The Ecological Limits of Work:

on carbon emissions, carbon budgets and working time

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The Ecological Limits of Work

Faced with accelerating technological progress and a deepening ecological crisis, a growing discussion sees a reduction in working hours as a multiple dividend policy, increasing, among other things, individual wellbeing, productivity and gender equality whilst simultaneously potentially contributing to a reduction in unemployment and greenhouse gas (GHG) emissions. One cannot help but feel reminded of some earlier sociotechnical visions of a society in which productivity gains would be shared broadly to allow for radically shorter working hours and thus a qualitatively better life.

1 History of an Idea

As early as the 1880s, Paul Lafargue, a son-in-law of Karl Marx, put forth the demand for a three-hour work day, enthusiastically highlighting the emancipatory potentials of technological progress (Lafargue 1883). Roughly half a century later, John Maynard Keynes dedicated himself to discussing the "economic possibilities for our grandchildren", likewise putting forth the prospect of three-hour shifts or a fifteen-hour work week (Keynes 1930). Societal development, however, took a different route: working hours largely decreased, but nowhere near to the extent discussed by Lafargue and Keynes, whilst increases in productivity lead to qualitatively and quantitatively vastly expanded production that provided the base for modern-day mass-consumer culture.

2 The Urgency of the Situation

The ecological crisis contributes to bringing the question of how productivity gains ought to be used to the fore once more. With little time left to prevent long-lasting and irreversible changes to our global ecosystem, "rapid, far-reaching and unprecedented changes in all aspects of society" (IPCC 2018) are required. Rather than discussing how to maximize economic performance (all too often a code for forcing the vast majority of the population to work long hours to the benefit of capital owners), the climate crisis forces us to change the conversation and raise the question: provided current levels of carbon intensity of our economies and current levels of productivity, how much work can we afford? To approach this question, I will build on existing research on the connection between working hours and GHG emissions and present a framework to assess sustainable levels of working hours based on OECD data.[1]

3 Using Available Research

While there is a general agreement that GHG emissions and working hours have a strong, positive relationship, the exact magnitude of this relationship is still being discussed. Research by Nässén and Larsson suggest that a 1 percent decrease in working hours could lead to a 0.8 percent decrease in GHG emissions (Nässén and Larsson, 2015; see also Autonomy's report: Stronge and Harper, 2019, 50).

[1] *Anthropogenic climate change is of course just one of the ecological challenges facing humanity today (others include soil degradation, for example). The focus on GHG emissions as an indicator for ecological sustainability could accordingly be challenged. However, due to climate change being considered the key issue of ecological sustainability by policy makers, GHG emissions are more reliably tracked than other indices of ecological sustainability and at the same time one can hope that if a radical reduction of hours would contribute to a decrease in carbon emissions, it would also contribute to reducing other forms of stress on the ecological system.*

In their paper "Reducing Growth to Achieve Environmental Sustainability: The Role of Work Hours" Knight et al. (2012) predicted that a 1 percent decrease in working hours could lead to a 1.46 percent decrease in carbon footprint and 0.42 percent decrease for CO_2 emissions. This significant difference is explained, in their research, by the fact that changes in consumption patterns are reflected in the carbon footprint as it is a consumption-based indicator, including the consumption of imported goods and excluding those exported, while the CO_2 emissions indicator is production-based and therefore does not account for changes in consumption of imported goods.

4 Constructing Another Calculation

I will be using the data compiled by the OECD on carbon productivity per industry sector (Data Set 1). This data is in part drawn from the 2018 National Inventory Submissions to the United Nations Framework Convention on Climate Change. As this data links GHG emissions to units of GDP, and because GDP maps closely onto waged working time in one form or another, I will assume a proportional relationship between labour time and GHG emissions.[2]

We must also understand how much GHG is sustainable per capita, including what the remaining Carbon Budget per capita (CB) is. In their paper "A good life for all within planetary boundaries", O'Neill et al. (2018) assume that 1610 kg CO_2 eq emissions per year per capita would allow the world to stay within the planetary boundary of 2°C warming compared to pre-industrial levels.

