



# Are intangibles running out of steam?

**Is the Rise in Intangible Investment Intensity and Productivity Growth Getting Disconnected?**

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## Are intangibles running out of steam?

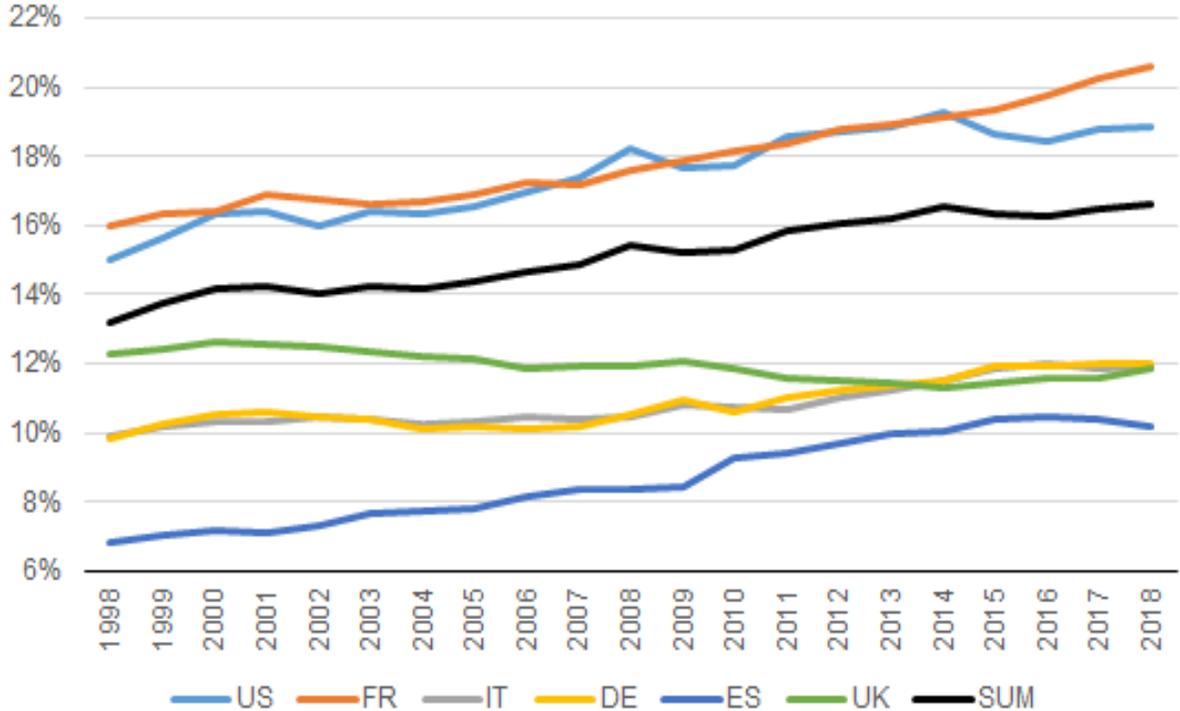
- Some indications that pace of intangibles capital accumulation has slowed since GFC
  - Reduced contribution of intangibles to productivity growth (Haskel & Westlake, 2022)
  - “Ideas are getting harder to find” hypothesis – fewer spillovers (Bloom et al., 2020)
  - Greater difficulties to get productivity from complementarities of tangible and intangible assets
- We stress tested the new EUKLEMS – INTANProd database
  - We looked at intangible share of GDP, real intangibles growth, and contributions to labour productivity growth
  - Six countries: France, Germany, Italy, Spain, UK and US
  - Aggregate, intangible asset and sector decomposition (only market sector!)
  - Focus largely on 1996-2006 and 2011-2018, excluding GFC-period (2007-2010)

## Intangibles keep contributing more to productivity growth but also account for part of the slowdown

- Contribution of intangibles to productivity growth has increased in **absolute terms** in the four EU economies, but dropped in the US and especially in the UK.
- In **relative terms** (i.e., as a % of productivity growth), the contribution of intangibles to productivity growth has strengthened modestly but picture is mixed.
- Weak evidence suggesting that the **increased ratio of intangible to tangible capital intensity** was not conducive to productivity growth during the post-GFC period.
- Stronger evidence that **relatively intangible-intensive industries** have contributed more to the slowdown in productivity growth than less intangible-intensive.
- Together with the **rapid slowdown in TFP growth**, this evidence points to a suboptimal distribution of intangibles across industries and a lack of spillover effects and complementarities translating into greater TFP performance.

