

5 SUSTAINABLE ACCOUNTING AND THE BALANCE SHEET

William the Conqueror is famous for at least two things: winning the Battle of Hastings, thereby conquering England; and commissioning the Great Survey, better known as the Domesday Book. Remarkably, neither exercise has been repeated since then: England has not been successfully invaded and there has been no ‘Great Survey’ of the assets of the country.¹ To meet the first principle of the sustainable economy, a somewhat similar survey is now required, howbeit for a very different purpose. To be good stewards of the capitals, and the systems they are embedded in, especially the natural capital, requires accounts that answer the question: how well is this generation looking after them? To fill these accounts in, a baseline is needed.

The assets and systems approach lends itself to balance sheets and national accounting that are very different from the way the current GDP accounts are put together. The current national accounts answer a different question: how well is the economy doing in terms of flows of consumption, production and income? And, more narrowly, is the government balancing its books in cash terms? Neither of these questions addresses the stewardship of the sustainable economy, and in particular the primacy of maintaining its capitals, so that the

¹ Although there was a ‘1873 Return of Owners of Land’. Local Government Board (1873), ‘1873 Return of Owners of Land’, presented to both Houses of Parliament by Command of Her Majesty, Volume 1, HMSO 1875.

consumption is sustainable and we are not living beyond our sustainable means. Neither provides an assessment of the liabilities, environmental or otherwise. Getting the question right is the most important thing for accounts, telling us what the accounts are *for* and hence whether they tell us anything useful.

To construct the national accounts of the sustainable economy, the starting point is the capital maintenance of the core systems. This is all about making sure that the assets are not in decline. It requires a baseline of the set of assets the current generation inherited. Remedial investment may be required to bring the baseline up to scratch. Next come enhancements and improvements to these assets. With maintenance and remedial investment and enhancements properly incorporated, the sustainable economy balance sheet can be constructed. This sets the frame for the macroeconomics and how the aggregates for investment, savings and consumption should be determined. These are the accounting issues for the sustainable economy: the maintenance of all the main capitals (natural, physical, human and social); plus remedial investments; plus enhancements.

Capital Maintenance

Renewable natural capital is an asset-in-perpetuity, provided the stocks do not fall below their critical thresholds. For practical purposes, key physical system network infrastructures can also be treated as assets-in-perpetuity, as are ideas and new technologies. So too is social capital, built up over past generations. These are all assets the first principle requires us to protect and pass on to the next generation. Within this wider context, there are also many limited-life assets, like vehicles, many buildings and equipment that depreciate through use and hence the capital is used up, and there are many borderline cases. Cathedrals are best thought of as assets-in-perpetuity; modern blocks of flats are not.

Almost any asset can be maintained in perpetuity if enough is spent on its maintenance. A car could be kept in pristine condition if it is continually repaired, and its parts replaced. There are many examples in museums and collections of very old vehicles that work just as well as when they were manufactured, and sometimes even better. The reason we do not maintain all but the museum trophies is not that we cannot, but rather because of the advances in

technology. A 1930s Model T Ford car is very inefficient compared with a current Ford model. The new models are faster, more comfortable, vastly more fuel-efficient and much cheaper. In due course, with decarbonisation, new electric models should be much less polluting and therefore it will be better to replace the current petrol and diesel models with these.²

These simple examples illustrate the two ways the value of assets can be kept intact: existing physical assets can be maintained; or a set of assets necessary to deliver the services can be maintained, recognising that the physical configurations might change. In the latter case, different types of pipes and wires, different materials and different ways of coordinating can replace existing assets to deliver the services, as technical change comes along.

In the case of renewable natural capital, physical preservation is the correct and only way to keep the benefits to future generations open-ended. To maintain renewables, we have to both limit our consumption of them and engage in spending to protect the environmental systems within which they can reproduce. Although there are many environmentalists who think that the cost of capital maintenance would be close to zero if only we left the environment alone, and that the best way to do this is to rewild, the reality is that humans have changed the natural world so profoundly that there is no wild to get back to. As a result, as managers of the land, sea and air, the protection of renewable natural capital, and maintaining its value at least constant, typically requires proactive capital maintenance spending. If renewable natural capital is allowed to depreciate, as assets in mainstream economic and business accounting are, then it eventually ceases to be renewable, lost forever.

