The UK's capital gap: a short-fall in the trillions of pounds that will take decades to bridge

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Date:
May 2025

The Productivity Institute
Productivity Insights Paper No.055

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Key words
labour productivity, capital stock, capital intensity, investment gap, UK economy, international comparisons, public investment, economic policy

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Acknowledgements
We are grateful to Bart van Ark, Diane Coyle, Robert Inklaar, Massimiliano Iommi, and Josh Martin for their valuable comments and insights during the preparation of this paper. All remaining errors and omissions are the sole responsibility of the authors.

Suggested citation

T. Allas, D. Zenghelis (2025) *The UK's capital gap: a short-fall in the trillions of pounds that will take decades to bridge.* Productivity Insights Paper No. 055, The Productivity Institute.

The Productivity Institute is an organisation that works across academia, business and policy to better understand, measure and enable productivity across the UK. It is funded by the Economic and Social Research Council (grant number ES/V002740/1).

The Productivity Institute is headquartered at Alliance Manchester Business School, The University of Manchester, Booth Street West, Manchester, M15 6PB. More information can be found on The Productivity Institute's website. Contact us at theproductivityinstitute@manchester.ac.uk

Abstract

A low level of capital to support workers is a key cause of the UK's low labour productivity. We estimate that for each hour worked, people in the UK benefit from a third less capital than workers in higher-productivity peer countries (the US, Germany, France, and the Netherlands). This is the first rigorous quantification of the UK's capital gap, and we estimate that it was around £2 trillion in 2019 in absolute terms.

This estimate varies depending on the assets in scope and the data used, demonstrating the significant challenges associated with estimating internationally comparable productive capital stocks per hour worked. Nevertheless, we are confident that the UK's capital gap is measured in the trillions of pounds. In this context, the government's current level of ambition for raising UK investment—which frequently talks about tens of billions—is far too low. Even if the UK was able to step up its investment rate by about 4%-points of GDP, it would take almost a century to catch up with the capital intensity of higher-productivity peer countries.

Marginal increases to public investment combined with minor initiatives to encourage private investment are a distraction, and do not constitute a strategic take on the issue. A clear, credible and coordinated push is necessary to dislodge the UK from its low productivity/low capital stock equilibrium.

1. The UK's low productivity is not a puzzle

The UK's productivity problem—the low levels and growth rates in its labour productivity—is widely recognised. GDP per hour worked in the UK is estimated at 15 percent below Germany and the US and 10 percent below France (van Ark and O'Mahony, 2023).

This underperformance has translated directly into stagnant incomes. From 1970 to 2007, real wages grew on average by 33% per decade. Since the global financial crisis of 2008, they have flatlined—an unprecedented trend for post-industrial, peacetime Britain (Resolution Foundation and Centre for Economic Performance, 2023). As the government has identified, failure to deliver productivity growth will constrain our ability to reduce poverty and improve the health and wellbeing of British citizens.

There is broad consensus on the proximate causes of the UK's low productivity: low and volatile investment, skills mismatches, and poor diffusion of technology and innovation (Zenghelis et al, 2024; The Productivity Institute, 2023; Chadha and Samiri 2022). The underperformance is broad-based across sectors, reflected in services as well as manufacturing (Alayande and Coyle, 2023) and across firms and regions (van Ark and O'Mahony, 2023). The sharpest slowdown appears to have been in advanced, intangibles-heavy, high value-added sectors such as ICT, software and pharmaceuticals – areas traditionally seen as UK strengths (Coyle and Mei, 2022; Goodridge and Haskel, 2023).

Much of the UK's productivity weakness is due to persistently low investment. Investment is the flow into productive assets —equipment and structures, workforce skills, ideas and processes, and natural systems like air, water, and climate—that drive labour productivity, earnings, and incomes. These forms of capital—produced, human, intangible, institutional, and natural—are complementary and mutually reinforcing. For example, new equipment enables new types of innovation. In the endogenous growth model, investment in physical and knowledge capital can drive increasing returns to scale, where more knowledge begets increased output and liberates resources for further investment: a virtuous growth spiral in which future output becomes 'path-dependent'.[i] Because these capitals are complementary, a shortfall in one leads to constraints on the others.

So, why is UK investment so weak? Some answers are familiar: policy uncertainty and fragmentation, underinvestment in public infrastructure, and poor management practices, including short-termism (The Productivity Institute, 2023). Digging deeper reveals more complexity and a diversity of perspectives. For instance, we still lack a clear explanation for the UK's weaker management quality, or why creative destruction fails to reallocate more resources faster toward the best-run firms (Resolution Foundation and Centre for Economic Performance, 2023).

Yet, we should not let what we don't know obscure what we do: low levels of investment—and the resulting shortfall in capital stock—are a major cause of the UK's productivity problem. This is borne out by theory—as explained above—as well as practice—whereby workers in the UK's manufacturing plants, construction sites, warehouses, hospitals, and offices are often equipped with out-dated machinery and software, less automation, and less absorptive capacity for innovation, than their peers abroad.

This diagnosis is also borne out by data.

2. A new data-driven perspective

Most analyses of the UK's low levels of investment tend to focus on flows: gross fixed capital formation (GFCF) as a share of GDP. This ratio has clear benefits: both GFCF and GDP are established, internationally consistent measures, and—being a ratio—avoids the complications of currency conversion.

By this measure, the UK's (public and private) investment performance has long lagged its peers. In the period from 1993 to 2024, GFCF averaged just under 18% of GDP in the UK, compared with 22% in France and Germany and 21% in the US (Zenghelis et al., 2024). Relative to the G7 average (excluding the UK), the UK invested 4.7 percentage points less annually over this period (ibid).

To compensate for decades of underinvestment– across physical, natural, human, knowledge and social capital – Zenghelis et al. (2024) estimated that public investment needs to rise by at least 1% of GDP, or £26 billion (at current prices), as part of a broader increase in total public and private investment of at least 3% of GDP, or £77 billion. This builds on analysis by Brandily et al. (2023), which found that if UK private investment had matched the average of France, Germany and the US since 2008 –requiring additional investment of just over 2% of GDP annually –UK GDP today would be nearly 4% higher, equivalent to an extra £1,250 per worker in annual wages.

It is important to distinguish the short-run, demand-side impact of investment from its long-run, supply-side effects. Brandily et al. (2023) show that sustained 'growth accelerations' (periods of prolonged GDP per capita growth) are rarely seen without accompanying 'investment booms', in which capital stock per person grows substantially over time).[ii]

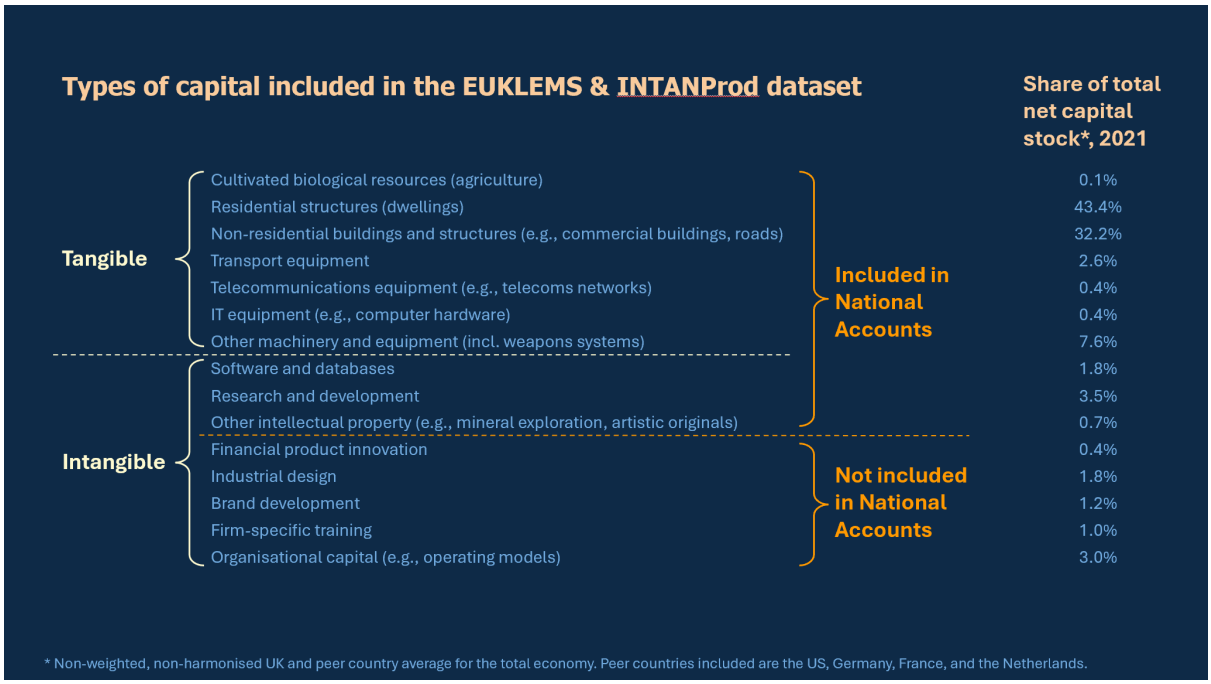
While gross investment *flows* clearly matter, they tell only part of the story. To assess the full impact on labour productivity—the key to raising living standards in a sustainable, non-inflationary way—we must focus on the *stock* of productive capital available to workers. Moreover, rather than comparing capital to GDP, it is more meaningful from a productivity standpoint to relate capital to the number of workers or the number of hours worked[iii].

