

DEMAND-LED STAGNATION:
REINTERPRETING THE UK
PRODUCTIVITY PUZZLE

Graham Gudgin, Ken Coutts and
Saite Lu

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Graham Gudgin

Honorary Research Associate, Centre for Business Research, Judge Business School, University of Cambridge. Email: gg14@cam.ac.uk

Ken Coutts

Honorary Research Associate, Centre for Business Research, Judge Business School, University of Cambridge and Emeritus Fellow in Economics, Selwyn College, Cambridge. Email: kjc1@cam.ac.uk

Saite Lu

Mead Fellow and College Lecturer in Economics, Emmanuel College, Cambridge. Email: sl590@cam.ac.uk

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Abstract

Growth in UK labour productivity has stagnated markedly since the 2008 Global Financial Crisis (GFC), constraining living standards and public spending. Moving beyond traditional supply-side explanations of this "productivity puzzle", this paper analyses the slowdown through a demand-led framework based on the Kaldor-Verdoorn relationship, combined with a macro-economic environment of historically low interest rates. The Kaldor-Verdoorn relationship is conventionally interpreted as faster growth in demand leading to greater economies of scale and learning by doing and hence higher productivity. We document a persistent cross-sector and international link between output and productivity growth with an international average elasticity of 0.7, only a little above Kaldor's value of 0.5 (which was for manufacturing only). Following the GFC, a severe credit contraction and subsequent fiscal austerity suppressed aggregate demand, reducing UK average annual output growth from 2.8% to 1.1%, while productivity growth more than halved from 2.1% to 0.87% (using recently revised ONS data). Productivity growth fell after 2008 despite an increase in real business investment. The decline in productivity growth has not been greater in the UK than in other G7 nations and the elasticity of productivity growth to output growth was close to the G7 average of 0.7. The slowdown in output growth was not matched by a similar slowdown in employment (although hours worked did fall). This structural shift in employment reflected ultra-low interest rates that stimulated low-productivity business formation, an elastic labour supply, and a retreat from globalised production. In short, our view is that slow growth in demand since 2008, occasioned by a squeeze on private credit accompanied by fiscal austerity, led to slow growth in productivity, made worse by extremely low interest rates. Because aggregate productivity dynamics are fundamentally endogenous to effective demand, conventional supply-side interventions remain largely ineffectual. Re-establishing long-run productivity growth requires macro-demand regimes capable of sustaining autonomous expenditure across both public and private sectors.

Keywords: Demand-led growth, Productivity puzzle, Endogenous productivity, Effective demand, Monetary policy, UK economy

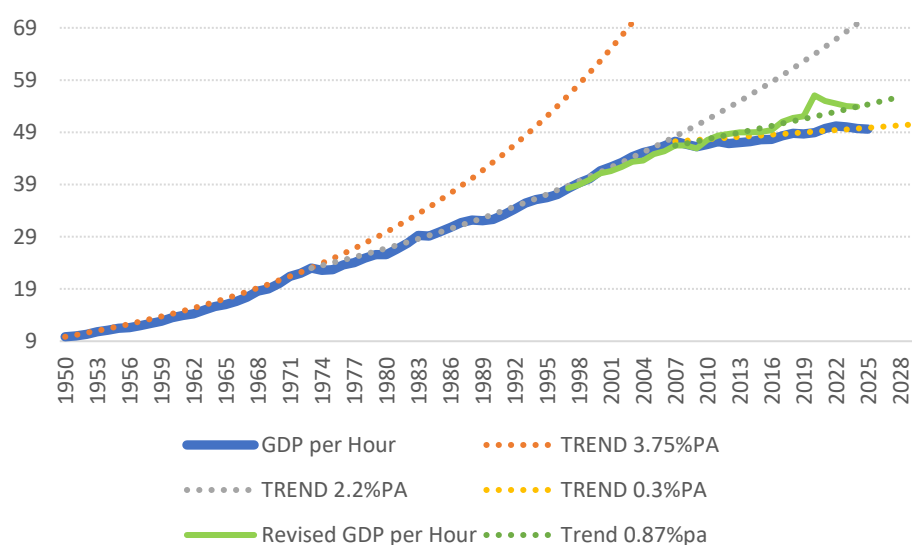
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1. Introduction

Slow growth in labour productivity has been the defining macroeconomic feature of the UK economy since the banking crisis of 2008–09. Over the postwar period, three distinct phases of productivity growth can be identified (see Figure 1.1). During the so-called “golden age” of economic growth up to 1973, labour productivity (measured as real GDP per hour worked) expanded rapidly, at close to 4 per cent per annum. In the subsequent 34 years up to 2007, productivity growth slowed but remained relatively robust at around 2.2 per cent per annum. Notably, the structural reforms implemented during the Thatcher administrations did not materially alter this longer-term trend, which had been established prior to 1979. Following the banking crisis of 2008–09, however, productivity growth fell sharply to a historically low rate of around 0.9 per cent per annum¹. It is this most recent and pronounced slowdown—requiring urgent attention—that forms the focus of this article.

Figure 1.1: Three Phases of Postwar Productivity Growth in the UK



Source of data: ONS and OECD

This protracted stagnation has entered its second decade, imposing profound constraints on real wage growth, public expenditure, and aggregate living standards, while driving social and political instability. The depth of this crisis is illustrated by the fact that average real wages in July 2024 were only 0.5% higher than in December 2007. While political frameworks, such as the current administration’s 2024 Industrial Strategy, explicitly acknowledge that this productivity breakdown is the primary driver of stagnant living standards, institutional diagnoses routinely label the phenomenon an unresolved “productivity puzzle”. Mainstream policy literature, including prominent

assessments by the Productivity Institute (Coyle et al, 2023), the Resolution Foundation (Bell et al, 2023)², and the OECD (2024)³, frequently characterises the UK's underperformance as a collection of structural, long-standing, and interrelated supply-side deficiencies, such as skills shortages, infrastructure gaps, and regional inequalities. However, because these supply-side constraints have long been features of the UK economy, they fail to provide a compelling account for the abrupt, sharp, and persistent post-2008 structural break.

Furthermore, standard neoclassical growth-accounting frameworks are fundamentally incapable of explaining the core empirical paradoxes of the post-GFC British economy. According to conventional theory, a collapse in productivity growth should stem from capital shallowing or an exogenous contraction in TFP. Yet, the empirical data directly contradict these assumptions. Regarding the capital stock of corporations, rather than a reduction in capital accumulation, the post-GFC era coincided with a small rise in the capital output ratio⁴ both in absolute terms and relative to the previous trend. There was also a substantial expansion in real business investment, which rose from approximately 9% of real GDP during the 1989–2007 period to 11% after 2015. This was partly offset by a rise in the depreciation rate⁵. Simultaneously, the economy exhibited an employment paradox. Instead of the labour shedding typically expected in response to weak output, employment and aggregate hours worked remained exceptionally resilient, continuing to expand at their pre-crisis rates.

To resolve these apparent anomalies, this paper departs from supply-side paradigms and revisits the productivity puzzle through a demand-led macroeconomic perspective inspired by Kaldor and Verdoorn. We document that over the 1997–2024 period, UK productivity dynamics were fundamentally driven by aggregate demand: as a contraction in bank credit and prolonged fiscal austerity forced average annual output growth down from 3.1% to 1.1%, productivity growth collapsed symmetrically from 2.4% to 0.9%. Crucially, we find that the UK's post-crisis output-to-productivity elasticity is close to unity, demonstrating a structural decoupling where output variations dictate productivity changes rather than employment levels.

We argue that this demand-driven deceleration was heavily modified by a structural regime change unique to the post-crisis decade. Historically low nominal interest rates suppressed the financial pressure on incumbent firms to rationalise labour, while simultaneously lowering barriers to entry for an unprecedented wave of new, small enterprises. Supported by an elastic supply of labour, the new firms were concentrated overwhelmingly in intrinsically low-productivity service sectors. Concurrently, a retreat from rapid globalisation led UK-based multinational firms to redirect capital away from foreign greenfield

markets back into domestic operations, explaining the paradox of elevated real investment matching depressed technological efficiency.

The remainder of this study is structured as follows. Section 2 critically reviews the empirical literature on the UK productivity puzzle, highlighting the theoretical limitations of mainstream supply-side growth accounting. Section 3 establishes the theoretical framework following the Kaldor-Verdoorn relationship. Section 4 presents empirical evidence using cross-country G7 comparisons and a comprehensive cross-sectoral analysis of the UK economy. It substantiates the core demand-led argument by evaluating how ultra-low interest rates, an elastic labour supply, and shifting foreign direct investment (FDI) patterns altered firm demographics and labour intensity to generate the post-crisis paradoxes. Section 5 presents the counterfactual simulations generated by the UKMOD to isolate the direct impacts of post-GFC credit contractions and fiscal austerity. Finally, Section 6 reviews the policy implications of these findings before offering concluding remarks.

2. Literature review

2.1 Mainstream explanations

A prominent synthesis of the prevailing consensus attributes the UK's post-GFC productivity slowdown to structural supply-side deficiencies. Van Ark and O'Mahony (2023) observe that while labour productivity decelerated globally since the GFC, the UK performed exceptionally poorly relative to international peers. Although the initial context is the productivity slowdown since 2008 much of the focus is on the causes of longstanding low levels of productivity. Benchmarked against the G7 using purchasing power parity (PPP)-adjusted levels, the study points out that UK productivity rests below the United States, France, and Germany, but remains above Italy, Spain, and Japan. This variance highlights a recurring conceptual ambiguity in the literature, which frequently conflates three distinct analytical issues: the UK's post-2008 growth slowdown relative to its pre-crisis trend, its long-standing disparities in productivity levels, and the comparative severity of its post-crisis decline relative to peer economies. Conflating these related yet distinct phenomena risks obscuring the true macroeconomic triggers of the post-crisis break.

To explain the growth collapse, the conventional paradigm relies heavily on production-function framework decompositions. Van Reenen and Yang (2024) formally articulate this view, demonstrating that after 2008, UK labour productivity growth slowed by an annual 2.1 percentage points—a drop more severe than that observed in the United States (-1.5), France (-1.6), or Germany (-1.0). Operating within a standard growth-accounting framework, they attribute

approximately half of the UK's productivity shortfall by 2019 to weak capital accumulation, particularly in intangible assets and capital intensity across manufacturing, finance, and professional services. Van Ark and O'Mahony (2023) similarly isolate chronic, broad-based underinvestment, weak technology diffusion, and institutional fragmentation as the central structural drivers of this poor performance. Much of their concern rests with the policies required to raise levels of productivity.

Despite its dominance, this neoclassical growth-accounting framework offers little explanatory power for the core paradoxes of the post-2008 British experience. As Chadha and Samiri (2025) observe, standard Solow-Swan exogenous growth models expect rapid expansions in labour supply to be met with capital deepening to preserve steady-state capital-labour ratios. Instead, the post-GFC UK economy experienced the exact inverse: accelerating employment growth and resilient aggregate hours worked alongside stagnant productivity. RBC specifications are similarly unhelpful, as the post-crisis drop in real interest rates can only be mathematically reconciled with a simultaneous TFP slowdown by assuming extreme, empirically implausible values for the household elasticity of intertemporal substitution. Because mainstream frameworks treat labour supply as exogenous, they fail to explain why the UK stumbled into a high-employment, low-wage, and low-productivity equilibrium, an anomaly that deepens when contrasted with simultaneous improvements in aggregate workforce qualifications.

Furthermore, the explanatory utility of production-function accountancy exercises is inherently descriptive rather than causal. The choice of specification drastically alters the empirical diagnosis without identifying underlying drivers. Standard growth accounting defines capital deepening using the capital-labour ratio (K/L), attributing roughly one-third of the post-GFC slowdown to capital shallowing. Conversely, the Solow-style growth accounting framework used by Fernald et al. (2017) attributes nearly the entire growth deceleration to slow total factor productivity (TFP) growth and falling labour force participation, rather than capital shallowing.

This analytical instability stems from profound methodological flaws built into the aggregate production function paradigm. Neoclassical models treat the aggregate capital stock as a homogeneous physical quantity, even though it can only be measured practically as a value aggregate deflated by a price index. As Keynes (1936) famously critiqued, there is an inherent, insoluble ambiguity between measuring the increment of physical product generated by an additional physical unit of capital and measuring the increment in value generated by an additional value unit of capital. Applied growth accounting typically sets this

valuation issue aside, ignoring extensive evidence that the estimated coefficients of aggregate production functions frequently capture an underlying value accounting identity—where total output mathematically equals the sum of factor incomes—rather than an empirically identified technological or engineering relationship (Felipe & McCombie, 2015).

Because the dominant framework (incorrectly in our view) isolates supply-side factors as independent variables, its associated policy prescriptions are fundamentally misaligned. If capital shallowing is diagnosed, one conventional response is to provide supply-side fiscal incentives, such as lower corporation tax or investment allowances, to stimulate capital accumulation. If the slowdown is attributed to the TFP residual, prescriptions devolve into generalised calls for skills training, regional planning reforms, and diminished policy uncertainty. Because these frameworks fail to explain why profit-seeking UK firms would systematically underinvest despite maintaining stable post-crisis returns on capital, which remained within their historical 20–24% range (see Figure 2.1), the post-2008 deceleration remains labelled an unresolved "productivity puzzle".

Figure 2.1: Post-tax Gross Operating Surplus as % of Lagged Capital Stock



Source of data: ONS.

Note: Firms include private and public corporations, but not unincorporated businesses, which are included in the household sector In the ONS National Accounts

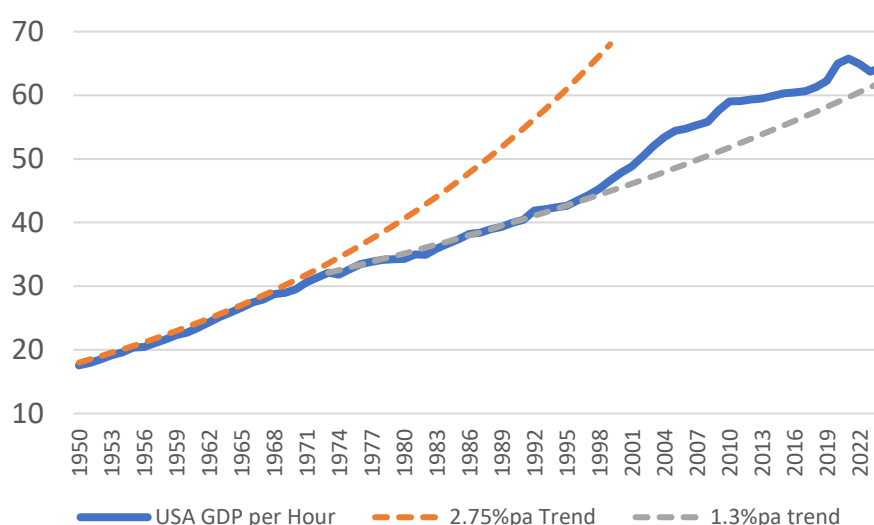
In this context, it is essential that economists provide a convincing explanation for the historic slowdown in productivity growth since 2008, together with guidance on practical policies capable of reversing it. Yet despite extensive research, progress toward a coherent and widely accepted explanation has been limited. The persistence of the term “productivity puzzle” in both academic and

policy discussions reflect the extent to which the phenomenon remains poorly understood and inadequately explained within existing analytical frameworks.

2.2 Alternative explanations and historical precedents

Compounding the conceptual ambiguity of the contemporary mainstream consensus are prominent measurement and structural shift arguments within the wider productivity literature, a situation that closely mirrors historical analytical gridlocks. The limited progress toward a coherent and widely accepted explanation for the post-2008 productivity break is not for want of effort. Rather, it reflects a persistent difficulty within existing analytical frameworks that closely parallels the experience surrounding the first major productivity slowdown after 1973. Following the 1973 shock, a large body of research—particularly in the United States⁶—sought to explain why trend productivity growth fell from around 2.4% per annum during the 1950–1973 period to approximately 1.0% per annum in subsequent decades, with real GDP trend growth decelerating from 4.0% to 3.0% (see Figure 2.2). The immediate macroeconomic explanation centred on global demand and price shocks, specifically the quadrupling of oil prices in 1974 and a further doubling in 1979, which generated a large accumulation of foreign-exchange reserves among OPEC nations that recycled into global spending only slowly. The result was a deep recession across advanced economies, a sudden rise in global savings, and financial instability that culminated in a second global recession in the early 1980s, coinciding with the completion of post-war reconstruction and the exhaustion of large labour reallocations from agriculture to manufacturing in continental Europe.

Figure 2.2: USA Real GDP per Hour (chained \$2017)



Source of data: US Bureau of Economic Statistics

The mainstream literature of the era focused heavily on supply-side alternatives (Cullinson 1989). Denison's (1985) influential study concluded that the completion of the structural labour reallocation out of agriculture accounted for 15% of the post-1973 slowdown, while the adverse cyclical effects of the 1973–1975 and 1980–1982 recessions explained a further 16%. Other contemporaneous accounts emphasised declining labour quality (Englander et al, 1988a, Englander et al, 1988b) and changing relative prices (Jorgenson & Fraumeni, 1981; Jorgenson et al., 1987; Jorgenson, 1988), rising environmental regulatory expenditures (Gollop & Roberts, 1983), diminishing investment opportunities linked to resource constraints (Nordhaus, 1980), and the combined effects of higher energy costs and slower innovation (Englander & Mittelstadt, 1988; Englander et al., 1988; Griliches, 1988). Crucially, measurement issues featured prominently in the post-1973 debate; Baily and Gordon (1988) argued that substantial mismeasurement of output in service sectors—much of it predating 1973—weakened empirical confidence in precise productivity growth estimates, even if such errors only accounted for a modest share of the measured deceleration.

This historical measurement debate directly informs modern controversies regarding the post-GFC slowdown. A major strain of the current debate similarly argues that productivity growth appears weak because standard statistical frameworks fail to capture rapid quality improvements in digital services. However, Syverson (2017) demonstrates that modern mismeasurement cannot plausibly explain the magnitude or timing of the post-2008 slowdown, as these measurement errors existed long before 2008 and did not suddenly worsen in a manner consistent with the post-GFC break. International comparisons are further distorted by accounting techniques: productivity comparisons based on GDP at purchasing power parity (PPP) are appropriate for assessing living standards, but less so for analysing productive growth, since firms compete internationally at market exchange rates rather than PPP-adjusted prices. Because international comparisons based on a common currency implicitly embed exchange-rate movements, they frequently confound changes in structural efficiency with valuation effects.

Other supply-side hypotheses focus on a structural allocation shift from manufacturing—traditionally high-productivity and capital-intensive—toward low-skill service jobs (Autor & Dorn, 2013). This framework posits that automation replaces routine middle-skill jobs, pushing displaced workers into low-productivity personal services, thereby lowering aggregate productivity growth even if specific digital sectors remain highly efficient. At the global level, this is occasionally linked to secular arguments regarding a decline in innovation

efficiency, where major general-purpose technologies have already diffused and contemporary innovations produce smaller productivity gains because "ideas are getting harder to find" (Gordon, 2016; Bloom et al., 2020). Yet, these structural and technological trends are long-standing, global features that fail to explain the abrupt and severe post-2008 break unique to the UK. The mainstream assertion that the UK's post-2008 slowdown reflects the fragility of low-productivity firms or the struggles of low-skilled workers is similarly incomplete, as these features characterise longstanding structural weaknesses. It has not been shown that they worsened materially after the financial crisis in ways that would explain the sharp decline in productivity growth, and the argument risks conflating persistent low productivity in parts of the economy with the distinct phenomenon of the post-2008 deceleration.