Since capital maintenance is a cost of delivering the services, not an investment, it should be a first charge on the revenues of the country, municipalities or businesses. For assets-in-perpetuity, it should be deducted from the profit and loss account and should not be a balance sheet adjustment through depreciating the asset. This simple point has very radical consequences, rewriting our national accounts and restating how well we are doing and what our sustainable consumption can be. Depreciation is a repayment of capital, and hence capital consumption. It requires capital investment to replace

² M. Scott (1991), *A New View of Economic Growth*, Oxford: Oxford University Press.

what has been consumed. Maintenance is just a running cost, a cost of operations.³

Capital maintenance might be to clear up pollution, create and enforce protected areas, protect peat bogs, and for other land conservation measures. In particular, since the biodiversity that remains is the biodiversity that has evolved and adapted alongside humans, many of the human landscapes need to be maintained to protect what we have shaped. Alpine meadows work because of the grazing routines; water meadows function as specific farming techniques, and their plant, insect and animal lives are dependent on this being maintained. Hedges require laying. Simply rewilding means setting capital maintenance to zero and will often be detrimental, especially so where it causes a reversion to a uniform ecosystem. Much rewilding is actually a type of asset depreciation. It cannot be repeated too often that the sustainable economy is not an economy with only nature, and without people and human interventions.

It has begun to be appreciated how great the cost of capital maintenance of the atmosphere is, to prevent further damaging climate change. Let's assume that our first principle includes the duty of the current generation to bequeath to the next at least as good an atmosphere, and hence a climate, as it inherited. Though there are some interesting arguments about whether the current climate is optimal, it is nevertheless the one we and nature have adapted to. Over a period of more than 10,000 years, there can be ice ages and warm periods, but for now, the current climate is what we should concentrate on maintaining. It is the climate most suited to the needs of the next generation. The simple fact is that we are failing to do so because the required capital maintenance is not being carried out. Indeed, we have already given up on anything better than a 2°C warming, and remedial action back to 0°C warming is not contemplated.

Suppose we now decide to maintain the climate, and stop global warming beyond 2°C. The costs of doing at least this should come from current revenues and not from borrowing. It is maintenance not investment. Imagine if this sum was deducted from the national current accounts. The fiscal position would be radically worse, and this is a measure of how far we are living beyond our environmental

³ See 'Concepts of capital and capital maintenance', <https://annualreporting.info/intfinrep/stan/8-concepts-of-capital-and-capital-maintenance/>, accessed 23 December 2021.

means just in respect of the climate. The sustainable economy would have a revenue-raising charge on pollution of the atmosphere and an expenditure on the capital maintenance of the energy, transport, water and other core physical infrastructures to render them net zero. It is a very big and radical ask.

Nature gives us our climate for free. Natural ecosystems are made of carbon and they sequester it.⁴ The green biomass on land and in the seas, plus the natural absorption of the seas and the weathering of rocks,⁵ all combine to soak up the emissions and have helped to create our current climate. This has changed over long time periods. Nature gave us the carboniferous periods when the fossil-fuel deposits, and especially the coal, were created in a giant sequestration burst. At other times, there has been a very different balance.

The capital maintenance of the atmosphere requires not just stopping the emissions, but enhancing the ability of the earth's ecosystems to take back the carbon we emit. Restoring peat bogs, protecting the great rainforests, and returning to a greater tree cover are all examples of capital maintenance. The units for capital maintenance should be ecosystems, not individual species, and these great ecosystems include the catchments of rivers, large and small, the coastal fringes, marshes and mangroves, and of course the oceans. A glimpse at how far we are from the sustainable economy is provided by recalling the observation that parts of the Amazon are now net emitters of carbon.⁶

For man-made physical system infrastructures, capital maintenance is to protect the services that the assets enable, without undue pollution. The bundle of assets-in-perpetuity which deliver the services (such as electricity, clean water, sewerage, transport and communications network systems) may change over time. Lead pipes were once widespread for water supply; now they tend to be plastic. Once the electricity networks used oil-filled cables; now they use modern wires. Telephone calls used to be made via copper wires; now internet access and calls are made possible with smartphones and fibre.

⁴ This is reflected in the division in chemistry between organic (carbon) chemistry and non-organic (inert) chemistry.

⁵ The weathering of rocks, the chemical breakdown of minerals in mountains and soils, sequesters carbon from the atmosphere and transforms it into stable minerals. This notably includes the creation of carbonic acid as carbon dioxide and water combined in soils and oceans.

⁶ L.V. Gatti, L.S. Basso, J.B. Miller et al. (2021), 'Amazonia as a Carbon Source Linked to Deforestation and Climate Change', *Nature*, 595, 388–93.

The extent of these changes can be overstated, but nevertheless the general rule is for *operational* capital maintenance rather than setting the physical capital assets in stone. In some cases, like communications, this has mattered a great deal over the last thirty years, but now the fibre-optic cables may last fifty or even a hundred years. The natural gas pipes have been used for the last forty years, but now many need to be upgraded and altered to take hydrogen. The water pipes, reservoirs and sewers may last fifty or a hundred years.

