De-industrialization and the Great Productivity Slowdown: What Comes Next?

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Abstract

Productivity growth in advanced economies has been slowing internationally for many years. Despite much academic research, there is no consensus on why. Many researchers assume a break in productivity growth around 2007-09. This article argues that there was no such break. Rather, the slowdown is a much longer-term phenomenon and is largely an inevitable consequence of de-industrialization. Unfortunately data measurement – especially of productivity - remains biased towards a now small manufacturing sector, rather than the dominant services and digital sectors. Whatever policies are pursued, manufacturing will continue to shrink as a share of value-added and the measured productivity growth trend will continue to slow. Policy needs to look forwards, not backwards. That means a focus on welfare improvements, not GDP growth and investment in the new technologies and growing sectors, not a doomed fight to restore the manufacturing glories of the past. Investment policies should support critical digital networks, especially to support services such as health and education which are key to productivity in the services sector. Investment is also needed in the transition to net zero to address the climate crisis. These developments would be growth positive and may stem the measured productivity slowdown for a time.

The trend in productivity growth has been slowing in most advanced economies for many years, leading to slower than expected output growth. The slowdown has been especially noted in the United Kingdom where it has been a research focus for at least 15 years. In 2022, the United Kingdom established an academic-led Produc-

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tivity Commission, echoing initiatives in at least 10 other countries (Pilat, 2023).

Despite an extensive academic literature, there is no agreed understanding of why productivity growth has slowed internationally, nor why the United Kingdom has underperformed (Goldin *et al.*, 2022), nor even when the productivity slowdown started. The United Kingdom has been investing less than other countries on a national accounts basis but there is no consensus on why that has happened either. The problem is nicely summarized by this BBC news report (Islam, 2023):

> "The future of the economy and prosperity depends on investment spending. The United Kingdom has an underinvestment crisis, and it affects both the private and the public sector."

The United Kingdom was in second place in the G7 for private investment, as a share of the economy in the mid-1990s, but has now fallen behind the rest. The long-term impact of this is low productivity - we take more time to produce less than our rivals - which results in low growth, low real wages, and then problems raising money for public services.

This article takes a fresh look at some of the underlying issues. It argues that the long-term slowdown in productivity growth results naturally from the inevitable de-industrialization of advanced economies, as they become dominated by their services sectors. The slowdown can therefore be expected to continue for the foreseeable future. The arguments can be viewed as drawing on the classic "Balassa-Samuelson effect" (Balassa, 1964 and Samuelson, 1964) and the "Baumol disease" (Baumol, 1967) but go somewhat further.

This article contains seven sections. The first section considers when the productivity slowdown started. Many analyses start by assuming a break point during the Great Financial Crisis (GFC) of 2007-09. This article draws on a publicly available historical database to suggest that the slowdown in advanced economies has been more gradual, stretching back perhaps 50 years for the United States and at least 25 years for the United Kingdom. The assumption that there was a break point around the GFC, rather than a longer-run structural change, may have hindered previous analysis.

Section 2 addresses the causes of the productivity slowdown. Most of the existing literature does not attempt a root-cause explanation, rather it documents and accounts for the slowdown in differing dimensions, without 'solving the puzzle'. In contrast, a simple explanation based on naturally evolving economic structure following de-industrialization, appears to account for much, if not all, of the relevant patterns in the data. The proposition that the developed economy productivity slowdown is a natural consequence of the economic maturity of industrialization has been made by others (e.g. Vollrath, 2020), but in the United Kingdom the long-term process may have been obscured by events: the demand boom of 2002-2007, the GFC from 2007-2009, exit from the EU from 2016 onwards, and the Covid-19 pandemic from 2020 and its inflationary aftermath.

Section 3 contrasts the slowdown with what has been happening to broader living standards. The slowdown in productivity and GDP growth seems inconsis-

tent with the IT revolution that has dramatically changed the way we all live. GDP is likely becoming a less good proxy for changes in living standards. In part that is because the national accounts do not capture well the productivity improvements of many service sector industries. Given the clear benefits to living standards from the growth of IT, investment policy should prioritize the digital economy through the rapid improvement of digital networks. That would enable the service sector to thrive.

Section 4 considers some public policy issues. If nothing else, slower output growth as a result of slowing productivity growth, creates problems for the fiscal position: Governments rely on economic growth to finance growing stocks of sovereign debt. Many countries are now faced with rising sovereign debt: GDP ratios which may cause future funding crises. Can growth be restored to its former rate? What sort of investment does policy need to promote and support? How can growth in living standards be maximized?

Section 5 looks at selected sectors where higher investment in services could produce improvements in living standards, with a focus on education and health. Investment in people is the key to support many service sector businesses, even if not counted as such in the national accounts. That investment should draw heavily on the opportunities provided by the digital transformation.

Section 6 considers the one further policy area in which investment might stimulate at least a temporary return to higher growth: The transition to net zero carbon emissions. To deliver and utilize new supplies of secure, plentiful renewable energy, will require huge investment in infrastructure and changes to industrial and commercial processes that could boost productivity and output growth. Section 7 concludes.

This article is not anti-growth, nor is it intended as a counsel of despair. The constructive recommendations are that policy needs to focus on the maximum sustainable rate of growth going forwards, given the evolving economic structure, not trying to recreate or even compare with past performance. To do that, policy needs to support investment that supports the services sector, especially the growing digital environment, with the aim of more sustainable, healthy economic growth, and to focus on improving living standards rather than the production of 'things'.

When Did the Productivity Slowdown Start?

