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## Final report

# 28 hours per week: the mobility and energy implications of working time reduction in Germany

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## Executive summary

**There is a very high risk that continued economic growth will not be environmentally sustainable, which could easily trigger social upheaval.** This risk can be reduced by preparing for the stagnation or reduction of economic output. One main reason for which we are not yet prepared – so periods without economic growth are socially problematic today – is that shrinking production tends to increase unemployment. Without radical measures that would make unemployment socially acceptable, like a substantial basic income, strategies to keep people employed are vitally important. There are only two ways to produce less with the same workforce: either labour productivity or total working hours must fall. In view of historical data and the centrality of competition to capitalism, the widespread reduction of productivity looks much less likely than reductions in working hours.

**While working time reduction (WTR) seems necessary to reduce the risks associated with social and environmental unsustainability, there is no reason to believe that it is also a sufficient condition to achieve this goal.** Yet it often appears like that in public discourse. Many media representations portray WTR as a strategy that will simultaneously increase workers' well-being, facilitate environmental sustainability, and deliver economic benefits. How the specific conditions of WTR influence such impacts is often neglected, despite the importance of what exactly is reduced, who can participate, how wages change, etc. For instance, many articles discuss four-day workweek scenarios in which both salaries and total production are unchanged (because of productivity growth) – and expect environmental benefits without any clear justification.

**A potentially interesting type of WTR is the voluntary reduction of working hours that goes together with a proportional change in earnings, which promises simultaneous benefits for workers' well-being and environmental sustainability without necessarily harming the economy.** If people can afford to work less, then they can use the time for activities that matter most to them, while lower production and consumption correlate with lower resource use and emissions. Simultaneously, the cost of labour may not grow significantly. If such WTRs are widespread and significant, then they could help to keep people employed without relying on economic growth, which would be a major step towards a precautionary strategy targeting sustainability. Yet there are many complexities that need to be explored on a case-by-case basis to understand actual impacts of concrete WTR schemes.

**In 2018, the largest European labour union, IG Metall, made it possible for more than a million workers in Germany to reduce their weekly working hours to 28 (“Verkürzte**

**Vollzeit”, VV scheme).** In addition, shift workers and employees with care obligations could choose between an annual extra payment equivalent to 6 days’ wages and 8 extra days off (“Tarifliche Zusatzgeld – Wahloption”, TZ scheme). Whether and why workers wanted to participate in these schemes may offer lessons about WTR as a strategy to achieve the various goals.

**We studied how workers covered by the IG Metall agreement made WT decisions and the consequences of potential participation.** To facilitate understanding, we conducted literature reviews on workers’ WT preferences and on the relationship between WT and environmental indicators, looked at country-level indicators describing economic activities, mobility, as well as greenhouse gas emissions in Germany, and studied workers’ perceptions through interviews and a survey. These investigations offer various insights as discussed below.

**The literature review on WT preferences confirmed that job characteristics, family circumstances, financial conditions, and the societal context all influence how much people want to work and showed that most people would not like to be too far from the normal workday standard of the country.** The literature is substantial but overly quantitative, which makes it difficult to find surprising or context-specific determinants of WT. Moving towards more qualitative understandings of preference formation is essential, not least to develop strategies for workers at different ends of the socio-economic distribution. **Regarding the WT-environment relationship, the only clear finding is that higher household incomes usually result in larger environmental impacts.** This is called the “scale effect”. The “composition effect”, which refers to changes in the consumption structure of households, is very uncertain, not least because of the differences between WTR schemes and study contexts. The reliability of country level investigations is questionable. Overall, the literature is small and methodologically problematic. The main way forward is case study research in various WTR settings using longitudinal – before/after – data collection. Exploring good and bad examples to understand how WTR can be done in an environmentally sustainable way is perhaps more important than trying to understand how, on average, current WT values are currently related to environmental impacts.

**In our case study, the macro-view of the German context showed decreasing household greenhouse gas footprints, partly because of shrinking mobility footprints over 2000-2019.** The main drivers of these developments are technological factors like improvements in energy intensity and the emissions intensity of energy supply. Total working hours in the country increased because of a growing number of employed people, even as average hours

per worker decreased. Shorter working hours do not always reflect voluntary reductions (like in the voluntary IG Metall schemes that were launched at the end of the time period studied here), as the share of marginal employment grew.

**Regarding the specific WTR options that we analysed, the VV option was unpopular, attracting only a few thousand people (less than 0.5% of the eligible workforce), whereas the TZ option was popular, with hundreds of thousands participating.** Decisions on WT were found to be complex, involving many private and workplace factors, but the relationship between time and money offered a useful way to gain a preliminary understanding. As many workers concentrated on the financial loss associated with WTR through the VV scheme, they never seriously considered participation in it. The TZ scheme was more financially attractive and was framed as forgone income, which is much less undesirable than an outright loss. This is interesting because framing effects and the financial conditions under which WTR is unimaginable to most workers have not received much attention in the literature so far.

**Workers who chose a shorter workweek were motivated more by private reasons than work-related stress.** Although both played roles, impacts on private life were usually cited as the main reasons for choosing WTR. Participants almost always enjoyed financial security. The most important new time uses were family activities, sports, unpaid work, meeting friends, and travelling. Most workers had relatively clear opinions whether or not they wanted to participate in WTR and perceived the decision as easy, but interviews showed that often there was a long history of experiences and thinking behind these standpoints.

**While impacts on well-being were generally positive, environmental implications of planned post-lockdown time uses varied greatly between households.** For some workers, decreasing total consumption definitely reduces environmental impacts while the composition of consumption hardly changes. For others, increased mobility in the form of (planned) leisure travel is responsible for significant environmental impacts, which may overcompensate emission reductions stemming from lower consumption. Secondary impacts, such as moving further away from the workplace, which is a significant impact for a minority of workers, also deserve attention. As the scientific literature on the WT-environment relationship gives little guidance on the impacts of concrete types of WTR, various case studies conducted on this relationship could add useful insights for more informed discussion.

**The role of mobility in WT decisions and impacts deserves substantially more attention than it currently receives in the literature.** Although few people in our samples mentioned commuting as a separate reason to reduce WT, the tendency to use WTR in the form of fewer days per week instead of fewer hours per day suggests that it may have a role. The hypothesis

that mobility is a key aspect when it comes to the impacts of WTR in terms of people's well-being as well as environmental sustainability is supported by our findings. We confirm that motivations of WTR matter for environmental impacts, while pointing out that activities which may look benign from an environmental perspective – such as meeting family members or doing sports – often create significant travel demands. How the composition of consumption changes due to mobility patterns in different social groups could help to determine which complementary policies are appropriate to make WTR policies environmentally effective.

## 1. Reducing working time: a promising direction with many unknowns

This report focuses on policies that reduce working hours. Given the many challenges of contemporary societies including socio-economic instability, environmental unsustainability, and widespread feelings of meaninglessness, alternative visions are badly needed. A growing number of thinkers believe that a society focused less on work could be part of such a vision (Bregman, 2018; Schor, 2010; Soper, 2008).

The promise of radical working time reductions (WTRs) – shifting to a 4-day workweek as a first step – is that primary objectives, such as better work-life balance or lower unemployment, will be accompanied by a number of co-benefits, not harmful side-effects as in the case of most technological solutions to the same problems. In the best case, working less could lower time pressure for individuals, lower unemployment for countries, and lower energy use and emissions for the planet. Social benefits such as more time for family, friends, and community activities, better work-life balance, and a more relaxed workforce are so tangible that they are often the primary aims of WT policies. In other cases, working hours are shortened to reduce unemployment, as in France around 2000, or to retain the workforce during economic downturns, as in Germany around 2009. From an environmental point of view, a less hurried life may lead to lower consumption in general and a lower demand for environmentally impactful mobility services in particular. This is especially the case if full workdays are cut, thereby reducing commuting – unless the newly found time is used for more high-carbon leisure travel.

The combination of these aims may also help to constructively respond to one of the most severe problems of our economic systems built on continuous GDP growth, namely the “productivity trap” (Jackson and Victor, 2011). In capitalism, most employers try to increase labour productivity (i.e. the amount of production per worker per hour) to increase production or to cut labour costs. If average labour productivity grows, then either total production grows, or the total number of working hours decreases. However, both of these options are problematic. Further increasing total production and consumption in all countries is an extremely risky strategy from the perspective of environmental sustainability: limitless economic growth seems to be inherently unsustainable (Antal and van den Bergh, 2016; Haberl et al., 2020; Wiedenhofer et al., 2020). On the other hand, reducing the total number of working hours usually means higher unemployment, which is a big problem in the absence of very strong social protections. Therefore, the reduction of working hours per person is a very

interesting strategy that may help to transcend the growth paradigm without social upheaval (Antal, 2018, 2014).

This project was conceived in 2018, when more than a million workers covered by the largest labour union in Europe, IG Metall (IGM), won the right to reduce their working time to 28 hours per week, with a proportional change of wages. Four workdays of seven hours - this would be a significant step and it gained a great deal of attention in the global media. Even though part-time work had already been available as an option for many of these workers, the possibility of going back full time after a period of lower hours, as enabled by the new scheme, looked advantageous. The story was usually framed positively in the media, mostly as an opportunity for workers, especially those with family obligations. Details of earlier German discussions concentrating on more conflictual aspects, such as skilled labour shortages, the power to determine work schedules, and costs of labour supply received less attention.

Given the generally positive tone of the media coverage of WTRs, this is not very surprising. The German scheme actually enables a “4-day-workweek”, unlike other reductions discussed under the same headline, such as the highly publicized Icelandic scheme, which only reduces weekly working hours to 35 or 36 (Haraldsson and Kellam, 2021). It also provides an opportunity for a much larger part of the population and for a longer time period than many world-famous trials, such as that of Microsoft Japan, which involved less than 3000 people and consisted of five free Fridays in total (Kleinman, 2019). While the usual talking points of journalists, for instance workers becoming more productive and companies becoming more attractive were emphasised less in the German case, likely because employers had tried to resist the scheme, benefits to employees were all the more emphasized, not least because they went on strike during the negotiations.

In addition to the VV option (which stands for “Verkürzte Vollzeit”, shortened full-time), another WTR scheme was launched. Every year, shift workers and those with care obligations got the opportunity to choose between an extra payment equivalent to 6 day’s wages or 8 extra days off. This may look insignificant compared to the approximately 45 days off in the VV option, but the slight financial advantage of choosing time in the TZ scheme (which stands for Tarifliche Zusatzgeld – Wahloption, i.e. an extra payment option) suggested that its popularity may be greater, even if fewer workers were eligible. From a mobility perspective, impacts could be expected to be different, as the 8 days were framed as extra holiday, which



differs from a shorter workweek in terms of the characteristic duration and the possibilities for the distance of leisure travel.

