Economic Methods and Models

Dyrehaugen Web Notebook

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Contents

1

Economics

Economics is a broad field. Here we look at Methods and Models.

Economics is too important to leave to the economists

2

Economic Planning

Krahé

Planning—the setting of economic priorities via non-market means—must be distinguished from a command economy. A command economy, in contrast to planning, is one particular way of injecting plans into the division of labor, namely with command and control measures.16 As France, Sweden, Japan and other mixed economies demonstrated in the wake of WWII, there are many other ways to introduced plans into an economy: from direct public investment, via taxes and subsidies, to banking regulation, credit guidance, and foreign exchange allocation, to name but a few.17 The advantage of planning is its ability to focus resources, create and channel energies, and reduce uncertainty. Pierre Massé, former General Commissioner of Planning in France, called it *l'anti-hasard*.

When the Monnet Plan was introduced in France in 1946, its goal was to reach the nation's pre-war production level by 1948, and then surpass it by 50 percent by 1950. Under the slogan "modernization or decadence," it prioritized investment over consumption, allocated scarce US dollar reserves to their most important uses, and channeled resources into sectors identified as crucial for restarting and growing France's economy. "Bottlenecks were broken during the early days,"19 and while not all targets were reached, the plan provided "discipline, direction, vision, confidence, and hope."20

The Monnet Plan navigated a situation not entirely unlike our own. In the postwar moment, both domestic funds and foreign exchange were scarce. Since dollars and francs were not freely exchangeable at the time, they had to be budgeted for separately, acting as a double budget constraint. Today, we again face a double budget constraint: economic and ecological.

The Monnet Plan navigated this tightly binding double constraint through prioritization. Instead of attempting to plan for all sectors, the Plan focused on

six strategic industries: electricity, steel, coal mining, transport, cement, and agricultural machinery.21 The lesson for today is obvious. Focus on the five sectors driving climate change, land use, and biodiversity loss today: energy, transport, industry,22 housing, and agriculture.

The process of sectoral planning was led by a core staff in the Commissariat général du Plan, numbering around 100. This core staff cooperated with a number of so-called modernization commissions, composed of representatives from the state, employers, and trade unions, which tackled either specific sectors or cross-cutting themes like finance or labor.

Krahé (2002) The Whole Field - Markets, planning, and coordinating the green transformation

3

Planning

Organising production and consumption without the market.

Roberts on Cockshott

The only way humanity has a chance of avoiding a climate disaster will be through a global plan based on common ownership of resources and technology that replaces the capitalist market system. In a new book by Scottish Marxist economists Paul Cockshott, Alin Cottrell, and Jan Philip Dapprich, entitled Economic Planning in an Age of Climate Crisis, the authors take up this issue.

Tthe major innovation in this book is to consider how to plan for environmental needs as well as production per se in a non-market economy.

There are two main parts to the planning of resource allocation and production. The first is the macro allocation for social needs eg investment in capital goods, health care, education, transport, public services and basic consumer goods – free to all at the point of production. But second, there needs to be a mechanism for allocating other resources for personal consumption beyond the 'social wage'. These personal consumer needs will be determined by the labour time used to produce them and individuals will 'buy' them based on the 'labour time vouchers' issued to to a worker for the individual contribution to overall production in labour time.

The authors propose an adjustment to that model based on the economic category of opportunity cost. "To specify the cost of a product, we must thus determine what else could have been produced instead. Moreover, we must be able to measure this on a common scale so that costs of various products can be compared." So if the planners 'priced' products with an extra constraint on greenhouse gas emissions that they generate, this require a higher 'opportunity cost' valuation for high emission products. This would result in a shift of demand towards low-emission products. "Rather than simply reducing the

economy's overall output to abide by emission constraints, the composition of output is changed to emphasise green products."

This book offers a further development of technical feasibility of socialist planning that incorporates the climate crisis. It further enhances the advantages of the planning mechanism for human organization over the anarchic, crisis-ridden, exploitative capitalist market economy that is failing to deliver the needs of humanity and is destroying the planet. It offers yet more powerful arguments for planning over the market.

Roberts (2022) Planning not Pricing](https://thenextrecession.wordpress.com/2022/12/15/planning-and-the-climate/)

4

Economic Measurements

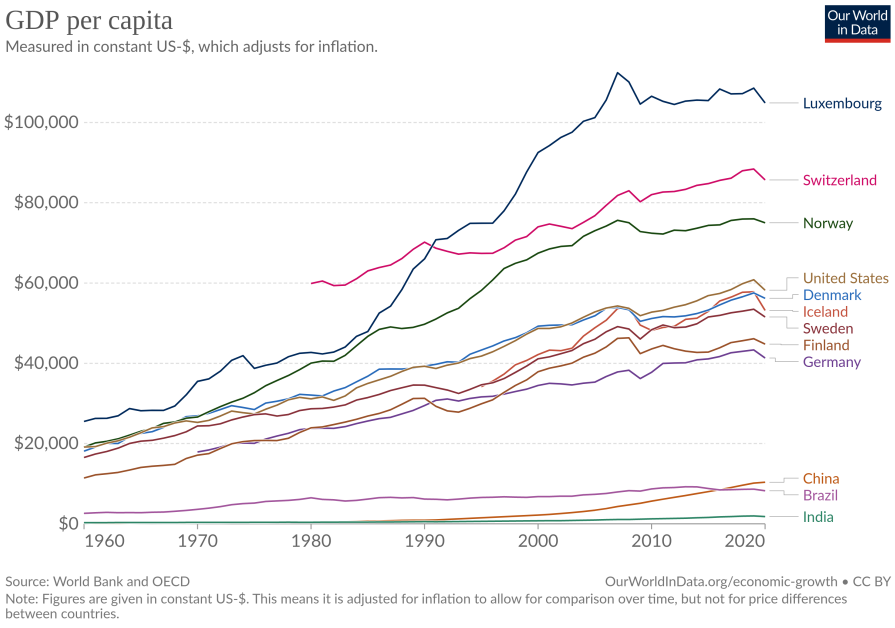


Fig: Todays policy implies every country's goal is to become a Luxembourg!

GDP is insufficient as a measure to capture what is essential about the economy.

All of GDP is not created equal. Some output in the economy is more important, more fundamental to how the economy functions than other output.

Simply put, Russia makes more of the stuff that is used to make other stuff. Think about this with respect to energy. Russia produces around 40 per cent of Europe's natural gas, a key commodity used in electricity and heat generation. Can a service sector business remain open without access to this energy? Obviously not. A high street retailer, for example, would not be able to function without electricity. Now put the shoe on the other foot: can an energy provider continue to produce energy if all the high street retailers closed their doors? Of course. Pilkington (2022) The West's self-defeating sanctions

4.1 Our BESDA economy

4.1.1 GDP and EBITDA

While the deficiencies of GDP as a measure have been well known, less emphasized has been the fact that every single financial statement with which we build GDP exhibits the same deficiency of being a limited barometer of value. Ironically, the main users of these financial statements, in the business and financial sectors, are wise to the incompleteness of certain metrics within financial statements, but act in a way that indicates they are oblivious – or perhaps just willing to overlook – the incompleteness of financial statements writ large. To explain,

consider that GDP exhibits clear parallels with the profit metric of EBITDA (earnings before interest, taxes, depreciation and amortization), Though there are technical differences of formulation, GDP and EBITDA both represent partial measures of "wealth creation" disembedded from a fuller conception of value. However, while financiers are wise to the deficiencies of EBITDA, they have not acknowledged that the same pattern of incompleteness reappears at the level of the overall financial statement – and then at the yet higher level of GDP. With the "DA", EBITDA conveys the profitability of a company as if it would never again have to spend a dollar on keeping its factories, equipment, property and software in good repair and up to date. In other words, EBITDA excludes the cost of maintaining in good condition the whole infrastructure upon which a company depends! It is the homeowner's fantasy of how wealthy they would be if they never had to fix or repair anything in their house ever again.

EBITDA came to prominence during the leveraged buyout (LBO) boom of the 1980s. As Moody's recounted in 2000: "LBO sponsors and bankers have promoted the use of EBITDA for its obvious image benefits. EBITDA creates the appearance of stronger interest coverage and lower financial leverage." As a general rule, beware profit metrics promising image benefits. Forbes was blunter still: "EBITDA is essentially a tool that shows what a company

would look like if it wasn't actually that company." EBITDA is now clearly recognized as a "wool-over-your-eyes" measure, such that accounting authorities deny it official status. It is a "non-GAAP" metric – not a Generally Accepted Accounting Principle. Its ongoing ubiquity – besides being trivially easy to calculate – is because it masks the fact that a business may be overleveraged – that it may have borrowed against its future more than it can ever repay.

GDP is a "wool-over-all-of-our-eyes" metric for the same reason that it excludes the full cost of maintaining in good condition the social and ecological infrastructure upon which the whole economy depends. In steering society by GDP, we are effectively managing the planet on an EBITDA basis. GDP is not just a benignly incomplete measure of wealth, it is the tool with which we are conning ourselves.

Businesspeople – and homeowners - know how these stories end. Eventually the under- investment in infrastructure catches up with you. Of course, by then, you hope to have passed the asset – and the problem – on to someone else. This is feasible, if not best form, where the asset is not the whole planet. The deception works for as long as you can get away with the under-investment and the factories and software hold up. Buffet's partner, Charlie Munger, is characteristically more forthright on the topic: "I think that, every time you see the phrase 'EBITDA earnings', you should substitute the phrase 'bullshit earnings'." By analogy, GDP is "bullshit wealth". That we have been able to enjoy the comforts of its deception without mishap for so long is simply because it was introduced against higher levels of social and ecological infrastructure that we have not yet completely run down. The under-investment is only now becoming apparent.