# Intangible investment shares keeps increasing almost everywhere

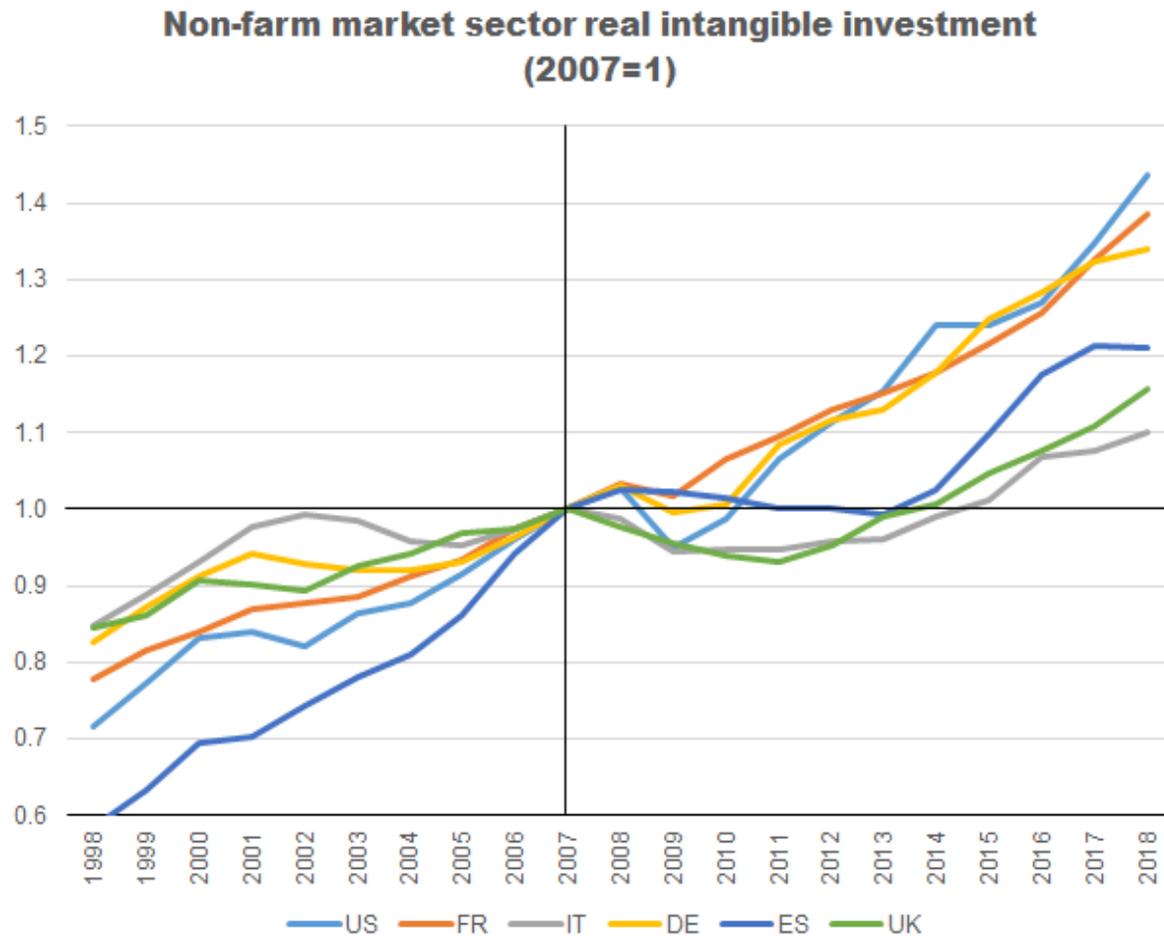
**Non-farm market sector intangible investment share (% of GVA)**



Note: aggregation for six countries based on GDP PPPs to convert investment and value added into a common currency.

- Intangibles as a share of GVA has continued to increase.
- No clear break visible following GFC
- Some moderation visible since 2015, but may be related to improvements in GDP
- UK is main exception, following ONS GDP revisions, but in particular different ways at which intangibles are measured (Appendix A)

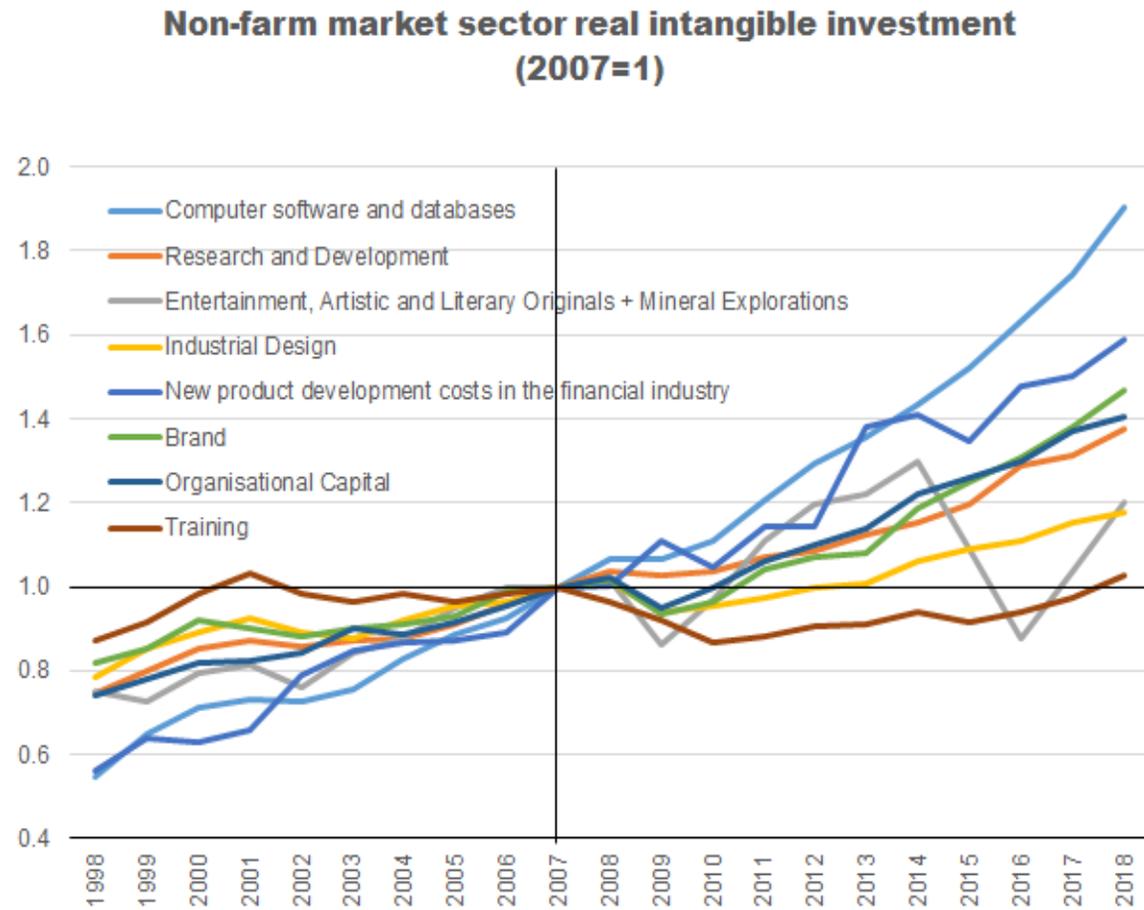
# Real intangible investment recovered after GFC with delay in Italy, Spain and UK