University-based analyses of the productivity puzzle are in our view constrained by traditional ideas and methods which are unable to explain much about productivity growth. Economists working in thinktanks outside of academia have tended to be more open-minded about the causes of slow growth. A good example of this is the very recent chapter on 'Credit' by Tyler Goodspeed in Freman D and Niemietz K (2006). Goodspeed has examined 132 recessions in the UK and USA over four centuries and finds no support for the conventional view that slower recoveries follow deeper recessions. Instead, he blames the prolonged period of slow economic growth in the UK since 2008 on government policy and specifically on the official restrictions imposed on bank lending. This accords with our own views outlined below, although Goodspeed focuses more on reduced bank lending to companies whereas our focus is on mortgage lending. His view is that the UK was more affected by restriction than the USA because UK banking is more concentrated, with big banks more constrained by new regulations. More research is needed on the relative importance of reduced bank lending to companies and households.

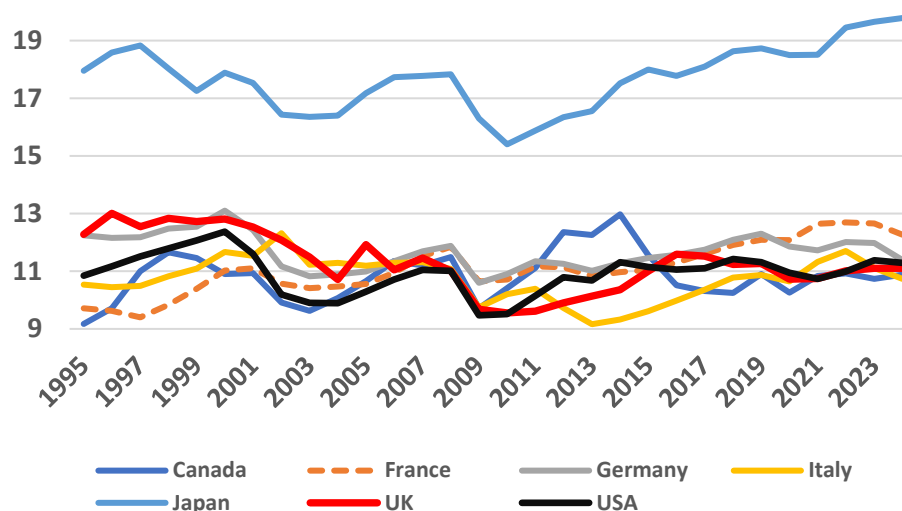
3. An empirical deconstruction of the capital shortfall thesis

UK investment is frequently characterised as persistently low by international standards, particularly when measured as a share of GDP. Such comparisons, however, sometimes rely on total investment, including housing and public-sector expenditure, which has limited direct relevance for business-sector productivity. Focusing instead on corporate sector investment provides a more appropriate proxy for productive capital formation. Even here it is widely believed that the UK is an international laggard. For instance, the following from Chancellor Rishi Sunak in his 2022 Mais lecture:

However, capital investment by UK businesses averages just 10% of GDP, considerably lower than the current OECD average of 14%. The lower level of capital investment we see by UK businesses is not primarily driven by the sectoral composition of our economy, or by differences in firm size, and is observed across all regions. This is a pervasive economy wide issue, it has been persistent for decades, and we must fix it to improve productivity, growth, and living standards. Indeed, we need the private sector to invest to level up this country⁷.

OECD data on this basis confirm that UK business investment has been relatively low within the G7 over the past two decades, but the pattern is more nuanced than is often suggested (see Figure 3.1). UK investment rates in the late 1990s were broadly comparable with those of other major economies, with a temporary divergence emerging after the GFC in 2008. Part of this reflects the declining contribution of North Sea oil and gas investment, which had previously inflated UK totals. When adjusted for these factors, recent UK corporate investment as a percentage of GDP tracks closely with the USA, above Italy and Canada, trailing only slightly behind Germany. Structurally higher investment rates remain confined to Japan, which features persistently elevated capital-output ratios compared to Europe or North America without notably boosting productivity. Crucially, the corporate investment recovery following the initial post-GFC drop directly challenges Van Reenen and Yang's (2024) contention that unusually weak capital accumulation explains a large share of the UK's productivity gap. While corporate capital formation over the last decade sits slightly below its pre-GFC average, the variance is minor and remains robust when residential investments by corporations are strictly filtered out. Importantly, all of this is in current prices and we show below that the constant price record is quite different.

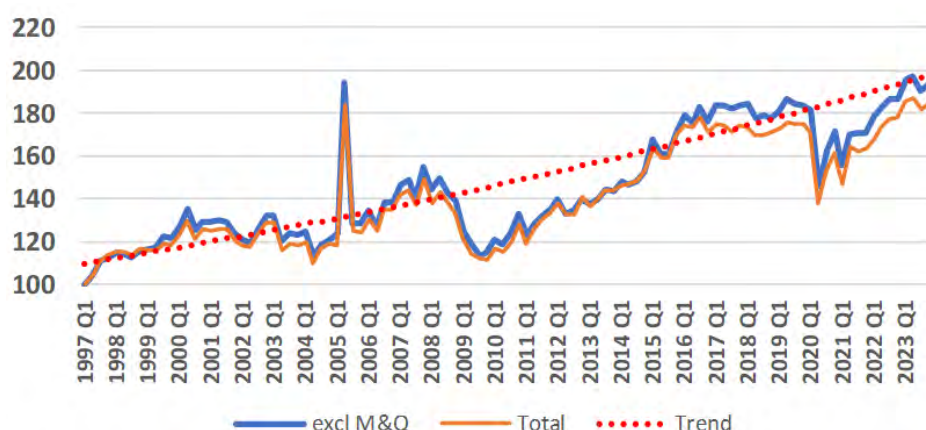
Figure 3.1: Investment by Corporations (% of GDP)



Source of data: [OECD](https://data.oecd.org/)

The idea that a post-GFC slowdown in productivity is due to low investment is also hard to square with the trend in business investment within the UK itself. Figure 3.2 shows that real business investment has been on its pre-2008 trend since 2015 except for a fall during and after the Covid epidemic. The level of real business investment has been substantially higher on average since the GFC than in the previous decade.

Figure 3.2: Business Investment excluding Mining and Quarrying (1997Q1=100)



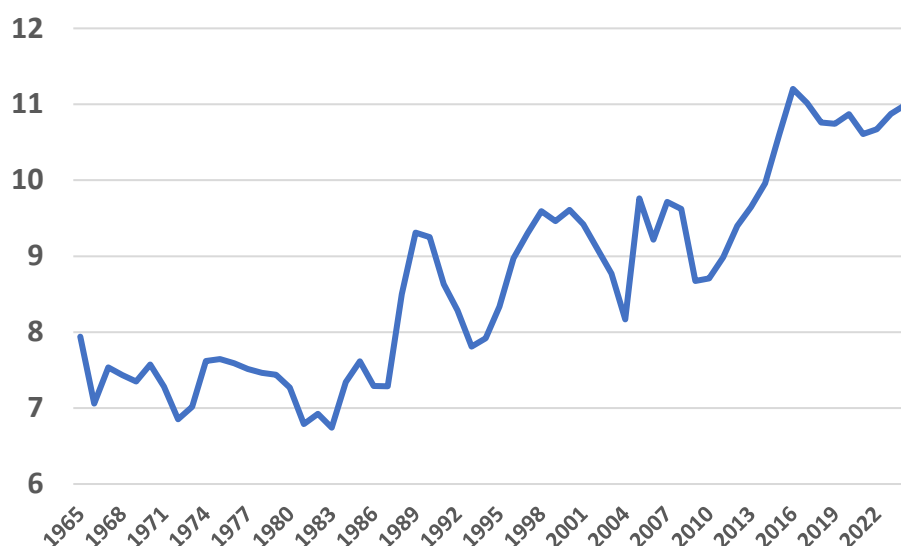
Source of Data: ONS series NPEL in constant 2022-based prices

Notes: Trend is 1.5% per annum and it is fitted by a regression of the log of business investment between 1970 and 2019

Allas and Zenghelis (2025) argues that the productivity trend is not a puzzle since the issue is clearly one of a low level of capital. However, the latest ONS data for

business investment shows that real business investment in the UK has increased from 7% of real GDP in the 1965-1987 period to near 9% for 1989-2007 and 11% since 2015. Hence the period of slowest growth in productivity coincides with a high level of business investment and not a low level (see Figure 3.3).

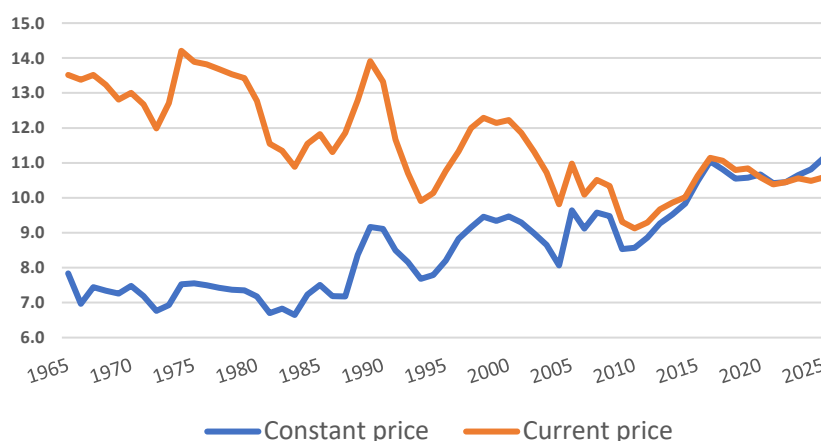
Figure 3.3: Real Business Investment (% of GDP)



Source of data: ONS series NPEL

The divergence between a slight drop in the nominal OECD investment-to-GDP ratio and the rise in real ONS data stems entirely from the chosen pricing basis (See Figure 3.4). Prior to the GFC, a major gap opened between the falling price of investment goods and services and the broader GDP deflator. The slower relative inflation rate for capital equipment mechanically compresses the ratio of current-price investment to nominal GDP over time, even as real capital formation accelerates. For productivity analysis, real investment volume is the preferred metric, as it tracks the physical deployment of assets rather than their falling monetary cost.

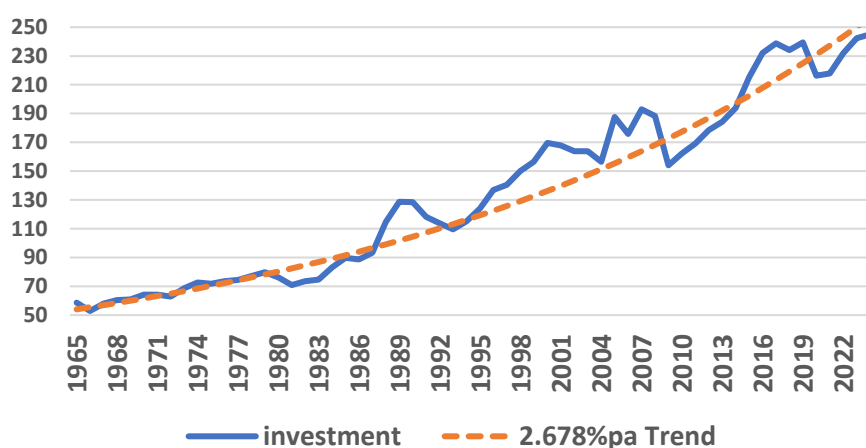
Figure 3.4: Business Investment, Constant versus Current Prices (% of GDP)



Source of Data: ONS series NPEL and NPEK

A time trend fitted to business investment since the mid-1960s (i.e. 1965-2024) does not obviously indicate any slowing of growth in investment after 2008 (see Figure 3.5). Actual investment is above the trend for a long period from 1995-2007 but this coincides with the productivity surge in the USA and the now-completed convergence in UK service sector productivity towards the USA frontier (Fernald and Inklaar, 2025).. A similar investment surge in the late 1980s followed the so-called ‘big-bang’ deregulation in the UK financial sector.

Figure 3.5: Business Investment Excluding Mining & Quarrying (£bn 2022 prices)



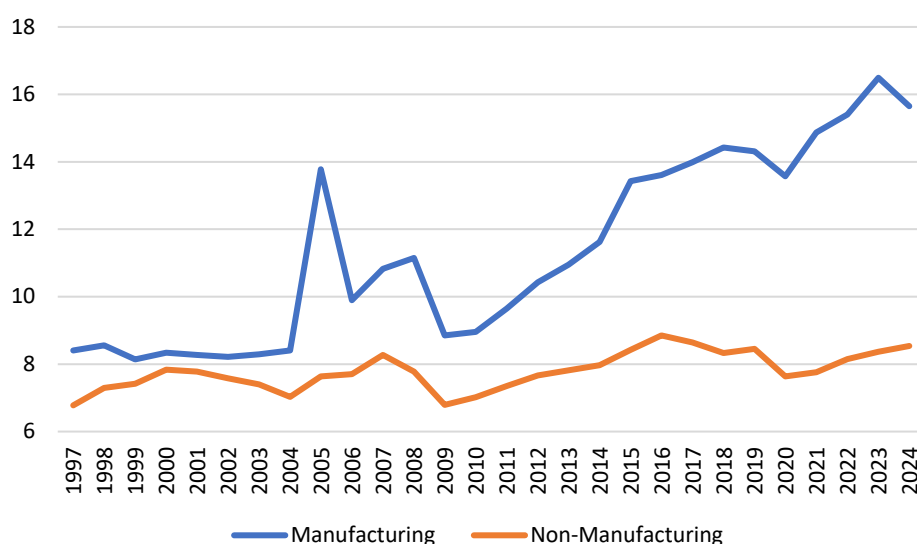
Source of data: ONS series NPEL

Note: Trend is 2.68% per annum. and fitted by a regression of $\log(\text{business investment})$ on a time trend 1965-2023. A trend fitted over 1965-2016 would be

2.78 but is boosted a little since the period to 2016 culminates at the peak of a cyclical upturn.

This upturn in business investment in the UK has also occurred despite no shift in the sectoral composition of UK industry (since 1997) towards higher productivity sectors⁸. Since investment per employee in manufacturing is now double that of the rest of the private sector (see Figure 3.6), the small size of the manufacturing sector in the UK is a major influence on aggregate investment. If the UK manufacturing sector were twice as large as it currently is (which is the case in Germany or Italy relative to GDP) then aggregate business investment would be 10% larger and above the level in Germany or Italy⁹.

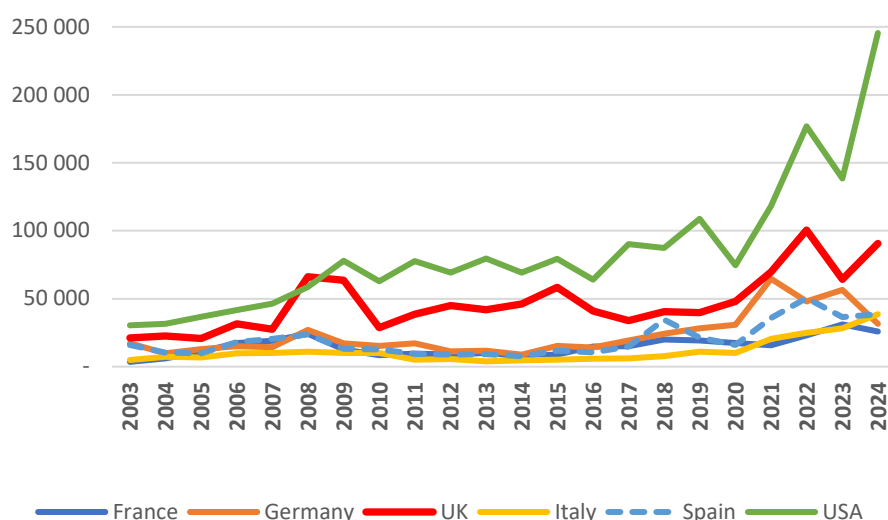
Figure 3.6: Investment Per Employed Person (£m 2022 prices)



Source of data: [ONS Business investment by industry](#)

The structural competitiveness of the UK investment climate is further corroborated by international capital flows. UNCTAD data confirm that the UK consistently maintains a strong record in greenfield Foreign Direct Investment (FDI), ranking second globally only to the US and vastly outperforming France and Germany (Figure 3.7). If foreign investors find the UK an attractive place to invest despite its lack of tax concessions (unlike Ireland), there is no theoretical reason to assume that the UK's massive stock of global multinational firms is uniquely underinvesting.

Figure 3.7: Greenfield FDI into Major European Economies, US\$ millions



Source of data: [UNCTAD World Investment Report Annex Table 14](#)

The idea that low investment is not an important cause of the slowdown on productivity growth after 2008 aligns closely with Fernald and Inklaar (2025). In their growth-accounting analysis, reduced growth in TFP more than explains the decline in labour productivity, while reduced capital deepening appears mainly as a symptom of slower output growth. They however argue that the post-2008 productivity slowdown in the UK and continental Europe largely reflects a lagged response to an earlier slowdown at the US productivity frontier. While a slowdown in productivity growth in the USA did precede the GFC by a few years, this is not necessarily a convincing proof that the long-term slower growth in productivity was mainly due to the GFC, as the authors themselves concede. Our interpretation places greater emphasis on a common, severe demand shock after 2007. In line with Verdoorn’s Law, we argue that weaker demand growth across advanced economies reduced productivity growth directly, with investment adjusting endogenously to restore long-run capital–output ratios rather than acting as an independent source of stagnation.

4. A Kaldorian view of productivity and growth

Kaldor (1966) set out his views on the process of long-term economic growth in an inaugural professorial lecture at Cambridge. At the core of his argument is the idea of increasing returns, or dynamic economies of scale, arising from the expansion of market demand. In developing this view, Kaldor drew explicitly on earlier contributions by Alfred Marshall (1920) and, in particular, Young (1928), who emphasised the cumulative interaction between scale, specialisation, and technical change. As Young observed, “we cannot isolate the influence of the economies of large-scale production due to indivisibilities of various kinds, and

which are in principle reversible, from such changes in technology associated with a process of expansion which are not reversible". The key implication is that technical progress is not an autonomous process, but one that is intimately linked to the expansion of output and market size. Kaldor further reinforced this argument by drawing on Arrow's (1962) concept of "learning by doing", whereby productivity improvements arise as experience accumulates through the production process itself. In this view, productivity growth is not simply the result of disembodied technological advances, but is generated endogenously through repeated production, experimentation, and the gradual refinement of techniques as output expands.

Another key transmission mechanism within the demand-led framework is the physical embodiment of new technologies in addition to the existing capital stock. As Salter (1960) emphasised, the aggregate capital stock does not consist of a homogeneous mass, but rather of distinct vintages of capital goods, each embodying the specific productivity limits of its era. The rate of productivity growth is thus closely related to the rate of investment, since higher output growth induces faster capital accumulation and more rapid incorporation of new technologies.

This conception of productivity growth led Kaldor to focus on the empirical relationship between the rate of growth of productivity and the rate of growth of output, commonly referred to as Verdoorn's Law, after Verdoorn (1949), who first presented evidence of such a relationship in an article originally published in Italian. Kaldor assembled data on output, employment, and productivity growth in manufacturing for twelve countries, using average annual growth rates over a ten-year period. His results revealed a statistically significant positive relationship between productivity growth and output growth. His baseline estimates indicated a Verdoorn coefficient of approximately 0.5, meaning that a 1% increase in output growth yielded a 0.5% increase in productivity growth and 0.5% growth in employment.

