#248: The Surplus Energy Economy, part 3

A WORLD LESS PROSPEROUS

Introduction

Now that we have addressed first principles, economic output and the role of energy, we can turn our attention to **prosperity**. The conclusions set out here are that, whilst aggregate prosperity has gone into decline, the real costs of energy-intensive necessities will continue to increase. This creates leveraged downside in the scope for both capital investment and the affordability of discretionary (non-essential) products and services. The dynamics of prosperity are explored here by reference to the SEEDS economic model.

These conclusions do not, of course, accord with the essentially cornucopian assertions of orthodox economics, but we are in a position to observe that *economics* and *the economy* have parted company. It is suggested here that the energy-based interpretation of deteriorating prosperity is consistent with much that we can see around us.

Ultimately, the purpose of economics is – or should be – to identify, explain, calibrate and anticipate the delivery of *prosperity*. To do this, we need to know what prosperity actually *is*. Properly considered, prosperity is a material concept, consisting of the products and services that are available to society.

Prosperity isn't 'money' but, rather, *the things for which money can be exchanged*, which is a significantly different concept. This is why orthodox economics, which concentrates on the financial and pays scant attention to the physical, struggles to interpret the meaning, quantum and processes of prosperity.

By way of analogy, we can usefully equate prosperity with households' 'disposable income', which is what remains after necessary expenses have been deducted from total income. At the macroeconomic level, *output* is the equivalent of total income, whilst the essential expense of system operation is the Energy Cost of Energy. Therefore, we can define prosperity as *output minus ECoE*.

In part one of this series, we identified a direct (and remarkably invariable) relationship between underlying or 'clean' economic output (C-GDP) and the use of energy. Essentially, economic output rises or falls as the availability of energy increases or decreases, and this connection cannot be circumvented.

In part two, we saw how relentless rises in ECoEs can be expected to continue, whilst increasing supplier costs are likely to combine with decreasing consumer affordability to reduce the quantitative availability of energy. In short, prosperity has started to decline because of rising ECoEs, and this process may be exacerbated by a decreasing supply of primary energy.

The material and the monetary

Though the economy needs to be understood in the material terms of energy, the economic debate is customarily conducted in the language of money. The calculation of prosperity in monetary terms is possible, because we can multiply energy use (calibrated in thermal units) by the relatively invariable unit conversion ratio (stated in money) to measure and project the financial equivalent of material economic *output*. From this, the deduction of ECoE, as a percentage, identifies *prosperity* as a financial number.

This calibration of prosperity yields a wealth of useful statistics and benchmarks. We can, for instance, compare the scale of monetary transactions with prosperity to measure the degree of equilibrium (or disequilibrium) in the relationship between the 'financial' economy of money and credit and the 'real' economy of products, services and energy.

We can likewise use the relationship between the monetary and the material to measure systemic inflation, noting that

prices are the *financial* values attached to *physical* products and services. These issues will be addressed later in this series.

Now, though, our interest is in the evolution of prosperity and its constituent parts. These are (a) the supply of necessities, (b) capital investment in new and replacement productive capacity, and (c) the scope for discretionary (non-essential) consumption. Critically, whilst aggregate and per capita prosperity are now contracting, the real costs of energy-intensive necessities are rising.

The bottom line is that *prosperity excluding essentials* – a metric abbreviated in SEEDS terminology as PXE – is in leveraged decline. This means that the affordability both of capital investment and of discretionary consumption is coming under worsening pressure. This process of **affordability compression** also has implications for the *streams of income* which flow from households to the corporate and financial sectors.

One conclusion which follows from this is that discretionary consumption will decline. Another, to be examined in the next part of this series, is that the global financial system is in very big trouble.

Past, present and future

From our energy-prosperity perspective, modern economic history fits into a logical framework. The accessing of energy from coal, petroleum and natural gas had a completely transformative effect on the economy. Advances in geographic reach, economies of scale and technology delivered falling ECoEs for most of the period in which energy use was expanding rapidly. Accordingly, for much of the industrial era, **surplus** – post-ECoE – energy supply increased *even more rapidly than* the total availability of energy itself.

Latterly, though, the depletion of fossil fuels has started pushing ECoEs back upwards, threatening to bring down the curtain on two centuries of exponential economic expansion powered by oil, gas and coal.

