© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.

# CONTENTS





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.

# Introduction

TREATMENTS FOR neurological diseases such as Parkinson's have not much progressed since the 1960s. The standard medication, levodopa, has been in use for over half a century; it was introduced in Western medicine in 1967. The active compound was in fact in use in ancient Indian ayurvedic medicine as the powdered seeds of *Mucuna pruriens*, a type of legume that grows in Africa and parts of Asia (Ovallath and Suthana 2017). The most significant recent weapon added to the treatment arsenal for Parkinson's has been deep brain stimulation (DBS), which involves implanting electrodes in the brain through holes drilled in the skull, controlled via a wire linking them to a pacemaker-type device implanted under the skin of the chest. DBS is often effective, but certainly invasive. Recently, though, my husband Rory (who has Parkinson's and writes about health technology) was invited to watch a potential new treatment using ultrasound (Cellan-Jones 2024). Ultrasound is familiar from its everyday use for everything from prenatal scans to investigating soft tissue injuries from sport or falls. In this innovative application to tackle the tremors that characterise diseases such as Parkinson's, an MRI scanner is used to direct focused ultrasound beams that burn away the brain cells causing debilitating symptoms. For the patients Rory observed being treated at the Queen's Square Imaging Centre in London, the beneficial results of the ultrasound therapy were immediate and striking.

What does this have to do with measuring economic progress? It is one of many astonishing examples of technological progress that hold



For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.



great promise for health, or for the convenience and enjoyment of life. Innovations in biomedicine, personalised cell and gene therapies, mRNA-based vaccines, and medications such as the new generation of weight loss drugs all leap to mind. But there are also innovations in digital, such as generative artificial intelligence (AI)—an astonishingly powerful technology even if you think it's overhyped—and in materials and low-carbon energy. How do these all get reflected in the gross domestic product (GDP) growth figures that dominate media comment and political debate? After all, the ultrasound example is not new technology but a clever reuse of an existing one. If the therapy becomes widespread, it will surely be a good thing but will reduce the use of other treatments; sales of levodopa might fall. How is what is clearly a potential improvement in many people's lives captured in the way we measure progress? And what about who gets the treatment: will access be widespread, and fair?

Other new ideas improve outcomes but might even reduce the economic footprint of an activity. Another health example is the possibility of substituting Avastin for Lucentis in treating age-related macular degeneration (Nakamura 2020). Lucentis is the approved treatment in the United States, requiring a monthly injection. Avastin, a cancer medicine, turns out to be at least as effective, and cheaper (about $55 compared with over $2,000 per dose in the United States). The manufacturers have long fought to prevent doctors from prescribing it instead of Lucentis, as it would reduce their revenues (D. Cohen 2018); the United Kingdom's National Health Service (NHS) won the right to do so only in 2018 after a court battle (Sagonowski 2018). Consumers would pay less, directly or indirectly, but the measurement of health output in GDP makes it likely a switch in the drug used would reduce the measured size of the economy (Sheiner and Reinsdorf 2024). Are we measuring productivity in a way that captures such shifts from material to ideas? Almost certainly not.

There are other areas where an innovation would bring tremendous benefits in the shape of a lighter footprint on the planet. The use of ideas to innovate is constantly shrinking the need for stuff (Coyle 1997). For example, for decades the aim in making silicon chips has been to make

For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.



them more powerful at computation, and very successful it has been (Coyle and Hampton 2023). But now the priority may be to make them more energy efficient. "Better" now means "more efficient" rather than just "more powerful computationally" (Conway 2024). How could this change of definition be captured in measuring output of the chip industry? How does an energy-saving chip compare with a conventional chip in the economic statistics when carbon emissions are not priced?

All these modern marvels suggest the possibility of a dawning new era of human progress. But innovation often has transformational effects that are hard to crystallise in economic statistics. How on earth could you measure the impact of a treatment that can immediately reverse disabling symptoms and restore a patient's ability to lead an independent life?

