The continuity and replicability of the modern industrial economy: a mathematical test

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One assumption underpins virtually all current responses to the climate threat: depending on the country, the continuity of the modern industrial economy, and, in 'developing' societies, its universal replicability.

This assumption ensures that there is indeed no way to avert catastrophe. For it rests on a sister assumption that, on scrutiny, turns out to be no less than fantastic: technology will bring down carbon emissions while GDP increases. This is the "decoupling" of fossil-fuel energy and GDP growth —a concept that informed politicians and their advisory technocracies love because it doesn't require them to, well, entirely rethink society before they know what the relevant policy responses are.

The problem with decoupling is that it amounts to an accounting sleight of hand, or just incompetent economics. A phenomenon well known among specialists ever since William Stanley Jevons (one of the inventors of modern economics) undoes this expectation: the "rebound effect." Savings from better fuel efficiency, to use a simple example, allow you to travel more kilometers for the same budget —so after the decoupling, you end up polluting just as much, absent caps on emissions.

Simple primary school arithmetic thus dispels the technotopian illusion: the notion that the solution to survival and economic prosperity in a carbon-constrained world lies in more and better manipulation of matter (aka 'technology'). The amount of emissions, indeed, is determined by the IPAT equation (Impact = Population X "Affluence" X Technical efficiency), whose application to the climate challenge is expressed in the "Kaya identity" (from Yoichi Kaya, the economist who formulated it):

CO2 Emissions = Population X GDP per capita
X Energy per GDP $ X CO2 per Energy unit

High-school arithmetic therefore allows us to estimate roughly how fast technological efficiency would have to improve in order to sustain growing populations and GDP in energy-intensive societies.

To see the illusion, we don't even need to calculate its implications for a 1.5ºC limit to manmade global warming: it is apparent even at the grossly insufficient 2ºC limit that is now our vaguely official global target.

For meeting the carbon concentrations that could limit manmade warming to 2ºC means global annual emission reductions of 8-10% per year globally (and far more for historical emitters). Differently put: ensuring climate security while maintaining (1%) population and (say, 4%) global GDP growth rates would require improvements in the carbon intensity of the global economy (CO_2 per GDP $)

Historical change in population, GDP and carbon intensity

	pop	GDP/person	CO2/GDP: energy/GDP	CO2/GDP: CO2/energy	CO2/GDP
average	**0,80%**	**2,10%**	**-1,33%**	**-0,43%**	**-1,77%** *
1972-82	0,90%	1,90%	-1,90%	-0,70%	-2,60%
1982-92	0,70%	2,60%	-1,20%	-0,50%	-1,70%
1992-02	0,80%	1,80%	-0,90%	-0,10%	-1,00%

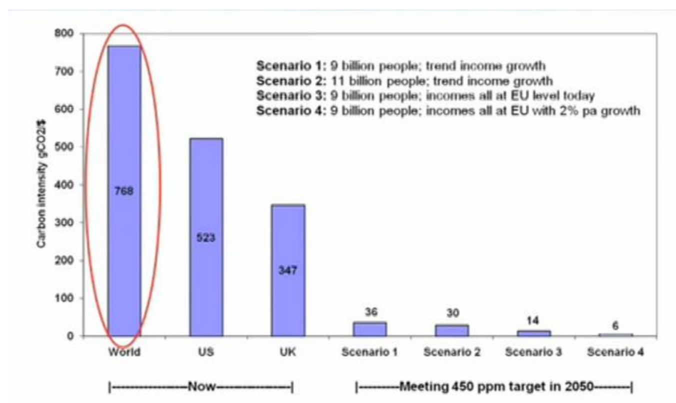
* In 2002, the US adopted a policy of "reducing the GHG intensity of the US economy by 18% over the 10-year period from 2002 to 2012" (US EPA, National Goal to Reduce Emissions Intensity - http://epa.gov/climatechange/policy/intensitygoal.html)

Reductions in CO2 intensity necessary to avoid RGW

(assuming historical population and GDP increases plus reductions of)

world*	oecd**	NorthAmerica***	
2,50%	5,50%	7%	of total GHG emissions per year
	=		
5,40%	8,40%	9,90%	= carbon intensity reductions needed to maintain climate integrity
	that is, roughly:		
-3,1	-4,8	-5,6	times the average historical reduction in carbon intensity

* yearly reduction needed to total 70% reductions
** yearly reduction needed to total 90% reductions
*** yearly reduction needed to total 95% reductions



http://www.ted.com/talks/tim_jackson_s_economic_reality_check.html

1997 Rank	Country	Energy Intensity (Thousand Btu per 1990 U.S. Dollar of Gross Domestic Product) 1980	1997
1	United States	17.77	13.84
2	Japan	7.78	6.36
3	Germany	9.37	7.60
4	France	8.94	7.42
5	Italy	7.02	6.48
6	United Kingdom	11.70	9.07
7	China	109.63	45.53
8	Canada	22.05	18.59
9	Brazil	10.73	13.26
10	Spain	8.82	8.06

of 13-15% —twice an order of magnitude larger than historical rates, which have been at some 0.7% per year since 2000! Never mind that the very *rate* of efficiency improvement has been falling: for in the four previous decades, global CO_2 emissions relative to GDP had been declining at about 1.3 % per year!

In other words, only by revising our assumptions about GDP growth, energy demand and even population can the climate (and more generally environmental) threats be dispelled while sustaining human welfare.

. . . .

The pursuit of GDP growth, in a word, is a key obstacle to the adoption of a *1)* carbon-*constrained*, *2)* carbon-*equitable* and *3)* carbon-*neutral* economy. The reason should be obvious: GDP growth is driven by *1)* polluting energy, *2)* regressive redistribution (transfers to carbon-intensive systems, that only in the more sophisticated social democracies are —partially— compensated by transfers to citizens), and *3)* hugely distorting policy.

The transition to a safe climate future thus lies in the redefinition of the fiscal (and, more generally, macro-economic) "framework of incentives," that will be needed to coordinate the environmentally "level playing field" needed to render all clean technologies, methods and ways micro-economically viable. The climate challenge replaces the central issue now emerging before us, and the focus and organizing goal of policy.

For the first question that we must answer to ensure the continuity of life does not concern how much or what production and investments are made. It has to do with how much carbon we put into (or extract from) the atmosphere. That affects different production processes and consumption options differently, according to their carbon content. GDP can represent the product of small-scale organic agriculture or of carbon-intensive industrial agriculture (including such externalities as the medical costs entailed by its chemical-intensive methods); novel goods and services or the deliberately less durable products of planned obsolescence. GDP measures market transactions, even if nefarious —even during the Second World War, most belligerents were usually "growing."

Depending on a society's GDP per person, a carbon-constrained, -equitable and -neutral fiscal framework can thus mean the increase of GDP, its decrease, or a steady state. The critical factor is carbon: ("sustainable") reorganization will follow —the goal defines the strategy. And the carbon-*constrained* economy that the carbon budget institutes requires both a carbon-*equitable* and a carbon-*neutral* macro-economic framework: it is not politically possible, or economically rational, without either the systemic income security, or the radical flexibility, that each dimension respectively enables.

In other words, the usually contradictory concerns of ("social") redistribution and undistorted prices ("free markets") can be reconciled as long as both the socialist and liberal ideologies that have respectively defended them abandon their shared embrace of "growth" as society's organizing principle. Instead, welfare will follow from adoption of its key determinants: the three-tiered principle of environmental limits, distributive equity and economic efficiency.

A *geophysically adequate* "price on carbon" whose revenues are shared by citizens —the so-called Fee&Dividend that's already being touted— is only its first component.