INTERNATIONAL MONETARY FUND

IMF Country Report No. 25/205

UNITED KINGDOM

SELECTED ISSUES

July 2025

This paper on the United Kingdom was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on July 1, 2025.

Copies of this report are available to the public from

International Monetary Fund • Publication Services
PO Box 92780 • Washington, D.C. 20090
Telephone: (202) 623-7430 • Fax: (202) 623-7201
E-mail: publications@imf.org Web: http://www.imf.org

International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

UNITED KINGDOM

SELECTED ISSUES

July 1, 2025

Approved By
European Department

Prepared By Leonardo Indraccolo, Andrew Hodge (EUR), and Samuel Pienknagura (RES)

CONTENTS

BRIDGING THE GAP: UNDERSTANDING THE UK-US PRODUCTIVITY DECOUPLING[1]

The UK's productivity gap with the US has widened over the past two decades, with productivity growth rates decoupling after the Global Financial Crisis (GFC). This paper complements existing studies by using sectoral and firm-level data to discuss different microeconomic drivers of the diverging trends. While the loss of pre-GFC growth engines, in particular the leverage-driven boom in the financial sector, accounts for a large part of the productivity slowdown relative to the US, it is only part of the explanation. Outside the financial sector, the UK's publicly listed companies, especially frontier firms, have lagged behind the US due to a significant decline in post-GFC total factor productivity (TFP) growth, resulting in widening efficiency gaps within firms. We discuss how reduced investment in intangible capital following the GFC, along with lower R&D spending compared to the US, may contribute to subdued TFP growth among UK firms. To revive productivity, this analysis suggests a two-pronged approach aimed at: 1) building on the UK's strengths and revitalizing traditional growth engines, especially the financial and ICT sectors; and 2) fostering a more conducive environment to business innovation through greater access to scale-up finance and continued efforts to retain high skilled individuals.

A. Introduction: The Decoupling From the US

1. **Over the past two decades, the labor productivity gap between the UK and the US has grown substantially.** In the early 2000s, the UK experienced strong aggregate labor productivity growth, nearly matching the US's average annual rate of 2 percent. However, the Global Financial Crisis (GFC) marked the beginning of a significant divergence, with the UK achieving only half the productivity gains seen in the US since 2010 (Figure 1).[2] Although many advanced economies, particularly in Europe, experienced a drop in productivity growth following the GFC, the UK's decline was notably severe, with the country recording the lowest productivity growth among G7 economies, except Italy. Today, the UK's aggregate labor productivity level is approximately 20 percent lower than in the US, while it was just about 10 percent lower in the early 2000s.[3] Low productivity growth has been the main driver of subdued medium-term growth prospects, and revitalizing it is a key priority for the authorities.

[1] Prepared by Leonardo Indraccolo. Gloria Li provided excellent research assistance. The paper greatly benefited from comments by Luc Eyraud, Andrew Hodge, Kristina Kostial, and Pragyan Deb. Additionally, it received excellent suggestions and insights from Prof. John Van Reenen and Sophie Piton, as well as seminar participants at the HM Treasury and colleagues from the Bank of England.

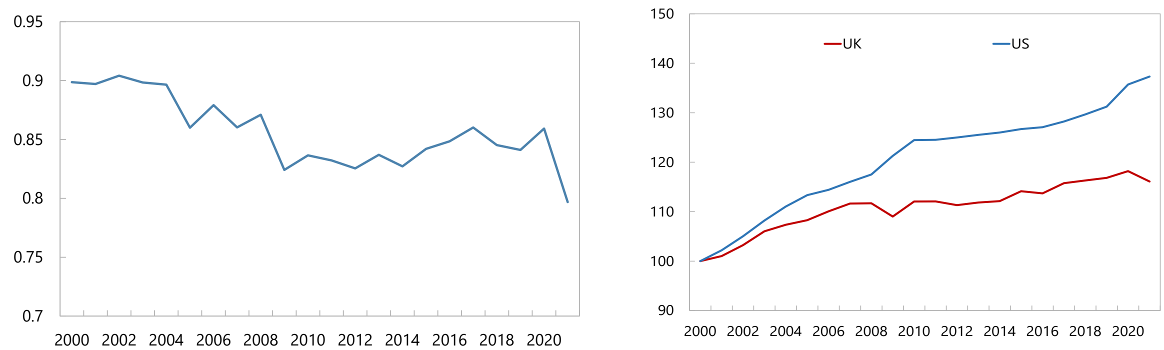
[2] According to national accounts data from ONS (2023) between 2000 and 2008 the UK experienced average labor productivity growth, measured as output per hour worked, of approximately 1.8 percent, close to the US's 2.1 percent growth rate. After the financial crisis labor productivity growth slowed down in both countries, but while the US maintained a growth rate of around 1 percent, the UK's rate fell to 0.5 percent.

[3] Annex I describes how labor productivity is measured in ONS (2023).

Figure 1. United Kingdom-United States Aggregate Labor Productivity Decoupling

Ratio of United Kingdom-United States Aggregate Labor Productivity

Aggregate Labor Productivity Trends
(Index, 2000=100)



Source: ONS (2023) and IMF Staff Calculations.
Note: Labor productivity is measured as output per hour worked.

2. This paper mainly focuses on the evolution of labor productivity defined as output per worker. Labor productivity is the fundamental driver of long-term economic growth and improvements in living standards. We measure firms' labor productivity, a key metric for assessing how effectively input factors are utilized in production processes, as real output per worker (see Box 1 for a discussion of different measures). A related productivity concept is firms' total factor productivity (TFP), which captures all residual economic factors that contribute to increasing a firm's output beyond increases in labor and capital. While not the primary focus of this paper, we will also discuss TFP as an underlying driver of firms' labor productivity.

3. We contribute to the existing literature by taking a microeconomic and comparative approach to shed light on the factors driving the UK's productivity growth slowdown. This paper examines different hypotheses that can account for the UK's sluggish productivity growth and decoupling from the US. We begin with a sectoral analysis by assessing the extent to which structural changes in industry size and performance can explain the diverging productivity patterns, using data from EU-KLEMS (see Box 1 for description of the dataset). Then, to better understand the underlying microeconomic origin of the observed aggregate trends, we turn to firm-level data from Compustat. In particular, we evaluate whether US productivity has grown faster because of better allocation of resources across firms (*between-firm* component), or because of firms' greater internal efficiency (*within-firm* component). After finding evidence in favor of the latter explanation, we examine possible reasons why US firms have been more efficient compared to those in the UK after the GFC. Our analysis suggests that low investment in intangible capital and R&D spending has contributed to a slowdown in UK firms' TFP growth since 2010, thereby widening the efficiency gap of UK firms with those in the US. We conclude by discussing how fostering a more conducive environment to business innovation through greater access to scale-up finance and continued efforts to retain high skilled individuals can have the potential to revive UK's productivity growth.

4. The paper is organized in four main sections. The first section reviews traditional explanations to the UK's productivity puzzle and illustrates how this paper contributes to existing work. After that, section two focuses on sectoral patterns. Section three discusses the role of between versus within-firm factors while the last two sections examine further within-firm productivity differences across UK and US firms. The last section concludes and provides policy recommendations to narrow UK's productivity gap with the US.

Box 1. United Kingdom: Description of the Datasets

- **This paper relies primarily on firm-level data from Compustat, complemented with sectoral-data from EU-KLEMS.** For firm-level information we rely on Compustat, which contains detailed balance sheet information on publicly-listed firms in the US and the UK covering the period 2000 to 2023 and is compiled by Standard & Poor's. For the sectoral analysis we rely on data from EU-KLEMS which provides harmonized cross-country sectoral level data on employment, productivity and intangible capital constructed from national accounts over 2000–21. The advantage of EU-KLEMS is that it covers all sectors of the economy.

- **In both datasets labor productivity is measured as real output per worker.** In Compustat, firm-level labor productivity is measured at the firm level as real revenues per number of employees, where revenues are converted to a common currency using PPPs and deflated using one-digit sectoral deflators. In EU-KLEMS labor productivity is measured at the sectoral level as real sectoral value added per total employment.

- **Firm-level data from Compustat capture the broad trends of productivity recorded in national accounts data.** Aggregate productivity trends in Compustat align with national accounts patterns, with the productivity gap between UK and US-listed firms widening over time, and productivity growth rates diverging after the GFC (see Annex I for a discussion).

- **Nonetheless this dataset has limitations.** First, Compustat only covers publicly-listed firms, representing a sample of businesses, which are, on average, larger than the average firm in the economy. This implies that our findings do not necessarily extend to smaller firms. Second, the dataset does not allow entry and exit of firms to be observed explicitly, so that we cannot directly address issues related to business dynamism. Third, financial sector firms are excluded given challenges with estimating TFP for these firms (Li and others 2022).

B. UK's Productivity Puzzle: A Review of Existing Explanations

The strong decline in the UK's productivity growth since the GFC is often referred to as the UK's productivity puzzle. While there is no single, straightforward answer to this puzzle, this section reviews the most commonly proposed explanations and how this paper's analysis relates to existing findings.

5. Macroeconomic studies have traced the UK's productivity slowdown to low aggregate TFP growth. Aggregate labor productivity growth can be decomposed into changes in labor supply, capital accumulation and total factor productivity (TFP). Recent work by Fernald and others (2025), Goldin and others (2024) and IMF (2024a) has used a production function decomposition applied to national accounts data to show that most of the UK's slowdown in aggregate labor productivity growth over time can be attributed to a decline in TFP growth, with labor supply and capital intensity playing a minor role. Statistically, aggregate TFP is measured as the residual part of a country's aggregate output not explained by labor and capital inputs. As such, it is a measure of "ignorance", with a range of different factors potentially affecting it. In the context of the UK, several factors have been discussed to explain the decline in TFP growth, including persistent scarring effects after the GFC, subdued productivity growth in key trading partners, declining business dynamism contributing to resource misallocation, and the lack of sufficient technology diffusion within the country (see, for instance, Ilzetzki 2020; Haldane 2018, Adler and others 2017). While analyses based on macroeconomic data are useful for identifying *where* the problem lies, microeconomic studies rely on firm-level data to understand better *why* labor productivity has slowed down.

6. At the microeconomic level, low investment among firms is one of the most common explanations behind sluggish productivity growth. Understanding what drives productivity improvements at the firm-level is a challenging area of research (see, for example, Blackwood and others 2021). In the case of the UK, firms' chronic underinvestment is among the most cited explanations (Ayantola and Coyle 2023). Business investment as a share of GDP in the UK is below that of many other G-7 economies, and has been low for the past two decades. Establishing a direction of causality between business investment and productivity is complex, as both variables affect each other at the same time. However, persistent economic shocks, difficulties for SMEs in accessing finance, planning restrictions and frequent policy changes creating an uncertain and unstable environment for businesses are contributing factors (see Carella and others 2023; Oliveira Cunha and others 2021).

7. Moreover, weak management practices and skills gaps in the workforce have been found to weigh on UK firms' productivity growth by hindering the adoption of new and more efficient technologies and processes. Although the UK has leading universities, there have been challenges in translating scientific advances into productivity gains (see, for instance, Haldane 2018). This is partly due to skills gaps in the workforce, compared with the US. While the average skill level in the economy is above that of other advanced economies, businesses report skills shortages in some sectors, with the degree of skill mismatch in the UK being higher than the OECD average, resulting in the sub-optimal use of the labor force (Deb and Li 2024). These mismatches and skills gaps complicate the adoption of new technologies, contributing to firms' subdued productivity growth (Criscuolo and others 2021; D.Grimshaw and others 2023). Additionally, weak management practices have been found to hinder the adoption of new technologies and organizational procedures within firms (see Bloom and others 2012).

8. Fewer papers have put the UK's productivity puzzle into international perspective. Most academic and policy papers have analyzed the UK's productivity puzzle over time, through a combination of macro and micro data, however cross-country comparisons are more limited. There are some notable exceptions based on aggregate macro and sectoral level data, including Van Reenen and Xuyi (2024), who argues that low rates of capital deepening played an important role in explaining the productivity divergence vis-à-vis other countries. Other exceptions are Fernald and others (2025), who examine aggregate TFP slowdowns across the UK and other advanced economies, De Loecker and others (2024) who study the role of business dynamism and Pittaway (2025) who highlights the role of specific sectors, particularly the UK's healthcare sector, in explaining the UK's productivity growth divergence from the US after the pandemic. Finally, IMF (2024b) has recently focused on Europe's productivity slowdown and divergence from the US showing that low business dynamism and a smaller footprint of high-growth firms in the economy have contributed to widening gaps.

9. This paper offers new insights to the debate, based on cross-country comparisons, using a firm-based approach. Compared to previous analyses, we examine the role of both sectoral shifts and firm-level differences to explain the UK's productivity decoupling from the US. Our approach differs from the existing literature in several aspects. First, we conduct a cross-country comparison, while most of the literature on the UK has focused on domestic developments. Second, we base our analysis on publicly-listed firms, which has not been the primary focus of other papers. This helps us center our analysis on larger firms which tend to be more productive. Third, comparing the UK with the US provides valuable insights, revealing that while frontier firms have performed relatively well compared to other UK firms, they have not fared as well against their US counterparts.

C. Breaking Down Aggregate Productivity: Sectoral Patterns

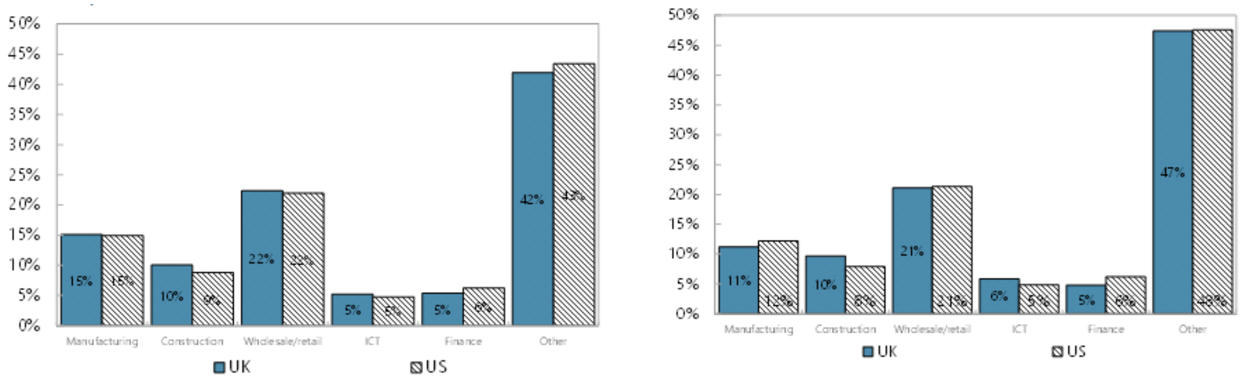
We start the analysis using sectoral data from EU-KLEMS to assess the extent to which structural changes in sectoral size and performance can explain the diverging productivity patterns.

10. This section evaluates how different sectors have contributed to the UK's productivity slowdown vis-a-vis the US. Using data from EU-KLEMS we decompose annual aggregate labor productivity growth into sectoral contributions for the period pre-GFC (2000–2008) and post-GFC (2010-2021).[4] For simplicity, we plot the sectoral contributions of manufacturing, construction, retail, finance, food services and ICT which make up more than 60 percent of total employment in the economy and define the remaining sectors residually as "other sectors" (Figure 2).

[4] We decompose aggregate productivity growth of the non-agricultural market economy. The Appendix describes the mathematical formula.

Figure 2. Sectoral Structure United Kingdom-United States

Sectoral Employment Shares (Pre-GFC, percent) | **Sectoral Employment Shares** (Post-GFC, percent)



Source: EU-KLEMS and IMF Staff Calculations.

11. The productivity contribution of the UK's financial sector pre-GFC was both high and likely unsustainable, leading to a substantial fall in its productivity growth post-GFC being a driver of the productivity decoupling from the US. While productivity growth slowed down across several sectors in both countries after the GFC, the decline in the UK's financial sector contribution stands out when compared to the US (Figure 3).[5] In the immediate years preceding the GFC, the expansion of the UK's financial sector sustained both the economy's GDP and productivity growth, after which its contribution turned from largely positive to negative. Different hypotheses have been proposed to explain the slowdown (see Brennan and others 2010). Besides potential mismeasurement issues related to quantifying output of financial service activities, the main explanation is that high leverage and risk tolerance artificially boosted profits and income in the years leading up to 2008. Higher asset prices and credit growth may have attracted resources from other sectors, contributing to a rapid expansion of the financial sector. When the GFC hit, these channels reversed, leading to falls in asset prices, wealth, and higher uncertainty, while structural weaknesses in other sectors slowly emerged.

