RESEARCH NOTE

Ecological Limits and Hierarchical Power

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Nowadays, it is commonplace to claim that the economy overuses our limited material and energy resources (Figure 1) and that this overuse threatens both human society and the biosphere. Other than anti-science cranks, the only ones who seem to deny this claim are mainstream economists (Fullbrook 2019).

In our view, though, this conventional condemnation of the economy is somewhat misleading. As we see it, the root of our ecological problems lies not in the 'economy', but in the *hierarchical power structure of capitalism*.

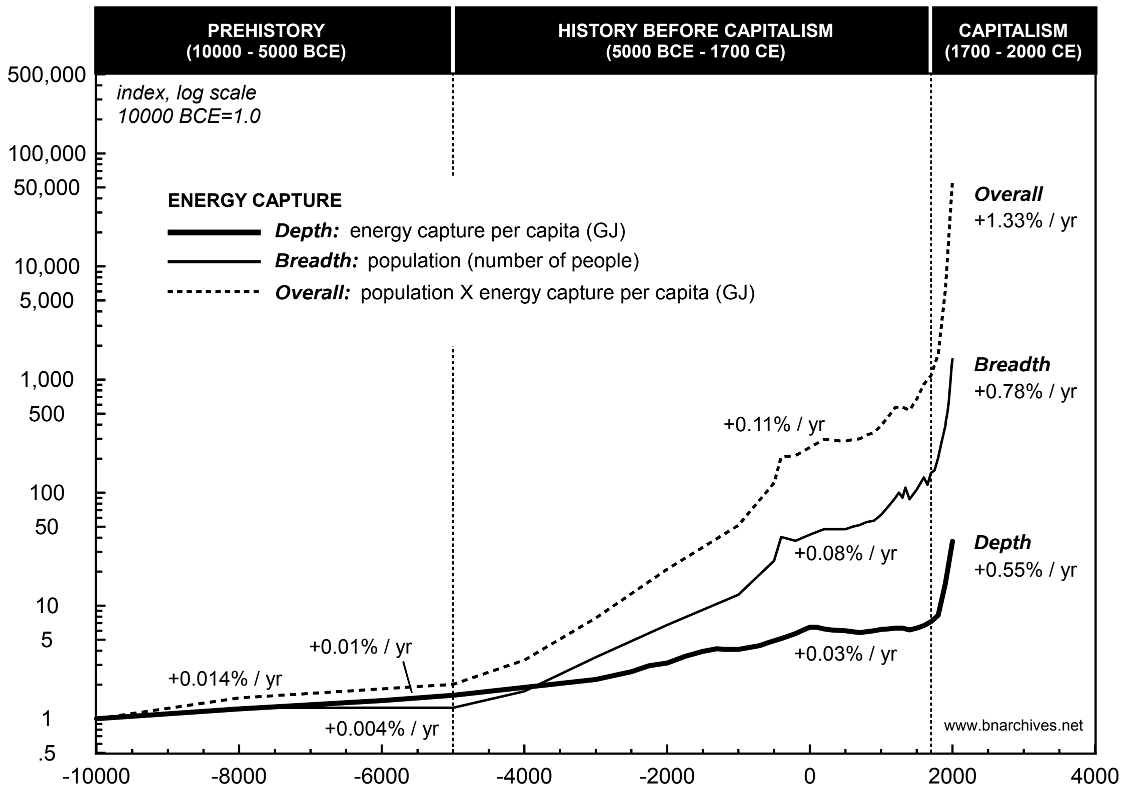

Figure 1: World Energy Capture

NOTE: Series are rebased with 10000 BCE = 1.0. Overall energy capture is the product of energy capture per capita (Depth) and population (Breadth). Energy capture per capita is the arithmetic mean of Ian Morris's estimates for Western and Eastern energy capture per capita. The yearly growth rates next to the series represent geometric means for the relevant periods.

SOURCE: This figure was first published in Bichler and Nitzan (2017). World energy capture per capita is from Ian Morris (2013), Table 3.1 (p. 61) for Western estimates and Table 3.4 (p. 111) for Eastern estimates. World population is from the US Census Bureau's tables: 'Historical Estimates of World Population' for 10000 BCE to 1940 (middle estimate for 10000 BCE; lowest estimates for the rest; goo.gl/VeH4YS) and 'World Population' for 1950 to 2000 (mid-year estimates; goo.gl/RvrjLn); both tables were accessed on June 18, 2017.