Technical change demands pragmatism in considering what exactly capital maintenance means in terms of the asset composition. For natural and social capital, capital maintenance is tied to the configuration of assets as they currently stand, and for human capital, ideas and technologies it is built on the current theories and hypotheses (Popper's World 3). For physical system utility infrastructures, it is a moving feast.

All this has very radical implications for us and what we need to do to live within our sustainable means. Consider the implications of charging capital maintenance for just the main physical infrastructures to us as citizens and taxpayers and what it means for national accounts. When your bike or car hits a pothole, you know that it is because the roads are not being properly maintained. This sort of neglect tends to result from political considerations and expediency. When governments and local authorities find they need to placate their voters, the roads may be given less priority over other consumption spending. In the early 1980s and in the post-2007/8 austerity, the potholes got bigger and more numerous in the UK, however 'shovel-ready' the maintenance might have been. They are generally worse now after the pandemic. Across the EU and the US, the state of roads, railways and bridges is widely acknowledged to be poor and they cope very badly with droughts, floods and heatwaves. They have little resilience. For the climate, the rise in oil and gas prices in 2021/2 led to a political downgrading of the relative importance of the capital maintenance of the climate, inducing a retreat from net zero.

Suppose that national accounts prepared by the national statistical offices were required, with regular audits, to set out the state of the infrastructure systems, report the capital maintenance requirements and any shortfalls, and set these against the current revenues. There would be no more capital consumption subsidising current consumption. Capital maintenance would be on a pay-as-you-go basis.

The scale of the adjustment would be enormous, showing that, in addition to living beyond our wider environmental and social means, we are also living beyond the means of our physical infrastructure systems. These are examples of our excess consumption now at the expense of future generations. The physical manifestations are reflected in power cuts, hosepipe bans, potholes, defective bridges and broken rails. The accounting manifestations are in the depreciation numbers.

Capital maintenance of human capital focuses on the transmission of knowledge between the generations. Each generation must be educated in a continuous process. The calculation here is in one sense easier. We could simply take it as the cost of education and charge it against current revenues. Indeed, this is roughly what is done. Attempts to fund education through borrowing and hence finance it through debt have not been a great success anywhere for school education, and have had at best mixed results at the university level.⁷ Pay-as-you-go by each generation funding the education of the next has been the norm for good reason. We gained our education for free and we should provide it to the next for free, so that the basic human capital assets are passed on at least intact to the next generation. The sustainable economy does not rely on student loans, or a specific graduate tax. Education is not primarily an investment in asset enhancements, but a capital maintenance generational necessity. Capital maintenance in education is the steady-state charge. (The really interesting questions are about *who* should be educated and *how* the human capital should be spread across the population. Not everyone needs to understand nuclear physics for the knowledge assets to be maintained.)

On top of education, there is the research base. Much of this is enhancement not capital maintenance, adding to our stock of ideas and technologies. The research base needs protecting, but the output of the research adds to the knowledge and hence improves the prospects for the next generation. This is investment not capital maintenance.

Maintenance of social capital focuses on the provision of a wider social cohesion and hence on cultural values and communities. New methods of social interaction, such as WhatsApp, Twitter (now X), Instagram and TikTok, emerge alongside older local networks based on

⁷ L. Dearden, E. Fitzsimons and G. Wyness (2011), 'The Impact of Tuition Fees and Support on University Participation in the UK', IFS Working Paper W11/17, 5 September, Institute for Fiscal Studies.

books, magazines and religions. The set of assets is largely intangible, and while many of them can take a long period of time to build up, they can be quickly dissipated. Shared history makes social capital location-dependent, and much social capital maintenance is about the support for voluntary organisations and charities. Though more diffuse and harder to measure, capital maintenance is not zero cost. Each generation should provide for the maintenance of social capital.

Taking each of the capital assets in turn, and working through the capital maintenance for each, provides an economy-wide estimate of the overall aggregate baseline against which sustainable consumption can begin to be defined. Even though this would be a radical departure from the status quo, holding the line, particularly for renewable natural capital, is hardly a great achievement. This aggregate baseline is already greatly depleted. Given the damage the current generation has done, and is responsible for, there are many aspects of core systems where remedial action to repair the damage is required to improve the inheritance of the next generation. Education and social capital are just a couple of examples. But only after we have properly accounted for and carried out the capital maintenance.

