



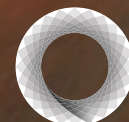
UNIVERSITY OF
CAMBRIDGE



Valuing Wealth, Building Prosperity

The Wealth Economy Project on Natural and Social Capital,
One Year Report

LETTER **1** ONE




Bennett Institute
for Public Policy
Cambridge



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“Prosperity will depend on stewardship of the whole portfolio of society’s assets”

1. WEALTH ECONOMY - PREFACE

Diane Coyle

The 12 months since the launch of the Bennett Institute's Wealth Economy research programme have brought more progress in terms of our research and its impact on decision makers than we could have foreseen. The fundamental message - that sustained prosperity will depend on stewardship of the whole portfolio of society's assets, which therefore need to be properly measured and understood - has struck a chord.

During this first year we focused on natural capital, particularly climate, and social capital. In recent years there has been little evidence on the empirical relationships between trust, social capital, and the economy as a whole. We have demonstrated that meaningful measurement of social capital is feasible, and that this helps explain 'hard' economic outcomes like productivity growth. We have provided an additional important lens on accounting for CO₂ in terms of the damage caused by climate change - so that while for example Australia accounts for just 1.3% of global CO₂ production, it is on track to experience between 12 and 24 times more damage from climate change than the world per capita average. These findings and more, from the dynamics of tackling emissions to the financial market consequences, are described in this report.

Our messages are hitting home. We have discussed the opportunities and implications of the wealth economy approach with other academics, with senior officials around the world and also with the general public. Our work has been used by bodies including the UK's Industrial Strategy Council and the United Nations Statistics Division. New research examining the links between climate change and sovereign risk, is attracting interest and funding from a consortium of 54 central banks working to enhance the global financial system's resilience to climate change.

Thanks to the generous support of LetterOne, we will be able to continue this research programme, expanding it to look at human capital - the key raw material of the 'knowledge economy' - and at the interactions between human capital and social capital, or in other words between people and their social environment.

The need for our researchers, and a growing band of others elsewhere, to continue this work could not be more urgent.

Diane Coyle, Bennett Professor of Public Policy



**“prosperity
will depend on
stewardship
of the whole
portfolio of
society's assets”**

“Measurements of economic success need to align more closely with how people think of true prosperity”



2. WHY THE WEALTH ECONOMY?

How the nation manages its comprehensive wealth determines how much our economies can prosper. Comprehensive national wealth accounts help us understand changes in assets such as natural resources or people's skills - these are the foundations of progress. Accounting for them helps inform policymakers and businesses of the consequences of their choices. It provides a measure of the true wealth of a nation. It measures the long-term capacity of the economy to deliver sustained growth and improving living standards.

Monitoring critical assets like these can safeguard national economic strategies, guide forward-looking business plans, and help address many of today's pressing social and economic challenges. Perhaps most importantly, it offers a necessary and urgent means to steer the world towards a more prosperous future. Access by individuals or groups to these different assets determines their ability to earn, to spend, and to engage in any other activities needed to lead the kind of lives they want.

This ambitious framework requires measurement of access to six types of economic assets. These add up to what is known as comprehensive wealth:

- Physical assets and produced capital, including access to infrastructure, and to new technologies
- Net financial capital
- Natural capital - the resources and services provided by nature
- Intangible assets, such as intellectual property and data
- Human capital, the accumulated skills, and the physical and mental health, of individuals
- Social and institutional capital

The measurement of economic success needs to align more closely with how people think of true prosperity. The Wealth Economy project is guided by the understanding that the quality of life depends on more than just short-term income. No individual would assess their prosperity solely on the basis of one month's earnings. Yet by focussing almost exclusively on GDP as a metric of economic performance, that is the standard approach at the national level.

GDP is a useful, but insufficient measure. GDP is a standardised, commonly understood and commonly applied measure of the flow of output, income and expenditure comparable across time and between countries. Yet forward-looking economic policy must manage a portfolio of assets that a country can access, to ensure that citizens enjoy a sustainable flow of benefits into the future.

The Wealth Economy project is leading a global movement toward a world that looks beyond GDP. By supplementing GDP with complementary measures of natural, social, and human capital, our work provides a deeper assessment of the underlying wealth of nations. Our work is influencing policymakers, statisticians and academics across the world.

As economies evolve, so too must the tools of measurement. Many of the challenges we face today - including climate change, the 'productivity paradox' plaguing many advanced economies, and even political upheaval - can be traced to an erosion of natural, human, social and institutional capital. But these trends are not reflected in standard official statistics.

Measuring wealth provides a more comprehensive understanding of the modern economy. The World Bank measures the 'true wealth' of nations and estimates that intangible assets including ideas, culture and customs now comprise around a third of total wealth in developed countries. Ignoring this immense source of wellbeing is to act blindly. Today, about four out of five dollars spent in the leading OECD economies purchase services or intangible goods.

Global economic and political structures continue to change so official data needs to keep up. Increasing greenhouse gas (GHG) emissions have put the world at severe risk from climate change; while environmental degradation has threatened health and social stability. In many countries, sharply increasing shares of wealth and income for the rich have also threatened social cohesion and many have seen falling confidence and trust in social and political institutions. Globalisation of trade and investment flows have meant the impacts of wealth generation in some regions have been matched by the destruction of wealth in others.

“As economies evolve, so too must the tools of measurement”

2. WHY THE WEALTH ECONOMY?

Wealth Economy Measuring Wealth

Wealth determines prosperity
The measurement of economic success needs to align more closely with how people think of true prosperity.

Six Capitals
Social, Natural, Human, Institutional, Financial, Intellectual

Forward-looking economic policy must manage a portfolio of assets that a country can access, to ensure that citizens enjoy a sustainable flow of benefits into the future.

GDP growth derived from depleting capital is not sustainable and deprives future generations of wellbeing

Capital Interaction
The complex interrelationships between assets exacerbate the impacts of placing undue stress on any one form of wealth.

Extreme weather events can also threaten physical capital. Such damage to natural, physical and human capital can further create tensions which undermine social capital.

Damage to natural capital can undermine human health.

Improving the quality of information and statistics on our access to key assets is not easy, but even partial progress can yield substantial gains and imputing zero for want of better data is always likely to be damaging.

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The pace of change makes social and institutional capital even more important. New technologies such as AI, machine learning, biotechnologies, big data and automation create both opportunities and challenges. The effects in some places could be severe. Managing these changes will require social, economic, and political institutions that can mitigate the losses whilst maximising the gains.

Social cohesion and economic justice require that such transitions are managed. This puts investment in adaptive and flexible human capital at the fore, including the training and re-training of current workers and the provision of continuing education.

The Wealth Economy project began by focussing on social and natural capital. Social capital matters because cross-sectional data has long shown that robust social capital based on trust, civic engagement and effective institutions go hand-in-hand with economic wellbeing and economic growth. Devising standard measures and approaches to social capital, and understanding its links to productivity and prosperity, is therefore essential.

GDP growth derived from depleting capital is not sustainable and deprives future generations of wellbeing. This is why natural capital is so important to measure. It includes the water, air, soil, geology, and living things that provide us with the basic and interdependent building blocks of life and economic welfare. Natural capital loss threatens both the stocks and returns to all other forms of capital. Whereas human, physical and knowledge capital may be growing, natural capital is generally in decline, with grave prospects for wellbeing.

Not all of these assets can be substituted for each other. In particular, natural asset depletion, such as deforestation of the Amazon or mass extinction of fish or insects, cannot be adequately compensated by production and human capital. Any study of sustainability must identify the forms of capital that need to be preserved for the wellbeing of future generations.

The complex interrelationships between assets exacerbate the impacts of placing undue stress on any one form of wealth.

Damage to natural capital such as air and water quality undermines human capital due to illness, loss of labour productivity, and even death. Extreme weather events can also threaten physical capital. Such damage to natural, physical and human capital can further create tensions which undermine social capital.

The important thing is to acknowledge the limitations of the data and what is missing. One problem is that the valuation of assets, unlike that of goods and service flows, needs to be forward-looking.

This reliance on expectations means valuations are liable to change through time. But they are no less real. Changing value reflects the fact that the structure of the economy is always changing. The accelerating pace of change highlights the urgency with which better measures of assets and potential revaluations are needed.

By encompassing the future, wealth offers a better indicator of sustainability and the health of a nation than GDP. Moreover, because expectations can be influenced, credible leadership from business and government can change the real world by creating and destroying wealth. It does this by steering new behaviours, technologies and markets to replace old ones, shaping innovation, and growing new markets and resources (see section 6).

Measurement itself can shape the economy. Statistics are a lens for observing the economy and a tool for shaping its future. Policymakers, businesses and individuals change their behaviour in response to the picture they see.

more comprehensive wealth stats

lens through which we view world

understanding of challenges and opportunities

invest in key assets

need to monitor effectiveness of investment

more comprehensive wealth stats

“Statistics are a lens for observing the economy and a tool for shaping its future”

The image is a composite of two photographs. The background is a dense forest of tall, thin trees with a light-colored sky. In the foreground, there is a large pile of cut logs stacked neatly. The ground is covered in a layer of snow. A white text box is overlaid on the left side of the image, containing a quote. A white arrow points from the text box towards the log pile.

“Natural capital is the only component of wealth facing worldwide decline”

3. WHAT IS NATURAL CAPITAL?

Conceptually, natural capital is similar to other types of capital produced by humans. Manufacturing plants are physical capital assets that produce flows of goods (e.g. cars) over time. Overuse wears down heavy machinery (depreciation). If the rate of depreciation is greater than the rate of reinvestment (capital maintenance expenditure), future output falls.



Similarly, stocks of natural capital assets generate flows of environmental goods and services over time. Forests and fisheries are like 'natural factories' producing flows of timber and fish. These natural capital assets are depleted and degraded by excessive pollution and overharvesting (depreciation), and future output will fall if this depreciation exceeds the combined rate of natural regeneration and human investment in natural capital maintenance (e.g. planting new forests, environmental restoration, conservation investments).



Unlike human, physical and knowledge capital, natural capital – which provides the building blocks of all other forms of capital – is generally in decline. This poses grave risks for wellbeing. GDP growth derived from depleting natural capital - which includes water, air, soil, minerals, and renewable capital such as forests or marine ecosystems (which are prone to system collapse) - deprives future generations of wellbeing. This is why natural capital is so important to measure.

'Natural capital provides the building blocks for all other forms of wealth'

A photograph of a woman in a white lace dress drinking water from a public tap in a public square. The water is splashing around her. In the background, another person is also drinking water. The scene is set outdoors with a stone structure and some foliage visible.

**“GDP growth achieved by
depleting capital deprives
future generations
of wellbeing”**

4. WHAT IS SOCIAL CAPITAL?

Social capital is the glue that holds societies together. It encompasses personal relationships, civic engagements and social networks. Without it, there can be little or no economic growth or human wellbeing. This notion has strong intuitive appeal, but social capital has proven slippery to nail down, not least because it consists of many interrelated elements.

Most of these elements relate to generalised trust, shared rules, and the social norms and values that shape the ways we behave in everyday relationships and transactions. Social capital reduces transactions and monitoring costs, and enables social and economic cooperation and exchange. The World Bank estimates that intangible capital (consisting primarily of human, social and institutional capital) may make up between 60% and 80% of total wealth in most developed countries. Ignoring this immense source of wellbeing – and its potential fragility – is to act blindly.