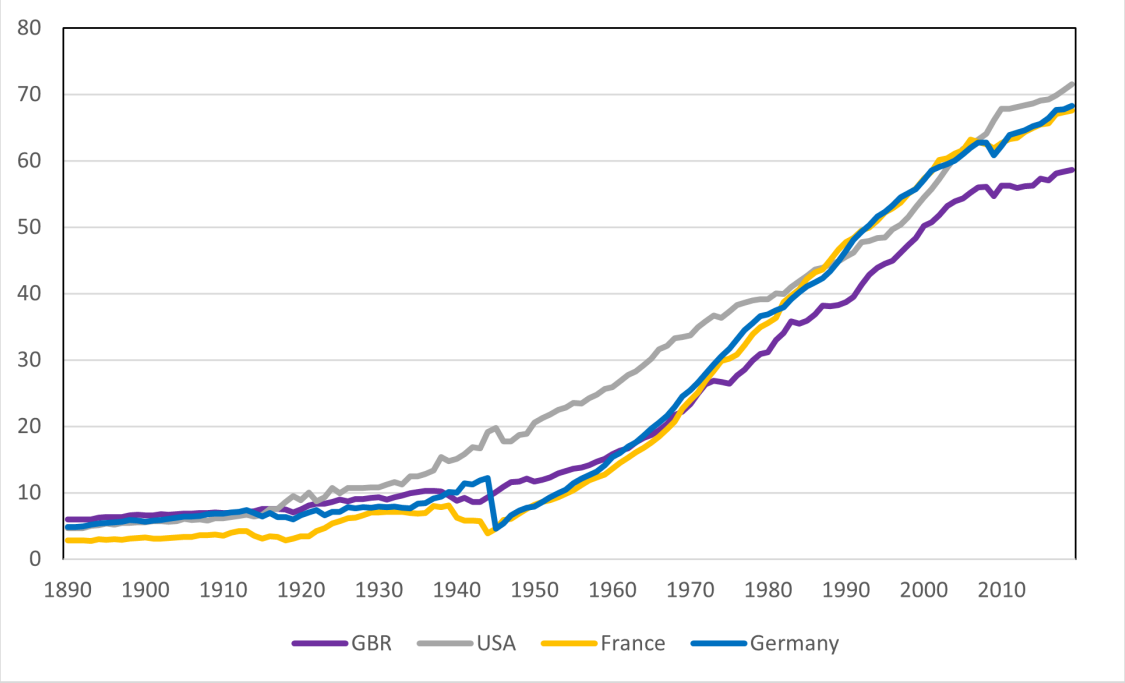
There has been a slowdown in productivity growth amongst the world's most advanced countries, since at least the GFC of 2007-09. This is shown in Chart 1, which replicates a chart from the UK Productivity Commission's first evidence review (Productivity Commission, 2022).[2]

Panel A of Chart 1 is potentially misleading. When comparing productivity levels over the long term these are two consid-

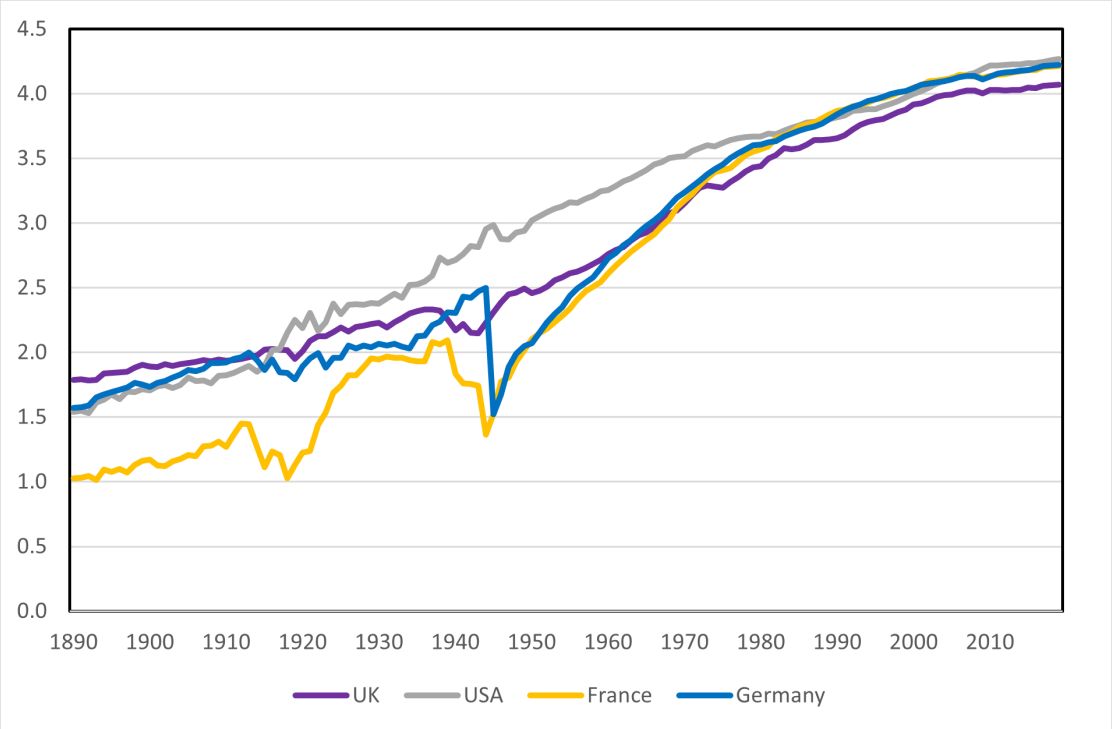
2 Chart recreated here uses data from version 2.6 of the database published online by Bergeaud *et al.* (2016) which was updated after the PC 2022 report.

Chart 1: Productivity Growth Slowdown in Advanced Economies, 1890-2019

Panel A: Output per hour (expressed in $US 2010 ppp)



Panel B: Output per hour (expressed in logs)



Source: Calculations based on the public database underlying Bergeaud *et al.* (2016).

erations. First, the challenges of data measurement are severe, within each country over time and especially across countries. These data have been meticulously calculated and are probably the best available, but such data - like most macroeconomic data - are always only estimates. Confidence intervals are not available, and we have little idea how accurate the numbers really are. For example, the data are constructed using estimated purchasing power parity exchange rates to enable international comparisons.

Second, the data is non-stationary, and this distorts one's visual interpretation. Charts of absolute (index) levels for over a century mean that proportionately larger differences in the distant past look small relative to more recent data. The conventional solution is to use a log transformation, as shown in Panel B of Chart 1, so that a given percentage change or difference is seen to be the same magnitude at every time point.

The difference in visual interpretation between the two panels of Chart 1 is striking. The peak in US productivity growth for example, is shown in Panel B of Chart 1 to be around the late 1960s, not immediately prior to the GFC as in Panel A. There is no clear break point in Panel B, with the GFC appearing as a small blip. Panel B of Chart 1 thus suggests that the slowdown in productivity growth has been more common across countries, and much longer lasting than generally appreciated. Recent differences between countries are important but not as historically unusual as often assumed, even before allowing for the uncertainty in comparative estimates.