1. Hierarchy as a Means

In his *PLOS ONE* article, 'Energy and Institution Size' (2017), Blair Fix shows that per capita energy capture (or energy use) is positively and often tightly correlated with organization size, both corporate and governmental: the larger and more hierarchical the organizations in a society, the greater that society's capture of energy per person.

This positive correlation is evident in the U.S., where time-series data go back to the late nineteenth century (Figure 2).

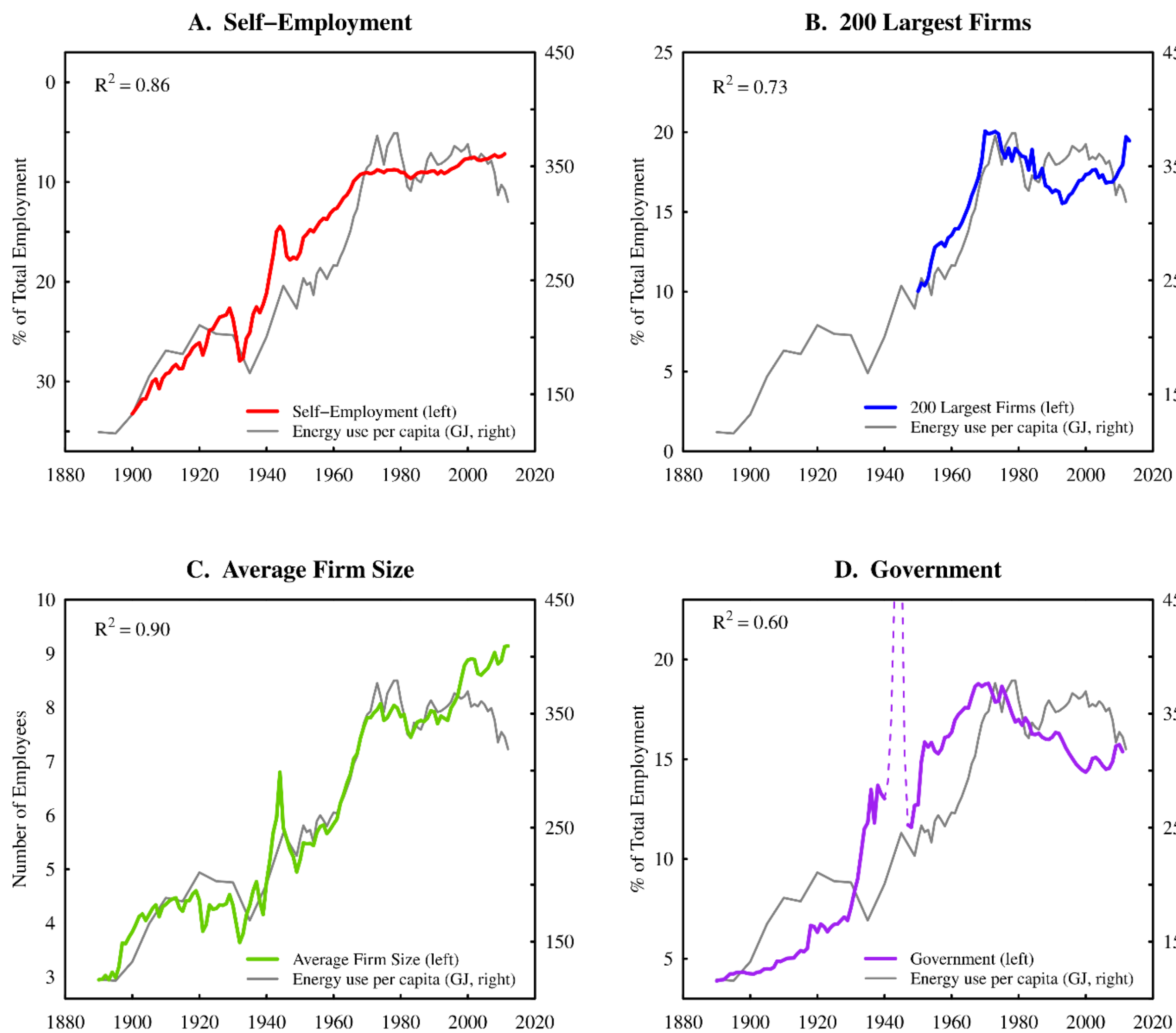

Figure 2. Institution Size vs. Energy Use Per Capita in the United States

This figure was first published in Fix (2017). It shows the trends for various measures of institution size in the United States over the last century. As energy use per capita increases, self-employment rates decline (Panel A, note the reverse scale), the employment share of large firms increases (Panel B), mean firm size increases (Panel C), and the government employment share increases (Panel D). Note that government regressions exclude the Second World War (dotted line). For sources and methodology, see Fix (2017, S1 Appendix, Part A).