Data has long shown that trust, civic engagement and effective institutions go hand-in-hand with wellbeing and economic growth. One important study found that a moderate increase in country-level trust significantly increases economic growth. Another showed how regional differences in social capital (levels of cooperation, participation, social interaction and trust) dating back several hundred years determined Italian cities' and regions' ability to function effectively. Studies find that the quality of governance and institutions explains a significant part of the variation in rates of growth and investment across countries by supporting social capital.

Investment and innovation in institutions, behaviours and cultures can build social capital. Institutions can steer social norms which in turn guide law-makers and jurisprudence. Last year's Nobel Prize winner Paul Romer pointed out that innovation drives growth, but is not limited to technological capital and knowledge capital: it also applies to rules, governance, and policies. New technologies can even be harmful if not accompanied by rules that make growth sustainable – for example, rules that limit pollution, soil degradation, and overfishing – or rules that regulate employment and limit monopolistic rent-seeking.

Generalised trust in fellow citizens and institutions and the quality of governance are both the result and cause of productivity growth and higher reported wellbeing. These positive feedback mechanisms mean sustained, carefully targeted policy interventions could trigger a virtuous cycle of good governance and higher productivity.

**“civic engagement
and effective
institutions go
hand-in-hand with
wellbeing and
economic
growth”**



**“Trust, civic engagement
and effective institutions
go hand-in-hand with
wellbeing and growth”**

5. RESEARCH OUTPUTS

Measuring Social Capital and Investigating its Drivers

Anyone shopping online places their trust in someone they do not know, whose product they cannot see. In business, trust comes as goodwill, which makes it easier for a company to raise new capital. Social capital lies behind the effective functioning of the police and judiciary as well as a government's ability to levy taxes and provide public goods. But how can statisticians measure it?

No economy can function without social capital but its definition is imprecise. To explore its measurement, we analysed 10 questions capturing different aspects of trust, a wide-spread metric for social capital from the European Social Survey.¹ Seven of these questions investigated trust in institutions, and three examine trust in individuals.

We used a data reduction technique called principal components analysis to identify two underlying dimensions of trust that can explain up to 65% of the variation in the initial 10 questions (Figure 1). The first dimension, which we label *Generalised Trust*, shows a positive correlation with all ten initial questions. The second dimension, which we label *People VS Institutions*, shows a positive correlation with the three initial questions investigating trust in individuals, but a negative correlation with those seven questions investigating trust in institutions. Such an approach, which leverages the commonality among different forms of trust, can yield a novel perspective on its essential, underlying elements.

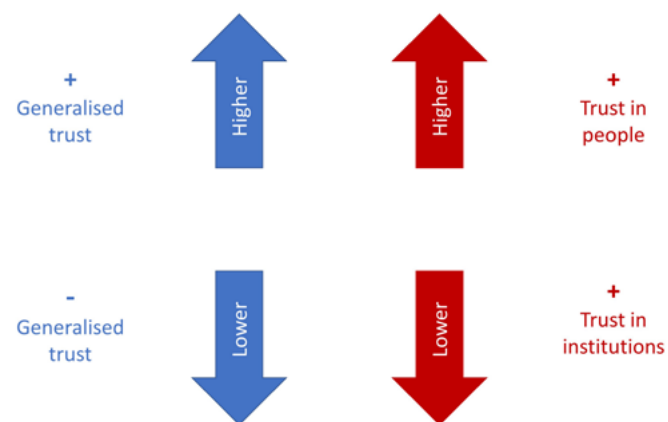


Figure 1: The two components structure of trust

The UK's Industrial Strategy Council² has adopted our social capital indicators in its *Success Metrics Project*. Subsequently our work has focused on exploring the evolution of these two components through time, as well as identifying possible drivers of trust.

For instance, dividing the sample into five age groups and looking at how *Generalised Trust* evolves over time for each group (Figure 2, left), reveals that those aged 15 to 30 show consistently higher levels of *Generalised Trust* as compared to the other age groups. Moreover, the gap between the youngest and the rest has been increasing over time. Repeating the same exercise for five groups based on income levels (where the 1st quintile represents the lowest income group), shows that higher income groups display higher *Generalised Trust* (Figure 2, right).³

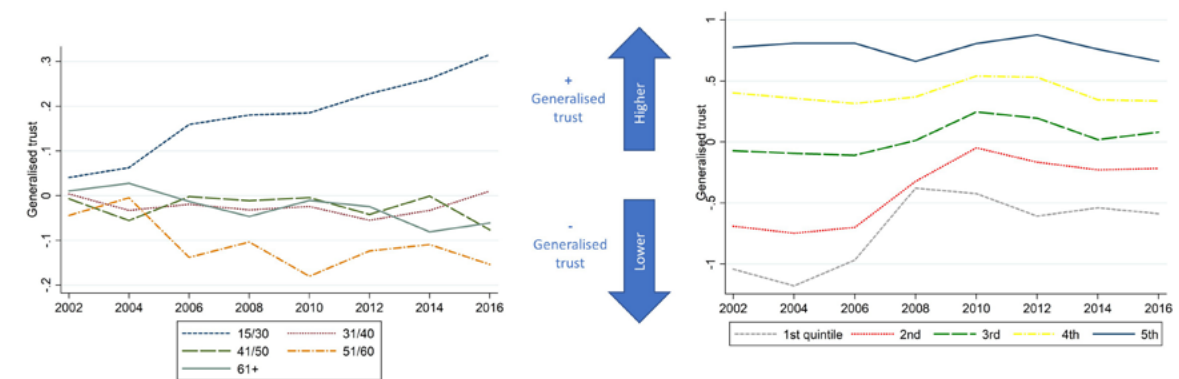


Figure 2: Variations across age and time (left), and age and income (right), for generalised Trust

These correlations do not tell the whole story. Regression analysis can isolate a clearer relationship between age, income and the two trust components, and helps explain if other variables play a role in determining social capital. Figure 3 below reports how age and income are related to the two components once we account for a number of possible confounding factors, including country of residence, date the survey was administered, demographic and socio-economic variables such as gender and education, and additional measures of social capital.⁴ We also controlled for the prevailing country inequality using the Gini coefficient and for a measure of policy uncertainty at a country level.

“wealth [is] a better indicator of sustainability ... The future is ‘priced in’ ”

5. RESEARCH OUTPUTS

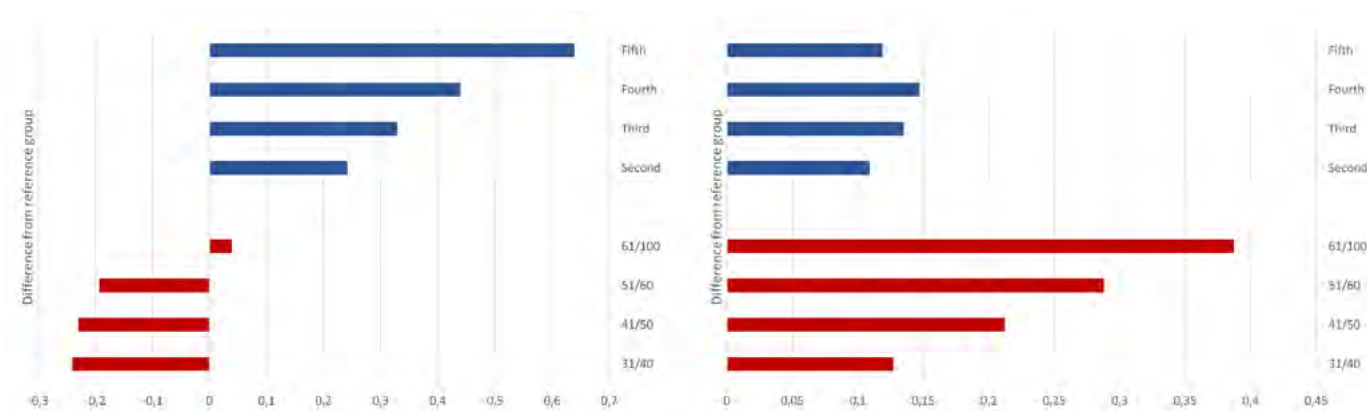


Figure 3: Regression coefficients for age and income for Generalised Trust (left), and for People VS Institutions (right)

Each bar in Figure 3 represents the difference in the trust indicator between each group and the reference category, which is the first income quintile in the case of income (blue bars), and those aged 15 to 30 for age (red bars). The relative patterns observed in Figure 2 still hold when we control for all the other variables: indeed, all age groups show lower values for *Generalised Trust* as compared to the 15 to 30 group;⁵ they also show higher values for *People VS Institutions* (that is, they appear to trust individuals relatively more than institutions). On the other hand, as compared to the first income quintile, all other income groups show higher values for both *Generalised Trust* (in agreement with Figure 2) and *People VS Institutions*.

These results do not establish causality. It is impossible to claim, for instance, that higher income causes higher *Generalised Trust*, but we can say that the two are related. Identifying causal drivers is difficult given the complex relationships between variables (Figure 4).

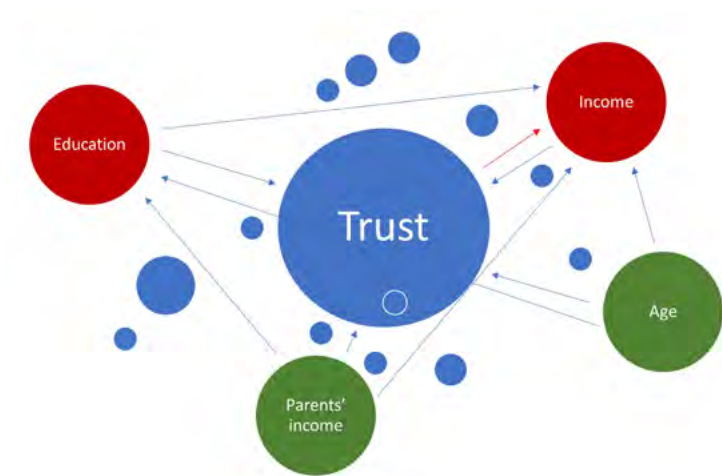


Figure 4: Possible causal links between exogenous variables (green), endogenous variables (red) and trust

For example, variables such as age or parental income cannot be affected by other relevant variables and are therefore broadly exogenous. Income, on the other hand, may be affected by parental income, or education (which is itself affected by parental income) all of which may affect the level of trust, which may affect some of these variables in turn. Investigating this network of directed links to isolate evidence of causality forms the next aim of our research.

1. We use the eight waves (2002–2016) of the European Social Survey (ESS), which comprises data at an individual level for over 30 countries (the sample varies depending on the year). The ESS is a [widely respected source](#) and provides cross-country as well as cross-time comparability. It is also especially insightful with respect to certain themes, including [social capital](#).
2. The UK's Industrial Strategy Council is tasked with providing impartial and expert evaluation of the UK government's progress in delivering the aims of the Industrial Strategy. It is an independent advisory group led by Andy Haldane, the Chief Economist at the Bank of England. The Council recommends the criteria to measure and monitor the success of the UK's Industrial Strategy.
3. A change in measurement for the income variable occurred between 2006 and 2008, therefore the observed pattern of convergence among the series might be driven by it (in addition, Generalised Trust is demeaned so that mean-shifting changes should not appear).
4. These measures include how often one meets socially, whether the respondent is member of a trade union or a similar organisation, how many people with whom to discuss personal matters one has and whether the respondent voted in the last national election.
5. With the exception of the 61/100 category, whose coefficient is statistically indistinguishable from 0.