[2] *The data puts a nation's total GHG emissions in relation with its GDP. However, it does exclude emissions from land use, land-use change and forestry (LULUCF). These have been largely negative for the United Kingdom, Sweden and Germany however, with Germany and the UK roughly being on the same level and Sweden registering three times as much negative emissions form LULUCF. The intensity per unit of GDP (expressed in USD at 2010 prices and PPPs) is calculated on gross direct emissions (excluding LULUCF). Due to the limitation of the data provided by the OECD, the effects of unpaid work had to be excluded in this paper for pragmatic reasons.*

The OECD data details the total GHG emissions per unit of GDP (kg CO_2 eq per dollar GDP), or Carbon Intensity of an economy (CI).[3] Combining this data, we can learn how much GDP per capita would be sustainable, provided a per Carbon Budget of 1610 kg eq CO_2 per year derived from research literature and the levels of Carbon Intensity provided by the OECD.

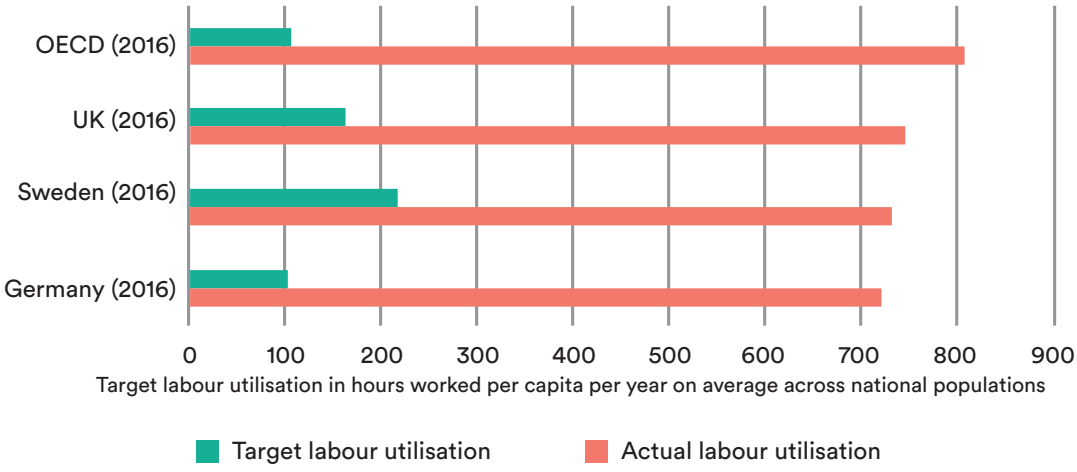
In another step we can divide this sustainable GDP by the productivity, measured in GDP per hour worked (P in dollar per hour worked) to see how many hours[4] worked within a given economy (target Labour Utilisation tLU_i in hours per year) might be sustainable.

Accordingly, we can solve:

$$tLU_i = \frac{CB / CI_i}{P_i}$$

(whereby index *i* denotes the country and year the data refers to) for various countries.

Chart 1: Actual vs. Target Labour Utilisation



[3] *I would like to thank Nela Šalamon for her help in formalizing my initial 'back-of-the-envelope' approach.*

[4] *Hours worked per capita per year on average across the whole national population.*

Actual working hours levels vastly exceed the levels that might be considered sustainable

As we can see, actual working hours levels vastly exceed the levels that might be considered sustainable, with Sweden, whose Carbon Intensity is around half of that of Germany reaching unsustainable levels of work at a much later point, [5] whereas the slightly lower-than-average Carbon Intensity of the German economy compared to the OECD-average hardly registers due to the higher per hour productivity in Germany.

Since almost no one deals with statistics on labour utilisation on a regular basis, the question arises: what does a labour utilisation of 100 or 240 hours per capita per year actually mean? The relation between the length of full-time employment and labour utilisation varies from economy to economy, as a number of factors such as vacation times or the number of bank holidays differ. Additionally, the composition of national labour markets might differ both in regards of who participates (e.g. number of students or the share of population occupied by the retired population) and how (e.g. whether part-time jobs are widespread or not). This explains why the overall labour utilisation is significantly lower than the average per capita hours worked by the employed population in these countries (which usually lies between 1.3 and 1.5 thousand hours per year).

It is possible, however, to calculate the relation between actual labour utilisation (LU_i) on the one hand and the actual length of an average full-time employment week (WT_i) though.

