From finance to climate crisis: An interview with Steve Keen

Steve Keen and Jamie Morgan[1] [University College London, UK; Leeds Beckett University Business School, UK]

Steve Keen is Distinguished Research Fellow at the Institute for Strategy, Resilience and Security, University College London. Steve is one of the more publicly engaged Post-Keynesians and first came to prominence with the publication of his book, *Debunking Economics* (Keen, 2001, 2011), which provides a wide-ranging critique of the assumptions, mathematical incoherencies, conceptual inconsistencies, and adverse socio-economic consequences of "neoclassical economics" – a dominant strain of mainstream economics whose influence spreads further than merely those who self-identify as neoclassical economists. In terms of his own theoretical contributions, he is best known for his work on the macroeconomic significance of private debt – banking practices, financial asset expansion and debt-deflation in the tradition of Hyman Minsky, Irving Fisher etc. Work from this perspective proved particularly timely – putting Steve in a position to identify the underlying tendencies that would eventually manifest as the "Global Financial Crisis" (GFC), 2007-8. Steve first started to draw attention to problems in late 2005 and readers of *Real-World Economics Review* voted him recipient of the "Revere Award" for this in 2010 (and Alan Greenspan was awarded the matching "Dynamite Award"). Steve's subsequent *Minsky* software package project (see https://sourceforge.net/projects/minsky/) provides a free, Open Access alternative to mainstream macroeconomic modelling tools like Dynare and GAMS.[2] Steve has published numerous papers (e.g. Keen, 2017a; Gallegati et al., 2006; Keen, 2014; Keen, 1993). Some of this work is collected in *Developing an Economics for the Post-Crisis World* (Keen, 2016). He has also published a further book on his central themes – *Can We Avoid Another Financial Crisis?* (Keen, 2017b). In recent years, Steve has become increasingly interested in mainstream environmental economics and increasingly influenced by its alternative, ecological economics. His most recent work provides a systematic critique of mainstream economic work on climate change, particularly "Integrated Assessment Models" (IAMs), of which the best known are the "Dynamic Integrated Model of Climate and the Economy" (DICE) variety (e.g. Keen, 2020a; Keen et al, 2019; Asefi-Najafabady et al., 2020). These models have influenced the Intergovernmental Panel on Climate Change (IPCC) and play a role in informing policy for mitigation and adaptation. Many climate and Earth system scientists (and increasingly so) are sceptical regarding these models, but it was mainly for his work on them that William Nordhaus received the "Sveridges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel" (jointly with Paul Romer) in 2018.[3]

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[1] debunking@gmail.com www.isrs.org.uk
[2] https://sourceforge.net/projects/minsky/
[3] See https://www.nobelprize.org/prizes/economic-sciences/2018/summary/
Note: The original prizes were initiated in 1901, economics is *not* a "Nobel Prize", it is an addition. According to the Nobel Prize organization: "In 1968, Sveriges Riksbank (Sweden's central bank) established the Prize in Economic Sciences in Memory of Alfred Nobel, founder of the Nobel Prize. The Prize is based on a donation received by the Nobel Foundation in 1968 from Sveriges Riksbank on the occasion of the Bank's 300th anniversary. The first Prize in Economic Sciences was awarded to Ragnar Frisch and Jan Tinbergen in 1969."
https://www.nobelprize.org/prizes/economic-sciences/

Steve's blog and Twitter activity have made him something of a controversial, perhaps maverick figure in economics circles and his route into academia and subsequent career have been atypical. He attended University of Sydney in the 1970s, graduating Bachelor of Arts in 1974 and Bachelor of Law in 1976, before completing a Diploma in Education in 1977 at Sydney Teaching College. Having worked as a school librarian, NGO education officer, computer programmer and journalist he turned to economics, completing a Masters of Commerce in economics and economic history in 1990, followed by a PhD in economics in 1998, both at University of New South Wales. He was professor of economics at University of Western Sydney (UWS) until 2013, moving to Kingston University, London in 2014, following the closure of the economics program at UWS. He then took the unusual if not unique step in 2017 of initiating a crowdfunding project to free him from the administrative burden that came with his full-time higher education post. In December 2018 he announced he was now fully "retired" from Kingston.

His blogs, podcasts and funding site can be accessed at:[4]
https://www.patreon.com/ProfSteveKeen

He is interviewed by Jamie Morgan for *RWER*…

Jamie: "Independence" has costs and benefits for an academic. It worked out well, for example, for the well-known climate scientist and inventor James Lovelock, who though associated with many institutions over his life took the decision decades ago to be dependent on and beholden to none. What was your motivation, and how has it turned out so far?

Steve: The motivation was circumstantial. You note that UWS closed its economics program. That was in response to a classic Neoliberal education deform (not a typo!) to allow universities to offer as many 1st year positions as they liked, rather than imposing quotas. When there were quotas, UWS used to get 120-150 "first preferences" from school leavers, and ultimately about 300 enrolments each year. With quotas removed, first preferences plunged immediately to just 16, and similar plunges affected all other humanities subjects. UWS then brutally shut the economics program down during the final exams in 2012, without waiting to see the impact on enrolments in 2013 – which would not have been as severe. They made all 5 Professors of Economics redundant, not just me.

At the time, I had a $52,000 a year income from Rupert Murdoch, of all people: my blog used to be republished for free by a website that Murdoch purchased. I wasn't going to let him get it for free, so I insisted on $1000 per post. I could survive on $1000 a week, but without a University position, I couldn't apply for research funding, so I ran a crowdfunding campaign for Minsky on Kickstarter. It raised US$78,000, so I knew then that crowdfunding could work.