5. RESEARCH OUTPUTS

Trust and Productivity

The relationship between trust and social capital is of keen interest across the social sciences. But although much economic research has focused on the small scale, there is relatively little evidence on the empirical relationships between trust, social capital, and the economy as a whole.

Early work on the macroeconomic effects of economic institutions (especially informal institutions) grew in the 1990s and early 2000s. But there are few studies of how social capital impacts macroeconomic growth, partly due to the challenges in quantifying the variables of interest. So paradoxically, although social capital is widely believed to have significant consequences for economic development and growth, this rests on a limited empirical base.

Using data from 1970-1992, several early studies found positive relationships between trust and various aggregate economic outcomes.⁶ But using data for the same countries for the later period 1990-2000, [Berggren et al. \(2007\)](#) found the relationship between trust and economic growth was no longer either as large or statistically significant.

The causal mechanism between trust and economic growth is not fully understood ([Algan and Cahuc 2010](#)), which might lie behind these conflicting results. However, [Dasgupta \(2010\)](#) presented a convincing theoretical model to demonstrate how interpersonal trust can lead to higher output for the entire economy with no change in the aggregate level of capital and labour inputs used. We, therefore, wanted to test whether the improved efficiency of resource allocation would be captured empirically by the total factor productivity (TFP)⁷ statistics.

[Gordon \(2016\)](#) pointed out that the slowdown of TFP growth since 2004, particularly during the post-crisis period, would have significant implications for potential real GDP growth in advanced economies. Identifying the determinants of TFP growth is central to current policy and academic debates. We argue that social capital should be taken into consideration when designing and implementing structural policies that aim to improve productivity growth in the medium and long term.

Our research has shed light on the relationship between trust, social capital, and economic outcomes in two ways. First, we update the evidence on the trust-growth relationship from the earlier literature, most of which uses data up to about 2000. Second, we test empirically whether total factor productivity is the channel through which trust affects levels and growth rates of income.

The Data

Our estimates are based on a panel of data covering 15 European countries⁸ from 2002-2016.⁹ For the general trust measure (independent variable of interest) we have used the European Social Survey (ESS), which requires the respondents to choose a score from 0 ("you can't be too careful") to 10 ("most people can be trusted").

There is significant variation in this index among countries in the ESS survey. However, the relative position of each country stays broadly stable over time.¹⁰ See (Figure 5)

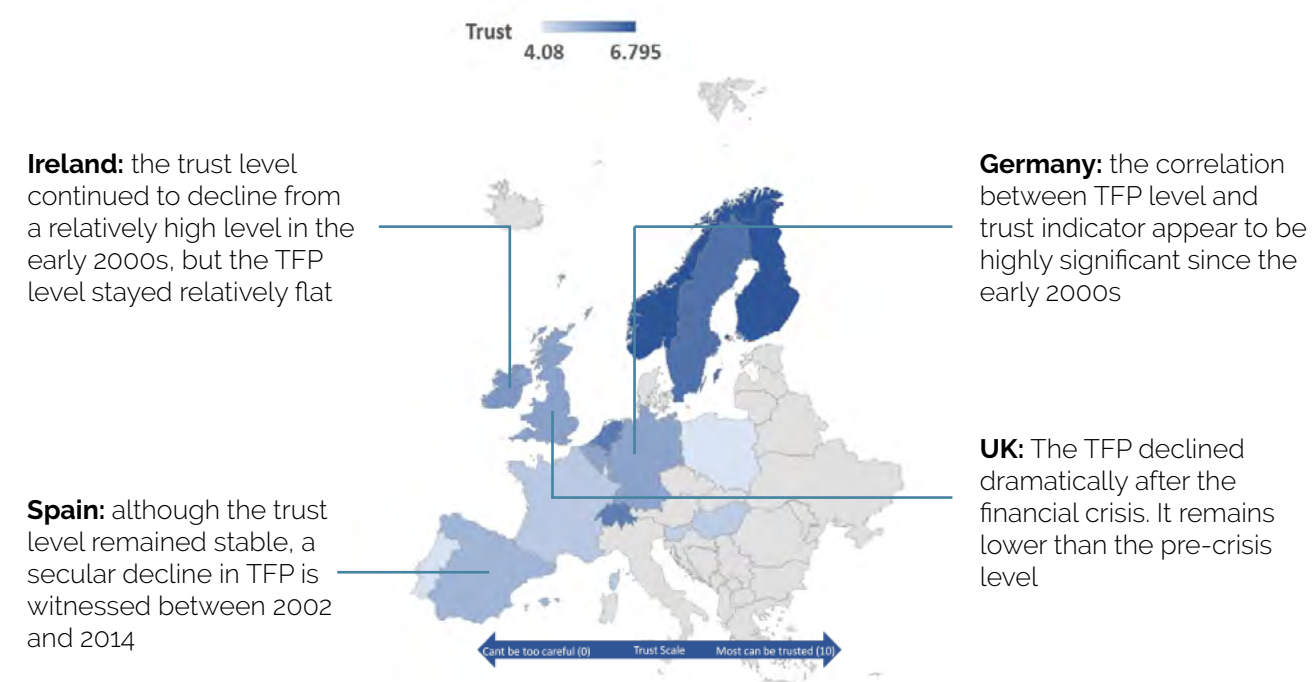


Figure 5: Trust indicator map, 2016

5. RESEARCH OUTPUTS

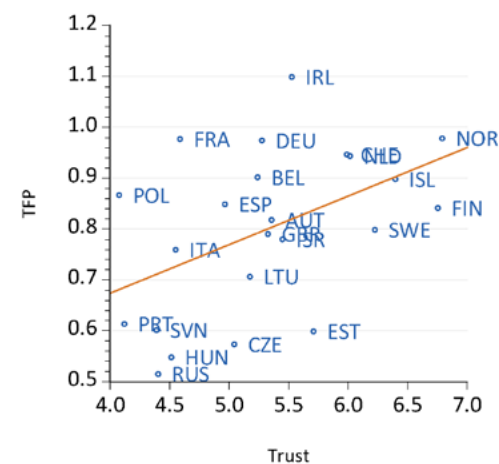


Figure 6: TFP levels versus Trust, 2016

Data sources: European Social Survey and Penn World Tables

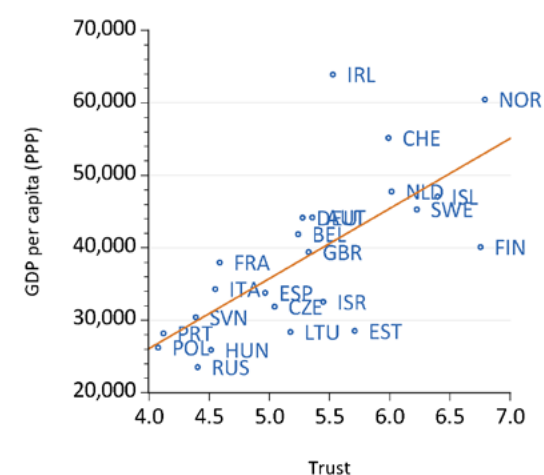


Figure 7: GDP per capita (PPP) versus Trust, 2016

Data sources: European Social Survey and the World Bank

The 2016 trust index data support the view that higher levels of trust within society lead to higher levels of TFP as well as GDP per capita. Figures 6 and 7 shows that a one-unit increase in the 0 to 10 scaled interpersonal trust indicator is associated with an increase of 0.09 units¹¹ in the level of TFP.

This finding is robust. We used several estimation methods and controlled for a range of other variables, such as human capital, research and development (R&D) expenditure as a percentage of GDP, the average wage, and openness indicators. A 10 per cent increase in trust is associated with around 6 per cent in relative TFP levels using Ordinary Least Squares regression. Using an alternative approach (a fixed-effects model)¹² to control for country-specific and time-specific factors. The results confirm a positive effect of trust. A 10 per cent increase in trust is in this case associated with a 1.3-1.5 per cent increase in TFP.¹³ Although the increase is lower, the positive impact of trust is significant and this model is a good fit to the data used.

6. See [Knack and Keefer \(1997\)](#) and [Zak and Knack \(2001\)](#) for the level and growth of GDP
7. For economists, TFP is the residual item of the aggregate output changes unexplained by changes in labour and capital inputs. You could think of it as the structural elements (e.g. institutions, technology and economic policies) that affect the efficiency of the joint use of (measured) labour and capital inputs in the production process.
8. They are Belgium, Switzerland, Germany, Spain, Finland, France, UK, Hungary, Ireland, Netherlands, Norway, Poland, Portugal, Slovenia and Sweden.
9. The primary data sources for total factor productivity TFP (dependent variable) are the OECD's database and the Penn World Table (PWT).
10. This is also true at the global scale in the World Value Survey (WVS)
11. The unit is the relative position against the US level. The US TFP level is normalised to 1 in the PWT data.
12. The choice of model is justified by Hausman test.
13. This is a different TFP measure. It is measured using constant domestic price (2011=1) so that can be used for time series and panel data analysis. A 10% difference is equivalent to difference between the UK and Germany, which are close to the EU average level of trust, and the Netherlands and the Switzerland which are roughly 10 percentage points higher.

Resource Depletion - Who Pays the Price?

Since the industrial revolution, economic progress has coincided with the opening of markets, facilitated the spread of people, ideas, and culture, and lifted hundreds of millions out of poverty. But alongside indisputable improvements in the human condition, the global economic system has ushered in an era of unprecedented resource depletion and generated 1.5 trillion tons of CO₂ emissions.

Many of the development challenges we face today lie at the intersection of these two trends: the benefits of economic progress and the mounting costs of environmental degradation. International trade plays an important role in both. Global supply chains facilitate specialisation and diversification, but also separate places of production from centres of consumption. Climate and ecological systems react, driving a wedge between those who demand natural resources, the countries that govern them, and those who experience the embedded social, economic, and environmental consequences.

Most wealth accounting efforts employ territorial accounts that focus on domestic natural capital whilst ignoring depletion and impacts elsewhere along the supply chain. Measurement systems that fail to account for the wider impacts of local decisions provide a distorted picture of national and global sustainability. Indeed, the 2009 Stiglitz Commission concluded that a measurement approach “centred on national sustainabilities may be relevant for some dimensions of sustainability, but not for others.”¹⁴ The more natural capital is traded internationally, the more important this distortion becomes.

International trade represents a large and growing share – approximately 61% – of gross world product, up from 24% half a century ago. Resource extraction increased by a factor of 1.8 from 1980–2011, while resource trade increased by a factor of 2.5. The divergence between domestic and global resource use is accelerating.