Kaldor's empirical findings were subsequently criticised by Rowthorn (1975), who questioned both the interpretation and the robustness of the estimated relationship. In response, Kaldor (1975) argued that a growing body of subsequent empirical evidence broadly supported the existence of a Verdoorn-type relationship, even if its precise magnitude varied across countries, sectors, and periods. He later refined his position by acknowledging that the existence of a Verdoorn relationship does not, by itself, prove the presence of dynamic increasing returns. Nevertheless, he maintained that the empirical association of a coefficient on productivity growth which was positive and less than one remained a powerful stylised fact requiring explanation.

A central issue raised by this literature concerns the direction of causation in the observed relationship between productivity growth and output growth. One possible interpretation is that rapid productivity growth, by reducing costs and prices, stimulates faster growth of demand. In such a view, productivity growth is the autonomous driving force. However, Kaldor argued that this interpretation is difficult to reconcile with several empirical observations. First, productivity growth rates differ substantially across industries operating at similar points in time, despite access to broadly similar technological knowledge. Second, productivity gains do not necessarily translate into lower prices if they are absorbed by higher wages or profits. As a result, there is no compelling reason to expect autonomous productivity growth to systematically generate faster demand growth.

Kaldor therefore concluded that the more plausible interpretation is that the statistical association primarily reflects the effect of demand growth on productivity growth. Expanding demand creates opportunities for innovation, encourages investment, and facilitates the exploitation of scale economies, with capital accumulation emerging as a by-product rather than an independent cause of growth. In this framework, the direction of causation runs from demand to induced technical progress.

5. Kaldor–Verdoorn law in action in the UK

A substantial empirical literature has documented a positive relationship between productivity growth and output growth in the UK over long historical periods. Early evidence was provided by Salter (1966), who found a statistically significant correlation between labour productivity growth and output growth across British industries for the period 1924–50.

This finding was subsequently confirmed over later historical horizons by Oulton and O'Mahony (1994), who identified a matching correlation across a broad cross-section of British industries for the 1954–1986 period, as well as within the 1954–1973 and 1973–1986 subperiods. Extending this empirical framework internationally, O'Mahony and Wagner (1994) demonstrated that comparable Kaldorian dynamics held for both the UK and Germany across four distinct subperiods between 1960 and 1989, though the relationship moderately weakened in Germany during the final decade (1979–1989). A critical, uniform insight across these historical studies is that productivity growth exhibits virtually no systematic relationship with labour input growth over extended periods. This consistently reinforces the view that macroeconomic output growth, rather than autonomous labour supply adjustments or employment dynamics, serves as the primary driver of structural productivity changes.

More recently, the demand-led paradigm has been evaluated using international panel datasets. Utilising Penn World Table data, Deleidi et al. (2023) provided evidence supporting a Kaldor-Verdoorn interpretation by showing that aggregate demand growth endogenously induces productivity growth. Constructing a structural panel vector autoregression (SVAR) framework based on Pedroni (2013), their model covers 52 countries with a minimum of 30 years of observations per country. They specify a linear relationship using variables in levels: GDP per worker hour, the capital-labour ratio, and alternative measures of aggregate demand.

There are two points to make about their results. The first is that the model is a structural VAR which makes important assumptions about that structure. Regarding the contemporaneous relationships of the economic variables, they assume that the capital-labour ratio and productivity do not affect output or demand, but the demand variables affect the current capital-labour ratio and productivity. They rule out a two-way causation by assumption. The conventional approach derived from the production function is that technical progress improves productivity and leads to lower prices inducing expansion of demand and output.

The second point is that Deleidi et al. (2023) include the capital-labour ratio in their model to mirror Kaldor's original technical progress functions (Kaldor, 1957; Kaldor & Mirrlees, 1962), which were designed to analyze growth without relying on an orthodox aggregate production function. McCombie and Spreafico (2016) have shown that since in the accounting identity the sum of factor incomes must equal GDP, production functions can result in statistical estimates of aggregate production functions with plausible coefficients, even when no such technological function exists. It is well known, for example, that Kaldor's technical progress function with steady economic growth can equivalently be written as a production function. McCombie and Spreafico (2016) conclude that: *"...the proposed technical progress function cannot be regarded as satisfactory way of giving effect to the relationships that Kaldor had in mind"*. They further distinguish between the technical progress specification and the Kaldor-Verdoorn specification (the latter without a capital-labour term). Estimates of the former may be picking up the implicit accounting identity of factor incomes. By estimating their model in levels rather than rates of change, the specification chosen by Deleidi et al. (2023) also contradicts Kaldor's dynamic formulation, even though the capital-labour ratio remains statistically significant within their estimations.

We find similar coefficients using the UK growth data. The upcoming sections deploy two distinct analytical approaches to map the relationship between output changes and productivity dynamics. First, a comparison with other G7 countries suggests a general slowdown in productivity following the GFC with a typical Verdoorn relationship. However, the slowdown in productivity was greater in the UK than elsewhere. Second is an analysis of output, productivity, employment and investment across UK sectors.

6. A cross country analysis

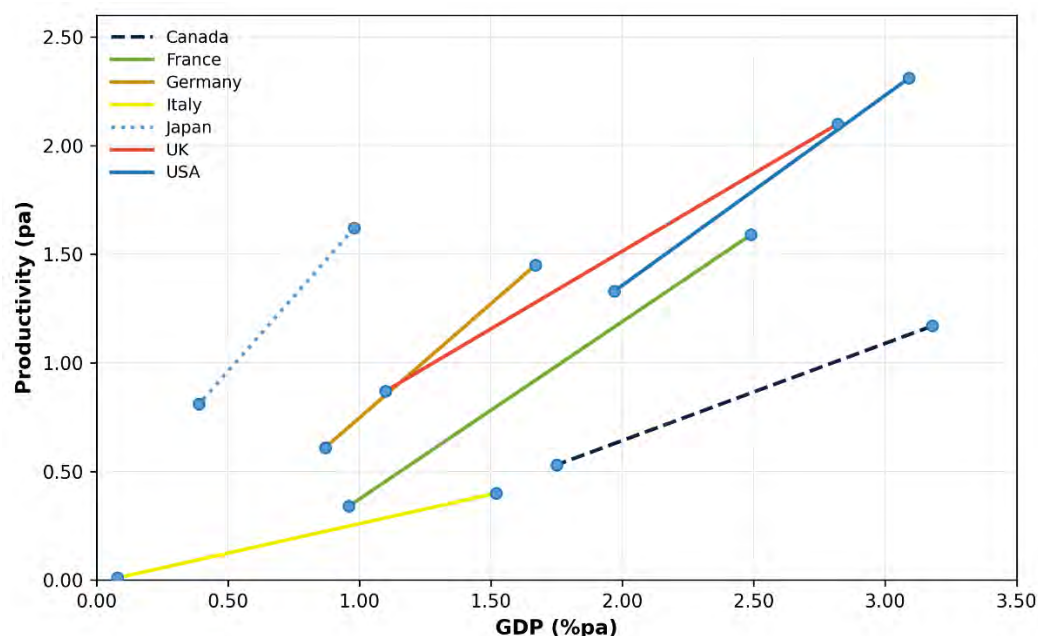
Following the Global Financial Crisis (GFC), all G7 economies experienced a synchronised deceleration in both aggregate output and labour productivity growth. Across the G7 sample, average real GDP growth fell from 2.2% (1997–2007) to 1.0% (2007–2024), accompanied by a corresponding drop in productivity growth from 1.6% to 0.6%. Despite this slowdown, the static Verdoorn coefficient—the ratio of annual productivity growth to GDP growth—remained remarkably stable across both sub-periods, averaging 0.70 in the pre-crisis era and 0.63 post-2008.

Of primary analytical interest, however, is how productivity responds to a contraction in trend demand growth. These cross-country dynamics are visualized in Figure 6.1. For each G7 economy, a line segment connects its pre-crisis average annual growth rates (1997–2007, upper-right endpoint) to its post-crisis trajectory (2007–2024, lower-left endpoint). Every vector slopes downwards toward the origin, confirming a synchronised deceleration in both GDP and labour productivity growth across the G7. The UK stands out for the absolute scale of its economic contraction: its GDP growth decelerated by 1.7 percentage points, closely mirrored by France (-1.5) and Canada (-1.4). Using the revised ONS productivity data however, the UK no longer exhibits the largest decline in productivity growth. At 1.2 percentage points its decline is the same as France and not far behind the USA and Canada. Furthermore, the slope of each segment illustrates the dynamic Verdoorn elasticity (i.e. the ratio of the percentage points difference in the growth of productivity between the two periods to the percentage points difference in growth of GDP. While most G7 economies cluster around an average gradient of 0.76, this now includes the UK with an average elasticity (0.71).

Output in the UK grew rapidly in the decade prior to 2007, almost as fast as the USA and Canada and faster than the other G7 nations (See Figure 6.2). This was a period of rapid credit growth in the UK and USA. The banking crisis recession was deeper in UK than most other countries and the recovery was a little slower than in the US or Canada but not slower than the rest of the G7. After 2012 the

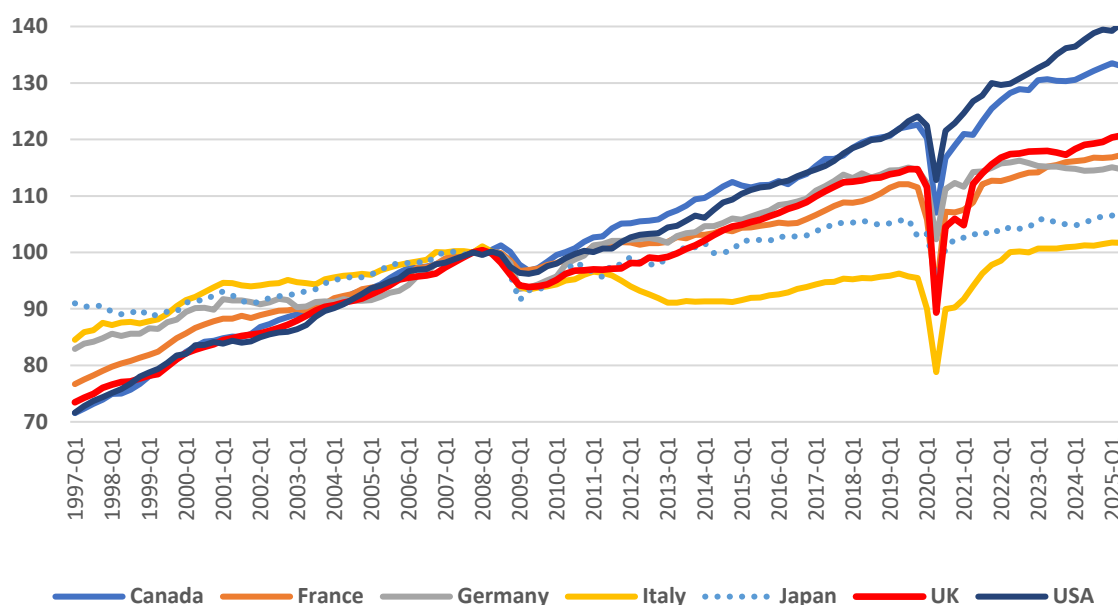
UK once again matched US growth rates but after 2016 and the arrival of Trump, growth in the UK successively fell further behind the USA but not the other G7 countries.

Figure 6.1: GDP and Productivity Annual Growth (National Currency) Change From 1997-2007 to 2007-2024



Source of data: [OECD](#) The data for UK productivity is from the revised ONS source. The data for this chart is in Appendix C

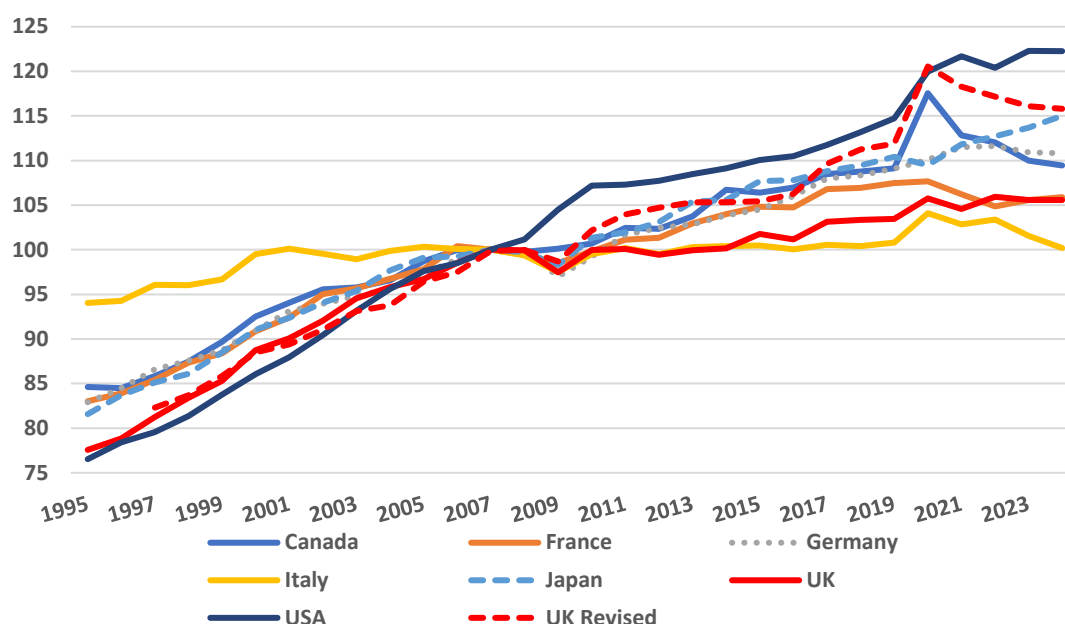
Figure 6.2: Real GDP (2007q4=100)



Source of data: OECD

The time series for productivity (see Figure 6.3) once again matched the USA in the decade before 2007 but outpaced other G7 countries. One factor was a catch-up in service-sector productivity to the US productivity frontier. UK businesses in finance and retail were highly efficient but once this catch-up was complete these sectors no longer provided the same boost to UK productivity (Fernald and Inklaar, 2025). Productivity growth in the UK became much slower after 2007 falling behind the USA but not the other G7 countries. The previous observation that the UK experienced the largest post-GFC slowdown of any G7 country in the growth of productivity¹⁰ has been revised away in the latest ONS data.

Figure 6.3: GDP Per Hour Worked (National Currency at Constant Prices, 2007=100)



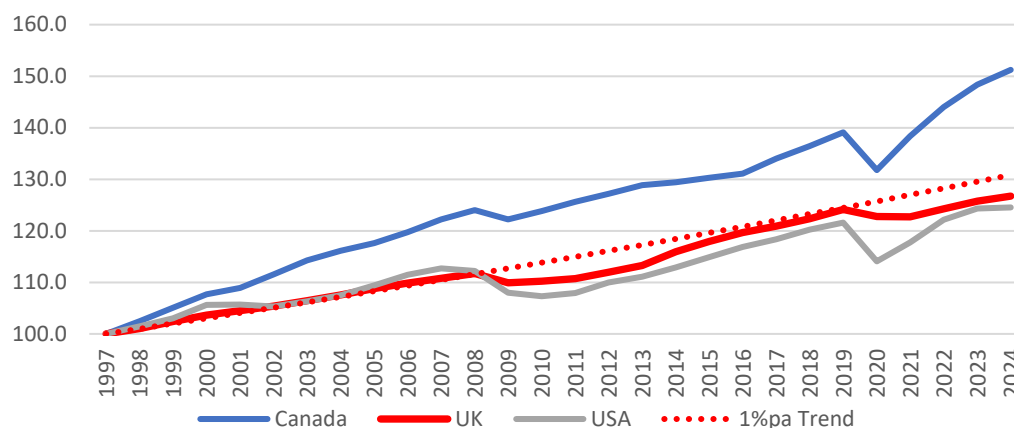
Source of data: OECD

The revisions to the ONS data are for hours worked and the employment figures are largely unchanged. This means that the growth rates for GDP per worker are also unchanged. Strong growth in employment after the GFC, without a matching strength in growth of GDP slowed the growth of GDP per worker. It was the reduction in hours worked per person in the revised data that boosted production growth above most other G7 countries.

Figure 6.4 and 6.5 show that employment indeed continued to expand after 2007 with the job losses during the GFC recession fully restored by 2017. The second jobs recession, during the Covid period, has in contrast not yet been fully recovered. Employment growth in the UK has been faster than the USA since

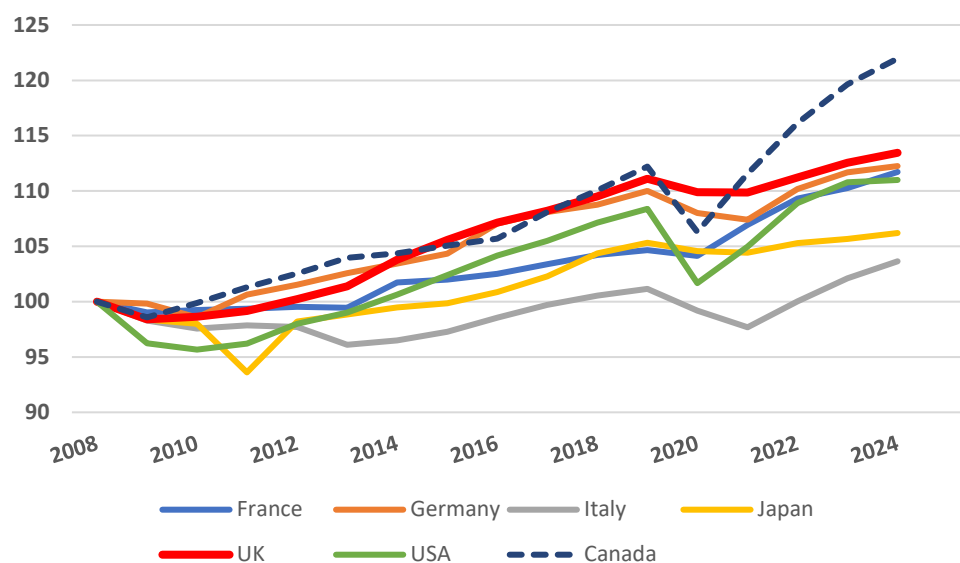
2007 and faster than all other G7 nations except for Canada where jobs were created particularly rapidly both before 2007 and since 2021.

Figure 6.4: Employment, 1997=100



Source of data: OECD

Figure 6.5: Employment, 2008=100



Source of data: OECD

A dynamic structural shift represents a clear break from the earlier post-war era. A rapid expansion of employment in the UK has taken place since around 1993. In the 43 years from 1950 to 1993 the number of jobs in the UK increased by 2.6 million – a sedate rate of expansion of only 0.25% per annum. In the following 33 years to 2025 the rate of growth quadrupled to 1% per annum and a further 9 million jobs were added. This dramatic expansion of the aggregate labour supply

was driven by a combination of two reinforcing factors: rising domestic participation and international migration flows.

Demonstrating these structural shifts, the UK working-age employment rate surged from 68% in 1993 to a historical peak of 76% in 2019, before stabilizing near 75% in the post-pandemic era. Crucially, as detailed in Table 6.1, the post-GFC domestic supply expansion was highly asymmetric across demographic cohorts, concentrated heavily among older workers (50 +) while youth entry experienced a marked contraction.