Remedial and Enhancement Investments

The scope for improvement over and above the capital maintenance for our system assets and this generation's remedial responsibilities is considerable. We could have a much better natural environment, better communications, a decarbonised electricity system and much better water and river catchments, and bequeath these better assets to the next generation. We could have even more ideas and technologies and greater trust and social cohesion. This is where investment comes in, on a systems basis.

These considerations provide a distinction between two sorts of investment, both of which are advances on the current baselines. *Remedial investment* makes good damage in this generation relative to the assets it inherited; *new investment* enhances the overall stock of assets. In theory, we could go back iteratively through the damage past generations have caused too, but for pragmatic reasons, and because the sins of past generations are not our fault, we should pragmatically stop the analysis at our generation. The results would be so radical anyway, even from this limited within-generation perspective, that

anything over and above this would be politically extremely difficult. There is a symmetry here too: we should care about the next generation because we are closely connected to it; we should address the pollution and the damage this generation has caused to natural capital because we are the responsible party.

Let's start with remedial investments. Take renewable natural capital. We need a baseline, and we have a rough idea of the state of the natural environment in the years immediately following the Second World War and increasingly detailed data since then. In the UK, natural historians have painstakingly documented the decline of our natural fauna. It is a very sad story, punctuated by some successes which need to be balanced off. Much of the total loss of the 97 per cent of water meadows,⁸ and 50–75 per cent of the insects,⁹ has happened since that war. The asset deficit is clear. It would be impractical to put them all back. But that is no excuse for not recognising the damage in the accounts and not doing at least some remedial works.

Biodiversity has been hammered by modern agriculture, plastic pollution and atmospheric pollution. Capital maintenance requires that we do not make matters worse, that for the carbon content of the atmosphere we hold the current line, now over 420ppm (as at the time of writing). But what about the 100+ppm we have added since before the Industrial Revolution? That baseline might be somewhere around 275ppm.¹⁰ Should investment be made as *reparations* for all the damage done, just as it is often demanded from perpetrators to compensate for the destruction wrought during wartime, and notoriously so in 1918 after the First World War, and now in respect of Ukraine? The point here is a fundamental one: there is no 'optimal' baseline to get back to.

If we were to put right all the environmental damage done in just this generation and choose as a baseline the state of assets which we inherited from the last generation, it would require an enormous correction and would seriously reduce our standard of living. This

⁸ Environment Agency (2022), 'Working with Nature', Chief Scientist's Group report, July, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1094162/Working_with_nature_-_report.pdf.

⁹ C.A. Hallmann, M. Sorg, E. Jongejans et al. (2017), 'More than 75 Percent Decline over 27 Years in Total Flying Insect Biomass in Protected Areas', *Plos One*, 18 October, <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809&type=printable>.

¹⁰ 'CO₂ and Greenhouse Gas Emissions – Our World in Data', <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>.

would be the case even if all the investment made in new ideas and technologies and in some new physical assets was subtracted. China, for example, might set all its new hard infrastructure and educational gains against the destruction of its three main rivers, the widespread land pollution, the massive coal-related emissions and the pollution of the South China Seas. If the true economic costs of China's expansion over the last thirty years were properly accounted for, the balance might even be negative.¹¹

The key point about the accounting for remedial investments is that they have to be paid for by the current generation. Using debt finance, with debt falling on the next generation, is only consistent with our intergenerational rule, the first principle, if it is a positive *improvement* above the baseline back in the early post-Second World War context we might have arbitrarily chosen, but practically, selected as the start line for the current generation. (We could have simply set it at say 1970 or 1990 or even 2000 – any one of these would create a major remedial requirement.) We did the damage and we need to repair and enhance the environment back to where it was. That is why it should be charged to our current account as a repair to our balance sheet.

In the case of genuine new enhancements, the *additional* assets are created which the next generation will benefit from. While, on the environmental front, it has largely been a downhill path, in other dimensions of the economy there have been positive advances in this generation which the next generation will benefit from. The next generation will get a full fibre network and communications system on a whole new level. In the UK, they may (or may not) get HS2 whether or not it is value for money.¹² They may also inherit a significantly decarbonised energy system. Some of this will be an operational way of maintaining the system services, and some, like fibre, will be a considerable enhancement over and above the copper wires it replaces. The

¹¹ See, for example, K. Arrow, P. Dasgupta, L. Goulder et al. (2004), 'Are We Consuming Too Much?', *Journal of Economic Perspectives*, 18(3), 147–72, especially Table 3. In so-called inclusive wealth type calculation, China escapes the negative numbers because very high values are ascribed to educational advancement and the relief of poverty. See also E.C. Economy (2010), *The River Runs Black: The Environmental Challenge to China's Future*, Ithaca: Cornell University Press.