4.1.2 A BESDA economy

Long-term or ESG (environmental, social and governance) investors may protest that they understand all this but that their own investment process insulates them from such blinkered thinking. ("We don't use EBITDA"). Yet the point is that the whole financial system is operating on a "before ecological and social depreciation and amortization" basis – call it BESDA, perhaps. So, every single financial metric on the Bloomberg screen is a BESDA metric – profits- BESDA, earnings per share-BESDA, return on capital-BESDA, return on equity-BESDA, etc. The millions of financial numbers processed daily by our increasingly automated markets – which, in turn, steer our economy and drag our culture along behind, ripping up nature in its wake – are all BESDA numbers. It might not only be EBITDA with which we are conning ourselves, but every financial number in the book. They all represent different degrees of disembedded value, some of which we have unmasked, some of which we have not. We have a sustainability challenge because the entire financial system repeats the problems of the discredited EBITDA metric at the level of the whole economy. This is the invisible conceptual cage we have wrapped around our decision-making and from within which the ESG movement is frantically trying to make a difference. Alas, given the incompleteness of our markets, the ESG movement increasingly resembles a hopeful grafting of good intentions onto an unchallenged accounting reality that remains the largely intact source of our problems. This is the root cause of our collective "greenwish" in which we are hoping that well-intended efforts to make the world more sustainable are much closer to achieving the necessary change than they really are

TRUECOST

Trucost, the sustainable consulting firm, estimated in 2013 that large swathes of primary industry – including agriculture and energy companies – would simply not be profitable if they had to pay the full costs of their 14 environmental damage. In 2011, the American Economic Review, published similar work showing that the solid waste combustion, sewage treatment and oil- and coal-fired power production industries generated air pollution damages – air pollution alone – that were greater 15 than their economic value added (EVA). On this fuller accounting perspective, these are effectively EVS – economic value subtracted – industries.

Duncan Austin: Pigou and the dropped stitch of economics RWER95 (pdf)

4.2 GDP

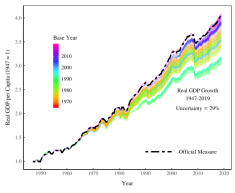
For measurement to be accurate, the units must be stable. Unlike natural scientists, however, economists are not in the business of carefully defining units using universal physical constants. Economists instead use prices, a social construct, as their unit of analysis.

The problem is that prices are unstable units of measurement. Relative prices between commodities vary wildly over time. This instability means that prices fail the only requirement of a good unit — to be uniform over time.

Instead of reporting the severe uncertainty in 'real' GDP, governments report a single official value. This value hides a myriad of subjective decisions that are used to 'correct' for unstable prices.

Instead of wasting time with a useless quantity that reveals nothing profound about the world, we should seek new pluralistic methods for understanding aggregate economic activity.

Price instability translates into uncertainty in the growth of 'real GDP'. While the US government reports only one official measure of 'real' GDP, it quietly maintains a database of 'vintage' GDP estimates. These are estimates calculated with different base years. Using this 'vintage' data, we can quantify the uncertainty in the growth of 'real' GDP caused by unstable prices.



Notice that the official measure of US 'real' GDP is at the upper end of the range of uncertainty. We doubt this is a coincidence. In fact, it is common for national governments to boost GDP growth by changing the base year. India recently showed a small increase in GDP growth by choosing a new base year. While this boost was small, it can sometimes be spectacularly large. Nigeria, for instance, recently changed its base year from 1990 to 2010. As a result, real GDP doubled, making Nigeria the largest economy in Africa. Base-year changes have led to similar boosts to GDP growth in Ghana, Kenya, Tanzania, Uganda and Zambia.

The NIPA Handbook, the US Bureau of Economic Analysis notes:

> The fundamental problem confronting the efforts to adjust GDP and other aggregates for inflation is that there is not a single inflation number but rather a wide spectrum of goods and services with prices that are changing relative to one another over time. The index numbers for the individual components can be combined statistically to form an aggregate index, but the method of aggregation that is used affects the movements of the resulting index.

Ambigous

The growth of 'real' GDP is fundamentally uncertain. Or perhaps a better word is ambiguous.

Mainstream economists reach a very different conclusion. Their response is to simultaneously admit that calculating 'real' GDP requires arbitrary choices, but then to report a single value as though it was the 'truth'.

ChainWeighting

The US government currently calculates 'real' GDP by adjusting nominal GDP with an aggregate index formed through the multiplication of successive Fisher indexes in adjacent time periods. In popular parlance, this method is called 'chain-weighting'. Rather than choose a single base year in which to fix prices, chain-weighting uses a technique that resembles a rolling base year. The method is meant to simulate the effect of changing prices and spending patterns over time. This method was adopted in the mid-1990s. The official justification was that structural changes in the US economy, especially rapidly falling computer prices, compelled the government to end the fixed base year method.

GDP treats everything with a price as contributing positively to society. Again, this comes down to the assumption that all prices reveal utility. If machine guns sell for the same price as MRI machines, neoclassical theory tells us that both contribute the same utility to society.

In response to such absurdities, ecological economists have developed alternative indicators that subtract the value of social 'bads' from the value of social 'goods'. While well-motivated, this approach still assumes that we can aggregate the 'real' value of 'goods' and 'bads'. But because prices are unstable, this aggregate is still ill-defined.

'Real' GDP is a regressive measure of social progress. Not only is it ill-defined and based on flawed premises, it equates market value with social welfare. This justifies the income of the powerful.

Alternatives

The key, we believe, is to separate the study of economic distribution from the study of economic scale. The former is the appropriate domain of prices. The latter is best measured using biophysical units.

Prices: Distribution

We believe it is important to distinguish between economic *distribution* and economic *scale*. 'Real' GDP assumes that prices can be used to measure economic scale. In contrast, we assume that prices do nothing of the sort. Prices are a tool for distributing resources. The proper place for prices, then, is for understanding economic distribution.

Scale: Energy

To measure the scale of the economy, we think it is appropriate to focus on energy. Physicist Eric Chaisson argues that energy is the universal currency of science. By measuring economic scale using energy, we put economics in line with the rest of science. And if we are concerned with sustainability, there is no

better starting point than to focus on energy use. After all, the profligate use of fossil fuels under a capitalist economy is the primary driver of climate change.

Energy has many forms as it is flows through society. One possibility is to focus on primary energy consumption, and see how this relates to changes in social structure. Another possibility is to measure 'useful work' — the consumption of end-use energy. Still another possibility is to measure the aggregate flow rate, which is a measure of all annual energy conversions in an economic system.

The study of economic growth, which should focus on biophysical flows.

Continuing to use 'real' GDP as a measure of social progress implicitly accepts a theory (neoclassical economics) that has long been used as an ideological justification for capitalist power.

Fix GDP

4.2.1 GDP mismeasurement

Burn-Murdoch

The United Arab Emirates is a great example of how stats like GPD per capita can be misleading.

1. GDP per capita: $89,000
2. remove distortion of oil revenues: Mean average salary: $48,000
3. adjust for vast exploited migrant workforce: Median salary: $21,000

Burn-Murdoch (2023) tweet

4.2.2 GDP Revisions

Assa Abstract

What are the implications of changes in measurement standards of GDP for global convergence debates? What are the political economy implications? To answer the former question, we examine the changes in national accounting standards from the early 1990s. Revisions to the System of National Accounts (SNA) – the international standard for constructing GDP – include several major changes to how production is measured, including the reclassification of financial intermediation services, R&D, and weapons systems as productive activities – all areas in which countries in the West has had an advantage in recent decades. In addition, there has been an increase in the proportion of imputations in the 1993 and 2008 revisions, which privileges the economic structures of the West. Overall, we find that these changes have had the effect of boosting the GDP of the West relative to the rest of the world and thus to an underestimation of global convergence compared to previous measures of GDP. To answer the second question, the paper unpacks the political economy implications of national

accounting standards favouring Western economies along several axes, including the impacts on voting shares in international institutions, domestic policy incentives and epistemological debates about sustainable development.

Assa and Kvangraven (2021) Measurement for Convergence Debates and the Political Economy of Development

Assa Abstract

Over the last half century, a large literature has developed on both the nature and the drivers of uneven development. While different methodologies and theoretical approaches to the issue of convergence abound, the use of GDP growth as a measure of economic growth has, remarkably, gone unquestioned. This paper reviews the convergence debates to date, and examines what the changes to the System of National Accounts (SNA) - the international standard for constructing macroeconomic indicators such as GDP - imply for assessing economic convergence. The 1993 and 2008 revisions to the SNA include several major changes to how production is measured - including the reclassification of financial intermediation services, R&D, weapons systems and owner-occupied dwellings as productive activities - all areas in which developed countries have had an advantage in recent decades. We argue that these changes to the production boundary constitute a form of 'kicking away the ladder,' i.e. redefining the yardstick of development to fit the new strengths of developed economies. We analyze data series for a range of countries concurrently available under the 1968 SNA, 1993 SNA and 2008 SNA standards. The earlier measure shows a larger and faster convergence of most countries in 'the Rest' with those of 'the West'. Going a step further, we build on Basu and Foley's (2013) Measured Value-Added concept as a proxy of 'Core GDP'. This indicator omits any sector for which value-added is imputed based on net incomes, in the absence of an independent measure of output. This allows us to examine more countries and a longer, more consistent time series than concurrent SNA data, but the conclusions are the same - developing countries have caught up more in Core-GDP terms than the contemporary imputation-heavy measure of GDP would suggest. These findings suggest that the current measure of GDP has become decoupled from core employment-generating activities, and is therefore a misleading measure of growth in an economy. Furthermore, it is inconsistent with the understanding the Sustainable Development Goals of inclusive and sustainable growth. Finally, the paper considers the political economy implications of the changes in GDP methodology, such as the justification of voting shares in international financial institutions, epistemological consequences, and domestic political economy considerations.

Assa and Kvangraven (2018) Imputing Away the Ladder: Implications of Changes in National Accounting Standards for Assessing Inter-country Inequalities (pdf)

Kvangraven

Economic growth was first measured by governments in the 17th century. In the

modern era, the United Nations took over responsibility for measuring output in 1953, and was joined in 1993 by the World Bank, IMF, OECD and EU. They all feed into decisions about the international measurement rules, which are taken by the UN inter-secretariat working group on national accounts (ISWGNA), and all countries are meant to comply. This reflects a gradual move away from national governments controlling the statistics to financial institutions having a larger say.

Both in 1993 and again in 2008, the so-called "production boundary", which determines what is included in GDP, was broadened by the ISWGNA to include many activities that were hitherto excluded or at most seen as intermediate inputs.

Thanks to these reforms, financial intermediation, research and development, and the production of weapons all began to be counted within GDP data across the world. For example, in 1993 the income banks earned on interest from lending to households was included in GDP for the first time. And then in 2008, even bank money that had nothing to do with intermediation services began to be included.