I heard about Patreon in 2016: it provides a monthly income, whereas Kickstarter, Indiegogo and so on are one-off. I was about to launch a Patreon campaign for *Minsky*, when Kingston was forced, by exactly the same Neoliberal deform that killed UWS, to make 30% of its humanities staff redundant – though it did so in a far more measured and responsible way than did UWS. In my case, they required me to either quadruple my teaching load (unlike most Heads of School, I was teaching two courses, the introductory undergraduate subject

[4] Most posts on Steve's Patreon page are freely accessible to non-subscribers. Only his weekly podcast with Phil Dobbie is behind a paywall. He also posts at: http://www.profstevekeen.com/
The podcasts are also available at: http://debunking.podbean.com
See also: https://en.wikipedia.org/wiki/Steve_Keen

and a Masters course), or take a 75% pay cut. I took the pay cut option, and turned the Patreon campaign into one for myself rather than *Minsky*. I launched my Patreon page in March 2017.

It started quickly – $2800 per month in the first month – and then rose slowly to reach about US$9,000 a month from about 1500 supporters three years later. That's roughly equivalent to my salary at Kingston, so I'm comfortable and able to work full-time on creative research, as well as getting the message out about how bad Neoclassical economics is – especially on climate change.

Overall, I love it. I miss teaching, but I don't miss marking, let alone the tedious, pointless administration, which was particularly bad at Kingston. There was a time when administrators supported academics, doing the inevitable paperwork while we did the teaching and research. Now they tell us what to do, without being able to do it themselves, and throw paperwork at us all the time as well.

Jamie: I read somewhere that there was a gradual increase in the ratio of administrators to front-line (teaching) staff of around 3:1 in the UK in the earlier part of the Millennium, but Austerity and budget controls have started to reduce that again, though without changing the way all of this now works – as you say, administration seems to be about dissemination of electronic paperwork to teaching staff and then monitoring compliance;[5] though this is only one aspect of a neoliberal approach to education, which as many observers have noted conflates the marketisation of education as a system of provision with an instrumental approach to both knowledge and teaching and their goals (e.g. Patomäki, 2019; Giroux, 2014; Lynch, 2006). There is now an oddly distorted concept of education as an investment with a tangible (and so measurable economic return) and a transition from student to consumer (who requires consumer protection, with the potential for actionable claims in relation to the measurable benefits of the investment as a tangible return). Value for money is now more a matter of metrics (employability) and less about intangible benefits to society derived from well-educated community citizens. In the UK this has been further embedded by the Higher Education and Research Act 2017. Some of this, of course, fits with your own work since student debt is a major issue for financial processes.

Steve: Yes, the financialisation of higher education has gone hand in hand with the growth of bureaucracy. More than all of the money raised from student loans has gone into the black hole of administration, so despite the increase in funding, there is less money going to education now than when universities were fully funded by the state. This has also perverted the educational process, for both administrators and students. Whereas administrators used to support the learning and research process, now they direct the fund-raising process; whereas students used to come for an education, they now come for vocational training. Stuck in the middle, academics are harried by performance targets and measurement metrics from above and "I've paid for my degree, so give it to me" pressures from below.

When I started as an academic in 1987, my workload was huge (developing a new course from scratch each of my first 3 years, teaching 12 hours a week of classes, plus marking and 6 hours of consultation, plus doing my Masters full-time), but I was spending the bulk of my time doing interesting stuff under my own direction, and small class sizes let me really interact

[5] For current figures see: https://www.hesa.ac.uk/news/23-01-2020/sb256-higher-education-staff-statistics

with the students. Now, academics' time is dominated by performance monitoring and form filling, while classes are unmanageably large, at least in the low-ranked universities where heterodox economists can get a job. It's counterproductive, soul-destroying, and certainly in the UK, low-paid. I'm glad to be out of the system.

For students, it has meant they're paying for a much lower quality education than their predecessors used to get for free, and they leave university saddled with tens of thousands of pounds of debt which locks them out of the housing market because they can't service the additional debt of a mortgage.

In any case, all my frustrations about that deform process, which I watched from my early days as a tutor at the University of New South Wales in 1987 till my final days as Head of the School of Economics, Politics and History at Kingston University, exploded on the day that I found out what had happened to my office in November of 2018.

Jamie: "Exploded?"

Steve: I remember leaving the Dean's office on the day of my arrival in July 2014, and walking off expectantly to see my new office, now that I'd moved from the bottom of the departmental hierarchy in 1987 to the top in 2014 – not that climbing hierarchies is my thing, but I was at least looking forward to the perk of a decent office. It was in Holmwood House, a quaint three-storey house on the campus.

What I saw was the worst office I'd had since I graduated from my undergraduate degree back in 1975. In addition to being small and poky with a view of brick wall, it had a huge patch of mould next to the window, and I refused to enter it until the mould had been removed. I never bonded with the place, which is why the shelves never had any books on them: I was better off working from home instead.

Then in 2018, academics were turfed out of the building to make way for the relocation of the Vice Chancellor's office onto campus, from its previous off-campus location overlooking the Thames. A bureaucrat had scheduled a meeting with me to help publicise my research – which is ironic in itself, since I was already quite effective at that on my own. It was to be held in my old office because the University hadn't updated my address: she thought it was still my office, and I thought it was hers. I got there prepared for the irony of discussing how to promote my research in my old office, but I wasn't prepared for finding instead that the building had been tarted up, while my office had been converted into a galley kitchen. It was good enough for a Professor and Head of School apparently, but not good enough for a bureaucrat.

I just lost it. I rarely lose my stack in public, but I did that day. It was a sign of how much pressure I was under, partly because, as well as taking a 75% pay cut, I was voluntarily teaching an additional Masters subject since the unexpected departure of Engelbert Stockhammer for a position at King's College. But I turned abusive in public, mainly because this cameo – of a Head of School's office being converted into a galley kitchen for bureaucrats – summed up the deterioration in academic conditions that I had witnessed over the preceding 30 years.

I'm sorry about my offensive rant about this in front of, and at, the poor bureaucrats in Holmwood House at the time – including the Vice-Chancellor's personal secretary.[6] They were just doing their jobs, and they had no appreciation of the process I'd witnessed over the previous 30 years. But as the immortal bard Tom Cruise put it in Cocktail, "Things always end badly, otherwise they wouldn't end". A week later, I was out of academia forever (apart from my honorary position at UCL), and I've been by far the better for it – thanks to Patreon. Getting rid of the "assistance" of academic managers has dramatically improved my academic productivity.