“Production accounts record depletion that takes place within a country’s borders, regardless of where those resources are ultimately consumed”

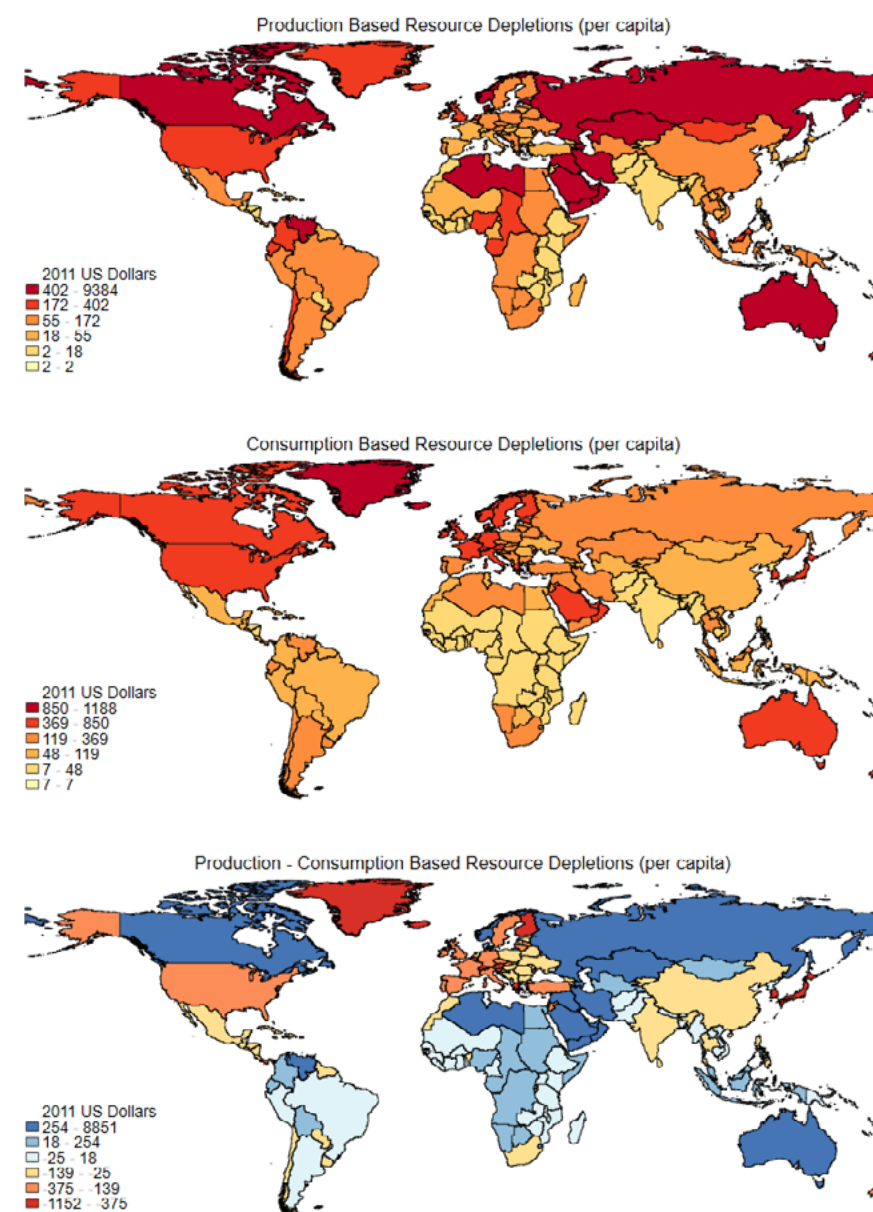


Figure 8: Production and Consumption Accounts for Natural Resource Depletion

Figure 8 a-b show per capita production and consumption based resource depletion. Fig 8 c shows the difference (production minus consumption) in per capita resource depletion. Resources include forestry, fisheries, coal, oil, natural gas, and other mining (metal ores, uranium, gems). Values in 2011 USD (\$). Greenhouse gas emissions are not included.

5. RESEARCH OUTPUTS

The wealth economy project¹⁵ developed new natural capital accounts to assess the difference between an economy's domestic and global natural capital depletion. It deploys two simultaneous and complementary accounts. One from the traditional production, or territorial perspective, and another from the consumption based perspective. Each perspective conveys a different story about the resource use of nations.

The research develops a 57-sector, 140-region multi-regional input-output model to calculate natural capital depletion from both the production and consumption perspectives, covering oil, coal, natural gas, minerals, ocean (fisheries), and forest (timber) natural capital depletion. Figure 9 shows per capita resource depletion for each region. From the production perspective, these range from \$1.81 in Nepal to \$9,384 in Qatar. But from the consumption perspective, they vary from \$6.76 in Malawi to \$1,187 in Luxembourg. The wide variation is driven by both the geographical concentration of people and resources, and differences in the resource intensity of production and consumption across countries.

The final panel in Figure 8 highlights the per capita difference in resource depletion when calculated from the production versus the consumption perspectives. It is the magnitude of the 'policy blind spot' that we impose when we rely on just one accounting perspective. Examining both sets of accounts simultaneously provides a more complete understanding of an economy's contributions towards national and global sustainability, as well as domestic, bilateral and international issues of resource management, dependency and security.

Examining national aggregates rather than per capita values, Figure 9 lists the 20 economies with the greatest divergence between the value of production and consumption based resource depletion. As in Figure 8, negative (positive) values represent net importers (exporters) of natural capital. It suggests that the accounting gap, or policy blind spot, is relevant for countries at all stages of development.

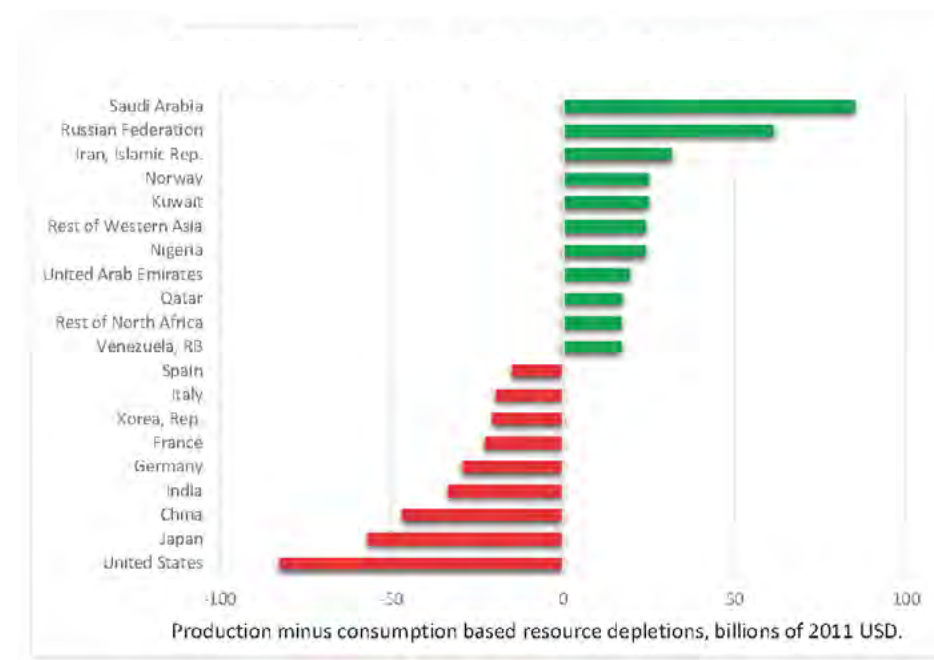


Figure 9: Natural resource depletion: the production versus consumption 'accounting gap'

Figure 9 shows the 20 economies with the greatest difference between production- versus consumption-based resource depletion. Negative values indicate that consumption based depletion are greater than production based depletion. Resources include forestry, fisheries, coal, oil, natural gas, and other mining (metal ores, uranium, gems). Values in billions of 2011 USD. Rest of North Africa includes Algeria, Libya, and Western Sahara. Rest of Western Asia includes Iraq, Lebanon, Occupied Palestinian Territory, Syria, and Yemen.

¹⁴ Stiglitz et al (2009). P77.

¹⁵ With Matthew Agarwala, Giles Atkinson (LSE), and Pablo Munoz (UN)

Climate Pollution - Who Really Pays?

A stable climate system is a central element of natural capital. It is degraded by greenhouse gas emissions. With an increasingly integrated global economy, the question of where along the supply chain to account for these emissions determines the types of insights and incentives that accounts can reveal. The dominant approach used in climate policy accounts for emissions at the point of production. Others contend that emissions should be attributed to the final consumers. But a wealth-based accounting system requires us to go one step further.

The geographic distribution of emissions is driven by specialization, trade and comparative advantages. Some countries produce carbon-intensive heavy manufacturing goods, others produce lower-carbon services. But the geographic distribution of climate damages – storms, floods, and fires – is determined by the global climate system. So while production and consumption accounts can tell us that wealth is lost, they cannot tell us *whose*.

Our research with colleagues at the London School of Economics examines who suffers the damages from climate change by constructing the first wealth-based climate change accounts. Two approaches to identifying country-level damages from climate change are adopted: disaggregating results from a widely used integrated assessment model down to the country level, or using [econometric models](#) of country-level long-run (50 year) relationships between temperature and GDP growth to estimate the impacts of future warming.

Alongside a 140-region 57-sector multi-regional input-output model, these results enable us to construct production, consumption, and damage based accounts with global coverage. Figure 10 shows the 20 economies with the greatest difference between production and consumption based greenhouse gas emissions, measured in millions of tons of CO₂.

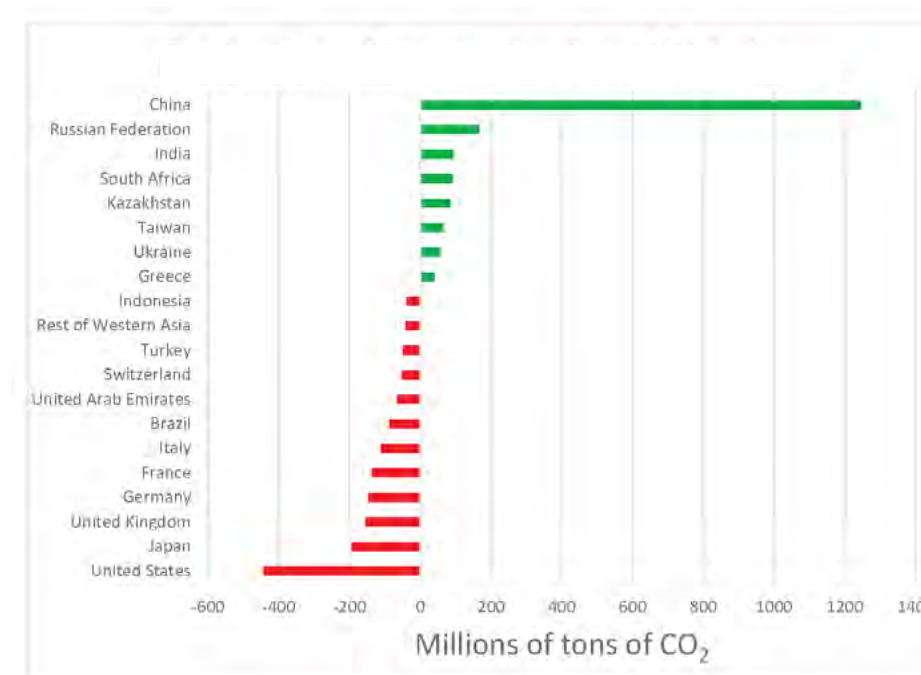


Figure 10: Carbon accounting gap: Production minus Consumption Based Emissions

The 20 countries with the greatest absolute value difference between PB and CB emissions. Values in millions of tons of CO₂ for 2011. Rest of Western Asia includes Iraq, Lebanon, Occupied Palestinian Territory, Syria, and Yemen. Positive (negative) values indicate the country is a net exporter (importer) of virtual carbon.