- US grows real intangible fastest followed by France and Germany as close runner ups
- Spain, and in particular Italy, recover later as of 2015
  - Spain slowed relative to rapid growth during pre-2007 period
  - Italy has been slow all along
- UK is weaker
  - Mainly caused by measures of design, brand and organisational capital

# Software + databases saw largest gains

## Training saw lowest gains since GFC



- Software + Databases show clearest sign continued growth
- Training remains flat both pre- and post GFC
- Industrial design some weakening post GFC
- Originals + mineral explorations raises some question marks? A possible role for collapse in oil prices?

Note: Weighted aggregate across all six countries based on nominal investment converted into a common currency based on GDP PPPs.

# A sector perspective shows a mixed picture but not much change

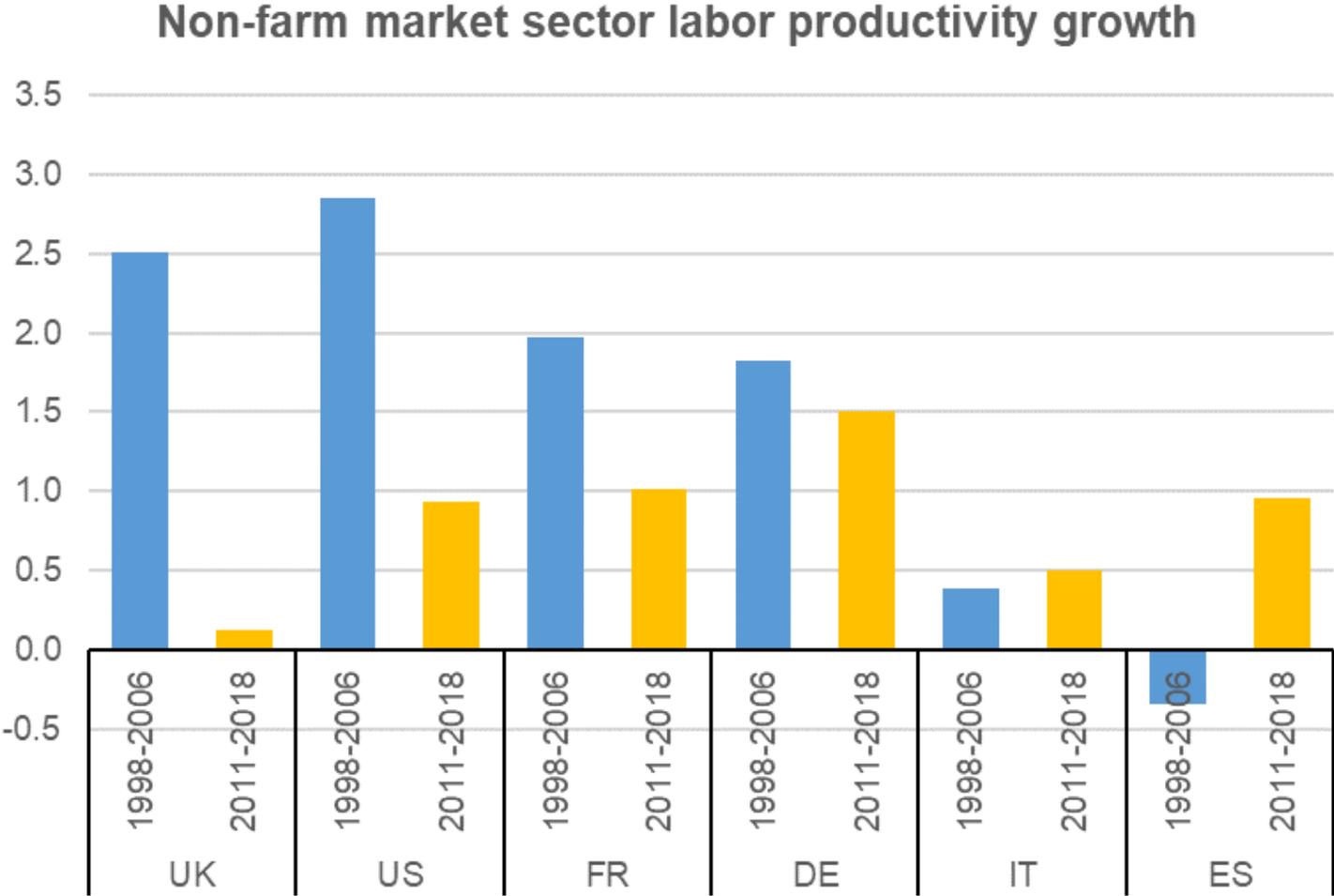
- US: strong across the board
- Some possible weakness in ICT and finance
- Spain and Italy weakest in traditional sectors?
- UK weakest in services?
- Statistical significance generally quite weak