¹² S. Glaister (2021), 'HS2: Levelling Up or the Pursuit of an Icon', Institute of Government, July, www.instituteforgovernment.org.uk/sites/default/files/hs2-levelling-up-stephen-glaister.pdf.

service provided is vastly enhanced compared with that which could be provided by copper.

It is in the new and additional human capital and the ideas and technologies where enhancement is likely to be most apparent. Each generation inherits a *better* body of science and its applications than the previous one, making future generations better off. It is what constitutes genuine economic growth and hence allows for an element of discounting. Enhancements in the arts are harder to identify and very hard to evaluate. It is not clear that there is ‘progress’ in literature. These arts cases are best regarded as capital maintenance only. Enhancements in social capital are at best aspirational. Maintaining trust is a huge ask, before thinking about how to create a more socially cohesive society.

The first principle of the sustainable economy suggests that these genuine enhancement benefits should be charged to those who will benefit from them, and hence the new enhanced assets should come with the debt liabilities. This, and not remedial investment or capital maintenance, is where borrowing is justified, and the total borrowing should reflect the enhancement investments that are being made. Debt on the balance sheet should be equal to or less than (if the investments have high returns) the new asset enhancements it facilitates.

The Contrast with Existing Accounts

We now have a conceptual framework that enables us to construct the sustainable economy’s national accounts and its balance sheet, which in turn guides us to an understanding of what the sustainable level of consumption is, consistent with a sustainable growth path. It is remarkably different from what our current national income accounts report, and it shows just how misleading GDP is as a measure of both what we can spend and how the economy is growing. It transforms our understanding of macroeconomic policy and of the scope for tax cuts and extra current spending.

The assets approach is based upon *stocks* (assets); almost all modern macroeconomics, and especially Keynesianism, is focused on *flows*. The key difference between the sustainable economy’s accounts on the one hand, and what the current national accounts and GDP really record on the other, is between an assets-based long-term perspective and a flows-based short-term account. They answer very

different questions. GDP is the culmination of the vision of Keynes and Keynesians. Neither it, nor the Keynesian economic policies constructed upon it, answer the question of whether we are being good stewards of our natural, physical, human and social capitals, and hence whether we are fulfilling our obligations to the next generation.

Assets are about the longer-term sustainability of an economy. Keynes was never seriously interested in the long run. His concern was recessions and unemployment, and especially the Great Depression of the 1930s, and later how to pay for the Second World War. For the Keynesians who followed, the macroeconomic problems are about short-term effective demand, not supply, and, provided that the economy is using its capacity to the full, it can motor ahead, creating cumulative improvements from which the economics of the grandchildren, Keynes thought, would look very rosy.¹³ The future is a set of overlapping short periods.

This is all very relevant to the (absence of) balance sheets and the neglect of assets. The national accounts which Keynes encouraged Richard Stone¹⁴ and others to develop were all about the flows of income, expenditure and output, and GDP measured them in gross rather than net forms. Gross meant that no proper account was taken of capital maintenance. The economy is a vast circulating machine of flows, where income = expenditure = output.¹⁵ The accounting task for them is to estimate output (and output gaps compared with full capacity utilisation) and then to manipulate consumption and investment (effective demand) to increase that output up to full employment. This was the answer to a very different question. It is one we shall tackle more extensively in developing the concept of sustainable consumption when we come to the macroeconomics of the sustainable economy.

The sustainable economy approach starts in a very different place and asks a different question about the accounts. The question is whether the assets, rather than the flows, are being maintained and enhanced, in order to work out the longer-term economic outlook and to calculate the sustainable level of consumption consistent with this.

¹³ See J.M. Keynes (1931), 'Economic Possibilities for Our Grandchildren', reprinted in J.M. Keynes (2010), *Essays in Persuasion*, London: Palgrave Macmillan.

¹⁴ L. Johansen (1985), 'Richard Stone's Contributions to Economics', *Scandinavian Journal of Economics*, 87(1), 4–32.

¹⁵ See W. Beckerman (1968), *An Introduction to National Income Analysis*, London: Weidenfeld and Nicholson.

This does not rule out short-term stimuli and measures to better use existing capacity in the labour and capital markets. Idle workers are not good, full stop. But it does create a deep conflict between the view that consumption is too high to match the maintenance of the natural, physical, human and social capitals, and hence standards of living have to adjust downwards, and the Keynesian preoccupation with taking current wages as the baseline and then increasing consumption. Because the assets approach puts the emphasis on capital maintenance, remedial investment and asset enhancements, from the baseline that consumption is already too high, the ‘output gap’ should be measured against the long-run sustainable growth path and sustainable consumption path, not the GDP path.

