Rheinland-Pfälzische
Technische Universität
Kaiserslautern
Landau

Saving the midnight oil?

The impact of working time reductions on the environment, well-being, and gender equality

Vom Fachbereich Psychologie der Rheinland-Pfälzischen Technischen Universität Kaiserslautern-Landau zur Verleihung des akademischen Grades Doktor der Philosophie (Dr. phil.) genehmigte Dissertation von

Sebastian Felix Neubert, M.Sc.

9. Oktober 2025. Disputation wurde abgehalten am 20. April 2026.

Berichterstatter:innen:

Prof. Dr. Gerhard Reese (Victoria University of Wellington, ehemals RPTU)

Dr. Stephanie Moser (Universität Bern)

Vorsitzender des Promotionsausschusses:

Prof. Dr. Stephan Winter (RPTU Kaiserslautern-Landau)

Summary

Working time reductions (WTRs) have been proposed as a policy with potential benefits for both the environment and well-being. Yet, empirical evidence remains limited. Moreover, the mechanisms through which WTRs affect well-being and environmental outcomes are not well understood. Income and time exert distinct influence, while moderating factors such as gender further shape these outcomes.

To address these research gaps, my co-authors and I systematically reviewed 30 longitudinal and (quasi-)experimental studies examining the effects of different conceptualisations of WTRs (Manuscript 1). Second, I conducted a quasi-experimental study comparing Swiss employees who reduced their working hours with those who did not (Manuscript 2). Third, I cross-sectionally analysed the same data, focussing on gendered effects on time use and well-being (Manuscript 3).

Our findings show that WTRs improve well-being, health, and work-family conflict, but that evidence on environmental effects is less convincing. In the longitudinal study, I found that while lower working hours enhance well-being, lower income negatively affects it, resulting in only short-term improvements in subjective well-being for those reducing their hours. For environmental behaviour, a WTR had small positive impacts for some, but no changes for other environmental behaviours. Furthermore, our research indicates that women may benefit more from WTRs than men regarding work-family conflict, suggesting gender dynamics play a crucial role.

This research advances our understanding by synthesising empirical evidence of WTRs across multiple domains with more robust and causally interpretable methods. Importantly, I could replicate that environmental outcomes appear to primarily depend on income effects, whereas framing well-being outcomes in terms of income and time effects alone may be insufficient for understanding the complex dynamics of different factors at play – such as gender, work-family conflict, and time use. Crucially, the counteracting influences of income and working hours on well-being have implications for the income–well-being debate: Working less might provide a more sustainable route to increase well-being than earning more. Finally, my research highlights a possible conflict: Environmental effects of WTRs may require decreasing income, whereas social benefits may require a full wage compensation.

Zusammenfassung

Arbeitszeitreduktionen (AZR) wurden als politische Maßnahme vorgeschlagen, die potenzielle Vorteile sowohl für die Umwelt als auch für das Wohlbefinden mit sich bringen könnte. Die empirische Evidenz hierfür ist jedoch begrenzt. Auch die Mechanismen, über die sich AZR auf Wohlbefinden und Umwelt auswirken, sind nicht vollständig geklärt. Einkommen und Zeit üben teilweise gegensätzliche Einflüsse aus, während Faktoren wie Gender diese Zusammenhänge moderieren.

Meine Co-Autoren und ich haben 30 Längsschnitt- und (quasi-)experimentelle Studien systematisch ausgewertet, die die Auswirkungen von AZR untersuchten (Manuskript 1). Zweitens führte ich eine Studie durch, in der ich Schweizer Arbeitnehmende, die ihre Arbeitszeit verkürzt haben, mit solchen verglich, die dies nicht getan haben (M2). Drittens habe ich dieselben Daten querschnittlich auf genderspezifische Auswirkungen auf Zeitnutzung und Wohlbefinden analysiert (M3).

Unsere Ergebnisse zeigen, dass AZR Wohlbefinden, Gesundheit und Work-Family-Konflikte positiv beeinflussen, während wenig Evidenz für positive Umweltauswirkungen existiert. Zwar steigern kürzere Arbeitszeiten das Wohlbefinden, ein geringeres Einkommen wirkt sich jedoch negativ darauf aus, sodass sich das Wohlbefinden der AZR-Gruppe nur kurzfristig verbessert. Eine AZR hatte zudem nur positive Auswirkungen auf einige Umweltverhaltensweisen. Darüber hinaus scheinen Frauen im Hinblick auf Work-Family-Konflikte stärker von AZR zu profitieren; genderspezifische Dynamiken spielen somit eine entscheidende Rolle.

Diese Arbeit trägt zu einem besseren Verständnis bei, indem sie empirische Belege zu AZR mit robusteren und kausal interpretierbaren Methoden zusammenführt. Ich konnte bestätigen, dass Umwelteffekte in erster Linie von Einkommenseffekten abhängen, während Wohlbefindenseffekte nicht allein Einkommens- und Zeiteffekten abhängen, sondern von komplexen Wechselwirkungen der beteiligten Faktoren – wie Gender, Work-Family-Konflikte sowie Zeitnutzung. Die gegensätzlichen Auswirkungen von Einkommen und Arbeitszeit auf Wohlbefinden haben Konsequenzen für die Debatte um AZR: Weniger zu arbeiten könnte einen nachhaltigeren Weg zur Steigerung des Wohlbefindens darstellen als mehr zu verdienen. Schließlich zeigt meine Forschung einen möglichen Konflikt auf: Positive Umweltauswirkungen von AZR scheinen eine Einkommensminderung zu erfordern, während positive soziale Effekte einen vollständigen Lohnausgleich benötigen.

Table of contents

1. Introduction

Planetary boundaries and sustainable development

Humanity is currently vastly transgressing multiple environmental boundaries that make up our natural environment – the very foundation of human survival and flourishing (Steffen et al., 2015). For example, we are witnessing a rapid decline in biodiversity and may be heading towards a "hothouse Earth", a hotter and potentially far less habitable climate system (Steffen et al., 2018). This has led many scientists to warn that we are facing a "climate emergency" (Ripple et al., 2019).

At the same time, humanity also still struggles to obtain a decent quality of life, or even just meet basic needs, of a large percentage of its population, failing to eradicate extreme poverty, hunger, preventable diseases, and stark gender inequalities, to name just a few (Sachs et al., 2025). The challenge, therefore, is to meet everyone's physiological and psychological needs without transgressing environmental boundaries. We must therefore operate in a "doughnut economy": an economy with sufficient economic activity to meet human needs, but not so much that it breaches environmental boundaries (Raworth, 2017).

To address these challenges, the United Nations adopted 17 Sustainable Development Goals (SDGs) in the 2030 Agenda in 2015, combining both environmental and socio-economic goals and indicators of development (United Nations General Assembly, 2015). Although the SDGs have been criticised for insufficiently addressing environmental challenges, neglecting planetary boundaries, and lacking binding measures (Kotzé et al., 2022), they nonetheless provide a framework for assessing progress on these different environmental and social challenges. Strikingly, current assessments show that the world is not on track to achieve any of the 17 SDGs globally (Sachs et al., 2025). In general, highly developed nations in the Global North struggle to meet environmental goals such as mitigating climate change and halting biodiversity loss, while developing nations in the Global South face financial constraints in achieving both socio-economic and environmental targets (Sachs et al., 2025).

There also appears to be an inherent dilemma: the more socio-economic goals a country attains, the more ecological boundaries it tends to transgress (O'Neill et al., 2018; Roberts et al., 2020). High income countries must therefore radically reduce material consumption and carbon footprints in order to remain within planetary

boundaries while sustaining or improving their citizens' well-being (Akenji et al., 2016; O'Neill et al., 2018; Roberts et al., 2020; Steffen et al., 2015). Considerably more efficient infrastructures and provisioning systems (in terms of needs met per unit of environmental impact) appear to be possible, but the challenge is immense: Provisioning systems may need to become two to six times more efficient than those currently in place (O'Neill et al., 2018). Thus, humanity must find ways to drastically reduce environmental impacts while sustaining or improving well-being and socio-economic provisioning if it is to stay within planetary boundaries. How best to achieve this, however, remains unclear.

Change within the system or system change

There is a growing debate over whether the scale of change required can be achieved within the current socio-economic system, or whether entirely new economic paradigms and system changes are necessary. Proponents of the mainstream position – that sustainable development is possible within the existing structures – advocate "green growth": economic growth driven by renewable energy, technological innovation, and greater efficiency. This approach assumes that it is feasible to reduce carbon emissions and environmental footprints sufficiently while maintaining economic growth – a decoupling of economic activity from environmental impact (Shao, 2020).

However, absolute decoupling (defined as the *reduction* of environmental impact with a growing economy, as opposed to a *slower growing* environmental impact) has not been observed consistently on an economy-wide scale, let alone at the speed required (Vadén et al., 2020). This has led many scholars to question whether adequate change is achievable within the current system. They argue for "degrowth" or "a-growth" in highly developed countries in the Global North, hypothesising that societies can be reorganised and transition towards another system that delivers comparable or greater well-being with much lower resource throughput (Kallis et al., 2018; Krpan et al., 2025; Shao, 2020). Yet, this approach might also prove challenging: smaller material and energy footprints of nations have been empirically linked to lower well-being (De Neve & Sachs, 2020; Roberts et al., 2020).

Nevertheless, these scholars and advocates shift their focus from economic growth as an end in itself towards economic activity – and its resulting environmental pressures – as a means of meeting human needs and fostering well-being through provisioning

systems (Castro & Bleys, 2024; Dengler & Plank, 2024). This involves, for example, analysing which provisioning systems best meet specific basic needs and with what efficiency (e.g. Vita et al., 2019). From this perspective, pursuing economic growth is seen as a highly indirect (and potentially dangerously inefficient) strategy for fostering well-being and meeting human needs (Fanning & O'Neill, 2019). Increases in economic activity (as measured by GDP) are indeed associated with gains in well-being, but with diminishing marginal returns: the higher the economic activity, the weaker the relationship with well-being. By contrast, sustainable development – particularly social and economic development – appears to be associated with *increasing* marginal returns (De Neve & Sachs, 2020). Moreover, certain nations and world regions have demonstrated that relatively high levels of well-being can be achieved with comparatively low levels of material consumption, suggesting that alternative, more efficient socio-economic systems are possible (Roberts et al., 2020).

What remains unclear is how a transformation towards these systems could take shape in the nations of the Global North. In particular, it raises questions about which policies might foster this transformation (Polewsky et al., 2024). As these policies would deviate from mainstream debates, they would require strong public appeal to gain sufficient support for implementation.

Working time reductions

A societal working time reduction (WTR) has been proposed as one policy for highly developed countries that could both support broader societal transformations and also prove popular (Antal et al., 2021; Kallis et al., 2018; King & Van Den Bergh, 2017; Roberts et al., 2020; Shao, 2020). Evidence shows that several nations have successfully reduced unemployment during economic downturns by cutting working hours and redistributing work among the employed population (Gunderson, 2019; Herzog-Stein et al., 2018). WTRs could therefore also prove effective in redistributing paid work within a degrowth or a-growth economy, which may need to reduce its total work in order to reduce environmental pressures, or where work contracts due to automation and productivity gains driven by digital technology and artificial intelligence (Gunderson, 2019).

Moreover, it has been argued that WTRs may generate a "triple dividend": lowering environmental pressure through reduced economic activity and consumption, decreasing unemployment, and enhancing well-being through more leisure time

(Bader et al., 2020; Buhl & Acosta, 2016). This potential triple dividend makes WTRs particularly appealing to many. In addition, collective reductions in working time may promote gender equality if carefully designed (Godin & Langlois, 2021; Piasna & De Spiegelaere, 2021): By redistributing informal care and household work, by enabling women to participate in the full-time labour market, and by addressing unfair competition between men in uninterrupted full-time careers and women in part-time jobs with career breaks for childcare (Piasna & De Spiegelaere, 2021). A societal WTR can thus be seen as both a measure consistent with new economic approaches and as a potential "degrowth" policy – while also being supported by many citizens and advocates. Accordingly, science concerned with sustainable development faces the important task of assessing the real potential of WTR policies.

Effects of working time reductions

WTRs appear to enjoy broad public appeal, with numerous advocates campaigning strongly for policy adoption and media outlets likewise reporting frequently on the positive outcomes of organisational WTR trials (Lehmann et al., 2024). Yet this enthusiasm is only partly grounded in scientific evidence, raising concerns that the benefits of WTRs may be overstated while their actual (particularly environmental) impact could prove very limited (Antal et al., 2021; Lehmann et al., 2024). Given the central role of WTRs in the reasoning and modelling of many degrowth researchers (e.g. D'Alessandro et al., 2020; Wretschitsch et al., 2024), the scarcity of robust evidence is striking, highlighting the urgent need for further scientific inquiry.

The strongest scientific evidence relates to positive health and well-being outcomes of WTRs (Antal et al., 2021). Indeed, several organisational WTR trials of 6-hour-workdays have reported, for example, increased job satisfaction, more restorative sleep, reduced fatigue, and fewer cardiovascular and respiratory symptoms, among others (Akerstedt et al., 2001; Barck-Holst et al., 2017; Schiller et al., 2017). In the economic domain, findings suggest small positive effects on employment (e.g. Raposo & Van Ours, 2010), contested or context-dependent effects on productivity (e.g. Devicienti et al., 2018; Von Thiele Schwarz & Hasson, 2011), and detrimental effects on career outcomes for women who voluntarily work less in the absence of a societal WTR (Dex & Bukodi, 2012).

In the environmental domain, evidence indicates that on a national level, increases in working hours have been followed by increases in carbon emissions (Fitzgerald et al., 2015). Cross-sectional evidence comparing households points to similar conclusions

(Fremstad et al., 2019). However, these findings should be treated with caution: the relationship between working hours and environmental impact may be highly indirect, while commonly studied data are often inconsistent and incomplete, limiting the possibility of drawing causal or longitudinal conclusions from cross-sectional evidence (Antal et al., 2021). Furthermore, there might be rebound effects, as time formerly spent working may be redirected towards more carbon-intensive activities (Buhl & Acosta, 2016). In cases of voluntary reductions in working hours, it seems likely that the life changes triggered by such a reduction might not be enough to lead to a substantial shift in environmentally harmful consumption (Lindsay et al., 2020). Overall, further research is needed to ensure the current societal debate on WTRs is grounded in robust scientific evidence.

Income and time effects

Complicating matters further, it remains unclear how exactly a WTR contributes to both well-being and environmental outcomes. Scholars have argued that at least two diverging mechanisms may play a role: an *income effect* and a *time effect* (Bader et al., 2020). Working fewer hours may reduce income, thereby limiting consumption and greenhouse gas intensive behaviour, but also lowering well-being through reduced consumption and increased financial stress (see, e.g., Bruderer Enzler & Diekmann, 2019; Moser & Kleinhückelkotten, 2018; Persson et al., 2022). At the same time, it may create more discretionary and leisure time, enabling beneficial shifts in time use and consumption patterns, such as less commuting and travel (Buhl & Acosta, 2016), or more engagement in time-intensive, but environmentally sustainable leisure activities (Isham et al., 2019).

Evidence suggests that the income effect may dominate in the environmental domain, or even account for all differences when comparing employees with varying working hours (Buhl & Acosta, 2016; Sorrell et al., 2020). For example, for behaviours with particular relevance for carbon emissions like mobility and housing, income has been found to be a stronger predictor of emissions than working time (Bruderer Enzler & Diekmann, 2019; Ivanova et al., 2018). Exceptions appear to be intent-oriented environmental behaviour (defined by pro-environmental intent rather than the actual impact), and commuting, which seems more strongly related to time effects (King & Van Den Bergh, 2017; Moser & Kleinhückelkotten, 2018). Furthermore, it has been argued that discretionary time (that is, time that is not spent on work or personal care)

may be necessary for translating environmental values into conservation practices or environmental purchasing, as such behaviours often require time, as does reflecting on one's values. Some evidence supports such a moderating effect of discretionary time on the link between environmental values and behaviour (Chai et al., 2015), though findings are inconsistent (Melo et al., 2018). More broadly, it may be a combination of financial and time resources, alongside a mindset of environmental concern, that ultimately leads to environmentally friendly behaviour (Godin & Langlois, 2021). In contrast, other scholars suggested that at the macro-economic level, in countries with high GDP, the relationship between working hours and environmental outcomes might even be inverted. For these countries, fewer working hours may lead to more environmental impact, as time, rather than income, becomes the limiting factor to consumption (Shao & Shen, 2017; Sorrell et al., 2020). Thus, the environmental consequences of a WTR, as well as the mechanisms underpinning them, remain contested.

In the social domain, the reduced income resulting from working fewer hours may diminish well-being, as income has consistently been shown to benefit well-being, at least up to certain thresholds (Jebb et al., 2018). This relationship appears stronger for cognitive well-being than for emotional well-being (Diener et al., 2010; Jebb et al., 2018; Kahneman & Deaton, 2010). Spending money seems to increase well-being only until basic needs are met, after which it does so primarily when directed towards experiences rather than material possessions (Mogilner & Norton, 2016; Pullinger, 2014). Experiences, however, require time, suggesting that at higher income levels, time rather than money may become the limiting factor for well-being. A reduction in working hours may therefore facilitate experienced-focused spending of money (Balderson et al., 2022). Furthermore, many employees report time squeezes and work-family conflict, and a desire to reduce their working hours in order to gain more discretionary time, again pointing to a potential beneficial time effect of working less (Antal et al., 2024; Castro & Bleys, 2024; Pascucci et al., 2022; Sonnentag et al., 2023). It remains unclear whether time or income effects dominate for well-being after a WTR, although the positive well-being outcomes observed in existing studies of WTRs suggests time effects may play a more important role.

Overall, the effects of WTRs on environmental outcomes and well-being might be due to two different and sometimes divergent mechanisms: a time effect and an income

effect. The relative importance of these remains debated and require further investigation.

Working time reductions and time use

A key reason for the complexity in the relationship between time use and its environmental and well-being implications is that these effects are highly dependent on how that time is spend. Isham et al. (2019) suggest that certain activities may have particular potential for enhancing well-being while also reducing environmental impact; activities that induce flow while also having low per-hour environmental footprint. By combining experience sampling data assessing how much flow different activities induce with an environmental input-output model estimating each activity's per-hour environmental footprint (Druckman et al., 2012), the authors identify five activity domains with potential benefits for both well-being and the environment: social engagement; sports; creative activities such as music or the arts; religious and spiritual activities such as yoga, praying or meditation; and positive romantic relationships. Reading also appears to offer high potential for both well-being and the environment. These are all forms of active leisure, in contrast to more passive leisure activities, such as watching television, which are associated with worse well-being outcomes (Kuykendall et al., 2020). Conversely, commuting is linked to worse well-being *and* high carbon emissions (Isham et al., 2019; Liu et al., 2022) – suggesting that reductions in commuting time following a WTR could be particularly beneficial. This raises the question of whether WTRs actually lead to shifts in time use along the line of these beneficial categories.

Qualitative interviews indicate that they might. Individuals reducing their working hours report reallocating time to non-consumption activities like exercise and social engagement (Balderson et al., 2022; Persson et al., 2022), and those planning to reduce their working hours intend to allocate time primarily to activities with low carbon intensity, with increased travel for non-parents as a notable exception (Castro & Bleys, 2024; Mullens & Laurijssen, 2024). However, few quantitative studies have rigorously examined how time use varies with different working hours, despite its importance for understanding the overall effects of WTRs on both well-being and the environment, particularly regarding the proposed time effects.

Working time reductions in a gendered context

These questions must also be considered in a gendered context, as gender shapes the reasons for reducing working hours (Lane et al., 2020), how time is spent following a WTR (Mullens & Laurijssen, 2024), and its effects on well-being and health (Gash et al., 2012; Lepinteur, 2019; Sánchez, 2017).

Regarding the reasons for working less, reductions in working hours may often be a necessity for women to cope with the double burden of care work and employment that falls mostly upon them (Piasna & De Spiegelaere, 2021). Consequently, women's reasons for reducing working hours may differ substantially from those of men.

Similarly, time use and its effects after a WTR are highly gendered. For parents, and particularly for mothers, most non-working time is devoted to childcare and household activities (Castro & Bleys, 2024; Hanbury et al., 2019). In contrast, it has been shown that while fathers who reduced their working hours in a paternal part-time scheme in Germany invested more time into childcare and household work, they largely reverted back to previous levels, unlike mothers (Bünning, 2020). Prevailing societal norms around care work, employment, and gender therefore shape time use following a WTR.

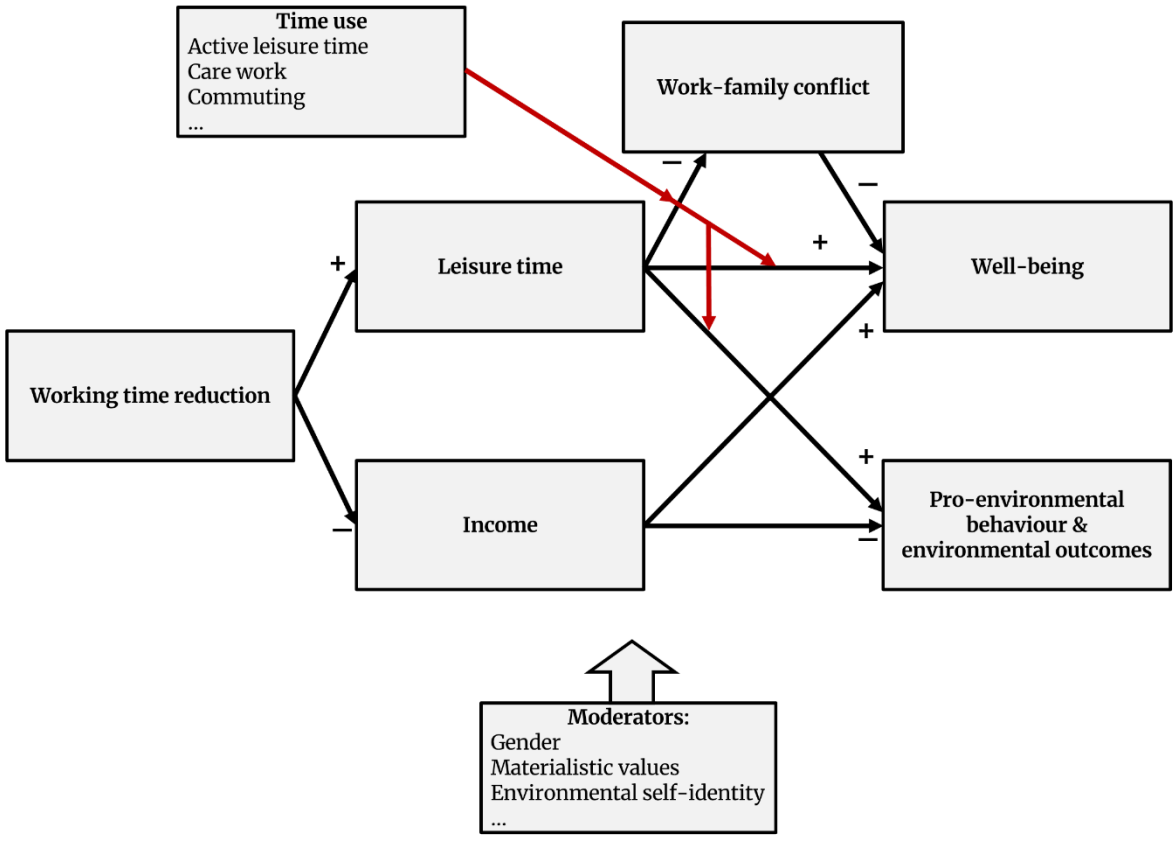
As women carry greater care work responsibilities, the potential well-being benefits of active leisure when working less may be limited for them. However, this does not imply that women benefit less from spending less time in paid employment. On the contrary, women appear to experience stronger health and well-being benefits from WTRs (Gash et al., 2012; Lepinteur, 2019; Sánchez, 2017), possibly in part due to reductions in work-family conflict (Craig & Churchill, 2019; Fagnani & Letablier, 2004; Grönlund & Öun, 2018). Conversely, one study reported decreased health for women reducing their working hours, although this might be due to women reducing *because* of a double burden of unpaid care work and paid employment (De Raeve et al., 2007).

As such, these findings underscore the importance of understanding WTRs in a gendered context and highlight the need for research that accounts for these gender differences. They also challenge the simplistic model of WTR influencing well-being solely through time and an income effects. Additional factors and moderating influences must be considered, with gender being a prominent example – making more theoretical reasoning and empirical research all the more important.

Research questions

In summary, addressing the environmental and social challenges of our time requires a better understanding of transformative policies that simultaneously provide environmental benefits while also enhancing well-being, thereby gathering broad public support for the large-scale systemic changes needed. This research focussed on the policy of working time reductions, examining its effects on well-being and environmental behaviour, as well as the gendered patterns of these effects. In doing so, it also aims to clarify the pathways through which WTRs influence both well-being and environmental outcomes. The hypothesised pathways explored in this research are presented as a heuristic model in Figure 1.