As an example of other evidence, Tenreyo (2018: Chart 3 and 6) demonstrates very clearly, that the peak in UK productivity growth was around 1970 and that it has been declining since then, albeit not smoothly. But unfortunately, the analysis of why (including sectoral compositions), as in many other papers, focuses only on much shorter periods where events at a cyclical frequency dominate. The United Kingdom does appear to have slowed more than the United States, Germany or France. The thesis advanced in this article is that the slowdown is a consequence of economic maturity in general and de-industrialization in particular. The United Kingdom was the home of the Industrial Revolution and may be at a more mature stage of post-industrial economic development than others. Rather than being an outlier, the United Kingdom may indicate the shape of things to come elsewhere.

The dating of the slowdown in the United Kingdom and the United States, is complicated by the fact that, prior to the GFC, both countries had long-lasting aggregate demand booms. That was not evident in inflationary pressures over the period, but it can be seen in growing current account deficits (as a share of GDP).[3] Those deficits were matched by capital inflows, which likely helped to fuel the expansion of the banking systems in both coun-

3 The US current account deficit as a share of GDP reached 6 per cent in 2006, its biggest ever. The UK deficit had been on a long-term (but cyclical) worsening trend since the 1960s and reached 3.9 per cent by 2008. It subsequently reached 5.4 per cent by 2016 before finally recovering to 2.4 per cent in 2024.

tries and hence contributed to the eventual financial crisis.

When looking at productivity or output trends, one should not extrapolate economic performance forward from a single peak of a boom (or bottom of a trough), especially when the booms are long and the peaks are high. But this is commonly done. A frequent approach is to look for a structural break around the GFC of 2007-09. Examples include Riley *et al.* (2018) and Barnett *et al.*, (2014). The latter calculate the pre-crisis trend growth in labour productivity between 1997 Q1 and 2008 Q1, and project that forward from 2008 Q1. This extrapolates a trend which is too strong, starting from a peak, and thus creates a much bigger 'productivity puzzle' than there really is. Fisher (2024) shows that alternative trend assumptions can almost eliminate the existence of a UK-specific puzzle, at least up to the start of the Covid-19 pandemic in 2020. The pandemic has clearly affected comparisons of growth since 2020, and the United Kingdom's exit from the European Union will also have had an ongoing impact on both productivity and output. These near-term events may well obscure the underlying trends for some years to come.

What Caused the Productivity Slowdown?

Much of the productivity literature does not attempt a root cause explanation of why advanced economies are slowing down, nor why the United Kingdom would be underperforming. Rather, research tends to describe or account for it by identifying patterns in the data.

Coyle (2023) offers a summary of research on the apparent weaknesses in the United Kingdom's performance relative to peers, including: [4]

- weak Total Factor Productivity (TFP) growth, from under-investment and lack of capital deepening (Carella *et al.*, 2023);
- a low-level of Research and Development spending (Jones, 2022);
- under-investment in intangibles (Corrado *et al.*, 2022, Goodridge and Haskel, 2022);
- extreme United Kingdom differences in regional/spatial productivity (Tilley *et al.*, 2023);
- wage flexibility leading to less automation (Pessoa and Van Reenen, 2014);
- lack of inward investment (Driffield *et al.*, 2021);
- over-centralization of institutions (Westwood *et al.*, 2021);
- a lack of public investment in education (Nelles *et al.*, 2022);
- a shortage of technically qualified graduates (Stansbury *et al.*, 2023);
- insufficient infrastructure investment (Coelho *et al.*, 2014); and
- welfare spending (Driffield *et al.*, 2022).

This selection is not exhaustive of the explanations on offer. For example, over-regulation and high taxes are often cited by business and popular media.

This article does not take a view on the relative merits of these propositions, many

4 This is a selection of references: apologies to those not included who wrote about the same topics.

of which are well-researched, important observations and all of which have strong supporting evidence. They contribute significantly to our understanding of many aspects of productivity, but even collectively, they do not appear to have reached any consensus on the root causes of its slowdown.

In this article we draw two working conclusions from the existing literature: First, despite the slowdown being an international phenomenon, and the measured United Kingdom under-performance persistent, there is no single cause that has been identified to convincingly explain either. At best, there is a long list of candidate explanations. Second, the explanations offered seldom amount to root-cause explanations. Rather they account for or document the slowdown and locate it in a particular dimension – which is useful - but they do not provide causality. For example, to explain that low productivity has been caused by low TFP, or weak investment, or reflects weak regional performance simply relocates the underlying question. To claim causality, one would need to identify the original shock and/or the fundamental economic and social forces at work.

Economic policy is much more likely to be effective if one is sure of the root cause(s) of the problem. Otherwise, the risk is of addressing the symptoms only. Alleviating symptoms may be worthwhile, and this article does not take issue with many of the policy recommendations that have been made, which can be justified on grounds other than productivity growth. But policy is failing to address the fundamental productivity objective.

Structural Explanations for the Global Slowdown

One hypothesis for the slowdown is that there is a lack of ideas that can be translated into investment opportunities (Bloom *et al.*, 2017). That hypothesis appears to be quite widely cited but does not sit easily with the internet-based revolution over the past quarter century which has visibly transformed the way most people work and live. Nor is it a root cause explanation unless one can explain why the lack of ideas has occurred. Nevertheless, it is worth bearing in mind as it could be consistent with the explanation advanced here.

This article argues that there is a very straightforward but uncomfortable explanation for why productivity is slowing down. As economies industrialize and then de-industrialize, their structure changes. First away from agriculture and to manufacturing (supported by services as an intermediate input). Then from manufacturing towards services as a final-expenditure item. Additionally, we now see many services becoming digitalized.

As an economy moves from manufacturing to services to digital, it follows that measured productivity growth will naturally slow and so will gross fixed capital formation (GFCF) measured by the national accounts as investment. There are good reasons related to economic dynamics for why this compositional shift occurs. One can think of this as a simple 'S-curve' model of economic development.

Essentially, whether production of a good or service has high labour productivity growth depends on the extent to which labour can be substituted by machines and

that is less easy to achieve – and hence a slower process - in many service sector industries, especially where the actions of an individual person is the essence of the service provided (much of entertainment, hospitality, beauty, etc). This is the essence of the 'Baumol disease', although that has been interpreted rather narrowly by many: It is certainly not a disease, as interpreted here it is simply part of economic maturity.

