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"How entropy drives us towards degrowth"

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Introduction

A voracious beast devours the equivalent of an entire Mount Everest's worth of resources every 20 months. It also accelerates its metabolism, reducing this timeframe to just 10 months within the next two decades.[1] As it fills its belly, the beast exhausts its environment and burdens it with waste, disrupting natural systems for resource renewal and waste management. Ultimately, it annihilates its own habitat. I am, of course, referring to global capitalism.

This system demands continued accumulation of capital and falters when hindered in this process. The typical response to the ecological crisis is therefore not to restrict economic growth but to pin all hope on efficiency, circularity, dematerialization, decarbonization, and other profit-driven green innovations within capitalism. In this exposition, I argue that this hope is false because entropy always looms. Entropy serves as a physical measure of disorder, and we observe its inexorable increase all around us: everything decays, rots, disintegrates, and falls into disorder. Simultaneously, the biosphere establishes order through processes like photosynthesis, ecological succession, or cellular regeneration. These natural processes delay and reduce entropy.

In this article, I demonstrate how the capitalist system disrupts this equilibrium by raising entropy and overwhelming natural entropy-reducing processes. I then argue that circular and other green economies are trapped in fruitless efforts to divorce growth from its detrimental ecological effects. We must consider the idea of an economy that doesn't necessitate expansion. I therefore conclude by endorsing the radical proposition of *degrowth*.

Conservation of energy

The environmental crisis stems not merely from a quantitative imbalance between available resources and their consumption by the world economy but also from the qualitative deterioration of matter and energy coursing through the economy. To comprehend this, we must turn to thermodynamics, a branch of physical science that explains how energy transforms from one form to another, following a few fundamental natural laws. Given the complexities of thermodynamics, I'll strive to present the arguments in a tangible manner.

In the heart of a forest, a monkey finds concentrated chemical energy in the form of a banana. The monkey quickly converts the banana into usable energy to maintain its physical condition, climb trees, fight enemies, and so on. *The first law of thermodynamics states that energy can change forms but*

[1] Calculated on the basis of Krausmann et al. 2018 en UNEP & IRP 2017.

cannot be created or destroyed. The initial chemical energy held within the banana transforms into: chemical energy regenerating cells in the monkey's body, kinetic energy fueling its physical activities, and thermal energy radiating as body heat. The same principle applies to natural gas: when one measures the energy contained in a cubic meter of natural gas and burns it to run a generator, the energy stored in the natural gas equals the energy consumed in electricity generation plus with the heat released by the generator. In short: *energy changes form but never disappears*.

The Entropy Law

Why do we face an energy crisis when energy is indestructible? The second law of thermodynamics, also known as the Entropy Law, holds the answer. When we turn off the heating in our house, the heat from the radiator will disperse and seep through the walls until a state of 'thermal equilibrium' is reached, meaning that the indoor and outdoor temperatures are equal. At this point, entropy, a measure of energy dispersion, reaches its maximum. *According to the Entropy Law, thermal energy flows spontaneously from a hotter body to a colder one, never the reverse*. If we do not restart the heating system, the heat will eventually escape into the outside world, and new energy will be needed to raise room temperature once more. Inevitably, this newly added energy will also dissipate, rendering it unavailable for further use. This encapsulates the essence of the energy crisis.

The Entropy Law applies not only to heat but to energy in general. A charged battery contains concentrated chemical energy. When connected to a device, this chemical energy transforms into electrical energy that spontaneously flows out of the battery. Essentially, the Entropy Law dictates that energy moves naturally from areas with high energy concentrations to areas with lower concentrations, resulting in an increase in entropy. The radiator from the earlier example held a higher concentration of thermal energy than its cooler surroundings, causing this energy to radiate outwards. In short: *energy flows from high to low concentrations*.

This dispersion of energy also affects matter. For example, it can lead to food spoilage, metal corrosion, and clothing wear and tear. This deterioration occurs through the spontaneous release of energy that binds atoms and molecules together. According to the Entropy Law, both energy and matter therefore tend to disperse, increasing overall entropy. This process also underlies the gradual breakdown of our cells. " Entropy carries a rather ominous connotation," my partner once remarked.

Energy Consumption and Inefficiencies

Fortunately, other natural processes operate in the opposite direction; otherwise, bananas would never grow. But how does energy become concentrated when, following the law of entropy, it spontaneously disperses? The answer lies in a sub-law of the Entropy Law: *heat can only flow from a cold body to a warm body by 'performing work' in the physical sense*. This means that additional energy is required to transfer energy from a dispersed to a concentrated state. For example, a radiator only emits heat after a heating system has concentrated thermal energy. A battery only delivers electricity after a charger has performed work by concentrating the chemical energy. Likewise, a monkey must perform work by picking and digesting bananas to replenish the lost chemical energy and concentrate it in its body. In short: *energy concentration requires supplementary energy*.

But beware, there's a catch: 'work' comes at a cost. Work can reduce entropy locally, but it consumes energy from an external source, thereby increasing entropy elsewhere. The monkey maintains its own low entropy by eating bananas but causes an increase in entropy in the forest through discarded

banana peels, body heat, and feces. Gas heaters counteract heat loss but achieve this reduced indoor entropy at the expense of elevated entropy in the biosphere through the extraction, purification, delivery, and burning of low-entropy natural gas.

And there's another catch: total entropy net increases. *A second sub-law of the law of entropy states that no energy transfer to useful work is 100% efficient*. Work is deemed 'useful' when it diminishes entropy. As previously mentioned, our primate friend eats bananas to maintain relatively low entropy in its body. However, energy losses transpire during the energy transfer from banana to monkey in the form of food waste and perspiration. Not only does the monkey lower its own entropy at the cost of an increase in the forest, but due to these losses, the reduction is smaller than the increase. Useful work always entails losses, like the residue of peanut butter left on your knife after breakfast. In short: *Energy conversions are never 100% efficient*.

Entropy and the Economy

What do these natural laws mean for the economy? In the 1970s, Nicholas Georgescu-Roegen, the pioneer of ecological economics, foresaw the inevitable demise of capitalism, primarily due to its inherent tendency to escalate entropy.[2] He demonstrated that the economy involves not just a circulation system but also a digestion system directly connected to the environment at both ends. The growth rate of the economy essentially signifies the pace at which we transform low-entropy resources into high-entropy wastes. Fossil fuels enter our economy as organized matter and energy but exit as dispersed heat, chemicals, carbon dioxide, and microplastics.

We delude ourselves when we assume that our economies can establish order by converting low-entropy natural resources into materials with even lower entropy. This semblance of order is deceptive, as the production process invariably entails an increase in entropy in the environment. The purification of ores into usable materials may reduce entropy in the materials themselves, but the purification process requires external energy sources (as dictated by the first sub-law of the Entropy Law) and inevitably incurs energy losses (as dictated by the second sub-law of the Entropy Law), thereby augmenting the overall entropy. So, a lower entropy of semi-finished products compared to the materials from which they are produced does not mean that the law of entropy has been violated.

Nature's Counterbalance to Entropy

So far, I have mainly discussed how entropy increases, but what about its decrease? When monkeys eat bananas, they increase entropy in the forest. How can the forest then produce new bananas? The forest can recycle peels and feces, but this waste contains insufficient energy to produce new bananas because the monkeys have used up the difference. Nature steps in to compensate for this deficit through the inexhaustible energy of the sun. The biosphere taps into solar power to perform 'useful work,' namely concentrating dispersed energy and matter into the form of new bananas (as dictated by the first sub-law of the Entropy Law). A healthy and well-functioning biosphere thus stands as the only force on Earth capable of counterbalancing the rise in entropy.

Nonetheless, nature has its limits when it comes to absorbing and recycling waste streams. For example, banana regeneration depends on the rates of photosynthesis, nutrient uptake, tree growth,

[2] Georgescu-Roegen 1971

and fruiting. These rates also limit the monkeys' rate of reproduction. In contrast to the metabolism of a group of forest monkeys, the metabolism of the destructive beast called capitalism expands too fast for the biosphere to keep up. Ecosystems have evolved over millions of years to optimize energy consumption in ecological food webs and to delay and reduce entropy through biodiversity. Tragically, growth-oriented economies do the exact opposite by pushing against this natural order and increasing entropy at a devastating rate.

And when nature imposes limits, capitalism actively seeks ways to circumvent them, inevitably leading to new limits. As an illustration, we develop monocultures to facilitate mechanical agriculture, but as a result, the soil dries out. In response, we introduce irrigation, which then depletes groundwater, and so we come up with drought-tolerant crops. When these crops degrade soil life, we come up with something else. Unfortunately, this pattern carries grave consequences, as evidenced by the ongoing climate crisis and biodiversity decline. Capitalism, in its pursuit of relentless growth, damages the very biosphere it relies on to mitigate its entropy-amplifying activities. If we stay on this path, the planet faces a bleak future as an environmental wasteland.

Decoupling the economy from Nature?

Can we not combat entropy through frugal and circular production? The typical response to the ecological crisis isn't to slow down growth but to rely on dematerialization and circularity. However, "green capitalism" cannot maintain itself, let alone grow, by merely reusing its own waste and by-products. Just as monkeys require fresh bananas from the forest and can't survive on their own feces, production systems require new input of low-entropy matter and energy to function. The same goes for a forest that depends on solar energy from space and can't survive solely on falling leaves. Shifting to biomass as a raw material for production also won't save green growth as it will intensify pressure on land, water, and soil.

At first glance, it may seem that there remains immense potential for circularity and efficiency, given that the global economy recovers less than 10% of waste material[3] and retains only 28% of global primary energy consumption after conversion.[4] Nevertheless, substantial constraints arise long before reaching 100% circularity and efficiency. The potential for circularity is restricted to a mere 29% of total throughput. The remaining portion includes food and energy that have undergone irreversible degradation, along with net additions to buildings and infrastructures unavailable for recycling.[5]
Even achieving that 29% will be difficult. As explained, the reconcentration of dispersed materials requires energy investments and comes with inevitable transmission losses that increase overall entropy. Energy consumption increases as recycling rates increase, and energy itself can't be recycled. And even if we had access to inexhaustible renewable energy sources, closed loops won't be established for agrochemicals, coatings, lubricants, adhesives, inks, and other complex materials for which recycling technology is not available.

Let me emphasize: even though we are far from achieving 100% circularity and efficiency, the laws of nature will always obstruct us from attaining such a goal. To counteract all unavoidable losses and inefficiencies, we require a constant influx of fresh, low-entropy matter and energy. This requirement holds true for circular economies and other green growth models as well. The encouraging news is

[3] UNEP & IRP 2020

[4] Forman et al. 2016

[5] Haas et al. 2015

that the biosphere can convert certain types and quantities of waste back into raw materials. However, we should not anticipate the biosphere to sustain this service at the same accelerating pace at which our economies increase entropy.

In Search of Radical Alternatives

Our presumed dominion over nature is an illusion. No matter how clever technological innovations may seem, they remain subject to the laws of thermodynamics. Consequently, a growth-centered capitalist economy finds itself trapped in futile attempts to completely decouple itself from nature – aiming for a 100% circular, service-oriented and zero-waste existence. This obsession stems from an incapacity to imagine an economy that does not grow, where both the quantity and quality of its metabolism remain within secure ecological and planetary boundaries.

Hence, we must seek radically different pathways (the Latin *radix* means root). One such alternative is *degrowth*. In the broadest sense, degrowth represents a socio-economic transformation aimed at reducing and redistributing material and energy flows, with the goal of respecting planetary boundaries and promoting social justice.

The growing metabolism of the voracious beast with which I began this article has unevenly distributed burdens and benefits. World trade has resulted in a net outflow of low-entropy resources from the poorer areas of the world[6] and an inflow of high-entropy waste back into those same areas.[7] This has the consequence of depriving the poor of vital resources and damaging their local ecosystems, while wealth continues to accumulate for a small minority.

The argument for degrowth extends beyond a response to the ecological crisis and includes the pursuit of a more just system. The voracious beast must yield to the turtle. As a child, my parents gave me a small turtle. Over time, I noticed that it stopped growing before it became too large for the aquarium. Nevertheless, we bought a larger aquarium, and the turtle resumed its growth. But once more, it stopped before becoming too big. Although the turtle no longer grew in size and weight, it continued to change in its proportions, colors and behaviors. Thus, the end of growth does not mean the end of development but rather the opportunity to free ourselves from the compulsive and ruinous capitalist system. This will enable us to lead a healthier, more social, sustainable, and just life.

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[6] Dorninger et al. 2021

[7] Hornborg 2009

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"It is much too soon to act" – Economists and the climate change[1]

Giandomenico Scarpelli
[Former manager of the Bank of Italy, interested in ecological economics]

Tomorrow is not only very close, but in many respects it is already here

K. E. Boulding

Introduction

Nicholas Georgescu-Roegen wrote that "economic thought has always been influenced by the economic issues of the day. It also has reflected – with some lag – the trend of ideas in the natural sciences".[2] In this article I show that in the case of global warming and climate change that lag was long. The thought of economists, in fact, for many years did not reflect at all the knowledge achieved by climate science consensus: many distinguished economists with a neoclassical background have ignored the problem or, when they have dealt with it, they denied it, dismissed it with superficial jokes or underestimated it in terms of its economic effects. For a long time only a few economists took seriously the warnings of climate scientists.

In more recent years orthodox economists have become more aware of the catastrophic outcomes of climatic disturbances, but at this point the traditional policies they recommend could be insufficient.

Economists and the climate change: the forerunners

In 1968 the late Herman Daly – who in the following years became the pioneer of ecological economics – wrote:

> "… since the Industrial Revolution the tremendous consumption of carbon fuels has resulted in an increased concentration of carbon dioxide in the atmosphere. Since this gas increases the heat retention of the atmosphere, thus raising the average

[1] This article is a revised and expanded version of the article appeared in Italian, with the title "È troppo presto per agire. Gli economisti e il cambiamento climatico*",* in the review *Nuova Economia e Storia*, XXVII, No. 1-2, 2021.

[2] N. Georgescu-Roegen (1971), "The Entropy Law and the Economic Problem", in *Distinguished Lecture Series No. 1*, Department of Economics, The University of Alabama, p. 4.

> temperature, it may well be that the ultimate effect of the Industrial Revolution will be the melting of the polar ice cap and the inundation of large parts of the world."[3]

The quote shows that at the end of the 1960s of last century the basic mechanism of global warming and its potential effects were already known to some economists. Nevertheless in the years immediately following only very few economists mentioned the problem in their writings. In the economic literature of that period, in fact, references to climate change and to the potential consequences on the economic system were small in number and very cautious.[4] Even *The Limits to Growth* – the first Report to the Club of Rome released in 1972, by many considered excessively pessimistic about the future of mankind – dealt with the issue only *en passant* arguing that "It is not known how much CO_2 or thermal pollution can be released without causing irreversible changes in the earth's climate";[5] however, the Authors proposed to apply the precautionary principle.[6] A similar caution emerges from the third Report to the Club of Rome, released in 1976 and coordinated by the Nobel laureate economist Jan Tinbergen.[7] However in 1975 Nicholas Georgescu-Roegen already mentioned the dangers of thermal pollution deriving from the accumulation of carbon dioxide in the atmosphere.[8]

In the second half of the 1970s, some economists began to carry out specific studies on the possible economic effects of global warming: we can remember in particular William Nordhaus, who – after a first article in 1973[9] – published his first comprehensive work on the topic in 1977,[10] and Ralph D'Arge, who delivered a paper at the World Climate Conference which took place in 1979 in Geneva, organized by the World Meteorological Organization.[11]

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[3] H. E. Daly (1968), "On Economics as a Life Science", *Journal of Political Economy,* vol. LXXVI, No. 3, p. 399. In the passage quoted Daly referred to a speech of the physicist Edward Teller.

[4] Consider, for example, the following quote from a book published in 1977 by a leading environmental economist:

> "It is […] possible that the continually expanding use of fossil fuels will so increase carbon dioxide content of the atmosphere that the planet will tend to heat up, the ice caps will melt, inundating the coastal cities, and other unforeseen climatic effects will occur. Whether such events are a genuine danger is still a matter of uncertainty and even dispute among scientists": A. V. Kneese (1977), *Economics and the Environment,* Penguin Books, p. 32.

[5] D. H. Meadows, D. L. Meadows, J. Randers, W. W. Behrens III (1972), *The Limits to Growth,* A Potomac Associates Book, Universe Books, p. 81.

[6] "This ignorance about the limits of the earth's ability to absorb pollutants should be reason enough for caution in the release of polluting substances [included CO_2 - ed.]", ibid.

[7] The Report made a list of global problems and proposals to address them, stressing the uncertainty about climate change induced by the use of fossil fuels: "It can be expected that world climate will itself be affected by the ever-increasing production of energy; but we do not know when, or how": J. Tinbergen et al. (1976), *Reshaping the International Order*, A. Elsevier, p. 324.

[8] N. Georgescu-Roegen (1975), "Energy and Economic Myths", *The Southern Economic Journal*, Vol. 41, N. 3, p. 358.

[9] W. D. Nordhaus (1973), "World Dynamics: Measurement without Data", *The Economic Journal*, Vol. 83, No. 332, pp. 1156-83. The article was written to criticize *The Limits to Growth*, it was not dedicated specifically to global warming.

[10] W. D. Nordhaus (1977), "Economic Growth and Climate: The Carbon Dioxide Problem", *The American Economic Review* Vol. 67, No. 1, pp. 341-6.

[11] R. C. d'Arge (1979), "Climate and Economic Activity", in World Meteorological Organization, *Proceedings of the World Climate Conference*, Geneva, 12-23 February 1979, WMO No. 537.

Anyway, apart these few signs of interest, the vast majority of economists, i.e. the neoclassical mainstream – which prevailed (and still prevails) in universities (especially in the US) and which had (and has) influence on governments – in the 1970s showed no interest, much less concern, about global warming.

The alarms of scientists and the first reactions of mainstream economists

During the 1980s the scientific evidence on global warming became clearer, so much so that several important international initiatives followed one another and fundamental publications appeared.

In 1987 the Report of the United Nations World Commission on Environment and Development, titled *Our Common Future* (also known as "Brundtland Report"), addressed the climate emergency at length and with worried tones, making the fight against it one of the cornerstones of "sustainable development".[12] The following year the United Nations General Assembly, with the Resolution 43/53, having recalled the risks of disastrous events for humanity due to global warming, made a long list of requests, exhortations and recommendations to governments, international organizations and scientific institutions "to treat climate change as a priority issue to undertake and promote specific, co-operative action-oriented programmes and research", in order to achieve an adequate protection of the climate at a global level, for the benefit of present and future generations.[13]

In November 1990, in another world conference on climate change held in Geneva, hundreds of scientists warned that, without a drastic reduction in greenhouse gas emissions, the Earth's average temperature would rise so much as to cause serious damages to living beings. In the following year the first report of the Intergovernmental Panel on Climate Change (IPCC) – established in 1988 with the task of collecting data and carrying out scientific assessments – concluded that there was unequivocal evidence of the carbon dioxide accumulation in the atmosphere and of the trend in the Earth's average temperature to increase.[14]

In the face of the repeated alarms briefly mentioned, economists reacted in different ways. The most common reaction was the lack of any reaction: the vast majority of economists continued to ignore the global warming and to have a "business as usual" approach.

A second reaction consisted in a superficial approach to the problem: many economists concluded hastily denying its existence or minimizing its relevance. These positions were largely based on opinions of the few scientists which considered the climate change a natural (not due to human activities) process or a "mistake" due to measurement errors. It cannot be excluded that these opinions were influenced by powerful oil lobbies.[15] Thus, in 1991 Lawrence Summers, at the time chief

[12] World Commission on Environment and Development (1987), *Our Common Future*, UNEP - Oxford University Press; see in particular Ch. 7, par. II. 1 "Managing Climate Change".

[13] See https://www.ipcc.ch/site/assets/uploads/2019/02/UNGA43-53.pdf.

[14] See https://www.ipcc.ch/site/assets/uploads/2018/03/ipcc_far_wg_I_full_report.pdf.

[15] In 1989 the big international carbon emitters set up the Global Climate Coalition (GCC) in order to make lobbying to cast doubts on the effects of greenhouse gas emissions. The GCC dissolved in 2001. Jeffrey Sachs, Director of the Center for Sustainable Development at Columbia University and President of the UN Sustainable Development Solutions Network, wrote that oil, gas and car companies are very big and capable to exert a strong influence. They "hope, plan and lobby for the world to remain heavily dependent on oil and gas, despite the risks to ourselves and to future generations. … Some companies have gone so far as to promote antiscientific

economist of the World Bank (and later US Secretary of the Treasury), stated that "the danger of an apocalypse due to global warming or anything else is non-existent".[16] Also in 1991 Gary Becker (Nobel laureate in the following year) declared that greenhouse effect produced by CO_2 emissions is "still a controversial issue".[17] Herbert Simon (Nobel laureate in 1978) stated that global warming was not an economic problem "but rather a technical problem".[18] In the same year Milton Friedman (Nobel laureate in 1976) declared that pollution was not a serious problem, recommended not to take initiatives leaving the solution to the free market, and called the Clean Air Act a "monstrosity".[19]

Finally, a third, not numerous, group of economists explored the question in depth, although reaching different conclusions about possible policy options.

The 1992 *World Report* issued by the World Bank and dedicated to the environment identified the possible policy options:

1. "*Do nothing.* Finance additional research but incur no other costs until the extent and implications of warming become clearer";

2. "*Take out an insurance policy*. Adopt precautionary measures that entail modest costs now but will reduce the costs of a stronger response in the future should it become necessary…";

3. "*Take immediate action to stabilize or reduce total output of greenhouse gases*".[20]

The latter policy option had been substantially proposed by David Pearce, Anil Markandya and Edward Barbier in 1989, in a report (which later became a book) for the United Kingdom Department of the Environment. In this work – albeit with some caution resulting from the uncertainty about climate dynamics – they argued that "damage from global warming and sea-level rise due to greenhouse gases is of particular concern"; consequently, Authors recommended to start immediately an appropriate policy, since "the longer the world community delays action on the greenhouse effect, the greater will

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propaganda and to sow doubt in the public mind regarding well-known and mainstream science": J. D. Sachs (2014) *The Age of Sustainable Development,* Columbia University Press, p. 396. More recently the Secretary-General of United Nations, Antonio Guterres, declared that "Shamefully, some companies have even tried to block the transition to net zero – using wealth and influence to delay, distract and deceive": U.N. (2023), *Secretary-General's Opening Remarks at the Climate Ambition Summit,* 20 September (https://www.un.org/sg/en/content/sg/statement/2023-09-20/secretary-generals-opening-remarks-the-climate-ambition-summit). See also N. Oreskes and E. M. Conway (2010), *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*, Bloomsbury Press.

[16] L. Summers (1991), interview by Kirsten Garrett, "Background Briefing", Australian Broadcasting Company, second programme, World Bank and IMF annual assembly in Bangkok. Quoted in E. Toussaint (2020), "Climate: Sorcerers' apprentices at the World Bank and the IMF", CADTM (http://www.cadtm.org/Climate-and-environmental-crisis-Sorcerer-s-apprentices-at-the-World-Bank-and).

[17] Interview in C. Ravaioli (1992), *Il pianeta degli economisti ovvero l'economia contro il pianeta*, ISEDI, p. 12 (my translation from Italian). Becker added that the problem of pollution in general was "a real problem", but "felt beyond reason, overstated" (ibid.).

[18] Ibid., p. 24.

[19] Ibid., pp. 15, 42-5, 58.

[20] World Bank (1992), *Development and the Environment*, World Development Report, World Bank – Oxford University Press, p. 159. https://documents1.worldbank.org/curated/en/995041468323374213/pdf/105170REPLACEMENT0WDR01992.pdf

be the 'committed' level of warming (…). Delay is therefore not costless: the damage from greenhouse gases will simply be the greater the longer we delay".[21]

The second policy option identified by the World Bank was proposed by the World Bank itself:

> "Bringing together the various estimates of economic costs and benefits leads to a simple conclusion: the balance of the evidence does not support a case for doing nothing, but neither does it support stringent measures to reduce emissions now – the costs are too high in relation to the prospective benefits…. The wisest course is to make modest immediate reductions in emissions of greenhouse gases and investments designed to lower the cost of achieving larger reductions should this become necessary in the future".[22]

Basically to the same conclusion came, in this period, the aforementioned William Nordhaus. He assessed the impact of climate change for each sector of the United States economy using his Dynamic Integrated Climate Economic (DICE) model, and concluded: "Reducing the risks of climate change is a worthwhile objective, but humanity faces many other risks and has many other worthy potential investments […]".[23] Then he proposed a "flexible" policy that consisted in avoiding immediate and drastic interventions to reduce emissions, in increasing investments if the threat of global warming worsened and in relaxing policy if science or technology improved the situation.[24]

In the same period the policy to avoid drastic interventions was shared by the Oxford economist Wilfred Beckerman. He wrote: "… the cost of any major cut in CO2 emissions would be incomparably greater than the damage that global warming is likely to bring […]".[25]

The "dumb mistake"

After the Earth Summit held in Rio de Janeiro in 1992, during which a climate convention was approved,[26] the attitude of most economists did not change significantly: they continued to neglect the risks of climate change. In some cases the data that worried climate scientists and led to the organization of many international conferences and agreements were deemed insufficient or contradictory, not serious enough to induce containment emissions policies. Along with the skeptical economists, after Rio some scientists and journalists produced books and articles to deny in principle

[21] D. Pearce, A. Markandya, E. Barbier (1989), *Blueprint for a Green Economy*, Earthscan Publications, pp. 12, 18. We can also include in the group of the "concerned scholars" of the beginning of the 1990s William Cline of the Institute for International Economics. Using a long-term perspective and a low discount rate to compare benefits versus costs over time, he came to the conclusion that an aggressive programme of emissions abatement was warranted: W, R. Cline, (1992). *The Economics of Global Warming*. Peterson Institute for International Economics

[22] World Bank (1992), *Development and the Environment* (see above, note 20), pp. 160-1.

[23] W. D. Nordhaus (1991), "Economic Approaches to Greenhouse Warming", in R. D. Dornbusch and J. M. Poterba (eds.), *Global warming: Economic policy responses*, MIT Press, p. 63.

[24] W. D. Nordhaus (1991), "Economic Approaches to Greenhouse Warming", (see above, note 23), p. 63.

[25] W. Beckerman (1992), "Economic Growth and the Environment: Whose Growth? Whose Environment?", *World Development*, Vol. 20, No. 4, p. 489.

[26] https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf.

the anthropogenic global warming, or to recommend waiting for better data before acting. Along this line I can mention, among others, the works of Julian Morris, at that time co-director, with Roger Bate, of the Environment and Technology Programme of the Institute of Economic Affairs (IEA). In 1994 – while the United Nations Framework Convention on Climate Change (UNFCCC) entered into force – Morris and Bate wrote a book in which they argued that, in absence of incontrovertible data, policies to reduce carbon emissions were not appropriate.[27] Morris in 1997 reiterated his ideas in another book[28] in which he admitted that man's emissions of greenhouse gases play a role in altering climate, but not crucial; moreover, he wrote that the estimates and predictions of IPCC were exaggerated. He also wrote that the cost of imposing limits on emissions of carbon dioxide and other greenhouse gases would have been too high. In the same period other scholars embraced the argument of the limited predictive power, or even of the roughness, of climate models.[29]

In the meantime, during the 1990s the view of William Nordhaus quickly became dominant among economists, according to which the upheaval of the climate induced by the greenhouse effect would not be a serious problem for the economic system because it would only affect agriculture, forestry and coastal activities which, at least in the most industrialized countries, represent only a small fraction of GDP:

> "Climate change is likely to have different effects on different sectors. In general, sectors of the economy that have a significant interaction with unmanaged ecosystems – that is, those that are heavily dependent upon naturally occurring rainfall, runoff, or temperatures – may be significantly affected by climate change. Agriculture, forestry, and coastal activities fall in this category. Most of the U.S. economy has little *direct* interaction with climate, and the impacts of climate change are likely to be very small in these sectors".[30]

This idea was shared, among others, by the aforementioned Beckerman[31] and by Thomas G. Moore, former member of President Ronald Reagan's Council of Economic Advisers.[32] In 1997 Thomas C. Schelling, before the winning of the Nobel Prize (awarded in 2005), wrote: "Agriculture is practically

[27] R. Bate, J. Morris (1994), *Global warming: Apocalypse or Hot Air?*, Institute of Economic Affairs.

[28] J. Morris (ed.) (1997), *Climate Change: Challenging the Conventional Wisdom*, Institute of Economic Affairs.

[29] See for example M. L. Parsons (1995), *Global Warming: the Truth Behind the Myth*, Insight Books.

[30] W. D. Nordhaus (1991), "Economic Approaches to Greenhouse Warming" (see above, note 23), p. 40.

[31] W. Beckerman (1995), *Small Is Stupid*, Duckworth, p. 91.

[32] Moore wrote: "An examination of the record of the last twelve millennia reveals that human kind prospered during warm periods and suffered during cold ones… Climate affects principally agriculture, forestry and fishing. Manufacturing, most service industries and nearly all extractive industries are immune to climate shifts. Factories can be built in Northern Sweden or Canada or in Texas, Central America or Mexico. Banking, insurances, medical services, retailing, education, and a wide variety of other services can prosper as well in warm climates (with air-conditioning) as in cold (with central heating). A few services, such as transportation and tourism, may be susceptible to weather": T. G. Moore (1995), *Global Warming: a Boon to Humans and Other Animals,* Hoover Inst. - Stanford University, pp. 3-4. The last statement is very interesting because testifies that this kind of literature "has pretended that climate change is no more than a change in the weather": S. Keen, in J. Morgan (2021), "From finance to climate crisis: An interview with Steve Keen*", Real-world economic review*, No. 95, p. 135. Three years later Moore repeated his message that "warmer is better, colder is worse" in T. G. Moore (1998), *Climate of Fear. Why We Shouldn't Worry about Global Warming,* Cato Institute.

the only sector of the economy affected by climate and it contributes only a small percentage–three percent in the United States–of national income".[33]

The idea that climate change can have at most some effect only on "outdoor" activities and therefore a modest impact on the economic systems of industrialized countries, was defined by Herman Daly a "dumb mistake". He argued that, first of all, it is not true that agriculture is the only economic sector affected by the extreme events induced by climate disruption (just ask, Daly wrote with bitter irony, the insurance companies and citizens of New Orleans after the passage of hurricane Katrina).[34] Moreover, Daly wrote that measuring the importance of an economic sector on the basis of its contribution to the national GDP makes no sense if there are in place dynamics that modify prices: "it should be evident", he wrote, "that in the event of a climate-induced famine the price of food would skyrocket and the percentage of GNP going to agriculture, which is not a constant of nature, could easily rise from 3 percent to 90 percent".[35] The idea that the loss of "3 percent" of GDP in agriculture could be easily substituted by a 3 percent of GDP in other sectors is absurd, because dollars are fungible, but the real component of GDP is not: "The fungibility of dollars does not imply the fungibility of food and, say, of information services. … If I am hungry I want a meal, not a recipe…. True, agriculture accounts for only 3 percent of GNP, but it is precisely the specific 3 percent on which the other 97 per cent is based!".[36]

Despite the compelling validity of this criticism, for many years the majority of economists' papers held firm the assumption that manufacturing, mining, transportation, communication, finance, insurance, non-coastal real estate, retail trade, wholesale trade and government services will be unaffected by climate change.[37]

The Economists' Statement on Climate Change and the persistence of the "dumb mistake"

In 1997 – the year during which, in December, the Kyoto Agreement was signed – there was a surge of interest for the global warming among economists; up to that point, in fact, there had been little interest.[38] In that year *The Economists' Statement on Climate Change* was published with the objective to promote market-based solutions to the problem. The *Statement,* coordinated by "Redefining Progress" (an environmental economics think tank founded by Ted Halstead), was a brief declaration in which one reads, among other things, that

> "the balance of evidence suggests a discernible human influence on global climate. As economists, we believe that global climate change carries with it significant

[33] T. C. Schelling (1997), "The Cost of Combating Global Warming", *Foreign Affairs*, November-December, p. 9.

[34] Katrina was a tropical cyclone that struck the Gulf of Mexico and in particular the cost of Louisiana in August 2005. New Orleans was devastated and more of 1.800 people lost their lives.

[35] H. E. Daly (2007), "When Smart People Make Dumb Mistakes", in *Ecological Economics and Sustainable Development*, Edward Elgar, pp. 188-9 (originally in *Ecological Economics*, Vol. 34, No. 1 (2000), pp. 1-3).

[36] Ibid., pp. 189-190.

[37] S. Keen (2021), "The appallingly bad neoclassical economics of climate change", *Globalizations*, 18:7, p. 1153.

[38] See A. H. Goodall (2008), "Why have the leading journals in management (and other social sciences) failed to respond to climate change?", *Journal of Management Inquiry* 17: 408-420. See also A. Oswald, L. Stern (2019), "Why are economists letting down the world on climate change", *VoxEU-CEPR* (https://voxeu.org/article/why-are-economists-letting-down-world-climate-change).

> environmental, economic, social, and geopolitical risks, and that preventive steps are justified. Economic studies have found that there are many potential policies to reduce greenhouse-gas emissions for which the total benefits outweigh the total costs. …The United States and other nations can most efficiently implement their climate policies through market mechanisms, such as carbon taxes or the auction of emissions permits".[39]

The original drafters of the *Statement* were Dale Jorgenson, Paul Krugman, William Nordhaus, Kenneth Arrow and Robert Solow (the last two had won the Nobel Prize in previous years) and it was signed by more than 2,600 economists, including many Nobel Prize laureates at that time (besides original drafters: Gerard Debreu, John Harsanyi, Lawrence Klein, Wassily Leontief, Franco Modigliani and James Tobin).

The *Economists' Statement* and the increase in the number of economic studies dedicated to this issue in the second part of the 1990s were important steps but should not be overestimated: the Statement, in fact, was a very generic text, on which (almost) everyone could agree, while the increasing number of economists' works for the most part continued to adopt methodologies that led to a systematic underestimation of the severity of global warming economic effects, with the consequent proposal (much appreciated by governments) to postpone or to avoid policies to reduce greenhouse-gas emissions.[40] In particular, William Nordhaus, who at that time had become the leading authority for these studies, continued to draw from his models the "dumb mistake", i. e. the conclusion that sectors other than agriculture and coastal activities, "… are estimated to be relatively invulnerable to climate change (ignoring indirect impact through others sectors)".[41] He based his scientific activity on the assumption that "Climate change is unlikely to be catastrophic in the near term, but it has the potential for very serious damage in the long run".[42] From this, he repeated the proposal not to intervene immediately with a strong reduction in greenhouse gas emissions, but rather gradually and increasingly over time. A policy, therefore, which entails the obvious risk of "turning off the tap when the house is already completely flooded".

In 2005, Carl N. Mc Daniel wrote enlightening words, useful to understand the attitude of the economists of that period (and in part also of the present period):

> The possibility of unforeseen human catastrophes, along with the certain devastating effect climate change will have on biodiversity, greatly concerns the majority of natural scientists; however, the dire consequences of rapid climate change seem to trouble only a few economists… Nordhaus and neoclassical economists in general do not

[39] https://web.archive.org/web/20160304023618/http://rprogress.org/publications/1997/econstatement.htm.

[40] On the methodologies used see C. S. Bahinipati, U. Patnaik (2015), "Climate Change Economics: A Review on Theoretical Understanding and Controversies*", GIDR W.P.* No. 226; J. M. Harris, B. Roach, A.-M. Codur (2017), "The Economics of Global Climate Change", *GDAE* Tuft University; S. Keen (2021) (see above, note 37). The latter article lists the few scholars that did not share the idea that climate change could have only a trivial impact on the economic system as a whole (p. 1150). See also D. Zengelis (2021), "Climate change: how economists underestimated benefits of action for decades*", The Conversation* (https://theconversation.com/climate-change-how-economists-underestimated-benefits-of-action-for-decades-170825).

[41] W. D. Nordhaus, J. Boyer (2000), *Warming the World. Economic Models for Global Warming*, MIT Press, p. 77.

[42] W. D. Nordhaus (2008), "Reply to F. Dyson (2008), The Question of Global Warming*", The New York Review*, 25 September (https://www.nybooks.com/articles/2008/09/25/the-question-of-global-warming-an-exchange/). For an analysis of Nordhaus' work see S. Keen (2022), *The New Economics. A Manifesto.* Polity Press, Ch. 4.

> deny that climate change is likely, but they are perfectly happy to do little to avoid it because, in their view, the economic costs are likely to be relatively low. They hold this view for two fundamental reasons: first, economists believe that products traded in markets would be minimally affected by warming and that non market resources like species and ecosystems have little value; and, second, they believe that any particular life-support feature has a substitute or can be replaced by human invention at low cost".[43]

The "Copenhagen Consensus"

The idea that the abandonment of fossil fuels and energy reconversion was not a priority was expressed by the important economists that in 2004 collaborated with Bjorn Lomborg, a Danish professor of Statistics who in 2001 had published the controversial book *The Skeptical Environmentalist*.[44] That book launched a very optimistic message about the current and the future situations of mankind including the risks of catastrophic climate change; so, not surprisingly, it was very well received by large part of public opinion: "*The Economist*, the *New York Times*, and *Washington Post*, among others, published reviews that lavished praise on Lomborg's "truth" about the real state of the world".[45] But, "in contrast to the enthusiastic reception of Lomborg's book in the popular media, the two most important prestigious peer-reviewed science journals in the world, *Nature* and *Science*, published scathing reviews, as did *Scientific American*…".[46] The judgment on Lomborg's work expressed by prestigious science journals and by eminent scientists did not prevent the participation of distinguished economists to the "Copenhagen Consensus", a research promoted by Lomborg – later transposed into a book – aimed at examining the challenges that humanity had (and must) face and the related remedies.[47]

More precisely, a group of famous economists – including Nobel Prize winners Thomas C. Schelling, Robert W. Fogel, Douglass C. North and Vernon L. Smith – identified the 10 most pressing world problems, examined 17 possible remedies and listed them on the basis of urgency answering "… the focal question… 'where should the world invest, say, $50 bn *extra* over the next four years to do the most good?'"[48]. Well, the three identified remedies to climate change ("Optimal carbon tax", "The Kyoto Protocol" and "Value-at-risk carbon tax") were put in the last three places of the list.[49] The reason for that was the alleged lack of certainties about the negative consequences of atmospheric warming in comparison to the huge certain costs of energy conversion.