As the fossil fuel dynamic fades out, we can postulate three versions of the economic future. One of these, propounded by conventional economics, says that economic prosperity, being a wholly monetary phenomenon, isn't subject to material constraints, such as those which apply to energy resources, or the limits of environmental tolerance.

This idea – that innovation in the *immaterial* field of monetary policy can restore expansion to the delivery of *material* prosperity – has been tried, and has failed spectacularly, over a quarter of a century of futile financial gimmickry.

Another claim is that technology can provide us with abundant, low-cost energy from renewables. As we saw in part two, this argument isn't credible, because it overlooks the reality that *the potential of technology is bounded by the laws of physics*. Renewables cannot replicate the characteristics – including the density, portability and flexibility – of fossil fuels.

This leaves us with the third, least palatable conclusion, which is that prosperity is deteriorating because we have no

complete replacement for the fading dynamic of fossil fuels. This downturn in prosperity is by no means a sudden event, but one which can be traced through a long *precursor zone* of deceleration, stagnation and contraction

Our understanding of prosperity as the post-ECoE value of energy enables us to calculate prosperity at any point in time, and to identify the trends which will determine prosperity in the future. For forward projection, we need to anticipate (a) the amount of energy available to the economy, (b) the financial equivalent of the output provided by this energy, and (c) the proportionate ECoE deduction that differentiates prosperity from output.

Conventional economics cannot calibrate prosperity, because it does not recognize either the energy-output linkage or the 'first call' on resources made by ECoE. The best that orthodox economics can do is to count – as GDP – financial *transactional* activity, a measure which cannot inform us about *value* created within the economy.

Energy-based modelling, such as the proprietary SEEDS system used here, can calculate prosperity, which can then be used, not just as an analytical and predictive tool, but as a benchmark for referencing numerous other calculations and ratios.

The big picture

Naturally, our first concern here is with the quantum of prosperity itself, stated either as an aggregate or in per capita terms. But we also need to explore a number of other issues which we can access with prosperity itself established.

How, over time, is prosperity allocated between the provision of *essentials*, the financing of capital *investment* and the provision of *discretionary* (non-essential) products and services? Looking ahead to the next instalment of *The Surplus Energy Economy*, what is the relationship between the 'real' economy of prosperity and the 'financial' economy of monetary *claims* on that economy? And what can this relationship between the material and the monetary tell us about inflation?

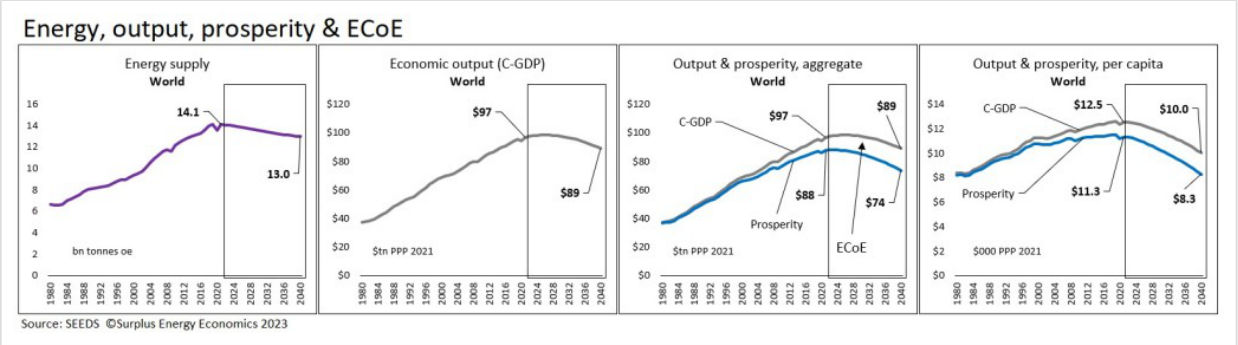
The outlook for prosperity itself is stark. Until recently, the global economy has carried on expanding, but at a decelerating rate. Now, prior growth in prosperity has gone into reverse. At the same time, the costs of energy-intensive necessities are increasing, not just as absolutes, but as a proportion of available resources. The resulting *affordability compression* undermines the scope both for discretionary consumption and for capital investment.

As we shall see in part four, there is a severe disequilibrium between the material and the monetary economies, meaning that enormous 'value destruction' has become unavoidable. This points towards disorderly degradation within the interconnected liabilities which are the 'money as claim' basis of the financial system.