My free time for research has effectively quadrupled, and I do outreach these days via social media, media appearances – almost all of which occur on non-mainstream and non-Western outlets – and invited seminars.

Jamie: So independence has turned out very well for you it seems… providing you with more time.

Steve: Yes. It also allowed me to escape Europe when Covid-19 hit. The move I made to Thailand in March would have been impossible if I'd been an academic still, or dependent on income from an employer or a consulting business. Thanks to Patreon, I swapped an allegedly First World country with 65 million people that (as I write this on February 15th 2021) has over 4 million recorded Covid-19 cases and over 100,000 deaths, for a supposed Third World country with the same population but under 30,000 cases, and less than 100 deaths.

Jamie: And I suppose being freed from the constraints of departmental disciplinary research processes has also had its benefits? In the UK an academic is typically required to undertake performance review, construct a research plan for the following year and then justify how the plan contributes to a departmental research focus for the purposes of the university "Research Excellence Framework" (to which careers are tied). You seem to be more of a "public intellectual" these days and seem to have greater scope to be critical and to also be flexible. Though you have never had any trouble being oppositional, as your work on the emergence of the financial crisis in Australia indicates.

Steve: Absolutely! My productivity has gone through the roof, thanks both to the time I now have, and my freedom from bureaucratic management. I published one major paper (on the role of energy in production) in 2019, and five more papers in 2020 – despite Covid-19 (Keen 2020a, 2020b, 2020c; Hanley et al., 2020; Garrett et al. 2020; Keen et al 2019). Plus, I've almost finished a new book for Polity Press (*The New Economics: a Manifesto*), and I've managed major improvements in my *Minsky* software thanks to a £200,000 grant from Friends Provident Foundation. There are yet more papers in train on the role of energy in production, after a joint research project with the mathematician Matheus Grasselli and atmospheric physicist Tim Garrett (this work was funded by the Rebuilding Macroeconomics program run by the NIESR). And I hope to start work on a 3rd (and final!) edition of *Debunking Economics* later this year.

I also didn't have to justify to anyone my change in focus from financial instability to climate change. I still do work on financial crises and debt-deflation of course – in fact I've managed to work out the crucial link between "endogenous money" and aggregate demand (Keen

[6] See Keen, S: "The circumstances of my retirement from Kingston"

2020b). But otherwise, I've moved from Hyman Minsky and financial instability to climate change, without having to justify the shift to anyone.

Jamie: This raises the obvious question, what took you from an interest in financial instability and debt processes – Hyman Minsky etc. – to climate change and ecological breakdown? Clearly, these are subject matters that no concerned citizen of the world can now afford to be ignorant of. But superficially, at least, from an academic perspective, this seems a strange sideways step.

Steve: There's a commonality to the issues though, in that both involve the consequences of pushing an unsustainable trend. In financial instability, it's the level of private debt compared to GDP. In climate change, it's the load humanity is putting on the planet relative to the capacity of the biosphere to renew itself.

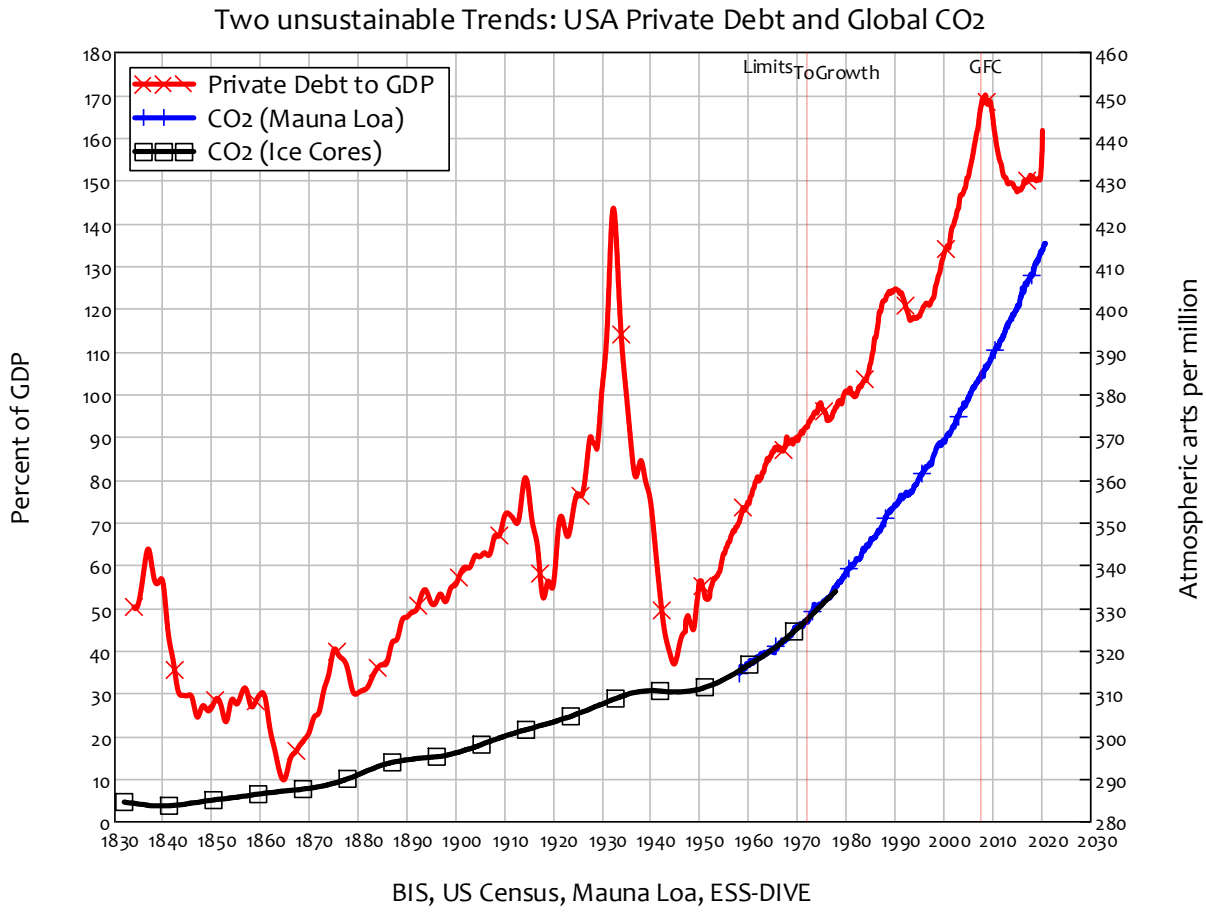
That comparison calls for a chart (or two). Figure 1 shows correlation not causation, but the exponential trend in both series simply can't continue – and mainstream economics fails to understand both of these.