Since western countries such as the UK and US have specialised in these activities in recent decades – the US is first in weapons and second in financial services and R&D, while the UK leads on financial services – the changes have disproportionately benefited their GDP numbers.

Kvangraven in The Conversation

4.2.3 GDP Alternatives

Coyle

How should we measure economic success? Criticisms of conventional indicators, particularly gross domestic product, have abounded for years, if not decades. Environmentalists have long pointed out that GDP omits the depletion of natural assets, as well as negative externalities such as global warming. And its failure to capture unpaid but undoubtedly valuable work in the home is another glaring omission. But better alternatives may soon be at hand.

In 2009, a commission led by Joseph Stiglitz, Amartya Sen, and Jean-Paul Fitoussi spurred efforts to find alternative ways to gauge economic progress by recommending a "dashboard" of indicators. Since then, economists and statisticians, working alongside natural scientists, have put considerable effort into developing rigorous wealth-based prosperity metrics, particularly concerning natural assets. The core idea is to create a comprehensive national balance sheet to demonstrate that economic progress today is illusory when it comes at the expense of future living standards.

In an important milestone in March of this year, the United Nations approved a statistical standard relating to the services that nature provides to the economy.

That followed the UK Treasury's publication of a review by the University of Cambridge's Partha Dasgupta setting out how to integrate nature in general, and biodiversity in particular, into economic analysis. With the consequences of climate change starting to become all too apparent, any meaningful concept of economic success in the future will surely include sustainability.

The next steps in this statistical endeavor will be to incorporate measures of social capital, reflecting the ability of communities or countries to act collectively, and to extend measurement of the household sector. The COVID-19 pandemic has highlighted how crucial this unpaid work is to a country's economic health. For example, the US Bureau of Labor Statistics intends to develop a more comprehensive concept of living standards that includes the value of such activity.

But many advocate thinking about economic success and failure in terms of well-being, a broader and fuzzier concept. The idea that policy decisions should focus on what ultimately matters in people's lives is intuitively appealing. And a number of governments, from New Zealand to Scotland, have recently adopted explicit well-being policy frameworks.

Public policy based on well-being thus still lacks a theoretical underpinning. One recent UK study, co-produced by researchers and people experiencing poverty, found that while basic material needs including health were important to well-being, autonomy and a sense of purpose mattered just as much. The top-down aggregate indicators devised by social scientists and statisticians cannot capture such findings.

Keep in mind that the concept of well-being is much richer than most other economic indicators. Importantly, the comprehensive wealth and well-being approaches outlined here are complementary: the assets measured by the former provide the means to achieve the latter. Indeed, New Zealand's policy framework makes this link explicit. What is exciting about these alternative approaches to assessing and measuring the economic success of a community or country is the amount of practical progress already made in defining concepts, creating metrics, and building expert consensus about the direction policymaking should take. Ditching GDP as the main gauge of prosperity was always impossible in the absence of broad agreement about what the alternative might be. And it will take many more years of work at the statistical coalface to develop a framework as sophisticated and well-embedded as GDP and related economic indicators. But the direction of change is clear, and the impetus to bring it about is powerful.

Coyle (2021) GDP's Days Are Numbered

4.2.3.1 GDP vs GDI

Roberts

here is another measure of economic growth than the change in gross domestic product (GDP). There is gross domestic income (GDI). In macroeconomic

accounting both these measures should be equal in theory. GDP measures the total value of goods and services produced in an economy. GDI measures aggregate income received across all sectors of the economy, including wages, corporate profits, and tax receipts from that output. Accounting-wise, these two measures should add up to the same. But the measures can vary because the data to measure them come from different sources.

However, currently GDP and GDI growth rates are diverging to a degree not seen since 2007, just before the Great Recession of 2008-9. As said above, US GDP growth was (an annualised) 5.2% in Q3 this year, but GDI growth was just 1.5% annualised. And although GDP yoy growth has slowed, it remains positive, implying a strong economy, but GDI yoy has been falling for two consecutive quarters, implying a recession.

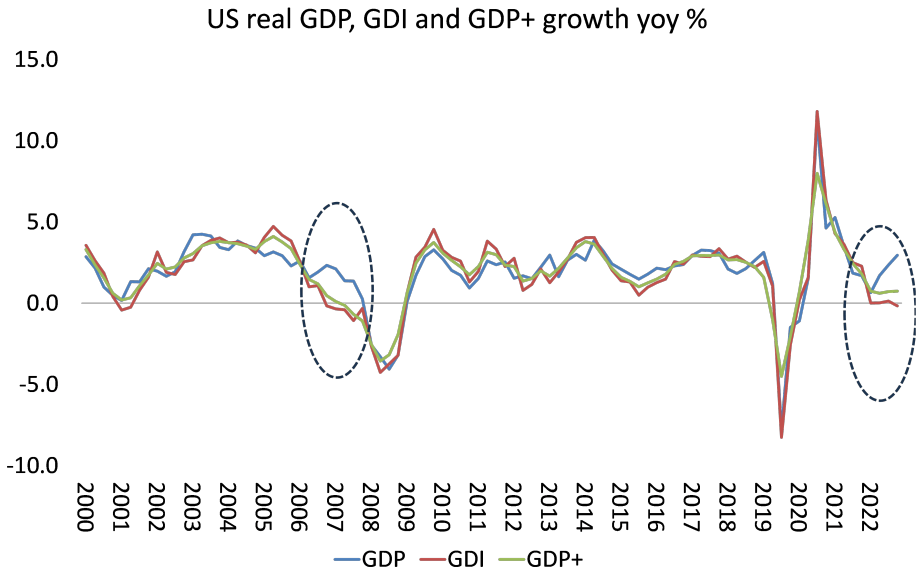
Why the big difference? And which measure is more accurate? Various explanations have been presented. It's 'statistical noise' that will subside and both measures will soon be in line. That's one answer. Another is that, according to the official statisticians at the US BEA, "corporate profits, proprietors' income (small business and self-employment income), and capex are the components of GDP/GDI that are most prone to revision." In other words, production of goods and services may rise but that may not be translated into increased incomes (profits and wages).

Indeed, the strong GDP figure was partly due to a large rise in inventories or stocks of unsold goods, not earning any revenue. Private inventory investment contributed 1.3 percentage points to GDP in Q3. Inventory swings could even subtract from GDP in future quarters, bringing it closer to the GDI measure. If you strip out the build-up of stocks and just measure the increase in actual sales (after inflation), then sales growth was about 2% yoy in Q3, not over 3% yoy as measured in GDP. Real final sales are still 7-8% below pre-pandemic trend growth.

GDP has been growing faster than GDI because there is more consumer borrowing (and running down savings) and because there is more production without sales. So the GDI measure may well be more accurate about what is happening to the US economy than GDP. Over the last four quarters US GDP is up 3.0% while US GDI is down 0.2%.

The average of the two is 1.4% over the last four quarters. One answer to this conundrum then is to do an average of the two measures. The Congressional Budget Office (CBO) does that. There is also a similar combined measure called GDP-plus, produced by the Philadelphia Federal Reserve.

I put these three measures together in the graph below. I think it is significant that the GDI and GDP diverge most when production growth is being driven more by credit than by increased revenues (wages and profits), as just before recessions. Since the pandemic, real wages have fallen behind inflation and now profits for all companies have also started to slow sharply. That's a sign that GDP growth may well slow soon as well.



Roberts (2023) Goldilocks and the last mile

4.3 SNA

Milanovic

How should GDP account for the use of exhaustible resources, or should it include net income from financial services and insurance?

(For a nice book on GDP measurement, see Diane Coyle's GDP: A Brief, but Affectionate History; for a tough review of the book, see Moshe Syrquin's long essay.)

When the System of National accounts (SNA) and GDP in its more or less current version were defined, Simon Kuznets thought that transportation services should be considered an intermediate good and not included in value added. This was not accepted even if Kuznets' logic was impeccable: if you use bus, metro, or your own car to go to work, depreciation of the car and the expense of gas etc. have to be deducted from your wage. Travelling to work is a means, not a goal. Kuznets' argument reappears rather unexpectedly today with the "explosion" of online work during and after the pandemic. Online work reduces the travel cost but since we have decided that transportation to and from workplace should be counted as value added, less of commuting traffic lowers GDP. We thus have a paradoxical situation that what is clearly an improvement in the welfare of workers is counted as a reduction of GDP.

SNA vs SMB

There was a very important difference between the System of National Accounts and the System of Material Balances used in centrally-planned economies. The difference was due to what was considered to be the goal of economic activity. SMB excludes all activities that result in non-material output: government administration, education and health services. Gross output in centrally-planned economies was thus systematically lower than when expressed in the SNA. The difference was estimated at between 10 and 15 percent, and in some cases even 20 percent.

On the other hand, given that productivity growth is slower in education and health than in the production of material goods, underestimation of gross output in socialist countries was combined with an overestimation of the rate of growth. We thus had, judged from the standpoint of SNA, two opposite biases in centrally-planned economies: lower level of output, but its higher rate of growth.

The SMB claimed to have been based on Marx's view of productive labor, but this is not obvious because we do not know what exactly was seen by Marx to be the goal of economic activity in socialism. Marx believed that "productivity" (and thus the goal) is a historic concept, defined from a systemic point of view. In a capitalist system, productive is the worker who produces surplus value for the capitalist. This is the origin of Marx's famous example of the opera singer who is a productive worker if he is hired by a capitalist, but not when he works for himself. Productivity of labor is not, according to Marx, deducted from labor being embodied in goods as opposed to services (as held by the SMB) but from labor's contribution to what is the goal of economic activity in a given system. Under capitalism, it is profit. So if the opera singer generates profit for the impresario who hired him, he is a productive worker. Similarly, if the goal was to provide net income for the elite as Physiocrats thought, and if the only source from which this can be extracted is agriculture, the correctly defined net product is indeed as they defined it.

What we call value added or useful output in one system is not necessary the same as what we call useful output in the other. It depends on what the ruling ideology tells us is the reason why we engage in economic activity at all.