Positive values indicate production emissions are greater than consumption emissions, and the region is a net exporter of 'virtual' carbon. Negative values indicate the reverse. For most countries, the difference between production and consumption emissions is relatively small. At the median, this difference is just 5.8 million tons, or 0.02% of global emissions – roughly equivalent to the production emissions of Senegal. However, the countries shown in Figure 10 represent 3.3 billion people, nearly half the global population, and 78% of all the virtual carbon traded internationally. For these countries and half the world's population, these distinctions are crucial.

5. RESEARCH OUTPUTS

Figures 11 and 12 map production and consumption of greenhouse gasses for all countries in the sample. Units are in percentage of the global total. Both figures use the same scale, but the intervals are of unequal range. Many of the sub-Saharan African countries represent very small – less than 1% - shares of global emissions under either perspective. In both perspectives, China, the USA, India, Russia, Japan, and Canada are dominant. Europe's share of global emissions appears lower in production relative to consumption accounts, confirming that Europe is a net importer of virtual carbon.

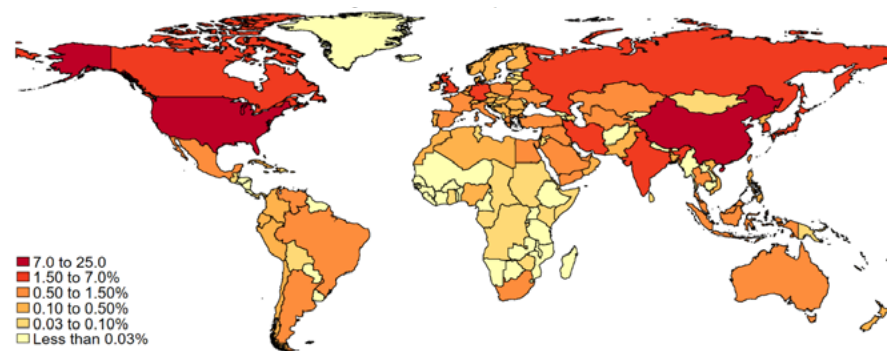


Figure 11 Country-specific shares of global emissions under production-based accounting

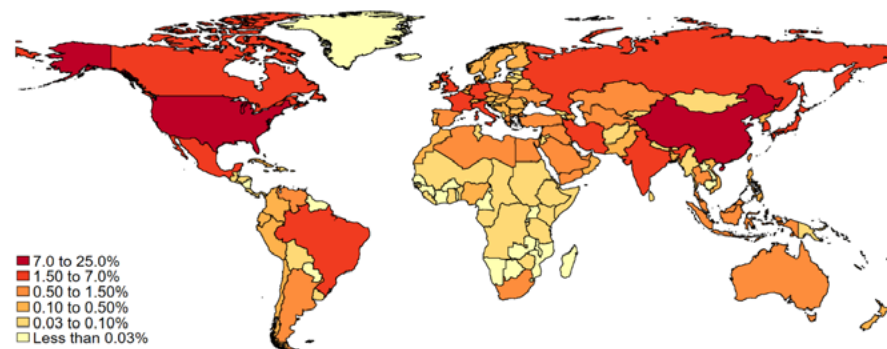


Figure 12 Country-specific shares of global emissions under consumption based accounting

Figures 11-12. Country-level attribution coefficients under accounting perspectives. Both versions are dominated by a small number of outliers. Full sample, $n = 140$ regions (as in GTAPvg). Country-level coefficients represent the share of global emissions attributable to each country under each accounting perspective. Intervals are the same for panels **a** and **b**, but within panels the intervals are of unequal range.

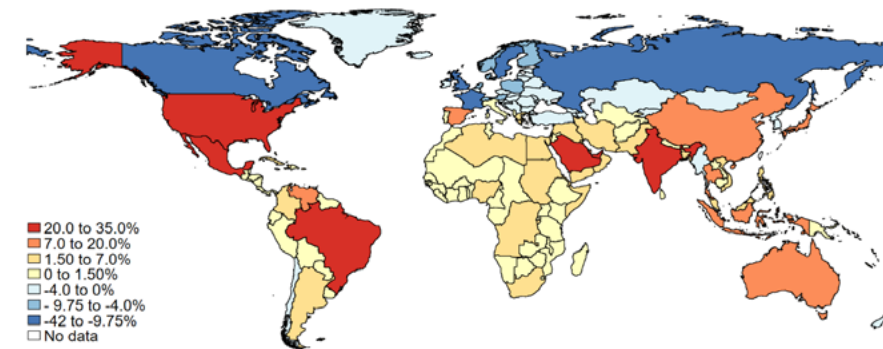


Figure 13 shows the damage-based account, with results expressed again as a percentage of the total global damages. Country-level damages are calculated as in Burke et al (2015). The most striking feature is the disparity of impacts between currently colder countries of Canada, Russia, and Northern Europe and the rest of the world. This is because small amounts of initial warming may actually boost GDP in some places (blue), for some periods,¹⁶ whereas severe damages are already occurring in places such as Australia, Brazil, and India (red).

Each perspective produces a different map of the world, and tells us something different about country relationships to global emissions. More importantly, relying on any single accounting perspective creates and reinforces 'policy blind spots'. For instance, Brazil's production based emissions are only 1.3% of the global total, yet it is expected to suffer 14%-30% of the global damages from climate change. This provides a direct and immediate incentive for Brazil to lobby for strong international action to reduce emissions. Australia faces a similar fate, with per capita damages 12 to 24 times that of the global average citizen.

16. Despite unequal and short-lived benefits in some places, the sum of damages depicted here is 2.5 – 100 times greater than estimates from leading climate models, and even this may be an understatement as it does not factor-in the effects of tipping points and social upheaval which could accompany runaway climate change. Estimating country-level impacts is an emerging field, and the Wealth Economy team will continually update damage-based accounts as newer models become available.

Other Major Research Outputs

In a chapter on path dependence, innovation and the economics of climate change (with Phillippe Aghion, Cameron Hepburn and Alex Teytelboym) in the [Handbook on Green Growth](#) Dimitri Zenghelis investigated the changing value of assets and highlighted how [changing expectations](#) accelerate the deployment of new technologies. This contributes further to tipping points across key technologies, institutions and behaviours as agents [shift rapidly to new networks](#) (see section 8).

Zenghelis and Ekins extend this argument in a paper on the costs and benefits of environmental stability to be published in a special edition of Sustainability Science. They argue that the 'grow now clean up later' model of development generates a variety of unwelcome outcomes for humanity, with potentially very significant impacts for human health and economic activity. A key conclusion is that no conventional cost-benefit analysis for either a clean or dirty development scenario is valid because the final cost of meeting various decarbonisation and resource-management pathways is path-dependent. Specifically, our ability to efficiently decarbonise depends on decisions made on which assets to invest in over the pathway. Both authors contributed to the latest UNEP [Global Environment Outlook GEO 6](#).

In a [paper](#) published for the National Institute for Economic and Social Research (NIESR), Dimitri Zenghelis argued that while the UK cannot by itself materially affect global climate change, it has an opportunity to play an influential role, both by persuading others of the need for action, but also by reshaping its domestic economy to benefit from a low-carbon transition. Zenghelis was on the advisory group for the Committee on Climate Change in [its assessment of the costs and benefits](#) of the UK applying a net zero target. Their report emphasised the role of innovation and investing in assets to boost productivity and reduce emissions.

A paper by Matthew Agarwala and Dimitri Zenghelis for the United Nations Statistics Commission sets out how natural capital accounts can improve macroeconomic decision making. They argue that climate change and environmental degradation are the result of poor capital management. By organising data on natural capital, the UN System of Environmental Economic Accounts enables policy makers to measure and manage natural capital as part of broader economic strategies. The paper shows how SEEA accounts can help manage the fiscal triangle (tax-spend-borrow), the public sector balance sheet, and support objectives in competitiveness, stability, and growth. The UN is currently building a training programme around this paper for use in finance ministries and central banks.

A working paper by Matthew Agarwala asks whether the Sustainable Development Goals (SDGs) *in practice* deliver the paradigm shift they represent *in principle*. Combined, the 17 SDGs, 169 targets, and 232 unique indicators are the 'North Star' of the international development community and provide the benchmark against which success is measured. Alternatives to GDP often face a 'catch-22'. If the new measure is well correlated with GDP, it offers no new information. If it is not, then it ignores too much relevant information. Conducting statistical analysis on the SDG performance of 162 countries, Agarwala finds that 52% of performance can be explained by per capita GDP, but that 48% of SDG performance is described by factors uncorrelated with income.

Diane Coyle and Marianne Sensier (of the University of Manchester) published a paper on the unsuitability of the standard government tool for appraisal of investment projects, cost benefit analysis (CBA). The paper (in *Regional Studies*) looked at its application to public transport investments but the tool is widely used in environmental contexts too. Its flaw is that it only delivers valid appraisals when the change being considered is small. It fails to take account of significant consequences over time when there are non-linear dynamic changes or spillovers. For example, a CBA of a particular habitat loss due to widening a small stretch of road might give reasonable results, but one for any development big enough to cause local ecosystem damage would not.

“Good economics is about more than the study of the allocation of scarce resources; it is about understanding the dynamics of assets”



6. CULTIVATING WEALTH

Good economics is about more than the study of the allocation of scarce resources; it is about creating resources. This means understanding the dynamics of assets and how they change over time. This is particularly important at a time of rapid technical change.

Rising productivity is necessary for the protection of natural and human capital, provided resources and pollution are properly priced to cover social externalities. Without it, growth is unlikely to be decoupled from the use of materials, environmental degradation and emissions. Prosperity rises when we innovate to get more out of the resources and we innovate when prosperity rises. This has important consequences for wealth accounting.

Investing in intangible assets like knowledge or social and institutional capital enables the economy to dematerialise and grow. It also generates scale economies in innovation and production. Knowledge capital is not subject to diminishing returns: it grows as people learn and innovate.

Innovation does not just happen. It is highly *path dependent*. Strong inertia and high switching costs make it initially difficult, for example, to shift the innovation system from dirty to clean technologies without direct policy intervention. This is true even when the clean technologies promise to be more efficient in the long run. Firms and scientists tend to direct innovation toward what they are already good at. But they can reach a tipping point, where expectations change rapidly and technologies switch from one network to another. Those late to the transition stand exposed to stranded or devalued assets (see section 9). So a key question becomes, how to initiate early innovation in sectors that have yet to become profitable?

A key source of path dependence in socioeconomic systems is the presence of 'strategic complementarities' in expectation formation. These arise when agents make individual decisions that affect each other's welfare and one agent's action increases the welfare of *all* the other agents. The payoff to action by any agent thereby becomes a function of the actions of all the others.

Research and development externalities and learning spill-overs in low-carbon technologies have these features. As more scientists start thinking about clean energy, more ideas and innovations emerge that other scientists can use. Technology and finance costs fall and profitable new markets emerge. This increases the incentive to invest in the new innovations generating a positive feedback that can tip systems to entirely new networks.