For the former (finance), mainstream economics deludes itself with the now demonstrably false "Loanable Funds" model of banking to argue that the level and rate of growth of private debt are irrelevant to macroeconomics. For the latter (climate), the truly delusional work of Nordhaus and friends has pretended that climate change is no more than a change in the weather. Neoclassical economists profoundly misunderstand both processes.

Private debt to GDP and CO_2 in the atmosphere are stocks, something that Neoclassical economics is very poorly equipped to handle. Its models are all about flows, like output, and rates, like the unemployment rate, the inflation rate, but they rarely connect to levels (except say from output to investment to the capital stock and back), and certainly not in ways that can threaten the production system if they are too high. But if there is a level of private debt that is too high, that implies the need to control the rate of change of private debt; ditto for CO_2 in the atmosphere. You only get dangerous levels of both private debt and atmospheric CO_2 if the rate of change of these two stocks is positive for too long. Figure 2 below shows the annual change in debt on one axis, and the decadal change in CO_2 on the other. Both have been too positive for too long.

The special danger with climate change is that, while it's relatively easy to reverse the growth of private debt, either unintentionally (as in the USA's three great crises – the Panic of 1837, the Great Depression and the Great Recession), or by design (as in my proposal for a Modern Debt Jubilee), it's very difficult to reduce CO_2.

Figure 1: Private Debt and Atmospheric CO_2



Jamie: Given that this is cumulative, since CO_2 can stay in the atmosphere for over a hundred years and other greenhouse gases can also stay for years…

Steve: Yes. If we stop adding it to the atmosphere, then the process of absorption by natural processes takes centuries. Government policy can also relatively easily attenuate the impacts of a credit crisis, as we saw during the Great Recession. But there's no such salve for the impact of climate change.

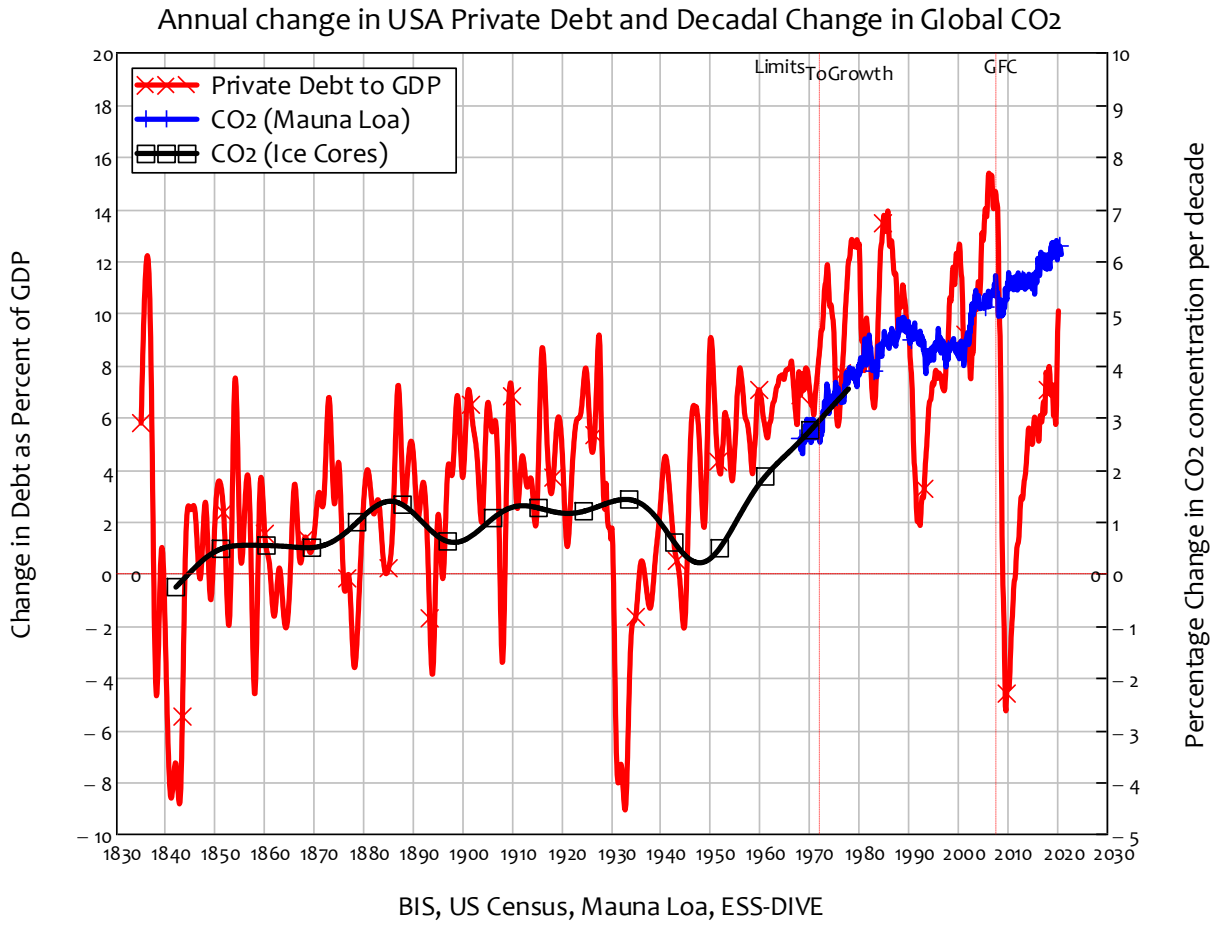
Jamie: And the impact can be extensive since this says nothing regarding the threshold effects or tipping points and feedback consequences that emissions can induce – warming leading to effects on the operation of natural systems, shifting them into new states – the "hothouse Earth" scenario, for example… and there are many identified tipping points for climate change and ecological breakdown. In any case, apart from the comparative aspects of finance and climate, what made you choose to switch to climate change?[7]

