

Policies for investing in sustainable growth: risks and opportunities in the current macroeconomic environment

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Policy insight

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Summary

Key messages

- As many countries struggle with close to record levels of public debt relative to GDP post-COVID, the unexpected threat of stagflation is changing the macroeconomic discourse.
- However, the underlying case for active public sector support for the low-carbon economy remains as strong as ever.
- Overstretched supply chains and the withdrawal of workers from the labour force are likely to prove temporary features, helping ease inflationary pressures as fiscal and monetary policy continue to tighten.
- In the medium term, demographic conditions favouring low inflation and low real interest rates show little sign of reversing, making public borrowing for investment affordable.
- Public and private investment in energy-efficient low-carbon sectors should more than pay for itself by crowding in capacity and lowering public debt relative to GDP.
- Expanding investment in renewables, electrification and resource efficiency will yield significant gains to productivity in the medium to long term, through economies of scale in production and discovery. This is most likely to impart a counter-inflationary force and reduce vulnerability to global supply bottlenecks.
- Some low-carbon or 'clean' sectors are particularly vulnerable to higher interest rates that may result from any policy reaction: they tend to be capital-intensive with their full profit potential yet to be realised and are therefore discounted more highly.
- Uncertainty enhances the importance of strong, predictable and transparent public policy to steer private investment and to reinforce expectations of tangible returns from a clean transition.
- The task for decision-makers in the current macroeconomic environment of rapidly mounting uncertainty and structural change is to maximise opportunities and minimise risk.

Recent developments in the macroeconomic environment

The macroeconomic environment has shifted rapidly in the past year. This has posed serious challenges for policymakers seeking to avoid recession and inflation but also to boost productivity growth and prevent dangerous climate change and environmental degradation. Mounting uncertainty regarding the global geopolitical and macroeconomic environment makes prediction increasingly difficult. In March 2022 the Secretary-General of the Organisation for Economic Co-operation and Development explained that due to the war in Ukraine, which he described as a "threat to the international rules-based order", the OECD was unable to present its *Interim Economic Outlook*. Yet important policy decisions still have to be made and economic theory and evidence can provide a guide.

At times of enhanced uncertainty and major structural change, there is a premium to flexibility and ensuring that options are not prematurely closed. A combination of global supply constraints and shifting patterns of demand associated with the recovery from COVID-19 and the subsequent conflict in Ukraine have led to a sharp spike in prices, particularly for energy.

The primary source of inflationary pressure is not excess domestic demand except, at the moment, in the United States and maybe the United Kingdom. Although in its most recent quarterly *Monetary Policy Report* (of May 2022) the Bank of England attributed most of the rise in 12-month Consumer Price Index inflation to “previous large increases in global energy and tradable goods prices”, an increase in domestic inflationary pressures was also recognised. But we argue this is likely to diminish, possibly quite quickly, as recessionary pressures mount.

However, strong increases in demand in certain sectors and an increasingly tight labour market, as well as mounting expectations that inflation might endure, do threaten more entrenched inflation, and policymakers will seek to respond if it does occur. After a period of very loose monetary conditions, there is a strong argument in favour of monetary policy returning closer to neutral levels and in response, key policy rates in the US and UK have begun to rise.

The neutral level of interest rates – the level at which an economy is neither overheating nor being reined back, given the stance of fiscal policy – is not directly observable, yet the rise in nominal interest rates has failed to keep pace with the increase in inflation. Ex-post real interest rates have thereby fallen to historic lows and remain negative. Overall, this suggests strongly that global uncertainty, rather than the cost of capital, remains the key barrier to investment, though as nominal interest rates rise, the risk of credit constraints increases. It is also notable that many of the key new technologies and industries are not particularly intensive in physical capital: for example, they include many ‘intangible’ internet-based innovations. The advent of the weightless economy is likely complicating our understanding of investment and productivity, thereby complicating monetary policy.

Vulnerability and uncertainty for clean sectors and technologies

These macro developments and corresponding policy shifts follow a period of rising asset prices and increased public and private indebtedness. Some clean sectors and technologies for sectors that need decarbonisation are particularly vulnerable to higher interest rates that may result from any policy reaction: they tend to be capital-intensive with their full profit potential yet to be realised and therefore discounted more highly. Conditions may be ripe for what will likely be the first of many bubbles on the route to a major structural transition to a clean economy. This is especially likely if inflation becomes embedded, such that the ultimate policy response has to be more aggressive. Although unexpected inflation initially boosts tax revenues, by pushing income sources into higher tax bands, higher nominal interest rates will eventually begin to have negative consequences for the public finances, limiting the perceived fiscal space available for public investment because of the rising cost of public borrowing.

For clean-tech investors, this marks a period of uncertainty as short-run risks rise even while the long-run opportunities remain high. For government, this enhances the importance of strong public policy to steer private investment and to reinforce expectations of tangible returns from a clean transition.

The case for public sector support for renewables and energy efficiency

The underlying case for active public sector support for the clean economy remains as strong as ever. Greater reliance on cheap and secure domestic sources of energy are key to reducing vulnerability to global supply bottlenecks. The evidence suggests renewable and energy-efficiency investments are likely to yield significant gains to productivity, resilience and capacity in the medium to long term and have the potential to act as powerful disinflationary forces.

Expanding investment in renewables, electrification and resource efficiency will impart a counter-inflationary force. This is because commodity-based systems, such as fossil fuels, have limited scope for operational cost reductions as they are in general subject to diminishing returns to scale, as the resources that are easier to extract and transport are harvested first, while those

coming from increasingly remote and costly locations generate externalities that are expensive. They are also punctuated by periodic supply constraints and energy price spikes.

As energy based on commodities is replaced by technologies such as renewables and battery storage, which exhibit increasing returns to scale, learning by doing, and rapid technological progress, the economy is likely to experience sharp productivity increases, more reliable supply and falling operating costs. This remains true regardless of how most economic scenarios unfold in the short run, making such investments future-proof. The key question concerns the role of finance ministries in facilitating and managing this transition in the present economic environment.

Growth multipliers associated with scaled-up public and private investment in the clean economy remain significant. But the short-run macro environment can impact the perceived risk-adjusted returns and the cost of capital. A managed and flexible policy response may be required to sustain a cost-effective transition through a period of macroeconomic turbulence.

Although there are significant inflationary threats in the near term, these are unlikely to persist in the long term. Demographic conditions favouring surplus desired saving over desired investment, primarily through the sustained relative size of the global cohort of prime working (and saving) age, show little sign of reversing in the near term. Part of the reason is rising inequality. As the very rich tend to save disproportionately more, the rise in their numbers has a dampening effect on equilibrium interest rates. This in turn boosts the price of assets held disproportionately by the very rich, further widening inequality and sustaining low interest rates. This is one of the drivers of the global savings glut recently highlighted by the International Monetary Fund. With the surplus of desired net saving likely to continue to push real interest rates close to, or below, zero, the returns to promoting investment in clean technologies remain substantial, both from the perspective of private investors and for national policymakers seeking to boost productivity and restore public debt sustainability.

Recommended policy response

In such an environment, the appropriate policy response remains one of strong fiscal support for clean sectors, even while monetary policy is tightened to tackle inflation. It is possible that inflation would prove more persistent and the policy response turn out to be more contractionary. This might occur because demographics and the possible unwinding of global trade and investment links turn out less favourable to surplus desired saving, for example because of rapid unwinding of global trade and investment links or additional investment demands to adapt to and combat the impacts of climate change. Even in such circumstances, however, the boost to innovation, productivity and capacity that clean investment can yield would mean investment in this sector would be unlikely to crowd out more productive alternatives.

Durable returns to building the supporting infrastructure for the digital and sustainable transition seem assured. The soundness of public policy depends on whether it fosters strong and sustainable private sector investment and provides the enabling infrastructure required to boost productivity growth. Policymakers must prepare society for the economy of the 21st century while recognising that many people's livelihoods are wedded to the economy of the 20th century.

Conditions are such that 2022 may be a pivotal year for clean investment/finance. The evidence on structural transition shows clearly how policy action now will determine how the world evolves. The 21st century economy will emerge as an expression of the policies, behaviours and technologies policymakers and investors commit to today. The task for decision-makers in the current macroeconomic environment of rapidly mounting uncertainty and structural change is to maximise opportunities and minimise risk.

1. Introduction

The G7 economies have suffered a historically severe shock as a result of the COVID-19 pandemic, most of them experiencing record annual contractions in 2020. For most G7 countries this follows decades of slowing productivity growth and a cumulative shortfall in infrastructure spending relative to previous post-war decades. It also comes at a time of accelerating innovation in digital technologies (OECD, 2019), growing inequalities (McKinsey & Co., 2019) and the immense threat of climate change as well as the challenges associated with the low-carbon transition.

The purpose of this paper is to set out a stable and prudent course for macroeconomic policy in the current global environment. Although fiscal and macroeconomic pressures will differ from country to country, common patterns can be discerned. A policy approach which encourages an acceleration in clean investment is best placed to address issues of slow productivity growth, boost competitiveness and account for the risks and opportunities associated with rapid technological, environmental and social change.

On the face of it, higher interest rates and inflation would seem to reduce the scope for direct fiscal intervention to support the clean economy as debt interest costs rise. Yet, it has been demonstrated that the collective drive towards fiscal austerity in large economies post-2008 throttled productivity-enhancing government investment (Stern and Zenghelis, 2021).

The economic challenge associated with managing a structural transition in the world economy remains unchanged. The new energy economy will be cheaper, more innovative, cleaner, fairer, safer and more secure than the fossil fuel economy. That is why the transition is already happening everywhere, and fast. The challenge for policymakers will be to anticipate and manage change as well as induce and steer it. Inertia, uncertainty and upfront barriers are discouraging private investment in potentially profitable low-carbon sectors (Aghion et al., 2014).