And the same positive correlations – using time-series/cross-section data – are also evident internationally (Figure 3)

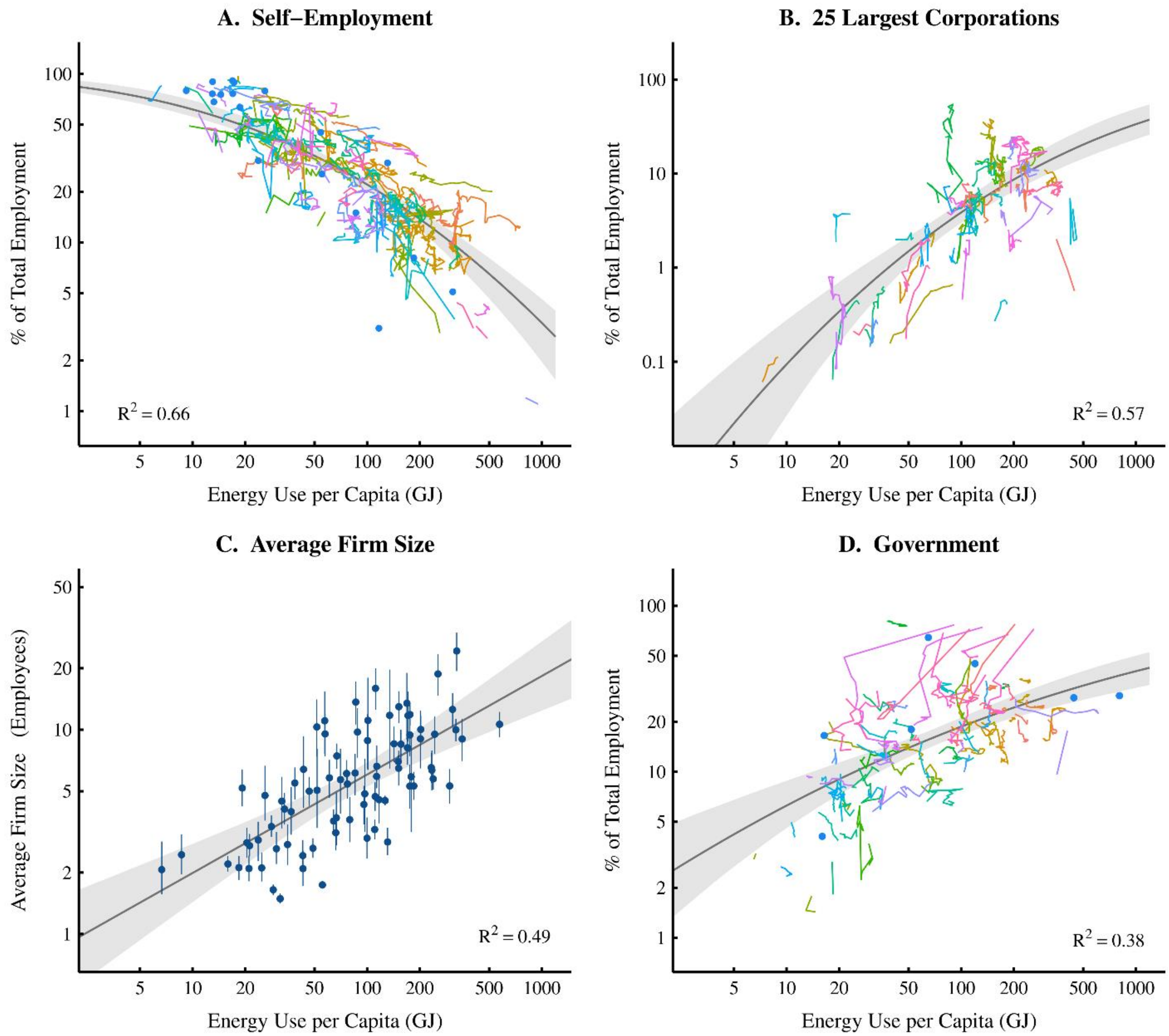

Fig 3. Institution Size vs. Energy Use per Capita at the International Level

This figure was first published in Fix (2017). It shows how different metrics of institution size vary with energy use per capita. As energy use increases, self-employment rates decline (Panel A), the employment share of large firms increases (Panel B), average firm size increases (Panel C) and government employment share increases (Panel D). To show as much evidence as possible, Panels A, B and D are a mix of time series and scatter plot. Lines represent the path through time of individual countries, while points represent a country with a single observation. Error bars in Panel C represent the 95% confidence interval of mean firm size estimates. Regressions on self-employment, large-firm and government employment share vs. energy are modelled with log-normal cumulative distribution functions. Mean firm size vs. energy is modelled with a power law. Grey regions indicate the 99% confidence region of each model. For sources and methodology, see Fix (2017, S1 Appendix, Part A).