Table 6.1: UK Employment Change by Age Profile (2008-2026)

Age Cohort	Absolute Employment Change (Thousands)	Relative Employment Change (%)
16–17	-212	-14.0%
18–24	-160	-5.5%
25–34	1,282	+4.1%
35–49	448	+2.5%
50–64	2,274	+6.4%
65+	1,073	+6.1%

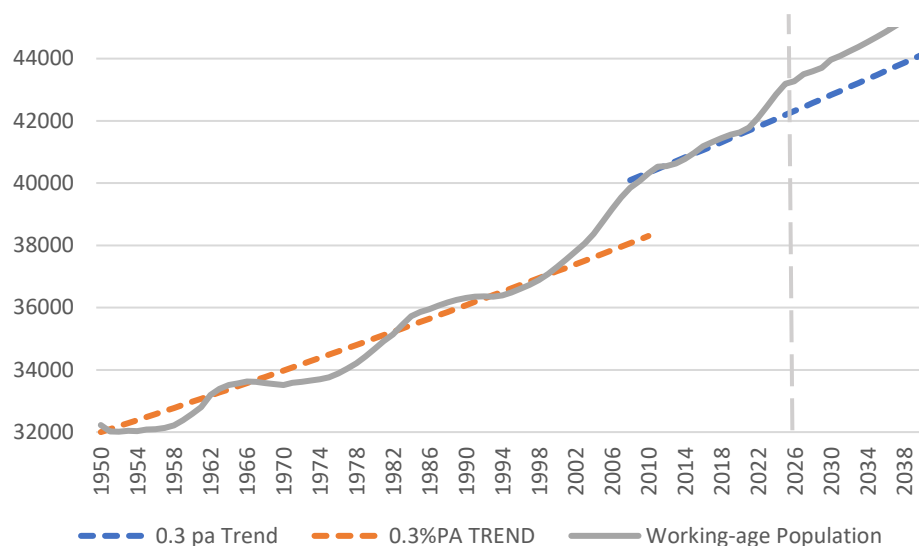
Source of data: ONS Labour Force Survey

Concurrently, global migration also played an important role in expanding the labour supply. During the 1997–2010 administrative period¹¹, the working-age population grew at double its baseline trend rate, expanding by 0.6% per annum compared to the historical 0.3% trend and adding 4 million individuals in 13 years. This trend continued between 2010 and 2021 with an additional 1.5 million working-age arrivals, followed by a further migration wave in the post-2021 period (see Figure 6.6). By outstripping peer G7 working-age population growth—excepting Canada—these dual supply channels ensured that UK firms faced no binding domestic labour constraints as they navigated the post-GFC macroeconomic landscape (Figure 6.7).

The availability of an elastic, mobile workforce is likely to have influenced corporate strategies by favouring labour-intensive operational models over capital-intensive technological updates. To evaluate whether this demographic expansion altered nationwide productivity paths, it is necessary to examine the sectoral distribution of the workforce. Census and ONS data reveal that the foreign-born workforce is widely distributed across the UK economy, maintaining a notable presence in manufacturing and professional services,

alongside high concentrations in transport, storage, wholesale distribution, and hospitality. Crucially, nearly half of this workforce arrived prior to 2007, meaning their structural presence cannot account for the post-GFC productivity break.

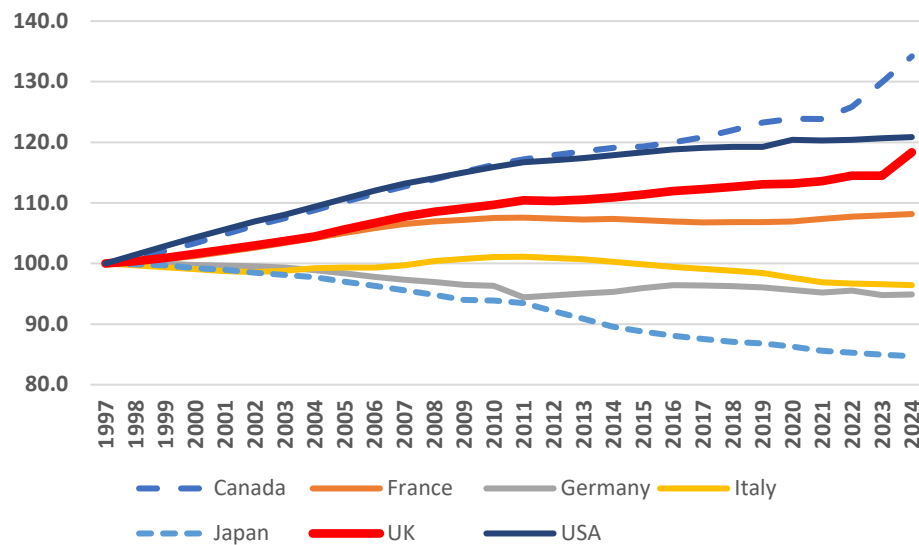
Figure 6.6: Population of Working Age in the UK (000s)



Source of data: ONS

While non-UK-born labour expansion was concentrated in transport, hospitality, and financial services (Figure 6.8), official data for the 50–64 cohort reveals a complementary supply footprint defined by high-volume absorption in services and extreme demographic dependency in primary sectors¹² (Department for Work and Pension, 2025). By absorbing high domestic labour volumes in non-tradable services while retaining aging incumbents in industrial activities, this dual supply channel enabled UK firms to sustain output growth while bypassing capital-deepening investments.

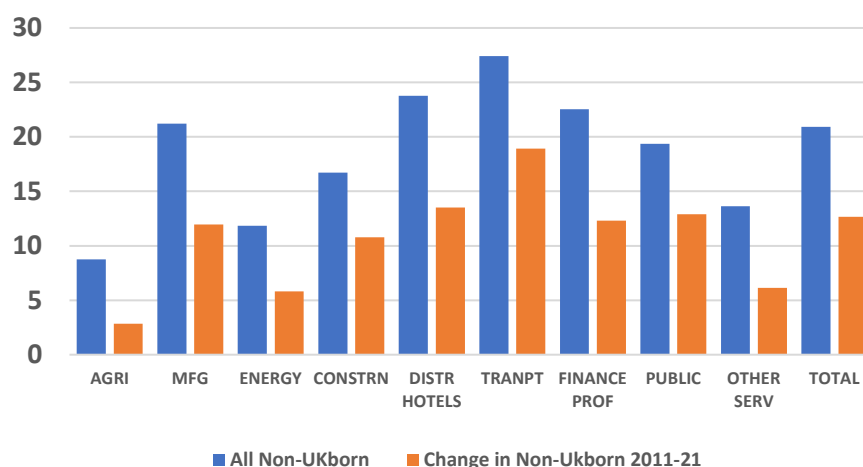
Figure 6.7: Working-Age Population in the G7 (1997=100)



Source of data: OECD

Caution must be taken to avoid double-counting foreign-born individuals who have aged into the 50+ cohort—particularly those who arrived prior to the GFC and accrued domestic human capital. However, disaggregating these pools does not alter the underlying macroeconomic dynamic. Whether labour supply expansion originated from UK-born older workers extending their tenure or foreign-born arrivals entering specific service niches, both flows expanded the aggregate elasticity of low- to mid-skilled labour. Within an endogenous, Salter-style vintage capital framework, this broad-based labour supply buffer suppressed the economy-wide wage-push dynamics that typically compel firms to replace aging physical capital with automated solutions. Consequently, the concentration of employment in lower-productivity functions reflects a systemic strategy of capital shallowing across diverse sectors, rather than an isolated compositional shock unique to recent migration.

Figure 6.8: Sectoral Distribution of Non-UK-Born Workers in England and Wales, % of Employment



Source: ONS (2023) Censuses [2021](#) and [2011](#) England and Wales¹³

7. Sectoral analysis

Using UK data for the period 1997–2024, we examine the relationship between growth in output (GVA) and growth in labour productivity (measured as output per hour) across sectors¹⁴, distinguishing between the pre-crisis period (1997–2007) and the post-crisis period (2007–2024). At the aggregate level, the contrast between the two periods is stark. Between 1997 and 2007, UK aggregate output grew at an average rate of 2.8 per cent per annum, while labour productivity grew at 2.1 per cent. Between 2007 and 2024, output growth slowed to approximately 1.1 per cent per annum and productivity growth collapsed to around 0.3 per cent (using unrevised productivity data or 0.9% using the revised ONS data). The slowdown between the two periods was therefore almost exactly two percentage points per annum for both output and productivity. This symmetry is a central empirical fact of the paper.

In both periods, the estimated relationship between aggregate productivity growth and aggregate output growth is close to one-for-one across sectors, with only small negative constants. This implies that productivity tends to rise or fall at approximately the same rate as output, with only a modest independent drift. This also implies almost no relationship between changes in output and changes in employment.

Relationships between output and productivity were very variable between sectors in this period as Table 7.1 shows for major sectors. The verdoorn coefficients (shown in the final column of table 7.1) were well above the overall average in manufacturing and admin support services (which includes agency

workers). In some sectors the relationship was negative. In construction for instance there was no change in the growth rate of output between the two periods, but productivity grew in the post-GFC period after previously being on a declining trend.

Table 7.1: Average Annual Growth Rates of Output and Productivity Across Sectors

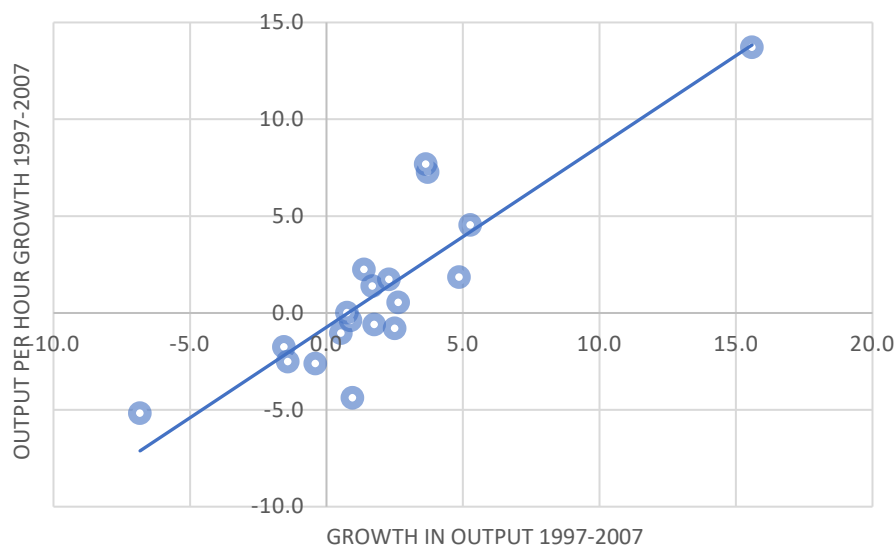
Sector	Y 1997q1–2007q4	Y 2007q4–2025q3	ΔY	Prod 1997q1–2007q4	Prod 2007q4–2025q3	ΔProd	$\Delta \text{Prod}/\Delta Y$
Manufacturing	4.3	0.8	-3.5	8.2	1.7	-6.5	1.8
Construction	0.8	0.8	0.0	-0.7	0.6	1.4	NA
Wholesale & Retail	1.7	-0.3	-2.0	1.2	-0.1	-1.3	0.7
Information & Comm	16.4	7.5	-8.9	14.2	5.5	-8.6	1.0
Financial Services	5.5	-1.6	-7.0	4.6	-1.7	-6.4	0.9
Professional Services	5.1	2.5	-2.6	2.0	0.7	-1.3	0.5
Admin Support	2.6	2.8	0.2	-0.9	1.6	2.5	10.5
Public Services	1.3	0.9	-0.4	-0.4	-0.4	0.0	0.0
Total	3.4	1.1	-2.3	2.6	0.3	-2.3	1.0

Source of Data: ONS

Note: Output (Y) is gross value added at CVM, Productivity (Prod) is GVA per hour worked. The table shows major sectors accounting for 80% of total GVA. Public services is defined as public administration plus education and health

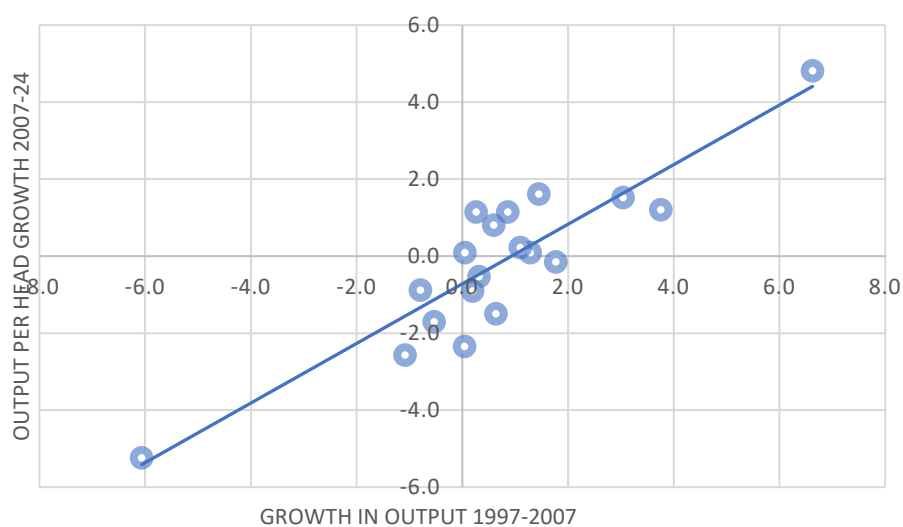
Figure 7.1 and 7.2 however show a relatively clear relationship across sectors for output and productivity at a more disaggregated level. The relationship is visible across the majority of sectors in both periods and remains statistically significant when outliers are excluded. The two outlier sectors are information and communications, which experienced rapid output expansion, and mining (primarily North Sea oil), where output declined sharply. In both periods, productivity movements closely mirror changes in output, reinforcing the interpretation that sectoral productivity outcomes are strongly demand-driven. Manufacturing and agriculture also emerge as positive outliers, with productivity growth exceeding that predicted by output growth by around five percentage points per annum in the pre-crisis period and by roughly 1.5 percentage points in the post-crisis period.

Figure 7.1: Productivity Growth Versus Output Growth Across Sectors (1997-2007)



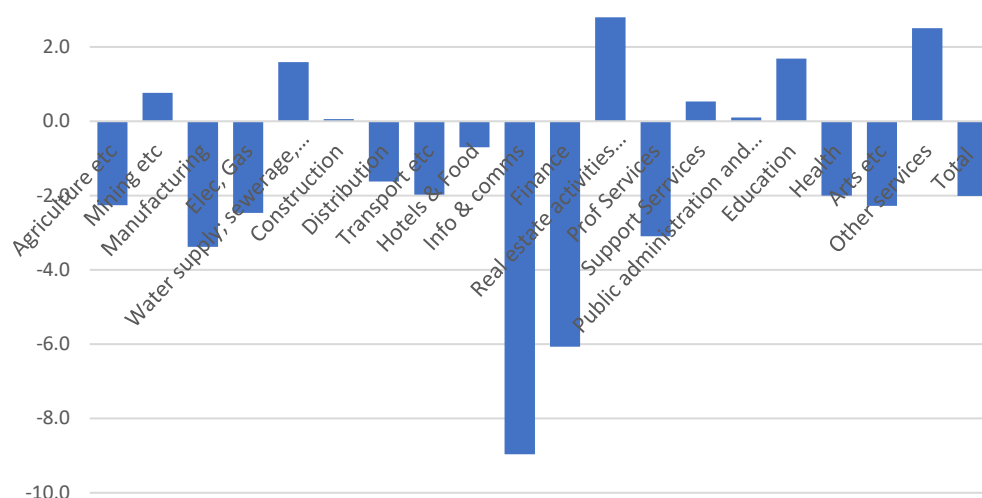
Source of data: ONS [Output per hour, UK](#)

Figure 7.2: Productivity Growth Versus Output Growth Across Sectors (% growth 2007-24)



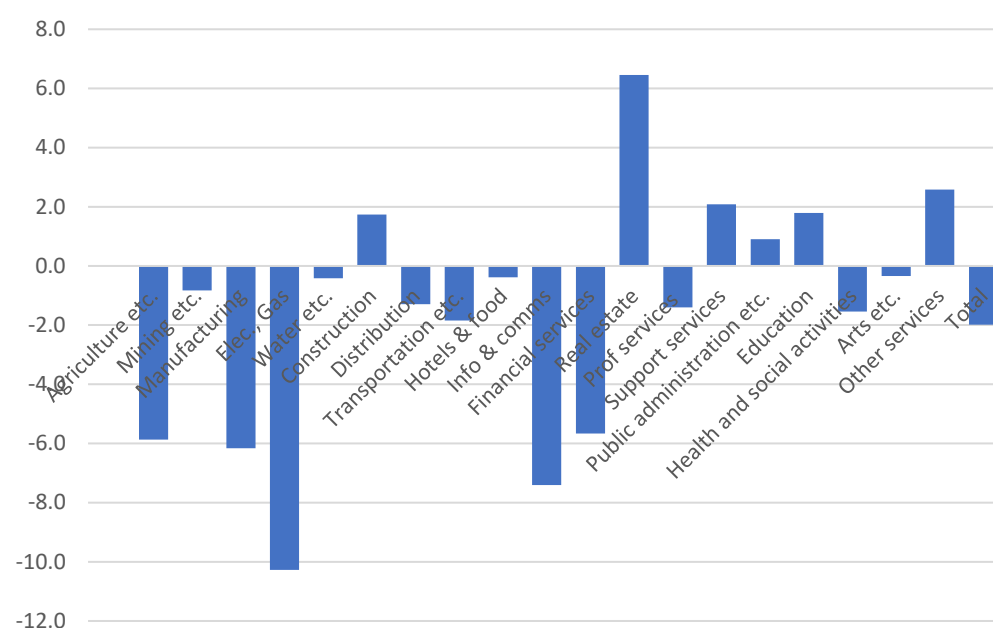
Source of data: ONS [Output per hour, UK](#)

Figure 7.3: Change in Growth rate of Real GVA (%), 2007-24 vs 1997-2007



Source of data: ONS [Output per hour, UK](#)

Figure 7.4: Change in Productivity Growth (%), 2007-24 vs 1997-2007



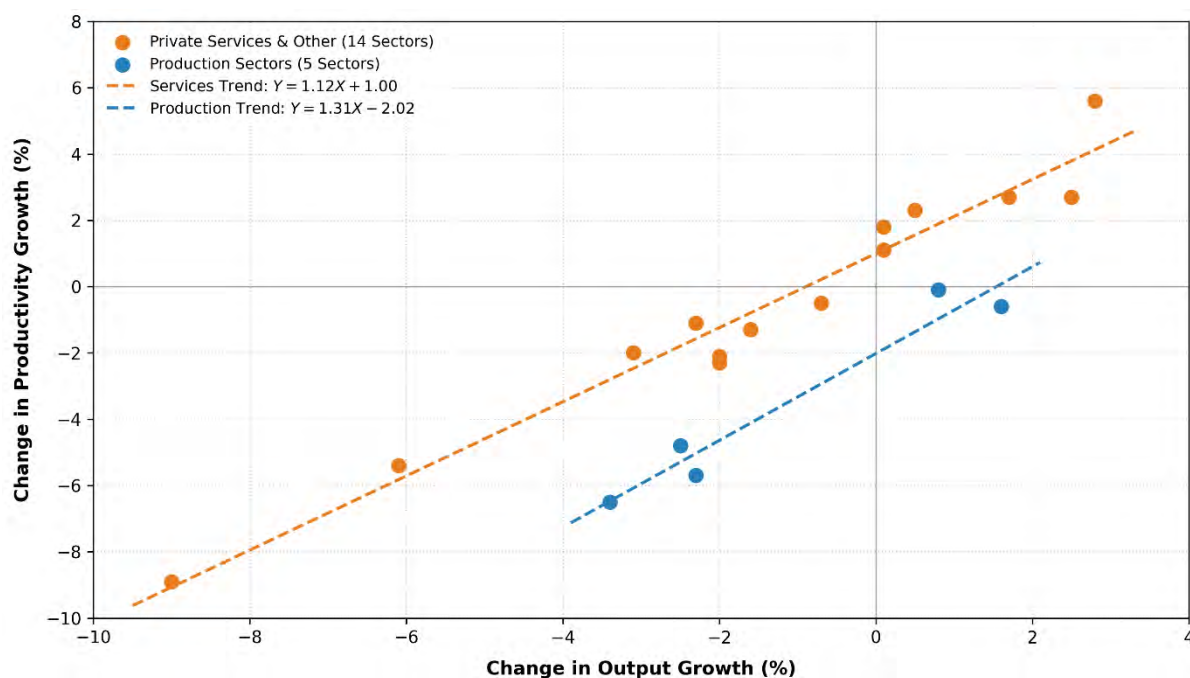
Source of data: ONS [Output per hour, UK](#)

Examining sectoral changes between the two periods provides further insight (See Figure 7.3 and 7.4). Growth in output declined in most sectors and declined most in information & communication and in finance & insurance. A few sectors bucked this trend, including mining (North Sea oil), water, real estate and education. The decline in productivity growth was more severe, with again

mining, water, real estate and education bucking the trend of declining growth. Within the production sectors, agriculture, manufacturing, and electricity generation experienced particularly large declines in productivity growth - between five and six percentage points per annum - despite output falling only moderately more than in other sectors. In weighted terms, manufacturing alone accounts for just over half of the aggregate decline in productivity growth between the two periods, with export-oriented engineering industries contributing roughly half of this effect¹⁵. No other sector makes a comparably large weighted contribution, even where absolute declines in productivity growth are substantial as in the case of information and communication or finance and insurance.