As an economy industrializes, investment in more complex plant and machinery made possible by previous advances drives manufacturing productivity up and relative prices down. Simultaneously, the growth of employment in manufacturing (away from agriculture) increases the real incomes of workers. As relative prices of manufacturing goods fall, and income rises, demand for manufactures increases. Thus, the market for goods expands, facilitated further by international trade. Through the Balassa-Samuelson effect, an increase in wages in the tradable goods sector will also lead to higher wages in the non-tradable (service) sector even if productivity growth is not replicated, adding further to demand. The process of productivity improvement in manufacturing is self-reinforcing. New processes create the technology to support more efficient production techniques, 'standing on the shoulders of giants'. Total manufacturing production and employment can rise alongside strong manufacturing productivity growth.

Eventually there are both demand and supply limits. The market for goods will start to become saturated. Even if total demand continues to rise alongside real incomes, it will no longer keep up with the rate of technical progress in production. At that point the manufacturing sector maintains its productivity growth by first slowing workforce growth and then by shedding workers. New generations of workers are absorbed by the growing services sector. Over time the service sector displaces the manufacturing sector as the dominant source of value added - whether measured as output, income, expenditure or via employment. This has happened in all developed countries.

In 1970, UK manufacturing was over 30 per cent of total output. By 2024 it was just 8.6 per cent. It was 10.0 per cent in the United States (2024), 9.7 per cent in France (2023), 18.5 per cent in Germany (2023) and 19.2 per cent in Japan (2022).[5] In all these countries, the sector shares have been declining on trend for some considerable time, with expenditure on goods being outgrown by services and with the remaining domestic manufacturing often being displaced partly by imports. There have also been upward trends in public sector output which is predominantly services.

In 2024 UK manufacturing investment was around 15 per cent of business investment, but the latter is just over half of total investment meaning that manufacturing investment was only around 8 ½ per cent of GFCF. And manufacturing employment was only around 8 per cent of total UK employment. Productivity in the service sector does improve over time. But service sector output is conceptually more

5 Sources: FRED database St Louis Federal Reserve, OECD data and national statistical offices.

difficult to define, harder to measure and can be harder to value. As an example, the contribution of financial services to the national accounts is known to be extremely difficult to estimate. Financial income and expenditure can depend on the price fluctuations of financial assets and the units of output are not well-defined.

Output (and hence productivity) measurement can be particularly problematic for public services where the price is not set by market forces and/or there may be no measured price at all (e.g., most UK education up to age 18 and many public health services).

In the United Kingdom, the Office for National Statistics is engaged in extensive work to improve public sector productivity statistics to incorporate quality-adjusted measures of output (Heys, 2025). These are much more difficult to estimate, less timely and do not have a long history. As well as services increasing in final expenditure, one of the accompanying trends to deindustrialization has been that value-added in manufactured goods is increasingly being provided from inputs classified as services.

There have been many stories over the years comparing the retail price of a fashionable pair of training shoes with the manufactured cost (e.g. Solereview, 2022). A reasonable estimate seems to be that an Asian producer receives only about 20-25 per cent of the western retail price. Most of the cost goes to a variety of input services from elsewhere such as design, transport, marketing and sales (plus taxes and profits). Even within a producer's share of cost, factories will have bought-in or in-house services which make the true 'manufacturing' share of value added less than recorded. An extreme case would be where the actual shoe production was person-less but there could be a growing number of high-value people involved in providing the input services to the final retail item.

As manufacturing processes continue to become ever more automated, that is likely to result in ever-diminishing value added. This process is not new or unique. It is broadly what happened to agriculture after the industrial revolution. Agriculture in the United Kingdom was once very labour intensive – in 1600 it accounted for about two thirds of the male workforce (Wallis *et al.*, 2018). It has now become highly mechanized and counts for just 1 per cent of total UK employment – and only around 0.7 per cent of GDP, even though the United Kingdom clearly produces vastly more food now than it did 400 years ago. Manufacturing value-added will continue shrinking as a share of value-added in advanced economies, under the force of its own relative productivity growth.

It is worth noting that the structural changes described here as the source of the productivity slowdown are fundamentally driven by changes in supply, embodying improved production processes to automate. Of course, demand patterns also change, but the process of manufacturing becoming ever more efficient until its value-added share declines does not require any exogenous changes to demand preferences.

Summary of the Model

Given that any theory or model is only as useful as its explanations of the world, we can ask what this simple S curve model of

development would help explain. It would suggest the following:

- The productivity slowdown would not be consistent across sub-sectors which are at different stages of maturity.
- The slowdown would not start at an identifiable fixed point in time – it would happen slowly unless accelerated by a shock. There need be no break point.
- The slowdown would not occur at the same time in all countries - which differ in economic structure and work cultures. But it would become observable in all advanced economies as they matured.
- Manufacturing as a share of value added will continue to decline and hence the measured productivity slowdown will continue.
- It could explain the United Kingdom as an early case. The United Kingdom was the first to have an Industrial Revolution and was one of the first to experience widespread de-industrialization.
- Studies looking for some other exogenous factor(s) to explain a 'sudden' slowdown would not find one, but their results should all be consistent with the de-industrialization narrative.

The history of the past quarter century, and most of the current research literature, would appear to be consistent with these predictions of an S curve development model, but more work would be needed to investigate it thoroughly, ideally through testable propositions not considered here.

Productivity and Living Standards

Over 35 years ago, Robert Solow astutely observed that 'you can see the computer age everywhere but in the productivity statistics' – itself evidence that the productivity slowdown started a long way back. The period since then has seen one of the most astonishing transformations in human existence. The creation and expansion of the internet, personal computing and finally smart mobile devices, means that there has been a massive change in the way people live. It is still changing. Transportation, communications, entertainment, education, how and where people work, how they socialize and even meet life-long partners. And this is pretty much available to everyone.

In the United Kingdom, as of 2024, some 94 per cent of the adult population are estimated to have owned a smart phone. In 2023, smart phone ownership ranged from 80 per cent of the over-65s to 98 per cent of the 16-24s. Going back to 2008, those numbers were 4 per cent for over-55s and 29 per cent for 16-24s. Of course, the 6 per cent or so of adults who do not have a smart mobile device is a considerable number – 2.5 million individuals in the United Kingdom – although many of those might have access to the internet through other channels.