Fix's explanation for this positive correlation emphasizes 'economies of scale' (Figure 4). Higher energy capture, he argues, demands increasingly complex coordination. Human beings, though, are limited in their *natural* ability to organize in larger groups. According to Robin Dunbar (1992), the size of the human neocortex makes it impossible to maintain stable personal connections with more than 150 people, give or take (Dunbar's Number).

The historical solution to this coordination problem is hierarchy (Turchin and Gavrilets 2009). In a hierarchy, each person has a limited number of personal connections – one superior above and a few subordinates below. The modular nature of these connections makes it possible to combine them into huge vertical organizations of almost any size (think of a country like China).

From this viewpoint, hierarchical power is a *means* of harnessing more energy. Societies that wish to increase their standard of living can do so only by accepting more hierarchical power structures. Without such vertical structures, they would be unable to coordinate on a scale large enough to harness the energy they need.

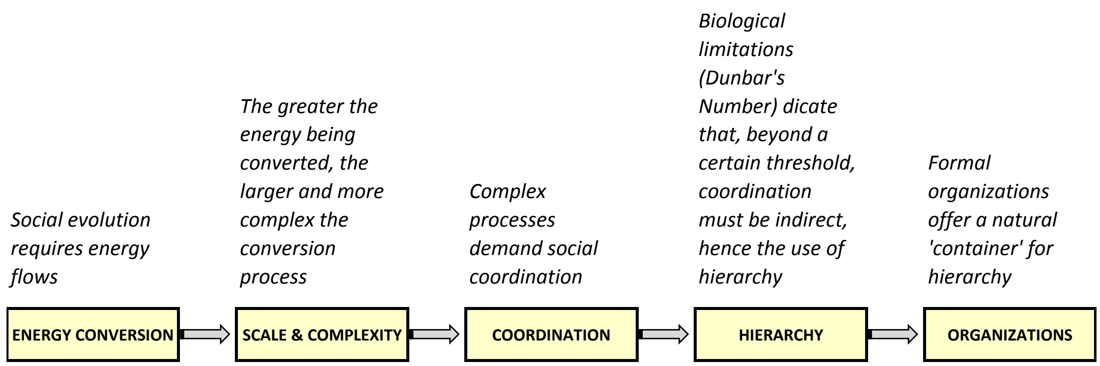

Fig 4. From Energy Conversion to Hierarchical Organization

SOURCE: This figure was first published in Bichler and Nitzan (2017).

2. Hierarchy as a Goal

But there is a flip side to this argument. In their paper, 'Growing through Sabotage: Energizing Hierarchical Power' (2017), Shimshon Bichler and Jonathan Nitzan argue that much of the energy harnessed by hierarchical societies does not go to wellbeing at all, but rather to *building, fortifying and sustaining power hierarchies as such* (Figure 5).

The starting point of this argument is that capitalism is best understood not as a mode of production and consumption, but as a *mode of power* (Nitzan and Bichler 2009). According to this view, the power of a capitalist or a group of capitalists is quantified by *differential capitalization* – namely, by the size of a group's capitalization relative to the capitalization of other groups or entities (for example, the ratio of Amazon's capitalization to Google's; FAANG's to the S&P 500's; the top ten global integrated oil companies' to Datastream's world aggregate of all firms; the S&P 500's to the U.S. population's average, etc.).

From this perspective, capitalists are driven to augment their power *for the sake of power* – a quest that leads to a never-ending differential race to erect larger and larger hierarchical organizations, regardless of whether these organizations are more 'effective' capturers of energy.

Moreover, the build-up of hierarchical power elicits resistance from those who are subjected to this power, which in turn drives capitalists to build even more hierarchies in order to limit and contain that resistance.