It is interesting to glean among the observations that each economist of the Copenhagen Consensus wrote in a personal capacity at the end of the volume. Fogel stated: "The environment is considered

[43] C. N. McDaniel (2005), *Wisdom for a Livable Planet*, Trinity University Press, pp. 179, 184.

[44] B. Lomborg (2001), *The Skeptical Environmentalist: Measuring the Real State of the World*, Cambridge University Press.

[45] C. N. McDaniel (2005), *Wisdom for a Livable Planet* (see above, note 43), p. 221.

[46] Ibid., p. 222.

[47] https://copenhagenconsensus.com/copenhagen-consensus. See B. Lomborg (ed.) (2004), *Global Crisis Global Solutions,* Cambridge University Press.

[48] Ibid., p. 3.

[49] Ibid., p. 606.

to be important, but it is not yet time to do anything massive about climate change";[50] North: "…climate change cannot compete with the other urgent issues we confront, although it is clear that some steps must be taken now to forestall adverse consequences down the road;[51] Vernon Smith: "It is clear from both the science and the economics of intervention that those of us who care about the environment are not well advised to favour initiating a costly attempt to reduce greenhouse gases (ghgs) build-up in the atmosphere in the near future based on the available information. Although the ultimate dangers may turn out to prompt action, the current evidence indicates that it is much too soon to act *relative to the many other important and pressing opportunities that demand immediate attention*".[52] Finally Schelling went so far as to write: "Future generations will be much richer than current ones, and it thus makes no sense to make current generations 'pay' for the problems of future generations".[53]

The *Stern Review* debate

Since the October 2006, for a time, the debate on economic policies to tackle human-induced climate change was focused on the *Stern Review*, the Report to the British Chancellor of the Exchequer, prepared by a team of experts led by Lord Nicholas Stern, former chief economist of the World Bank.[54] The *Review* was a very long and comprehensive analysis not easy to summarize; but I still try to list below what in my opinion were the key messages:

1) "An overwhelming body of scientific evidence now clearly indicates that climate change is a serious and urgent issue";[55]
2) "… the body of evidence and the growing quantitative assessment are now sufficient to give clear and strong guidance to economists and policy-makers in shaping a response";[56]
3) "business as usual will entail continuing increases in global temperatures well beyond levels previously experienced by humankind";[57]
4) "… prompt and strong action is therefore clearly warranted".[58]

These messages, and in particular the last one, were quite different from that offered by the vast majority of literature on that topic, so the *Stern Review* provoked an heated debate among economists. Even though there were several favourable reactions,[59] most economists criticized the *Stern Review,*

[50] R. W. Vogel (2004), "Expert Panel Ranking" in B. Lomborg (ed.) (2004), (see above, note 47), p. 613.

[51] D. C. North (2004), ibid., p. 625.

[52] V. L. Smith (2004), ibid., p. 635 (italics in the text). From that statement I took the title of this article.

[53] T. C. Schelling (2004), ibid., p. 627. It's difficult to understand on what grounds Schelling predicted that future generations will be "much richer" than the generation living in 2004; in any case those grounds were weak, considering that after only three years his own generation was impoverished with the financial crisis of 2007-2008 and with the subsequent economic recession, for which millions of people loss job and house.

[54] The Report was published on the web and then in a book form: N. Stern (2007), *The Economics of Climate Change: The Stern Review*, Cambridge University Press.

[55] Ibid., p. 3.

[56] Ibid.

[57] Ibid., p. 201.

[58] Ibid. p. 641.

[59] See for example G. Heal (2008), "Climate economics: A meta-review and some suggestions", NBER Working Paper 13927.

in particular for the level close to zero of discount rate used; critics argued that this approach would have caused too heavy investments in cutting emissions and then a waste of resources (on the contrary, an high discount rate would lead to a low level of investment).[60] Consistently with his positions, Nordhaus criticized The *Stern Review.*[61]

The sunset of misconceptions and the signs of attention from mainstream economists

In 2018 the Nobel Prize for economics was awarded to William Nordhaus precisely for his studies on the economic consequences of climate change. On that occasion many of his colleagues and the mainstream press presented him as a sort of "hero" of the environmental protection. But others took the opportunity to criticize the methodology he applied, which led to an underestimation of the risks of climate change for many years and consequently to a postponement of strong policies against global warming in order to achieve a higher current GDP growth. However, in the Nobel Lecture Nordhaus seemed more worried than in the past: “Global warming is the most significant of all environmental externalities. It menaces our planet […]. It is particularly pernicious because it involves so many activities of daily life, affects the entire planet”.[62] And if it “affects the entire planet”, it affects all sectors of the economic system, not only agriculture and others “outdoor activities”. So, the "dumb mistake", although its spectre still haunts literature from time to time,[63] now seems a largely outdated idea, also for the disasters that occur with increasing frequency affecting all economic sectors and the very life of millions of people. In fact, the disrupted climate not only ruins crops and reduce fishing (however vital resources for mankind), but destroys infrastructures, interrupts supplies of raw materials and the flow of trade, causes loss of human life and mass migration. Moreover, affecting real economy, it brings about upheavals in the banking and insurance sectors, with bad consequences on financial stability.[64] Also the second *core belief* of neoclassical economists who dealt with global warming, i.e. the idea that it is better to avoid an immediate strong reduction in greenhouse gas emissions to safeguard growth and employment, now seems outdated, even among the usually prudent international organization, such as the IMF.[65]

[60] See *The Economist* (2009), “Is it worth it? What economists have to say about mitigating climate change”, December 5th, pp. 6-10.

[61] W. D. Nordhaus (2007), “A Review of the Stern Review on the Economics of Climate Change”, *Journal of Economic Literature*, Vol. XLV (September 2007), pp. 686-702. On this controversy and in general on the reactions to the *Review*, see C. S. Bahinipati, U. Patnaik (2015) (see above, note 40). Even if not formulated by a full-fledged economist, it is worth mentioning the criticisms to the Stern Review made by Nigel Lawson, former Secretary of State for Energy and Chancellor of the Exchequer in Margaret Thatcher’s government. Lawson’s criticisms had notable echo insofar they were formulated not in an academic paper but rather in an elegant booklet with wide circulation: N. Lawson (2008), *An Appeal to Reason: A Cool Look at Global Warming*, Duckworth Overlook. Lawson, who previously opposed the Kyoto Protocol, in this booklet repeated the usual arguments for doing nothing: “the science of global warming is far from settled” (p. 5), models used by IPCC are unreliable, the impact of climate change will be moderate and for this reason urgent actions are unnecessarily expensive.

[62] W. D. Nordhaus (2018), *Climate Change: The Ultimate Challenge for Economics*, Nobel Prize Lecture, p. 441 (https://www.nobelprize.org/uploads/2018/10/nordhaus-lecture.pdf).

[63] See D.J. Arent et al (2014), “Key Economic Sectors and Services”, in C. B. Field et al, *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Part A: Global and Sectoral Aspects. Cambridge University Press.

[64] See C. Lagarde (2020), *Climate change and the Financial Sector*, ECB, (https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200227_1~5eac0ce39a.en.html).

[65] See IMF (2020), *World Economic Outlook – A Long and Difficult Ascent*, Ch. 3. More recently IMF considered "climate shocks" one of the factors - together with the pandemic and the war in Ukraine - that "contributed to a

After the Nobel Prize was awarded to Nordhaus, economists' interest in the topics of global warming and climate change has seen a certain increase, as confirmed by the number of articles published on this topic.[66] Another sign of attention was the success of a statement which appeared in 2019 on Wall Street Journal signed by many US economists – including 27 Nobel Prize winners, 4 former presidents of the Federal Reserve and 2 former Treasury secretaries. The Statement affirms that "Global climate change is a serious problem calling for immediate national action", and this "action" should be a carbon tax.[67] Another Statement, launched in 2019 by the European Association of Environmental Economists (EAERE) and signed by over 1700 economists from around the world, confirms the recent interest in this topic.[68]

As regards recent individual positions by leading economists, it is worth remembering the articles against climate change denialism published by the Nobel Prize winner Paul Krugman.[69]

The need for a new economic paradigm

As documented in the previous paragraph, in recent years it finally seems that most orthodox economists have become more aware of the catastrophic outcomes of climatic disturbances; but at this point the traditional policy they recommend could be insufficient to meet the goals set at international level. In fact, that policy consists mainly of pollution permits and carbon taxes, but if the permits are offered with great generosity and if carbon taxes are low, these policies are ineffective.[70] In order to counter climate change effectively economists should abandon the "… irrational commitment to exponential growth forever on a finite planet subject to the laws of thermodynamics".[71] This commitment is based on the assumption that GDP growth is always a good thing, and for this idea many distinguished economists for decades did not take into account the warnings of climate scientists, arguing that it was not worth giving up some points of GDP growth to implement an immediate and strong action to stabilize or reduce total output of greenhouse gases.

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reversal in decades-long poverty reduction trends": IMF (2023), *World Economic Outlook – Navigating Global Divergences,* p. 2.

[66] The increase of interest was already found in 2015 (see P. Howard, D. Sylvan, 2015, *Expert Consensus on the Economics of Climate Change,* Institute for Policy Integrity) and later confirmed (see E. McLaughlin, 2021, *How have economists thought about climate change?*, https://www.economicsobservatory.com/how-have-economists-thought-about-climate-change).

[67] https://clcouncil.org/media/EconomistsStatement.pdf. Among the signatories of this Statement we can find Lawrence Summers, who, as I reported earlier, in the past stated that there was no danger of a climate apocalypse.

[68] The document (https://www.eaere.org/statement/#:~:text=A%20price%20on%20carbon%20offers,towards%20a%20low%2Dcarbon%20future) has been released with the aim of obtaining the setting of a price on carbon dioxide emissions that is adequate to combat climate change.

[69] See for example P. Krugman (2017), "Conspiracies, corruption and climate", *The New York Times*, 11 September.

[70] See Dixson-Declève et al. (2022), *Earth4All: A Survival Guide to Humanity*, A Report to the Club of Rome, New Society Publishers, Ch. 7, par. *The Energy Turnaround in the Earth4All Analysis*. As the IMF put it: "Tangible policy responses to reduce greenhouse gas emissions have been grossly insufficient to date": IMF (2020), *World Economic Outlook* (see above, note 65), p. 61.

[71] H. E. Daly (2014), "Climate policy: from 'know how' to 'do now'", in *From uneconomic growth to steady-state economy*, Edward Elgar, p. 88 (originally in Sophie Foundation, Tenth Anniversary Booklet, June 2007).

Also for this reason Herman Daly for a long time advocated a “paradigm shift” in economic theory, suggesting a new paradigm not focused on growth.[72] We need such a paradigm to counter climate change, or a "climate revolution".[73] Otherwise, as professor Steve Keen wrote, “if climate change does lead to the catastrophic outcomes that some scientists now openly contemplate (…), then these Neoclassical economists will be complicit in causing the greatest crisis, not merely in the history of capitalism, but potentially in the history of life on Earth”.[74]

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[72] See H. E. Daly (1973), “Introduction”, in H. E. Daly (ed.), *Toward a Steady-State Economy*, W.H. Freeman and Co., pp. 1-10; H. E. Daly, J. Farley (2011), *Ecological Economics. Principles and Applications*, Island Press, p. 23ss.

[73] T. Brookes, G. Wagner (2021), *Economics Needs a Climate Revolution*, Project Syndicate (https://www.project-syndicate.org/commentary/neoclassical-economics-fails-with-climate-change-by-tom-brookes-and-gernot-wagner-2021-06).

[74] S. Keen (2021) (see above note 37), p. 1170.

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Addressing the climate and inequality crises: An emergency market plan simulation

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[Sweden]

It is the way of Heaven to take away from those
that have too much
And give to those that have not enough.

Not so with man's way:
He takes from those that have not
And gives it as tribute to those that have too much.

Tao Te Ching. Ch.77. Transl. Lin Yutang

Introduction

The ominous gravity of the climate and inequality crises cannot be glossed over anymore. As declared by United Nations Secretary-General António Guterres: "Humanity is in the hotseat. … Climate change is here. It is terrifying. And it is just the beginning. The era of global warming has ended; the era of global boiling has arrived."[1] He added, "It is still possible to limit global temperature rise to 1.5C [above pre-industrial levels] and avoid the very worst of climate change. But only with dramatic, immediate climate action." That is, decisive, ambitious, and also rational and effective action is urgently needed. Also recently, in an open letter to the United Nations and the World Bank, 320 economists and experts, including Jayati Ghosh and Joseph Stiglitz, describe a "crisis of extreme inequality."[2] The letter expresses deep concern about the violent rise in inequality, which has recently grown more rapidly than at any time since the Second World War:

> We are living through a time of extraordinarily high economic inequality. Extreme poverty and extreme wealth have risen sharply and simultaneously for the first time in 25 years. Between 2019 and 2020, global inequality grew more rapidly than at any time since WW2. The richest 10% of the global population currently takes 52% of global income, whereas the poorest half of the population earns 8.5% of it. Billions of

[1] From a speech at the UN headquarters commenting on data released by the European Union and the World Meteorological Organization, declaring July [2023] set to be the hottest month on record. (https://www.un.org/sg/en/content/sg/speeches/2023-07-27/secretary-generals-opening-remarks-press-conference-climate). The global average temperature for July 2023 is confirmed to be the highest on record for any month (https://climate.copernicus.eu/climate-bulletins).

[2] https://equalshope.org/index.php/2023/07/17/setting-serious-goals-to-combat-inequality/

> people face the terrible hardship of high and rising food prices and hunger, whilst the number of billionaires has doubled in the last decade.

The present study aims to explore the probable effects of a policy aiming to address both the climate and inequality crises simultaneously. The policy consists in the global regulation of the right to pollute the atmosphere through the allocation of individual tradable quotas for the emission of greenhouse gases.

The idea of equal rights to a common resource such as the atmosphere was the basis of Barnes's (2006) proposal of establishing a common asset trust fund whose (net) incomes for the sale of emission permits would be equally distributed among US citizens. Since the 1980s in the US such an institution, the Alaska Permanent Fund, manages that state's oil resources and distributes dividends among its inhabitants.

At first sight, the idea of a common asset fund looks like an equitable and effective managing system for controlling climate warming. Alas no country, even the big emitter US, can by itself notably influence the level of global emissions. The idea of a regulatory common asset fund, however, once generalized to the global level, may indeed be a realistic and viable solution to our present planetary "tragedy of the commons" (Buzaglo 2007). Such a generalized global common asset system was proposed by Peter Barnes and other authors (including "economics Nobel prize" Elinor Ostrom) in Barnes et al. (2008). Their proposed *Earth Atmospheric Trust* would auction off all greenhouse gas emission permits and allow trading among permit holders, progressively reducing the total volume of permits over time. Half of the revenues would be distributed among the earth's inhabitants, and half devoted to green investments. The dividend to be distributed, estimated to be between 100 to 405 dollars (current dollars of 2024) per capita per year (corresponding to lowest and highest assumed carbon prices), would be "… insignificant to the rich but will be enough to be of real benefit to many of the world's poor people."

Barnes et al. (2008) results are based on a rough "back-of-the-envelope calculation." As such, they rely on a few simplified assumptions, which may be closer to the real world than that of artificially sophisticated delusional models.

The present study is also a (somewhat more elaborated) back-of-the-envelope calculation. It does not try to trace all the imaginable repercussions throughout the world economy of introducing an effective and equitable emissions rationing system. It concentrates instead on the effects on the distributional aspects of the problem.

A clear and generally acceptable distributional approach is an unavoidable necessary condition for the political viability of any successful system of control of greenhouse gas emissions.

Analyses of the distributional consequences of different approaches to confronting climate change have been largely lacking in the policy discussion. Avoidance of the "sensitive" and "controversial" distributional aspects – an inconvenient topic for the prevailing interests – has been detrimental to the possibility of advancing toward a globally acceptable solution.

The notion that the atmosphere is a global common resource, a global commons, is a universally acceptable principle. An approach to a solution based on the recognition of such a universally acceptable principle implies the recognition of equal rights to the atmospheric commons by all participants.

Open and clear recognition of equal rights to the atmospheric commons leads naturally to the principle of equal emission rights of greenhouse gases for all. Everybody is entitled to the same share of the world's total sustainable amount of emissions. Every person has the same right to emit a definite amount of greenhouse gases, the same quota.

Desired emission quantities, related to different income levels, differ among persons. Some will emit below, others above the emission quotas. In the system proposed here emission quotas are tradable at a global *Climate Emergency Exchange* (or simply *Carbon Exchange*) market. In the Carbon Exchange high income/emission individuals, emitting more than their allotted quota, are buyers of emission rights (demand). Lower income/emission individuals, emitting less than their allotted quota, are sellers of emission rights (supply). The mission of the emission rights market is to find the equilibrium price, at which supply equals demand.

The fact that the carbon price is based on the personal decisions of individuals is the specific difference of the model proposed here. It differs from its closest relative, the Barnes et al. (2008) scheme, in that emission permits are not auctioned among intermediate emitters (producers, firms), but are traded between final users (individual consumers and public entities according to their constituencies). There is a direct connection between consumption, emission, and cost to the consumer, as every good and service has an "emissions tag" that indicates the cumulative amount of emissions incurred along its production, in a way similar to the cumulative determination of the value added tax.

Presented as economically and ethically superior, this scheme was still considered futuristic in Buzaglo (2009). Since then, the permanent revolution in information and communication technologies has made its implementation perfectly feasible, and not particularly complex or demanding in comparison with existing large systems. One can only hope that this or some other similar system will not need to wait until "… we reach a tipping point that opens a window of opportunity for embracing major changes," as put by Barnes et al. (2008).

Logical structure of the calculation

Our back-of-the-envelope model of global trading of personal emission quotas has a simple structure, made possible by the relatively recent research on the global distribution of incomes and greenhouse gas emissions by Chancel and Piketty (2015), updated and extended by Kartha et al. (2020) and Khalfan et al. (2023).

With global distribution data on emissions, with data on the science-based time path of total emissions that is consistent with keeping global warming below 1,5 degrees, and data on the expected increase in world population, we can take the first step in the logical chain of the recursive model.

Global emissions are (expected to be) 59,1 billion tons CO2e (CO2 equivalent) in 2024 – a more than 30 percent increase since Barnes et al. (2008) 16 years ago. They should decrease by 2/3, to 18,3 billion tons in 2040. The world population is today 8,1 billion, and is expected to be 9,2 billion in 2040. Given the path of sustainable global emissions, and the expected path of demographic growth, the permissible level of the individual quotas is 7,3 tons per capita in 2024; 6,7 in 2025; etc. (More details on the data and its sources in the following section.)

Given the total level of sustainable emissions, knowledge of the world distribution of emissions allows for determining the expected level of emissions by group of emitters (how much do emit the top 10 percent, the middle 40 percent, and the bottom 50 percent). Because of the extreme inequality of world

incomes and emissions, the average top 10 percent person emits much more than his/her quota, the middle group person is more or less in balance, and the bottom 50 percent individual has a large excedent. Persons of the bottom 50 percent group are sellers of emission rights, the top 10 percenters are big buyers, and the 40 percenters are small quantity buyers. Their demands and supplies meet each other at the Carbon Exchange, where the price of a unit CO2e gas emission right is determined.

The initial (2024) price is one of the given initial conditions of the simulation. (In the next section we explain in detail the basis of the choice of 50 USD as the initial price.) When the price is 50 USD, supply/sales by the bottom 50 percent emitters equals demand/purchases by the 10 + 40 percent top and middle emitters. The quantities sold times the price represent the increase in the incomes of the bottom group; the quantities purchased times the price represent the decrease in the incomes of the top and middle groups, motivated by the exchange.

There are thus changes to the initial, known global income distribution. These changes are traced by computing – given the expected trajectory of world income – the total incomes of each income group. The seller's group incomes are increased by the amount of sales, and the buyer's group incomes are decreased by the amount of purchases. These changed amounts, in relation to world income, make the global income distribution of the next period.

We have thus a change in the income distribution: an increase in the income share of the bottom 50 percent, and a decrease in the shares of the 10 and 40 percent top and middle income earners.

Incomes and emissions are related; a change in income causes a change in quantities emitted. A standard assumption about the association between income levels and gas emissions is that a percentual change in income is related to the percentual change in emissions by a constant elasticity. We adopt a plausible value of 1 for the income elasticity of emissions, close to the levels adopted by Chancel and Piketty (2015) and Kartha (2020). This means that the percentual change of group emissions in the period is equal to the percentual change in the group's income.

We have determined in this way the distribution of incomes and emissions of the next period. Together with the given exogenous data on sustainable world emissions, expected population and world income growth, they are the basis for the calculation of the income and emissions changes of the next period. A critical additional variable is the carbon price.

The model assumes a given carbon price as one of the initial conditions in year 2024. We assume that the price of carbon emission rights, starting from a given initial plausible level of 50 USD per ton, is determined in subsequent periods by supplies and demands in a carbon market. Suppliers in that market are the bottom 50 percent of low emitters. Demand is formed by the members of the 10 and 40 percent groups of high and middle emitters. On supply, we assume an inelastic supply (zero elasticity), as the group is close to subsistence and cannot afford to reduce consumption any further to respond to an increase in the carbon price. About demand, we assume that it is relatively elastic, with elasticity equal to (minus) one, as we consider changes over the relatively long period of one year. That is, the percentual decrease in the quantity demanded is equal to the percentual increase in price. From year to year, as their income and emissions increase, the (vertical) supply by the bottom 50 percent decreases, and the price augments (along the minus one elasticity demand curve). More inelastic (closer to zero) values for the elasticity of demand will result in steeper price increases and stronger redistributive effects. (More details on the carbon price mechanism in the next section.)

With known values for the income and emissions distributions, given the expected path of global emissions, population, and income, and given the assumed forms of demand and supply functions, we

are ready to calculate the values for the following year, and the next, and recursively so on for the period 2024 to 2040.

Exogenous variables, initial conditions and parameters

We give now some more details about the chosen values of exogenously given variables, initial conditions and parameters used in the calculation.

Sustainable level of global greenhouse gas emissions.
One of the most alarming conclusions of the Synthesis Report of the Intergovernmental Panel on Climate Change (IPCC 2023) is that adverse climate impacts are already more far-reaching and extreme than anticipated. Even limiting global warming to 1,5 degrees will imply serious hardship for hundreds of millions. Should warming reach between 2 and 3 degrees, the West Antarctic and Greenland ice sheets could melt almost completely and irreversibly over many thousands of years, causing sea levels to rise by several meters. The last time global temperatures exceeded 2,5 degrees above pre-industrial levels was more than 3 million years ago.

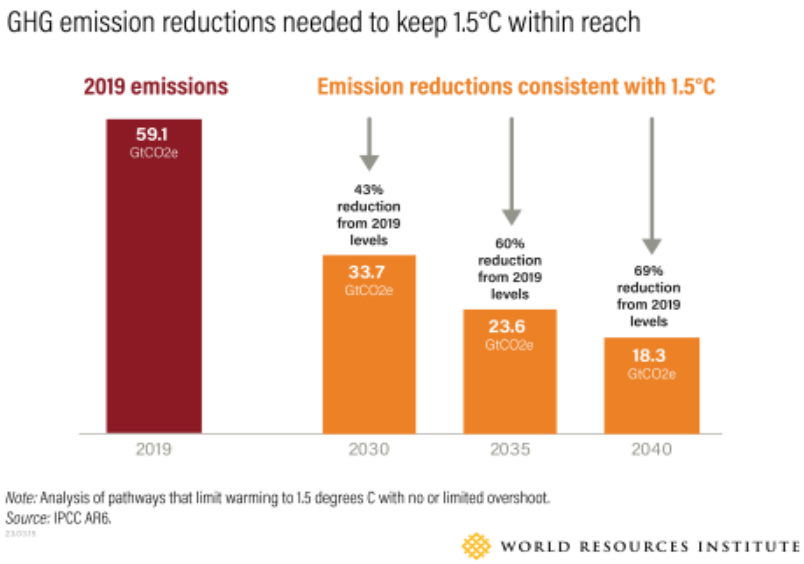
Changing course to limit global warming to 1,5 degrees will require deep emissions reductions in the near-term. Emissions should peak immediately or before 2025 at the latest. They should then drop rapidly, declining by 43 percent by 2030 and 60 percent by 2035 (relative to 2019, expected to be the same as the 2024 level).

In contrast, with the presently existing international approach, if countries achieved their climate pledges (Nationally Determined Contributions), global emissions would be reduced by just 7 percent from 2019 levels by 2030 (Fransen et al. 2022, see also UN 2023) – while a 43 percent reduction is required. A dramatic and immediate change of approach is necessary. By 2040 emissions should have been reduced by 69 percent.

Our simulation adopts the IPCC (2023) science-based emissions trajectory necessary for maintaining global warming below the 1,5 degree's level. The scheme is assumed to be implemented immediately as recommended there. 2024 is the start year, with the allocation of 59,1 billion tons of greenhouse gas emission rights.[3] Permitted global emissions rapidly decline (linearly) to 33,7 billion tons in 2030. They decline thereafter at slower rates, to 23,6 billion tons in 2035, and 18,3 billion in 2040 (see figure 1). 2040 is the final year of our simulation.

[3] Emissions were 59,1 billion tons in 2019 (see figure); they declined during the covid pandemics of 2020, and are expected to be about the 2019 level by 2024.

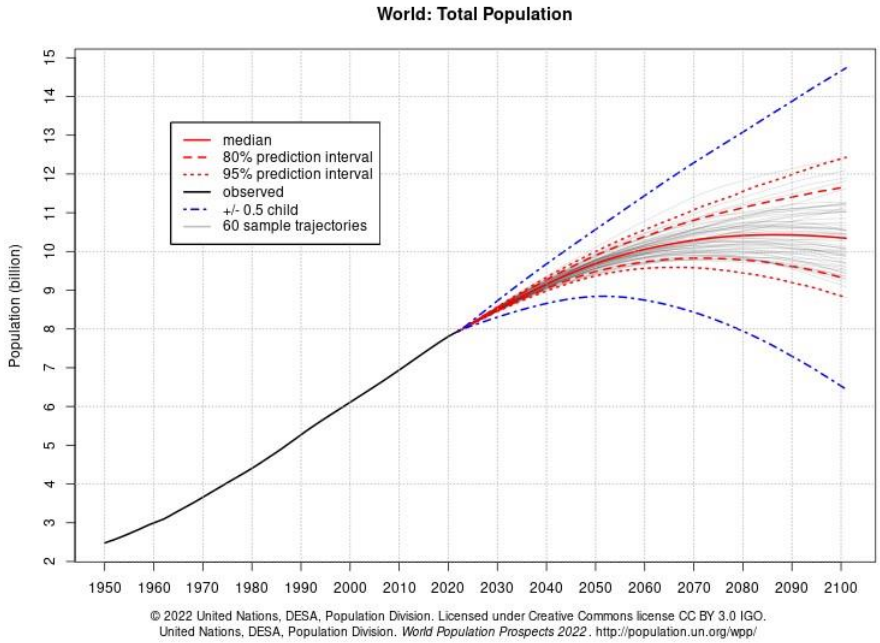
Figure 1.



Evolution of the world population.

World population is another given exogenous variable influencing the behavior of the model over time. Together with the permissible level of emissions, population size determines the quota levels. According to the United Nations World Population Prospects 2022, population in 2024 is 8,1 billion (UN 2022). Given the emission level of 59,1 billion tons in 2024, the resulting emission quota for 2024 should be 7,3 tons per inhabitant.

Figure 2.



From 8,1 billion in 2024 population is expected to increase to 9,2 billion in 2040. Our calculation assumes a linear population growth between those years. With permissible global emissions diminishing, and world population augmenting, emission quotas diminish rather steeply over time.

World income growth.
The pattern of redistribution, together with the global rate of growth, determines the pattern of average income growth of the different income groups. "Paretian redistributions" – that is, redistributions in which there are no declines in average incomes for any income group – require global income growth above a certain threshold.

There are both high and low expectations about future growth in circulation among economists, experts and the general public. There are "pessimistic" expectations of "secular stagnation," and "optimistic" expectations about a high-growth type of technology- and corporations-intensive ecological transformation. The "neutral" assumption of the simulation is that the world rate of growth in 2024-2040 will be the same as the world average growth rate in 2000-2022, that is, 2,9 percent per year (data source: World Bank). Incidentally, this estimate coincides for the first years with the World Economic Outlook: "The baseline forecast is for growth to fall from 3.4 percent in 2022 to 2.8 percent in 2023, before settling at 3.0 percent in 2024." (IMF 2023)

The simulation's initial (2024) expected world income is 105 trillion USD (IMF 2023). World income increases thereafter at the rate of 2,9 percent per year.

Initial carbon price.
Our simulation model posits a known carbon price as one of the initial conditions in year 2024. This initial carbon price has a key influence in the posterior evolution, as it sets the level at which the income redistribution process will proceed over time – the higher the initial price, the larger the value of the quota quantities sold by the bottom 50 percent over time.

In the determination of a plausible initial carbon price, the internationally existing systems, partial and heterogenous as they are, are of no avail: they cover only 15 percent of global emissions and span from less than 1 to 126 USD, and about three-quarters of the emissions that are covered by a carbon price are priced below 10 USD. Of no avail are also the existing "integrated assessment models," as they produce wildly diverse carbon-price trajectories (HLCCP 2017). The High-Level Commission on Carbon Prices chaired by J. Stiglitz and N. Stern however concludes that "…the explicit carbon-price level consistent with achieving the Paris temperature target is at least 40–80 USD by 2020 and 50–100 USD by 2030, provided a supportive policy environment is in place." (HLCCP 2017, p. 3)

For their part, Barnes et al. (2008) had assumed in their calculation a price of between 20 and 80 USD per ton emitted (28 and 113 USD today).

All these considerations taken into account, we choose a price of 50 USD per ton CO2e as the initial value for our central simulation, which aims to be a realistic, or plausible representation of the effects over time (2024-2040) of introducing a global system of individual tradable emission quotas.

The price function.
Our simulation assumes the simplest form of demand and supply functions. Supply is inelastic, that is, quantities supplied by the bottom 50 percent of low emitters, are fixed at the level of their excess emission rights. The demand function is assumed to be a constant elasticity function, of the form:

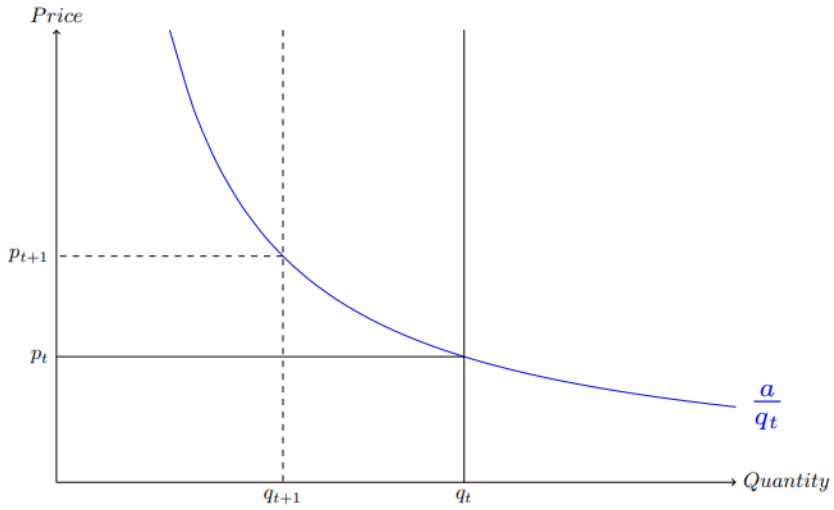
$$q_t = \frac{a}{p_t^{\varepsilon}} ,$$

that is, quantities q_t demanded in period *t* are equal to a constant a times the inverse of the price p in period *t* , raised to the power of ε, the price elasticity. With assumed demand elasticity equal to one, and expressing price as a function of quantity we have:

$$p_t = \frac{a}{q_t} .$$

In each period, given the parameter a, the quantity of rights offered, i.e., the excess emission rights of the bottom 50 percent, determines the price of carbon. With time, quantities supplied decrease, and prices increase (see figure 3).

Figure 3. .



We can see in the carbon price equation that the higher the parameter a, the higher the price. The a parameter indicates the distance of the equilateral demand hyperbola from the origin. If the price in the initial period is as we assume given, and if the supply of rights is given by the model, the parameter a is:

$$a = p_1 q_1 .$$

Given the exogenous initial price of 50 USD and the endogenously generated offered quantity of 25 billion tons in 2024, $a = 1250{,}0$ in the central simulation of the study.

Initial distribution of incomes and emissions.
Initial income and emission shares of the 50 (bottom), 40 (middle), and 10 (top) percent of the world population are provided by Khalfan et al. (2023) for year 2019. We assume that there have not been significant changes in distributions since 2019.

Table 1. Global shares of income and emissions, 2019 (percent)

	Top 10 percent	Middle 40 percent	Bottom 50 percent
Income distribution	55,0	38,0	7,0
Emissions' distribution	49,8	42,5	7,7

Source: Khalfan et al. (2023) (attached document: Data set one).

The world distribution of income is highly concentrated; measured by the Gini coefficient, the world's degree of inequality is close to that of the most unequal country (South Africa). Another intuitive idea of extreme inequality is given by the associated levels of income per capita: the top 10 percent's average income is 39 times the average income of the bottom 50 percent.

The world distribution of emissions among individuals or households follows closely the distribution of incomes. According to Chancel and Piketty (2015), the best way to explain emission variations at the individual or household level is to relate them to variations in income or consumption. They arrive at an average income elasticity of emissions of 0,9 across the studies they review. Kartha et al. (2022) apply the same methodology and arrive to similar results. Our central simulation adopts an elasticity of 1.

Parameters of the central simulation.
We have commented along the text on the adopted values of the different parameters of the calculation model. They are (1) the price elasticities of supply (equal to zero), and demand (minus one), (2) the income elasticity of emissions (equal to one), and (3) the a parameter indicating the level of the demand function (a = 1250). In fact, given the initial carbon price, the a parameter is given.

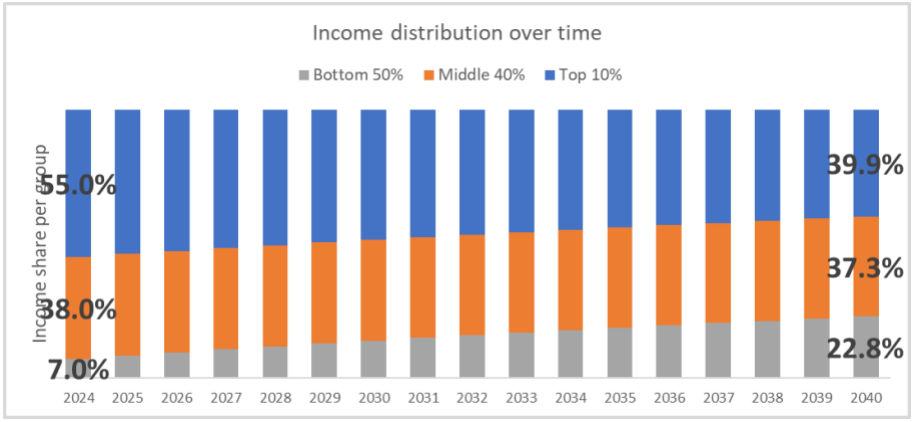
Simulation results

When run with the relations, initial values, and parameters described above, the simulation model gives some encouraging results. The perhaps most interesting result of the individual tradable quota system is the clear effect on the world income distribution.[4]

Global income shares 2024-2040
Global income distribution shows a progressive, clear change away from extreme inequality. If we look at changes from the initial (2024) to the final (2040) distribution we see some interesting characteristics.

[4] The calculation and its results are documented in Excel spreadsheets that can be obtained from the authors by request.

Figure 4.



Source: The authors.

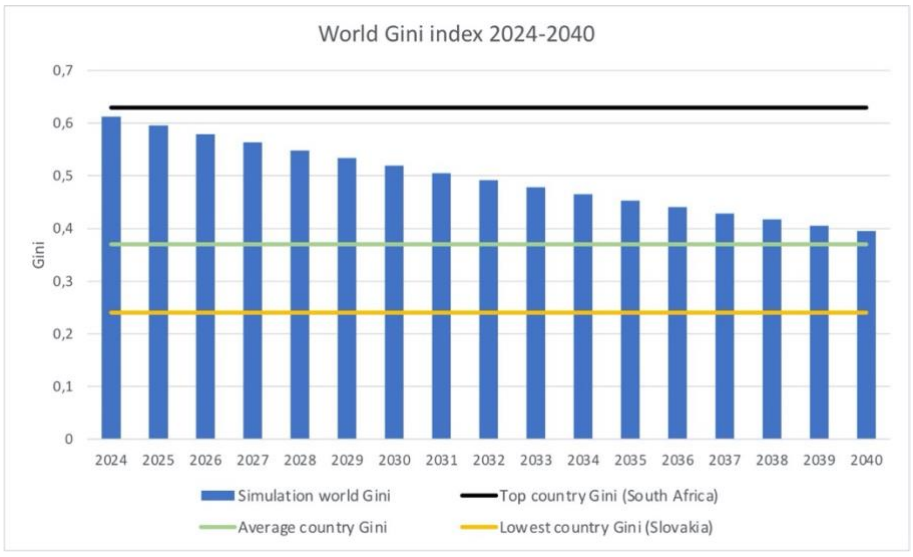
Redistribution proceeds basically between the top 10 percent and the bottom 50 percent group. The 40 percent middle group's share is more or less unchanged.