Technology is not the only source of rapid change and innovation: behavioural; institutional and social innovation can guide consumer preferences. *Social norms* can be defined as the predominant behaviour within a society, supported by a shared understanding of acceptable actions and sustained through social interactions.

Social feedbacks help make norms self-reinforcing. Formal institutions struggle to enforce collectively desirable outcomes without popular support. Acceptable standards of behaviour and social norms are the sources of law and ultimate drivers of legislative change. Studies show that when a committed minority of individuals reach a critical mass of as little as 25% of the total, they can consistently overturn the established behaviour and initiate social change.

Thankfully, expectations are not set in stone. Social norms can change quickly – think of the change in smoking habits in many societies, for example, or the spread of vegan diets.

6. CULTIVATING WEALTH

Clear and credible policy designed to steer innovation can be immensely powerful in overcoming dynamic market failures.

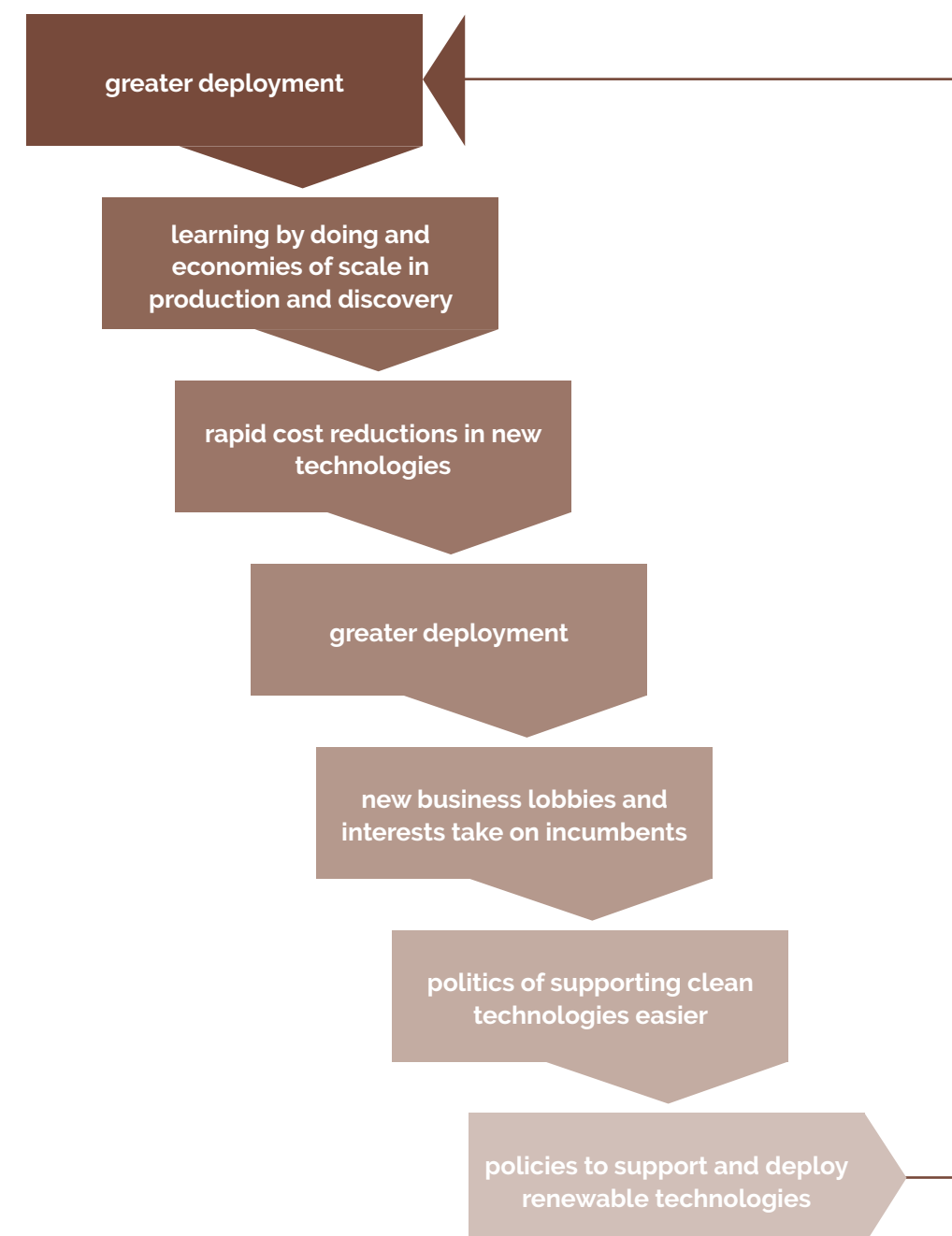
Consider the following: whether one cares about climate risks or not, early policy action to support new technologies is already delivering cheaper electricity and more efficient cars than conventional fossil alternatives. The market would not have delivered these; economists with static models could not have predicted them. This transition started with a lot of public money going into initially expansive technologies (as with the €150bn expenditure of the German *Energiewende* programme).

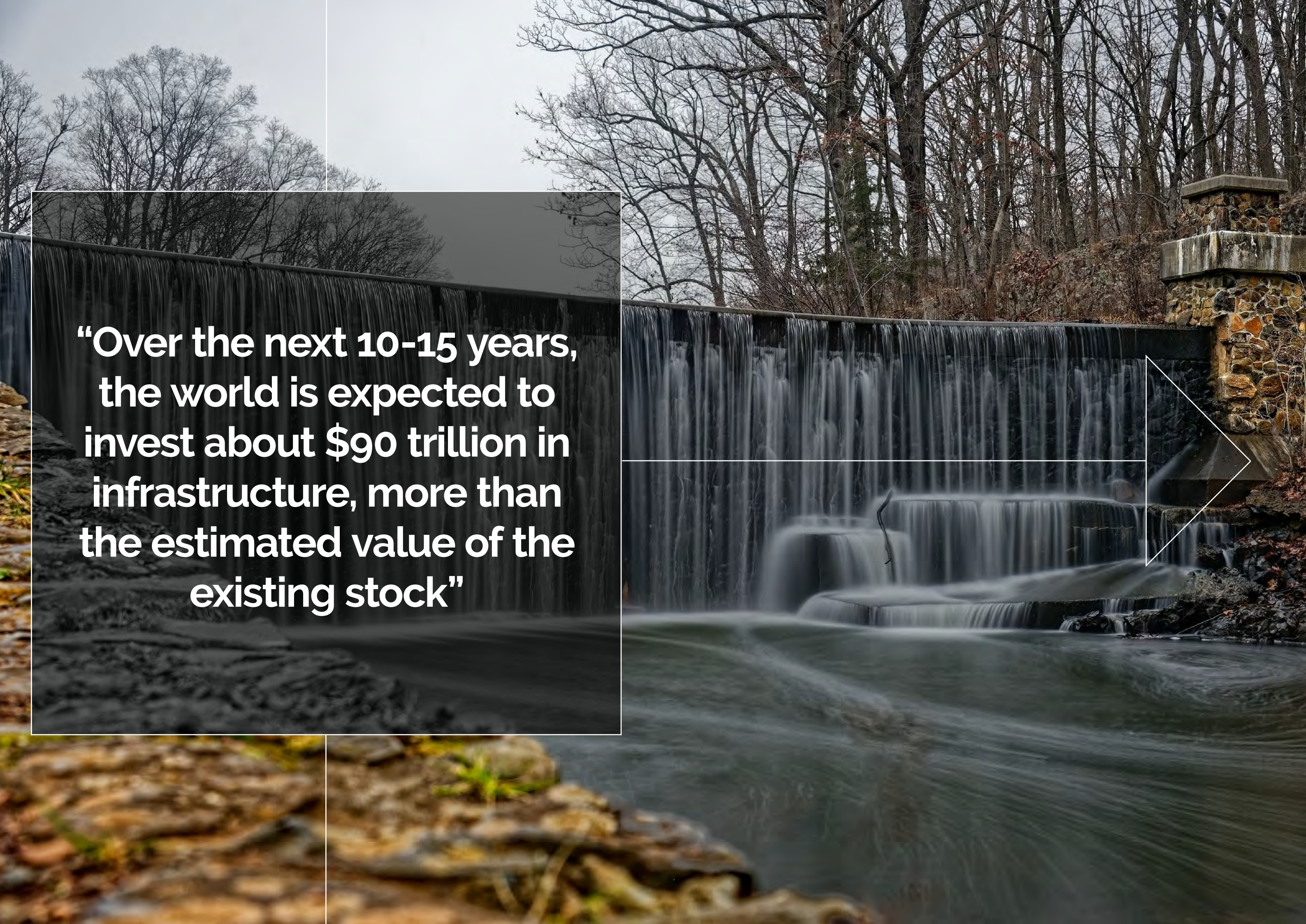
The growing belief that a low-carbon future is inevitable is prompting accelerating investment in clean technologies, lowering their costs and, as they outcompete conventional technologies, generate dynamics that help fulfil that belief.

Furthermore, there is mounting evidence that productivity-boosting knowledge spill-overs generated along the way are substantially greater than those emanating from conventional technologies. Low-carbon investments crowd in, rather than crowd out, productive assets.

The value of our critical assets is what economists refer to as 'endogenous'. Their future values depend on choices made now and in the intervening pathway. Investment in the right assets creates value and generates prosperity. By starting early to induce the right technologies, behaviours and institutions, there could be huge benefits in the form of a cleaner, quieter, safer, more efficient, productive and ultimately wealthy world.

Policies to support and deploy renewable technologies





**“Over the next 10-15 years,
the world is expected to
invest about \$90 trillion in
infrastructure, more than
the estimated value of the
existing stock”**

7. NEW ASSETS, OLD ASSETS AND STRANDED ASSETS

Investment is essential to create value. Over the next 10-15 years, the world is expected to invest about \$90 trillion in infrastructure, more than the estimated value of the existing stock. If this new infrastructure is anything like the old, it will deplete critical natural capital. Without a steep reduction in resource use and greenhouse gas emissions in urban economies, it will be almost impossible to avoid the dangerous consequences of climate change.

It is estimated that between two thirds and four fifths of global proven and possible fossil fuel reserves will need to remain in the ground if the world is to have a 50-80% probability of keeping global warming below 2 °C (or, if they are combusted, the greenhouse gases must be captured and stored). This means almost all new fossil fuel related infrastructure will need to be prematurely scrapped or subject to costly retrofitting.

Investment in new technologies has delivered rapidly declining costs of clean energy alternatives. Together with increasingly stringent climate and energy policies across the globe, this increases the risks of economic dislocation and 'stranded assets'. The implementation of policies for a 2°C warming scenario could cause the fossil-fuel industry to lose of the order of \$30 trillion in revenues over two decades. Moreover, assets can easily become liabilities, with a growing spate of litigation against companies and countries involved in the fossil fuel industry.

Business risks associated with unsustainable investments are increasingly guiding financial investors away from fossil fuel energy and toward clean sectors. Many countries increasingly see sustainable investment as enhancing rather than hampering competitiveness and growth. This helps generate the self-fulfilling dynamics outlined in the previous section.