Steve: I've been interested in climate change ever since I read *Limits to Growth* in 1972. I thought the system dynamics software the authors developed was brilliant, and their arguments were compelling. So, I've been reading about the area ever since then, but I didn't

[7] Note from Jamie: there are many works in recent years exploring trends and tipping points and drawing attention to the cumulative problem. For example, Ripple et al (2020); Lenton et al (2020); Wunderling et al. (2020); Steffen et al (2015, 2018).

feel that I could engage in the academic debate until I could make a genuine contribution – not just an incremental one. That came in 2016, when I worked out how to properly incorporate energy into production functions with the simple insight that "labour without energy is a corpse, capital without energy is a sculpture" (see Keen et al., 2019).

Figure 2: Change in Private Debt per Year & Change in CO_2 Concentration per Decade



Jamie: And ecological economists core critique of mainstream economics is that it lacks adequate attention to the material and energy content of economic activity – hence the ecological economists' interest in throughput and metabolic flow, as well as issues like entropy and the waste generated by an economy, affecting and being affected by the Earth system in which this economic subsystem is embedded. So, they are always looking for ways to synthesise standard economic measurement and climate and ecological metrics (though with varying degrees of critique of how feasible this is).[8]

Steve: I have always thought that this couldn't be done properly until energy was incorporated into economic models in a fundamental way. Existing "production functions", basically the Cobb-Douglas at one extreme and the Leontief at the other, both express output as a function of inputs of Labour ("L") and Capital ("K"). When some economists have tried to

[8] Note from Jamie: see the edited text, *Routledge Handbook of Ecological Economics* (Spash, 2017).

incorporate energy ("E"), they've added it as a third factor of production, on the same footing as L and K. In a functional form, that's something like:

$$Y = F\left(L, K, E\right)$$

Especially in a Cobb-Douglas model, this implies a trivial role for energy if you use the share of the energy sector in GDP as your coefficient (akin to using the wages share as the coefficient for Labour).

With my focus on how to soundly incorporate energy into production functions I realised there was an incredibly simple way to show that energy was vital for production. If you treat energy as an essential input to both workers and machines that enables them to do useful work, then you get something like:

$$Y = F\left(L\left(E\right), K\left(E\right)\right)$$

Even if you stick with the standard Cobb-Douglas coefficients, which Shaikh (1974) showed are nonsense in his brilliant paper "The Humbug Production Function", this still increases the importance of energy by a factor of ten over the way Stiglitz (1974a, 1974b) and Solow (1974a, 1974b) used it in their responses to the *Limits to Growth*. It also allows the incorporation of waste production into economic models: the simplest way to treat L and K as functions of E is as the units (L,K) times the energy inputs (E_L, E_K), times the efficiency with which they are turned into useful work (e_L, e_K). In the Cobb-Douglas form, that results in:

$$Y = \left(C_L \times \left(e_K \times E_K\right)^{\alpha}\right) \times K^{\alpha} \times L^{1-\alpha}$$

Where C_L just acknowledges that the energy input of unskilled labour is a biological constant (roughly equivalent to 100 Watts), while what Neoclassicals call "Total Factor Productivity" is actually the energy output level of the "representative machine" – which was (say) 10% of 10 tonnes of coal per day in James Watt's time versus (say) 30% of 10 tonnes of kerosene per second in Elon Musk's.

In the Leontief form, it shows that what we've called the "capital output ratio" is actually the efficiency with which energy inputs to machinery are turned into useful work. Using u for capacity utilisation, this is:

$$Y = u \times e_K \times K$$

In both forms, waste necessarily turns up: since e_K is the fraction of energy turned into useful work, $(1\text{-}e_K)$ is waste. There's much more to it than that, and I'm working with Matheus Grasselli and Tim Garrett to develop more complete models, but that was enough for me to feel that I could now take part in the environmental economics debate. So then I read Nordhaus, and I was beyond horrified with how bad his work is – and that of the cabal of Neoclassical "climate change" economists that he's assembled.

Jamie: And there is, of course, something of a crossover with your longstanding interest in neoclassical economics (or rather core mainstream economics). The response to *Limits to*

Growth was mainly dictated by what was to become environmental economics and by parallel commentary from growth theory. Environmental economics has been heavily influenced by core mainstream theory and perspectives rather than has been influential on it. This was obvious as early as 1974, and your comments allude to this. In that year the *American Economic Review* published an issue containing Robert Solow's Ely Lecture in which he essentially reduces the limits to growth problem to merely a choice between more state and market as an economy grows (Solow, 1974a). The same issue contains a special section in which William Nordhaus and Herman Daly both appear, but Nordhaus essentially ignores the entire basis of Daly's ecological economics case – that an Earth system creates definite limits to an economic system but economics continues to fail to recognise this because it focuses on exchange values without appropriate attention to the material processes that an economy entails. Your most recent work has a great deal to say about how Nordhaus's work and those who have followed him has evolved. Perhaps you might introduce it by explaining one of the more arresting parts of your analysis – the use and misuse of a "controlled environments" concept.