Milanovic (2023) Net economic output in history: Why we work? Ideology behind economic a ccounting

5

Economic Modelling

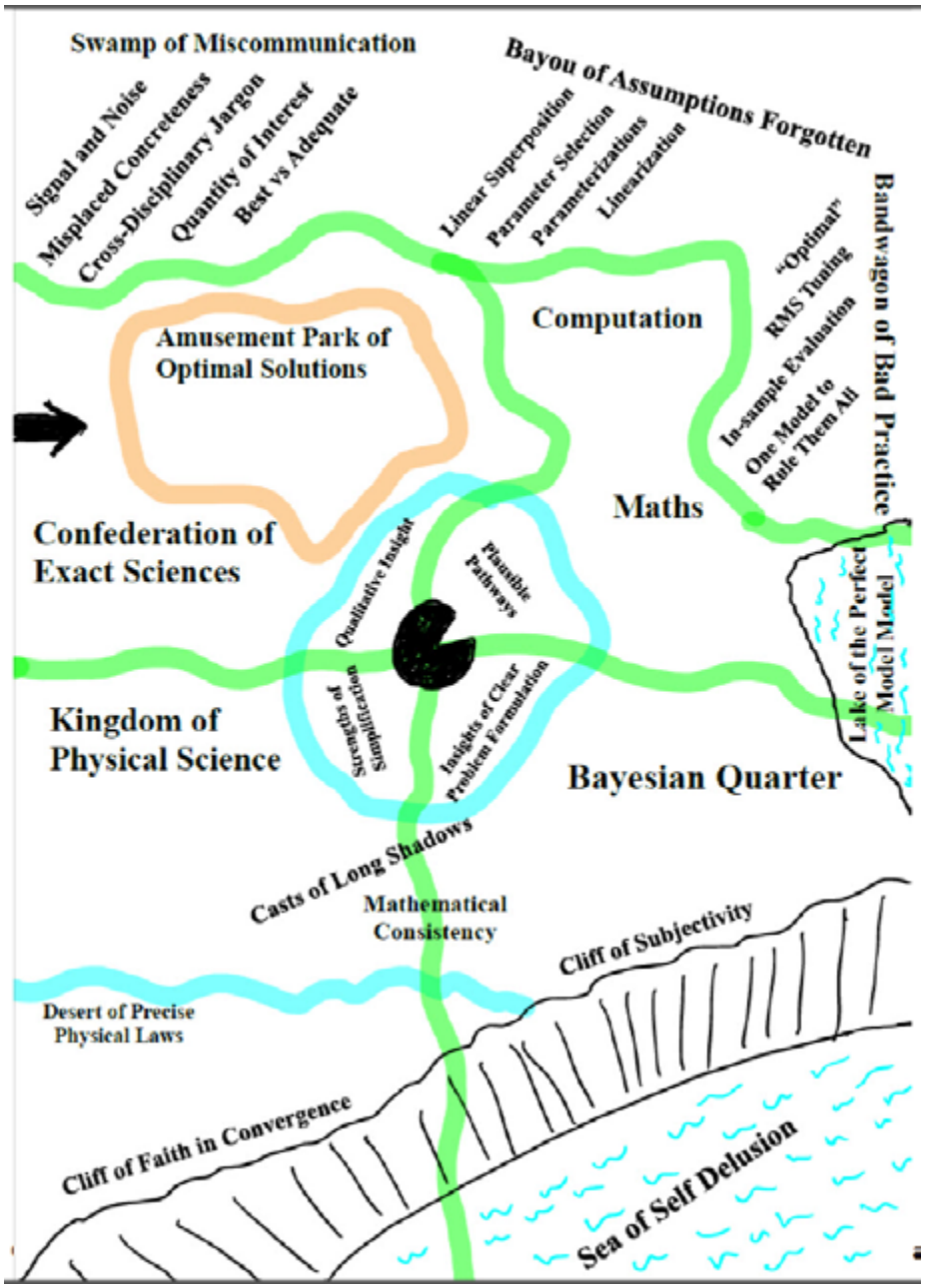
All models are wrong but some are useful.

It takes a model to beat a model.

5.1 Model-land

Thompson Abstract

Both mathematical modelling and simulation methods in general have contributed greatly to understanding, insight and forecasting in many fields including macroeconomics. Nevertheless, we must remain careful to distinguish model-land and model-land quantities from the real world. Decisions taken in the real world are more robust when informed by estimation of real-world quantities with transparent uncertainty quantification, than when based on "optimal" model-land quantities obtained from simulations of imperfect models optimized, perhaps optimal, in model-land. The authors present a short guide to some of the temptations and pitfalls of model-land, some directions towards the exit, and two ways to escape. Their aim is to improve decision support by providing relevant, adequate information regarding the real-world target of interest, or making it clear why today's model models are not up to that task for the particular target of interest.



Thompson (2019) Escape from Model-land (pdf)

5.2 End of Theory

Bookstaber

The End of Theory: Financial Crises, the Failure of Economics, and the Sweep of Human Interaction

Our economy may have recovered from the Great Recession—but not our economics. In The End of Theory, Richard Bookstaber discusses why the human condition and the radical uncertainty of our world renders the standard economic model—and the theory behind it—useless for dealing with financial crises. What model should replace it? None. At least not any version we've been using for the past two hundred years. Instead, Bookstaber argues for a new approach called agent-based economics, one that takes as a starting point the fact that we are humans, not the optimizing automatons that standard economics assumes we are.

Bookstaber's groundbreaking paradigm promises to do a far better job at preventing crises and managing those that break out. As he explains, our varied memories and imaginations color our economic behavior in unexpected hues. Agent-based modeling embraces these nuances by avoiding the mechanistic, unrealistic structure of our current economic approach. Bookstaber tackles issues such as radical uncertainty, when circumstances take place beyond our anticipation, and emergence, when innocent, everyday interactions combine to create sudden chaos. Starting with the realization that future crises cannot be predicted by the past, he proposes an approach that recognizes the human narrative while addressing market realities.

Sweeping aside the historic failure of twentieth-century economics, The End of Theory offers a novel and innovative perspective, along with a more realistic and human framework, to help prevent today's financial system from blowing up again.

Bookstaber (Book Page)

5.3 Jackson-Victor

The "new normal": Hyper-Capitalism, Proto-Socialism, and Post-Pandemic Recovery

Jackson Abstract

Post-pandemic recovery must address the systemic inequality that has been revealed by the coronavirus crisis. The roots of this inequality predate the pandemic and even the global financial crisis. They lie rather in the uneasy relationship between labor and capital under conditions of declining economic growth, such as those who have pre- vailed in advanced economies for almost half a century. This paper explores the dynam- ics of that relationship using a simple stock-flow consistent (SFC) macroeconomic model of a closed economy.

It examines in particular the role of two key factors—the savings rate and the substitutability (elasticity of substitution) between labor and capital—on the severity of systemic inequality under conditions of declining growth. The paper goes on to test the efficacy of three redistributive measures—a graduated income tax, a tax on capital and a universal basic income—under two distinct structural scenarios for an economy with a declining growth rate. We find that none of these measures is sufficient to control structural inequality when institutions aggressively favor capital over labor (hyper-capitalism). Taken in combination, however, under con- ditions more favorable to wage labor (proto-socialism), these same measures have the potential to eliminate inequality, almost entirely, even as the growth rate declines.

Jackson Memo

The two key structural factors, which determine the evolution of inequality under a declining growth rate, are (1) the savings rate and (2) the elasticity of substitution between labor and capital. Depending on the configuration of these factors, two radically different futures may emerge. Under one future, which we have described here as "hyper-capitalism" (Scenario 1), a constant savings rate and high sub- stitutability between capital and labor lead to accelerating inequality, even under a progressive combination of redistributive measures. Under another kind of future, which we describe as proto-socialism (Scenario 2), a declining savings rate and low substitutability between capital and labor, lead to declining inequality, which in combination with progressive redistributive policies, have the potential to eliminate inequality almost completely.

Hyper-capitalism is likely to emerge in a world where labor is increasingly (and easily) substituted with capital and the interests of the owners of capital are privileged over the rights of workers. These privileges encourage capitalists to continue to save even as the growth rate declines, leading to a rising capital to output ratio and an escalating inequality. Such a scenario could, for example, accompany a world in which an aggressive drive towards automation or the imple- mentation of artificial intelligence (AI) by monopolistic companies removes the need for wage labor across large swathes of the econ- omy. Failure to protect the livelihoods of the immiserated work force facilitates continued savings and investment by asset owners. By the same token, it concentrates incomes (and wealth) increasingly in a minority of the population, leading to the kinds of dystopian trends in inequality illustrated in Scenario 1. 13 Proto-socialism on the other hand aims for strong institutions to protect the rights of workers, introduce a job guarantee, and establish an adequate minimum wage. Such interventions slow down the sub- stitution of capital for labor. Attempts by capitalists to maintain a con- stant savings rate under these conditions lead (Figure 3a) to a dramatic collapse in the rate of return on investment, and a partial reversal in the relative fortunes of workers and capitalists. Faced with the prospect of declining rates of return, these conditions are more likely to lead to a decline in the rate of savings (Scenario 2) and a reduction in the capital intensity of the economy, features that will reinforce a more equal distribution

of incomes. In short, proto-socialism is likely to involve a transition away from resource-intensive mass production processes and toward the evolu- tion of an economy of quality and service (Jackson, 2017). It might well also involve institutional innovations which better represent the interests of workers in the management of firms (Ferrera, 2017), bet- ter distribute the rewards of innovation to the populace (Varoufakis, 2016) and allow government to operate as an "employer of last resort" (Minsky, 1986). It will not have passed unnoticed that the sectors that emerge stronger under proto-socialism are precisely the labor-intensive sectors associated with care, distribution and maintenance—the frontline ser- vices of the pandemic—described at the beginning of this paper. Other labor-intensive sectors such as those associated with crafts, creativity, and community-based recreation and leisure (Jackson, 2021) are also likely to flourish under these conditions. Proto-socialism, in other words, could provide a robust basis for a post-pandemic recovery— even under conditions of low-growth.