At the same time, many aspects of modern life are all too obviously pointing to things getting worse. In some countries—notably the United States—improvements in life expectancy have halted or reversed. This is not just due to COVID but also to the increase in "deaths of despair" (Case and Deaton 2020). Inequality of incomes, wealth, and also health and leisure remain as high as they have ever been in modern times. A burst of inflation has left many households unable to afford heating, or has left them homeless or using food banks, in supposedly prosperous countries. Young people—and their parents—no longer expect steady improvements over time in living standards, with housing becoming less and less affordable and too many people having to hold down more than one job. We might question, too, the benefits of some innovations, whether social media that eats people's attention and spreads misinformation or harmful behaviours, or novel financial instruments that turn out to impoverish customers or increase risk rather than mitigate it. Although free online search and maps are useful, using many everyday services has turned into a nightmare of complicated tariffs, unhelpful chatbots, and higher prices, often deceptively designed into online interfaces using "dark patterns." The experience of having to spend time in the labyrinth of online chat or voicemail menus trying to sort out a problem that doesn't seem to fit the automated script, or of puzzling over a comparison website trying to figure out which of

For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.



hundreds of different policies or contracts will be best, is all too familiar. This "time tax" is one of the new costs of doing business as a human being in today's advanced economies, to the extent that, in August 2024, the Biden Administration launched a "Time Is Money" regulatory crackdown on corporations involving measures such as making it easier for people to cancel subscriptions or get automatic refunds, instead of getting caught in customer service "doom loops." Corporations seem to have forgotten that their purpose is to serve customers rather than raise their share prices (Mayer 2023), so that pharmaceutical companies profit from illness, financial services companies profit when customers lose out, insurance companies only want the customers unlikely to need to claim, and food companies make more when they sell people the most processed and unhealthy products.

In short, it seems nigh on impossible to evaluate what is going on in the economy—is it getting better or worse, and for whom? This is hampering policymakers' ability to tackle slow growth in productivity and living standards. Meaningful economic statistics are needed for governments to devise policies, manage their societies effectively, and deliver for their voters; after all, the word *statistics* derives from *state*. Inevitably, though, the statistical lens through which we all try to understand the economy will become blurred at a time when the economy is changing significantly and rapidly—as it is now with the two technological revolutions of AI and digital and of energy transition from carbon-based to net zero. These two—information and energy—are the fundamental "general purpose technologies" that decisively shape the structure of the economy in each era.

This is a new era, and a new statistical framework will be needed. The current System of National Accounts (SNA), including the all-important figure for GDP, dates from the 1940s when physical capital was the binding constraint on growth in the postwar era, natural resources seemed free, and the pressing economic policy challenge was seen as effective demand management so the Great Depression could never recur. Now, nature is the binding constraint. Extreme weather will destroy much physical and human capital, biodiversity loss will reduce agricultural productivity, and new zoonotic diseases seem likely

For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.



to emerge as humans press harder upon natural habitats. And the main economic policy challenge is now on the supply side, restarting the economy's productivity engine to drive improving living standards, at a time when there are headwinds such as climate shocks, conflict, and ageing societies.

Just as important a reason for rethinking the approach to economic measurement lies in the signs of a substantial shift in the public philosophy that started to emerge from the aftermath of multiple economic shocks: the 2008 financial crisis, the 2020 pandemic, the cost-of-living crisis since 2022, the reemergence of geopolitical tension and conflict. Protests against what is often described as the "neoliberal" era of globalisation and financialisation predate 2008. But the past decade or two have seen doubts about the assumptions underpinning economic policies—that individual interests will add up to societal well-being, and that individual choice in markets will bring about the best outcomes—spread far beyond groups of activists or fringe politicians. Although many finance and economics ministries remain bastions of 1980s-vintage free market economics, a large number of voters could not be making it clearer that the resulting economic system is not working for them. Economic discontent is one important contributor to the rage expressed in volatile and extremist politics today.

There is no obvious fully formed new public philosophy replacing the one that has predominated globally since the Reagan and Thatcher governments, but a fragmented picture is starting to take shape. The ongoing digital transformation of work and leisure will be part of this, enabling creativity and satisfying new uses of individuals' time on the one hand and dangerous concentrations of money and power on the other hand. An ostensibly free market approach has created the most powerful corporations the world has seen, raising questions about individual and collective freedom, and indeed about the power of the state. The environmental crises also play into an emerging sense of collective interest being at odds with market outcomes. There is a feedback loop between events (like the crises from 2008 on), politics, and economic ideas; political priorities shape what is measured, and the measures in turn define ideas about the economy and thus political

For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.



choices (Coyle 2020). Articulating a new political economy, if it is indeed starting to emerge, will require a different framework of economic statistics. The underlying structure of the economy and society is changing with the dual transition in general purpose technologies, zero carbon energy, and the ongoing digital and information revolution.

