Inequality and Sustainability

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This thesis is my original work, except where indicated.

Signed

Colin David Butler

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Abbreviations and acronyms

AIDS	Acquired Immuno-Deficiency Syndrome
ANU	Australian National University
bp	before present
BMJ	British Medical Journal[1]
C	carbon
CH_4	methane
CFC	chlorofluorocarbon
CO_2	carbon dioxide
CRES	Centre for Resource and Environment Studies
EKC	environmental Kuznets curve
ENSO	El Niño Southern Oscillation
FAO	Food and Agricultural Association
FX	foreign exchange (adjusted)
G7	Group of Seven
GEC	global environmental change
GDP	gross domestic product
GID	global income distribution
GHG	greenhouse gas
GMO	genetically modified organisms
GNP	gross national product
GPI	Genuine Progress Indicator
Gt	gigaton (10^9 tons).
ha	hectare
H-1211	halon-1211
HIV	Human Immunodeficiency Virus
IIASA	International Institute for Applied Systems Analysis
ICP	International Comparison Project

[1] The British Medical Journal changed its name to the acronym several years ago.

IGEC	Index of Global Environmental Change
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
KC	Kravis coefficient
ky	kiloyears
JAMA	Journal of the American Medical Association
LSE	London School of Economics
LSH&TM	London School of Hygiene and Tropical Medicine
m	metre
MAPW	Medical Association for the Prevention of War
MJA	Medical Journal of Australia
mm	millimetre
NASA	National Aeronautics and Space Administration
NBP	net biome production
NCEPH	National Centre for Epidemiology and Population Health
NEP	net ecosystem production
NGO	non-government organisation(s)
NID	national income distribution
NIWA	National Institute for Water and Atmospheric Research
NOAA	National Oceanic and Atmospheric Administration
NPP	net primary production
NRC	National Research Council
OCF	Our Common Future
ODS	ozone depleting substance(s)
OECD	Organisation for Economic Development and Co-operation
OPEC	Organisation of Petroleum Exporting Countries
pa	per annum
pc	per capita
PHC	Primary Health Care
PNG	Papua New Guinea
ppbv	parts per billion by volume

ppmv	parts per million by volume
PPP	purchasing power parity
pptv	parts per trillion by volume
PRC	Peoples Republic of China
PWT	Penn World Tables
RSPAS	Research School of Pacific and Asian Studies
RSBS	Research School of Biological Sciences
RSSS	Research School of Social Sciences
SAPs	structural adjustment programme(s)
SF_5CF_3	trifluoromethyl sulphur pentafluoride
SLAPP	strategic law suit(s) against public participation
SOL	stratospheric ozone layer
SOD	stratospheric ozone depletion
SST	sea surface temperature(s)
UK	United Kingdom
UN	United Nations
UNCED	United Nations Conference for Environment and Development
UNCTAD	United Nations Conference on Trade and Aid
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFPA	United Nations Fund for Population Activities
US	United States
USSR	Union of Soviet Socialist Republics
UVR	ultra violet radiation
WB	World Bank
WCED	World Commission on Environment and Development
WDI	World Development Indicators
WDR	World Development Report
WHO	World Health Organisation
WMD	weapons of mass destruction
WW	World War
WWF	Worldwide Fund for Nature

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Inequality and Sustainability

Abstract

Global civilisation, and therefore population health, is threatened by excessive inequality, weapons of mass destruction, inadequate economic and political theory and adverse global environmental change. The unequal distribution of global foreign exchange adjusted income is both a cause and a reflection of global social characteristics responsible for many aspects of these inter-related crises.

The global distribution of foreign exchange adjusted income for the period 1964-1999 is examined. Using data for more than 99% of the global population, a substantial divergence in its distribution is found. The global Gini co-efficient, adjusted for national income inequality, increased from an already high value of 71% in 1964 to peak at more than 80% in 1995, before falling, very slightly, to 79% in 1999. The global distribution of purchasing parity power income is also examined, for a similar period. Though also found to be extremely unequal, its trend has not been to increased inequality. Implications of the differences between these two trends are discussed.

A weighted time series index of global environmental change (IGEC) for the period 1960-1997 was also calculated. This uses nine categories of global time series environmental data, each scaled so that 100% represents the level of each category in nature prior to anthropogenic change; zero represents decline to a critical point. This index fell from 82% in 1960 to 55% in 1997, and will further decline during this century.