Jackson (2021) Confronting inequality in the "new normal" : Hyper-capitalism, proto-socialism, and post-pandemic recover (pdf)

Thanks to **?** and Peter Victor. This paper is crucial to challenging the assumption, represented in the IPCC's existing scenarios, that slower growth rates mean rising inequality. It all depends on policy, and the power of labour vis-à-vis capital. (Jason Hickel)

5.4 Eurogreen Model

Feasible alternatives to green growth

Abstract D'Alessandro

Climate change and increasing income inequality have emerged as twin threats to contemporary standards of living, peace and democracy. These two problems are usually tackled separately in the policy agenda. A new breed of radical proposals have been advanced to manage a fair low-carbon transition. In this spirit, we develop a dynamic macrosimulation model to investigate the long-term effects of three scenarios: green growth, policies for social equity, and degrowth. The green growth scenario, based on technological progress and environmental policies, achieves a significant reduction in greenhouse gas emissions at the cost of increasing income inequality and unemployment. The policies for social equity scenario adds direct labour market interventions that result in an environmental performance similar to green growth while improving social conditions at the cost of increasing public deficit. The degrowth scenario further adds a reduction in consumption and exports, and achieves a greater reduction in emissions and inequality with higher public deficit, despite the introduction of a wealth tax. We argue that new radical social policies can combine social prosperity and low-carbon emissions and are economically and politically feasible.

D'Alessandro (2020) Feasible alternatives to green growth (Paywall) SI (pdf)

D'Alessandro Presentation

Green Growth

The main response to the global challenges posed by climate change are currently based on Green Growth policy proposals, namely: • mainstream and institutional paradigm focused on technological optimism; • market-oriented view: trickle-down effect should improve welfare and job creation; • one-size-fits-all solution: GDP growth

Critiques to the ability of market mechanisms and innovations to: - foster material decoupling (Wiedmann, 2015) - meet planetary boundaries (Steffen, 2015, O'Neill, 2018) - avoid critical transitions (Scheffer, 2012) - ensure social justice: within-country inequality (Piketty, 2014) - overcoming the rebound effect: % RES and CO2 per capita

Green Deal

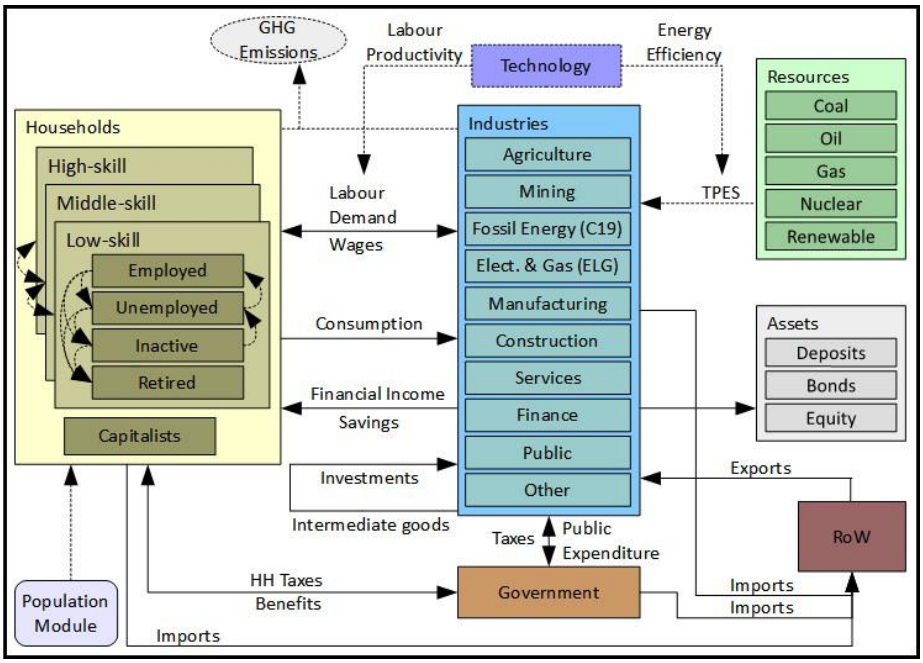
Recognizes the need to address inequality and environmental issues in a unified perspective combining social policies with green growth measures

Post-Growth

Advocates that continuous economic growth and ecological sustainability are incompatible: down-shift of economic scale. Social policies becomes essential to face inequality

EUROGREEN

A macrosimulation model tailored to compare the long-run effects, synergies and trade-off of these three alternative narratives.



Indicators

GHG emissions with respect to 1990. Targets: −40% in 2030 and −80% in 2050 • Gini coefficient for income inequality: from 0% (no ineq.) to 100% (max ineq.). Computed over 13 groups (3 skill by 4 work status + capitalists) including incomes from labour, financial assets and wealth • Deficit/GDP: fiscal sustainability • GDP growth • Unemployment: total and by skill • Energy Mix: shift in source composition in electric power generation and TPES.

Discussion

• Our results suggest that there are no win-win solutions • Similar reductions in emissions can result in radically different social consequences in terms of income distribution, employment, and fiscal stability. • Green Growth Paradox The effectiveness of GHG reductions depends on the failure to promote GDP growth. • Techno-scepticism: Environmental policies alone fails to deliver the advocated improvements in employment and income distribution • Radical social policies (JG and WTR) can combine social prosperity and low-carbon emissions • Lower aggregate demand helps emission target achievement

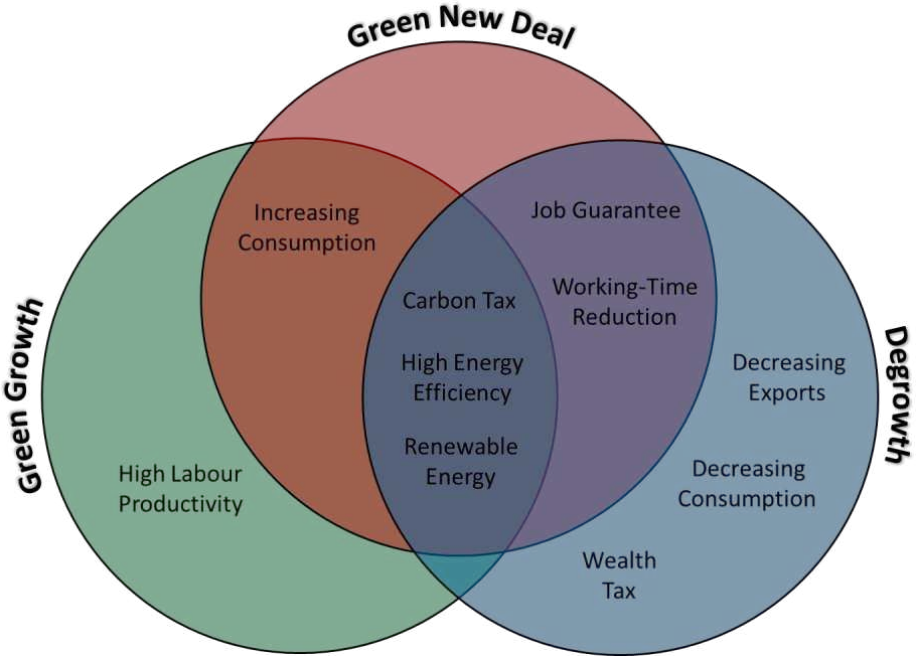
D'Alessandro (2020) feasible Alternatives - Presentation (pdf)

O'Neill

** 'Green Growth' will increase inequality and unemployment unless accompanied by radical social policies.**

The economy is embedded within society, which is in turn embedded within

the biosphere. Economic processes are therefore analysed in terms of flows of biophysical resources and social outcomes not just in terms of flows of money, as in conventional macroeconomic models.



Ecological macroeconomic models allow for multiple non-substitutable goals to be explored (e.g. sustainability, equity, and human well-being). These models have been developed to address issues such as the link between growth and inequality 5 and the effect of climate change on financial stability.

Green growth reduces greenhouse gas emissions, but inequality and unemployment both rise. The Green New Deal dramatically lowers unemployment and reduces inequality, but at the expense of an increase in the government deficit-to-GDP ratio. Degrowth reduces emissions and inequality further than the other two scenarios, but it leads to a higher increase in the deficit-to-GDP ratio (because GDP decreases). In short, there is no win win scenario.

These results have important implications. First, they suggest that a purely market-based green growth strategy is likely to have serious negative side effects. These side effects may be corrected by complementing environmental policies with strong social policies, such as working-time reduction, a guaranteed jobs programme, and a wealth tax. Second, the results suggest that degrowth can dramatically reduce environmental impact and lead to improved social outcomes (e.g. more leisure time, higher employment, greater equality), provided the appropriate policies are in place. Third, a Green New Deal, with an explicit focus on achieving a just transition 7 , may represent a compromise that advocates of both green growth and degrowth can support.

The Eurogreen Model makes a number of important contributions, but like any model it also has limitations. Importantly, the model does not assess whether the degree of decoupling assumed in its green growth scenario is actually possible, an assumption that has been challenged empirically.

The degrowth scenario does not include a number of additional changes that have been put forward by degrowth authors, such as alternative business models, new measures of progress, or public money creation 9 . For example, central banks could potentially create money to help fund a low-carbon transition (as they created money to bail out the banks), which would reduce the government deficit.

We need to choose our economic policies carefully. We cannot expect economic growth to deliver sustainability, or green growth to deliver social equity. If we want to achieve a sustainable and just society, then we need to move beyond the pursuit of growth, and target these outcomes directly.

ONeill (2020) Beyond Green Growth (pdf)

Russel (2020) Climate crisis: Is it time to ditch economic growth? (DW)

Mudge (2020) Fact check: Does climate protection stifle economic growth?

5.5 HARMONEY

King Abstract

This paper explains how the Human and Resources with MONEY (HARMONEY) economic growth model exhibits realistic dynamic interdependencies relating resources consumption, growth, and structural change. We explore dynamics of three major structural metrics of an economy. First, we show that an economic transition to relative decoupling of gross domestic product (GDP) from resource consumption is an expected pattern that occurs because of physical limits to growth, not a response to avoid physical limits. While increasing operational resource efficiency does increase the level of relative decou- pling, so does a change in pricing from one based on full costs to one based only on marginal costs that neglect depreciation and interest payments. Marginal cost pricing leads to higher debt ratios and a perception of higher levels of relative resource decoupling. Second, if assuming full labor bargaining power for wages, when a previously-growing economy reaches peak resource extraction and GDP, wages remain high but profits and debt decline to zero. By removing bargaining power, profits can remain positive at the expense of declining wages. Third, the internal structure of HARMONEY evolves in the same way the post-World War II U.S. economy. This is measured as the distribution of intermediate transactions within the input- output tables of both the model and U.S. economy.