There are important changes in the shares of the top and bottom groups. The top 10 percent's share decreases by 30 percent, while the share of the bottom 50 percent triplicates. A given percent decrease in the top earners' share implies a much larger percent increase for the low-income group's share. The top 10 percent income group is the main demander of emission rights; the bottom 50 percent group is the only supplier. The middle 40 percent group, a very small demander, keeps its place in the income distribution.

Changes in the global Gini

The Gini index (varying between 0 for total equality and 1 for total inequality) allows for some interesting observations on the changes in the degree of inequality associated with the emergency plan.

Figure 5.



Sources: Authors' calculation of Global Gini, and World Bank for (most recent) country Gini values.

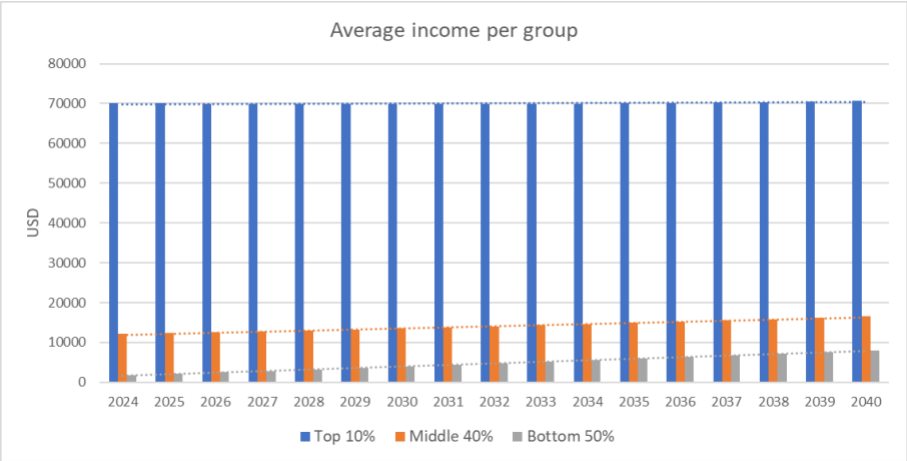
The global Gini of the simulation shows a significant 36 percent decline in inequality between 2024 and 2040. From the present 61 percent, close to the highest country-level of inequality (South Africa, most recent value, 63 percent), it declines to 39 percent in 2040. This later level of inequality is approximately the present country-average level of inequality. Countries such as Latvia, Italy, and Portugal are close to the country-average level of inequality.

Evolution of per capita incomes and quota exchanges

Per capita incomes 2024-2040

The evolution of per capita incomes of the 10, 40, and 50 percent groups over time shows an interesting feature: significant downward redistribution occurs without declines in the average income of any group (see figure). This type of "Paretian redistribution" could potentially increase the acceptability of the scheme among the 10 percent of the world population with the highest incomes. Also, governments in rich countries may be less inclined to oppose tradable quotas schemes than they resist financial support of climate policies in poor countries, understood by them as "aid."[5]

Figure 6.



The importance of the changes in living standards and conditions may be better perceived if we look at the rates of change in per capita incomes for each group from the start to the end of the climate emergency plan.

[5] One could also formulate the converse argument: the implicit subsidization of the emissions of high emitters by low emitters is a form of aid.

Table 2: Average incomes by group

	2024	2040	Annual cumulative growth rate
Top 10 percent	70 074	70 719	0,0 percent
Middle 40 percent	12 102	16 536	1,9 percent
Bottom 50 percent	1 784	8 073	9,9 percent
Ratio top/bottom	39	9	-9,6

Source: The authors

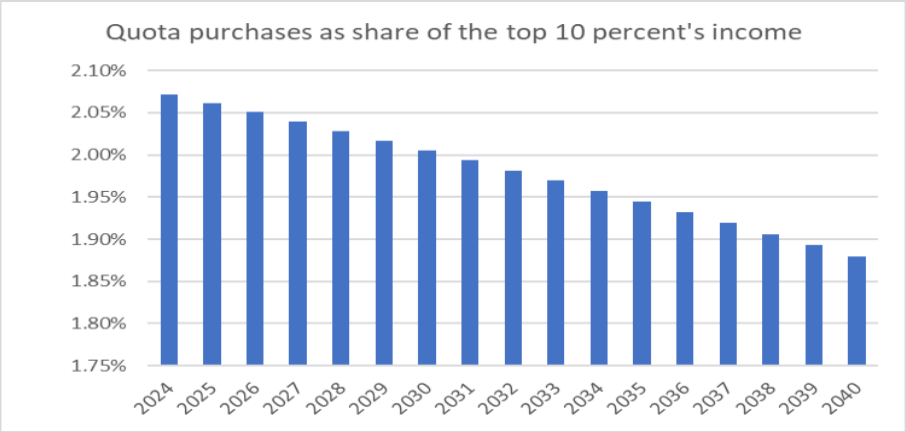
The simulation reveals an important betterment for the poorer half of humankind. The average income of the global 40 percent middle class also increases, although at a somewhat slower rate than the expected world GDP rate of 2,9 percent. The extreme initial disparities in average incomes between the top and bottom groups have been reduced radically (see top/bottom ratios).

The poorer half of world citizens are clear beneficiaries of the individual quota trading system. The 40 percent world middle class also benefits on average – the lower middle class more than the upper middle groups. This makes an important potential majority of at least 50 to 70 percent approval of the scheme. To increase the probability of adoption, it would be necessary that this potential majority becomes a factual majority in the general opinion. It would also be necessary that governments with large majorities pertaining to the world's bottom/middle groups represent the general opinion and interests of their constituencies.

Quota purchases and the top 10 percent incomes

Does this scheme impose an exorbitant, unaffordable cost to the top 10 percent quota buyers? The simulation says no. The purchase of emission rights represents 2,07 percent of the top 10 percent's income in 2024, and decreases gradually to 1,88 percent in the final year of 2040 (see Figure). It does not seem to be an exorbitant price for avoiding the types of scenarios described in the many studies by the climate research community – see for instance one of the latest and largest, IPCC (2023).

Figure 7.

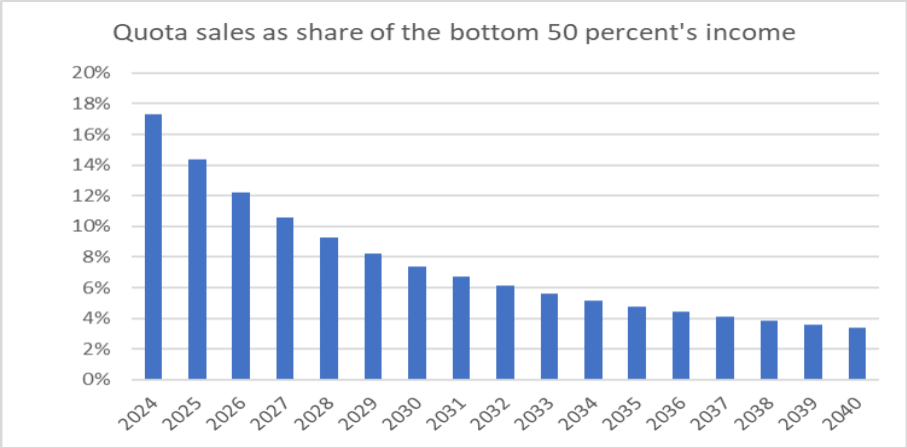


Since 2009, global climate talks have agreed on the mobilization, by 2020, of 100 billion USD a year for developing countries to reduce emissions and adapt to climate change. The 100 billion USD goal has not been reached – in 2020, high income countries provided 83,3 billion USD (IEGCF 2020).[6]
100 billion USD is of course "peanuts" when compared to the (2024) 1 176 billion USD in rights purchases that the 2,07 percent of the top 10 percent's total income (of 56 760 billion USD) represent as income transfer to the bottom 50 percent.

It seems unlikely that the "aid" type of approach by governments permanently confronting "budgetary consolidation" problems may succeed in controlling climate change and/or reducing inequality.

Quota sales and the bottom 50 percent incomes
For the bottom 50 percent group, on the other hand, the sale of emission rights is a relatively important income source.

Figure 8.

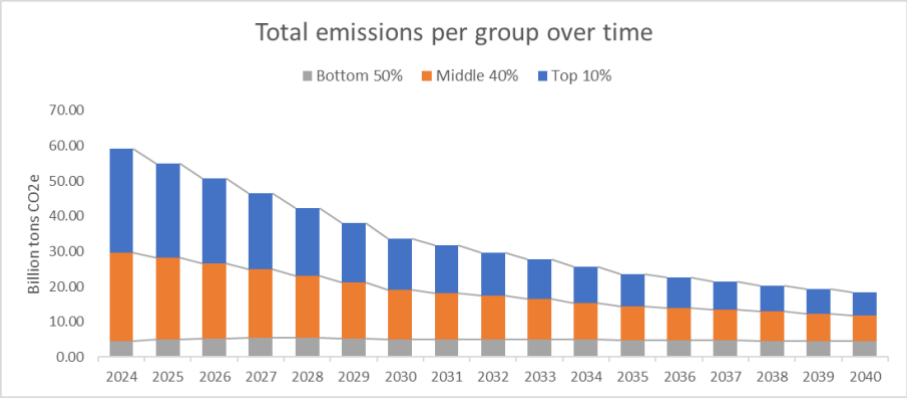


The sale of emission rights by the bottom 50 percent represents an initially important part of their incomes. This share decreases gradually with the increase in their incomes – and emissions.

Emissions over time
Total emissions per group
Total emissions follow the science-based path put forward by IPCC (2023) for emissions to be compatible with the 1,5 degree's target. From present (2024) 59,1 billion tons CO2e, they decline to 33,7 billion in 2030, to 23,6 billion in 2035, and 18,3 in 2040. Of course, this assumes that the quota system has had an intelligent design and was implemented effectively – more on this in the following sections.

[6] Oxfam (2022) estimates the value of climate finance provided was only around a third (USD 21–24,5 billion) of that reported.

Figure 9.



The bottom 50 percent as a group maintains its level of emissions, which means, with a declining permissible total level of emissions, that their share augments over time – from 7 percent in 2024 to 22 percent in 2040 (see table below).

Table 3. Global shares of emissions in 2024 and 2040 (percent)

	Top 10 percent	**Middle 40 percent**	**Bottom 50 percent**
Initial 2024	50	43	8
Final 2040	35	41	24

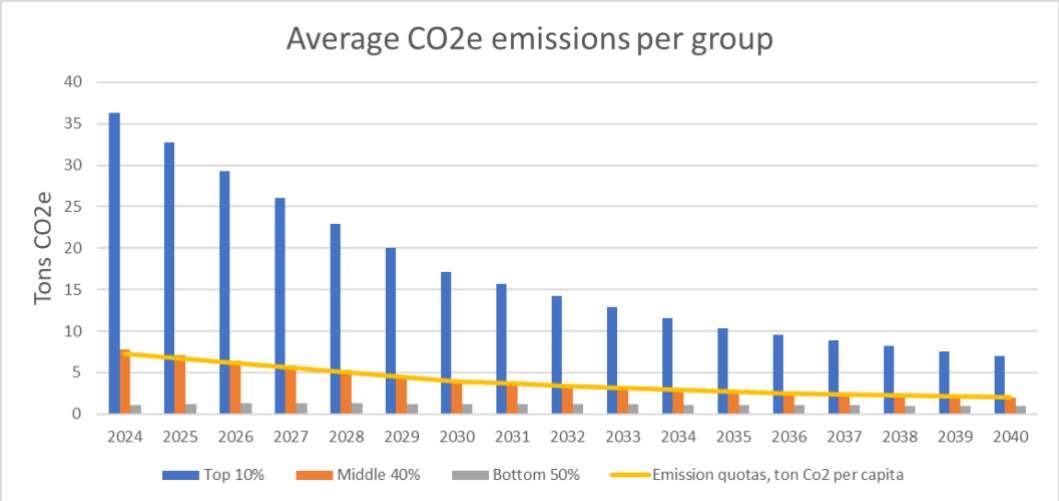
Source: The authors

The level of emissions is closely associated with the income level by the income elasticity of emissions (equal to 1). The distribution among the top, middle and bottom groups of emitters is then similar to the distribution of incomes over time. The middle group's share is more or less unchanged, the bottom group triplicates its share, while the top 10 percent´s share decreases by one-third.

Per capita emissions per group

Most interesting is perhaps to see what happens with the groups' per capita emissions. In 2024 the top 10 percent's per capita emissions are 32 times the average emissions of the bottom group, and 5 times the quota. The emission quota represents the sustainable level of emissions if all individuals were emitting at the same rate. It is a level compatible with the same volume of emissions by all individuals, that is, it is a generalizable level.

Figure 10.



Individual emissions above this level are not generalizable, that is, it is not sustainable, or permissible, for all individuals to emit above this level. Non-generalizable behavior is unethical from the Kantian ethical perspective (the *categorical imperative*). If the (2024) average emission level of the top 10 percent (36,3 tons per person) were to be generalized to the whole world population, the resulting world emissions would be 294 billion tons, five times the present level. Greenhouse gas emissions of 294 billion tons are certainly associated with temperatures incompatible with most life forms on earth.

Such non-generalizable behavior is also unethical from the rather universal "golden rule" perspective: Do not do unto others what you do not want others to do unto you – do not damage the atmosphere of others if you do not want others to damage yours.

The type of quota trade mechanism proposed here solves the ethical dilemma by the consensual exchange of personal quota rights. The top 10 percent emitters are the main purchasers of the emission rights sold by the bottom 50 percent. In the simulation, the 10 percenters' emissions decline steeply, but by 2040 their emissions are still 7 times the average emissions of the bottom group, and more than 3 times the world quota.

Comments on implementation

How probable is the implementation of a climate emergency plan with the characteristics proposed here? Not much, as the opinion of the day is inclined to consider Artificial Intelligence a greater danger for humanity than Artificial Warming or Artificial War. In such conditions, the most probable form of evolution will be dominated by the Hobbesian struggle of states defending what they think are their interests.

This "realist" view, however, can be discarded out of hand. In the present conditions, the Hobbesian path is uninteresting: the triumph of Warming or the victory of War cannot be contemplated, because there is no one there to contemplate. They are paths of annihilation.

That is, we have a certain rational support for the alternative of analyzing the improbable, yet possible and desirable, forms of organizing the establishment of a system capable of rescuing humankind from the danger of climate warming and the scourge of inequality.

The first level of a strategy towards implementation should be the level of research. There is an ample amount of research on the economics of climate warming and how to stop it.[7] This research is currently dominated by narrow national perspectives that do not lead very far. One can even say that this type of research is in part responsible for the lack of progress since climate change became an internationally recognized problem. Global warming is a global problem and the approach should be global. Research of high ethical and scientific standards is needed.

The second level is public opinion. This level is decisive and many movements are flourishing everywhere. These movements are supporting independent research which in turn nourishes advanced and knowledgeable programs for change.

The third level is the level of government. Containing global warming would save all humanity from the risk of catastrophe. Particularly, as we said in a previous section, individual tradable quota systems would economically benefit a clear majority (50-70 percent) of the world population. It would also benefit a majority of the population of a majority of states. A mobilized public opinion in those countries should influence their governments; mobilized governments should influence the United Nations and other international organizations. A vote at the UN General Assembly should demand the introduction of a climate emergency plan with desirable characteristics.

The concrete, implementable form of the system can only be given in sketchy, general lines. Every individual should have a cell phone or electronic card, in which a periodic (daily, weekly or monthly) quota amount (quota x price) is credited. Administrations and public entities are allotted quota amounts in proportion to their constituencies. The price of all final goods and services includes the total accumulated volume of intermediate emissions incurred times carbon price (cumulated emissions incurred in every step of the production process, similar to the value added tax). Individuals with unused quota pay with a discount of the carbon content (CO2e times price). Individuals with exhausted quotas pay the whole price. The price of a unit of CO2e is determined (daily, weekly or monthly) at the global Carbon Exchange, where demand by individuals above their quotas meets supply by individuals below their quotas. The system would also include the supply of negative emissions by different kinds of CO2e absorption investments. The design of the market should block the possibility of speculative manipulation, fraud and the like.

The scheme would induce great changes in economic structures which are outside the scope of our calculations. But increased prices and reduced demand for CO2e-intensive goods and services will induce reductions in those sectors – and the development of new productive alternatives and new technologies. This will create redundancy in contracting sectors and employment opportunities in new branches and expanding sectors. Investment policy should accompany and guide the new structural change, and social and educational policy should help in the reorientation and support of new employment.

The individual tradable quota system will also induce changes in the spatial configuration of the world economy. Redistribution will enlarge the markets of quota net-seller areas, mostly in low- and middle-income economies. A common world price for carbon will induce investment in CO2e absorption in low-cost, impoverished economies, and promote increased efficiency in the spatial allocation of abatement projects.

[7] A broad survey of research in the field (Kangxin et al. 2023) reviews 1002 articles, exclusively based on computable general equilibrium models.

The emergency market plan requires flexible economic structures and institutions. It also assumes effective, enlarged investment policies for structural transformation, and well-designed strategies for supporting redistribution.

Final comments

When presenting their proposal of an Earth Atmospheric Trust (Barnes et al. 2008), the authors were well aware that the control of climate change will require drastic departures from business as usual, and that their idea "may seem idealistic or visionary today, but that could become realistic once we reach a tipping point that opens a window of opportunity for embracing major changes".

It does not seem that a tipping point has been reached yet. Climate warming does not seem to have entered the stage in which the world rapidly evolves into a universal oven. Not yet a tipping point, but very close to it, according to UN Secretary-General António Guterres: "The era of global warming has ended; the era of global boiling has arrived." He says: "Dramatic, immediate climate action is needed." The type of policy analyzed in our study confronts the climate crisis by addressing the inequality crisis. The present "crisis of extreme inequality" described by Jayati Ghosh, Joseph Stiglitz, and others (quoted in the Introduction) must be addressed for the climate crisis to be solved.

In the system proposed in our study, the sustainable world total of emissions is allocated in equal personal quotas to all individuals. All final goods and services have a tag indicating the CO2e content of the item.

In such a system the bottom 50 percent, a very low emitting group, would sell their excess quotas to high emitters and earn an additional income. The top 10 percent of high emitters, would need to buy the quotas above their personal allowances at the for that aim created Carbon Exchange. The middle 40 percent would in most circumstances be more or less in balance.

The system has then potentially the support of the bottom 50 percent, and perhaps also the support of the lower half of the global middle class. It is even possible that many among the richer 10 percent may find that life is more important than privilege, and support the scheme.

The simulation of such an emergency plan against global warming and inequality shows that, if carefully implemented, it would produce some hopeful effects. Global income distribution, initially (2024) as unequal as that of the most unequal among countries, is gradually reduced to the country-average level of inequality – a 36 percent decline in inequality as measured by the Gini coefficient. Also interesting is that the redistribution process can be considered "Pareto sanctioned," as it does not imply the decline of the average income of any group – while the average income of the bottom group increases by a factor of 4,5.

That is, the sale of emission rights implies an important increase in the average earnings of the bottom 50 percent group – it represents (in 2024) 16 percent of their income, or about 309 USD a year per person.[8] As the incomes of the bottom group increase, the sale of emission rights declines over time as a share, but not in absolute terms.

[8] For the 648 million persons below the extreme poverty line of 2,15 USD a day it would represent about 39 percent of their incomes in average (https://www.worldbank.org/en/news/factsheet/2022/05/02/fact-sheet-an-adjustment-to-global-poverty-lines#2).

Our results are based on the reduction path for CO2e emissions compatible with keeping global warming below 1,5 degrees put forward by the Intergovernmental Panel on Climate Change (IPCC 2023), produced by hundreds of scientists and experts. The quotas distributed among the world population are equal shares of that total emissions' path. Our calculations assume that the system put in place – similar to the value added tax – is an effective one, with minimal filtrations. The same applies to the Carbon Exchange, which should not be susceptible to manipulations of any kind.

The quota system, under these effectiveness assumptions, ensures that total CO2e emissions follow the sustainability trajectory. Income redistribution through sales and purchases of emission rights at the Carbon Exchange produces changes in the distribution of emissions. The emission share of the top 10 percent declines gradually, by one-third in 2024-2040, while the bottom 50 percent's share increases by a factor of 3 – although the level of emissions of the group is constant. The reduction of emissions occurs basically among the top 10 percent group – and much less so among the 40 percent's group.

This puts on the emergency plan an ethical seal of approval. Individual emissions above the generalizable level of the emission quota – that is, above sustainable levels of individual emissions – infringe widely accepted ethical rules such as the Kantian *categorical imperative* or the universal "golden rule." The emergency plan's reduction of emissions occurs among the top 10 percent, whose emissions are far over the sustainable quota level – 4 times the quota in 2024, and 3 times in 2040.

Our study did not focus on the effects of the emergency plan on the distribution of incomes and emissions in particular countries. Yet the redistributive process initiated at the global level by the emergency plan produces simultaneous effects at the level of national economies. Individuals belonging to the global top 10 percent of buyers are citizens of diverse countries; the bottom 50 percent of sellers are citizens of many countries. Countries with high inequality levels experience larger reductions in inequality than more equal economies. Large "exports" of emission rights by low-income countries may significantly increase their national incomes. To more precisely determine how the redistributive process proceeds in every country could be the object of further research.

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Stocking Up on Wealth … Concentration

Blair Fix
[York University]

Abstract

It turns out that like the rest of us, billionaires experience wealth inequality. (Individuals who top the Forbes billionaire list are far richer than those at the bottom of the list.) Interestingly, this billionaire wealth concentration fluctuates over time … in tight correlation with the movement of the stock market. Why? A plausible reason — explored here — is that stock indexes like the S&P 500 are unwitting indicators of corporate concentration. And corporate concentration, in turn, seems to drive the concentration of individual wealth.

Studying the rich

There's an old joke that economics is too important to be left to economists. In the same vein, I think rich people are too important to be left to the self-help industry.

Yes, the popular appeal of you-can-get-rich-too books is obvious. But what's not obvious is why so few social scientists study wealth. Clearly, the public thirsts for serious inquiries about the rich. (Thomas Piketty's 2014 opus on inequality was a bestseller.) But for the most part, social scientists are content to focus on 'poverty' and let the self-help gurus wax about 'wealth'.

The irony, in my view, is that poverty and wealth are two sides of the same coin. Concentrated wealth begets concentrated poverty. Still, there is an asymmetry between the two extremes. As a rule, poor people have little power, which means they cannot be blamed for their own poverty. But almost by definition, the rich wield power to their own benefit, which means they create the conditions of their own opulence … and everyone else's misery.

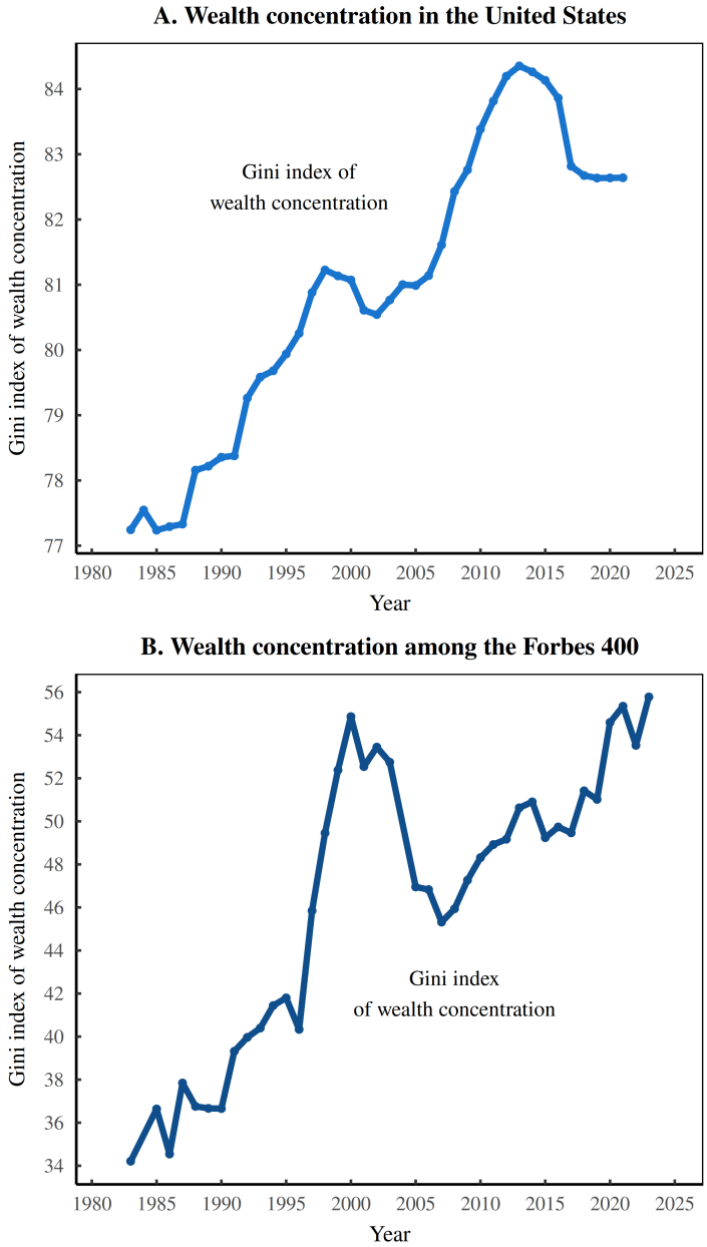
Given their power over society, I find myself on a research kick studying rich people (Fix, 2023a, 2023b, 2023c; Fix & Cochrane, 2023). This article concludes the binge with a look at what drives wealth concentration among the richest Americans. I find that there's a straight line between wealth concentration, corporate consolidation, and the strategy of 'buying, not building'. In short, Peter Thiel is correct when he says that "competition is for losers" (2014).

A neoliberal experiment

Speaking of competition and losers, Ronald Reagan set the tone of the neoliberal era when, in 1981, he fired 11,000 striking air-traffic controllers (Houlihan, 2021). The message? Workers were losers who would be subjected to the discipline of competition. Reagan called it 'morning in America'. But really, it was 'morning for American big business'.

Today, we are well into the next-day's hangover, and we know how the party played out. For workers, it was a disaster. But for the rich, it was an incredible boon. Wealth didn't trickle down so much as it got catapulted up. The result, as Figure 1A shows, was a relentless rise in the concentration of American wealth.

Figure 1: A neoliberal experiment — rising wealth concentration among Americans, and American elites. The top panel shows the Gini index of wealth concentration among all Americans. The bottom panel shows the concentration of wealth among the 400 richest Americans. (For more details, see the Appendix.)



Interestingly, as wealth got catapulted from the poor to the rich, it also got transported from the mega rich to the supremely rich. This is the story told by Figure 1B. Here, I've focused on the richest Americans — the folks who grace the Forbes 400 list. Even here, among the upper crust of elites, wealth has grown more concentrated. Why?

As you'll see, the culprit seems to be the stock market. But before we interrogate our suspect, let's have a quick look at the brethren of the American rich — the globetrotting, jet-fuel belching species otherwise known as Earth's billionaires.

A billionaire hammer

They say that when you've got a hammer, everything looks like a nail. Lately my hammer has been data from Forbes.

Backing up a bit, the reason I'm holding a Forbes hammer is that since late 2021, I've been scraping Forbes' global billionaire data. The endeavor started with an email from my colleague DT Cochrane, who pointed out the value of having a daily snapshot of billionaires' wealth. I concurred, and set some billionaire-scraping code in motion. The result is that today, I have just over two years' worth of daily data about the wealth of the world's billionaires.

Billionaires. The word itself evokes a kind of class coherence. But the reality is that billionaires are a deceptively unequal group. For example, the world's billionaires have a median wealth of about $2.4 billion. And to most people, that seems like a tremendous fortune. But compared to the *$240B* wealth of the world's richest man, Elon Musk, $2.4B is chump change. Recently, Musk spent 16 times more than that just to buy a social-media company and set it in fire.

The message is that billionaire wealth is both spectacularly large and spectacularly concentrated. And as it turns out, this concentration varies with a coherent pattern. Figure 2 shows the picture over the last two years. Something is driving billionaire wealth concentration up and down. What could it be?

Figure 2: Wealth concentration among the world's billionaires.
The blue curve shows the Gini index of wealth concentration among the world's billionaires, measured daily since late 2021. Data is from the Forbes real-time billionaires list. (For more details, see the Appendix.)

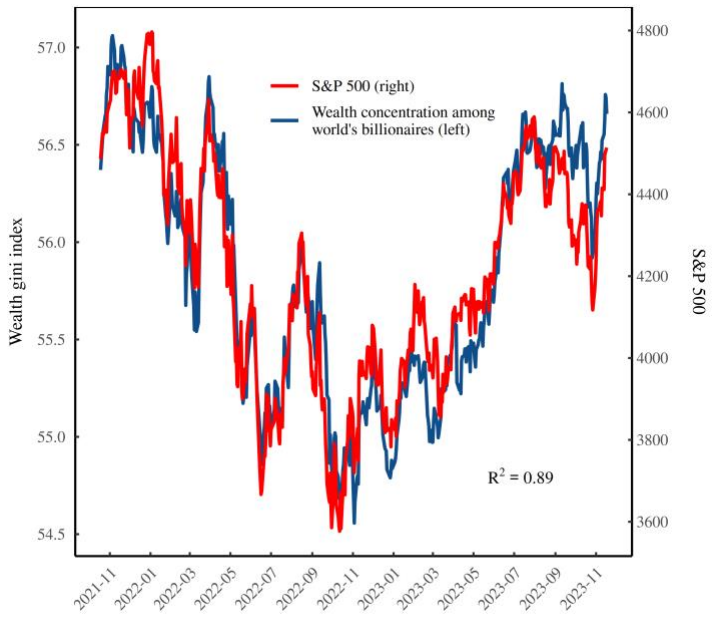
The stock market confesses

The physicist Richard Feynman claimed to dislike reading scientific papers because, as his biographer James Gleick put it, "every arriving paper was like a detective novel with the last chapter printed first."[1] The format, Feynman complained, spoiled the fun of doing detective work.

With apologies to detectives like Feynman, I'm about to spoil the fun. When it comes to wealth concentration among billionaires, the main driver appears to be the *stock market*.

To be fair, the culprit was fairly obvious. Almost without exception, the richest individuals have their fortunes invested in corporate property rights — rights which are traded on the stock market.[2] So if we want to understand inequality in these investments, the stock market is the primary suspect. Still, you might be surprised by the detail of its testimony. In Figure 3, I bring the stock market in for questioning. 'What drives billionaire wealth concentration?' I ask. The stock market squeals, 'I do! I do!'

Figure 3: The stock market confesses — billionaire wealth concentration moves with the S&P 500.
The blue curve shows the Gini index of wealth inequality among the world's billionaires. The red curve shows the movement of the S&P 500 — a popular index of US corporate stocks. (For more details, see the Appendix.)



[1] Commenting on Feynman's distaste for the way scientific papers are organized, James Gleick writes:

… [Feynman] could not bear to sit down with the journals or preprints that arrived daily on his desk and piled up on his shelves and merely read them. Every arriving paper was like a detective novel with the last chapter printed first. He wanted to read just enough to understand the problem; then he wanted to solve it his own way (Gleick, 1993).

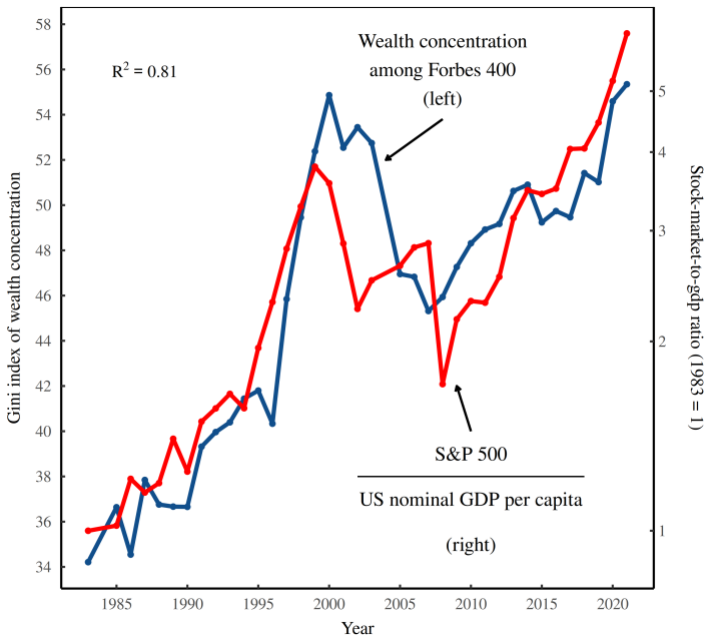
[2] True, some billionaires own private companies, so their investments are not traded on the stock market. But even then, Forbes looks to the stock market to capitalize the value of private property. (To guess the value of private businesses, Forbes takes their profit/sales and capitalizes it using the average discount rate found in the market.)

A longer track record

Looking at the confession in Figure 3, the detective in me worries that it's too good to be true. Seriously, the fit between the S&P 500 and billionaire wealth concentration is so tight that it makes me fret that I've flubbed the analysis. Fortunately, our suspect has given other confessions.

Turning to the United States, we find a similar connection between elite wealth concentration and the movement of the stock market. Figure 4 shows the record. The blue curve plots the level of wealth concentration among the Forbes 400. The red curve plots the rise of the S&P 500, measured relative to US GDP per capita. Again, it's a compelling testimony. Elite wealth concentration seems to be driven by the stock market.

Figure 4: A longer track record — the S&P 500 predicts changes in wealth concentration among the Forbes 400.
The blue curve plots the Gini index of wealth concentration among the Forbes 400. The red curve plots the rise of the S&P 500, measured relative to US nominal GDP per capita. (For more details, see the Appendix.)



Within the confession, a (math) puzzle

At this point, it's tempting to close the case. When questioned about elite wealth concentration, the stock market confessed to the crime. And yet, if we think more deeply about the testimony, we find that it comes with a puzzle.

The mystery starts when we realize that the stock market is not one thing. It is many things — many corporate stocks that each have a mind of their own. Now, when we look at the S&P 500, we're measuring the average movement of these stocks. Fine. But the thing about *averages* is that they typically tell us nothing about measures of *spread*. Yet elite wealth concentration is definitely a measure of spread.

And so we have a mathematical puzzle. The stock-market average seems to 'know' about something that it shouldn't. Why?

Growth through inequality

To unwrap our stock-market puzzle, we need to review some math. In general, measures of spread are unrelated to measures of central tendency.[3] There is, however, an exception. It happens when *growth* is driven by *inequality*.

To illustrate this exception, we'll turn to a simple thought experiment. Imagine two people, Alice and Bob, who both have $1 in their pocket. Over time, we hand out money to the pair, thereby increasing their pool of wealth. But the catch is that we give the money exclusively to Bob.

Table 1 shows how these handouts affect Alice and Bob's average wealth, along with their wealth concentration. As we hand money to Bob, Alice and Bob's average wealth grows. But this average is driven not by shared prosperity, but by rising inequality. Importantly, in this situation of one-sided handouts, the wealth *average* becomes an (unwitting) indicator of the level of wealth *spread*.

Table 1: Growth through inequality

Year	Alice's wealth	Bob's wealth	Average wealth	Wealth concentration (Gini index)
1	$1	$1	$1	0.00
2	$1	$3	$2	0.50
3	$1	$9	$5	0.80

Note: To measure wealth concentration, I've used the sample-size adjusted Gini index. For details, see Deltas (2003).

Putting on our detective hats, it seems likely that similar behavior — what I'm calling 'growth through inequality' — explains our stock-market results. We've found that the S&P 500 index (an average) is connected to levels of elite wealth concentration (a form of spread). But this connection only makes sense if the S&P 500 is an (unwitting) indicator of stock-market inequality.

So with inequality in mind, we need to peer inside the S&P 500 to see how it gets made.

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[3] To be more technical, measures of central tendency are typically unrelated to *scale-independent* measures of spread. For example, the standard deviation is a common, scale-*dependent* measure of spread which *is* related to the mean. But the coefficient of variation (the standard deviation divided by the mean) is not related to central tendency because it is scale independent.

The Gini index is a good example of a scale-independent measure of spread. If you multiply everyone's wealth by a constant factor, it won't affect the Gini index. This is by design. But for what it's worth, some people think this design feature is a bug. For example, anthropologist Jason Hickel (2019) argues that we should use measures of inequality that are sensitive to *absolute* differences in income/wealth. I disagree, for reasons discussed in Fix (2020).

Inside the S&P 500

In simple terms, the S&P 500 tracks the *total market capitalization of the 500 largest US firms*. For the math averse, you can take this fact and skip to Figure 5. But for the equation lovers, here are the details.