Measuring the productive capital stock in an internationally comparable way is difficult. National statistical agencies report gross and net capital stocks, but neither these is a direct measure of the productive capital stock (OECD, 2009). Differences in depreciation methods and assumptions further undermine cross-country consistency. However, as explained in Annex A, we believe that the harmonised net capital stocks in the EUKLEMS & INTANProd dataset, constructed using geometric depreciation, offer a reasonable, internationally comparable estimate of the productive capital stock (Bontadini et al., 2023).

Another challenge is defining the scope and definition of capital. This should include all assets which generate returns and which are identifiably distinct from, yet complementary to, other assets. Traditional measures of GFCF have expanded to include some intangibles relevant to productivity—such as software, databases, R&D, and certain intellectual property assets—but many intangibles remain outside the National Accounts asset boundary. These include training, organisational development, design, branding, and market research. Though often treated as current expenditure, much of this spending creates assets that deliver value over time and should arguably be capitalised. Because such intangible investment has historically been excluded, past productivity estimates have likely understated the role of capital deepening and overstated multi-factor productivity (Corrado et al., 2006).

There are many detailed issues in measuring these intangibles. Nevertheless, several statistical agencies, including the ONS (ONS, 2024) have begun to address these gaps by publishing complementary measures of "additional" intangibles. The EUKLEMS & INTANProd database brings this data together with traditional National Accounts, offering cross-country capital stock data that is broader in scope (Figure 1) and more comparable (Bontadini et al., 2023).

Figure 1: Categories of tangible and intangible capital included in national accounts and the broader EUKLEMS & INTANProd dataset



In this paper, we put forward a complementary metric for gauging the quantum of the UK's capital gap: total harmonised net capital stock per hour worked. This metric has several benefits: it focuses on stocks, rather than flows, it includes non-national-account intangibles (hence the label "total"), it approximates productive (rather than wealth) capital stock, and it relates the amount of capital to workers and hours worked (rather than GDP).

Using our preferred measure, in our main case sensitivity which excludes residential dwellings, we find that UK workers benefit from 33% less capital per hour worked compared to higher-productivity peer countries, which we define here to include the (unweighted average of) US, Germany, France, and the Netherlands. In absolute terms, the UK capital gap in 2019 was approximately £2 trillion.

This figure is not just useful for quantifying the UK's investment challenge—it starkly illustrates the magnitude of the problem. Here's an illustration.

In March 2025, the Chancellor Rachel Reeves announced that the National Wealth Fund would direct "tens of billions of pounds" into the UK's industrial strengths (HM Treasury, 2025a). The expected additional public and private investment over the course of the parliament is around £100 billion (HM Treasury, 2024). That sounds substantial—but amounts to £20 billion per year. This would be insufficient to close the gap in capital flows, let alone narrow the £2 trillion capital stock gap, which would require UK net investment flows to rise above, and stay higher than, peer group levels. Even if the UK

was able to step up its investment rate by 4%-points of GDP, more than £100 billion a year, it would take a century to catch up with the capital intensity of higher-productivity peer countries (see Section 7).[iv]

We believe that quantifying the gap in absolute terms forces a more grounded conversation about what is needed to shift the UK's productivity trajectory. We return to the policy implications in the final section.

3. Utilising EUKLEMS & INTANProd data

The EU KLEMS & INTANProd 2025 release is a new database for productivity analysis, funded by the Directorate General for Economic and Financial Affairs (DG-ECFIN) of the European Commission. It updates previous editions of the EU KLEMS database (EU KLEMS, 2023) and, for the first time, integrates data on intangible investment from INTAN Invest (Bontadini et al., 2023).

For our purposes, this dataset has several advantages.

It provides internally consistent data on value added, employment, hours worked, capital investment, and harmonised net capital stocks, from 1995 to 2021. The coverage spans 27 EU countries plus the UK, US, and Japan. The capital stocks data is broken down by asset type, allowing us to test the sensitivity of our results to different asset boundaries (e.g., whether residential dwellings are included). The data captures investment in additional intangibles beyond national accounts boundaries, including brand, design, new product development costs in the financial industry, organisational capital, and training. Harmonised capital stock estimates, derived using geometric depreciation, provide an estimate of productive (rather than wealth) capital stocks (see Annex A). Finally, adjusted value added figures are available to match the inclusion of non-national-account intangibles.

There are additional benefits to the EU KLEMS & INTANProd dataset, including its sectoral granularity and its growth accounting module. However, we do not utilise these features in the analysis in this paper (see, for example, Van Ark, De Vries and Erumban, 2024). While other datasets exist, EU KLEMS & INTANProd offers a combination of flexibility and coverage and a harmonised treatment of net capital stocks across countries.

Despite these strengths, it is fair to say that multiple measurement challenges remain across key variables (i.e., value added, hours worked, and net capital stock). We address some of these through sensitivity analyses but emphasise that our core results should be understood as order-of-magnitude estimates.[v]

The methodologies for measuring both national account and non-national account net capital stocks—and especially intangibles—continue to evolve. Nevertheless, we

believe that utilising this data is one step towards also making it better, and improving its interpretation, in the future (Van Ark, De Vries and Erumban, 2024).

Other data sources and converting values into common currency

In addition to EU KLEMS & INTANProd, we use data from the OECD and Penn World Tables (PWT).

In our main case, we use hours worked data from OECD productivity statistics and run separate sensitivities using the EU KLEMS & INTANProd hours data. Even though the latter is more consistent with value added measures, it is less consistent across countries, due to national statistical agencies' differing methodologies (Van Reenen and Yang, 2024).

Converting national currency values of value added and, especially, of harmonised net capital stock, into a common currency is a major challenge. No single method is ideal (Feenstra et al., 2015)[vi]. For value added, we use output-side GDP purchasing power parities from PWT. However, we also run sensitivities using market exchange rates (from PWT for 2019 and OECD for 2021).

For capital stocks, there are three options for currency conversions. As we explain in Annex A, for our main case, we apply a purchasing parity adjustment using PWT estimates of price levels for capital services, which are conceptually the closest to the productive capital stock we aim to approximate. We also run sensitivities using price levels for net (wealth) capital stocks and using market exchange rates (from PWT).

Further detail on sensitivities, data sources and variables is provided in Annex B.

4. Methodology for calculating total net capital stock per hour worked

Choice of timeframe

We use data from 2019, as more recent years (2020 and 2021) were likely distorted by the COVID-19 pandemic. Historical patterns also suggests that labour productivity and net capital stock change slowly—so observations on 2019 should still be relevant in 2025. (A sensitivity analysis using 2021 figures is provided in Annex B Table B4 and shows a very similar pattern to the main results.)

Choice of variables

Ultimately, we want to compare levels of labour productivity—value added per hour worked, adjusted for including all intangibles—with total harmonised net capital stock (tangibles and intangibles) per hour worked. To do this, we have used the following EUKLEMS & INTANProd variables (for 2019):

Table 1: EUKLEMS & INTANProd variables of interest used in the analysis

EUKLEMS & INTANProd variable code	Variable explanation	Used in calculation for
VAadj	Adjusted gross value added (GVA), consistent with the inclusion of non-national-account intangible assets, current prices, millions of national currency	Labour productivity
VA_CP	Gross value added (GVA), consistent with national account intangibles, current prices, millions of national currency	Labour productivity (sensitivity analyses only)
H_EMP	Total hours worked by persons engaged, thousands	Labour productivity, capital stock per hour worked (sensitivity analyses only)
HK_Tang	Harmonised net capital stock, total tangible National Accounts assets, current prices, millions of national currency	Capital stock per hour worked
HK_Intang	Harmonised net capital stock, total intangible (including non-national-accounts) assets, current prices, millions of national currency	Capital stock per hour worked
HK_NatAcc	Harmonised net capital stock, total National Accounts (only) intangible assets, current prices, millions of national currency	Capital stock per hour worked
HK_TangNRes	Harmonised net capital stock, total tangible National Accounts assets excluding residential structures (dwellings), current prices, millions of national currency	Capital stock per hour worked
K_Tang	Non-harmonised net capital stock, total tangible National Accounts assets, current prices, millions of national currency	Capital stock per hour worked
K_Intang	Non-harmonised net capital stock, total intangible (including non-national-accounts) assets, current prices, millions of national currency	Capital stock per hour worked
K_NatAcc	Non-harmonised net capital stock, total National Accounts (only) intangible assets, current prices, millions of national currency	Capital stock per hour worked
K_Rstruc	Non-harmonised net capital stock, residential structures (dwellings), current prices, millions of national currency	Capital stock per hour worked

Note: Total net capital stock equals the sum of (national accounts) tangible (HK_Tang for harmonised, or K_Tang for non-harmonised) and (national accounts and non-national accounts) intangible net capital stock (HK_Intang for harmonised, or K_Intang for non-harmonised). For more detail, see Annex B.