King Memo

HARMONEY v1.1 is a system dynamics model centered on simulating a set of ordinary differential equations using stock-flow consistent tracking of monetary flows. HARMONEY v1.1 is still a toy model, which is to say it is not yet calibrated (we're working on it!) to a real economy, such as the United States. Nonetheless, it has critical features and structural assumptions that make it applicable and valuable for comparing its trends to long-term trends in real-world data.

This is to say, an important part of HARMONEY is that it has a conservation of flow principle for both mass (as physical resources, energy or minerals, extracted from the environment) and money (at any given instant flows of money are tracked between firms, households, and private banks). While this idea has been around for many decades, this is still relatively unique for macroeconomic models.

Here are several assumptions in the design of the model that help explain why it can mimic long-term real-world trends relating energy consumption and economic variables

- The resource that supports the economy is a regenerative renewable resource stock, such as a forest.
- Resource (mass, energy) consumption is required for three purposes in the model, just like the real world: To operate machines (as fuel) To become new machines when they are manufactured (embodied in new capital) To "operate" or feed people to keep them alive (as food)
- Money is effectively defined as all of the following the compensation labor (workers) receive, the profits received by companies, money (as credit) is created when banks give loans to companies to invest in capital at levels beyond their profits, and the money is destroyed when companies pay back debt, and the interest payments on the debt, or loans given to companies.
- There is no government in the model.
- Population declines when there is not enough resource consumption for households.

The HARMONEY model overcomes three neoclassical limitations:

- the inadequate incorporation of natural resource consumption as required physical inputs to operate capital,become embodied in new capital investment, and keep people alive;
- the lack of consideration of credit, or private debt, in a modern economy; and
- the assumption that factors of production contribute to growth in relation to their cost share.

Unlike neoclassical growth theory (exogenous or endogenous), the post-Keynesian and biophysical structure of the HARMONEY model does not

assume an aggregate production function, TFP, or directly impose scaling of GDP to aggregate labor, capital, or natural resources consumption. Thus, the model enables a different exploration into the effects of resource efficiency and whether the economy has similar energy-GDP scaling as biological systems, and for the same reasons, throughout a growth cycle.

Global primary energy consumption (PEC) and gross world product (GWP) scale approximately linearly from 1900-1970, and since 1970 scale sublinearly at $PEC \propto GWP^{2/3}$ Post-1980 trends show PEC of countries scales with their GDP nearly as $PEC \propto GDP^{3/4}$

… explicitly considers the "energy cost of maintaining the structure and function" of an economy as a complex system …does not address the exact scaling (i.e., value of b) between energy consumption and GDP, but it explains why we expect a transition from superlinear or linear scaling to sublinear scaling, just as observed in biological systems.

…also contributes to the discussion of decoupling of GDP from PEC via increases in energy effi- ciency. Sublinear scaling in the economy, often referred to as a state of declining energy intensity (= PEC/GDP), is often seen as a consequence of increasing energy efficiency. …economy-wide rebound effects might erode more than half the reductions in engineering energy efficiency investments.

King Conclusion

The purpose of this paper was to explore the coupled growth and structural dynamic patterns of the HARMONEY model (v1.1) as updated from King (2020). The differences in the simulation results in this paper versus King (2020) derive from the more robust method in solving for prices and the explicit inclusion of wage bargaining power that augments a short-run Phillips Curve. Despite the assumption of a single regenerative natural resource (akin to a forest) to support the modeled economy, HARMONEY v1.1 exhibits several important high-level structural, biophysical, and economic patterns that compare well with global and U.S. data, and thus provide insight into long-term trends. The HARMONEY model provides a consistent biophysi- cal and monetary basis for explaining the progression in global and country-level data from an increasing or near constant energy intensity (energy consumption/GDP) to one of decreasing energy intensity. That is to say, both HAR- MONEY and global data first show a period of increasing growth rates, when the growth rate of natural resource con- sumption exceeds or is nearly equal to the growth rate of GDP, followed by a period of decreasing growth rates when the growth rate of resource consumption is lower than that of GDP. Thus, given this latter condition referred to as a state of relative decoupling, we conclude that it occurs due to a natural progression of self-organized growth, and not necessarily from independent conscious choice by actors within the economy to pursue resource efficiency. While we show that explicit choices to increase resource consumption efficiency in capital (e.g., machines) do increase the level of relative decoupling, we also show the choice of price formation affects apparent decoupling just as much. When

basing prices on only marginal costs the econ- omy appears more decoupled than if prices are based on full costs that include depreciation and debt interest payments. Further, marginal cost pricing generates higher debt ratios than full cost pricing, implying higher debt levels might pro- vide only a perception of a more decoupled economy. Thus, relative decoupling of GDP from resource consumption rep- resents an expected stage of growth, still similarly dependent on resource consumption, rather than a stage during which an economy is less constrained by resource consumption. When assuming full labor bargaining power for wages, such that wages increase with inflation, once resource con- sumption stagnates, profit shares decline to zero and wage share increases. An explicit reduction in labor bargaining power at peak resource consumption enables some profits to remain. Thus, the HARMONEY model provides a basis for arguing that because profits decline to zero once resource consumption peaks under a full bargaining power situation, a new pressure emerges to reduce wage bargaining power of labor to ensure some level of profits at the expense of labor. This reasoning helps explain the wage stagnation and declin- ing wage share experienced in the U.S. since the 1970s.

King (2021) Interdependence of Growth, Structure, Size and Resource Consumption During an Economic Growth Cycle (pdf) (pdf SI)

King Summary (blog)

King (2019) HARMONEY-1 (pdf) King Website

King (2022) Abstract

This paper explains how the Human and Resources with MONEY (HARMONEY) economic growth model exhibits realistic dynamic interdependencies relating resources consumption, growth, and structural change. We explore dynamics of three major structural metrics of an economy. First, we show that an economic transition to relative decoupling of gross domestic product (GDP) from resource consumption is an expected pattern that occurs because of physical limits to growth, not a response to avoid physical limits. While increasing operational resource efficiency does increase the level of relative decoupling, so does a change in pricing from one based on full costs to one based only on marginal costs that neglect depreciation and interest payments. Marginal cost pricing leads to higher debt ratios and a perception of higher levels of relative resource decoupling. Second, if assuming full labor bargaining power for wages, when a previously-growing economy reaches peak resource extraction and GDP, wages remain high but profits and debt decline to zero. By removing bargaining power, profits can remain positive at the expense of declining wages. Third, the internal structure of HARMONEY evolves in the same way the post-World War II U.S. economy. This is measured as the distribution of intermediate transactions within the input-output tables of both the model and U.S. economy.

King (2022) Interdependence of Growth, Structure, Size and Resource Consumption During an Economic Growth Cycle

Fix on King

Figure shows King's key result. Without tuning it to do so, the HARMONEY model predicts that as resource use plateaus, the wage share of income should decline (top right). It so happens that this is exactly what ocurred in the United States. As energy use (per person) plateaued, the wage share of income plummeted (top left). HARMONEY also predicts that after resource use peaks, debt (as a share of GDP) should explode and then later peak (bottom right). Again, the model's prediction is eerily similar to US history (bottom left).

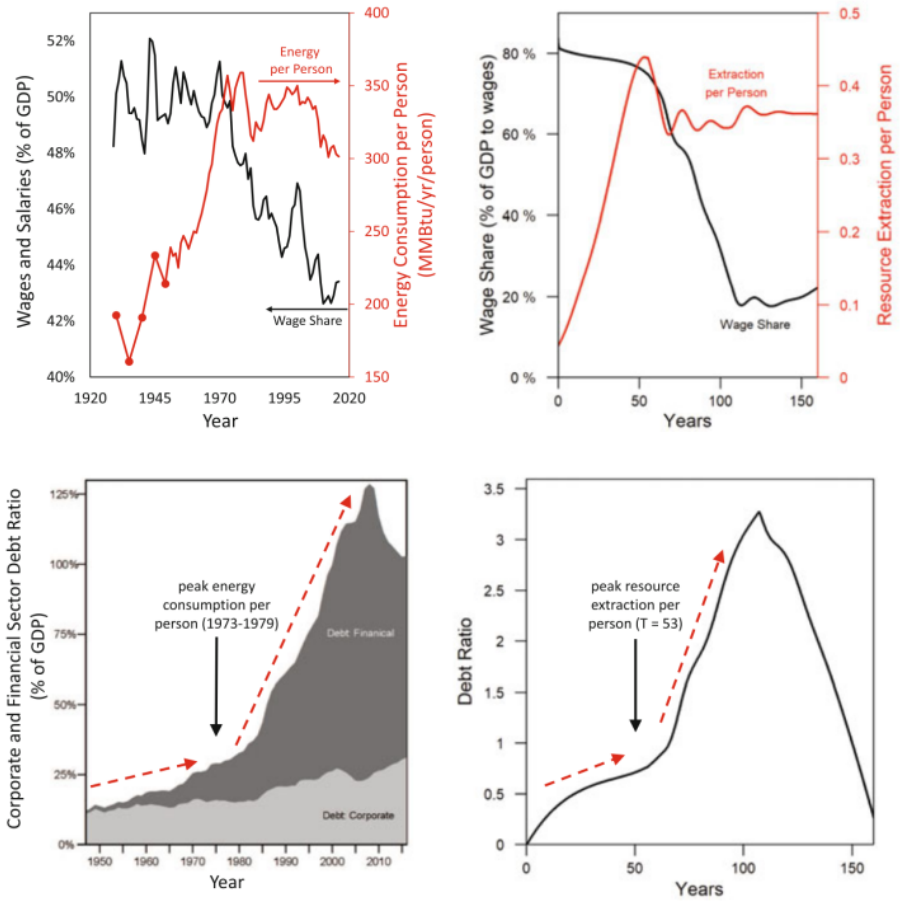


Figure: ***Results from King's HARMONEY model****. Top left: the wage share of income in the US declined as energy use per person plateaued. Top right: King's HARMONEY model predicting the same phenomenon. Bottom left: The growth and peak of US corporate and financial debt. Bottom right: King's HARMONEY model predicting the same phenomenon.*

One more thing to mention is that HARMONEY does not use an aggregate

production function. This is important, because there are many problems with such functions. Perhaps the most glaring flaw is that the standard production function (the Cobb-Douglas) is a tautology. It is a rearrangement of a national accounting identity. Hence, when systems modelers use such a function, they undermine what may otherwise be a sound model.3 By not using a production function, HARMONEY avoids this misstep.