The S&P 500 tracks the average stock price of five hundred of the largest US companies.[4] Importantly, S&P *weights* the average according to each company's size, measured in terms of outstanding shares. Here's the math. Let P_i be the stock price of company i. And let Q_i be the number of outstanding shares in this company. Summing over all 500 companies, the S&P 500 is then:

$$\text{SP500} \propto \sum_i P_i \times Q_i$$

Importantly, when we multiply stock price P by the number of shares Q, we are calculating a company's *market capitalization*, K. So in simplified terms, the S&P 500 sums the market capitalization of the 500 largest US firms:

$$\text{SP500} \propto \sum_i K_i$$

Backtracking slightly, note that I've used the '$\propto$' symbol (which stands for 'proportional to') in the formulas above. I've used it because I'm excluding some adjustments that go into calculating the actual S&P 500 index. Since these adjustments don't affect my argument, I'm going to ignore them.[5]

Forging ahead, our equations indicate that the S&P 500 is proportional to the total market capitalization of the 500 largest US companies. On that front, the empirical evidence suggests the same thing, as shown in Figure 5.[6]

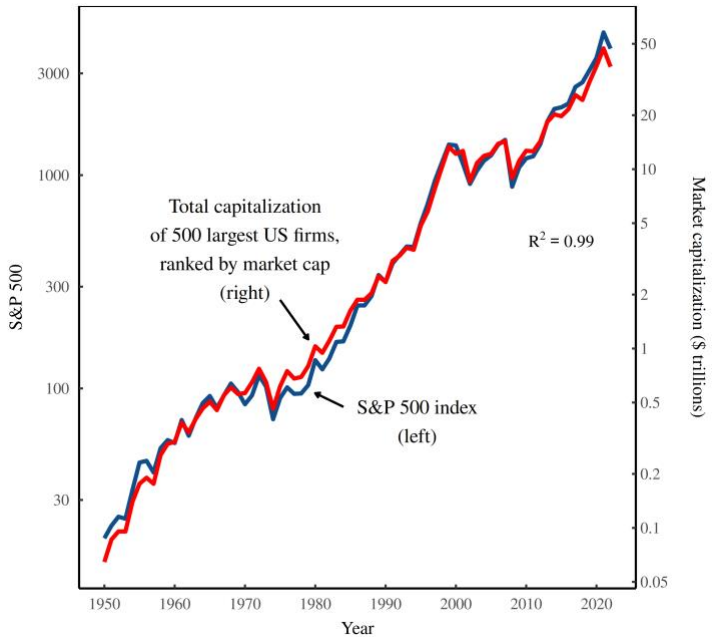
[4] Interestingly, the selection of S&P 500 companies isn't done simply by ranking market cap and taking the top 500 companies. Instead, S&P has a committee (whose membership is kept secret) that makes arbitrary changes to the list, swapping firms at their discretion (De Silva, 2019). So why the committee approach? Perhaps because it makes S&P brass feel important, and justifies their (presumably) fat pay checks.

[5] There are two major adjustments that go into making the S&P 500 index. First, changes in the index composition are not allowed to affect the index itself. So if Company A gets added to the S&P 500 and Company B gets removed, the swap can't change the resulting index.

Second, the S&P 500 is not affected by the issuance of new stocks. So if Apple increases its market cap by selling more shares, the change won't affect the S&P 500. For more details about these adjustments, see page 7 of S&P Dow Jones (2024).

[6] More equations for the math oriented; the S&P 500 index scales with market cap according to a power law. Let K_{500} be the total capitalization of the 500 largest US firms. The S&P 500 index (from 1950 onward) is then defined by the following equation: $SP500 = 5 \cdot (K_{500})^{0.84}$. The existence of this power-law scaling is due to the adjustments that go into calculating the S&P 500.

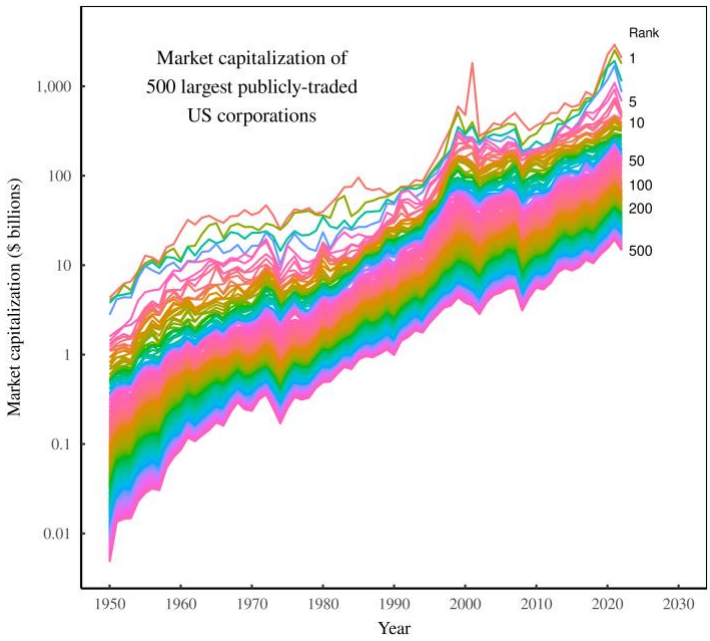
Figure 5: The S&P 500 is an adjusted index of market capitalization.
The blue curve shows the S&P 500. The red curve plots the total market capitalization of the 500 largest publicly-traded US firms, ranked by market cap. To a first approximation, the two curves are identical, meaning the S&P 500 is an adjusted index of capitalization. (For more details, see the Appendix.)



The reason I'm bothering with this stock-index math is that I want to look at the *components* of the S&P 500. We now understand that these components are basically the market capitalization of the 500 largest US firms. Let's use this knowledge to peer inside the S&P sausage.

Figure 6 shows a different view of the S&P 500. Rather than *summing* the market capitalization of our top 500 firms, I've plotted the market-cap values for *each* firm. Then I've connected the values with a pretty rainbow that shows the evolving composition of the S&P 500 index. Besides being nice eye candy, this market-cap rainbow (presumably) holds the key to understanding why the S&P 500 relates to elite wealth concentration.

Figure 6: Inside the S&P 500.
This figure shows the (approximate) components of the S&P 500 — the market capitalization of the 500 largest US corporations. Each colored line tracks a specific capitalization rank (not a specific corporation). Note that the vertical axis uses a log scale. (For more details, see the Appendix.)



Growth through corporate concentration

Having dissected the S&P 500, we're ready to return to our original question: why does a stock-market *average* tells us about a measure of elite wealth *spread*? The answer, it turns out, is that what appears as stock-market 'growth' is in part, an artifact of rising stock-market *concentration*.

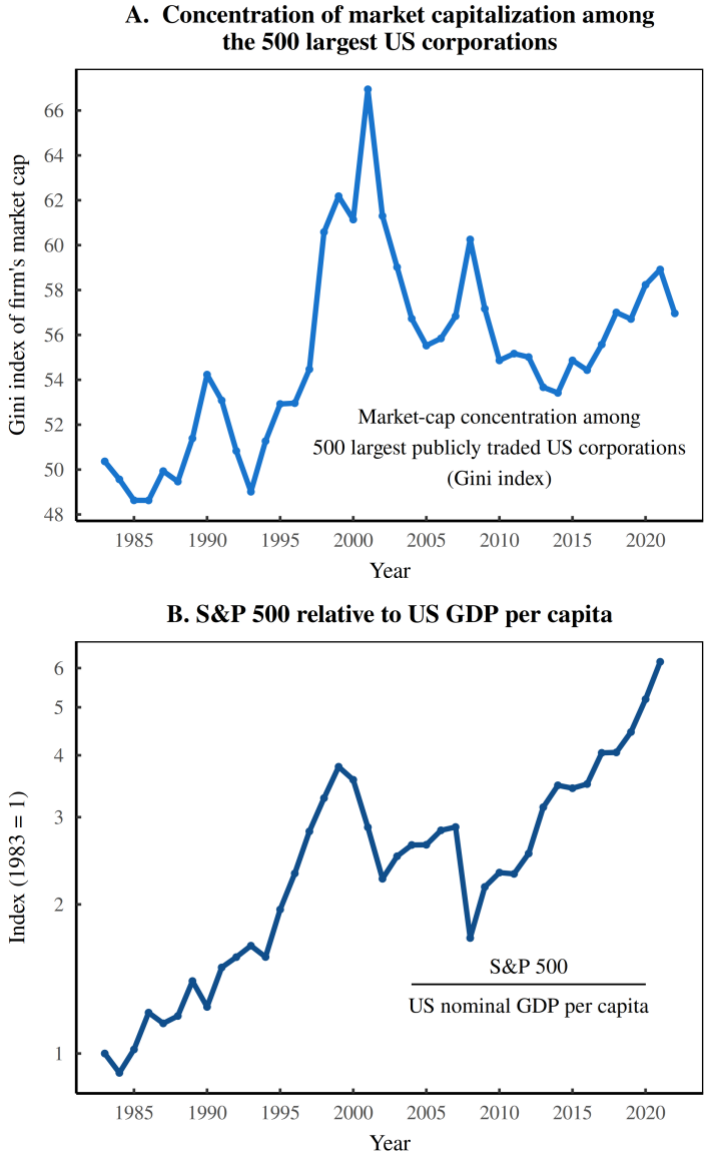
Here's how it works. Returning to our Alice-and-Bob thought experiment, we were able to increase Alice and Bob's average wealth by handing money solely to Bob. But this rising average didn't indicate shared prosperity. It was an artifact of the rich getting richer.

Turning to the stock market, the situation is similar. Except that Alice and Bob are not people, they are *firms*. The Bob-like firms are giant companies like Apple, Microsoft, Google and Amazon — four corporations that have a combined market capitalization of about $5.9 trillion. The Alice-like firms are the smaller companies on the S&P 500.

What's important is that collectively, our four Bob-like firms account for about a *sixth* of the value of the entire S&P 500. So if their stock rises, it will buoy the whole S&P 500 index. But this buoyancy isn't really 'growth'; it's an artifact of corporate concentration — rich firms getting richer.

In more general terms, when we look at the rise of the S&P 500 index, we find that it is connected to levels of corporate concentration. Figure 7 makes the case. In Figure 7A, I've plotted a measure of corporate concentration — the Gini index of market capitalization among the 500 largest US firms. When this Gini index grows, it signals that corporate wealth is being concentrated in the hands of the richest firms. Looking at Figure 7B, we see that this corporate concentration is tied to the movement of the S&P 500 (measured relative to US GDP per capita).

Figure 7: Stock-market growth through inequality.
Panel A plots the level of wealth concentration among the 500 largest publicly traded US firms — the Gini index of market capitalization. Panel B shows the movement of the S&P 500 relative to US nominal GDP per capita. The correlation between the two curves (R^2 = 0.42) suggest that the movement of the S&P 500 is driven in part by market concentration — rich firms getting richer. (For more details, see the Appendix.)



So in Figure 7, we've got evidence that the S&P 500 is an unwitting indicator of US corporate concentration. And it's not because S&P analysts tried to make that happen. (They didn't.) It's because historically, an important part of (apparent) stock-market growth is simply the richest firms getting richer.

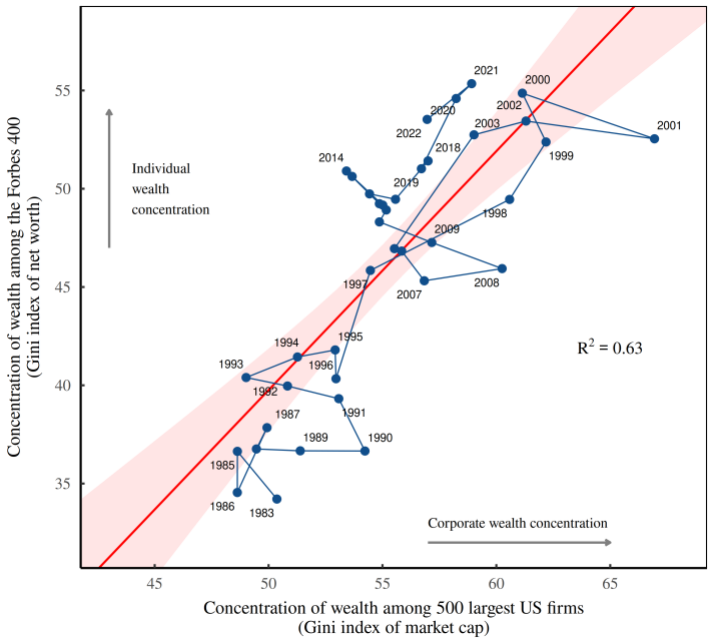
To the owners go the spoils

So what happens as rich firms get richer? Well, the rich *owners* of these firms also get richer.

Today, for example, the richest firms are companies like Amazon, Google and Microsoft. Unsurprisingly, the individuals who own these firms — Jeff Bezos, Larry Page, Bill Gates and Sergey Brin — are consistently among the world's richest people. Bringing dynamics into the fold, as these big-tech companies consolidate their holdings, we expect that this consolidation will concentrate wealth in the hands of big-tech owners. In other words, the concentration of *corporate* wealth should beget the concentration of *individual* wealth.

So does it? At least in the United States, the answers seems to be yes. Figure 8 makes the case. Looking at the richest firms and the richest individuals, we find that the concentration of corporate wealth (horizontal axis) strongly predicts the concentration of individual wealth (vertical axis). To the richest owners go the spoils of oligopoly.

Figure 8: The concentration of corporate wealth begets the concentration of individual wealth.
The horizontal axis plots a measure of corporate consolidation — the Gini index of market-cap concentration among the 500 largest publicly-traded US firms. The vertical axis plots a measure individual wealth concentration — the wealth Gini index among the Forbes 400. Evidently elite inequality has been driven in large part by corporate consolidation. (For more details, see the Appendix.)



Concentration through acquisition

At this point we've got some fairly incendiary evidence. The 'crime' of elite wealth concentration seems to be tied directly to corporate oligarchy. But before we put the case to rest, let's consider the testimony of the defense's expert witnesses. I'm talking, of course, about neoclassical economists.

Ostensibly, neoclassical economists love competitive markets and hate monopoly. But beginning in the 1980s, a weird thing happened; economists at the University of Chicago started to argue that

despite lacking competition, monopolies could still be 'efficient' (Bork, 1978). Their reasoning was that if monopolists actually behaved badly, they would be undercut by competitors, and their monopoly would be undone. Therefore, if a monopoly exists, it must be because the monopolist is doing what the market wants.

Now the logic here is torturous. We're positing *imaginary* competition to justify a lack of *real-world* competition. But then again, neoclassical economists have never let the real world get in the way of their imaginations. And in this case, the goal of the imaginary theorizing was always obvious: it was designed get government out of the way and allow big corporations to *purchase their way to power*.
Backing up a bit, politicians are rarely incensed when a big corporation builds more factories. So in that sense, the government is not opposed to big companies getting bigger. But from a corporate vantage point, factory building is a less-than-ideal route to bigness. The problem is simple: if everyone builds more factories, it leads to 'free run of production' which then collapses profits (Veblen, 1923). So savvy corporations are always looking for a better route to power. And that better route is to *buy* instead of *build*.

The buy-not-build tactic is hardly rocket science. As Jonathan Nitzan and Shimshon Bichler (2009) observe, when you buy your competitor, you solve two problems at once: you accumulate power *and* reduce your competition. The difficulty, though, is that this buy-not-build tactic has the appearance of being a blatant power grab. So there's the risk that an entrepreneurial government might get in the way.

That's where Chicago-school theorists come in. Starting in the 1980s, they successfully preached an ideology that got the government out of the way. The net result is the modern corporate landscape, forged in large part by a string of government-approved corporate acquisitions.

Tech monopolist Google has been a prime benefactor of this buy-not-build tactic. As Cory Doctorow notes, "Google didn't *invent* its way to glory — it *bought* its way there." He continues:

> Google's success stories (its ad-tech stack, its mobile platform, its collaborative office suite, its server-management tech, its video platform …) are all acquisitions. (Doctorow, 2022)

The same strategy holds for most of today's corporate oligarchies. Their tentacles have largely been *bought*, not *built*. On this front, the numbers don't lie: the consolidated corporate landscape of the 21st century was forged by a massive, neoliberal wave of mergers and acquisitions.

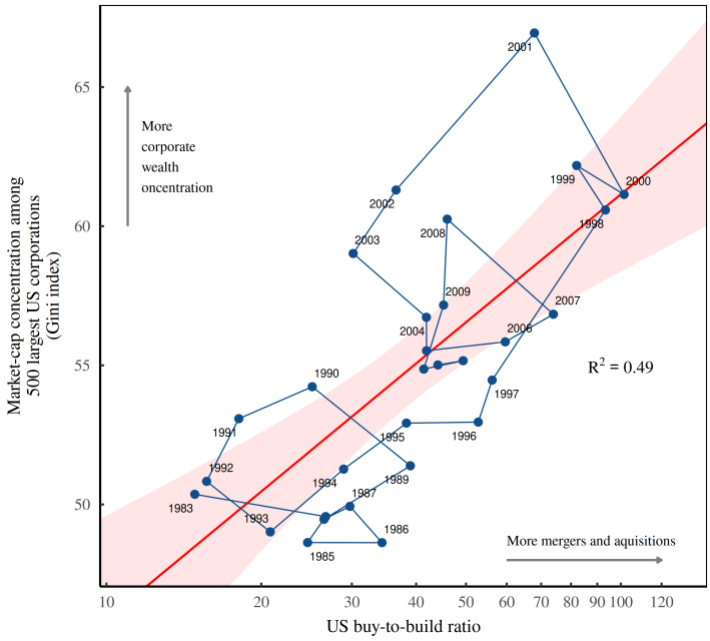
Let's have a look at the tsunami.

To quantify the scale of mergers and acquisitions, we'll turn to an index called the *buy-to-build* ratio. As the name suggests, the buy-to-build ratio measures the corporate proclivity for *buying* other companies instead of *building* new capacity. Created by Jonathan Nitzan and Shimshon Bichler (and first published in 2001), the buy-to-build ratio takes the value of corporate mergers and acquisitions and divides them by the value of greenfield investments. The greater this buy-to-build ratio, the more that corporations are buying (and not building) their way to power.

As I've alluded, the neoliberal era saw a massive wave of corporate mergers and acquisitions. As a result, from 1980 to 2000, the US buy-to-build ratio jumped nearly tenfold. And guess what accompanied this acquisition wave. That's right … a sharp rise in *corporate concentration*.

Figure 9 shows the connection. As the US buy-to-build ratio increased (horizontal axis), so did the market-cap concentration among the largest US firms (vertical axis). The lesson is clear: over the last forty years, big corporations have been buying their way to consolidated power.

Figure 9: US corporate concentration has been fueled by mergers and acquisitions.
This figure compares the market-cap concentration of the 500 largest US firms (vertical axis) to the US buy-to-build ratio (horizontal axis). The buy-to-build ratio measures the value of corporate mergers and acquisitions relative to greenfield investments. (I've used buy-to-build estimates from Joseph Francis, 2013). The correlation shown here suggests that the neoliberal wave of corporate concentration was fueled by a corporate buying spree. (For more details, see the Appendix.)



Competition is for losers

One of the (few) nice things about living in an era of concentrated corporate power is that modern plutocrats are brash enough to speak plainly about their ambitions. Forget the arcane language wielded by Chicago-school economists. Today's plutes — men like Peter Thiel — say the quiet part out loud. If you want to "capture lasting value", Thiel proclaims, "look to build a monopoly". Or in mantra form, "*competition is for losers*" (Thiel, 2014).

John D. Rockefeller would be proud.

Speaking of Rockefeller, he was one of the principle funders of the University of Chicago (Collier & Horowitz, 1976). Ironic, isn't it? Rockefeller, like Thiel, spoke openly about his pursuit of power and personal enrichment. So if, during Rockefeller's life, someone had connected elite wealth concentration to corporate consolidation, the reaction would have been "Well, that's obvious."

Fast forward to the 1980s and the connection became not-so obvious, at least to economists. And that's thanks in large part to Rockefeller's Chicago-school investment, which pumped out decades worth of pro-oligarch propaganda.

Today, we've come full circle. Billionaires like Peter Thiel are so hubristic that they speak brazenly about their pursuit of power, laying bare their inner robber baron. The upshot to this plute bravado is that few people will be surprised by the straight line that connects corporate oligarchy with the concentration of elite wealth.

Sources and Methods

Data and code for this article are available at the Open Science Framework: https://osf.io/6ybc3/

US distribution of wealth
In Figure 1, I calculated the US wealth Gini index using data from the World Inequality Database. Wealth threshold data is from series thwealj992. Wealth share data is from series shwealj992.

Forbes data
I scraped historic Forbes 400 data from many corners of the internet. For notes about the specific sources, see Fix (2023b). Data for global billionaire wealth is from the Forbes real-time billionaire list. I've been keeping a daily archive of the list since October 2021.

S&P 500
Data for the S&P 500 is from two sources. For Figure 3, I downloaded the daily data using the R package tidyquant, series ^GSPC. The long-term S&P 500 data plotted in Figure 4 is from Robert Shiller, available at http://www.econ.yale.edu/~shiller/data.htm.

US nominal GDP per capita
Data for US nominal GDP is from:

- 1983–2021: Bureau of Economic Analysis, Table 1.1.5
- 2021–2023: quarterly GDP per capita data from FRED, series A939RC0Q052SBEA.

Data for US population is from:

- 1983–2021: World Bank, series SP.POP.TOTL

Market capitalization
Data for the market cap of the largest US companies (Figure 5) is from Compustat. To calculate each company's market cap, I took the number of shares outstanding (series csho) and multiplied it by the annual closing share price (series prcc_c).

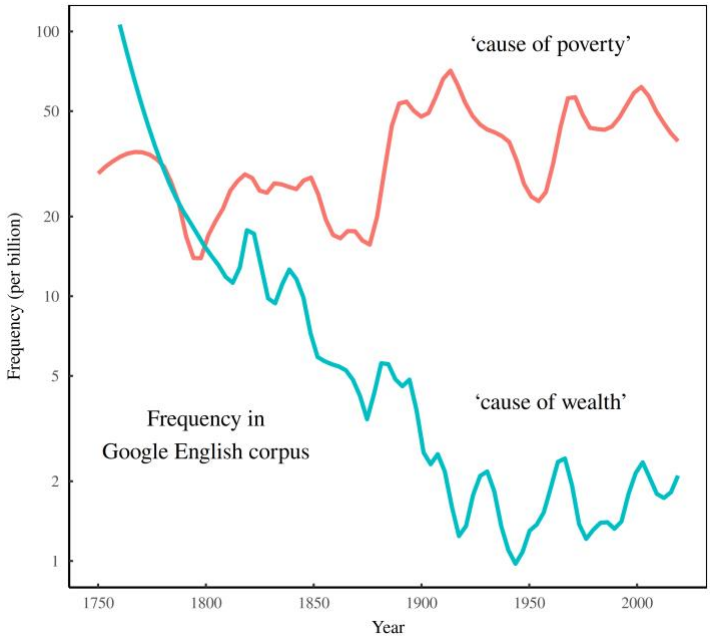
Buy-to-build ratio
The buy-to-build ratio is calculated by taking the value of corporate mergers and acquisitions and dividing it by the value of gross fixed capital formation (which is a rough measurement of 'greenfield' investment). Compiling the requisite historical data for this calculation is no small task. The main hurdle, as Jonathan Nitzan notes, is that "there are no systematic historical time series for mergers and acquisitions" (2001). So any estimate must piece together a hodgepodge of different sources.
In this article, I've used Joseph Francis' (2013) estimates for the US buy-to-build ratio. The data is available here: http://joefrancis.info/databases/Francis_buy_to_build.xlsx. It's also worth reading Bichler and Nitzan's comments on Francis' calculation (Bichler & Nitzan, 2013).

Speaking of wealth and poverty

It turns out that social scientists (at least those who write in English) haven't always prioritized studying 'poverty' over 'wealth'. Figure 10 makes the case using data from the Google English corpus.

Two centuries ago, the phrase 'cause of wealth' was just as popular as the phrase 'cause of poverty'. And that makes sense. In 1776, Adam Smith published his famous tome about the *wealth* of nations (Smith, 1776). Clearly, he and other political economists wanted to understand wealth. But throughout the 19th century, interest in wealth waned, leading to today's dichotomy. Judging by word count, about ten times as many people study the 'cause of poverty' as study the 'cause of wealth'.

Figure 10: From wealth to poverty.
Apparently, social scientists have not always prioritized the study of poverty over the study of wealth. Judging by word frequency from the Google English corpus, 18th century English writers were quite interested in the 'cause of wealth' — at least as interested as they were in the 'cause of poverty'. But over the 19th century, the study of wealth fell out of favor, leading to today's dichotomy. Studying the 'cause of wealth' is now about ten times less popular than studying the 'cause of poverty'. [Notes: I downloaded Google ngram data using the R package ngramr.]



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Back to the past: Income Distribution in America

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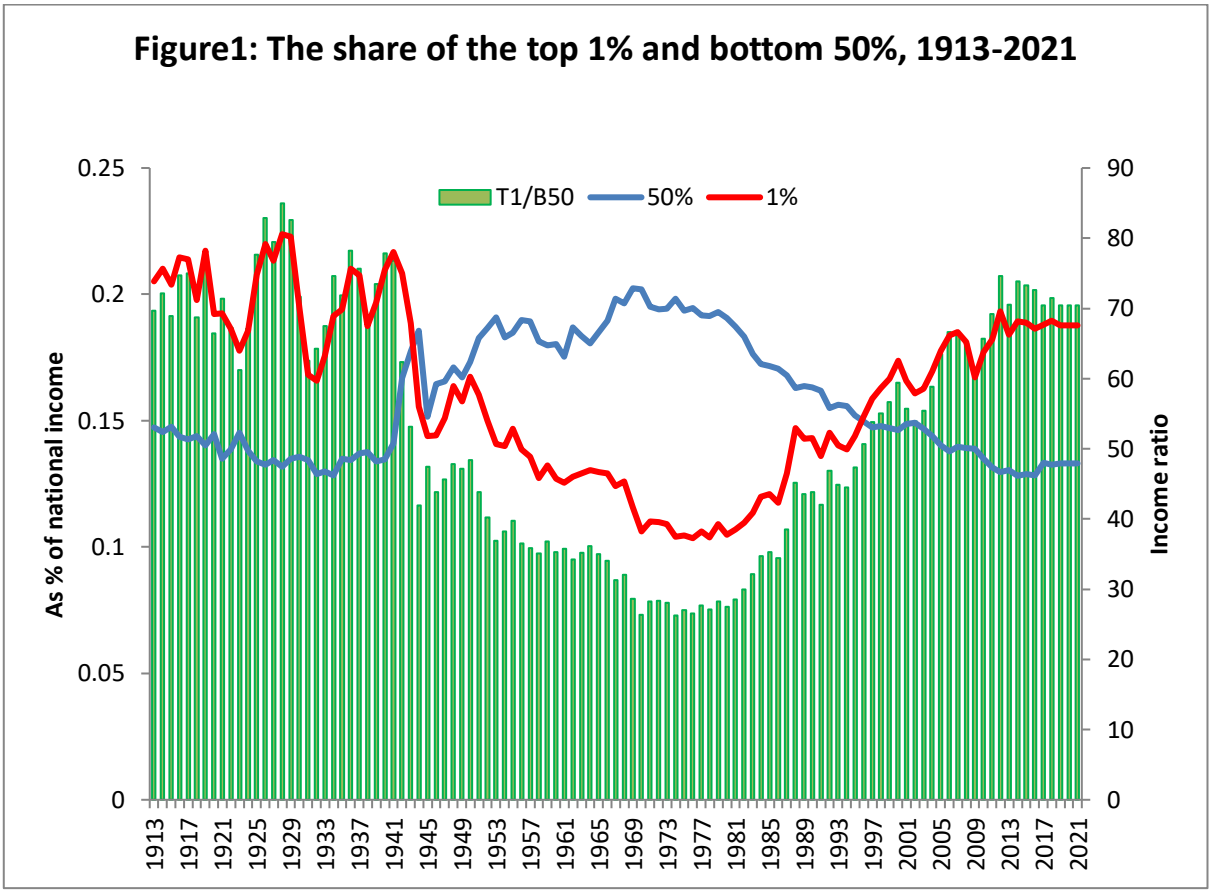
Examining income distribution in the United States is both extremely important and extremely complex. Its importance is that it is the largest and indeed richest economy in the world, and for many years now, acted as a kind of global "sheriff" having a huge impact on the world economy. The complexity is that, as far as I know, we have much more statistical data on the evolution of income distribution in the United States, which potentially allows us to examine many factors that we are not able to examine in the case of other countries. In this note, which is by no means a comprehensive survey of income distribution in the United States, I try to provide a picture of these developments using some of these statistics.

Figure1: The share of the top 1% and bottom 50%, 1913-2021



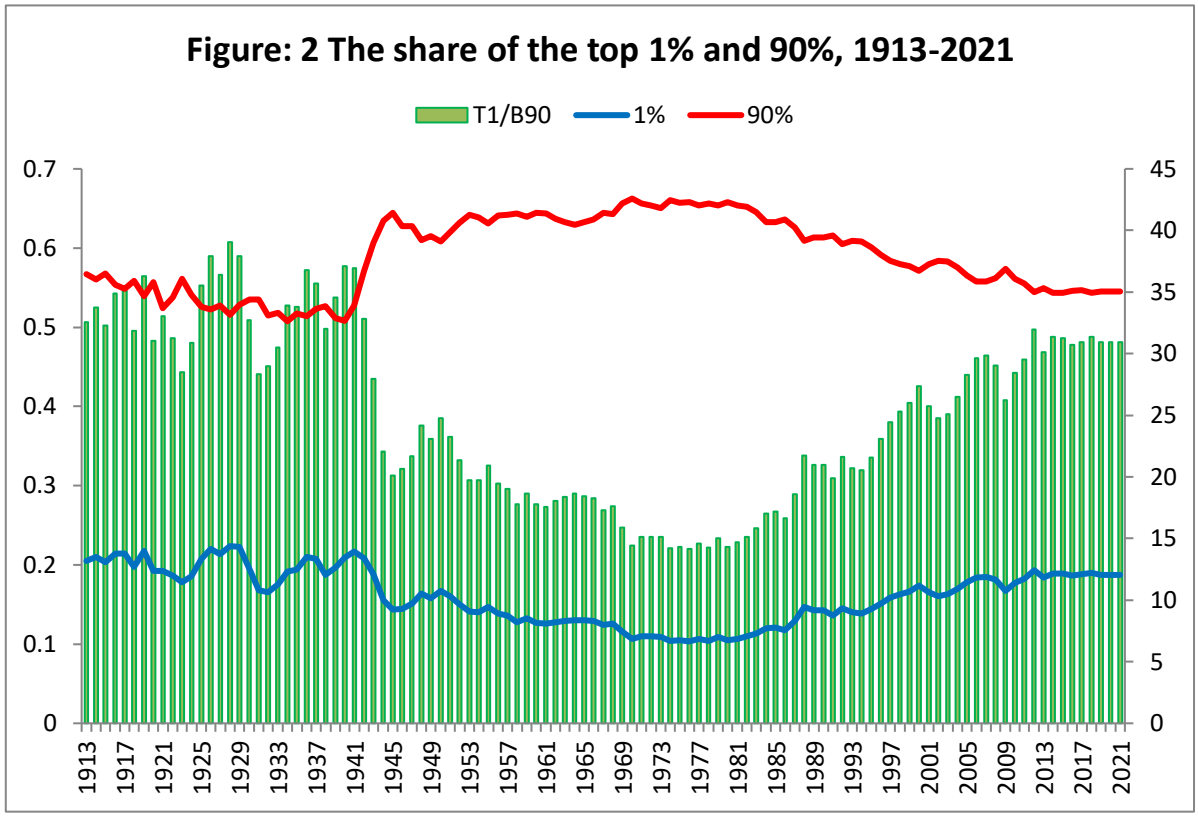
Source: All data on the percentage distribution of income in the USA come from the World Inequality Database, available at: https://wid.world/country/usa/.

This chart, covering more than a century, actually represents a kind of return to the past that we are witnessing in America. First on the axis on the left hand we have the share of the top one percent and

the bottom 50 percent as percentage of the national income covering the period from 1913 to 2020, that is, for 108 years. As it can be seen above, the share of the top 1 percent, resembles a U shape, i.e., it starts very high, in fact more than 22 percent of the national income in 1929, declining to about 10 percent in the 1970s and subsequently settling down at about 19 percent in 2021. By contrast, the share of the bottom 50 percent shows a different pattern, an inverted U-shape; it starts at about 15 percent in 1913, then increases to 20 percent of national income in 1970, and ends up at 13 percent by 2020. In other words, in the early years of the twentieth century, the share of the top one percent out of national income was high, and the share of the bottom 50% was low and then, as a result of policies adopted by successive US governments, especially at the time of the Great Depression of 1929 and after, the share of the top 1% declined and the shares of the bottom 50% went up. It can be stated that up to the mid-1970s, the share of the top 1 percent had a declining trend, and then started to rise. Around the same time, the share of the bottom 50 percent experience changes too but in the opposite direction, i.e. the highest share is reached in the mid-1970, and then a declining trend sets it. For all these years, we can also measure the income ratio, i.e. on average, how richer are the top 1 percent as compared with the average income level among the bottom 50 percent. This ratio in measured on the right hand axis and shown in the green columns above. The highest gap appeared in 1928, when the average income of the top 1% was 85 times higher than the average income of the bottom 50%. Given the changes in the percentage distribution of income, this ratio declined to 26 times by 1974 and likewise, started to rise again reaching 75 times by 2012 and levelling off at 70 by 2020. It should be noted that this ratio in 2020, is equal to what this ratio was in 1913, i.e. more than a century ago in the USA.

From the early 1970s, the shares of the bottom 50 percent show a decreasing trend and the top one percent enjoys an increasing trends and the income ratio has a significant upward trend too. In 1913, for example, the one percent held 21 percent of national income and the bottom 50 percent accounted for only 15 percent. In 1980, the share of the top 1 percent declined to 10 percent, and the share of the bottom 50 percent increased to 19 percent, and the income ratio fell sharply to 27 times too. Although this ratio is still significant, but compared with 70 times in 1913 or even 63 times in 1931, this is a sign of a significant reduction in income inequality in the USA. Then Mr. Reagan came to power and started his economic "revolution", at the very beginning of which his government embarked upon a fights with the trade unions, and then came Mr Bush Sr. and Clinton, who did promise too much, and after Bush Jr. was the turn of the first black American to became President - Mr. Obama. In short, with all the promises, and after two world wars and the so-called "dominance" over the world economy, income distribution in the United States in 2020 is almost the same as what it was in 1913. That is, its top 1 percent pockets one dollar of every $5 produced in the economy, and its bottom 50 percent- i.e. 50 times more American citizens will have to live with one dollar of every $10 dollar produced.

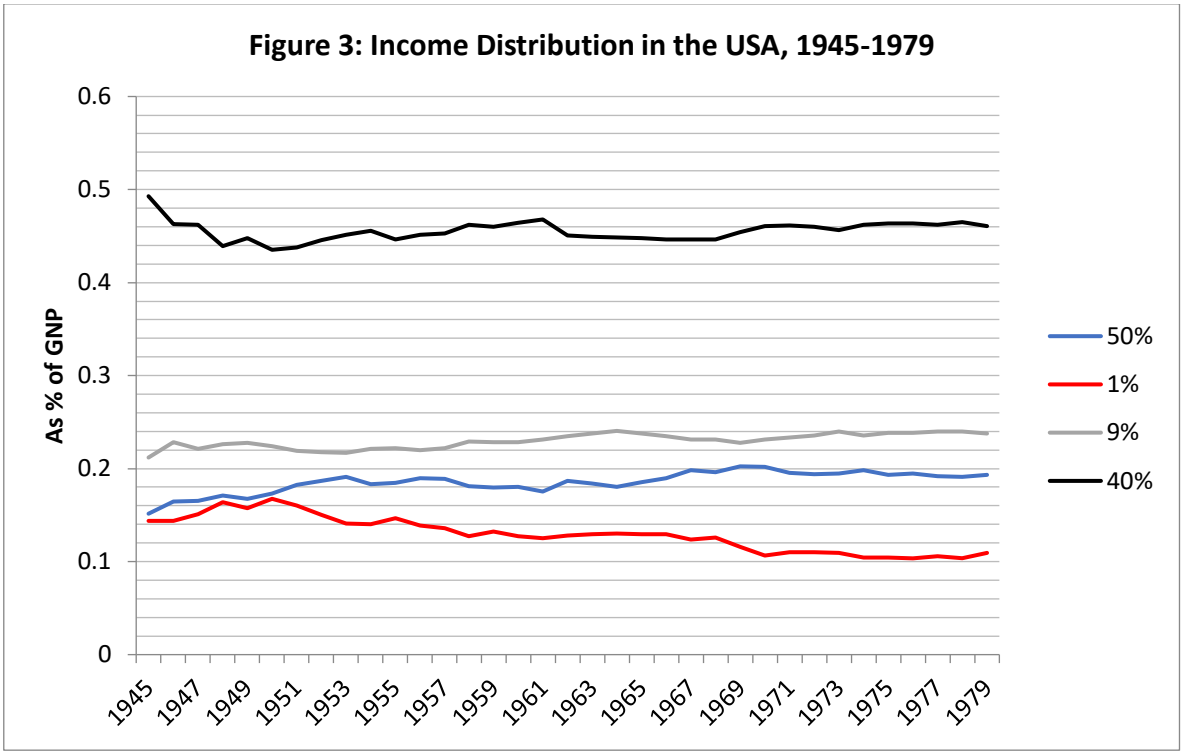
In the second diagram, we follow these developments in relation to the share of the bottom 90%.