Figure 1: Heuristic model of the hypothesised relationships between key variables



More specifically, the research pursued three objectives. First, I aimed for a better understanding of the environmental effects of working time reductions. As these depend on changes in working hours and income, I asked:

***Q1**: How are working hours and income related to, and how does a WTR influence, environmental outcomes?*

Second, I aimed to clarify the well-being effects of working time reductions. As these appear to depend on shifts in time use following a reduction in working hours, I asked:

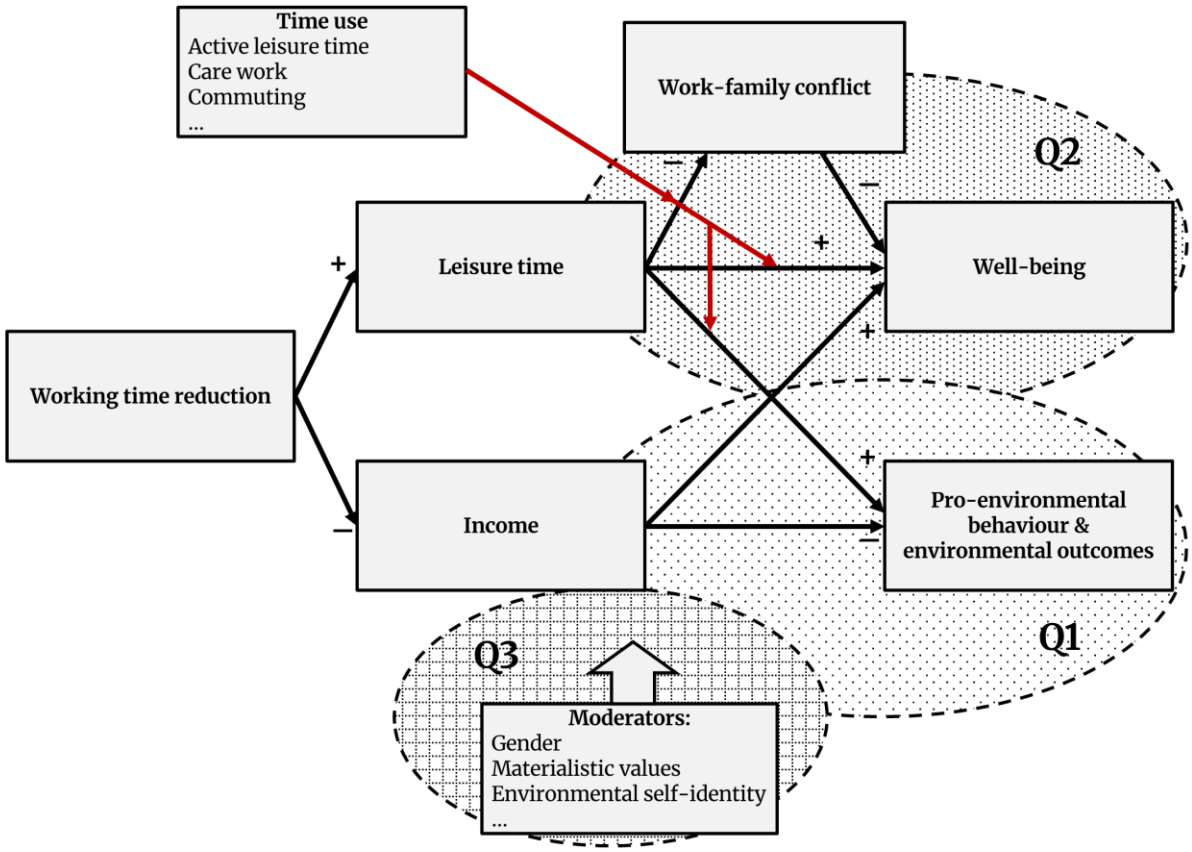
***Q2**: How are working hours, income and time use related to, and how does a WTR affect, wellbeing?*

Finally, recognising that these effects may differ across subgroups, I asked:

***Q3**: How do the relationships between working hours, income, as well as WTR, and environmental outcomes and well-being differ between subgroups, particularly by gender?*

These research questions are schematically represented within the heuristic model in Figure 2.

Figure 2: Heuristic model with schematic research questions



The psychological perspective

These research questions are inherently applied and interdisciplinary – as they address key gaps in our understanding of societal policies and transformations aimed at meeting environmental, societal, and individual challenges. Psychological science has a vital role in answering these questions yet is largely absent from current debates. Our socio-economic systems do not have the *goal* of producing environmental impact, rather, such impacts are a *side product* of attempts to fulfil individuals' psychological and physiological needs and thereby enhancing their well-being (Akenji et al., 2016). Therefore, psychological theory on psychological need fulfilment (e.g. Ryan & Deci, 2000), human well-being in general (e.g. Diener et al., 2018), and the antecedents and consequences of environmental and collective behaviour (e.g. Blankenberg & Alhusen, 2019; Hamann et al., 2024; Klöckner, 2013) can inform both improvements within current systems and the design of new provisioning systems.

Relatedly, the greatest challenges in transitioning to a more sustainable or even regenerative economy are likely social rather than technological, ranging from mobilising political action to organising local change (Barnard et al., 2021). Psychology can help identify factors that increase public support for systemic changes, such as degrowth policies, and understand the psychological consequences of such policies. Consequently, degrowth researchers have called specifically for psychological contributions on WTR policies (Krpan et al., 2025).

Psychology is particularly well suited to examine questions regarding environmental behaviour, well-being, time use, and key moderating variables, drawing on its methods and research tradition regarding these variables. More broadly, psychological science can contribute to a systemic understanding of societal change. Within a Multi-Level Perspective, different societal levels (such as the earth system, socio-technical regimes, and individuals) interact with and influence each other, leading to complex systemic transformations (Geels & Schot, 2007). Psychology aids in understanding both how higher levels influence individuals, and how individuals may influence these higher levels (Wullenkord & Hamann, 2021). More specifically, psychology can help understanding how to increase awareness of societal problems, how to promote public support for societal policies addressing these issues, and help designing these policies (Chater & Loewenstein, 2023). This research focuses on the latter two aims.

Pro-environmental behaviour and environmental outcomes

The study of pro-environmental behaviour has a long research tradition in psychology, with the first research being published in 1975, and has accelerated considerably in recent years (H. Tian & Liu, 2022). Pro-environmental behaviour encompasses "all behaviours undertaken by a single individual to reduce one's negative environmental impact with a clear intention to change the environment" (Blankenberg & Alhusen, 2019, p. 2). This includes behaviour ranging from reducing one's climate footprint to participating in activism. As a broad construct, it is influenced by a wide range of factors, including psychological variables such as attitudes, emotions, social norms, and habits, but importantly also contextual and socio-demographic factors such as income, age, gender (Blankenberg & Alhusen, 2019). These contextual factors, in particular, remain underexplored in their influence on pro-environmental behaviour and behaviour change (Hofmann et al., 2025), a gap this research tries to address in Research Question 1.

In addition to this psychological research tradition, many authors have called for psychological and behavioural research to shift from studying *intent-oriented* pro-environmental behaviour to studying *impact-oriented* behaviour (e.g. Geiger et al., 2018; Krpan et al., 2025; Nielsen et al., 2021). While it has been argued that psychological behavioural theories derived from a diverse set of environmental behaviours can contribute and be used to understand behaviour change in general (Van Valkengoed et al., 2021), several findings challenge that assumption. For once, the relationship between pro-environmental behaviour and actual environmental impact is generally weak. Individuals with high levels of pro-environmental behaviour do not consistently exhibit substantially lower environmental or carbon footprints, with some exceptions such as commuting and food-related behaviours (Moser & Kleinhückelkotten, 2018; Tabi, 2013). For another, individuals often behave inconsistently across different pro-environmental behaviours, making it difficult to generalise findings on the antecedents of one behaviour to another (Steg & Vlek, 2009). To address these limitations, my research includes both traditional pro-environmental behaviours and more impact-related behaviour specifically relevant to working time reductions, namely commuting, consumption expenditure, living space, and car and air travel.

Well-being

One can easily argue that the research tradition on well-being is way older than that on environmental behaviour, even as old as research itself, with early philosophers and religious thinkers revolving around trying to define and explain the good life (Diener et al., 2018). However, psychological research into well-being gained momentum with the formal definition of Subjective Well-Being (SWB) as the cognitive and emotional evaluation of one's own life (Diener et al., 2018). Subjective well-being research has dominated psychological and behavioural studies on well-being antecedents, particularly concerning contextual influences (Diener et al., 2018; Jebb et al., 2018; Ryan & Deci, 2001). Accordingly, my research similarly focuses on subjective well-being, incorporating measures of life satisfaction alongside the frequency of positive and negative emotional experiences, a composite often used to approximate subjective well-being (Dolan et al., 2008). Additionally, I included health measures (e.g. burnout symptoms and other indicators) as complementary indicators of well-being. Well-being influences health (Diener et al., 2017) and vice versa (Diener et al., 2018), with both shaped by key workplace variables (Sonnentag et al., 2023). Therefore, combining subjective well-being and health indicators provides a suitable approach to studying the effects of working time reductions on well-being and overall functioning.

The present research

In conclusion, to address the research questions outlined above, I examined the effects of working time reductions on a range of psychological outcomes, including (pro-)environmental behaviour, well-being, and time use, while investigated key moderating (contextual) factors. In Manuscript 1, my co-authors and I systematically reviewed 30 longitudinal and (quasi-)experimental studies on the effects of various conceptualisations of WTRs across social, economic, and ecological dimensions. We focused on studies published after 1999 in post-industrial countries, excluding qualitative or theoretical studies, considering only studies applicable to the general population. Key factors analysed included the implementation level, wage compensation, extent, and form of WTR policies.

In Manuscript 2, I conducted a quasi-experimental longitudinal study comparing Swiss employees who reduced their working hours with those who did not, using three online questionnaires administered at baseline and two follow-up points over a

period of 11 months, gathering data from May 2018 to February 2020. Participants were recruited from various sources, including larger employers and social media, resulting in a final sample of 864 participants. Data were analysed using Linear Mixed-Effects Regression models to assess the impact of working hours, income, and a working time reduction on pro-environmental behaviour, relevant impact-oriented environmental outcomes, and subjective well-being.

Manuscript 3 used that same data set, but analysed it cross-sectionally, focussing on gendered effects and the effects of working time schedules (i.e., shorter vs. fewer working days) on time use and subjective well-being. Participants reported their time use across various activities. I again tested my hypotheses using Linear Mixed-Effects Regression models to assess the impact of working time schedules and gender on time use and well-being outcomes.

By combining the results from these three manuscripts, I can shed light on the environmental and well-being effects of working time reductions, as well as on gender as a key moderating variable.

2. Manuscripts

Abstract of Manuscript 1

Hanbury, H., Illien, P., Ming, E., Moser, S., Bader, C., & Neubert, S. (2023). Working less for more? A systematic review of the social, economic, and ecological effects of working time reduction policies in the global North. *Sustainability: Science, Practice and Policy*, *19*(1), 2222595. https://doi.org/10.1080/15487733.2023.2222595

The increasingly studied effects of working time reductions (WTR) on social, economic, and ecological sustainability depend on how these reductions are conceptualized in terms of implementation level, form, extent and accompanying wage compensation. Very little research on WTRs considers more than one sustainability dimension or explores different conceptualizations of WTRs. We thus seek in this article to differentiate the effects of diverse conceptualizations of WTR policies within and across all three sustainability dimensions by conducting a systematic review of longitudinal and (quasi-)experimental research on the ecological, social, and economic effects of WTRs. The studies we reviewed on social sustainability (n = 18) suggest that WTRs have generally well-substantiated positive effects on well-being, health, and work-family conflict. Regarding economic effects (n = 14), however, the findings are mixed: WTRs appear to have small, positive employment effects and unclear productivity effects, on one hand, as well as negative career-trajectory effects, on the other. The only study reviewed concerning ecological sustainability suggests that WTRs have a positive effect on the environment. Research on different conceptualizations of WTRs is scarce but suggests that WTRs might be most beneficial when implemented with a substantial reduction in working hours, on the national or organizational level, in the form of fewer rather than shorter working days, and accompanied by progressive wage compensation. Based on these findings, we also outline a research agenda to address the knowledge gaps in this important field of study.

Abstract of Manuscript 2

Neubert, S., Bader, C., Hanbury, H., & Moser, S. (2022). Free days for future? Longitudinal effects of working time reductions on individual well-being and environmental behaviour. *Journal of Environmental Psychology*, *82*, 101849. https://doi.org/10.1016/j.jenvp.2022.101849

Working time reductions (WTR) are a promising strategy to foster both environmental behaviour and individual well-being. It is unclear, however, whether these possible effects are more likely due to reduced income or to more discretionary time. Moreover, prior studies have only tested the environmental effects of WTR cross-sectionally and have only tested the well-being effects of WTR including wage compensations. We conducted a longitudinal three-wave study with Swiss employees, including one group who voluntarily reduced their working hours following the first questionnaire. Between-subject analysis suggested that decreased working time is associated with decreased GHG-related behaviours and increased individual well-being. While the improved GHG-related behaviour is mainly due to reduced income, the well-being effects arise despite lower income. Analyses over time revealed that after reducing their working hours, participants reported increased well-being, more intent-related pro-environmental behaviour, less car commuting, and decreased clothing expenditures. However, no improvement was found regarding other GHG-related behaviours, which are strongly linked to income levels. Thus, reducing standard working time, and simultaneously reducing income, may be a promising strategy. However, voluntarily working a day less per week will probably not reach the full ecological potential of a societal-level WTR.

Abstract of Manuscript 3

Neubert, S., Bader, C., Hanbury, H., & Moser, S. (2025). *Let's Call it a Week: Gendered Patterns of Time Use and Well-Being for Different Reduced Working Time Schedules* [Manuscript submitted for publication].

Working time reductions (WTRs) have been proposed as a strategy to improve employee well-being by increasing time for non-work activities and enhancing work-life balance. While previous research has generally supported the positive effects of WTRs on well-being, more recent findings are inconclusive. The well-being impact of WTRs largely depends on how individuals use their non-work time, a factor that often varies by gender. Moreover, little is known about the effects of different forms of WTR – such as working shorter days as opposed to a shorter week – on time use and well-being across genders. To address this gap, this study examines the time use and well-being outcomes of reduced working time schedules among employees in Switzerland.

Using standardized online survey data from 864 employees, we conducted Linear Mixed-Effects Regressions to explore how gendered working time arrangements influence time use and subjective well-being. As expected, longer working hours and overtime were associated with increased commuting time and less time for active leisure, care work, and sleep. More time spent working was also associated with lower levels of time affluence, life satisfaction, and emotional well-being. Gendered time use patterns revealed more nuanced dynamics: women working fewer days reported spending more time on care work and less time on active leisure, while men working fewer days reported significantly higher time affluence. Men working shorter days reported experiencing more commuting but not increased active leisure.

Overall, these findings highlight the importance of incorporating gender and broader contextual factors into WTR policy and research. Effective policy design must consider occupational differences, gendered care responsibilities, and the diverse realities of employees to ensure WTRs achieve their intended benefits.

3. Discussion

Summary of results

Humanity's current trajectory is causing severe environmental degradation while still failing to meet basic human needs of all – drastic systemic changes are needed. Such changes likely require policies that support a structural transformation. Working time reductions (WTRs) have been proposed as one such policy. However, robust evidence on their positive effects is limited, particularly research that allows for causal interpretation. Outcomes may also depend on moderators such as gender, the form of WTR, or accompanying wage compensation. Moreover, the mechanisms underlying WTRs remain unclear, as both income and time effects play a role, sometimes diverging in their influences on well-being and environmental outcomes.

To address these research gaps, my co-authors and I conducted a systematic review of longitudinal and (quasi-)experimental studies on the social, environmental, and economic effects of reduced working hours (Manuscript 1). I then designed a longitudinal, quasi-experimental study in Switzerland, comparing employees who reduced their working hours with those who did not, to examine effects on well-being and environmental behaviour (Manuscript 2). Analysing that same dataset cross-sectionally, I further explored gendered effects and differences between working time schedules (that is, working shorter vs. fewer days) on time use and well-being (Manuscript 3).

Concerning environmental outcomes of working less (Research Question Q1), our review indicated modest positive effects of WTRs, but the evidence remains thin and further research is needed, particularly longitudinal and experimental research (Manuscript 1). In my quasi-experimental longitudinal study, lower working hours were associated with lower expenditure on clothing, smaller living space, fewer kilometres of air travel, and fewer hours of car travel – effects largely explained by associated lower income, indicating a dominant income effect. Commuting by car was linked both to sociodemographic factors and working time, indicating a time effect. Intent-oriented pro-environmental behaviour, however, was primarily predicted by high environmental self-identity and low materialistic values. In accordance, a WTR led to reduced commuting, a short-term increase in pro-environmental behaviour, and less increasing expenditure on clothing compared with those not reducing their hours, but

no changes in the more income-related environmental indicators (Manuscript 2). Overall, the environmental impacts of working less appear modest, and driven mostly by income effects, with time effects influencing only some behaviours. Voluntary WTRs as examined in the longitudinal study may therefore only have limited environmental benefits.

Regarding well-being (Research Question Q2), our systematic review showed that WTRs have positive effects on employees' well-being, health, and work-family conflict. Although these findings appear robust, we argued that more longitudinal and experimental research is needed (Manuscript 1). Responding to this, in the quasi-experimental longitudinal study I found that income and working hours exert opposing effects on well-being: lower working hours were positively related to well-being, while lower income was negatively related. Consequently, a WTR led to short-term improvements in life satisfaction and emotional well-being, and a sustained improvement in burnout symptoms, compared with employees who did not reduce their working hours (Manuscript 2). These effects appear linked to time use, as I also showed that working time and overtime were associated with less time for active leisure, care work, and sleep, and more time spent commuting, and working time and overtime were associated with less well-being (Manuscript 3) Also, time spent on active leisure and sleep was positively associated with well-being, while commuting was negatively associated. The picture is less clear for other activities; media use and care work both showed positive and negative associations with different well-being indicators (Manuscript 3). Taken together, my research suggests that working less and WTRs have a positive, and possibly causal, effect on well-being.

My research also highlights gendered dynamics and the role of working time schedules (Research Question Q3). Our review indicated that women may benefit more than men from WTRs in terms of well-being, health, and work-family conflict. Additionally, it suggested that working fewer days as opposed to shorter days might lead to more positive effects of WTRs, though evidence for both conclusions is scarce (Manuscript 1). In line with this, I found that women spent more time on care work and less on active leisure when working fewer days, and again more on care work when working shorter days. Also, it appears that only men experience more time affluence when working fewer days. These findings suggest that women primarily reduce working hours to meet care responsibilities, which continue to fall disproportionally on them (Manuscript 3). As such, women may benefit more from working less due to reduced

work-family conflict under prevailing gender and care roles. Working time schedules seem to play a role in this, but more research is required.

Finally, we examined other moderating factors (also Research Question Q3). Firstly, larger reductions in working hours appear to generate stronger social and ecological benefits. Secondly, blue-collar employees seem to gain more well-being and health benefits than white collar workers. However, a full wage compensation may be necessary for low-income groups, such as many blue-collar professions, to realise positive social outcomes (Manuscript 1). Thus, context and targeted population subgroup (and gender) are crucial when designing WTR schemes to maximise social and environmental benefits. In the following, I will discuss my research findings in relation to the research questions and the broader scientific field.

Environmental effects of WTRs

My and our research indicates that WTRs yield, at best, very modest environmental benefits. This contrasts with the promises and hopes of degrowth literature and the optimistic framing of WTR trials in the media, but aligns with recent meta-analytical research questioning the robustness of evidence on their environmental effects (Antal et al., 2021; Kallis et al., 2018; Lehmann et al., 2024). It also concurs with stakeholder research my co-authors and I conducted: many stakeholders within the current debate assume that currently discussed WTR policy schemes are unlikely to reduce environmental impact (Hanbury et al., 2023). Furthermore, an unpublished study of my co-authors and me conducted in a Swiss hospital similarly supports this conclusion: Reducing working hours by 10% for a subset of employees likewise did not lead to changes in environmental behaviour (documented in Moser et al., 2024).

The absence of clear environmental effects in many (quasi-)experimental studies of WTRs appears to stem from the different relative influence of the time and income. Indeed, in Manuscript 2, I showed that time effects were relevant only for commuting, not for other environmental outcomes. For most outcomes, income effects thus dominated. This might help explain the modest environmental benefits observed in many studies, as most WTR trials include a full wage compensation – limiting the possible environmental effects. Even in studies of voluntary WTRs without wage compensation (such as the one studied in Manuscript 2), employees may draw on savings or other household income, thereby also reducing the potential income effects on environmental outcomes. As cross-sectional associations between working

time and climate-relevant behaviour appear to be stronger than causal effects of reducing working hours, expectations regarding the environmental outcomes of a WTR may be inflated. Loss aversion may explain why individuals rarely reduce working hours in ways that substantially cut income – and a societal WTR that would do so may lack public support (Hanbury et al., 2023). Concludingly, as most environmental effects appear to be dependent on income effects, currently debated WTR proposals may not deliver the benefits many advocates assume.

However, as already stated, cross-sectional differences in environmental outcomes across working time levels are larger than the longitudinal effects of WTRs. This raises the question how these differences arise. Possibly, they arise from divergent trajectories of environmental footprints over the working life course – especially through divergent upward trajectories. As income typically rises with age and careers with stable employment over long periods (Weisshaar & Cabello-Hutt, 2020), higher working hours early on, and uninterrupted careers may set individuals on paths of greater long-term consumption and emissions. Similarly, critical moments of change in one's life – such as labour market entry, job switches, or career changes – may shape income and environmental outcomes later on (Whitmarsh et al., 2025). These upward trajectories are yet underexplored and require more research. However, if so, policies that flatten them could yield substantial environmental benefits. For example, a societal WTR gradually reducing working hours for current full-time employees, while capping entry-level jobs at a new full-time norm (e.g., 30 hours per week) may produce substantial environmental benefits. Future research should therefore explore working time policies with greater potential for environmental benefits – as currently discussed WTR policies appear insufficient.

Regarding intent-oriented pro-environmental behaviour, I found no substantial income or time effects in Manuscript 2. Instead, pro-environmental behaviour was mostly associated with values, attitude and identity, such as environmental self-identity – consistent with earlier research (Moser & Kleinhückelkotten, 2018). Interestingly, I still observed a short-term increase in pro-environmental following a WTR – suggesting other mechanisms at play. While some scholars proposed an interaction between environmental values or attitudes and available time as a potential factor (Chai et al., 2015; Melo et al., 2018), I did not find support for this. Instead, it might be other factors, such as shifting towards care work among those reducing hours for family reasons. This might induce a broader mindset of care that

may extend towards distant others and the environment (Godin & Langlois, 2021). Future research should further examine the interaction of these contextual factors, working hours, and intent-oriented pro-environmental behaviour (Hofmann et al., 2025).

Well-Being effects of WTRs

For well-being, the findings of my co-authors' and my systematic review align with another synthesis that shows robust evidence for the positive effects of WTRs (Karhula et al., 2023). Although my longitudinal study found only short-term increases in subjective well-being after a WTR, it did reveal longer-term reductions in burnout symptoms (Manuscript 2). These results are again further supported by my co-authors' and my study of an organisational WTR in a Swiss hospital which similarly indicated a decrease in burnout symptoms and stabilised subjective well-being (Moser et al., 2024). Interestingly, while employees in this study planned to spend more time on enjoyable and social activities after the WTR, they reported less additional free time than anticipated, with most of it allocated to care work. This finding is consistent with recent research (Mullens & Laurijssen, 2024), pointing to sometimes unexpected consequences of WTRs.

Regarding theoretical contributions understanding the pathways through which a WTR leads to well-being benefits, my research highlights the divergent effects of working hours and income on subjective well-being (Manuscripts 2 & 3). To my knowledge, it is among the first to account for both simultaneously, revealing their counteracting influences. This brings new light onto previous research debating whether income has a consistent or diminishing effect on well-being, and for which aspects of well-being it matters most (Fanning & O'Neill, 2019; Jebb et al., 2018; Joshanloo, 2018; Kahneman & Deaton, 2010). For instance, studies suggest that income may be associated with well-being, but only up to certain satiation points. These vary between world regions or nations, with satiation occurring at higher incomes in countries with higher mean incomes (Jebb et al., 2018). However, reassessing these assumptions by considering the counteracting effects of income and working hours on well-being, my findings suggest a different interpretation. Rather than reflecting satiation points and reduced marginal gains of income, these patterns may stem from increasing marginal losses of well-being due to longer working hours. Indeed, working excessively long hours appears to be particularly harmful to well-being (Virtanen et al.,

2018). This reframing would have implications for the income–well-being debate: Well-being may be more sensitive to income changes than previously assumed. But crucially, it might also offer a more environmentally sustainable route to increase well-being – decreasing working hours rather than increasing income.