## Non-farm market economy real investment in intangible assets 2011-2018 minus 1998-2006 annual average

	US	FR	IT	DE	ES	UK-GH
Non-agricultural market economy (Market economy less industry A)	+	+/-	+/-	+	-	+
B-Mining and quarrying	+	+	+	+	+	-
C-Manufacturing	+	+	+	+	-	+
D-E-Electricity, gas, steam; water supply, sewerage, waste management	+	+	+	-	-	+
F-Construction	+	-	-	+	-	+/-
G-Wholesale and retail trade; repair of motor vehicles and motorcycles	+	+/-	-	+	-	+/-
H-Transportation and storage	+	+/-	-	-	-	+
I-Accommodation and food service activities	+	-	-	+/-	+	+
J-Information and communication	+/-	-	-	+	-	+/-
K-Financial and insurance activities	+/-	+	+	-	+/-	-
M-Professional, scientific and technical activities	+/-	+/-	-	+/-	-	-
N-Administrative and support service activities	+	-	+/-	-	+	+
R-Arts, entertainment and recreation	+	-	-	+	-	-
S-Other service activities	+	+/-	+/-	+/-	+	+

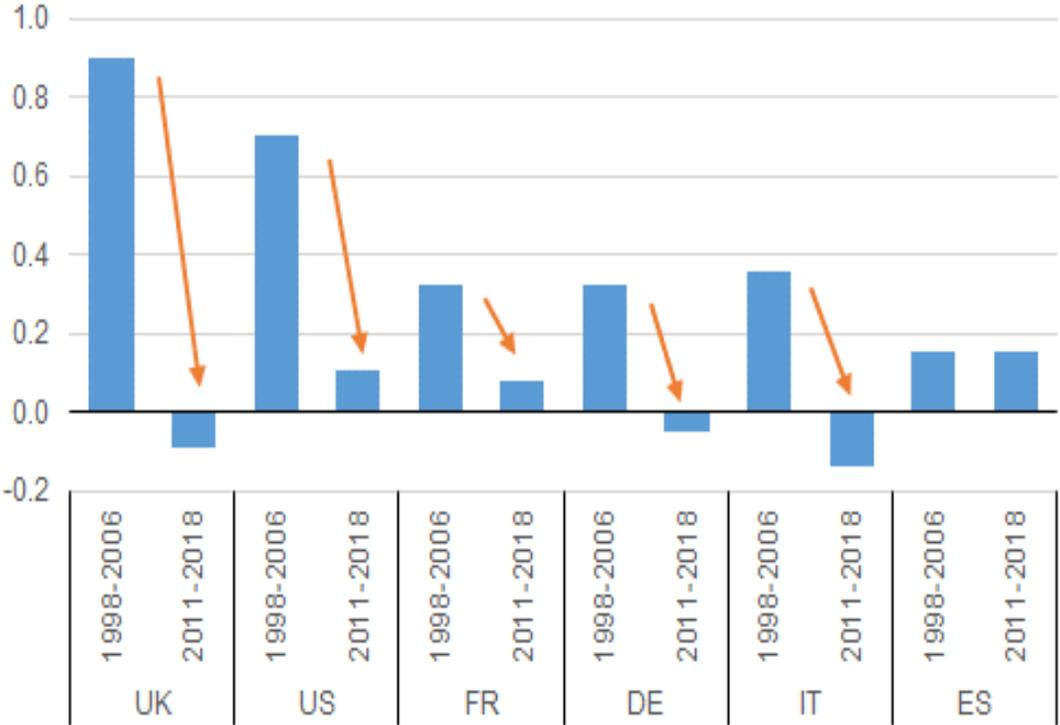
Note: The table shows the difference between average annual growth of the 2011-2018 period versus the 1998-2006 period  
A + sign indicates a ppt difference of above 0.5, a - sign a ppt difference of below -0.5 and +/- anything in between.