With the prevalence of mobile computing devices, so much has changed – home shopping deliveries, ticket purchases for travel or entertainment, car parking, banking and other finance, television, life-long learning, the list is long. The 'productivity' of individual human activity has changed in dramatic fashion. And many more improvements are still possible as other services become digitized. Yet the data suggest that this transformation has happened at the same time as the unprecedented

slowdown in productivity growth (Van Ark *et al.*, 2023).

How can one reconcile these two observations? The answer may be partly in mismeasurement. As noted previously, there is an inherent difficulty in quantifying the quality of services and hence their true price (Coyle and Mei, 2022). Another possibility is network effects: It is not the smart phone alone which delivers benefits to consumers, but the services that the device gives access to. Mobile computing devices are frequently used for accessing social media. The average social media user is reported as spending over 15 hours a week doing so (Kemp, 2024). This activity does not involve much marginal cost: some electricity and the cost of data allowances if not connected to wi-fi. There are some fixed costs for access to hardware and software.

GDP was never designed to measure living standards and the past 15 years may be evidence of a greater disconnection between the two, as consumers place less value on owning 'things' and more on experiences. This topic has been explored by McAfee and Brynjolfsson (2017), amongst others. Given this conundrum, what can one say constructively for policy? People's digital access should be prioritized if that is where societal benefits can most readily be achieved i.e. in virtual networks rather than physical networks. The government's job should be to make sure that the national digital infrastructure is close to the frontier, reliable, comprehensive regionally, that the systems are safe to use, that consumers are well served (e.g. preventing monopoly pricing) and that government itself takes advantage of the opportunities to improve its own productivity.

There is a tax issue. A huge amount of personal utility is being generated by social media with very little monetization and hence little tax revenue, and not just because of the large corporations which manage their tax liabilities internationally. The main form of revenue generation for social media platforms appears to be advertising. There is also a monetizable gain by tech firms in the value of consumer data which allows targeted behavioural research to underpin advertising, product design, and sales.

To make sure governments can pay for public services, they need to consider their tax policies in relation to digital services. As an example, it would be worth considering whether some digital services need to be taxed regardless of whether they are commercially monetized. A tax of 1p/1¢ for every individual digital event (posts, mails etc), would probably solve any government's tax revenue challenges. To avoid voter distress, such a tax should be imposed on social media owners and related platforms directly, rather than on their individual users. This can be justified in part by the costs of policing social media to investigate and prevent abuse. Taxation of service providers based on usage would likely force more explicit charging for consumers, which could have some benefits such as reducing anti-social usage.

Public Policy Issues

Given that slow productivity growth is creating public policy problems in all advanced economies, we have seen surprisingly few attempts to directly improve supply-side performance of the economy.

In contrast, there have been persistent attempts since the GFC to stimulate growth through unconventional monetary policy alongside growing fiscal deficits – the latter sometimes as an unplanned consequence of low growth outcomes.

Given that the productivity slowdown is fundamentally a supply-side issue, demand expansion would never be an effective or sustainable policy response. One should not look to monetary policy or the fiscal stance as a cause or a solution. There are certain structural aspects - the size of the public sector, its investment content, how efficiently it is organized, and the level and incidence of taxation - which are all relevant. We do not address those detailed fiscal issues here, as they are relatively well-researched. We focus instead on the extent to which public policy can interact with the structural issues created by a service-sector economy.

Is Exponential Growth Sustainable?

It is quite common in economic studies to assume that the average growth rate of output over the past can be extrapolated into the future as a benchmark (e.g. NIESR, 2025, Figure 1.1). But there is no economic rationale for why output growth should be a constant parameter. The most basic theories of growth break down the driving forces into growth of the labour supply and technical progress. These elements change slowly, and for short-term analysis can be assumed to be exogenous to the problem, but neither is necessarily constant. Fisher (2024) explores some of the limits to population and workforce growth. Here we ask whether output can keep growing exponentially.

Suppose an advanced economy grew at 2 per cent per year. At that rate, output doubles every 36 years and quadruples every 72 years. Clearly, that could not be reflected in the quantity of 'things' being produced. Many of the Earth's physical planetary boundaries are already either under stress and possibly broken and there are forecast shortages in key materials (rare earth metals for example). Manufacturing may come increasingly to depend on the circular economy: reuse, refurbish, repurpose, reclaim, and recycle.

Market forces will also ensure that patterns of demand and supply shift away from those materials which are in scarce supply: their relative prices will rise, making the circular economy more attractive. Overall, it seems optimistic to think that manufacturing growth can always remain positive. A continued expansion of services is much more likely than manufactures, with services being bounded more by labour supply and energy than raw materials. The widespread adoption of artificial intelligence (AI) could boost the productivity of services and lift labour constraints. A combination of renewable and nuclear energy, and new energy storage technologies, could lift what would otherwise become a hard constraint on energy supplies, without contributing to greenhouse gas pollution.

Could Policy 'Stop the Rot'?

If a natural process of de-industrialization leads inexorably to a measured productivity slowdown, would it be possible to adopt policies to preserve the status quo or even reverse that

trend? Unfortunately not. Unless one could somehow prevent manufacturing becoming more productive, it will inevitably 'eat' its own value added. Responding with attempted demand expansion could make outcomes for output and incomes worse over the medium-term. Initially, excess demand growth creates inflationary pressures and/or trade deficits. Growing imbalances in the economy eventually need to correct. If not policy-induced then eventually such demand bubbles collapse under their own weight. Macroeconomic policy analysis long ago concluded that over the long-run, it is the supply-side of the economy that determines the sustainable rate and level of output (albeit subject to second-order hysteresis effects).

This should not be taken as the 'politics of despair', nor of an 'anti-growth' agenda. Rather it argues for focusing policy on what is beneficial looking forwards not backwards, and on improving living standards, not the quantity of things.

It might be possible to close gaps in productivity levels between countries, but not by following policies which worked for the historical economic structure. For example, promoting domestic manufacturing of steel, cars or electrical goods and agriculture might be beneficial on economic security grounds but would no longer employ many people. The shares of manufacturing or agriculture in an advanced economy will never return to what they once were. With that in mind, promoting investment remains a crucial economic policy, and governments need to take a more imaginative view of what is needed to support the evolving economic structure.

The Digital Infrastructure and Working from Home

As noted in Section 3, to facilitate structural change and maximize the benefits from new technology, governments need to encourage investment in the digital infrastructure, including cloud computing and AI. One benefit is the growing ability of people to work from home (wfh). In 2019, 4.7 per cent of UK employees worked from home. By end 2024, 13 per cent wfh all the time and another 27 per cent for part of the time.[6] And even at the office many business meetings now happen through video conference calls rather than require travel.