Choice of sectors

We analyse the whole economy excluding households as employers ("Total industries (A–S)")[vii]. This maintains consistency, as household capital stock is recorded as zero, but their value added is not. (Except for dwellings, household capital stocks are, by statistical convention, outside of the National Accounts boundary. However, in reality, people working for households—such as nannies, cleaners, cooks, or chauffeurs—make significant use of non-national-accounts household capital stock, such as cars,

kitchen equipment, cleaning equipment, and so on. Including their output, but not all of the relevant capital stock, would introduce an inconsistency.)

Choice of peer countries

We compare the UK to an unweighted average of four higher-productivity economies: the US, Germany, France, and the Netherlands. They are broadly similar to the UK in terms of their level of economic development but have significantly higher labour productivity. Data is available for other countries and we show it where relevant (e.g., in Figure 2). We do not weight the results, to avoid the US dominating the figures. A comparison with just the US could be misleading, as the UK's economic structure is closer to that of Germany, France, and the Netherlands. We avoid one-to-one comparisons between countries to minimise risk of spurious interpretations.

Choice of "main case"

There are a number of important choices to be made about which data to use. These choices make a big difference. In addition to our "main case", we provide the results for 15 other permutations, and separately, for one permutation using data for 2021. The full detail for these is provided in Annex B, with a more in-depth justification for the key choices relating to capital stock in Annex A. To summarise, the "main case" presented in this paper:

- Uses harmonised (rather than non-harmonised) net capital stocks, as these are the closest approximation for comparable productive (rather than wealth) net capital stock
- Includes non-national-accounts intangibles, as these represent important assets that contribute to output and labour productivity
- Excludes residential dwellings, which, while expected to contribute to productivity (e.g., via better labour market mobility and matching and agglomeration economies), can exaggerate the productive capital gap between the UK and other countries
- Converts national currency harmonised net capital stock values into purchasing-power-parity (PPP) adjusted international dollars using capital services (rather than capital stock) price level differences relative to the US, as capital services are conceptually closer to the productive capital stock approximated by harmonised net capital stock
- Uses the adjusted value added (rather than National Accounts value added) data from EUKLEMS & INTANProd, to adjust for the inclusion of non-national-accounts intangibles, so that the value added and capital stock figures are consistent
- Converts national currency value added into PPP-adjusted dollars using output-side GDP price level differences relative to the US (rather than market exchange

rates), as level comparisons of productivity are more meaningful when price differences are taken into account

- Uses hours worked data sourced from the OECD (rather than EUKLEMS & INTANProd) to calculate "per hour" values, because the OECD provides a more internationally comparable set of hours worked numbers.

Data manipulation

To arrive at internationally comparable estimates of labour productivity levels and total harmonised net capital stock per hour worked in 2019 in our main case, we use the steps outlined below. For sensitivity analyses, which vary in the detail of the data used, see the section 'Sensitivity analysis' and Annex B.

1. Download and merge (by year, country, and sector) the full data for "National Accounts", "Capital", and "Intangibles" datasets from the EUKLEMS & INTANProd website
2. Filter the data to only include variables of interest (see Table 1), only the year 2019 (or 2021 for the sensitivity analysis in Annex B Table B4), only the sector "Total industries (A-S)", and only countries with no missing data
3. For each country, calculate the total harmonised net capital stock by adding up harmonised tangible and intangible net capital stock and deducting harmonised residential dwellings net capital stock
4. For each country, convert the adjusted gross value added first into current US dollars by dividing it by the market exchange rate and then into PPP-adjusted dollars by dividing it by the output-side GDP price level ratio relative to the US
5. For each country, convert the harmonised net capital stock first into current US dollars by dividing it by the market exchange rate and then into PPP-adjusted dollars by dividing it by the capital services price level ratio relative to the US
6. For each country, divide the resulting adjusted gross value added and harmonised net capital stock values by total hours worked

This gives us adjusted gross value added per hour worked in PPP-adjusted dollars and total harmonised net capital stock per hour worked in PPP-adjusted dollars.

5. Main results: UK workers have access to around a third less capital to be productive

The results of the analysis for 2019 are plotted in Figure 2 and summarised in Table 2.

Figure 2: Total harmonised net capital stock per hour worked and labour productivity, main case, 2019

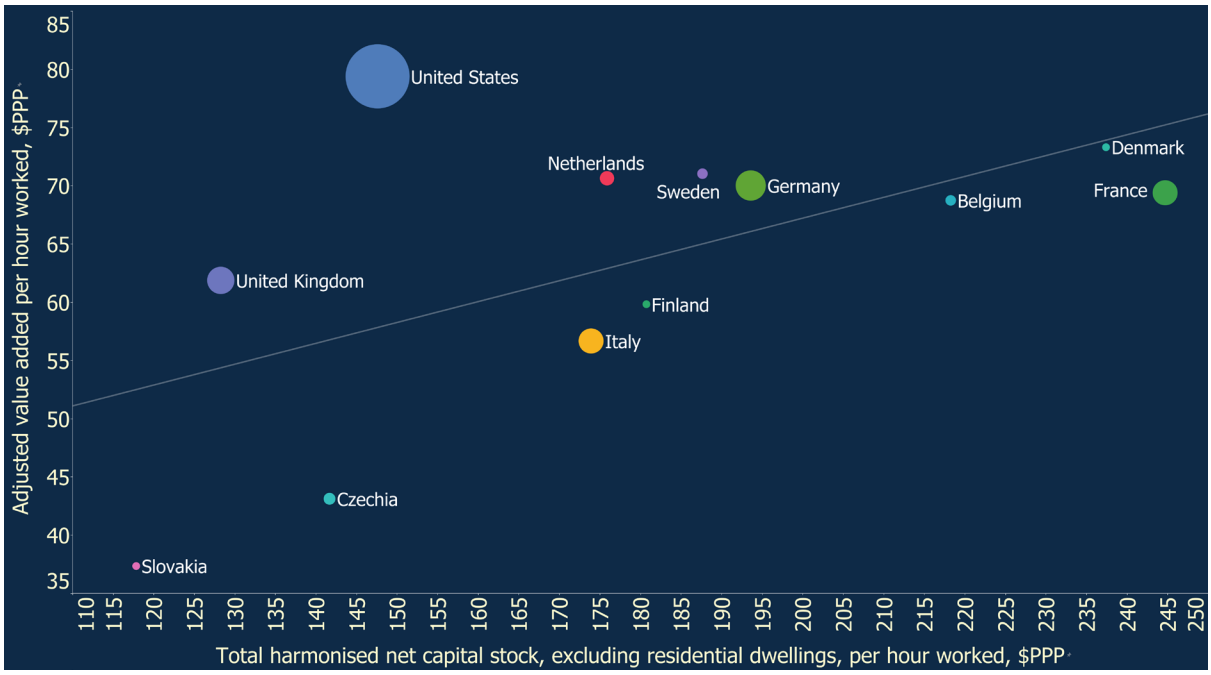


Table 2: Summary results for the UK and the higher-productivity peer group

	UK	Non-weighted peer group average*	UK relative to non-weighted peer group average
Adjusted value added per hour worked in 2019, PPP-adjusted dollars	66	72	-15%
Total harmonised net capital stock per hour worked in 2019, PPP-adjusted dollars	128	190	-33%

* Countries included in peer group: US, Germany, France, and the Netherlands.

There is a moderate correlation between total harmonised net capital stock per hour worked and adjusted value added per hour worked (R2 = 0.341; P-value = 0.0463). (The correlation is tighter in some of the other sensitivities, as excluding or including residential dwellings and adjusting national currency values using price levels relative to the US introduce a lot of variation.)

Of the 12 countries shown in Figure 2, the UK had the second lowest total harmonised net capital stock per hour worked. **In 2019, UK workers had access to around a third less capital per hour than workers in the peer group.**

In the main case in 2019, the UK's labour productivity (adjusted gross value added per hour worked) was 15% lower than the peer group average. Given strong theoretical and

empirical links between capital and labour productivity, this reinforces the conclusion that a low capital stock is a key contributor to the UK's productivity shortfall.[viii]

We can also express the UK's capital gap in absolute terms. In 2019, the UK's total harmonised net capital stock (including non-national-account intangibles but excluding residential dwellings) was £4.0 trillion. This equates to £60 ($128 in PPP-adjusted terms) of capital stock per hour worked, 33% below the peer country average. For the UK to have the same net capital stock per hour worked as peer countries (all other things equal) would require the UK to close a capital gap of £2.0 trillion.