Human and knowledge assets can also be stranded. If people are trained in skills that are not fit for a low-carbon economy, they will be excluded from it. This applies to a wide range of professions from engineers to lawyers, planners to researchers, drivers to administrators.

Policy is being repurposed to efficiently manage a transition to a low-carbon, resource-efficient economy. Better measurement and management of the world's assets is a prerequisite to steering investment efficiently towards new infrastructure, behaviour and institutions that will support future prosperity.

“The implementation of policies for a 2°C warming scenario could cause the fossil-fuel industry to lose of the order of \$30 trillion in revenues over two decades”



“Wealth accounts are essential for strategic policy choices about tackling 21st century challenges”

8. NATURAL CAPITAL ACCOUNTS FOR MACROECONOMIC DECISION-MAKING

The fiscal triangle of government finances balances taxation, borrowing, and spending. Overall economic performance takes a broader view, encompassing growth rates, productivity, inflation, international competitiveness, and overall stability.

Figure 14 shows how wealth accounts can inform macroeconomic decision making. For instance, the UK's natural capital accounts show a decline in the value of fossil fuels and a seven-fold increase in the share of electricity generated by renewables over the last decade. A treasury interested in stable tax revenues may wish to consider how much it depends on fossil fuels in the future. Such accounts not only clarify the potential for tax revenues, but also for the use of fiscal policy to correct market failures and incentivise innovation, for instance towards a low-carbon economy. But their use is not limited to environmental policies. Natural capital accounts can indicate changes in air quality which can be linked to health impacts and demand for NHS services, giving decision makers advanced warning of potential liabilities.

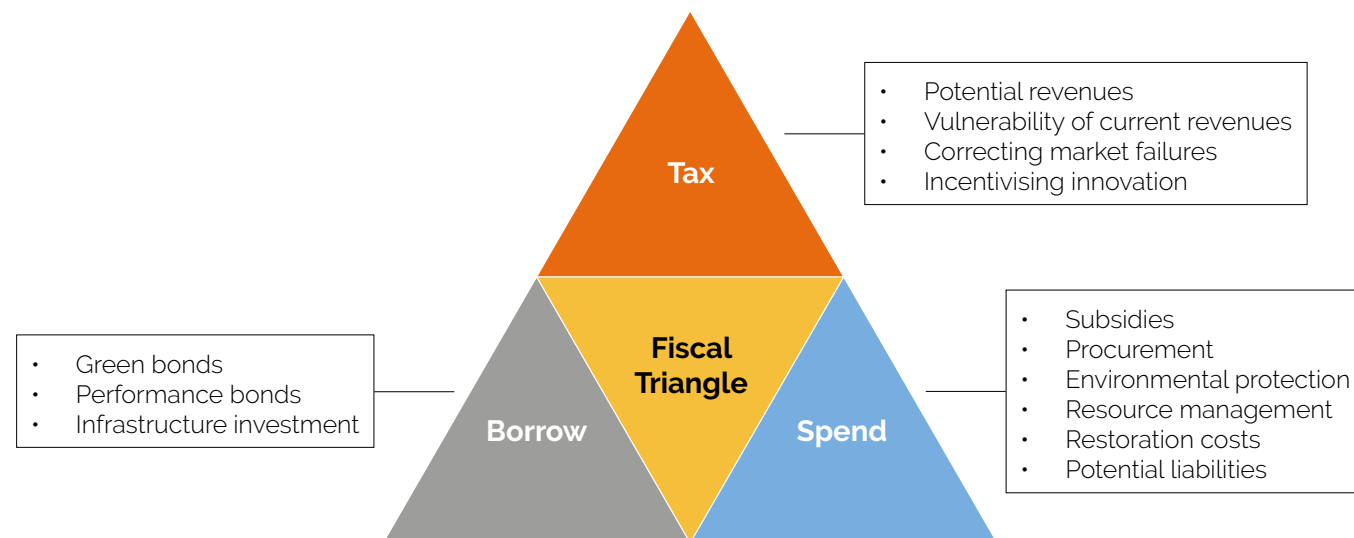


Figure 14: The 'fiscal triangle'

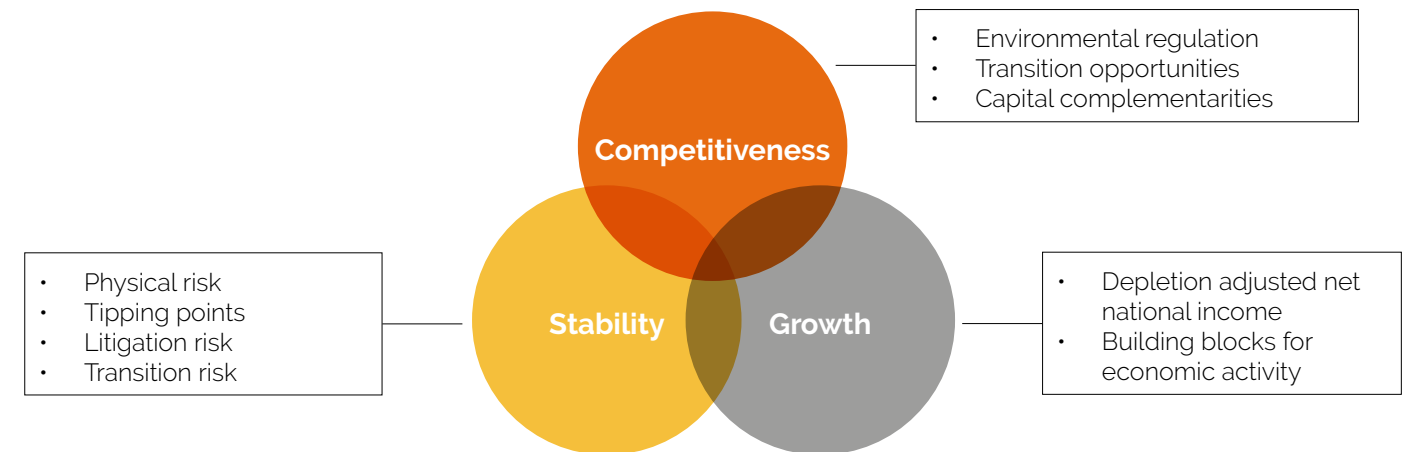


Figure 15: Core macroeconomic objectives

Beyond fiscal decisions, wealth accounts can inform strategic decision making for addressing 21st century challenges such as climate change, environmental tipping points, and transition risks as the global economy either faces the consequences of climate change or acts early to mitigate them. Such accounts can provide a more comprehensive evaluation of the public sector balance sheet, better reflecting liabilities, future revenues, the changing value of assets, and enhancing economic resilience.

**“wealth accounts
can inform strategic
decision making”**

**“The phase of
development driven
by investment solely in
physical capital is over”**



9. GROWING CHINA'S WEALTH

The wealth economy team are working with Professor Lord Nicholas Stern and in China to adopt a wealth approach for developing policy advice for China. We show that a wealth economy approach to the 14th plan can support stable, sustained growth in China for years to come. The extent to which it does so depends on China's ability to harness the strategic complementarities arising from investing in physical, human, natural and social capital.

China's economic transformation since 1978 has lifted a country of more than a billion people from low-income to upper-middle-income status. However, the phase of development driven by investment solely in physical capital is over. It is being supplanted by investment in a broader range of assets including intangible assets, such as knowledge and social capital, as well as the preservation of natural capital, which offer the strongest and most durable growth opportunities.

The depletion of natural capital poses one of the biggest threats to China's continued growth and prosperity. The air of cities has been severely polluted. So too have soil and water. Climate change is an immense risk. This directly affects human health and wellbeing, undermining human capital and trust in the government's ability to lead in the 21st century.

As it matures to an advanced economy, China will need to dematerialise. China is in a strong position to lead the world in the resource-efficient, low-carbon revolution which is already underway. Investment in new clean infrastructure and technologies offers many near-term opportunities to tackle issues related to waste, inefficiency, insecurity, pollution and congestion.

A new strategy of environmental quality, wellbeing and inclusivity can transform China's economy in the next 30 or 40 years as it drives towards becoming a high-income economy. This would involve fundamental structural change towards higher tech, higher skills, more service sector opportunities, and the role of artificial intelligence (AI) and robotics, automation and the recasting of cities.

As well as enabling workers to reskill, structural reform requires transparent and efficient institutions which promote competition and innovation and limit rent-seeking and clientelism.

Neglecting China's capital assets or balance sheets comes with great risk. China's future development, wellbeing and quality of life will depend critically on the sustainability of its asset base. This is clearly and strongly recognised by the leadership in China: in President Xi's [19th Party Conference Speech \(2017\)](#) there were more references to "environment" and "green" (89 times) than the "economy" (70 times).

China's development strategy will have a profound effect on the rest of the world, particularly the Belt and Road Initiative (BRI) countries. China can steer the future by developing and scaling the technologies the world will want to use and buy. Moving up the value chain will require changing relationships between China and its trading partners. The countries of the BRI have income per capita and wages, on average and approximately, half that of China.

Had the technologies of today had been available to China 25 years ago, its development path might have been much cleaner and more sustainable, to the great benefit of its citizens. If it had been able to look ahead more clearly to the problems of congested and polluted cities, it might have invested more heavily in low-carbon infrastructure, avoiding toxic emissions and easing congestion.

The countries of the BRI could play a powerful and positive role in the spread of an innovative and sustainable growth model. BRI countries would be wise to avoid some of the problems China encountered in the early phases of its recent development. China has an opportunity, by exporting and investing in more efficient new technologies and institutions around the world, to invest in global wealth and showcase the [shortcomings in the 'grow now clean up later' approach](#) to development.

**“Neglecting
China's capital
assets or
balance sheets
comes with
great risk”**



“The Wealth Economy programme has brought more progress in terms of its impact on decision makers than we could have foreseen”

10. WEALTH ECONOMY LEADS A GLOBAL MOVEMENT

Turning the tide

From local authorities in Cambridgeshire to international institutions such as the International Monetary Fund, our research, technical advice, and direct engagement with policy makers is helping guide the path to sustainability.

GDP's influence goes well beyond its use in research and national statistical offices. Referred to daily in national newspapers, it features prominently (if not always accurately) in the public discourse, shaping expectations about the future, influencing consumer and business decisions impacting political fortunes. Genuinely moving beyond GDP therefore requires [changing the public discussion](#) about the economy to be more inclusive of other elements of wealth.

From [viral videos](#) to the [national news](#) we're working to engage the public on all fronts. Our first [report](#) was covered in live interviews on Bloomberg News, and featured in both [The Times](#) and [Financial Times](#). It helped spark a global conversation about how wealth metrics can pave the way to a more sustainable future. Our popular [blog series](#) offers an accessible overview of key themes and research outputs, while multiple public talks and lectures across the globe have attracted [sell-out crowds](#).

Our dual interest in developing 21st century statistics and in making them accessible and useful in practice has attracted world-wide interest, with Wealth Economy presentations and collaborations in the US, Canada, Uruguay, France, Greece, Singapore, China, and Japan. Upcoming talks and events include the [Cambridge Literary Festival](#), the [2020 International Symposium on Finance](#), the [Glasgow Economic Forum](#), the [York Festival of Ideas](#), a [special session organised by ESCoE](#) and the [ONS at the Royal Economics Society annual conference](#) and the [Jean Monnet Centre at Charles University](#).