The basics, at the aggregate level and in per capita terms, are summarised in **Fig. 8**. Between 2021 and 2040, both energy consumption and underlying output (C-GDP) are projected to decline by -8%. With ECoE likely to rise from 9.4% in 2021 to over 17% by 2040, the fall in aggregate prosperity is leveraged from -8% to -16%. Further (though decelerating) increases in global population numbers indicate that prosperity *per capita* is likely to be 27% lower in

2040 than it was in 2021.

Fig. 8



It will be obvious that these projections differ starkly from orthodox forecasts, which are rooted in the proposition that financial management can enable economic output to increase in perpetuity, without encountering any material constraints imposed by the finite characteristics of energy, other resources or the environment.

Within our energy-based interpretation we can conclude, not just that output and prosperity have turned downwards, but also that much prior "growth" in reported economic output has been the cosmetic product, not just of disregarding ECoEs, but also of creating *transactional activity* by the injection of ever-growing quantities of cheap credit and cheaper money into the system.

With these parameters established, our interest now turns to the meaning of prosperity decline. First, though, we need to note that nothing that is happening now has occurred without prior warning.

Indications and warnings

Prior notice of impending economic contraction has taken two forms. One of these is modelled prediction, and the other is the action that has been taken by the authorities.

Where prediction is concerned, pride of place must be given to *The Limits to Growth* (LtG), published back in 1972. Using the World3 system dynamics model, LtG examined the relationships between critical metrics including population numbers, industrial output, food production, the supply of raw materials and what was then called "pollution". It concluded that economic growth must come to an end, with indicators pointing towards the early twenty-first century as the period in which this was likely to happen.

The LtG projections have proved remarkably prescient, as has been demonstrated by subsequent re-examinations of the calculations. These warnings were disregarded, not because they were wrong, but because they were inconvenient.

Policy actions and outcomes over the past quarter-century provide equally compelling proof of the gradual onset of economic contraction. We have been applying financial gimmickry in a series of futile efforts to restore economic

growth, something which we *would not have done* had the economy itself been continuing to deliver expansion.

To be clear about this, nobody introduced credit expansion, QE, ZIRP, NIRP or any other expedient for the fun of it, or 'to see what might happen'. These and other innovations were adopted **only** because the economy and the financial system were in trouble. Where economic deterioration is concerned, this is 'the evidence of behaviour'.

In the 1990s, observers identified a phenomenon which they labelled "secular stagnation", meaning a non-cyclical deterioration in the rate of economic expansion. Because of the convention which insists that all economic issues can be explained in terms of money alone, they did not trace this to its source, which was the relentless rise in trend ECoEs.

Proceeding instead from the mistaken premise that money explains everything in economics, they sought to 'fix' this problem with monetary tools. Their solution, amenable to the deregulatory preferences of the day, was to 'liberalise' the supply of credit, making debt easier to access than it had ever been before.

This initial policy approach is known here as "credit adventurism", and there was a period in which it appeared to be working, with global real GDP increasing by 50% between 1997 and 2007. This, though, was accompanied by a 77% real-terms increase in debt, with each $1 of reported "growth" accompanied by $2.40 of net new debt. Stripping out this 'credit effect' reveals that, within the total "growth" recorded in this period, more than half (54%) was the purely cosmetic, transactional effect of pouring abundant new credit into the system.

These strains, combined with hazardous lending practices and inadequate regulation, led directly to the global financial crisis (GFC) of 2008-09. Rather than accepting the failure of "credit adventurism", though, we opted to compound it with "*monetary* adventurism". ZIRP, NIRP and QE were used, supposedly on a "temporary" and "emergency" basis, to reduce the cost of capital to negative real levels, where it has remained ever since.

In the process, we **abrogated the basic principles of market capitalism**, which are that (a) value and risk must be priced by markets free from undue interference, and that (b) investors must earn positive real returns on their capital.

The results of this second-phase gimmickry have been completely predictable although, this time around, the numbers have been even worse. Between 2007 and pre-pandemic 2019, real GDP expanded by 48%, but debt increased by 81%. Each dollar of reported growth now required the creation of more than $3 of net new debt. Fully 64% of all the "growth" recorded between 2007 and 2019 was cosmetic.

The way in which historians of the future are likely to describe this period seems clear – they will recognize that prosperity was trending downwards, and conclude that we were prepared to try anything and everything, **however illogical** and **however dangerous**, rather than come to terms with this unpalatable reality. We can best describe the period since the second half of the 1990s as a quarter-century "precursor zone" to the *involuntary* economic de-growth that has now arrived.