For our purpose here, the key points of this flip argument are that (1) building and sustaining hierarchies *requires plenty of energy*; (2) the *proportion* of energy devoted to sustaining hierarchy tends to increase over time; and (3) a large and growing share of our energy use as a society *has little or nothing to do with the wellbeing of the population*.[1]

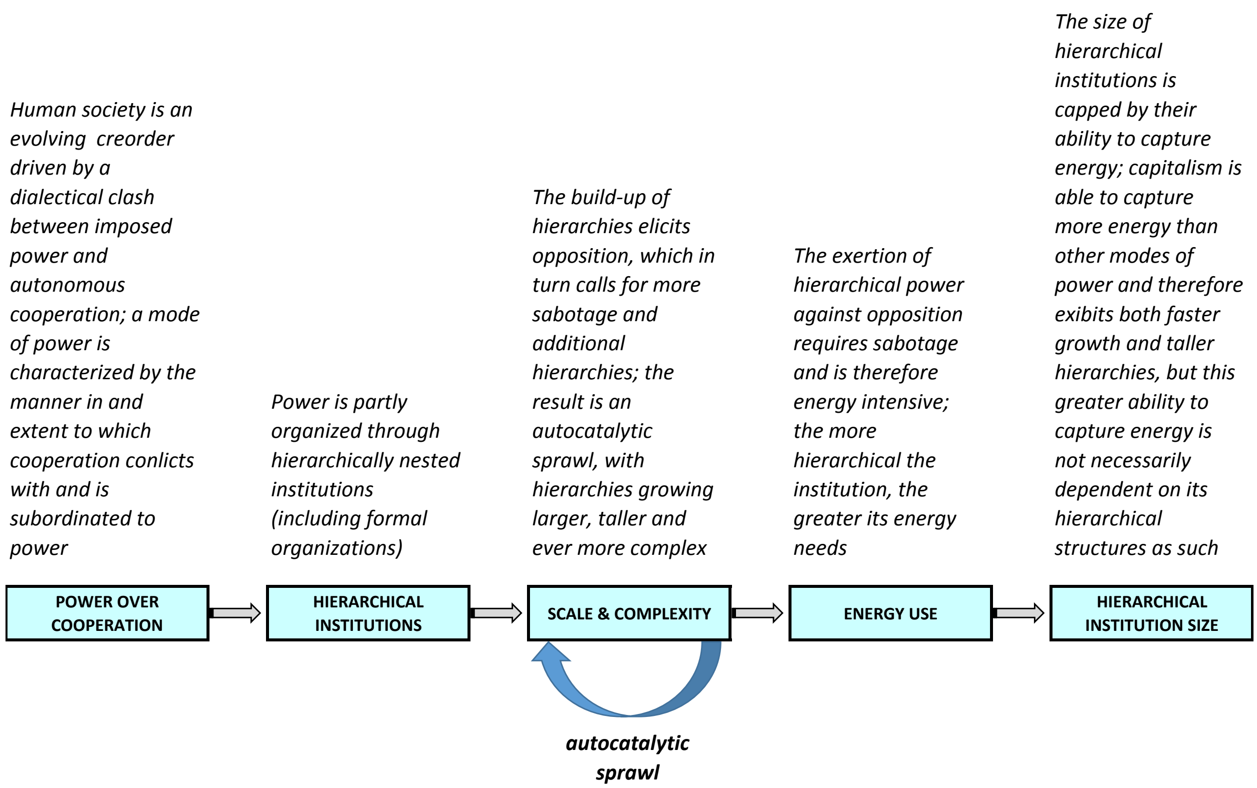

Figure 5: From Hierarchical Organizations to Energy Capture

SOURCE: This figure was first published in Bichler and Nitzan (2017).

3. It's Not the Economy, It's the Hierarchy

This thinking raises an interesting possibility. What if the recent exponential growth of energy capture (Figure 1) is caused not by 'economic growth', but by the growth of hierarchical structures*?* In this case, achieving sustainability would require *dismantling the capitalist hierarchies that dominate us*.[2]

Whether these hierarchies *can* be undone – and before it is too late – is of course a different question altogether.

[1] These claims should not be confused with David Graeber's notion of 'bullshit jobs' (Graeber 2018). Whereas Graeber identifies the rise of meaninglessness and waste, Bichler and Nitzan emphasize the fortification and extension of differential power. On the difference between wasteful spending and investment in differential power, see Bichler and Nitzan (2017, Section 12.3).

[2] We are speculating here that the expansion of hierarchical power drives the growth of energy. Even if the causal direction is reversed (the need for more energy requires more hierarchy) or is circular (energy and hierarchy drive each other), the need to dismantle hierarchy still seems plausible. If the energy-hierarchy correlation remains positive, a world that uses less energy is likely to be less hierarchical.

References

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