Using evidence from several disciplines, it is argued that the decline in the IGEC correlates with major macro-environmental changes, which, combined with flawed social responses to scarcity and its perception, place at risk the ability of civilisation to function. This could occur because of the interaction of conflict, economically disastrous extreme climatic events, deterioration of other ecosystem services, regional food and water insecurity, and currently unforeseen events. Uncertainty regarding both a safe rate of decline and the tolerable nadir of the IGEC is substantial.

Substantial reduction in the inequality of foreign exchange adjusted income is vital to enhance the development of policies able to reverse the decline in the environmental goods which underpin civilisation, and to promote the co-operation needed to maximise the chance that civilisation will survive.

Synopsis

This thesis is multi-disciplinary, drawing especially from epidemiology, environmental science, pherology,[1] economics and demography. It is divided into three main sections. The first introduces the main ideas, propositions, and non-economic literature upon which the thesis is constructed. The second section presents an improved, comprehensive measure of global economic inequality and an index of global environmental change, and also discusses relevant literature of a more technical nature. The final section has two chapters. The first presents a new theory concerning carrying capacity and inequality, and attempts to explain the main argument of the thesis from a different view. The final chapter summarises the main contributions of the thesis and suggests avenues for further research.

Section one

Chapter one introduces three main elements of the thesis. Two – inequality and sustainability – already have a vast literature. The third, "civilisation failure" is less familiar, but it too is attracting increasing attention, though not generally as this term. The writer's home academic discipline is in public health and epidemiology, and this chapter contains an extensive review of the health literature concerning global environmental change (GEC). The chapter argues that the most serious potential adverse health effects of GEC is via a pathway of significant global "civilisation failure".

To substantiate this claim, the chapter reviews the general scientific literature relevant to many aspects of global environmental change. This is also done to introduce the "Index of Global Environmental Change" (IGEC) in section two. The chapter concludes that adverse human health effects resulting from GEC is a legitimate, currently under-explored topic for public health research and that seeking to better understand the causes of GEC is an important and legitimate research question.

Chapter two introduces the main idea explored by this thesis, which is that the contemporary scale of global inequality risks civilisation failure by undermining and

[1] The science of carrying capacity

obstructing efforts to achieve sustainability, while at the same time risking the provocation of a "global guerrilla war" via pathways of large-scale population exclusion and resentment. It is argued that inequality acts to undermine sustainability via the cumulative effect of many individual government policies.

The methodology used in the thesis is discussed. It is argued that the existing epidemiological causal criteria can be adapted to contribute to causal theory for the emerging discipline of "sustainability science", and that the thesis makes important steps towards this. These include quantitative estimates of the distribution and trend of global economic power and the scale and trend of global environmental change, over recent decades. However, causation in this field will primarily depend on plausibility. Because of the inevitability of both uncertainty and pre-existing (Bayesian) biases, it is admitted that adducing causality beyond all doubt will continue to be elusive. Nevertheless, the evidence of a causal relationship between inequality and sustainability is at least as strong as that for most existing economic and policy assertions.

I argue that inequality – the relationship between groups with different power on a global scale – acts most directly to impair sustainability by delaying the global *attitudinal transition* by limiting awareness, at both elite and public levels, of the risks to civilisation from both inequality *itself*, and also from adverse global environmental change. This leads to policy making which obstructs the other, material elements of the sustainability transition.

Chapter three introduces the conventional, alternative pathway to the global sustainability transition, termed, provocatively, the "Cornucopian enchantment". This is an exaggerated, simplistic set of arguments, based almost on magical thinking, which essentially proposes that sustainability can be achieved, with little effort, almost automatically, provided certain economic elements – especially free market principles – are be embedded into global society. The most articulate spokesperson associated with this view is the late Julian Simon. The literature that gives rise to Cornucopianism is generally founded on reality, but an exaggerated form has great potency, and properly deserves the term "enchantment". An alternative – and less charitable explanation for the widespread faith in Cornucopian principles is that it avoids any effort to redistribute wealth and power, and thus is compatible with increasing inequality and the self-interest of powerful populations. Probably both explanations are partially true.