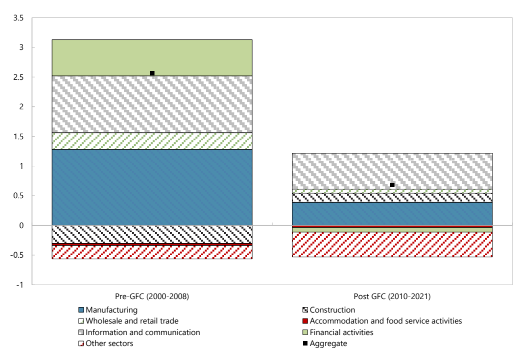
12. Beyond the financial sector, wholesale and retail trade has also contributed to the decoupling. While the role played by the financial sector stands out, the wholesale and retail trade sector has also been a driver of widening productivity gaps. The contribution of wholesale and retail trade to the UK's productivity growth declined vis-à-vis the US after the GFC and this resulted from lower sectoral productivity growth, rather than a declining sectoral share in the economy.

[5] Bank of England (2021) finds a smaller role of UK's financial sector contribution to productivity growth before the GFC by examining a longer pre-GFC time period (1997-2007) and after accounting for methodological changes to GDP measurement introduced by the ONS in 2021. In general, measuring output of financial firms and their contribution to GDP and productivity growth can be challenging as discussed in Burgess (2011) and in Akritidis and others (2017).

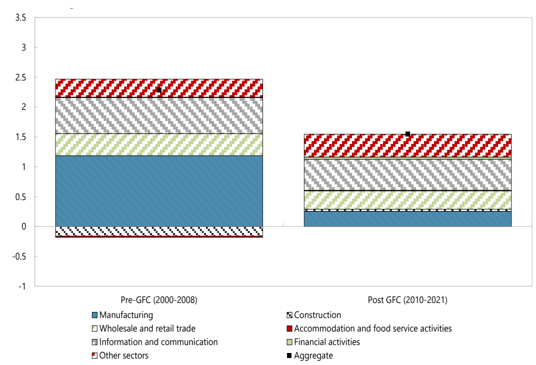
13. **The decline of the UK manufacturing sector explains the productivity slowdown over time, but not the decoupling from the US.** The manufacturing sector's contribution to productivity growth declined significantly after the GFC. However, the US experienced a similar pattern, suggesting a common or related set of sectoral structural shifts might have been driving the trends. Among other forces, difficulties competing with global manufacturing firms offering cheaper products are likely to have crystallized in the aftermath of the GFC, when the sector's high labor costs could no longer be offset by greater investment in physical capital, as in the early 2000s (Tenreyro 2018).

Figure 3. Sectoral Productivity Patterns

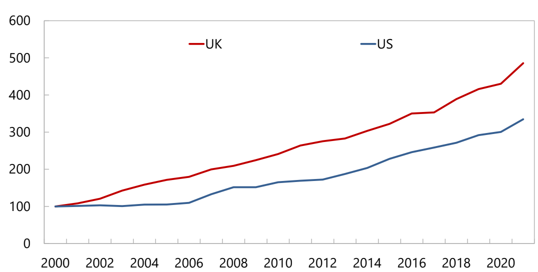
United Kingdom: Sectoral Contributions to Productivity Growth
(Pre and Post GFC, pp)



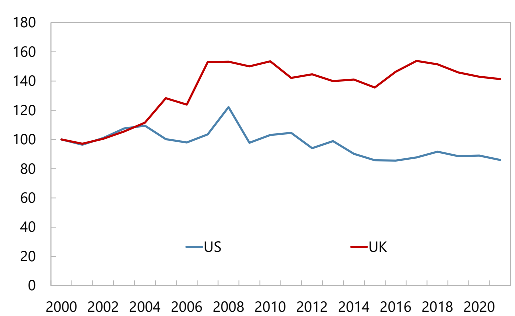
United States: Sectoral Contributions to Productivity Growth
(Pre and Post GFC, pp)



ICT Sector: Evolution of Labor Productivity
(Year 2000=100)



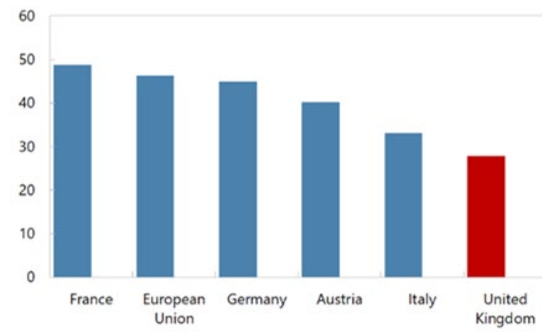
Financial Sector: Evolution of Labor Productivity
(Year 2000=100)



Source: EU-KLEMS and IMF Staff Calculations

14. The ICT sector has been fairly resilient in the UK, although it could not make up for the slowdown in other sectors. The ICT sector experienced sustained productivity growth in the past two decades, although with some signs of slowdown in recent years (Figure 3; OECD 2019; Ilzetzki 2020; Pittaway 2025 for the sector's slowdown post Covid). However, its impact as a growth driver for the rest of the economy does not seem as large as in the US. This may in part reflect the fact that, compared to other advanced economies, UK firms lag behind in terms of access to digital infrastructure, like high-speed internet (Figure 4), which slows the adoption of the latest digital technologies. Recent studies have also documented that the lack of appropriate skills in the labor market makes it hard for smaller firms to leverage new technologies, thus constraining the potential spillover effects from ICT (see Tuckett and others 2017; Deb and Li 2024; Criscuolo and others 2021).

Figure 4. Share of Businesses With Broadband Download Internet Speed of at Least 100 Mbit/s
(Percent)



Source: The OECD Going Digital Toolkit, based on the OECD ICT Access and Usage by Business Database.

D. Has Resource Misallocation Played a Big Role?

Besides the idiosyncratic pattern of UK's financial sector, this section uses firm-level data to explore whether widening productivity gaps between UK and US businesses emerged in the rest of the economy because of misallocation of resources between firms, or because US firms became increasingly more efficient internally.[6]

15. Productivity differences across countries can reflect both differences in "within-firm" production efficiency or "between firm" allocation of input factors. Aggregate productivity depends on the productivity of the average firm in the economy (*within-firm* component) and to what extent resources are being allocated to the most productive businesses (*between-firm* component, also called resource misallocation). Aggregate productivity can be decomposed as the sum of these two components through a framework initially proposed by Olley and Pakes (1996).[7] *Within-firm* productivity hinges on firms' ability to improve their production processes and produce more output using the same amount of inputs by adopting more innovative technologies. This ultimately depends on firms' ability to invest in research and development (R&D), attract and retain high skilled workers, and improve their internal efficiency.[8] On the other hand, the *between-firm*

[6] This section is based primarily on the Compustat dataset, which does not cover financial sector firms and firms that are not publicly listed.

[7] The appendix describes the decomposition formula.

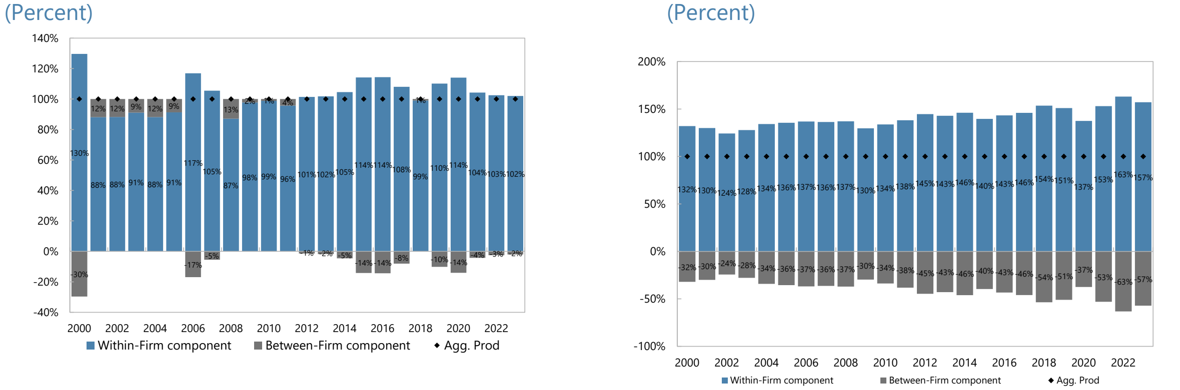
[8] The exercise is a simple accounting decomposition; as such it does not reflect how factors interact with each other, and reforms aimed at improving the allocation of productive resources can have an effect on a firm's internal productivity and vice versa.

component captures whether less efficient firms are absorbing resources, resulting in production factors being misallocated in the economy. If an economy's resources do not flow to the most innovative and efficient companies those enterprises cannot grow and drive economic progress. If this is the case, policies that promote the reallocation of workers and financial capital towards the most productive businesses could boost aggregate productivity.

16. **The decomposition shows that, outside of the financial sector, the widening productivity gap between the UK and the US is largely due to a divergence in within-firm productivity growth.** Figure 5 shows the results of the static decomposition framework developed by Olley and Pakes (1996). Between-firm factors contribute negatively to the level of aggregate productivity in the US, while explaining a much smaller fraction of it in the UK. Despite the larger negative contribution from the between-firm component, aggregate productivity in the US is higher than in the UK. This reflects the fact that the US experienced average within-productivity growth of 2.5 percent per year, against only 0.9 percent for the UK over the sample period. Strong "within" productivity growth in the US was the main factor contributing to the widening productivity gap between firms in the two countries.

Figure 5. Olley-Pakes Decomposition of Aggregate Productivity

United Kingdom: Olley-Pakes Decomposition (Percent) | **United States: Olley-Pakes Decomposition** (Percent)

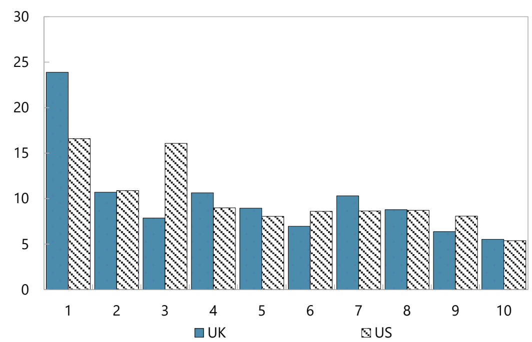


Source: Compustat and IMF Staff Calculations.

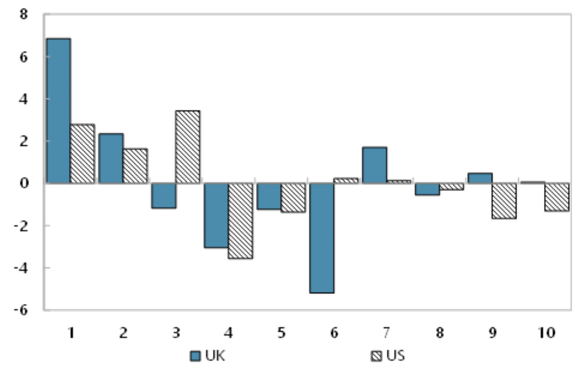
17. **Other stylized facts also suggest that resource misallocation is not the primary driver of the decoupling from the US.** There are many ways to assess how well resources are allocated across firms in an economy. A straightforward approach is to examine the share of total employment across firms at different productivity deciles; a higher proportion of workers employed in low-productivity firms indicates poorer resource allocation. Figure 6 reveals that the share of workers employed in the lowest productivity decile of UK firms is higher than in the US. However, when looking at the evolution over time, the picture is slightly different the US experienced a stronger reallocation towards less productive firms after the GFC, with a sharper decline in the share of workers employed in the most productive firms (those in the top two deciles of the productivity distribution). The right panel of Figure 6 illustrates the point by showing the change in employment shares for firms at different productivity deciles between the post and pre GFC period.

Figure 6. Distribution of Employment by Productivity Deciles

Share Employment by Productivity Decile
(Post GFC, percent)



Change in Employment Shares Post-Pre GFC
(Employment shares by productivity decile, percent)



Source: Compustat and IMF Staff Calculations.

E. Understanding the Within-Firm Productivity Growth Divergence

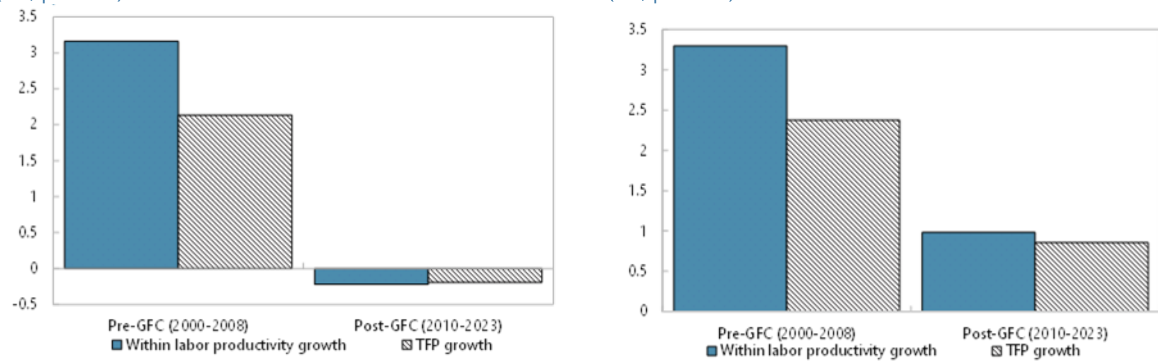
We estimate firm-level production functions to identify the drivers of labor productivity: TFP and capital intensity. Our findings suggest that the decoupling with the US is largely due to sluggish firm-level TFP growth, especially among the UK's frontier firms. Among other contributing factors, low levels of investment in intangible capital and R&D spending in the UK are likely explanations for slow TFP growth.

18. We use an accounting framework to decompose within-firm labor productivity growth into capital intensity and TFP components. Labor productivity increases if firms have higher capital intensity and/or if they are able to generate more TFP. We measure TFP at the firm level by estimating production functions of individual firms (see the Appendix for the methodology). This allows us to decompose within-firm productivity growth as the sum of TFP growth and a capital intensity component.

19. Compared to the US, UK firms have experienced a stronger decline in TFP growth after the GFC. Growth in capital per worker and TFP growth both contributed to within-firm productivity growth in the decade leading up to the GFC. But afterwards, while growth in capital intensity has been broadly flat in both countries, the TFP patterns differed: while for US firms annual TFP growth declined from approximately 2.5 percent to 1 percent, the decline was more pronounced for UK businesses, explaining most of the divergence from the US (Figure 7).

Figure 7. Firm-Level TFP Growth United Kingdom-United States

Within-Firm Labor Productivity and TFP Growth (UK, percent) | **Within-Firm Labor Productivity and TFP Growth** (US, percent)



Source: Compustat and IMF Staff Calculations.

20. The decline in firm-level TFP growth after the GFC has been particularly apparent among UK frontier firms. Frontier firms[9] play a crucial role in expanding a country's technological frontier through disruptive innovations (Andrews and others 2015). Our evidence shows how the decline in TFP growth was much stronger among UK frontier firms than laggards, as captured by a shift of the distribution. On the other hand, the distribution of TFP growth rates among US frontier firms has remained broadly unchanged (Figure 8). While the UK's top-performing businesses were experiencing labor productivity gains above their US counterparts until the GFC, this pattern reversed thereafter. Since then, UK frontier firms have experienced cumulative labor productivity growth below that of their US counterparts and even below US laggard firms (Figure 9).