If we compare changes in output growth with changes in productivity growth (Figure 7.5) there is a highly significant linear relationship between the two in the service sectors, including construction¹⁶. In these service sectors, the fall in productivity growth is slightly more than proportional to the fall in output growth, although there is also a small positive shift in productivity unrelated to output changes. In contrast, the five production and utility sectors display a larger negative productivity shift that is not directly explained by output growth alone, although the estimated output-productivity relationship is not statistically different from that observed in services.

Figure 7.5: Changes in Sectoral Output & Productivity Growth (2007-24 versus 1997-2007)

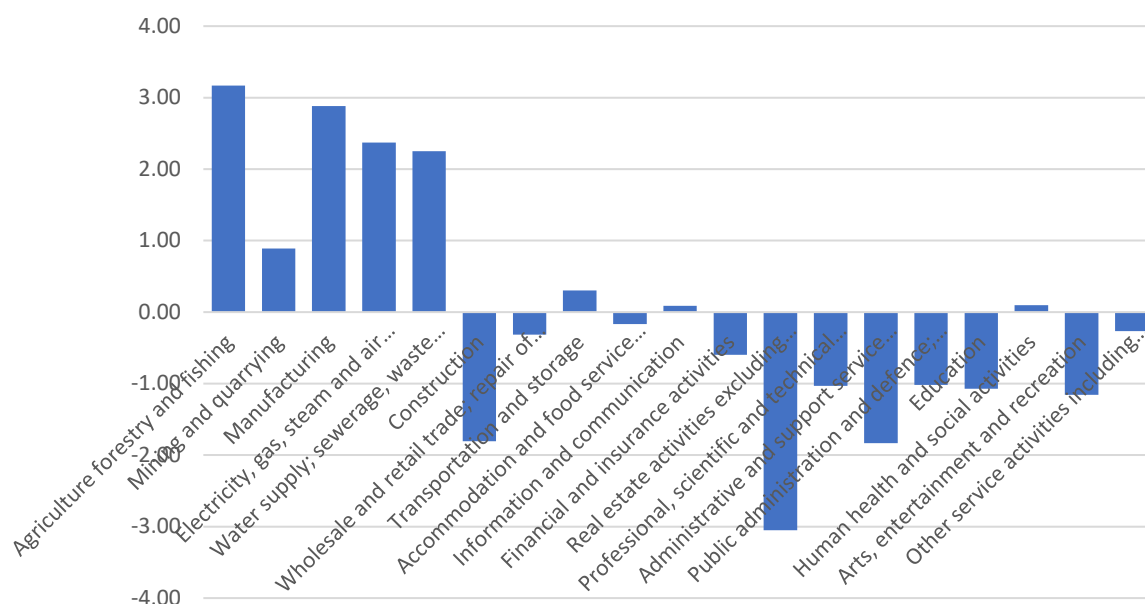


Source of data: ONS [Output per hour, UK](#) See table 4.2 to identify sectors

Note: This chart shows two trends, one for 14 private-sector services and the lower trend for the five production sectors.

These one for one relationships between output growth and growth in productivity imply that changes in the growth of employment (or hours worked) are unrelated to changes in output. Figure 7.6 shows a marked contrast between production and service sectors in hours worked (which has the same sectoral pattern as employment). While upward trends in hours worked generally slackened after 2007 in the service sectors the opposite was true for production sectors.

Figure 7.6: Difference in Annual Growth of Hours Worked (2007-24 versus 1997-2007)



Source of data: ONS [Output per hour, UK Table 10](#)

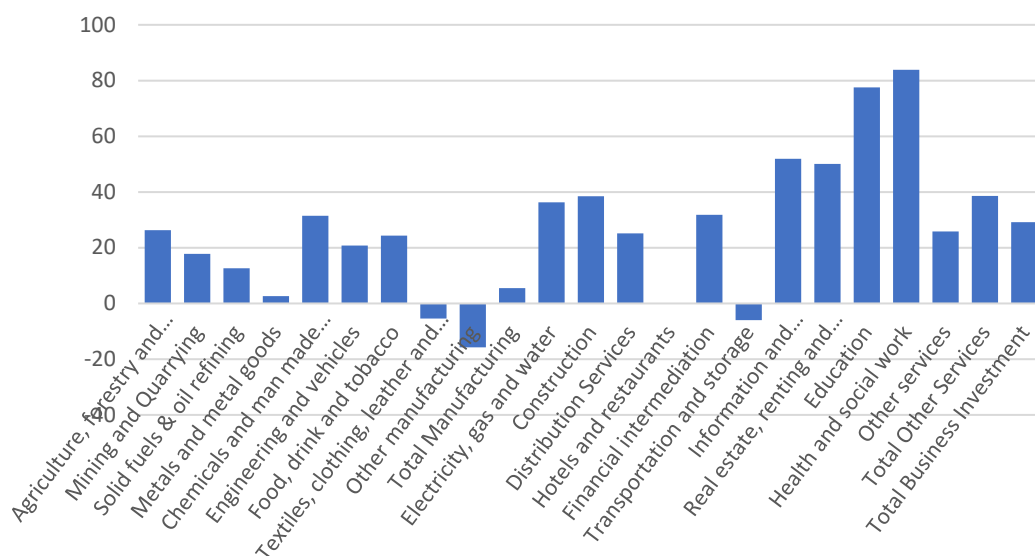
These findings raise an important question: can the post-2008 collapse in productivity growth be interpreted as a Verdoorn effect, in which slower demand and output growth lead directly to weaker productivity performance? In most sectors, output growth slowed sharply or turned negative after 2007, and productivity growth weakened in parallel. A standard explanation would attribute this pattern to reduced investment as the investment required to maintain a stable capital-output ratio declines. At the same time, we would expect the growth in employment to slow, but by less than the slowdown in output. However, neither employment or investment behave in this way. Hence, while demand is a key influence, factors other than simple Verdoorn influences must also be at work.

7.1 Factors beyond simple Verdoorn effect

Mean investment increased between the pre- and post-GFC periods in almost every sector (see Figure 7.7). One factor influencing the unexpected rise in investment in most sectors is the flow of foreign direct investment (FDI) in greenfield sites (i.e. investment in physical buildings, plant and machinery etc rather than in mergers and acquisitions). Before the GFC the net outflow of greenfield FDI from the UK was equivalent to around 10% of business investment in the UK. After the GFC this net flow fell to zero in most years. The average dollar value of outward FDI fell by 18% between the two periods while the value of inward FDI rose by 48% (see Figure 7.8). These changes reflect the

25% depreciation of sterling against the dollar after the GFC and the much slower growth of world trade in the same period. If this signifies a switch in investment away from foreign destinations and into the UK this is an important reason explaining why business investment rose in the UK after the GFC in a period of generally slower growth in output in most sectors.

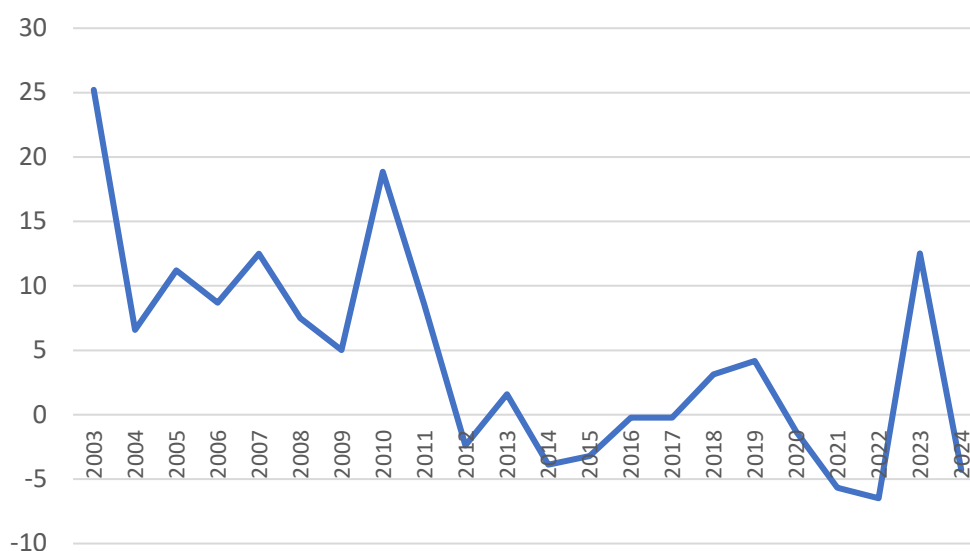
Figure 7.7: Percentage Change in Real Investment from 1997-2007 to 2007-24



Source of Data: ONS Business investment by industry and asset June 2025.

Note: Private sector and public corporations only. The percentage change is in the mean level of investment between each of the two periods

Figure 7.8: Net Outward Flow of Greenfield FDI (% of Business Investment)

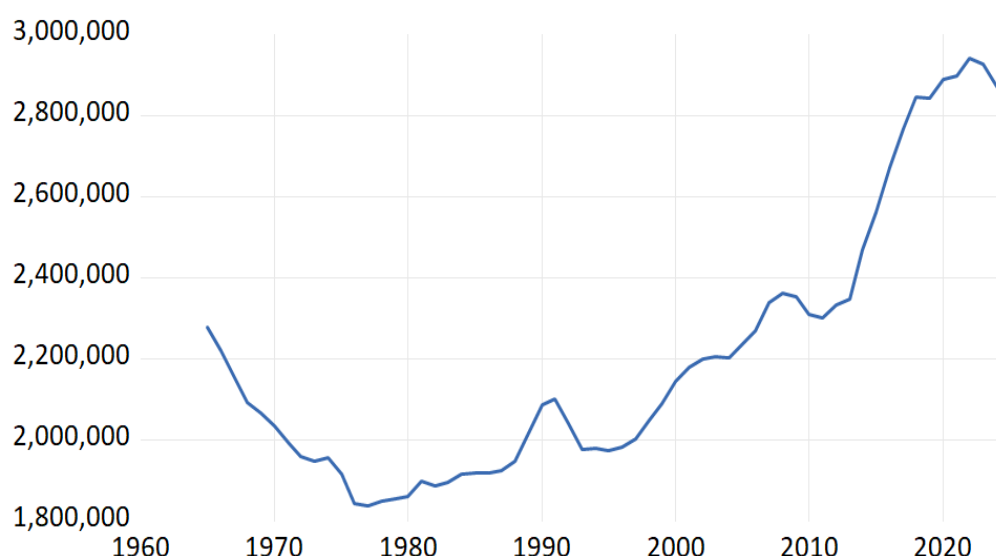


Source of Data: UNCTAD World Investment Report Annex Table 14

Note: The dollar value of net greenfield FDI converted to \$US and expressed as a % of current price business investment in the UK

A second distinctive macroeconomic feature of the post-2008 period has been historically unprecedented low nominal interest rates and a prolonged phase of negative real interest rates lasting until 2023. Standard economic theory would predict that such conditions should stimulate investment and hence raise productivity through higher capital-labour ratios and slower growth in employment. In practice, investment did increase after 2008 but the opposite outcome has been observed for employment and productivity. One reason is that low interest rates substantially lowered barriers to entry for new firms, particularly in low-productivity private service sectors¹⁷. Business formation rose sharply after 2010 (Figure 7.9), with an extra 400,000 new and predominantly small firms. If these young firms employed an average of 3 people each, it will result in an extra 1.2 million people in work accounting for 26% of the additional 4.6 million jobs created after 2010¹⁸. This additional employment was predominantly in lower productivity sectors and hence without corresponding gains in output per worker. In addition, lower interest payments may have reduced financial pressure on incumbent firms to raise efficiency through workforce reductions.

Figure 7.9: Stock of Active Enterprises, UK



Source of Data: ONS Business Demography

8. Model Simulations – What Happened to Aggregate Demand After 2008

To model the preceding arguments and quantify the structural mechanisms driving the post-crisis deceleration, we deploy a series of counterfactual simulations using UKMOD developed at the Cambridge Centre for Business Research¹⁹. These exercises allow us to construct a robust, demand-led explanation for the long-run productivity breakdown by directly testing the causality between demand components and aggregate outcomes.

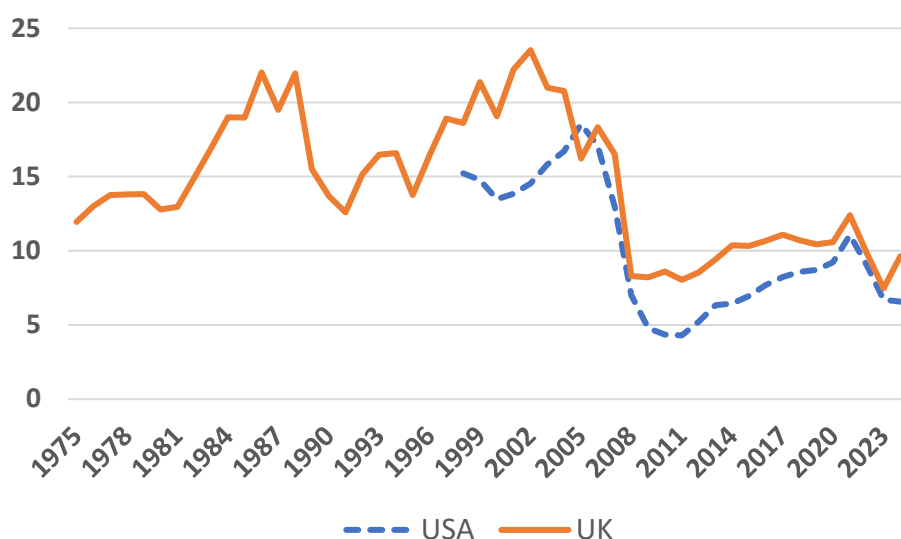
The productivity is modelled using an ECM equation (Equation 1, Appendix A), which confirms a strong long-run relationship between labour productivity and real aggregate output, alongside a significant short-run coefficient capturing labour-hoarding behaviour across the business cycle. Critically, the long-run elasticity between output and productivity is close to unity, indicating that structural shifts in trend output pass through almost one-for-one into productivity rather than employment levels. Within this framework, the central bank policy rate enters with statistical significance—capturing the role of ultra-low interest rates in shaping firm survival, entry, and labour retention—while cumulative net migration displays a weak negative association with measured output per worker.

The primary empirical hypothesis is that the collapse in commercial bank credit, particularly mortgage lending, played a key role in weakening aggregate demand. Mortgage lending in the UK is predominantly used to finance transactions in existing dwellings rather than new construction. As a result, new mortgage lending largely represents a transfer of deposits between households with only a

small associated rise in output. While borrowers may marginally reduce consumption due to additional debt-service obligations, these effects were limited in the post-crisis period given exceptionally low interest rates. By contrast, sellers receive substantial capital injections. Our estimates suggest that around 3 per cent of the value of new mortgage lending leaks into consumer spending in the long run²⁰.

Following the GFC, the volume of new mortgage lending contracted by approximately 60%. Even by 2024, total loan originations for house purchases remained at roughly half their pre-crisis peak (Figure 8.1). This credit crunch generated a structural, long-term drag on credit-financed consumption flows. Mirroring this mechanism, real household consumption growth decelerated precipitously—falling from an annual average of 3.1% over the 1987–2007 period to just 1.1% per annum between 2007 and 2023. Counterfactual simulations in UKMOD—holding post-2010 mortgage origination volumes at their pre-crisis baseline—reveal that this credit contraction accounts for just under half of the total post-GFC slowdown in real consumer spending growth.

Figure 8.1: Residential Mortgages for House Purchase, (number per thousand population)

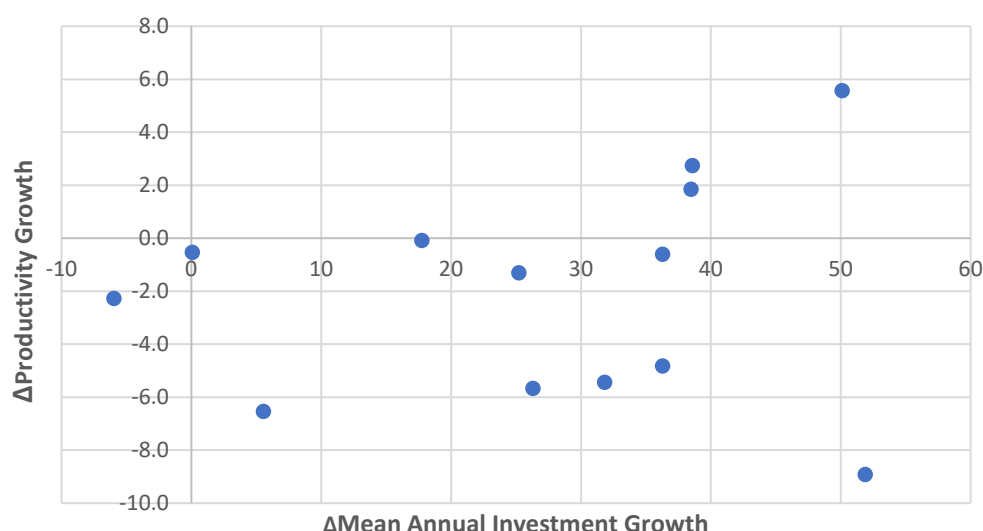


Source of data: Bank of England (LPQVTVU) and Federal Reserve Economic Database

Confronted with persistent weak demand and nominal interest rates near the effective lower bound, UK firms adapted by drawing on a highly elastic labour supply to fulfil operational requirements. This might have been expected to reduce the incentive to invest in productivity-enhancing capital, organisational

change, or workforce training. In practice this did not happen at least for business investment since business investment expanded rather than contracting after the GFC. Other factors, including low interest rates and the relative attractiveness of foreign to domestic locations for investment, appear to have been more important. In any case, in comparing pre-and post-GFC experience we observe no relationship between the change in investment levels and changes in productivity growth (see Figure 8.2).

