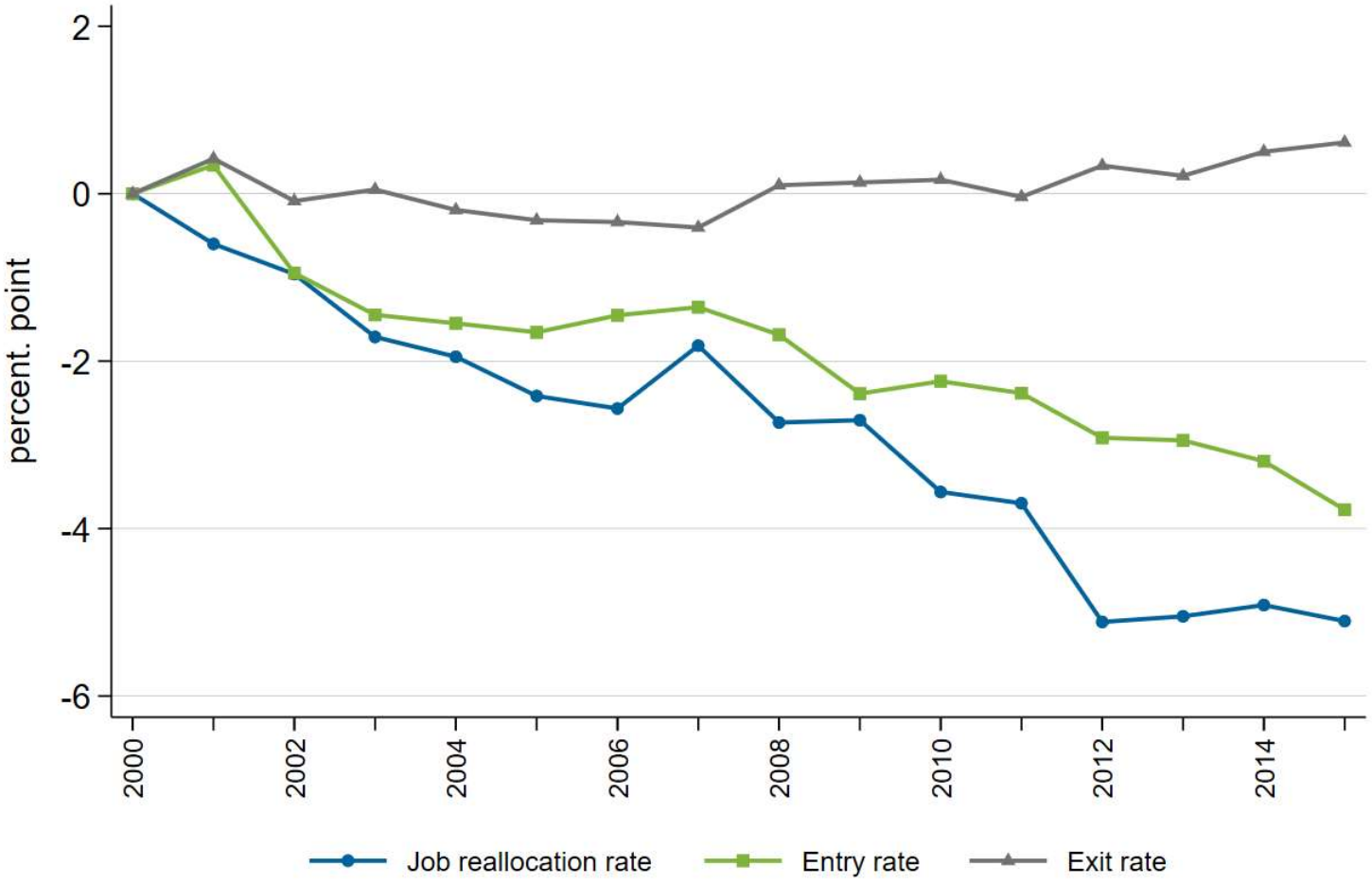
Capabilities

Organisational Capital	Share of jobs with high performance work practices
Talent Pool	Percentage of adults with no ICT skills
	Share of high-and low skilled in training
	Share of workers in lifelong training
Allocation	Skill mismatch

Incentives

Competition	Product Market Regulation
	Digital Trade Barriers
Reallocation	Employment Protection Legislation