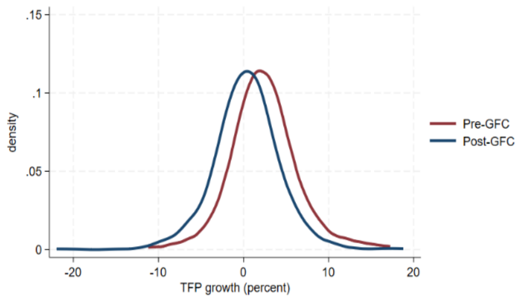
21. While multiple factors explain firm-level TFP growth, firms' ability to innovate is among the most important. Firms' ability to innovate and develop new products is a key engine of within-firm productivity growth (Aghion and others 2015). Over the past thirty years, an increasing share of innovations have been intangible in nature, especially in the ICT sector where innovations have taken the form of new software, computer codes and algorithms (Crouzet and others 2022). Intangible capital includes copyrights, audio and video material, and notably software and patents, with investment into intangible capital playing a growing role as a source of innovation-led productivity growth. However, the GFC led to a significant drop in investment into intangible capital by publicly-listed firms in the UK, more so than in the US. Prior to the GFC, UK firms' investment rate into intangible capital was approximately 4 percent, similar to the US. Post-GFC, US publicly-listed firms maintained an average investment rate of 3 percent in intangible assets, whereas in the UK the rate fell to 1 percent. By 2019, the UK's intangible capital stock level was lower than it had been at the onset of the financial crisis (Figure 10).[10]

[9] Frontier firms are defined as those firms belonging to the top decile of the labor productivity distribution, while middle firms are defined as those belonging to the 90th and 50th percentile. Laggard firms are defined as firms that belong to the bottom 50 percent of the labor productivity distribution in each sector.

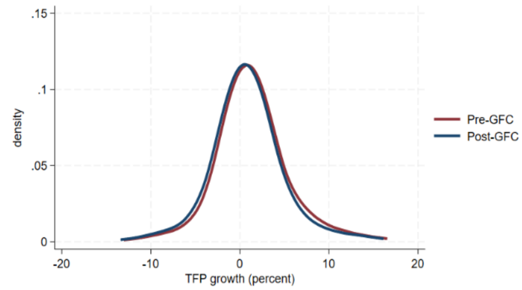
[10] The firm's investment rate is defined as the growth rate of intangible capital in this paragraph.

Figure 8. Distribution of TFP Growth of Frontier and Laggard Firms

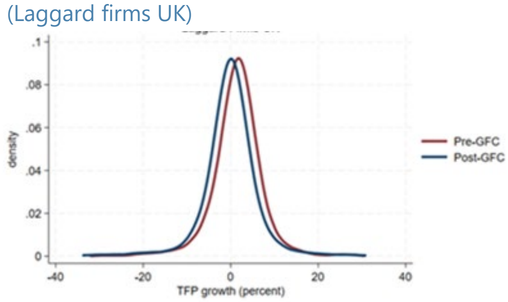
Distribution of TFP Growth
(Frontier firms UK)



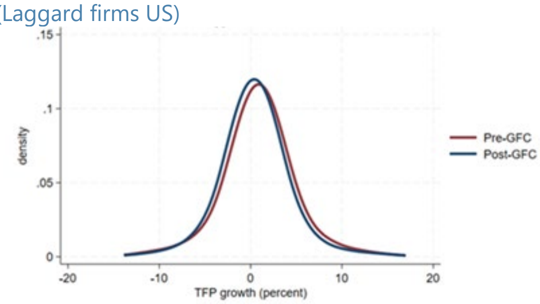
Distribution of TFP Growth
(Frontier firms US)



Distribution of TFP Growth
(Laggard firms UK)



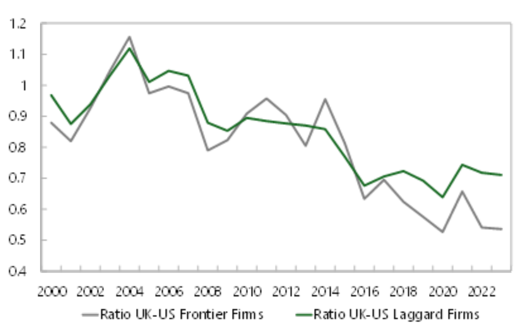
Distribution of TFP Growth
(Laggard firms US)



Source: Compustat and IMF Staff Calculations.

Figure 9. Labor Productivity of Frontier and Laggard Firms

Labor Productivity Gap
(Ratio of productivity levels, frontier and laggard firms)

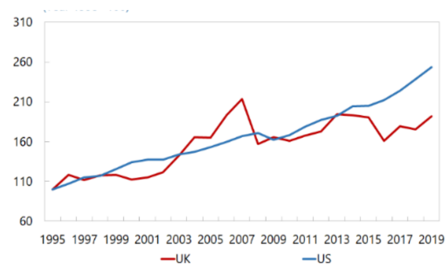


Labor Productivity of Frontier and Laggard Firms
(Year 2000=100)

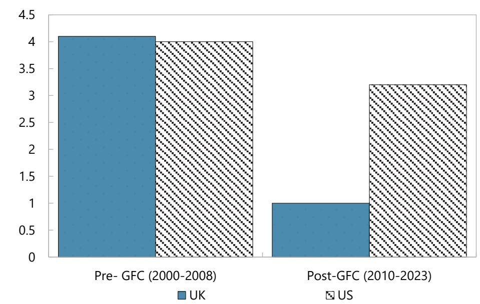
Source: Compustat and IMF Staff Calculations.

Figure 10. Investment in Intangible Capital

Real Intangible Capital Stock
(Index, year 1995=100)



Real Intangible Investment, United Kingdom vs United States Firms
(Average annual growth rates, percent)

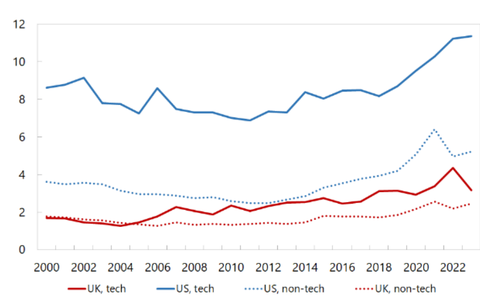


Source: INTANProd module of EU-KLEMS, Compustat and IMF Staff Calculations.

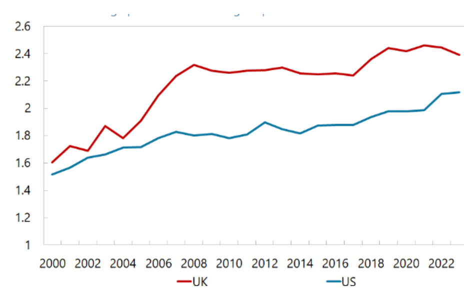
22. Spending on R&D by UK firms has lagged behind the US, despite generous tax policy incentives. Spending on R&D is the main component of intangible investment driving innovation. Although the UK is among the countries with the most generous R&D tax policies measures in place, aggregate spending on R&D as a share of GDP has lagged behind the US and other advanced countries. Even publicly listed firms, which are the largest firms in the economy, spend less on R&D as a share of their sales compared to US firms (Figure 11). This holds true across sectors, but is particularly striking among firms operating in tech, which has partly sustained US productivity growth in recent years (IMF 2024b). Moreover, the returns to knowledge capital—the stock generated by R&D investment—is more dispersed in the UK than the US (right panel of Figure 9). This also implies that there are productivity gains to be obtained by reallocating knowledge capital from low to high return firms in the UK.[11]

Figure 11. R&D Spending by Publicly Listed Firms

R&D Spending as a Fraction of Sales
(Percent)



Misallocation of R&D
(Std of average product of knowledge capital)



Source: Compustat and IMF Staff Calculations.

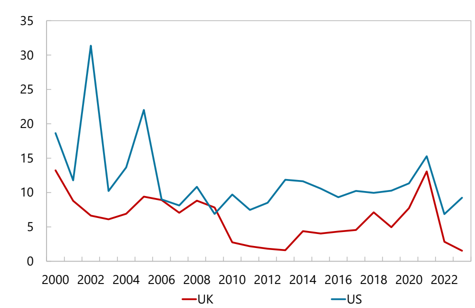
[11] Firm-level returns to knowledge capital are computed as the ratio of firm revenues to knowledge capital. The latter is constructed by applying the perpetual inventory method to R&D spending.

F. Possible Determinants of Firm-Level R&D Investment

While several factors can lead to differences in R&D spending across countries, this section focuses on the role of access to finance and trade openness. Investment into R&D is generally riskier compared to more traditional forms of investment, as the benefits of R&D are harder to quantify and may take longer to materialize. Firms' access to finance, including investors' risk-taking behavior, global competition and the size of the market to which new products can be sold, all contribute to innovation-driven productivity growth. We discuss the potential role of these factors in the UK and the US.

23. UK listed firms rely more on debt financing compared to their US counterparts, which is less suited to fund investment into R&D. Investment in R&D tends to be riskier compared to more traditional forms of investment like machinery and equipment, as the benefits of R&D investment are harder to quantify and may take longer to materialize. In addition, this investment is mostly intangible in nature, meaning it is difficult for firms to provide collateral for debt financing. Given these two factors, equity financing is generally better suited for investment in intangible capital, including R&D activities. In the UK, publicly listed firms rely less on equity financing compared to the US. Figure 12 shows net equity issuance as a share of firms' total assets. After averaging approximately 10 percent in both countries in the four years preceding the GFC, the difference in equity issuance has widened over time. Less reliance on equity financing implies that UK's largest firms have less capacity for undertaking riskier projects, which may have contributed to subdued spending on R&D.

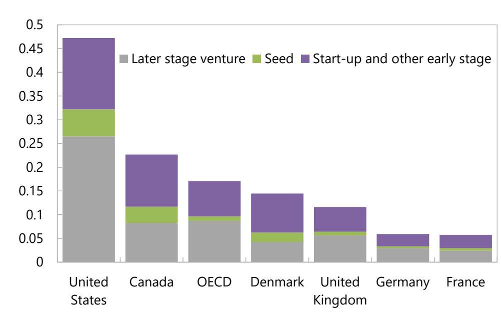
Figure 12. Net Equity Issuance of United Kingdom and United States Listed Firms
(Share of total assets, percent)



Source: Compustat and IMF Staff Calculations.

24. Compared to the US, difficulties in scaling up businesses with high growth potential, especially in the ICT sector, may limit investment into R&D. Firms that cannot grow have fewer incentives to spend on R&D because they are unlikely to expand their market to recoup the costs of this investment. The UK is known for having the largest venture capital market in Europe, providing valuable funds to start-ups and aspiring entrepreneurs. However, when compared to the US, the size of the UK market lags behind, particularly in specific sectors of the economy. Figure 13 shows the UK's venture capital investment in the ICT

Figure 13. Venture Capital Investment in ICT Sector, 2023
(Percent of GDP)



Source: OECD Venture Capital Investment Database and IMF Staff Calculations sector as a share of GDP, decomposed into different funding stages. In the ICT sector, venture capital investment in the UK has recently lagged behind not only the US but also other advanced economies like Canada and Denmark. Anecdotical evidence from commercial banks' reports additionally shows that while the UK's venture capital market provides adequate funds for early stage funding, firms that reach a certain size and need additional funding to scale up operations further, often prefer the US where more funds are available (FT 2025; BVCA 2024).

25. Lower trade openness and higher trade costs following Brexit may have also contributed to reducing firms' incentives to innovate. In the face of heightened global competition, the most productive companies typically invest in R&D to develop superior products and grow their market share. Conversely, trade barriers can limit firms' market size, deterring them from pursuing R&D investments that yield greater returns in a larger customer base, as noted in IMF (2024b). In the context of the UK, academic studies such as Bloom and others (2019), have shown that higher trade costs following Brexit have negatively affected firms' productivity by lowering the incentives to spend on R&D and develop better products to compete on the global market. Additionally, Ampudia and Pardy (2023) find that firms' rate of technological adoption decreased after Brexit due to future bureaucratic costs, as well as decreased demand. A second key aspect of R&D investment involves hiring highly skilled individuals whose expertise drives innovation. Brexit has further complicated firms' ability to attract and retain global talent by making immigration to the UK more difficult (Van Reenen 2016).

G. Conclusions and Policy Recommendations

Revitalizing the UK's Traditional Growth Engines

26. One pillar of a strategy to boost productivity growth could build on the UK's traditional sectoral strengths, like in finance and ICT. While the loss of pre-GFC growth engines, such as the leverage-driven boom in the financial sector, explains a large part of the productivity slowdown relative to the US, the authorities have launched strategies to give these sectors a welcome boost.

- Although it is unlikely that the **financial sector** will again make the same contribution to productivity growth as it did pre-GFC, as this would require unsustainable increases in leverage, there is still potential to bolster its role in driving economic growth. As outlined in the Article IV report, the authorities have initiated important measures to enhance the financial sector's contribution to growth. To further boost the UK's competitiveness as a financial center, reforms aimed at streamlining data collection and revising firms' listing requirements have the potential to boost the sector's efficiency. The simplification of existing regulatory rules should be conducted cautiously to preserve financial stability.

- The UK has the potential to exploit the latest technological advancements in the **ICT sector**, including AI. The IMF's AI readiness index shows that the UK is well-positioned to capitalize on AI technologies, with the index score surpassing the average of other advanced economies because of the large share of workers employed in cognitive-intensive jobs (Cazzaniga and others 2024). In addition, the authorities' reforms in the area of construction planning are expected to speed up the delivery of critical infrastructure needed for AI development. Furthermore, improving skills could allow more widespread adoption of digital technologies, so that productivity gains from the latest technological developments, including AI, are not concentrated in too few firms. Expanding tax credits or tax allowances for SMEs that invest in employees' training can facilitate upskilling the workforce and narrowing existing skill gaps.

The Road Ahead: Boosting Firm Innovation

27. Another pillar of the strategy could focus on fostering firms' innovation by improving access to scale-up finance and retaining talent. Compared to the US, the UK's leading frontier firms have experienced slower TFP growth since the GFC. Two sets of policies can stimulate TFP growth by fostering an environment conducive to R&D investment and innovation by firms.

- Further improving **access to scale-up finance** can support innovation at the frontier. While start-ups and young businesses in their early stages benefit tremendously from the UK's vibrant venture capital market, obtaining sufficient funding to significantly scale up operations can be more challenging in the UK compared to the US. Policies that incentivize the participation of institutional investors, like pension funds, in domestic venture capital markets can help firms of high growth potential to expand their operations within the country. The authorities' plans to consolidate pension funds are welcome as they have the potential to expand access to diverse asset classes.

- The authorities' ongoing efforts to create innovation hubs and intensify the collaboration between universities and businesses go in the right direction of supporting the development of new ideas that can be commercialized. Hiring workers with high levels of human capital and advanced skills is an important component of R&D investment. The UK has a strong record of attracting high-skilled individuals, but **talent retention** has become harder. In this regard, measures that help retain talent and encourage labor mobility of high-skilled workers should be prioritized. In a world where competition for talent is global, it is crucial to provide the right incentives for researchers and highly educated individuals to come and stay in the UK.

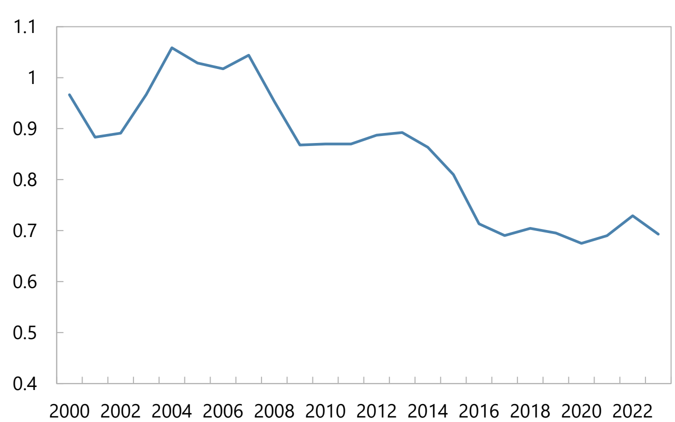
Annex I. Productivity Trends in Compustat Data and National Accounts

1. Productivity patterns of UK and US listed firms qualitatively align with national accounts data. Compustat data only contains information on publicly-listed firms and as such is not representative of the average firm in the economy. However, the qualitative patterns of aggregate productivity trends observed in the national accounts and Compustat are well-aligned. The table below shows labor productivity growth of the average publicly listed firm in the UK and the US pre- and post-GFC, as well as aggregate productivity growth (weighted by firms' employment share). UK and US publicly listed firms experienced similar labor productivity growth rates up to 2008, before diverging thereafter. The decline in labor productivity growth among UK firms after 2008 was stronger than the decline experienced by similar firms in the US. Figure 14 shows the evolution of the ratio between the productivity of the median UK and US publicly listed firm, which displays a declining trend over time, indicating widening productivity gaps.