Although significant reductions of working hours may look like an ideal strategy for a transition that yields social and environmental dividends without creating economic problems, there are several important unknowns, which we aimed to tackle in this research project. We focused on two overarching research questions:

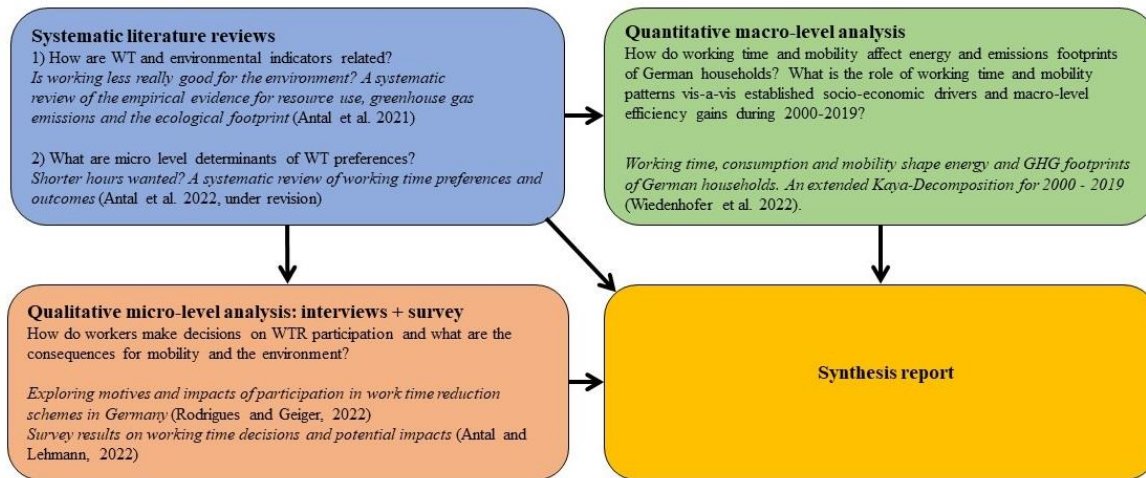
- 1) *Why and how do workers decide to participate in the WTR schemes?*
- 2) *How does participation in WTR shape mobility patterns and environmental impacts at the level of households?*

Despite the importance of the topic, there is little empirical research on these questions. Media representations often take interest in WTR for granted and refer to environmental benefits speculatively. We set out to explore the evidence in the context of the IGM schemes, utilizing various research methods ranging from literature reviews and the analysis of macro-level data to primary research focused on WTR participants (and control groups) at German companies. Our aim was a contextualized understanding of the IGM case. We first collected information on the determinants of WT preferences and the WT-environment relationship from the scientific literature. Then we looked at the broader national context of Germany in terms of changes in WT, employment, consumption, and greenhouse gas emissions between 2000-2019, specifically investigating how changes in mobility affected decarbonisation efforts. Finally, we tried to answer the two main research questions for the specific WTR schemes we investigated. On the one hand, we focused on self-reported reasons for reducing WT and the conditions that increase the likelihood of participation. On the other hand, we studied impacts on lifestyles and the environment, paying special attention to the role of mobility.

## 2. Research design and methods

Figure 1 gives a summary of the research design. The systematic literature reviews synthesised existing insights and informed later stages of our work. The quantitative investigation of the long-term dynamics of WT, household consumption, mobility, and greenhouse gas footprints provided the national context within which IGM WTR schemes

happen. The interviews and the survey represented a case study of WTR. The overall picture and conclusions drawn here rely on all of these elements.



**Figure 1** Work packages, research questions, and main outcomes.

We note that the originally envisaged research plan had to be substantially changed because of three major difficulties. First, the VV scheme turned out to be rather unpopular. A few months into the project we found out that only around 6000 workers chose to participate in it in the first year. The participation rate below 0.5% made it extremely difficult to find and recruit participants for our research, and we did not get effective help from the union headquarters. Second, the COVID-19 pandemic made it impossible to make contact physically, build trust with potential gatekeepers, and organize events related to our research as originally planned. Unfortunately, our data collection period coincided with the outbreak of the pandemic and the subsequent lockdowns. The emergency also undermined the capacity of the union to collaborate with us as their communication channels with the workers were disrupted and they had new and urgent tasks to deal with. We had to conduct the whole project remotely. This hindered qualitative data collection – instead of live focus groups we conducted individual interviews remotely – as well as recruitment for the survey that was supposed to use contacts established in the qualitative phase. Third, access to individual household level data from Germany turned out to be extremely restricted. Not even researchers in an Austrian research institute were granted access, which forced us to rely on different data sources. As a result of all these difficulties, the methods and, to some extent, the types of data used in the project had to be changed.

### Systematic literature reviews

We conducted two systematic literature reviews. One on the quantitative relationship between WT and environmental indicators (energy use, greenhouse gas emissions, materials use, and ecological footprint), and the other on the determinants of the WT preferences and decisions of workers. We searched for relevant studies in scientific databases that cover a large number of journals in various disciplines using combinations of search terms that we iteratively refined. We systematically screened all search results by first checking the titles, then the abstracts, and finally the full text. Then we analysed the papers using a consistent coding method.

Despite the similar method, the two reviews posed different challenges. In the environmental case, we screened 2494 articles, out of which only 10 were relevant. We used citation snowballing to find further relevant papers, which resulted in a total of 15 studies. We analysed these studies in great detail. In the case of WT preferences, the original pool consisted of 2352 publications, out of which we included 173 in the analysis. The larger number of papers meant that the analysis was somewhat less detailed.

### Macro-level analysis of working time, consumption, mobility, and household footprints

The aim of the macro-level analysis was to understand how German household greenhouse gas (GHG) emissions footprints can be understood through their production- and consumption-related aspects that influence the size and composition of these footprints (Wiedenhofer et al., 2022). Traditionally, four determinants are distinguished: population size, GDP per capita (affluence), energy use per GDP (energy intensity of the economy), and emissions per unit of energy (carbon or greenhouse gas intensity of energy supply). We extended this decomposition, called the Kaya-identity, in two major ways. First, we substituted population by total paid WT in the economy. Second, we substituted GDP by the product of household incomes per WT and household expenditures per income. In subsequent steps, we decomposed changes in total aggregate WT into the effect of population growth, changes in (un)employment, and changes in average WT per employed person. For the mobility-focused decomposition analysis, we investigated energy and emission footprints from mobility provisioning sectors in more detail and looked at the role of WT, the number of trips, distances, transport modes and trip purposes. We note that conclusions only apply at the aggregate level.

## Micro-view of working time reduction

### Interviews

The aim of the micro-view was to gain a nuanced understanding of workers' motivations to join available WTR schemes in Germany and to illuminate the subjective meanings of WTR grounded in lived experiences. For this purpose, we conducted individual semi-structured interviews with workers eligible to join the IGM WTR schemes. Interviews were supported by a question guide, with questions about the time period before and after the WTR decision, as well as expectations for the future.

Participants' recruitment followed a purposive sampling approach relying on local union contacts. We contacted 140 IGM regional offices, asking them to disseminate information about the project among the companies they supported. In addition, we asked interviewees for recommendations of further potential participants, following a snowballing approach. We offered a financial incentive of 75€ for each interview.

We conducted 25 interviews over the telephone or through video chat applications. 8 interviewees were participants of the VV scheme, 8 participated in the TZ scheme, 4 in both, and 5 chose to not reduce WT. We used the full transcripts of the interviews to conduct software-assisted thematic analysis. During the analysis we aimed to account for the breadth of experiences and to cover a wide spectrum of perspectives on WTR. We identified patterns in the data, documenting the frequencies of codes while also capturing distinct opinions and positions, including special cases.

### Survey

Informed by the findings from the literature review and the interviews, we also explored the attitudes, decision processes, and actual or hypothetical behaviours of workers eligible to participate in the VV scheme through a survey. We specifically focused on the level of ambivalence during WT decisions, motivations to participate in the VV scheme, and how people would use time in a 28-hour scenario in terms of activities, locations, and mobility implications. The online survey took approximately 15-20 minutes to complete. We offered 15€ for participation.

Our recruitment strategy relied on contacts with interview participants, IGM offices, large companies, and researchers working on related subjects, as well as Facebook advertising and assistance by a specialized market research company. As a result of substantial efforts, we obtained 80 fully usable and 4 partially usable responses. Our sample consisted of 12 respondents who were participants of the VV scheme but not the TZ scheme, 13 who

participated in both, 24 who only chose to participate in the TZ scheme, and 36 who did not participate in WTR. We analysed the data mainly by calculating averages and by comparing the responses of various groups of workers

### 3. Results

How does WT affect environmental impacts according to previous studies?

#### Key findings:

- The quantitative literature on the WT-environment relationship is very small, consisting of less than 20 studies.
- Both country-level and household-level investigations are very problematic from a methodological perspective.
- WT affects environmental impacts through its influence on incomes and the composition of consumption.
- Higher income usually results in higher environmental impacts when households in a country are compared, but all other insights are questionable.
- We suggest approaches to resolve some methodological problems and directions for further research.

How WT and environmental impacts are related is a very complex question. Depending on the type of reduction and the workplace context, direct and indirect impacts can be entirely different. For instance, if a highly skilled software developer individually decides to work and earn less, then their total consumption will likely decrease because of the lower salary, and it is unlikely that they will be replaced at the workplace, so total production will also decrease. The overall impact will likely be a reduction of environmental impacts, as lower production and consumption typically means lower resource use and emissions. On the other hand, if a municipality decides to reduce working hours without reducing salaries to employ more people and reduce unemployment, then WTR participants will not consume less while newly employed workers will consume more. Total production will not change but total salaries will grow, which basically means an economic stimulus program that characteristically increases environmental impacts. Results of the literature review (which is freely available, see the link to Antal et al., 2021) help to shed light on such complexities and to demonstrate the strength and consistency of the evidence base.

A preliminary remark is that WTR schemes may differ from each other in terms of several characteristics, out of which three are important to mention here. Regarding participation,

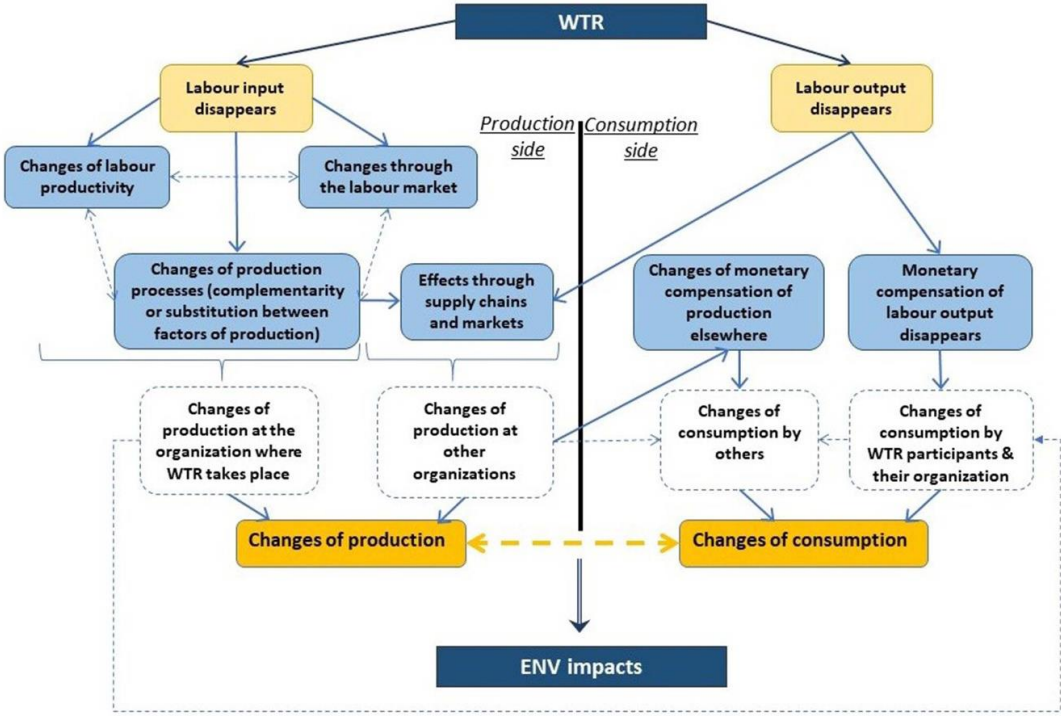
WTRs can be collective in a country, collective in an organization, and individual opt-in schemes. In terms of timing, daily, weekly, annual, and lifetime reductions are possible. As for financial impacts, there are fully compensated reductions in which pay is unchanged, partially compensated reductions in which pay is reduced less than proportionally, and uncompensated reductions in which pay is reduced proportionally.