While we return to policy implications later, a casual glance at Figure 2 suggests that the UK sits in a different 'steady state' from most of its peers, as it reasonably fits the regression line. However, the correlation sheds little light on causality. Endogenous growth theory tells us that total factor productivity (TFP) growth is endogenous to capital growth, while the classic Solow model suggests that capital growth and thus capital deepening are endogenous to TFP growth. [ix] The UK is therefore stuck in a sub-optimal equilibrium.

For a decision maker, it matters little which came first, the chicken or the egg; the important thing is to crack the self-reinforcing cycle of low productivity and low capital stock.

6. Sensitivity analysis: the UK capital gap is large under a range of assumptions but the spread of estimates is very wide

There are four main sources of variance that we have captured in our sensitivity analyses:

- Asset coverage: whether residential dwellings are included, and whether non-national-accounts intangibles are included
- Capital stock type: whether harmonised or non-harmonised net capital stocks are used;
- Currency conversion: whether capital stock is converted into a common currency using capital services price levels, capital stocks price levels, or without purchasing-power adjustments (i.e., market exchange rates only).
- Hours worked data source: whether hours worked data is sourced from the OECD or EUKLEMS & INTANProd.

The detailed sensitivities and results are presented in Annex B.

Regardless of permutation, the UK's capital gap remains substantial–but the range is also very wide. Across the 16 sensitivities analysed, the UK's total net capital stock per

hour worked is between 12% and 50% lower than higher-productivity peer countries', corresponding to an absolute capital gap between £0.5 to £6.2 trillion.

Two factors drive most of the variation. Including or excluding residential dwellings has a large impact on the total capital stock figures and the UK gap. As discussed in Annex A, both approaches have merit, and the appropriate choice depends on the exact context and question at hand.

The second large driver of differences is whether capital stocks are converted into PPP-adjusted dollars using price level differences for capital services or net (wealth) capital stock. The wide range—and the significant price level differences between the US and other countries indicated by the PWT data—point to the need for further exploration of the appropriate currency conversions in future iterations of this analysis.

Some of the variation may also reflect broader measurement challenges. These issues are summarised in Section 2 and addressed in part by our sensitivity tests. Whether these discrepancies affect the UK numbers in a disproportionate manner should be a matter of further research. The UK's relatively service-oriented economy and similar structural characteristics to the comparison countries make it unlikely that this alone explains much of the capital gap. Still, the potential for mismeasurement underscores the importance of improving data quality and comparability in future research.

7. UK policy recommendations: boosting investment by hundreds of billions is needed

Fixing the UK's productivity problem requires the scaling up capital investment by an order of magnitude and acting on all other available productivity levers.

Notwithstanding measurement issues, the conclusion is clear: the UK's capital gap is vast. Bridging it will require sustained investment increases measured in the hundreds of billions. Yet the current outlook offers little hope of such a shift. Business confidence remains weak (ICAEW, 2025) while public sector gross investment is forecast to stay flat, as the government responds to mounting fiscal pressures, themselves fundamentally sourced from enduring UK productivity weakness. Indeed, net investment is set to decrease from 2.7 per cent of GDP in 2024–25 to 2.4 per cent by 2029–30 (HM Treasury 2025b). Fiscal stability relies on a significant improvement in UK productivity growth[x]. However, as has been well publicised (Financial Times, 2025), the OBR's optimistic productivity growth estimate has yet to materialise (OBR 2025).

Even if the UK was able to step up its investment rate by 4%-points of GDP, it would take a century to catch up with the capital intensity of higher-productivity peers. Were the UK not just to match peer countries' investment rates, but to raise investment as a % of GDP to 3 percentage points *above* the peer country average (less than the magnitude by

which it has lagged the average since 1993), it would still take almost four decades to close the gap. To close the gap over two decades, the UK would need to exceed the average by around 6 percentage points each year. This implies a UK gross investment rate of more than 28% of GDP, some 10 percentage points higher than the UK's average rate for the last 30 years.[xi] These are simple first approximations but highlight how the scale of the challenge is greater than generally recognised.

Why has UK investment been so weak? Research indicates a relatively high average profit rate on existing capital in the UK (Brandily et al, 2023). Indeed, looking at our data from another angle, for each unit of capital, the UK delivers 22% more value added than the peer group average (see Annex B Table B6). Depreciation in the UK, with its lower capital stock, should also be proportionately lower, meaning that gross investment would deliver greater net investment (i.e., net capital accumulation).

This is suggestive of relatively high capital returns. Although we argue that the UK finds itself in a lower steady state, the data also displays characteristics associated with the classical model, in which the marginal returns of each additional unit of capital per worker generally fall as the capital stock increases. The core drivers are unobservable, but an informed yet agnostic approach would recognise both interpretations as arguments for much greater investment to boost productivity.

Yet UK firms and managers are not investing—even when returns appear favourable (ibid). There have been numerous studies of UK management practices indicating that poorly managed firms make less accurate assessments of future risks and returns. Contributing factors to lack of investment include short-termism, fragmented ownership structures[xii], lack of access to long term capital (e.g., from pension funds), and cultural differences in ambition and risk tolerance relative to international peers (Brandily et al., 2023; Fisher, 2024; Mann, 2024).

Making the UK more attractive to global investors, in terms of expected risk adjusted returns, is a pre-requisite to generating inflows of global capital. This is particularly true in the carbon-constrained and digital markets of the future, where future returns may not be reflected in current costs and projects may not appear monetisable. Perceived risk is further exacerbated by pessimism about future growth in the economy, rapid political change and enduring fiscal restraint. In this context, the government has an important role to play in helping to guide investors towards profitable, future-proofed assets. By strategically creating new markets, inducing innovation and reskilling and retooling workers, the UK can participate more fully in the opportunities of the 21st century economy (Zenghelis et al., 2025).

High returns and weak investment suggest coordination failures—across firms, financial markets, and government. Addressing these requires a more active role for public policy. Public investment in depleted core infrastructure is also necessary to

enhance the returns to private investment. This investment must be rigorously assessed and subject to tough criteria but should be implemented quickly. Together with supportive policies and regulations, this could help deliver a rise in total investment, boosting productivity and generating the resources for further investment; a virtuous cycle necessary to boost the living standards of UK citizens. Yet, as we discuss below, even such an unprecedented rise may be inadequate to bridge the productivity gap.

This discussion about investment in the long-term structure of the UK economy interacts with fiscal sustainability and macroeconomic policy. On the one hand, pressure on the public finances augurs for belt-tightening to meet fiscal rules. On the other hand, macroeconomic theory and evidence suggests that economies almost always grow rather than cut their way sustainably out of debt/GDP problems (Zenghelis et al., 2024, Caswell et al., 2024). In the UK's case, borrowing to invest in productive capacity is more likely to support long-term debt sustainability. Conversely, delaying or cutting vital investment—especially at a time of evident capital deficiency—could prove both economically and fiscally counterproductive, as well as environmentally damaging. The balance of risks and opportunities is becoming increasingly clear.

The government's recent decision to adjust fiscal rules to account for net investment and the preservation of net worth is a welcome step. Past underinvestment has been reinforced by accounting conventions that focus on liabilities, while ignoring the asset side of the public balance sheet.[xiii] But investment must also be calibrated to macroeconomic conditions. Over the period 2010 to the present, the UK's average saving rate lagged almost all the other advanced economies, resulting in a lack of domestic funds for investment (Zenghelis, 2025). Measures to boost household saving, such as raising the minimum pensions auto-enrolment level, should help. Without measures to reduce consumption and boost domestic saving— such as raising the minimum pensions auto-enrolment level —interest rates will remain higher for longer, crowding out private investment. This was the clear lesson of the October 2024 Budget. But in the nearer term, and in the absence of obvious opportunities to reduce public spending, broader revenue raising measures can be deployed to boost the current budget while creating macroeconomic space for additional investment (ibid).

However, breaking out of the UK's low productivity trap will require more than just greater spending. Low investment is a major explanation for the UK's poor productivity performance, but it is itself due to many factors (Chadha and Venables, 2023), implying that no single reform will be sufficient to resolve the problem. Without attempts to fix the factors that have accompanied the UK's slide into an unproductive steady state, whereby low value-added generates (and is generated by) a low productive capital stock, higher investment alone can prove costly, as it risks being misallocated or insufficiently productive. It could require a significant sacrifice to current consumption and could lead to a large increase in the tax or debt burden.

The UK therefore needs to identify and actively improve its performance on other productivity levers. Efforts to stimulate investment would be more effective if aligned with coordinated action to promote regional development, address failing further education, drive science and technology institutions, tackle reduced global market access, and encourage competition and creative destruction, while also bringing stability in place of decades of policy churn (Brandily et al., 2023).