Figure 8.2: Difference in Annual Average Growth Rates by Sector, 1997-2007 v 2007-24



Source of data: ONS NB Productivity is measured without the recent ONS revisions

The slowdown in consumption growth not only contributed directly to weaker output growth but also indirectly to deteriorating public finances. Slower growth reduced tax revenues, while the recession associated with the banking crisis itself necessitated large public outlays. The subsequent policy response relied heavily on fiscal consolidation, with sustained reductions in public spending growth²¹. In our view, the combination of private credit contraction and prolonged fiscal austerity was the principal cause of the decline in real GDP growth from its pre-2007 trend rate of around 2.75 per cent per annum to approximately 1.1 per cent thereafter.

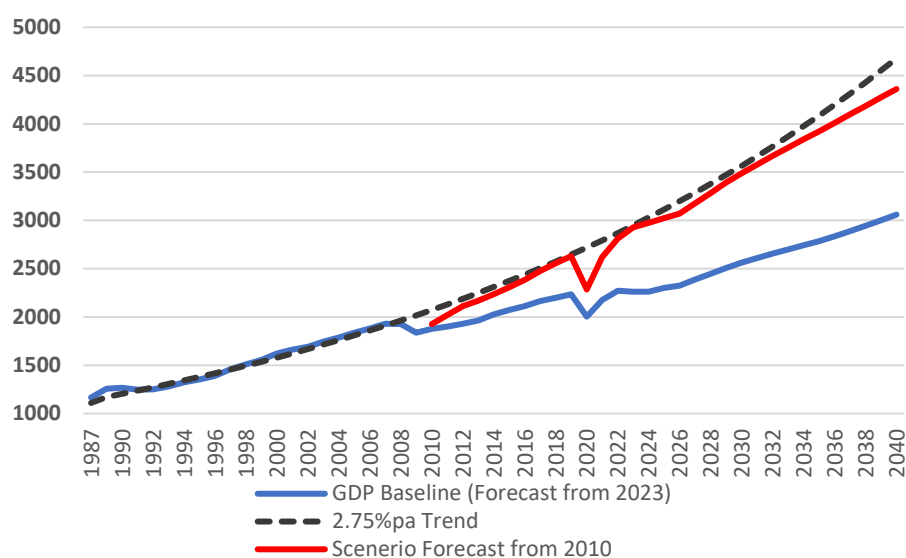
To explore this mechanism more formally, we simulate a counterfactual scenario using the UKMOD. In this scenario, mortgage lending does not collapse after 2007 and remain at its pre-crisis level. Public spending also avoids austerity, growing at 4 per cent per annum until 2024. In effect, both private and public deficits are allowed to expand relative to the baseline, sustaining the aggregate

demand channel necessary to drive endogenous productivity gains via Verdoorn dynamic elasticities.

Under this scenario, GDP recovers rapidly from the 2008–09 recession and returns to a growth path close to the pre-crisis trend of around 2.75 per cent per annum (Figure 8.3). Government deficits are initially lower than in the baseline despite faster public spending growth, reflecting stronger tax revenues. Public debt remains below the baseline projection until around 2023, after which it rises more rapidly, reaching approximately 100 per cent of GDP by 2027 and 120 per cent by 2030. Beyond the mid-2020s, some fiscal tightening would therefore be required.

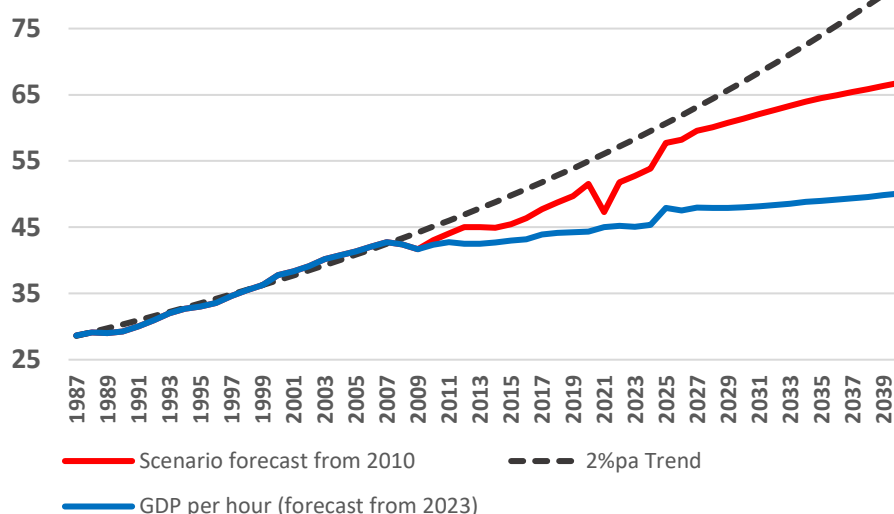
Short-term interest rates in the scenario are around 4 percentage points higher than actual rates in the years leading up to the Covid pandemic, reflecting stronger demand under a Taylor-rule framework. Household debt stabilises at around 185 per cent of GDP, compared with an actual pre-Covid level of around 162 per cent.

Figure 8.3: Real GDP Scenario forecast from 2010 (£m)



Sources: ONS national accounts data and model-based forecasts

Figure 8.4: Productivity: Scenario forecast from 2010 (£ per hour)



Sources: ONS national accounts data and model-based forecasts

Despite the near restoration of pre-crisis output growth, productivity growth does not fully return to its earlier trend (Figure 8.4). Growth in GDP per hour over 2010–2025 rises to around 1.3 per cent per annum—well above the actual outcome of roughly 0.4 per cent, but still below the pre-2008 rate. Productivity growth in the scenario is dampened by the creation of nearly one million additional jobs in new small firms, predominantly in low-productivity service sectors, reflecting interest rates that remain below pre-crisis norms. This result reinforces the view that productivity growth responds to demand conditions but is also shaped by the composition of employment growth. However, this scenario was generated using unrevised data for productivity, and the conclusions may change when revised data is available.

The sustained weakness of actual mortgage lending after 2008 is unlikely to reflect deficient household demand alone. Although demand may have been subdued during the immediate aftermath of the crisis—owing to falling real incomes between 2007 and 2014—mortgage demand should have recovered as real incomes began to rise after 2014, particularly given historically low borrowing costs. In practice, the number of mortgage loans increased only marginally. Nor can high house prices relative to incomes provide a complete explanation: by 2025, the ratio of mean house prices to household incomes was only slightly above its 2007 peak, when mortgage lending volumes were almost twice as high.

A more plausible explanation lies in constraints on banks' willingness or ability to lend. In the immediate post-crisis period, banks were focused on repairing

balance sheets and rebuilding capital buffers. However, even as bank balance sheets strengthened, mortgage lending remained subdued. This points to the role of post-crisis financial regulation and macroprudential policy.

9. Financial regulation after 2008

The reason for the dramatic fall in the flow of mortgage credit after the banking crisis is unlikely to be due to lower household demand for mortgages, even if this is the case during and immediately after the banking crisis. With historically low mortgage costs, demand should have soared, although falling real earnings between 2007 and 2014 must have depressed demand. Once real incomes began rising again after 2014 there was only a small rise in the number of mortgage loans, and as we have noted, by 2024 the number of mortgages was a little over half its pre-GFC peak. Nor can high house prices relative to household incomes be a prime cause. By 2025 the ratio of mean house prices to household incomes was only a little above the previous peak in 2007 when the number of mortgage loans was almost double the current level. More plausible are constraints on banks' willingness or ability to lend for house purchase. Initially, after 2009 the need for banks to restore their battered balance sheets would have limited the expansion of loans but as the recovery in banks financial strength developed the number of loans stayed low.

In the aftermath of the 2008 GFC, the UK undertook a series of policy responses to address the collapse in financial stability and the risk of excessive credit and mortgage expansion. Between 2008 and 2010, the focus was on stabilising the financial system and preserving credit access. During this period, government interventions were not aimed at restricting credit or mortgage issuance, but rather at preventing a complete withdrawal of lending activity that could deepen the recession. The following years, from 2010 to 2016, marked a shift toward regulatory tightening, with a specific focus on curbing systemic risks arising from the housing market and household leverage.

In the immediate response to the crisis, the UK government launched the Bank Recapitalisation Scheme in October 2008, injecting approximately £50 billion into key banks such as RBS and Lloyds (Buchholtz, 2021). These capital injections came with lending conditions that encouraged the continuation of mortgage and small business lending. Simultaneously, the Bank of England introduced the Special Liquidity Scheme (SLS) in April 2008, allowing banks to swap illiquid mortgage-backed securities for government bonds (John et. al., 2012). This ensured that banks retained access to funding channels, thereby sustaining mortgage issuance during market disruption. The Credit Guarantee Scheme, launched shortly after in October 2008, further supported banks' ability

to issue new debt by providing government guarantees, indirectly supporting continued mortgage funding.

Monetary policy during this phase complemented these liquidity and recapitalisation measures. The Bank of England aggressively reduced interest rates, bringing the policy rate down to 0.5% by March 2009. This significantly lowered mortgage interest rates and aimed to stimulate demand for borrowing. Although the Financial Services Authority (FSA) called on banks to strengthen their capital buffers, no formal constraints on mortgage issuance were introduced at this stage. The combined aim of these policies was to avoid a collapse in credit availability and maintain confidence in the financial system, rather than to limit the flow of credit or household borrowing.

The post-crisis recovery phase from 2010 onwards witnessed a strategic shift in policy objectives. As financial markets stabilised, concerns about emerging housing market risks and household indebtedness grew. The establishment of the Financial Policy Committee (FPC) in 2011 (interim) and its statutory empowerment in 2013 marked a turning point. The FPC, operating under the Bank of England, was tasked with overseeing systemic financial risk and was granted macroprudential tools to intervene in credit markets.

Among the most consequential policies during this phase was the implementation of the Mortgage Market Review (MMR) by the Financial Conduct Authority (FCA) in April 2014. The MMR introduced stringent affordability assessments for mortgage applicants, mandated income verification, and required lenders to conduct stress testing to ensure that borrowers could withstand interest rate rises. The MMR also curtailed the issuance of interest-only mortgages unless borrowers could demonstrate a credible repayment plan. This significantly reduced the scope for high-risk mortgage lending and realigned credit practices with long-term affordability and prudence.

In parallel, the FPC issued a major recommendation in June 2014, implemented from October of the same year, imposing a cap on loan-to-income (LTI) ratios (BoE, 2014). Under this rule, no more than 15% of a lender's new residential mortgage lending could be at LTI ratios exceeding 4.5. This measure directly limited the capacity of borrowers to take on large debts relative to their income and was particularly effective in cooling overheated housing markets, especially in London and the South East.

These constraints were reinforced by the phased implementation of Basel III capital standards starting in 2014. The Prudential Regulation Authority required banks to hold higher capital against mortgage exposures, including the introduction of the Capital Conservation Buffer and the Liquidity Coverage

Ratio. The combination of these measures increased the cost of capital for mortgage lending and encouraged more cautious underwriting practices.

The FPC was also given authority to activate the Countercyclical Capital Buffer (CCyB), which could be adjusted in response to systemic risks. Although initially set at zero, the CCyB became an important signalling mechanism and policy lever to moderate credit growth during periods of excessive optimism. Additionally, the Bank of England's stress testing regime, introduced in 2014, required banks to demonstrate resilience against housing market downturns, further discouraging aggressive credit expansion.

Collectively, these medium-term measures marked a significant reorientation of UK financial regulation from reactive stabilisation to proactive risk containment. Whereas the immediate post-crisis response focused on keeping credit flowing, the medium-term policies recognised the structural vulnerabilities that unchecked mortgage expansion could pose. The integration of affordability checks, LTI caps, higher capital requirements, and stress testing into the UK's regulatory framework reflect a deliberate strategy to embed financial stability into mortgage lending practices.

Thus, the UK's post-GFC policy trajectory transitioned from crisis mitigation, liquidity and capital support to systemic risk management through macroprudential oversight. The tightening of mortgage lending standards was not arbitrary but formed part of a broader effort to ensure that the recovery was not derailed by a repeat of the credit excesses that precipitated the 2008 crisis. These policy responses offer important insights into the sequencing and calibration of credit policy in a post-crisis context. In July 2025 the Bank of England has begun easing the loan to income ratios to help first-time buyers, but concerns remain within the FCA about the vulnerability of poorer borrowers (BoE, 2025).

10. The Employment Puzzle

While Verdoorn effects appear to account for much of the post-GFC productivity slowdown, they do not provide a complete explanation. As shown in Figure 8.4, even a scenario that restores output growth close to its pre-crisis trend fails to fully re-establish the earlier trajectory of output per hour. Put differently, productivity growth has been weaker than would be expected given the recovery in GDP²². Sectoral evidence reinforces this point: the close to one-for-one relationship between changes in output and productivity implies that employment and hours worked adjusted far less than output itself. Ordinarily, weaker demand would be expected to reduce labour input more sharply, cushioning the fall in productivity. The central puzzle, therefore, is why employment and hours worked

continued to expand so strongly during a prolonged period of sluggish output growth after 2008.

For this reason, the productivity puzzle can equally be described as an employment puzzle. What distinguishes the post-2008 period is not merely slower GDP growth, but the exceptionally strong expansion of employment. Between 2007 and 2024, total employment increased by around 3.6 million, contributing to a cumulative rise of roughly six million jobs since the late 1990s. This employment growth was overwhelmingly concentrated in service activities, many of which are characterised by low capital intensity and low measured productivity. Health and social care, other public services, hospitality, retail, and a range of personal and business services together account for the majority of net job creation over this period. Structurally, this elastic labour expansion was absorbed through two primary channels: a net inflow of non-UK born workers and a marked increase in domestic participation rates among older cohorts, particularly for the 50–64 and 65+ age groups.

It is important to stress that the association between employment growth and migration should not be interpreted as reflecting the intrinsic characteristics of migrant workers. The relevant mechanism operates on the demand side of the labour market. Firms responded to an institutional environment that enabled employment expansion at relatively low wage costs, reducing incentives to substitute capital for labour or to invest in productivity-enhancing technologies and training. In this context, access to a large pool of relatively low-cost labour—shaped by migration policy, weak collective bargaining, and limited wage pressure—allowed firms to meet demand through labour-intensive adjustment rather than productivity growth. Migration constraints bind only when wages rise sufficiently to attract domestic workers. When wages remain low, firms can expand employment without altering production techniques.

A structurally similar mechanism explains the contribution of domestic older workers, where demographic aging intersected with institutional policy shifts. The post-2008 period saw an expanding 50+ population cohort as larger demographic waves reached late-career ages. Crucially, this structural expansion was matched by a sharp rise in employment rates within these older cohorts—driven by the aging population, the change in pension policies, and the income shock of stagnant real wages delaying retirements. Together with international migration, these demographic shifts formed an abundant, highly elastic pool of domestic labour for UK firms and disproportionately absorbed into lower productivity service roles. This mechanism aligns directly with the macroeconomic evidence: while post-2008 GDP growth slowed markedly, employment and total hours worked declined only marginally—and by some

measures expanded faster than in the pre-crisis period—whereas productivity growth collapsed. As summarised in Table 10.1, this stark divergence illustrates how low-cost labour elasticity effectively decoupled job creation from productivity growth.

Table 10.1: Annual Average Growth Rate of Selected Macroeconomic Variables

	1997- 2007	2007- 24
Output	2.8	1.1
Employment	0.9	0.8
Hours worked	0.7	0.8
Investment	2.7(1.5)	1.2(3.2)
Productivity	2.1	0.87

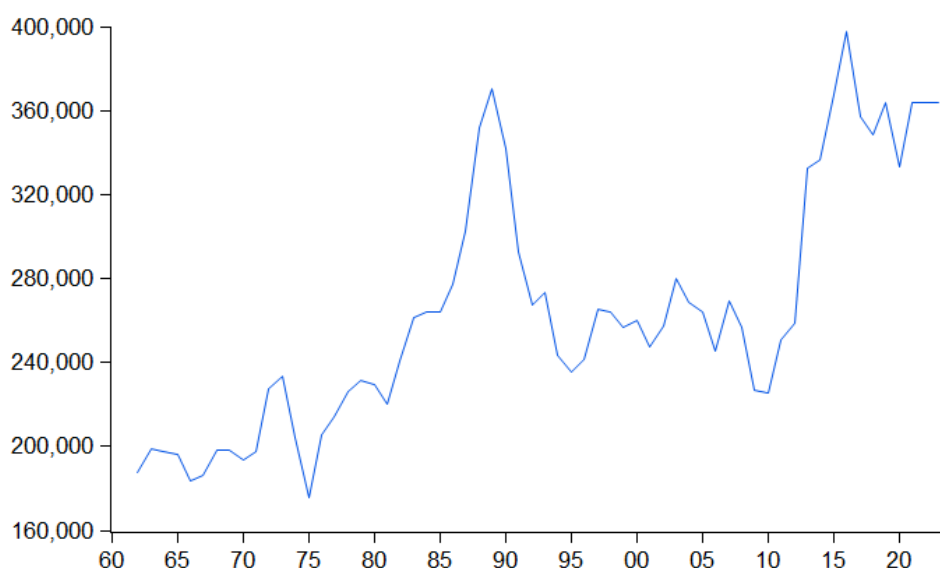
Source of data: [ONS](#)

Note: Figures in parentheses are for 1997-2010 and 2010-2024

In addition to labour elasticity, the ultra-low-interest-rate environment may also have significantly influenced firm behaviour. In the employment equation of the UKMOD, the short-term interest rate indeed enters as a highly significant determinant of employment for any given level of output.

Low interest rates stimulated investment during parts of the post-crisis recovery, particularly between 2010 and 2017. However, a more important and often overlooked channel was their impact on firm entry and business formation. Cheap credit substantially lowered the cost of establishing new firms, particularly in private service sectors with low fixed-capital requirements. VAT registration data show a sharp rise in new business formation after 2010, with the stock of registered businesses increasing by around 400,000 relative to trend²³ (See Figure 10.1). Even allowing for high exit rates, this surge plausibly accounts for a significant share of post-2008 employment growth. Crucially, the subsequent contraction in active enterprises following post-pandemic interest rate hikes (Figure 7.9) provides compelling empirical support for this hypothesis: just as the ultra-low interest rate regime encouraged the creation of marginal, low-productivity firms, monetary tightening rapidly reversed these gains.

Figure 10.1: Number of New Enterprises registered for VAT



Source of Data: [ONS Business Demography](#)

The interaction of low interest rates, weak demand, and an elastic supply of labour therefore created a structural bias towards labour-intensive adjustment²⁴. Firms faced limited pressure to raise productivity through capital deepening or organisational change, especially in an environment of subdued demand growth and weakened collective bargaining power. The long-term decline in union coverage further reduced wage pressure, reinforcing incentives to expand employment rather than invest in productivity. International comparisons further support this interpretation. Employment growth in the UK was not markedly out of line with other G7 economies despite weaker GDP growth than the United States and Canada. France and Germany experienced slower output growth than the UK but similar rates of job creation, consistent with a broader post-crisis pattern in which ultra-low interest rates supported employment expansion across advanced economies.