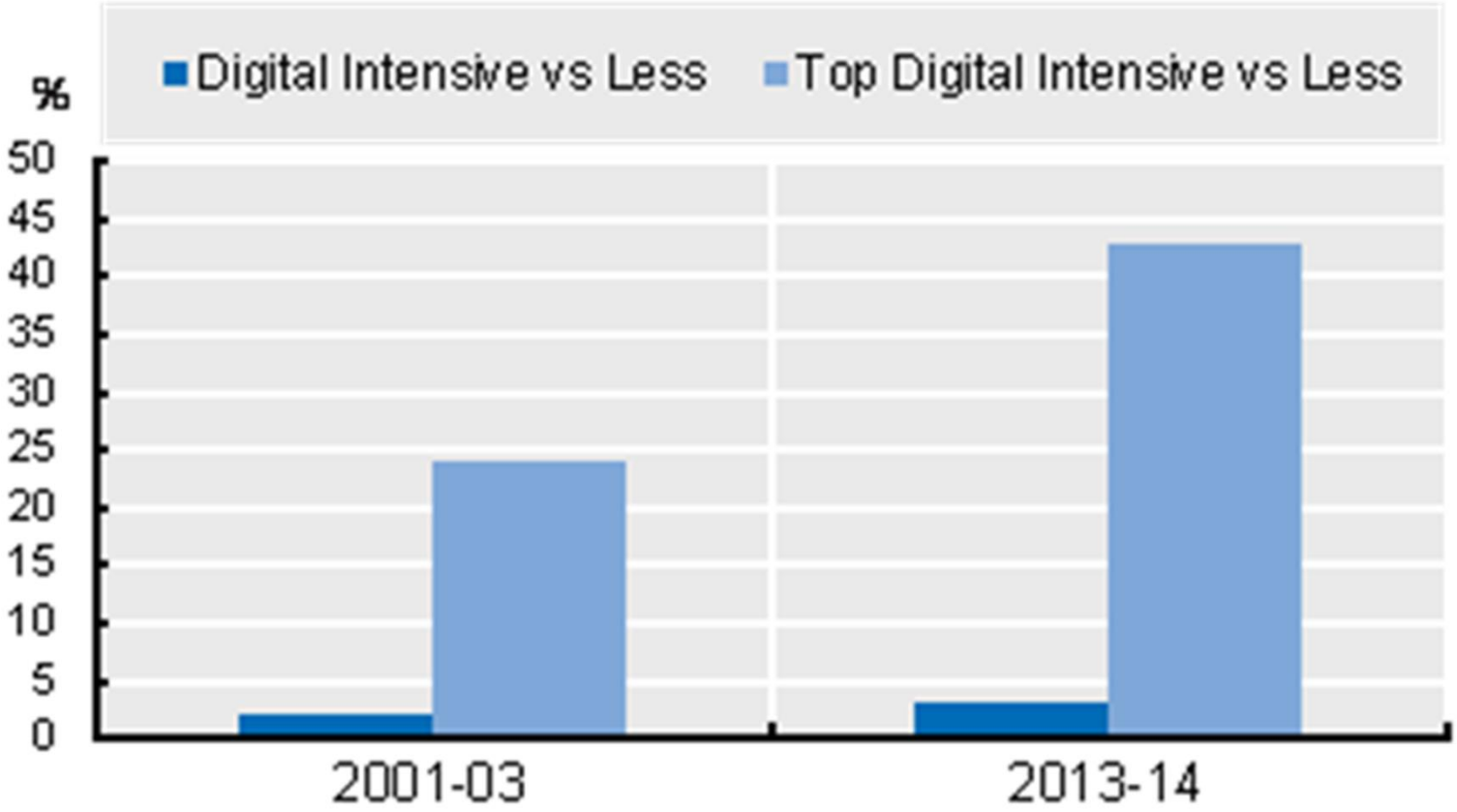
And decline in business dynamism



… and mark-ups are growing, particularly in digitally intensive sectors, raising questions about competition

Mark-up growth in digital intensive vs less digital intensive sectors, 2001-2014

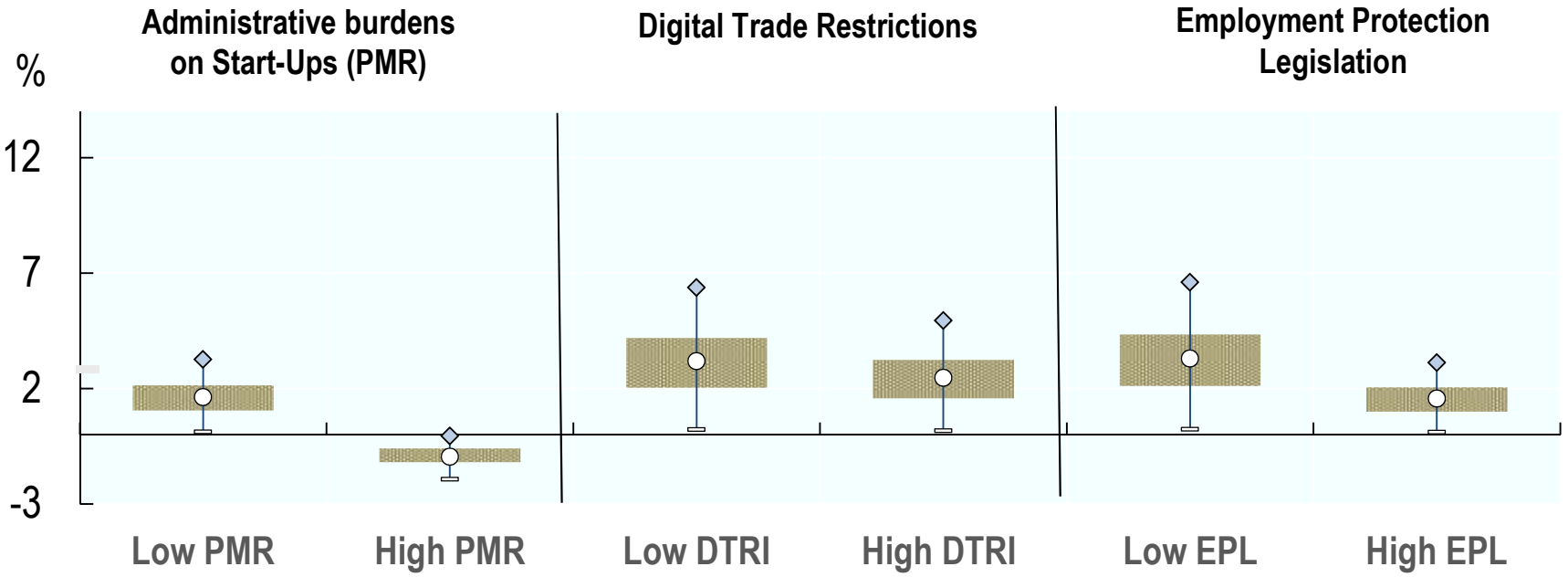
Average percentage differences in mark-ups between firms in less digital intensive and in digital intensive sector at the beginning and at the end of the sample period.



Source: OECD estimates based on Orbis® data.