At the firm level, incentives need to be sharpened for improved labour quality—which is more about the upskilling and reskilling of the existing workforce than it is about education (as new flows into the workforce only account for a small minority of the stock of workers)—and technology and innovation diffusion. Arguably, a focus on the quality of management could be a "sensitive intervention point", as better managers and leaders are likely to invest more in capital—tangible and intangible—as well as drive innovation (both at the frontier and adopting existing technologies and practices).

An exogenous boost to the UK's capital stock or an exogenous boost to its total factor productivity would both be expected to generate a dynamic shift to a higher capital/value-added steady state. From a policy perspective, this would augur for a large-scale, coordinated push on all assets (tangible, intangible, and human) with targeted action to unlock complementary drivers of productivity. Boosting UK investment is not just about spending more—it is about investing at scale, in the right places, and with the institutional follow-through to make it count.

Conclusion

Analysis of the most comparable data shows that a deficiency of capital available to UK workers is the single most important driver of the UK's poor productivity performance. The challenge is far greater than suggested by simply comparing past investment rates. There is therefore no plausible route to improved economic performance without a significant and sustained increase in productive capital growth. This will take time — and must start immediately.

This is not a call for 'more investment of any kind at any cost'. It is a call for the government to prioritise strategic reform to boost the UK's investment performance as the fundamental driver of its economic and fiscal performance. Marginal increases to public investment, combined with minor policy initiatives, are a distraction. Fiscal and macroeconomic strategy, as well as specific business policies, must recognise this.

The analysis presented here is unambiguous: productivity depends on capital available, and the UK has a sizeable gap to close. A clear, credible and coordinated push is necessary to dislodge the UK from its low productivity/low capital stock equilibrium.

ANNEX A: Choices around how to measure and compare capital stocks

There are at least three important conceptual and data choices that need to be made when comparing capital stocks across countries. These are: whether to use gross, net or some other measure of capital stocks, which asset types to include in the capital stock, and how to convert capital stocks into a common currency. Below, we discuss each of these and explain the reasons for the choices made for the "main case" in this paper. It is fair to say that, for most of these, there is no "correct answer". Rather, the choice reflects the purpose of the analytical exercise and context in which the results are intended to be used.

Whether to use gross, net or some other measure of capital stocks

In various data sources, it is possible to access estimates for gross and net capital stocks. However, in National Accounts, both of these refer to so called "wealth" stocks and are not equivalent to what we would ideally measure in this paper: the productive capital stock that supports workers' productivity.

The appropriate way to measure *productive capital stock* would be to apply a so-called age-efficiency profile to each asset. For each vintage of new investment of a particular asset type, the calculation would involve reducing the capital stock each year by an amount corresponding to a loss in productive capacity at each age. (Note that, technically, productive capital stocks cannot be aggregated as such—rather, in growth accounting, by attaching user costs to them, a transformation is made to corresponding capital service flows, which are then aggregated. In practice, growth accounting typically assumes that capital service flows are proportional to the productive capital stock for each asset type, with the proportionality factor reflecting the asset's relative efficiency or utilisation rate.)

Gross capital stocks are an intermediate step towards calculating net and productive capital stocks. By definition, they ignore the potential decay in an asset's quality and efficiency, and any depreciation in its price (or market value) over time (even though they do reflect a schedule of asset retirements). In most cases, gross capital stocks are likely to over-estimate the productive capacity of capital. (It is worth noting that the EUKLEMS & INTANProd dataset does not provide estimates of gross capital stocks.)

Net capital stocks, in turn, represent a measure of wealth, i.e. the market value of assets at a given point in time. They are calculated by applying a so-called age-price profile (also called depreciation) to each vintage of investment (net of retirements), based on what the asset is worth at each age. While the productive capacity of an asset is one driver of its market value, it is not necessarily the only driver. For example, a month-old car has essentially the same productive capacity as a brand new one, but the former will sell at a discount.

Therefore, the productive stock for a single (type of) asset may or may not coincide with the net (wealth) stock of a single (type of) asset. The two stock measures are only identical if the age-efficiency profile is identical with the age-price profile. Such an identity holds for geometric age-efficiency and age-price profiles (OECD 2009). Because geometric depreciation assumes a constant proportional decline over time, it ensures that the assumed efficiency (for productive capital stocks) and value (for net, or "wealth" capital stocks) of each asset fall in lockstep across all vintages.

While other identical profiles—such as straight-line or hyperbolic—could in theory also yield this identity, geometric profiles are uniquely convenient in practice: they allow for time-consistent aggregation across vintages and simplify the estimation of productive and net (wealth) capital stocks. This is the reason why, in this paper, the main case analysis uses the EUKLEMS & INTANProd estimates of *harmonised net capital stocks*, which have been generated using geometric depreciation for all countries and asset types. From the data we have explored and that is available, these harmonised net capital stocks appear to be the best approximation for productive capital stock.

Even if harmonised net capital stocks are only an approximation of productive capital stock, there is no clear reason to expect systematic bias across countries—so relative comparisons should still be informative.

Which asset types to include in the capital stock

The EUKLEMS & INTANProd dataset provides not just total capital stocks, but a breakdown of them into relatively detailed categories. (For a full list, see Figure 1 in the main paper.) Most of these categories—such as transport equipment, commercial buildings, and software—are fairly obviously important inputs into the production function, not least because most of them are held by firms in the private sector. Moreover, as we argue in Section 2 of the paper, the non-national-account intangibles that have been added to capital stocks in the EUKLEMS & INTANProd dataset are also relevant as they all have an impact on the quality and quantity of organisations' output.

However, the one large asset class that is arguably less central to production of output is *residential dwellings (housing)*. Across the UK and the 4-country peer set, residential dwellings made up, on average, 43% of the total non-harmonised net capital stock in 2021 (Figure 1). Therefore, whether it is included in the capital stock figures makes a big difference to absolute calculations of the capital gap. Because of countries' different housing stocks, it also affects comparisons between countries.

There are strong arguments and some evidence to suggest that the quantity and quality of housing *does* have an impact on output and productivity. First, National Accounts include imputed rents for owner-occupied dwellings in GDP, meaning housing directly contributes to measured output through the provision of housing services. More broadly, housing plays an important enabling role in economic performance. Adequate,

affordable, and well-located housing allows people to live closer to jobs, reducing commuting time and improving job matching, which enhances labour productivity. Housing also underpins health, educational attainment, and social stability—key components of human capital. Poor or insecure housing can impair workforce participation and performance through stress, illness, or frequent relocation, while stable, quality housing supports well-being and long-term investment in skills.

At a macro level, the availability of housing in high-productivity areas facilitates labour mobility and agglomeration economies, supporting urban scale and specialisation. Conversely, housing constraints can contribute to spatial misallocation, limiting growth potential. Finally, housing represents a major store of household wealth, which can support entrepreneurial activity and consumption smoothing. In these ways, housing—though not always directly productive—plays a foundational role in shaping output and productivity outcomes across the economy.

However, despite its broader economic importance, there is also a strong rationale for excluding residential dwellings from capital stock figures when assessing productivity, particularly in relation to the capital deepening of firms and sectors outside residential real estate. Housing is not a core productive asset in the production functions of most firms or public service organisations—it does not directly contribute to the production of goods or services in the way that machinery, software, commercial buildings, or intellectual property do.

While housing provides essential living space for workers, it is largely a consumption good rather than an input into firm-level output. Including housing stock can therefore distort measures of capital intensity and capital productivity, especially when comparing across countries with different patterns of homeownership, urban form, or housing policy. For productivity-focused analyses, particularly those concerned with capital deepening within firms, it may be more appropriate to treat housing as a contextual factor rather than a productive asset.

The arguments for and against including residential dwellings in the capital stock, in the context of labour productivity analysis, are finely balanced. In this analysis, we have decided to exclude it from the "main case" capital stock for two main reasons: the absolute numbers are very large (as a proportion of the total capital stock) and could result in exaggerating the productive capital gap between countries; and while housing contributes to productivity, it is arguably less core to it than the other assets included. We do, however, provide sensitivities that also include residential dwellings.

How to convert capital stocks into a common currency

In the EUKLEMS & INTANProd dataset, capital stocks are expressed in national (local) currency units. Since, in this paper, we want to compare levels of capital stock per hour worked, we need to convert these values into a common currency. There are two basic

options: market exchange rates or purchasing-power-parity adjusted rates, which take into account price levels for assets in different countries.

Conceptually, it is important to account for differences in price levels. From the point of view of comparing capital stock per hour worked, what matters is the underlying productive capacity of the assets—e.g., the quantity and quality of vans, trolleys, navigation software, scanning equipment, and communications technology—available to delivery drivers. If those inputs are more expensive in one country than another, the recorded monetary value of capital stock will be higher—even if the underlying volume is the same.

However, data on the price levels of capital stocks is not easily available. Specifically, it is not available for productive capital stocks, at exactly the same asset composition as used in our analysis based on the EUKLEMS & INTANProd dataset. However, the Penn World Tables (PWT) do provide two relevant variables which we can use as approximations. Neither of them is ideal and they provide a very wide range of results (see sensitivity analyses in Annex B).