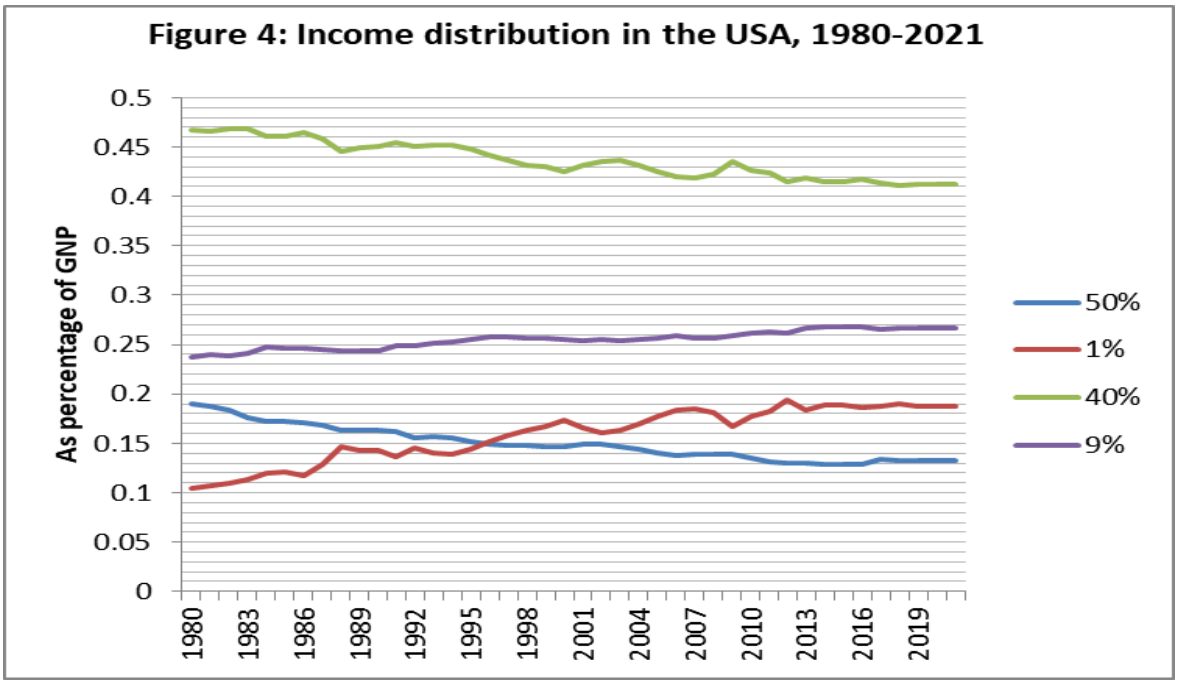
Source: In order to estimate these capture rates in the US, we have used data on GDP from the World Bank, available at: https://data.worldbank.org/indicator/NY.GDP.MKTP.KN?locations=LV

It should come as no surprise that we are witnessing similar developments here. In other words, in terms of enjoying the fruits of their labour, the bottom 90 percent in the USA, in 2020, has reached the point where it was in 1913. First of all, the general pattern is identical to what we have already seen, a U-shape and an inverted U-shape. Focusing on the share of the bottom 90 percent, it was relatively low at the beginning of the period, and then their share increased in the middle decades, but in the last few decades, a declining trend begins again. As a result, the income ratio also changes. In the previous section, we examined how the share of the top 1 percent evolved, but on the shares of the 90 percent, like the 50 percent, there has been a similar transformation. Their share increased from 57 percent of national income in 1913 to 66 percent in 1980, but, then lost about 11 percent of national income, reaching 55% in 2020, a share which is even less than what it was in 1913. The income ratio - that is, the relationship between the average income of the top one percent and 90 percent, which was 33 times in 1913, decreased to 15 times in 1980 and increased to 31 times again in 2020.

If we divide this period into two sections, one, 1945-1979 and the next, 1980-2020 an interesting picture emerges. In the first period, it seems that all the variables changed in a direction that should have changed to improve social welfare, and vice versa in the second period, the exact opposite of this process happened.

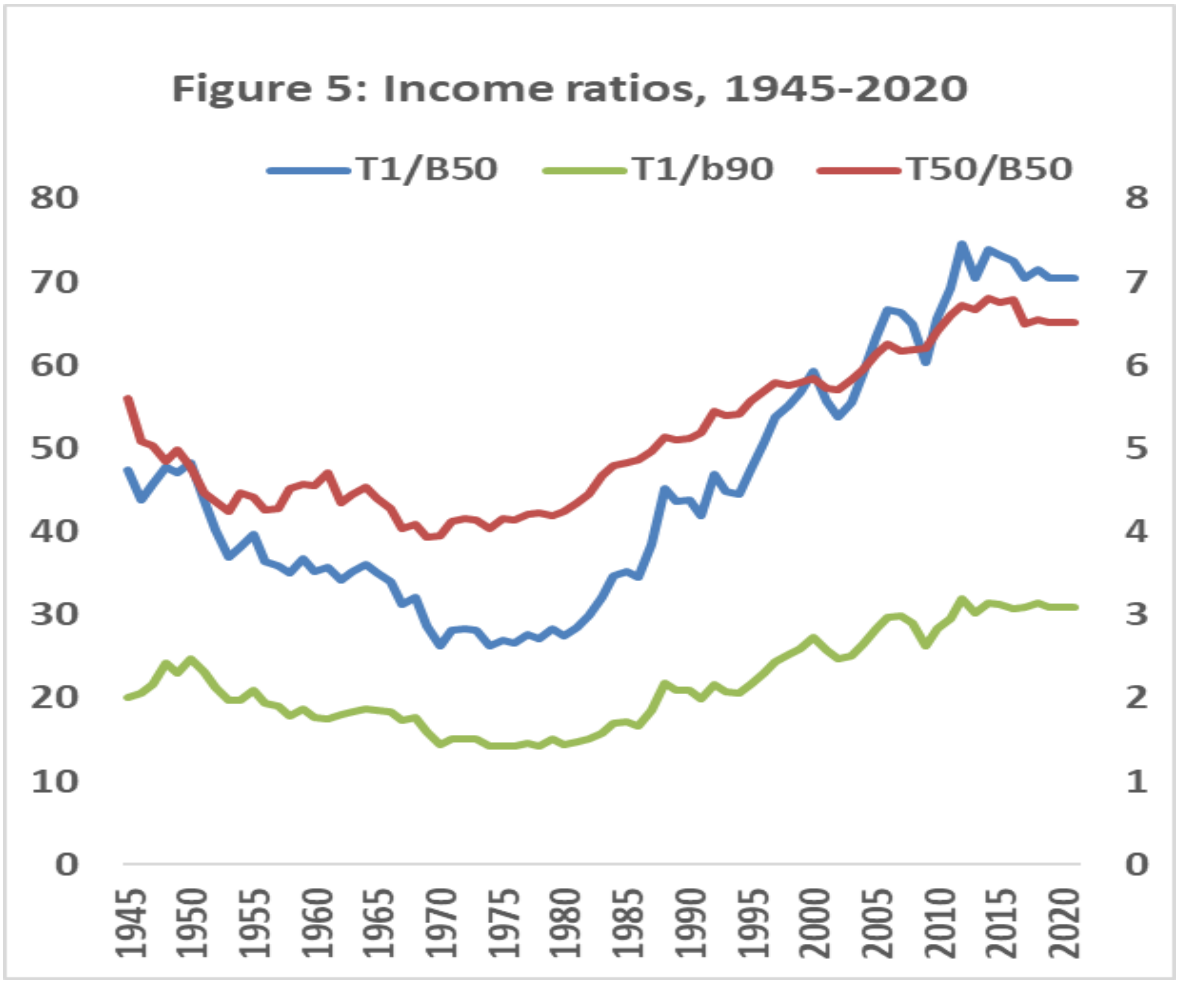


Obviously the size of the US economy in 1979 was larger than what it was in 1945, but the bottom 50 percent has increased its share of this much larger economy by 4 percentage points during this period while the share of the top 1 percent has decreased by 3%. Most likely, the reason for this relatively small improvement compared to European countries is that the US government, unlike most countries in Europe, did not adopt a welfare state model, although policies in those decades differed from policies that began after Reagan. When the New Deal stopped and there was policy reversal in the US, we will see that the small achievements were lost and the distribution of income became more unfavourable in 2020 than it was in 1945. Figure 4 shows this situation.



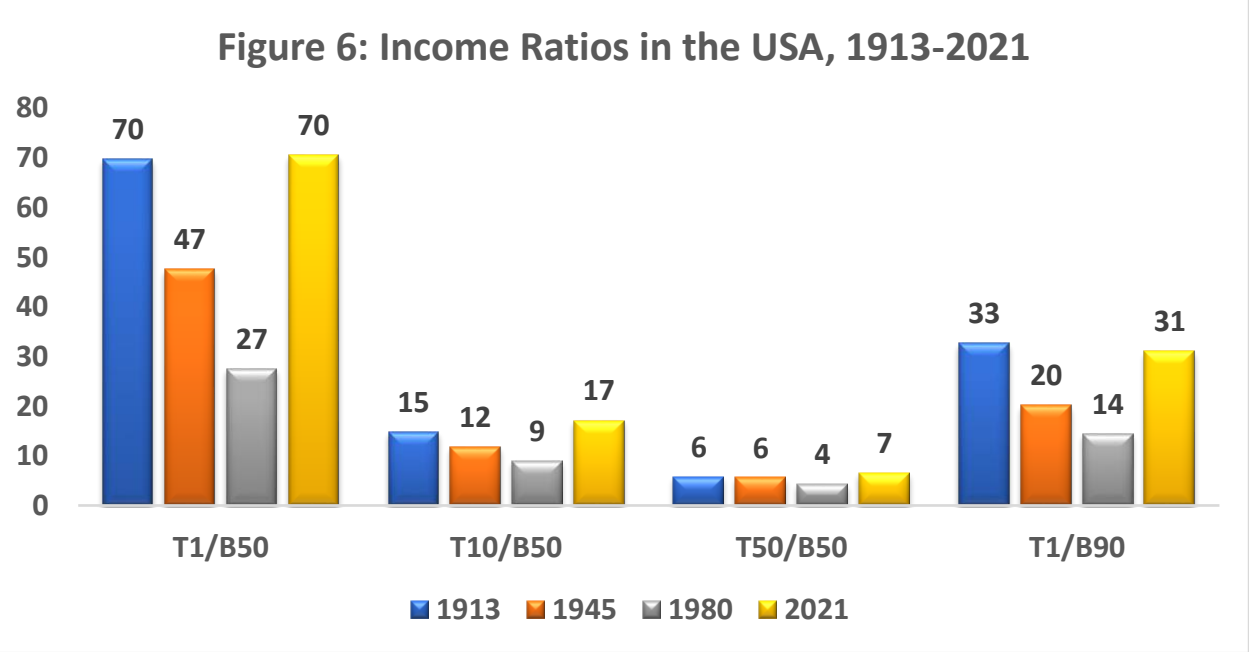
What can be seen here is that the share of the bottom 50% and middle 40% in 2021 is less than what they had in 1980. To be precise, the bottom 50% lost 6% of the national income, the same as the middle 40 percent. By contrast, the top 1% increased its share by 9% and the share of the top 9% rose by 3% of the national income.

To summarize these developments, I have prepared Figure 5, which shows the income ratio from 1945 onwards. As indicated earlier, income ratio measures the relative position of different groups in an economy, and here we compare average income of different groups. Figure 6, summarizes these ratios from 1913 onwards, and as it can be seen here, the distribution of income in the United States in 2021 is more unequal than in 1913.



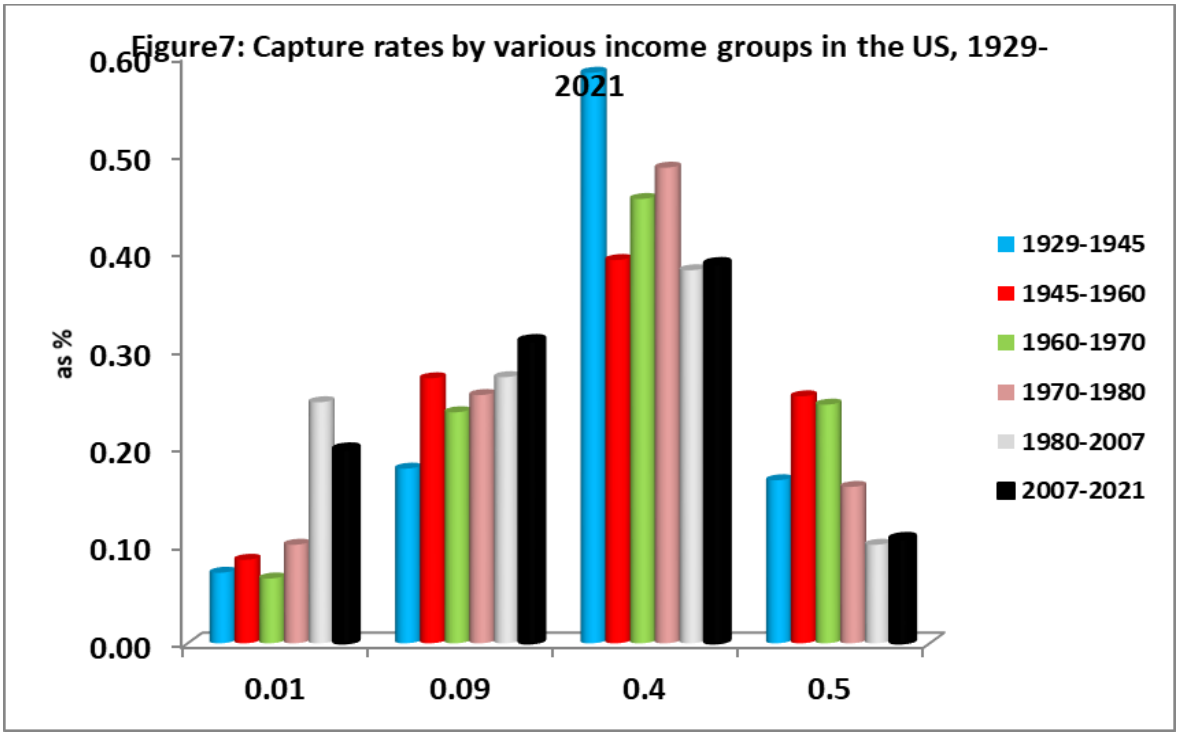
In this diagram, which shows the evolution from 1945 onwards, it can be seen that the shape of all three curves has become like the letter U in English, meaning that the changes can be divided into two segments. In one, that is, from about 1945 to 1978, this trend is decreasing, and then the increasing trend begins. What these changes mean is simple, the average income of the top 1 percent increased much faster than the average income of the bottom 90 percent in the USA. In 1945, the average income of the top 1 percent was 47 times higher than the average income of the bottom 50 percent, but it went down to 26 times in 1974 and by 2021, it was 70 times, a lot larger gap in 2021 than the gap in 1945. This means that all the gains were lost and the inequality was far greater in 2021 than it was in 1945 or in 1974. Similar pattern existed in relation to the share of the bottom 90 percent. The average income of the top 1 percent was 20 times higher than the average income of the bottom 90 percent in 1945, but by 1974, the ratio went down to 14 times, and subsequently increased to 31 times

in 2021, again much higher than the gap in 1945. There have been similar changes in the average income of the top 50 percent as compared with the average income of the bottom 50 percent and the ratio is measured on the axis on the right. Figure 6 gives a summary of the data as far back as 1913.



In relation to all these income ratios, it is interesting that the turning point seems to have happened in 1980, when, the declining trends are reversed and the ratio rises in all cases. The income ratio between the top 1 percent and bottom 50 and 90 percent, in 2021 is the same as what it was in 1913. Looking at the situation in 2021, in each and every case, there has been a sharp rise in the income ratios. Accepting the view that income ratio is a useful measure of income inequality in an economy, it can be seen that the US economy in 2021 is several times more unequal than what it was in 1980. The issue that should be of a great concern for policy makers in the US, is the fact, that income inequality in 2021 seems greater than what it was in 1913.

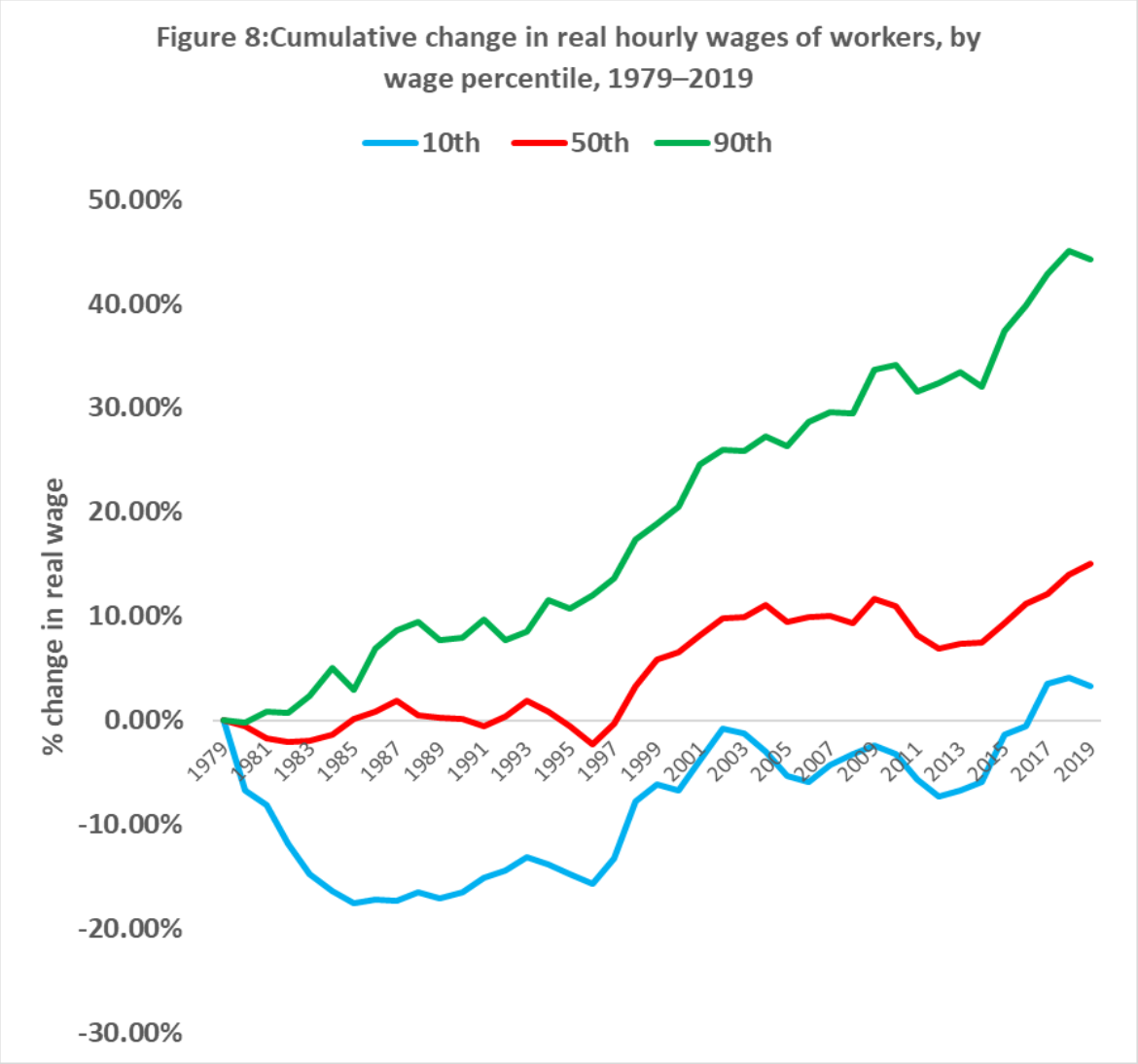
Why this has happened is an important question that requires a very detailed examination of policy making in the USA in all these years. It is common sense to suggest that the underlying factor causing this growing inequality is different groups of people benefited differently from the gains of economic growth over the years. We have called this the capture rate, i.e. how much of the extra income was pocketed by the top 1 percent or, by the bottom 50%? In relation to other income groups we estimated their respective capture rates too and present them in our figure 7.



What this illustration shows are how the benefits of economic growth in the USA were shared among the US citizens. For instance, if we take the period between 2007 and 2021, the black columns show how the extra income generated by economic growth during these period has been divided? The top 1% took 20%, and 31% went to the 9% and the share of the middle 40% was 39 percent and last, but not least, only 11% of the extra income thus generated went to the bottom 50% of the US citizens. Other columns here show income distribution in other periods as indicated.

It is clear that the capture rate for the top 1% shows an increasing trend, i.e. it increases over time, and the same is true about the capture rate for the 9% of the population. However, the capture rate for the bottom 90%, i.e. middle 40% and bottom 50% shows a clear declining trend. Here, the middle 40 % seems to have maintained their grounds, i.e. their capture rate reflects their share in the population, it is in fact slightly above it, as their average for the whole period is 45% meaning that between 1929 and 2021 the middle 40% US citizens captured 45% of the benefits of economic growth. By the same token, the capture rate of the bottom 50% shows a very deep declining trend, declining form 25% during 1945-1960 to just 11% during 2007-2021. The average rate of capture for the bottom 50% for the whole period was 17%. From 1980 onwards there was a sharp rise in the top 1% capture rate, from just around 10 in the 1970s, to 25% by 2007 and levelled off at 20% by 2021. It is clear that these different capture rates would produce larger inequality, and it can be reported here that as a result of this growing divided, the income gaps have increased among all income groups in the US.

In order to provide further evidence showing this different capture rate, let us look at the growth of real wages for different deciles since 1980.

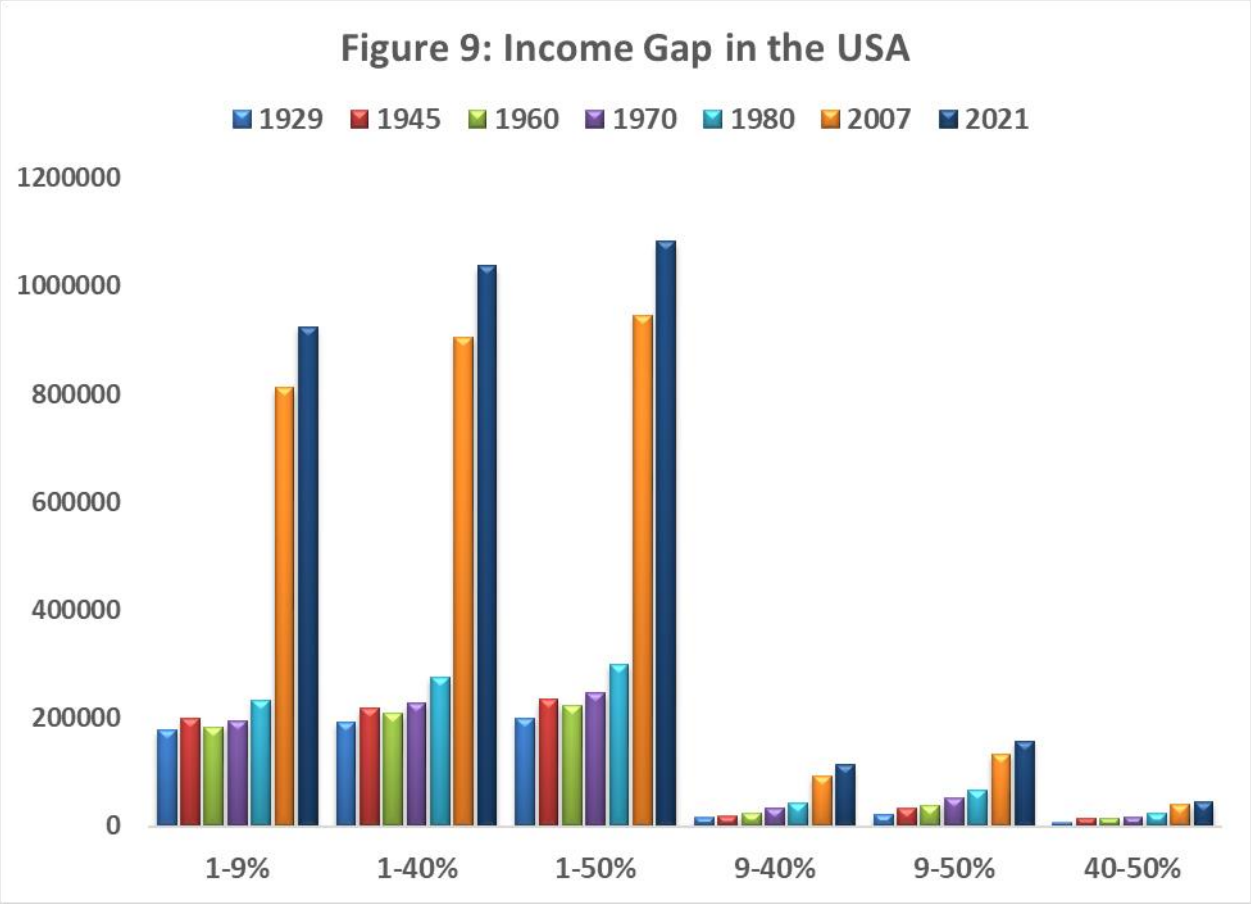


Source: https://www.epi.org/publication/moral-policy-good-economics/

We are comparing the growth patterns of real wages for different deciles of workers in the USA. In the previous pages we have offered evidence showing a growing income divide and here, we offer data on a contributory factor to this growing income divide. The growth of wages for three groups of workers are compared here, the blue curve shows how the wages received by the lowest paid workers changed since 1979. By contrast, the green curve shows how the real wages of the top 10 percent of workers changed and last, but least, the red curve captures the changes in the wages of the middle 10 percent, i.e. 40-50%.

As can be seen in the blue curve, the change in the actual wage of the ten percent with the lowest wage has been negative in almost all of these years except the last two years. The changes in the real wages of the middle 10 percent, were not satisfactory until the late 1990s, but subsequently, a rising trends begins. The fate of those who received the highest wages in the US economy was different. From 1979, it started to rise and continued to rise up to 2019. If we consider 2007, the real wage of the lowest ten percent actually decreased by 4.3 percent, while the real wage of the middle ten percent increased by 10.10 percent, and the increase in the wage of the highest ten percent was 29.6 percent. For the last three years, the wages increased for all workers, but at a very different pace. For the lowest

paid decile, the rise was 3.5, 4.1 and 3.3 percent whereas the increase in the real wages of the top 10 percent of workers was 42.9, 45.1 and 44.3 respectively. Owing to this different growth path, it is observed that the wage gap has widened in the USA. In 1973, the hourly wage gap between the two was a little over $25, but by 2019, this gap increases by 67 percent and reaches $41.87. Our investigation confirms the growing income gap between different income groups in the USA. It is noticeable that from 1929 up to 1980 the income gaps among different income groups was growing, but the speed of change was not significant. But, in post-1980 there seems to have been an explosion of growth in the average income of the top 1% not repeated for the rest of citizens in the US, as the income gap between their average income and average income of the rest skyrocketed. In 1929 the income gap between the average income of the top 1% and the 9%, middle 40% and bottom 50% was less than $178000, $194000 and a little over $200000 respectively. However, for 2021 these gaps increased to more than $ 924000, $1030000 and $1,082000 respectively. While other gaps increase too, but at a much smaller scale as shown in Figure 9.



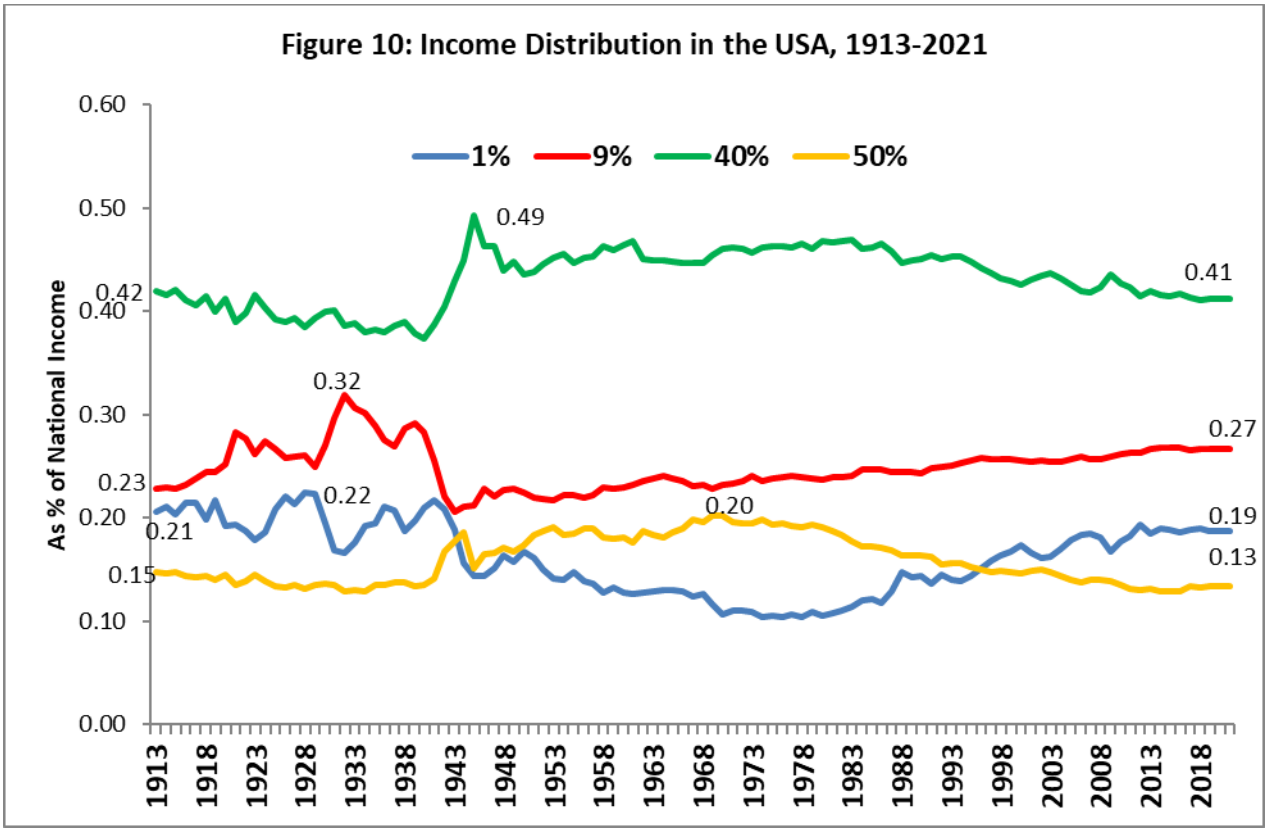
There is no doubt that the US economy has dramatically changed in the last 100 years, in fact, the economy was about 18 times larger in 2021 than what it was in 1929. During these years, its population has increased nearly 3 times, and putting these two together, it is clear that per capita income has also gone up by a factor of 6. These are all good and clear, but the skewed income distribution would produce slightly different outcomes. It could be reported here that ever since 1929, the average income of the top 1% has never been less than 10 times the national per capita income and on average, this ratio for the top 1% for 1929-2023 was a little more than 15 times. On the other hand, it could be reported here that ever since 1929, the average income of the bottom 50% in the USA has never been

more than 40% of the national per capita income, and indeed the average for the whole period was slightly above 30% of per capita national income. Why is this important? It is suggested here that these findings have serious implications for the measurement of poverty in the USA. Fremstad (2019) criticizing the official poverty measurement in the US, points out that" many of our international peers' measure poverty in relative terms, as well. In addition to the OECD, which uses half of median disposable income for its comparisons of poverty in member countries, Canada, Ireland and the United Kingdom use similar measures in their domestic statistical reports on poverty"[1]. If this basic rule is applied to poverty measurement in the US, it will be obvious that the number of people living in poverty in the USA will increase greatly. How can this conclusion be justified? It has been reported that the median income in 2021 was $76330[2]. On the other hand, our calculations show that the average income for the bottom 50% in 2021 was $15577 representing only 20% of the median income on that year. It may be safe to suggest that the bottom 50% in the USA, in 2021 whose income was far short of 50% of the national median income were indeed in absolute poverty, and this will involve more than 165 million of US citizens.

Let us bring our discussion to a close by looking at the changes in the income distribution for the whole period under study here. It is noticeable that income distribution in 2021 is almost identical to the distribution of income in 1913. Between these two dates, there have been changes in the distribution of income in the USA. The share of the middle 40% of the population that stood at 42% of national income in 1913 went up to 49% in 1945 and levelled off to 41% in 2021. The income share of the bottom 50% that was 15% in 1913 increased to 20% by 1969 and then levelled off to 13% in 2021. In relative term, the bottom 50% of the American citizens had a smaller portion of the national cake in 2021 than they enjoyed in 1913. The top 9%, 91-99% of the population were one of the main beneficiaries of these changes as their share of national income in 1913 being 23% reached its peak of 32% in 1932 and levelled off at 27% which shows a 4% increase for the whole period. Last but not least, the top 1% starting with 21% of national income in 1913, enjoyed a much smaller slice in the 1970s, but then gained much of the losses in that decade and ended up with 19% of national income in 2021. These changes are illustrated in Figure10.

[1] https://www.washingtonpost.com/outlook/2019/09/16/official-us-poverty-rate-is-based-hopelessly-out-of-date-metric/

[2] https://www.census.gov/library/publications/2023/demo/p60-279.html#:~:text=Highlights,and%20Table%20A%2D1



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Blinded by science: The empirical case for quantum models in finance

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Abstract
The idea that markets are at equilibrium and price changes follow some version of a random walk or diffusion process is key to foundational results from quantitative finance including the Black-Scholes option-pricing model, and is related to other tenets of finance such as market efficiency and the no-arbitrage principle. However it is also inconsistent with the observed price behaviour of both assets and options. Quantum finance offers an alternative approach which captures the dynamic and probabilistic nature of financial transactions, and leads to different predictions of market behaviour. This paper summarises a range of empirical evidence which falsifies the classical equilibrium-based approach including the principles of no-arbitrage and market efficiency, and shows how contradictory data have long been downplayed or ignored in the classical literature. The aim of the paper is not to explain or justify the previously-published quantum model, but rather uses its predictions as a prompt to investigate data in a new way.

1. Introduction

> *Whether you can observe a thing or not depends on the theory which you use. It is the theory which decides what can be observed.*
>
> Albert Einstein (quoted in Salam, 1990).

> *Suppose the paradigm not only describes the subject matter of the field; suppose it also describes the field's appropriate methodology. In this case, observations that contradict the existing paradigm will be dismissed if they violate the prescribed methodology.*
>
> George A. Akerlof, 2020

In classical quantitative finance, prices are assumed to undergo some version of a random walk (or its continuum limit of a diffusion process) with a certain volatility, which may change with time. The idea goes back to the time of Bachelier (1900) who first used this approach to estimate the price of options on the Paris Bourse in his dissertation; and was rediscovered in the post-war era by economists including Paul Samuelson. It forms the basis of foundational theories from finance including the Black-Scholes model and the efficient market hypothesis, and it still shapes the way that economists and

practitioners alike think about markets. Indeed, as seen below, the random walk assumption is so widely accepted that evidence to the contrary is often simply ignored.

While economists often speak of the "forces of supply and demand" the fact that these forces are assumed to be at equilibrium means that their nature is not explored. The quantum approach (Orrell, 2018; Orrell, Haven, and Hawkins, 2024) differs because it assumes that price can be modelled as a probabilistic dynamical system. The simplest kind of force to consider is a linear restoring force, as in a spring system. While we know that price does not follow deterministic oscillations, it turns out that the quantum version of a spring – the quantum harmonic oscillator – is a much better match.

This paper presents and compares a range of recent empirical evidence which falsifies the classical random walk approach, and supports the quantum model. The following sections consider some of the oldest and most basic questions in finance, namely the distribution of price changes; the response of asset price to large transactions; the relationship between volatility and price change; the pricing of options (which shapes economists' understanding of risk); and the nature of the implied volatility surface. In each case the classical theory is radically inconsistent with empirical findings, while the quantum model predicts them. Furthermore, the results directly contradict the principles of market efficiency and no-arbitrage which are central to the classical approach.

Before proceeding, we should note that the quantum model does not satisfy the "need to escape from imaginary worlds" (for one thing, it involves imaginary numbers) or counter the problem of "the uncontrolled use of mathematics" identified by protesting economics students in 2000 (Morgan, 2022). However, it does offer a coherent alternative to the neoclassical approach which allows one to see empirical evidence in a new way. Also, some readers drawing analogies with physics may associate quantum models with "spooky" or "magical" phenomena such as interference and entanglement, so will expect empirical evidence to come in that form. We return to this topic in the final section, but note that the test of a model is not its ability to surprise or confound, like a kind of magic trick, but rather its ability to understand and predict a system; and by this standard, as seen below, it is the classical approach which lacks empirical support.

2. The market bell

Quantum finance is a developing area which encompasses a range of techniques, but this paper will concentrate on the quantum oscillator model described in Orrell (2024a). To summarise briefly, the model represents the probability of a transaction between a buyer and a seller by a complex-valued wave function which rotates around the imaginary axis. The oscillator has an integer energy level which corresponds to the number of representative transactions in a time period. In its ground state, so the case with no transactions, the price uncertainty equates to the bid/ask spread, which gives a base level of volatility. By assuming that transactions across the bid/ask spread boost the energy level of the oscillator, the energy level should follow a Poisson distribution with an average of around $1/4$ (although this parameter can be adjusted).

Rather than treating price as being at equilibrium, the quantum model therefore sees transactions as caused by fluctuating imbalances between buyers and sellers, leading to a state which might be pictured as a kind of constant vibration (the leading three energy eigenvalues of the oscillator have frequency ratios of 1, 3 and 5, so the "tone" produced is a major chord).[1] This leads to a number of

[1] For example the following notes produce a major C chord: C1 (frequency 32.703), G2 (97.999), and E3 (164.81), so the frequency ratios are 1, 2.996636, and 5.039599, or about 1, 3, 5.

predictions about price behaviour, which have been presented in earlier form elsewhere and are summarised and refined here.

The first prediction concerns the correct distribution for log returns, which the classical model treats as Gaussian. Of course, the fact that log returns are not perfectly Gaussian is a well-known property of markets (Mandelbrot and Hudson, 2004; Wilmott, 2010: 219), and defenders of the classical model will point out that the model still serves as a reasonable approximation for most situations. The quantum model however predicts that, as a result of variable energy levels, log returns should follow a Poisson-weighted sum of Gaussians, of the sort shown in Figure 1 of Orrell (2024a). As seen later this quantum model allows us to make specific predictions about option pricing and implied volatility.

Another prediction relates to the question of market impact. A good way to understand the dynamics of a system, in physics, engineering, biology, or even economics, is to test how it responds to perturbations, such as in this case a large order. According to Kyle and Obizhaeva (2018) "Understanding market impact is one of the most puzzling and difficult issues in finance … theory suggests a market impact function has a linear functional form, with price impact proportional to the number of shares traded, while empirical evidence suggests a square root model, with marginal price impact diminishing as the number of shares traded increases." Attempts have therefore been made to develop models which match this observed behaviour; for example, Tóth et al. (2011) present a square-root model in which price change varies with the term $\sqrt{Q/V}$ where Q is the size of the excess order, and V is the average volume per day.