The Assets Balance Sheet

Let’s now consider the national accounts with the sustainable economy in mind. The starting point is the conventional balance sheet, that accounting framework familiar to most businesses and organisations (but not economists and economics textbooks). The balance sheet is a statement of assets and liabilities. The assets are listed and, where appropriate, valued. Liabilities are then similarly documented, comprising, in particular, debt. The balance sheet balances: an organisation where liabilities exceed assets is bust. The balance sheet is a modern version of William the Conqueror’s Domesday Book.

Starting with the national assets, these should contain the main system network infrastructures for which the state is the guarantor, as well as incorporating natural capital. They should add in the ideas and technologies (World 3) and social capitals too. That is what a comprehensive asset side of the accounts would contain.

It is immediately obvious that national accounts do not do this, other than in specialist satellite accounts. Why? Partly because they include only publicly owned assets, and not private ones. When the great nationalised utilities were privatised, they moved from the public national to the private company accounts. There was no corresponding recording of the decline in the asset base for the state. The proceeds were treated as cash income, making the governments of the day look in better shape. This is classic GDP accounting at its worst.

There is no perfect hard-and-fast rule about what should be on the state’s balance sheet and what should be in private company

accounts. It depends upon which question the accounts are supposed to provide an answer to. The criterion currently used is that the state's accounts should include only those assets that depended on taxpayers for their remuneration and as a generator of their liabilities. They should be *taxpayer* accounts, just as William Gladstone had once promoted in the Victorian era.¹⁶ When the utilities were privatised, provided they received no state support, the assets were taken onto the companies' balance sheets, and the interest and the dividends remunerating them were charged to customers' bills.

This all assumes that what matters is ownership and the neat distinction between consumers and taxpayers. Citizens are both, and what actually matters is those aspects of the economy that are determined by, and rely on guarantees from, the state. These include the great system infrastructures, with their long-term assets, a big gap between marginal and average costs, monopoly and public good excess capacity margins. Most of the owners of these have some sort of explicit (and sometimes implicit) guarantee from the state that their assets will not be expropriated and that they can finance their functions. No government can let them fail. If the question is about the sustainability of the economy, all the main infrastructures should be on the government's books. These are *citizens'* accounts, given the state's role is to ensure that these provide their services and meet the duties to the next generation. Only governments can guarantee this. Indeed, so essential are these functions that they should form a requirement of the sustainable economy's constitution.

One particularly interesting case relating to the physical infrastructure, relevant to the sustainable economy, is agriculture. In developed countries, agriculture is no longer the driving force in the economy, and in the UK's case produces only around 0.5 per cent of GDP. Much of this is made up of explicit subsidy, supplemented by a host of implicit subsidies.¹⁷ This is repeated across much of the world, and notably in the US and EU. On the criterion of reliance on the state and the implicit guarantee, quite a lot of agriculture should be on the national balance

¹⁶ H. Matthew (1979), 'Disraeli, Gladstone, and the Politics of Mid-Victorian Budgets', *Historical Journal*, 22(3), 615–43.

¹⁷ In the UK, these include exemptions from business rates and inheritance tax, subsidised diesel and a host of payments for flood damage, livestock deaths and other events. Crucially, the agricultural industry does not pay for the considerable pollution it causes, including the carbon emissions, and water and air pollution.

sheet. This is true of most developed countries, with the exception probably of New Zealand, which abolished its subsidies, though, even here, it might be argued that land ultimately belongs to the citizens, and ownership is more leasehold than freehold from a generational perspective.

A further example is provided by energy, and in particular power generation. Almost all UK investments rely on a contract with the state (through, for example, contracts-for-differences, feed-in tariffs and capacity contracts), not customers. In the nationalised days, the assets of the Central Electricity Generating Board (CEGB) in the UK were those of the state. Today, they are treated as private. Arguably, they should all be back on the state's balance sheet now that the state is again the primary contractor and guarantor.¹⁸ They are in this sense also *citizens'* assets. In the EU, there is a host of supports and guarantees, and the US is tiptoeing in this direction too. There would be a credit on the national current account for the income net of the subsidies, as there was in the nationalised industries.