Higher bang-for-the-buck from packaging reforms

Increasing managerial quality (HPWP) to sample maximum (DNK) in different market environments

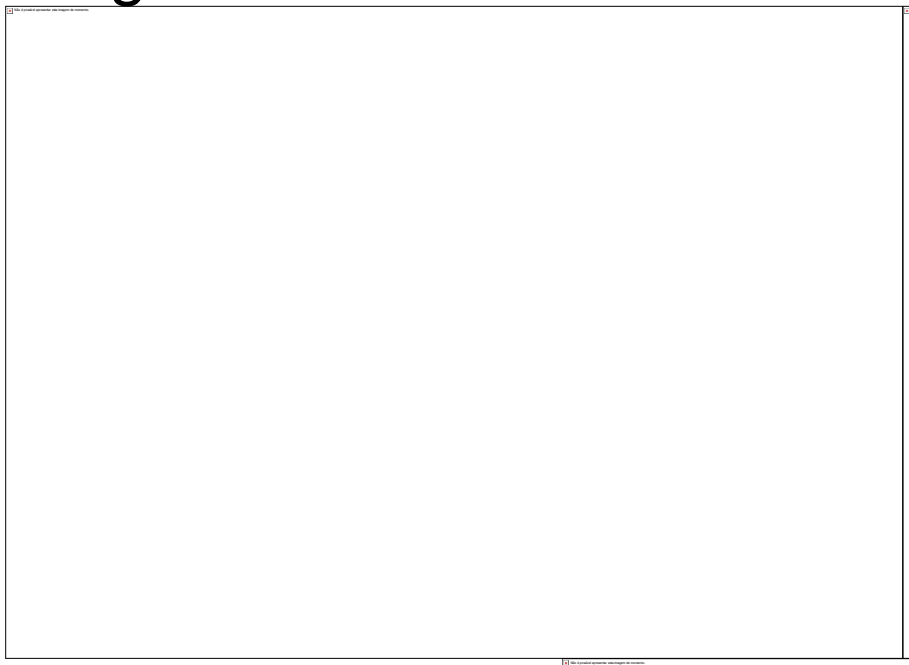


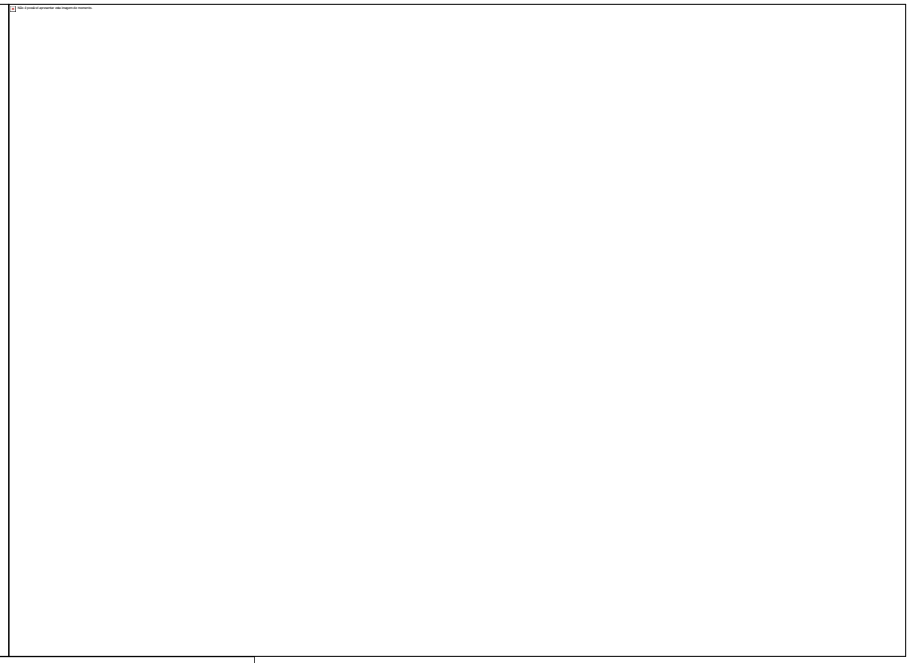
The positive effect of managerial quality on adoption is boosted by easier access to markets and reallocation

