

The Role of Tangibles and Intangibles in Explaining the Productivity Slowdown – An International Perspective¹

Evidence contribution to the UK Productivity Commission
Investigation on “Investment and Productivity”

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¹ This note is based on ongoing research by the authors on the productivity slowdown in advanced economies during the post-GFC crisis period. A first draft of our paper, titled “Are Intangibles Running out of Steam?”, was presented at the World KLEMS conference in October 2022 in Manchester ([Van Ark, de Vries and Erumban, 2022](#)). A revised working paper under the same title will be published by The Productivity Institute soon. The current note uses updated data from [EUKLEMS & INTANProd \(Release 2023\)](#). To secure international comparability, we use the EUKLEMS data for the UK, However, in the appendix to this note we compare those with recent UK data based on [Goodridge and Haskel \(2022\)](#) which shows a sharper weakening in the contribution of intangibles in the UK than the EUKLEMS data.

Summary and main observations

- *Much of the blame for slowing growth in labour productivity has been put on the slowdown in total factor productivity growth – meaning less efficiency in how we are turning the factor inputs (capital and labour) into output. However, there is clear evidence that slower growth in the investment in capital has played an important role as well.*
- *In analysing the role of investment and total factor productivity, it is important to make a distinction between tangible investment (machinery, equipment and structures) vis-à-vis intangible investment (including digitised information, innovative property and economic competencies).*
- *Across two EU sub-regions (Northwest and South), the UK and the US, we find that the share of tangible investment in value added in the market economy has fallen substantially since the Global Financial Crisis (GFC). In contrast, the value added share of intangible investment has slightly increased.*
- *For the UK, the value added share of those intangible assets already included in the national accounts (in particular software, databases and R&D) is relatively small, while the share of intangibles investment not (yet) included in the national accounts (e.g., financial product development, market research and branding and management competencies) is relatively large. In this respect, when only comparing the official national accounts-based measures, the share of investment in value added is somewhat understated for the UK in comparison to other countries.*
- *In all four regions/countries we find that the growth rates of capital services delivered by tangibles and intangibles assets have weakened since the GFC, though substantially more for tangibles than intangibles.*
- *The weakened growth rate of capital services from intangible assets has occurred despite the modest rise in the share of intangible assets in value added. This points at the possibility that intangible investments are not as effective as a driver of productivity as used to be the case before the GFC.*
- *For the UK, we observe a relatively sharp weakening in the growth rate of intangible capital services in Finance & Insurance, which accounts for a relatively large share in the value added of the economy. On the other hand, the growth of intangibles capital services from Trade, Transportation and Accommodation & Food Services accelerated since the GFC.*
- *Despite similar trends in the slowdown of capital services from tangible and intangible investment between regions/countries, the UK is an outlier in terms of a severe slowdown in the growth rate of labour productivity since the GFC. This has created the paradoxical situation that the role of intangibles in the UK has become bigger in the context of weaker productivity growth.*
- *The note identifies various channels that need to be further researched to explain why the “intangible-intensive” economy has lost much of its power to create productivity, including the malfunctioning of channels which typically create spillovers and complementarities.*

Introduction

The productivity slowdown across advanced economies over the past one and half decade has been widely documented in the literature.² Many potential explanations for the slowdown have been investigated. These include an exhaustion of the productivity benefits from technological change and innovation, the drag from the Global Financial Crisis (GFC) because of low demand and weak investment, resource misallocation, an erosion in catch-up growth in emerging markets and less effective global value chains, and the potential mismeasurement of outputs and inputs in an increasingly digital and intangible economy. More recently, the COVID pandemic has also left significant scars on critical sources of productivity growth, including skilled labour, investment and global trade. In our own work, we have put much emphasis on the explanation of a time lag between the invention of the latest new (digital) technologies and its successful implementation in productive business practices ([Van Ark, De Vries and Erumban, 2021](#)).

Much of the blame for slowing growth in labour productivity has been put on the slowdown in total factor productivity (TFP) growth (see, for example, [Fernald, Inklaar and Ruzic, 2023](#))³. While weak or even negative TFP growth has undoubtedly played a large role, pointing at a deterioration in the efficiency by which we are turning factor inputs (capital and labour) into output, the “residual” nature of the TFP growth measures makes it difficult to identify what is at the core of the productivity puzzle.