Firstly, PWT provides estimates for the prices levels of *net capital stocks* for each country. As discussed above, net capital stocks are conceptually *wealth* stocks, and not necessarily equal to productive stocks. Given that we do have sensitivities that take net (wealth) capital stocks (rather than harmonised net capital stocks) as the basis, for those sensitivities, we use these net capital stock price levels to convert capital stocks into PPP-adjusted dollars.

Secondly, PWT provides estimates of the price levels of *capital services* for each country. Conceptually, since our use of net harmonised capital stocks is intended to approximate the productive capital stock, and because it is reasonable to assume that capital services are proportional to productive capital stock (albeit with differential ratios for different assets), the price levels of capital services are a more consistent choice for converting harmonised capital stocks into a common currency. This is indeed the choice we have made for our main case.

ANNEX B: Full results of the sensitivity and additional analyses

This section describes the range of sensitivity analyses that were conducted and the data sources and variables for each and presents the results. It also contains supplementary analysis and tables referred to in the main text.

The table below summarises the sensitivity analyses that were conducted using alternative permutations of the data available.

Table B1: Details of data variants used in each sensitivity analysis

Sensitivity analysis number	Value added variant	Exchange rate for value added	Capital stock variant	Exchange rate for capital stock	Hours worked variant
1 ("main case")	Adjusted value added	GDP (output) PPP	Harmonised total assets excluding residential structures	Capital services PPP	OECD
2	Adjusted value added	GDP (output) PPP	Harmonised total assets	Capital services PPP	OECD
3	National Accounts value added	GDP (output) PPP	Harmonised National Accounts assets	Capital services PPP	OECD
4	Adjusted value added	Market exchange rates	Harmonised total assets excluding residential structures	Market exchange rates	OECD
5	Adjusted value added	GDP (output) PPP	Non-harmonised total assets excluding residential structures	Capital stock PPP	OECD
6	Adjusted value added	GDP (output) PPP	Non-harmonised total assets	Capital stock PPP	OECD
7	National Accounts value added	GDP (output) PPP	Non-harmonised National Accounts assets	Capital stock PPP	OECD
8	Adjusted value added	Market exchange rates	Harmonised total assets excluding residential structures	Market exchange rates	OECD
9	Adjusted value added	GDP (output) PPP	Harmonised total assets excluding residential structures	Capital services PPP	EUKLEMS & INTANProd
10	Adjusted value added	GDP (output) PPP	Harmonised total assets	Capital services PPP	EUKLEMS & INTANProd
11	National Accounts value added	GDP (output) PPP	Harmonised National Accounts assets	Capital services PPP	EUKLEMS & INTANProd
12	Adjusted value added	Market exchange rates	Harmonised total assets excluding residential structures	Market exchange rates	EUKLEMS & INTANProd
13	Adjusted value added	GDP (output) PPP	Non-harmonised total assets excluding residential structures	Capital stock PPP	EUKLEMS & INTANProd
14	Adjusted value added	GDP (output) PPP	Non-harmonised total assets	Capital stock PPP	EUKLEMS & INTANProd
15	National Accounts value added	GDP (output) PPP	Non-harmonised National Accounts assets	Capital stock PPP	EUKLEMS & INTANProd
16	Adjusted value added	Market exchange rates	Harmonised total assets excluding residential structures	Market exchange rates	EUKLEMS & INTANProd

Note: All EUKLEMS & INTANProd data is for 2019 for the sector "Total industries (A-S)" (TOT_IND) and monetary amounts are in current prices. All OECD data is for 2019 whole economy (as hours worked data is not separately available for sectors T and U).

The data sources for the variables listed above are summarised in the table below.

Table B2: Data sources and variables used in sensitivity analyses

Description in Table B1	Data source	Variables used
Market exchange rates	Penn World Tables 10.01 (PWT)	xr
GDP (output) PPP	Penn World Tables 10.01 (PWT)	pl_gdpo
Capital services PPP	Penn World Tables 10.01 (PWT)	pl_k
Capital stock PPP	Penn World Tables 10.01 (PWT)	pl_n
Adjusted value added	EUKLEMS & INTANProd - Release 2025	VAadj
National Accounts value added	EUKLEMS & INTANProd - Release 2025	VA_CP
Harmonised total assets	EUKLEMS & INTANProd - Release 2025	HK_Tang + HK_Intang
Harmonised total assets excluding residential structures	EUKLEMS & INTANProd - Release 2025	HK_TangNRes + HK_Intang
Harmonised National Accounts assets	EUKLEMS & INTANProd - Release 2025	HK_Tang + HK_NatAcc
Non-harmonised total assets	EUKLEMS & INTANProd - Release 2025	K_Tang + K_Intang
Non-harmonised total assets excluding residential structures	EUKLEMS & INTANProd - Release 2025	K_Tang + K_Intang - K_Rstruc
Non-harmonised National Accounts assets	EUKLEMS & INTANProd - Release 2025	K_GFCF
Hours worked data from OECD	OECD Productivity levels dataset	Hours worked for total employment
Hours worked data from EUKLEMS & INTANProd	EUKLEMS & INTANProd - Release 2025	H_EMP

The main results of the sensitivity analyses are summarised in the table below.

Table B3: Summary of sensitivity analysis results, 2019 data

Sensitivity analysis number	UK capital stock per hour worked, PPP or USD	Peer group average capital stock per hour worked, PPP	UK capital stock per hour worked, relative to peer group	Relevant UK total capital stock, £ trillion	Relevant UK capital gap relative to peer group, £ trillion	UK value added per hour worked, PPP or USD	Peer group average value added per hour worked, PPP or USD	UK value added per hour worked, relative to peer group
1	128	190	-33%	4.0	2.0	62	72	-15%
2	213	377	-44%	6.7	5.2	62	72	-15%
3	195	356	-45%	6.2	5.1	55	66	-16%
4	102	137	-25%	4.0	1.4	56	67	-16%
5	143	163	-12%	3.3	0.5	62	72	-15%
6	221	293	-25%	5.1	1.7	62	72	-15%
7	197	274	-28%	4.6	1.8	55	66	-16%
8	102	137	-25%	4.0	1.4	56	67	-16%
9	119	192	-38%	4.0	2.5	57	73	-22%
10	197	380	-48%	6.7	6.2	57	73	-22%
11	180	359	-50%	6.2	6.1	51	67	-23%
12	94	138	-31%	4.0	1.9	52	67	-23%
13	132	164	-20%	3.3	0.8	57	73	-22%
14	205	296	-31%	5.1	2.3	57	73	-22%
15	182	276	-34%	4.6	2.3	51	67	-23%
16	94	138	-31%	4.0	1.9	52	67	-23%

Sensitivity 1 covers our "main case". Across the other sensitivities, the results look directionally similar, but with a very wide range, with the UK's net capital stock per hour worked at 12% to 50% less than peer countries. Across the sensitivities, UK's value added per hour worked is between 15% to 23% lower than that of peer countries, on average. The set of absolute capital gap estimates from the 16 sensitivites ranges from £0.5 trillion to £6.2 trillion.

The largest differences between the sensitivities are driven by two factors. First, including residential dwellings in the capital stock understandably increases the absolute numbers considerably. For example, the UK's underlying capital stock (in the harmonised case which includes non-national-accounts intangibles) goes from £4.0 trillion (main case) to £6.7 trillion (Sensitivity 2). It also increases the gap between the UK and other countries (in the case using PWT capital services PPPs and OECD hours) from 33% (main case) to 44% (Sensitivity 2).

Second, the choice of purchasing-power adjustment factors also makes a large difference to the results. When using capital services PPPs, all countries' capital stocks are boosted relative to the US, as all countries' price levels are lower than the US. However, because those for other peer countries (Germany, France, and the Netherlands) are a lot lower than for the UK, their capital stock gets boosted more than the UK's, and the resulting capital gap (even when the US is included in the peer group average) is larger compared to, for example, Sensitivity 4, which uses market exchange rates.

Conversely, when using capital stock PPPs, again all countries' capital stocks are boosted relative to the US, because their price levels are lower. However, in this case, price levels are significantly lower for the UK than for the non-US peer countries, so in the conversion, the UK's capital stock gets boosted a lot, relative to market exchange rates. Indeed, compared to the main case (Sensitivity 1), the capital gap shrinks to £0.5 trillion (Sensitivity 5). Given these large influences of the PPP conversion factors, further investigation is warranted in future iterations of this analysis.

The main case and sensitivities have used data for 2019, as that year is less likely to have been distorted by COVID-19 and as not all relevant data is available for 2021. The table below presents results for Sensitivity 4 using 2019 data and a new sensitivity, Sensitivity 17, which is otherwise identical, but uses 2021 data. The results are directionally very similar.