Asset Valuation

The next problem is how these assets should be valued on the balance sheet. Here, there is a shortcut. Recall that these are mostly assets-in-perpetuity. Once built, they are not going to be depreciated and no debt should be set against them in the balance sheet because they should already have been paid for. In consequence, the overall asset value is not very interesting. Where valuation of the assets matters is for remedial investment and where enhancements take place. If assets have been allowed to deteriorate because they have not been properly maintained, the balance sheet needs an adjustment downwards for the value of the impaired or lost assets and their services. Where enhanced, there is a positive adjustment upwards. Both of these are crucial for the inter-generational accounts. But there is no need to try to value the plants and the animals and the ecosystems in which they abide and rely upon. These only require a qualitative list, an asset register. Nor do we need an empirical valuation of social capital or even current human capital.¹⁹

¹⁸ When the assets were owned by the CEGB, and on the government's account, customers paid most of its costs.

¹⁹ C. Mayer (2013), 'Unnatural Capital Accounting', Natural Capital Committee, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/516947/ncc-discussion-paper-unnatural-capital-accounting.pdf.

This point is missed on many economists engaged in cost-benefit analysis. The conventional economic argument is that everything has a price, either explicitly or implicitly through its shadow value.²⁰ It leads to inane and silly arguments about the value of bats and birds and flowers. Renewable natural capital assets are not to be bought and sold (in discrete units), all with neat prices to insert into the competitive marketplace. Renewable natural capital is not just another sort of capital: it is a special type of capital because it is renewable and hence can go on delivering its benefits in perpetuity at little or no cost other than capital maintenance. Only in very exceptional cases would one want to get rid of it, and only then does the question of compensation arise. Similarly it is silly to try to say how much the equation $E = mc^2$ is worth, or to put a monetary value on trust.

It is here that the Keynesian approach to the accounts has a positive contribution. If the economy is about the circular flows, there is cash spending on consumption and investment by government, and this is all one aggregate flow. The way this was carried over to the great nationalised industries, and hence the systems we are most concerned about, was through the principle of *pay-as-you-go*. The current generation paid for the building of power stations out of current revenue, and each generation did the same. It was an intergenerational chain letter, biased to the benefit of future generations. The nationalised industries had virtually no debt. Provided that the government maintained the assets, there was no need for a balance sheet valuation. Pay-as-you-go solves the problem of intergenerational capital maintenance responsibilities. It did so too in education, including in universities. There were no tuition fees. There were of course costs to meeting the capital maintenance requirements, but these do not require valuation of the underlying assets. We do not need to value the London Underground or the London sewers. We just need to maintain them. Where underlying assets were sold in privatisations, the opening valuation was somewhat arbitrary and circular, in effect, capitalisation of the revenue stream from customers' bills which had evolved in the public sector to make pay-as-you-go add up in cash terms and by the arbitrary application of a rate of return.²¹

²⁰ A shadow price arises for goods not traded in markets. It is an estimate of what the price would have been had the goods been traded, reflecting both demand and costs.

²¹ See I.C. Byatt (1986), 'Accounting for Economic Costs and Prices: A Report to HM Treasury by an Advisory Group' (the Byatt Report), 2 vols., HMSO. For detailed comment, see

A balance sheet is needed to show whether the assets are maintained and the balancing of enhancement investment against debt finance. It is all the more important because the pay-as-you-go principle was widely abandoned in the 1980s, and it is now not only enhancements that are paid for by future generations through debt finance, but even current spending and capital maintenance and remedial spending are partly funded by borrowing too.²² It was (and continues to be) a great betrayal of future generations, little noted at the time. All this should be reflected in a decline in the balance sheet, and a writing-up of the consequent liabilities. Properly accounted, it should shame the current generation.

As the debt piles up, but the assets do not, what stops the government from going bankrupt is the assumption that all these liabilities will be guaranteed and honoured by the next generation. In contrast to the sustainable economy, the current approach relies on an increase in liabilities and a higher standard of living of the current generation that will be paid for by the next generation. In effect, the increase in liabilities is offset by a promise to pay on behalf of the next generation, assuming that they are going to honour this. The liabilities on future generations should be reported for all to see in the national accounts. They should be reported annually in finance ministers' budgets.

It remains to be seen whether future generations will in fact pay, or whether governments have to implicitly default through inflation, exchange rate depreciation and even allow outright explicit default. In the UK, inflation and the exchange rate declines have been the implicit preferred routes for defaulting for the last 100 years. No accountant would sign off these accounts for a private entity.

Incorporating Capital Maintenance into the Accounts

The remaining accounting point relates to how to handle the profit and loss account – current revenue, current expenditures and the current balance. For the state, this includes all of its educational, health and

G. Whittington (1988), 'The Byatt Report: A Review Essay', *British Accounting Review*, 20, 77–87. On applications to asset value, see D. Heald (1989), 'The Valuation of Power Stations by the Modern Equivalent Asset Method', *Fiscal Studies*, 10(2), 86–108.