A first insight of the review is that impacts of various types of WTRs at the level of households, companies, countries, and the globe often differ, but none of these are easy to study. The relationship between changes in WT and changes in environmental impacts cannot be analysed at the global level because WT is not measured consistently. By focusing on lower levels, some impacts of changes in WT will not be captured. One potentially important effect is the sufficiency rebound, i.e. that lower demand by those who implement a sufficiency strategy – e.g. by reducing WT and consumption – may reduce prices and increase consumption by others. If consumption grows in units excluded from the analysis, then the environmental impacts of WTR may be overestimated. More generally, the smaller the studied system, the more impacts will occur beyond its boundaries. This is an important limitation for all household-level studies, e.g. because new workers may be hired to substitute WTR participants at the workplace or interactions between the WTs of household members may not be captured. On the other hand, the larger the studied system, the more impacts not related to changes in WT can be expected to influence the environmental indicator. A key question is how important WT (or a change in WT) is compared to drivers of environmental impacts (or their changes) that are excluded from the analysis. In the reviewed country-level studies, the answer is not encouraging: the importance of unobserved variables seems to be enormous. Changes in resource use and emissions are strongly driven by technical and structural changes in sectors like electricity, transport, buildings, and industry, so separating the impacts of changes in WT, which are often substantially smaller than the impacts of unobserved variables, is very challenging. These difficulties are likely responsible for the fact that only a handful of studies have even tried to quantitatively link WT and environmental impacts.

The review also shows that the reliability of previous efforts to quantify the relationship have often been hindered by the lack of consistent data on WT and environmental indicators, as well as by methodological mistakes. At the household level, a major problem is how reliable data on WT and emissions could be collected from the same persons, especially in longitudinal samples where changes in WT may occur. This would require both reliable WT and household expenditure data (from which emissions are calculated), preferably from all

members of the household before and after changes in WT. No such data exists, so the best available knowledge comes from the cross-sectional sample of a study that used WT and expenditure data from the same households. At the country level, cross-sectional data are useless because of country-specific drivers of environmental indicators (e.g. weather patterns). For longitudinal data, the international comparability of data raises questions. This is especially true for the calculation of average WT, which is a very complex task in itself due to methodological decisions (regarding the group over which the average is calculated, the data source, and the adjustments), and for several non-CO2 greenhouse gases.

Given the many complexities, the current literature is insufficient to move us significantly beyond previously known correlations and conceptual speculations. The most important widely supported finding is that higher consumption tends to generate larger environmental effects – a result that is corroborated by articles on WTR. These studies often differentiate between the scale effect, which refers to the relationship between incomes and environmental impacts, and the composition effect, which refers to the impacts associated with the composition of consumption. While the scale effect is clearly positive in most samples, the composition effect is uncertain. Furthermore, the relatively simple, consumption-side approach to the quantification of environmental impacts gets substantially more complex if various consumption-side and production-side effects are considered (Figure 2).



**Figure 2** Economic pathways through which working time reductions influence environmental impacts (for details see Antal et al. (2021)).

Unfortunately, it is not realistic to expect a comprehensive understanding of the impacts of various types of WTRs. A more realistic aim is to collect a set of empirical observations that enable more informed speculation. One way to move forward is to study smaller samples of people changing their WT and tracking their consumption (and emissions) through bank account transactions. In countries where cash use is insignificant (e.g. Sweden), this may deliver useful insights. The costs of such research will likely be high because substantial incentives will be needed to recruit participants. Another approach to gain further insights is to look at individual countries and check how environmental impacts have been related to changes in WT and a number of other social and technological drivers. This will help to assess whether existing country-level studies are reliable. Such household-level and country-level efforts can help us to go beyond the observation of the positive correlation between incomes and environmental impacts.

#### What influences the WT preferences of workers according to previous studies?

##### Key findings:

- The literature on WT preferences is extensive, consisting of more than 170 studies.
- The overwhelming majority of papers focuses on rich countries and applies a quantitative approach.
- Findings regarding the roles of gender, childcare, and current working hours are more or less consistent.
- More is known about age, job characteristics, and remuneration as drivers of WT preferences than the role of social norms and mechanisms of preference formation.
- Qualitative research regarding WT preferences is necessary, especially as WT becomes increasingly fragmented due to digitalisation and remote work.

Individual preferences are important for the number of working hours. Although labour markets are never fully flexible and structural forces (tax systems, bargaining structures, etc.) matter, people can change their jobs, take on second jobs, or try to negotiate changes in hours with employers if they are dissatisfied. How much people want to work is thus an important question.

However, measurements of WT preferences are never perfect: neither observations of actual WT, nor stated preferences provide fully reliable information. Mere observations of actual WT outcomes are imperfect because actual and desired hours often differ. Labour market rigidities prevent desired changes of WT, so mismatches are very common. On the other



hand, stated preferences do not necessarily reflect actual behaviours because asking questions that exhaustively describe the situation in which the decision on WT is made (including the job context, workplace relationships, consequences of part-time employment, etc.), is virtually impossible. Therefore, survey questions are always incomplete. In addition, WT decisions are so complex that people may not even know what they would choose if they were offered full-time and part-time options (Campbell and van Wanrooy, 2013).

Instead of trying to tell how much people would work if they were perfectly free to choose, we studied how characteristics of individuals (gender, age, etc.), their circumstances (caring responsibilities, unpaid work, etc.), their job (pay, workplace relationships, etc.), and the wider context (work ethic, norms, economic conditions, the share of part-time workers, etc.) influence WT preferences and outcomes. So, instead of trying to exactly quantify preferred WT we focus on the factors that influence WT preferences: we seek to tell which factors influence WT preferences and what their effects are.

The articles on which the following insights are based focused almost exclusively on rich countries (Europe, the USA, and Australia), paid similar attention to WT outcomes and mismatches (i.e. desired changes in WT) while focusing less on hypothetical preferences, and mainly used quantitative analyses of survey data. In terms of broad factor categories, individual-level factors, work-related factors, and household characteristics (such as the number and age of household members) received most attention, while the broader context and social norms were studied less. Most articles did not focus on specific jobs, but two thirds of the 59 studies that did looked at medical professions.

A couple of insights can be considered almost universally true. Women do less paid work than men. Marriage, a well-paid husband, and especially motherhood further reduce paid hours. Mismatches exist in both directions: women often do not find jobs that offer optimal hours for them – some of them want to increase, others want to decrease paid hours. Old age increases the likelihood that reductions in WT are preferred. Strong labour market position (high level of education/experience, high salary, professional or management role) predicts overemployment, marginal labour force affiliation increases the likelihood of underemployment. Dual earner couples want reductions more than singles, especially if they have specific leisure pursuits. Those who work substantially more than the average usually want to decrease WT, and vice versa, those who work less than the average usually want to increase WT.

Other results based on substantial empirical evidence are not so clear-cut or vary with the context. For example, effects of fatherhood on WT and mismatches are ambiguous, just like

the effects of the partner's income on men's actual WT and preferred changes. Age is not a good predictor of actual WT before workers get very old. The effects of caring for old people also seem to depend on the life circumstances of workers.

A smaller number of studies suggest that business owners and self-employed persons work more than the average. Intrinsic motivations and extrinsic pressures also increase observed WT, but too much pressure can result in workers developing a preference for part-time work. People in more affluent countries generally work less and want to reduce more. Higher inequalities correlate with longer average hours, whereas more prevalent part-time work increases the popularity of reductions.

Since there are at least ten different factors that strongly affect WT outcomes and mismatches, identifying further – more context dependent – factors requires more qualitative research. This is also necessary to better understand the causal mechanisms through which WT preferences are formulated since current understanding is largely based on mere correlations.

There are several messages that matter for WTR. First, the tendency to desire reductions over average WT and to desire increases below the average suggests that people tend to internalise prevailing conditions as preferences. Therefore, despite the increasing fragmentation of working time and remote work, influencing the working day standard is still important. Second, strategies to influence WT should be completely different at different ends of the socio-economic distribution. Rich and successful people, especially male managers, are often interested in WTR, but workplace demands and motivations keep them overemployed. Whether maximum income regulations and caps on success in winner-take-all markets could benefit society through less unequal distributive impacts as well as better work-life balance for those who 'make it' is a question to be explored. At the other end of the hierarchy, the shrinking share of labour income means that uncompensated WTR is unimaginable for many. Stronger public provisioning (e.g. health care) and minimum standards (e.g. regarding incomes) that prevent precarity could help to reduce the pressure on workers and, to some extent, counterbalance the processes that led to the polarization in terms of incomes and opportunities. Third, profession-specific investigations beyond the medical sector are absolutely necessary to understand barriers to WT reductions and opportunities for change. These should not only focus on the motivations of stakeholders, but also on the practical measurability of WT and how imperfect measurements may help or hinder actual reductions.

## Macro-view of the context

### Key findings:

- Major drivers of German household GHG footprints are income growth and increasing mobility, which are counter-balanced by energy efficiency and decarbonisation, resulting in a footprint reduction of ~1% per year.
- Increasing total WT drove up greenhouse gas (GHG) footprints, while declining per capita WT decreased household footprints. On average, per capita WT is decreasing and may have some potential within a policy mix for demand-side mitigation measures.
- Growing distances and rapidly growing air travel drove up mobility-related emissions, which were counter-acted by the slightly decreasing number of trips and, most importantly, energy efficiency gains along supply chains, as well as some progress in decarbonising mobility, resulting in reductions of the mobility-related CO<sub>2</sub>-emissions footprint by 1.4% per year.