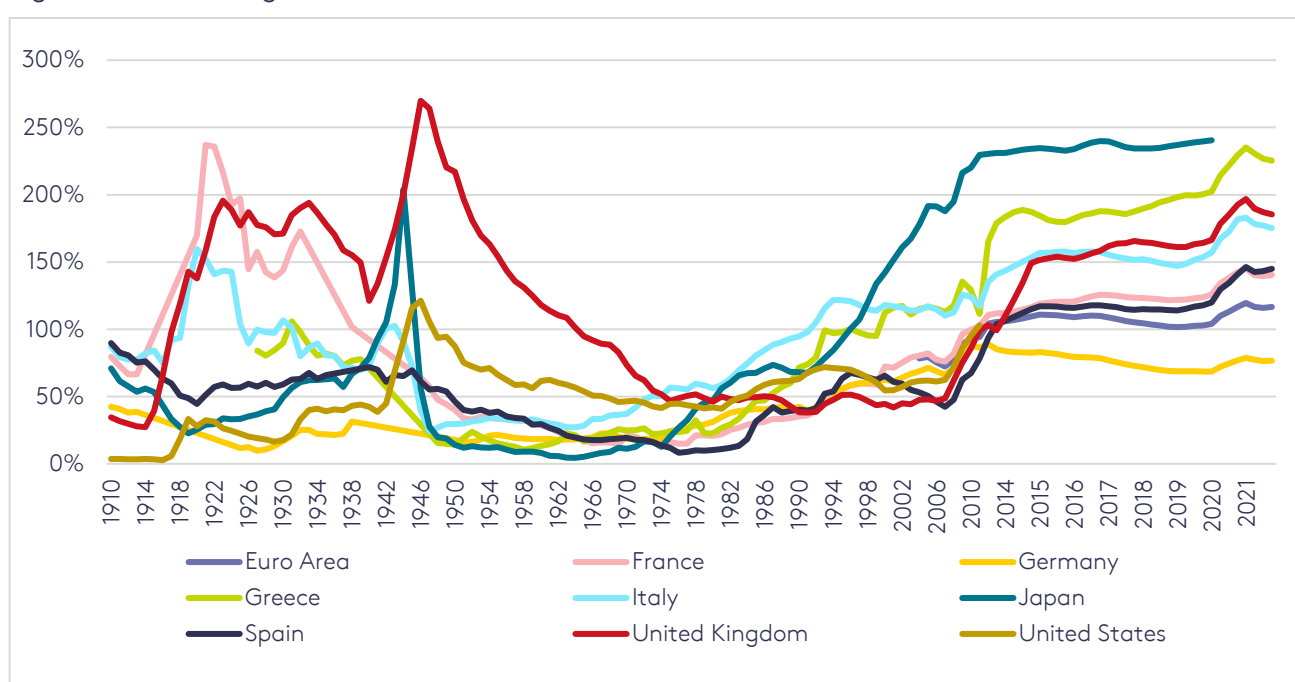
We have argued in the past that the public sector has significant scope to 'crowd in' productive capacity by investing, and thereby stimulating private investment, in clean sectors. We argue in this paper that the returns to this investment will be higher than the returns to tax cuts, provided appropriate safeguards are in place to prevent policy failure such as enhanced rent-seeking. However, we further argue that this investment is currently best funded through public borrowing rather than through tax increases. Moreover, the scope for public intervention to leverage private finance without a direct call on the public purse, through policies such as carbon pricing, regulations and standards, remains substantial.

Appropriate account must be taken of the changing macroeconomic environment. In contrast with the last two decades, in which a surplus of net desired saving worldwide led to subdued inflationary pressures and low and often negative real interest rates in advanced economies, the current macro environment has seen a resurgence of inflation and a rise in nominal policy rates (though not yet in real rates). It cannot be known for certain whether or not the era of low inflation and low real interest rates is at an end. But the evidence on structural change and global demographics suggests rowing back on investment in the clean economy now would have significant negative consequences in terms of capacity, inflation and productivity growth.

2. Assessing the broad macroeconomic environment

The recent rise in the debt to GDP ratio has led to understandable concerns about fiscal space when it comes to publicly financed intervention to support the economy. Beginning in 2010, both advanced economies and emerging market and developing economies experienced a wave of debt accumulation, following the global financial crisis of 2008–9 (Kose et al., 2021). Even before the onset of the COVID-19 pandemic, government debt as a percentage of GDP had reached its highest level since the end of the Second World War in many advanced economies and was even greater in others. Government debt grew further and very rapidly in 2020, as large packages of fiscal support were deployed in response to the pandemic-induced recession. Although debt/GDP began to fall in 2021 as economies rebounded, its level remains high by recent historical standards in most advanced economies (see Figure 2.1).

Figure 2.1. General government debt, % GDP, 1910–2021



Sources: International Monetary Fund, International Financial Statistics, Bank of Japan¹

We argued in a paper published last year on fiscal responsibility in advanced economies that governments must step in with sufficient ambition to provide the enabling environment to foster private investment, by investing in infrastructure, skills and intangible knowledge-generating assets (Stern and Zenghelis, 2021). The level of public debt to GDP, we suggested, matters less than its quality in terms of generating sustainable investment and growth. It is the latter that secures prosperity and provides the foundations for public debt sustainability. The only route to

¹ The UK Office for National Statistics measures general government consolidated gross debt (GGGD) under the Maastricht Treaty definition of public debt liabilities. This includes currency and deposits, debt securities and loans. The IMF definition is broader and measures 'total liabilities', which also includes public service pensions (which accounts for the bulk of the difference) and converts the face value of debt securities to their market value. The face to market value adjustment was negligible before the financial crisis but has grown since and is fairly volatile, reflecting the excess of coupon rates over falling market rates. See ONS (2022b).

growth without inflation is through investment in the economy's productive capacity, in physical, human, knowledge, social and natural capital (Zenghelis et al., 2020b).

We were not alone in making these points. The International Monetary Fund, Organisation for Economic Co-operation and Development and others have argued strongly for public investment in clean infrastructure to induce private innovation and investment and generate real returns which 'crowd in' long-run capacity. The potential for targeted investment funded by public borrowing to boost productivity and crowd in private investment is why the IMF *Fiscal Monitor* for October 2020 suggested that an additional \$1 in public borrowing, to invest in "job-rich, highly productive, and greener activities", would generate an estimated extra \$2.7 of additional output (Gaspar et al., 2020; IMF, 2020).

We argued that such investment enabled higher growth without inflationary bottlenecks, expands the future public revenue base and promotes public debt sustainability without raising tax rates (Stern and Zenghelis, 2021). Much of this argument hinged on the persistent low interest rate environment and the spare capacity evident in October 2020 as a result of COVID-19. This meant that borrowing to invest in essence pays for itself many times over. We argued that in an environment where real GDP growth was above the real rate of interest, debt sustainability could be achieved by governments running primary deficits while keeping their debt ratios stable. However, the expectation of low nominal interest rates can no longer be relied upon.

The threat from inflation

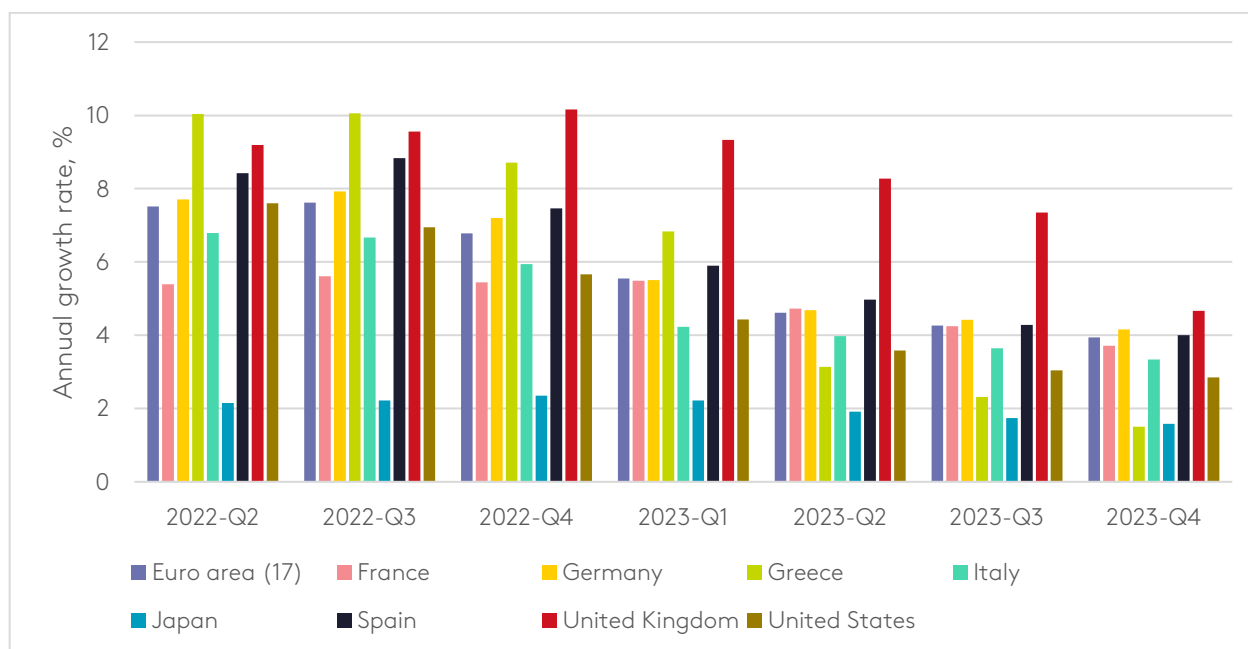
The macroeconomic environment has changed since March 2021 when we published our paper on fiscal responsibility in advanced economies (Stern and Zenghelis, 2021). Inflation in the US hit 8.5% in March 2022, the highest rate in 40 years (Smith et al., 2022). Few economists (us included) predicted that. Further rises following the response to Russia's invasion of Ukraine in February 2022 cannot be ruled out (see e.g. Guerrieri et al., 2020).

Some did, however, predict a secular rise in inflation. In February 2021 former US Treasury Secretary Larry Summers argued that, "there is a chance that macroeconomic stimulus on a scale closer to World War II levels than normal recession levels will set off inflationary pressures of a kind we have not seen in a generation" (quoted in Miller, 2021).