Table I.1. United Kingdom: Productivity Trends in Compustat

	Average Labor Productivity Growth	Aggregate Labor Productivity Growth
UK pre- GFC (2000-2008)	3.1%	4.3%
UK post- GFC (2010-2021)	-0.3%	-0.2%
US pre- GFC (2000-2008)	3.4%	2.2%
US post- GFC (2010-2021)	1.1%	0.9%

Figure I.1. Ratio of Median Productivity of United Kingdom-United States Firms



Sources: Compustat and IMF Calculations.

2. In national accounts data labor productivity can be measured as output per worker or output per hour worked. Labor productivity is defined as real output per labor input. Output per worker and output per hour worked are the most common measures of labor productivity. These two measures correlate strongly, but do not necessarily always align. Regardless of the measure of labor productivity, the qualitative patterns of UK's productivity decoupling from the US remain unchanged. The table below summarizes different measures of average productivity growth provided by the ONS (2023). For comparisons of levels of productivity, ONS (2023) use current price GDP, converted to a common currency using purchasing power parities (PPPs). To compare productivity growth rates, GDP at constant prices (volume measure) in national currencies is utilized.

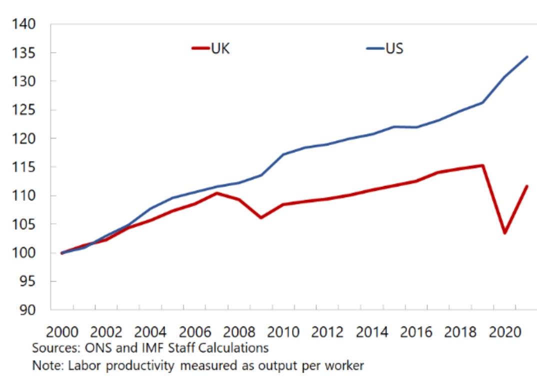
Table I.2. United Kingdom: Productivity Trends in National Accounts

	Growth Rate Output per Worker	Growth Rate Output per Hour Worked
UK pre- GFC (2000-2008)	1.3%	1.7%
UK post- GFC (2010-2021)	0.5%	0.5%
US pre- GFC (2000-2008)	1.5%	2.1%
US post- GFC (2010-2021)	1.4%	1%

Figure I.2. Labor Productivity Comparisons

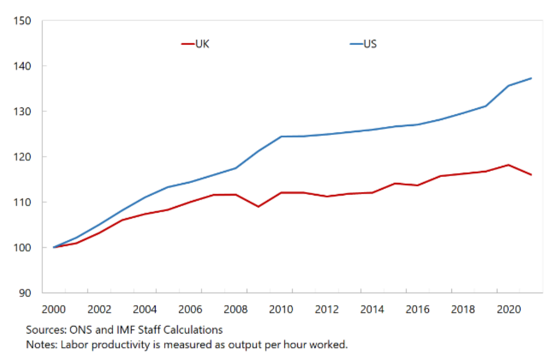
Aggregate Labor Productivity Trends

(Output per worker)



Aggregate Labor Productivity Trends

(Output per hour worked)



Source: ONS (2023) and IMF Staff Calculations.
Notes: Output in each country is measured as real GDP, chained volume measure.

Appendix I. Mathematical Appendix

1. Decomposition of aggregate productivity growth in sectoral contributions. Aggregate labor productivity growth in year t can be decomposed as follows: $G\_prod_t \approx \sum_{i=1}^{N} y_{i,t-1} * g\_prod_i$, where y_{it-i} is the nominal value-added share of sector i in year $t-1$ and g_prod_{it} is the labor productivity growth rate of sector i in year t. Nominal value added shares are computed as shares of total value-added of the non-agricultural market economy. Sectors are defined at the NACE 1-digit aggregation level.

2. Olley-Pakes decomposition framework. Following the static decomposition framework developed by Olley and Pakes (1996), aggregate productivity can be decomposed as the sum of within and between firm productivity. More formally, aggregate productivity at time t, P_t, can be decomposed as follows: $P_t = \sum_{i=1}^{N} p_{it} s_{it} = \overline{p_t} + \sum_{i=1}^{N} (p_{it} - \overline{p_t})(s_{it} - \overline{s_t})$. Where p_{it} is labor productivity of firm i at time t , s_{it} is the employment share of firm i, and $\overline{p_t}, \overline{s_t}$ are respectively the average labor productivity and employment share at time t . The first term of the equation, $\overline{p_t}$, captures the productivity of the average firm in the economy, also known as within-firm productivity, as it does not depend on the firm's weight. The second term is the covariance between firm productivity and the employment share. This component captures how well resources are allocated and is also known as the between-firm component. Essentially, the higher the covariance between firm-level productivity and the employment share, the more efficiently resources are allocated, as more productive firms utilize a larger share of resources in the economy.

3. Production function and TFP estimation at the firm-level. Estimating production functions at the firm-level to compute TFP is known to be complex because of challenges in estimating factor input elasticities. We estimate a Cobb-Douglas production function in logs:

$$\mathrm{y_{it}} = \alpha + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + e_{it}$$

where $\mathrm{e_{it}}$ is an i.i.d idiosyncratic shock, while ω_{it} is the unobserved firm-level total factor productivity we seek to estimate. The standard concern in estimating β_l and β_k via OLS is that ω_{it} is generally correlated with input factors $\mathrm{l_{it}}$ and $\mathrm{k_{it}}$, so an OLS estimator for β_l and β_k will deliver biased estimates. The literature on production function estimation has proposed several methods to deal with this omitted variable bias, see Levinsohn and Petrin (2003), Wooldridge (2009) for an overview. We follow the recent literature and employ a non-parametric approach used by IMF (2024b) and developed by Gandhi and others (2020).

4. Decomposition of labor productivity growth into capital intensity and TFP growth. By rearranging the firm-level production function one can express firm-level productivity growth into capital intensity and a TFP component. By subtracting $\mathrm{l_{it}}$ from both sides above, productivity growth at time t can be approximated by log changes:

$$\Delta \mathrm{prod_i t} = (\beta_l - 1)\Delta \mathrm{l_i t} + \beta\_k\, \Delta k\_it + \Delta\, u\_it$$

Where $u_i t = \omega_i t + e_i t$. By averaging across all firms at time t and using the fact that under constant returns to scale $\beta_k = 1 - \beta_l$, we can decompose within-firm productivity growth (the average productivity growth) as:

$$\Delta \text{prod}_t = (1 - \beta_l)(\Delta k_t - \Delta l_t) + \Delta \omega_t$$

Where the first term captures the growth rate in capital intensity and the second term is the growth rate in total factor productivity (TFP).

References

Adler Gustavo, Romain Duval, Davide Furceri, Sinem Kilic Celik, Ksenia Koloskova and Marcos Poplawski-Ribeiro. 2017. "Gone with the Headwinds: Global Productivity." *IMF Staff Discussion Note, No 2017/04*.

Aghion, Philippe, Ufuk Akcigit, and Peter Howitt. 2015. "Lessons from Schumpeterian Growth Theory." American Economic Review 105 (5): 94–99.

Akritidis, Leonidas, and P. Francis. 2017. "Financial intermediation services indirectly measured (FISM) in the UK revisited." *UK Office for National Statistics (ONS)*.

Ampudia, David, and Martina Pardy. 2023. "Brexit and Digital Technology Adoption of UK SMEs." *ESRC Working Paper*.

Ayantola Alayande, and Diane Coyle. 2023. "Investment in the UK: Longer Term Trends." *Working Paper, Bennet Institute for Public Policy Cambridge*.

Andrews Dan, Chiara Criscuolo, and Peter N Gal. 2015. "Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries." *OECD Working Paper*

Bank of England. 2021. "Monetary Policy Report - November 2021"

Blackwood, G Jacob, Lucia S Foster, Cheryl A Grim, John Haltiwanger, and Zoltan Wolf. 2021. "Macro and Micro Dynamics of Productivity: From Devilish Details to Insights." *American Economic Journal: Macroeconomics* 13 (3): 142–72.

Bloom, Nicholas, Philip Bunn, Scarlet Chen, Paul Mizen, Pawel Smietanka, and Gregory Thwaites. 2019. "The Impact of Brexit on UK Firms." *National Bureau of Economic Research*.

Bloom, Nicholas, Christos Genakos, Raffaella Sadun, and John Van Reenen. 2012. "Management Practices across Firms and Countries." *Academy of Management Perspectives* 26 (1): 12–33.

Bontadini Filippo, Carol Corrado, Jonathan Haskel, Massimilian Iommi and Cecilia Jona-Lasinio. 2024. "EUKLEMS & INTANProd: industry productivity accounts with intangibles - Sources of growth and productivity trends: methods and main measurement challenges." *The Luiss Lab of European Economics*

Brennan, Simon, Andrew Haldane, and Vasileios Madouros. 2010. "The Contribution of the Financial Sector Miracle or Mirage?" *London School of Economics Report on the Future of Finance, London*.

Burgess Stephen. 2011. "Measuring Financial Sector Output and Its Contribution to UK GDP", *Bank of England Quarterly Bulletin 51(3): 234-246*

BVCA. 2024. "Venture Capital in the UK." British Private Equity and Venture Capital Association.

Carella, Agnese, and Chen, Ruo. 2023. "Enhancing Business Investment in the United Kingdom." *International Monetary Fund, Selected Issues Paper*.

Cazzaniga, Mauro, Florence Jaumotte, Lonji LI, Giovanni Melina, Augustus Panton, Carlo Pizzinelli, Emma Rockall, and Marina Mendes Tavares. 2024. "Gen-AI." *IMF, Staff Discussion Notes* 2024 (001): 1. https://doi.org/10.5089/9798400262548.006.

Criscuolo, Chiara, Peter Gal, Timo Leidecker, and Giuseppe Nicoletti. 2021. "The Human Side of Productivity: Uncovering the Role of Skills and Diversity for Firm Productivity." *OECD Working Paper*.

Crouzet, Nicolas, Janice C Eberly, Andrea L Eisfeldt, and Dimitris Papanikolaou. 2022. "The Economics of Intangible Capital." *Journal of Economic Perspectives* 36 (3): 29–52.

De Loecker Jan, Obermeier Tim, Van Reenen John. 2024. "Firms and Inequality". *Oxford Open Economics*

D. Grimshaw, M. O'Mahony, and A. Westwood. 2023. "Skills for Productivity Growth." *Productivity Insights Paper No. 023, The Productivity Institute.*

Deb, Pragyan, and Gloria Li. 2024. "Upskilling the UK Workforce." *International Monetary Fund, Selected Issues Paper* 30.

Fernald, John, Robert Inklaar, and Dimitrije Ruzic. 2025. "The Productivity Slowdown in Advanced Economies: Common Shocks or Common Trends?" *Review of Income and Wealth.*

FT. 2025. "UK Start-Ups Consider Switch to US as Funding Falls to Post-Pandemic Low." *Financial Times*, April. https://www.ft.com/content/10466229-1e25-4e1d-aa03-52b329f84753?segmentId=bf7fa2fd-67ee-cdfa-8261-b2a3edbdf916.

Gandhi, Amit, Salvador Navarro, and David A Rivers. 2020. "On the Identification of Gross Output Production Functions." *Journal of Political Economy* 128 (8): 2973–3016.

Goldin, Ian, Pantelis Koutroumpis, François Lafond, and Julian Winkler. 2024. "Why Is Productivity Slowing Down?" *Journal of Economic Literature* 62 (1): 196–268.

Haldane, Andrew. 2018. The UK's Productivity Problem: Hubs no Spokes

Ilzetzki, E. 2020. "Explaining the UK's Productivity Slowdown: Views of Leading Economists."

IMF. 2024b. "Regional Economic Outlook Europe." *International Monetary Fund*.

———. 2024a. "United Kingdom 2024 Staff Report." *International Monetary Fund*. https://doi.org/10.5089/9798400279379.002.

Levinsohn, James, and Amil Petrin. 2003. "Estimating Production Functions Using Inputs to Control for Unobservables." *The Review of Economic Studies* 70 (2): 317–41.

Li, Xiang, and Dan Su. 2022. "Total Factor Productivity Growth at the Firm-Level: The Effects of Capital Account Liberalization." *Journal of International Economics* 139:103676.

OECD. 2019. "OECD Economic Outlook, Volume 2019 Issue 1." *OECD Publishing*.

Oliveira Cunha, Juliana, Jesse Kozler, Pablo Shah, Gregory Thwaites, and Anna Valero. 2021. "Business Time: How Ready Are UK Firms for the Decisive Decade?"

Olley, Steven, and Ariel Pakes. 1996. "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica*.

ONS. 2023. "International Comparisons of UK Productivity." Office for National Statistics.

Pittaway, Simon. 2025. "Yanked Away: Accounting for the Post-Pandemic Productivity Divergence between Britain and America." *Resoultion Foundation*.

Tenreyro, Silvana. 2018. The fall in productivity growth: causes and implications.
Tuckett, Alex, and Thanh Dinh. 2017. "The Productivity Puzzle." *PWC*.

Van Reenen, John. 2016. "Brexit's Long-Run Effects on the UK Economy." *Brookings Papers on Economic Activity* 2016 (2): 367–83.

Van Reenen, John, and Xuyi Yang. 2024. "Cracking the Productivity Code: An International Comparison of UK Productivity." *POID Special Report.*

Wooldridge, Jeffrey M. 2009. "On Estimating Firm-Level Production Functions Using Proxy Variables to Control for Unobservables." *Economics Letters* 104 (3): 112–14.

INDUSTRIAL POLICY IN THE UK[1]

A key challenge facing the UK is to increase growth, which has slowed down markedly since the Global Financial Crisis. As part of the government's approach to this challenge, a new industrial strategy was published in June 2025. This paper discusses how to get the implementation of UK Industrial Policy (IP) right, to unlock its potential benefits while navigating the risks involved. IP has some potential to catalyze new investment and economic activity in key sectors, but the bar for getting it right is high. IP will only enhance productivity if well-targeted at overcoming market failures and the scale of IP is not too large, so as to mitigate potential distortions that it might introduce. Targeting IP is difficult because market failures are hard to identify, so an evidence-based approach is best, using quantitative metrics, as discussed in this paper. Including academic and industry experts on the new Industrial Advisory Council should help guide the targeting of IP and improve the design of IP programs. In order to limit the scale and fiscal cost of IP, continuing the targeted grant programs used to support UK advanced manufacturing and green industries in recent years can be a good model to follow, in addition to targeted financial investments by the National Wealth Fund (NWF). Monitoring the implementation of IP programs over time, using performance benchmarks to unlock continued funding, is important for ensuring IP's effectiveness and to limit fiscal costs. While IP can be a useful tool, horizontal policies and structural reforms, particularly in planning, skills and infrastructure remain the primary vehicles to lift UK productivity and are prerequisites for vertical IP interventions to be successful. The extent of what can be achieved with IP is also likely to be curtailed by the limited space for additional public spending, given high debt and interest costs.

A. Introduction: A Resurgence of IP in Advanced Economies

The launch of the UK's new industrial strategy follows increased use of IP by trading partners in recent years, aimed at meeting key challenges including slow growth, energy insecurity and fragmented supply chains.

1. **There has been a recent resurgence of IP in advanced economies, while it continues to be a key policy tool in emerging markets** (Figure 1). Since 2021, the United States has implemented a large program of fiscal support for manufacturing of electric vehicles, clean energy projects, batteries and semi-conductors, through the Inflation Reduction Act (2022) and CHIPS Act (2022). European countries have also increased use of IP over the past decade via the state aid framework (Figure 2), as well as through European Union (EU) level initiatives such as the Green Deal Industrial Plan, Batteries Strategy and European Chips Act (Hodge and others, 2024). Meanwhile, China has continued its long-standing industrial policy with the Made in China 2025 program, aimed at expanding advanced manufacturing via state-owned enterprises and through the use of government subsidies to targeted sectors (Rotunno and Ruta, 2024).