Newly released data from [EUKLEMS & INTANProd \(Release 2023\)](#) suggest that slower investment contributed substantially to the slowdown in labour productivity as well. A key feature of [EUKLEMS & INTANProd \(Release 2023\)](#) is that it, for the first time, fully integrates measures of tangible capital (machinery, equipment and structure) and intangible capital (including digitised information, innovative property and economic competencies), using an integrated growth accounting framework.⁴

Intangibles versus tangibles: trends and contributions to productivity growth

Intangible capital covers a wide range of business spending that should be treated as investment, as the outlays are expected to yield a return in a future period. The categorisation of intangible investment proposed by Corrado, Hulten, and Sichel (2005) provides widely accepted guidance for this broader investment concept. A substantial part of those intangibles investments (e.g. software, databases and R&D) are already capitalised in the System of National Accounts, or intended to be included in the SNA in due course (e.g. marketing and branding). (Figure 1).

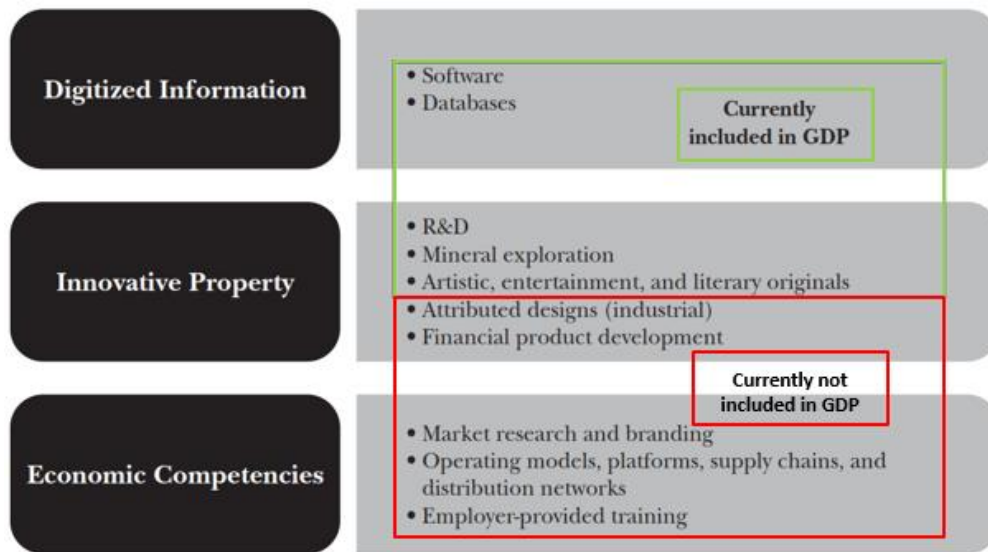
Data covering member states in the northwest of the EU (Austria, Belgium, Germany, Denmark, Finland, France, Netherlands and Sweden) and the south of the EU (Greece, Italy, Portugal and Spain) as well as the United Kingdom and the United States, show that the share of tangible investment in value added in the market economy has fallen substantially during the post-GFC period. In contrast, the share of intangible investment (and especially the share of those not yet included in the national accounts) has slightly risen. (Figure 2).

² For references on causes of the productivity slowdown, see [Van Ark, De Vries and Erumban, 2021](#).

³ For a discussion of the role of TFP vs. investment from a growth theory & accounting perspective, see [Chadha and Samiri \(2022\)](#).