Most economists still believe the inflationary surge will prove transitory, at least in the advanced economies, with leading indicators showing price pressure receding and forward inflation expectations remaining subdued (see Figure 2.2). The post-COVID global economy has been disrupted in a way that requires relative prices to shift in order to reallocate resources and meet shifting patterns of supply and demand. Downward price rigidity means this manifests in transitory inflation (Boivin et al., 2022).

The degree to which inflation becomes systemic will depend on price and wage capacity pressures on resources such as labour, raw materials and other factors of production, and price and wage setters' expectations. In 2021 we argued that hard-earned anti-inflationary credibility would likely take years of bad policy to dislodge. Yet, the fact remains that the persistence of inflation has caught many by surprise. The underlying environment is beginning to look more like 1970s stagflation, for example, than the temporary Korean War inflation shock of 1951 (both of which similarly began as terms of trade shocks). The impact of the recovery from COVID-19 and the Ukraine crisis on both demand and supply makes it hard to determine the degree of spare capacity in economies and the corresponding size of the gap between actual and potential output.

Figure 2.2. Inflation forecast, annual (%), Q2-2022 – Q4-2023



Source: OECD (2022a)

In particular, signals from the labour market remain muddled. The International Labour Organization has projected that total hours worked globally in 2022 will remain almost 2% below their pre-pandemic level (adjusted for population growth) (ILO, 2022). Whether the labour market is slack or tight will depend in large part on the degree to which workers who have recently left the labour force as part of 'the great resignation' decide to return in an environment where interest rates and asset prices begin to wane. Moreover, the power of organised labour to raise wages and erode profit margins in order to restore real wages (and labour share) remains arguably weak by historical standards. This follows secular institutional and industrial composition changes reducing the power of organised labour. For example, manufacturing's share of UK gross value added (GVA) is now around 10%, compared with around one-third in the 1960s and a series of restrictive trade union reforms. Other factors suppressing underlying inflation included the widespread operational independence of central banks, relatively free of political pressure to keep interest rates low, and increased openness to global competition, factors that are currently moving in reverse.

Fiscal policy is also slowing down the global economy. Following large fiscal stimuli to support the COVID-afflicted economies in 2020, fiscal policy has subtracted from demand in all major economies since 2021. Discretionary changes in a country's fiscal policy stance are measured by changes in its cyclically adjusted budget position (the cyclical adjustment makes it possible to distinguish the effect of the economy on the budget, through the automatic stabilisers, to reveal the effect of the budget on the economy). Estimates by Llewellyn Consulting suggest that since 2021 the G7 economies will have tightened their collective fiscal position by a substantial 5.2% of GDP, exerting a strong drag on growth (Llewellyn, 2022).

If inflation does persist, only a credible response from the monetary authorities would suffice to contain it. Rates may have to rise high enough to cause a recession sufficient to jolt inflation expectations out of the system. While some argue that the monetary authorities should act slowly in the face of uncertainty, awaiting more evidence before raising interest rates (Pill, 2022), others believe early and preventative action is key to avoiding more punitive rates later on (Bootle, 2022; Giles, 2022). But judging what is preventative but not excessive is not easy, especially when the numbers come as a surprise.

There is a further fear, albeit largely confined to political mutterings reported in the media, that the operational independence of central banks may be undermined. Governments facing populist pressure may balk at central bankers undermining recovery so soon, and put pressure on the authorities to keep rates low. This may make the ultimate shock all the more painful if inflation becomes embedded.

On the other hand, there is mounting evidence to suggest that the economic slowdown already underway in many developing countries in response to the squeeze on disposable incomes may bring inflation down significantly without an aggressive monetary response.

In short, central banks are feeling their way very tentatively, and the scope for error is considerable. The dynamics of inflation and interest rates over the next few years could make getting in place the right policies on climate change much more difficult.

Can low rates be relied upon to continue?

Whether or not real interest rates remain low will be a function of the degree of non-inflationary spare capacity in the economy. As capacity is squeezed, the return to capital should increase and desired net saving fall. Such an environment would reduce the returns to private investment in clean technologies as the scope for crowding in capacity declines (by the same token, the scope to crowd out productive alternatives increases). But, as we argue below, this can be thought of as a symptom of success as the global economy returns to a more balanced and sustainable growth path.

If the secular saving glut remains over the coming few decades, it seems hard to argue that inflation will be a serious threat. By definition, ex-ante spending will exceed ex-ante income at the global level. This is inconsistent with accelerating inflation. However, in the short run it does afford the possibility that higher interest rates in an overleveraged global economy would generate recession as the mechanism by which to bring inflation back under control. This rise in rates need not be high, as the unanticipated rise in inflation is already squeezing disposable income, which impacts its own negative multiplier on demand. We see a high likelihood of recession and expect it to impart a negative impact on investment in clean technologies.

But what are the medium-term prospects for desired global net saving? The two decades prior to the COVID-19 pandemic were characterised by low inflation and near-zero real rates of interest across the advanced economies. Near-zero real interest rates indicated an underlying environment in which global desired investment was weak relative to desired savings (Rachel and Smith, 2015). This was marked, in the advanced economies, by a period of weak growth in GDP and productivity. Private sector savers in the advanced economies apparently saw few attractive opportunities for productive investment. They were willing to buy government debt even though it paid an ever-diminishing rate of interest (Rachel and Summers, 2019).

Global desired saving was boosted by demographic factors such as high earning 'baby boomers' in industrial countries, the opening up of the former Soviet Union and China, where productivity increased as inefficiency fell and underemployed rural workers migrated to more productive cities, the rise in global trade giving access to lower-cost goods, increased female participation in the workforce increasing GDP, and the build-up of foreign reserves in Asia (Bernanke, 2015; Summers, n.d.).

The IMF recently highlighted a key contributor to the global savings glut: the rising share of wealth held by the very rich. The IMF's analysis shows that in advanced economies those at the top of the income distribution have been saving at a much higher rate than middle- and lower-income households, so that the richest 10% of households account for most aggregate saving (IMF, 2022). These rich households have been an important contributing factor behind the global savings glut, which in turn has been a driver of the secular decline in the global natural interest rate (ibid.). Rachel and Summers (2019) estimate that increased inequality accounts for 0.6 percentage points of the fall in real interest rates over the last half decade. This leads to a

perverse reinforcing feedback, whereby rising inequality reduces equilibrium interest rates, boosting the price of assets held disproportionately by the rich, further widening inequality and sustaining low interest rates.

At the same time, annual global corporate saving rose from 10% to 15% of GDP between 1980 and 2015, with the corporate sector becoming a net lender to the global economy rather than a borrower from it (Chen et al., 2017). This is perverse, given that successful firms ought to be borrowing (ultimately from households) to fund investment that generates a return on household saving. Part of this may reflect the shift towards the weightless economy. Statistical agencies struggle to measure the value of software, data, R&D design and organisational processes. Increasingly, information-based companies and economies are recycling their revenues into developing knowledge in ways that are not fully captured (Coyle, 2021; Haskel and Westlake, 2022).

All this surplus saving had to find a home, and as asset prices rose, global debt hit a record \$296 trillion in Q2 2021, with household and corporate borrowing rising on the back of cheap credit. The global stock of non-financial corporate debt was at record levels of \$74 trillion in Q3 2019 (Tiftik et al., 2020).

It has been argued that the drivers of higher desired saving and low inflation over recent decades will, with time, go into reverse (Goodhart and Pradhan, 2020). As many of these forces come to an end and as the cohort of 'baby boomers' of prime saving age become pensioners drawing down their savings, interest rates and taxes may have to rise and inflation pressure may mount. However, these demographic supply constraints can only be overcome by raising productivity rates in output per working person, highlighting the importance of investment. Moreover, this so-called 'great reversal' is likely to be decades away. As younger populations in developing countries such as India see growth in people of prime saving age, the global surplus in net desired saving is likely to endure for the foreseeable future. In addition, sustained income inequality in major economies, and the absence of a social safety net in rapidly developing countries such as China, will continue to support precautionary saving for old age.

In short, demographics make a return to high inflation and high real interest rates associated with the 1970s highly unlikely. An excess of desired net saving is the same thing as a shortfall in desired expenditure relative to income, conditions that militate against a rise in inflation. The Bank of England implicitly believes the UK nominal neutral interest rate is below 2%.² This can be inferred from the Bank's latest inflation forecasts (from May 2022), which show inflation stabilising and easing if rates rise above that level.

² The neutral level of interest rates is not directly observable but can be thought of as the real interest rate that, given the fiscal stance, supports the economy at full employment equilibrium output while keeping inflation constant. It is the level at which an economy is neither overheating nor being reined back by interest rates.