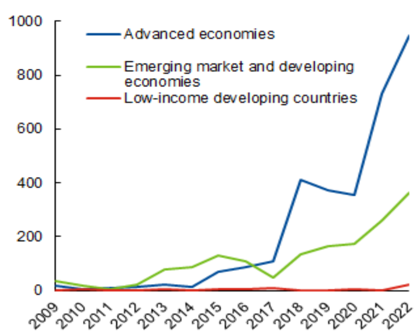
[1] Prepared by Andrew Hodge (EUR) and Samuel Pienknagura (RES). Kristina Kostial, Daria Zakharova, Luc Eyraud, Romain Duval, Florence Jaumotte, Aleksandra Zdzienicka, Sergio Rodriguez, Oliver Exton, Maximilien Queyranne, Ed Hearne, Graham Prentice and participants in an IMF internal seminar all provided helpful comments. The paper has also benefited from excellent suggestions by colleagues at the UK Treasury,

2. The resurgence of IP is primarily motivated by the need to boost growth, reinforce economic security, and facilitate the green transition. In Europe, IP is being increasingly used against a backdrop of weak growth, low productivity and an ageing population (IMF2024a). Concerns about economic security have also been a motivating factor, with US initiatives such as the CHIPS Act aimed at onshoring supply chains for critical inputs such as semi-conductors (The White House, 2024). Similarly, the Inflation Reduction Act has special provisions to support advanced manufacturing in regions that were previously dependent on fossil fuel industries (e.g. communities with closed coal mines) (Van Nostrand and Ashenfarb, 2023). IP in both the US and EU has also been used to advance the green transition, as reflected in the US subsidies for electric vehicles, while around half of non-crisis state aid in the EU has been directed to green initiatives on average during 2014–2022 (Figure 2). The recent escalation of trade tensions could further increase concerns about reliance on global supply chains, and prompt IP efforts to protect some affected industries and onshore the manufacturing of critical inputs.

Figure 1. Industrial Policy: Recent International Trends

Advanced Economies (AEs) have increased use of IPs sharply since 2019

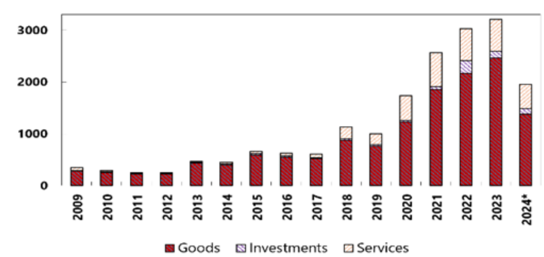
Number of IPs



Sources: Juhasz and others (2023a); Global Trade Alert Database.
Note: In Juhasz and others, 2023, IPs are defined as policies 'shaping the sectoral composition of economic activity.

Restrictive trade practices have also increased globally over the past five years

Number of Trade-Restrictive Measures



Sources: Global Trade Alert Database.
Note: Data accessed September 03, 2024; includes adjustment for reporting lags. *Incomplete data for 2024 (as of 03 Sep). All other years include measure as of 31 Dec.

3. Newly-adopted IPs target specific industries with a variety of policy instruments. Modern IP encompasses any 'vertical' policy targeted at one or more sectors of the economy to achieve government objectives and address market failures (see Juhasz and others, 2023b; IMF 2024b). This contrasts with 'horizontal' policies that aim to improve the general business environment and apply uniformly across the economy, such as tax incentives for business investment. The recent surge of IP is being implemented with a wide range of instruments, including (i) trade policy (e.g. tariffs and export subsidies); (ii) production subsidies or grants to firms; (iii) support for Research and Development (R&D) via grants and tax incentives; (iv) Special Economic Zones (SEZs); (v) financing on non-commercial terms (e.g. concessional loans, equity injections, and guarantees); (vi) regulatory policies such as local content requirements; and (vii) direct government action by limiting procurement to domestic suppliers (see Criscuolo and others (2022a) and (2022b); DiPippo and others (2022) and IMF (2024b). Subsidies nonetheless account for the majority of new IP in advanced economies, in the form of grants and loans to firms (see Hodge and others (2024); IMF (2024b).

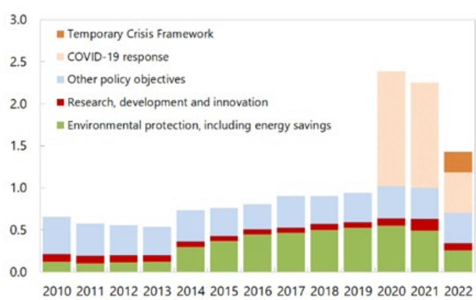
4. This paper provides insights about how to design successful IP under the new UK industrial strategy, drawing lessons from international experience, as well as showcasing empirical and model-based guidance on targeting and productivity impact. Section B contrasts the recent resurgence of IP in Europe with its more limited use in the UK, until the new industrial strategy was announced along with a greater role for the National Wealth Fund (NWF). Section C presents a conceptual framework for the design of IP, based on its benefits and risks. Section D then develops four principles of good IP design based on international experience, consistent with the IMF's approach to IP. Against the backdrop of these design principles, sections E and F use empirical and model-based analysis to identify the sectors of the UK economy where IP may be most effective, while quantifying the benefits to productivity, as well as some potential costs that need to be carefully managed.

Figure 2. Industrial Policy in the EU

The average EU country spends around 1 ppt of GDP per year more on IP than a decade ago

State Aid by Policy Objectives, 2010–22

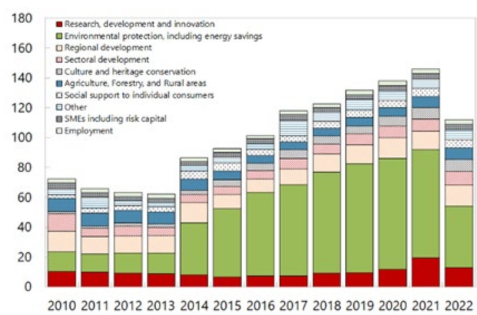
(Percent of EU GDP)



Green initiatives account for around half of state aid in the EU

Non-Crisis State Aid by Policy Objectives, 2010–22

(Billion euro, in current prices)



Sources: Eurostat; Hodge and others (2024).

B. The Recent History of IP in the UK

The UK has implemented IP in recent years via targeted grant programs in advanced manufacturing, green and creative industries, along with special economic zones, before the launch of the NWF in 2024 and the publication of the new Industrial Strategy in 2025.

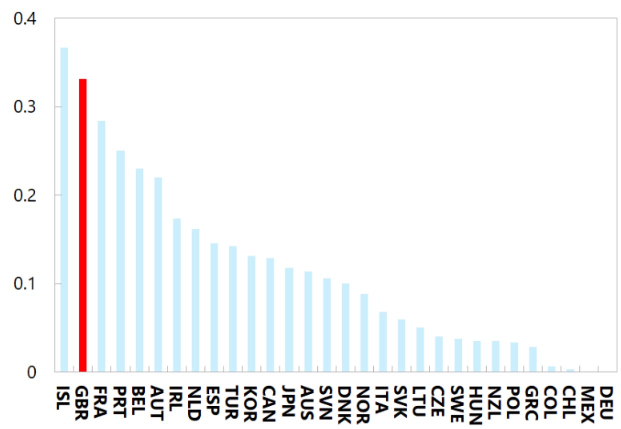
5. Compared to other advanced economies, the UK has pursued a more limited approach to IP, prior to the adoption of the new industrial strategy. The UK authorities have primarily focused on horizontal policy (relative to vertical interventions), such as economy-wide R&D incentives, which are among the most generous in the OECD (Figure 3), and full expensing (accelerated depreciation) of business investment in plant and machinery. Vertical interventions have been more limited since the pandemic, including grants targeted at key sectors, including advanced manufacturing, creative industries and a Green Industries Growth Accelerator, with a limited fiscal cost of only around 0.1 percent of GDP in FY2023/24.[2] This is substantially smaller that the fiscal cost of IP in the average EU country, which spends 1.5 percent of GDP per year on state aid, while conservative estimates indicate the total cost of Chinese IP at 1.7 percent of GDP (DiPippo and others, 2022). In the UK, there have also been Special Economic Zones called 'free ports', with simplified customs and tax arrangements (Adam and Phillips, 2023), as well as 8 Investment Zones and 48 Enterprise Zones, where businesses can take advantage of additional tax concessions or other forms of public support (Ward, 2024).

Figure 3. Public Support for R&D in the United Kingdom

The UK has some of the most generous tax incentives for R&D In the OECD

Tax Relief for R&D

(Percent of GDP)



Source: OECD.

6. **In June 2025, the UK government published a new industrial strategy to boost investment, create jobs, support the green transition and raise living standards across the country.** A public consultation about a new strategy was completed in November 2024. The strategy is focused on eight priority sectors which the government assesses as having growth potential that is not being realized because of market failures and other barriers. The sectors are advanced manufacturing; clean energy; creative industries; defense; digital and technologies; financial services; life sciences; professional and business services. In addition to the overall strategy, there are sector-specific plans that outline relevant policy initiatives. The ten-year strategy is to be implemented with the support of an Industrial Strategy Advisory Council, comprising members of the business community and other experts, that will oversee monitoring and evaluation.

7. **The new strategy encompasses both vertical and horizontal policies, some of which entail fiscal costs.** Vertical interventions are envisaged in the eight priority sectors, with a key focus on reducing energy costs for selected businesses, through the British Industrial Competitiveness

[2] The minimal use of IP in the UK since the pandemic marked a departure from a more interventionist approach that was pursued during 2017–21, called 'Building a Britain Fit For the Future', which was based on sectoral strategies and local growth plans, overseen by an economy-wide Industrial Council (Pickett and Hutton, 2025).

Scheme and British Industry Supercharger. The strategy will also include horizontal policies to strengthen the business environment, such as skills development, access to finance, competition, business regulation, planning and the availability of affordable energy (Department for Business & Trade, 2025). While the authorities are committed to accommodating the medium-term fiscal cost of the strategy's policy initiatives within the spending review's envelope, the total cost over ten years will need to be assessed with precision over time. Among the larger initiatives described in the strategy is £4.3 bn in public support for advanced manufacturing (0.15 percent of FY2025/26 GDP), including £2.8 bn in funding for R&D.

8. The NWF and other public financial institutions are to have a key role in delivering the industrial strategy, including by catalyzing private investment. The public financial institutions are designed to provide access to finance for UK firms of different sizes and stages of development. Moreover, to minimize the fiscal costs, the portfolios of projects supported by these institutions are required to generate a return at least equal to the cost of government borrowing, according to the government's Financial Transactions Control Framework. The following institutions each have a different focus:

- The **NWF** is designed to catalyze private investment at scale in key sectors, including clean energy, digital and technologies, advanced manufacturing, and transport. The NWF is the successor to the UK Infrastructure Bank, established in 2021, and has an endowment of around £27.8 billion (approximately 1 percent of 2025 GDP). It will use these funds to support projects using loans, guarantees and equity investments, with the target of crowding in private investment with a 3:1 mobilization ratio. The key objective of the NWF is to generate 'additionality', meaning that its interventions should unlock projects that would not go ahead otherwise (Carter and others, 2018; Winckler Andersen and others, 2021). This could be because of market failures that cause barriers to private investment, such as high upfront costs (e.g. Research and Development (R&D)).

- The **British Business Bank** is a state-owned bank supporting Small and Medium Enterprises (SMEs). It will be allocated an additional £4 bn of capital to support access to finance in the eight priority sectors, also targeting a 3:1 mobilization ratio, bringing its total endowment to £25.6 bn.

- The **UK's Export Finance Agency** is well-established and will be provided with an additional £3 bn of lending capacity, bringing to £13 bn the funds available to incentivize foreign demand for UK exports.

C. Designing IP: A Conceptual Framework

IP has the potential to support the development of productive firms and boost growth, while posing significant economic and fiscal risks (Table 1).

9. The ultimate goal of IP is boosting productivity and growth in sectors that will not reach their potential without public intervention, because of market failures. In some sectors, the private sector alone will deliver inefficient outcomes and an insufficient level of production, even in an otherwise ideal business environment. This is because of market failures, that are structural features that depress the risk-adjusted return on projects and deter firm entry and investment. Successful IP helps overcome these market failures, so as to crowd in additional private investment and economic activity that would not have otherwise occurred, boosting sectoral productivity and economic growth. For other IMF staff analysis of the role of IP and associated risks, see IMF (2024b) and Eyraud and others (2021).

10. IP can promote business activity, investment, and finance by overcoming the many forms of markets failures. Market failures can be numerous and sector-specific, resulting in the risk adjusted-return on investment being too low (Eyraud and others, 2021; Hodge and others, 2024). This can discourage firm entry and investment, and it also will deter investors from providing finance to projects in these sectors. The following are some examples of market failures:

- **Externalities.** There are a range of positive spillovers from private investment that individual firms may fail to take into account in their decision-making. For example, agglomeration effects exist in some industries, causing productivity to rise as more firms enter, because knowledge is more likely to be accumulated when there are more firms competing with each other. This is particularly the case in nascent industries where firms are competing through innovation at the technological frontier, such as in green industries. A prominent example of IP aimed at exploiting positive externalities is the regime of production subsidies offered to electric vehicle and semiconductor manufacturers by the Inflation Reduction Act and CHIPS Act, given significant knowledge spillovers in these sectors.
- **Imperfect Competition.** Some industries also exhibit natural monopolies, with too few entrants and insufficient competition, so that the industry does not develop to its potential and output prices are too high. Natural monopolies can develop because of high fixed costs of production, that create economies of scale for one or a small number of producers. These kinds of monopolies often arise in utilities industries, including the electricity grid. IP can play a role in providing finance to cover these large fixed costs, incentivize firm entry and promote greater competition.
- **Information Asymmetries.** Information asymmetries can prevent firms in nascent industries from accessing finance. The asymmetries may arise because of uncertainties about new technology that the firms are trying to develop and which may fail. This can occur in industries where firms are operating close to the technological frontier, and face large fixed costs such as R&D, while markets on the demand-side may not be fully developed. In these cases, the risk-adjusted return on investment may be too low for firms to attract private finance. IP can play a role providing concessional loans, equity investments or guarantees to facilitate access to finance, such as the support of the solar panel industry by the German Development Bank (KfW) in the early 2000s.
- **Delayed Returns.** There can also be delayed and uncertain returns for financial investors in nascent industries, because of the time needed for R&D, which investors can perceive as too long. Therefore, private projects may not materialize due to a lack of funding. Guarantees, equity investments, grants and loans from the public sector can raise the risk-adjusted return for financial investors and incentivize them to participate.

- **Coordination failures.** Nascent industries may require complex supply chains, all parts of which need to be developed simultaneously, or else a fledgling industry may fail. There can be a coordinating role for government in supporting the development of these supply chains. The establishment of the Airbus Consortium by UK and European governments is a key example of how an international supply chain was developed through government coordination.

11. Another motivation for IP is onshoring supply chains that are critical for national security in times of emergency. There are several industries critical in times of national emergency, including defense industries, energy, food and pharmaceutical supplies. An example that became apparent during the Covid pandemic was the capacity to develop and manufacture vaccines domestically, as well as deliver other critical medical supplies, like personal protective equipment, when international supply chains were under stress. Public interventions to onshore these capabilities have the potential to mitigate human, social and economic costs in times of emergency, such as pandemics.

Table 1. United Kingdom: The Benefits and Risks of IP

IP has the potential to overcome market failures in some industries, while carrying the risk of economic distortions, technological failures, governance failures and large fiscal costs

Benefits	Costs
Overcome market failures	**Picking losers ....**
- Scale externalities	- Supporting unproductive firms
- Coordination failures	- Investing in technology that fails
- Information asymmetries	- Creating dependence on public support
	Governance failures ...
that are barriers to	- Firms supported for political reasons
- Unlocking financing for investment	- Rent-seeking behavior by firms
- Start-ups by new firms	**Distortions to production & trade**
- Faster technological progress	- away from comparative advantage
- Higher productivity	... **which can lower productivity**
- Onshoring supply chains	... and incur **large fiscal costs**

Source: Hodge and others, 2024.