# Labour productivity growth slowed, except Italy and Spain who were much slower during pre-GFC period anyway

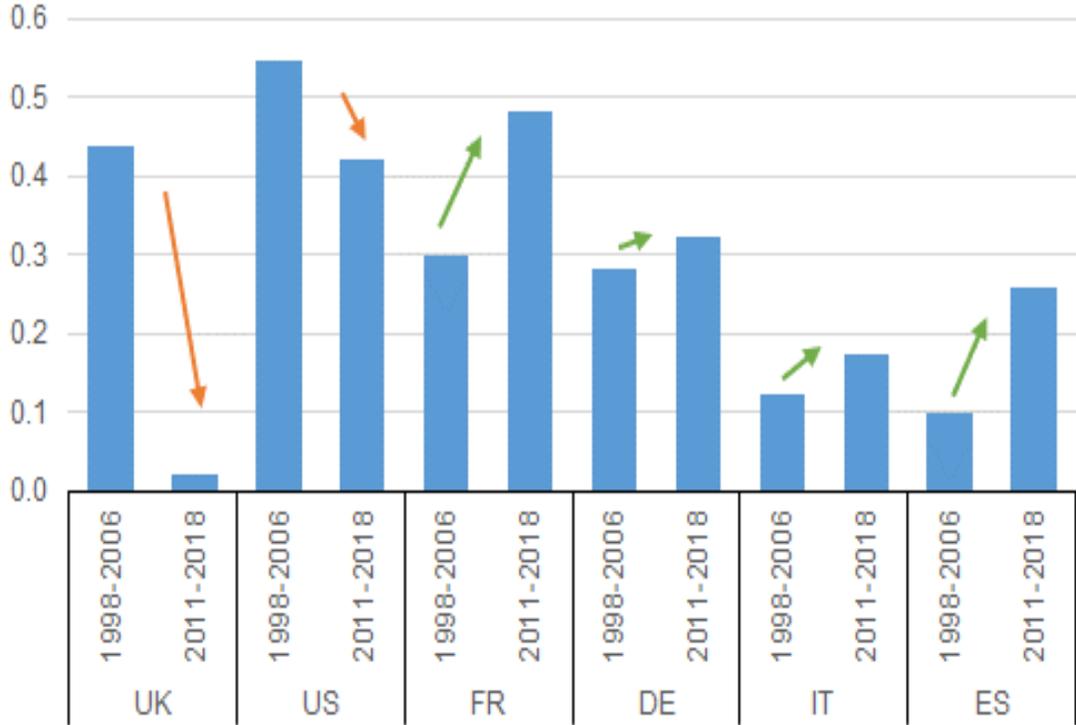


# Tangibles contributions to productivity growth dropped pretty much everywhere, but intangibles contribution increased, except in US and (especially) UK

Tangible capital contribution to labor productivity growth (ppt)



Intangible capital contribution to labor productivity growth (ppt)



# Industry contributions to productivity slowdown show a mixed picture

## Contribution to aggregate market economy labor productivity slowdown 2011-2018 versus 1998-2006

	US	FR	IT	DE	ES	UK
<b>Non-farm market economy</b>	<b>-1.87</b>	<b>-1.10</b>	<b>0.14</b>	<b>-0.16</b>	<b>1.12</b>	<b>-2.46</b>
B-Mining and quarrying	0.07	0.00	0.05	0.00	0.02	-0.06
C10-C12-Food products; beverages and tobacco products	-0.05	-0.05	-0.01	0.02	<b>-0.10</b>	-0.12
C13-C15-Textiles, wearing apparel, leather and related products	-0.02	-0.04	0.01	-0.01	<b>-0.07</b>	-0.07
C16-C18-Wood, paper, printing and reproduction	-0.04	-0.01	0.02	-0.04	-0.01	-0.09
C19-Manufacture of coke and refined petroleum products	-0.05	-0.01	0.03	-0.02	0.04	0.01
C20-C21-Chemicals; basic pharmaceutical products	<b>-0.16</b>	-0.07	-0.01	<b>-0.15</b>	-0.02	<b>-0.18</b>
C22-C23-Rubber and plastic products and other non-metallic mineral products	-0.03	-0.06	<b>-0.02</b>	-0.04	0.00	-0.09
C24-C25- <b>Manufacture of basic metals and fabricated metal products, except machinery and equipment</b>	-0.02	-0.02	0.03	-0.03	0.06	-0.05
C26-C27-Computer, electronic, optical products; electrical equipment	<b>-0.49</b>	<b>-0.13</b>	<b>-0.06</b>	<b>-0.19</b>	-0.01	<b>-0.17</b>
C28-Machinery and equipment n.e.c.	-0.06	-0.07	0.00	<b>-0.08</b>	-0.03	-0.13
C29-C30-Motor vehicles, trailers, semi-trailers and of other transport equipment	<b>-0.14</b>	-0.04	0.07	0.06	-0.04	<b>-0.15</b>
C31-C33-Furniture; jewellery, musical instruments, toys; repair and installation of machinery and equipment	-0.05	-0.07	0.01	-0.07	-0.04	-0.12
D-Electricity, gas, steam and air conditioning supply	-0.03	<b>-0.14</b>	<b>-0.07</b>	-0.02	<b>-0.13</b>	-0.10
E-Water supply; sewerage, waste management and remediation activities		-0.02	0.00	0.05	-0.01	-0.04
F-Construction	0.07	-0.04	0.04	0.02	0.59	0.07
G-Wholesale and retail trade; repair of motor vehicles and motorcycles	<b>-0.32</b>	0.05	0.27	<b>-0.21</b>	0.28	-0.11
H-Transportation and storage	-0.10	<b>-0.12</b>	<b>-0.24</b>	<b>-0.22</b>	0.16	-0.11
I-Accommodation and food service activities	-0.04	0.01	0.00	0.06	0.39	-0.03
J-Information and communication	-0.10	<b>-0.18</b>	<b>-0.17</b>	0.02	0.05	<b>-0.51</b>
K-Financial and insurance activities	<b>-0.35</b>	0.01	0.06	0.28	<b>-0.49</b>	<b>-0.38</b>
M-N-Professional, scientific and technical activities; administrative and support service activities	0.03	-0.01	0.14	0.37	0.48	-0.05
R-Arts, entertainment and recreation	0.00	-0.02	0.00	0.04	<b>-0.04</b>	-0.06
S-Other service activities	0.02	<b>-0.08</b>	-0.01	0.01	0.05	0.06