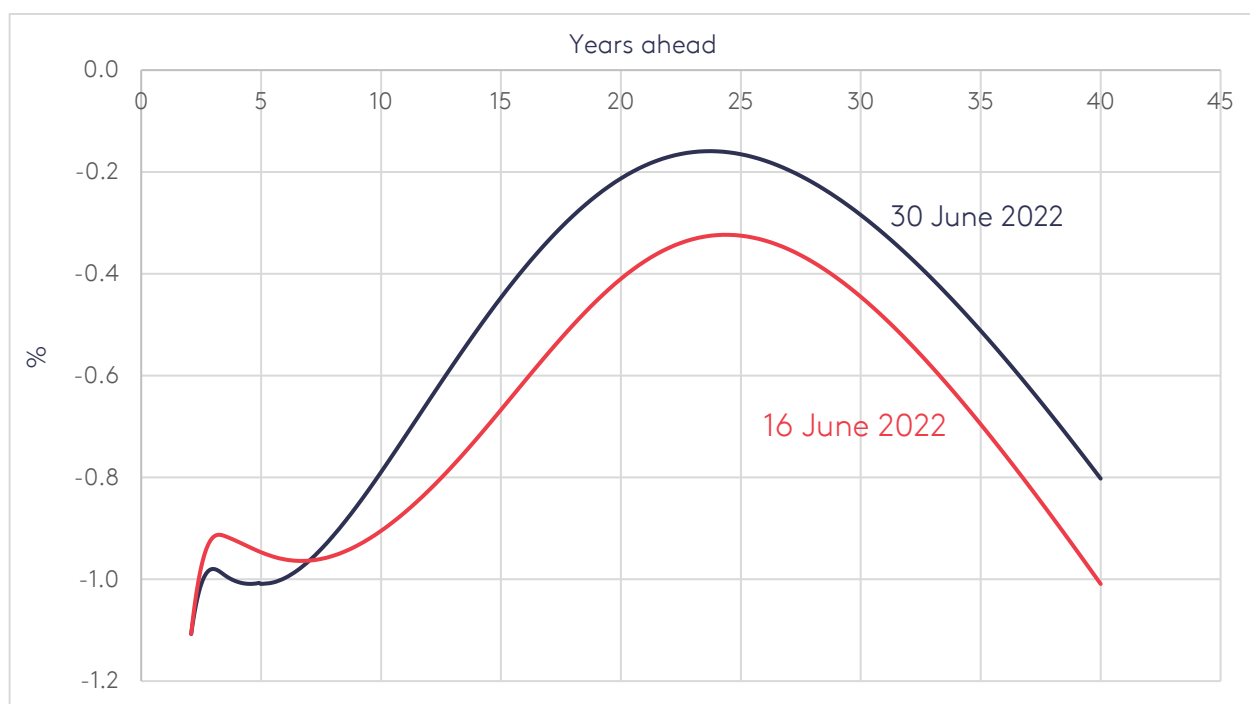
3. Affordability of public investment

The collective failure of public borrowing and investment across the major economies to absorb the surplus of global desired saving was a key factor in sending interest rates plummeting. The zero lower bound on interest rates forced monetary policymakers to seek ever more experimental approaches to boost private sector spending. This surplus of credit in turn inflated the price of a portfolio of assets held by the wealthiest (Eggertsson and Mehrotra, 2017), thereby exacerbating inequality,³ over a period in which average earnings for the majority stagnated (Sprague, 2017). Together with cumulative underinvestment in key public services, this helped spawn popular discontent and political polarisation.

With global planned saving likely to remain large relative to planned investment, neutral real interest rates are expected to remain low and close to zero. Indeed, inflation is making short-term interest rates still more negative.

Although real interest rates have increased from record lows in 2020, the UK Treasury can still borrow money for 30 years at negative real rates of interest (see Figure 3.1 below). The UK has an average maturity on its outstanding stock of debt almost twice as long as other G7 countries at nearly 16 years.

Figure 3.1. Forward implied real yield curve for UK gilts



Source: Bloomberg Finance L.P., Tradeweb and Bank calculations, via Bank of England (2022b)

The market is thereby signalling its belief that higher public debt is likely to be sustainable for some time, most likely on account of low servicing costs (Summers, 2020).

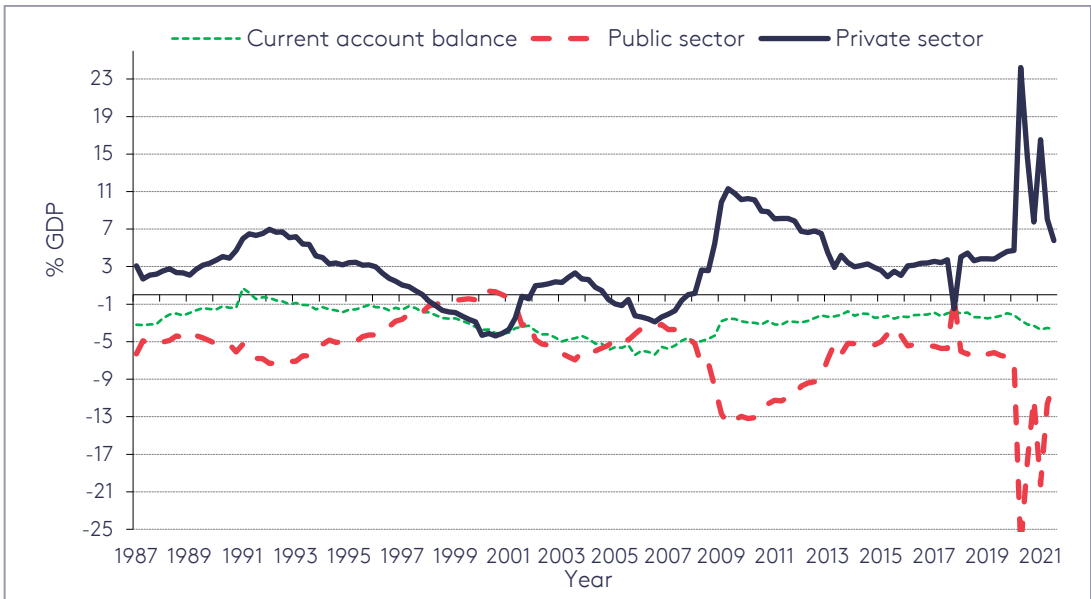
If public borrowing had shaped capital market conditions, then rates would have risen as profligate governments bid for limited funds. In fact, they remain at near-record lows. Investors

³ In many countries, this included rises in house prices, benefitting homeowners more than others, and those with more expensive homes, as well as those invested in the stock market, often indirectly through insurance and pensions schemes.

are willing to lap up government debt at high prices with paltry (or negative) returns reflected in persistently low neutral real interest rates (Rachel and Summers, 2019).

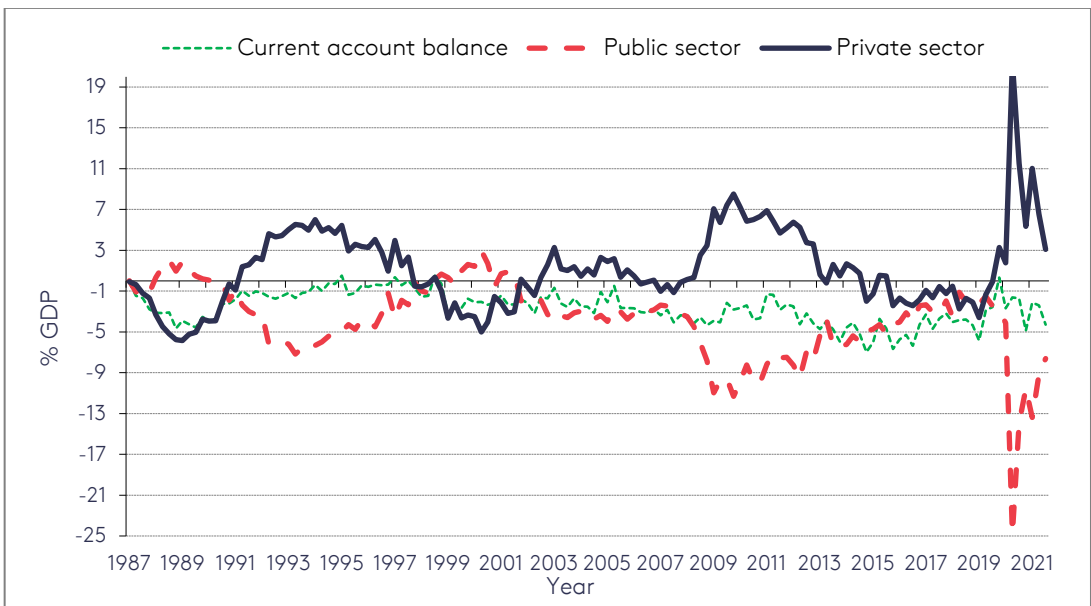
A key point is that inadequate public investment has been a factor exacerbating (or certainly not counteracting) the glut of global desired saving, holding back private investment and preventing sustained and resilient productivity growth in key economies (Rachel and Smith, 2015). Fiscal balances and debt have responded to, not led, private sector net balances. With little change in discretionary fiscal policy, Figures 3.2a and 3.2b show US and UK private financial balances surging into surplus over the pandemic, causing (rather than being caused by) expanding public sector deficits; a similar picture holds for all advanced economies. Rachel and Summers (2019) estimate that the rise in government debt over the past 50 years pushed up interest rates by a mere 1.5 percentage points, a figure more than offset by the factors associated with the secular rise in desired net saving.

Figure 3.2a. Sector financial balances (net lending), US, % GDP, 1987–2021 (Q3)



Source: Bureau of Economic Analysis (2022). Data to third quarter of 2021.

Figure 3.2b. Sector financial balances (net lending), UK, % GDP, 1987–2021 (Q3)



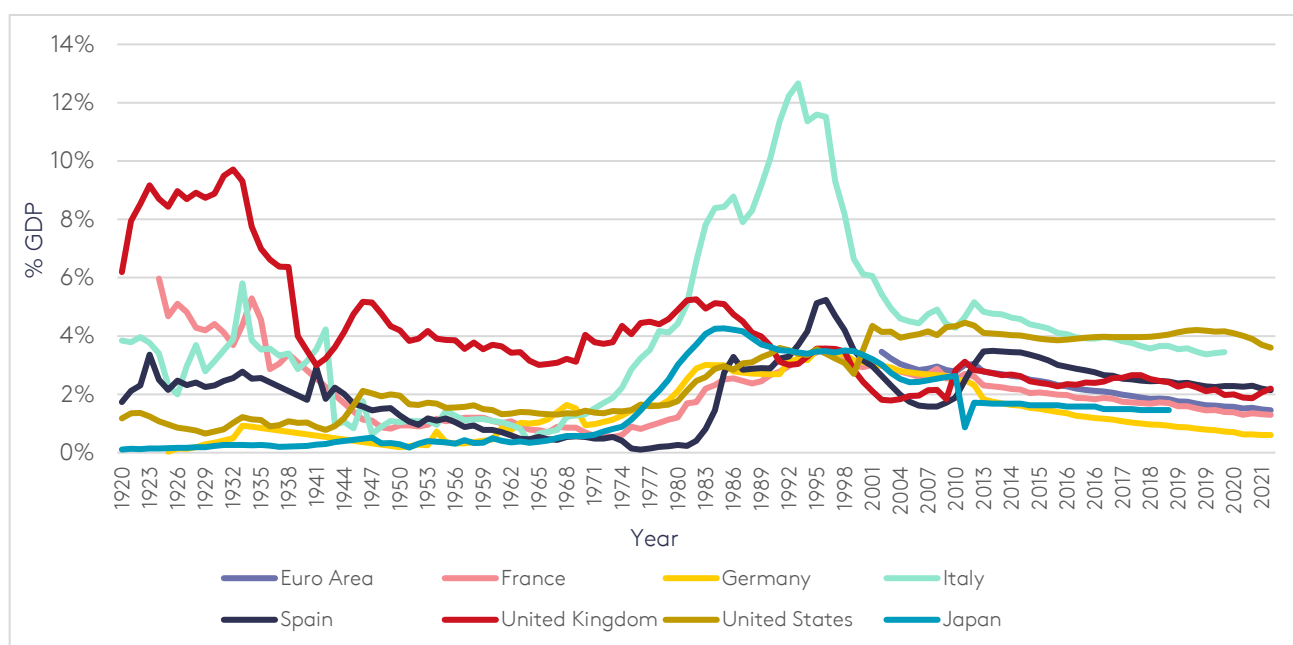
Source: Office for National Statistics (2022). Data to third quarter of 2021.