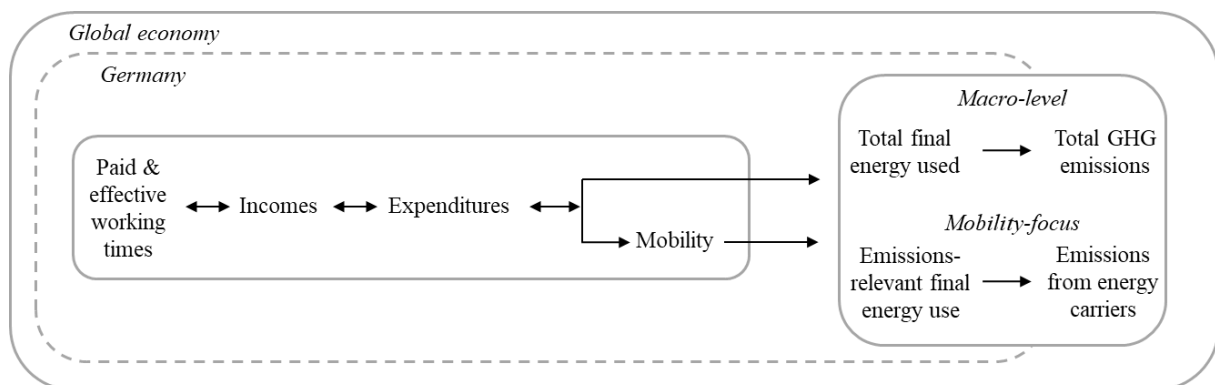
In the quantitative state-level analysis (Wiedenhofer et al., 2022), we focused on addressing some of the key limitations of the country-level WTR-environment literature identified previously (Antal et al., 2021). We investigate long-term changes in this relationship for a country with good data, in this case Germany from 2000 to 2019. Germany is a pioneer of policy-driven decarbonisation and a high-income country with high standards of living. However, it also exhibits growing disparities between well-paid full-time jobs on the one hand and increasing WT flexibilization and precarious freelance employees on the other. Furthermore, inequalities have been growing due to controversial structural reforms of the labour market and social security rules in the last 20 years (Krause et al., 2017; Nachtwey, 2016).

### State-level approach

For this state level analysis, we developed a consistent socio-economic dataset covering the direct relationship between German households' WT, their incomes earned, and the expenditures on consumption and mobility, to the resulting global GHG footprints (Wiedenhofer et al., 2022). For this analysis, we used the most recent high-resolution multi-regional input-output (MRIO) model Exiobase, which depicts supply chain networks of the entire world economy (showing in a very large table how sectors supply inputs to each other) and its relations to household consumption (showing which sectors provide final goods and services). Using this model, we derived energy and emissions footprints occurring along global supply chains and directly via household energy use. MRIO models are well suited to

investigate environmental implications of consumption by distinguishing consumption categories and assigning their upstream resource and emission footprints along international supply chains to these (Wood et al., 2018). Analytically, Kaya-Identity decomposition methods are useful tools to quantify how much each aspect of the production-consumption relations contributed to changing overall GHG footprints, and they are quite straightforward to apply and interpret (Ang, 2015, 2004). Furthermore, Kaya-Decompositions have not been applied to the WTR issue at all so far, thereby bringing a novel perspective to this literature. The state-level research aimed to answer the following two research questions:

- *How did working time and mobility affect energy and emissions footprints of German households between 2000-2019?*
- *What was the role of WT and mobility patterns vis-a-vis established socio-economic drivers and macro-level efficiency gains during this time?*



**Scope:**

- All German households and their paid working times, incomes, expenditures and mobility patterns, from 2000 – 2019
- Two matching pairs of energy-emissions footprints of households (excl. government and investment footprints)
- Descriptive analysis of the dynamics and compositions of each aspect
- Five extended Kaya-Decompositions dissecting two levels of analysis: macro-level and mobility-focused

**Figure 3.** Overview on the conceptual relationships and the scope of analysis. In the descriptive analysis, each topic is consistently broken down to cover changes in employment types and sectors, income groups, expenditure patterns, mobility modes and patterns, as well as energy and emissions footprints, before the extended Kaya-Decompositions then isolate and quantify the impacts of each variable/topic on subsequent GHG emission footprints. Source: Wiedenhofer et al. (2022)

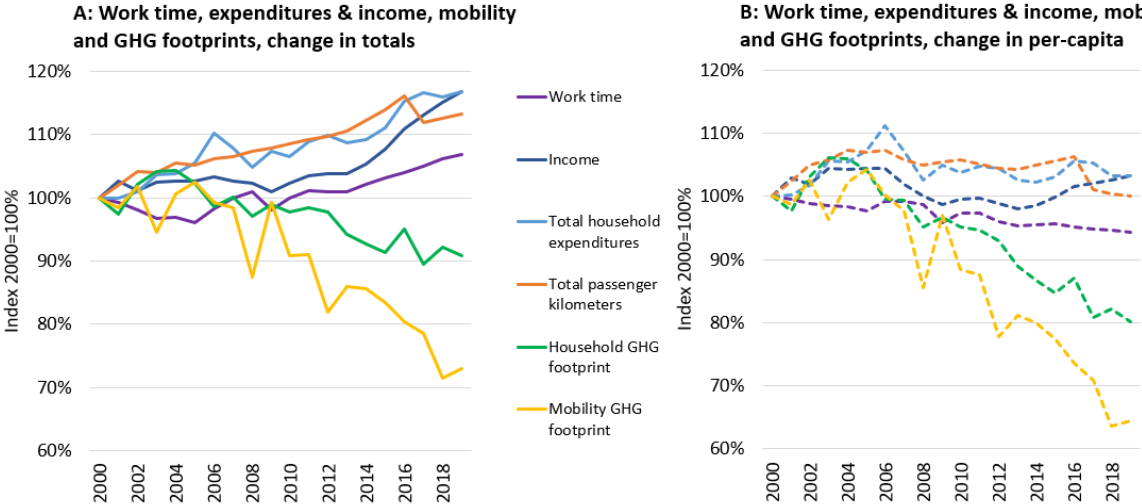
To investigate the relationships between paid WT, incomes, expenditures, mobility and the resulting energy and emissions footprints (Figure 3), we first compiled a comprehensive and mostly consistent dataset of these variables for all households, using a number of socio-economic datasets from official German statistics (National Accounts, Census Data, Employment Accounts, Working Time Measurements; German Sample Survey of Income and Expenditure, Laufende Wirtschaftsrechnungen; Verkehr in Zahlen; Deutsches Mobilitätspanel). Secondly, we used the high-resolution MRIO footprint modelling for the

years 2000-2019 to quantify household GHG footprints. Thirdly, we applied five extended Kaya-decompositions to isolate the effects of changes in paid WT, incomes, expenditures, mobility, and energy use on the change in household GHG footprints.

The dataset for this analysis covers, 1) all persons who are employed, self-employed (including farmers), or do not work for pay (kids, students, pensioners, unemployed persons), 2) their paid WTs (as opposed to only contracted hours, or unpaid work such as care work, household chores or voluntary work – paid WT could be zero), 3) incomes and expenditures in constant prices, 4) mobility patterns in monetary, physical and social terms (mobility expenditures, passenger kilometres or trips fulfilling certain purposes), and 5) two pairs of matching energy – emissions footprints for the two levels of analysis. We compiled and aggregated all this information into a common classification of 34 consumption- and activity categories, starting from different levels of detail and categories in each data source.

Findings on state-level trends and dynamics regarding work, mobility, and consumption

Here we summarize findings from the more detailed analysis and report on state-level trends and dynamics (Wiedenhofer et al., 2022), only giving a glimpse of the indicators we analysed by showing their development in total and per-capita values (Figure 4). We find that firstly, total hours worked in Germany increased due to a steady full-time segment and an expanding part-time sector, resulting in a slight reduction in average effective working hours per capita of the economically active population. Secondly, we find that real total and per-capita incomes as well as expenditures increased over the studied time period. The number of people with multiple part-time jobs, although still at low levels, indicates that not all WTRs might be socially beneficial or desirable.



**Figure 4.** Overview of the major trends and dynamics regarding WT, mobility, consumption, and household footprints in Germany, 2000-2019

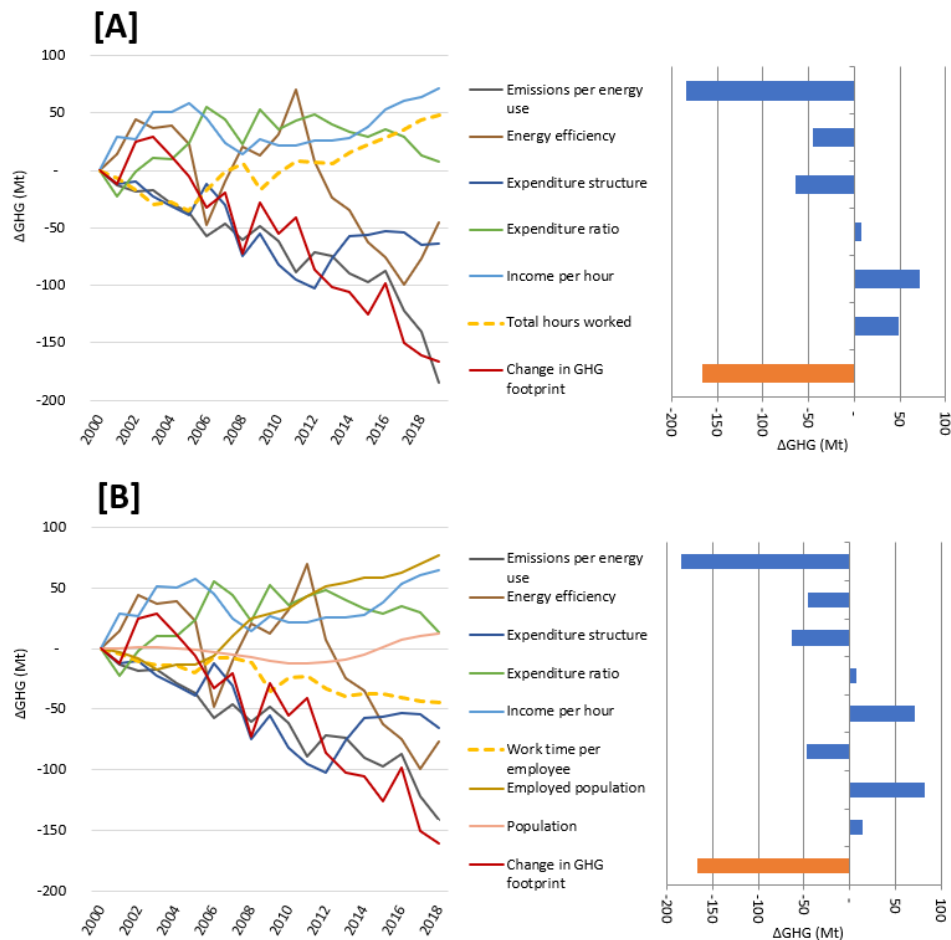
Thirdly, we find that travelled passenger kilometres increased by 13% across all trip purposes, while motorized individual mobility remains the dominant transport mode. The rise of total travelled distances was mainly driven by work-related motorized mobility, by vacation related car motorized mobility, and by leisure related railroad travel and leisure related air travel. Air travel showed a strong relative increase (66%), just like railroad (34%). However, their shares in total passenger kilometres remained low. Fourthly, we find that the decarbonisation of the German economy is finally taking off, especially since around 2010. Total household GHG footprints are declining at 1% per year and mobility-related footprints at 1.4% per year. Interestingly, the only part of the footprint that is still increasing is related to service sectors. This suggests that the service economy, often claimed to be low carbon, might actually hamper the decarbonisation of the total economy. Additionally, air transport emissions also increased substantially, although making up a small share.