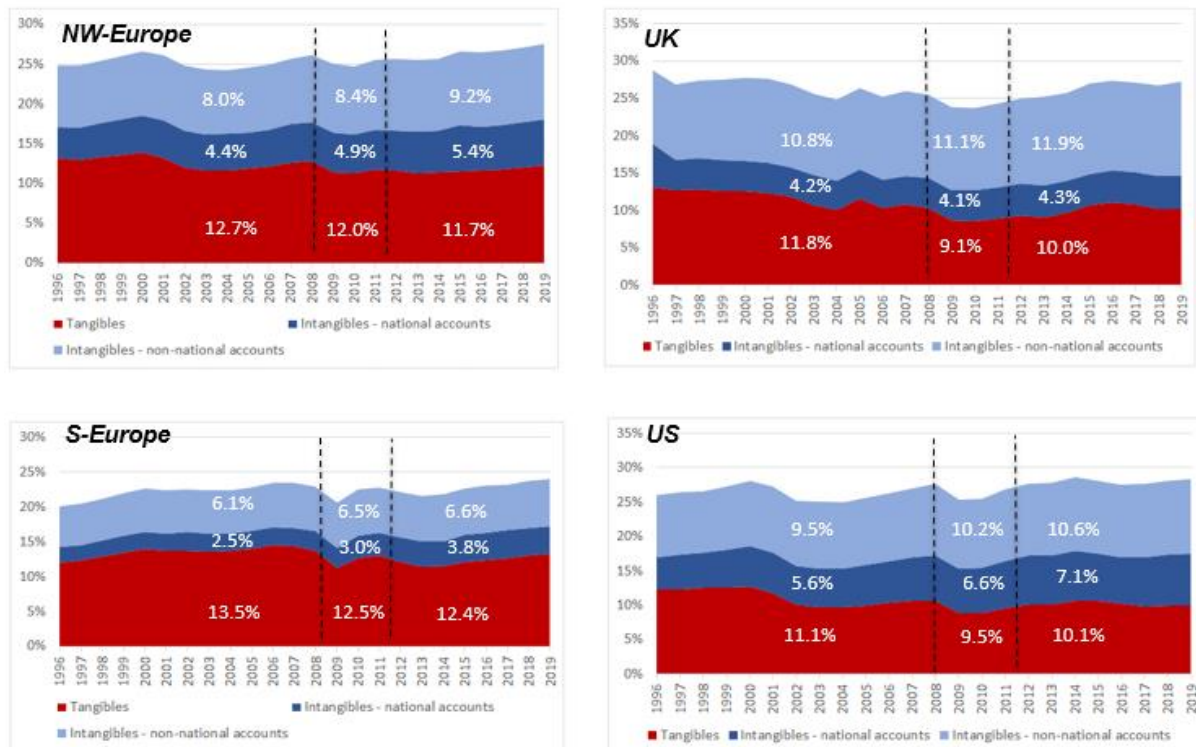
⁴ See [Bontandini et al. \(2023\)](#) for an explanation of sources and methods.

Figure 1: Intangible Capital: Broad Categories and Types of Investment



Source: [Corrado et al. \(2022\)](#).

Figure 2: Investment/GDP (tangibles, NA intangibles, non-NA intangibles), % share, market economy (1996-2019)



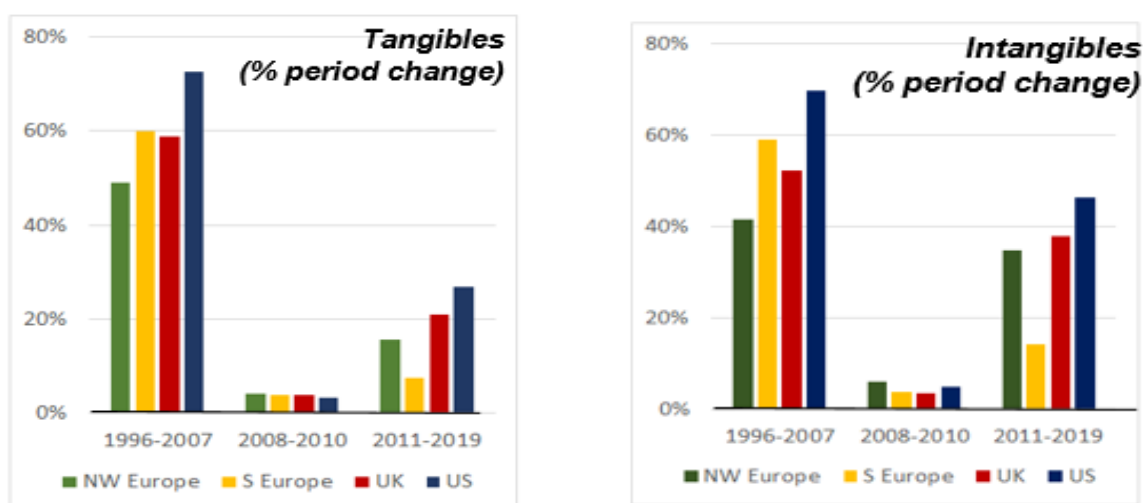
Source: [EUKLEMS & INTANProd \(Release 2023\)](#).