Table B4: Summary of sensitivity analysis results, 2019 and 2021 data for the comparable permutation*

Sensitivity analysis number	Year of data	UK capital stock per hour worked, PPP or USD	Peer group average capital stock per hour worked, PPP or USD	UK capital stock per hour worked, relative to peer group	Relevant UK total capital stock, £ trillion	Relevant UK capital gap relative to peer group, £ trillion	UK value added per hour worked, PPP or USD	Peer group average value added per hour worked, PPP or USD	UK value added per hour worked, relative to peer group
4	2019	102	137	-25%	4.0	1.4	56	67	-16%
17	2021	122	157	-22%	4.3	1.2	65	75	-14%

* Both permutations use market exchange rates, as PWT data for 2021 are not yet available. The 2021 market exchange rates have been sourced from the OECD. (Market exchange rates for 2019 are identical in PWT and OECD sources.)

As discussed in the main paper, using hours worked as the denominator for these analyses may be misleading if there are large differences in labour force participation or employment rates between countries. The table below provides a set of calculations using alternative denominators. The results do not change significantly.

Table B5: Alternative denominators for value added and capital stock, 2019 data, Sensitivity 1 (main case)

Country	Capital stock per capita, $PPP	Capital stock per labour force participant, $PPP	Capital stock per employed person, $PPP	Capital stock per hour worked, $PPP	Value added per capita, $PPP	Value added per labour force participant, $PPP	Value added per employed person, $PPP	Value added per hour worked, $PPP
United Kingdom	97,175	197,210	205,275	128	46,851	95,081	98,969	62
Germany	144,805	287,921	296,948	194	52,366	104,121	107,386	70
France	156,658	358,020	391,304	245	44,423	101,522	110,960	69
Netherlands	142,260	266,223	278,592	176	57,113	106,880	111,846	71
United States	125,068	268,610	278,982	148	67,264	144,464	150,042	79
Non-weighted peer country average	142,198	295,193	311,457	190	55,292	114,247	120,059	72
UK relative to peer group	-32%	-33%	-34%	-33%	-15%	-17%	-18%	-15%

Finally, in the main case, the gap between the UK's capital stock per hour and other countries is larger than the gap between its value added per hour. This implies that, for each unit of capital, the UK is able to produce more output than other countries. This is consistent with other studies that find that the UK's average returns on capital are high. The phenomenon is illustrated by the data in the table below. For each unit of capital stock per hour, the UK achieves 22% more value added per hour compared to peer countries.

Table B6: Value added per unit of capital, 2019 data, Sensitivity 1 (main case)

Country	Value added per hour worked, $PPP	Capital stock per hour worked, $PPP	Value added per unit of capital stock
United Kingdom	62	128	0.48
Germany	70	194	0.36
France	69	245	0.28
Netherlands	71	176	0.40
United States	79	148	0.54
Non-weighted peer country average	72	190	0.40
UK relative to peer group	-15%	-33%	22%

References

A. Alayande, D. Coyle (2023) *Investment in the UK: Longer Term Trends*. Working Paper No. 040, The Productivity Institute.
https://www.productivity.ac.uk/research/investment-in-the-uk-longer-term-trends/

Bontadini F, Corrado C, Haskel J, Iommi M, Jona-Lasinio C (2023) *EUKLEMS & INTANProd: industry productivity accounts with intangibles—Sources of growth and productivity trends: methods and main measurement challenges*
https://euklems-intanprod-llee.luiss.it/wp-content/uploads/2023/02/EUKLEMS_INTANProd_D2.3.1.pdf

Brandily P, Distefano M, Donnat H, Overman H G, Shah K (2022) *Bridging the gap: What would it take to narrow the UK's productivity disparities?* Resolution Foundation and Centre for Economic Performance, London School of Economics and Political Science.
https://economy2030.resolutionfoundation.org/reports/bridging-the-gap/

Brandily P, Distefano M, Shah K, Thwaites G, Valero A (2023) *Beyond Boosterism: Realigning the policy ecosystem to unleash private investment for sustainable growth*. Resolution Foundation and Centre for Economic Performance, London School of Economics and Political Science.
https://economy2030.resolutionfoundation.org/reports/beyond-boosterism/

Brynjolfsson, E., Collis, A., Liaqat, A., Kutzman, D., Garro, H., Deisenroth, D., Wernerfelt, N., Lee, J.J. (2023). *The Digital Welfare of Nations: New Measures of Welfare Gains and Inequality.* Working Paper Series.
https://doi.org/10.3386/w31670

Corrado, C.A., Hulten, C.R., Sichel, D.E. (2006). *Intangible Capital and Economic Growth*. NBER working paper series. National Bureau of Economic Research, Cambridge, Mass.
https://www.nber.org/papers/w11948

Caswell, B., Chada, J., Millard, S., Samiri, I. (2024) *Public Investment and Potential Output*. National Institute of Economic and Social Research.
https://www.niesr.ac.uk/wp-content/uploads/2024/09/Public-investment-and-potential-output.pdf

Chadha, J.S., Samiri, I. (2022) *Macroeconomic Perspectives on Productivity*. Working Paper No. 030, The Productivity Institute.https://www.productivity.ac.uk/research/macroeconomic-perspectives-on-productivity/

Chadha, J. S. and Venables, T. (2023) *Investing for the long-run.* Productivity Insights Paper No. 019, The Productivity Institute.https://www.productivity.ac.uk/research/investing-for-the-long-run/

Coyle, D (2017) *Do-it-yourself digital: the production boundary and the productivity puzzle.* Economic Statistics Centre of Excellence (ESCoE) Discussion Papers ESCoE DP-2017-01, Economic Statistics Centre of Excellence (ESCoE). https://www.escoe.ac.uk/publications/do-it-yourself-digital-the-production-boundary-and-the-productivity-puzzle/

Coyle, D (2025) *Why is it so hard to measure AI's effects on productivity?* Bennett Institute for Public Policy. https://www.bennettinstitute.cam.ac.uk/blog/why-is-it-so-hard-to-measure-ais-effects-on-productivity/

Coyle, D., and Mei, J., (2022) *Diagnosing the UK Productivity Slowdown: Which Sectors Matter and Why?* Working Paper No. 018 version 1, The Productivity Institute. WP018-Diagnosing-the-UK-productivity-slowdown-FINAL-v1-140422.pdf

Davies, R, Hamdan, N & Thwaites G, (2023) *Ready for change. How and why to make the UK economy more dynamic.* Resolution Foundation. https://economy2030.resolutionfoundation.org/wp-content/uploads/2023/09/Ready-for-change-report.pdf

EU KLEMS (2023) *Growth and Productivity Accounts*. Groningen Growth and Development Centre. https://www.rug.nl/ggdc/productivity/eu-klems/

Feenstra, R.C., R.C. Inklaar and M.P. Timmer (2015) *The Next Generation of the Penn World Table.* American Economic Review, 105(10), 3150-3182. https://www.rug.nl/ggdc/productivity/pwt/related-research-papers/the_next_generation_of_the_penn_world_table.pdf

Financial Times (2025) *From miserable to mediocre: the Reeves challenge continues*, Chris Giles. The Financial Times, March 26, 2025. https://www.ft.com/content/68e5e994-7f8c-4e13-85c0-1597fa17a69e

Fisher, P. (2024) *Productivity and Investment Time to Manage the Project of Renewal*. The Productivity Commission. https://www.productivity.ac.uk/research/productivity-and-investment-time-to-manage-the-project-of-renewal/

Goodridge, P., and J. Haskel (2023) *Accounting for the slowdown in UK innovation and productivity.* Economica. 2023; 90(359): 780-812. https://onlinelibrary.wiley.com/doi/full/10.1111/ecca.12468

HM Treasury (2024) *National Wealth Fund: Mobilising Private Investment*. https://www.gov.uk/government/publications/national-wealth-fund-mobilising-private-investment/national-wealth-fund-mobilising-private-investment-accessible

HM Treasury (2025a) *Chancellor's National Wealth Fund to deliver growth and boost security.* https://www.gov.uk/government/news/chancellors-national-wealth-fund-to-deliver-growth-and-boost-security

HM Treasury (2025b) *Spring Statement 2025 (table 1.2)*. https://www.gov.uk/government/publications/spring-statement-2025-document/spring-statement-2025-html

ICAEW (2025) *UK Business Confidence Monitor: National*. https://www.icaew.com/technical/economy/business-confidence-monitor/business-confidence-monitor-national

Inklaar, R.C., P.J. Woltjer and D. Gallardo Albarrán (2019), *The Composition of Capital and Cross-Country Productivity Comparisons*. International Productivity Monitor, Centre for the Study of Living Standards, vol. 36, pages 34-52, Spring. https://www.csls.ca/ipm/36/Inklaar_etal.pdf.