This chapter also reviews a fragment of recent demographic literature regarding the debate between neo- and anti-Malthusianism, concentrating mainly on a single journal, the *Population and Development Review*. It proposes, controversially, that the relevant papers in this have accepted the anti-Malthusian arguments too uncritically. Whether in response to subtle funding pressures, from a withdrawal of engagement with the issue, or for both reasons, it is suggested that demographers in recent decades have not acted with sufficiently clarity and purpose to effectively challenge the unconscious adoption of the Cornucopian enchantment by elite policy makers. A consequence of this has been the worldwide trend to reduced foreign aid. By default, this has delayed the demographic transition, thus making the attainment of global sustainability more problematic.

Of course, demographers cannot be held to have any special responsibility for the decline in foreign aid, nor any unique responsibility to contribute to the debate concerning global human carrying capacity. Nevertheless, it is suggested that if demographers had not distanced themselves as much, as a profession, from neo-Malthusians, lobby groups such as the Union of Concerned Scientists, and the general debate concerning sustainability, then the politically conservative advocates of the free market are likely to have had less influence upon government, especially with regard to reduced foreign aid, structural adjustment programmes, and other free market policies imposed on the Third World.

The final chapter in this section discusses two more key concepts, that of "critical environmental change" and "environmental brinkmanship". These provide a conceptual framework to explain how global environmental change may cause global civilisation failure, and thus cripple population health. Environmental brinkmanship is likened to nuclear brinkmanship, acting over a longer timescale, which undermines the environmental public goods which civilisation relies on, including for food security. It is argued that powerful populations are prepared to countenance environmental brinkmanship not only because of their faith in the free market, but also because of a perceived insurance policy provided by their power, income and affluence.

Again, therefore, global inequality provides a unifying mechanism to explain how environmental brinkmanship, and hence the erosion of sustainability, occurs.

Section two

Chapter five reviews the existing literature related to both subjective and objective measures of global inequality. It focuses on the health impacts of economic conditions in the Third World since World War II (WWII). It argues that the general rate of improvement in health in the first post-war decades, when there was less global emphasis on the free market policies, slowed when the global free-market became more powerful, especially in sub-Saharan Africa. This chapter also reviews the quantitative literature of global income inequality, in terms of foreign exchange (FX) and adjusted for purchasing power parity (PPP). This is relevant for chapter six, in which four time series studies of global income inequality, undertaken for this thesis, are presented. It is argued that FX adjusted income is the appropriate indicator of global political influence (compared to PPP adjusted measures), mainly because governments accrue foreign debt in FX terms. National inequality, especially in the Third World, evidenced by a widespread lack of democracy and government accountability, also helps to exacerbate indebtedness. This is because such governments are frequently prepared to sanction further debt to maintain living standards for their elite populations and their own power, including by the purchase of arms. This is the case even though a consequence is further economic and health disadvantage experienced by their general populations.

Chapter six presents four time series studies of global income inequality undertaken for this thesis. One study, using FX terms, finds a clear divergence in global income distribution, while the three PPP studies show no evidence of such a divergence. However, the data are sufficient to show that the relationship between the FX and PPP measures has changed over time. This is examined in detail for China and India. It is found that the Kravis coefficient[2] of the average income for these countries increased substantially during the 1970s and 1980s. It is argued that this represents a significant, previously undescribed, form of interest, which in this period acted to disadvantage these countries.

Chapter seven presents a fifth quantitative time series analysis, called the Index of Global Environmental Change. This draws on global environmental data, comprised of six main indicators, two atmospheric, one stratospheric, and three concerned with marine and terrestrial ecosystems. Technical literature relevant to each indicator is also reviewed.

[2] The ratio of PPP to FX adjusted incomes.

Section three

Chapter eight proposes that existing theories of human carrying capacity are flawed by insufficient consideration of inequality. Inequality, within limits, can act to increase or to decrease total human carrying capacity. Over comparatively short periods, inequality can effectively increase the living standards of powerful populations. It can do this – provided the total population is limited – without approaching *global* carrying capacity limits, provided the ecological utilisation of the marginal (additional) population is low. Indeed, this describes the recent global situation.

However, over a longer time period, the living standards of the disadvantaged population may deteriorate relatively, and even absolutely – at least if insufficient dissemination of technological and material progress occurs. This threatens civilisation failure in several ways. Resentment is likely to increase within the comparatively disadvantaged population, leading to civil strife and insurgency. This is likely to be concentrated within poor populations, but is unlikely to be confined there. Consequences of a global guerrilla war are likely to include reduced economic growth, civilisation failure, and eventually, civilisation collapse. We may already be on the brink of such a world.