Nevertheless, a rise in the sums attributable to both creditors and debtors increases leverage and creates financial vulnerabilities when difficult conditions (such as recession, stock market collapse or high interest rates) jeopardise repayment prospects. Accommodative monetary policy has incentivised households and businesses to take on greater risk, potentially contributing to the fragility of the financial system. So far, the apparent absence of higher risk premiums on interest rates suggests markets are not unduly worried. Yet higher indebtedness makes the global economy more sensitive to changes in interest rates.

Governments have not been ‘borrowing from the future’, they have been ‘borrowing’ from taxpayers. Government bonds are not net wealth. Every debtor/liability has a corresponding lender/asset. The rise in public borrowing is matched by an equal and opposite rise in private financial surpluses (Unsworth et al., 2020), and it is those citizens who lend to government who will be repaid.

Provided interest rates remain low, debt will remain affordable. Indeed, despite rising interest rates and a higher stock of public debt, debt service costs in most advanced economies remain low relative to GDP by historical standards, at around 1–4% (see Figure 3.3).

Figure 3.3. General government debt interest payment, % of GDP



Source: IMF, International Financial Statistics, World Bank (Japan)

Basic debt dynamics calculus tells us that if an economy grows faster than the rate of interest charged on its stock of debt, its debt to GDP ratio will fall. This is because the numerator (debt) grows more slowly than the denominator (GDP). A country can run primary deficits and still control debt to GDP. If these deficits fund productive investment, then this further decreases in the ratio of public debt to GDP both because the denominator increases and also because public revenues help reduce the numerator.⁴

For example, if public investment can help restore g [the rate of nominal GDP growth] to its trend rate of around 4% and r [the interest rate] is around 2%, a country can run a primary deficit of

⁴ Formally the change in $d = -p + (r - g)*d(-1)$ where $d = \text{debt}/\text{GDP}$, p is the primary balance (public borrowing after interest payments), r is the rate of interest and g the rate of nominal GDP growth.

the order of 2% of GDP while keeping debt/GDP unchanged. Once interest payments are added back in, the medium-term sustainable deficit is of the order of 4-5% of GDP.

But growth also drives the debt/GDP numerator. For example, if targeted investment generates a multiplier of 3, then 1% of GDP in extra borrowing can be expected to raise GDP by 3%, thereby generating public revenues sufficient to reduce the public deficit by around 1% of GDP.

Unfortunately, it is much easier for governments to slash investment rather than current spending in any period of austerity. Furthermore, in the UK and elsewhere, the political preference remains to return to an agenda of tax cuts, especially in advance of elections (see below).

The analysis here relates to the long run. Of course, in the shorter term, higher inflation raises the costs of replaying index-linked debt, but unless tax bands are increased proportionately it also pushes up nominal earnings and tax receipts (a process known as fiscal drag). In the medium term, compositional shifts in spending and production will also challenge the public finances, for example where new revenue sources are required to replace lost fuel duties as the economy decarbonises. However, the UK Office for Budget Responsibility's calculations suggest a boost to annual productivity growth of less than 0.05% would more than wipe out this loss (Agarwala et al., 2021).

Short-run bubbles may burst

Even though the long-run macroeconomic story remains little changed, the short-run environment does present policymakers and investors with a challenge when assessing the returns to clean investment. Clean energy sectors stand out as particularly vulnerable to the potential end of the 'everything bubble' in financial markets – so called because the surplus of desired saving caused at least in part by sustained and deliberate attempts by the monetary authorities to pump liquidity into the pandemic-afflicted global economy has been channelled into inflating all asset prices.

The reason these sectors stand out is that renewable technologies tend to be relatively capital-intensive, so that the upfront costs of financing them are sensitive to nominal interest rates (IEA, 2021a). Many green technologies have yet to establish themselves and their current valuation is a function of the net present value of future cost reductions, revenues and profit. As rates rise across the yield curve, future opportunities are discounted more heavily relative to business, generating strong revenues and profits today. A switch from clean to 'value stocks' in traditional sectors with more limited anticipated growth potential could mark the bursting of a 'clean bubble', especially if inflation expectations become entrenched and monetary policymakers are forced to act. This might reflect an orderly re-evaluation of relatively near-term relative returns or it might be comparable to the UK railway mania of the 1840s, automobiles and the roaring twenties, or the millennium dot.com bubble.

There is at least a risk of investors pulling out of clean sectors for short-term speculative reasons, potentially bursting a clean tech bubble. Bubbles are a feature of technologies that fail to live up to hopes or expectations, but they also happen in advance of major technological transformations. Carlota Perez describes 'technological revolutions' preceded by financial bubbles, over-investment and collapse followed by subsequent large-scale deployment involving general purpose technologies such as steam, electricity or cars (Perez, 2002). It is likely the current macroeconomic environment will generate a dispersion in asset values and militate against new clean sectors in favour of incumbent sectors and technologies. This shift reflects the changing short-run macro-environment, and possibly a lack of commitment to governments' original injunction to 'build back better' after COVID (Vivid Economics, 2021). Nevertheless, it does not alter the relative prospects of the clean sector over the coming decades, as will be discussed below.

Growth may need to pause

The driver of inflation is the transitory effect of post-COVID asset reallocation. The reality is that tighter monetary policy and higher interest rates in an environment of record indebtedness and over-leveraged private institutions may exacerbate a growth slowdown and asset price correction. Deutsche Bank recently predicted that the US corporate default rate will spike to 10% in 2024 (Wigglesworth and Steer, 2022). Indeed, this may be what is necessary to squeeze inflation out of the system and restore anti-inflationary policy credibility. Such an out-turn will aggravate efforts at fiscal consolidation and serve to put further pressure on fiscal space.

However, the temptation to tighten budgets as growth slows must be avoided while the real returns to borrowing for investment are so large. The current macroeconomic environment does not warrant a repeat of the same mistakes made after the great financial crash of 2008 (Stern and Zenghelis, 2021). Studies from the National Bureau of Economic Research (Auerbach and Gorodnichenko, 2012a) and the IMF (Blanchard and Leigh, 2013) suggest that fiscal multipliers (Christiano et al., 2011) associated with government spending range from near zero when the economy is operating close to capacity to about 2.5 during recessions. The OECD estimates a similar range (Mourougane et al., 2016). A problem in the current environment is assessing how close to capacity the economy is, particularly in the UK and US where unemployment rates are low (US demand having been bolstered by the Biden administration's fiscal package [Davis, 2021], while UK supply is constrained by post-Brexit trade bottlenecks, among other factors).

The risks from higher public debt still do not outweigh the benefits. There are growing opportunities associated with a public sector drive to the zero-carbon and climate-resilient economy. Crucially, the markets agree. Investment in the economy's productive capacity is a prerequisite to securing sustained recovery without inflationary consequences.⁵ With negative real interest rates on near 'risk free' borrowing, the markets are indicating that sustained growth in output and productivity remains the only secure way to ensure fiscal and debt sustainability.

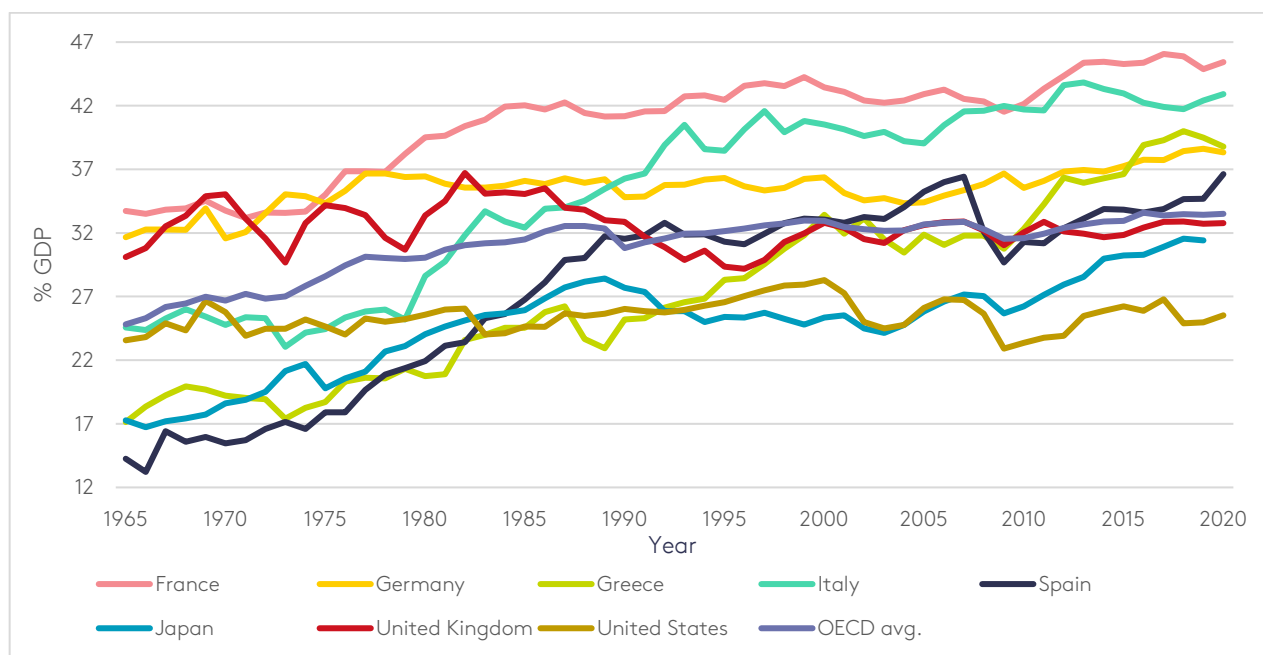
The case for tax cuts remains unpersuasive

The evidence therefore suggests that additional public and private finance to invest in clean technologies does not, in the current macroeconomic 'search for yield' environment, crowd out alternative net investment through extra borrowing. Yet, tax revenues as a percentage of GDP are high by historical standards, across a number of advanced economies (see Figure 3.4 below). Therefore, an appraisal of any public investment push should consider the risk that it would crowd out supply-side improvements that could result from tax cuts at a time of high taxes. That is, the multiplier effect of public investment spending should be considered against the multiplier effect of tax measures.