For the UK – which is the focus of this note – the share of tangible investment in market economy value added has dropped below the pre-GFC level by almost 2 percentage points, and is below that of European counterparts. While the tangibles investment share in the UK and the US are quite similar, nominal GDP and tangible investment have both risen much faster in the US compared to the UK.

On the investment share of national accounts-based intangibles, the UK has fallen far below the share of the US and (to a lesser extent) of Northwest Europe. This mainly reflects weaker nominal investment in software and databases. However, for other intangibles which are not included in the national accounts, the UK has outperformed the US and the two EU regions throughout the period. The strong performance of those intangibles (especially, marketing and branding and organisational capital) reflects the relatively large shares of the Finance and Insurance sector, other business services and the retail industry in UK GDP. In this respect, relying only on national accounts-based investment measures somewhat understates the UK investment share relative to other countries.

Switching to the growth of real capital services (after cumulating investment over time and computing annual service contributions of the stock) from tangibles and intangibles, we do not find that the UK is an outlier (Figure 3). In fact all four countries/regions have seen a sharp weakening, even though more so in tangible than intangible capital services.

Figure 3: Increase in Real Capital Services, market economy, & period change, (1996-2019)



Note: Northwestern Europe (AT, BE, DE, DK, FI, FR, NL, SE), Southern Europe (EL, ES, IT, PT); Tangible investment and capital services refer to ICT and non-ICT machinery and equipment, non-residential buildings and vehicles. Intangibles refer to digitized information, innovative property and economic competencies both included and excluded from the national accounts (see Figure 1). Country aggregation for EU sub-regions based on GDP PPPs to convert investment and value added into a common currency.

Source: [EUKLEMS & INTANProd - Release 2023](#); authors' calculations.

An important characteristics of [EUKLEMS & INTANProd \(Release 2023\)](#) is that the data also cover 40 industries and 23 industry aggregates.⁵ Looking at the difference in the growth rates of real capital services in 2011-2019 relative to 2000-2007 for the aggregate level of 12 major sectors, it appears there has been a lot of weakening in the services sector of the economy, especially in Information & Communication and in Finance & Insurance. In particular, the latter sector accounts for a relatively large share of UK GDP. Intangible capital services in other services industries, including Trade, Transportation and Accommodation & Food Services have continued to grow relatively strongly in the UK compared to the EU sub-regions and the US.

⁵ For a detailed description of sources and methods, see Bontadini, F, C. Corrado, J.Haskel., M.Iommi., C.Jona-Lasinio, [EUKLEMS & INTANProd: industry productivity accounts with intangibles](#), LUISS, February 2023.

The picture for production industries is much more varied across regions/countries. While manufacturing accounts for a relatively small part of the UK economy, intangible capital services did in fact substantially strengthen in Manufacturing during the post-GFC period, including the Computer, Electronic, Optical and Electrical Equipment industry. (Figure 4)

Figure 4: Growth in capital services in intangible assets, Market Economy, 2011-2019 minus 1996-2006

		NW-EU	S-EU	UK	US
MARKTxAG	Non-agricultural market economy (Market economy less industry A)	+/-	--	+/-	+/-
B	Mining and quarrying	++	-	+/-	+
C	Manufacturing	+	-	++	+/-
C26-27	Computer, electronic, optical products, electrical equipment	+/-	-	++	--
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-N	Professional, scientific and technical activities; Admin & support services	-	--	+/-	-
R-S	Arts, entertainment and recreation; Other service activities	-	--	+/-	+/-

Note: The table shows the difference between average annual growth of the 2011-2019 period versus the 1996-2006 period. '++' sign indicates a difference on average annual growth of capital services of more than 1.5 %-point; '+' sign indicates a difference of between 0.5 and 1.5 %-pt; '+/-' sign a difference of between -0.5 and 0.5; '-' sign between minus 0.5 and 1.5 %-point; '--' sign more than minus 1.5 %-point.

Source: [EUKLEMS & INTANProd - Release 2023](#); authors' calculations.