Fix on King 'Superorganism'

5.6 Input-Output

Technology matrices (IO tables) theoretically capture the conditions of production. Most presentations counterfactually assume they are constant (e.g. constant returns to scale). However, once the matrices are allowed to vary with demand then they capture market value too.

Ian Wright (tweet)

5.7 LowGrow SFC

Jackson

A simulation model of the Canadian economy

LowGrow SFC is a system dynamics model developed by Tim Jackson and Peter Victor, incorporating many features developed over several years. LowGrow SFC brings together: 1) the environmental and resource constraints on economic activity; 2) a full account of production, consumption, employment and public finances in the 'real economy' at the level of the nation state; 3) a comprehensive account of the financial economy, including the main interactions between financial agents.

LowGrow SFC is 'stock-flow consistent'. this means that expenditures by each sector are incomes of other sectors and financial assets of each sector are financial liabilities of other sectors, and vice versa. The 6 sectors in LowGrow SFC are: households, non-financial firms, financial firms, the central bank, government, and the rest of the world. Interactions within and between these spheres of interest are modelled using a system dynamics framework and used to generate scenarios for Canada.

Jackson (2022) LowGrow SFC (https://timjackson.org.uk/ecological-economics/lowgrow-sfc/)

6

Solow Model

Smith

The amazing thing about the Solow model is that it does tell us a few incredibly important things about growth. As I see it, the two key lessons are:

- Eventually, building more physical capital stops making your economy grow.
- It's possible to build so much physical capital that you make your people poor.

The Solow model assumes that economic output — also called "production" or "GDP" — comes from three things:

1. Labor (human work effort)
2. Physical capital (machines, buildings, vehicles, etc.)
3. A mysterious quantity called "total factor productivity" (TFP), usually abbreviated as "A", which some people associate with technology

The Solow model deals mostly with the question of how physical capital affects growth.

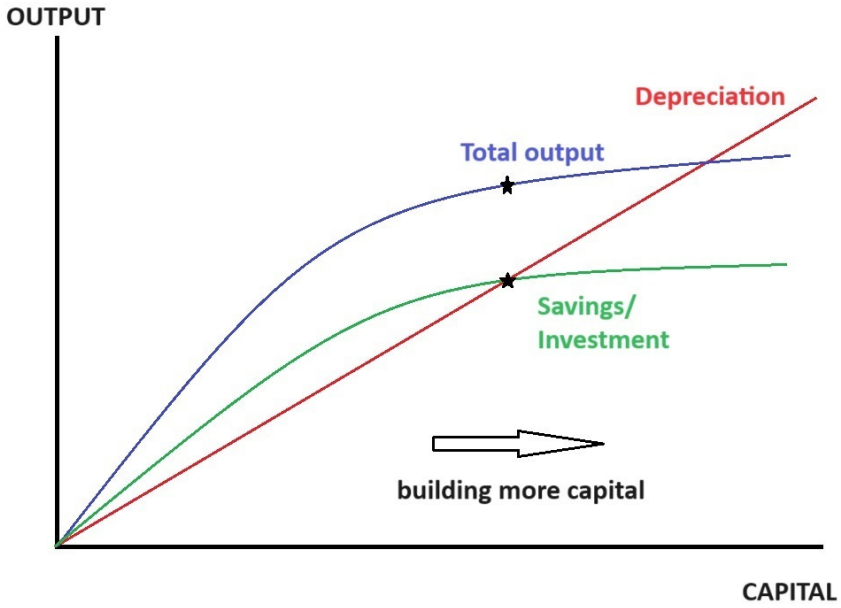
Solow's model makes three very reasonable assumptions about how physical capital works. It assumes:

1. You can build more physical capital by saving and investing.
2. Physical capital depreciates over time (at a constant rate).
3. On its own, physical capital has diminishing returns.

The first of these assumptions is actually the most subtle. The basic intuition is that you can set aside a certain amount of your GDP every year to build physical capital — like a farmer choosing to reserve a certain percentage of the annual

corn harvest as seed corn for planting next year's crop. But most real types of physical capital don't work like seed corn — a sewing machine can't be used to create new sewing machines, etc. So what Solow is actually assuming is that we set aside a certain percent of our financial income and use it to pay people to build more capital. It basically assumes a market where sewing machines, and any kind of capital, can be constructed for a price.

Suppose we hold the number of workers constant. In that case, the relationship between physical capital and economic output looks like this:



The red line is straight because depreciation just depends on how much capital you have. If you have 10 times as much capital, then 10 times is much is depreciating every year.

The blue line is how much gets produced. As I said before, when the number of people is fixed, building more physical capital has diminishing returns. That's why the curve is concave — each piece of capital you add gives you a little less additional output than the previous one.

The green line is how much production goes into building new capital. The Solow model assumes that a country saves and invests a constant fraction of its output. So the green line is just the fraction of output that gets invested — i.e, the fraction that gets plowed back into either building new capital or maintaining old capital. This has diminishing returns too, since investment has to come from output. That's why the green line is curved like the blue line.

So what does this tell us about how economies grow? It tells us one incredibly

important thing. It tells us that because of depreciation and diminishing returns, a country simply *can't* build its way to infinitely high standards of living. If you just keep trying to build more and more, at some point depreciation overwhelms you. and you just can't build any more!

Over the last four decades, China has built an absolutely incredible amount of physical capital — in absolute terms, the most any country has ever built in history. The Solow model gives a simple explanation for how China was able to build this much, this fast: It had a very high rate of savings and investment, far higher even than other Asian countries.

China dedicated everything it had to building massive amounts of physical capital, leaving relatively little of its economic output left over for its people's consumption. As a result, it grew very very quickly. This type of growth has a limit. Just as the model would predict, China started hitting diminishing returns. We started seeing "ghost cities" and massive overcapacity in all sorts of industrial sectors. China's incremental capital-output ratio — the dollars of capital needed in order to generate an additional dollar of GDP — rose relentlessly from around 2007.

On top of that, there's depreciation to deal with. When you build that many apartment towers and highways and office buildings, you're eventually going to have to maintain them. This is especially true of China, which tends to build things using cheap materials that don't last very long. And when you build that many machine tools and vehicles, you're going to have to work very hard just to replace them all as they age.

China is already probably struggling with capital depreciation. But it's likely that the Solow model's assumption of a constant rate of depreciation is only true in the long run, and that in the early days of a country's building spree it's not that much of a problem — you have to wait 20 or 30 years for all that shiny new stuff to start falling apart. So the depreciation of the massive capital stock China has built since the 1990s will probably be a bigger drag on growth in the years to come.

Slowing growth from physical capital accumulation is the Solow model's first big insight. The second is that it's actually possible for a country to save and invest so much of its income, and build so much physical capital, that it actually makes its citizens poorer. The more you build, the more you have to pay to upkeep in the future. There's a point called the "golden rule", above which saving and investing more of your national income just forces your citizens to forego more and more consumption in order to stave off capital depreciation.

In the Solow model, the optimal savings rate is lower if population growth is lower. China's population is now shrinking, and its working-age population is falling rapidly. So the Solow model serves as a warning to China's leaders that they should consider encouraging their people to consume more.

So even though it's a simplistic theory — almost a toy model, really — the Solow

model can tell us a lot about the biggest and most important economic growth story of modern history. The basic lesson is that the usefulness of building sprees like China's has a sell-by date. Eventually, physical capital accumulation stops being able to grow your economy, and can even backfire by reducing living standards. It's a lesson China's leaders, and companies considering investing in China, would do well to heed.

TFP

Of course, there is a vast amount that the Solow model can't tell us about economic growth. Most of those unanswered questions are contained in that innocuous little letter "A"; as one of Solow's contemporaries put it, total factor productivity is a measure of our ignorance. One factor exacerbating China's growth slowdown is that TFP growth has slowed relentlessly over the last three decades

As of right now, China's income is less than a third of the U.S.' If China's growth slows down to developed-country levels while only reaching 1/3 of rich-world living standards, it will represent a major failure for the country's economic system.

Smith (2023) What the Solow Model can teach us about China

7

Cost Benefit Analysis

Spash on Dasgupta Review

Decades ago environmental CBA developed a range of methods for imputing monetary values, but with limited applicability under specific conditions (Hanley & Spash, 1993; Spash, 2005). For a start, these methods only apply to marginal changes in environmental goods or services, not least because the value of money itself (its marginal utility) alters when there are large changes affecting income; also, economic welfare measures assume other things (e.g. all other prices) remain the same which is violated by large changes. Clearly things like mass extinction of species and human induced climate change are not small, marginal, changes. Two approaches are employed by social CBA: revealed and stated preference methods. The first relies upon existing markets that can be associated with environmental attributes (e.g. air pollution affecting house prices) and so is severely restricted. The second uses surveys designed to illicit, primarily, willingness-to-pay for environmental changes. Dasgupta attends to one stated preference approach: the contingent valuation method (CVM). He claims that: 'CVM is attractive because it appeals to our democratic instinct, that people should be asked for their opinion on matters that may be of concern to them' (Dasgupta, 2021, p. 304). In addition, the CVM is promoted as widely applicable (unbounded by existing markets) to revealing values for everything from aesthetics to biodiversity loss. The ability to include a range of value categories contributing to an individual's utility extends to including: 'respondents' sense of a species' existence value—perhaps even its intrinsic value' (Dasgupta, 2021, p. 304). Normally environmental economists define a set of four values: direct use, option, existence and bequest value. However, Dasgupta (Dasgupta, 2021, p. 301), for no apparent reason, claims a different set of six sources of value for biodiversity that mix-up objects of value with types of values. While all his examples are consequentialist and based on creating utility for humans, he confuses concepts of existence value with sacred values, moral worth and intrinsic value. So let us turn to the value problems.

Economic welfare theory requires that people should be compensated, not pay, for an environmentally degrading imposition on them (e.g. pollution, biodiversity loss). However, this is generally not undertaken because people could ask large sums, destroying the economic calculus, so economists prefer to restrict respondents replies to their income (i.e. ability to pay) regardless of their own theoretical requirements for validity. Besides being the incorrect measure, willingness-to-pay is not a democratic approach seeking an opinion, as claimed by Dasgupta. Despite their attempts to control respondents, CVM produces results deemed unacceptable because people appear willing-to-pay too much or refuse to bid (i.e. protest).