Steve: "Controlled environments"! The spin that Neoclassicals are capable of is wasted in economics, they should all be cricketers instead. Nordhaus and his equally deluded group of Neoclassical followers quite literally equate the climate with the weather, so that if you're not directly exposed to the weather, the implication is that you're immune to climate change, and all their projections are about cold places getting warmer (and thus benefiting) while warm places get warmer still (and thus suffer), with the overall outcome being a tossup.

A statement by Nordhaus from his "To slow or not to slow" paper in 1991 is worth citing in full here:

> Table 5 shows a sectoral breakdown of United States national income, where the economy is subdivided by the sectoral sensitivity to greenhouse warming. The most sensitive sectors are likely to be those, such as agriculture and forestry, in which output depends in a significant way upon climatic variables. At the other extreme are activities, such as cardiovascular surgery or microprocessor fabrication in 'clean rooms', which are undertaken in carefully controlled environments that will not be directly affected by climate change. Our estimate is that approximately 3% of United States national output is produced in highly sensitive sectors, another 10% in moderately sensitive sectors, and about 87% in sectors that are negligibly affected by climate change (Nordhaus 1991: 930; emphasis added).

"Controlled environments" is a euphemism for "indoors or underground"! How else can you justify simply assuming that all of manufacturing and services will be unaffected by climate change?

This is from the 2014 IPCC Report, which was clearly dominated by Richard Tol:

> ***FAQ 10.3 | Are other economic sectors vulnerable to climate change too?***
> Economic activities such as agriculture, forestry, fisheries, and mining are exposed to the weather and thus vulnerable to climate change. Other economic activities, such as manufacturing and services, largely take place in controlled environments and are not really exposed to climate change. However, markets connect sectors so that the impacts of climate change spill

> over from one activity to all others. The impact of climate change on economic development and growth also affects all sectors (Arent et al 2014: 688).

That "*carefully controlled environments*" assumption would be cold comfort to Texans right now – quite literally – as they freeze in sub-zero °F temperatures thanks to an unstable Jet Stream. Being indoors isn't much help when the power utilities fail because they are frozen solid.

I have to admit to being extremely angry about this garbage. Not only did Nordhaus destroy the credibility of the *Limits to Growth* study with shoddy research – as Forrester put it, "each point made by Nordhaus rests on a misunderstanding of *World Dynamics*, a misuse of empirical data, or an inability to analyze properly the dynamic behavior of the model by static equilibrium methods" (Forrester et al. 1974; see also Bardi, 2018). He replaced *Limits* with this delusional nonsense that shows a complete lack of understanding of what climate change actually is.

Because economists have spouted this nonsense, it has been taken seriously by politicians, and surely used to justify the tepid action they've taken to date to address climate change. But they clearly don't know what they're talking about.

Jamie: Something you also suggest underpins mainstream economics on financial crises only in this case the damage is even more basic?[9]

Steve: Yes. The same applied to Neoclassical economists before the Global Financial Crisis, but at least the damage that did could be relatively easily attenuated by government policy (even though policy has not fundamentally constrained the damaging dominance of finance over the real economy, nor reduced the private debt overhang that was the main cause of the crisis). But climate change? As its impacts become more extreme, there'll be precious little humanity can do to attenuate it, short of actions like geoengineering that can reverse the rise in global temperature, but will undoubtedly have dangerous side effects as well. Plus, we'll start taking action at best fifty years after we should have, when the human impact on the planet is far greater.

Jamie: And geoengineering and imagined technological fixes built into the "nationally determined contributions" (NDC) emissions reduction projections, which countries have started to provide under the Paris Agreement do seem highly unrealistic… despite the recent change in rhetoric revolving around climate ambition since the IPCC *Global Warming of 1.5 °C* report (IPCC, 2018), which called for a 45-55% reduction from the 2017 level in annual global carbon emissions by 2030 followed by "net zero" by mid-century – the UN "race to zero" project etc – behind this is a longstanding complacency heavily influenced by economics?[10]

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[9] Note from Jamie: on the lack of progress in emissions reduction see the UNEP emissions gap ten year summary see Christensen and Olhoff (2019). On the broad range of causes of delay see also Lamb et al (2020).

[10] Note from Jamie: the UN Climate Ambition Alliance is working to encourage countries to increase the ambition of their 'nationally determined contributions' to emissions reduction (NDCs) and has also launched the 'Race to Zero' campaign to feed this through to cities, regions, business and other actors: or the climate ambition alliance see: https://cop25.mma.gob.cl/en/climate-ambition-alliance/ Visit Race to zero at: https://unfccc.int/climate-action/race-to-zero-campaign On economics and complacency see Røpke (2020); Gills and Morgan (2020b).

Steve: Exactly. Climate activists target fossil fuel companies and wealthy right-wing ideologues as the main culprits of climate change denialism and trivialisation, but there has been a dereliction of duty by Neoclassical economists as well – and not just a duty humanity as in macroeconomics, but to the entire ecosphere. They have also enabled the professional trivialisers like Bjorn Lomborg, who cites the economics chapter of the 2014 IPCC report approvingly (Lomborg, 2020).

I firmly believe that Nordhaus and his followers should face consequences for this negligence, which is one reason that I support moves to establish the crime of ecocide – see https://www.stopecocide.earth/.[11]

Jamie: Still, it is extraordinary just how influential mainstream economics theory and policy frameworks have been over the decades, despite critique. Edward Fullbrook has been supportive of that critique since *Real-World Economics Review*'s inception and *RWER* has over the years published and promoted the work of Herman Daly, Peter Söderbaum, Clive Spash, Richard Smith, Ted Trainer and many others.[12] Though the IPCC and UNEP do draw on Integrated Assessment Models (DICE, RICE etc.) and the work of Nordhaus and Toll for their scenario pathways, there is also a growing awareness and scepticism about them – though this has been a long-time coming, since in addition to your own devasting critique there have been others across the spectrum of the social sciences (from politics, sociology, political economy, philosophy) and from some climate scientists.[13] Critique has, of course, become more timely as well as prominent because Nordhaus won a "Nobel Prize" for his work and because a climate emergency has been declared (the two seemingly in glaring opposition). Your recent work (Keen 2020a), for example, has been amongst the most "visible" in social science according to Altmetric criteria – though it has yet to be picked up by the main print media.