Mann, C. (2024). *Finance, Investment and Productivity Growth. Insights from research at the Bank of England and The Productivity Institute*. The Productivity Institute. https://www.productivity.ac.uk/news/finance-investment-and-productivity-growth/

OBR (2025) *Economic and fiscal outlook March 2025*. https://obr.uk/docs/dlm_uploads/OBR_Economic_and_fiscal_outlook_March_2025.pdf

OECD (2009) *Measuring Capital*. OECD Manual SECOND EDITION. *https://www.oecd.org/en/publications/2009/09/measuring-capital-oecd-manual-2009_g1ghad98.html*

Office for National Statistics (2016) *Chain-linking methods used within the UK National Accounts*. https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/methodologies/chainlinkingmethodsusedwithintheuknationalaccounts

Office for National Statistics (2024). *Investment in intangible assets in the UK: 2022*. Statistical bulletin. https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/bulletins/investmentinintangibleassetsintheuk/2022

Resolution Foundation, Centre for Economic Performance (2023) *Ending stagnation: A New Economic Strategy for Britain. Final Report of The Economy 2030 Inquiry.* https://economy2030.resolutionfoundation.org/reports/ending-stagnation/

The Productivity Institute (2023) *The Productivity Agenda*. Report No. 001. The Productivity Institute. https://www.productivity.ac.uk/research/the-productivity-agenda-report/

Van Ark B, de Vries K & Erumban A (2024) *Are Intangibles Running out of Steam?* International Productivity Monitor Number 46. https://www.productivity.ac.uk/wp-content/uploads/2024/07/IPM_46_vanArk.pdf

Van Ark B and O'Mahony, M. (2023) *The UK's productivity challenge: people, firms, and places*. Productivity Insights Paper No. 018, The Productivity Institute. https://www.productivity.ac.uk/research/the-uks-productivity-challenge-people-firms-and-places/

Van Reenen J, Yang X (2023) *Cracking the Productivity Code: An international comparison of UK productivity*. Centre for Economic Performance POID Special Report. https://cep.lse.ac.uk/pubs/download/special/cepsp41.pdf

Whelan, K (2000). *A guide to the use of chain aggregated NIPA data*. Review of Income and Wealth. 10.2139/ssrn.239400. https://www.federalreserve.gov/pubs/feds/2000/200035/200035pap.pdf

Zenghelis, D, Serin, E, Valero, A, Van Reenen, J, Ward, B, & Stern, N (2024). *Boosting growth and productivity in the United Kingdom through investments in the sustainable economy.* In CEP Reports 43. https://ideas.repec.org/p/cep/cepsps/43.html

Zenghelis , D., Costa-Allendes , A., Stephenson , S., Nemo Ramirez , C., Wale, W., & Hunnable, H. (2025). *Is reaching net zero a growth and prosperity plan? Economics, tools and actions for a rapidly changing world*. Cambridge Open Engage. https://www.cambridge.org/engage/coe/article-details/6787be4cfa469535b9218189

Zenghelis, D. (2025) *Unleashing growth in the UK: time to break the fiscal chains*. Grantham Research Institute on Climate Change and the Environment, London School of Economics. Commentary on 6 March. https://www.lse.ac.uk/granthaminstitute/news/unleashing-growth-in-the-uk-time-to-break-the-fiscal-chains/

[i] Processes of endogenous growth turn out to be central to modelling the net-zero transition and ecological sustainability more generally (Pollitt, 2022, Mercure et al, 2023).

[ii] The study adjusts for the economic cycle and the 'multiplier-accelerator effect', where higher growth causes higher investment, which in turn drives higher growth, so that it focuses solely on sustainable periods of investment growth, rather than unsustainable short run, inflationary cycles.

[iii] There is a case for looking at capital per population or capital per member of the labour force, in addition to that per employed person or per hour worked. Including the inactive and/or the unemployed people in the calculation avoids the so called 'batting average' effect where countries with high unemployment or inactivity exclude less productive individuals from the average, thereby obtaining higher

productivity numbers for those in work. In such situations, the high capital per worker or per hour numbers would overstate the potential productive capacity of a country, as more inactive or unemployed people are excluded from accessing the capital stock. To address this issue, we also provide alternative calculations based on population and the number of workforce participants in Annex B Table B5.

[iv] This is based on 3ppt of GDP additional investment per year to close the investment gap with the peer group (Zenghelis et al 2024) and then a further 1ppt of GDP additional investment to close the gap in the capital stock. This would result in UK investment 1ppt above the peer group average (4ppt of GDP above its recent trend) for roughly 100 years to close the capital stock gap. This is set against a baseline counterfactual of equal growth rates in GDP and capital stock. A negative multiplier accelerator might be expected to widen the gap in the case of inaction, making the challenge even harder (and the length of time to close the gap even longer). On the other hand, a favourable policy and regulatory environment can attract investment and induce a dynamic return, which accelerates the pace at which the gap is closed. This result should be treated as indicative, yet illustrative, of the magnitude of the challenge.

[v] It should also be noted that this paper does not assess trends through time. Comparing output levels over time requires the use of volume measures adjusted for inflation, such as chain-linked real GDP. Because relative prices—and therefore value weights—change over time, volume estimates are not additive except in the base year and volume aggregates are not comparable across time. There is no conceptual basis for developing an underlying time-independent 'real' or 'volume' level series, for comparisons over time. This is because the underlying application and value of goods and services will vary through time, as reflected in the change in relative prices (see Whelan 2000 and ONS 2016).

[vi] Current price exchange rates can be volatile and subject to short term deviations from trend, which make common currency comparisons difficult. Even over longer periods, they may also not equate the price of identical goods across countries as domestic prices can vary. Exchange values do not necessarily reflect purchasing power. This is particularly likely for non-tradable services. PPPs are also problematic, not least because of the significant heterogeneity of capital stocks and multiple methodological and empirical challenges (Inklaar and Woltjer, 2019).

[vii] In our main case, where we exclude residential dwellings from the harmonised net capital stock, we should technically also exclude some of the sector "Real estate activities (L)" from the value added measures. The value added of "Real estate activities (L)" includes imputed rents for owner-occupied housing, reflecting the value of housing services consumed by homeowners. The overall sector (L) accounts for a significant proportion (13% in the UK in 2019) of National Accounts value added. Future analysis of the UK's productivity and capital gaps should consider adjusting for this.

[viii] In Figure 2, the UK sits above the regression line, suggesting its labour productivity is slightly higher than one would predict based on the regression and the amount of capital per hour worked alone. Deviations from the regression line is to be expected, since the capital stock is not the only determinant of labour productivity. To an extent, the UK's position off the trend-line could reflect, for example, a more effective mix of capitals, better complementarity between types of capital and labour, or more effective agglomeration. However, the deviation is small and, given uncertainties in the data, the relatively small number of countries, and the relatively modest correlation in the main case, we would advise against over-interpreting this result.

[ix] The endogeneity of growth and the endogeneity of the capital stock (and most likely the reinforcing integration of the two, subject only to diminishing returns to factors) would in any case generate an observationally equivalent relationship.

[x] Productivity growth is the ultimate driver of wage, salary and profit growth. Directly or indirectly, these sources of income are also the key generators of public revenues from taxes and duties.

[xi] To estimate how long it would take for the UK to close its capital stock gap with peer countries, we use a simple illustrative calculation. We assume that the UK and its peers have the same output growth rate and the same depreciation rate (relative to capital stock), and that investment is a fixed share of GDP in each country. The only difference, for the purpose of this illustration, is that the UK invests an additional proportion of GDP annually in capital formation, over and above the average of peer countries. In the case, where one assumes the UK invests 1% of GDP in capital formation, over and above the average of peer countries, the number of years required to close the capital stock gap would be given by:

$$N = \frac{\log\left(\frac{K_{t-1}^{\text{peers}}}{K_{t-1}^{\text{UK}}}\right)}{\log\left(1 + \frac{0.01 \cdot Y_{t-1}^{\text{UK}}}{K_{t-1}^{\text{UK}}}\right)}$$

Where:

- N is the number of years required for the UK capital stock to catch up with that of peers
- K is the capital stock for a country at a point in time
- Y is the GDP for a country at a point in time
- The numerator reflects the initial capital stock gap
- The denominator reflects the additional annual growth in the UK capital stock, relative to peers, due to the additional 1% of GDP annual investment

This is a stylised calculation that abstracts from depreciation dynamics and compound feedback between capital and output, but it offers a useful first-order approximation of the time required for convergence.

[xii] The larger a shareholder's stake in a company and the less diversified their portfolio, the stronger their incentive to engage actively in the firm's strategy and operations. In contrast, small, fragmented shareholders have little reason to bear the substantial costs of monitoring management. Among OECD countries, UK listed firms have the most dispersed ownership structures, with the lowest share of companies having 'blockholder' shareholders—those with stakes large enough to influence decisions independently. Evidence suggests that this lack of concentrated, engaged ownership contributes to short-termism in UK firms: they are less likely to undertake profitable long-term investments and more inclined to prioritise dividend payouts. The result is a classic collective action problem, where firms may systematically underinvest and miss out on productive opportunities (Brandily et al., 2023).

[xiii] The latter are harder to value and less liquid in a fire sale, but they are assets which generate direct or indirect returns, and therefore critically determine the performance of the economy and sustainability of public debt, expressed relative to GDP.