Decomposing the contributions of multiple drivers to changing household footprints

To quantify how each of the above-described aspects contributes to changes in energy and emissions footprints, we utilize an extended Kaya-Decomposition, combining the socio-economic determinants of household consumption (WTs, incomes and expenditures), with mobility-related information (expenditures, kilometres and number of trips), and their environmental efficiencies (energy and emission intensities of consumption and mobility) to explain changes in energy and emissions footprints of household consumption and of household mobility. Crucially, the contribution of each factor in a decomposition can only be interpreted in combination with the contributions of all other factors. In other words, each factor shows how much the footprint would have changed if only this factor had changed, while all else had remained equal. The contributions of all factors then add up to the total change in footprints.

We differentiate two scopes in the analysis: macro-level and mobility-focused. For investigations at the national macro-level, we estimate final energy use (across all energy carriers including renewables) and total GHG emissions footprints covering the six most impactful GHGs. In a first step, we substitute the standard Kaya variable population by total paid WT in the economy and total GDP by total household incomes, the share of incomes that are spent (expenditure ratio), and expenditures by consumption category (expenditure

structure) (Figure 5A). In a second step, we further decompose the effect of total hours worked into the effect of total population growth, changes in (un)employment, as well as average working hours per employed person (Figure 5B).



**Figure 5.** Decomposition of change in GHG footprint of German households, from 2000 -2019 (left) & total contributions (right). Source: Wiedenhofer et al. (2022)

Regarding the systemic implications of working more or less, this analysis showed that the growth of total hours worked by an increasing number of economically active persons drove up GHG emissions, while decreasing average WT per person decreased GHG emission footprints. At the same time, growing income per hour is identified as a clear driver of GHG emissions footprints. Importantly, in this analysis the role of working hours and hourly income is only interpretable through their effects on total income and therefore total consumption, as this is what the Kaya variables represent (hours – income/hour – expenditure). In this analysis, time-use effects of working more/less would manifest themselves only indirectly by affecting patterns of expenditure and mobility. Quantifying whether people who work less have significantly different consumption patterns and whether

that is due to working less or some other factors, is out of scope of this analysis. Similarly, whether changes in WT affect hourly wages is not studied here.

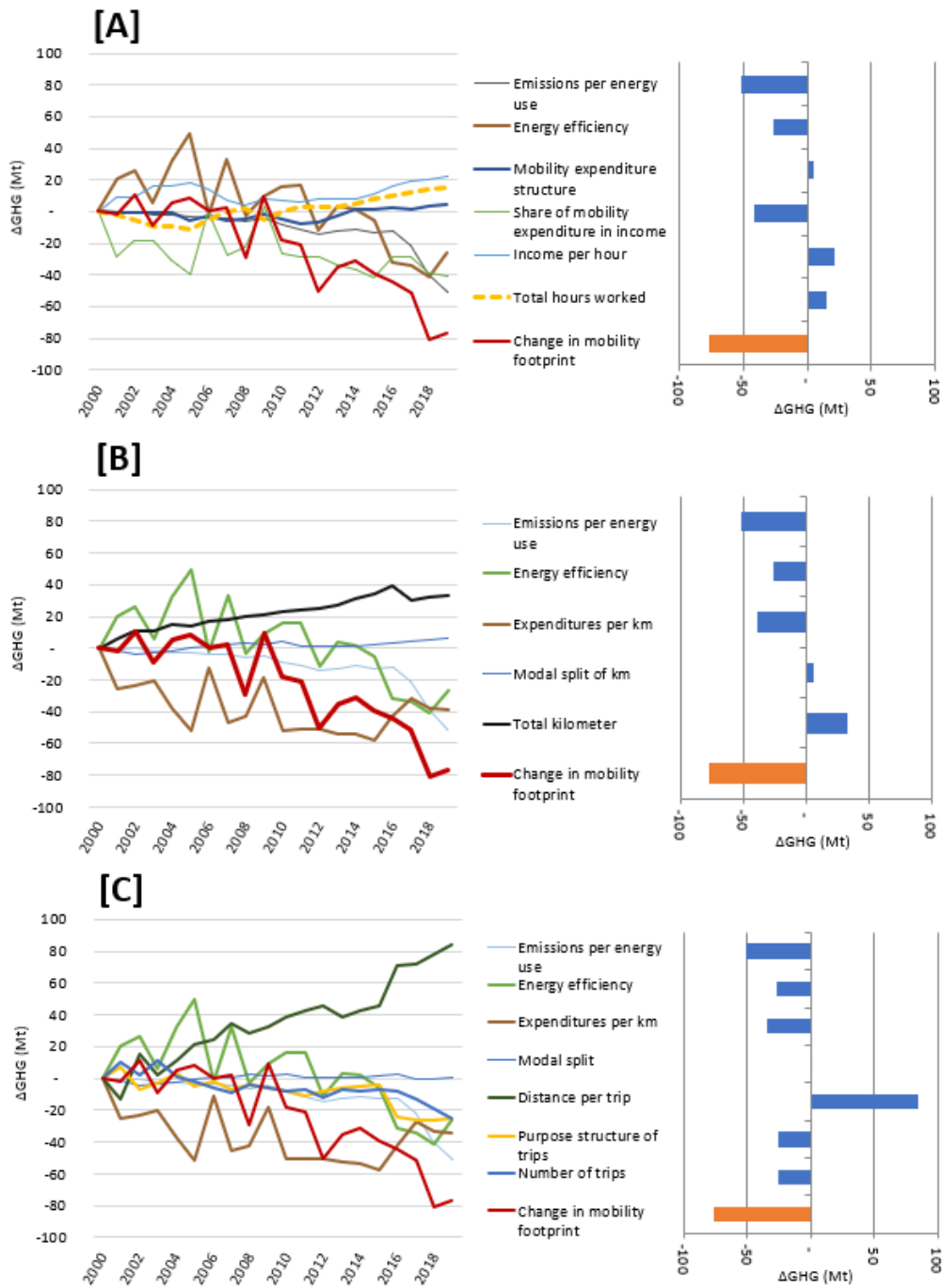
For the mobility-focused decomposition, we investigate energy and emission footprints from mobility provisioning sectors in more detail and look at the role of working hours, the number of trips, distances, transport modes, and transport purposes in this context. Mobility footprints used for these analyses cover only energy use causing emissions ( $EF_{mob}$ ) and CO<sub>2</sub> emissions from fossil fuel combustion ( $GF_{mob}$ ), making this system boundary narrower and more closely related to mobility itself. Firstly, we analyse mobility footprints in line with the macro-level analysis of Figure 5A, to see differences between total household consumption patterns and mobility patterns in particular (Figure 6A). Here we attribute changes in footprints to the changes in mobility expenditures by modes of transport (e.g., how much people spend on car-based transport, railway trips, etc.), enabling the observation of the role of changing mobility patterns of households. Secondly, we analyse the change in footprints as driven by mobility expenditures and total passenger kilometres (Figure 6B). Thirdly, we additionally include information on mobility purposes (i.e. work-related trips, education, shopping and errands, leisure and others) of passenger kilometres and the numbers of trips per purpose in our final mobility equation to be able to analyse changes in distances, purposes, and transport modes simultaneously (Figure 6C). Differentiating work-related mobility from other mobility purposes is crucial to understand the role of working time regimes (e.g. 4-day vs. 5-day weeks), as well as the underlying changes in settlement patterns, infrastructure, and changing spatial relations of places of residence and work places.

From this analysis, we find that the German mobility footprint is declining by 1.4% per year, primarily because of decreasing emissions intensity and secondly due to energy efficiency gains. While household expenditures on mobility are relatively stable in constant prices, people travel longer distances, primarily (still) use their cars and increasingly use airplanes, which by itself drives up emissions footprints. Interestingly, at the same time we find that people travel less often and increasingly due to work-related trips, which both by themselves contributed negatively to household mobility emissions. However, this effect is counteracted by large increases of distances per trip which are travelled by a steady car-dominated modal split across all purposes.

These findings indicate that demand-side measures to shift mobility towards more climate-friendly modes and away from fossil fuelled cars and planes, e.g. via infrastructural, institutional or behavioural measures, are urgently needed to counteract these growth dynamics and tackle a key challenge for European climate targets (Ivanova et al., 2020; Lamb



et al., 2021). We find that increasing total hours, given the influence of the other Kaya factors, would have contributed a small increase in mobility footprints. Regarding WT effects on mobility, a closer understanding of specific WTR schemes and specific mobility patterns is required. This requires in-depth study, because work-related travel, related expenditure and emissions are partially attributed to supply chain emissions and partially to household direct emissions in this analysis.



**Figure 6.** Decomposition of change in GHG footprint of mobility of German households, from 2000 -2019 (left) & total contributions (right). Please note that the trend break for the total kilometres and distances per trip is partially due to changes in the underlying survey. Source: Wiedenhofer et al. (2022)

Conclusions from the state-level analysis on the relations of work, mobility, consumption, and household footprints

In summary, we find that from 2000 – 2019, increasing total working hours drove up GHG footprints, while declining per capita working hours decreased household footprints. This effect is due to a growing economically active population which increasingly works part-time, resulting in an aggregate per-capita WTR. Energy efficiency gains and progressing decarbonisation both substantially decreased GHG emissions footprints, however growing incomes per capita and per hour counter-balanced much of these improvements. In summary, household GHG footprints in Germany decreased by ~1% per year with a small contribution from WTR, esp. since ~2010.

For mobility-focused CO<sub>2</sub> footprints, we find that growing distances, car-dominated modal splits and rapidly growing air travel drove up emissions, which was partially counter-acted by slightly decreasing numbers of trips, whose purpose is shifting towards more work-related and leisure trips. Most important were energy efficiency gains along supply chains and progress in decarbonising energy and mobility itself. In summary, the mobility-related CO<sub>2</sub>-emissions footprint of German households also decreases by 1.4% per year.

We conclude, that on average WTR per capita is already occurring and would have a moderately negative effect on GHG emissions footprints, while the major drivers remain income growth as well as energy efficiency and decarbonisation of energy supply. However, attention to potentially negative social side-effects of WTR, for example regarding decent incomes and work conditions in part-time jobs, growing inequality between jobs in different sectors and income groups, as well as the acceptance of WTR, need to be considered carefully.

## Micro-view of working time reduction

### Key findings:

- Most workers had relatively clear preferences regarding participation in the VV scheme and very clear preferences regarding participation in the TZ scheme.
- Personal motivations were more important than work-related reasons to choose WTR, while not choosing WTR may often have been motivated by work-related reasons.
- Flexible time use offered by the VV scheme was key for many workers.
- Family, sports, friends, relaxing and unpaid work were the most important new time use categories, some of which may require substantial travel.
- Individual differences between the mobility and environmental impacts of new time uses can be expected to be very significant.

To understand people's motivations and decisions to join the WTR schemes made available in Germany, we approached workers using two research instruments: individual interviews and a survey. This section reports combined findings from both instruments and explores the questions and potential ambivalence that surround WT decisions.