12. Poorly designed IP can nonetheless create significant economic and fiscal risks. IP can create economic distortions, particularly if poorly designed, and can fail to boost productivity. It can also involve large fiscal costs**:**

- **Picking losers.** Directing public resources to firms close to the technological frontier can backfire, if R&D is unsuccessful and firms fail, providing no boost to productivity (Hufbauer and Jung, 2021). Alternatively, providing public support to established firms may shield them from competition, disincentivize innovation and displace private investment, particularly if the firms do not face barriers associated with market failures. In both cases, there will be little, if any, boost to sectoral or economy-wide productivity.
- **Severe market distortions.** IP that favors particular firms, such as through grants or subsidies, can distort markets by drawing resources towards these firms and providing them with competitive advantages. While IP may boost productivity and profitability of the supported

firms, it can be harmful to their competitors and crowd out unsubsidized projects. This could even result in non-supported firms exiting the industry, shrinking its market size. This was confirmed by IMF staff analysis of IP implemented under the EU state aid framework, which included UK data pre-2020 (Brandao-Marques and Toprak, 2024).

- **Governance failures.** Pressure on political decision-makers to support particular industries or sectors can lead to rent-seeking behavior by firms (Criscuolo 2022a). This can distort the allocation of public support away from where it may be most beneficial, to firms that do not face market failures. In this case, IP can crowd out private investment and fail to boost productivity.
- **Fiscal costs and inflation.** IP can have substantial fiscal costs, particularly if it takes the form of production subsidies that are not subject to strict budgetary limits. The cost of the US CHIPS Act, Inflation Reduction Act and Infrastructure Investment and Jobs Act will likely be around 0.3 percent of GDP per year on average in direct government spending (Seydl, Matthews and Schaeffer, 2023), while the cost of Chinese IP was estimated to be around 1.5 percent of GDP in 2019 (DiPippo and others, 2019). If IP takes the form of trade measures such as tariffs, it can also be inflationary.
- **Trade distortions and retaliation.** IP can distort the sectoral make-up of the economy away from what underlying comparative advantage may suggest (Hodge and others, 2024; Ossa, 2011). This can create supply gluts in supported sectors, which can have adverse spillovers to trading partners, who may retaliate with trade policy, or other competing IP, starting a counter-productive 'subsidy race' that can undermine the benefits of IP.

D. Successful IP: Lessons from International Experience

IP must be carefully designed to unlock its potential benefits and manage its risks. Past international experience with IP provides a guide for UK policymakers on what works and what to avoid, as the new UK industrial strategy is implemented in coming years.

13. International experience reveals four key lessons for policymakers about IP targeting, governance, fiscal costs and the supporting role of horizontal policies. While market failures provide a sound economic justification for IP, identifying these failures in practice is challenging. Past experience with IP, particularly in recent decades and in advanced economies, provides an important guide for the UK on IP design (see also IMF (2024b)). The first lesson draws on international experience with targeting IP at firms facing market failures, while also managing risks associated with concentrating IP in too few firms and sectors. The second lesson concerns the institutional arrangements for designing and implementing IP programs, to ensure the right firms are chosen for support. Third, international experiences provide examples of best practices to contain the fiscal costs of IP. Finally, international experience shows the benefits of having strong horizontal policies in place, including skills and high-quality public infrastructure, in order for vertical IP interventions to be successful.

Lesson #1. IP should be targeted based on evidence of market failures, while taking care to manage concentration risks.

14. IP is most likely to support productivity if implemented using evidence-based targeting, rather than providing support widely across sectors, which may be wasteful and ineffective. As a general rule, public support to firms should be targeted and temporary. Providing blanket support to all firms in an industry is unlikely to target market failures precisely and risks subsidizing economic activity that would occur without government intervention. This suggests a waste of public resources and will likely make IP less effective in boosting sectoral or economy-wide productivity. It may even crowd out private sector investment, making firms more reliant on public assistance and less likely to innovate. Instead, firms selected for IP support should be chosen based on a rigorous evaluation process, including analysis of where market failures exist, so that IP catalyzes new economic activity.[3] An example of best practice is the Advanced Research Projects Agency (ARPA) model, used to provide public support to firms in health, energy and defense industries in the US. ARPA programs are run by a director selected from academia or industry, who selects programs based on extensive consultation with firms and researchers (Juhasz, Lane and Rodrik, 2023b).

15. Nonetheless, it is essential to refrain from "picking winners" to mitigate concentration risks linked to targeted IP. Picking only one or two firms to receive public support increases the risk of mistake and failure. This is particularly the case if recipient firms are seeking to develop new technology. Unsuccessful examples include the US government formation of an SOE to develop the shale oil industry in the 1980's (Synthetic Fuels Corporation), and a US government guarantee to Solyndra Corporation in 2009, to provide solar energy through new technology (Hufbauer and Jung, 2021). Both initiatives failed, partly because of falls in oil prices and in the price of more conventional solar technology, which made the respective investments in shale oil and new solar technology too expensive in comparison. A more favorable outcome was achieved by Operation Warp Speed in 2020, which swiftly and successfully supported the development of Covid vaccines, by diversifying support across multiple potential vaccine researchers and manufacturers, which managed concentration risk and increased the chances of success.

Lesson #2. IP programs should be managed with strong governance arrangements, to avoid discriminatory practices and enhance the selection of supported projects with technical expertise.

16. Enlisting academic and industry expertise when selecting firms to support can improve IP's targeting and effectiveness. IP support provided on the basis of political economy considerations, in order to support favored sectors or regions, is likely to be less effective in boosting productivity and wasteful. Incorporating academic or industry advice into decision-making, or even delegating decisions to experts outside of government, can help ensure the targeting of IP support remains evidence-based. Examples include the US ARPA model, where programs of public

[3] The appraisal process entails other important steps, such as cost-benefit analysis, tests for value-for-money, financial viability, assessment of fiscal costs and risks, and impact analysis.

support are supervised by a director chosen from academia or industry. Similarly, IP in Peru in the mid-2010s was based on a series of sectoral roundtables where industry leaders interacted with public officials to discuss market failures and areas where public support would be most beneficial (Juhasz, Land and Rodrik 2023b).

17. Considering all firms for IP support, irrespective of age, size or ownership, helps ensure that firms with the greatest potential for success are not excluded. Discrimination based on these factors can reflect political economy considerations and is unlikely to ensure that IP support is provided to firms where it can be most beneficial (IMF 2024b). First, it is worthwhile to consider both ***new entrants and existing firms*** for IP support, since firms that are already well-established may be less likely to face market failures and less disposed to engage in innovation, relative to new firms. For this reason, IP that prefers existing firms could be more likely to cause crowding out, rather than catalyze new investment. It may also reduce incentives for innovation and create reliance on public support. For example, Chinese IP in the early 2010s focused on EVs, which was a nascent industry with large fixed costs of R&D, rather than providing significant support for hybrid or internal combustion engine vehicles, given that these industries were already well-established and foreign manufacturers were more dominant in world markets. Similarly, ***small and big firms*** should both be considered for IP support, since new entrants are often small firms that may be more innovative, developing new technology from its infancy, so should not always be overlooked in favor of bigger firms. Third, both ***domestic and foreign-owned firms*** should be eligible for IP support, so that IP does not shield domestic firms from competition, nor disincentivize foreign investment (IMF 2024b).

Lesson #3. Fiscal costs can be limited by making support time bound, while subject to financial limits and ongoing monitoring, which can also facilitate firms eventually becoming independent of IP support.

18. Fiscal costs can be contained by making IP support to firms subject to financial limits, rather than open-ended. This could be achieved by providing grants to selected firms up to a set limit. Financial support in the form of equity investments, loans or guarantees also has a limited direct cost, although there can be contingent liability risks for the public sector (see Annex 1 on the NWF). In contrast, open-ended subsidy programs, where subsidies are available to all who meet eligibility criteria, make fiscal costs difficult to project, complicating medium-term budgeting and risking fiscal costs that are far larger than anticipated. For example, Electric Vehicle (EV) subsidy programs in China and the US have proved more popular and costly for the budget than originally envisaged (IMF 2024a). This likely reflects the open-ended design of the subsidy programs, with consumers receiving subsidies for purchase of EVs in China based on vehicle range, during 2013–22, while the US government allows tax credits for purchase of EVs.

19. Periodic monitoring of and time limits on IP programs can help facilitate eventual independence from public support, while also limiting fiscal costs. This involves formulating IP so that recipients are required to meet performance benchmarks over time, to unlock financial support, which should be designed to expire after the objectives of the policy have been achieved.

Time limits are usually inherent in grants, loans or guarantees provided to new firms or start-ups. Tax incentives and subsidies can also be made subject to explicit time limits or subject to periodic review, so that they can be suspended once a new firm or project becomes well established, having overcome market failures. Under the ARPA model in the US, supported projects have pre-defined milestones that need to be met to ensure continued public support (Juhasz, Lane and Rodrik, 2023b). Imposing these limits can be preferable to providing indefinite support, such as through ongoing tax incentives and subsidies, which can shield recipient firms from competitive forces and disincentivize productivity-enhancing innovation.

Lesson #4. Horizontal policy and structural reforms need to be in place before vertical IP interventions can be successful, and can also amplify the benefits of IP.

20. High-quality horizontal policies are a pre-requisite for successful IP, by improving the general business environment through the elimination of policy distortions. Vertical interventions are rarely a substitute for strong horizontal policies, which have been found to have a larger impact on industry performance (Baquie and others, 2025). In general, sequencing matters and vertical IP should only be considered if strong horizontal policies are in place and prove insufficient to address market failures. As discussed in IMF staff's 2025 Article IV report, a strong business environment, with policy certainty, stable tax and regulatory regimes, including planning laws, will help ensure that firms supported by IP will thrive once market failures are overcome.

21. Horizontal policies can directly complement vertical IP interventions in some sectors, amplifying their effects by providing a skilled workforce and critical infrastructure. While horizontal policies are a prerequisite for the success of vertical IP interventions, by delivering a business environment conducive to innovation and investment, horizontal policies can also be directly complementary to some IP initiatives. In particular, horizontal policies that boost skills and deliver high quality public infrastructure can be directly beneficial for firms receiving IP interventions. Since IP often supports firms operating close to the technological frontier, access to a skilled workforce is a critical input. Strong education and training policies, with a focus on technical skills can provide this. Active labor market policies and immigration policies also contribute to the supply of skilled workers to supported firms (IMF 2024b). Some forms of public infrastructure can also be critical for the expansion of firms benefiting from IP. This will include access to the electricity grid, as well as EV charging infrastructure. For example, US and Chinese IP subsidies for purchase of EVs are complemented with nation-wide public investment in EV charging infrastructure, which increases the utility of EVs for users.

E. Targeting of UK IP: An Evidence-Based Approach

Identifying market failures and demonstrating 'additionality' of IP is sound in theory but challenging in practice. An evidence-based approach can be used to guide policymakers, the NWF, and other public financial institutions, complementing less formal methods. Applied to the UK, one metric proxying for market failures points to advanced manufacturing as among the appropriate targets for IP.

22. Quantitative methods are useful to identify firms facing market failures, which can be appropriate targets for IP. While market failures provide a sound economic justification for IP, they are difficult to identify in practice (Winckler Andersen and others, 2021). In cases where firms are reluctant to enter nascent industries, it can be difficult to determine whether there is a market failure or whether firms are simply insufficiently innovative or productive to compete, which can occur even when private markets are functioning correctly. These types of indicators can be a helpful guide for policymakers in pinpointing the extent of market failures across various sectors and demonstrating 'additionality' of IP programs, in the sense that the programs support private investment that would not otherwise have occurred.

23. These approaches can estimate additionality directly based on the impact of IP support relative to the counterfactual, or take the form of proxies for the existence of market failures, and can be used alongside less formal methods. Of the two broad ***quantitative approaches*** to identifying market failures, the first involves measures that *directly test the effectiveness of IP*, by estimating the impact of IP on firms, relative to a counterfactual outcome without public support. If this shows a positive impact, the existence of market failures can reasonably by inferred. This can be done with econometric models (Hiroyuki and Yasumura, 2021), [4] or less formally by comparing similar firms that differ mainly by whether or not they receive IP support (Murphy and others, 2003). By using econometric methods or requiring a counterfactual, these quantitative methods are data intensive and can be difficult to apply ex ante, before IP support to a firm or project is approved. The second approach is more indirect and uses metrics that proxy for the *existence of market failures*. An example presented in this paper is a metric that gauges the degree of competition in an industry, since low levels of competition can be caused by market failures (Liu 2019). This approach can be applied ex ante and is firmly grounded in economic theory. These quantitative methods could be supplemented by more ***descriptive analyses*** explaining which specific market failures impact a group of firms or a subsector of the economy, and justify IP. Multilateral development banks have useful experience with these approaches, since they require additionality in all supported projects that involve private sector participation. These institutions generally include an account of relevant market failures in project descriptions, potentially with some quantitative metrics, based on a harmonized approach across institutions (African Development Bank and others, 2018).

24. The indicator of Liu (2019) is a proxy for the extent of market failures in each sector based on the degree of price markup, and suggests that advanced manufacturing and industries critical for supply chains exhibit market failures in the UK. The presence of market failures in an industry is more likely if there is evidence of distortions that cause market prices to deviate from marginal cost (i.e. mark-ups). The industry-level 'Distortion Centrality (DC)' metric of Liu (2019) takes account of mark-ups at the industry level *and* the industry's links with other parts of the economy, so that industries with a higher DC index (close to 1 and above) propagate distortions throughout the economy (see Annex II). Data for the UK suggest that manufacturing of electrical

[4] For instance, a diff-in-diff estimation of the impact of IP interventions on desired outcomes (e.g. private investment) could be conducted.

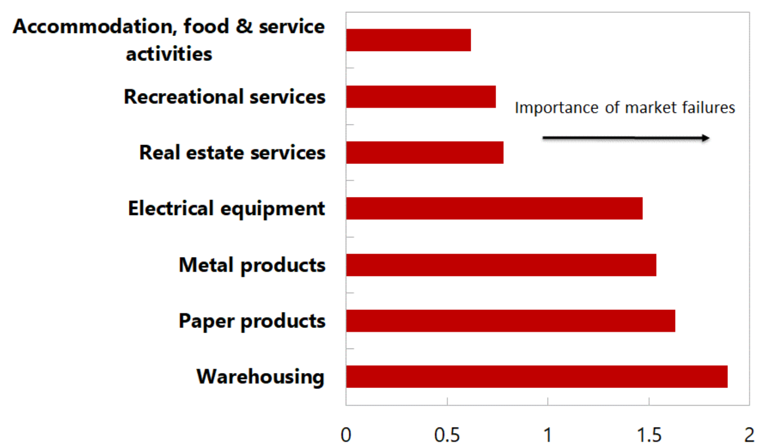
equipment, metal products, paper products, as well as warehousing, which is critical for supply chains, have among the largest distortions (Figure 4). These industries are likely to exhibit market failures and the most-affected firms could be appropriate targets for IP. Services industries such as accommodation, food services and real estate display the least evidence of distortions (Baquie and others, 2025) and likely exhibit fewer market failures, so that IP would risk crowding out private investment in these sectors. While the DC index helps pinpoint sectors where market failures are most acute, such as UK advanced manufacturing, it is important to build on this analysis by adding a descriptive diagnostic of what particular form the market failures take, to allow appropriate IP to be designed.

Figure 4. Market Failures in the United Kingdom

Advanced manufacturing industries in the UK are among those that exhibit market failures and amplify distortions

Market Failures for Selected UN Industries

(Distortion centrality index)



Sources: Liu (2019); Baquie and others (2025).

F. Modeling the Impact of UK IP on Productivity

Structural modeling shows that IP can be effective if well-targeted at firms facing market failures, contributing to higher productivity in these sectors. IP can also introduce distortions that need to be carefully managed, through limits on the scale and cost of IP.

25. The UK's weak productivity is a significant constraint on growth, and IP has the potential to be part of the policy mix to address this challenge. As discussed in the 2024 and 2025 IMF Article IV reports, the UK has experienced a sharp slowdown in trend growth of per capita income since the Global Financial Crisis (GFC), that has left the level of UK GDP about a quarter below what the pre-GFC trend would imply. A key driver of this slowdown has been the drop in labor productivity growth, which has declined from around 2 percent pre-GFC to approximately ½ percent since then, a larger decline than in some other advanced economies. Part of this decline can be attributed to chronic under-investment and a lack of innovation at the firm level (see 2025

SIP on UK Productivity). If well-designed, IP has the potential to help address the shortfall in both of these areas.