Additionally, even though the ecological impact of the comparatively poor fraction of the population is low on a per-capita basis its large size still adds significantly to the erosion of environmental global public goods, thus independently increasing the risk of critical global change and, eventually, civilisation failure. To reduce the risk of a global guerrilla war, living standards of poor populations need to be increased. Paradoxically, this will increase the rate of erosion of environmental global public goods.

The chapter also introduces the concept of marginal carrying capacity. It argues that any area and its associated population is characterised by a certain carrying capacity, a function particularly of resources, technology, ingenuity, organisation, debt and offshore income, including interest. Average living standards correlate with the per capita carrying capacity. At low populations, or when technology or other carrying capacity "co-factors" are increasing, population increments are likely to be comparatively welcomed. But as the rate of increase in carrying capacity slows, additional population are unlikely to be as welcomed, unless the living standard of the incoming population is substantially below that of the average population. Beyond another point, additional population may start to be resented, even if they are comparatively poor. This is not only because, at this point, they are unlikely to increase the

average living standard of the general population, but because they may even decrease it, or be perceived as so doing, because, for example of additional policing expenses and other transaction costs.

At a global scale, powerful populations reserve extensive resources, both to enable the high living standards enjoyed by their population, and also as a stock for the future. By definition, these resources are denied to less powerful populations, thus reducing their potential living standard. Estimates of the maximum theoretical global human population need to be reduced in view of this.

Chapter nine reviews the main contributions made by this thesis, and suggests several avenues for future research. The most important contribution is the argument that the current scale of global inequality undermines attempts to achieve sustainability. It reviews the terms of a new vocabulary to explain this. These include "environmental brinkmanship", "civilisation failure", "critical global environmental change" and the "Cornucopian enchantment". Essentially, powerful elements within civilisation, enchanted by both the cornucopian vision and their own enjoyment – made possible by the scale of inequality – embrace policies that lead to environmental brinkmanship. In turn, civilisation failure is threatened, in the short run by a global guerrilla war, and over a longer time, by critical global environmental change.

Secondly, the thesis comprehensively demonstrates, quantitatively, the extent of global income inequality over recent decades. It improves substantially on all previous measures of global exchange adjusted income inequality by its annual resolution, and by more completely accounting for changes in national income distribution. Thirdly, it suggests for the first time that changes in the Kravis coefficient act as either a hidden interest or subsidy for countries repaying loans in exchange adjusted currency. Fourthly, the thesis presents an authoritative, comprehensive and quantitative measure of global environmental change that surpasses previous measures because of its comprehensiveness and reduced selection bias.

A fifth contribution is the suggestion that carrying capacity theories need to explicitly consider the appropriation of carrying capacity by powerful populations. Finally, it suggests that several scientific fields, especially demography, have been insufficiently critical in the face of the Cornucopian enchantment.

This thesis should stimulate further work in several disciplines, including the emerging discipline of sustainability science. It serves as a conceptual basis for attempts to quantify civilisation failure, by creating different future scenarios. For example, these could assume

different rates of population growth, inequality, technological change, adverse global environmental change, and access by disadvantaged, resentful populations to weapons of mass destruction.

Secondly, the thesis should serve as an incentive to both extend and improve measures of global environmental change and also of inequality. It should stimulate a more critical examination of the concept of purchasing power parity income, further development of measures of genuine income, and of the relationship between exchange adjusted and purchasing power parity income.

The thesis concludes that even in the best case, environmental brinkmanship will continue for the rest of this century. Civilisation will need a deal of luck to survive. To minimise what is an unconscionable risk, civilisation needs to urgently adopt policies to accelerate the sustainability transition. Reducing inequality will accelerate the demographic transition, while technological and organisational transition will slow environmental brinkmanship. Reliance on poor populations as a form of safety net to protect wealthier populations is unacceptable for both moral and strategic reasons. Recognition of the pervasiveness and risk of this thinking will help to drive the attitudinal transition needed among wealthy populations to generate the political and technological changes required.

It is concluded that to increase the chance of sustainability policy makers will need to devise ways to redistribute wealth to poorer populations, mainstream economists will have to adopt the principles of ecological economics, and scientists as a whole will need to better inform the general public of the urgency and changes needed to facilitate the sustainability transition.

At the end of the bound volume, following the bibliography and index, is a collection of papers[3] relevant to the thesis and published or submitted during it. Many of these are referred to in the text.

[3] Written or co-written by the author.