Steve: I didn't even know of Altmetric until you pointed out how well the paper was doing there: it currently has a score of 1647, which puts it in the top 3,000 of the 17 million papers Altmetric has tracked. The invitation from *Globalizations* to turn my Twitter war with Richard Tol and Patreon blog posts into something more academic was extremely welcome: time is of the essence in climate change, and I'm very grateful to the journal for giving me the chance to get a substantial critique into the academic literature post haste.

I can't divulge further details at the moment, but that paper inspired one of the world's most prestigious scientific journals to invite me to write a more technical critique for their audience. That might help overcome the one disappointment that the *Globalizations* paper has received no mainstream media coverage – which reflects more on the parlous state of journalism these days than on *Globalizations*.

Jamie: As you say the, paper appears in *Globalizations*. It was part of a recent special issue titled "Economics and Climate Emergency" and this collection follows a similar format to the

[11] Note form Jamie: see also the Alliance of World Scientists which has been organized to coordinates pressure on governments and create public awareness of the urgency of the climate emergency. For example: Despite promising developments, the need for climate action has grown even more urgent this year - read "The Climate Emergency: 2020 in Review": https://bit.ly/3nk4QXt

[12] Note from Jamie: See for example, Daly (2015); Söderbaum (2018 [2016]); Smith (2020), Trainer (2020).

[13] Note from Jamie: for critique of Nordhaus etc. see for example: Dale (2018); Gelman (2019); Hickel (2018); Spash (2002). For something more mainstream see Pindyck (2017).

prior *RWER* collection "Economics and the Ecosystem" (Fullbrook and Morgan 2019).[14] A key feature of the many essays included in both (and these cover an array of ecological and political positions using a wide variety of terms – growth-critical, postgrowth, degrowth, a simpler way, social-ecological economics etc.)[15] is that mainstream economics is ideological. All non-trivial knowledge is, of course, in some sense, from a perspective and entails some underpinning value system, but the term ideological can carry further connotations. I was reminded of something you wrote in the preface to the first edition of *Debunking Economics* (Keen 2001: xiv) you state:

> I came to the conclusion that the reason they [neoclassical economists] displayed such anti-intellectual, apparently socially destructive, and apparently ideological behaviour lay deeper than any superficial pathologies. Instead the way in which they had been educated had given them the behavioural traits of zealots rather than of dispassionate intellectuals… there is no point trying to debate fundamental beliefs with a zealot… I abandoned any delusion that I might be able to persuade committed economists to see reason (though there has been the odd exception to the rule). Instead, I prefer to spend my time developing an alternative approach to economics, while persuading others not to fall for the superficially persuasive but fundamentally flawed arguments of conventional theory.

Perhaps, by way of bringing this interview together, you might elaborate on this in the context of our current "climate emergency" and where you see your work taking you?

Steve: You've chosen a good quote there. In general, I've moved from the "demolishing the glass house from the outside" stage characterised by *Debunking Economics* into a "build a new house" phase.

A major aspect of this is the development of *Minsky*, because I believe that system dynamics should be the analytic foundation of economics, and it was close to impossible to design models of financial dynamics using existing system dynamics programs. Some people have done it, but if they need to edit their design, it's ridiculously hard to do so with the flowchart paradigm, given the quadruple-entry nature of showing financial transactions at the aggregate level – something that Hyman Minsky emphasised was necessary. *Minsky*'s Godley Tables handle quadruple entry with ease, and as a result, editing the design of a financial sector is easy in *Minsky*.

We also need to win the "good foundations" debate. Neoclassicals firmly believe that macro must have good foundations – not be "ad-hoc" – and that means microfoundations to them, which is nonsense given the Sonnenschein-Mantel-Debreu theorem (e.g. Sonnenschein, 1972) and the empirical falsehoods in their theory of supply (see Lee 1998). So their first belief is valid, but their second is not. Macroeconomics does need sound, indisputable foundation, and as I show in my recent *Review of Political Economy* paper (Keen, 2020b), macroeconomic dynamics can be derived directly from macroeconomic definitions.

[14] Note from Jamie, for "Economics and the Ecosystem" see https://www.amazon.com/dp/B07ZM9G22Y The other papers can be found as: recent special issue of *Globalizations* on "Economics and Climate Emergency"

[15] Note from Jamie: for influential work that provides some background see Hickel and Kallis (2019); Parrique et al. (2019). The *Globalizations* collection contains, amongst others, work by James Galbraith, who RWER readers ought to be familiar with (see Galbraith, 2020). See Gills and Morgan (2020a).

Good foundations also include integration of economics with ecology at a fundamental level. That was the objective of my *Ecological Economics* paper (Keen et al, 2019). By treating energy as the essential input into Labour and Capital, the economy's reliance on the natural world (as a source of energy) and damaging feedback on the natural world (via the necessity, under the Laws of Thermodynamics, to dump waste energy – and matter – into the environment) become fundamental aspects of economics. It's a hard slog from that basic insight to models that integrate economics, energy and ecology, but I've made a start with Matheus Grasselli and Tim Garrett, and we hope to take that a lot further in the next few years.

I try to bring all this together in a new book for Polity Press, with the title – suggested by them, which I've tried to live up to – of *The New Economics: A Manifesto*. I hope to finish it this month, and have it published by the end of 2021. It's not my "magnum opus", but it sets out the basics in 40,000 words. I've taken to calling it my "mini opus".