In sum, the persistence of low productivity growth since the GFC reflects the interaction of weak demand, prolonged monetary accommodation, and labour-market institutions that facilitated employment growth. Corporate tax reforms or investment subsidies are therefore unlikely to provide a decisive solution. By contrast, a sustained recovery in productivity is more likely to emerge as interest rates normalise, wage pressures strengthen, and demand growth improves. Such changes may raise productivity growth over time, but they will do little on their own to address entrenched regional disparities, underscoring the continued need for targeted industrial and regional policy.

11. Conclusions

This article has argued that the sharp slowdown in UK productivity growth since the banking crisis of 2007–08 is best understood as the outcome of a prolonged weakness in aggregate demand rather than as the consequence of an autonomous deterioration in technology or investment incentives. In a Kaldorian framework, slow demand growth weakens the inducement to invest, limits opportunities for learning-by-doing and scale economies, and thereby depresses productivity growth. We attribute the post-crisis demand shortfall chiefly to the collapse of bank credit, especially mortgage lending, and to fiscal austerity, which together prevented a normal recovery in output.

The magnitude of the UK productivity slowdown exceeds what would be predicted by demand effects alone. This additional decline reflects unusually strong employment growth despite weak output performance. Historically low interest rates reduced financing costs, encouraged the formation and survival of small, low-productivity firms, and may have weakened pressures on firms to rationalise labour. Interest payments by non-financial corporations fell sharply after 2008, boosting profits and further reducing incentives to substitute capital for labour. This combination produced what might equally be described as an employment puzzle: job creation remained strong even as output growth slowed, diluting aggregate productivity.

Although low interest rates and weak productivity growth have been common across G7 economies since the GFC, the experience has varied. Growth in GDP and productivity was fastest in the USA among G7 nations before the GFC and has remained fastest since then. Large fiscal expansions since 2016 and low energy costs supported stronger growth in both output and productivity. The UK entered the crisis with relatively strong productivity growth by international standards, but unlike France and Germany it had never fully converged to US productivity levels. Even so, UK productivity growth since 2007 has exceeded that of France and Italy, and by 2023 productivity levels were above those of Canada, Italy, and Japan. The role of corporate investment is unclear. On the one hand real business investment has risen strongly since the banking crisis and is at a historic high relative to GDP. On the other hand, OECD data in current prices indicates that the UK has moved from having a higher level of corporate investment relative to GDP than most G7 nations to a mid-table position. One issue here is a substantial difference in time trend between the current and constant price series for corporate investment. In UK terms real business investment has risen since the GFC both in absolute terms and as a share of GDP. This is to be expected given the low interest rate regime in this period which among other things boosted new firm formation, but is also likely to be due to a fall in

globalisation. The net outflow of greenfield FDI fell from 10% of UK business investment before the GFC to zero afterwards. Relatively low comparative investment reflects, in part, the relatively small size of the UK manufacturing sector, where capital intensity is highest. Were manufacturing to account for a similar share of output as in Germany, aggregate investment rates would be substantially higher.

These findings yield policy implications that diverge sharply from mainstream consensus. In a demand-constrained economy, supply-side measures aimed at marginally boosting business investment through corporate tax reform are unlikely to yield sustained productivity gains. Instead, policy must prioritise steady, sustainable demand expansion. In the short term, recent measures to ease mortgage-credit constraints provide a welcome demand stimulus. However, because a reliance on household debt risks replicating the fragile, credit-driven growth model that precipitated the GFC, credit expansion can only serve as a temporary bridge.

In the medium to long term, sustainable demand must be anchored in export competitiveness—particularly in high-value services where the UK holds a comparative advantage—and a proactive industrial policy designed to expand high-productivity, capital-intensive sectors like manufacturing. While post-Brexit trade outcomes remain difficult to evaluate due to data collection revisions and the diversion of re-exports, exports of goods have fallen since 2019, much of it due to fuels and chemicals where depletion of North Sea capacity and high energy prices have had a large negative impact on UK production. Policies that will lower future energy prices will help here.

Rapid employment growth has been critically shaped by a structurally elastic labour supply. Post-2008 workforce expansion was sustained by two primary pools: elevated net migration and a marked increase in participation among the 50+ demographic, both primarily absorbed into low-productivity service roles. This structural availability of low-cost, flexible labour reduced pressure on firms to raise capital intensity or rationalize production processes. In this context, institutional labour market interventions, such as higher statutory minimum wages and compliance, can serve an important structural function to raise the floor on labour costs, which compress the space for low-productivity business models and encourage capital-for-labour substitution. Nevertheless, higher productivity growth alone will not resolve entrenched spatial imbalances. While sterling depreciations have improved manufacturing competitiveness, aided by rising wage costs in East Asia, active industrial policy remains essential to establish high-value production activities in former industrial heartlands, a

strategy demonstrated by recent targeted regional renewal programs in the United States.

Overall, the central conclusion is that the UK productivity puzzle is fundamentally a demand issue and employment puzzle, amplified by labour-market and credit dynamics. Sustained productivity growth requires a macroeconomic environment characterised by steady demand expansion involving appropriately calibrated credit conditions. Avoiding prolonged austerity, and hyper-low interest rates are therefore critical. Supportive industrial and skills policies are of course helpful but a lack of these have not caused the productivity slowdown and reforms will not end it. Productivity growth cannot be restored through supply-side reforms alone; it must be supported by a growth regime that generates the demand conditions under which productivity-enhancing investment and innovation are incentivised.

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Appendix A – Key Behavioural Equations

Equation 1. Productivity–output relationship for the UK private sector

The empirical specification estimated via Ordinary Least Squares over the 1972–2023 sample ($N = 52$ observations after adjustments) is given by:

$$\begin{aligned}\Delta \ln \left(\frac{GDPV_{PRIV_t}}{HOURS_{PRIV_t}} \right) = & -1.0514^{***} - 0.1573^{***} \ln \left(\frac{GDPV_{PRIV_{t-1}}}{HOURS_{PRIV_{t-1}}} \right) + 0.1570^{***} \ln(GDPV_{PRIV_{t-1}}) \\ & + 0.5957^{***} \Delta \ln(GDPV_{PRIV_t}) + 0.0042^{***} BR_{t-1} - 0.0045^{***} \Delta BR_{t-1} \\ & - 3.34 \times 10^{-6} * CUMSUM(MIGW)_t + 0.0711^{***} D2020_t - 0.0662^{***} D87_t - 0.0466^{***} D89_t\end{aligned}$$

Key Summary Statistics & Diagnostics:

Explanatory Power: $R^2 = 0.9077$, Adjusted $R^2 = 0.8879$

Model Fit & Error: S.E. of Regression = 0.0093 , Sum Squared Residuals = 0.003653

Overall Significance: F -statistic = 45.87 (p -value = 0.0000)

Autocorrelation: Durbin-Watson Stat = 2.2875

Information Criteria: Akaike (AIC) = -6.3409 , Schwarz (SIC) = -5.9657 , Hannan-Quinn = -6.1970

Log Likelihood: 174.8633

Note: GDPV_PRIV is real GDP in the UK private sector; HOURS_PRIV is total hours worked per week in the private sector; BR is bank rate; MIGW is net migration of working-age people (included here as cumulative migration)

Equation 2 Household consumption function

The empirical error-correction specification for real household consumption estimated via Ordinary Least Squares over the 1989–2023 sample ($N = 35$ observations after adjustments) is given by:

$$\begin{aligned}
\Delta(CV_HI_t) = & 63027.03^{***} - 0.2373^{***} CV_HI_{t-1} + 0.1582^{***} \left(\frac{YDN_HI_{t-1}}{CP_M_{t-1}/100} \right) \\
& + 1.2072^{**} \left(\frac{FASN_HI_{t-1}}{CP_M_{t-1}} \right) + 201159.3^{***} \Delta \ln \left(\frac{HP_MEAN_t}{CP_M_t} \right) \\
& - 0.1880^{***} \left(\frac{DEBT_HI_ST_{t-1}}{CP_M_{t-1}/100} \right) \\
& + 1.40 \times 10^{-7}^{***} \left(NUMLOANS_BOE_{t-1} \times \frac{HMEANADV_{t-1}}{CP_M_{t-1}/100} \right) \\
& - 243769.8^{***} D2020_t + 30413.86^{***} D2022_t
\end{aligned}$$

Key Summary Statistics & Diagnostics:

Explanatory Power: $R^2 = 0.9758$, Adjusted $R^2 = 0.9683$

Model Fit & Error: S.E. of Regression = 8625.78, Sum Squared Residuals = 1.93×10^9

Overall Significance: F -statistic = 130.87^{***} ($p = 0.0000$)

Autocorrelation: Durbin-Watson Stat = 2.5517

Information Criteria: Akaike (AIC) = 21.1799 , Schwarz (SIC) = 21.5799 , Hannan-Quinn = 21.3180

Log Likelihood: -361.6488

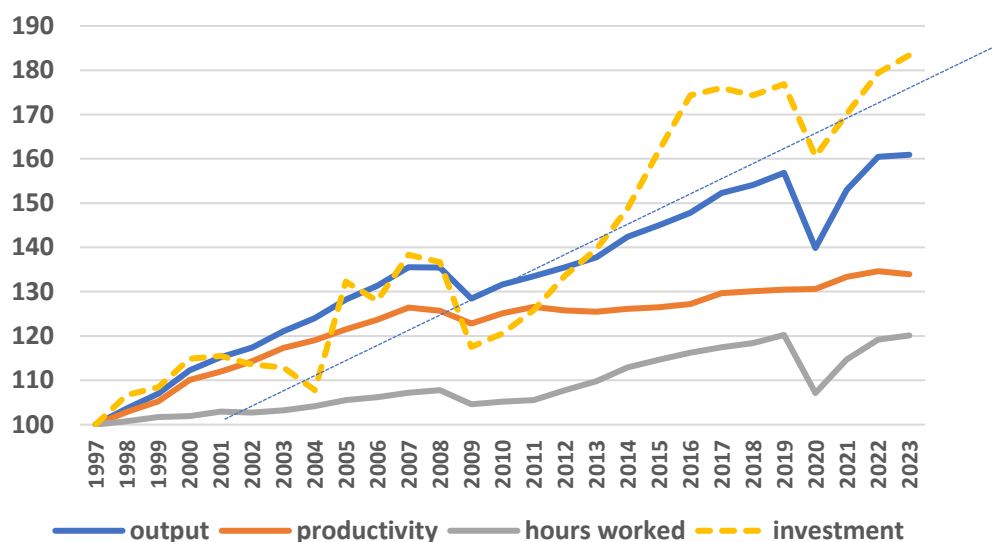
*Note: Significance levels denoted by * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; CV_HI: Real Household Consumption; YDN_HI: Household Nominal Income; CP_M : Household Consumption Deflator (100 = base year); FASN_HI : Household Financial/Net Wealth; HP_MEAN : Mean House Price; DEBT_HI_ST : Short-term Household Debt; NUMLOANS_BOE $\times$ HMEANADV: Total volume/value of mortgage loans for house purchase (Mean advance $\times$ loan count); D2020, D2022: Impulse dummy variables capturing COVID-19 lockdown shock and post-pandemic inflationary/energy shock recovery.*

Appendix B - Productivity, Output, Employment and Investment in Key Sectors

In this Appendix we examine the time trends of four key variables to see how they differ between key sectors. The data is from the ONS but is not revised. Hence, productivity growth is slower than the ONS now believes but until sectoral data becomes available, we do not know how this affects individual sectors. Starting with the whole private sector economy in the UK, the growth of

output and productivity clearly slow after 2007 but employment and business investment grow faster rather than slowing as might be expected (Figure B1).

Figure B1: Time trends of selected variables, private sector, (1997=100)

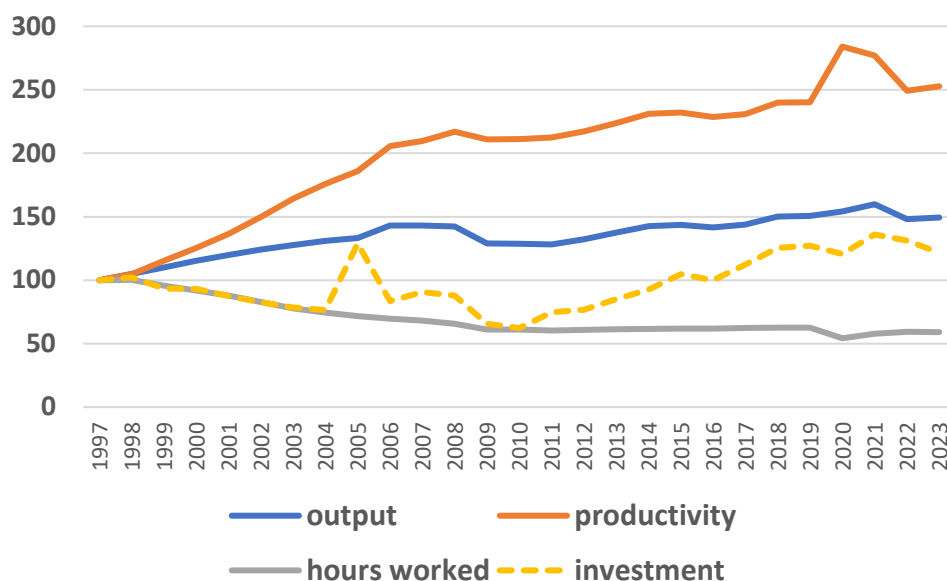


Source of Data: ONS [Output per hour, UK](#) and ONS *Business Investment by Industry*

Manufacturing

In the manufacturing sector the slowdowns in output and productivity are even more marked especially in productivity. At the same time the improvements in employment and investment after the GFC are very clear (Figure B2). There was a marked pickup in investment in 2005, while employment was still falling on its steep pre-GFC trend, but some firms may have been preparing for an influx of labour. A more sustained growth of investment began in 2010 and has continued ever since. This coincides with the change in net FDI. Instead of a net outflow of investment there was a broad balance. We do not know how much of this change was due to manufacturing firms, but it is likely to have been at least half. The suggestion is that the very rapid decline in manufacturing investment and employment prior to the GFC was driven by globalisation. Since productivity rose rapidly in this period, we can surmise that it was low-productivity activities which were being shifted out of the UK most rapidly. Output partially recovered after the deep recession of 2008/9 but peak to peak growth, from 2006-19 fell to only 0.4% per annum compared to 2.8% over the two decades before 2006.

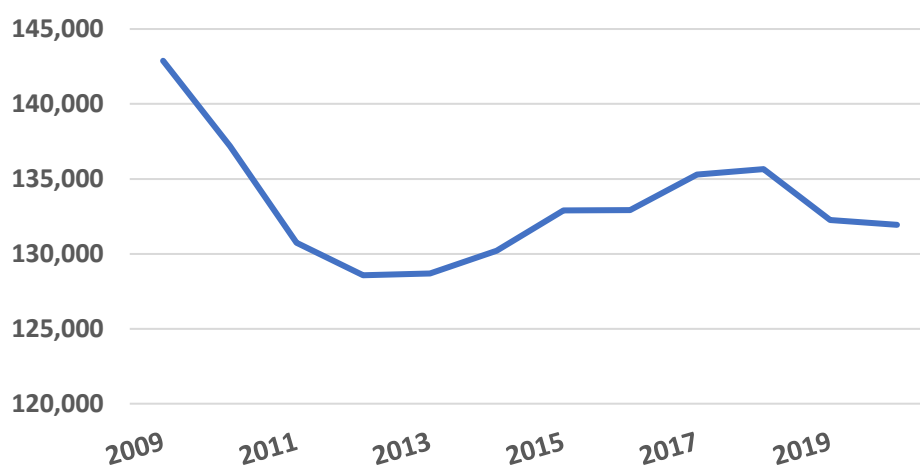
Figure B2: Time trends of selected variables, manufacturing sector, (1997=100)



Source of Data: ONS [Output per hour, UK](#) and ONS *Business Investment by Industry*

There was also a sharp turnaround in the trend of new business formation in manufacturing (Figure B3). From 2012 the number of new businesses rose at a rate of 1000 a year creating perhaps 3,000 new jobs each year. To set this in context, the end of the 40-year collapse in manufacturing jobs occurred in 2010 and since then employment has been broadly flat. The previous annual losses of 120,000 ceased and hence the net turnaround in jobs was much larger than the 3,000 new jobs created in new enterprises.

Figure B3: Number of Enterprises in Manufacturing

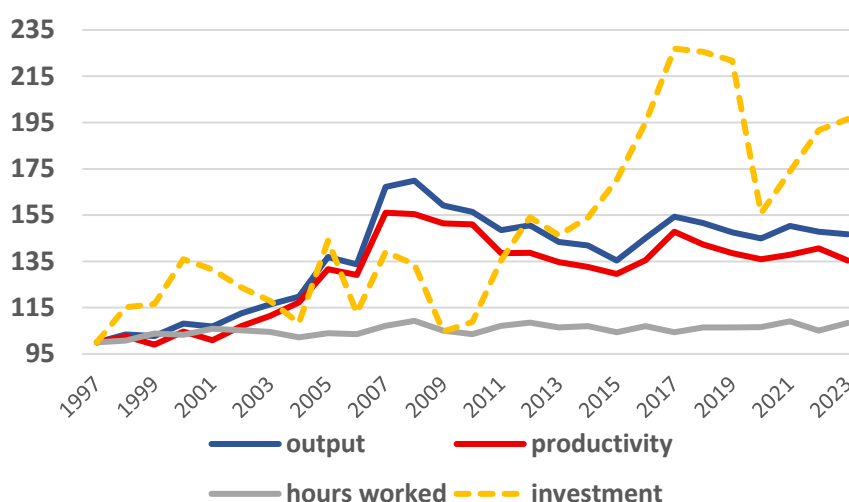


Source of Data: ONS [Output per hour, UK](#)

Finance and Insurance

There was also a sharp turnaround in output growth in the financial sector after the GFC. Previous buoyant growth was replaced first by decline and since the Brexit referendum by stasis (Figure B4). In this sector the path of productivity mirrored closely that of output, and the level of hours work has been broadly stable for a quarter of a century. The pattern is one of a stable employment level with output varying with economic conditions. The reason is mainly a significant change in the structure of the sector. Before the GFC, banking and other credit institutions comprised 60% of sector output but now are only 40%. Real GVA in banking fell by 30% after the GVA and has not recovered, GVA in the remainder of financial services (mainly insurance and pension funds) were little affected by the GFC and is now 50% larger than its pre-GFC peak. The number of people employed in banking, credit and investment trusts (SIC division 64) fell by only 25%. Employment in the rest of financial services (insurance and pension funds) has risen by two-thirds from its pre-GFC peak. The main reason for the sustained decline of banking has been post-GFC banking rules which restrain the growth of credit. The number of residential mortgages slumped by 60% after the GFC and has remained at a third below the pre-GFC peak.