The results should be read carefully given the recruitment difficulties (Section 2). The 25 interviewees and the 80 survey respondents worked in the metallurgic, electrical, and medical technology sectors and some of them were early adopters of the VV scheme in their respective companies. The interviews and the survey can be suspected to provide similar amounts of information in view of the total time commitment by participants (roughly 25x60 minutes vs. 80x20 minutes). The findings are not to be read as an accurate representation of a larger population of German workers. Instead of aiming for generalizable findings based on large samples, the goal of the interviews was to gain in-depth understanding of individual decisions about joining WTR schemes by paying attention to personal and household characteristics and linking these to the WT decisions. The survey then further refined this understanding and explored potential consequences regarding time use and mobility. Even if the diversity of people's circumstances excludes the possibility of reaching a point where new participants do not deliver any new insights, we believe that we were able to capture a wide range of perspectives, which helps to better understand decisions regarding WTR as well as some of its consequences. Here we discuss the decision process and motivations of workers, as well as the implications of participation that are most relevant from a mobility perspective.

### The decision process

Because of conflicting motivations and the complexity of decisions on WT, people may be ambivalent as to whether or not they should participate in WTR schemes. If preferences are malleable and decisions are hard to make, then abrupt changes in participation rates are possible, e.g. as a result of herd effects. If preferences are more stable, then participation depends more on objective conditions of the reduction schemes, so reductions can be popularized through changes in these conditions. How participation rates can be changed matters for the overall potential of WTR as a strategy to increase well-being and, potentially, to reduce environmental effects.

Around three out of four surveyed workers considered the decision of whether or not to participate in the VV scheme to be relatively easy, which was also expressed in the time needed to make a decision. Only 15 out of the 84 survey participants took more than a week to make the decision. Those who did not reduce their WT in particular thought that the decision was easy, mostly because they never seriously considered participation. However, the interviews showed that decisions on participation – which were described as easy when the question was first raised – actually matured over a long time period in many cases. Workers considered various potential implications of changes in WT for their own lifestyles and practices as well as impacts on other household members. Several interviewees could not mention a specific point in time when the decision for or against WTR was made, which suggests that thinking through WTR was part of a longer reflection on issues that were already contemplated earlier. Even those who referred to a specific moment in time when they made the decision explained how a broader context of cumulated experiences mattered. In other words, the background of the decision was complex and included several relevant life events.

Retrospectively, workers who found the decision difficult and chose to participate were generally satisfied with their decision and planned to apply again for reductions according to both the survey and the interviews. Those who regretted their previous decisions – a quarter of all survey respondents – either never participated in WTR or participated earlier but not when they made the last decision. In other words, it was way more common to regret working too much than working too little. Taking into account the explicit answers on the difficulty of the VV decision, the time people took to actually make these decisions, and the share of respondents who regretted their decisions, it seems that most – but not all – workers have fairly clear preferences regarding participation in the VV scheme. It is likely that the remaining ambivalence is linked the complex processes of preference formation and to

uncertainties about the impacts of participation. One example for the latter is that 14 survey respondents were uncertain as to whether they would be able to actually reduce weekly working hours to 28 by participation (which would mean less pay for similar amounts of work), and 30 expected that they would not be able to do so (which, even if not totally true, could be responsible for some level of ambiguity). The interviews suggest that tasks, work routines, and workplace relationships may also change, which may be a concern for workers who suspect this. A further question is whether workers could get the hours they desired or felt that further reductions would be better, as expressed by several interviewees.

In the case of the TZ scheme, ambivalence and uncertainties were substantially lower. Only two workers in the survey found the decision difficult, 80% made immediate decisions while the remaining 20% took less than a week to decide, and 71 out of 80 respondents believed that they would be able to actually reduce their WT by 8 days by joining the scheme. Nevertheless, a few people regretted their decisions, so clear preferences resulting in quick and easy decisions did not always mean decisions that looked equally good retrospectively.

Since preferences were relatively clear, it is sensible to look at changes to the schemes that would make WTR substantially more attractive to workers. The most important options according to the survey pertain to financial aspects: if the wage cut was less than proportional or pensions were affected less, then most people (62 and 56 respondents, respectively) would be more inclined to choose shorter workweeks. Interviewees suspected that the main reason for the limited popularity of the WTR schemes in Germany, in particular the VV scheme, is the low wage level in a number of economic sectors, regarded as insufficient to cover the basic necessities of working families. Even if interested in reducing their working hours, workers felt that they would not be able to cope with the resulting income loss and rejected WTR.

More flexibility regarding the timing of work came next with 49 positive responses in the survey: the power to determine schedules is also a common theme in collective negotiations. “If career opportunities were less impacted” was chosen by 30 workers, “more colleagues participating” by 25, and “better substitution” at work by 24 respondents. Family and friends working less looked rather unimportant as a condition (only 10 workers would see reductions as substantially more attractive than). This is aligned with the finding that most interviewees framed their decisions as individual choices, not heavily influenced by the social context.

For the TZ scheme, the participation of colleagues was almost as unimportant (10 respondents indicating it was important) as the lower WT of family and friends (7 positive responses). This means that a few more days off are entirely imaginable by all, while pressure by others at

the workplace was more of an important barrier to the 4-day workweek than the attraction of a social multiplier effect (enjoying free time together with others who are also free). The relative importance of financial considerations, flexibility, career aspects, and substitution corroborate the statements of most interviewees who described WTR as an individual decision, largely unaffected by others' behaviour.

An additional factor that mattered for the decision process of workers was how each WTR scheme was framed. The VV scheme was accompanied by a clear salary cut that was perceived as a loss. The TZ scheme was different in this respect: when choosing between time and money, choosing time was not only incentivized by giving 8 days off instead of 6 days' salary, but the money was also an additional payment, not part of the normal salary. Therefore, not getting it did not appear as a loss. The psychological difference between extra income not received and income lost is well-known, which partly explains the substantially higher popularity of the TZ scheme.

## Motivations

### *Personal vs. work-related motivations*

Whether personal or work-related motivations dominate when it comes to WTR helps to further understand how WT decisions are made in the German context. Motivations also matter for the social and environmental impacts, as well as the popularity of the schemes in case of changes at the workplace or the private sphere.

The interviews suggested that WTR decisions were mainly driven by personal, rather than work-related, reasons. Free time activities were emphasized more than spending less time at work. Findings from the survey point in a similar direction but are less clear-cut. Free time looked somewhat more important than work-related stress when explicit questions about the motivations to participate in WTR were asked (3.16 vs. 3.00 on a scale of 4). Similarly, slightly more people ranked free time activities than did stress as the most important (or a top-three) motivation to reduce WT (8 vs. 6 and 29 vs. 25). However, differences were relatively small, and work-life balance – a mixture of personal and work-related motivations – was ranked as the top motivation (average importance: 3.65, top rank: 19, top three: 49), suggesting that both realms are quite important.

A breakdown according to participation in WTR and perceptions of time pressure further illustrates this. Comparing those who participated in the VV scheme and those who did not, participants rated both free time activities and stress somewhat more important as motivations for WTR than non-participants (free time: 3.36 vs. 3.11; stress: 3.17 vs. 2.97). Those who

strongly agree with the statement that they do not have enough free time are motivated to reduce WT by both the desire to have more free time and to reduce work-related stress (3.75 vs. 3.63). The same values are somewhat lower for workers who somewhat agree or disagree with this statement (3.28 vs. 3.06 and 2.95 vs. 3.17). Workers who have enough time still rate free time activities high while stress drops (3 vs. 2.47). The explanation of this relationship may be that perceived time pressure hindering free time activities is related to stress at work, which is plausible if the cause of stress is overwork or too little control over work schedules – as mentioned by several interviewees.

The interviews suggest that in most cases it is not stress per se, but its impacts on the private realm of life that mainly motivate reductions. WT reductions were often described as an opportunity to create some distance from work and its stressful environment. However, even workers who considered their jobs as psychologically or physically demanding rarely mentioned workplace issues as primary reasons for WT reductions. Rather than alleviating the burden of work, most workers concentrated on the satisfaction of activities in private life and mentioned the reduction of stress as an opportunity to do so. Furthermore, the survey showed that almost all workers enjoy non-work time (average rating: 3.8), while work is around the midpoint of the scale (2.75). The meaningfulness of work to the world, which tends to be higher than the meaningfulness of most other activities except parenting in general surveys, was not mentioned as a very important motivation when decisions about WTR were made.

While work-related considerations had a rather indirect role in decisions to participate in WTR, decisions to *not* participate were more directly linked to the various functions of work. Non-participants rated the importance of changes in income and pensions substantially higher than participants (by 0.68 and 0.51 on the 4-point-scale), while the difference for meaningfulness and concerns about potentially overburdening others if one joins the VV scheme were rated 0.38 and 0.28 point higher by non-participants. In other words, worries about money, professional identity, and colleagues seem to pose a barrier to WTR. It is also useful to note that most interviewees who chose to participate in the VV scheme were close to retirement or did not have substantial career aspirations (at least where they currently worked), suggesting that few people take high career risks by reducing WT.

Almost all interviewees who participated in the VV scheme – and many who participated in the TZ scheme – were in comfortable financial situations. In the interviews, financial security was ubiquitously mentioned as a precondition for joining the VV scheme, regardless of motivations to work less. The only exception was when health conditions played a significant role. The fact that most participants did not have to fear financial hardships is illustrated by

the impacts of participation that they reported. When we asked them about potential changes in their consumption as a result of the salary cut, they hardly mentioned any effects, even after spending some time thinking about it. Instead, interviewees reported that they did not really perceive a trade-off between time and money, and often talked about money as a less important issue in their lives. However, some of them still made calculations of benefits vs. financial losses. VV participants emphasized that they did not have debts or mortgages, did not have children to support, or had spouses on good salaries. In other words, narratives emphasizing the value of free time, which could appear as a less materialistic way of thinking, did not mean that interviewees who participated in WTR would take a risk by working and earning less. Furthermore, these workers were generally aware that the pay cut was proportional in the case of the VV scheme and less than proportional in the case of the TZ scheme, and often referred to the latter as a justification for the decision to join that scheme (as well). Results of the survey show somewhat larger diversity in terms of financial security and participation in WTR, but those who are not in comfortable financial situations are a small minority among WTR participants.

#### *Desired free time activities*

How people (would) spend their time freed up by participation is directly relevant for social and environmental impacts, and also important for communication strategies when WTR is popularized. Insights from the interviews and the survey are similar but not identical. The most important time use reported by interviewees was spending time with the family, with friends and hobbies coming next in terms of frequency. In the survey, the most frequently mentioned activities were sports (53), different ways of relaxing (44), family programs (43) and household or garden work (41). Meeting friends and travelling were also mentioned by a quarter of the respondents (19-19), whereas volunteering (8) and learning (3) were mentioned by a few.