Realising what Neoclassical economists have done on climate change has also turbocharged my original motivation for writing *Debunking Economics*. Their zealotry about their model of the economy has ended up not merely causing crises in the real economy, but jeopardising the survival of human civilisation, and causing the extinction of a substantial slab of life on Earth. If civilisation does survive climate change, it certainly won't be in the form of the mythical free market capitalism they believe they're championing. In the struggle to survive, we could find ourselves in the equivalent of a War-based military command economy, with severe rationing, forced redistribution, and controlled production.

Jamie: Not a comforting thought and one that several strands of the climate movement are trying to prevent.[16]

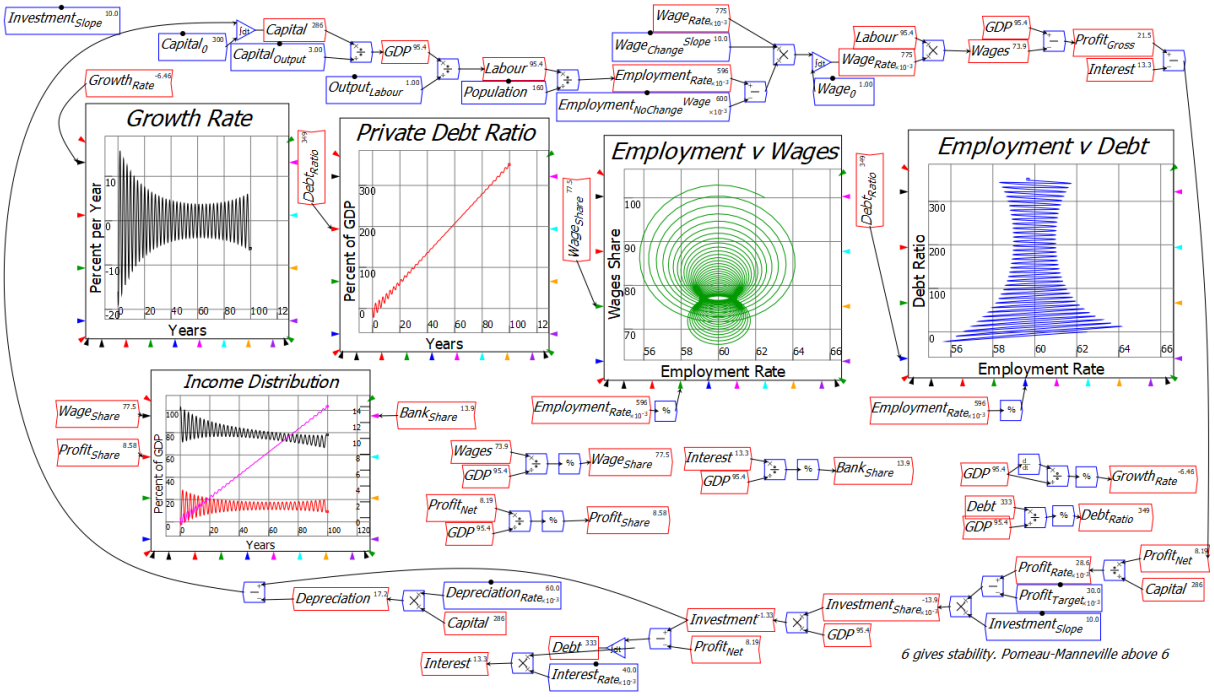
Steve: A worst case maybe, but a foreseeable one. And if we do come out the other side of that with a civilisation that puts a sustainable load on the biosphere, rather than the overload Neoclassical negligence has encouraged, the survivors will want to know how we made such a huge mistake in the first place. Though of course I want my work to be read now, largely I see myself as writing for that future audience, while at the same time helping develop tools we can use now to properly understand market economies and industrial production.

That's where my Open Source system dynamics Minsky software, and system dynamics in general, comes in.

I don't want humanity to survive a climate apocalypse only to resurrect the type of economic thinking that gave rise to it in the first place. As well as denouncing Neoclassical economics, we need to produce tools of thought – including not only software but memes, symbolic mental representations of reality – that are as powerful as the Neoclassical totem of intersecting supply and demand curves (see Leijonhufvud, 1973), but far more realistic. Above all, we have to represent our dependence upon pre-existing energy, the necessity of waste from the exploitation of that energy, and the limited capacity of the biosphere to accommodate the far higher pressure that industry imposes upon it compared to the feedbacks in the biosphere itself. I think Kate Raworth's (2017) "Doughnut" has done a brilliant job of communicating the biosphere's limits, but we still need a meme for our dependence on energy.

[16] Note from Jamie: For examples of problems see Morgan (2020, 2017).

Figure 3: Keen's Goodwin-based model of Minsky's Financial Instability Hypothesis in Minsky



Jamie: Raworth's work has certainly been high-profile and has a lot of champions – Tim Jackson, George Monbiot etc. It is also worth noting that George Lakoff suggested several years ago that climate activism needed a more effective communicative framework to compete with or displace the current more problematic framing of the whole problem (neoliberalism etc.). Still, there are also various critiques and counter-critiques of Raworth's work within and without academia and climate activism. What is your preferred imagery?[17]

Steve: My preferred meme is the wheel, or water wheel: it has the same shape as the doughnut, but it won't turn without moving water coming from the environment.

Jamie: And if there is any final thought you would want to leave a reader with, it would be…

Steve: Overall, the travesty that is Neoclassical climate change economics has elevated the struggle heterodox economists have waged for realism in economics from an issue merely about the proper nature of economics to a key requirement for humanity to have a future at all. This isn't just about the right way to do economics anymore; it's about the survival of human civilisation. If we are to have a future, then Neoclassical economics has to go, and we heterodox economists have to replace it with something properly grounded in the physical reality of planet Earth.

[17] See Lakoff (2010); and in the *Globalizations* collection (Spash, 2020).
See also: https://theconversation.com/economists-are-more-like-storytellers-than-scientists-dont-let-the-nobel-for-economic-sciences-fool-you-147722

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Author contact: Steve Keen: debunking@gmail.com and jamiea.morgan@hotmail.co.uk

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