These big questions—are things getting better? For whom? What does "better" mean?—motivate this book. It reflects over a decade's worth of research on questions of economic statistics and measurement, particularly on the digital economy. Some of this is rather detailed and technical (although technical sections are confined to boxes in the text). But there are also some questions of philosophy and politics involved. The fundamental issue is the definition of value. Economic measurement is deeply value laden, and (in contrast to many fellow economists) I believe it is important to engage with other disciplines and literatures; equally, the consideration of deep questions of value or power needs to be rooted in technical knowledge, whether of economic theory or computer science. The book makes a virtue of drawing on a wide range of research not limited to economics.

Unfortunately, the revision to the SNA to be adopted by the United Nations, SNA25, makes only incremental changes to the measurement framework, rather than the significant conceptual shift that is needed. Although welcome, the changes will not provide policymakers the information they need about the environmental sustainability of economic activity, or the importance of investment in human capital for living standards and progress. Much of the additional information governments and businesses need about the digital economy or unpaid household work will be contained in supplementary thematic tables that many countries might never get around to creating. Most of the chapters of this book set out the shortcomings in standard economic measurement, explaining why the current metrics miss important considerations. Each chapter focuses on specific areas, particularly regarding digital aspects of the economy where the absence of relevant statistics is striking.

The final two chapters broaden out to sketch an alternative approach to economic measurement, the generational conceptual shift we need.

For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.



This approach has two elements. One is the introduction of an asset-based framework, in effect a broadly defined balance sheet for the economy, with the associated flows of services for the assets, valued at shadow prices reflecting societal values rather than market exchange values. This new element has two key advantages over the current SNA. First, it embeds sustainability considerations because the appropriately measured value of assets and the services they provide today depends on their future condition. Second, by defining the assets society needs to have a functioning economy to more broadly include not only physical capital and infrastructure but also human and social or organisational capital, natural capital, and intangible capital, it illuminates how these assets operate as a portfolio. Different assets may complement each other—like human capital and many intangibles—or substitute for each other—like concrete flood defences and wetlands. Just as investors make good decisions by taking the correlations into account, so can policymakers improve their economic decision-making.

The downside of this capitals approach compared with today's measurement framework is that it is not an accounting framework: there is nothing the components need to add up to. It is worth underlining that the SNA itself is an accounting framework only when expressed in current price or nominal terms; the real terms measures often used by economists and commentators do not add up and indeed at an aggregate level are conceptually incoherent.

However, the second new element I set out in the book is an accounting framework based on time use. Everybody has twenty-four hours a day and must spend them all every day. The "user" side of this account involves a choice along several margins, allocating time to paid work, unpaid work in the household, consumption, and leisure. The "producer" side of the account also involves several margins, over the standard factors of production (including land, materials, and energy as well as capital and labour), location, and time: What production techniques and combinations of machines, other capitals, nature and energy, ideas, and humans are used to deliver what products or services? Productivity gains may correspond to time saving in production or higher quality in products and services provided—for in addition to the standard,

For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.



intuitive metric of labour productivity, we should look at the productivity of the other inputs too, including output per unit of carbon and other resources, and per unit of time.

This is not to argue for throwing away all the current statistics; for instance, a measure of nominal GDP growth and short-term inflation measures will continue to be important for macroeconomic policymakers who need tools for managing demand over the business cycle. Rather, the measures I advocate—of an economy's asset base and of the use of time for either efficiency (in production) or well-being (in consumption and leisure)—speak directly to the motivating question: Is there economic progress? That depends on whether people can lead the lives they want, and what resources they can access to help them do so. Many of the resources any of us needs or wants are collective: clean air, an energy grid, public transport or road networks, broadband, a school system. Such a framework speaks to the need to shift how the economy is understood—in policy and in academic economics—decisively away from seeing society as the sum of individual decisions, or GDP as the sum of individual incomes and spending decisions. Introducing time use and time saving as a criterion similarly shifts the focus for thinking about economic analysis and policy away from markets as the organising mechanism, and instead toward transaction costs and how institutions are organised.

This shift in focus, from individual and simple choices in markets to collective and complex choices in organisations or institutions, also represents a personal intellectual journey that began more than forty years ago, when I was an economics graduate student at the height of the discipline's insistence on rational, individual choice. The story begins at Harvard in 1982.

For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.

# INDEX

Note: Numbers in *italics* denote tables.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.





For general queries, contact info@press.princeton.edu