26. Structural modeling can be used to assess the impact of UK IP on productivity and household income in general equilibrium, since IP support to firms can create spillovers and spillbacks across industries and across international borders. Modeling can quantify the direct impact of UK IP on productivity across sectors, as IP overcomes market failures in the model. A key insight of general equilibrium modeling is also to quantify offsetting costs created by spillovers and spillbacks from IP. These arise because IP can draw labor and other resources to supported firms and away from their competitors. Furthermore, IP can have international spillovers and spillbacks, caused by distorting the pattern of trade away from underlying comparative advantages.

27. The analysis using the Krugman-style model of Lashkaripour and Lugovskyy (2023) implies that UK IP can contribute to an increase in the productivity of supported firms, with the impact differing across sectors depending on the extent of market failures. Although there are many forms of market failures in practice, the multi-industry, multi-country model embodies a type of market failures common in industries close to the technological frontier, in the form of scale externalities of firm entry (see Annex III).[5] These industry-specific scale externalities reflect agglomeration effects of entry by new firms, attributable to knowledge spillovers, that individual firms fail to take into account when making decisions about whether to enter an industry. The scale externalities differ significantly by industry and are calibrated based on evidence from micro-data. The model implies that industrial production subsidies targeted at industries with significant scale externalities can overcome these market failures and increase productivity, by incentivizing firms to internalize the externality when making entry decisions. While increases in labor productivity in the model are indistinguishable from increases in total factor productivity, since labor is the only production input, it is important to note that this is a convenient simplification for ease of modeling. In practice, labor productivity gains can be caused both by higher total factor productivity *and* by raising capital intensity (see SIP on productivity). Empirical analysis by IMF staff has indeed shown that IP can have a greater effect on capital accumulation than total factor productivity of firms (Baquie and others, 2025).

28. The model reveals that subsidies targeted at advanced manufacturing industries in the UK, that exhibit large scale externalities, will support sectoral and economy-wide productivity, while subsidies directed at other sectors will be less effective. The model is simulated using industry-level data for the UK, EU and selected G20 countries. Production subsidies correcting market failures in an advanced manufacturing industry with large externalities, like the UK electrical and optical equipment sector, incentivize firm entry into the sector, increasing its share of production and total employment. Given the large scale externalities, the productivity of the expanded electrical and optical equipment sector increases by 1½ percent in the long-run, raising economy-wide productivity (Table 2). In contrast, production subsidies that correct market failures in

[5] While scale externalities would differ between firms in reality, they are assumed to be the same for all firms within each industry in the model, which is a convenient modeling simplification.

sectors with smaller externalities, such as transport and plastics, as well as agriculture, will expand these less-productive industries while failing to increase their productivity significantly. The effects of supporting sectors with smaller externalities can be viewed as adverse cross-industry spillovers, by drawing resources towards less productive sectors (see Hodge and others (2024) for further discussion of these effects).

Table 2. United Kingdom: The Productivity Impact of United Kingdom IP

IP production subsidies to correct scale externalities can boost sectoral productivity

Model-Implied Impact of Externality-Correcting IP Subsidies in Selected UK Industries

	IP Subsidy (in percent of output price)*	Improvement in industry productivity (ppts, weighted by industry share)**
Electrical & Optical Equipment	**55**	**1.4**
Chemicals and Chemical Products	**23**	**0.8**
Basic Metals & Fabricated Metal	**21**	**0.3**
Rubber and Plastics	**14**	**0.1**
Transport Equipment	**13**	**0.2**

* Larger subsidies are required when scale externalities are higher.

** Denotes productivity improvement in the model's steady state. Dynamic effects are beyond the scope of the model.

Sources: Lashkaripour and Lugovskyy (2023); Hodge and others (2024).

29. **While IP can play a role supporting productivity growth in the UK, it can cause unintended international spillovers and spillbacks through trade channels.** While IP may lift productivity of sectors with large market failures, it can also create an expansion of production in these sectors that may cause supply gluts in export markets, particularly considering IP may be directed towards niche industries, such as advanced manufacturing of differentiated products close to the technological frontier. These supply gluts can depress export prices and worsen the terms of trade (Lashkaripour and Lugovskyy, 2023; Hodge and others, 2024). This is illustrated by using again the model, in a simulation where industry-specific production subsidies are implemented by the UK to *completely eliminate* scale externalities in *every* sector of the economy. While not realistic, this is a hypothetical benchmark case where IP is comprehensive in the UK, while other countries do not respond with any distortive policies. In this extreme case, the productivity benefits of correcting market failures are *outweighed* by the losses through the trade channel, generating an overall income loss for households. This exercise can be repeated for every country in the EU and G20, showing that household income could decline in many countries, particularly those more open to trade, such as the UK, because of spillbacks through trade channels (Figure 5). Although the results are not shown in this paper, retaliation by trading partners, including with trade policy, could further reduce welfare (see Lashkaripour and Lugovskyy (2023) for further details), including globally.

30. **Careful targeting of UK IP, under strict financial controls, with international cooperation on the design of IP policies, can help manage spillovers and spillbacks and maximize the benefits of IP.** Spillovers and spillbacks of IP become large the more is spent on IP, as the hypothetical benchmark case presented in Figure 5 illustrates. Careful targeting of IP at firms facing the largest market failures and imposing tight financial controls on the amounts committed

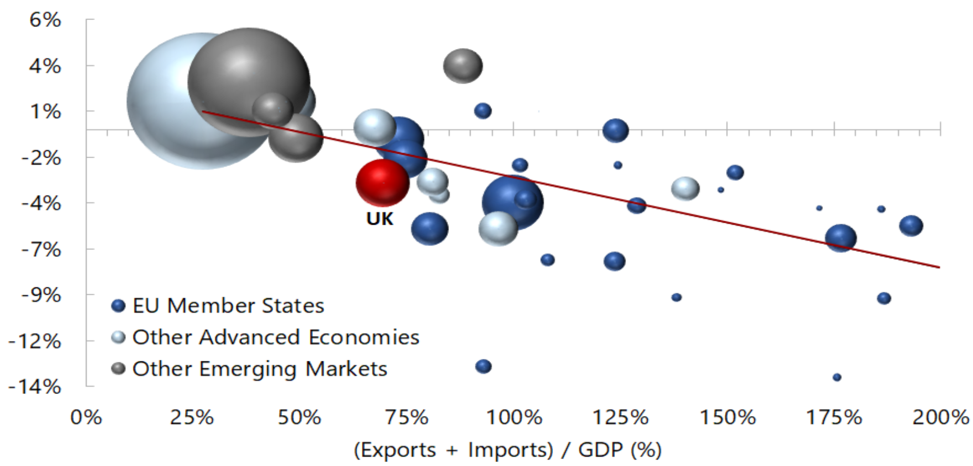
can help minimize these costs, while still catalyzing additional investment and supporting productivity. Cooperating with other countries on the scale of IP programs, in the spirit of the EU state aid rules, can also help to create a level playing field, limiting some of the distortions of IP through trade channels (see Hodge and others, 2024).

Figure 5. Spillovers and Spillbacks of United Kingdom IP

*Because of **international spillovers and spillbacks**, Krugman-style modeling implies that deploying IP across all sectors can reduce overall household income, if not carefully managed.*

Welfare Impact of Scale-Correcting Production Subsidies

(Relative to status quo of zero subsidies, percent)



Sources: Lashkaripour and Lugovskyy (2023); Hodge and others (2024).
Note: The chart shows the welfare gain (percent) when each country unilaterally implements scale-correcting production subsidies, while other countries maintain zero subsidies. The size of the bubbles corresponds to each country's nominal GDP (in USD) for 2023.

G. Conclusions: Making the New UK IP Strategy Successful

31. The UK's new industrial strategy has real potential to unlock private investment and boost UK productivity in key sectors. While horizontal reforms delivering policy stability, higher investment through planning reform and investment in skills, will be the main policy tools to lift UK productivity, IP can play a supporting but important role. Using IP to overcome market failures can help incentivize firm entry and investment in key sectors. The UK's new industrial strategy rightfully takes a strategic approach, directing public support to where it will be most effective, given limited fiscal space in the UK.

32. The bar for implementing IP well is high and will require a rigorous approach to targeting, sound institutional arrangements, and fiscal controls, with support of horizontal policies. While there is a sound economic justification for IP that targets market failures, they take many forms and are hard to identify in practice. Effective targeting requires strong governance arrangements, to take an evidence-based approach to selecting the right firms to support, without arbitrarily favoring particular firms. International experience suggests a role for academic and industry experts in IP design and implementation. IP programs that are time bound and subject to strict financial limits can help manage fiscal risks and support medium-term budgeting, together with transparent risk reporting. Horizontal policies that eliminate distortions and provide a stable policy environment also remain a pre-requisite for successful IP.

- **Targeting.** UK IP will have the greatest chance of success if targeted at firms and projects exhibiting market failures, which quantitative evidence suggests are most likely to exist in sectors like advanced manufacturing and industries critical to supply chains. Quantitative metrics provide a useful guide for decision-makers to demonstrate additionality of IP support, which can be targeted accordingly. For the UK, a metric that proxies for market failures using evidence of market distortions, suggests a role for UK IP in industries close to the technological frontier, where there can be large upfront investment costs, including for R&D. This would include digital and technology industries, green industries, including clean energy, which are among the priority sectors for the new industrial strategy.

- **Institutional Arrangements.** Targeting can be improved by harnessing participation of academic and industry experts in the UK's Industrial Advisory Council, to design IP programs and select firms and projects to support. The UK Industrial Advisory Council, which will be established by legislation as a permanent body, can use its academic and industry experts to help identify market failures in particular industries, and suggest metrics that could guide the selection of firms to receive IP support, as well as overseeing performance monitoring. A further step would be to mimic some aspects of the ARPA model of IP used in the US, where academic or industry experts are employed to manage IP programs, selecting firms to support and identifying performance milestones that unlock additional financial support.

- **Fiscal controls.** Fiscal costs can be contained by continuing the UK's recent approach to IP, through targeted grant programs that are time bound with a fixed budget allocation. The UK's recent experience with IP has incurred minimal fiscal cost, with programs in advanced manufacturing, clean industries and creative sectors. Rigorous monitoring of the implementation of these programs, for instance through clear performance benchmarks, can also limit costs and ensure continuous effectiveness. This approach is preferable to open-ended tax incentives or subsidies, available to all firms or consumers that meet eligibility criteria, since these programs can often exceed their anticipated cost significantly. Lump sum grant programs may facilitate firms benefiting from IP to become independent of public support, since the public financial support is not ongoing. This approach will help ensure that the cost of the strategy can be accommodated within the medium-term expenditure envelope announced at the spending review.

- **Horizontal policies.** Structural reforms in the areas of planning, skills and infrastructure, as outlined in the new strategy will help provide a strong business environment. If horizontal policies alone prove insufficient to overcome market failures, vertical policies could then be considered. High-quality horizontal policies will be critical to the success of these IP interventions and can even be directly complementary. Past experience has shown that firms benefiting from IP support generally need access to a skilled workforce. Ongoing UK investment in skills and training, including the announced approach of developing skills for the eight priority sectors in partnership with businesses, as well as continued skilled migration, will help develop the workforce needed by firms in advanced manufacturing, clean energy and other sectors close to the technological frontier. Infrastructure investments, such as the announced focus on developing ports, will likely also be required to support firms targeted by IP. The ongoing reforms to planning laws will help ensure that firms receiving IP support are able to proceed with investment as quickly as possible. These complementarities between horizontal policies and IP are important examples of synergies between the pillars of the UK's growth mission.

33. Despite the potential of IP, it is important to maintain realistic expectations about its impact on the economy, and other policies will be needed to support productivity growth. The UK has limited fiscal space, given high debt and interest costs, with ageing-related spending pressures set to mount in the longer term. Difficult fiscal choices may be needed to accommodate IP spending within the medium-term expenditure envelope announced at the recent spending review, given other competing priorities. Furthermore, the impact of horizontal reforms, particularly in planning and skills, as well as ensuring a stable policy environment, are likely to be substantially more important for boosting productivity than IP, which is most effective when narrowly targeted at tackling market failures.

34. In particular, the NWF's investment mobilization ratio is ambitious, given the difficulty of establishing additionality of projects and the importance of strict financial controls and fiscal risk management. The NWF is rightly focused on additionality and a more formalized approach to identifying projects facing market failures would help prioritize projects that would not go ahead without public support. The robust Financial Transactions Control Framework appropriately limits costs to the public sector, by requiring that the NWF's portfolio generate a return that covers government borrowing costs. However, projects meeting these criteria will likely be those that are *close* to proceeding on purely commercial terms, without public support. This is likely a narrow range of projects, so that a determined effort will be needed to achieve the 3:1 catalyzation ratio.

Annex I. The United Kingdom's National Wealth Fund

The UK's National Wealth Fund (NWF) has the potential to catalyze new investment, but faces the key challenges of achieving 'additionality' while covering financing costs and managing fiscal risks. An optimal approach to NWF investment would include rigorous appraisal processes, require evidence of additionality and satisfy robust risk management and reporting procedures.

Key Objectives of the NWF

1. **As a policy bank, the NWF is faced with three competing objectives.** First, the role of a policy bank is to unlock truly "additional" investment, by supporting projects that would not occur without public support, to crowd in private investment, rather than substitute for private investors. Second, the projects supported should generate a sufficient return to cover the government's financing costs, to limit the burden on the public sector. Third, fiscal risks need to be minimized, including contingent liability risks, if projects fail, and statistical re-classification risks, in case the project's debt is treated as being entirely that of the public sector.

2. **The range of projects that satisfy additionality tests and generate returns covering the NWF's financing costs is likely to be relatively narrow.** While there may be many projects that would not happen without public support, some of these may fall entirely within the traditional role of government (e.g. defense industries, public highways). In order to generate a return to cover the NWF's financing costs, with the NWF being a minority investor in the project, the projects will need to be close to being commercially viable without public support.

Enhancing the NWF's Policy Framework

3. **A rigorous *appraisal process* can help ensure that all supported projects are successful.** The NWF already has a practice of completing detailed impact assessments of supported projects, which are helpful to gauge their effect on priority sectors, such as the environmental impact of clean energy projects. This could be complemented with more detailed ex ante appraisal processes, including cost-benefit analysis, financial viability studies, and analyses of fiscal risks.

4. **An evidence-based approach to demonstrating '*additionality*' can also support good project selection.** There are many types of market failures that make a project unattractive to financial investors without public support. Quantitative methods can be used to demonstrate additionality, such as proxies based on whether an industry exhibits low levels of competition or methods to directly estimate the value of IP interventions. These rigorous methods can be used alongside more informal, narrative-based approaches. Requests by private investors for public participation in a project are encouraging, but do not in themselves constitute evidence of market failures.

5. **The NWF has a robust *risk management* framework, with quantitative risk controls.** The NWF's financial framework includes quantitative thresholds for different categories of risk and the NWF will inform HMT when thresholds are breached. In setting quantitative

benchmarks, the current controls of the UK Export Finance Agency provide a good guide, including limits on the maximum commitment in a single project. The financial transaction control framework also provides for at least annual engagement between NWF with HMT, which will facilitate monitoring of emerging risks. An economic capital limit of £7 billion will also ensure that losses on unsuccessful projects can be absorbed without requiring additional HMT financial support.

6. A detailed and transparent *risk reporting* regime will help manage contingent liability and statistical reclassification risks. Reporting the full range of liabilities associated with each supported project helps reveal the maximum potential liability of the public sector, in the event of project failure (contingent liability risks) or if the statistical agency classifies the entire project as within the public perimeter (reclassification risks). The NWF's risk reporting could be integrated into HMT reporting, and also studied as part of the OBR's fiscal risks reports, which are at the frontier of sound risk management practices.

Annex II. Identifying Market Failures Through Distortion Centrality

1. Liu (2019) metric. As a proxy for market failures or distortions, the distortion-centrality (DC) index by Liu (2019) combines sector-specific distortions with the sector's interconnections with other sectors, computed using input-output tables. The extent to which a sector's distortions propagate through the economy will depend on its connections to the rest of the economy.