During this long period, economic output and prosperity have followed a process of deceleration, stagnation and contraction. In denying this, and trying to fix a *material* problem with *financial* tools, we have created an asset bubble that is destined to burst, and a vast interconnected network of liabilities that cannot possibly be honoured 'for value' by a contracting material economy.

Observing prosperity contraction

As we have seen, a deteriorating energy dynamic has put prior growth in economic prosperity into reverse. This process will have to go a great deal further, and continue for a lot longer, before there will be any chance of this reality gaining widespread acceptance. We cannot expect recognition to arrive through persuasion, however logical and evidential such persuasion may be. For those of us who understand the dynamic that has put prior growth in prosperity into reverse, our best recourse is to knowledge, concentrating on the 'why?' and 'what?' of prosperity contraction.

As we have also seen, the primary factor driving prosperity downwards is the relentless rise in ECoEs. As ECoEs rise, energy availability becomes increasingly problematic, and the post-cost value of remaining energy supply decreases.

The way in which this works shows stark regional differences, and these are illustrated in **Fig. 9**, where trends in real prosperity per capita are compared with ECoEs.

In the United States, prosperity per person turned down after 2000, with the same thing happening in Britain in 2004. But Chinese prosperity per capita has carried on improving, and is only now drawing close to its point of reversal.

These inflexion-points have occurred at very different levels of ECoE. When prosperity turned down in America in 2000, national trend ECoE was 5.1%, and the British equivalent in 2004 was 4.7%. Almost all Western economies experienced prosperity reversal in the years before 2008, when global ECoEs were still below 6%. Yet if, as is now projected by SEEDS, prosperity per person in China turns down in 2023, it is likely to have happened at an ECoE above 11%.

The cause of these differences can be traced to *comparative complexity*. The high levels of complexity in the Advanced Economies result in upkeep expenses which increase these economies' sensitivities to rising ECoEs. In almost all Western countries, prosperity per capita had turned down even *before* the 2008-09 GFC.

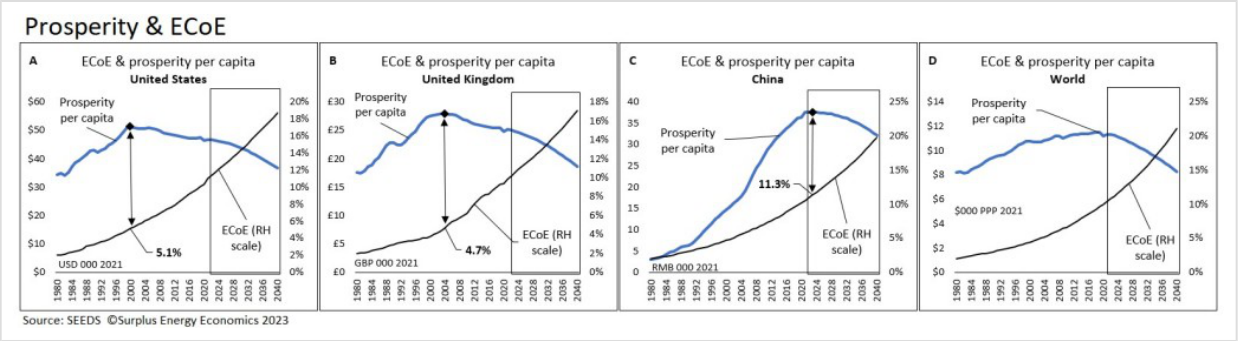
Less complex EM (emerging market) economies, which have lower systemic maintenance costs, are better equipped to cope with rising ECoEs. Only in recent years, at higher levels of ECoE, have EM countries started to encounter the process of prosperity reversal long ago experienced in the West. Whilst Mexican prosperity per capita inflected in 2007, and the same thing happened in South Africa in 2008, prosperity did not turn down in Brazil until 2013, followed by India and Indonesia in 2019, Turkey in 2021 and South Korea in 2022. One of the last countries to encounter this turning-point might be Russia where, all other things being equal, prosperity per person could carry on increasing until 2025.

The global result has been a long plateau in prosperity per capita, as shown in Fig. 9D. This plateau has been caused by continuing progress in EM countries offsetting deterioration in the West.