Note: Showing the difference between contribution to average annual market economy productivity growth in 2011-2018 minus the 1998-2006 period. The bottom-5 industries are marked in red.

- Sizeable negative contributions from Computers & Electronics (esp. US), Information (esp. UK) and Finance (esp. Spain, UK and US)
- Manufacturing weak across the board
- Sizeable positive contributions in Professional, Scientific and Technical Services (France, Germany, Spain)
- Also in Spain: Construction and Accommodation contribute positively

# Decomposing the sector contributions – two taxonomies

## Intangible intensity taxonomy:

- Based on intangible investment share in GVA
- 1= most intensive (two lowest quartile values); 2= least intensive (two highest quartile values)
- Average based on simple average of intangible investment shares across all countries (excl. UK-GH)
- Distribution is +/- 50-50% in terms of value added

## Digital intensity taxonomy:

- Based on OECD taxonomy used by Van Ark, Erumban and de Vries (2019)
- Separated out digital producing sectors

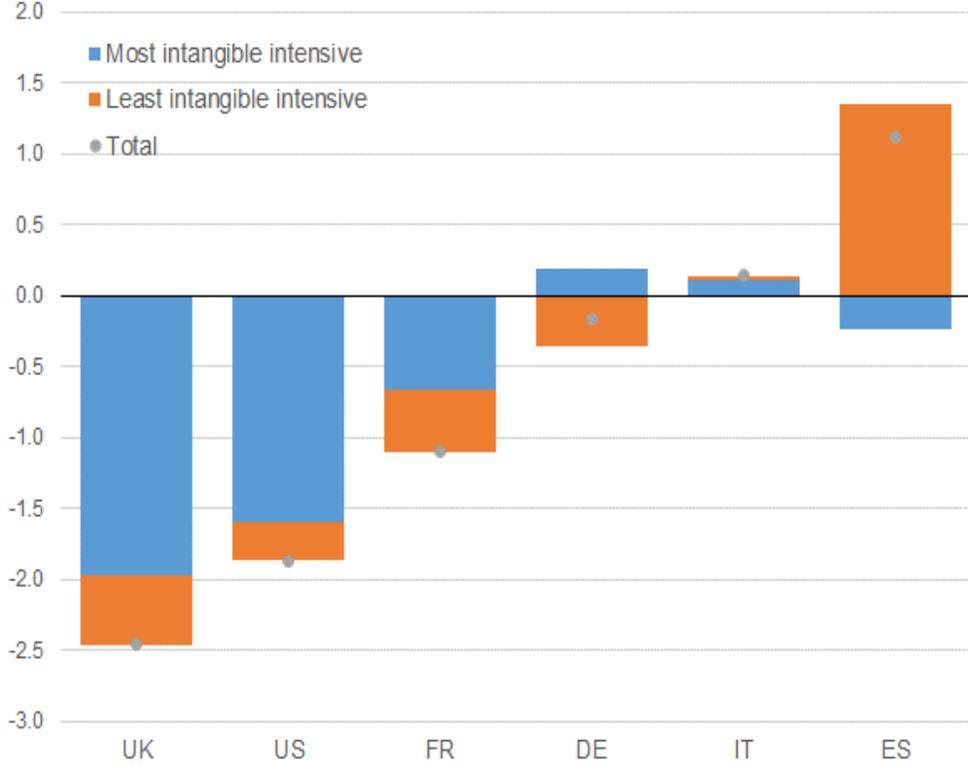
- 1 – most intensive;
- 2 – least intensive
- 3 – digital producing

	Intangible intensity	Digital intensity
B-Mining and quarrying	1	2
C10-C12-Manufacture of food products; beverages and tobacco products	1	2
C13-C15-Manufacture of textiles, wearing apparel, leather and related products	2	2
C16-C18-Manufacture of wood, paper, printing and reproduction of media	2	1
C19-Manufacture of coke and refined petroleum products	1	2
C20-C21-Chemicals; basic pharmaceutical products	1	2
C22-C23-Manufacture of rubber and plastic products and other non-metallic mineral products	1	2
C24-C25-Manufacture of basic metals and fabricated metal products	2	2
C26-C27-Computer, electronic, optical products; electrical equipment	1	3
C28-Manufacture of machinery and equipment n.e.c.	1	1
C29-C30-Manufacture of motor vehicles, trailers, semi-trailers and other transport equipment	1	1
C31-C33-Manufacture of furniture; jewellery, musical instruments	1	1
D-Electricity, gas, steam and air conditioning supply	2	2
E-Water supply; sewerage, waste management and remediation activities	2	2
F-Construction	2	2
G-Wholesale and retail trade; repair of motor vehicles and motor cycles	2	1
H-Transportation and storage	2	2
I-Accommodation and food service activities	2	2
J-Information and communication	1	3
K-Financial and insurance activities	1	1
M-N-Professional, scientific and technical activities; administrative and support activities	1	1
R-Arts, entertainment and recreation	2	1
S-Other service activities	2	1