Wfh is popular amongst many staff as it reduces the costs and stress of commuting, can sometimes allow more focus on work without distractions by colleagues, and can facilitate flexible engagement with domestic duties such as child or healthcare. For employers, it can result in reduced need for office space and less time wasted in travel delays.

On the downside, wfh can miss out on many of the productivity benefits from working together with colleagues in an office, including training, knowledge sharing, and culture. And for some people it is important to detach work from domestic surroundings.

Productivity losses from wfh do not have

6 Source: Forbes: UK Remote and Hybrid Working Statistics, 2025 available at https://www.forbes.com/uk/advisor/business/remote-work-statistics/.

to be accepted. Some people work from home still have poor IT equipment and/or are using unfriendly software, badly. Investment and training could resolve that, whilst better software and hardware to support instant inter-staff communication could improve staff knowledge sharing and training relative to a crowded office.

New work processes designed for a domestic environment deserve more attention and investment. Workflow management techniques could be substantially improved: Monitoring staff working remotely could be made more efficient than patchy manual oversight in a large office.

As noted when discussing healthcare, improved efficiency comes from altering existing processes to adapt optimally to new technology, not the reverse. And even if wfh does not always work everywhere for everybody it can be made to work well for many.

There are indirect consequences of wfh which could greatly change the economy. More people working from flexible locations takes some of the pressure off the transport network. It would also shift demand from facilities based in cities (retail, catering, health) to those in suburbs, feeder towns or even remote locations. This may lead to a boost in regional investment – and not solely in regional cities.

The 'return to the office' policy in its extreme form is a 'return to the past' mentality, often driven by concerns about reduced worker commitment. But it could also reflect the fact that most executives and managers do not have career experience in wfh and have not been trained in how to optimize wfh or hybrid working and do not feel confident in doing so. It is the senior staff who may be the biggest obstacle to productivity gains.

What Sort of Investment Do We Need?

The BBC report cited earlier (Islam, 2023) noted the following:

> "This spring, Mr Hunt (The UK Chancellor of the Exchequer in early 2023) announced a new scheme to allow every pound invested by businesses in **IT equipment, plants or machinery** to be deducted in full from taxable profits" (this author's emphasis in bold).

The investment needed to support services can be quite different to that needed for manufacturing. In the national accounts 'investment' is largely fixed capital formation. Historically, economic analysis of the business cycle - such as the accelerator model of investment - had a physical production context in mind in which there is a large element of fixed capital.

Policy needs to reconsider the nature of the investment required in the face of structural change. An old-fashioned focus on plant and machinery is irrelevant to most of today's service sector businesses. The service sector is not homogenous, and investment patterns differ, but investment in people is common for professional work at least. Investment in communications, advertising, and commercial premises may also be more important than machines that produce things. Investing in networks such as cloud computing or AI use, are more important than simply buying IT equipment (Andrews *et al.*, 2020). And the nature of

commercial premises is changing to include professional workers' own homes.

A lot of such investment spending by the service sector, including training, is not fixed capital and hence not recorded as investment. It is not surprising that GFCF is slowing down as a share of total final expenditure if it excludes concepts of investment spending which are especially important to the growing services sector.

Current measures of GFCF reflect 'produced capital' and so do include some intangibles including brand names, software and databases, research and development, mineral exploration and evaluation, and entertainment, literary and artistic originals and other forms of intellectual property. But they do not generally include investments in human capital, natural capital or social capital (Coyle, 2023). Such estimates can be made and are available from academic research but are not yet part of official statistics in most countries.

In the United Kingdom there has been a research focus on the importance of intangibles such as brands and patents, although this has not been a proactive focus of public policy to date. Haskel and Westlake (2022) investigate both the problems and potential solutions.

One facet of investment in people is that it is less able to play the traditional role of a fixed asset in securing finance. Firms such as technology start-ups, that are based on ideas and people but not physical assets, can find it difficult to obtain bank finance even though they need to pay wages up front, rent premises, and advertise before earning an income stream. Unsecured lending, including overdrafts or credit card debt, is usually very expensive and small business entrepreneurs may have to offer a claim on their own residential property as security for a loan, which significantly increases their personal risk.

Consideration of how to finance start-ups that have no tangible assets would be an area worth further consideration. Equity finance is often more appropriate than (bank) credit but the supply of equity investment for small businesses is less well orchestrated than the supply of bank lending. If the United Kingdom government wishes to address the productivity puzzle by stimulating investment, it needs to take a broad view of what type of investment is required in the light of the clear structural changes that have occurred and are ongoing in the United Kingdom economy.

Investment in Health and Education

There are huge opportunities to invest in public services in all advanced economies. Increasing the use of new technology which could substantially improve public sector productivity. To be clear from the outset, this does not mean attempting to recreate all existing public services on-line for everybody. The services will need to adapt to make best use of the technology.

In the United Kingdom, the focus is especially on health and education which are largely provided, for most people, by the state. Some of these services, for some people, will not always be amenable to change, but the following trends are already underway:

- People with health concerns may consult health professionals on-line or self-diagnose for simple ailments. This can be much

more efficient, freeing up both patient time and clinical resources.

• A multi-media approach to education can be deployed, which uses teaching staff efficiently and delivers more effective learning outcomes. This approach is increasingly commonly used for post-graduate or part-time studies.

Each country faces a strategic choice to make in terms of health and education investment. As countries become richer, it is notable that individuals (and/or governments on their behalf) tend to spend a greater proportion of their total income on health and education for themselves and their families.

Given that revealed preference, one should expect to see spending on health and education rising slowly as a share of GDP over time. The UK data do show an increase, but not a smooth one. In 1980, total UK spending on healthcare was just over 5 per cent of GDP and had reached 10 per cent by 2019. Within that, public healthcare spending rose from around 4 per cent of GDP to a peak of over 7 1/2 per cent in 2009/10 [7] before falling back somewhat over the ensuing decade to be around 7 per cent by 2019.[8] The data since 2020 have been distorted by the effects of the Pandemic and so are not considered here.

It is often alleged that the United Kingdom has not seen the benefits of extra spending on health and education, but usually these statements are based on unmet demand (such as waiting lists), rather than achievements (number of patients treated). Prior to the recent pandemic, UK life expectancy had been steadily rising for at least 180 years if not longer – albeit the improvements have slowed over the past decade.