²² Transport for London is a recent addition to the list of public companies borrowing to cover current expenditures. See <https://tfl.gov.uk/info-for/investors/borrowing-programme>.

social welfare provisions, the police, the army and much of the local government services. These are not relevant to the capital account, provided the capital maintenance (and remedial spending) is paid from current revenues, as it should be for our generational rule.

There should be an additional charge against this revenue line, so that the budget ‘balance’ on the current account (analogous to companies’ profit and loss accounts) is net of the total of this capital maintenance and remedial spending. This means that the costs of maintaining the natural capital asset base intact, the costs of the decarbonisation and the costs of maintaining the great physical systems (and the costs of ‘making good’) would all be deducted *before* the finance ministry decides how to spend what is left. They are all pay-as-you-go.

There is little doubt that the net revenue left for spending after the deduction of capital maintenance would be significantly lower. If the government sought nevertheless to maintain the current spending level, and unless tax was raised, borrowing would be higher. The higher the borrowing to cover current spending, including capital maintenance, the greater the burden that is shifted from this generation to the next, and the greater the violation of the intergenerational equity first principle, for this is not enhancement investment to create new assets. This is one measure of how far we are living beyond our means, for which sustainable, asset-based national accounts should give an estimate.

It remains to sort out savings and the funding of investment for enhancements (but not remedial investments). If, as is currently the case in the UK (and the US), saving is very low,²³ then it is foreigners who do much of the lending. If, in addition, the current account of the balance of payments is consistently negative, then again it requires foreign inward financial flows. There has to be a capital inflow to balance the external current-account deficits, so that the balance of payments balances. This is one reason why so many of the UK’s (and some US) assets, including much of its infrastructure systems, are now owned by foreign companies. Quite a lot of land, especially in the UK, is also in foreign hands. It is another consequence of living beyond our means: selling off our core assets to foreigners to pay for our lifestyles, by buying more imports than the exports we sell. It is the selling-off of capital

²³ The exception is saving during the pandemic.

to boost current spending, an exercise that the Labour government of the 1970s and then, on a greater scale, the Thatcher government that succeeded it in 1979 accelerated by selling off the nationalised industries (as well as council houses), and most European governments followed suit.²⁴ Everyone in the UK, US and the EU has been in the business of this creative accounting.

Changing the Questions

Macroeconomics, as it has developed over the twentieth century, has had almost nothing to say about the development and sustaining of the asset bases of economies and especially renewable natural capital. Yet this has not stopped a confluence emerging between those on the left who want a bigger state; those Keynesians who regard the current difficulties as the consequence of deficient effective demand; and environmental activists who want to reduce pollution, notably from carbon, but also generally to upgrade natural capital through large-scale borrowing.

None of these parties has shown much, if any, concern about the consequences of the debt this implies, and none has questioned the opening level of consumption and its relation to sustainability. For environmentalists, the benefits from a loss of demand during the lockdowns for aviation (and transport in general) and for a host of hospitality expenditures (in other words, a reduction in environmentally damaging consumption) should have been not only welcomed, but reinforced by a desire to limit any rebounding in consumption generally. What unites all these parties (the environmentalists and the political left and indeed even centre-right Conservatives) is their hostility to ‘austerity’, by which they mean measures to reduce fiscal deficits and hence to limit consumption. It is classic ‘cake-ism’: more consumption *and* a better environment. In the case of Covid, all wanted a return to the level of consumption and living standards that prevailed before the pandemic broke out.

The assets-based accounting rules set out here would reveal the true scale of the deceit that those Keynesian policies disguise. They would reveal that such deficits increase the gap between current and

²⁴ The Labour government at the end of the 1970s started selling off BP. Council houses were the biggest item in the first Thatcher government from 1979 to 1983.

sustainable capitalism. The debt which plugs this gap is a liability placed on the young and the next generation to support our unsustainable lifestyles now. It is a large-scale increase in liabilities on the balance sheet with the counterpart being future citizens as customers and taxpayers. It is a gross violation of the duty to leave the next generation with a set of assets at least as good as the current generation inherited. Proper accounts shine a bright light on this deceit, analogous to William the Conqueror's attempt through the Domesday Book to shine a light on what he had stolen.²⁵

²⁵ The Napoleonic Wars (1803–15) kicked off income tax to cope with the national debt incurred to fund them. See M. Slater (2018), *The National Debt: A Short History*, London: C. Hurst & Co. Publishers Ltd. See also E. Chancellor (2022), *The Price of Time: The Real Story of Interest*, London: Penguin Books; and B.S. Bernanke (2022), *21st Century Monetary Policy: The Federal Reserve from the Great Inflation to COVID-19*, New York: W.W. Norton & Co.