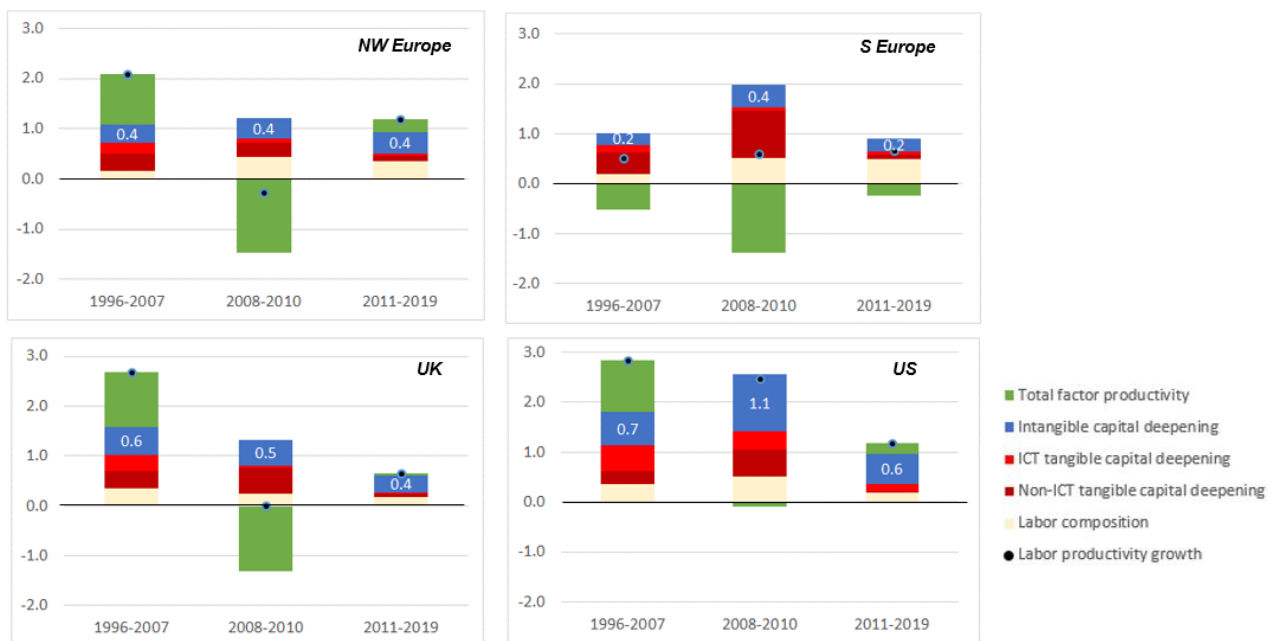
To measure how much of the slowdown in labour productivity growth can be accounted for by the change in tangibles and intangible capital services, we base ourselves on the contributions of tangible and intangibles capital deepening (i.e. the growth of both types of capital relative to the contribution of hours worked). These measures are also obtained from the extended growth accounts provided by [EUKLEMS & INTANProd \(Release 2023\)](#). (Figure 5).

When looking at the growth accounting results the outlier position of the UK becomes more clearly visible:

- The slowdown in UK labour productivity growth has been much larger than in NW-EU and S-EU, while productivity growth outperformed both regions from 1996-2007.
- As in other regions the weakening in TFP (total factor productivity) growth has been a key factor explaining the slowdown.
- The UK productivity slowdown from 1996-2007 to 2011-2019 has been particularly affected by a decline in the contribution of tangible capital deepening (from 0.4 to 0.1 %-point for non-ICT capital, and from 0.3 to 0 %-point for ICT capital).
- The contribution of intangibles capital deepening also weakened substantially in the UK (from 0.6 %-points from 1996-2007 to 0.4 %-points from 2011-2019) – which puts the UK contribution at par with NW Europe, but well below the US.

The relatively large contribution of intangibles to labour productivity growth in the UK creates a paradoxical situation. While the UK has become one of the most intangible-intensive economies, with more than half of labour productivity growth accounted for by intangible capital deepening, the large slowdown in productivity growth suggest that those intangibles apparently are not helping as much to drive productivity growth in the aggregate.