Social Capital

The Wealth Economy project is having a policy impact across sectors, and scales. Our work on social capital (see section 5) was selected as one of six [Headline Outcomes](#) by the UK's Industrial Strategy Council and forms one of the [Success Metrics](#) used to

assess the impact of the Strategy on the lives of UK citizens. Two of the [measures we created](#) were selected, one which assesses general trust and a second that contrasts trust in people versus in institutions. Together, these will enable the Council to make distributional comparisons in social capital across income, time, and between countries.

We're also engaging closely with the UK Office for National Statistics on how official statistics can best measure social capital. We're working to inform official guidance on how institutions – from local community groups to national governments – can best measure their impact on social capital. From specific survey questions to the best statistical methods for analysing them, this work is contributing to both the Government Statistical Service and the ONS project on Missing Capitals.

Beyond the UK, our work on social capital is attracting international interest. A [recent draft working paper](#) sets out how a wealth approach including social, human, and natural capital can support sustainable and inclusive growth in China's 14th plan. This will be followed by a high-level summit on innovation in China, with Lord Nicholas Stern and four Nobel Laureates in Economics. More globally, we will be working with World Bank's team on measuring the changing wealth of nations to show how our social capital metrics can help inform the Bank's work on comprehensive wealth accounting for all countries.

Natural Capital

Global efforts to develop natural capital accounts are gathering pace and our work is playing a central role. Our expertise in environmental valuation and national statistics is sought by the United Nations Statistics Division, as we provide technical guidance on [how to capture environmental benefits](#) within the System of Environmental Economic Accounts – Experimental Ecosystem Accounts (SEEA-EEA). The final revision will be submitted to the United Nations General Assembly for final approval and official adoption in 2021.

10. WEALTH ECONOMY LEADS A GLOBAL MOVEMENT

To pave the way for this historic milestone, we're organising a high-level conference on [Communicating the Path to Sustainability Through Natural Capital Accounting](#) in conjunction with Yale University, the United Nations, World Bank, International Monetary Fund, Capitals Coalition. The conference will convene world-leading academics, Heads of National Statistical Offices, business leaders, respected journalists, and senior representatives from central banks and finance ministries.

Our purpose is to boost the 'policy demand' for natural capital accounts by highlighting how their use can help us move beyond 20th century production-based metrics towards 21st century sustainable economies.

Macroeconomic policy

The project team has contributed to a review of the HM Treasury [Greenbook](#) and its programme to develop a national balance sheet for wealth in assets. It has been advising HM Treasury in its [Net Zero Review](#) launched to support the UK's world leading climate commitment. The team has worked with the [Committee on Climate Change](#) to set out a pathway for innovation and investment in key assets to deliver net zero. It has worked with the Bank of England, the [Network for Greening the Financial System](#), the [Oxford Sustainable Finance Programme](#) and the [Office of Budget Responsibility](#) to apply a wealth framing to the assessment of macroeconomic and fiscal sustainability risks to the UK economy. The team has [advised London's Mayor](#) in developing the city's natural and [social capital](#) assessment.

We are collaborating with academics in leading universities around the world and maintain close links with the [Oxford Wealth Project](#), the [Centre for Social and Economic Research on the Global Environment](#), and [Yale University](#) and our [advice on decarbonisation](#) was published in the NIESR National Institute Review 250th special edition.

Internationally, our team members are working with the United Nations Statistics Division to demonstrate how natural capital accounts can be used in macroeconomic decision-making, and a paper on this topic is being developed into an official UN training program for finance ministry and central bank personnel. The team is also working with the [Coalition of Finance Ministers](#) to contribute the strongest strategic and analytical input, value and leadership. Our work has informed the latest UNEP [Global Environment Outlook GEO 6 calling for credible leadership to boost innovation and sustainability](#).

We continue to hold regular meetings with the global financial media while posting regular commentaries in [key media outlets](#). Articles include '[How we measure the environment could change how the world works](#)', '[Social and natural capital – why we should invest in it?](#)', '[Towards a Framework for Time Use, Welfare and Household-centric Economic Measurement](#)' and '[Understanding the Sharing Economy](#)'.

The team's research has been presented at the [Royal Society](#), the FT Literary Festival, the Cambridge Alumni Festival, the [Big Tent Festival](#), the [Rethinking Capitalism lectures at UCL](#), the [Economic Statistics Centre of Excellence](#), the Royal Economic Society Conference, Cambridge Econometrics, LetterOne 'Townhall' event, the International Symposium on Finance, the [Cambridge Festival of Ideas](#), the Energy Policy Research Group, the UK Office for National Statistics, the Life Sciences MSc programme at Imperial College, the Wealth Economy workshop in Cambridge and at the Oxford Sustainable Finance Advisory Group meeting.

A photograph of a massive glacier wall meeting the water. The glacier is a deep blue color, and the water is a lighter blue. Several icebergs are floating in the water. The background shows a dark, forested hillside.

**“We’ll be working to ensure
that all human capital
investments deliver net-
zero compatible skills”**



11. NEXT STEPS


2020 is a pivotal year for the world of wealth accounting. The Sustainable Development Goals (SDGs) indicators will undergo their first 5-yearly revision, many aspects of the Paris Agreement are pegged to 2020, a revision of the System of National Accounts is underway, and the post-2020 "New Deal for Nature" will be established at the fifteenth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP-15). Finally, the UN Statistical Commission, the apex entity responsible for adopting statistical standards, will complete its revision of the System of Environmental Economic Accounts – Ecosystem Accounting, for approval by the UN General Assembly in 2021.

It is a big year for the Wealth Economy project as well. The team is growing, with new colleagues joining us in spring 2020, and we're expanding our research portfolio to include human capital and green finance.

The knowledge, skills, and health of the labour force make human capital a crucial component of the wealth economy story. Our work will coincide with and inform efforts by the ONS to review how it measures human capital, and will build the evidence base for addressing the UK's 'productivity puzzle'. With [Cambridge Zero](#), we'll be working to ensure that all human capital investments, from the curriculum in schools to advanced degrees and on-the-job training are designed to deliver net-zero compatible skills.

An exciting new project will examine links between climate and sovereign risk. Matthew Agarwala and Patrycja Klusak were awarded funding from the [International Network for Sustainable Financial Policy Insights, Research and Exchange \(INSPIRE\) Network](#), which commissions research for the [Network for Greening the Financial System](#) – a consortium of 54 central banks working to enhance the global financial system's ability to manage climate-related financial risks and mobilise capital for a green and low-carbon future. Dimitri Zenghelis will also be working on an INSPIRE project to Investigate [Options for Sustainable Crisis Response Measures](#) to the financial crisis.

Finally, with the UK hosting the 26th Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in Glasgow, the team is pleased to be hosting [Leverhulme Trust Visiting Professor Marie-Claire Cordonier Segger](#) who will deliver a series of lectures on law, climate, and sustainability across the UK.



“The loss of renewable assets like fish stocks or forests threatens to irreversibly squander the options available to future generations”

12. POLICY RECOMMENDATIONS

A balance sheet of comprehensive wealth will invigorate public debate, improve economic policies and serve as a 'sustainability scorecard'. It enables investors and innovators to profit from investing in a sustainable future with widely-shared benefits from economic growth.

The availability of national wealth statistics is a vital part of shifting government policy towards wealth generation for the long-term. Citizens will be empowered with science-based evidence to scrutinise governments and business on their stewardship of long-term interests.

After decades of rising prosperity for many people around the world, new stresses and challenges are rapidly emerging. The dangers of badly-designed, low-quality, or polluting physical capital are becoming all too clear. Such capital can generate dangerous climate risks, pollute soil and water, damage forests and biodiversity and deplete resources. The loss of renewable assets like fish stocks or forests threatens to irreversibly squander the options available to younger generations in the future. At the same time, the economic and social consequences of failure to invest in sustainable infrastructure, strong communities and modern skills are impossible to ignore.

Every economy faces a challenging transition. The impacts of, and responses to, climate change and resource scarcity come at a time of rapid and transformative advances in the field of automation, AI, data management, bio- and nano-technology.

This means there will be disruptions and risks to be managed, as well as innovation and investment opportunities. This will place great stress on existing economic structures and assets. Some sectors will decline and be replaced by others and, correspondingly, the impact on some places will be more severe than others. Good policies are flexible enough to enable diversification from old unsustainable assets to new higher productivity assets.

Coping with these challenges will not be politically feasible without institutions which enable as many people as possible to benefit from the changes while insuring those who lose from them (see section 4 on social capital). As well as retooling and reskilling workers, structural and regional reform requires transparent and efficient institutions which promote competition and innovation while limiting rent-seeking.

Meeting the challenges of the 21st century will be hard using the statistics of the twentieth century. A prosperous and sustainable growth path is possible, but it will likely embody higher quality, cleaner, more efficient and more sustainable consumption and production with more inclusive and cohesive economies and societies. Achieving these aims requires measuring and monitoring the health of our natural and social capital, evaluating which critical assets are under threat or, conversely, might be rendered devalued or obsolete.

This report makes the case for the urgent collection and assembly of comprehensive wealth figures by national statistical offices. This means investment in the measurement and valuation of key assets to provide a coherent and comprehensive dataset capable of informing policymakers. These should be integrated with conventional GDP and national accounts statistics in their forthcoming revision. Currently, the state of vital assets is effectively invisible.

Policy frameworks for assessing and responding to new information need updating. Examples include the setting up of an independent, statutory body to advise government on the health of, and stewardship of, critical assets. Parliamentary assemblies could in the first instance require an annual report on the state of the future using wealth accounts and changes in broad national balance sheets. Independent bodies such as the UK's Office of Budget Responsibility or Committee on Climate Change could be charged with reporting and supervision. All public bodies should be required to consider the impact on broad assets as part of policy appraisal and evaluation.

“Currently, the state of vital assets is simply invisible”

12. POLICY RECOMMENDATIONS

Investment in all forms of capital will require a combination of private and public finance. This will range from bank loans, angel investments and crowd funding for small enterprises, to capital markets for major private sector firms to raise debt and equity finance, to large-scale finance, including development banks for large-scale infrastructure projects. Sovereign wealth funds will also play a role in managing public saving and preserving and enhancing a country's wealth.

The role of public finance will be key. Investment in critical human, physical and natural assets is often too risky, too long term, or too prone to natural monopoly with high barriers to entry and large public spillovers for the private sector to undertake alone. Some fiscal revenues will need committing to assets which yield future benefits and are resilient to changes in the structure of the economy.

Trusted institutions must be at the heart of generating prosperity. Indeed, the quality of governance has a profound influence on how easy it will be to manage change (see section 4. On social capital).

Measuring wealth will be a challenge, not least because of the difficulties in estimating asset values. But while the technical basis for the accounts needs to be developed, a start has to be made and there is enough information available for it to be collated into meaningful data under standardised methodologies.

Developing the present national accounts including GDP took decades. The data, methodology and infrastructure were not there, and it is still being developed and updated. Similarly, fully integrated wealth accounts will take time, but the theory of wealth's importance is clear and much of the necessary data is available already. Agencies across the world have made a start and the Wealth Economy project aims to play a key information and coordination role in developing a full understanding of the wealth that surrounds us.

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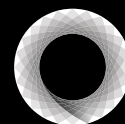
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