

Earth Syst. Dynam. Discuss., editor comment EC1  
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## Reviewer 1 report esd-2021-21

James Dyke (Editor)

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Editor comment on "Lotka's wheel and the long arm of history: how does the distant past determine today's global rate of energy consumption?" by Timothy J. Garrett et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2021-21-EC1>, 2021

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I have posted this comment on behalf of Reviewer 1

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The paper draws very long-term conclusions about the future, namely that present sustenance cannot be decoupled from long-term growth. I disagree with that conclusion. I have three objections to the analysis. (1) This conclusion is based on an analysis -- using data from the last 50 years -- is based on introducing a new production function:  $[Y = w (dE/dt)]$  where  $Y$  is GDP,  $E$  is current energy consumption and  $w = W/E$  is "nearly a constant" (based on data for the past 50 years).

(1). I object to arbitrarily introducing a new production function (equation 3) without serious discussion. The discussion in the text, based on curves in Figure 1 is not nearly sufficient to justify equation 3. The standard Cobb-Douglas production function was introduced in 1928 for a good reason and the other production functions economists have introduced and tested since 1928, have histories also. I am not defending any of them, but the reasoning behind equation 3 **cannot** simply be based on the data represented by the curves in Figure 1.

(2). In another place, the authors note that the usual relationship for capital growth is  $[dK/dt = Y - C - \delta K]$ , where  $\delta$  (the depreciation rate) is constant and  $C = cY$  where  $c$  also is assumed to be a constant. The last assumption is wrong. The ratio  $c = C/Y$  (the fraction consumed) may leave a significant surplus for capital investment now (and for the past 50 years) but 200+ years ago  $c$  was practically unity while the depreciation rate was smaller than it is now -- the surplus for investment or saving back then was virtually zero, and what surplus there was came from coal mines. In other words, until very recently almost everybody needed every bit of their income to buy consumables, mainly food and fuel (for light and heat). So, in the long run  $c$  is not a constant; it can (and will) decrease. Neither is the depreciation rate constant, by the way. Most people will spend their time playing computer games.

Also (3) the curve shown for capital stock  $K$  in Figure 1 is presumably based on prior work by Garrett but -- being central for the rest of the argument -- the underlying data also needs explanation and justification, especially since Garret's earlier work in this field has not been widely accepted. (That is not a criticism). The underlying capital stock  $K$  data for Figure 1 should be published.

In my opinion the paper, as written, is not convincing. I think it is potentially publishable, but only after the three points above have been addressed seriously.

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