Figure 5: Decomposition of Labour Productivity Growth to contributions of labour composition, tangibles and intangible capital deepening and TFP, market economy, 1996-2019



Note: See Figure 3. Note, output for the computation of labour productivity has been amended to take account of the output from intangible capital.

Source: [EUKLEMS & INTANProd - Release 2023](#); authors' calculations.

Are intangibles running out of steam?

Our analysis suggests that the contribution of intangible capital to productivity growth has not been sufficient to make up for the decline in the contribution of tangible capital. This effect seems to be especially strong in the UK, where the contribution of capital deepening of intangibles accounted for 54 percent of labour productivity growth between 2011-2019 (compared to 21 percent from 1996-2007) but dropped in absolute terms from 0.6 to 0.4 percentage point between both periods. The contributions of tangibles capital deepening and TFP declined even faster.

Preliminary econometric evidence from our analysis ([Van Ark, de Vries and Erumban, 2022](#)) supports the notion of a weakening impact from intangible investment on labour and total factor productivity growth. Indeed [Haskel and Westlake \(2022\)](#) make the observation that the levelling off of intangible investment growth might be a cause of slowing productivity growth.

Various channels could be responsible for intangibles running out of steam:

- Productivity spillovers from investment in intangibles have begun weaken, perhaps related to the “ideas are getting harder to find” hypothesis ([Bloom et al., 2020](#)).
- Complementarities between different types of intangible and tangible capital assets have become more difficult to realize, for example, because of insufficient upskilling of the labour force, a lack of organisational innovation or a weakness in business model innovation in relation to the rise of digital economy ([Brynjolfsson, Rock & Syverson, 2021](#)).

- A slowdown in globalisation (incl. finance, trade and FDI) could have reduced global spillovers from intangibles. This could include the possibility that some forms of intangible capital (e.g. data) are increasingly trade-protected and therefore more rival than previously ([Andrews et al. 2016](#)).

Specifically for the UK, it is worthwhile to investigate more deeply whether the slower growth performance of Britain's "intangible intensive" economy, can be explained by one or more of the following factors:

- Compositional (or between-industry) effects of the economy, giving a relatively large weight to industries with a small or a declining share of intangibles. This factor is not regarded as important in the recent work on the measurement of intangibles in the UK by [Goodridge and Haskel \(2022\)](#).
- A slowdown of productivity within relatively intangible-intensive industries, including Information & Communication services data and Finance & Insurance. This factor seems to carry more weight according to both [Goodridge and Haskel \(2022\)](#) and the data from [EUKLEMS & INTANProd \(Release 2023\)](#).
- Measurement challenges, which create uncertainty as to the precise contribution of intangible investment to productivity growth. Stress-testing of the [EUKLEMS & INTANProd \(Release 2023\)](#) database therefore remains an important priority (see also Appendix).
- The weakening of institutions which are critical to the creation of intangibles (e.g. science, technology and innovation institutions, the design of financial markets and policies, and competition) regarding the UK's performance of intangibles ([Haskel and Westlake, 2022](#))

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Appendix – Differences between EUKLEMS & INTANProd – Release 2023 and Goodridge & Haskel (2022) for the UK

This note relies on source data from [EUKLEMS & INTANProd \(Release 2023\)](#) – hereafter referred to as EUKLEMS. For comparison we also looked at recent data from [Goodridge and Haskel \(2022\)](#) – hereafter referred to as GH – used to construct vintages of industry level national accounts and growth accounting data for the UK.

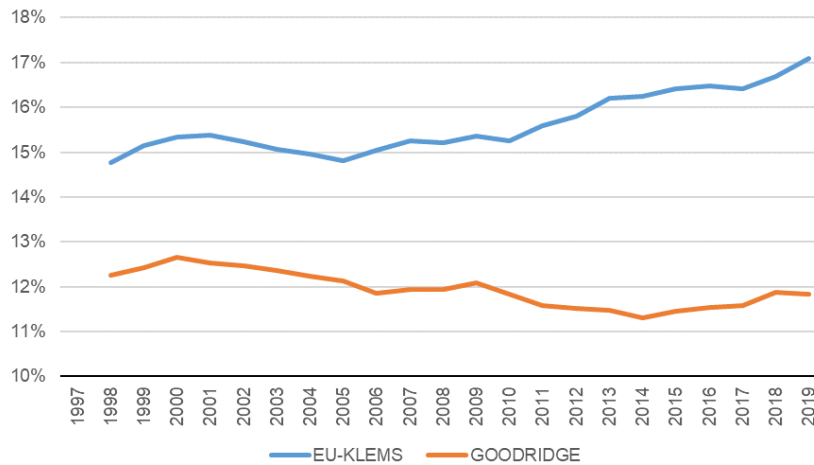
Both datasets rely on the Corrado-Hulten-Sichel framework to identify intangible assets, both use different somewhat different sources. GH relies entirely on (in part, experimental) data from the Office of National Statistics, whereas EUKLEMS is largely based on data from Eurostat (only including official ONS data) as well as slightly different computations by the KLEMS team in order to better harmonise data across countries and industries.