Furthermore, my research suggests that the income and time effect model of WTRs may be overly simplistic in explaining well-being outcomes. For once, income and working hours are not isolated variables. Part-time employment is more common in low-skilled jobs, which are often associated with lower hourly wages, less career opportunities, and less job security, leading to an "accumulation of disadvantage over a working life" for those working fewer hours (Piasna & De Spiegelaere, 2021). Thus, job type likely plays a substantial role beyond income in determining the effects of WTRs. For instance, a national reduction in working hours in France decreased smoking rates among blue collar workers, but not among white collar workers (Berniell & Bietenbeck, 2020). However, blue collar workers may also face greater financial hardships when working less (Persson et al., 2022) and, because they often burn calories on the job, may experience an *increase* in body mass index after reducing working hours, while white collar workers experience a *decrease* (Berniell & Bietenbeck, 2020). On the other hand, white collar workers working less may experience subjective "time squeezes," as the expectation to complete the same amount of work in less time is common for these outcome-based jobs, often resulting in more overtime work. This dynamic is less likely for time-based blue-collar work, where boundaries between work and non-work are clearer, and it is obvious to coworkers and supervisors that part-time employees can meet fewer work obligations than full-time employees. Regarding the accompanying income of different job types, and income differences in general, working fewer hours with proportionally reduced income may provide fewer positive well-being benefits for those with lower income (Manuscript 2). Similarly, it has been suggested that people who are "time rich" may only spend more time on active leisure activities when they are "income rich" as well, thus benefitting more from working less (Jäckel & Wollscheid, 2007), though evidence is mixed (Persson et al., 2022). Few studies have explored how job type and income class influence the results of a WTR (see Persson et al., 2022, as a notable exception), but this appears to be a crucial area for future research.

Additionally, the motivation for reducing working hours, and subsequent time, income and other effects may influence well-being outcomes. An exploratory study identified four main motives for reducing working hours: The need for more time for parenting,

taking up further education, volunteering, and the desire for more leisure time (Hanbury et al., 2019). In addition, reducing working hours may be associated with a mindset of valuing time over money, or life outside work, focussing on life's finitude (Castro & Bleys, 2024). Many individuals seem to combine several motives. On the other hand, individuals may also enjoy their work, not wanting to work less (Castro & Bleys, 2024), as work provides structure, social interaction and shared identity and goals (Kamerāde et al., 2019). While for many, work might be experienced as 'one of the least pleasurable times of the day', it might still provide meaning (Balderson et al., 2022; Wolf et al., 2022). As such, job characteristics and job satisfaction also likely shape WTR effects.

These considerations thus highlight our missing theoretical (particularly psychological) understanding of the pathways through which WTRs lead to well-being benefits. Current theorising seems to be limited to distinguishing between time and income effects (Bader et al., 2020; Buhl & Acosta, 2016), leaving plenty of room for more nuanced psychological theorising. As I argued in Manuscript 3, complex dynamics between leisure time use, care work, and work-life conflict are likely at play. In addition, as argued above, job satisfaction appears to be an important moderator, with high job satisfaction likely diminishing benefits of working less (Manuscript 3). Other factors discussed above, such as motives for working less, job type, income, the distribution of paid and unpaid work within households (Albertsen et al., 2008), or even basic psychological variables such as personality traits also seem important to consider, yet remain absent from theoretical models of working less and well-being. Overall, this constitutes an important and urgent research gap that psychologists could and should try to fill. Future studies should examine these suggested pathways in greater depth – considering working hours, working time schedules, time use, and well-being – to build a more comprehensive understanding of these relationships and to better inform WTR policies. This thesis underscores the complexity of these mechanisms and, I hope, can steer further research and theorising.

Gendered effects of WTRs

A particularly important set of moderating variables concerns gender, care work obligations and expectations, and the resulting work-family conflict. I could indeed show that gender plays a significant role regarding the motives for reducing working hours, as well as the subsequent effects. My findings also indicate that the specific

configuration of reduced working hours (i.e. the working time schedule) has differing effects on time use and well-being for different genders. Moreover, women are more likely to work part-time, often in non-standard, fixed-term jobs with poorer career prospects (Piasna & De Spiegelaere, 2021). These insights have direct implications for which WTR policy designs are likely to provide benefits for all genders, rather than only men in traditional full-time jobs.

Importantly, in the German-speaking context of my longitudinal study, WTR debates largely centre on individual choice models – that is, enabling individuals to reduce their working hours more easily. By contrast, in countries such as Spain, the debate focusses more on collective WTRs, for example in the form of a four-day-workweek (Goerlich & Vis, 2024). From a gender equality perspective, it has been argued that part-time work is often taken up by women to accommodate care work demands socially expected of them, but is linked to weaker job security and worse career prospects (Piasna & De Spiegelaere, 2021; Manuscript 1). Thus, individual WTR policies (such as those examined in my longitudinal study) may not address the root of gender inequality – which is that men "care less" under prevailing gender roles. This issue may only be tackled through a substantial collective WTR, removing disadvantages for women by redistributing paid and unpaid work more equally (Dengler & Plank, 2024; Piasna & De Spiegelaere, 2021). Although yearly paid working hours have generally declined in recent decades, a substantial gender gap in unpaid working hours remains (Gershuny, 2018), indicating that individual choice models may indeed be insufficient to remove these differences. Thus, when gender is considered, very different policy recommendations for WTRs emerge.

Although Manuscript 3 is, to my knowledge, the first to explicitly examine gender differences across various reduced working time configurations, it remains essential to adopt a more comprehensive gender-sensitive perspective. For instance, my co-authors' and my research, as well as the broader debate on WTRs, only partially consider the wide range of unpaid, and often invisible, care work carried out predominantly by women, occurring every day within our current economic systems (Dengler & Plank, 2024). This blind spot also extends to discussions of work-family conflict, which are often framed through a lens that assumes a clear distinction between work and non-work or family life, with the implicit norm that greater separation is beneficial. Yet, this assumption may not hold for many women. In particular, during three phases described as the "three M's" – menstruation, maternity,

and menopause – non-work experiences may blend into work. Under such circumstances, work-family conflict may be unavoidable, regardless of working time or schedules, at least within the prevailing ideal worker norm, which do not accommodate these experiences (Nohe et al., 2015). Thus, while my research shed some light on gendered dynamics, future research should adopt an even stronger gender-sensitive perspective when investigating WTRs.

Contributions and limitations

To my knowledge, this research, and particularly the systematic review, is the first to synthesise empirical evidence on the multiple possible dividends of WTRs (social, ecological, and environmental). By summarising findings across more than one dividend, it links empirical research with the broader scholarly debate on WTRs as a degrowth policy, thereby contributing to degrowth research (Kallis et al., 2018; Krpan et al., 2025). It also was the first attempt to highlight the variety of WTR configurations on which effects may depend, as well as divergent outcomes for different subgroups, especially gender. In doing so, it establishes a concrete research agenda and working hypotheses on how to design WTR policies to maximise benefits, as outlined in the systematic review (Manuscript 1).

This research further contributes by applying a more robust and more causally interpretable methodology to WTR effects, particularly through its longitudinal analysis (Cuello, 2023). This directly addresses calls for such approaches by ourselves, as well as multiple other scholars (e.g. Antal et al., 2021; Cuello, 2023; Lehmann et al., 2024). The longitudinal study fills an important gap by additionally considering both environmental and well-being outcomes of WTRs in a way that allows stronger causal interpretation. Together, these contributions move forward the wider field of research on solutions to current environmental and societal crises, identifying areas where WTRs might substantially contribute (well-being) and where their potential remains limited (environmental challenges).

Nevertheless, this research and thesis are subject to important limitations. One concerns the studied sample. Behavioural research has long been criticised for relying on samples drawn disproportionately from Western, Educated, Industrialised, Rich and Democratic (WEIRD) societies – rather than from a representative population (Henrich et al., 2010). Indeed, most studies included in our systematic review similarly focused on samples from the USA and Western Europe. Also, my co-authors' and my

longitudinal study drew on a sample of employed individuals in Switzerland – a highly WEIRD subgroup. Moreover, this longitudinal sample was not even representative for this WEIRD setting: Participants were primarily employees in large companies or the public sector, rather than self-employed, unemployed, or retired individuals, or employees of small companies. They also reported relatively high levels of income and education, even by Swiss standards (Manuscript 2). Outcomes may differ substantially for low-income workers, for instance regarding financial worry and hardship (Persson et al., 2022). At the same time, this particular subgroup may be precisely the one of interest, as the population it represents accounts for a large share of global carbon emissions (P. Tian et al., 2024). Still, the findings of the studies of this thesis cannot, and should not, be generalised beyond educated, employed populations in WEIRD societies.

Conversely, one could argue that the sample was not WEIRD enough. That is, both this research and the wider WTR debate risk overlooking the vastly unequal distribution of carbon emissions. Ultra-rich individuals have carbon footprints several orders of magnitude higher than the average person, even within WEIRD societies (Barros & Wilk, 2021). The bulk of the environmental burden appears to come from the top 10–20% high-income earners – up to 90% of boundary transgression may be attributable to them. If their consumption were reduced to that of their most environmentally friendly peers, humanity's overall environmental pressure could be halved (P. Tian et al., 2024). Similarly, while I argued that WTRs may yield environmental benefits via income and time effects, for these ultra-rich individuals, it is neither their income nor their time, but rather their wealth and investments that drive their environmental footprints (Barros & Wilk, 2021). The debate on WTRs therefore risks underestimating the extent to which our current environmental overshoot is concentrated among the world's richest. Environmental policies should arguably prioritise this group, particularly through taxation and wealth redistribution (Piketty et al., 2023). Still, as my co-authors and I have shown, WTRs can generate social benefits and thus complement such urgently needed redistributive measures – making this thesis relevant, nonetheless.

Beyond this, my research, although the first to empirically investigate working time schedules, does so in a limited way. For once, there where methodological and measurement challenges in how I operationalised schedules and their effects on time use (detailed in Manuscript 3). Moreover, I did not examine configurations where

reduced hours are channelled into more vacation days rather than shorter or fewer weekdays. Evidence suggests that vacations produce small to medium-sized improvements in health and well-being, but these effects fade quickly (De Bloom et al., 2009), and more vacation days do not significantly enhance health (Manuscript 1). How such configurations compare to fewer or shorter working days remains unexplored. Furthermore, my research on these schedules was cross-sectional, limiting the possibility of causal interpretation. Overall, working time configurations remain understudied, and this thesis could only provide limited insights. Future research should test a broader set of configurations, not only fewer or shorter days, and employ more rigorous methods to extend these findings.

It is also important to note that the operationalisation of well-being used in the studies of this thesis largely follow the definition of subjective well-being (SWB), often referred to as hedonic well-being (Ryan & Deci, 2001), which captures the individuals' evaluation of their lives. While SWB is the most widely used approach to measuring well-being, it has been criticised for reflecting people's satisfaction with themselves as consumers or in comparison to social norms rather than intrinsic evaluations of their lives (Balderson et al., 2022). Moreover, SWB can fluctuate substantially: Evaluations differ across the week (with Mondays typically rated lower than Saturdays), across the day, and even depending on the sequence of questionnaire items (Diener et al., 2018). This raises the possibility that the studies discussed in this thesis were influenced by who answered questionnaires when. For instance, full-time employees may have been less able to answer questionnaires during the workweek, and working time schedule may also have had influence on this.

More broadly, SWB has been criticised for neglecting more humanistic accounts of what constitutes a life worth living, or how individuals can live their lives closer to their true self. This approach is known as eudaimonic well-being research (Ryan & Deci, 2001). Within this more holistic approach emerges, for instance, Self-Determination Theory, which posits that human well-being and functioning depend on the fulfilment of three basic psychological needs: autonomy, relatedness, and competence (Ryan & Deci, 2000). Such a framework appears particularly suited to studying sustainability transformations, as these aim to enhance the efficiency of fulfilling physiological and psychological needs (Vita et al., 2019). A eudaimonic perspective may also lead to an even stronger argumentative critique of the current economic and societal provisioning systems, as inequality appears to be especially detrimental to eudaimonic

well-being (Ryff, 2018), and economic indicators correlate far less strongly with eudaimonic functioning than with SWB (Joshanloo, 2018). For these reasons, future research on WTR policies should adopt more holistic approaches to well-being that incorporate eudaimonic dimensions.

A broader limitation of this research concerns the possibility that the current socio-economic system of capitalism may ultimately be incompatible with a sustainable, equitable and democratic society – regardless of reductions in working hours. Capitalism and degrowth may prove irreconcilable, yet an economy with substantially lower material throughput appears essential to remain within planetary boundaries. Consequently, policies that genuinely acknowledge and address the scale of environmental degradation may be unattainable within capitalistic societies. Moreover, the unequal distribution of power and wealth that is cementing the status quo is likely to deepen, as is already evident (Kallis et al., 2018; Sachs et al., 2025). It may be a warning sign that many large employers now support and experiment with WTR policies (Hanbury et al., 2023; Lehmann et al., 2024). While not inherently problematic, this may indicate that current policy proposals are not sufficiently far-reaching. Were WTRs to adequately address the environmental and social issues of excessive working hours and environmental impact, they would challenge the very capitalistic socio-economic system responsible for many of these problems – likely provoking stronger resistance from powerful proponents of capitalism such as large corporate actors (Chater & Loewenstein, 2023).

Furthermore, while WTR debates may be understood as attempts to liberate employees *from* the constraints of work and paid employment, they rarely acknowledge the need to liberate employees *within* work (Gunderson, 2019). That is, within prevailing economic power structures, workers typically remain subordinate, with limited control not only over their own working time and schedule, but also over the broader purpose and direction of the organisation in which they invest their time and labour. A more democratised economy could alter this, liberating workers within their work, and potentially reducing the necessity of and demand for WTRs (Gunderson, 2019). We humans have inherent needs for contribution, growth, meaning and efficacy (Vita et al., 2019). Under the right societal conditions, work and employment could be structured to better fulfil these needs. In the present conditions, WTRs may be beneficial and worthwhile, but from a more holistic perspective, they may but be a

band-aid. In sum, WTRs may represent one valuable measure towards a sustainable (degrowth) society, yet they are insufficient on their own within current socio-economic circumstances given the magnitude of change required to match the magnitude of problems we face.

Finally, this research can be criticised for adopting an overly individualistic lens on societal change. A potentially fruitful approach to the systemic problems outlined in the introduction would be understanding and fostering collective action aimed at systemic change (Lutz & Schmitt, in press). Individual behaviour alone is insufficient, the scale of environmental degradation demands a similar scale of coordinated actions by many individuals challenging entrenched power dynamics – a focus of collective action research (Hamann et al., 2024; Lutz & Schmitt, in press). Indeed, simply "buying green" or reducing working hours and consumption at the individual level will not suffice to create a change towards a sustainable economy (Blackburn et al., 2024; Lutz & Schmitt, in press). Furthermore, an overemphasis of individual behaviour may crowd out collective and systemic action (Chater & Loewenstein, 2023; Werfel, 2017). Framing environmental problems and their solutions as individual responsibilities will produce different and less transformative answers than addressing the underlying systems (Chater & Loewenstein, 2023). Indeed, this research was at least partly guided by a theory of change assuming societal transformation results from individual behaviour change – a perspective that can and should be criticised (Chater & Loewenstein, 2023; Lutz & Schmitt, in press).

Nonetheless, this research advances not only our understanding of individual behaviour changes following a WTR, but also provides insights for policy advocates on designing WTR policies to maximise benefits for well-being, the environment, and gender equality. Moreover, it highlights that policies benefitting the environment can also benefit well-being – a necessary condition to reduce resistance to more broad societal change – showing WTR policies might, under the right conditions, serve this dual purpose (Lutz & Schmitt, in press). In this way, this research indirectly contributes to collective action and degrowth research, even if it does not explicitly draw on a pre-conceived guiding theory of systemic social change (Krpan et al., 2025; Lutz & Schmitt, in press). Future research should begin with such a theory in mind, recognising that collective action towards systemic change is needed. Only then can it fully assess the possible contributions of a societal working time reduction.

WTR as a societal (degrowth) policy

In my longitudinal research, I examined employees who voluntarily reduced their working hours. This must be distinguished from a societal working time reduction, which would typically be implemented on a larger scale (e.g. across entire work sectors) and usually involve some form of wage compensation. A *voluntary* reduction differs in that only specific employees can (or feels the need to) reduce their working hours. Most often, these are women, particularly mothers, or employees facing high stress or health issues (Antal et al., 2024; Manuscript 2). Other motives, such as a desire for more leisure time or even pursuing a minimalistic, ecological lifestyle, may also play a minor role (Blackburn et al., 2024; Hanbury et al., 2019). Yet not everyone has the option to work less: Working time is frequently determined by managers and company policy, and for some, working long hours is a necessity to secure subsistent retirement benefits (Fremstad et al., 2019).

The consequences of voluntary reductions, pursued by specific subgroups with specific motives, differ markedly from those of a societal working time reduction targeting the entire working population. For once, as argued, only the latter is likely to address gender inequalities. Additionally, voluntary reductions without wage compensation may also trigger financial worries, especially for low-income employees (Persson et al., 2022). Thus, while an individual decision to work less can lead to negative individual economic outcomes, a collective reduction may not (Piasna & De Spiegelaere, 2021).

Moreover, many anticipated effects of a societal WTR emerge at broader economic and societal levels. For instance, within the degrowth debate, working time reductions are seen as a means of redistributing paid employment in contexts of declining overall work hours (D'Alessandro et al., 2020; Krpan et al., 2025; Wretschitsch et al., 2024) – effects not addressed in my research. Also, some positive effects on working less may depend on others doing the same and thus not arise when voluntarily reducing working hours. For example, shared periods of discretionary time could enable firms to close one day per week, lowering resource consumption (King & Van Den Bergh, 2017). Similarly, a "social multiplier effect" may occur when more people reduce their hours (Pullinger, 2014), as opportunities for social connection during non-working time depend on others being available as well. My findings also indicate that individual reductions of some employees may increase stress and burnout among their colleagues

(Manuscript 2) – whereas a societal reduction would likely prompt firms to reconfiguring staffing.

In addition, consumption often carries a subjective positional value: If most people work full-time, working less may cause individuals to feel they are falling behind – making working full time an attempt to "keep up with the Joneses'" (Fremstad et al., 2019). Such disadvantages are likely mitigated under a collective WTR. In summary, while my longitudinal study expands our understanding of the effects of working less, its findings cannot be directly translated into insights about societal working time reductions, which are, however, ultimately of greater relevance.

The implications that a collective working time reduction would likely yield larger benefits than individual voluntary reductions contrast with findings that collective reductions lack stakeholder support: My co-authors and I showed that while WTR policy stakeholders such as policymakers, employees, employers, and civil society organisations generally support policies enabling *voluntary* reductions, their support is weaker for more binding measures like a societal shift to a 35-hour-workweek (Hanbury et al., 2023). By emphasising the limited environmental effects and the gendered social effects of voluntary reductions, this thesis thus highlights a potential societal conflict: Key actors may oppose *collective* measures, even though these are more likely to address gender inequality and deliver greater social and environmental benefits. Instead, they may strategically steer the debate towards individual-level, voluntary WTR schemes (Chater & Loewenstein, 2023), which are likely insufficient for either goal.

My findings also highlight a broader issue: The potential conflict between the effects of WTRs on well-being and the environment. As WTRs are often assumed to generate benefits in both domains, they have been promoted as a possible "shared agenda" between social and environmental actors and movements (Balderson et al., 2022). Yet this view may be overly simplistic. Because income and time effects have different implications for social and environmental outcomes, the overall effects of working less may depend on the degree of income loss involved. For environmental gains, working less without income losses are unlikely to produce strong effects, as much of possible environmental impacts seems to stem from income effects (Ivanova et al., 2018; Manuscripts 1 & 2). However, income reductions are not in the interest of many labour and social stakeholders (Hanbury et al., 2023), who generally advocate for WTRs with

full wage compensation (Lehmann et al., 2024). This stance is understandable, since income substantially influences subjective well-being (Fanning & O'Neill, 2019; Jebb et al., 2018; Kahneman & Deaton, 2010), and income losses tend to harm well-being more than equivalent gains improve it (Boyce et al., 2013; Fanning & O'Neill, 2019). For many, therefore, working less without a full wage reduction would result in real financial hardship (Castro & Bleys, 2024).

However, because higher income is only linked to greater well-being up to certain thresholds (Jebb et al., 2018), or at least delivers diminishing returns (De Neve & Sachs, 2020; Jebb et al., 2018), there may be ways out of this dilemma. One option is a gradual wage compensation, where low-income employees receive full wage compensation, while high-income employees do not (Bader et al., 2020). Moreover, because income losses and gains affect people differently, it may matter whether a WTR actively *decreases* income or simply does *not increase* it. Reflecting this, many labour movement WTR schemes allow employees to trade annual pay rises for equivalent reductions in working hours (Gerold & Nocker, 2018). These approaches fit this reasoning but remain largely unexplored empirically. Our research thus highlights a possible conflict: Environmental effects of WTRs may depend on a loss of income, whereas social effects may depend on a full wage compensation, especially for low-income workers. Thus, social, and environmental movements may pursue diverging goals regarding WTRs, rather than a unified agenda. Future research should explore ways to reconcile these differences.

In general, this research contributes to the debate on degrowth and on WTRs as a potential degrowth policy. However, future studies should more directly examine the effects of societal WTRs, rather than focusing solely on voluntary schemes or comparisons between employees with different working hours. This is, however, a challenging task, as it would likely require trials in which a substantially reduced working week is introduced for a significantly large group of employees with some form of wage compensation, while comparable employees maintain their hours. Although such studies likely fall short of the gold standard of randomised controlled trials, they would still be valuable in addressing urgent research questions at their core (Chater & Loewenstein, 2023). Given that this would demand substantial research budgets or fortunate circumstances, and that degrowth policy research remains severely understudied (Polewsky et al., 2024), the kind of research presented in this thesis can nevertheless provide meaningful contributions.

Conclusion

To meet humanities needs without exceeding environmental limits, we require new policies that move beyond our current socio-economic systems – policies that reduce our environmental footprint while maintaining and enhancing well-being. A working time reduction is appealing to many as a potential solution – after all, who wouldn't fancy less time at work and a little more for life? Yet while we could show that the social benefits may be evident, the proposed environmental advantages are less certain. At least, they depend on multiple factors, much like the anticipated social benefits. Gender is especially critical, though not the only significant moderating variable. Policymakers and advocates should therefore design WTR policies with care to maximise their potential for environmental sustainability, well-being, and gender equality.

Psychology has so far been notably absent from these debates – yet a psychological science that engages with systemic problems and changes is urgently needed. The questions we face on the path to a more just, equal, and sustainable society are inherently interdisciplinary, applied, and complex – and therefore demanding. But so too is psychological science, with its rigour and methodological toolkit. Starting from a theory of change that embraces a realistic, non-individualistic perspective, psychology can help identify steps forward – as demonstrated by the research presented in this thesis. This is a complex, time-intensive work. But hopefully, it is work that can also be shared.

4. References

Akenji, L., Bengtsson, M., Bleischwitz, R., Tukker, A., & Schandl, H. (2016). Ossified materialism: Introduction to the special volume on absolute reductions in materials throughput and emissions. *Journal of Cleaner Production*, *132*, 1–12. https://doi.org/10.1016/j.jclepro.2016.03.071

Akerstedt, T., Olsson, B., Ingre, M., Holmgren, M., & Kecklund, G. (2001). A 6-hour working day—Effects on health and well-being. *Journal of Human Ergology*, *30*(1–2), 197–202.

Albertsen, K., Rafnsdóttir, G. L., Grimsmo, A., Tómasson, K., & Kauppinen, K. (2008). Workhours and worklife balance. *SJWEH Supplements*, *5*, 14–21.

Antal, M., Lehmann, B., Guimaraes, T., Halmos, A., & Lukács, B. (2024). Shorter hours wanted? A systematic review of working-time preferences and outcomes. *International Labour Review*, *163*(1), 25–47. https://doi.org/10.1111/ilr.12406

Antal, M., Plank, B., Mokos, J., & Wiedenhofer, D. (2021). Is working less really good for the environment? A systematic review of the empirical evidence for resource use, greenhouse gas emissions and the ecological footprint. *Environmental Research Letters*, *16*(1), 013002. https://doi.org/10.1088/1748-9326/abceec

Bader, C., Hanbury, H. A., Neubert, S. F., & Moser, S. (2020). *Weniger ist Mehr – Der dreifache Gewinn einer Reduktion der Erwerbsarbeitszeit. Weniger arbeiten als Transformationsstrategie für eine ökologischere, gerechtere und zufriedenere Gesellschaft – Implikationen für die Schweiz.* https://doi.org/10.7892/BORIS.144160

Balderson, U., Burchell, B., Kamerāde, D., Coutts, A., & Wang, S. (2022). "Just the freedom to get good at things and stuff like that": Why spending less time at work would be good for individual, social and environmental wellbeing. *Futures*, *143*, 103035. https://doi.org/10.1016/j.futures.2022.103035

Barck-Holst, P., Nilsonne, Å., Åkerstedt, T., & Hellgren, C. (2017). Reduced working hours and stress in the Swedish social services: A longitudinal study. *International Social Work*, *60*(4), 897–913. https://doi.org/10.1177/0020872815580045

Barnard, P., Moomaw, W. R., Fioramonti, L., Laurance, W. F., Mahmoud, M. I., O'Sullivan, J., Rapley, C. G., Rees, W. E., Rhodes, C. J., Ripple, W. J., Semiletov, I. P., Talberth, J., Tucker, C., Wysham, D., & Ziervogel, G. (2021). World scientists' warnings into action, local to global. *Science Progress*, *104*(4). https://doi.org/10.1177/00368504211056290

Barros, B., & Wilk, R. (2021). The outsized carbon footprints of the super-rich. *Sustainability: Science, Practice and Policy*, *17*(1), 316–322. https://doi.org/10.1080/15487733.2021.1949847

Berniell, I., & Bietenbeck, J. (2020). The effect of working hours on health. *Economics & Human Biology*, *39*, 100901. https://doi.org/10.1016/j.ehb.2020.100901

Blackburn, R., Leviston, Z., Walker, I., & Schram, A. (2024). Could a minimalist lifestyle reduce carbon emissions and improve wellbeing? A review of minimalism and other low consumption lifestyles. *WIREs Climate Change*, *15*(2). https://doi.org/10.1002/wcc.865

Blankenberg, A.-K., & Alhusen, H. (2019). *On the determinants of pro-environmental behavior: A literature review and guide for the empirical economist*. University of Göttingen, Center for European, Governance and Economic Development Research (cege).