The square-root law also makes sense in the quantum picture, where the energy gain due to imbalance is countered by a shift in price, with the added benefit that the quantum model gives an estimate of unity for the multiplicative constant (Orrell, 2024a). However, a related question, which turns out to be key to broader topics such as option pricing, is what effect the excess order has on the volatility. If you hit a bell, you displace it but you also create a vibration, which makes a noise. So, when the market is struck by a large order, how loudly does it ring?

According to classical random-walk theory, the expected price change over a period *T* scales with the square-root of time, so volatility is assumed to have dimensions of inverse square-root of time (Pohl et al., 2017). The variance due to impact should therefore scale with the length of the period *T* over which the excess order occurs (Lillo, 2023). Empirical evidence is provided by (Bucci et al., 2019) which makes the same assumption, and demonstrates the model's prediction by plotting variance as a function of the excess order size. In the paper, the plot is made using log-log axes which are hard to interpret, however an obvious feature is that lines which are supposed to be parallel actually intersect; and a reanalysis of the data shows that a much better match is obtained if the variance depends on the inverse of the order time *T* as in Equation 1 (Orrell, 2024a). As with bells, a short, sharp hit (greater imbalance) creates more noise than a slower one.

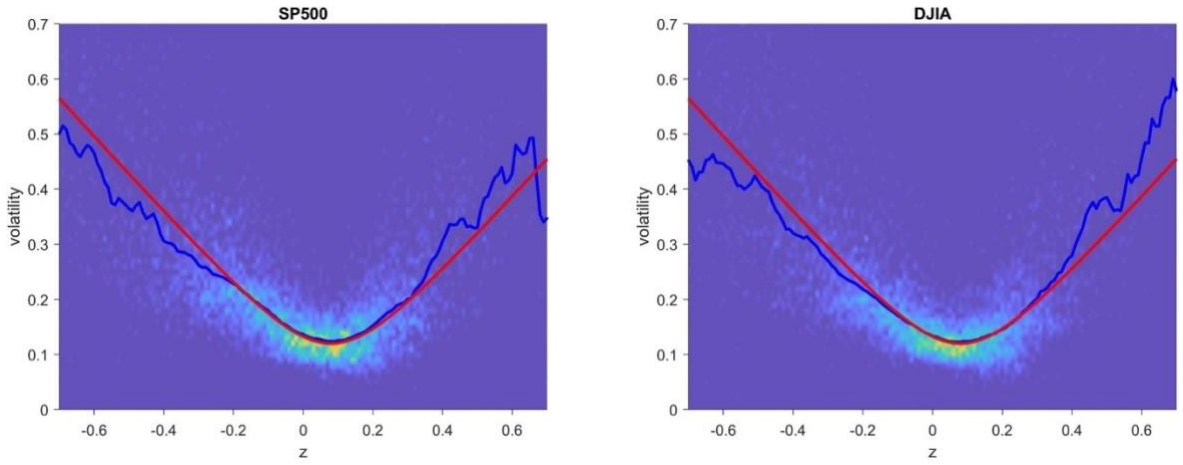
A related prediction of the quantum model is that price change and volatility over a period are related by the simple equation

$$\sigma_z^2 = \sigma_0^2 + \frac{x^2}{2T} = \sigma_0^2 + \frac{z^2}{2} \qquad (1)$$

where $z = x/\sqrt{T}$ and x is log price change over a period T adjusted for average drift (Orrell, 2024a). The reason is that, as mentioned above, the quantum model assumes, not only that markets are not at equilibrium, but that transactions occur exactly because of market imbalances (where the oscillator is not in its ground state). In other words, markets are always being impacted. Equation 1 violates the

classical assumption that volatility can be treated as constant, but is in good agreement with a range of empirical data including the S&P 500 and DJIA indices, as seen in Figure 1. (Note that this is an equation of actual volatility as a function of price change, not implied volatility as a function of strike price, which as discussed below has been more widely treated in the literature.)

Figure 1.
Heatmaps show volatility as a function of $\boldsymbol{z = x/\sqrt{T}}$ where $\boldsymbol{x}$ is log price change over time periods $\boldsymbol{T}$ of 2 to 100 days (measured in years). Blue line is smoothed average volatility, red line is Equation 1 with offset to account for drift (so the minimum is slightly to the right of $\boldsymbol{z = 0}$). Panels are for the S&P 500 1992-2023, and Dow Jones Industrial Average 1992-2023.



3. Option pricing

While the use of quantum probability changes how we model market behaviour, at a more fundamental level it also affects what constitutes an acceptable mathematical proof. In particular, a core tenet of classical finance is the no-arbitrage principle, which amounts to the idea that one cannot "make money out of nothing" by clever trading in the markets. As (Fontana, 2014) summarises, "Since the existence of such a possibility is both unrealistic and, loosely speaking, conflicts with the existence of an economic equilibrium, any mathematical model for a realistic financial market is required to satisfy a suitable no-arbitrage condition, in the absence of which one cannot draw meaningful conclusions on asset prices and investors' behavior."

However, hedge funds which exploit disequilibrium to extract value from financial markets might have a different perspective on what is realistic, or constitutes a meaningful conclusion (Wilmott, 2022); and the no-arbitrage principle only makes sense if transaction costs, and in particular the bid-ask spread between the seller's ask price and the buyer's bid price, are assumed to be zero. In the quantum model (or in real markets; see Wilmott, 2009) such arguments do not apply, because volatility is linked to the bid/ask spread. In the ground state, which corresponds to zero transactions, the base volatility is set by the half-spread, and reflects an irreducible level of uncertainty. Assuming that transaction costs are zero is therefore equivalent to saying that the volatility is also zero, which isn't useful if the aim is to make a prediction that involves volatility.

One example of arbitrage is that of the market maker, who buys stocks at the lower bid price, and sells them at the higher ask price. The arbitrage can be thought of as a fee for providing liquidity to the

markets. However the quantum argument is not that somehow arbitrage is easy, but only that the existence of the bid/ask spread means that transaction fees cannot be assumed to be zero.

These issues come to a head in the Black-Scholes option-pricing model (Black and Scholes, 1973). In their 1973 paper, the authors assumed that price changes are lognormal, and used a no-arbitrage/efficient-market argument to prove that the option price does not depend on the growth rate of the asset, but only on the risk-free rate r. The formula is therefore simply the expected payout from a call option whose underlying stock follows a lognormal price distribution with a drift equal to the risk-free rate. In fact, the formula was otherwise identical to an earlier result from Boness (1964), which featured a subjective estimate of a growth rate μ instead of the risk-free rate (Gatarek, 2023).

In a 1990 book Robert Merton wrote that "virtually on the day it was published [the model] brought the field to closure on the subjects of option and corporate-liability pricing," while Paul Samuelson added in a forward: "one of our most elegant and complex sectors of economic analysis – the modern theory of finance – is confirmed daily by millions of statistical observations" (Merton, 1990). Again though, it turns out that the formula performs better in theory than in practice, according to four criteria.

Firstly, the model assumes that price changes follow a lognormal distribution. However it is again easily checked that the actual distribution has a sharper peak and fatter tails than expected.

Secondly: the main conclusion of the Black-Scholes model, which distinguishes it from the Boness model, is that to capture the effect of growth, only the risk-free rate matters. This follows from a "dynamic hedging" no-arbitrage/efficient-market argument where holdings of options and the underlying stock are constantly rebalanced to create a risk-free portfolio. As discussed earlier, such a process is impossible in practice because of things like transaction costs. And a little reflection (or data analysis) will show that if prices are tending to go up, then this will affect the expected payout of options. Since the S&P 500 typically sees an annual gain which far exceeds the risk-free rate, it follows that call options will have performed better than put options. Since the purpose of an option pricing formula is to predict the prices which match the expected payouts, the earlier Boness model is in this respect more realistic.

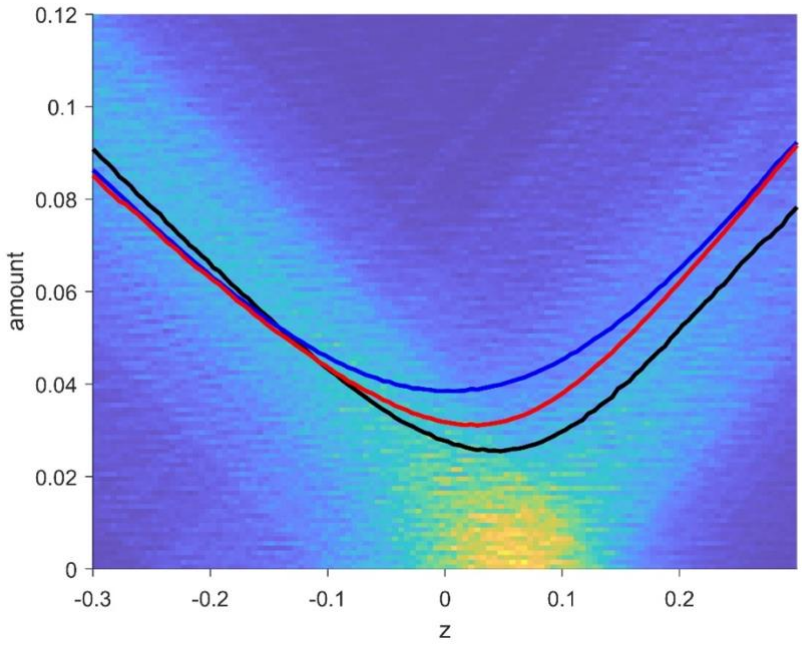
Thirdly, the Black-Scholes model, like the Boness model, assumes that volatility can be treated as a constant, and in particular is independent of strike and expiration. While this can work as a first-order approximation, as seen in the next section it leads to major problems in determining the properties of the implied volatility.

Of course, defenders of the theory will argue that such effects are well-understood and mostly come out in the wash. Again though, since the purpose of the formula is to predict the price which will match the expected payouts, a fourth and most basic test is to compare those prices with the actual payouts for historical data. The results are shown in Figure 2 for historical S&P 500 price data, with the VIX index as an estimate for implied volatility (for a discussion see Orrell and Richards, 2023). The Black-Scholes/VIX framework (blue line) gives systematic errors of up to about 40 percent when compared to actual payouts (black line). The background is a heatmap of actual straddle payouts over the period, representing over 4 million data points.

In practice, traders will adjust the volatility number, resulting in the implied volatility smile discussed further below, where at-the-money options with strike prices close to the current price tend to be assigned a lower implied volatility than options with more extreme strikes. The effect of this is to reduce the error by about half (red line), but it is still very significant, which is unsurprising given the influence of the dominant option-pricing model. This pricing error of course has not gone undetected;

researchers for example have noted that at-the-money straddle options consistently lose money. However rather than attribute this to a flaw in the model, it is rationalised as a "volatility risk premium" since straddles protect against volatility (Coval and Shumway, 2001; Goltz and Lai, 2009). As mentioned, one of the Black-Scholes assumptions was that markets are efficient, so price everything correctly and absorb new information instantaneously (Fama, 1965). The fact that the model has been helping to consistently misprice options for half a century therefore directly refutes its own assumption that markets are efficient.

Figure 2.
Plot of average price for 1-month straddle options versus log moneyness, for S&P 500 data over the years 2004 to 2020. The Black-Scholes model (blue line) systematically overprices options compared to the average payouts (black), while actual price paid splits the difference (red). The background is a heatmap of option payouts.



4. Implied volatility

Now, critics have been pointing out the drawbacks of the Black-Scholes model since the time it was invented – it is not news for example that price changes are not perfectly lognormal – but it is generally believed that the approach is "good enough" for its purposes, and the method has the advantage of simplicity. While one can add more refinements, just as ancient astronomers piled on epicycles to their geocentric models of the cosmos, the result will be a more complicated model with extra parameters that need to be set. And in any case, the results can be adjusted by choosing an appropriate implied volatility.

However, this flexibility is not a strength, because it means that the model can never be falsified. As Popper (1959) wrote: "In so far as a scientific statement speaks about reality, it must be falsifiable: and in so far as it is not falsifiable, it does not speak about reality." While it is trivially true that the model can be tuned to fit the data, the same could be said of just about any plausible model; and this simply shifts the burden of prediction from the model itself, to the choice of parameters. In this case, as (Derman and Miller, 2016: 5) observe, "The modeling of the volatility smile is likely one of the largest

sources of model risk within finance" which is why much attention in recent decades has focused on this topic (Horvath, 2023).

Because the classical model assumes that volatility is independent of strike, the implied volatility smile appears from a classical perspective to be a "logical inconsistency" (Simons, 1997). It is interesting then that attempts to model the implied volatility using classical logic lead to perhaps the most graphic illustration of its departure from empirical reality.

One example, discussed in Orrell (2024b), is the calculation of the VIX volatility index (Cboe, 2019). The VIX algorithm assumes that volatility is described by a single number (its goal is to find it), which is the main assumption of the Black-Scholes model; that the applicable growth rate is the risk-free rate, which is the main conclusion of the Black-Scholes model; and the principle of no-arbitrage (Carr and Wu, 2006), which is central to classical finance. Since none of these assumptions apply, the results of the algorithm are confusing at best. The historical average of the VIX index is about a third higher than the average realized volatility (Ahmad and Wilmott, 2005), which is the number relevant for option pricing. Also the fact that put options attract higher prices when markets are perceived to be falling means that the VIX algorithm, which tends to overweight these, is measuring not just perceived future volatility, but also perceived future price changes, which explains why the index is negatively correlated with price change (Bauer, 2022).

More generally, economists model implied volatility by constructing three-dimensional surfaces which specify its value as a function of log-moneyness x and expiration time T. A foundational result from Lee (2004) claims that "the large-strike tail of the Black-Scholes implied volatility skew is bounded by the square root of 2|*x*|/*T*." A consequence of the result is that the implied volatility in the tails cannot grow faster than $|x|^{1/2}$. According to (Raval and Jacquier, 2023) the formula "serves not only to infer directly observed information about the implied volatility smile into constraints on model parameters but also to provide arbitrage-free solutions to the extrapolation problem." For example (Lee, 2004) recommended that for extrapolating the volatility skew with splines, the formula "raises warnings against spline functions that grow faster than $|x|^{1/2}$, and against those that grow slower than $|x|^{1/2}$" which seems to limit the choices.

As an example, one popular approach is the stochastic volatility inspired (SVI) model given by

$$\sigma^{SVI} = \sqrt{\left|a + b\left(\rho(x-m) + \sqrt{(x-m)^2 + \sigma^2}\right)\right|}$$

which requires five parameters that must be calibrated for each expiry time. For large $|x|$ this formula scales with $|x|^{1/2}$ and therefore automatically satisfies Lee's formulas (Gatheral, 2006).

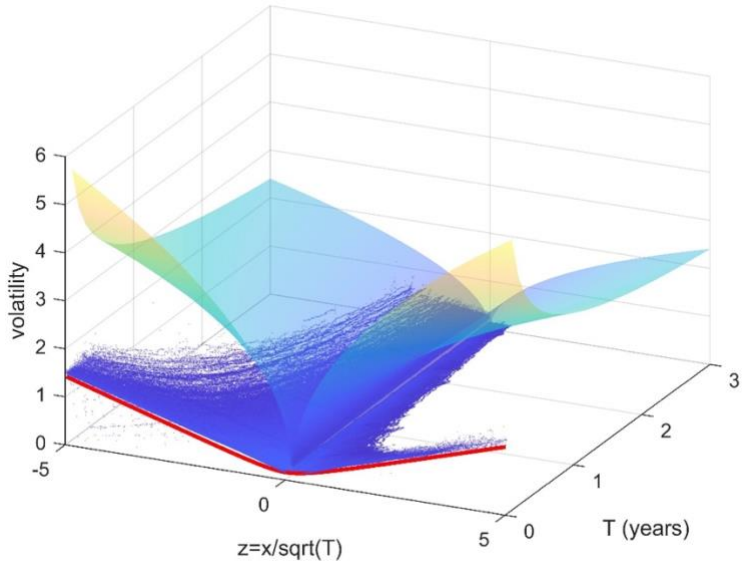
While it is beyond the scope of this paper to discuss the full array of implied volatility models, according to (Gatheral, 2006: 100) "the general shape of the volatility surface doesn't depend very much on the specific choice of model" especially since such models are usually designed to respect the Lee (2004) bounds. But while Lee (2004) stresses that "our formula is distinguished by its full *model-independent* generality" (his italics) it is based on the classical equilibrium-based, random walk approach. As with the Black-Scholes model, the proof relies on a no-arbitrage argument, and assumes for example that there is a parameter σ which corresponds to the volatility.

Again though the test of a model is not whether it is consistent with abstract theory or idealized principles, but whether it makes accurate predictions about the system's behaviour. Implied volatility is complicated by a number of behavioural and other effects (Derman and Miller, 2016; Orrell, 2021),

so the situation actually becomes clearer when we stand back to take a bird's eye of volatility for a large range of strikes and expirations as in Figure 3, which shows implied volatility as a function of T and $z = x/\sqrt{T}$. The data, shown by the blue points, is derived from SPX options during the period 2004-2020 (Orrell, 2024b). The option prices are averaged over each strike and expiration (from five days to three years), and the implied volatility is then computed assuming a constant risk-free rate for each year (this has only a small effect on the results). The classical bound (shown by the upper smooth curve) is too high to be useful, scales differently with both T and z, and generally bears little resemblance to actual data. A consequence is that models such as SVI which are designed to scale in the same way fail to capture the behaviour of implied volatility in the wings (Orrell, 2024c).

The red line is the quantum implied volatility model (Orrell, 2024c), which is derived by assuming that price change follows the associated non-lognormal distribution. The implied volatility can then be approximated as the volatility which gives the correct option price for that distribution. The fact that, over a large range of strikes and expirations, the agreement with observed data is good suggests that investors expect the market to have the same non-lognormal characteristics. In other words, while from a classical perspective the implied volatility curve seems to be a puzzling and illogical anomaly, it is best viewed as a numerical anachronism which results from a normal model being used to model a non-normal system. Instead of being a sign that market participants are illogical, it is a marker of model error.

Figure 3.
Plot of implied volatilities (dark blue points) from SPX options 2004-2020, plotted as a function of $\boldsymbol{T}$ and $\boldsymbol{z}$. Smooth surface is the upper bound from Lee (2004). Red line is the quantum model for implied volatility, which is constant along the $\boldsymbol{T}$ axis when plotted in this way.



5. Conclusions

To summarise, key results from classical finance – which ultimately derive from core principles including no-arbitrage and efficient markets – are based on the idea that price changes follow a lognormal distribution with a drift equal to the risk-free rate. Empirical evidence, on the other hand, shows that price change follows a distribution with sharper peaks and fatter tails, and a drift equal to

the growth rate. While the Black-Scholes model gives correct results (by definition) if you input the correct implied volatility for the particular strike and expiration time, the classical approach breaks down completely when it is used to calculate this number (as with the VIX index) or predict its properties (such as its scaling behaviour). Better results can be obtained if you assume that price change follows the quantum distribution, and use that to determine a strike-dependent implied volatility. Or more simply, since the concept of implied volatility refers to a lognormal framework: just generate the corresponding price distribution, including an estimated growth term, and calculate the option price numerically from the expected payout.

The reason that the Black-Scholes model took its place in the financial firmament, while the Boness model is usually mentioned only in books about the field's history (Gatarek, 2023), is because by replacing a subjective growth estimate with an objective risk-free rate, it appeared to put option pricing onto a rational, objective basis, with only one unknown parameter remaining, namely the volatility (Orrell, 2023). But that is a marketing test, not a scientific one (Wilmott, 2022). And the apparent simplicity was won only by exporting the complexity to the calculation of the implied volatility. The net result is that the classical option-pricing model – which helps underpin the quadrillion dollars worth of derivatives that hang over the world economy (Wilmott and Orrell, 2017) – systematically misprices risk.

In general, classical models typically have little or no predictive power because they rely on made-up parameters with no financial interpretation. With one extra fitting parameter, intersecting lines can be made parallel. With five parameters, financial engineers can fit the implied volatility curve, at least for a single expiration and some strikes; however, the formula still does not work in the wings. For comparison, Von Neumann once said "With four parameters I can fit an elephant, and with five I can make him wiggle his trunk" (Dyson, 2004). Rather than coerce a flawed model into giving sensible answers, a better approach is to start with the quantum model, which (being based on the quantum version of a spring) in terms of parameters is about as simple as a useful model can get.

An inescapable conclusion from the results above is that economists appear to have been turning a blind eye to data which contradicts the classical model. While other areas such as biology and psychology have experienced a replication crisis, where published results cannot be reproduced (Baker, 2016), the problem here seems worse, because observations which do not fit the data are simply ignored. A plot of intersecting lines for the variance due to price impact is taken as proof that the lines are parallel. The Black-Scholes model is called "the most successful theory not only in finance, but in all of economics" as measured by its "ability to explain the empirical data" (Ross, 1987); but claims that the formula is confirmed daily by "millions of statistical observations" do not hold up when we test it using millions of statistical observations. The implied volatility smile is treated as a puzzling anomaly, even though actual volatility shows a similar (but more accentuated) shape when plotted against price change. Figures 2 and 3 clearly violate the efficient market hypothesis (since option prices do not reflect payouts) and the no-arbitrage principle (since the Black-Scholes model and the Lee model do not match observed data) on a truly industrial scale, but the necessary data to make the comparison has long been publicly available. In short, the classical model seems to have been immune to any empirical evidence which contradicts it, due to what might be called a form of model blindness, where the model takes priority over observed reality.

As (Derman and Miller, 2016: 3) note, the Black-Scholes model "sounds so rational, and has such a strong grip on everyone's imagination, that even people who don't believe in its assumptions nevertheless use it to quote prices at which they are willing to trade." More to the point, they also

consistently and in a variety of contexts ignore evidence which doesn't fit the story.[2] A historical analogy is provided by supernovas, those massive stellar explosions which release a burst of radiation lasting months or even years. The first observations of such events by Western astronomers were in 1572 (recorded by the astronomer/alchemist Tycho Brahe) and then 1604 (recorded by his associate Johannes Kepler). However, Asian astronomers had known about them for centuries. The reason it took so long for the West to catch on was because astronomers there were blinded by Aristotelian science, which said that the planets rotated around the earth in spheres made of ether, and the heavens were immutable. Brahe also tracked a comet and showed that it would have smashed through those crystalline spheres, had they existed. As Abraham (2005) wrote, "We have to conclude that the astronomers of medieval Europe were effectively blinded by their faith in Aristotelian dogma."

Since its invention, classical quantitative finance has been built on the crystalline spheres of efficiency, rationality, and equilibrium, which seem similarly robust to contradictory evidence. Elaborate mathematical proofs for theories such as Black-Scholes are constructed from the principles of market efficiency and no-arbitrage, despite the fact that arbitrage is the main business model of much of the financial sector. Of course, mathematical models do not just conceal, they also act as prompts to investigate. The experiments described in this paper, including the reanalysis of price impact data, the relationship between volatility and price change, the test of theoretical and observed option prices against payouts, and the nature of the implied volatility curve, were all motivated by predictions of the simple quantum model. One can always argue that such effects could in principle be modelled using a sufficiently complicated classical model (just as a quantum computer can be emulated with a classical computer), but perhaps the best empirical defence of the quantum approach is that they weren't.

Mathematical models are vital to the proper functioning of markets because they are used to put a price on assets, options, and risk in general. As in other fields such as engineering, modellers therefore have an ethical responsibility to ensure that their models are giving accurate guidance, especially given the role that models have played in previous crises (Wilmott and Orrell, 2017). Instead, economists often seem as obsessed with their elegant equations and normal distributions ("normal" is from the Latin for "square") as early astronomers were with circles and spheres. Writing in the aftermath of the 2007/8 financial crisis, Bouchaud (2008) called on economists "to focus on data, which should always supersede perfect equations and aesthetic axioms." Wilmott (2010: 377) warned, "Being blinded by mathematical science and consequently believing your models is all too common in quantitative finance." Akerlof (2020) observed that the emphasis in economics on "hard" mathematics meant that "observations that contradict the existing paradigm will be dismissed if they violate the prescribed methodology." But maybe part of the problem is the type of mathematics. It is past time for economists to open their eyes to the possibility that markets and the economy are not as normal or square-like as their classical equilibrium-based models suggest.

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[2] An amusing example was provided by comments on an earlier version of this article (Orrell, 2024d).

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Menoetius revolted: Critique of Ayn Rand's *Atlas Shrugged* political economy, and its place in neoliberalism

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Abstract
This article analyses Ayn Rand's *Atlas Shrugged*, from the point of view of the critique of political economy. Using immanent analysis, we critically analyze the objectivist philosophy of the novel and its superficial resemblances with Marxism, especially its idea of a utopic society in the John Galt's Gulch. While Rand presents the individual producer as a realized and rational human being, we contrast him with the idea that the capitalist is merely the personification of capital to show how Galt's Gulch fails as a utopia. Such analysis allows us to situate *Atlas Shrugged* in the liberal project, arguing that liberalism still has an aristocratic bias which facilitated the 2008's economic crisis.

Keywords: Ayn Rand; neoliberalism; critique of political economy; aristocracy; economics and literature.
JEL Code: B24, B29, Z11

> *Now Iapetus took to wife the neat-ankled maid Clymene, daughter of Ocean, and went up with her into one bed. And she bore him a stout-hearted son, Atlas: also she bore very glorious Menoetius and clever Prometheus, full of various wiles, and scatter-brained Epimetheus who from the first was a mischief to men who eat bread; for it was he who first took of Zeus the woman, the maiden whom he had formed. But Menoetius was outrageous, and farseeing Zeus struck him with a lurid thunderbolt and sent him down to Erebus because of his mad presumption and exceeding pride. And Atlas through hard constraint upholds the wide heaven with unwearying head and arms, standing at the borders of the earth before the clear-voiced Hesperides; for this lot wise Zeus assigned to him.*
>
> Hesiod, *Theogony*

> *Thus the fundamental form-determining intention of the novel is objectivized as the psychology of the novel's heroes: they are seekers.*
>
> György Lukács

1. Introduction

Atlas holding the heavens on his back has entered the social consciousness as a powerful image. The American writer Ayn Rand made use of this image in her novel *Atlas Shrugged* ([1957] 2006, henceforth *Atlas*) as a metaphor for the productive class and the desire to just shrug off the ones who "exploit" them – something the Portuguese Brazilian translation (Rand, [1957] 2017) does not capture when adopting the term "revolt" (literally, *Atlas's revolt*). Rand would be known as one of the fiercest defenders of capitalism, through her philosophy of Objectivism. Such philosophy is one of the most extreme defenses of liberal capitalism, by taking the apology of rational egoism as a virtue and altruism as a fakery, an insult to human spirit (Senra, 2011).

From the point of view of the American culture, *Atlas* is a phenomenon. In the introduction of Rand's academic biography, Jennifer Burns (2009, p. 1) wrote that "in 2008 alone combined sales of her novels […] topped eight hundred thousand, an astonishing figure for books published more than fifty years ago". The data used by Burns come from the Ayn Rand Institute and, even if it has an interest in inflating its patron's importance, Rand's influence in the American culture is undeniable. According to Alonso and Rodríguez (2019, p. 77), it would be impossible to list all American businessmen that read and felt inspired by any of her books. According to Duggan (2019, p. 89-90), former American president Donald Trump considered himself aligned with Rand's thinking, just as a good part of his government. To someone outside her context, it is a mystery how she became so popular.

Therefore, in spite of her fame/infamy, we aim to critically evaluate this book because it is a *text*. Marc Bloch (2002) wrote that, in order to make good use of the historical method, we must analyze what the witnesses of history produced: "we know that witnesses can lie or deceive. But, before all, we must let them speak." Such procedure must also be observed in literary criticism and its intersection with economics. We argue that letting *Atlas Shrugged "*speak", and making use of the tools of the critique of political economy, will tell us something about the reality of capitalism and of the neoliberalism.

In order to illustrate the argument, it must be reminded that one of Rand's most popular disciples was Alan Greenspan, who considered her and Friedman[1] the "iconoclasts" of his time (Greenspan, 2008). Although he downplayed her influence in later years, in his memories he exalted the role of Randian ideas in his worldview and, above all their performance: "I began to study how societies form and how cultures behave, and to realize that economics and forecasting depend on such knowledge… [Rand] introduced me to a vast realm from which I'd shut myself off". Greenspan did not see a lot of issues in supporting violent dictatorship in foreign countries and, as we will show below, this does not enter in contradiction with Randian ideas. Taking in consideration practical aspects of society implies, both for him and his mentor, promoting gains for their own agents, not to all of society. Therefore, we mention Raymond Williams's (1977, p. 145) reminder that "literary theory cannot be separated from cultural theory", because *Atlas* has an underlying influence, from which an analysis of political economy would be relevant. The English novelist and essayist G. K. Chesterton (1904) once wrote that "a good novel tells us the truth about its hero; but a bad novel tells us the truth about its author". Judging by this standard alone, *Atlas* is doubtlessly a terrible

[1] Friedman never met with Rand, but considered her "an utterly intolerant and dogmatic person who did a great deal of good." (Burns, 2009, note 6:22).

novel. But Chesterton continues: “But from bad literature he might learn to govern empires and look over the map of mankind”.[2]

Following the argument proposed by Žižek (2002), that the book’s ideological presentation should not be underestimated, we see that Rand’s use of controversial language and appeal to her readers’ ego guarantees her success with some demographic targets. These, however, are distractions. More than that, it provides a window into the liberal worldview, as well as being a piece of an “aristocratic rebellious” literature (Losurdo, [2002] 2019). In spite of its rebellious proposal, we argue that if we let *Atlas Shrugged* “speak”, we will see that it is not a book about “shrugging” or “revolting”, as in the Brazilian translation, but it is a book about *submission*. Instead, we argue that a more accurate metaphor would be Atlas’s brother, Menoetius. In the *Theogony*, Menoetius was cast off to the Erebus by Zeus for his pride and punished in a lake of fire (Hesiod, 1914). With climate change, created by the pride and greed of a capitalist society, in which Capital needs to consume, produce and expand as an existential need, Menoetius raging against Olympus for things he caused seems to be a more appropriate metaphor.

The article makes use from the contributions of many authors that used the so-called “immanent analysis” in order, from the reading of a text, to make explicit the decisive meanings of a body of ideas (cf. Chasin, 1999; Losurdo, [2002] 2019; Lukács, 2020; Mesquita, 2021). We intend to show that, on the contrary, in its own words, *Atlas* represents a regressive ideology, a reactionary defense of an exclusionary elitism, which advanced in the 1970s, having as its peak the early 21st century. Besides this introduction, the article is divided in four sections. In the first, we present a brief biography of the author; in the second, we realize an immanent reading of *Atlas*, focusing on the Galt’s Gulch chapters. In the following, we study the ideological aspects of the Randian text, contrasting with Marx writings. In the final section, we discuss the reactionary character of Rand’s liberalism. We, then, conclude reaffirming the points of the article.

2. The utopia of greed as an ideal society

Heller (2009) considers *Atlas* as the synthesis of her philosophical ideas in form of a novel. They can be summarized in John Galt’s discourse, the book’s climax, which took two years to be written: “I swear—by my life and my love of it—that I will never live for the sake of another man, nor ask another man to live for mine.”

If Lukács (2000) defined the novel as the bourgeoise epic, *Atlas* is the culmination of this definition, in the way that it openly portrays the capitalist class as the ultimate hero. In the novel, communist governments took over the entire world and the United States, last bastion of democracy, is more

[2] The entire citation is worth reproducing: “In one sense, at any rate, it is more valuable to read bad literature than good literature. Good literature may tell us the mind of one man; but bad literature may tell us the mind of many men. A good novel tells us the truth about its hero; but a bad novel tells us the truth about its author. It does much more than that, it tells us the truth about its readers; and, oddly enough, it tells us this all the more the more cynical and immoral be the motive of its manufacture. The more dishonest a book is as a book the more honest it is as a public document. A sincere novel exhibits the simplicity of one particular man; an insincere novel exhibits the simplicity of mankind. The pedantic decisions and definable readjustments of man may be found in scrolls and statute books and scriptures; but men's basic assumptions and everlasting energies are to be found in penny dreadfuls and halfpenny novelettes. Thus a man, like many men of real culture in our day, might learn from good literature nothing except the power to appreciate good literature. But from bad literature he might learn to govern empires and look over the map of mankind.”

and more under their control. The heroine, Dagny Taggart, has the dream of building a transcontinental railway while the country is on its way to be literally turned off. She faces off against the statist villains, who want to take advantage of her gifts, while she unveils the mystery on who John Galt is. Meanwhile, she discovers that the "producers" exited society and left to a mysterious valley where they can fulfill their most selfish desires, far from the collectivist world. Galt created a perpetual energy engine, that sustains a "utopia of greed" in the Vale. Most of the story is centered on Dagny and her lover, Hank Rearden, discovering the truth behind all of this as they learn the virtues of egoism. In the end, the heroes win, waiting the outside world self-destruct itself as they plan the new society, which belongs now to heroes and individual creators. "'The road is cleared…We are going back to the world.' He raised his hand and over the desolate earth he traced in space the sign of the dollar." (Rand, [1957] 2006).

The book is written in simple language. Her career as scriptwriter helped her to organize her stories so that they can be easy to read (Alonso, Rodríguez, 2019, p. 78). In spite of being published in 1957, she took almost 15 years to finish it. It was published in the apex of the Golden Age of capitalism, where the only general fear in the United States was the Soviet Union. Thus, Rand shocked her audience by portraying the United States as decadent. The book was badly received by critics, but, due to the structure concocted by her financiers, it became a success. After the publication, Rand ceased to write novels and dedicated herself to political activism.

Both Burns (2009) and Heller (2009) biographies dedicated many chapters to the writing of *Atlas*. Because it is Rand's most iconic work, it receives most attention and, for the purposes of this article, it is enough to analyze the chapters on the Vale, commonly called Galt's Gulch. *Atlas* has many unique excerpts, such as Francesco d'Anconia's discourse on the empowering property of money, the narration of the failure of the Twentieth Century Motors (a company managed by a workers' cooperative, therefore "damned" according to Rand's views), and even John Galt's radio speech, but we chose the Vale because it is the epitome of objectivism's *praxis*, the "utopia of greed".

Utopias have a great political value because they are capable of confronting an ideal situation with reality, with the intention of "provoke the political imagination of the readers, a *sine qua non* condition to transform the real" (Loty, Schang, 2021, p. 19). Clardy (2012, p. 245) writes that the Vale "is a sketch of what the world could and should be like if things were done according to this Objectivist philosophy" – confronting the American reality with the ideal of the Vale.

It is allowed to Dagny enter the Vale, where she finds many "producers" there: bankers, entrepreneurs, celebrities and even urban workers and farmers (Rand includes herself as a fishwife[3]), all of them enlightened by rational egoism and rejected by a society that does not understand them. Upon portraying a large diversity of actors, Rand tries to show Dagny and Hank, and the reader by default, that they are not alone in the fight against "collectivism" – there is a "conspiracy of good people" guiding them to a final victory. She inverted the logic of representation movements by framing the capitalist businessman as a member of an oppressed minority, in which their talents and energy are exploited by the majority. The productive class is forced to hand over the work of their hands to a country that exploits them[4]. For this reason, the producers go on a

[3] Galt: "She's a writer. The kind of writer who wouldn't be published outside. She believes that when one deals with words, one deals with the mind." Dagny is jealous of her closeness with Galt.

[4] Galt: "You proclaim yourself unable to harness the forces of inanimate matter, yet propose to harness the minds of men who are able to achieve the feats you cannot equal. You proclaim that you cannot survive

social strike and retreat to the Vale. She used anticonformist language to create a "superconformist" theory (Žižek, 2002).

The Vale itself is located in Colorado. Francesco d'Anconia, Dagny's childhood friend, had talked to her about an "Atlantis" that only heroes can enter. The place has no official name, people call it what they want. Galt explains to her that there are no laws or rules, not because Rand was anarchocapitalist[5], but because she believed that an enlightened person would transcend the need of laws. There is only one law, that was more of a custom: to never use the taboo work "give". Thus, nobody receives anything for free, not even a cup of water. Everyone works, including Dagny. Non-monetary favors are seen as "compromises" that must be paid back.

As said before, the Vale's inhabitants can enjoy Galt's genius and live according to the customs of rational egoism. They can create pieces of art and inventions without others' pressure. In a talk with Ellis Wyatt, an oil baron, Dagny asks why he abandoned his privileged position to stay in the Vale, to which he replies: "I now work for use, not for profit—my use, not the looters' profit. Only those who add to my life, not those who devour it, are my market. Only those who produce, not those who consume, can ever be anybody's market. I deal with the life-givers, not with the cannibals."

One of the main messages of *Atlas* is that the producer owes nothing to nobody. Different from what the Friedman doctrine[6] says, the Randian producers owe nothing to no one, not even their shareholders. And yet, there is an ardent desire to create and to be recognized by their creations in the producer's heart. In the novel, it is given emphasis to the moral strength of the producers. Hank meets with another businessman and they refuse to accept a deal with the government in order to keep their principles. He considers Dagny to be the only worthy client of his miraculous metal. Clardy (2012, p. 243) argued that the question of how the public goods work (among them, the force field separating the Vale from the outside world) is left without answer. We argue that Clardy's question can be answered in the narrative itself: only the enlightened people are worthy of receiving the public goods supplied by Galt. The looters and moochers are automatically excluded. Therefore, the tragedy of commons is solved in the Randian system through a worthiness mechanism, as in the reactionary catchphrase: "human rights for the right humans".