Figure B4: Time trends of selected variables, finance and insurance, (1997=100)

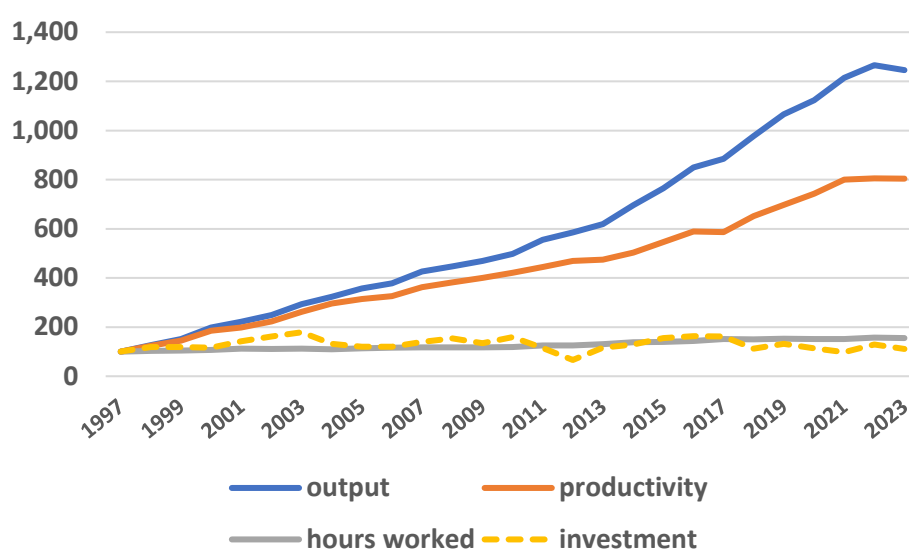


Source of Data: ONS [Output per hour, UK](#) and ONS *Business Investment by Industry*

Information and Communications

The Information and Communications sectors is an amalgam of disparate activities including publishing, films, broadcasting, telecommunications, computing and data processing. Productivity growth over this diverse set of activities behaved closer to a Verdoorn pattern than in most other sectors (Figure B5). Output (real GVA) grew very rapidly before the GFC (at over 15% per annum) while productivity grew only a little slower. The slowdown after the GFC was much the same for output and productivity with a Verdoorn coefficient of close to unity. Employment numbers remained relatively unchanged despite the slowdown in output growth and perhaps more unexpectedly so did real investment. This suggests that investment is tied more closely to employment (i.e. office premises etc. than to output or productivity).

Figure B5: Time trends of selected variables, information and communication, (1997=100)



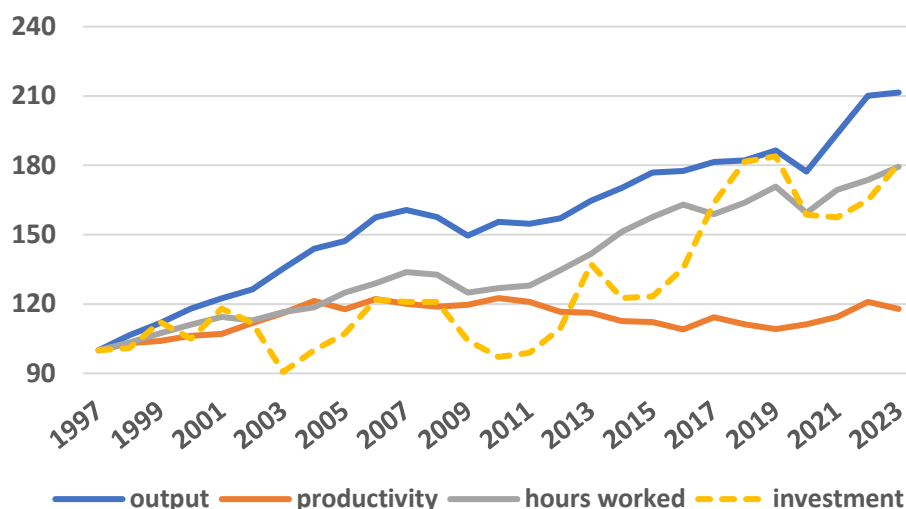
Source of Data: ONS [Output per hour, UK](#) and ONS *Business Investment by Industry*

Professional, scientific and technical activities

The professional, scientific and technical activities sector is large at 6.3% of GDP and considerably larger than financial services. It includes the lawyers, architects, advertising, vets and management and other consultants. Output grew almost as rapidly as financial services before the GFC at over 5% per annum. The growth rate has been half this since 2007, but output did not slump as much as financial services in the GFC recession and unlike financial services has been on a growth track since 2009 (Figure B6). The sector exhibits Verdoorn-like behaviour with productivity growing at a little less than half the growth-rate for output (using

quarterly data to 2025q3). The rapid growth of employment since the GFC has kept productivity growth low despite the high level of investment in recent years. Once again, investment appears to be related more closely to employment (i.e. office premises et) than to productivity-enhancing equipment or research.

Figure B6: Time trends of selected variables, Professional, scientific and technical activities, (1997=100)

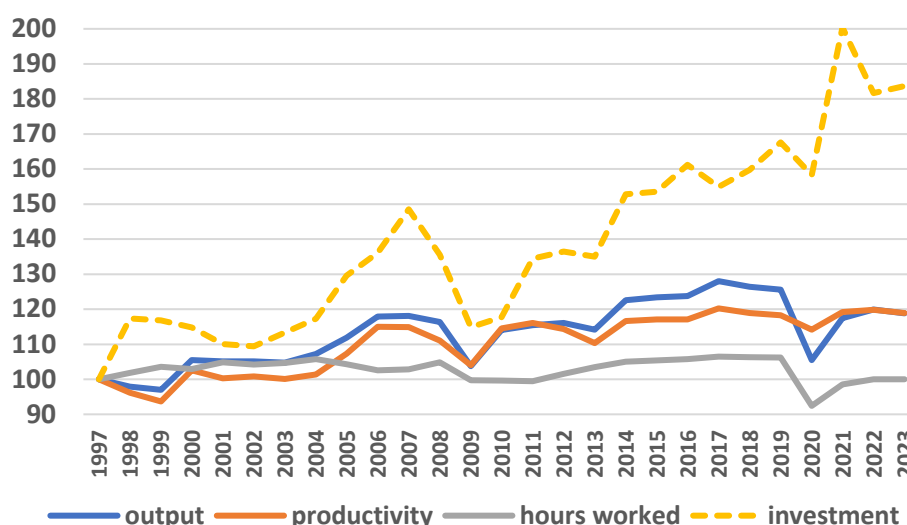


Source of Data: ONS [Output per hour, UK](#) and ONS [Business Investment by Industry](#)

Wholesale and Retail Trade

The distribution section (wholesale and retail trade) has grown relatively slowly over the last quarter century, only temporarily affected by the GFC, and with productivity mirroring output, but more closely before the GFC than afterwards (Figure B7). The change in productivity growth between the two periods was 70% of the change in output growth giving a Verdoorn coefficient of 0.7 and hence close to the international average of 0.5. Employment has close to flatlined since 1997 although it never fully recovered losses in the Covid downturn. Investment however has been much higher in recent years than it was before the GFC.

Figure B7: Time trends of selected variables, Wholesale and retail trade,



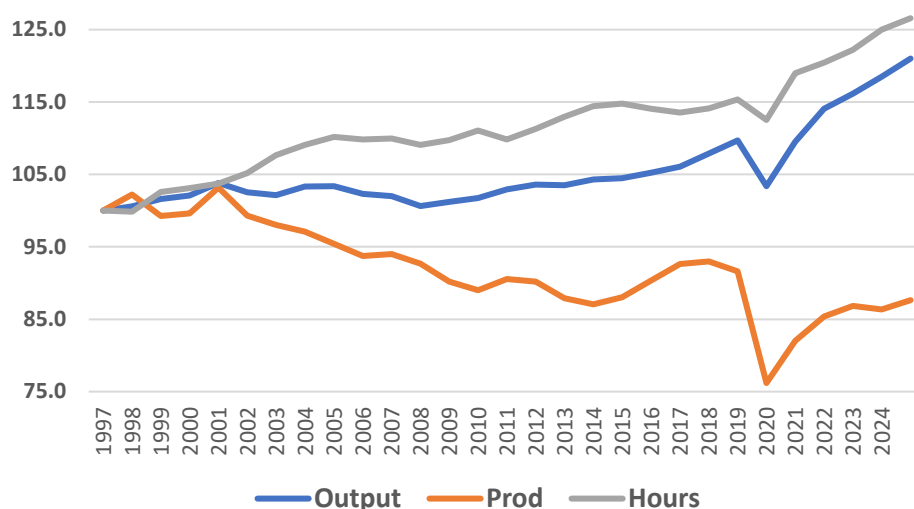
(1997=100)

Source of Data: ONS [Output per hour, UK](#) and ONS Business Investment by Industry

Public Sector Services

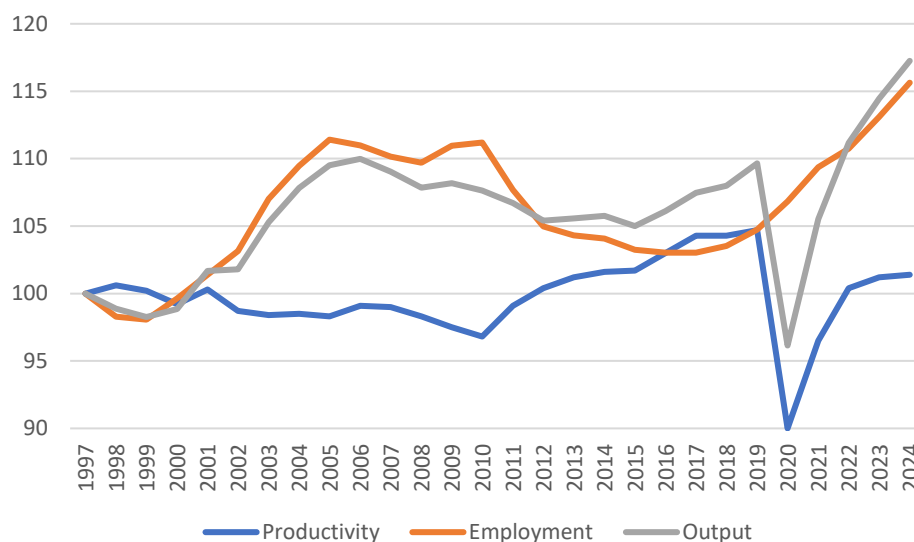
Public sector²⁵ productivity has been flat or falling in recent decades and is thus a drag on aggregate productivity. The chart below (Figure B8) measures productivity in the same way as in the sectors above i.e. by real GVA divided by hours worked. The data covers the public administration, education and health sectors which themselves include small elements of private sector activity. The second chart (Figure B9) is from the ONS Public Services Productivity Bulletins. These use direct measures of output such as number of children taught, GP appointments or hospital operations. The direct measures show a somewhat more favourable productivity trend, but still one that is relatively flat over the whole period. Since output has risen it is not possible to calculate a positive Verdoorn coefficient. In other words, there is no obvious relationship between output and productivity. More teachers or medical staff will generally increase output without altering productivity. In theory, additional investment might raise productivity, but the relevant types of investment are hard to detect within published figures for government investment which includes substantial elements of defence equipment, roads and buildings which themselves have limited impact on productivity.

Figure B8: Time trends of selected variables, Government services, (1997=100)



Source of Data: ONS [Output per hour, UK](#)

Figure B9: Time trends of selected variables, public services, (1997=100)



Source of data: [ONS](#)

Note: Public sector employment from ONS C9KB. Output obtained by multiplying employment by productivity.

Taken together, the evidence strongly supports a demand-led interpretation of the UK productivity slowdown at least for the private sector. Productivity growth declined in most sectors after the GFC in line with the slowdown in output. The decline was greater than in other G7 countries and the puzzle for the UK is why employment growth was generally better after the GFC than in previous years

when output was growing faster. There was little indication that capital deepening has operated as an autonomous driver. Instead, investment responds endogenously to demand conditions and, in some cases, appears to have facilitated employment growth and retention rather than productivity growth. The post-GFC combination of weak demand, ultra-low interest rates, and an institutional environment that enabled employment expansion at relatively low wage levels—particularly in service activities—provides a coherent explanation for the collapse in productivity growth observed since 2008.

Appendix C – Growth rates for GDP and Productivity

This table shows annual average growth rates for GDP and productivity for two periods pre- and post-the GFC. The final three columns show the Verdoorn coefficients for the two periods and for the difference between the two periods. This data is depicted in Figure 6.1.

Table C1: Real GDP Growth, Productivity Growth, and Verdoorn Ratios across G7 Economies

Country	Real GDP (National Currency)			Real GDP per Hour			Verdoorn Ratio		
	1997–2007	2007–2024	Difference	1997–2007	2007–2024	Difference	1997–2007	2007–2024	Difference
Canada	3.18	1.75	-1.43	1.54	0.53	-1.01	0.48	0.30	0.70
France	2.49	0.96	-1.53	1.59	0.34	-1.25	0.64	0.35	0.82
Germany	1.67	0.87	-0.80	1.45	0.61	-0.84	0.87	0.70	1.05
Italy	1.52	0.08	-1.44	0.40	0.01	-0.39	0.27	0.15	0.27
Japan	0.98	0.39	-0.59	1.62	0.81	-0.81	1.66	2.07	1.39
UK	2.82	1.10	-1.72	2.10	0.87	-1.23	0.74	0.79	0.71
USA	3.09	1.97	-1.11	2.31	1.33	-0.99	0.75	0.67	0.88
Average	2.25	1.02	-1.23	1.57	0.64	-0.93	0.70	0.63	0.76

Notes: Data are sourced from the OECD and updated with recent ONS revisions for UK GDP per hour. Growth rates for real GDP and real GDP per hour reflect average annual rates (%), with differences calculated as post-2007 values minus pre-2007 values. For each period, the Verdoorn Ratio is computed as productivity growth divided by output growth. The Ratio Difference is defined as the ratio of the period differences ($\Delta Productivity\ growth / \Delta GDP\ growth$).

Endnotes:

¹ Since undertaking this exercise ONS have revised upwards their estimates of hours worked and hence productivity growth since 1997. We plan to revise this paper in line with the new data when it becomes fully available from ONS and OECD.

² It offers a broad assessment of the UK's prolonged stagnation and rising inequality, advocating higher public investment, greater policy stability, and improvements in education and skills. While persuasive in highlighting structural weaknesses, their analysis pays limited attention to the mechanisms through which these policies would be implemented or to why productivity growth slowed so abruptly after 2008 rather than earlier.

³ The report similarly attributes weak productivity growth to slow innovation, policy uncertainty, infrastructure gaps, skills shortages, regional inequalities, and post-Brexit trade frictions. Many of these constraints, however, are long-standing features of the UK economy and therefore do not fully account for the sharp and persistent post-2008 break in productivity growth.

⁴ The capital output ratio is measured (using ONS data) as real capital stock of public and private corporations (ONS codes mm5r and mm26) divided by private sector GDP.

⁵ The ratio of depreciation (ONS codes mm6n and mm24) to lagged net capital stock in constant prices for all corporations experienced a trend rise from 7.5% to 9.5% between 1995 and 2024. This trend rise reflected changes in the composition of capital stocks in the direction of more short-lived assets such as R&D and computer software plus changes in ONS estimates of useful service lives for some major asset classes.

⁶ Real GDP in the USA grew on a trend of 4% per annum in the decades up to 1973. The trend in following decades after 2007 was 3% per annum punctuated by the oil prices recessions of 1974 and 1982.

⁷ <https://www.gov.uk/government/speeches/chancellor-rishi-sunaks-mais-lecture-2022>

⁸ Data from ONS [Output per job, UK - Office for National Statistics](#) The calculation compares the actual output per hour for the aggregate of all sectors with a weighted average of sectoral output per hour using fixed employment shares as weights.

⁹ To quantify the compositional impact of structural deindustrialization on aggregate capital intensity, consider a counterfactual shift-share exercise. Assuming baseline investment per worker values of 8 in the non-manufacturing sector and 16 in manufacturing, the observed labour share of manufacturing (9%) yields an economy-wide investment per worker of 8.72:

$$\bar{I}_0 = (0.91 \times 8) + (0.09 \times 16) = 8.72$$

If the manufacturing share of total employment had been preserved at 20%, aggregate investment per worker would instead reach 9.60:

$$\bar{I}_1 = (0.80 \times 8) + (0.20 \times 16) = 9.60$$

Holding sectoral investment intensities constant, this structural reallocation implies that maintaining a 20% manufacturing employment share would have generated a 10.1% increase in aggregate investment per employee ($\bar{I}_1/\bar{I}_0 = 1.101$). This highlights the extent to which structural deindustrialization has suppressed macro-level capital deepening.

¹⁰ As far as we know at the time of publication, OECD data for productivity in other countries remains unchanged.

¹¹ The Labour Government relaxed immigration controls from 1997 and allowed free-entry of EU A10 citizens after the accession of the A10 countries in 2004.

¹² In terms of absolute volume, older workers closely mirror the 35–49 demographic, absorbing massive headcount in Banking and Finance (17.6%) and Health and Social Work (15.2%)—with older women anchored in Health (24.3%), Finance (16.6%), and Education (16.4%), while older men disperse across Finance (18.5%), Transport (14.9%), and Distribution/Hotels (12.9%). Conversely, relative sectoral headcount exposes extreme demographic dependency in primary industries: although Agriculture accounts for under 1% of total 50–64 employment, workers aged 50–64 constitute 40.3% of its total workforce, with Energy (33.8%), Manufacturing (33.2%), and Construction (32.2%) similarly exceeding the economy-wide 29.3% baseline.

¹³ To align sectoral classifications between the two censuses, certain categories were merged to calculate changes in employment shares, though minor margins of error may remain due to classification discrepancies.

¹⁴ Since revised sectoral data is not yet available from the ONS, this section uses unrevised data. If the revisions in hours worked per worker prove to be different across sectors the patterns reported in this section will change.

¹⁵ This calculation uses 2024 employment weights for sectors. The difference in productivity growth rates between the two periods are multiplied by the weights to obtain a weighted average difference, which is calculated as -1% in aggregate.

The weight for manufacturing is 0.075 and the weighted growth rate difference is -0.5.

$$^{16} \Delta g_{productivity} = 1 + 1.125 \Delta g_{output}$$

¹⁷ Eggertsson et al (2014) also highlight that while supply-side structural reforms yield long-term gains, implementing them during a zero-lower-bound economic crisis can exacerbate short-run downturns by inducing deflationary pressures and raising real interest rates.

¹⁸ The calculations based on ONS Business demography, UK: 2023.

¹⁹ See Gudgin et al. (2015) and Lu et al. (2023) for model description.

²⁰ See Equation 2 in Appendix A, which is the consumption function within UKMOD.

²¹ The period of austerity 2010-15 is strongly associated with Conservative Chancellor George Osborne. However, the final (2010) Budget under Labour Chancellor Alistair Darling projected a similar level of austerity.

²² Since undertaking this exercise ONS have revised upwards their estimates of productivity growth since 2007. We plan to revise this paper in line with the new data when it becomes fully available from ONS and OECD.
<https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/methodologies/componentapproachtomeasuringlabourproductivityuk1997to2024>

²³ The threshold requirement for registration for VAT is a turnover of £85,000. This equates to businesses with around one employee. Hence almost all businesses with employees are included.

²⁴ Similarly, Nikiforos et al (2026) argue that structural reforms combined with macro-contractionary policies triggered an adverse service transition—reallocating labour away from high-value manufacturing and tradable sectors into low-productivity, low-wage "café economy" in Greece.

²⁵ This is Public Administration, Education and Health and Social Services. Not all of this is in the public sector, but most is.