Boyce, C. J., Wood, A. M., Banks, J., Clark, A. E., & Brown, G. D. A. (2013). Money, Well-Being, and Loss Aversion: Does an Income Loss Have a Greater Effect on Well-Being Than an Equivalent Income Gain? *Psychological Science*, *24*(12), 2557–2562. https://doi.org/10.1177/0956797613496436

Bruderer Enzler, H., & Diekmann, A. (2019). All talk and no action? An analysis of environmental concern, income and greenhouse gas emissions in Switzerland. *Energy Research & Social Science*, *51*, 12–19. https://doi.org/10.1016/j.erss.2019.01.001

Buhl, J., & Acosta, J. (2016). Work less, do less?: Working time reductions and rebound effects. *Sustainability Science*, *11*(2), 261–276. https://doi.org/10.1007/s11625-015-0322-8

Bünning, M. (2020). Paternal Part-Time Employment and Fathers' Long-Term Involvement in Child Care and Housework. *Journal of Marriage and Family*, *82*(2), 566–586. https://doi.org/10.1111/jomf.12608

Castro, D., & Bleys, B. (2024). Unravelling motives and time use of additional leave in a flexible benefits plan: A mixed-methods case study in Belgium. *Humanities and Social Sciences Communications*, *11*(1), 1466. https://doi.org/10.1057/s41599-024-03965-8

Chai, A., Bradley, G., Lo, A., & Reser, J. (2015). What time to adapt? The role of discretionary time in sustaining the climate change value–action gap. *Ecological Economics*, *116*, 95–107. https://doi.org/10.1016/j.ecolecon.2015.04.013

Chater, N., & Loewenstein, G. (2023). The i-frame and the s-frame: How focusing on individual-level solutions has led behavioral public policy astray. *Behavioral and Brain Sciences*, *46*, e147. https://doi.org/10.1017/S0140525X22002023

Craig, L., & Churchill, B. (2019). Labor Force Status, Transitions, and Mothers' and Fathers' Parenting Stress: Direct and Cross-Spousal Influences. *Journal of Marriage and Family*, *81*(2), 345–360. https://doi.org/10.1111/jomf.12540

Cuello, H. (2023). *Assessing the validity of four-day week pilots*. European Commission, JRC.

D'Alessandro, S., Cieplinski, A., Distefano, T., & Dittmer, K. (2020). Feasible alternatives to green growth. *Nature Sustainability*, *3*(4), 329–335. https://doi.org/10.1038/s41893-020-0484-y

De Bloom, J., Kompier, M., Geurts, S., De Weerth, C., Taris, T., & Sonnentag, S. (2009). Do We Recover from Vacation? Meta-analysis of Vacation Effects on Health and Well-being. *Journal of Occupational Health*, *51*(1), 13–25. https://doi.org/10.1539/joh.K8004

De Neve, J.-E., & Sachs, J. D. (2020). The SDGs and human well-being: A global analysis of synergies, trade-offs, and regional differences. *Scientific Reports*, *10*(1). https://doi.org/10.1038/s41598-020-71916-9

De Raeve, L., Jansen, N. W., & Kant, Ij. (2007). Health effects of transitions in work schedule, workhours and overtime in a prospective cohort study. *Scandinavian Journal of Work, Environment & Health*, *33*(2), 105–113. JSTOR.

Dengler, C., & Plank, C. (2024). Foregrounding invisible foundations: (Eco-)feminist perspectives on provisioning systems. *Sustainability: Science, Practice and Policy*, *20*(1). https://doi.org/10.1080/15487733.2024.2312667

Devicienti, F., Grinza, E., & Vannoni, D. (2018). The impact of part-time work on firm productivity: Evidence from Italy. *Industrial and Corporate Change*, *27*(2), 321–347. https://doi.org/10.1093/icc/dtx037

Dex, S., & Bukodi, E. (2012). The Effects of Part-Time Work on Women's Occupational Mobility in Britain: Evidence from the 1958 Birth Cohort Study. *National Institute Economic Review*, *222*, R20–R37. https://doi.org/10.1177/002795011222200103

Diener, E., Ng, W., Harter, J., & Arora, R. (2010). Wealth and happiness across the world: Material prosperity predicts life evaluation, whereas psychosocial prosperity

predicts positive feeling. *Journal of Personality and Social Psychology*, *99*(1), 52–61. https://doi.org/10.1037/a0018066

Diener, E., Oishi, S., & Tay, L. (2018). Advances in subjective well-being research. *Nature Human Behaviour*, *2*(4), 253–260. https://doi.org/10.1038/s41562-018-0307-6

Diener, E., Pressman, S. D., Hunter, J., & Delgadillo-Chase, D. (2017). If, Why, and When Subjective Well-Being Influences Health, and Future Needed Research. *Applied Psychology: Health and Well-Being*, *9*(2), 133–167. https://doi.org/10.1111/aphw.12090

Dolan, P., Peasgood, T., & White, M. (2008). Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being. *Journal of Economic Psychology*, *29*(1), 94–122. https://doi.org/10.1016/j.joep.2007.09.001

Druckman, A., Buck, I., Hayward, B., & Jackson, T. (2012). Time, gender and carbon: A study of the carbon implications of British adults' use of time. *Ecological Economics*, *84*, 153–163. https://doi.org/10.1016/j.ecolecon.2012.09.008

Fagnani, J., & Letablier, M.-T. (2004). Work and Family Life Balance: The Impact of the 35-Hour laws in France. *Work, Employment and Society*, *18*(3), 551–572. https://doi.org/10.1177/0950017004045550

Fanning, A. L., & O'Neill, D. W. (2019). The Wellbeing–Consumption paradox: Happiness, health, income, and carbon emissions in growing versus non-growing economies. *Journal of Cleaner Production*, *212*, 810–821. https://doi.org/10.1016/j.jclepro.2018.11.223

Fitzgerald, J. B., Jorgenson, A. K., & Clark, B. (2015). Energy consumption and working hours: A longitudinal study of developed and developing nations, 1990–2008.

Environmental Sociology, *1*(3), 213–223. https://doi.org/10.1080/23251042.2015.1046584

Fremstad, A., Paul, M., & Underwood, A. (2019). Work Hours and CO_2 Emissions: Evidence from U.S. Households. *Review of Political Economy*, *31*(1), 42–59. https://doi.org/10.1080/09538259.2019.1592950

Gash, V., Mertens, A., & Gordo, L. R. (2012). The Influence of Changing Hours of Work on Women's Life-Satisfaction. *The Manchester School*, *80*(1), 51–74. https://doi.org/10.1111/j.1467-9957.2011.02255.x

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, *36*(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Geiger, S. M., Fischer, D., & Schrader, U. (2018). Measuring What Matters in Sustainable Consumption: An Integrative Framework for the Selection of Relevant Behaviors. *Sustainable Development*, *26*(1), 18–33. https://doi.org/10.1002/sd.1688

Gerold, S., & Nocker, M. (2018). More Leisure or Higher Pay? A Mixed-methods Study on Reducing Working Time in Austria. *Ecological Economics*, *143*, 27–36. https://doi.org/10.1016/j.ecolecon.2017.06.016

Gershuny, J. (2018). Gender symmetry, gender convergence and historical work-time invariance in 24 countries. *Centre for Time-Use Research, Department of Sociology, University of Oxford*.

Godin, L., & Langlois, J. (2021). Care, Gender, and Change in the Study of Sustainable Consumption: A Critical Review of the Literature. *Frontiers in Sustainability*, *2*, 725753. https://doi.org/10.3389/frsus.2021.725753

Goerlich, C., & Vis, B. (2024). Different Ways of Promoting Working Time Reduction: A Comparative Analysis of Actors, Motives, Forms, and Approaches in Germany,

Ireland, and Spain. *Journal of Comparative Policy Analysis: Research and Practice*, *26*(2), 159–177. https://doi.org/10.1080/13876988.2024.2332437

Grönlund, A., & Öun, I. (2018). Beyond the Mummy Track? Part-time Rights, Gender, and Career-Family Dilemmas. *Nordic Journal of Working Life Studies*, *8*(3). https://doi.org/10.18291/njwls.v8i3.109546

Gunderson, R. (2019). Work time reduction and economic democracy as climate change mitigation strategies: Or why the climate needs a renewed labor movement. *Journal of Environmental Studies and Sciences*, *9*(1), 35–44. https://doi.org/10.1007/s13412-018-0507-4

Hamann, K. R. S., Wullenkord, M. C., Reese, G., & Van Zomeren, M. (2024). Believing That We Can Change Our World for the Better: A Triple-A (Agent-Action-Aim) Framework of Self-Efficacy Beliefs in the Context of Collective Social and Ecological Aims. *Personality and Social Psychology Review*, *28*(1), 11–53. https://doi.org/10.1177/10888683231178056

Hanbury, H., Bader, C., & Moser, S. (2019). Reducing Working Hours as a Means to Foster Low(er)-Carbon Lifestyles? An Exploratory Study on Swiss Employees. *Sustainability*, *11*(7), 2024. https://doi.org/10.3390/su11072024

Hanbury, H., Moser, S., Neubert, S., Bottazzi, P., & Bader, C. (2023). Public support for worktime reductions in Switzerland in the context of a transition to a post-growth society. *GAIA - Ecological Perspectives for Science and Society*, *32*(3), 304–311. https://doi.org/10.14512/gaia.32.3.7

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*(2–3), 61–83. https://doi.org/10.1017/s0140525x0999152x

Herzog-Stein, A., Lindner, F., & Sturn, S. (2018). The German employment miracle in the Great Recession: The significance and institutional foundations of

temporary working-time reductions. *Oxford Economic Papers*, *70*(1), 206–224. https://doi.org/10.1093/oep/gpx047

Hofmann, W., Betsch, C., Böhm, R., De Ridder, D., Drews, S., Ewert, B., Hertwig, R., Sniehotta, F. F., & Mata, J. (2025). Rethinking behaviour change interventions in policymaking. *Nature Human Behaviour*. https://doi.org/10.1038/s41562-025-02284-5

Isham, A., Gatersleben, B., & Jackson, T. (2019). Flow Activities as a Route to Living Well With Less. *Environment and Behavior*, *51*(4), 431–461. https://doi.org/10.1177/0013916518799826

Ivanova, D., Vita, G., Wood, R., Lausselet, C., Dumitru, A., Krause, K., Macsinga, I., & Hertwich, E. G. (2018). Carbon mitigation in domains of high consumer lock-in. *Global Environmental Change*, *52*, 117–130. https://doi.org/10.1016/j.gloenvcha.2018.06.006

Jäckel, M., & Wollscheid, S. (2007). Time is Money and Money Needs Time? A Secondary Analysis of Time-Budget Data in Germany. *Journal of Leisure Research*, *39*(1), 86–108. https://doi.org/10.1080/00222216.2007.11950099

Jebb, A. T., Tay, L., Diener, E., & Oishi, S. (2018). Happiness, income satiation and turning points around the world. *Nature Human Behaviour*, *2*(1), 33–38. https://doi.org/10.1038/s41562-017-0277-0

Joshanloo, M. (2018). Optimal human functioning around the world: A new index of eudaimonic well-being in 166 nations. *British Journal of Psychology*, *109*(4), 637–655. https://doi.org/10.1111/bjop.12316

Kahneman, D., & Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the National Academy of Sciences*, *107*(38), 16489–16493. https://doi.org/10.1073/pnas.1011492107

Kallis, G., Kostakis, V., Lange, S., Muraca, B., Paulson, S., & Schmelzer, M. (2018). Research On Degrowth. *Annual Review of Environment and Resources*, *43*(1), 291–316. https://doi.org/10.1146/annurev-environ-102017-025941

Kamerāde, D., Wang, S., Burchell, B., Balderson, S. U., & Coutts, A. (2019). A shorter working week for everyone: How much paid work is needed for mental health and well-being? *Social Science & Medicine*, *241*, 112353. https://doi.org/10.1016/j.socscimed.2019.06.006

Karhula, K., Anttila, T., Vanttola, P., & Härmä, M. (2023). *Workplace-level interventions and trials of working time reduction: A scoping review*. Finnish Institute of Occupational Health.

King, L. C., & Van Den Bergh, J. C. J. M. (2017). Worktime Reduction as a Solution to Climate Change: Five Scenarios Compared for the UK. *Ecological Economics*, *132*, 124–134. https://doi.org/10.1016/j.ecolecon.2016.10.011

Klöckner, C. A. (2013). A comprehensive model of the psychology of environmental behaviour—A meta-analysis. *Global Environmental Change*, *23*(5), 1028–1038. https://doi.org/10.1016/j.gloenvcha.2013.05.014

Kotzé, L. J., Kim, R. E., Burdon, P., Du Toit, L., Glass, L.-M., Kashwan, P., Liverman, D., Montesano, F. S., Rantala, S., Sénit, C.-A., Treyer, S., & Calzadilla, P. V. (2022). Planetary Integrity. In F. Biermann, T. Hickmann, & C.-A. Sénit (Eds), *The Political Impact of the Sustainable Development Goals* (1st edn, pp. 140–171). Cambridge University Press. https://doi.org/10.1017/9781009082945.007

Krpan, D., Basso, F., O'Dell, D., Hickel, J. E., & Kallis, G. (2025). A call for psychological and behavioural science on degrowth. *Nature Human Behaviour*. https://doi.org/10.1038/s41562-025-02211-8

Kuykendall, L., Lei, X., Zhu, Z., & Hu, X. (2020). Leisure Choices and Employee Well-Being: Comparing Need Fulfillment and Well-Being during TV and Other

Leisure Activities. *Applied Psychology: Health and Well-Being*, *12*(2), 532–558. https://doi.org/10.1111/aphw.12196

Lane, R., Arunachalam, D., Lindsay, J., & Humphery, K. (2020). Downshifting to care: The role of gender and care in reducing working hours and consumption. *Geoforum*, *114*, 66–76. https://doi.org/10.1016/j.geoforum.2020.06.003

Lehmann, B., Kmetty, Z., & Antal, M. (2024). *Too good to be true: The English-language discourse of the four-day workweek and steps towards more transformative working time reductions*. SSRN. https://doi.org/10.2139/ssrn.4885328

Lepinteur, A. (2019). The shorter workweek and worker wellbeing: Evidence from Portugal and France. *Labour Economics*, *58*, 204–220. https://doi.org/10.1016/j.labeco.2018.05.010

Lindsay, J., Lane, R., & Humphery, K. (2020). Everyday life after downshifting: Consumption, thrift, and inequality. *Geographical Research*, *58*(3), 275–288. https://doi.org/10.1111/1745-5871.12396

Liu, J., Ettema, D., & Helbich, M. (2022). Systematic review of the association between commuting, subjective wellbeing and mental health. *Travel Behaviour and Society*, *28*, 59–74. https://doi.org/10.1016/j.tbs.2022.02.006

Lutz, A. E., & Schmitt, M. T. (in press). Psychological approaches to social change for environmental protection and environmental justice. In I. Walker (Ed.), *Handbook of Environmental Psychology*. Edward Elgar Publishing.

Melo, P. C., Ge, J., Craig, T., Brewer, M. J., & Thronicker, I. (2018). Does Work-life Balance Affect Pro-environmental Behaviour? Evidence for the UK Using Longitudinal Microdata. *Ecological Economics*, *145*, 170–181. https://doi.org/10.1016/j.ecolecon.2017.09.006

Mogilner, C., & Norton, M. I. (2016). Time, money, and happiness. *Current Opinion in Psychology*, *10*, 12–16. https://doi.org/10.1016/j.copsyc.2015.10.018

Moser, S., Gurtner, L., Bezzola, N. R., & Neubert, S. F. (2024). *Wohlbefinden und Ökologie durch mehr Zeit?* https://doi.org/10.48350/194439

Moser, S., & Kleinhückelkotten, S. (2018). Good Intents, but Low Impacts: Diverging Importance of Motivational and Socioeconomic Determinants Explaining Pro-Environmental Behavior, Energy Use, and Carbon Footprint. *Environment and Behavior*, *50*(6), 626–656. https://doi.org/10.1177/0013916517710685

Mullens, F., & Laurijssen, I. (2024). An organizational working time reduction and its impact on three domains of mental well-being of employees: A panel study. *BMC Public Health*, *24*(1), 1727. https://doi.org/10.1186/s12889-024-19161-x

Nielsen, K. S., Cologna, V., Lange, F., Brick, C., & Stern, P. C. (2021). The case for impact-focused environmental psychology. *Journal of Environmental Psychology*, *74*, 101559. https://doi.org/10.1016/j.jenvp.2021.101559

Nohe, C., Meier, L. L., Sonntag, K., & Michel, A. (2015). The chicken or the egg? A meta-analysis of panel studies of the relationship between work–family conflict and strain. *Journal of Applied Psychology*, *100*(2), 522–536. https://doi.org/10.1037/a0038012

O'Neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018). A good life for all within planetary boundaries. *Nature Sustainability*, *1*(2), 88–95. https://doi.org/10.1038/s41893-018-0021-4

Pascucci, T., Hernández Sánchez, B., & Sánchez García, J. C. (2022). Being stressed in the family or married with work? A literature review and clustering of work-family conflict. *European Journal of Management and Business Economics*, *31*(2), 239–265. https://doi.org/10.1108/EJMBE-06-2021-0191

Persson, O., Larsson, J., & Nässén, J. (2022). Working less by choice: What are the benefits and hardships? *Sustainability: Science, Practice and Policy*, *18*(1), 81–96. https://doi.org/10.1080/15487733.2021.2023292

Piasna, A., & De Spiegelaere, S. (2021). Working time reduction, work-life balance and gender equality. *Dynamiques Régionales*, *10*(1), 19–42.

Piketty, T., Saez, E., & Zucman, G. (2023). Rethinking capital and wealth taxation. *Oxford Review of Economic Policy*, *39*(3), 575–591. https://doi.org/10.1093/oxrep/grad026

Polewsky, M., Hankammer, S., Kleer, R., & Antons, D. (2024). Degrowth vs. Green Growth. A computational review and interdisciplinary research agenda. *Ecological Economics*, *217*, 108067. https://doi.org/10.1016/j.ecolecon.2023.108067

Pullinger, M. (2014). Working time reduction policy in a sustainable economy: Criteria and options for its design. *Ecological Economics*, *103*, 11–19. https://doi.org/10.1016/j.ecolecon.2014.04.009

Raposo, P. S., & Van Ours, J. C. (2010). How a Reduction of Standard Working Hours Affects Employment Dynamics. *De Economist*, *158*(2), 193–207. https://doi.org/10.1007/s10645-010-9142-5

Raworth, K. (2017). A Doughnut for the Anthropocene: Humanity's compass in the 21st century. *The Lancet Planetary Health*, *1*(2), e48–e49. https://doi.org/10.1016/s2542-5196(17)30028-1

Ripple, W. J., Wolf, C., Newsome, T. M., Barnard, P., & Moomaw, W. R. (2019). World Scientists' Warning of a Climate Emergency. *BioScience*. https://doi.org/10.1093/biosci/biz088

Roberts, J. T., Steinberger, J. K., Dietz, T., Lamb, W. F., York, R., Jorgenson, A. K., Givens, J. E., Baer, P., & Schor, J. B. (2020). Four agendas for research and policy on

emissions mitigation and well-being. *Global Sustainability*, *3*. https://doi.org/10.1017/sus.2019.25

Ryan, R. M., & Deci, E. L. (2000). The Darker and Brighter Sides of Human Existence: Basic Psychological Needs as a Unifying Concept. *Psychological Inquiry*, *11*(4), 319–338. https://doi.org/10.1207/s15327965pli1104_03

Ryan, R. M., & Deci, E. L. (2001). On Happiness and Human Potentials: A Review of Research on Hedonic and Eudaimonic Well-Being. *Annual Review of Psychology*, *52*(1), 141–166. https://doi.org/10.1146/annurev.psych.52.1.141

Ryff, C. D. (2018). Eudaimonic Well-being: Highlights from 25 Years of Inquiry. In K. Shigemasu, S. Kuwano, T. Sato, & T. Matsuzawa (Eds), *Diversity in Harmony – Insights from Psychology* (1st edn, pp. 375–395). Wiley. https://doi.org/10.1002/9781119362081.ch20

Sachs, J. D., Lafortune, G., Fuller, G., & Iablonovski, G. (2025). *Financing Sustainable Development to 2030 and Mid-Century. Sustainable Development Report 2025*. Dublin University Press. https://doi.org/10.25546/111909

Sánchez, R. (2017). Does a Mandatory Reduction of Standard Working Hours Improve Employees' Health Status? *Industrial Relations: A Journal of Economy and Society*, *56*(1), 3–39. https://doi.org/10.1111/irel.12163

Schiller, H., Lekander, M., Rajaleid, K., Hellgren, C., Åkerstedt, T., Barck-Holst, P., & Kecklund, G. (2017). The impact of reduced worktime on sleep and perceived stress – a group randomized intervention study using diary data. *Scandinavian Journal of Work, Environment & Health*, *43*(2), 109–116. JSTOR.