In 1980 around one in seven of UK youth went into higher education[9] and by 2019 over half were going to university.[10] One can of course argue about the quality of degrees, and the nature of what is taught, but UK health and education have clearly improved significantly over the long run, in large part because the state has spent more on them. The United Kingdom, like other countries, faces a choice whether to pursue private or public models for these services. If that choice is to be public provision, then the NHS needs sufficient investment to deliver efficiently. That would be consistent with NHS spending continuing to rise somewhat faster than GDP.

Investment is necessary to ensure efficiency. Yet allegations of inefficiency are often used as an argument against increased NHS spending.

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7 The peak in these figures and those quoted below for education will have been distorted by the sudden fall in GDP during the GFC. But pre-GFC levels of UK GDP were recovered by 2013 Q2 and the trends since then have still been of general decline as a share of GDP.

8 Sources: Statista and Health Foundation, 2019.

9 The higher education system in 1980 was mixed between universities and 'polytechnics' which were set up to focus on technical subjects such as engineering. From 1992, all polytechnics have become designated as universities.

10 In 1950 the number was just 3 1/2 per cent. Source: Times Higher Education.

All firms and organizations are inefficient to some degree whether private or public. Good managers are constantly identifying and removing inefficiencies, at the same time as investing in and developing new processes, products and services. New inefficiencies arise to displace the old, and the process is never-ending. If one waited for all inefficiencies to be tackled before new investment was allowed, the long-run productivity outcome would be very poor in any context. Squeezing budgets or bureaucratic spending limits applied top-down to 'save money' nearly always lead to poor productivity outcomes. Managers struggling to maintain services in such circumstances often face cost increases they do not control, exceeding budgets they cannot influence. The outcome of such pressure is short-term decision making which reduces efficiency in the longer term. This includes cutting planned investment expenditure as the quickest way to meet a budget shortfall. Hiring cheaper, less experienced staff or leaving vacancies open for longer, also tend to lead to poor long-term outcomes.

If insufficient money is available to fund a service, ultimately someone must decide what is not going to be done. If that is not consciously decided at the top level, then managers or front-line staff will make those decisions instead. That is how quality and efficiency of both public and private services become reduced when budgets are squeezed top-down.

Similarly, measurement of performance is not a substitute for improving it. In some circumstances, what is measured miraculously improves to the detriment of what is not. In other circumstances, underperformance may be exaggerated as part of a 'cry for help'. Measurement and targets are essential but one needs a follow-up strategy of how to engage and respond constructively, otherwise such measures just become an extra cost burden.

Any net increase in public expenditure needs to be funded either by recourse to taxation or debt. If the United Kingdom decides that it wants continually improving health services, then a choice needs to be made as to how much of that is provided by the private sector and how much by the public sector. The consequences of greater private sector provision are worth spelling out. Ultimately it would mean that the NHS was no longer the main health provider for all the services it currently offers. In some areas this is already happening: in 2023 less than half of adults in England had an NHS dentist.[11]

Private health care provision would become increasingly funded by private health insurance. That could allow overall expenditure on health to rise in line with the revealed preference of UK citizens and would doubtless generate substantial new investment in private facilities. It would reduce financial pressure on the NHS. And it would probably help move the United Kingdom towards the productivity frontier, if it made the workforce healthier. That private-sector solution would be politically challenging. To support a voluntary shift by those who could afford to pay, the private system would likely have to provide a

11 Source: NHS Dental Statistics for England 2022-23

better quality of service than the NHS, creating a two-tier system. To enforce a shift by closing existing public services could mean that those on low incomes no longer had access.

In the United States, health expenditure is over 18 per cent of GDP but is dominated by large, vested interests charging high prices for drugs and medical services, with manifestly poor outcomes for many of those on lower incomes (Deaton, 2023).

Education in the United Kingdom faces similar choices. In 2010, government spending on education was over 5.6 per cent of GDP but by 2019 it had declined steadily to around 5.2 per cent of GDP.[12] There was no alternative policy to expand private sector education.

To be clear: this article is not advocating a party political or ideological position on whether investment in health and education should be public or private or with a particular mix. But it is making the case for an ambition, backed by policy, to increase total investment in health and education over time, rather than continuing with a budgetary squeeze or passive decline.

Investing in the Transition to Net Zero

The Climate Change Threat

Climate change is arguably the single most important challenge facing humanity today (Stern, 2006; WEF, 2024). The Earth has already warmed by over 1.5°C since the 'pre-industrial period' of 1850-1900 (used as the reference point in the 2015 Paris Agreement). Most of that warming has happened in the past 50 years or so and recent data indicate an acceleration (WMO, 2025). It is not just a long-term problem – the world economy has already witnessed major loss of life and huge financial losses as a result of climate change (EEA, 2024).

To achieve net zero greenhouse gas emissions and ultimately move to net extraction there needs to be some basic changes in the global economy. At its simplest, fossil fuels need to be replaced by energy sources that do not produce greenhouse gases such as renewables (wind, solar, hydro) or nuclear. To enable that, investment is also needed in industrial-capacity energy storage solutions: the wind does not always blow, and the sun does not always shine.

Price mechanisms and pollution taxes are also among the necessary mechanisms to address the externality of greenhouse gas emissions. But carbon pricing is not sufficient to address climate change, even if it were to be comprehensively and consistently applied – which it has not been. Carbon emissions need to be eliminated, not just discouraged or compensated for. The reasons why carbon pricing is necessary but not sufficient to achieve that are explored in Fisher *et al.*, (2023).

The Cost of the Transition

Transition to net zero is necessary to pre-

12 Source: World Bank.

serve the existence and effectiveness of a global economy. It should not be thought of as a net cost. The costliest path would be to allow global temperatures to rise to a catastrophic level, leading to a disintegration of the global social and economic system.[13] Investing in the transition to net zero is a pre-requisite for the survival of the global economy. It is also a huge business opportunity for the private sector and provides a channel for governments to stimulate renewed economic growth.

The transition will create demand for new goods and services – this could range from electric cars and local renewable energy generation through to an increased demand for efficient air conditioning. Those businesses which can provide appropriate new products and services will thrive, investing in new facilities and creating new jobs.