According to one branch of supply-side economic theory, economic growth can be fostered by tax cuts and deregulation (Canto et al., 2014). By reducing inefficient distortions and altering the incentives for labour supply and capital investment, these policies are said to increase employment and increase output (Laffer, 1981). Supply-side economic thinking played a prominent role in the policy choices of the Reagan administration in the US and the Thatcher government in the UK in the 1980s (Redenius, 1983).

⁵ Larry Summers also said, "I would be an enthusiastic supporter of a package of the size the Biden administration has proposed — and even larger — if it focused on build-back-better-style investments" (*Washington Post*, 8 February 2021).

Figure 3.4. Tax revenue in advanced economies, % of GDP, 1965–2020



Source: OECD (2022b)

The merits of such supply-side economics will vary according to the institutional and policy structures of any given economy at any given time. They remain much debated by economists. For example, when 40 leading economists were polled in 2012, none of them agreed with the statement that: “A cut in federal income tax rates in the US right now would raise taxable income enough so that the annual total tax revenue would be higher within five years than without the tax cut” (IGM Economic Experts Panel, 2012).

Measuring multipliers from tax cuts is difficult because of the endogenous relationship between fiscal policy and the business cycle and because changes in taxes and spending rarely occur in isolation, which makes it challenging to disentangle their effects from other policies such as monetary policy (Jalil, 2016). But a variety of approaches have been used to produce estimates of tax and spending multipliers (see e.g. Blanchard and Perotti, 2002; Romer and Bernstein, 2009; Romer and Romer, 2010; Barro and Redlick, 2011; Auerbach and Gorodnichenko, 2012; Nakamura and Steinson 2014; Fritsche et al., 2021). The range of these estimates is large and the findings of different studies can be contradictory depending on the method applied, but there is suggestive evidence that tax multipliers are not as large as spending multipliers, *especially during economic downturns*. This applies even at current levels of tax to GDP. For example, two key findings emerge from a meta-regression analysis of 98 empirical studies, which controls for the prevailing economic circumstances: firstly, the multiplier effect of public investment spending tends to be greater than the multiplier effect of tax measures; secondly, spending multipliers can be significantly larger during economic downturns, and, notably, above 1 for public investment spending, whereas tax multipliers are not sensitive to the business cycle or crisis situations (Gechert and Rannenberg, 2018). Given the historic contraction induced by the response to the COVID-19 pandemic (IMF, 2020), these findings reinforce the likelihood that in the current context public investment spending would indeed ‘crowd in’ private investment.

Energy crunch will not derail the clean transition

Despite 197 countries signing an agreement in November 2021 at COP26 to phase down coal, coal use surged to record levels over the winter of 2021/22. In its *World Energy Outlook 2021* (IEA, 2021b) the International Energy Agency predicted the demise of fossil fuels, but this process has been disrupted by the global energy crunch. Even before the crisis in Ukraine, a strong revival in

global demand had met with restrictions to supply, dramatically pushing up the wholesale price of oil and natural gas. Some countries, in particular China, turned back to coal generation to keep the lights on. This has led to concerns that the energy crunch may limit ambitious plans to decarbonise the global economy.

Only weeks after publishing its *World Energy Outlook 2021* the IEA warned that an unexpected rise in coal generation was threatening goals to decarbonise the global economy (IEA, 2021c). With Europe looking to curtail its dependency on Russian gas, the temptation to burn coal to keep the lights on (or, more relevantly, the Internet running) has increased further. And now, with energy bills driving the cost of living higher and causing difficulties for energy suppliers, the appetite to pay for new renewable generation has waned.

Post-COVID supply disruptions and swings in demand, together with the rapidly changing trade environment corresponding with the global political response to Russia's invasion of Ukraine, has resulted in large relative price shifts necessary to reallocate resources worldwide. These have hit all tradable sectors but the effects have perhaps been felt most acutely in the energy sector (Bond et al., 2022). Some have recently suggested high energy prices were driven by climate policy, with further price increases predicted on the basis that in restricting fossil fuel supplies in order to meet climate targets, this will push up prices (Steinberg and Wallace, 2021; *The Economist*, 2021; Schnabel, 2022). However, the evidence shows that electricity bills are rising because the costs of fossil fuels have risen (Biro, 2022) and not because of the cost of investing in renewables.

In the short run, the global energy crunch will doubtless slow progress on decarbonising energy and prompt a return to burning more (and dirtier) fossil fuels. This in part reflects a lack of investment in fossil fuel capacity (for example, the UK's gas storage) in recent years in recognition of the long-term decline in demand for the sector. This has made it hard to cushion the effects of the recent unexpected shifts in demand. However, in the long run the impact of the current energy crisis is likely to be relatively limited (Zenghelis, 2022). Indeed, it could hasten the transition to a low-cost, low-carbon future if policymakers recognise and seize the opportunity to accelerate the move to renewables.

However, today's energy crunch shows that the road to cheap renewable energy is neither linear nor smooth. Historical episodes suggest that price crunches induced substitution to and innovation in cheaper alternatives. In the aftermath of the 1973 oil shock governments across the world put resources into investigating new energy sources such as wind and solar. Using a model that includes the effects of induced innovation, Mercure et al. (2021) find that a combination of policy and technology reduce demand for fossil fuels and therefore prices, although they show that in a transition uncertainty increases so there is a reduction in price stability.

Despite the concern that investment in fossil fuel capacity will increase following the current spike in energy costs, in the medium term the energy crunch can be expected to induce an acceleration of innovation to clean and secure domestically-sourced energy sources. This would increase the risk that fossil fuel-related assets will become stranded. Many of the medium-term strategies to decarbonise energy overlap with strategies to reduce dependency on Russian gas. The response to supply bottlenecks will likely lead to even greater cost reductions in renewables relative to fossil fuels, as clean energy infrastructure is rapidly rolled out. Renewable and resource-efficient investments have the potential to act as powerful disinflationary forces.

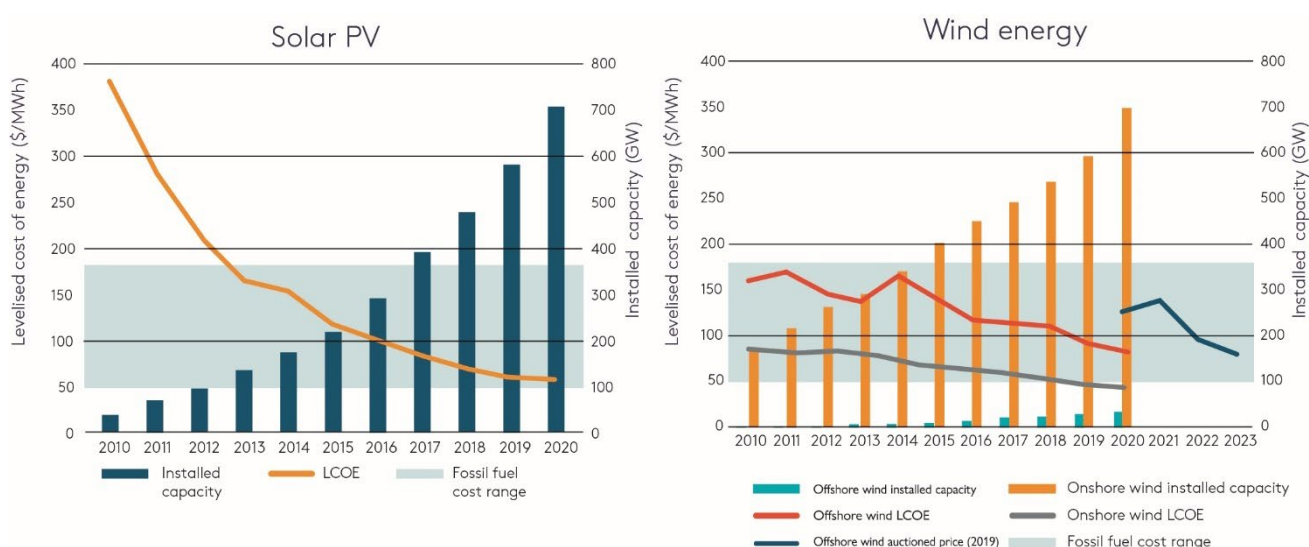
Whereas fossil fuels are a commodity, renewables are a technology. The returns to scale from fossil fuels are diminishing, as resources are extracted from ever more marginal locations using broadly unchanged technologies and labour-intensive supply lines and processes. By contrast, the returns to scale from many renewable and energy efficiency technologies are positive, whereby increased deployment yields rapid cost reductions. Put another way, fossil fuel combustion is becoming a limiting factor for growth. It is hard to cut energy production and end-use costs much anymore (see Figure 1 in Farmer and Lafond, 2016). Behind the short-run recovery in the coal sector lies an unchanged truth – thermal coal remains in structural decline.