Shao, Q. (2020). Paving ways for a sustainable future: A literature review. *Environmental Science and Pollution Research*, *27*(12), 13032–13043. https://doi.org/10.1007/s11356-020-08247-9

Shao, Q., & Shen, S. (2017). When reduced working time harms the environment: A panel threshold analysis for EU-15, 1970–2010. *Journal of Cleaner Production*, *147*, 319–329. https://doi.org/10.1016/j.jclepro.2017.01.115

Sonnentag, S., Tay, L., & Nesher Shoshan, H. (2023). A review on health and well-being at work: More than stressors and strains. *Personnel Psychology*, *76*(2), 473–510. https://doi.org/10.1111/peps.12572

Sorrell, S., Gatersleben, B., & Druckman, A. (2020). The limits of energy sufficiency: A review of the evidence for rebound effects and negative spillovers from behavioural change. *Energy Research & Social Science*, *64*, 101439. https://doi.org/10.1016/j.erss.2020.101439

Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., Biggs, R., Carpenter, S. R., De Vries, W., De Wit, C. A., Folke, C., Gerten, D., Heinke, J., Mace, G. M., Persson, L. M., Ramanathan, V., Reyers, B., & Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, *347*(6223), 1259855. https://doi.org/10.1126/science.1259855

Steffen, W., Rockström, J., Richardson, K., Lenton, T. M., Folke, C., Liverman, D., Summerhayes, C. P., Barnosky, A. D., Cornell, S. E., Crucifix, M., Donges, J. F., Fetzer, I., Lade, S. J., Scheffer, M., Winkelmann, R., & Schellnhuber, H. J. (2018). Trajectories of the Earth System in the Anthropocene. *Proceedings of the National Academy of Sciences*, *115*(33), 8252–8259. https://doi.org/10.1073/pnas.1810141115

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004

Tabi, A. (2013). Does pro-environmental behaviour affect carbon emissions? *Energy Policy*, *63*, 972–981. https://doi.org/10.1016/j.enpol.2013.08.049

Tian, H., & Liu, X. (2022). Pro-Environmental Behavior Research: Theoretical Progress and Future Directions. *International Journal of Environmental Research and Public Health*, *19*(11), 6721. https://doi.org/10.3390/ijerph19116721

Tian, P., Zhong, H., Chen, X., Feng, K., Sun, L., Zhang, N., Shao, X., Liu, Y., & Hubacek, K. (2024). Keeping the global consumption within the planetary boundaries. *Nature*, *635*(8039), 625–630. https://doi.org/10.1038/s41586-024-08154-w

United Nations General Assembly. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. https://docs.un.org/en/A/RES/70/1

Vadén, T., Lähde, V., Majava, A., Järvensivu, P., Toivanen, T., Hakala, E., & Eronen, J. T. (2020). Decoupling for ecological sustainability: A categorisation and review of research literature. *Environmental Science & Policy*, *112*, 236–244. https://doi.org/10.1016/j.envsci.2020.06.016

Van Valkengoed, A. M., Steg, L., Perlaviciute, G., Schultz, P. W., Brosch, T., Gatersleben, B., Nordlund, A., Pahl, S., & Whitmarsh, L. (2021). Theory enhances impact. Reply to: 'The case for impact-focused environmental psychology'. *Journal of Environmental Psychology*, *75*, 101597. https://doi.org/10.1016/j.jenvp.2021.101597

Virtanen, M., Jokela, M., Madsen, I. E., Magnusson Hanson, L. L., Lallukka, T., Nyberg, S. T., Alfredsson, L., Batty, G. D., Bjorner, J. B., Borritz, M., Burr, H., Dragano, N., Erbel, R., Ferrie, J. E., Heikkilä, K., Knutsson, A., Koskenvuo, M., Lahelma, E., Nielsen, M. L., … Kivimäki, M. (2018). Long working hours and depressive symptoms: Systematic review and meta-analysis of published studies and unpublished individual participant data. *Scandinavian Journal of Work, Environment & Health*, *44*(3), 239–250. https://doi.org/10.5271/sjweh.3712

Vita, G., Hertwich, E. G., Stadler, K., & Wood, R. (2019). Connecting global emissions to fundamental human needs and their satisfaction. *Environmental Research Letters*, *14*(1), 014002. https://doi.org/10.1088/1748-9326/aae6e0

Von Thiele Schwarz, U., & Hasson, H. (2011). Employee Self-rated Productivity and Objective Organizational Production Levels: Effects of Worksite Health Interventions Involving Reduced Work Hours and Physical Exercise. *Journal of Occupational & Environmental Medicine*, *53*(8), 838–844. https://doi.org/10.1097/JOM.0b013e31822589c2

Weisshaar, K., & Cabello-Hutt, T. (2020). Labor Force Participation Over the Life Course: The Long-Term Effects of Employment Trajectories on Wages and the Gendered Payoff to Employment. *Demography*, *57*(1), 33–60. https://doi.org/10.1007/s13524-019-00845-8

Werfel, S. H. (2017). Household behaviour crowds out support for climate change policy when sufficient progress is perceived. *Nature Climate Change*, *7*(7), 512–515. https://doi.org/10.1038/nclimate3316

Whitmarsh, L., Mitev, K., Nash, N., Hoolohan, C., Poortinga, W., Whittle, C., Haggar, P., Tipping, C., Dudley, H., Turner, L., Carr, D., Felder, L., Verplanken, B., & Graham, H. (2025). "Moments of Change" and Low-Carbon Behaviors: A Multidisciplinary, Systematic Review. *WIREs Climate Change*, *16*(4), e70014. https://doi.org/10.1002/wcc.70014

Wolf, T., Metzing, M., & Lucas, R. E. (2022). Experienced Well-Being and Labor Market Status: The Role of Pleasure and Meaning. *Social Indicators Research*, *163*(2), 691–721. https://doi.org/10.1007/s11205-022-02884-y

Wretschitsch, E., Spittler, N., & Kirchner, M. (2024). *Modelling national pathways to achieving the SDGs in Austria – Insights from a system simulation approach*

with focus on inequality, economic growth and climate mitigation. Elsevier BV. https://doi.org/10.2139/ssrn.5038315

Wullenkord, M. C., & Hamann, K. R. S. (2021). We Need to Change: Integrating Psychological Perspectives Into the Multilevel Perspective on Socio-Ecological Transformations. *Frontiers in Psychology*, *12*, 655352. https://doi.org/10.3389/fpsyg.2021.655352

Appendix 1: Manuscript 1

Hanbury, H., Illien, P., Ming, E., Moser, S., Bader, C., & Neubert, S. (2023). Working less for more? A systematic review of the social, economic, and ecological effects of working time reduction policies in the global North. *Sustainability: Science, Practice and Policy*, *19*(1), 2222595. https://doi.org/10.1080/15487733.2023.2222595

SUSTAINABILITY: SCIENCE, PRACTICE AND POLICY
2023, VOL. 19, NO. 1, 2222595
https://doi.org/10.1080/15487733.2023.2222595

Taylor & Francis
Taylor & Francis Group

RESEARCH ARTICLE

Working less for more? A systematic review of the social, economic, and ecological effects of working time reduction policies in the global North

Hugo Hanbury[a], Patrick Illien[a,b], Eva Ming[a], Stephanie Moser[a], Christoph Bader[a] and Sebastian Neubert[a]

[a]Centre for Development and Environment, University of Bern, Bern, Switzerland; [b]Department of Environmental Systems Science, ETH Zürich, Zürich, Switzerland

ABSTRACT

The increasingly studied effects of working time reductions (WTR) on social, economic, and ecological sustainability depend on how these reductions are conceptualized in terms of implementation level, form, extent and accompanying wage compensation. Very little research on WTRs considers more than one sustainability dimension or explores different conceptualizations of WTRs. We thus seek in this article to differentiate the effects of diverse conceptualizations of WTR policies within and across all three sustainability dimensions by conducting a systematic review of longitudinal and (quasi-)experimental research on the ecological, social, and economic effects of WTRs. The studies we reviewed on social sustainability ($n=18$) suggest that WTRs have generally well-substantiated positive effects on well-being, health, and work-family conflict. Regarding economic effects ($n=14$), however, the findings are mixed: WTRs appear to have small, positive employment effects and unclear productivity effects, on one hand, as well as negative career-trajectory effects, on the other. The only study reviewed concerning ecological sustainability suggests that WTRs have a positive effect on the environment. Research on different conceptualizations of WTRs is scarce but suggests that WTRs might be most beneficial when implemented with a substantial reduction in working hours, on the national or organizational level, in the form of fewer rather than shorter working days, and accompanied by progressive wage compensation. Based on these findings, we also outline a research agenda to address the knowledge gaps in this important field of study.

ARTICLE HISTORY
Received 2 November 2022
Accepted 2 June 2023

KEYWORDS
Working time reduction; sustainability; triple dividend; policies

Introduction

A growing body of research suggests that working time reductions (WTRs) could help mitigate a variety of challenges that post-industrial societies in the global North currently face across all three sustainability dimensions: social, economic, and environmental. Referring to these dimensions, scholars have described WTRs as providing a "triple dividend" (e.g., Bader et al. 2020; Buhl and Acosta 2016). Regarding the social dividend, the literature suggests that WTRs can significantly improve well-being and health, for example by decreasing burnout risks (Neubert et al. 2022) or alleviating work-family conflict (Anttila, Nätti, and Väisänen 2005). Regarding the economic dividend, there are indications that WTRs could increase employment rates if work resulting from reductions among certain employees is re-allocated to other unemployed or underemployed individuals (Antal 2014; Jackson and Victor 2011). Regarding the ecological dividend, WTRs may reduce environmental burdens on two levels: at the national level, countries in the global North featuring lower average annual working hours also have lower environmental impacts (Schor 2008) at the individual level, employees with fewer working hours tend to have a lower carbon footprint (Fremstad, Paul, and Underwood 2019).

Besides being discussed in academic circles, WTRs have entered the public discourse in various countries of the global North, culminating in concrete policy changes in various contexts. Resulting policy changes have included society- or sector-wide reductions to the standard full-time workweek in countries such as Austria, France, Germany, Portugal, and Sweden (Persson, Larsson, and Nässén 2022), as well as diverse organizational or communal-level experiments in Nordic countries comprising reductions to standard daily work hours (Barck-Holst et al. 2021; Anttila, Nätti, and Väisänen 2005).

CONTACT Hugo Hanbury hugo.hanbury@unibe.ch Centre for Development and Environment, University of Bern, Bern, Switzerland
Supplemental data for this article can be accessed online at https://doi.org/10.1080/15487733.2023.2222595.

Exactly which positive or negative effects emerge from WTRs—and to what extent—depends on the conceptualization of WTR policies though. WTRs can vary by extent (e.g., a 35-hour workweek vs. a 28-hour workweek); implementation level (e.g., national or regional, or social partnerships, or organizational, or individual)[1]; form (e.g., reduction of daily, weekly, monthly, yearly, or biographical working hours); as well as accompanying measures, such as the degree of accompanying wage compensation (e.g., progressively weighted to benefit lower-earners more or applied across the board). The myriad of combinations of these conceptual elements of WTR policies results in an array of conceptualizations, which in turn have implications regarding the effects of WTRs on the three dimensions of sustainability.[2]

Despite the importance of these variations in policy design, very few studies examine the effects of WTRs that (1) jointly consider multiple sustainability dimensions (exceptions include Buhl and Acosta (2016)) or (2) explicitly differentiate between conceptualizations of WTRs (exceptions include Anttila, Nätti, and Väisänen 2005; King and van den Bergh 2017). Instead, most studies tend to focus either on one specific or a generic conceptualization of WTRs. As a result, to date, it has not been possible to generalize findings on the effects of WTR policies according to different conceptualizations. Hence, there is also a lack of research exploring what conceptualizations of WTRs could maximize their positive effects across all three sustainability dimensions, while minimizing possible negative effects.

The present study aims to help address these research gaps by means of a systematic review that differentiates the effects of various conceptualizations of WTRs within and across all three sustainability dimensions. The introduction at hand is followed by a description of the methods that were applied in order to conduct this systematic review. The subsequent section of this article presents the results of our systematic review, which are then discussed according to the various conceptual elements of WTRs in the fourth section of this article. In the fifth and final section conclusions are drawn based on our results on the effects of WTRs across all three sustainability dimensions and according to the various conceptual elements of WTRs in the form of working hypotheses and, in connection with this, a research agenda is outlined that should advance the state of research on WTRs in a way that promotes their contribution to mitigating challenges that post-industrial societies of the global North face in all three sustainability dimensions.

Materials and methods

In our systematic review, we searched for longitudinal and (quasi-)experimental studies examining the effects of WTRs on one or multiple outcomes related to the three dividends, i.e., social, economic, or ecological benefits.

Data collection and preparation

Search strategy, criteria, and screening

Due to the causal emphasis of the research topic—namely, the assumption that WTR policies cause social, economic, and ecological effects—and in order to increase the reliability of the conclusions drawn from our analysis, our primary focus was on longitudinal and (quasi-) experimental studies.[3] In the case of the latter this usually consisted of studies that explicitly measured the effects of a specific conceptualization of one or more WTR policies, as opposed to only analyzing the effects of shifts in working hours. Our search terms comprised working time or WTR, on one hand, and topics related to the three possible dividends, on the other (e.g., positive effects on well-being, health,[4] gender, work-family conflict, employment, productivity,[5] career outcomes, and environmental impacts). The two search strings are detailed in the Supplemental Material accompanying this article. As the debate on WTR policies has mainly occurred in post-industrial countries of the global North, we limited our focus to data collected in studies implemented in Australia, Canada, Europe, New Zealand, and the United States after 1959, as well as countries of the former Soviet Union conducted after 1991. For consideration, the resulting articles had to be published after 1999 and written in English or German. We performed our search using the databases Scopus and Web of Science and generated 3,628 results, excluding duplicates.

We followed up our initial literature-search process with three screening phases (title screening, abstract screening, and full text screening), in which inclusion and exclusion criteria were applied. Prior to the screening phases, the first three authors and the last author independently screened the titles and abstracts of an initial random sample of ten sources, subsequently discussing and comparing individual choices to develop a shared understanding of how literature sources should be categorized. We subsequently repeated this process with a random sample of 100 sources to ensure the reliability of our methodological procedure. To check the soundness of our data, only sources based on quantitative empirical data—namely studies published in peer-reviewed

journals or working papers and reports—were considered for selection. Therefore, studies with simulation models and qualitative or theoretical studies were excluded from our sample. Finally, to guarantee a certain degree of generalizability of our results, only studies exploring WTR policies that could be applied to the general population—as opposed to WTR policies whose conceptualizations inherently only apply to a part of the general population, such as people in specific life phases in the form of early retirement schemes or parental leave—were included in our review. For a full overview of our inclusion and exclusion criteria, see the Supplemental Material accompanying this article. Figure 1 presents a PRISMA flow chart of the complete search and screening process. Our final sample comprised 30 articles (see Appendix 1).

Data analysis

The main analytical categories used to compare the various studies were as follows: the extent, implementation level, form, and accompanying wage compensation of the WTR policies concerned; the independent and dependent variables, specific methods, and sample sizes of the respective studies; and the direction and extent of the assessed effects of WTR policies. We only included frequently reported conceptual elements of WTR policies in our analyses, resulting in, for example, shorter workdays or shorter workweeks representing the only two forms of WTRs that we considered.

Results

In the following, we present the results of the 30 studies we identified that met our inclusion criteria. An overview of the relevant studies can be found in Appendix 1. For each dividend, we preliminarily characterize the studies identified, then present the evidence found for various reported effects. In a final step, we discuss the evidence regarding differences in various social subgroups. Table 1 presents a synopsis of the evidence found. For each effect in the three sustainability dimensions, the table summarizes the strength, direction, and amount of evidence of various conceptualizations of WTRs (i.e., whether the described effect derives from a single or several studies).

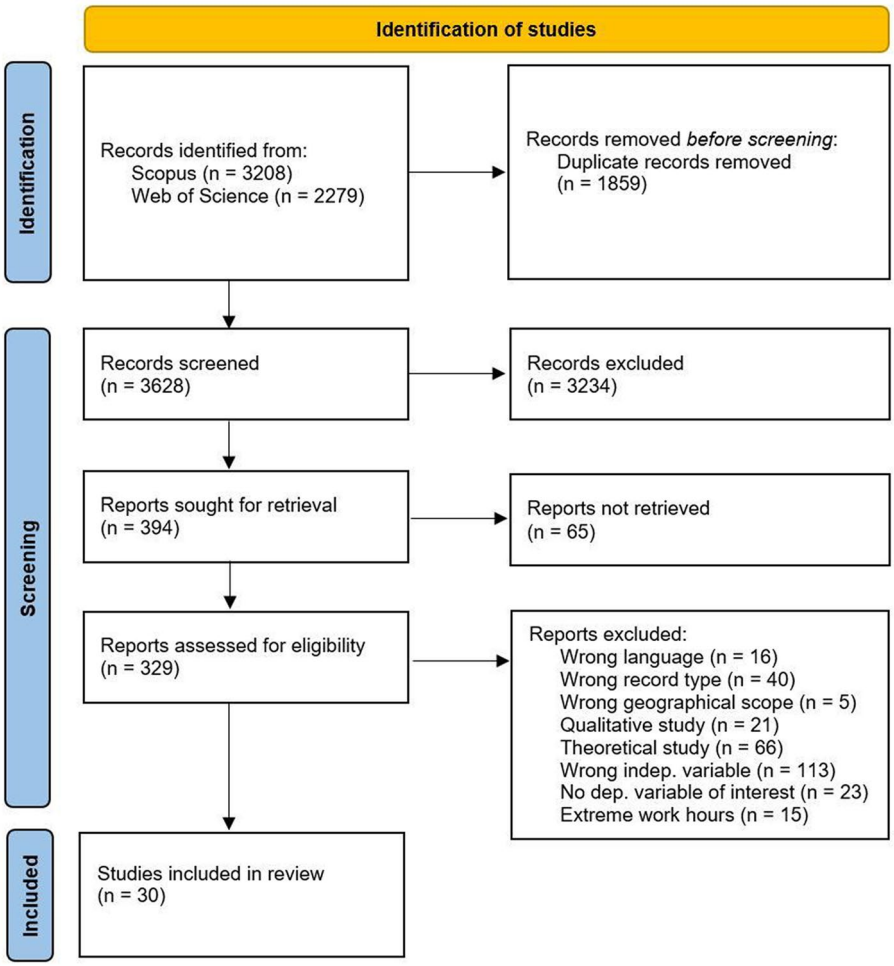


Figure 1. PRISMA flow chart.

Table 1. Overview of effects of WTR conceptualizations.

Dividend	Outcome	Extent (per week)		Implementation level			Form		Wage compensation		
		<6 hours	≥6 hours	National	Organizational	Individual	Fewer hours per day	Fewer days per week	Full	Partial	None
Social	Well–being	+	+ | ++	+	+ | ++	0 | +	+ | ++		+		0 | +
	Health	?	+	? | +	+	–	+		+		–
	Work–family conflict	+	+ | ++	+	+ | ++	+	+	+ | ++	+		+
Economic	Employment	0 | +		0 | +	+				0 | +	+	+
	Productivity	+			–|+		–	0	+		–
	Career outcomes			–		–					–
Ecological	Low resource use					+					+

Note. Darkness and boldness of symbols show evidence strength; effects with only one study are shown in light grey; effects with two studies are shown in dark grey; effects with at least three studies indicating the same direction of effect are shown in **black and bold**.
++: large positive effect; +: small to moderate positive effect; –: small to moderate negative effect; 0: nonsignificant effect;? : debated effect/effect with different direction for different subgroups. A vertical line (|) indicates that the studies in question have found effects in different directions illustrated by the symbols on both sides of the vertical line.

Social dividend

The studies of our sample that relate to the social dividend focused on the subtopics of *employee well-being*, *health*, and *work-family conflict*. Overall, the social dividend features the strongest evidence base of our systematic review sample—deriving from 18 studies—and exhibits the most pronounced effects of WTR policies. With the exception of one study (Australia: Craig and Churchill 2019), all the research was conducted in Europe and the majority was based on primary data (secondary data: Berniell and Bietenbeck 2020; Buhl and Acosta 2016; Craig and Churchill 2019; De Raeve, Jansen, and Kant 2007; Gash, Mertens, and Gordo 2012; Lepinteur 2019; Sánchez 2017). In all cases, the unit of analysis comprised individuals (i.e., employees) and the sample size range was 29–8,240. The studies using primary data were conducted in single- or multi-organization WTR (quasi-)experimental trials, whereas the studies using secondary data were mostly longitudinal in construction, looking either at groups affected differently by WTR policies (Berniell and Bietenbeck 2020; Lepinteur 2019; Sánchez 2017) or assessing longitudinal changes following individual WTRs (Buhl and Acosta 2016; Craig and Churchill 2019; De Raeve, Jansen, and Kant 2007; Gash, Mertens, and Gordo 2012). As an exception, Gronlund and Oun (2018) studied the effects of a transition from full- to part-time work in Sweden using cross-sectional data.

Well-being

The sample concerning employee well-being comprised seven studies examining a range of outcomes (satisfaction with work hours, leisure satisfaction, job satisfaction, life satisfaction, negative emotions, recovery and quality of life). In terms of implementation level, one study analyzed the effects of WTR at the national level in Portugal and France and found small positive effects (Lepinteur 2019). Four studies examined the effects of WTR trials in Sweden on an organizational level, finding that compared to a full workday of roughly eight hours, a six-hour workday led to more satisfaction with work hours and with the amount of time for social activities and friends (Akerstedt et al. 2001), less negative emotions on workdays and weekends, as well as more restorative sleep (Barck-Holst et al. 2017), less emotional exhaustion (Barck-Holst et al. 2021), and more time for recovery (Schiller et al. 2018). Lastly, individual WTRs did not lead to significant changes in life satisfaction in a general sample (Buhl and Acosta 2016), but increased life satisfaction for women when combined with staying in the same job (Gash, Mertens, and Gordo 2012; effects only measured for women). Gash, Mertens, and Gordo (2012) suggest that the latter phenomenon is explained by the likelihood of WTRs being voluntarily higher if an individual WTR is implemented in the same institutional settings.

Studies on WTRs with a larger extent appear to find larger effects than those on WTRs with a smaller extent (see Table 1). WTRs on a national and organizational level appear to be somewhat more effective at improving well-being than those on an individual level, although it must be stated that the latter is based on only one study. Concerning the form of the WTRs, the WTR policies in Portugal and France did not clearly stipulate what form the WTR should take when implemented. By contrast, the organizational WTR trials conducted in Sweden were mostly implemented as six-hour days and showed positive results. Finally, all national and organizational WTR policies analyzed in this sample

included full-wage compensation and showed positive effects. The two studies researching individual WTRs likely did not include wage compensations and exhibited only mixed results. Notably, these different conceptual elements were strongly related (e.g., all studies on individual WTRs excluded wage compensation), complicating comparisons of different conceptualizations.

Health

Nine studies examined WTR effects on the health outcomes of employees (e.g., sleep, stress, smoking, body-mass index, self-reported health, sickness absence, diverse health symptoms). On the national level, Berniell and Bietenbeck (2020) found a small positive effect of the French work-week reform on self-reported health and smoking behavior, while Sánchez (2017) did not find overall positive health effects of WTRs in France and Portugal. On the organizational level, four studies on Sweden's WTR trials found that WTRs lead to improved health in the form of positive effects on heart and respiratory symptoms, mental fatigue, and sleep quality (Akerstedt et al. 2001; trial duration: 12 months); on stress, fatigue, and sleep quality (Barck-Holst et al. 2017; Schiller et al. 2017; trial duration 20 months and 9 months, respectively); and on neck/shoulder pain (but not on backpain) as well as exhaustion (Wergeland et al. 2003; trial duration: 12–18 months). Additionally, two studies looked at a WTR trial in Stockholm and found no clear health effects for a reduction of two hours per week (von Thiele Schwarz, Lindfors, and Lundberg 2008; von Thiele Schwarz and Hasson 2011). Finally, one study looked at individual WTRs and found no significant effects on self-reported health for men, but a negative effect on self-reported health and distress for women (De Raeve, Jansen, and Kant 2007).

As noted above, the conceptual dimensions of all WTRs were highly interrelated with, for example, all the national and organizational level WTR policies including full-wage compensation, in contrast to the one study looking at an individual WTR, which likely did not include wage compensation for those reducing their working hours. At the same time, studies on WTRs with a high extent found stronger effects than those on WTRs with a small extent. Again, the WTR trials in Sweden were mostly implemented as six-hour workdays and the four studies found positive effects. No studies looked at other forms of WTRs. Finally, WTRs accompanied by wage compensation produced positive health effects, while those without wage compensation produced a negative net effect.

Work-family conflict

Five studies in our sample examined the effects of WTR policies on work-family conflict outcomes (work-family conflict, work-family interference, parental stress, subjective adequate time for family, and work-family balance). Overall, all studies suggest WTRs lead to a reduction in work-family conflict. On a national level, the introduction of the 35-hour week in France in 1998 and 2000 resulted in roughly 60% of those affected reporting that their work-family balance had improved (Fagnani and Letablier 2004; it is unknown whether the work-family balance of the other 40% of respondents remained the same or deteriorated). On an organizational level, work-family conflict among employees who reduced their working hours in Finnish commune-level WTR experiments in the 1990s was reduced to a higher degree than was the case with the control group (Anttila, Nätti, and Väisänen 2005) and participants in a Swedish trial reported having adequate time for family more frequently (Akerstedt et al. 2001). On an individual level, two studies found that reducing personal work hours significantly reduced parental stress and work-family conflict in various subgroups (Gronlund and Oun 2018; Craig and Churchill 2019).

Overall, WTRs with a high extent appear to have stronger effects on work-family conflict—although our sample size for examination of this domain was rather small, making interpretation difficult. Further, organizational level WTRs appear to have larger effects than those on other implementation levels. Findings on the effects of different forms of WTRs on work-family conflict appear mixed. On one hand, Fagnani and Letablier (2004) suggest that reducing weekly working hours improves work-family conflict more than reducing daily or annual working hours. On the other hand, Anttila, Nätti, and Väisänen (2005) found that reducing daily working hours—for instance shifting to a six-hour workday—led to greater improvements in work-family conflict than other WTR forms. This ambiguity may very well be because the WTR conceptualizations of concern differ to a high degree, namely in terms of the degree to which they are binding and their implementation level, which in turn has a bearing on the degree to which various social subgroups such as genders are affected and therefore the scope of the studies' samples. Once again, the WTR implementation level and degree of wage compensation were closely linked, as both studies on the national and organizational level included at least partial—if not full—wage compensation, and pointed to positive effects on work-family conflict. Meanwhile, both studies on the individual level displayed positive effects in the absence (we

assume) of wage compensation, making the isolated effect of wage compensation unclear in this domain.

Subgroup analyses

The studies reviewed above reveal that various societal subgroups are affected in different ways by WTRs. In terms of socio-professional status, the subgroup analyses showed that the health effects of WTRs in France and Portugal were more noticeable, or stronger, among blue-collar workers (Berniell and Bietenbeck 2020; Lepinteur 2019). This appears to agree with the positive effects found in Swedish trials that included mostly employees working in social services and rather stressful occupations. At the same time, two of three studies on work-family conflict that took study participants' socio-professional status into consideration found that for employees with high job demands—such as upper-level white-collar employees—WTR-based reductions in work-family conflict were smaller or even inverted (Anttila, Nätti, and Väisänen 2005; Gronlund and Oun 2018), with the third study only finding a small influence on work-family conflict (Fagnani and Letablier 2004).