This logic of worthiness is also reflected in the organization of the market in the Vale. Rand seems to have a dubious relationship, almost schizophrenic with the concept of "competition" itself. On one hand, she supported capitalism, framing the government as a villain for creating laws limiting competition. And, yet, competition is just something in the background at the Vale. Although Rand denounced monopolies as anticapitalistic collectivism (Burns, 2009, p. 39), all goods and services in the Vale are produced through monopolies (Clardy, 2012, p. 242). In reality, each monopoly is gained through competition in which the winner takes the entire market and the loser may be free

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without us, yet propose to dictate the terms of our survival. You proclaim that you need us, yet indulge the impertinence of asserting your right to rule us by force—and expect that we, who are not afraid of that physical nature which fills you with terror, will cower at the sight of any lout who has talked you into voting him a chance to command us."

[5] The relationship between Rand and Murray Rothbard, father of anarchocapitalism, was of mutual hatred. He went to meetings at her apartment for a while and defended her works, but one day in July 1958, Rothbard realized "I hated the guts of [Nathan] and Ayn and the rest of the gang" (Burns, 2009, p. 183).

[6] The only social responsibility of the corporation is to maximize long-term profits for its shareholders (Friedman, 1970).

to do other things or work for the winner. They resemble more medieval duels. In a scene, Dagny talks to Andrew Stockton, owner of the Vale's foundry, showing her his former rival who is now a sculptor, a rambunctious man that became docile after losing and accepts peacefully his "destiny", earning more money than before. And Andrew also says he cannot wait Hank joining the Vale so that he can be defeated by him and become his servant[7]. No word is said about the logistics of this market, only the consolidated power relations.

When Rand puts the individual in the center of her work, it is necessary to ask who is this individual. Much of Rand's philosophy comes from Nietzsche (besides Albert Jay Nock, José Ortega y Gasset, and other earlier authors that fused reactionary and free market ideas). Although Sciabarra ([1995] 2013, p. 92) emphasized that Rand scoffed at him for his emotionalism, Burns (2009, p. 16) showed that she was his reader, devouring his books. She even did many direct references to him in her works, before realizing that such references would harm her project of presenting herself as a completely original thinker. Nietzsche's influence stands out because Losurdo ([2002] 2019) presented, using an anachronic comparison, a "Rand-like" Nietzsche, who believed that the *übermensch* were a group of people separated from their peers and, through their efforts, they had an inner superiority over the others. For this reason, Nietzsche criticized abolitionists, because he considered slavery a fundamental institution of a healthy society. Rand would also be a "radical aristocrat", like Nietzsche.

These influences from Nietzsche are also reflected in John Galt. Generally, Rand divides the human nature between unique, highly motivated individuals that are indifferent to social norms, and the rest (Clardy, 2012, p. 19). Galt, however, is not just a hero with these traits, but akin to a Messiah of a new age. In the words of Rand, the objective of her writing was "the projection of the ideal man" (Sciabarra, [1995] 2013, p. 107). Galt proposes that the individual who has the control of themselves, has the control of anything, a process that Rand called "mind focus" (Senra, 2011, p. 69). Galt is not ashamed of working in the lowest digging trenches and, yet, he still has time and fortitude to create fantastic machines, capable of producing infinite energy, whose usage he accedes only to those whom he deems worthy of his vale of egoism. Galt does not hesitate, nor he is scared. He does not need his human flaws. And, because of that, he can always take the correct moral decision.

Not even when he is being tortured by the government, does he stops being serene. He even gives instructions to his incompetent torturers of how to do their job better. He cannot hate them, neither feel pity for them, because these are not rational reactions; they are just common people. Because he has control of himself, he has control over the world around him. He can recognize potential in others, such as Dagny and Hank, while rejecting others. While disguised as a trench worker, he always entertained Eddie Willers, Dagny's friend that failed to live up the Randian ideal; he was always polite to him, but he never talked about the Vale to him. Eddie was just a common person; he could not understand the lesson that a person should only live to themselves. For this reason, he is left to die in the end. Common people like Eddie must not be allowed in the new world.

[7] Andrew: "When I came here, he and his partner had a sort of combination hand-forge and repair shop. I opened a real foundry, and took all their customers away from them. The boy couldn't do the kind of job I did, it was only a part-time business for him, anyway—sculpture is his real business—so he came to work for me. He's making more money now, in shorter hours, than he used to make in his own foundry […] I know one man who could [defeat me] and probably will, when he gets here. But, boy!—I'd work for him as a cinder sweeper. He'd blast through this valley like a rocket. He'd triple everybody's production."

Atlas can be classified as a *bildungsroman* (coming of age novel), because it involves a journey of self-discovering. Suarez (2005) classifies *bildungsroman* in stages, that can be filled by *Atlas:*

Table 1: *Atlas* as a *bildungsroman*, a coming-of-age story

Bildungsroman	Atlas Shrugged
Work in the *bildung* emphasizes practical actions of the protagonist, they take the initiative.	*Atlas* emphasizes that wealth is accumulated through hard work and that the egoist and rational person should be proud of the fruits of their work and protect them from looters and moochers.
Long journeys are very important, because they allow the protagonist to leave the known world in order to experience new discoveries about the world and themselves.	Dagny and Hank travel through the entire United States looking for the "truth" about John Galt and discover the virtues of self-love, while observing the evils of collectivism – one is not born a Man, one must become one.
Translation was a valued discipline in the romantic era, represented as not just mere translation of texts, but also learning from the mystical Other, that allows the protagonist to achieve inner revelations.	The Vale is a place outside society, where the enlightened can realize their most personal ambitions and to be helped by a community that understands them.
The past is inhabited by heroes, that references the glories of ancient conquests.	A great emphasis is given to the characters' lineages, such as the Taggart patriarch and the first d'Anconia that migrated to Argentina, who already showed the egoist virtues.

Source: Elaborated by the authors using Suarez (2005) and Rand ([1957] 2006).

Thus, the novel follows Dagny's journey to learn the virtues of egoism. In the beginning, she has an intuitive understanding of egoism, but she lacks the realization that she must love herself more than her railway. Throughout the one thousand pages of the book, Dagny is subject to a journey that ends with the holistic realization of the person. While the Vale's guerrilla invades the government complex to rescue Galt, Dagny orders a worker to stay out of her way. The confused worker stays immobile. Then, Dagny goes for the simpler solution: she shoots him. He falls dead and Dagny goes forward without any weight in the consciousness. The narrative shows that no one can condemn her for this. Dagny has control of herself; for that reason, she has control of everything around her, including other people's lives. Her relationship with Hank is possible because they both share the same worldview. If one day they become obstacles to their ambitions, they will discard each other. If Eddie was even a bit near enlightenment, he would have accepted his death in peace.

From the point of view of political economy, the logical extension of objectivist philosophy is to decide the fate of nations. For that reason, Rand defended enthusiastically the genocide of Native Americans for the crime of not recognizing property rights in the way she understood (Norton, 2015). Although she had denounced racism as "collectivism", and had herself experienced antisemitism, her writings remain hostile and blissfully unaware of the structural effects of racism in American society. For Tucker-Abramson (2017), there is a racialized language in the escape from the producers into the Vale as metaphor of the White Americans running away from urban

centers to suburban refuges, after the Second World War. Capitalist escapist fantasies are still popular among the elites – see Rushkoff (2022), in which many companies aiming wealthy clients promise escapes, resembling the Vale, from a supposed societal and environmental collapse, or Simpson and Sheller (2022) on the use of islands to foster fantasies of cryptosecessionism, in which liberal utopias can be realized through cryptocurrency. Such escapes are very attractive to the elite, because they are simple solutions that turn extraneous structural engagement.

3. The dialectics of capital: the Randian project against Marxism

Another reason why the chapters on the Vale were chosen was because they illustrate another of *Atlas*'s main point: its antagonism with Marxism. Rand never referenced real people in *Atlas* to avoid outdating her setting, but it is clear which ideas she had in mind. Due to her strong personality, she accumulated enemies from all sides of the political spectrum. But, in all of her work, she shows a deep hatred of Marxism.

Such attitude can be explained by her time in the Soviet Union, where her family experienced terrible life conditions while adapting to the new Soviet reality (Nikiforova, Kizilov, 2018) and fueled the major part of her political activism, be it against New Deal, or testifying to senator Joseph MacCarthy's House of Unamerican Actions on Communism in Hollywood. And yet Sciabarra ([1995] 2013) argued that there are many parallels to be made between Rand and Marx. Both saw themselves influenced by Aristotle and his dialectics. Similarly, Shah (2021) observed parallels between Gramsci and Rand, in which the Vale's inhabitants adopted a world domination strategy based in a hegemonic domination, control of key areas. Although she read some Marxist literature in the then called University of Petrograd, its departments were not fully influenced by the official Soviet ideology (Sciabarra [1995] 2013; Burns, 2009). Her use of utopia is both a rupture with the liberal anti-utopia tradition (Loty, Schang, 2021) and an attempt of dialectically overcoming the problems of capitalism. Just like Marx and Engels ([1847] 2010) ended *Communist Manifesto* with "Workers of all countries, unite!", Rand also shared a similar message to the producers, writing in a previous work titled *Capitalist Manifesto:* "Individualists of the world, unite!" (Burns, 2009, p. 38).

From a Marxist point of view, *Atlas* is another manifestation of capitalist discourse – the difference is that it fully embraces ideas that would be "impolite" to be openly admitted by capitalists. Galt is just another attempt to deny that the alienation of the worker exists or is relevant. In contrast, for Rand, alienation is imposed by looters and moochers. A simple method to identify heroic companies in *Atlas* is to see if they have the name of their founders. A company such as Twentieth Century Motors is fraudulent because there is no indication of its founder in its name. Unlike these poor imitations of a true firm, all the companies with personal names have their founders in the Vale. To Rand, producers create unalienated extensions of themselves. They need to be constantly sacrificed to attend the looters' demands – consumers that do not recognize the true value of the things they consume.

Although the tone might be as tempestuous as Marx's style in *Capital*, the fight against alienation using pure entrepreneurial psychic energy is wishful thinking, if we follow Marx. The capitalist is just a personification of capital (Marx, [1867] 2011, v. 1, p. 307), an avatar. It is as if capital acquired a life of its own, whose objective is growth and nothing else. As an avatar of capital, the capitalist must take decisions that foster the increasing accumulation of capital. In the moment that a capitalist decides to take a "non-rational" decision – such as a large studio execution giving preference to an artistic movie of low return, instead of a sappy blockbuster – they will jeopardize

their career, because they can simply be replaced by another one who will take more decisions in line with what is to be expected. Obviously, sometimes it does not work, the most apparently rational decision might not be the best (especially when involving long term returns, such as any activity with environmental impact), but this is the imperative logic. Galt gleefully achieves, therefore, a point that Marx warned about: the complete subsumption of the individual in the capital. Galt will do all he can to maximize returns to himself, because his creations are an extension of himself. Any person that stays in the way of a producer, such as the nameless worker that Dagny kills, must get out of the way or be crushed by the Juggernaut. Just like the religious ceremony, as described by Marx ([1867] 2011, p. 167, 330), the ultimate capitalist fantasy includes the supposition that the workers celebrate being tossed to the Juggernaut. *Atlas* realizes it under the peaceful environment of the Vale.

The lack of consideration with others is a noted theme in *Atlas's* negative reviews. Arrogance, to Rand, is a virtue as long as it is backed up by talent. The Randian capitalist takes the role of a patriarchal dictator, taking the company and everything in its inner workings – workers included – as extensions of their productive actions. The objective is to realize a product without alienation, an artistic expression of their desire to create[8]. And they have right to this dictatorial role because they are enlightened by their rational egoism. As said before, Galt does not make mistakes. The destruction of the old world is according to the "plan". The managers of Twentieth Century Motors are condemned because they did not take hard decisions, such as laying off workers. Thus, *Atlas* allows the businessman to justify "tough decisions", such as elimination of worker benefits. They should not feel guilty because, if the workers are enlightened, they would gladly accept and celebrate the decisions of the leaders, and do the same.

Marx would recognize this as the bourgeoise discourse of his time, that success depends of abstinence and some entrepreneurial spirits, hiding the exploitation process (Marx, [1867] 2011, section VIII). Rand inverted the logic of oppression – entrepreneurs are the oppressed minority – and upon removing the *noblesse oblige* as a duty of the elite ever since the pre-capitalist age, she set up a model of action. Rand's heroes are people who live in austere, but comfortable houses in the Vale, without practicing conspicuous consumption (and when they do, they do it to make a point, like Francesco). All of them emphasize hard work, aiming to legitimize the American myth of the self-made man, "connected to utopian visions of a classless society, or at least to a society that allows considerable social mobility", what Adorno called "the barbaric success religion" (Paul, 2014, p. 367-368). Hank, for example, came from a poor family and built everything he had using his blood, sweat and tears[9]. Greed, covetousness, selfishness are virtues that advance mankind, while altruism is a mortal sin.

[8] This reflects Schumpeter's entrepreneurship discourse: "[to fulfill their] will to conquer: the impulse to fight, to prove oneself superior to others, to succeed for the sake, not of the fruits of success, but of success itself" (Schumpeter, [1934] 1949, p. 93).

[9] A common critique to Rand was that "she hated the poor". We consider this to be a vulgar critique because there is diversity of characters in *Atlas:* many characters that are producers in the outside are, in reality, moochers and use their undeserved riches to harm the heroes; the most sympathetic villain is a union leader, to the point some readers think he was an infiltrated agent of Galt. Burns (2009, p. 173) argued that Rand abandoned her sympathy for the poor present in previous works in Galt's speech, but we believe she still keeps it. Galt is generalizing the language that there are looters and moochers in all classes. Similar rhetoric is found in Plínio Salgado's integralism, that saw something heroic in the poor farmers (Chasin, 1999).

The matter of sacrifice is also explored. It is an insult to sacrifice oneself to the others in the Randian system. Although Rand had a distorted view of what exactly is being sacrificed, these ideas find echo in Marx, because that is what has been demanded from workers. The descriptions of workers' conditions in *Capital* are just a sample of how the progress hailed by the Randian system demands the sacrifices of many bodies. Such sacrifices do not exist in the Vale, because they are all working for the good of themselves. As Clardy (2012) argued, no word is said about the Vale's worker class, assuming that all of them docilly work for the winner monopolists. Although Galt swore to never ask another man to give his life for him, what is a *Man*? Again, one is not born a Man, one must become one – in the words of Francesco: "The reason my family has lasted for such a long time is that none of us has ever been permitted to think he is born a d'Anconia. We are expected to become one." (Rand, [1957] 2006). *Atlas* is a work that has a cast of both people who managed to become Men and those who failed. And the readers already understand what happens to the ones who fail.

In real life, it is questionable how much businessmen would accept being "cinder sweepers" to more successful people. Empirical evidence has shown that the more a worker behaves like the Vale model worker – loving their job, docilly submitting to the enlightened capitalist, trusting their decisions – the higher the chances they will be exploited, denied benefits or increases in wages, being rewarded with just more work (Tokumitsu, 2015; Stanley et al, 2023). Plus, the idea of a city only made of rich people was already ridiculed centuries before by the Christian preacher John Chrysostom, in the 4th century. In his sermons, he exhorted the rich people from Constantinople, including empress Eudoxia, to abandon their greed and exploitation of the poor. He made many enemies because of this. In one of his sermons, he described a city of poor and a city of rich. If they start from the same point, the city of poor will prevail, even if it stays "poor", without luxury, because the rich will be too proud to do "poor" tasks. He concluded: "When will the city of the poor have need of the rich? Clearly, when the time comes to destroy it" (González, 2002, p. 208). In summary, Clardy (2012) argued that the Vale fails to represent a utopia because, in order to work, it is necessary to not make questions on the logistics of many services.

4. *Atlas* and the liberal worldview: Eleutheria shrugs?

Rand has an ambiguous place in the pantheon of liberalism. Although her books are read by liberal figures, mentions to her most extreme ideas are swept under the rug or even shunned. In spite of her fame, few people would claim to be "objectivists" in meetings of liberal scholars and sympathizers. But, due to her fanatical devotion to her own ideas and ideals, many conservatives and libertarians saw her as an asset to promote their ideas against the Left. Ginzburg's (1999) discussion on the berserker is relevant. The berserkers were, originally, Viking warriors (whose historicity is not clear) that took drugs in order to fight under the effect of a frenzy in the battlefield, without caring for pain or wounds. Ginzburg observed how this "tradition" continues today, anachronically appropriated by reactionary authors. It evokes the idea of a debater that is capable of resisting to any rhetorical attack, while fight tenaciously to defend their own ideas. Rand can be seen a capitalist berserker.[10] Burns (2009) mentioned many examples of interlocutors that claimed

[10] Political berserkers can be one of the most effective assets of a capitalist. For those who ignored her as just an eccentric, Teitelbaum (2020) shows that esoteric eccentrics, like Steve Bannon, Olavo de Carvalho and Aleksandr Dugin, influenced new right governments exactly because of their combative attitude and talent in attracting reactionaries under their wings. They don't even need to wield *actual* power, symbolic power is enough. An eccentric berserker is, essentially, a very low-cost asset for a capitalist: if they are unsuccessful, the capitalist can simply abandon them; *au contraire*, the capitalist class has a loyal, low-maintenance elite

it was nearly impossible to win a debate against her due to the tenacity of her arguments and devotion to her ideals. Many see her as a religious leader (Walker, 1999; Gunalaban, 2017).[11]

In her view, there was no contradiction between condemning racism as collectivist delirium and defending genocide of peoples who have alternatives to property rights as she understood. Would such ideas be incompatible with the liberal worldview? As Mariutti (2019, p. 21) wrote, what determines the liberal worldview is "competition as basic ordering principle of society". Although there are differences between how liberals understand this, Mariutti identified the "neoliberals" as the ones that emphasize "competition supported by regulatory mechanisms that minimize the costs". It is the also the current that is closer to Rand's thought, due to her emphasis on competition as an arbiter of success and social justice as an obstacle. The human being must become a personal enterprise and compete based on their abilities, seeking higher stages of competition. Therefore, far from the expectation of self-destruction of capitalism by its contradictions, the capitalism of *Atlas* is a "strong, stable, and natural force" and the shocks heal the system, being the holy duty of those who live in it to not just survive, but thrive as well (Tucker-Abramson, 2017, p. 89). Shock therapy becomes a lifestyle.

For this reason, racism, sexism, elitism, all other "-isms" can be seen as collectivism deliria because they harm the competitive system, by stopping the oppressed from contributing to the competition system and improve themselves. Slips such as former Brazilian, Chicago-trained minister of economy Paulo Guedes indignant with domestic helpers going to Disneyland (Arcanjo, 2021) are just slips. What if they aren't?

History shows that, in its insertion, liberalism had a distorted view on this issue. Losurdo ([2006] 2011) showed that this a conveniently ignored trait in the history of liberalism, to the point of being necessary a "counter-history" of liberalism. If we take liberalism as "the tradition of thought whose central concern is the liberty of the individual, which is ignored or ridden roughshod over by organicist philosophies of various kinds" (*ibid*, p. 1), Losurdo asks who this individual is. This individual is more limited than it is supposed. The classic liberal authors were inserted in a deeply racist society, that they internalized in their writings. John Calhoun, for example, is remembered as an important representative of liberal thought, who defended free markets and the free initiative (Tabarrok, Cowen, 1992). He also saw Black slavery in the Southern United States as a "positive good", something fundamental to society and considered abolitionists deluded. The reason why Losurdo started with Calhoun is a rhetorical *reductio ad absurdum,* but it soon becomes clear that this was not an isolated opinion, neither an artifact of a less enlightened era – Grotius, Locke, Tocqueville, Acton, all of them had similar opinions that puts in question if all of humanity should be included under the liberty liberalism defends. While the English liberals prided themselves for their free-market policies and freedom of expression in the 19th century, they also condoned the

soldier. Such model is quite successful in the age of social networks, while conservative parties depend more and more on eccentric candidates that shock and advance the audience, such as Marjorie Taylor Greene in the United States and Nikolas Ferreira in Brazil (Nagle, 2017). Jordan Peterson, for example, can write the wildest garbage about "woke moralists" in the space a tweet allows and yet not lose his power among his followers. On the contrary, he might even incite a berserk frenzy. Burns (2009, p. 69, 171) emphasized how Rand's career was supported the American entrepreneurial elite: "business had found a champion."

[11] Luigi Corvaglia, board member of the European Federation of Centres of Research and Information on Sectarianism, has noted the relationship between cults and libertarian thought, when conservative and libertarian ideas converge and, in the process, liberal ideals are swept under the rug to create cultic propagation of ideas (Corvaglia, 2023).

systematic destruction of the Gaelic culture just across the Irish Sea, considering it incompatible with the new capitalist culture. Alfredo Bosi (2007, p. 363) concludes in his review that it is "strange that people still claim, in good or bad faith, that liberalism was or still is synonym of social and economic democracy."

Losurdo had a controversial critical view of Nietzsche. According to him, the German philosopher understood that there were some people naturally superior to the others – the division between *übermensch* and *üntersmensch*. Such division is also present in the writings of classical liberals, which are inherited by modern liberals.[12] Among Rand's allies, there was Ludwig von Mises. He was one of Rand's economic teachers (Burns, 2009).[13] He went to some meetings at Rand's apartment and wrote positively about *Atlas*. Mises, who was an aristocrat by birth, and whose coat-of-arms is adopted by many institutes that inherit his name, subscribed to the ideal of free initiative. His liberalism, however, is embedded in a religious and aristocratic nature (Augusto, 2016). There is, in his work, a "defense of the natural differences and the superiority of few in relation to others" that "extends…to the relationship between those who rule and those who do not, both in politics and between individuals in the economy" (*ibid*. p. 104). Such elitism is present in Mises's effusive comments on *Atlas*: "You have the courage to tell the masses what no politician told them: you are inferior and all the improvements in your conditions which you simply take for granted you owe to the effort of men who are better than you." (Burns, 2009, p. 177).

Just like Rand's heroes have the power to decide the fate of entire nations, so do economists in real life covet this power. Slobodian (2018) argued that one of the founding principles of the neoliberal international order are the "xenos rights", the idea that, in economic missions, the natives must have their rights suspended or, at least, put as secondary concern in order to give free reign for the liberal consultants to reform their economies according to the neoliberal agenda. It is crystalized in proposals, such as the charter cities championed by Paul Romer and used in cryptosecessionist projects (Simpson, Sheller, 2022). One can see the antiracist rhetoric from liberal thought, but practical indifference when confronted with reality. This is obvious in the South African apartheid, with liberal economist W. H. Hutt telling South African Blacks they must endure their suffering in name of economic freedom (Slobodian, 2018; Darity et al, 2023).

This has consequences to how Rand saw the "endgame" of her worldview. Both in *Atlas* as in *The Fountainhead*, Rand adopted the common Hollywood ending: the world is saved (or left to die so it can be reborn) and the couple ends together. Using utopia as a political fiction, Rand could create a *just* world, where the producers are rewarded and, above all, looters and moochers, socialists and communists, and recalcitrant liberals and conservatives are punished. Eddie Willers's ending is necessary for the purification of the world. While Dagny joins the apotheosis of the producers, Eddie is relegated to history's garbage bin. He committed the capital Randian sin: he did not live for himself. When he took over Dagny's company in the last act, he did it to impress her. But, even before, most of the main characters noted he did not have something fundamental that the elite

[12] Nietzsche influenced many earlier economists, not just liberals, among them members of the German Historical school (Reinert, Reinert, 2006), Schumpeter (Santarelli, Pesciarelli, 1990), Hayek and Mises (Robin, 2015) and Pigou (Maciò, 2019).

[13] She might have referenced his ideas on the socialist economic calculation debate in Galt's speech: "Now you have placed modern industry, with its immense complexity of scientific precision, back into the power of unknowable demons—the unpredictable power of the arbitrary whims of hidden, ugly little bureaucrats. A farmer will not invest the effort of one summer if he's unable to calculate his chances of a harvest." It is reasonable to think that Mises might have talked about his ideas to her and she is referencing by memory.

had. Although Galt had entertained him in their talks, in any moment he exhorted Eddie to live for himself or even implied he had a chance, even if it was near-zero, to join the Vale. On the contrary, in spite of his kindness and devotion, for the justice of the world be fulfilled, he must die with the old world[14]. The novel never shows a final meeting between Dagny and Eddie, but she does not need it. Dagny, being enlightened by rational egoism, can abandon Eddie without any weight in the consciousness. She could even kill him in case he becomes too bothersome, just like the worker that did not open the way for her. Mercy is too valuable to be wasted on common people like Eddie.

Ayn Rand presumed herself part of the "winners", thus she placed herself in the Vale as the fishwife. In the words of Burns (2009, p. 34), "Nietzsche's elitism fortified her own. Like many of his readers, Rand seems never to have doubted that she was one of the creators, the artists, the potential Overmen of whom Nietzsche spoke". But she saw no future for the ones who needed to go. In the same way, libertarians do not seem to be particularly conflicted with right-authoritarian regimes. James Buchanan's opposition to the Chilean dictatorship was tepid, when compared to his opposition to student movements in the 1970s California (Mongiovi, 2019). Friedrich Hayek (in)famously said he preferred a liberal dictatorship to a non-liberal democracy, but he could only say that because he never saw himself as part of those who are persecuted by a military dictatorship (Filip, 2018). Hayek's ideas on spontaneous orders, that promote a self-regulating market, also foster submission in a population, in which they must accept the market result (Whyte, 2019). Both in Hayek, apparently, and in Rand, explicitly, there is this presumption that the market will benefit the ones who trust on it. Therefore, structural problems like racism, patriarchalism, military authoritarianism etc., are given secondary attention at best because, ultimately, they are not their problem. The market will eventually "solve" these problems and they will not have to make any noise – just as Rand emphatically claimed the market was solving the problem of racism until leftists reintroduced it in America (Norton, 2015). Eleutheria, the Greek goddess of liberty, shrugs.

As mentioned before, there is a contradiction between liberal rhetorical activism and practical indifference towards structural problems of society. Isn't it contradictory how an ideology that prides itself in freedom of choice accepted so promptly Thatcher's slogan "there is no alternative"? If there is no alternative, then there is no choice. And, if there is no choice, then what is the point of fighting back? The message of *Atlas*, therefore, is not about "shrugging", nor "revolting" as in the Brazilian translation, but rather "submission".

5. Conclusion

Atlas's appeal to its demographic target, however, should not be ignored. Rand's work is also capable of earnestness and sincerity. In a scene, Dagny is at a diner and immediately sees ways to improve the road ahead. She is only thinking of how to improve it, without any egoist intention, seeing her work as a way to artistically express herself. Academics tend to underestimate the power of stories like these, of how they can resonate with audiences. Although Rand was not near as a good writer as Dostoevsky or Tolstoy, Rosa Luxemburg noted how these reactionary authors could have "a rousing, edifying, and liberating effect on us" (*in* Frölich, 1972, p. 187) that socialists

[14] Ayn Rand had, for many years, an affair with Nathaniel Branden. Meanwhile, Branden and a younger follower, Patrecia, started an affair without Rand knowing, which spelled doom to the objectivist project. Nathan tried to calm Rand, calling Patrecia "an Eddie Willers" to assure her that there was nothing between them and she was as irrelevant as Eddie; history showed she was definitely not irrelevant (Heller, 2009).

should pay attention to.[15] Rand wanted to tear down the wall that separated elite cinema and people's cinema, vulgar art and cultured art (Sciabarra, [1995] 2013, p. 126). Similar ideas can be found in the critique of political economy tradition: "in a communist society there are no painters, but only people who engage in painting among other things" (Marx; Engels, [1845] 1976, p. 418). The desire to practice nonalienated, *meaningful* work transcends differences in worldviews. Independent of how academia treats her, her works will have appeal to some people because, just like any work of fiction, they appeal to basic desires of mankind.

The resemblances stop there. Rand believed it to be acceptable to shrug the world's plight to reach this goal. Both Eddie the anonymous worker killed by Dagny are examples of this. For that reason, we consider that *Atlas* is a novel about submission. Even if it denounces a certain type of tyranny, it remains indifferent to others, that pose no direct threat to libertarianism.

The Aristotelian objectivism helped, after the collapse of Bretton Woods, creating exclusionary policies. The defense of liberalism implied an increase of the irrational powers of the monetary authority, with winners and losers determined beforehand. Its executor, not by chance, was Greenspan. Only after the 2008 crisis, he would cynically admit that the irrational policy he adopted, under the influence of the liberal objectivism, starting from the 1970s, was wrong. The ideal Randian man is an exclusionary entity and, ultimately, fated to fail when he leaves the world of fiction and is confronted by the real world *in ways the author could not expect*. The critique of political economy sees the capitalist as more Menoetius than Atlas, making John Galt nothing more than an idol.

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[15] As an anecdote, when I (Rafael) discussed the book in a reddit thread, another user claimed it was one of their favorite books. They considered themselves an anticapitalist and rejected Rand's ideals and yet they said they felt inspired by the book's characters attitude of not giving up and even helped them recognize an abusive relationship in real life. In my view, this capacity of unpredictability when reading is one the many reasons why Atlas (italicized) should be considered a work of art, in spite of Rand's average writing ability and malice, and my personal opinion that the world would be a slightly better place without it."

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Twenty-first century money: Huber and the case for CBDC

Joseph Huber. *The Monetary Turning Point: From Bank Money to Central Bank Digital Currency (CBDC).* Cham: Palgrave Macmillan, 2023. Hbk, 192 pages. ISBN 978-3-031-23956-4. £119.99.

Jamie Morgan [Leeds Beckett University]

Joseph Huber is Professor Emeritus in Economic Sociology at Martin Luther University, Halle-Wittenberg, Germany.[1] He is perhaps best known as author of the book *Sovereign Money* published in 2017 and is likely well known to readers of this journal for his various papers in *Real-World Economics Review* addressing the debates concerning how money is created in the modern banking and finance system.[2] He is, however, also known for his longstanding advocacy of what today is called "green ethical banking" and for his early work on ecological modernisation theory.[3] In his latest book, *The Monetary Turning Point*, he argues that while money creation continues to be dominated by a "split circuit" in which the vast majority of money creation is undertaken by commercial banks (with a host of attendant problems resulting from this), there is now a further category of money which includes new forms of digital money, several of which exhibit technologically based advantages that speak to a likely transition in regard of what form of money dominates in the future. In keeping with his long term concerns Huber argues that among these new forms, central bank digital currency (CBDC) in particular provides an opportunity for states to reassert sovereignty over money i.e. recapture control for public benefit over what is currently a mainly privatised and adversely constituted money system. To reiterate, this argument is situated to a concept of dominant money:

> The dominant money within a currency area is that which is system defining during a certain historical period, in that it determines how the monetary system and monetary policy work, and which has the lead in creating money and readjusting its stock. (Huber 2023: 34)

[1] For background visit: https://sovereignmoney.site/ and the monetary reform campaigning organization: https://www.monetaryalliance.org/our-team/joseph-huber/

[2] Re *Sovereign Money* see Huber (2017a). For papers in *Real-World Economics Review* see Huber (2014, 2017b, 2019). See also the earlier joint report written for the New Economics Foundation (Huber and Robertson 2000).

[3] Ecological modernization refers to policy informed by the precautionary principle which seeks to shape long-term structural change in production and consumption in line with environmental concerns. It was not originally intended to be a focus on efficiency in the mainstream economics sense of that term. See, for example, Huber (2000).

The book consists of eight chapters and covers a great deal of ground but in what follows I first concentrate on the core of the argument made in Chapters Four, Five and Six. Here Huber distinguishes a premodern and modern history of money and identifies three main periods in the modern era and suggests a transition to a fourth period has begun. I then move on to briefly address Huber's further discussion of some of the potentials and prospects offered by CBDC. *The Monetary Turning Point* is one of the first book-length treatments to approach this issue from a systemic point of view and one of the first whose approach accords with post-Keynesian and financialization theory sensibilities. As such it warrants careful consideration.

Modern money in historical context: change through solutions to emergent problems

In *The Monetary Turning Point* Huber does not discuss the early history of how money came to be or the various debates for what constituted a "monetised" society or economy, rather he simply notes that since ancient times the general power of money creation as well as the licencing of private money issuance have been claimed as the prerogative of rulers.[4] This, of course, is not to suggest that all forms of circulating "means of payment" begin life as creatures of the state or are from the outset recognised and sanctioned by the state. It is simply to suggest that there is an obvious attraction in (Huber 2023: 57):

1. Determining the currency as the realm's monetary unit of account,
2. Creating and issuing the money or several types of money denominated in that currency, and
3. Benefitting from seigniorage, the gain from money creation.

As Huber notes, the modern-nation state has inherited this from previous forms of territorial power. He then goes on to further distinguish a pre-modern and modern era. In pre-modern times the dominant *issued* form of money was metal coinage and the beginning of a modern era is defined by the proliferation of paper money. To be clear, Huber is not suggesting that the use of metal coins (a commodity) proves that the origin of money is in the adoption of a super-commodity as a solution to the problem of coincidence of wants i.e. the spontaneous invention of a medium of exchange by self-interested individuals in a situation of barter, and nor is he suggesting that use of paper money is an entirely new invention in the modern era. He is simply noting that a modern era can be identified based on the *growth* of paper money. He then identifies three sub-divisions or periods of relative dominance of money issuance within this modern era (Huber 2023: 63-64):

1. 1660s to the 1840s: growth of unregulated private paper money and relative decline in systemic importance of sovereign coins.
2. 1840s to around 1910: a power shift in which central banks begin to issue legal tender paper money and private banknotes (and equivalents) are displaced.
3. Late 19th century to around 2010: the growth of commercial bank money and the relative decline in systemic significance of central bank money (legal tender paper money).

Two qualifications are important here. First, for Huber it is *systemic importance* that is being identified not just use. Second, the periods are delimitations of *historical processes* in regard of which Huber is interested in *relative dominance* and in "turning points". Relative dominance (a rise

[4] Among the many references he provides see, for example, Hudson (2004) and Ingham (2004a, 2004b) for a sense of the context he is working with.

and fall) implies a general direction of travel, but this can only be approximate as a periodisation and it is always possible to identify exceptions. Exceptions, however, need not necessarily invalidate the general claim (though it may affect its specific relevance to a given time and place). In any case, Huber's main historical-geographic focus seems to be Europe and the US (albeit he is interested in everywhere else and especially in relation to incipient change today).

Importantly for Huber there is an internal logic (though he does not use this phrase) to the process of (re)composition of the money supply. Change occurs (Huber 2023: 64):

> (1) when the respective monetary system, or the incumbent dominant money, respectively, pose problems that cannot be solved within the given framework, and
>
> (2a) a new type of money emerges that offers some solution to the problems, and/or
>
> (2b) offers efficiency advantages such as lower costs of production, provision and handling, improved ease of use and faster transferability of the money. So incumbent monies are less convenient, circulate at lower use frequency, and are more expensive to produce and handle than the competing new monies.

Insofar as it is focused on this logic of change *The Monetary Turning Point* is a book about systems of money in the sense of what these systems do. As such, its concerns are different than say Tony Lawson's interest in an ontology of what money is.[5]

Modern money in historical context: Huber's periods

As regards the first of Huber's periods (1660s to 1840s), he notes that despite the massive influx of precious metals from Latin America (a rather polite way of describing the depredations of Hernán Cortés, Francisco Pizarro and others beginning in the early 1500s), the period was marked early on by a chronic shortage of silver and gold, and hoarding and debasement of coins and that this provided some impetus for the adoption of notes over the period and that "Paper money opened the door to monetary modernity by substituting a purely symbolic or informational token for the traditional commodity money" (Huber 2023: 66).[6] Paper money was issued in various ways by different entities and it was common for this to require a licence from the state and some private banks were given privileged status, becoming the beginnings of state or central banks (such as

[5] See Lawson (2019: Chps 5 and 6). Note, Huber does, however, seem to share an interest in the problem of what a language of credit money conveys (if not the same inference from that problem), "At least on the balance sheet of central banks, money should always be present for what it is: a liquid monetary asset of safe stock, the money base of a nation or community of nations. Even if money is created in connection with extending credit, money and credit are two different things. "Credit money" or "debt money" are handy metaphors, especially in a world of book-money banking, but they insinuate a false identity of money and credit" (Huber 2023: 7).

[6] Visit: https://www.statista.com/statistics/1282384/gold-silver-shipped-americas-europe-historical/ Note, Huber is sympathetic to credit theory of money and seems to have in mind reference to the money thing i.e. what is used to encapsulate the concept of money, rather than any implication of what money is in regard of a commodity. He goes on to note in regard of his statement, "This does not contradict Keynes' view of stamped silver coins to have always been token money. With paper money, however, modern money was starting to break away from its traditional commodity substrate" (Huber 2023: 66).

the Bank of England in 1694).[7] According to Huber, at this time there was no "coherent idea of a monetary regime for banknotes" (Huber 2023: 67). And while the use of paper money facilitated growing economic activity during the mercantile era:[8]

> the multitude of paper notes issued by individual banks and principalities, often of only local reach and uneven trustworthiness, meant a varied and overall limited acceptance of the banknotes. A related problem was the convertibility of notes into silver coin, which was promised but, due to the fractional base of silver coin and bullion, not always kept. The lack of universal acceptance was the Achilles' heel of unregulated paper money throughout the eighteenth and far into the nineteenth centuries. The paper money's patchy acceptance hampered the development of well-integrated national markets and also international trade. Furthermore, and also from the beginning, the ease of issuing notes lured bankers and certain treasuries into over-issue of paper money. This in turn resulted in unstable currency exchange rates and unstable purchasing power, as well as banking crises and hitherto unknown boom and-bust-cycles due to over-investment and under-demand (Huber 2023: 68).