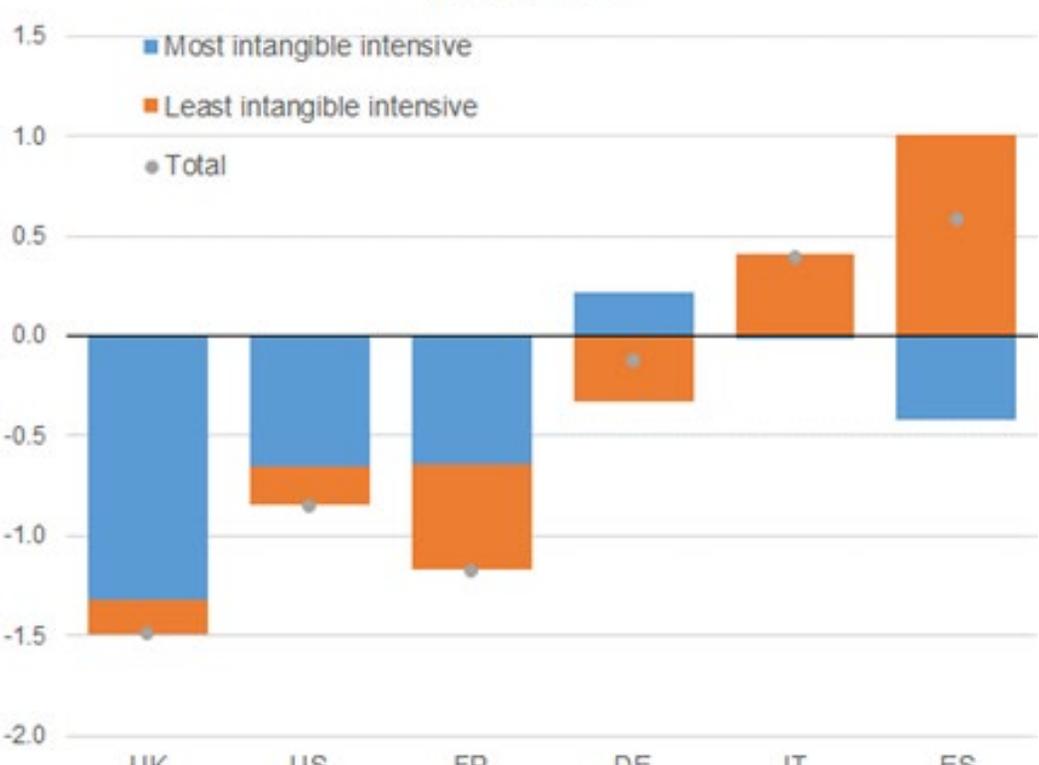


# Intangible-intensive industries contribute most to slowdown in productivity growth since 2011

**Contribution to nonfarm market sector labor productivity growth slowdown, 2011-2018 vs. 1996-2008**



**Contribution to nonfarm market sector TFP growth slowdown, 2011-2018 vs. 1996-2008**



# TFP is the main source of the productivity slowdown, but tangible ICT and intangibles play up as well in several places

Decomposition of labour productivity slowdown, in %-point and %, select industries in the US and UK (period averages)

	Computer, electronic, optical products; electrical equipment				Information and communication				Financial and insurance activities			
	US		UK		US		UK		US		UK	
	11-19 minus 98-06	%- contri- bution	11-19 minus 98-06	%- contri- bution	11-19 minus 98-06	%- contri- bution	11-19 minus 98-06	%- contri- bution	11-19 minus 98-06	%- contri- bution	11-19 minus 98-06	%- contri- bution
<b>Labor productivity growth (3)</b>	-13,5	100%	-8,6	100%	-1,5	100%	-5,8	100%	-3,0	100%	-3,7	100%
<b>TFP (4)</b>	-12,0	88%	-6,6	76%	-0,1	4%	-3,0	52%	-1,7	57%	-3,2	88%
<b>Labor composition (5)</b>	0,1	-1%	-0,7	8%	-0,3	18%	-0,1	1%	-0,3	11%	0,0	0%
<b>Capital Deepening (6)</b>	-1,6	12%	-1,4	16%	-1,1	77%	-2,7	46%	-0,9	31%	-0,4	12%
<b>Tangible – non-ICT (7)</b>	-0,5	3%	-0,8	9%	-0,2	11%	-0,1	2%	-0,4	12%	0,2	-5%
<b>Tangible – ICT (8)</b>	-0,3	2%	-0,2	2%	-0,5	31%	-1,5	27%	-0,6	19%	0,2	-4%
<b>Economic Comp (9)</b>	0,0	0%	-0,2	2%	-0,1	4%	-0,3	5%	0,0	-1%	-0,5	14%
<b>Innovative Prop (10)</b>	-0,5	4%	-0,2	3%	-0,4	29%	-0,3	5%	0,0	-1%	0,1	-2%
<b>Digitized info (11)</b>	-0,4	3%	0,0	0%	0,0	2%	-0,4	7%	0,0	1%	-0,3	9%