It is useful to note that “family-related activities” is a broad category, which includes daily family routines as well as various leisure activities. While some workers favoured WTR because they wanted to play a more active role in family logistics (take children to the school, do more shopping for/with the family), others wanted to use this time for leisure travel during extended holidays. Those who were planning or doing more routine activities often framed such time uses as a necessity. Parents of small children who work and manage households face challenges and may experience conflicts related to time pressure. Unsurprisingly, interviewees who had small children almost universally expressed a desire to spend more time



on family responsibilities. The survey strongly supports these findings. The importance of household responsibilities as a motivation for WTR was rated substantially higher by participants of the VV scheme than by non-participants (participants rated this 0.6 points higher on the 4-point scale, which was the largest positive difference between the two groups).

An interviewee who has two small children and a wife who has not yet finished her PhD experienced constant time allocation problems. They were both dissatisfied. Professionally, the wife sacrificed much to dedicate time to their children, which significantly slowed down progress with her doctoral studies. Simultaneously, the husband used his time for various business meetings and built a career, but he did not feel that he performed well as a father, which made him dissatisfied too. His decision to participate in the VV scheme can be understood as a response to the traditional but unsatisfactory gender roles.

Other examples corroborate that non-work time is often not leisure time. Care work, household work, and garden work all show that unpaid work can be a motivation for WTR. However, it is not always easy to differentiate unpaid work and leisure time, as the intensity of unpaid work and whether it is done for the output or just for the sake of enjoyment is unknown. Gardening and childcare are time uses that are notoriously difficult to categorize as work or non-work, but often motivate WTR.

Another type of potentially involuntary WTR is when motivated by health issues. The interviews showed that these may be physical problems or psychological issues, sometimes related to the pressures at work and at home, potentially combined with desires related to more serious hobbies (e.g. competitive sports). Depending on the causes and the seriousness of the health conditions, it can be difficult to categorize WTR as voluntary or involuntary. Unlike many articles that use such a dichotomous categorization, we think it is better to think about this as a scale with some totally voluntary, some totally involuntary, and many “in-between” situations.

Closer to the voluntary end of the scale, various types of activities were mentioned. Many people (would) devote time to sports and other physical activities, to relationships with significant others, and to connect with nature (be with animals, go hiking or visit green areas, etc.). Music, trips to various cities, and a number of activities specific to individuals were also mentioned. Sports were mentioned somewhat more often by men than women, whereas family-related activities were mentioned more frequently by women. Given the different positions of these categories on the voluntary-involuntary axis, gender imbalances known from time use diaries cannot always be expected to disappear as a result of WTR.

An additional observation from the survey is that few people (would) spend their time with civic duties and other community-level activities. These are often imagined by researchers as time uses that could be meaningful for the person and useful for the communities. However, they do not seem to be very attractive for many, likely because there are several easier and more enjoyable alternatives.

These results also show that how time is valued can change at particular moments in the lives of workers. Some parents do not want to miss the unique moments of their children's development and their participation in household work is very important when children are still dependent on them. Others must provide care to family members in poor health. Again others have family members or friends who change their daily routines (e.g. after retirement), which may trigger desires for reductions as spending time together becomes more feasible – such social multiplier effects were not rated as important in the survey but were mentioned in the interviews.

Furthermore, time use during participation in WTR schemes can change over time. For example, an interviewee decided to participate in the VV scheme to care for her mother who was very old and sick. When the mother passed away, the interviewee started to spend more time with her grandchildren in her time off, which became a very meaningful activity for her. She decided to stay in the VV scheme. This suggests that providing opportunities for workers to experiment with different WT options can help to discover what suits them best.

### *Flexibility*

While concrete motivations are important, both the interviews and the survey made it clear that the possibility of simply having more flexibility can be just as important for many workers. For these WTR participants, it becomes more feasible to adapt schedules to those of others or to be more spontaneous. Whether they would undertake household activities earlier in the week and free up weekends for leisure activities or go out with others is unimportant when the decision on WTR is made, what matters is the freedom to do so if they wish. Put differently, people may not have a very clear idea about which activities they would prioritize while working less and still regard WTR as attractive. The survey shows that the more flexibly workers can choose the timing of the remaining working hours, the more interested they are in WTR. Only financial conditions were rated as more important than flexibility when potential changes to the VV scheme were explored (the VV scheme would be more attractive if the pay cut was less than proportional according to 62 respondents, if pensions were less impacted according to 56, and if the extra time could be used flexibly according to

49). Therefore, increasing the flexibility of WT during reductions would be a step that would favour employees. However, controlling work schedules is also very important for employers because of the continuity of production processes. If VV participants are substituted by newly employed workers, then their work schedules cannot be ignored. A dilemma emerges here: the proper substitution of VV participants reduces flexibility, whereas the lack of this increases the risk of unchanged work demands leading to higher intensity or overwork. In other words, flexibility and proportional workload reductions are two conflicting aims, between which the balance has to be found. An easier way to provide flexibility is the existing option to go back full time after a few months of WTR. This helps workers try out shorter WT, which reduces uncertainties compared to traditional switches to part-time work.

*Where would people spend time if they worked 4 days a week?*

Results regarding the locations where people would spend their time during shortened workweeks are somewhat contradictory. Interviews revealed that most VV participants did not engage in new activities, just increased the duration or frequency of non-work activities they did before. This suggests few changes in terms of locations, perhaps just a shift between them. To what extent this was due to the pandemic is difficult to tell. On the other hand, survey results suggest very large individual differences regarding the same impacts. Some workers would not change anything and spend their time at the same places as today, while others would travel to distant locations. The largest difference can be observed between those who would shorten their workdays and those who would collect several days and use the additional days off for longer holidays. Shorter workdays neither reduce commuting, nor do they significantly impact other travel behaviour. In contrast, longer holidays almost always mean more long-distance travel. Actual 4-day workweeks fall somewhere between these extremes: for most people they increase the frequency and length of either short-distance or long-distance trips, but there is very substantial diversity even within our relatively small sample. As the share of actual WTR participants was lower in the survey than in the interviews, these results are more hypothetical. While probably not all plans reported in the survey would be realised, it was also indicated by interviewees that travel intentions were depressed during the pandemic.

## 4. Consequences for mobility

We look at two main questions about the mobility aspects of WTR using the German example. First, whether considerations related to mobility play a role in WTR decisions. This question not only involves the effects of the time spent commuting, which can be most obviously impacted by a 4-day workweek (if working hours are actually distributed over 4 days), but also the wish of travelling more or longer for leisure as a potential motivation for WTR. Second, the mobility implications of WTR are investigated to better understand what purposes mobility serves and the likely consequences for well-being and environmental sustainability.

The first insight from this analysis is that commuting rarely appears explicitly as a factor in WTR decisions. Neither interviewees, nor survey participants mentioned reducing associated burdens as a driver of decisions. The fact that travelling to work was not perceived as a stress factor by interviewees may be partly explained by the relatively short distances and remote work during the pandemic. The same observation is more interesting in the pool of survey respondents because many of them spent substantial time commuting: the average distance to the workplace was around 23 km and – after the lockdowns when the survey took place – most workers went to work by car, which means that getting to the workplace and going home took at least half an hour on average, but likely more. For many workers, commuting time could easily exceed 10% of daily WT, yet it was not mentioned as a separate motivation to work less. Nevertheless, this is likely because people consider commuting as part of the workday, and the fact that most workers (>85%) would take entire days off instead of choosing shorter workdays suggests that commuting may not actually be unimportant.

On the other hand, approximately a fifth of the surveyed workers had plans to travel in the time freed up by participating in the VV scheme, and a few people in our sample cite this as a main motivation of WTR. This indicates that differences between motivations to reduce WT are very diverse, and even a comprehensive review on WT preferences and decisions showed the almost complete absence of mobility-related aspects in the literature. As the current literature on WT outcomes and mismatches says very little about anything related to mobility, both commuting and desires for leisure travel deserve more attention, especially because they are very important from an environmental perspective.

This leads to the second question on the role of mobility in the transformed lives of WTR participants. The hypothesis that mobility patterns may significantly change as a result of WTR is supported by the findings. This is important for both well-being and environmental sustainability, in some cases being a main driver of both. Therefore, we give a point-by-point

list of the main findings from the different parts of the research and offer interpretations that go somewhat beyond the strict boundaries of our current project.

The review on the relationship between WT and environmental impacts revealed very little about the specific role of mobility. While it is clear that transportation is responsible for a significant share of energy use and pollution both at the household and the country level, changes triggered by WTR have not yet been studied.

Quantification at the country level would require the identification of causal connections between aggregate WT – made up of the number of workers, employment rates, and average WTs, as shown in the macro-analysis of this report – and changes in transport volumes. Since passenger transport is affected by cultural trends, weather patterns, and a number of other factors, while freight volumes are driven by economic activities, separating the impacts of changes in WT is only feasible if there are radical changes in average WT. Therefore, countries with nation-wide WTR programs should be analysed. A breakdown of transportation data by purposes seems essential for the analysis.

At the household level, detailed travel data – diaries or automatic data collection – could be used in a longitudinal setting before and after changes in WT. Despite being quite resource intensive, this is a more widely feasible type of analysis than the macro-level approach to explore different contexts. Yet there are important barriers to overcome. For manual travel logs that cover a sufficiently long period, the main question is whether participants can be properly incentivized without strengthening financial motivations so much that this would compromise data quality. For automatic methods, such as the passive collection of GPS data from mobile phones, a key issue, in addition to accuracy and the question of whether phones are always carried around, is whether travel modes can be registered. In the absence of such quantified data, interviews and survey data can be used to speculate about changes.

The micro-level analysis delivered several insights for such informed speculation. To begin with, it showed that the motivations of WTR do matter for environmental impacts, as suggested in the literature (Hanbury et al., 2019), but led to several qualifications of this broad statement. While people motivated by leisure travel will definitely change their consumption patterns towards higher energy intensity, others reducing WT for different reasons – e.g. to do more sports or to spend more time with family – may also travel substantially more. A sizeable proportion of workers in our samples did or planned to do sports and family-related activities that require regular middle- or long-distance trips, e.g. to meet people who live hundreds of kilometres away. In other words, activities that increase well-being and look benign from an environmental perspective at first sight may actually be energy and pollution

intensive. Taking the average commuting distance of 45 km per day, 4-day workweeks cut commuting by around 2000 km per year, which is less than one international long-distance trip or a handful of domestic middle-distance journeys. In other words, from a transportation perspective, WTR can easily backfire even if traveling is not the main motivation to participate.

Nevertheless, this does not necessarily mean that overall environmental impacts are negative. As total consumption falls, the question is how savings stemming from the scale effect relate to impacts of the composition effect. A very clear finding of the analysis is that the answer is different for different participants of WTR. For some people, e.g. workers before retirement who mainly want to spend more time with family members or others living close by, the composition effect will be negligible whereas the reduction of total consumption will reduce environmental impacts. In this case, benefits to well-being and the environment are fully compatible, not least because of the lack of serious mobility impacts. For others, e.g. families with young children who want to spend more time together and on local holidays, it is possible that the composition effect will be slightly negative for the environment because of higher energy consumption at home and more travel, but the overall reduction of production and consumption will overcompensate this. In other words, there will be some rebounds compared to a proportional scale effect, but the strategy will not backfire from an environmental point of view. And lastly, in some cases, e.g. for young workers who want to have more time to travel or for people with travel-intensive hobbies such as diving, environmental backfire effects are possible. The average carbon intensity of consumption is between a quarter and a third of the carbon intensity of fuel consumption in Germany, which means that every euro spent on travel is likely to cause 3-4 times as much carbon pollution as it would cause elsewhere. If WT is reduced by 20%, then an additional spending of 5-7% of the original salary on fuel is likely to overcompensate the original savings in emissions.