Attempts have then been made to redesign the surveys to get the responses economists want and hence they developed choice experiments, cited as a problem solving advance by Dasgupta (2021, p. 304). Here respondents have restricted ability to protest, or violate the economists model of how they should behave, and can only refuse to answer completely and fall into the ignored non-respondent category. Failing 'success' with survey design, collected data may be subject to manipulation to get the desired values.

The welfare economics underlying social CBA assumes that all values can be reduced to individual preferences as expressions of utility.

Refusing to make trade-offs is also a principled positon disallowed by mainstream economics or treated as an anomaly.

The valuation question of social CBA, 'what is your maximum willingness-to-pay for more/less X?', implicitly assumes there is no moral objection to the question itself.

More frogs do not equate to fewer tigers. What then is 'natural capital'?

Health (mortality/morbidity) as a capital investment is even worse. Producing money numbers here requires the conjuring trick of talking about abstracted non-real people who are represented as 'statistical lives', under the VSL. For example, the results are used in transportation assessment to decide upon road building programmes and the installation of safety equipment. However, the public rejection of this approach is exposed when there is a train crash, people are killed and the public discover the lack of safety equipment is due to the calculation that it cost more than the expected fatalities times the VSL. Politicians rarely defend the numbers in such circumstances, although their transport departments may continue to use them on a daily basis.

IPCC

A major example of the failings of VSL arose during the third assessment report of the Intergovernmental Panel on Climate Change (IPCC). Willingness-to-pay informed VSL, based on Fankhauser (1995, p. 47), gave a range from \$0.2–\$16.0 million with an average of \$3 million, and \$1.5 million adopted as the VSL for developed countries. Adjustment was made for income to give 'an arbitrary value of \$300,000 for middle income and \$100,000 for low income countries'. The

result was a factor of fifteen difference between VSL in high ($1.5 million) and low ($0.1 million) income countries. A storm raged when the IPCC chapter employing this approach appeared (see Spash, 2002a, Chapter 7). Representatives from industrially developing nations, led by India and China, refused to accept the report citing it as absurd, discriminatory, unethical, technically inaccurate and anti the poor.

Shortly after the IPCC VSL controversy a prime example of commensurability problems arose when CBA was applied to climate change by Nordhaus (1998a, 1998b). He claimed increased moridity/mortality would be outweighed due to increased leisure opportunities by a factor of 30 to 10 in China and by 38 to 3 in the USA. An example Nordhaus was using at the time concerned claiming that golfers may view global warming as a boon to year-round recreation. So, if we extend this logic to global studies, more golfing days in Florida could compensate for dead people in China. The commensuration of values in The Review is no different. Classes of capital are values, equated and summed. Human capital is an aggregation of values so that, for example, more 'education' can compensate for increased risk of death. More than this, if education pays better financial dividends than avoiding loss of life then, according to the economic accountants, the optimal world should have more education and more death.

7.1 Discounting

The mechanism chosen by Dasgupta to allocate natural resources between current and future generations is a social discount rate (SDR). Alternatives, such as allocation on grounds of justice, rights or needs, are therefore excluded,

While acknowledging the major ethical objections to discriminating against future generations via discounting, Dasgupta (2021, Chapter 10) nevertheless chooses a positive discount rate. He justifies this using the dubious argument that since returns on judiciously chosen investments are positive (by assumption), fairness requires discriminating against future generations, because otherwise the current generation would be unduly limited in consumption and condemned to excessive poverty. This is a productivist logic based on assuming the future is always better-off.

Dasgupta follows standard neoclassical theory in treating future outcomes (flows of costs and benefits) for public policy projects as subject to a social time preference (STP). The basic positon here is to follow a formulae, called the Ramsey rule, that determines the SDR and STP as follows:

$$SDR = r + hg = STP$$

where g is annual per capita growth of consumption, is the elasticity of marginal utility of consumption and is the utility discount rate, consisting of a component for pure time preference, , and, in HM Treasury practice, a component

for certain types of risk, L. Components of the formulae are so uncertain that economists appeal to surveying themselves to get estimates, as if this provided objective data.

In The Review commitment to an actual number is vague, and subject to speculation as to economic growth and uncertainty. Elsewhere Dasgupta (2008) has argued that could be zero, while, contrary to others, he argues for a much higher in the range 2–3 or more. The basic rate used by HM Treasury, in its Green Book, is 3.5%, 6 where = 0.5, L = 1 so that = 1.5 with the remainder consisting of consumption growth g = 2 and = 1. If Dasgupta's argument for is adopted then the STP would be between 5.5% and 7.5%, but he has argued favouring = 0 which would give 5.0–7.0%. This is extremely high.

For comparison consider how Nordhaus uses such rates to recommend catastrophic global warming as economically rational. He states that 'the cost-benefit optimum rises to over 3°C in 2100' (Nordhaus, 2018, p. 452), and his Figure 5 shows a 2100 optimum around 3.6°C and rising, because he recommends discounting the future at around 5% (Nordhaus, 2018, p. 455), writing off any importance of future damages by 2100 (damages would weigh around 2% of their value today meaning, for example, under VSL an action saving 2 people today at the cost of killing 97 people in 2100 would be a net gain, an optimal choice). This is neither unique to Nordhaus nor new, for example, the economic working group of the IPCC third assessment used discount rates between 5% and 12%. A common claim, also made by Nordhaus, is that empirically observable rates of return should be used. However, in actual economies the rate of return on risk free investment has been zero or negative in real terms for years (Freeman et al., 2018, p. 16), but discounting has persisted regardless of the theoretical justifications.

In fact there is no such thing as a singular rate in actual economies. The recognition that differential rates for different projects is theoretically justified, and specifically for projects with environmental impact, has led HM Treasury to discount at a lower rate (1.5%) for project impacts on health and life. However, while recognized as formally correct Dasgupta rejects this on the grounds, not of theory but, that it will be 'cumbersome' in practice and 'lead inevitably to errors'. Indeed he states it would be 'unsafe' because (now) the 'social evaluator' (or 'citizen investor') cannot be trusted to get things right. Instead he recommends a single rate applied to all projects. The reader might wonder at such pragmatism, for if all the problems of neoclassical economics can be so easily dismissed on a whim as impractical and too cumbersome for his social/citizen evaluator/investor this rather begs the question why he bothers us with his models, theories and extensive mathematical detours and what other fallibilities his central decisionmaker might suffer from. That markets are not guides to intergenerational fairness, ethics or equity, would seem to bring the whole approach into question. In his paper on discounting for climate change Dasgupta concludes: 'Intergenerational welfare economics raises more questions than it is able to answer satisfactorily'. However, as usual, Dasgupta's recognition of

the problems has no impact on his esteem for and continued use of neoclassical economics and, unsurprisingly, he recommends discounting on this basis.

Spash (2021) The Dasgupta Review deconstructed: an exposé of biodiversity economics (pdf)

Part I

Appendices

Appendix A

About

Dyre Haugen and *Dyrehaugen* is Webian for *Jon Martin* - self-owned Globian, Webian, Norwegian and Canarian with a background from industrial research policy, urban planning and economic development consulting on global, regional and urban scales. I am deeply concerned about the (insane) way humanity (i.e. capitalism) interfere with nature. In an effort to gain insights in how and why this happens stuff is collected from around the web and put together in a linked set of web-sites. The sites are operated as personal notebooks. However, these days things can be easily published to the benefit of others concerned with the same issues. But be aware - this is not polished for presentation or peer-reviewed for exactness. I offer you just to have a look at my 'work-desk' as it appears in the moment. Any comment or suggestion can be mailed to dyrehaugen@gmail.com You can follow me on twitter as @dyrehaugen. Thanks for visiting!

Appendix B

Links

Current Dyrehaugen Sites:

- rcap - On Capitalism (loc)
- rclm - On Climate Change (loc)
- recs - On Economics (loc)
- rfin - On Finance (loc)
- rngy - On Energy (loc)
- renv - On Environment (loc)
- rsts - On Statistics (loc)
- rurb - On Urbanization (loc)
- rvar - On Varia (loc)
- rwsd - On Wisdom (loc)

Blogs:

- rde - Blog in English (loc)
- rdn - Blog in Norwegian (loc)

Discontinued:

- jdt - Collection (Jekyll) (loc)
- hdt - Collection (Hugo) (loc)

Not listed:

- (q:) dhe dhn jrw56
- (z:) rcsa rpad rstart

Appendix C

NEWS

C.1 221220 Market-based development finance in crisis

On December 13 Ghana reached staff-level agreement on a $3 bn IMF credit package. In addition it is seeking to negotiate a 30 percent haircut with private creditors on tens of billions in bonds. Already in September Ghana's 2026 eurobonds plunged to a record low of 59.30 cents on the US dollar. By the end of October yields had surged to 38.6 %, up from less than 11% at the end of 2021. Meanwhile, inflation is headed to 40 percent and the cedi is the worst performing currency not just in Africa but of all currencies in the world.

You could shrug and say that this is Ghana's second IMF deal in 3 years and its 17th since independence in 1957. Plus ça change. But it is more than a national crisis. It is the latest sign that the entire model of market-based development financing is in crisis.

Tooze (2022) Chartbook #181: Finance and the polycrisis (6): Africa's debt crisis

C.2 210717 Carney calls for stronger Government Regulation

For the world to meet its climate goals, governments would have to force industries to follow *clear rules, on everything* from energy generation to construction and transport, and set carbon prices that would drive investment towards green ends and close down fossil fuels.

"We need clear, credible and predictable regulation from government," he said. "Air quality rules, building codes, that type of strong regulation is needed. You

can have strong regulation for the future, then the financial market will start investing today, for that future. Because that's what markets do, they always look forward."

Without such robust intervention from governments, markets would fail to address the crisis.

Gurdian

Appendix D

Sitelog

Latest Additions

December 12, 2023 measurement\ gdp mismeasurement UAE example
December 23, 2023 solow\ noah smith applies solow to china
July 25, 2024 modelling\ king 2022paper on Harmony added abstract

Bibliography