We do not need to conclude, as many have, that some form of greater national 'vibrancy' explains the superior economic performance of countries such as China, India, Russia and Brazil in comparison with supposedly 'staid' Western economies. Rather, the explanation lies in *the varying impact of rising ECoEs in countries with differing levels of complexity*.

As a rule-of-thumb, we can state that Advanced Economies need ECoEs of less than 5% if they are to grow their prosperity, whereas EM countries can carry on doing so until ECoEs are between about 8% and 10%.

Fig. 9



Essentials – the leveraged equation

Based on SEEDS analysis, aggregate global prosperity is likely to have peaked last year, at $88tn and will, by 2030, have fallen by a seemingly-modest 3%, though even this will equate to a 10% decrease in per capita terms. By 2040, aggregate prosperity is expected to have fallen by 16%, and its per capita equivalent by 27%, from their 2022 levels.

These references, though, are to top-line prosperity, whether expressed per capita or in aggregate. Our need now is to calculate what deteriorating prosperity is likely to mean in terms both of economic activities and of lived experience.

What we are watching is a two-stage process in which, just as top-line prosperity is falling, the real costs of energy-intensive necessities are rising. This creates a process of **affordability compression** which has far-reaching implications.

Conventional economic presentation divides the economy into sectors, which are households, government and business, with the latter sometimes further subdivided into financials (such as banks and insurers) and private non-financial corporations (PNFCs).

The SEEDS preference, on the other hand, is for functional *segments*, which are the supply of **essentials**, capital **investment** in new and replacement productive capacity, and **discretionary** (non-essential) consumption.

There is no hard-and-fast definition of 'essential' which, in any case, varies between countries and over time. Many products and services now deemed essential were regarded as 'luxuries' (discretionaries) in earlier times. This process of definitional change can be expected to continue, though this time in the opposite direction, with some things now seen as essential once again becoming discretionaries as prosperity contracts.

SEEDS analysis of 'essentials' fall into two categories. The first of these is *public services* provided by the state. This is not to assert that every service made available by government is indispensable, but these services rank as 'essential' because the individual has no *discretion* – choice – about paying for them. This definition does not embrace all public spending, because it excludes those *transfers* (such as pensions and welfare benefits) made between groups. The other category of essentials is household necessities.

It will be apparent that, in definitional as well as quantitative terms, the 'essentials' numbers used by SEEDS are estimates. The composition of 'essentials' varies between countries, not least because services provided by the government in some states are paid for privately in others.

Going forward, the general picture seems to be that public service costs are growing by about 1.5% annually *on a per capita basis*, with the costs of household necessities increasing by about 2.0%. Both are 'real' measurements, meaning that they are increases *in excess of broad inflation*. Rises in the real costs of necessities clearly over-shot this trend in 2022, because of sharp increases in the costs of energy and food. Inflation itself is an issue that will be examined later in this project.

Harmonised analysis

As we have seen, reported GDP is a misleading metric, capable of being inflated artificially by precisely the kind of credit expansion that we have been experiencing over a very long period. Even so, latest-year GDP is a number in common use, and it's helpful, for purposes of comparison, to base some SEEDS projections on this number. In SEEDS terminology, this is known as *harmonised* analysis.

This process is illustrated in **Fig. 10**, which presents global GDP on three different formats. The first of these is *nominal*, otherwise called 'current money', in which GDP is shown without adjustment for inflation. On this basis, global GDP rose from $53tn in 2001 to $147tn in 2021, an increase of 177% (see Fig. 10A).

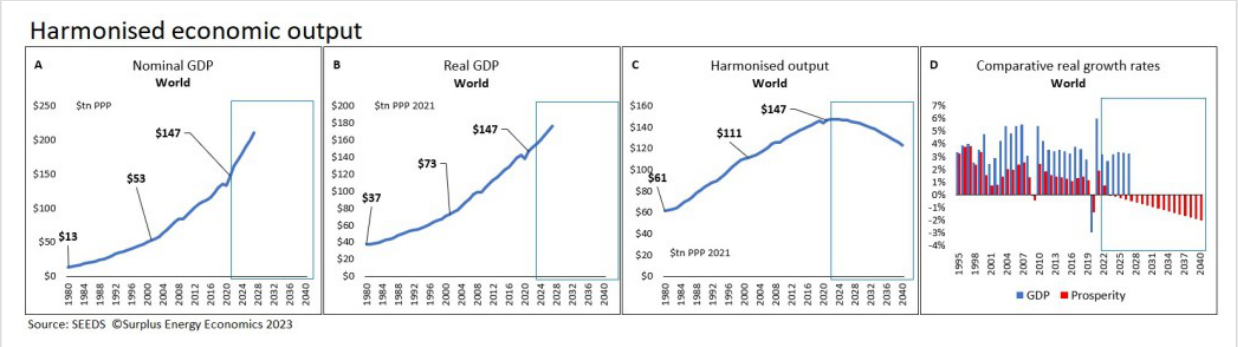
It is essential, of course, that adjustment is applied for changes in the general level of prices. In conventional economics, this is undertaken by applying the broad-basis GDP deflator to convert historic numbers into their current-value equivalents. With 2021 set as 100, the global GDP deflator for 2001 is 72.6 and, on this basis, GDP for that year is revised upwards, by 100/72.6, from $53tn at current prices to $73tn at 2021 values. On this basis, 'real' growth in GDP was 101% between these years (Fig. 10B).