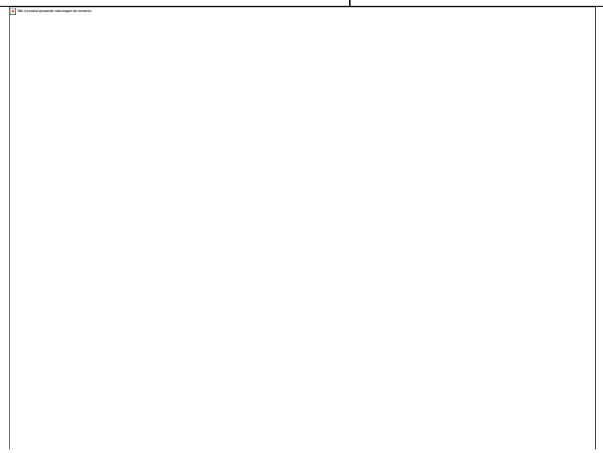
References

- Andrews, D., C. Criscuolo and P. Gal (2016), "The Best versus the Rest: The Global Productivity Slowdown, Divergence across Firms and the Role of Public Policy", *OECD Productivity Working Papers*, No. 5, OECD Publishing, Paris, https://doi.org/10.1787/63629cc9-en.
- Aghion, P. and P. Howitt (1998), Endogenous Growth Theory, MIT Press.
- Acemoglu, D., P. Aghion and F. Zilibotti (2006), “Distance to the Frontier, Selection and Economic Growth”, Journal of the European Economic Association 4(1), pp. 37-74.
- Álvarez R. (2016), ‘The impact of R&D and ICT. Investment on innovation and productivity in chilean firms', Inter-American Development Bank Technical Note Series: Washignton DC, IDB-TN-1056, June.
- Bartelsman, George van Leeuwen & Michael Polder (2016) CDM using a cross-country micro moments database, Economics of Innovation and New Technology, 26:1-2, 168-182,
- Dhyne et al (2017), IT and Productivity
- Gal, P. (2013). *Measuring Productivity at the Firm Level Using ORBIS*. (OECD Economics Department Working Papers; No. 1049). OECD: OECD Economics Department. DOI: 10.1787/5k46dsb25ls6-en
- Griffith, Rachel, Stephen Redding, and John Van Reenen (2004) “Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries,” The Review of Economics and Statistics, Vol. 86, No. 4, pp. 883–895.
- Griffith, Rachel, Stephen Redding, and Helen Simpson (2009) “Technological Catch-Up And Geographic Proximity,” Journal of Regional Science, Vol. 49, No. 4, pp. 689–720.
- Hall B., Lotti F., Mairesse J. (2012), ‘ Evidence on the impact of R&D and ICT investment on innovation and productivity in Italian firms,’ Economics of Innovation and New Technology , 22, 300–328.
- Polder, Michael & Leeuwen, George van & Mohnen, Pierre & Raymond, Wladimir, 2009. "Productivity effects of innovation modes," MPRA Paper 18893, University Library of Munich, Germany.

Job reallocation rate of incumbents: changes over time, digital intensive vs. other sectors