4. Managing the structural shift to the clean economy

Companies are going to be obliged to reduce their emissions, both by policy and by the threat posed by new technologies and processes outcompeting their own. As progressively more businesses and policymakers realise that decarbonising can be as much about opportunities for new, more efficient and better innovations as it is about increased carbon and energy costs, they will invest more in clean technologies. But deployment of new technologies is the key driver of cost reductions just as cost reductions become a key driver of investment in new technologies. The investment induces powerful reinforcing feedbacks – learning by doing; economies of scale; network effects among combinatorial technologies; and changing social norms, institutions and consumer habits.

Figure 4.1 shows the strong relationship between deployment and clean technology costs in key renewables.

Figure 4.1. The deployment and cost of renewables



Source: Grubb et al. (2021), reproduced with permission. Note: LCOE = levelised cost of energy.

Solar and wind are already the cheapest form of new electricity generation in countries covering 77% of global GDP (BNEF, 2021). Far from adding to costs, investment in clean technology and renewables has created new resources. When the UK Parliament passed the Climate Change Act in 2008, solar power cost between five and ten times as much as coal and gas electricity and offshore wind power was still prohibitively expensive. Since then the cost of wind has fallen by more than half (Jennings et al., 2020) while solar PV costs have declined more than 90% (Grubb et al., 2021). The cost of lithium-ion batteries has also fallen nine-fold (Nykqvist et al., 2019). Today, both wind and solar are cost-competitive even when accounting for the need to cover for intermittency, at current rates of penetration. Since 2010 annual investment in solar energy has grown by a factor of 20 and for wind by a factor of four.

Adopting clean technologies induces creativity and innovation across the whole economy and generates new learning and experience along the way (Dechezleprêtre et al., 2017). It unleashes economies of scale (Zenghelis, 2019) in discovery (Aghion et al., 2016) and production (van der Meijden and Smulders 2017), as businesses fabricate and distribute things more efficiently and dramatically lower costs (Acemoglu et al., 2012). This in turn makes deploying new technologies even more attractive – generating a virtuous cycle of innovation, investment and falling costs.

Because of these reinforcing feedback and network effects, such transitions happen much more quickly than decision-makers and analysts expect (Ives et al., 2021), catching most by surprise. Like most analysts, the IEA has long underestimated the scale of deployment in renewables (Roberts, 2015) and, correspondingly, overestimated falling costs. But it now notes that solar power offers the “cheapest electricity in history” (IEA, 2020b). It predicts that “renewables will overtake coal to become the largest source of electricity generation worldwide in 2025” (IEA, 2020a).

By improving efficiency and productivity, clean infrastructure and technologies can exert a powerful disinflationary force. One report estimates that renewables and efficiency technologies will allow energy expenditure to drop from the current level of 3.2% of GDP to less than 1.6% by 2050 (DNV, 2021). Supporting the clean transition will act as a powerful long-term anti-stagflation policy.

Once the ‘clean innovation machine’ (Acemoglu et al., 2012) is switched on and running, it has the potential to become more innovative and productive than the conventional alternative. By driving prices for disruptive technologies extremely low, growth in new sectors will have a positive impact on productivity growth (Zenghelis, 2019). In short, profitable ideas are hard to contain.

The presence of many path-dependent reinforcing mechanisms means that conventional analytical approaches, such as static optimisation and cost-benefit analyses, cannot cope with the multiple equilibria they generate (see Section 5.5 of the UK Government’s *Green Book 2022*). So they ignore them. This is why these analyses consistently underestimate the pace of systemic change to clean technologies and their corresponding cost reductions (Zenghelis, 2021). Put simply, the future structure of the economy in terms of technologies, tastes and preferences, behaviours and institutions is an endogenous function of the choices and investments made today and along the pathway. With this in mind, it makes more sense to talk about risks and opportunities and the processes that drive clean innovation and steer the economy, conditional on the specific policies and investments, than it does to make unconditional predictions based on predetermined variables and processes (such as future production possibilities and tastes and preferences).

There are many reasons (other than climate change), mostly related to energy system efficiency, that suggest that the fossil combustion economy was going to run into a dead end in terms of growth potential (Jarvis, 2018). Productivity and sustainability could be boosted by enabling a rapid transition towards a more digital and automated economy, consistent with the secular trends associated with the ‘Fourth Industrial Revolution’ (Schwab, 2016). These include facilitating AI, automation, machine learning, big data, the Internet of Things, nanotech and biotech, which have already created significant disruption and opportunity. This is the new wave of innovation and these areas have the potential to come together and be coherent and transformational.

This means that in the longer term, there remains genuine value and huge profit opportunity from cost dynamics in key clean sectors, though investors need to be selective in dealing with asset bubbles and dispersion in performances. Bubbles in a structural transition are inevitable (Perez, 2002) and leave giant network-generating survivors. No one lost money picking Amazon before the dot.com bubble burst, and there will be parallels in the clean economy. Creative disruption means some weaker firms will go bust, but the long-term viability of the clean and resource-efficient economy remains unchanged.

It is clear that the underlying structural features associated with the global transition to a low-carbon, resource-efficient world remain unchanged. The requirement for infrastructure investment remains very strong and will stay that way for probably a couple of decades. Technical progress continues to be rapid and in the long run there ought to be durable returns to building the supporting infrastructure for the two ‘great re-wirings of our economies’: the digital revolution and the sustainable transition (Carney, 2021).

There will undoubtedly be investors who invoke environment, social and governance (ESG) policy as a greenwashing exercise to virtue signal and attract funds. But the fact that consumers are demanding some ESG disclosure tells about changing preferences. Major institutional investors are assessing the long-term return of their investments and concluding that low-carbon assets offer more certain returns than carbon-intensive businesses. For example, Larry Fink wrote in his '2022 Letter to CEOs':

Engineers and scientists are working around the clock on how to decarbonize cement, steel, and plastics; shipping, trucking, and aviation; agriculture, energy, and construction. I believe the decarbonizing of the global economy is going to create the greatest investment opportunity of our lifetime. It will also leave behind the companies that don't adapt, regardless of what industry they are in. And just as some companies risk being left behind, so do cities and countries that don't plan for the future. They risk losing jobs, even as other places gain them. (Fink, 2022)

At the same time, increasing activity and investment now can improve productivity by avoiding post-pandemic 'scarring' that could render countries permanently poorer (DeLong and Summers, 2012).

5. Public investment in future-proofed assets for productivity and competitiveness

It is clear that historically low interest rates reflect the market's hunt for returns and help greatly with the affordability of governments' rescue and recovery expenditures. The challenge is to put in place the incentives for private investment in sectors likely to prove most resilient and profitable in the coming century with the greatest scope for increasing returns. The returns to public investment and the large growth multipliers associated with public borrowing are not threatened by rising inflation in the short run. Nor is fiscal tightening an appropriate response to any slowdown in growth induced by monetary policy.

We have argued that the appropriate response to any embedded inflation is monetary and not fiscal, given continued low rates of real interest. Borrowing to invest increases demand but also expands capacity (and therefore saving out of augmented income). The impact on neutral real interest rates and inflation would be ambiguous in the long run. Nevertheless, with time, public investment designed to absorb the glut in desired net saving and restore growth would be expected to raise equilibrium-neutral interest rates (all else being equal).⁶ With time, the scope for 'crowding in' will become reduced as global imbalances are addressed. Debt servicing costs would be expected to rise as real bond yields return gradually towards more normal levels. But this would be a symptom of success and we are not there yet. Borrowing to invest marks the pathway.

Sustained economic growth has always offered the most secure avenue for bringing down the debt/GDP ratio (Nugée, 2020). By contrast, aiming to balance budgets prematurely after a transitory economic shock is often self-defeating.

Fiscal sustainability relies on investing in assets that generate sustainable private and public returns. If public borrowing is used to invest in the productivity of public assets (Buiter et al., 2020), or to enable private assets to become more productive, it can generate growth and tax revenues that allow debt interest to be repaid (Robins et al., 2020). This means investing in complementary assets that raise productivity and offer the greatest potential in the carbon constrained markets of the future and which will not be left stranded and devalued (Aghion et al., 2016). It means locking into future-proofed physical/produced capital and also investment in human capital to secure the skills and jobs necessary for the 21st century.

There is a pressing need to adopt a broader, balance sheet-based, approach to measure a more comprehensive range of assets the public sector invests in, in order to better understand and measure the impact of policies (Zenghelis et al., 2020a). This should include measures of natural capital (Dasgupta, 2021).

⁶ The neutral real rate of interest, often referred to as R^* or Wicksell's neutral or natural interest rate, is the rate at which investment fully absorbs saving at full employment. Policymakers can raise rates above and below the neutral rate with a view to accelerating or retarding growth below or above its trend rate in order to address perceived imbalances such as accelerating or decelerating inflation.

6. Policies to unlock private investment

Market participants are increasingly recognising that outdated infrastructure, skills and ideas are becoming a liability. This is affecting asset prices today, even as fossil fuels continue to play an active role in the economy. This is why the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD) is encouraging companies to disclose the effects they are having on the stock of natural capital, as well as calling for mandatory disclosure and stress testing of assets. Data disclosure requirements are necessary to make an accurate assessment of which sectors have long-term opportunities and which contain value-at-risk. Investors need standardised, comprehensive information that is consistent across time, sectors and regions. Policymakers should support efforts to develop generally accepted accounting principles for the environment.

Direct investment will be necessary to support the low-carbon transition. Policy support needs to move beyond wind, solar PV and electric vehicles, which are sufficiently competitive to sustain strong growth momentum without policy support. Other clean sectors that are riskier and may not be as ready for the market (hydrogen, haulage, aviation and steel) need to be kick-started publicly to attain sufficient momentum. Governments should commit to investing in R&D and deployment of new technologies and related networks to draw in private finance and induce productivity-enhancing innovation.