As we have seen, though, this trend in recorded real GDP **does not reflect the progression of prosperity over time** – GDP has been inflated artificially through credit expansion, and no allowance has been made for ECoE.

Using 2021 GDP as a basis for comparative forecasting does not remotely mean that we should accept the misleading past trends presented by conventional data. SEEDS analysis informs us that prosperity increased by only 32%, rather than the reported 101%, between 2001 and 2021. The application of this pattern to prior years gives us a 'harmonised' trajectory, whereby 2021-equivalent output in 2001 wasn't $73tn, but $111tn. This is shown in Fig. 10C.

As Fig. 10D illustrates, underlying growth (shown in red) has been far lower than the reported equivalent over an extended period, *and has now turned negative.*

Fig. 10



Segmental interpretation

Restating past trends in economic prosperity has two purposes, both of which are extremely important. First, it provides a historical context for forward projections. Second, it gives us an ability to interpret segmental trends as they affect essentials, capital investment and discretionary consumption. This is illustrated in **Fig. 11**, where the first three charts correspond to their 'nominal', 'real' and 'harmonised' equivalents in Fig. 10.

Nominal progressions (Fig. 11A) are of no great significance, as it's generally recognised that allowance has to be made for inflation. But the inadequacy of past restatement on the basis of 'real' GDP is of huge importance. Seen in this conventional way, the rate of increase in the real costs of essentials has been more than matched by growth in top-line output, enabling both capital investment and the affordability of discretionaries to expand. Continuation of these positive trends – particularly in discretionary sectors – is **the default assumption** for anyone, in business or government, who makes plans on the basis of economic orthodoxy.

Quite how mistaken such assumptions are is apparent in Fig. 11C, which sets out segmental progressions and projections on the basis of output *harmonised* to trends in prosperity. As prosperity deteriorates **in a way that orthodox interpretation cannot project** – and as the real costs of essentials continue to rise – the affordability both of capital investment and of discretionary consumption are set to decline markedly.

It's worthwhile pausing to contemplate what this means. Anyone involved in capital investment, or in the supply of discretionary products and services to consumers, is likely to be planning in **the mistaken belief that these activities**

can be relied upon to expand. He or she is being misled by fallacious interpretations of the past into unrealistic expectations for the future.

This issue of mistaken expectation is captured in the metric PXE. Meaning *prosperity excluding essentials*, PXE is a measure of the past and projected **combined affordability** of capital investment and non-essential consumption.

In Fig. 11D, PXE is shown in two formats. The harmonised, SEEDS-interpreted history and outlook for PXE is shown in blue, and the equivalent based on orthodox economics is shown in black.

Anyone planning on the conventional basis is using past growth (most of which didn't actually happen) to project forward expansion (which is an unrealistic expectation). By comparing these lines, we can see **the extent of mistaken expectation** informing decisions in capital investment and in discretionary sectors.

We don't, in fact, need to rely on projection, in that 'affordability compression' *has already become a reality*. But the fundamental significance of this process lies in its implications for the financial system, something which will be examined in the next part of this series.

In essence, affordability compression doesn't only mean that consumers are going to have to adjust to a decreasing ability to make non-essential purchases. It also means that households will find it an ever-greater struggle to 'keep up the payments' on everything from secured and unsecured credit to staged-payment purchases and subscriptions.

Readers can reach their own conclusions on what this means for individual sectors and for the broad shape of the economy. Our interest turns next to what declining prosperity and worsening affordability compression are likely to mean for the financial system.

Fig. 11