Further changes in mobility that would significantly affect a smaller proportion of participants are changes in transport modes and potential changes in the location of residence. 7 surveyed workers indicated that they would likely change transport modes, all towards more sustainable alternatives. On the other hand, 5 people indicated that they would move further from their workplace and 4 others were unsure about this. If the time spent on travel actually stays constant as suggested by a famous theory (Ahmed and Stopher, 2014), then commuting distances will likely grow with remote work and shorter workweeks.

Finally, the timing of reductions matters for mobility implications. Shorter workdays have minimal impacts, perhaps slightly increasing the frequency and duration of longer trips by

enabling people to solve administrative and other issues during their normal workdays, thereby freeing up time for holidays. If WT is reduced by one day a week, which is by far the most common way of using WTR (chosen by two thirds of the workers in our sample), then commuting is reduced, but both weekend trips and longer holidays can be expected to become more frequent and longer on average. As this group is very diverse, infrastructures and complementary policies have a large influence on the average. If the free days are collected but the number of weekly workdays remains unchanged, then there is no change in weekend trips, but longer holidays increase substantially, with very few exceptions. Whether this option should be allowed is a question to be explored, as it is unclear how the same workers would use 3-day weekends.

## 5. Research frontiers and next steps

The crucial question is, how WTR could become both attractive – at least for workers – and environmentally beneficial at the same time? What complementary policies could facilitate this? And what can research say about the pros and cons of different policy approaches? The current research points towards several interesting dilemmas.

- (1) If workers feel that they need more income to consider participation, but desired incomes are high and increase over time, then environmentally beneficial WTR may not be achievable outside a relatively narrow group of high-income workers. Research may help to understand whether perceptions of financial security depend more on absolute or relative incomes. This is important because high relative incomes are, by definition, not achievable for many, which may constrain the popularity of WTR. Material security and comfort in absolute terms are more realistic goals. In this case, the relationship between the strength of the welfare state and willingness to reduce WT could be studied. This could also deliver insights regarding potential interactions between WTR and a universal basic income or universal basic services.
- (2) Paying more attention to workers with lower wages and less comfortable financial situations would be necessary to learn more about the time-vs-money trade-off and to better understand the full potential of WTR. Several previous studies, including ours, are deficient from this point of view.
- (3) It could be quantitatively assessed how changes in WT, income, mobility, and the resulting energy and GHG footprints of households could be substantially reduced. For this, high-resolution panel data tracing the same households and their consumption

and activity patterns over time could be used for different social groups and employment types. While Germany has such panel data, its resolution is too low for a proper household footprint modelling, and WT information is lacking. An intermediate solution could be to utilize detailed household budget surveys released every 5 years to conduct time series analysis, although these surveys cover different households in each survey wave. Therefore, either case studies in other countries with better data, or targeted studies following a smaller sample of households participating in a WTR scheme over longer time periods (before/after) could be a useful solution.

- (4) Regarding household footprint estimates, we utilized a global multi-regional input-output model representing the world economy at high resolution, which, however, does not properly endogenize capital and investment flows. The latter can affect footprint estimates, which means that better models could allow more accurate quantifications. This is a general research frontier in MRIO modelling and the community is working on better models and data.
- (5) The complex relationships between WT, mobility, lifestyles, and the climate/environment can also be investigated along other causal pathways and at various levels and scopes of analysis. For example, instead of linking up work-income-consumption, one could ask what is being produced during work and thereby ask how incomes are earned. In other words, income-based responsibilities could be quantified by attributing emissions along the supply chains of products and services to the agents who earned their income producing them.
- (6) It seems that properly understanding the WT-environment relationship in larger groups is extremely data intensive, so very challenging. Furthermore, it may not even be the most important question because the current relationship may change as a result of environmental policies. While WTR may be used to prevent the endless growth of production and consumption (i.e. to take care of the scale effect), supplementary policies may be applied to influence how people spend their time and what they consume (i.e. to deal with the composition effect). Therefore, it may be reasonable to focus on environmentally good and bad examples of WTR instead of trying to understand current averages. Is it travel demand, household energy consumption, or both that must be constrained to make it more sustainable? Is it possible to significantly curb travel demand by changing the timing of WTR? The answers can help to identify beneficial types of WTR as well as complementary policies that work well together with these reductions.



- (7) Modern work conditions, especially flexibility and remote work may influence the formation of WT preferences. How do these changes matter and do they weaken social norms by making work invisible? The answer may be crucial to prevent overwork in the future. Whether economic conditions or well-being considerations drive change towards lower WT is a related question to be explored. Such questions are especially important as burnout rates are increasing, potentially as a result of the lasting psychological effects of the pandemic.
- (8) The German example also suggests that the types of work arrangements, especially in the lower paid sectors, and the shift to fewer working hours distributed across more employees might result in more trips to work. Work-related mobility is already increasing substantially, which deserves future attention regarding the spatial organization of work and potential shifts of emissions from household consumption to the production sphere. As the number of people with multiple jobs grows (from relatively low levels: 2% of all hours but 10% of jobs), these trends could easily result in a self-reinforcing feedback loop of increased inequality and increased work-related mobility. In other words, the growing number of people holding multiple jobs to earn a sufficient income may not only produce social problems but also increase travel demands when people go from one workplace to the other. How this could be prevented is a question that needs attention.
- (9) Whether the IGM WTR schemes provide a good starting point for future WTR models that are compatible with mobility reduction and environmental benefits is also a question. Should these schemes be improved for better environmental performance? If yes, how? If not, what types of WTR schemes could perform better? We had limited possibilities to compare the VV and TZ schemes as eligibility criteria were different, but WTR schemes understood as extended holidays deserve scrutiny.
- (10) Differences between impacts on men and women could be more explicitly studied. Do the current WTR schemes represent real opportunities to advance gender equality? And do environmental impacts also depend on the gender roles participants assume?

Many other avenues of research, including focused case studies and qualitative work also seem crucial for a deeper understanding, as research in this field is still in its infancy. Only a larger set of different study designs, methods, and empirical cases will enable researchers to draw more specific and more widely applicable conclusions.

## 6. Conclusions: social and policy implications

If one tries to understand how decisions on WT are made, the time vs. money dilemma is a useful starting point, even if the full picture is much more complex. Finding the balance between desired activities and desired earnings is an explicit aim of many workers participating in our research, and an implicit one for many others. This means that economic and cultural conditions that matter for these aspirations are crucial. Current barriers to WTR include weakening welfare states, decreasing job security, the polarisation of labour markets in terms of opportunities, and the dominance of consumerist values. Reversing these trends and strengthening alternatives to consumerism are thus essential to make WTR more widely feasible and more popular.

At the same time, in line with the results of the literature review on WT preferences and decisions, we find that workers consider a large number of factors including job characteristics, workplace relationships, family circumstances, social aspects and individual pursuits when making decisions about the amount of work they want to do. Despite the complexity of these decisions, most of them formulate relatively clear preferences once they feel that uncertainties about the effects of participation are small. Very few people are undecided about the TZ scheme, and the majority also develops clear preferences regarding participation in the VV scheme. This means that instead of waiting for herd effects to increase adoption rates, the conditions of WTR must be changed to popularize more radical WTR. Step-by-step changes in financial conditions could be used to test whether a slight advantage of choosing time instead of money is sufficient, as in the case of the popular 8-days-off scheme. Conditions could also be different at lower and higher levels of pay, as the main condition of participation is a sense of financial security. Reducing WT each year instead of raising salaries is another option to minimize loss perceptions.

Motivations for WTR are rarely entirely voluntary or involuntary. It is usually a mixture of both, with activities that are often difficult to categorize as unpaid work or leisure time, such as parenting. Caring for others, doing sports, and having more time for social connections often simultaneously motivate WTR. Workplace factors have a secondary, but not unimportant, role in these decisions. Chronic stress or exhaustion, and especially health issues stemming from these, can strongly increase motivations to reduce WT. However, people usually refer to the non-work parts of their life to justify WTR decisions and explain how negative impacts related to work harm their private sphere. This underlines the role of culture

and personal identities. In particular, strengthening non-consumerist, non-work identities – e.g. based on community or group membership – is key for more widespread WTR.

The consequences of WTR for well-being are generally positive. Most people report that they are satisfied with their decisions to reduce WT and regret it much less frequently than those who chose not to reduce WT. WTR participants spend time with their family, do care and household work, engage in sports, relax, meet friends, and plan to travel (depending on post-covid regulations). In addition, they can more flexibly adjust their schedules when they want. Feelings of meaninglessness are not common, likely because they find the new activities meaningful and are still part of the core workforce that can go back full-time if they want. Nevertheless, participation is largely restricted to those who feel they can afford it without financial risks, so the group of participants is narrow. This calls for different conditions at different ends of the socio-economic hierarchy. Whether WTR can be popular without very high wages that cause large environmental impacts is a key question to be explored.

From an environmental perspective, changes in mobility are very important, but overall impacts are poorly understood. The only clear relationship is the positive correlation between incomes and environmental impacts at the household level in cross-sectional samples. This could suggest environmental benefits as a result of uncompensated WTR, but there are two main complications. On the one hand, effects of the changing composition of consumption are not properly quantified, so impacts at the household level may not always be beneficial for the environment. This strongly depends on the behaviours of individual participants: while in certain cases reductions in resource use and emissions are virtually guaranteed, for other participants the strategy may backfire due to substantially increased mobility driven by desires to travel or to do travel-intensive hobbies. To reduce such negative impacts, complementary policies are necessary, such as carbon pricing or even individual quotas, given the very unequal distribution of travel-related emissions. Changing norms by strengthening groups and associations that provide meaning, status, and enjoyment at a more local level can also be part of the solution, especially if local transport options enable such activities without high emissions.

Although WTR is not a sufficient condition of environmental sustainability, it is a necessary condition of a precautionary strategy. As the ever-increasing growth of consumption is likely to be unsustainable, production must also decrease to avoid the risks of continued growth. Unless labour productivity starts to fall, which would be surprising given historical trends, this requires WTR. The challenge is to make it attractive and sustainable, which requires further research.

Regarding popularity, deeper understandings could be attained by focusing more on concrete WTR schemes instead of analysing general questions on WT mismatches as is usually done in the literature. More qualitative research is necessary to better understand causal mechanisms of preference formation and the attractiveness of different WTR options. A large number of case studies could deliver insights for the planning of future reductions.

Regarding social and environmental impacts, smaller groups of workers could be studied for longer time periods to observe actual changes as a result of WTR. Comparing changes in commuting and leisure travel, as well as mobility-related impacts and the impacts of activities taking place in buildings could be particularly useful. Such research is expensive but necessary to know more about behavioural change triggered by WTR. A review of case studies could then help to explain the role of social norms and the infrastructural context. These strands of research could be complemented by separate studies on production-side responses to obtain a fuller picture of the impacts of WTR.

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