Huber's second period extends from the 1840s to around 1910. In terms of the internal logic the issuance of a standardised central bank money and the transition to legal tender solved the problem of multiple note issue. Many banks issuing their own paper money across different geographic localities created problems of familiarity, acceptance and trust, as well as a problem of unstable purchasing power and relative value of each to the other and reliance on the continued existence of a given bank. Absence of consistency and in worst cases bank failure are obvious impediments to an integrated domestic economy and thus to economic development and trade more generally. In contrast, a standardised national bank note (and denominations) created a universal means of payment, visibly supported by the state, and legal tender status reinforces this. As Huber notes, the shift began in Britain and invited considerable theoretical debate from around 1800. The Banking School argued in favour of private money and made the case that the issuance of banknotes could avoid a problem of inflationary oversupply and ought to operate with little intervention. Demand and supply in combination with collateral were sufficient. The Currency School in contrast highlighted banking crises, problems of acceptance and tendency for inflation. They advocated for a legal monopoly on banknotes vested in a suitably empowered institution and:

[7] As Huber notes, the American War of Independence was in part a response to interference in paper money issuance. Governors of American territories (which would become Federal States) issued colonials bills (colonial scrip) to taxpayers but the British Currency Acts of 1751 and 1773 attempted to restrict the practice. In 1775 the Continental Congress issued its own continental dollars and the helped finance the War (see Huber 2023: 67)

[8] Note, mercantilism is a product of economic theory from around 1600 to 1800. Its central tenet was that a country should maintain a positive 'balance of trade', maximize its exports and minimize its imports, and thereby accumulate wealth (not only does this assume trade is a zero-sum game of competition over fixed resources, historically it seemed to encourage countries to expropriate resources of other countries and then reexport them – recalling that the 1600s to 1800s began the process of European empire expansion to the rest of the world – slavery etc.). Paper money was attractive insofar as it "was much cheaper to produce and more convenient to handle than the cumbersome and cost-intensive mining, melting, minting and handling of coins and bullion. The related seigniorage for note issuers was accordingly much higher. Payment of larger amounts of money in banknotes carried in a wallet was more convenient than payment in coins carried in belt bags and strongboxes. However, paper money is susceptible to counterfeiting, succeeding the previous fraudulent coin debasement." (Huber 2023: 66).

> The legal basis for central bank notes was created with the Bank of England Act in 1833 and the Bank Charter Act in 1844. This then became the point of reference for most European states at a Paris meeting in 1867. Central-bank notes are still about paper money, but monetarily they represent a different type of money: legal tender, reflecting the monetary sovereignty of a nation-state, issued by the national central bank on the basis of a legal mandate (Huber 2023: 69).

As Huber also notes, versions of the Banking School and Currency School debate has resurfaced in different guises at various times since.[9] Moreover, historically the problem of central bank paper money became entangled with the problem of a gold standard, since a standard was deemed necessary to limiting supply and maintaining value, and over the years this has confused the issues because linking the value of money to a commodity shifts the focus to the significance of having, and the role of, the standard. While having a standard may create scarcity it produces numerous other problems and historians such as Charles Kindleberger and Barry Eichengreen have discussed this in detail. For Huber, however, the imposition of a gold standard provided incentives for the development of commercial bank money and this occurred in two stages marked by surges in economic activity and trade. First, the period from around 1900 to the Great Depression and second after World War II. In most countries M1 has been the main measure of the general money supply and in simple terms it can be defined as available currency and bank deposits that are sufficiently liquid to be used for payments.[10] As Huber notes, in the two identified stages commercial bank money rose as a share of M1. Today it constitutes over 85% and as much as 97% of the relevant money stock and cash is a small and declining part of the supply of money. This brings us to Huber's third period characterised by the growth of commercial bank money and the relative decline in systemic significance of central bank money over the past hundred years or so.

The dominant money today is commercial bank money. This is created when a bank extends a loan and creates a new deposit to the sum of that loan. Repayment destroys this money, but in the meantime it is new purchasing power that can either be transferred from bank account to bank account as payments are made or can be exchanged for cash when withdrawn from an account. When a payment is made from one bank to another the transfer is settled in the reserve account of the respective commercial banks held at the central bank. Reserves do not leave the central bank reserve accounts, few central banks have a set minimum reserve ratio, commercial banks are happy to make loans and then seek additional reserves if necessary and the central bank tends to accommodate this, and in any case a thin base of reserves can enable a great deal of banking activity. This combined with payments made on behalf of the state and central bank activity intended to implement financial and monetary stability, comprise a "split circuit", two separate but related tiers of a money system in which bank money has come to dominate and especially from

[9] For example, Hayekian neo-Austrians have advocated against the existence of a central bank and for radical free banking and money competition. Since Chartalists following Knapp hold that creation (but not use) of money is a state prerogative and money is a creature of the state, they typically stand in opposition to the Hayekian position.

[10] Note, many central banks do not use M1 as their main measure these days. The Bank of England, for example, focuses on M4. For data visit the ONS site: https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/auyn/qna

And the Bank of England: https://www.bankofengland.co.uk/boeapps/database/index.asp?first=yes&SectionRequired=A&HideNums=-1&ExtraInfo=false&Travel=NIxSTx

the 1960s/70s onwards (numbers of bank accounts grew, cashless payments between accounts grew, extension of credit of various kinds formalised and proliferated and cash declined proportionally). Historically:

> The reason for this tidal change to the benefit of bank money was not a problem with the note monopoly. The problem was the gold standard. The artificial scarcity of money it induced was a hindrance amidst strongly growing populations, industries and commerce. As a result, the gold standard repeatedly had to be relaxed or even temporarily suspended. In addition, an amount of national government bonds were counted as part of the gold coverage without much fuss. More importantly, as an alternative to cash and a way to bypass the constraints of the gold standard, the banking sector developed the possibilities of book money, that is, cashless payment by transfer of non-bank account balances and interbank clearing of claims and liabilities (Huber 2023: 71).

This again speaks to a logic of change, including reasons to innovate. Cheque books, for example, while not new started to come into common use from the 1920s/30s.[11] For Huber, however, the important point is that the rise of commercial bank money has been indicative of a loss of control over monetary sovereignty and this has had numerous consequences. While central banks are not powerless it is commercial banks that ultimately decide how much credit is created and to who it is extended and thus how not only the money supply evolves but also how the economy is structured and develops in relation to this credit creation.[12] Pro-cyclical banking activity, the flow of finance to other financial institutions, asset inflation, rent seeking and inequality, rising private debt levels and a tendency to periodic financial crisis have been intrinsic to the dominance of commercial bank money within a split circuit. The idea of an efficient allocative equilibrium in finance is misleading and recurrent financial market failures are not at root caused by isolated acts or shocks but by processes that are vulnerable to triggering events. Among these processes are those that have facilitated the growth of non-bank financial institutions, who have, in turn, added to the connectivity and complexity of finance and this has included growth of intermediation activity, payment service providers and shadow banking, growth which now means that the system extends far beyond the banks themselves. As Huber notes, the shadow banking sector was reported to have $227 trillion in financial assets in 2020 compared to $180 trillion in the banking sector.

For Huber, in keeping with his interest in rising and falling aspects of historic processes and with turning points, the current system has growing pathologies and recurring problems and as such is ripe for change. Money market fund (MMF) shares have been used as a money surrogate for quite some time and there has been development of various e-money and electronic payment systems

[11] And for Huber, growth of bank money, exacerbated problems for the gold standard and contributed to its demise: “The growing demand for bank money, not least because of the financing needs of the two world wars as well as the economic stimulus programmes of the 1930s, was accompanied by a more frequent suspension of the gold standard. The gold standard was followed by the gold-linked US dollar standard agreed upon in Bretton Woods in 1944. No sooner had this standard been adopted than it was softened again as a result of the Korean War of 1950–53 and the American intervention in the Vietnam War from 1965–75. In 1971, US President Nixon took the dollar off the gold peg.” (Huber 2023: 72).

[12] “In industrial countries until around 1980, bank credit, and thus the money supply, grew at about the same rate as nominal GDP. Thereafter, however, money and credit growth sharply diverged from GDP growth. In general, money supply growth exceeded GDP growth by a factor of 3.5 to 4.5.19 The M1/GDP ratio (the Marshallian k) has risen accordingly.” (Huber 2023: 43)

that have created new possibilities, but new forms of digital money have characteristics that speak to Huber's itemisation of change: solutions to problems, efficiency advantages etc.

A third tier and fourth turning point: new forms of digital money

Digital money is not new if by that one simply means money held in electronic form. A bank deposit is digital money in this sense but this is not what people mean when they refer to new forms of digital money. These subdivide in general terms into cryptocurrencies, stablecoins and central bank digital currencies (CBDC) depending on who issues them, how they are administered and how their relative value is maintained.[13] It is no-one's responsibility to maintain the value of a cryptocurrency. A stablecoin is issued by some organization on the basis of some mechanism that (at least in theory) "guarantees" the value of the token against some reference entity (usually whatever it is denominated in such as the US$). A retail CBDC meanwhile needs no mechanism to stabilise its value against a currency since it is just another version of that currency (a digital $, a digital £ etc.).[14] In any case, in all three subdivisions the money takes the form of digital tokens, typically held in e-wallets that are used for payments via some process of validation or authentication of transfer of the token. The key innovation here is use of some combination of distributed ledger technology (DLT), blockchain or some equivalent, cryptographic security and smart contracts.

One does not need to understand the technical details of new forms of digital money to appreciate the potential the technology offers. If well designed and effectively implemented the information transfer and validation technology offers speed, certainty, security, transparency and also means there is no need for an intermediary to clear and settle payments with the additional costs that might entail. This translates into a standard economic argument for efficiency (see e.g. Huber 2023: 120-124). Moreover, the technology facilitates micropayments (one can make digital payments of small sums expressed as decimals of the denomination, useful in situations where multiple charges may be applied – road charging, internet of things, alternatives to subscriptions etc) and automated payment (a given designated event triggers payment, useful for automatic payment of sales tax to the state at point of purchase and also useful where large transactions were previously dependent on an intermediary such as property purchase) and can be used to support programmable money (money with an expiration date or which is tied to particular purposes that facilitate policy such as carbon budgets, healthy eating and so on, but equally has the potential for malign surveillance and discipline in terms of access and rights within society and economy).

To be clear, the technology of these new forms of digital money is continually developing and has yet to establish itself in regard of many of its potentials and there are still concerns over energy use (though energy use depends on how a digital money is issued, administered and what form validation of payments take). Except in a few localities most people's direct experience of the technology is via trading of cryptocurrencies on coin exchanges for speculative purposes and their indirect experience probably amounts to not much more than lurid headlines regarding misbehaviour at those exchanges – FTX etc. Along with this speculative trading has come a campaign (from advisors who stand to earn fees) to promote cryptocurrencies as a form of

[13] For further discussion see Morgan (2023a).

[14] Except insofar as programmable. See further comment for what this means.

legitimate investment asset that might be found as a component within any normal investor's portfolio according to "risk appetite", and paralleling this there has been pressure for the provision of services and instruments in the respectable heartland of financial trading (the US Securities and Exchange Commission, for example, authorised its first crypto exchange-traded-funds in early 2024). However, there is still a question mark concerning which if any of the new forms will ultimately proliferate as a universal means of payment that is treated as a money and fulfils the functions of money (a somewhat different issue than merely the role of money as one asset among many in Keynes's liquidity preference concept).

A competent regulator, of course, is proactive in regard of future prospects rather than merely reactive. Most central banks, the Bank for International Settlements, the International Monetary Fund and a host of other sources of regulatory principle have produced material on new forms of digital money, though there is also commentary among regulators that they are not taking the issues seriously enough or at least not with appropriate urgency (despite the flurry of regulatory analysis in response to the prospect of "systemic stablecoins" issued by one or several large corporations with existing payments infrastructure, millions of customers and global reach).[15] It is also the case that economists, again with a few notable exceptions, typically lack the imagination and skillset to say much of interest on the subject. If you take the time to look through the literature much of it amounts to little more than regressing values of, and volume of trade of, various cryptocurrencies against other financial assets and against macroeconomic indicators, notably economic growth. There is very little on the issue of what difference it makes to adopt different means of payment that is created and administered in different ways. As I suggested in the introduction, however, Huber is different. *The Monetary Turning Point* builds on his long years of interest in exactly those subjects that few economists have taken an interest in with the exception of post Keynesians, financialization theorists and similar.

According to Huber, cryptocurrency and stablecoin form part of a third tier of money in addition to the two tiers that constitute the split circuit that currently dominates. While tokens may transfer from wallet to wallet, unless cash or assets are used cryptocurrency and stablecoin are initially acquired via payments of commercial bank money and are redeemed back for these. Moreover, currently stablecoin reserve systems are managed through some designated bank's services and not via an account at the central bank. As things stand, therefore, cryptocurrency and stablecoin stand in relation to commercial bank money. However, since retail CBDC is issued by the central bank it stands in a different relation as part of the first tier.

This brings us to Huber's prospective fourth turning point i.e. the scope to transition to a fourth period in which the dominant money will be different than it currently is. For Huber, the technologically based advantages that are common to new forms of digital money mean that it isn't going to go away, and of the three main variants cryptocurrency lacks stability of store of value and stablecoin creates a host of problems for the state by adding a new form of privatised money to the problems already ingrained via the split circuit. CBDC, meanwhile, offers an opportunity for the state to achieve or recover monetary sovereignty.[16]

[15] See, for example, Arner, Auer and Frost (2020) and Bank of England (2021).

[16] There is something tragicomic about the widespread presumption that bank money is under central-bank lead and control, the system overall thus being supposed to represent a sovereign currency system rather than the bank-led para-sovereign bank money regime it actually is. If bank money is inherently unsafe and has to be rescued time after time by central-bank and government intervention, the question arises as to why this screwed-up situation is repeatedly accepted instead of leaving the banks to their private liabilities, and

The significance of monetary sovereignty isn't a subject most of us are used to thinking about and when one just states the term it doesn't evoke any particular set of thoughts or feelings. But perhaps it should and if we put the issue slightly differently it probably does. If we adopt Huber's terminology, the split circuit has privatised much of money creation and given inordinate power to commercial banks. The business models and lending foci of these banks have major implications not only for how money supply varies, but also regarding how the economy and society develop in accordance with how debt is created and financial assets are traded. The main visible policy levers of the central bank in regard of monetary and financial stability have evolved over time in relation to the dominance of bank money and in particular in relation to the need to ensure commercial bank stability in a world of evermore complex financial connections. As any familiarity with the world of banking and finance will make abundantly clear, this has dragged central banks into a host of interventions that only make sense in this pathological system – continual provision of reserve liquidity, quantitative easing, broker-dealer and financial asset market maker of last resort etc. and even then the system continually seems to innovate in ways designed to exceed central bank oversight and attempts at control.

The existence of CBDC is an opportunity to reset the situation and as Huber notes many countries are at one stage or another in this process.[17] For Huber, ultimately use of CBDC might allow a central bank to detach itself from an overwhelming concern with commercial bank reserve liquidity and focus instead on aligning money creation with social and economic goals in a more (in the ordinary language rather than the perverse economic sense) rational way. Much of this turns on what role CBDC plays.[18] According to Huber it is, for example, significant that commercial banks cannot readily switch to some version of the new forms of digital money and maintain the system as is since issuing "uncovered bank tokens" would be a "relapse" into "insufficiently backed paper money" with all the problems this entailed – multiple competing notes (now tokens) invoking problems of parity and trust (Huber 2023: 96). Huber has a great deal more to say about issues of scope, and of design and implementation (see e.g. Huber 2023: 140-141) and a great deal to say about how this might affect concepts of monetary accounting and use of terms like asset and liability in regard of the balance (e.g. Huber 2023: 174-178). To fully appreciate the nuance of the case he makes one must read the book but suffice to say, if CBDC becomes a larger portion of M1 then the role of commercial banking is set to change.

Conclusion

To avoid misunderstanding, *The Monetary Turning Point* is not a manifesto and does not make an MMT type case for monetary financing of the state in order to achieve a better world. It does, however, start from critique of the current situation and argues that if we take history seriously then the dominant money is bound to change. At the same time, Huber is an economic sociologist of

providing the non-bank public with central-bank sovereign money of safe stock—such as a dominant supply of sovereign cash once was, and as CBDC can become, if properly implemented. In constitutional terms as well as in the interest of effectual monetary policy, it is time to put the checks and balances in the monetary system right again (Huber 2023: 60).

[17] For comparative state of play visit: https://cbdctracker.org/

[18] For an example of how development is being conceived see Bank of England (2020, 2023a, 2023b). For some of the issues see also Kuehnlenz, Orsi and Kaltenbrunner (2023) and Morgan (2022, 2023b).

some sophistication and his argument that new forms of digital money offer technologically based advantages is by no means a tacit form of technological determinism. It is rather a discussion of potential and opportunity which takes seriously the idea that problems of systems lead to change through solutions and alternatives. If there is any comment to made here on the book (which to be clear is well worth a read) it is that there is a great deal more that could be said about the politics of agency and the problems in the world into which a CBDC (if it in fact comes to dominate) will be introduced. The book has a short section on the current problem of "too big to fail" banking where central banks and government must rescue commercial banks in order to preserve the payments system and the status of bank money – ring-fencing etc notwithstanding – which has a "certain blackmail character" (Huber 2023: 136) and a section which discusses the technical means by which CBDC can be put into circulation, for example, via open market operations to buy up existing government bonds using CBDC payments rather than injections into central bank reserve accounts (Huber 2023: 138), but there is far more that might be said here. This is especially so when one recalls that Huber's concept of dominant money is one that "determines how the monetary system and monetary policy work" (Huber 2023: 34) and this is a matter of politicised relations and power rather than merely technological capacity. A similar point also applies to the first of Huber's reasons for recomposition of the money supply insofar as the statement "pose problems that cannot be solved within the given framework" (see Huber 2023: 64) is ultimately a contingent issue of who gets to decide and on what basis.

I by no means intend to imply Huber is unaware of the points just made, but it strikes me there is great scope for a second volume opening up debate on the democratic possibilities for control over money creation and in regard of the need for a different way to think about the role of money in economy and society. One does not need a CBDC to engage in monetisation of the state but, and especially via programmability, it offers a particularly interesting way to undertake that financing. Arguably, we are now in a position where we are acting as though we have choices we don't really have in regard of climate change and ecological breakdown and important aspects of that are debates over who pays for change and whether we can afford to save ourselves.[19] A strange set of questions indeed as Huber surely appreciates given his background. There are many other issues that could also be transformed by reclaiming monetary sovereignty. The UK, for example, as a recent report from the Centre for Social Justice sets out, has a chronic problem of (in every sense) under-resourcing of social care despite that local authorities spend just under £27 billion per year on that care (which after years of austerity funding cuts across their budget now accounts for more than half of their total spending).[20] Given years of neglect and an aging population, fixing social care is an urgent problem and this seems an area ripe for CBDC experimentation. Futures are made not merely discovered and new forms of digital money could be a tool for good. As Huber notes though, currently central banks are being cautious. Reading Huber's book may help you have your say.

[19] For some background visit the Focus 2030 New Global Financing Pact Summit 2023 site: https://focus2030.org/Special-Edition-New-global-financing-pact-what-to-expect-from-the-June-22-23 And see appendix.

[20] And with an estimated further £162 billion annually in value of unpaid care. See Centre for Social Justice (2024).

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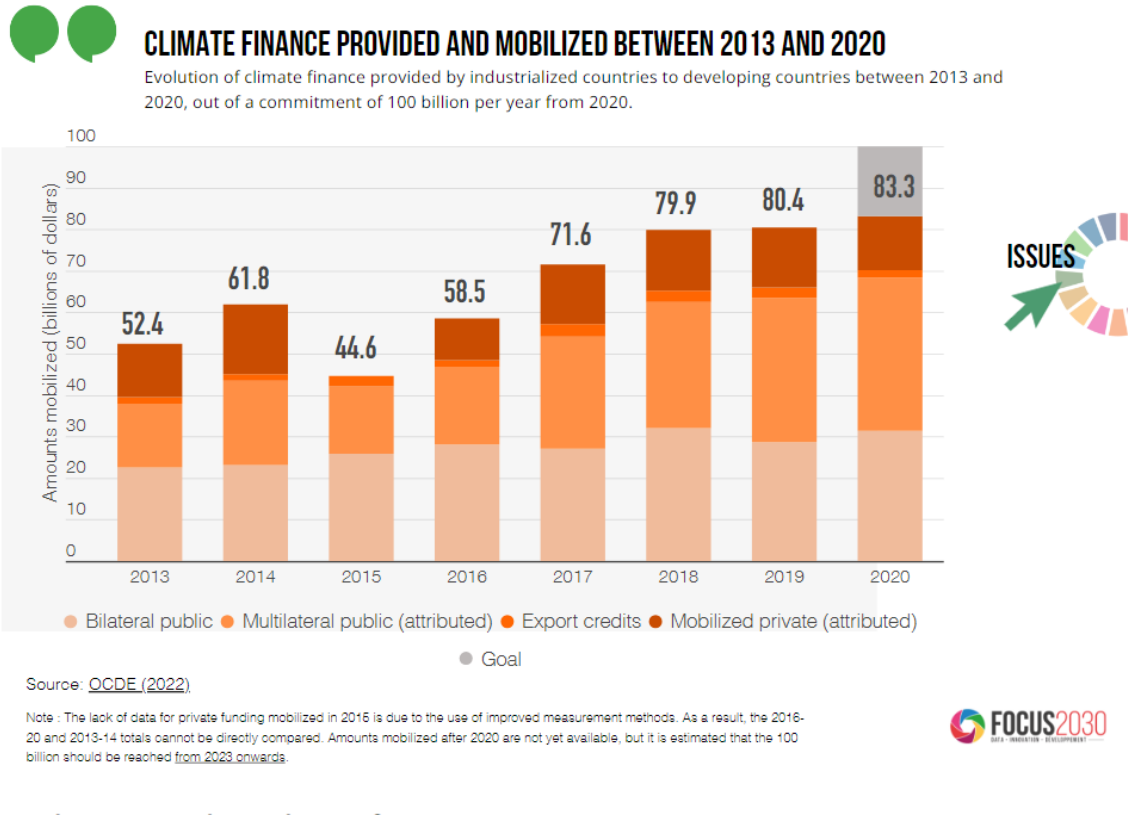
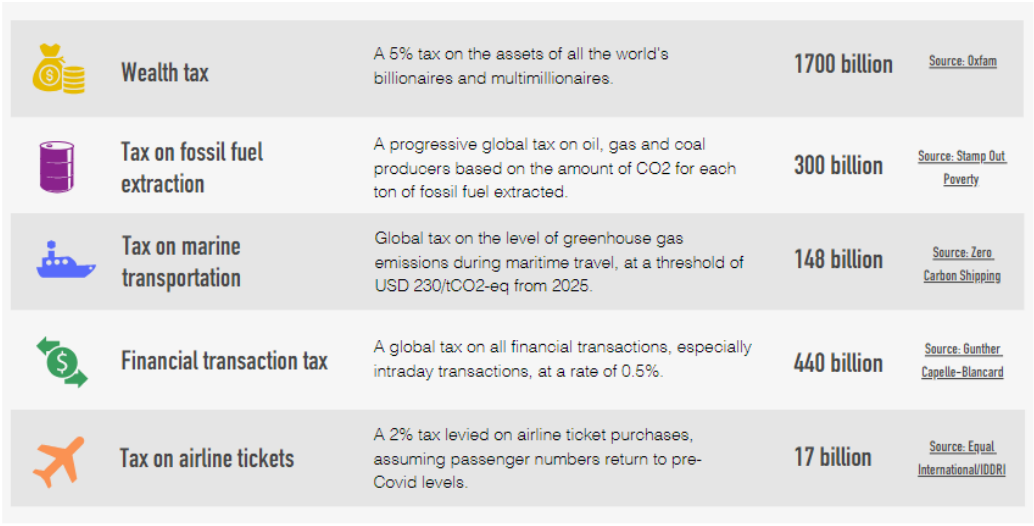
Appendix

The recent global financing pact highlights commitments to reallocate IMF special drawing rights as well as using taxes and redistribution to meet development and climate finance goals and make up for shortfalls, beginning with the failure to meet the pledge at COP15 in 2009 to provide an annual $100 billion in climate finance by 2020:





Wealth tax	A 5% tax on the assets of all the world's billionaires and multimillionaires.	1700 billion	Source: Oxfam
Tax on fossil fuel extraction	A progressive global tax on oil, gas and coal producers based on the amount of CO_2 for each ton of fossil fuel extracted.	300 billion	Source: Stamp Out Poverty
Tax on marine transportation	Global tax on the level of greenhouse gas emissions during maritime travel, at a threshold of USD 230/tCO_2-eq from 2025.	148 billion	Source: Zero Carbon Shipping
Financial transaction tax	A global tax on all financial transactions, especially intraday transactions, at a rate of 0.5%.	440 billion	Source: Gunther Capelle-Blancard
Tax on airline tickets	A 2% tax levied on airline ticket purchases, assuming passenger numbers return to pre-Covid levels.	17 billion	Source: Equal International/IDDRI

Note: The figures presented are the highest estimates made for each funding source. Other estimates may exist and are for the most part identified in this paper.

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Book Review

Chang, Ha-Joon
Edible Economics, Public Affairs, New York, 2022
224 pages, ISBN-13: 978-1541700543

Junaid Jahangir [MacEwan University]

I first came to know of Ha-Joon Chang while reading *The Econocracy* (Earle, Moran, and Ward-Perkins, 2017), a book which calls for a paradigm shift in teaching economics and which cautions that economics is too important to be left to the experts. His name intrigued me, and I googled to find popular books written by him including *Kicking Away the Ladder* (2002), *Bad Samaritans* (2008), *23 Things They Don't Tell You About Capitalism* (2010), and *Economics: The User's Guide* (2014). These books provide a countervailing narrative to the usual popular books like *Freakonomics* (2006), *The Undercover Economist* (2006), *Economics in One Lesson* (2008), and *Excuse Me Professor* (2015). Chang's latest book *Edible Economics* (2022) crystallizes the narrative that he has developed through his popular books over the years. While he uses the imagery of food in this book to reinforce his narrative, I have reviewed the salient ideas as follows in a bid to draw out lessons I could share with my ECON 101 students.

In the introduction, Chang states that until the 1970s, pluralism was recognized in economics through diverse schools including Classical, Marxist, Neoclassical, Keynesian, Austrian, Institutional, and Behavioural. The "different moral values and political positions" of various schools were recognized, as was the idea that there is "no single economic solution" or that the solution is contingent on the circumstances and conditions of the economy (p. xx). However, since the 1980s, the neoclassical school dominated, which emphasized mathematics and ignored issues of inequality and power (p. xxi). This school has "normalized self-seeking behaviour" with the assumption of utility maximizing individuals and has reduced altruistic behaviour as based on "ulterior motives" (p. xxii). Chang notes that based on the assumption of self-interest, neoclassical economic theory creates a society where cooperation is difficult (p. xxiii). He adds that it promotes privatization where the market based on "one dollar one vote" overrules democracy based on "one person one vote" (p. xxiv). Finally, he pushes against the idea that economics is only for the "experts", as it is replete with "jargon, complex equations, and statistics" (p. xxiv).

In Chapter 1, he breaks negative cultural stereotypes stating that Muslim culture is not against development because it lacks social hierarchy, values trade, and emphasizes learning and scientific thinking (p. 7). Similarly, he counters the positive cultural stereotypes of Confucian emphasis on hard work, thrift, and education (pp. 7-8). He argues that Confucian culture valued philosophy and poetry over business and engineering for it looked down upon artisans and merchants (pp. 7-8). He adds that South Korea developed not because of Confucian culture but because of land reforms, upward social mobility, and government investment in science and

engineering (pp. 9-10). Thus, it is not culture but policy that determines economic development (pp. 9, 11).

In Chapter 2, he states that the U.S. could not have become a superpower without slave labour, as cotton and tobacco farmed by black slaves constituted up to 65% of exports that allowed to import machines and technologies for economic development (p. 14). Likewise, Britain gained from slave labour by importing cheap U.S. cotton for textile factories during the Industrial Revolution (p. 14). Chang uses this example to argue that freedom for free market advocates is about economic freedom of consumers, corporations, and property owners and not the political and social freedom of workers to push for better jobs and the welfare state (pp. 18-19).

In Chapter 3, he dispels the myth that "poor countries are poor because their people do not work hard" (p. 23). He states that poor people in poor countries work much harder and longer than their counterparts in rich countries (pp. 24, 25). For instance, workers in Bangladesh and Cambodia work 60 – 80% longer than the Germans (p. 25). Additionally, poor people in poor countries start work from a young age and continue beyond retirement age. In contrast, people in rich countries start work later because of schooling that does not necessarily increase their "economic productivity" (p.25). Chang argues that poor people in poor countries are not poor because of low productivity but because the elites in their countries are unproductive (p. 26). This is because when such people immigrate to rich countries their productivity increases with access to better technology and infrastructure, which are lacking in poor countries because of "unproductive landlords", "undynamic" business leaders, and "corrupt political leaders" (pp. 26-27).

In Chapter 4, he states that technology allows to overcome the restrictions of nature as in the case of Japan that overcame its lack of natural fuel through fuel efficient technologies (p. 37). He adds that primary commodity producers are threatened by inventors of synthetic substitutes and efficient producers, as rubber was transplanted from Brazil to Malaysia, tea from China to India and Sri Lanka, and chocolate from Latin America to Africa under colonialism (pp. 35, 36). Thus, he states that "capabilities through industrialization" overcome natural resource constraints (p. 38).

In Chapter 5, he draws a parallel between "economic development and child development" and argues for protectionism with the caveat that it needs to be weaned out just as parents gradually reduce protection as children grow up (pp. 43, 45). He gives the example of the Japanese government that used high tariffs, channelled bank loans, and banned foreign companies to develop advanced industries like automobiles and electronics instead of focusing on its then comparative advantage in silk and textiles (p. 42). Comparative advantage therefore is not static and therefore can be developed through "better machines, up-skilling workers and technological research" (p. 43). Finally, Chang states that contrary to popular understanding, Britain and the U.S. developed economically through protectionism and that East Asian economies of Japan, South Korea, and Taiwan also used "infant industry protection" (p. 44).

In Chapter 6, he states that the success of Hyundai Motor Company is not about individual brilliance of entrepreneurs but rather the multiple workers who worked long hours, mastered imported advanced technologies, made incremental improvements, and then developed their own technologies (p. 52). He adds that the U.S. government funded research in semiconductors, internet, the GPS system, touchscreen, and that without these technologies there would be no IBM, Intel, Apple, or Silicon Valley (p. 55). Thus, he dispels the myth that entrepreneurship and corporate success are about individuals (p. 55).

In Chapter 7, he highlights the issue of interlocking patents where minute pieces of knowledge are patented and therefore impede the creation of new knowledge (p. 59). Therefore, he argues for shortening the life of patents or alternatively to offer a one-off prize to inventors (pp. 60-61).

In Chapter 8, he critiques free trade, arguing that it was imposed by colonial powers through "unequal treaties", which prevented "tariff autonomy" in subjugated countries (p. 71). Likewise, the WTO limits governments from regulating multinational companies (MNCs) and from instituting "local content requirement" on MNCs to buy a certain percentage of inputs locally (p. 73). Chang adds that the rich countries have made trade liberalization a "key condition for their financial support" and use their soft power through academia and policy think tanks to push developing countries towards free trade (p. 74). In contrast, Britain did not pursue free trade out of ideology but only when it became suitable. For example, Britain repealed the Corn Laws, as it allowed access to cheap grains that in turn facilitated paying low wages and therefore investment in manufacturing industries (p. 70).

In Chapter 9, he offers a nuanced perspective on MNCs, mentioning how they can negatively impact the host countries (p. 82). He mentions the role of United Fruit Company and Standard Fruit Company (respectively Chiquita and Dole today) in pushing coup d'état against governments that tried to raise taxes or strengthen worker rights (pp. 79-80). The benefits of MNCs materialize when they hire locally and buy from local firms instead of using the host countries for cheap labour for final assembly (pp. 82, 83). This explains why governments regulate MNCs through "local content requirement" and restrict MNC ownership to facilitate joint ventures (p. 84). Thus, Chang argues that the benefits of MNCs materialize only through public policy that ensures technology transfer and management techniques (p. 85).

In Chapter 10, he argues that neo-liberal policies that rest on the Washington Consensus policies of trade liberalization, deregulation, and privatization since the 1980s have brought slower growth, higher inequality, and financial crises (pp. 89, 94). Thus, Latin American countries pushed back against such policies by increasing welfare spending, increasing minimum wages, and strengthening labour unions (p. 91). However, their economic development was limited as they did push enough to develop high value-added industries to replace natural resource-based industries (pp. 91-92).

In Chapter 11, he argues that the welfare state alleviates insecurity under capitalism and makes capitalist economies more dynamic, as it reduces people's resistance to technological change (p. 104). He adds that welfare benefits including pension, healthcare, employment insurance, and housing subsidies are not freebies as people pay taxes including value added taxes and sales taxes that burden the poor (p. 102). In contrast, corporations evade taxes through tax havens and pay less than the living wage, which makes the workers dependent on the welfare state (p. 102).

In Chapter 12, he argues that "treating people with different needs differently" is not special treatment but fairness (p. 107). He states that paying people according to their contribution is efficient, as it incentivizes people to "work hard, invest and innovate" (p. 108). This necessitates ensuring equality of opportunity (p. 108). However, Chang adds that equality of opportunity is not sufficient, and some equality of outcome is required, which allows people to have minimum capability to avail of the opportunity (p. 111). This means ensuring equal access to education and healthcare, instituting a minimum wage, redistributing income, and restricting speculation to lower inequality (p. 112).

In Chapter 13, he states that in a capitalist economy, care work is undervalued compared to its contribution (p. 117). In the market, value is determined by willingness to pay instead of need, and which explains that billionaires raced to space whereas nursing staff faced a shortage of protection equipment during the pandemic (pp. 118, 119). Thus, Chang argues that value should not be left to the market and that the marketization of care services should be restricted and regulated (p. 120).

In Chapter 14, he argues that both individual change and government action are required to address climate change (p. 133). He states that better technologies are not enough to address climate change and that lifestyle changes like using public transportation, investing in energy efficiency, and eating less meat are required (p. 130). Moreover, energy efficiency investment requires government subsidies and loans, and "greener eating" is not effective, as it requires processing lots of information on the carbon footprint of every food item (p. 132). He adds that markets and incentives are not enough to promote green technologies, as the private sector under financial deregulation is focused on short term results whereas the returns on green technologies are recouped over the long term (p. 131).

In Chapter 15, he mentions that financial deregulation has impeded shareholders from long term commitment to companies and instigated managers to focus on short term gains by raising stock prices through share buybacks and paying high dividends (p. 139). Thus, he argues for long-term shareholding, giving a bigger say to long term stakeholders like workers, and regulating against speculation in the financial market (pp. 139-140).

In Chapter 16, he states that apart from eliminating jobs, automation creates new jobs, as in the case of workers producing robots, and more jobs, as the prices of goods fall and demand increases (pp. 145-146). He adds that it is very difficult for workers whose skills become obsolete to retrain for a new job without government support (p. 148). Thus, he argues that government policy can help address the challenge posed by automation by offering subsidies for retraining and by creating more jobs, as in the case of the government mandating "higher number of workers per people" in education, healthcare, and senior care (pp. 146, 148).

Finally, in Chapter 17, he dispels the myth of the post-industrial economy where economic development is based on services instead of manufacturing (p. 153). He counters the stereotype of Switzerland as a country based on tourism and banking, stating that it is the most industrialized economy, as it manufactures producer goods like machines and equipment (pp. 153, 154). He adds that deindustrialization where the significance of manufacturing falls and services rises is due to increased productivity in manufacturing and services becoming expensive (pp. 153-155). Thus, he argues that manufacturing remains the main source of technological innovation and the most important determinant of a country's living standards (p. 155). Moreover, services like management consulting, engineering, and design do not exist without manufacturing (p. 155).

To recapitulate, the main ideas of Ha-Joon Chang can be distilled in point form as follows.

1. Neoclassical economics gives precedence to mathematics over real-world issues of inequality and power. It emphasizes markets over democracy.

2. Culture has elements both conducive and detrimental to development. Policy directs economic development, which then shapes culture.

3. Free market advocates focus on the economic freedom of consumers and corporations and not the freedom of workers to push for better jobs.

4. Poor people in poor countries are not poor because of low productivity but because the elites in their countries are unproductive, as they have failed to provide better technology and infrastructure.

5. Comparative advantage is not static and can be developed with temporary protectionism. Britain, the U.S., and East Asian economies of Japan, South Korea, and Taiwan, all used infant industry protection.

6. Entrepreneurship rests on collective efforts; interlocking patents impede technological progress.

7. Free trade is imposed on developing countries by advanced economies that used infant industry protection themselves.

8. The benefits of foreign investment materialize only when public policy ensures technology transfer and management techniques.

9. Neoliberal policies of trade liberalization, deregulation, and privatization have brought slower growth, higher inequality, and financial crises; the secret of economic development is to access advanced technologies and develop high value-added industries.

10. Welfare benefits including pension, healthcare, employment insurance, and housing subsidies are not freebies; they make capitalist economies more dynamic by reducing people's resistance to technological change.

11. People pay value added taxes and sales taxes that burden the poor, but corporations evade taxes.

12. Equality of opportunity is not sufficient, and some equality of outcome is required, which necessitates equal access to education and healthcare, instituting a minimum wage, and redistributing income.

13. The market does not value based on contribution or need; marketization of care services should be restricted and regulated.

14. Both individual change and government action are required to address climate change, as the private sector is fixated on short term gains.

15. Shareholders and managers focus on short term gains in deregulated markets; multi-stakeholder capitalism recognizes that workers have a long-term stake in the firm.

16. Policy can help address automation with subsidies for retraining and by creating good jobs based on higher number of workers per people in education, healthcare, and senior care.

17. The post-industrial economy is a myth; manufacturing is the main source of technological innovation and the most important determinant of a country's living standard.

18. Economics is not just for the "experts" with jargon, equations, and statistics; economics is for everyone.

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