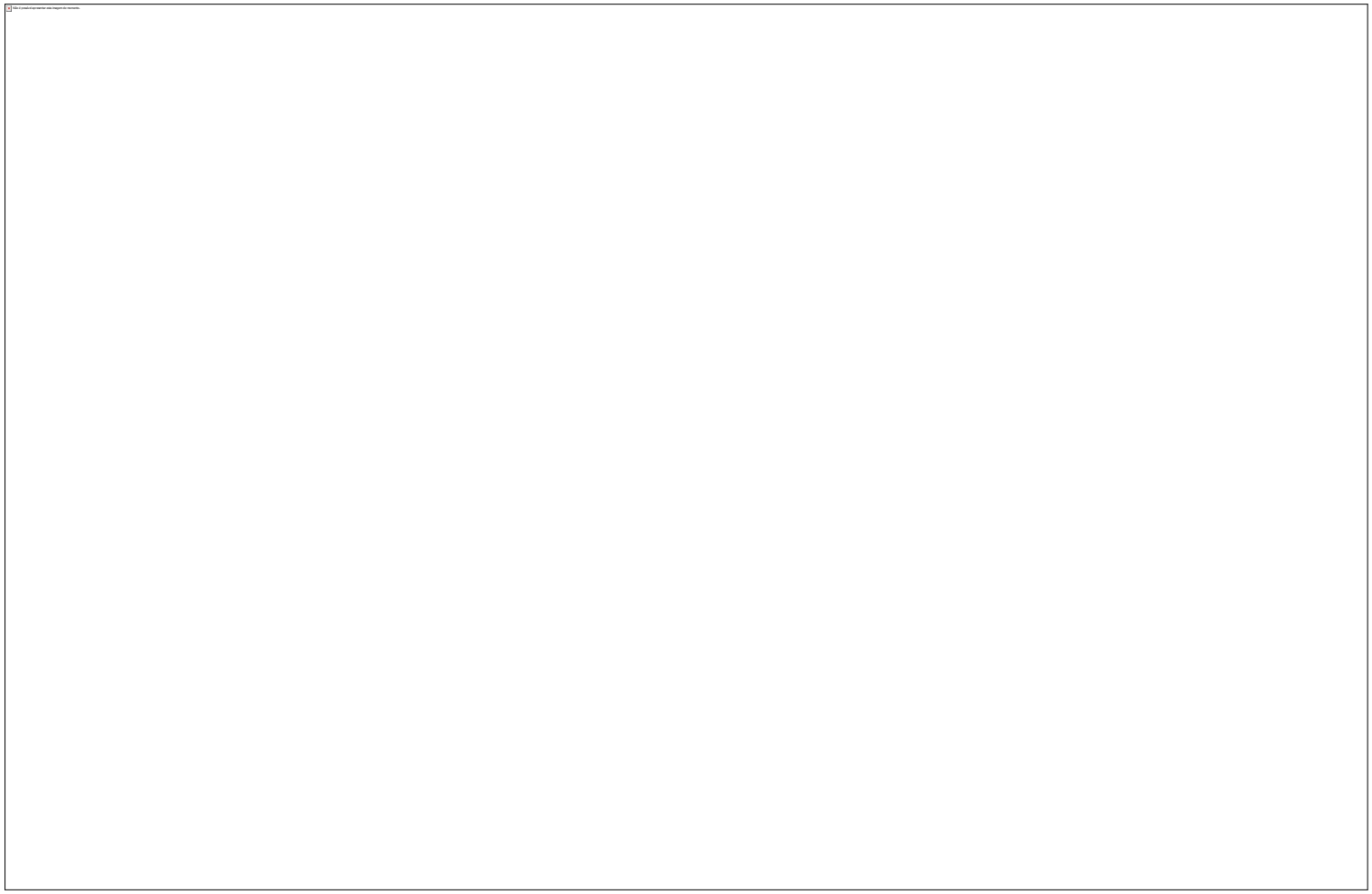




Source: OECD DynEmp3 database, March 2019

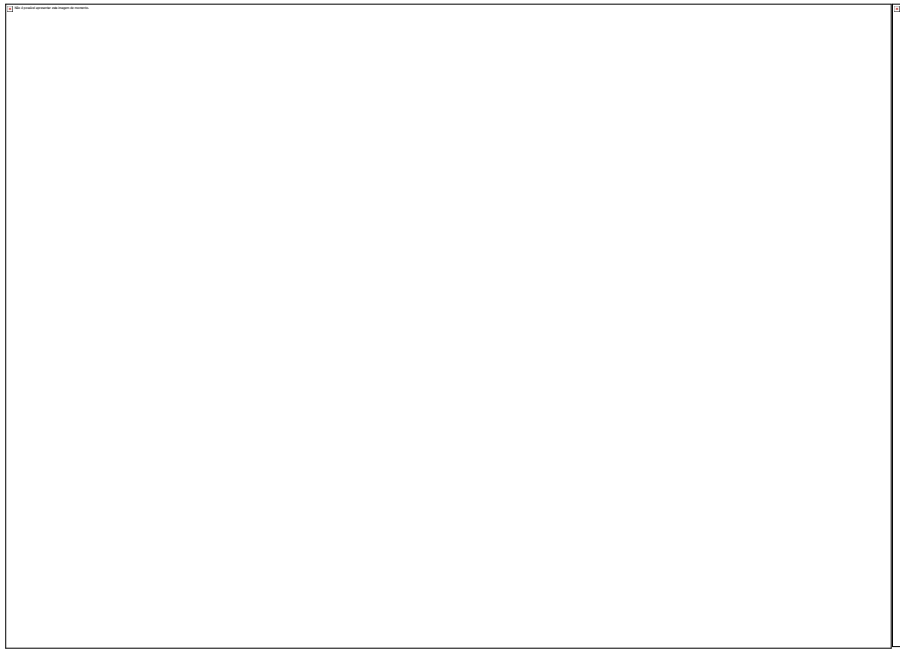
For comparison: figure from Business dynamics & digitalisation (note earlier start year!), p. 19

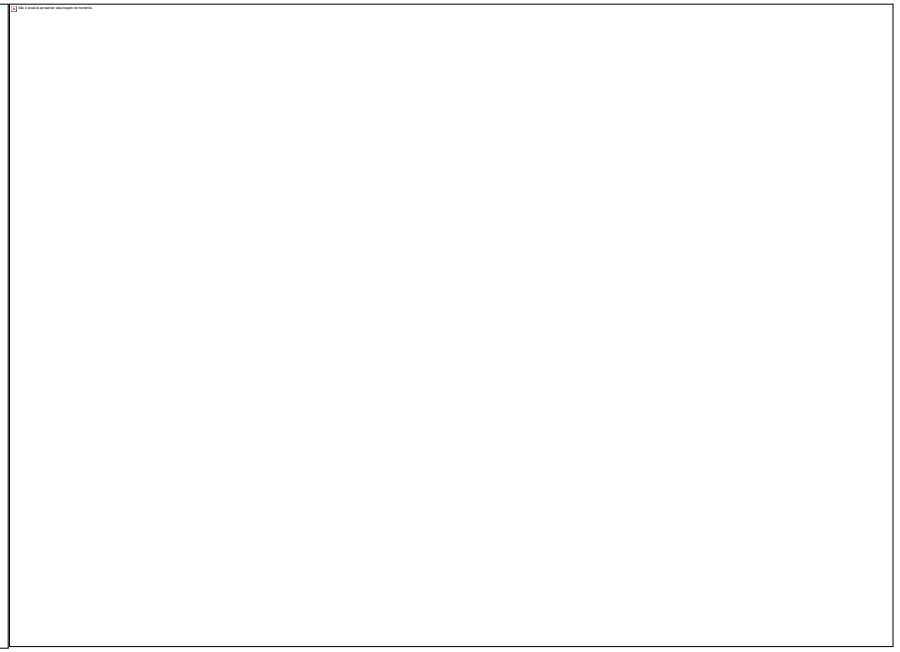
Job reallocation rate of incumbents: before 2004 - after 2009, digital intensive vs. other sectors



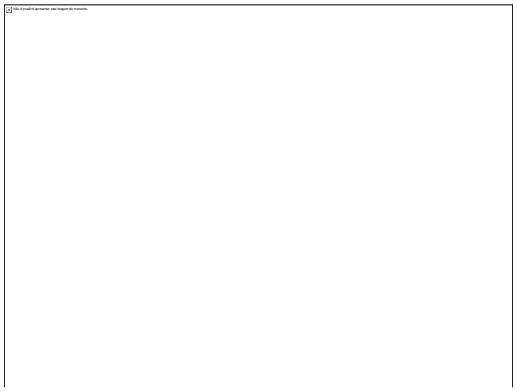
Source: Calvino and Criscuolo (2019).