In terms of gender and in the case of Portugal and France, the positive well-being and health effects of WTRs were stronger for women than men (Lepinteur 2019; Sánchez 2017). One study that looked exclusively at women also found positive effects on their life satisfaction—though only when, as mentioned above, women stayed in the same job (Gash, Mertens, and Gordo 2012). The latter finding was also reflected in Swedish WTR trials that consisted primarily of female employees. In regard to work-family conflict, all relevant studies that distinguished gender found stronger benefits for mothers than fathers (Craig and Churchill 2019; Fagnani and Letablier 2004; Gronlund and Oun 2018).

Also of note is that beside societal subgroups, other factors exhibit a significant influence on the effects of WTRs. For example working conditions—including nonstandard working times, lack of job control, and male-dominated work environments—can dampen or even reverse the benefits of WTRs regarding work-family conflict (Gronlund and Oun 2018; Fagnani and Letablier 2004).

Economic dividend

The economic dividend of WTRs was revealed to be a contentious topic with three key dimensions at the heart of the debate: employment, productivity, and career outcomes. In total, 14 studies in our final sample included outcome variables related to the economic dividend. They were mainly based on secondary data (exceptions were von Thiele Schwarz, Lindfors, and Lundberg 2008 and von Thiele Schwarz and Hasson 2011) from Europe (exception was Tracey and Polachek 2020 who analyzed secondary datasets from the United States) and generally focused on individual employees or firms as the main unit of analysis, with sample sizes varying widely, from a few hundred (von Thiele Schwarz and Hasson 2011) to around half a million (Chemin and Wasmer 2009). While the studies relating to employment and productivity effects used a wide array of econometric methods to compare before and aftereffects or different groups of employees, those centered on career outcomes solely employed longitudinal methods to examine the effects of labor-force transitions. Only two studies were based on a randomized experiment (von Thiele Schwarz, Lindfors, and Lundberg 2008; von Thiele Schwarz and Hasson 2011) and the majority relied on observational data.

Employment

The employment dimension comprised eight studies focusing on outcomes such as layoffs and (un) employment rates. At the national implementation level, Crépon and Kramarz (2002) found that the reduction in maximum work hours per week from 40 to 39 hours in France in 1982 increased unemployment among employees who had previously been employed 40 hours or who had worked overtime. However, the authors did not estimate the effect of shortening the workweek on *aggregate* employment levels. In 2000, France introduced another reduction in the standard workweek—this time to 35 hours. At the same time, wages were prohibited from being cut in response. The results of this policy change appear to be more positive. Both Estevão and Sá (2008) and Chemin and Wasmer (2009) did not detect any significant shifts in overall employment levels (though Estevão and Sá 2008 did find increased turnover rates); Du, Yin, and Zhang (2013) found that the national annual unemployment rate was actually *reduced* by 1.58% and real GDP growth rate *increased* by 1.36% between 2000 and 2007. With respect to Portugal's wage-compensated reduction of the standard workweek from 44 to 40 hours in 1996, Raposo and van Ours (2010a, 2010b) found that it reduced job elimination and they underline the benefits of accompanying measures, such as the calculation of weekly hours based on a four-month average to adjust the workforce. At the organizational level, Tracey and Polachek (2020) and Herzog-Stein, Lindner, and Sturn (2018) found that active labor-market policies (e.g., short-time work[6]) helped

reduce layoffs in the United States and Germany, respectively. No studies researched employment effects of individual reductions in working hours.

As all the WTRs in our review sample were of a rather small extent, we could not draw any conclusions regarding the effect of this conceptual element on employment. In addition, we could not identify any evidence regarding implementation level or different forms of WTRs, as the WTR form was usually not specified in the studies. At the same time, wage compensation at least did not prevent the national level WTRs in France and Portugal from having positive effects on employment.

Productivity

Only three studies focused on productivity effects, and they showed contradictory results. At the organizational level, Devicienti, Grinza, and Vannoni (2018) found that a higher share of part-time employees working *shorter days* reduced firm productivity in Italy, while part-time employees working *fewer days* per week had no significant negative effect. By contrast, Von Thiele Schwarz et al. (2008) and von Thiele Schwarz and Hasson (2011) examined the effects of a randomized controled trial involving a 2.5 hours weekly work reduction among Swedish dentistry employees and found that self-rated productivity increased compared to the control group. There were no studies that looked at the impact of WTR policies on productivity at the national or individual implementation level, so no conclusions can be drawn regarding productivity based on the implementation level of WTRs. The evidence did not suffice to make any interpretations regarding the effects that the extent of WTRs have on productivity. The small sample sizes of the studies also preclude generalizations regarding the productivity effects of wage compensation—found in the Swedish study, but not in the Italian study. Nevertheless, both studies highlight the benefits of accompanying measures in addition to wage compensation. While a 2.5-hour weekly reduction in work hours left productivity unchanged in von Thiele Schwarz and Hasson's study (2011), the productivity effect was negative in the control group—but positive when the work reduction was combined with mandatory physical exercise. Regarding part-time work, Devicienti, Grinza, and Vannoni (2018) found that the use of legal clauses permitting Italian employers to adjust the working times of part-time employees (with two days of notice and financial compensation) serves as an effective support tool for employers to significantly curb productivity losses associated with part-time work.

Career outcomes

Overall, the three included studies looking at career outcomes—operationalized as job chances, downgrading of job quality and skill use, and downward mobility—suggest that in the absence of other support mechanisms or broader societal changes the implementation of WTRs (or merely giving people the right to reduce their working hours) has a negative impact on the career outcomes of those involved. This insight only applies to women because two of the three studies in question only analyzed female employees (Connolly and Gregory 2008; Dex and Bukodi 2012) and the third study that took both men and women into consideration assessed a very specific setting (Fernandez-Kranz and Rodriguez-Planas 2021). Hence, it is difficult to make any assertions regarding how far WTRs effect the career outcomes of men.

At the national level, Fernandez-Kranz and Rodriguez-Planas (2021) found that the employment protection issued to Spanish employees with children younger than six years of age who have asked for a shorter workweek due to family responsibilities led to substantial disadvantages for women of childbearing age in terms of hiring, promotion, and the likelihood of their job contracts being terminated (regardless of whether they actually had children or not) in comparison to men of the same age or women of non-childbearing age. At the individual level, depending on which study one refers to, 14.0–48.5% of women who transitioned from full- to part-time work experienced some form of "downgrading" (Connolly and Gregory 2008; Dex and Bukodi 2012). None of the included studies reported on the extent of the WTRs, comprised a WTR policy at the organizational level, or referred to any form of wage compensation, precluding conclusions regarding these conceptual elements.

Subgroup analyses

The employment effects of WTRs appear very heterogenous, varying greatly according to, for example, the type of job, hours worked, and gender of participants. Crépon and Kramarz (2002) found that minimum-wage employees who worked 40 hours per week were particularly harmed by France's mandatory shortening of the workweek. However, we note that this quite possibly was not inherently because of their status as minimum-wage employees, but rather because of a law that enforced their full wage compensation in the context of the WTR made them slightly more expensive than minimum-wage employees hired after the WTR. By contrast, Raposo and van Ours (2010a) found that employees who already

worked fewer than 40 hours per week prior to the policy change were more likely to lose their jobs than employees whose hours were directly affected by the new WTR policy. Estevão and Sá (2008) found that hourly wages and transitions out of employment increased more for men than for women. At the firm level, Tracey and Polachek (2020) found that a short-time compensation program in the United States had significantly positive effects for businesses that exhibited cyclical employment fluctuations and a reliance on layoffs, but showed no effect for stable firms. Overall, it is difficult to draw any general conclusions from the diverse results outlined above.

Regarding differences in productivity effects, the evidence base is even weaker. Devicienti, Grinza, and Vannoni (2018) looked at gender differences in their analysis and found that in Italy women comprise about 79% of part-time workers.

Findings on the role of people's socio-professional level in the relationship between WTRs and career outcomes are mixed. According to the research of Fernandez-Kranz and Rodriguez-Planas (2021), particularly low-skilled women of childbearing age working for small companies were negatively affected by the introduction of employment protection for employees with children under the age of six who had asked to work part-time. In contrast, both Dex and Bukodi (2012) and Connolly and Gregory (2008) found that the likelihood and duration of career-related downgrading was significantly higher among intermediate or highly skilled female employees compared to women with lower occupational skills or those who transitioned from part-time to full-time work.

In addition, studies in our sample indicated that various characteristics of the work environment may have an influence on the relationship between WTRs and career outcomes. For example, all three studies that took the share of part-time employees in job sectors into consideration found that a higher share of part-time work in a particular sector reduces the likelihood of downgrading for individual employees who transition to part-time work (Fernandez-Kranz and Rodriguez-Planas 2021; Connolly and Gregory 2008; Dex and Bukodi 2012). In contrast, other work environment-related factors were shown to increase the likelihood of downgrading. These issues included working in a small company (Fernandez-Kranz and Rodriguez-Planas 2021), switching employers while transitioning from full- to part-time work (Connolly and Gregory 2008), or having a high share of men in particular occupations (Dex and Bukodi 2012). In this context, it must be noted that some combinations of the factors that have a bearing on the effect of WTRs on downgrading may exacerbate their influence. For example, high-skilled (female) employees working in male-dominated occupational sectors carry a higher risk of occupational downgrading than if they worked in female-dominated sectors (Dex and Bukodi 2012).

Ecological dividend

Only one study in our review sample addressed the possible ecological dividend of WTR policies (Buhl and Acosta 2016) as other longitudinal studies were conducted at the macro-economic level and occurred without a WTR (e.g., Fitzgerald, Schor, and Jorgenson 2018; Shao and Shen 2017). This particular study employed longitudinal, secondary, individual-level data of an unknown sample size collected in Germany. It looked at changes in workloads based on the individual decisions of employees—in other words, WTRs lacking wage compensation and no specific policy conceptualization. Nevertheless, we included the study due to its longitudinal nature, even if no insights could be obtained regarding the form of WTRs in the sample or their extent. This investigation found that a (marginal) decrease in working hours led to a (marginal) increase in non-working time, which, in turn, resulted in an *increase* in the amount of resources used per hour. However, if we also take the cross-sectional data and analyses of the same study into consideration, it appears that the decrease in resources used due to income losses was larger than the aforementioned increase, leading to a net positive ecological effect. No subgroup analyses were conducted that could provide indication of the circumstances under which these effects are stronger or weaker.

Discussion

Social, economic, and ecological effects of WTRs

We conducted a systematic review of longitudinal and (quasi-)experimental studies looking at the effects of WTRs and different conceptualizations of WTR policies on various outcomes regarding social, economic, and ecological sustainability—the so-called three dividends. Our results suggest that WTRs positively influence employees' well-being, health, and work-family conflict. They appear to have a small, but possibly positive, effect on employment, however their effects on productivity seem to have no clear direction. In contrast, they appear to have a harmful effect on the career outcomes of women (see Table 1; their effect on men's career outcomes is unknown

based on the systematic review at hand). Finally, the results indicate positive ecological effects, but the evidence for this effect is thin.

In terms of possible social benefits, the effects identified in our review sample echo the findings of prior research (that did not meet our inclusion criteria), for example, regarding the benefits of shorter working hours for employees' well-being and health (Ahn 2016; Hamermesh, Kawaguchi, and Lee 2017; Jansen-Preilowski, Paruzel, and Maier 2020; Voglino et al. 2022), as well as work-family conflict (Higgins, Duxbury, and Johnson 2000; Hill et al. 2004; Hughes and Parkes 2007; Russell, O'Connell, and McGinnity 2009).

In terms of economic benefits, cross-sectional studies and studies from other regions that were therefore not included in this systematic review, support the notion of zero to small positive effects of WTRs on overall employment levels (Gonzaga, Filho, and Camargo 2003; Kapteyn, Kalwij, and Zaidi 2004; Logeay and Schreiber 2006; Rafael Sánchez 2013; Skuterud 2007), suggesting that positive employment effects might be overestimated in existing modeling studies (e.g., D'Alessandro et al. 2020). While the relatively small employment effects of WTR policies are seen as a weakness (e.g., Rafael Sánchez 2013), we instead choose to see it as evidence that shortening the national workweek is arguably still worth pursuing in light of its other proven beneficial social effects.

In terms of the effect of WTRs on productivity, studies that were not included in our systematic review also exhibit ambiguous findings. This is hardly surprising given the diverging assumptions regarding the effects of WTRs on productivity. Devicienti, Grinza, and Vannoni (2018) assume that part-time work itself is prone to additional communication and coordination efforts, as the same amount of work is done by more employees than if it was done by full-time employees, and that part-timers may have less incentive to invest in the accumulation of human capital. By contrast, it is plausible to assume that above a certain threshold of working hours mental and physical fatigue lead to a reduction in productivity. This ambiguity may also be explained by the concrete conceptualizations of WTRs (e.g., form and accompanying measures (Devicienti, Grinza, and Vannoni 2018; von Thiele Schwarz and Hasson 2011) or size of workload (Moonesinghe et al. 2011; Passicot and Murphy 2013; Peets and Ayas 2012). Indeed, Devicienti, Grinza, and Vannoni (2018) explain that, depending on the job sector, part-time employees who work shorter workdays may be less productive due to inefficiencies related to getting up to speed for each workday (employees are usually less productive in the first hours of work). Further, any assertions made based on the results of the current systematic review must be made with caution, as the analyzed studies (Devicienti, Grinza, and Vannoni 2018; von Thiele Schwarz and Hasson 2011) operationalized productivity in very different ways, which restricts the comparability of the findings and possibly explains their ambiguity.

Finally, cross-sectional studies without WTR policies in their research design (and therefore excluded in our systematic review) support our finding that WTRs can harm career outcomes (Abendroth, Maas, and van der Lippe 2013; Fernandez-Lozano et al. 2020; Gallie et al. 2016; Hill et al. 2004).

While previous literature reviews on the ecological effects of WTRs (Antal et al. 2021; Shao 2020) have included more than one study, as opposed to the systematic review at hand, they also state that more evidence is necessary in this area. Indications are that WTRs have positive ecological effects, but the evidence base is too thin to support robust conclusions. Several studies that *did not* meet our inclusion criteria suggest that WTRs do indeed have positive ecological effects. These studies range from individual level studies (Devetter and Rousseau 2011; Fremstad, Paul, and Underwood 2019; Kennedy, Krahn, and Krogman 2013; Nässén, Larsson, and Holmberg 2009; Nässén and Larsson 2015) to cross-country comparisons (Fitzgerald 2022; Fitzgerald, Schor, and Jorgenson 2018; Hayden and Shandra 2009; Knight, Rosa, and Schor 2013; Schor 2008; Simionescu et al. 2021)—though cross-country WTR effects may depend on a country's particular stage of development (Shao 2015; Shao and Shen 2017; Shao and Rodríguez-Labajos 2016). Two longitudinal studies (Neubert et al. 2022; Persson, Larsson, and Nässén 2022) that would have fulfilled our inclusion criteria, but were published after our data collection, concluded that reduced working hours are associated with lower environmental impacts, mainly due to income losses, but also due to a shift in time use toward activities associated with comparatively low environmental impacts such as socializing. Nevertheless, the magnitude of this beneficial effect appears rather modest (Neubert et al. 2022; see also Fremstad, Paul, and Underwood 2019).

Our results revealed two important subgroup effects. First, in terms of the social benefits of WTRs, blue-collar employees appear to benefit more than white-collar employees. One reason for this could be that blue-collar employees are more affected by work stressors and generally have fewer resources to cope with them in comparison to white-collar employees. Another reason could be that for employees in higher positions (i.e., white-collar employees), work-life

conflict is more pronounced and the boundary between work and private life less clearly delineated. Indeed, a recent study that was not included in this systematic review found that manual laborers who reduced their working hours using Gothenburg's "right to part-time" policy were more likely to describe their work as too mentally or physically demanding—compared with white-collar workers—in general and as a motive for reducing their working hours. They were also less likely to experience a post-WTR intensification of work, offering initial support for both arguments (Persson, Larsson, and Nässén 2022).

Second, our review points to gendered effects, namely greater WTR benefits for women's health, well-being, and work-family conflict. One reason for these gendered effects may be the perceived threat of WTRs to men's "breadwinner" identity (Lepinteur 2019), such that women react more positively. Second, it is possible that women benefit more because of the higher initial "double burden" they face in terms of providing unpaid (e.g., childcare) and paid work (De Raeve, Jansen, and Kant 2007). WTRs can alleviate this double burden, enhancing women's health and well-being. These gendered patterns are reflected by the reality that women are more likely to work part-time than men, especially in the case of "short part-time" (less than or equal to 20 hours per week; Bartoll and Ramos 2020), a work schedule one can assume exacerbates the negative effects of part-time work (Doerre et al. 2006). Indeed, it seems that WTRs cause greater harm to women's career outcomes than men's (Fernandez-Kranz and Rodriguez-Planas 2021). However, it is difficult to make such assertions based on the current systematic review, as they are predicated on one study (the other studies on career outcomes only analyzed female employees). In any case, future policies should account for the different situations men and women face when it comes to working time, as well as the conditions of employees with different income levels, so as to prevent privileging one subgroup while harming others.

WTR conceptualizations and their implications

Our review showed that the specific conceptualization of WTR policies in terms of extent, implementation level, form, and wage compensation can decisively influence the degree to which the beneficial social, economic, and ecological effects can or cannot be realized.

Extent

Overall, it appears that more extensive WTRs (≥6 hours per week) generate greater social and ecological benefits and do not harm productivity when implemented in the form of fewer workdays—rather than shorter workdays—though it remains unclear up to which extent of WTR these findings are generalizable. Based on our sample, from a social point of view, the WTR benefits appear to be stronger the larger the extent of the given WTR. Conversely, other research that was not included in the systematic review at hand has shown that there is no relationship between the amount of part-time work and health, as long as unemployment or excessive workloads are avoided (Kamerāde et al. 2019; Virtanen et al. 2018).

From an ecological point of view, studies that were not included in the current review point toward the positive effect of WTRs on the environment stemming primarily from an income effect (e.g., Nässén and Larsson 2015). In this way, substantial losses of income—corresponding with more extensive WTRs—might be necessary to achieve a positive effect for the environment (Fremstad, Paul, and Underwood 2019; Neubert et al. 2022). From an economic point of view, it could be more the form of WTR than the extent that determines productivity gains or losses (Devicienti, Grinza, and Vannoni 2018). Moreover, the relationship between working hours and productivity is not linear, but is instead characterized by the interaction of two counteracting forces: a learning effect and a fatigue effect, resulting in multiple sector-specific thresholds in this relationship (Lee and Lim 2017 (not included in this systematic review).

Implementation level

Overall, it appears that WTR policies on more wide-ranging implementation levels, such as the national level, are more effective in producing social, economic, and ecological benefits than those on more localized levels. However, more sweeping policies are likely to be more difficult to implement, possibly leading to a reduced extent of these WTRs. Against this background, organizational WTRs fostered and supported by national policies may be best positioned to achieve the strongest positive effects. It must be noted though that the specific level WTR that policies are implemented on has a bearing on the accessibility of such policies and should therefore be taken into consideration when conceptualizing them.

Regarding the social dividend, the studies in our sample show positive effects across all implementation levels, though organizational level trials appear to be the most effective. However, it remains unclear whether this stems from the implementation level or

is rather due to those trials having a comparably large extent of WTR in comparison to those implemented at the national level—and include wage compensation, in contrast to voluntary individual WTRs.

From an economic perspective, since (under-) employment is a macroeconomic phenomenon, employment effects have predominantly been assessed at the national level. As a result, there is very limited evidence on the relationship between working time and employment at the organizational or individual level. Yet these latter levels are where productivity effects are best measured. At present, the available evidence does not enable any robust conclusions about the merits of different implementation levels. The effect of WTRs on productivity may be less influenced by the implementation level and more by the organizational policies accompanying these reductions.

Regarding the ecological dividend, one might assume that the extent of WTR policies is more relevant than their implementation level. However, WTRs that involve large portions or even the whole of society may lead to shifts in time use toward activities with lower environmental impacts (e.g., socializing), in contrast to implementation levels that are less likely to generate simultaneous phases of discretionary time, prompting individuals with more free time to use it in more resource-intensive ways (e.g., traveling or shopping). Beyond this, further research that was not included in the current systematic review suggests that synchronous phases of discretionary time may also enable organizations to organize their workplaces in ways that save resources (e.g., by closing offices for one day per week; King and van den Bergh 2017).

Form

Policies leading to fewer workdays per week might be the most beneficial from a social, economic, and ecological perspective. Regarding social effects, evidence that was not included in the systematic review at hand shows that compressing work—i.e., working fewer but longer days, so that total work hours remain stable—worsens overall employee health, but increases job satisfaction, decreases work-family conflict, and reduces stress on days off (Bolino, Kelemen, and Matthews 2021). Accordingly, WTR policies that reduce the number of workdays, but do not increase daily work hours—as opposed to compressed workweeks—may ensure all the WTR benefits concerning work-family conflict, job satisfaction, and reduced stress on days off, while avoiding the negative effects of longer daily working hours.

Regarding economic effects and productivity in particular, while shorter workdays lead to less productivity (presumably due to so-called startup and communication costs of daily work flows), fewer workdays do not (Devicienti, Grinza, and Vannoni 2018) and therefore constitute a form of WTR worth considering when conceptualizing WTR policies.

As for the ecological effects of WTR policies that shorten the workweek, macroeconomic calculations that were not included in this systematic review suggest that reducing the number of days employees work per week is more beneficial for the environment than reducing daily working hours or increasing holiday leave, especially if the day off is *not* adjacent to the weekend (King and van den Bergh 2017). The reasoning here is that fewer workdays makes it possible to close some offices and factories for whole days, leading to reduced energy use, as well as to less environmentally harmful commuting behavior. When the day off is adjacent to the weekend, however, it may lead to more traveling in the context of weekend trips, diminishing these positive effects. Indeed, empirical studies show that compressed workweeks lead to less emissions from commuting (Percoco 2018; Sundo and Fujii 2005). Echoing this reasoning, a recent study found that individuals who reduced their working time showed an increase in low-emission, high-pleasure activities, like hobbies and socializing, especially when they reduced their working days per week, as opposed to their working hours per day (Persson, Larsson, and Nässén 2022).

WTR policies with more vacation days, by contrast, might produce fewer benefits. Research that was not included in the systematic review at hand shows that the small to medium-sized positive effects of holidays on health and well-being fade shortly after vacation (Bloom et al. 2009), and more vacation days do not produce significant health benefits (Hofmarcher 2021). Meanwhile, vacation activities usually imply a certain amount and type of mobility that is associated with environmental harm.

Wage compensation

Overall, wage compensation may be necessary to ensure the social benefits of WTR policies for subgroups with low income. However, further research that was not included in the current systematic review suggests it must be carefully implemented so as not to override the beneficial ecological effects of WTRs. As noted above, while decreasing income might be the most important factor influencing whether WTRs have beneficial ecological effects (e.g., Bader et al. 2020), income has also been shown to be beneficial for well-being, albeit with

diminishing returns (Jebb et al. 2018). Thus, there appear to be tradeoffs between the social and ecological benefits of WTRs depending on whether they are implemented with full, partial, or no wage compensation. Indeed, a recent study found that although low-income workers who voluntarily reduced their working hours without wage compensation experienced higher well-being, they also indicated more financial hardships (Persson, Larsson, and Nässén 2022), which may diminish well-being in the long term. However, there might be a solution to this tradeoff. On one hand, research shows that income is especially important for low-income workers (Jebb et al. 2018). On the other hand, the ecologically harmful effects of income appear more pronounced for high-income households, as it increases luxury consumption (Bruderer Enzler and Diekmann 2019; Moser and Kleinhückelkotten 2018). Thus, WTRs featuring progressive wage compensation—i.e., full wage compensation exclusively for low-income earners and partial or no wage compensation for high earners—might prevent negative social effects due to financial hardship, while preserving most of the ecological benefits of WTRs (Bader et al. 2020; Schumacher et al. 2019).

Limitations

This study is the first to review the effects of WTRs across multiple dividends and according to multiple conceptualizations. However, as it draws on existing research and is subject to methodological choices, certain limitations regarding its results apply.

The decision to only include longitudinal and (quasi-)experimental research on WTRs led to higher quality evidence, but lower in quantity, making it difficult to draw general conclusions and possibly producing blind spots. The application of the same inclusion and exclusion criteria in general, and the exclusive focus on longitudinal and (quasi-)experimental studies in particular, led to a highly heterogeneous degree of evidence among the three dividends and subtopics. While, for example, the social dividend possesses a sample consisting of 18 studies, the sample for the entire ecological dividend comprised merely one article. Thus, for many of the outcomes, the evidence base was rather scarce, complicating the differentiation of the effects of WTRs by implementation level, form, extent, and degree of wage compensation. Further, only three studies in our sample included outcomes comprising more than one dividend simultaneously (Buhl and Acosta 2016; von Thiele Schwarz, Lindfors, and Lundberg 2008; von Thiele Schwarz and Hasson 2011).