But most of the investment will come from the private sector, especially in energy, transport and industry (investment in housing might require a larger public contribution). Only private finance can match the scale of climate action needed to deliver the net zero transition. The key aim is for credible policy frameworks to unlock and steer £3–4 trillion additional global investment a year into clean sectors and away from unsustainable and risky asset accumulation (IEA, 2021d; Stern, 2021; McKinsey & Co., 2022). This is true regardless of the short-run economic cycle.

Investment costs of tens of trillions of dollars are often cited as necessary to transition to a clean economy over the next few decades (IEA, 2021d; Stern, 2021; McKinsey & Co., 2022). These sizable sums are used implicitly or explicitly to imply that the requisite investment is 'unaffordable' in some sense. But that is misleading as there need not be a financing problem concerning the sums required. Llewellyn Consulting recently illustrated that if all companies starting from 2023 worked with the investment replacement cycle to invest only in 'green compatible'⁷ capital as old plant is retired, then by 2050 fully 90% of the world's capital stock would be green compatible (Llewellyn and Sepping, 2021).

Most, although not all, clean options save costs in the long run, especially where they replace fuel consumption, in which there is no productivity growth, with upfront investment in technology in which there is plenty of productivity growth. Therefore, with a supportive policy environment, these options should attract private investment in the expectation of returns.

Public investment and infrastructure banks, operating with clear sustainability mandates, will play a crucial role in reducing, sharing and managing policy risk and thereby encouraging private investment. This must be complemented by clear strategic planning for investment in zero-carbon and resilient infrastructure networks, backed by regulation that can enable the private sector to scale up investment.

This requires coordination of macroeconomic, structural, industrial, innovation, skills, labour market and energy policies. A clear and coherent policy landscape is necessary for building robust,

⁷ The authors define 'green compatible' investment as an addition to the capital stock that will be able to function with inputs that have been produced in a 'green' manner.

resilient and sustainable assets. Many of these signals do not require direct public disbursements. Government must complement direct support with broadening the scope for carbon pricing and introducing standards and regulations for non-price-sensitive sectors such as efficiency standards for buildings or bans for combustion engines.

Kickstarting the clean innovation machine (Acemoglu et al., 2012) means minimising the policy risk faced by private investors. Credible and predictable policy intervention can provide investors and companies with greater clarity and confidence that a low-carbon future will be a profitable one, thereby reducing the risk premium and the cost of capital.

Once private investors and entrepreneurs can see that strong, sustainable economic growth is a prospect, they can be expected to drive innovation in new technologies and competitive business networks. Countries that act early will grow the knowledge clusters that allow economies to thrive in the marketplace of the 21st century.

More government does not mean better government and any policy intervention needs to be carefully designed and balanced to avoid replacing market failure with policy failure. With the state taking on a bigger role, some policy will need to be 'mission orientated', targeting key sectors, while supporting policy should aim to be non-discriminatory to support competition, prevent rent-seeking and protect the consumer. Policy must be sufficiently stringent to change behaviour, predictable in order to contain policy risk, yet flexible in evolving in response to changing circumstances while containing compliance costs (Helm, 2010). This argues for constrained discretion for policymakers and institutional rules about revising policy settings, as with the UK's Climate Change Act enshrining in legislation five-year rolling carbon budgets overseen by an independent, specialised Climate Change Committee.

Managing change equitably

The real challenge for policymakers is not whether investing in the new economy is affordable, but how to anticipate and manage the disruption.⁸ Some investment costs may temporarily need to be borne by tax-payers as well as consumers of goods and services including energy. Not everyone will benefit from the inevitable change, at least not in the short term.

Economic growth has nearly always required structural change. Whether it is IT and digitisation or globalisation, these have had huge consequences in terms of inequality inclusion and the distribution of opportunity. However, the pace and scale of digital, resource-efficient transition is arguably unprecedented.

Job security will diminish in declining fossil fuel-related sectors. The new jobs are unlikely to be in the same places as old ones. Many financial assets will be devalued. But other policies can tackle the distributional issues (Peñasco et al., 2021), and make adjustment more palatable, retooling and reskilling workers, to enable those affected by change to participate in and benefit from the opportunities associated with the new economy (Robins et al., 2019).

Years of underinvestment in social capital suggest the marginal returns to this investment in community cohesion and social institutions must be high. Investment in providing equal access not just to transport but also housing, police, justice and other community services will form a central part of any successful levelling-up agenda. Managing change is not just about investing in technologies and skills.

⁸ See the Grantham Research Institute's work on investing in a just transition: www.lse.ac.uk/granthaminstitute/investing-in-a-just-transition-global-project/

The very secular forces that drive desired net saving have exacerbated inequality. Finding a home for saving and thereby generating high returns and high real wages for workers will be a key part of enabling low- and middle-income earners to share in the prosperity of the next century.

Recommendations for policymakers and investors

The global economy is at a crucial juncture: policy action now will determine how the 21st century economy evolves. At the same time, there is mounting uncertainty regarding the global geopolitical and macroeconomic environment. What should policymakers do to maximise opportunities and minimise risk given how the world might evolve?

The appropriateness of policy will, to an extent, depend on the persistence of inflation, and the corresponding size of the policy response required to tame it, which is a function *inter alia* of the amount of underlying spare capacity in the system. This, in turn, hinges on long-run desired net saving, which determines pressure on demand relative to capacity, the underlying driver of inflation.

As we have argued:

- **The appropriate response to any embedded inflation is monetary and not fiscal.** Central banks hold responsibility for this response.
- **Market creation and crowding in capacity is the best way to secure long-run debt sustainability.** Borrowing to invest in shoring up the denominator, which is vulnerable to climate transition risks, is the best way to reduce public debt/GDP.
- **Finance ministers must ensure that fiscal policy supports investment in future-proofed assets,** resilient to the rapidly changing technological, economic and social environment, until the neutral real interest rate rises in response to healthier returns. This means investing in physical, human and intangible as well as natural and social assets so as to limit the risk of asset stranding and devaluation.
- **With productive capacity limited by years of underinvestment, policymakers should resist the temptation to slash capital over current spending,** and avoid becoming focused on cutting taxes.
- **Policymakers must recognise the increasing returns to scale from the knowledge and technology-based clean economy** as it progressively outcompetes and replaces the commodities-based fossil fuel economy.
- **All governments, and particularly those of the G7, should seek to make their fiscal policies for the recovery 'predictably flexible',** with transparent and credible criteria for reducing deficits as sustainable growth returns.
- **Finance ministers have an important role in offering a strong public policy steer to guide private investment into clean sectors,** by taking on policy risk and applying 'skin in the game', to reinforce expectations of tangible returns from a clean transition. Such a framework is necessary for investment in recovery now and for building robust, resilient and sustainable assets that can secure strong growth in productivity and finance debt sustainability over the coming decades.
- **Carbon taxes are a necessary condition for steering behaviour.** They are transparent and non-discriminatory. However, despite being necessary, they are not sufficient to induce an effective clean transition, given the multiplicity of static and dynamic market failures. Different market failures point to the use of different policy instruments, but the collection of instruments that policymakers implement must be mutually reinforcing. Finance ministers should work with ministers across the whole of government to ensure the policy package is coherent and coordinated.

- **Finance ministers should commit to invest in R&D and deployment of new technologies, particularly those not yet market-ready.** Investment is also required in related physical, human and intangible infrastructure networks, to draw in private finance and induce productivity-enhancing innovation.
- **Where it is politically expedient to do so, governments might consider hypothecation of revenues and explicit ring-fencing of climate-related investment spending.** For example, combustion engine duties and road pricing revenues could be used to support investment in public transport.
- **Public investment and infrastructure banks, operating with clear sustainability mandates, will play a crucial role in reducing, sharing and managing policy risk and thereby encouraging private investment.** Finance ministers should ensure that this is complemented by clear strategic planning for investment in zero-carbon and resilient infrastructure networks, backed by regulation, that can enable the private sector to scale up investment, giving public investment maximum leverage.
- **Policymakers will need to predict and overcome resistance to change by implementing policies that ensure a ‘just transition’;** it is evident that the main barriers to the clean transition are not technological or economic, but political, institutional and behavioural. Investing in retooling and reskilling workers will be important, as will investing in community cohesion and social institutions. There is also scope for a range of active labour market policies, such as vocational training, accreditation, assistance in the job search process, wage subsidies or public works programmes to facilitate the transition.
- **There is a need to learn lessons from other transitions, assess gaps and opportunities and determine who are the winners and losers and what is needed to make key zero-carbon sectors equitable.** This means building governance capacity for communities to co-design local policy and decisions to develop projects to support key groups who stand to lose out.
- **Countries should renew their diplomatic push by focussing on opportunities and self-interest as a means to encourage collaboration.** In sectors where a country has comparative advantage, it can lead by example through aiming to build knowledge clusters and supply lines in rapidly growing sectors. Where a country is not well placed to lead, there must be an understanding of the pace of change in the rest of the world and its likely domestic impact, to avoid investing in stranded assets.
- **Economic analysis must be made fit-for-purpose, moving from static optimisation cost-benefit approaches to dynamic analysis** of the drivers of innovation and change, the scope for economies of scale and the endogenous risks and opportunities associated with policy choices. This means developing research priorities based on a range of metrics, including positive technology spillovers and a forward-looking strategy to retain comparative advantage in future markets. It will involve assembling a range of analyses of change – microeconomic, structural, technological and macroeconomic – that account for the challenges and opportunities that particular countries and communities face, and it will require economists to work with specialists in other disciplines.
- **Enhanced discretion, active management and careful selection of technologies, firms, sectors and infrastructure may become more important** for clean-tech investors, given that the short-run risks are rising even while the long-run opportunities remain high. Effective risk management requires seeking a long-term view and deviating from the herd as sector-specific risks unfold.
- **Coordination of policies across government will be required.** All relevant policies – macroeconomic, structural, industrial, innovation, skills, labour market, energy, and other policy frameworks – must work strategically with supporting institutions, to drive the requisite economic recovery and structural change.

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