Entry rate: changes over time, digital intensive vs. other sectors



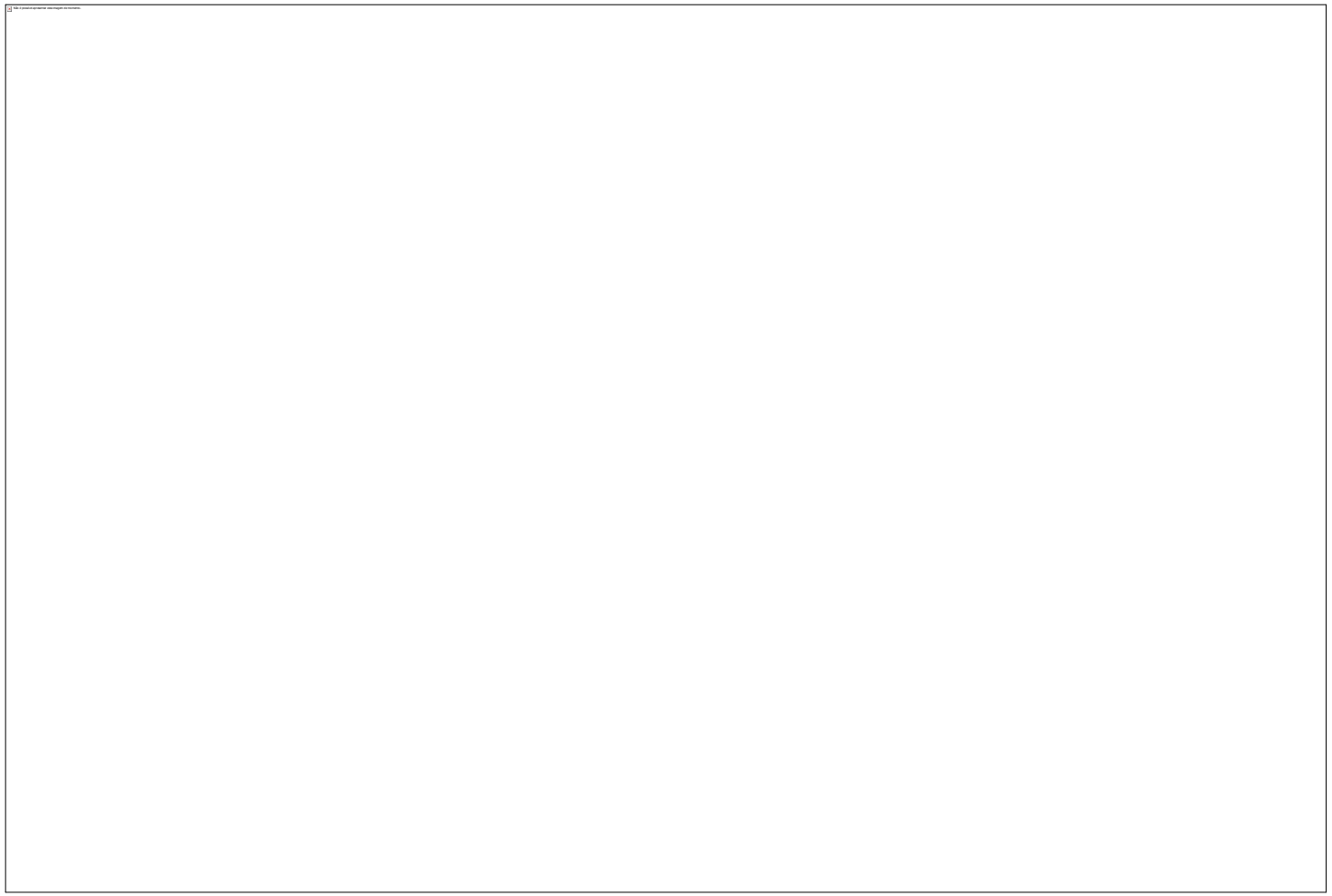


Source: OECD DynEmp3 database, March 2019



For comparison: figure from Business dynamics & digitalisation (note earlier start year!), p. 20

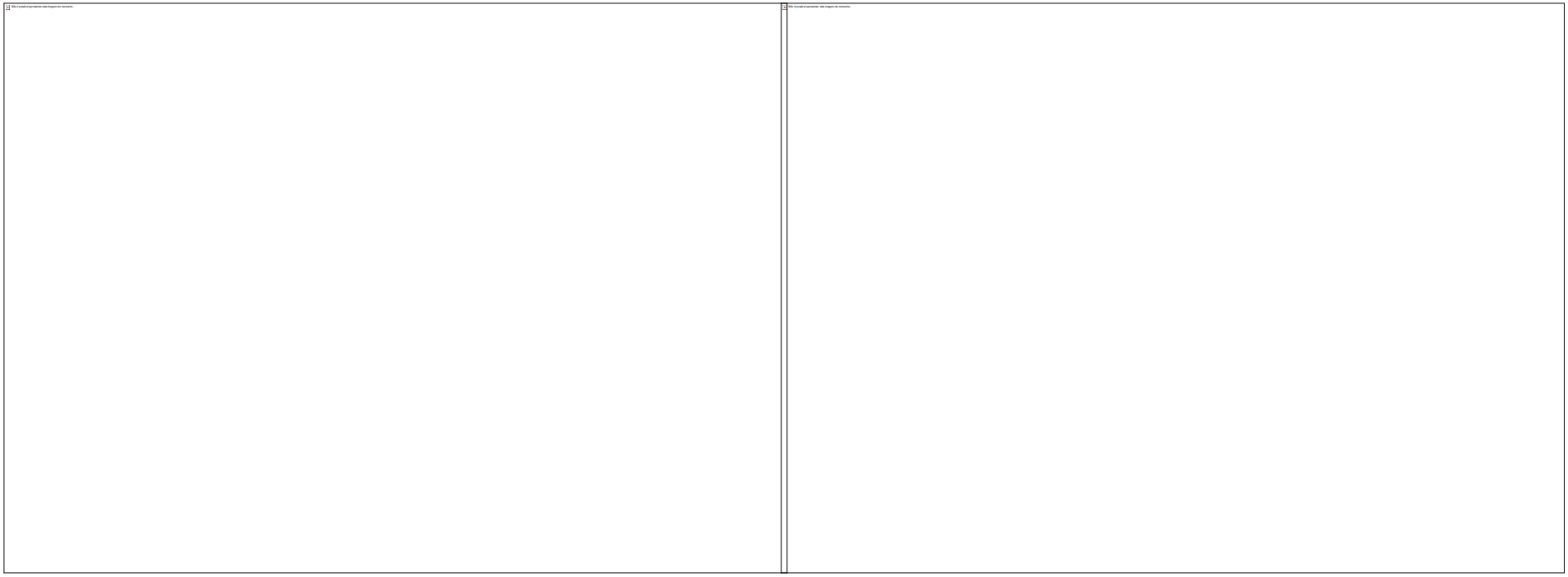
Entry rates: before 2004 - after 2009, digital intensive vs. other sectors



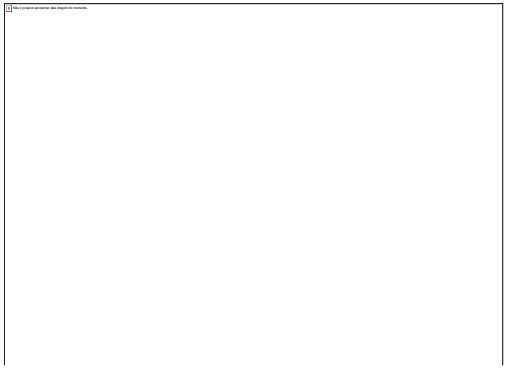
Source: Calvino and Criscuolo (2019).