# Some econometric analysis UK and US, 22 industries, 1999-2006 & 2011-2018, LP and TFP growth

- Using simple correlation analysis, there was no evidence of a large substitution of intangible for tangible capital
- Some models testing:
  - Panel data with fixed country effects, looking at impact of intangibles and tangibles capital-hour growth on productivity growth with a period dummy for 2011-2018 (Models 1 and 2)
  - Same, but with interaction with relative levels of intensity as well as interaction between organizational capital and ICT intensity growth (Models 3 and 4)
  - OLS regressions including and dummy variable for the most intangible-intensive industries (Models 5 and 6)
  - Same but with interaction with relative level of intensity (Models 7 and 8)

**Country-industry Fixed effects regression:**

	Labor productivity growth		TFP growth	
	Intangible growth rates	Relative levels of intangibles (to tangible)	Intangible growth rates	Relative levels of intangibles (to tangible)
Non-ICT capital	.505***	.486***	.24*	.243
Total intangible growth	n.a	.161*	n.a	-.094
Organizational K	.136**	-.093***	-.008	-.088***
ICT Organization interaction	n.a	.001***	n.a	.001***
Dummy 2011-2018=1	-3.479***	-.73	-3.452***	-.118
<b>Interactions with period Dummy</b>				
Non-ICT capital	<i>-.175</i>	<i>-.154</i>	-.046	<i>-.026</i>
ICT capital	.142	<i>-.469***</i>	.094	<i>-.571***</i>
Total intangible growth	n.a	<i>.477</i>	n.a	.362
Brand	<i>.466***</i>	-.133	<i>.496***</i>	-.12
Organizational K	-.243**	-.064	-.194**	-.072
R&D	<i>.327***</i>	-.041	<i>.272***</i>	-.023
ICT Organization interaction	n.a	<i>.041***</i>	n.a	<i>.043***</i>

\*\*\*=significance at 1%; \*\*=5%; \*=10%. Red ones are with joint significance (interaction + main effect)

### OLS regression with intangible industry dummies

	Labor productivity growth		TFP growth	
	Intangible growth rates	Relative levels of intangibles (to tangible)	Intangible growth rates	Relative levels of intangibles (to tangible)
d.Non-ICT capital	.523***	.516***	.253**	.284**
d.ICT capital	-0.001	-0.056	-0.019	-.082*
d.Organizational K	0.167	-.045***	0.05	-.05***
d.R&D	0.011	.038*	-0.009	0.019
Dummy (Int-intensive=1)	2.203***	2.449***	2.29***	2.435***
Dummy 2011-2011=1	-2.841**	-0.266	-2.795**	0.101
<b>Interactions with period Dummy</b>				
d.Non-ICT capital	-.408**	<b>-0.248</b>	-0.261	-0.143
d.ICT capital	<b>0.18</b>	<b>-.459**</b>	0.131	<b>-.534***</b>
d.Brand	<b>.458**</b>	<b>-.517**</b>	<b>.503**</b>	<b>-.518**</b>
d.R&D	<b>.443***</b>	<b>-.061***</b>	<b>.379***</b>	<b>-.046**</b>
d.Software & DB	0.021	<b>.397**</b>	-0.003	<b>.394**</b>
d.ICT * Org. K /Tangible	na	<b>.041***</b>	na	<b>.043***</b>
Dummy (Int-intensive=1)	-1.342	<b>.043***</b>	-1.507	<b>-2.128**</b>

\*\*\*=significance at 1%; \*\*=5%; \*=10%. Red ones are with joint significance (interaction + main effect)

## Our findings from the econometric analysis

- The rise in **intangible capital intensity** contributes positively to productivity growth over the entire period, but more so during the post-GFC period.
  - In particular, **R&D and brand intensities** have significantly stronger effects on labour productivity growth in the later period than in the earlier period.
  - **Organisational capital intensity** stronger during the pre-GFC period but during the post-GFC period there is a stronger interaction between levels of organisational capital and growth of ICT capital intensity
- When interacted with the rapid decline in the **level of tangible capital intensity**, the role of the increase in intangible capital intensity becomes less prominent.
- There is no evidence that **intangible-intensive industries** have come to the rescue in terms of improving their productivity performance.

## Bottom lines

- No evidence of intangibles investment running out of steam nor any signal of it getting better
- Intangible and digital intensive industries explain most of productivity growth, but also played a role in accounting for the productivity slowdown
- The positive contribution of intangible capital to productivity growth has not been sufficient to make up for the decline in the contribution of intangible relative to tangible capital
- Productivity growth has not increased as rapidly as it did when tangible capital intensity was the main driver of growth
- The slowdown in TFP growth suggests that the effects of spillovers from particular investments and complementarities between those investments have weakened

## Some next steps

- Measurements remain an issue, especially for intangibles-intensive industries
- Is this the ICT-productivity paradox all over again?
- More analysis on industry-by-industry case basis. Have some countries or industries “over-intangibilised” in pre-GFC period, and are others still catching up?
- Institutional aspects of intangibles, such as the role of science, technology and innovation institutions, the design of financial markets and policies, and competition need to be studied in more detail (Haskel and Westlake, 2022)