The aggregate level of nominal intangible investment as a share of value added is substantially higher in EUKLEMS data than in GH, and the EUKLEMS share also increased whereas it slightly declined according to GH. EUKLEMS shows particularly higher levels of intangible investment for Brand, Design, and Organizational Capital, where GH show higher levels of training investment data.

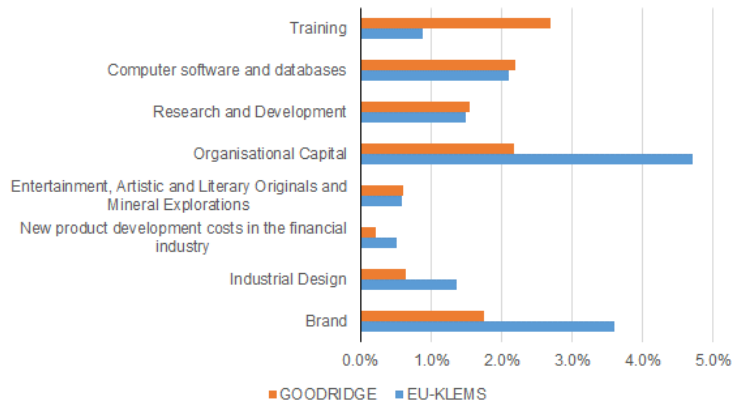
The growth rates of real investment in intangibles are also different between the two datasets. Overall real intangible investment grew on average 1.6 percent per year between 1998 and 2019 according to GH, versus a much faster 3.3 percent growth rates in the EUKLEMS dataset. The differences are largest for design, organizational capital and training where EUKLEMS shows much faster growth (in the latter case GH even shows a decline); while New Product Development costs in the financial industry show much faster growth according to GH. With regards to real intangible investment growth by industry, EUKLEMS shows faster growth in all sectors, except for C13-15 (textiles and apparel).

On balance, the weaker growth performance on intangible capital according to GH would have further reduced its contribution to UK labour productivity growth. While this may have slightly lessened the paradoxical situation of a relatively large contribution of intangible capital in the context of weakening productivity growth, the observation that intangible capital has been insufficient in supporting productivity growth during the post-GFC period is maintained.

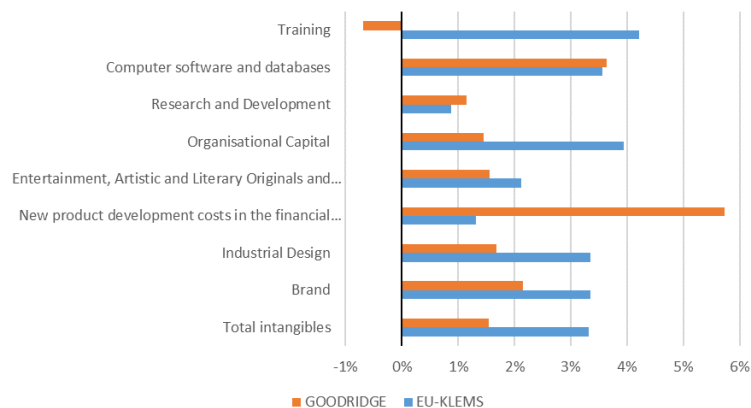
Nonfarm market sector intangible investment share



Nonfarm market sector intangible investment share, 2010



Nonfarm market sector real intangible investment growth, 1998-2019 (average annual % change)



Real intangible investment growth, 1998-2019
(average annual % change)