ADDITIONAL SLIDES

Exit rate: changes over time, digital intensive vs. other sectors

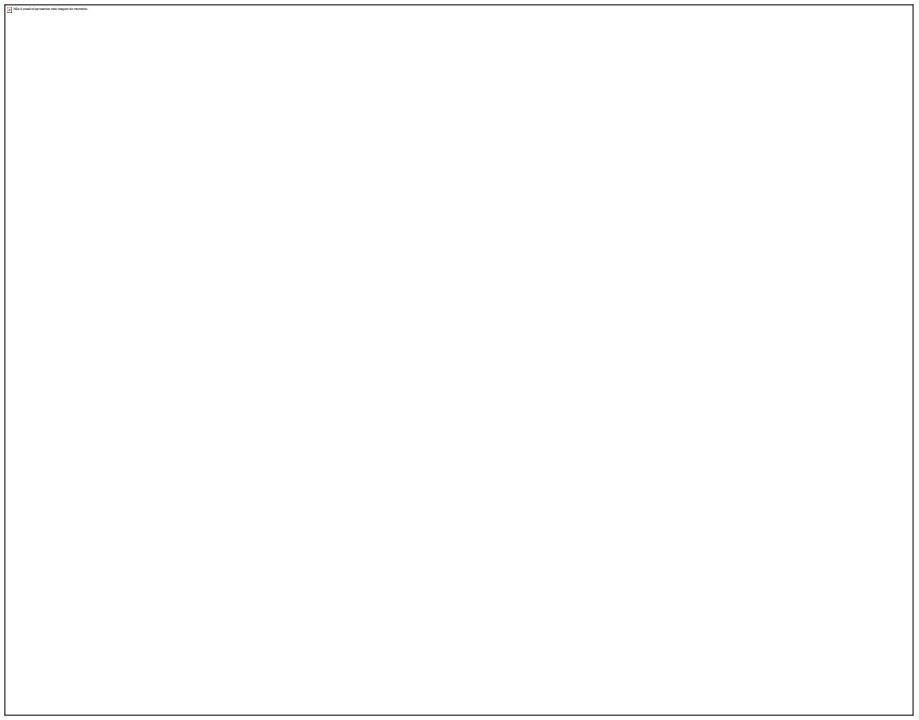


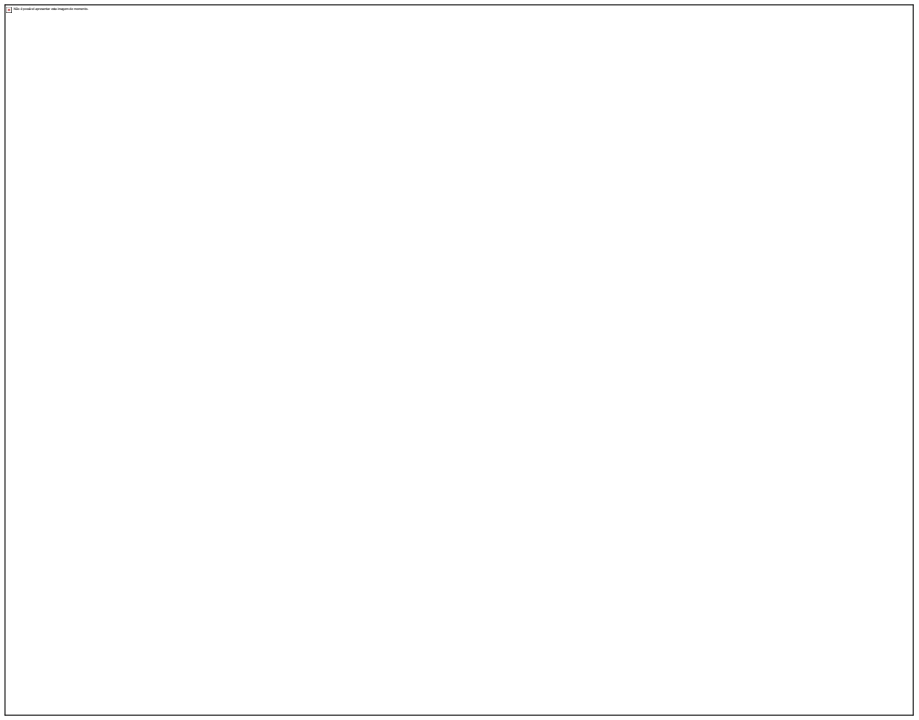
Source: OECD DynEmp3 database, March 2019



For comparison: figure from Business dynamics & digitalisation (note earlier start year!), p. 20