Similarly, there is limited evidence, and the problem of confounded effects, with respect to the different conceptualizations of WTR policies, as most studies reported few, if any, specific conceptualizations of WTRs studied. Only three studies in our sample examined, for example, the differential effects of reducing daily hours of work versus reducing the weekly number of workdays (Anttila, Nätti, and Väisänen 2005; Devicienti, Grinza, and Vannoni 2018; Fagnani and Letablier 2004). Thus, it is difficult to distinguish the effects of various WTR conceptualizations and their individual elements, for example whether a particular WTR effect is based on the extent or accompanying wage compensation of the respective WTR. Conclusions regarding these questions are therefore rather speculative.

Topically, one of the blind spots that the decision to only include longitudinal and (quasi-) experimental research produced concerns the bearing of time use next to paid work (discretionary time and unpaid work) and the shift thereof over the course of WTRs on various effects of WTRs. Various studies illustrate that this is relevant for a multitude of WTR effects such as health (De Raeve, Jansen, and Kant 2007) or environmental impact (Druckman et al. 2012; Klein et al. 2021; Nässén and Larsson 2015).

Despite the decision to only include longitudinal and (quasi-)experimental research leading to less and unevenly distributed evidence, this approach helps to distinguish between what we know with some degree of certainty (e.g., the positive social effects of WTRs) and what we can only speculate on (e.g., the positive ecological effects of WTRs).

Finally, it must be noted that other relevant characteristics of our sample were represented unevenly. Most notably was the geographic locations of where the studies were conducted with most of the work conducted in Europe.

Conclusion and research agenda

To date, existing longitudinal and (quasi-)experimental studies show that WTRs lead to improvements in well-being, health, and work-family conflict. In addition, however, there are indications that WTRs may hinder career advancement, especially among women. At the same time, the overall employment effects of WTRs appear small, especially in the long run. Evidence regarding productivity effects is thin and contradictory and does not allow for generalizations. Including accompanying measures in the conceptualization of WTR policies could make a large difference in this respect. Ecological effects are almost unstudied in longitudinal and (quasi-)experimental

research designs (Buhl and Acosta 2016). However, other research that was not included in the systematic review at hand suggests that there may indeed be positive ecological effects of WTRs, especially when corresponding incomes are reduced (Nässén and Larsson 2015; Neubert et al. 2022).

The evidence base of our findings may not be solid enough to justify unambiguous policy recommendations, but it does allow us to formulate working hypotheses. Based on our systematic review and several working hypotheses (WHs), we offer the following provisional assessment.

- WH 1: WTRs are especially beneficial for social outcomes.
- WH 2: The beneficial effects of WTRs are more likely to occur if they are implemented to a meaningful extent.
- WH 3: The beneficial effects of WTRs are more likely to become manifest if the associated strategies are mandated and supported at a broad level (e.g., national) but implemented at an organizational level (rather than on an individual level).
- WH 4: The beneficial effects of WTRs are likely to become manifest if they are implemented in the form of fewer days per week as opposed to fewer hours per day or more vacation days.
- WH 5: The beneficial effects of WTRs are more likely to become manifest if lower income groups receive a disproportionate amount of wage compensation.

These assertions remain hypotheses though and therefore require more research. In this context, some of the WHs, the currently inexistent research on certain aspects of the effects of WTRs (clearly illustrated by the empty cells in Table 1), and further limitations of the systematic review at hand allow us to propose the following research agenda.

First, and in the context of WH 1, conducting studies that compare WTR effects with respect to at least two (or even better all three) dividends—social, economic, environmental—preferably from the same WTR conceptualization(s), could help to identify ideal conceptualizations of WTR policies in terms of synergies and tradeoffs between their effects. Balancing synergies and tradeoffs in the context of the conceptualization of WTR policies is, in all likelihood, of great relevance for garnering public support required for their implementation. For example, wage compensation, no matter whether full or partial, may reduce the ecological effect of WTRs, however, in terms of social justice, it would be very important in terms of protecting low-income earners from income losses. Further, as the amount and type of people affected by WTRs, and therefore the scopes of the samples of studies based on different WTR conceptualizations differ to a great degree, being able to analyze multiple dividends from the same WTR conceptualization(s) would improve the reliability of research. Scholars should therefore consider assessing various effects on different dividends (e.g., as done by Fitzgerald 2022 on a macroeconomic level or by Neubert et al. 2022 on an individual level).

Second, and in the context of WHs 2–5, conducting studies that incorporate at least two or more WTR policies, or even just two or more manifestations of at least one conceptual element of WTR policies (implementation level, form, extent, and accompanying measures), would enable direct comparisons of their efficacy. Scholars planning (quasi-) experimental studies—for example with organizations testing WTRs—should consider varying the WTR policies over different experimental groups to address this important research gap.

Third, more research in general would help to clarify the role of intervening variables and subgroup effects, in particular skill level, work environment, and other labor-market characteristics. Such intervening variables are not negligible, as they can be pivotal in determining whether a beneficial WTR effect actually occurs or not. The gendered effects of WTRs on well-being and health are a relevant point in this regard (Lepinteur 2019; Sánchez 2017).

Fourth, and in the context of WH 1, longitudinal or (quasi-)experimental research is urgently needed on the ecological effects of WTR policies. So far, conclusions regarding the ecological benefits are very limited (Antal et al. 2021).

Fifth, wherever possible and applicable, studies should take all accompanying supportive measures of WTRs into consideration more often, for they can be decisive in guaranteeing and combining multiple beneficial effects of WTRs, such as in the case of different levels of wage compensation that accompany WTRs. From the standpoint of WH 5, the latter deserves particular attention—for example more effort should be devoted to identifying at which levels of income the degree of wage compensation would maximize the beneficial effects of WTRs and minimize any possible tradeoffs. In the case of wage compensation, this depends on two aspects: On one hand, we need to determine the levels of income above which the increases in well-being start getting smaller or even disappear altogether. On the other hand, we need to identify the level of income at which environmental impact reaches a significant size or even starts to increase disproportionately. The level of income above which wage compensation should start to

decrease should be determined in a way that minimizes the reduction of well-being, but still guarantees a sizeable reduction of environmental impact.

Sixth, current research suggests that time use next to paid work (unpaid work and discretionary time) and the shift thereof over the course of WTRs has a bearing on the effects of WTRs. In other words, researchers should pay more attention to the role unpaid work and discretionary time play in regard to the effects of WTRs.

Finally, where possible and useful, it is important for future research to differentiate the effects of WTRs according to gender. It would be beneficial to examine under which conditions the negative career outcomes of WTRs that appear to particularly affect women could be minimized, or whether WTRs can contribute to a more equitable distribution of paid and unpaid work between men and women.

It is essential to address these research gaps on the effects of WTRs to more effectively inform associated policies. A more robust knowledge base would allow for the design of policies that more closely approximate conceptualizations that maximize the beneficial effects of WTRs while minimizing possible harms. Importantly, WTR policies should also carefully consider the different effects they can have on various population subgroups. Wisely designed WTR policies could contribute to efforts to address the sustainability challenges facing post-industrial societies of the global North.

Notes

1. National or regional level WTRs are issued by law, social partnership WTRs are based on collective bargaining that applies to a selection of occupational sectors, organizational WTRs are implemented by organizations such as businesses or institutions, and individual WTRs describe individuals reducing their working hours on their own accord based on whatever means they have to do so. It must be noted, that some WTR conceptualizations exhibit an overlap between implementation levels.
2. Accessibility to, and therefore also the effects of WTRs, vary by occupational sector in general and furthermore depend on how WTR policies are conceptualized.
3. Experimental studies compare a temporal development in an intervention group, i.e., a group in which WTRs were implemented, with a control group, i.e., a group in which no WTRs were implemented. In an experimental design, participants are randomly assigned to the experimental and control groups; in a quasi-experimental design, these two groups are not randomly created (e.g., a WTR is implemented in a particular department or company and is compared to a control group from another existing department or firm). Compared to cross-sectional comparisons of only one data point or theoretical and qualitative case studies, longitudinal and (quasi-)experimental studies are more likely to enable conclusions about causal effects.
4. It must be noted that only health indicators and not changes in health expenditure were examined, even though the latter is also relevant from an economic point of view.
5. Productivity is defined as the overall output of an entity, as opposed to a rate, maintaining productivity on a macroeconomic level over the course of a WTR would limit the WTR's ecologically beneficial effects.
6. Short-time work refers to WTRs that are usually implemented in the context of a recession on an organizational level to reduce layoffs, often of a temporary nature and sometimes supported by government schemes.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Hugo Hanbury http://orcid.org/0000-0003-3443-2285
Patrick Illien http://orcid.org/0000-0001-8185-1808
Eva Ming http://orcid.org/0000-0001-7181-3787
Stephanie Moser http://orcid.org/0000-0002-1564-447X
Christoph Bader http://orcid.org/0000-0002-8991-353X
Sebastian Neubert http://orcid.org/0000-0001-7415-6583

References

Abendroth, A.-K., I. Maas, and T. van der Lippe. 2013. "Human Capital and the Gender Gap in Authority in European Countries." *European Sociological Review* 29 (2): 1–20. doi:10.1093/esr/jcr059.

Ahn, T. 2016. "Reduction of Working Time: Does It Lead to a Healthy Lifestyle?" *Health Economics* 25 (8): 969–983. doi:10.1002/hec.3198.

Akerstedt, T., B. Olsson, M. Ingre, M. Holmgren, and G. Kecklund. 2001. "A 6-Hour Working Day – Effects on Health and Well-Being." *Journal of Human Ergology* 30: 197–202. doi:10.11183/jhe1972.30.197.

Antal, M. 2014. "Green Goals and Full Employment: Are They Compatible?" *Ecological Economics* 107: 276–286. doi:10.1016/j.ecolecon.2014.08.014.

Antal, M., B. Plank, J. Mokos, and D. Wiedenhofer. 2021. "Is Working Less Really Good for the Environment? A Systematic Review of the Empirical Evidence for Resource Use, Greenhouse Gas Emissions and the Ecological Footprint." *Environmental Research Letters* 16 (1): 013002. doi:10.1088/1748-9326/abceec.

Anttila, T., J. Nätti, and M. Väisänen. 2005. "The Experiments of Reduced Working Hours in Finland: Impact on Work-Family Interaction and the Importance of the Sociocultural Setting." *Community, Work and Family* 8 (2): 187–209. doi:10.1080/13668800500049704.

Bader, C., H. Hanbury, S. Neubert, and S. Moser. 2020. *Weniger ist mehr – Der dreifache Gewinn einer Reduktion der Erwerbsarbeitszeit. Weniger arbeiten als Transformationsstrategie für eine ökologischere, gerechtere*

und zufriedenere Gesellschaft – Implikationen für die Schweiz [*Less is More – the Triple Benefit of a Reduction in Working Hours. Working Less as a Transformation Strategy for a More Ecological, Fairer and Happier Society – Implications for Switzerland]. CDE Working Paper*. Bern: Centre for Development and Environment. doi:10.7892/boris.144160.

Barck-Holst, P., A. Nilsonne, T. Akerstedt, and C. Hellgren. 2017. "Reduced Working Hours and Stress in the Swedish Social Services: A Longitudinal Study." *International Social Work* 60 (4): 897–913. doi:10.1177/0020872815580045.

Barck-Holst, P., A. Nilsonne, T. Akerstedt, and C. Hellgren. 2021. "Coping with Stressful Situations in Social Work Before and After Reduced Working Hours, a Mixed-Methods Study." *European Journal of Social Work* 24 (1): 94–108. doi:10.1080/13691457.2019.1656171.

Bartoll, X., and R. Ramos. 2020. "Working Hour Mismatch, Job Quality, and Mental Well-Being Across the EU28: A Multilevel Approach." *International Archives of Occupational and Environmental Health* 93 (6): 733–745. doi:10.1007/s00420-020-01529-2.

Berniell, I., and J. Bietenbeck. 2020. "The Effect of Working Hours on Health." *Economics and Human Biology* 39: 100901. doi:10.1016/j.ehb.2020.100901.

Bloom, J., M. Kompier, S. Geurts, C. Weerth, T. Taris, and S. Sonnentag. 2009. "Do We Recover from Vacation? Meta-Analysis of Vacation Effects on Health and Well-Being." *Journal of Occupational Health* 51 (1): 13–25. doi:10.1539/joh.K8004.

Bolino, M., T. Kelemen, and S. Matthews. 2021. "Working 9-to-5? A Review of Research on Nonstandard Work Schedules." *Journal of Organizational Behavior* 42 (2): 188–211. doi:10.1002/job.2440.

Bruderer Enzler, H., and A. Diekmann. 2019. "All Talk and No Action? An Analysis of Environmental Concern, Income and Greenhouse Gas Emissions in Switzerland." *Energy Research & Social Science* 51: 12–19. doi:10.1016/j.erss.2019.01.001.

Buhl, J., and J. Acosta. 2016. "Work Less, Do Less? Working Time Reductions and Rebound Effects." *Sustainability Science* 11 (2): 261–276. doi:10.1007/s11625-015-0322-8.

Chemin, M., and E. Wasmer. 2009. "Using Alsace-Moselle Local Laws to Build a Difference-in-Differences Estimation Strategy of the Employment Effects of the 35-Hour Workweek Regulation in France." *Journal of Labor Economics* 27 (4): 487–524. doi:10.1086/605426.

Connolly, S., and M. Gregory. 2008. "Moving Down: Women's Part-Time Work and Occupational Change in Britain 1991–2001." *The Economic Journal* 118 (526): F52–F76. doi:10.1111/j.1468-0297.2007.02116.x.

Craig, L., and B. Churchill. 2019. "Labor Force Status, Transitions, and Mothers' and Fathers' Parenting Stress: Direct and Cross-Spousal Influences." *Journal of Marriage and Family* 81 (2): 345–360. doi:10.1111/jomf.12540.

Crépon, B., and F. Kramarz. 2002. "Employed 40 Hours or Not Employed 39: Lessons from the 1982 Mandatory Reduction of the Workweek." *Journal of Political Economy* 110 (6): 1355–1389. doi:10.1086/342807.

D'Alessandro, S., A. Cieplinski, T. Distefano, and K. Dittmer. 2020. "Feasible Alternatives to Green Growth." *Nature Sustainability* 3 (4): 329–335. doi:10.1038/s41893-020-0484-y.

De Raeve, L., N. Jansen, and I. Kant. 2007. "Health Effects of Transitions in Work Schedule, Workhours and Overtime in a Prospective Cohort Study." *Scandinavian Journal of Work, Environment & Health* 33 (2): 105–113. doi:10.5271/sjweh.1113.

Devetter, F.-X., and S. Rousseau. 2011. "Working Hours and Sustainable Development." *Review of Social Economy* 69 (3): 333–355. doi:10.1080/00346764.2011.563507.

Devicienti, F., E. Grinza, and D. Vannoni. 2018. "The Impact of Part-Time Work on Firm Productivity: Evidence from Italy." *Industrial and Corporate Change* 27 (2): 321–347. doi:10.1093/icc/dtx037.

Dex, S., and E. Bukodi. 2012. "The Effects of Part-Time Work on Women's Occupational Mobility in Britain: Evidence from the 1958 Birth Cohort Study." *National Institute Economic Review* 222 (1): R20–R37. doi:10.1177/002795011222200103.

Doerre, K., U. Brinkmann, S. Roebenack, K. Kraemer, and F. Speidel. 2006. *Prekäre Arbeit: Ursachen, Ausmaß, soziale Folgen und subjektive Verarbeitungsformen unsicherer Beschäftigungsverhältnisse* [*Precarious Work: Causes, Extent, Social Consequences and Subjective Processing Forms of Insecure Employment Relationships]*. Bonn: Friedrich-Ebert-Stiftung.

Druckman, A., I. Buck, B. Hayward, and T. Jackson. 2012. "Time, Gender and Carbon: A Study of the Carbon Implications of British Adults' Use of Time." *Ecological Economics* 84: 153–163. doi:10.1016/j.ecolecon.2012.09.008.

Du, Z., H. Yin, and L. Zhang. 2013. "The Macroeconomic Effects of the 35-h Workweek Regulation in France." *B.E. Journal of Macroeconomics* 13 (1): 881–901. doi:10.1515/bejm-2012-0073.

Estevão, M., and F. Sá. 2008. "The 35-Hour Workweek in France: Straightjacket or Welfare Improvement?" *Economic Policy* 23 (55): 417–463. doi:10.1111/j.1468-0327.2008.00204.x.

Fagnani, J., and M.-T. Letablier. 2004. "Work and Family Life Balance: The Impact of the 35-Hour Laws in France." *Work, Employment and Society* 18 (3): 551–572. doi:10.1177/0950017004045550.

Fernandez-Kranz, D., and N. Rodriguez-Planas. 2021. "Too Family Friendly? The Consequences of Parent Part-Time Working Rights." *Journal of Public Economics* 197: 104407. doi:10.1016/j.jpubeco.2021.104407.

Fernandez-Lozano, I., M. José González, T. Jurado-Guerrero, and J.-I. Martínez-Pastor. 2020. "The Hidden Cost of Flexibility: A Factorial Survey Experiment on Job Promotion." *European Sociological Review* 36 (2): 265–283. doi:10.1093/esr/jcz059.

Fitzgerald, J., J. Schor, and A. Jorgenson. 2018. "Working Hours and Carbon Dioxide Emissions in the United States, 2007–2013." *Social Forces* 96 (4): 1851–1874. doi:10.1093/sf/soy014.

Fitzgerald, J. 2022. "Working Time, Inequality and Carbon Emissions in the United States: A Multi-Dividend Approach to Climate Change Mitigation." *Energy Research & Social Science* 84: 102385. doi:10.1016/j.erss.2021.102385.

Fremstad, A., M. Paul, and A. Underwood. 2019. "Work Hours and CO_2 Emissions: Evidence from U.S. Households." *Review of Political Economy* 31 (1): 42–59. doi:10.1080/09538259.2019.1592950.

Gallie, D., M. Gebel, J. Giesecke, K. Halldén, P. Van der Meer, and R. Wielers. 2016. "Quality of Work and Job Satisfaction: Comparing Female Part-Time Work in Four European Countries." *International Review of Sociology* 26 (3): 457–481. doi:10.1080/03906701.2016.1181839.

Gash, V., A. Mertens, and L. Gordo. 2012. "The Influence of Changing Hours of Work on Women's Life Satisfaction." *The Manchester School* 80 (1): 51–74. doi:10.1111/j.1467-9957.2011.02255.x.

Gonzaga, G., N. Filho, and J. Camargo. 2003. "Os efeitos da redução da jornada de trabalho de 48 Para 44 horas semanais em 1988 [The Effects of Reducing the Workday from 48 to 44 Hours a Week in 1988]." *Revista Brasileira de Economia* 57 (2): 369–400. doi:10.1590/S0034-71402003000200003.

Gronlund, A., and I. Oun. 2018. "Beyond the Mummy Track? Part-Time Rights, Gender, and Career-Family Dilemmas." *Nordic Journal of Working Life Studies* 8 (3): 177–198. doi:10.18291/njwls.v8i3.109546.

Hamermesh, D., D. Kawaguchi, and J. Lee. 2017. "Does Labor Legislation Benefit Workers? Well-Being After an Hours Reduction." *Journal of the Japanese and International Economies* 44: 1–12. doi:10.1016/j.jjie.2017.02.003.

Hayden, A., and J. Shandra. 2009. "Hours of Work and the Ecological Footprint of Nations: An Exploratory Analysis." *Local Environment* 14 (6): 575–600. doi:10.1080/13549830902904185.

Herzog-Stein, A., F. Lindner, and S. Sturn. 2018. "The German Employment Miracle in the Great Recession: The Significance and Institutional Foundations of Temporary Working-Time Reductions." *Oxford Economic Papers* 70 (1): 206–224. doi:10.1093/oep/gpx047.

Higgins, C., L. Duxbury, and K. Johnson. 2000. "Part-Time Work for Women: Does It Really Help Balance Work and Family?" *Human Resource Management* 39 (1): 17–32. doi:10.1002/(SICI)1099-050X(200021)39:1<17::AID-HRM3>3.0.CO;2-Y.

Hill, E., V. Märtinson, M. Ferris, and R. Zenger Baker. 2004. "Beyond the Mommy Track: The Influence of New-Concept Part-Time Work for Professional Women on Work and Family." *Journal of Family and Economic Issues* 25 (1): 121–136. doi:10.1023/B:JEEI.0000016726.06264.91.

Hofmarcher, T. 2021. "The Effect of Paid Vacation on Health: Evidence from Sweden." *Journal of Population Economics* 34 (3): 929–967. doi:10.1007/s00148-020-00789-z.

Hughes, E., and K. Parkes. 2007. "Work Hours and Well-Being: The Roles of Work-Time Control and Work-Family Interference." *Work & Stress* 21 (3): 264–278. doi:10.1080/02678370701667242.

Jackson, T., and P. Victor. 2011. "Productivity and Work in the 'Green Economy': Some Theoretical Reflections and Empirical Tests." *Environmental Innovation and Societal Transitions* 1 (1): 101–108. doi:10.1016/j.eist.2011.04.005.

Jansen-Preilowski, V., A. Paruzel, and G. Maier. 2020. "Arbeitszeitgestaltung in der digitalisierten Arbeitswelt: Ein systematisches Literatur Review zur Wirkung von Arbeitszeitverkürzung in Bezug auf die psychische Gesundheit [Working Time Organization in the Digitized World of Work: A Systematic Literature Review on the Effects of Working Time Reduction in Relation to Mental Health]." *Gruppe. Interaktion. Organisation. Zeitschrift für Angewandte Organisationspsychologie* 51 (3): 331–343. doi:10.1007/s11612-020-00530-0.

Jebb, A., L. Tay, E. Diener, and S. Oishi. 2018. "Happiness, Income Satiation and Turning Points around the World." *Nature Human Behaviour* 2 (1): 33–38. doi:10.1038/s41562-017-0277-0.

Kamerāde, D., S. Wang, B. Burchell, S. Balderson, and A. Coutts. 2019. "A Shorter Working Week for Everyone: How Much Paid Work is Needed for Mental Health and Well-Being?" *Social Science & Medicine* 241: 112353. doi:10.1016/j.socscimed.2019.06.006.

Kapteyn, A., A. Kalwij, and A. Zaidi. 2004. "The Myth of Worksharing." *Labour Economics* 11 (3): 293–313. doi:10.1016/j.labeco.2003.08.001.

Kennedy, E., H. Krahn, and N. Krogman. 2013. "Downshifting: An Exploration of Motivations, Quality of Life, and Environmental Practices." *Sociological Forum* 28 (4): 764–783. doi:10.1111/socf.12057.

King, L., and J. van den Bergh. 2017. "Worktime Reduction as a Solution to Climate Change: Five Scenarios Compared for the UK." *Ecological Economics* 132: 124–134. doi:10.1016/j.ecolecon.2016.10.011.

Klein, F., S. Frews, I. Savin, and J. van den Bergh. 2021. "How Work Patterns Affect Leisure Activities and Energy Consumption: A Time-Use Analysis for Finland and France." *Energy Research & Social Science* 76: 102054. doi:10.1016/j.erss.2021.102054.

Knight, K., E. Rosa, and J. Schor. 2013. "Could Working Less Reduce Pressures on the Environment? A Cross-National Panel Analysis of OECD Countries, 1970–2007." *Global Environmental Change* 23 (4): 691–700. doi:10.1016/j.gloenvcha.2013.02.017.

Lee, D., and H. Lim. 2017. "Multiple Thresholds in the Nexus Between Working Hours and Productivity." *Contemporary Economic Policy* 35 (4): 716–734. doi:10.1111/coep.12230.

Lepinteur, A. 2019. "The Shorter Workweek and Worker Wellbeing: Evidence from Portugal and France." *Labour Economics* 58: 204–220. doi:10.1016/j.labeco.2018.05.010.

Logeay, C., and S. Schreiber. 2006. "Testing the Effectiveness of the French Work-Sharing Reform: A Forecasting Approach." *Applied Economics* 38 (17): 2053–2068. doi:10.1080/00036840500427031.

Moonesinghe, S., J. Lowery, N. Shahi, A. Millen, and J. Beard. 2011. "Impact of Reduction in Working Hours for Doctors in Training on Postgraduate Medical Education and Patients' Outcomes: Systematic Review." *BMJ* 342: d1580. doi:10.1136/bmj.d1580.

Moser, S., and S. Kleinhückelkotten. 2018. "Good Intents, but Low Impacts: Diverging Importance of Motivational and Socioeconomic Determinants Explaining Pro-Environmental Behavior, Energy Use, and Carbon Footprint." *Environment and Behavior* 50 (6): 626–656. doi:10.1177/0013916517710685.

Nässén, J., and J. Larsson. 2015. "Would Shorter Working Time Reduce Greenhouse Gas Emissions? An Analysis of Time Use and Consumption in Swedish Households." *Environment and Planning C: Government and Policy* 33 (4): 726–745. doi:10.1068/c12239.