At the same time the transition will shift production methods to be more sustainable. Contrary to the 'cost' arguments, renewable energy is likely to be much cheaper as well as more secure in the long run. Offshore wind is now reckoned to be the cheapest form of energy supply in the United Kingdom (Carbon Brief, 2023).

The key question is how investing in the transition could help restore economic growth and productivity. The historical process of industrialization was able to continue for so long partly because it could rely on new power sources which became available. The economy moved from wood, to coal, oil, gas and nuclear with each contributing to electricity generation. The mass exploitation of renewable energy sources is a fundamental factor which might change the structure of the economy towards high productivity sectors, at least during the transition.

In employment terms, the benefit of moving to net zero is perhaps clearer: In the US coal industry in 1923 883,000 people were employed. By 2013 that had fallen to just under 85,000 and by 2023 to 55,000.[14] In contrast the US solar industry in 2022 employed 263,000.[15] New jobs will be generated in the new industries, not the old.

Although new energy forms could support renewed productivity growth, the focus of public investment in the transition should be on preserving and improving the quality of life. Clean air and a sustainable environment are an investment in natural capital (Dasgupta, 2021) even if that is not currently reflected in GDP.

Green Investment Strategy

The United States and EU have taken different approaches to stimulating green investment. The United States passed the Inflation Reduction Act (IRA) in August 2022. It contained some two dozen tax provisions and committed to $370 billion in federal funding for clean energy, with the goal of substantially lowering national carbon emissions by 2030. The effect of the IRA is a subject of political debate,

13 Dasgupta (2021) has a good discussion on these issues.

14 Source: IBIS World website.

15 Source: IREC website.

but it does seem to have galvanized relevant sectors of the US economy. It is widely thought to be one reason why the United States has grown faster than other advanced economies since it was implemented.

The EU announced a 'European Green Deal Investment Plan' in 2020. This was a set of policy initiatives by the European Commission with the overarching aim of making the EU climate neutral in 2050. It comprised two principal financing streams totalling €1 trillion. Critics have complained that most of this was not new funding, merely an exercise in greenwashing (Varafoukis and Adler, 2020). Much of the EU green agenda does seem to have been pursued through regulation and the economy did not respond as positively in growth terms as did the United States.

Whatever the claims and criticisms of the different approaches embedded in United States and EU policies, it seems clear that to achieve net zero will require a pro-active policy approach, and preferably one which directly boosts the real economy.

The transition to net zero will generate huge public benefits which the private sector cannot internalize on its own. In some areas public funding will be needed. In other areas incentives for the private sector will be needed to drive the economy forward quickly. That balance is subject to political debate, but drawing on the United States and EU plans, and UK experience to date (both positive and negative) the requirements might be tentatively proposed as follows:

- The amounts of new money invested (public or private) need to be credibly large and commensurate with the existential threat posed by climate change.
- A range of financing tools should be used by the public sector to alleviate financial constraints: tax credits, guarantees, public-private partnerships etc.
- The plans should be certain and must be honoured in delivery, to enable both public and private sectors to plan and implement. If subject to second thoughts, or de-funding on short-term financial or political grounds, credibility is lost.
- A full transition plan for net-zero should be published, to demonstrate how it is to be achieved and against which progress can be judged.
- Ideally the transition plan would have multi-party support. Although no government can constrain a future government entirely, swings in policy – even those caused by frequent changes in junior government ministers - can destroy long-term policy consistency.
- The plans should be judged on how they map into reductions in GHGs but can also be designed to maximize their impact on stimulating productivity and growth.

Conclusions

Despite the evidence and analysis submitted to the UK Productivity Commission, and an extensive academic literature elsewhere, there is no consensus on why there has been an international slowdown in productivity growth, nor why the United Kingdom has been underperforming (Goldin *et al.*, 2022). There is a lot of detailed evidence accounting for the slowdown, identifying absolute or relative weaknesses, but little root cause analysis. That makes it hard to construct effective policies to ad-

dress that slowdown.

In reviewing the data, this article observes that the international slowdown has been under way since well before the Great Financial Crisis (GFC). It has been present at least since 2000 in a range of advanced economies, and for the past 50 years in the United States.

Many studies look at the specific productivity slowdown in the United Kingdom since the GFC in 2007-09. But the demand-driven expansion of United Kingdom (and United States) output in the years 2002-2007 means that such studies generate a bigger puzzle than is warranted.

Over the longer period, the pattern of slowdown seems consistent internationally. It most likely reflects the de-industrialization of mature economies, leading to slower measured productivity growth as a natural and inevitable outcome of a change in economic structure.

Exponential GDP growth at a constant rate, as currently measured, is unlikely to be feasible, given the constraints imposed by the limited physical resources of the planet.

The underlying slowdown is likely to continue but the conclusions of this article should not be taken as anti-growth, nor a counsel for despair. Policy should be aiming to support the maximum sustainable growth rate going forward. It should do that looking at how the economy is evolving, not by looking at or even comparing with the 'glories of the past'.

Macroeconomic data does not seem to be reflecting enormous changes in lifestyle following the internet-based IT revolution. It does not seem plausible that living standards have been growing as slowly as has GDP per capita. Society itself is focussing increasingly on aspects of welfare going much broader than material possessions. Existing economic indicators are not sufficient to measure the nature of well-being in a services-dominated society.

Any national investment strategy should focus on maximizing the benefits to society arising from deployment of new technology. Many of the services provided by mobile computing are not monetized and that does create an ongoing problem for the tax base which needs to be addressed.

Building on the Productivity Commission evidence with regards to intangibles, investment policy needs to go much wider than the traditional focus on supporting physical or even produced capital assets. That includes, especially, investing in the workforce themselves. As the structure of the economy changes, so does the nature of the investment required.

As part of a new approach to investment strategy, the article argues for a more activist policy on investment in services that are currently being provided by the public sector in the United Kingdom, especially health and education. The strategic choice is between maintaining these services as public provisions and investing in them appropriately, or to actively incentivize more private sector provision. Continuing to depress budgets below costs, with consequent insufficient investment would be damaging to UK productivity and hence growth going forward.

The global economy needs to raise its investment game on the transition to net zero. UK policy to date has been piecemeal, subject to myopic budget constraints, continual revision and under-delivery. The

United Kingdom is in danger of falling a long way behind the United States and EU in transforming its economy to a competitive net zero.

There is no trade-off between achieving net zero and long-run growth, environmental stability is a pre-requisite for raising living standards globally.

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