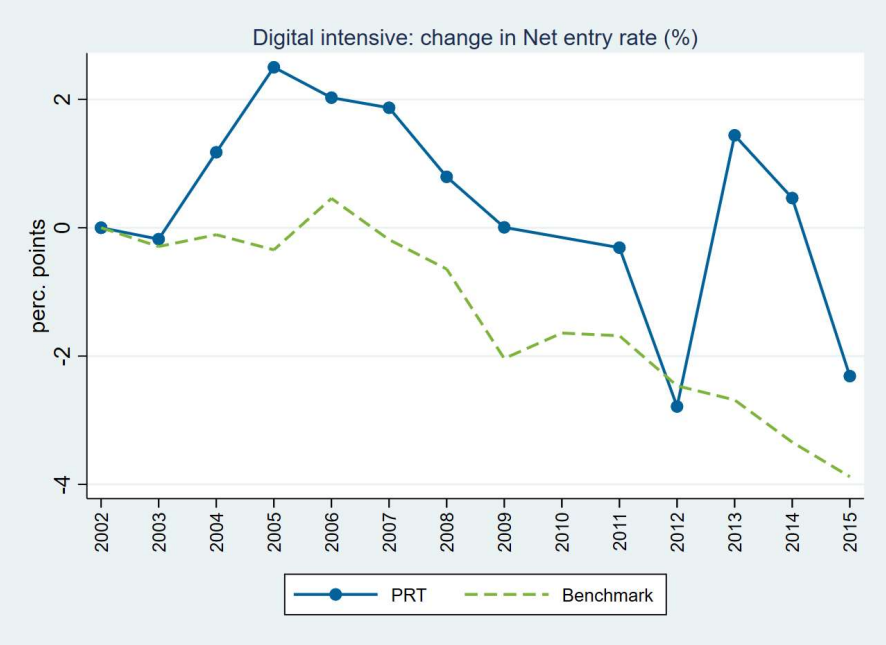
Job reallocation rate: changes over time, digital intensive vs. other sectors

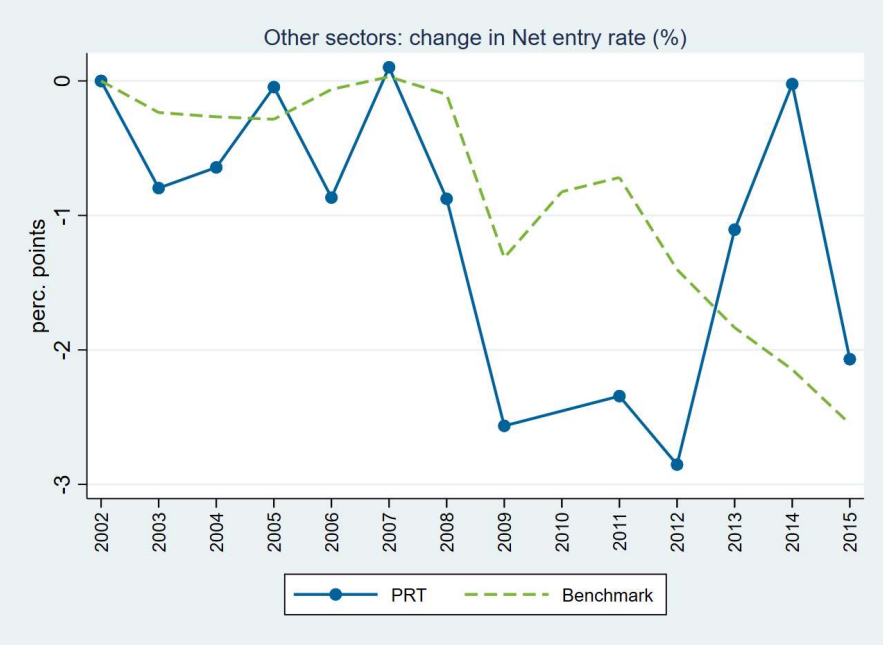




Source: OECD DynEmp3 database, March 2019

Net entry rate: changes over time, digital intensive vs. other sectors





Source: OECD DynEmp3 database, March 2019

- Method note on the graphs
  - The figures report the estimated year dummies from a regression of the variable of interest (job reallocation rates, exit rates, entry rates), within industries in Portugal, and within country-industry pairs in the set of benchmark countries, taking the first year as the baseline. Regressions are conducted separately for high-ICT and low-ICT industries.

Policy variables summary – Portugal and other countries

	PRT			Latest av. year	
	2001-2007	2008-2015	Latest av. year	Minimum	Maximum
Years of schooling	7.53	7.75	2010	6.75 (TUR)	13.15 (JPN)
Gov. Exp. Secondary Educ. (% GDO per capita)	30.60	32.39	2013	14.77 (TUR)	34.70 (FIN)
Higher Educ. Exp. In R&D (% GDP)	0.28	0.55	2015	0.167 (HUN)	0.876 (SWE)
Workplace training (% GDP)	0.03	0.08	2015	0 (HUN,NLD)	0.120 (PRT)
Venture capital (early stages, refers to 2005 only)	0.04		2005	0.002 (ITA,NLD)	0.052 (SWE)
Commercial banks (per 100,000 adults)	66.71	59.31	2015	6.55 (FIN)	67.51 (ESP)
PMR (overall)	2.12	1.49	2013	0.915 (NLD)	2.543 (BRA)
PMR (administrative burdens for start-ups)	2.72	2.65	2013	1.248 (NLD)	3.080 (TUR)
Size of stock market (% GDP)	25.76	18.62	2014	0.133 (CRI)	99.917 (JPN)
Efficiency of business regulations (EFW)	5.9	6.8	2015	3.481 (BRA)	8.432 (FIN)
Contract enforcement (days)	577	555.6	2015	280 (NOR)	1185 (ITA)
Large firm support for innovation (1-B Index)	0.22	0.28	2011	-0.015 (SWE)	0.425 (FRA)
EPL (individual and collective dismissals)	4.49	3.94	2013	1.369 (JPN)	3.185 (PRT)
Bankruptcy regulations (years to resolve insolvency)	2	2	2015	0.6 (JPN)	4 (BRA)

Source: OECD SPIDER database