2. Alternative measures. IMF staff have constructed the index for 141 countries, measuring distortions using markups within a sector to gauge economies of scale (Ackerberg and others, 2015). The analysis is robust to using the sector's external financial dependence (Rajan and Zingales, 1998) as an alternative measure. Input-output information is sourced from the Global Trade Analysis (GTA) Project. For further details see Baquie and others (2025).

3. Results. The metrics based on either measure of distortions are correlated, and sectors like electricity production and biotech research rank high on both dimensions. Staff finds that the number of protectionist IPs targeting a sector correlate positively with its DC, with this relationship strengthening in recent years. It is also found that the positive correlation between IPs and DC is stronger for AEs.

Annex III. A Structural Model of United Kingdom IP

1. Model Description. The multi-country, multi-industry model of Lashkaripour and Lugovskyy (2023) used in this paper is from a recent strand of literature in which industrial policies are modelled as subsidies that remove distortions arising from external economies of scale at the sectoral level (Bartelme et al. 2019; Haaland and Venables; 2016). In this Krugman-style model, industries differ by the degree of scale economies or elasticity of trade volumes to prices. Each country $i \in \bar{C}$ has population of L_i individuals who each supply one unit of labor inelastically. Labor is the sole factor of production in each country.[1] Workers are perfectly mobile across industries within countries, but cannot cross international borders, so are paid country-specific wage w_i.

2. Consumers. The representative consumer in country i maximizes utility subject to a budget constraint. The consumer chooses a vector of industry-level product bundles from each $k \in \bar{K}$ industries. Each industry-level product bundle has a corresponding price index $\widetilde{P_{i,k}}$ and may contain goods sourced from multiple countries. Each industry-specific product bundle is an aggregation over various country-specific varieties, each of which is itself an aggregation over firm-level varieties from that country. The within-industry utility aggregator has a nested CES structure, so that the parameter determining the elasticity of substitution between country-specific varieties differs from the parameter determining the elasticity of substitution between firm-specific varieties. The former parameter σ_k determines the degree of price-elasticity of foreign demand in industry k (i.e. the higher the market power, the lower is price-elasticity of foreign demand) , while the latter parameter γ_k determines the degree of firm-level market power and 'love-of-variety' preferences, with $\gamma_k > 1$.

3. Firms and Production. Each country $i \in \bar{C}$ is populated with a mass $M_{i,k} = \Omega_{i,k}$ of monopolistically competitive firms producing a single product in industry $k \in \bar{K}$, using labor as the only factor of production. Under the assumption of free entry of firms, a pool of ex ante identical firms can pay an entry cost $w_i f_k^e$ to operate in industry k from country i. Each firm $\omega \in \Omega_{i,k}$ draws a random productivity $z(\omega) \geq 1$ from distribution $G_{i,k}(z)$ and faces a marginal cost $\tau_{ij,k} w_i / z(\omega)$ for producing and delivering goods to destination $j \in \bar{C}$, where $\tau_{ij,k}$ is a flat, iceberg transport cost. Given these assumptions, the average unit labor cost in origin i is declining in the number of firms and varieties. One way to demonstrate this is to note that the elasticity of the Producer Price Index (PPI) of the composite good in industry k, produced in country i, is negative: $-\mu_k = \partial lnP_{ij,k}/\partial M_{ik} < 0$ and its absolute value μ_k is the industry-level scale elasticity, being the elasticity of the PPI to the number of firms. It is equivalent to observe that μ_k is the elasticity by which variety-adjusted total factor productivity increases with industry-level employment, which is proportional to firm mass $L_{i,k} \propto M_{i,k}$. The scale elasticity is exactly equal to a constant firm-level mark-up within that industry, $1/(\gamma_k - 1)$, which also determines the extent of love of variety.

4. Policy Instruments. The simulations presented in this paper are based on a version of the Lashkaripour and Lugovskyy (2023) model where the only policy instrument available to a government in each country i is an industry-specific production subsidy applied to industry k's

[1] The model can be extended to introduce intermediate goods.

output produced in country i, irrespective of where the output is sold. The subsidy is financed via lump sum taxes to consumers.

5. Welfare Implications of IP. The welfare implications of unilateral industrial subsidies are quantitative questions, depending on the calibration of parameters, notably the scale elasticity μ_k and the price-elasticity of foreign demand σ_k. Lashkaripour and Lugovskyy (2023) find that σ_k and μ_k are negatively correlated empirically[2] (see Table III.1). This implies that production subsidies (i) correct misallocation, by expanding output in high returns-to-scale (high μ_k) industries, while also; (ii) worsening the terms of trade by expanding exports in these same industries which have lower price-elasticity of foreign demand (low σ_k).

6. 'Immiserizing' Growth. Under these parameter values, it also follows that unilateral implementation of Pigouvian industrial subsidies worsens the terms of trade, which can offset some or all of the welfare gains from establishing allocative efficiency. This is referred to as an 'immiserizing' welfare effect.

7. Data for Calibration. Observable data used to calibrate the model include data from 43 countries (including all EU member states and the UK) on production and expenditure across 56 industries, from the 2014 World Input-Output Data (WIOD) (Timmer and others, 2015). Following the methodology in Costinot and Rodriguez-Clare (2014), the 56 industries in the WIOD are aggregated into 15 traded industries (for which Lashkaripour and Lugovskyy (2023) have estimated trade σ_k and scale elasticities μ_k, plus a services sector (assumed to have $\mu_k = 0$ and $\sigma_k = 11$) (see Table III.1). Data on bilateral applied import tariffs (i.e., the status quo for import tariffs) are constructed following the methodology of Kucheryavyy, Lyn and Rodriguez-Clare (2023), based on information from the UNCTAD Trade Analysis Information System (TRAINS), using latest data available (mainly from 2022). Following Lashkaripour and Lugovskyy (2023), the status quo for export subsidies and industrial Pigouvian subsidies is assumed to be zero.

[2] Lashkaripour and Lugovskyy (2023) estimate σ_k and μ_k using micro data and their results align with others in the literature.

Table III.1. United Kingdom: Industry-level Trade Elasticities and External Scale Parameters

Econometric Estimation Results Used for Model Calibration

(Standard errors in parentheses)

	Trade Elasticity: of Export Prices to Output	External Scale Parameter
Agriculture and Mining	6.2 (2.3)	0.1 (0.1)
Food	2.3 (0.8)	0.4 (0.1)
Textiles, Leather & Footwear	3.4 (0.4)	0.2 (0.02)
Wood	3.9 (1.9)	0.2 (0.1)
Paper	2.6 (1.1)	0.3 (0.1)
Petroleum	0.6 (0.5)	1.2 (0.9)
Chemicals	4 (0.4)	0.2 (0.02)
Rubber & Plastic	5.2 (1.2)	0.1 (0.03)
Minerals	5.3 (1.7)	0.2 (0.06)
Metals	3 (0.5)	0.2 (0.03)
Machinery	7.8 (1.3)	0.1 (0.02)
Elec. & Optical Equip.	1.2 (0.3)	0.6 (0.1)
Transport Equip.	2.8 (0.9)	0.1 (0.04)
Recycling and others	6.2 (1)	0.2 (0.02)

Source: Lashkaripour and Lugovskyy (2023), based on Colombian trade data at level of Harmonized System 10-digit product category, 2007–13. In the model's calibration, the services sector is assumed to have a trade elasticity of 11 and an external scale parameter of zero.

References

Ackerberg, D.A., Caves, K. and Frazer, G., 2015. Identification properties of recent production function estimators. *Econometrica*, 83(6), pp.2411-2451.

Adam, S and Phillips, D. (2023). Freeports: What are they? What do we know? And what will we know? London: Institute for Fiscal Studies.

Aiginger, K., Rodrik, D. Rebirth of Industrial Policy and an Agenda for the Twenty-First Century. *Journal of Industry, Competition and Trade* 20, 189–207 (2020). https://doi.org/10.1007/s10842-019-00322-3

African Development Bank (AfDB), the Asian Development Bank (AsDB), the Asia Infrastructure Investment Bank (AIIB), the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Inter-American Development Bank Group (IDBG), the Islamic Development Bank Group (IsDBG), the New Development Bank (NDB), and the World Bank Group (WBG). (2018) 'Multilateral Development Banks' Harmonized Framework for Additionality in Private Sector Operations' Washington DC.

Bartelme, Dominick G., Arnaud Costinot, Dave Donaldson, and Andres Rodriguez-Clare (2019), "The Textbook Case for Industrial Policy: Theory Meets Data," NBER Working Paper, No.26193, National Bureau of Economic Research.

Baquie and others. 2025. Industrial Policies: Handle with Care. Staff Discussion Note SDN/2025/002. International Monetary Fund, Washington, DC.

Beznoska, M., von Haldenwang, C., & Schüler, R. M. (2023). Tax expenditures in OECD countries: Findings from the Global Tax Expenditures Database (IDOS Discussion Paper 7/2023). Bonn: German Institute of Development and Sustainability (IDOS). https://doi.org/10.23661/idp7.2023.

Luis Brandão-Marques, and Hasan H Toprak. "A Bitter Aftertaste: How State Aid Affects Recipient Firms and Their Competitors in Europe", *IMF Working Papers* 2024, 250 (2024).

Patrick Carter, Nicolas Van de Sijpe, and Raphael Calel, 2018. "The Elusive Quest for Additionality." CGD Working Paper 495. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/elusive-quest-additionality

Costinot, Arnaud and A. Rodriguez-Clare (2014), "Trade Theory with Numbers: Quantifying the Consequences of Globalization," in Gopinath, G., Helpman, E. and Rogoff, K., (eds), Handbook of International Economics, vol. 4, pp.197–261 (Amsterdam: Elsevier).

Criscuolo, C., et al. (2022a), "An industrial policy framework for OECD countries: Old debates, new perspectives", OECD Science, Technology and Industry Policy Papers, No. 127, OECD Publishing, Paris, https://doi.org/10.1787/0002217c-en.

Criscuolo, C., G. Lalanne and L. Díaz (2022b), "Quantifying industrial strategies (QuIS): Measuring industrial policy expenditures", OECD Science, Technology and Industry Working Papers, No. 2022/05, OECD Publishing, Paris, https://doi.org/10.1787/ae351abf-en.

DiPippo, Gerard, Ilaria Mazzocco, Scott Kennedy, and Matthew P. Goodman. "Red ink: Estimating Chinese industrial policy spending in comparative perspective." Center for Strategic & International Studies (CSIS). May (2022).

Evenett, Simon, Adam Jakubik, Fernando Martín, Michele Ruta (2024), *The World Economy* 47, no. 7 2762-2788.

Eyraud, Luc, Devine, Hilary, Peralta Alva, Adrian, selim, Hoda, Sharma, Preya and Ludger Wocken. 2021. "Private Finance for Development: Wishful Thinking or Thinking Out of the Box?" IMF Departmental Paper DP/21/11.

Garcia-Macia, Daniel and Alexandre Sollaci (2024), "Industrial Policies for Innovation: A Cost-Benefit Framework", IMF Working Paper, 2024/176, International Monetary Fund.

Haaland, Jan I., and Anthony J. Venables. "Optimal trade policy with monopolistic competition and heterogeneous firms." *Journal of International Economics* 102 (2016): 85-95.

Taguchi, Hiroyuki, and Kota Yasumura. 2021. "Financial Additionality of Multilateral Development Banks in Private Participation in Infrastructure Projects" *Sustainability* 13, no. 15: 8412. https://doi.org/10.3390/su13158412

Hodge, Andrew., Roberto Piazza, Fuad Hasanov, Xun Li, Maryam Vaziri, Atticus Weller, and Yu Ching Wong. "Industrial Policy in Europe: A Single Market Perspective", IMF Working Papers 2024, 249 (2024).

Hufbauer, Gary Clyde., and Euijin Jung (2021) 'Scoring 50 years of US Industrial Policy 1970-2020'. Peterson Institute for International Economics Briefing 21-5, November 2021.

International Monetary Fund (IMF) 2024a, Fiscal Monitor: Fiscal Policy in the Great Election Year, Washington, DC, April (see chapter 2: Expanding Frontiers: Fiscal Policies for Innovation and Technology Diffusion).

International Monetary Fund (IMF) 2024b. Industrial Policy Coverage in IMF Surveillance: Broad Considerations.

International Monetary Fund (IMF) 2024c. Regional Economic Outlook: Europe. Washington, DC, October.

Juhász, Réka, Nathan Lane, Emily Oehlsen, and Verònica C. Pérez. 2023a. "The Who, What, When, and How of Industrial Policy: A Text-Based Approach", Manuscript, University of British Columbia.

Juhász R, Lane N, Rodrik D. 2023b. The New Economics of Industrial Policy. Annu. Rev. Econ. 16: Submitted. DOI: https://doi.org/10.1146/annurev-economics-081023-024638.

Lane, N. (2020). The new empirics of industrial policy. *Journal of Industry, Competition and Trade*, 20, 209-234.

Yang, Zeyi (2023) 'How China Came to Dominate the World of Electric Cars' MIT Technology Review (February 21, 2023).

Kucheryavyy, Konstantin, Gary Lyn and Andrés Rodríguez-Clare (2023), "Grounded by Gravity: A Well-Behaved Trade Model with Industry-Level Economies of Scale," *American Economic Journal: Macroeconomics*, 15 (2): pp.372–412.

Lashkaripour, Ahmad, and Volodymyr Lugovskyy (2023), "Profits, Scale Economies, and the Gains from Trade and Industrial Policy," *American Economic Review* 113, no. 10: 2759–2808.

Liu, Ernest. 2019. "Industrial Policies in Production Networks", *Quarterly Journal of Economics*, 134 (4): 1883–1948.

McDonald, Brad, Michele Ruta, and Elizabeth Van Heuvelen. 2024. "Industrial Policy: Trade Policy and World Trade Organization Considerations in IMF Surveillance." IMF How to Note 2024/002, International Monetary Fund, Washington, DC

Murphy, Anthony, Brendan M. Walsh, and Frank Barry. "The Economic Appraisal System for Projects Seeking Support from the Industrial Development Agencies." Forfás, 2003.

OECD (2021), "Measuring distortions in international markets: Below-market finance", OECD Trade Policy Papers, No. 247, OECD Publishing, Paris, https://doi.org/10.1787/a1a5aa8a-en.

OECD (2023), "Government support in industrial sectors: A synthesis report", OECD Trade Policy Papers, No. 270, OECD Publishing, Paris, https://doi.org/10.1787/1d28d299-en.

OECD (2024), "R&D Tax Incentives Database", OECD Paris, https://www.oecd.org/en/topics/sub-issues/rd-tax-incentives.html.

Ossa, Ralph. (2011), "A 'New Trade' Theory of GATT/WTO Negotiations," 119 *Journal of Political Economy* 122-152.

Pickett, Lewis., and Georgina Hutton. (2025) 'Industrial Strategy in the UK.' House of Commons Research Briefing No. 7682.

Rajan, Raghuram G., and Luigi Zingales. 1998. "Financial Dependence and Growth." *American Economic Review*, vol. 88, no. 3, 1998, pp. 559–86.

Rotunno, L. and M. Ruta (2024), 'Trade Spillovers of Domestic Subsidies,' IMF Working Paper, 2024/41, International Monetary Fund.

Seydl, Joe., Matthews, Jessica., and Ian Schaeffer. (2023) 'The Opportunity in Renewed U.S. Industrial Policy' J.P. Morgan. June 1, 2023.

The White House (2024) 'Fact Sheet: Two Years after the CHIPS and Science Act', Washington DC, August 9 2024.

UK Department for Business & Trade (2024) 'Invest 2035: the UK's Modern Industrial Strategy'. 24 November 2024.

UK Department for Business & Trade (2024) 'The UK's Modern Industrial Strategy'. 23 June 2025.

Van Nostrand, Eric., and Matthew Ashenfarb (2023) 'The Inflation Reduction Act: A Place-Based Analysis' United States Treasury, Washington DC, November 29, 2023.

Ward, Matthew (2024) 'Enterprise Zones' House of Commons Library Research Briefing, 12 September 2024.

Winckler Andersen, O., Hansen, H. and Rand, J. "Evaluating financial and development additionality in blended finance operations", OECD Development Co-operation Working Papers, 2021, No 91 OECD Publishing, Paris.