Drawing on our initial formula, the length of a sustainable full-time week, assuming a linear decrease in working times, would be:

$$tWT_i = \frac{tLU_i}{LU_i \,/\, WT_i}$$

[5] *The lower Carbon Intensity of the Swedish economy can partly be explained by its composition which is not as centred on manufacturing as the German economy, but more importantly it points to an early adoption of progressive sustainability policies such as carbon taxation and a relatively high share of renewable energies, supported by government investment.*

This looks as follows:

Chart 2: Actual vs. Target Full-time Working Weeks

Although the results differ greatly between countries, with Sweden reaching its limit for sustainable working time twice as late as the OECD average, these findings imply that unless enormous progress in carbon efficiency would be achieved, cutting the work-week by, for example, just one day would fail to decrease carbon emissions to a sustainable level by itself.

One could provocatively say that the length of the working week, as envisioned by Lafargue and Keynes, actually matches sustainable levels of work

With Sweden reaching its limit of sustainable work hours at close to 12 hours, one could on the contrary say that the length of the working week envisioned by Lafargue and Keynes match sustainable levels of work more closely and thus provide a more sound normative orientation than any approach that propagates full-employment with working weeks of around the current 40 hours per week.

I would thus argue that the climate crisis calls for an unprecedented decrease in the economic activity that causes GHG emissions, and this confronts us with, to adapt Paul Lafargue's phrase, the 'necessity to be lazy'. If ecological sustainability requires an overall decrease in material consumption, a vast expansion in terms of leisure time and thus an increase in "time prosperity" would be less of a luxury and more of an urgency.

5 Other Considerations

Working time reduction as an isolated policy by itself will likely be insufficient to combat climate change

At the same time, these findings reinforce that working time reduction as an isolated policy by itself will likely be insufficient to combat climate change. Rather, it needs to be supplemented by other policies facilitating radical economic transformation, for instance to shift jobs from sectors such as manufacturing and fossil fuel extraction towards employment in service professions and green jobs (e.g. reforestation operations).

This is particularly true as the carbon budget of 1610 kg CO_2 eq per year emissions per capita already seems quite generous today: Not only does it assume a population of only 7 billion people, it is also based on the 2°C goal rather than the more ambitious goal of limiting climate change to a 1.5°C increase.

Additionally, as discussed in previous sections, reductions in working hours might lead to less than proportionate decreases in GHG emissions due to an increase in per hour productivity caused by organisational improvements, a more motivated and efficient work force and/or technological improvements.

Lastly, the working week reductions above assume a linear and absolute decrease in working time, which would therefore not allow the use of working time reductions to offer jobs to the unemployed or to increase the working hours of the underemployed (which would require a more equal sharing out of current working hours). If we wished to achieve these social goods, an even more radical conclusion emerges: the actual sustainable work week, based on today's levels of productivity and carbon intensity, would likely need to be well below 10 hours per week per person, even in relatively carbon-efficient economies such as Sweden.

In addition to shortening the working week quantitatively and pushing for a substantial reconfiguration of the economy, a more qualitative approach to a politics of time might also be needed (Stronge and Harper, 2019). The existing high levels of productivity could also in part be used to reverse the intensification of work that is having significant negative impact on individual wellbeing and mental health.

Clearly, such a transformation of work cannot be brought about overnight. It is becoming equally clear, however, that driving the current mode of production forward is even more unrealistic if we are to avoid disaster. In the past, progress towards ecological sustainability, if it was made at all, oftentimes amounted to too little, too slow. Today, it might be high time to use the momentum that is behind the demand for a shorter work week to discuss even more ambitious goals in terms of ecological sustainability and time prosperity. I hope this paper might provide some stimulation to such a debate.

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7 Data Sets

Data Set 1:

National Inventory Submissions 2018 to the United Nations Framework Convention on Climate Change (UNFCCC, CRF tables), and replies to the OECD State of the Environment Questionnaire. Available at:

https://stats.oecd.org/Index.aspx?DataSetCode=AIR_GHG

Other data found at: https://stats.oecd.org/

> Dataset: Greenhouse gas emissions / Total GHG excl. LULUCF per unit of GDP
>
> Dataset: Level of GDP per capita and productivity / GDP per hour worked
>
> Dataset: Productivity / Level of GDP per capita and productivity / Labour utilisation (hours worked per head of population)
>
> Dataset: Average usual weekly hours worked on the main job / All persons, dependent full-time employment

[All data extracted on 23 Apr 2019]