Nässén, J., J. Larsson, and J. Holmberg. 2009. "The Effect of Work Hours on Energy Use: A Micro-Analysis of Time and Income Effects." In *European Council for an Energy Efficient Economy Summer Study* 2009, 1801–1809. La Colle sur Loup, France: ECEEE 2009 Summer Study. https://www.eceee.org/static/media/uploads/site-2/library/conference_proceedings/eceee_Summer_Studies/2009/Panel_8/8.242/paper.pdf

Neubert, S., C. Bader, H. Hanbury, and S. Moser. 2022. "Free Days for Future? Longitudinal Effects of Working Time Reductions on Individual Well-Being and Environmental Behaviour." *Journal of Environmental Psychology* 82: 101849. doi:10.1016/j.jenvp.2022.101849.

Passicot, P., and G. Murphy. 2013. "Effect of Work Schedule Design on Productivity of Mechanised Harvesting Operations in Chile." *New Zealand Journal of Forestry Science* 43 (1): 2. doi:10.1186/1179-5395-43-2.

Peets, A., and N. Ayas. 2012. "Restricting Resident Work Hours: The Good, the Bad, and the Ugly." *Critical Care Medicine* 40 (3): 960–966. doi:10.1097/CCM.0b013e3182413bc5.

Percoco, M. 2018. "The Impact of Working Time on Fuel Consumption and CO_2 Emissions of Public Fleets: Evidence from a Policy Experiment." *Transport Policy* 71: 126–129. doi:10.1016/j.tranpol.2018.08.003.

Persson, O., J. Larsson, and J. Nässén. 2022. "Working Less by Choice: What Are the Benefits and Hardships?" *Sustainability: Science, Practice and Policy* 18 (1): 81–96. doi:10.1080/15487733.2021.2023292.

Raposo, P., and J. van Ours. 2010a. "How a Reduction of Standard Working Hours Affects Employment Dynamics." *De Economist* 158 (2): 193–207. doi:10.1007/s10645-010-9142-5.

Raposo, P., and J. van Ours. 2010b. "How Working Time Reduction Affects Jobs and Wages." *Economics Letters* 106 (1): 61–63. doi:10.1016/j.econlet.2009.10.001.

Russell, H., P. O'Connell, and F. McGinnity. 2009. "The Impact of Flexible Working Arrangements on Work-Life Conflict and Work Pressure in Ireland." *Gender, Work & Organization* 16 (1): 73–97. doi:10.1111/j.1468-0432.2008.00431.x.

Sánchez, R. 2013. "Do Reductions of Standard Hours Affect Employment Transitions? Evidence from Chile." *Labour Economics* 20: 24–37. doi:10.1016/j.labeco.2012.10.001.

Sánchez, R. 2017. "Does a Mandatory Reduction of Standard Working Hours Improve Employees' Health Status?" *Industrial Relations* 56 (1): 3–39. doi:10.1111/irel.12163.

Schiller, H., M. Lekander, K. Rajaleid, C. Hellgren, T. Akerstedt, P. Barck-Holst, and G. Kecklund. 2017. "The Impact of Reduced Worktime on Sleep and Perceived Stress – A Group Randomized Intervention Study Using Diary Data." *Scandinavian Journal of Work, Environment & Health* 43 (2): 109–116. doi:10.5271/sjweh.3610.

Schiller, H., M. Lekander, K. Rajaleid, C. Hellgren, T. Åkerstedt, P. Barck-Holst, and G. Kecklund. 2018. "Total Workload and Recovery in Relation to Worktime Reduction: A Randomised Controlled Intervention Study with Time-Use Data." *Occupational and Environmental Medicine* 75 (3): 218–226. doi:10.1136/oemed-2017-104592.

Schor, J. 2008. "Sustainable Consumption and Worktime Reduction." *Journal of Industrial Ecology* 9 (1–2): 37–50. doi:10.1162/1088198054084581.

Schumacher, K., F. Wolff, J. Cludius, T. Fries, K. Hünecke, R. Postpischil, and V. Steiner. 2019. *Arbeitszeitverkürzung – Gut Fürs Klima? Treibhausgasminderung Durch Suffizienzpolitiken Im Handlungsfeld "Erwerbsarbeit"* [*Reduction in Working Hours – Good for the Climate? Greenhouse Gas Reduction through Sufficiency Policies in the Field of Action "Gained Work"*]. Dessau-Roßlau: German Federal Enviornment Agency.

Shao, Q. 2015. "Effect of Working Time on Environmental Pressures: Empirical Evidence from EU-15, 1970–2010." *Chinese Journal of Population Resources and Environment* 13 (3): 231–239. doi:10.1080/10042857.2015.1033803.

Shao, Q., and B. Rodríguez-Labajos. 2016. "Does Decreasing Working Time Reduce Environmental Pressures? New Evidence Based on Dynamic Panel Approach." *Journal of Cleaner Production* 125: 227–235. doi:10.1016/j.jclepro.2016.03.037.

Shao, Q. 2020. "Paving Ways for a Sustainable Future: A Literature Review." *Environmental Science and Pollution Research International* 27 (12): 13032–13043. doi:10.1007/s11356-020-08247-9.

Shao, Q., and S. Shen. 2017. "When Reduced Working Time Harms the Environment: A Panel Threshold Analysis for EU-15, 1970–2010." *Journal of Cleaner Production* 147: 319–329. doi:10.1016/j.jclepro.2017.01.115.

Simionescu, M., Y. Bilan, P. Zawadzki, A. Wojciechowski, and M. Rabe. 2021. "GHG Emissions Mitigation in the European Union Based on Labor Market Changes." *Energies* 14 (2): 465. doi:10.3390/en14020465.

Skuterud, M. 2007. "Identifying the Potential of Work-Sharing as a Job-Creation Strategy." *Journal of Labor Economics* 25 (2): 265–287. doi:10.1086/511379.

Sundo, M., and S. Fujii. 2005. "The Effects of a Compressed Working Week on Commuters' Daily Activity Patterns." *Transportation Research Part A: Policy and Practice* 39 (10): 835–848. doi:10.1016/j.tra.2004.06.001.

Tracey, M., and S. Polachek. 2020. "Heterogeneous Layoff Effects of the US Short-Time Compensation Program." *Labour* 34 (4): 399–426. doi:10.1111/labr.12184.

Virtanen, M., M. Jokela, I. Madsen, L. Magnusson Hanson, T. Lallukka, S. Nyberg, L. Alfredsson, et al. 2018. "Long Working Hours and Depressive Symptoms: Systematic Review and Meta-Analysis of Published Studies and Unpublished Individual Participant Data." *Scandinavian Journal of Work, Environment & Health* 44 (3): 239–250. doi:10.5271/sjweh.3712.

Voglino, G., A. Savatteri, M. Gualano, D. Catozzi, S. Rousset, E. Boietti, F. Bert, and R. Siliquini. 2022. "How the Reduction of Working Hours Could Influence Health Outcomes: A Systematic Review of Published Studies." *BMJ Open* 12 (4): e051131. doi:10.1136/bmjopen-2021-051131.

von Thiele Schwarz, U., and H. Hasson. 2011. "Employee Self-Rated Productivity and Objective Organizational Production Levels Effects of Worksite Health Interventions Involving Reduced Work Hours and Physical Exercise." *Journal of Occupational and Environmental Medicine* 53 (8): 838–844. doi:10.1097/JOM.0b013e31822589c2.

von Thiele Schwarz, U., P. Lindfors, and U. Lundberg. 2008. "Health-Related Effects of Worksite Interventions Involving Physical Exercise and Reduced Workhours." *Scandinavian Journal of Work, Environment & Health* 34 (3): 179–188. doi:10.5271/sjweh.1227.

Wergeland, E., B. Veiersted, M. Ingre, B. Olsson, T. Akerstedt, T. Bjornskau, and N. Varg. 2003. "A Shorter Workday as a Means of Reducing the Occurrence of Musculoskeletal Disorders." *Scandinavian Journal of Work, Environment & Health* 29 (1): 27–34. doi:10.5271/sjweh.701.

Appendix 1. Effects and WTR conceptualization of complete review sample

Article	WTR	WTR conceptualization				Effects
		Extent	Level	Form	Wage compensation	
Akerstedt et al. (2001)	Organizational WTR experiment	9 hours	Organizations	Shorter workday	Full	SOC: improved heart/respiratory symptoms, sleep quality, fatigue, satisfaction with work hours, self-rating of having adequate time for social activities, friends and family
Anttila, Nätti, and Väisänen (2005)	Communal WTR experiment	6–8 hours	Organizations	Shorter workday or fewer working days	Partial to full	SOC: reduction in work-family conflict
Barck-Holst et al. (2017)	Organizational WTR experiment	9 hours	Organizations	Shorter workday	Full	SOC: reduction in work intrusion on private life, stress, negative emotions, sleepiness, fatigue, exhaustion, memory difficulties, increase in restorative sleep and sleep quality on weekends
Barck-Holst et al. (2021)	Organizational WTR experiment	9 hours	Organizations	Shorter workday	Full	SOC: reduction in emotional exhaustion
Berniell and Bietenbeck (2020)	35-hour workweek in France	4 hours	National	Unclear	Full	SOC: reduction in smoking and body-mass index (BMI), increase in self-reported health
Buhl and Acosta (2016)	Individual reduction in working hours	Unclear	Individuals	Unclear	Likely none	SOC: no significant effect on life satisfaction ECOL: negative time effect on resource use, but positive and larger income effect on resource use
Chemin and Wasmer (2009)	35-hour workweek in France	4 hours	National	Unclear	Full	ECON: no significant effect on employment
Connolly and Gregory (2008)	Transition to part-time work	Unclear	Individuals	Unclear	Likely none	ECON: occupational downgrading for women transitioning to part-time
Craig and Churchill (2019)	Transition to part-time work	Unclear	Individuals	Unclear	Likely none	SOC: reduction in parental stress, especially for women
Crépon and Kramarz 2002)	Reduction from 40 to 39 hours with increase in minimum wage in France	1 hour	National	Unclear	Partial	ECON: increased probability of unemployment
De Raeve, Jansen, and Kant (2007)	Transition to part-time work	Unclear	Individuals	Unclear	Likely none	SOC: reduction in self-reported health and increase in psychological distress for women, no significant effect for men
Devicienti, Grinza, and Vannoni (2018)	Increase in part-time share of organizations	Unclear	Organizations	Shorter workday or fewer working days	Likely none	ECON: decrease in productivity for increase in part-time share for shorter workdays, but not for fewer working days per week
Dex and Bukodi (2012)	Transition to part-time work	Unclear	Individuals	Unclear	Likely none	ECON: occupational downgrading for women transitioning to part-time
Du, Yin, and Zhang (2013)	35-hour workweek in France	4 hours	National	Unclear	Full	ECON: reduced unemployment rate
Estevão and Sá (2008)	35-hour workweek in France	4 hours	National	Unclear	Full	ECON: no significant effect on employment
Fagnani and Letablier (2004)	35-hour workweek in France	4 hours	National	Shorter workday or fewer working days	Full	SOC: improved work-family balance
Fernandez-Kranz and Rodriguez-Planas (2021)	Law granting employment protection for parents reducing their working hours	Unclear	National	Unclear	Likely none	ECON: lowered career chances for women of childbearing age after implementation of law
Gash, Mertens, and Gordo (2012)	Transition to part-time work	Unclear	Individuals	unclear	Likely none	SOC: increased life satisfaction for women
Gronlund and Oun (2018)	Transition to part-time work	Unclear	Individuals	Unclear	Likely none	SOC: reduction in work-family conflict for mothers but not fathers
Herzog-Stein, Lindner, and Sturn (2018)	Temporary WTR	Unclear	Organizations	Unclear	None or partial	ECON: lowered unemployment in recessions
Lepinteur (2019)	35-hour workweek in France and 40-hour workweek in Portugal	4 hours	National	Unclear	Likely full	SOC: increased job and leisure-time satisfaction
Raposo and van Ours (2010)	40-hour workweek in Portugal	4 hours	National	Unclear	Likely full	ECON: increase in employment through less job destruction
Raposo and van Ours (2010)	40-hour workweek in Portugal	4 hours	National	Unclear	Full	ECON: decreased likelihood for directly affected workers to lose job
Sánchez (2017)	35-hour workweek in France and 40-hour workweek in Portugal	4 hours	National	Unclear	Full	SOC: no significant health effect in Portugal, positive effect in France for women <39 but negative for men

(*Continued*)

Appendix. (Continued)

Article	WTR	WTR conceptualization				Effects
		Extent	Level	Form	Wage compensation	
Schiller et al. (2017)	Organizational WTR experiment	9 hours	Organizations	Shorter workday	Full	SOC: increased sleep quality, sleep duration, decreased sleepiness, perceived stress, worries and stress at bedtime
Schiller et al. (2018)	Organizational WTR experiment	9 hours	Organizations	Shorter workday	Full	SOC: increased recovery activities
Tracey and Polachek (2020)	Short-term work- program participation	Unclear	Organizations	Unclear	Partial	ECON: decrease in layoff rate
von Thiele Schwarz et al. 2008)	Organizational WTR experiment	2.5 hours	Organizations	Shorter workday	Full	SOC: less general symptoms as compared to control group but increased waist-to-hip ratio ECON: improved self-rated work ability compared to control
von Thiele Schwarz and Hasson (2011)	Organizational WTR experiment	2.5 hours	Organizations	Shorter workday	Full	SOC: no significant effect on sickness absence ECON: improved self-rated work ability compared to control
Wergeland et al. (2003)	Organizational WTR experiment	9 hours	Organizations	Shorter workday	Full	SOC: decreased neck-shoulder pain and exhaustion

Note. SOC: social dividend; ECON: economic dividend; ECOL: ecological dividend.

Appendix 2: Manuscript 2

Neubert, S., Bader, C., Hanbury, H., & Moser, S. (2022). Free days for future? Longitudinal effects of working time reductions on individual well-being and environmental behaviour. *Journal of Environmental Psychology*, *82*, 101849. https://doi.org/10.1016 /j.jenvp.2022.101849

Journal of Environmental Psychology 82 (2022) 101849

Contents lists available at ScienceDirect

Journal of Environmental Psychology

journal homepage: www.elsevier.com/locate/jep

Free days for future? Longitudinal effects of working time reductions on individual well-being and environmental behaviour

Sebastian Neubert [a,b], Christoph Bader [a], Hugo Hanbury [a], Stephanie Moser [a,*]

[a] Centre for Development and Environment (CDE), University of Bern, Switzerland
[b] Social, Environmental, and Economic Psychology, University of Koblenz-Landau, Germany

ARTICLE INFO

Handling Editor: W. Schultz

Keywords:
Greenhouse gas emissions
Impact-oriented behaviour
Pro-environmental behaviour
Emotions
Life satisfaction
Burnout
Working time
Income
Discretionary time

ABSTRACT

Working time reductions (WTR) are a promising strategy to foster both environmental behaviour and individual well-being. It is unclear, however, whether these possible effects are more likely due to reduced income or to more discretionary time. Moreover, prior studies have only tested the environmental effects of WTR cross-sectionally, and have only tested the well-being effects of WTR including wage compensations. We conducted a longitudinal three-wave study with Swiss employees, including one group who voluntarily reduced their working hours following the first questionnaire. Between-subject analysis suggested that decreased working time is associated with decreased GHG-related behaviours, and increased individual well-being. While the improved GHG-related behaviour is mainly due to reduced income, the well-being effects arise despite lower income. Analyses over time revealed that after reducing their working hours, participants reported increased well-being, more intent-related pro-environmental behaviour, less car commuting, and decreased clothing expenditures. However, no improvement was found regarding other GHG-related behaviours, which are strongly linked to income levels. Thus, reducing standard working time, and simultaneously reducing income, may be a promising strategy. However, voluntarily working a day less per week will probably not reach the full ecological potential of a societal-level WTR.

1. Introduction

To date, no country in the world has succeeded in achieving and maintaining a high level of prosperity without massively exceeding planetary boundaries according to their appropriate share of natural resources (O'Neill et al., 2018). Global North countries, in particular, must greatly reduce their consumption-related environmental impact, especially in terms of greenhouse gas emissions (GHG; IPCC, 2021). This task requires a radical transformation of our consumption and lifestyle patterns, supported by far-reaching cross-sectoral policies (Independent Group of Scientists appointed by the Secretary-General, 2019). However, such policies will likely only obtain public approval if they produce co-benefits, that is, not only benefit the environment, but also benefit people's well-being (Verhofstadt et al., 2016). One such policy that has gained increasing interest in sustainability debates is *working time reduction* (Coote et al., 2010; King & van den Bergh, 2017; Mastini et al., 2021; Schor, 2008), that is, reductions to the hours worked for payment per week or per year. It has been argued that working time reductions (hereafter, WTR) could provide multiple benefits – increasing environmental sustainability, social justice, gender equality, and well-being (e.g. Coote et al., 2010; Fitzgerald, 2022; Stronge et al., 2019). Several empirical studies have found that countries with shorter working hours have lower per capita environmental impacts (Fitzgerald et al., 2018; Knight et al., 2013; Rosnick & Weisbrot, 2007; Shao & Shen, 2017). Studies at the level of the individual show a similar relationship between working hours and personal GHG emissions (e.g. Buhl & Acosta, 2016; Devetter & Rousseau, 2011; Nässén & Larsson, 2015; see Antal et al., 2021, for a review).

So far, however, it has remained unclear how, exactly, working less affects individual consumption patterns. In the past, two different processes have been proposed (Bader et al., 2020; Buhl & Acosta, 2016; Nässén & Larsson, 2015): On the one hand, individuals with more working hours tend to have higher income on average, causing more consumption and thus higher consumption-related GHG emissions (*income effect*). On the other hand, individuals with more working hours have less discretionary time, resulting in different time use and consumption patterns (*time effect*).

With the present study, we seek to improve understanding of the

* Corresponding author. Centre for Development and Environment (CDE), University of Bern, Mittelstrasse 43, 3012, Bern, Switzerland.
E-mail address: stephanie.moser@unibe.ch (S. Moser).

https://doi.org/10.1016/j.jenvp.2022.101849
Received 9 February 2022; Received in revised form 15 June 2022; Accepted 9 July 2022
Available online 16 July 2022

effects of WTR on individual consumption patterns and thus impact-oriented environmental behaviour. In addition, we aim to improve understanding of the potential co-benefits of WTR in terms of individual well-being. We do this using a quasi-experimental design that enables us to observe not only differences between employees with different levels of working hours, but also the longitudinal effects of WTR among employees who voluntarily reduce their working time. The results shed light on the potential environmental and well-being benefits of WTR policies.

1.1. Working time reduction and environmental behaviour

It has been argued that WTR improves personal environmental behaviour both because of decreased income and of increased discretionary time. At the same time, it is important to distinguish between *impact*-oriented environmental behaviour (GHG-behaviour; e.g. measurements of energy consumption, ecological footprint, or GHG footprint) and *intent*-oriented pro-environmental behaviour (PEB). The latter encompasses behaviours intended by individuals to protect the environment, regardless of whether these behaviours actually reduce their environmental impacts (Nielsen et al., 2021; Stern, 2000). The link between individual and household income and impact-oriented GHG-behaviour is largely agreed upon at this point. Income has been repeatedly found to predict individual- and household-level GHG emissions resulting from mobility, housing, and general consumption of goods and services (Bleys et al., 2018; Bruderer Enzler & Diekmann, 2019; Huddart Kennedy et al., 2015; Ivanova et al., 2018; Moser & Kleinhückelkotten, 2018; Wiedenhofer et al., 2018). Accordingly, studies simulating the potential effects of WTR policies estimate that a reduction in working hours of 1% could produce an income-induced reduction in GHG emissions between 0.3% and 0.82% (Buhl & Acosta, 2016; Fremstad et al., 2019; Nässén & Larsson, 2015). As for predicting PEB, income appears to play a less important role; PEB is mainly influenced by motivational variables, like environmental self-identity and environmental concern (Bruderer Enzler & Diekmann, 2019; Huddart Kennedy et al., 2015; Moser & Kleinhückelkotten, 2018).

Findings on environmental impacts derived from WTR *time effects* are less clear. Some observers argue that decreased working hours benefit PEB, as many motivational pro-environmental actions require time, and the conscious process of breaking out of environmentally harmful habits might also require time. However, the evidence regarding this claim is mixed: Chai et al. (2015) found supporting empirical evidence, while another more rigorous study did not find any objective or subjective work–life balance impact on PEB (Melo et al., 2018). As for the time effect on GHG emissions, studies have not found evidence for a clear link when controlling for income (e.g. Ivanova et al., 2018). However, there may be time effects regarding specific GHG-relevant behaviours such as eating out or owning energy-intensive time-saving equipment (Devetter & Rousseau, 2011), use of energy-consuming household devices (Whillans et al., 2017), or commuting (Kallis et al., 2013; King & van den Bergh, 2017). Conversely, several studies estimate a WTR-related *time rebound effect*, whereby new free time is spent on activities (e.g. travel) that cause *higher* GHG emissions per hour than working would have (Hanbury et al., 2019; Jalas, 2002). Studies estimating this time rebound effect have concluded that a WTR of 1% could lead to increases in GHG emissions due to shifts in time use – namely, increases of 0.02% (Nässén & Larsson, 2015) or 0.48% (Buhl & Acosta, 2016). Notably, these estimates suggest that the time rebound effect does not fully neutralize the income effect.

In conclusion, the direction and magnitude of WTR-related time effects are subject to ongoing debate, whereas the income effect is relatively well established. However, virtually all the available evidence has been derived from cross-sectional studies. To our knowledge, only one study has longitudinally tested the environmental effects of WTR at the individual level – namely, the above-mentioned study on time rebound effects by Buhl and Acosta (2016). However, even in this study, the authors estimated the income effect cross-sectionally, limiting the validity of their conclusions about the overall environmental effects of WTR.

1.2. Working time reduction and individual well-being

Certain income and time effects of WTR can also be hypothesized regarding individual well-being: Generally, the more individuals work, the less discretionary time they have for other life domains, possibly influencing their overall well-being. It is known that involuntary unemployment, on the one side, and excessive workloads, on the other, can have detrimental effects on psychological and health-related well-being (Kamerāde et al., 2019; Virtanen et al., 2018). Between these two extremes, however, no linear relationship has been found between individual working time and well-being (Kamerāde et al., 2019; Pereira & Coelho, 2013). At the same time, individuals frequently express a desire to work less (e.g. Angrave & Charlwood, 2015; Bartoll & Ramos, 2020; Holly & Mohnen, 2012) and this subjective mismatch between desired and actual working hours has been associated with diminished well-being (Otterbach et al., 2016; Wooden et al., 2009). In this way, reduced working hours could benefit people's well-being by freeing up time for other domains of life – and increasing their well-being in these domains. Indeed, it has been reasoned that the effect of WTR on well-being might depend especially on how the new discretionary time is actually spent (Buhl & Acosta, 2016; Druckman et al., 2012; Jalas & Juntunen, 2015). In addition, there is evidence that the relationship between working time and well-being is partly influenced by people's materialistic orientation (Andersson et al., 2014; Andersson & Nässén, 2016). In conclusion, from a time perspective, shorter working hours (but not unemployment) might be beneficial for individual well-being because it satisfies the expressed desire of many employees to work less, prevents the health harms of overwork, and frees up time for other activities that benefit well-being.

In contrast to time effects, the relationship between individual and household income and well-being has been thoroughly investigated: In general, income plays an important role in predicting well-being (Diener et al., 2018; Kahneman & Deaton, 2010). However, it has also been found that this only holds true as long as increases in income help to better satisfy needs (Pullinger, 2014). Further, there is evidence of satiation or turning points regarding the positive relationship between income and subjective well-being: While income increases enable substantial improvements in well-being among those with relatively little income, they do not enable similarly sized improvements among higher earners (Inglehart et al., 2008; Jebb et al., 2018). Whatever the case, from an income perspective, it is important to note that shorter working time could be detrimental to individual well-being when it leads to reduced income among lower earners in particular.

These potentially counter-directed WTR effects of income and time highlight the importance of directly testing the effects of WTR on well-being. Very few studies have explicitly focused on the potential effects of changes in working hours on well-being. Lepinteur (2019) used the European Community Household Panel to analyse the effects of a national reduction in standard working hours from 44 to 40 h per week in Portugal and from 39 to 35 h per week in France in 2002 (both with full wage compensation), respectively. He found positive effects for these reductions with regards to both leisure satisfaction and job satisfaction. Barck-Holst et al. (2017) analysed data of a longitudinal quasi-experimental WTR with full wage compensation in Sweden and found positive effects on various measures of psychosocial health, including sleep quality and quantity, stress, negative emotions, and fatigue. Schiller et al. (2017) conducted a randomized intervention looking at the effects of a 25% WTR with full wage compensation and found positive effects of WTR on stress and sleep. These studies generally support the conclusion that WTR benefits individual well-being, particularly people's health. However, these studies researched the effects of WTR on well-being including *full wage compensation*, thus only

taking the time effect into account, but not testing the effect of reduced income. The question remains as to whether such well-being benefits also occur when WTR is accompanied by corresponding reductions in income. To our knowledge, the study by Buhl and Acosta (2016) is the only such research that also controls for income losses. They found no beneficial effects of WTR on life satisfaction. However, as mentioned, the time effect of WTR on well-being frequently manifests in connection with health measures, which the authors did not include in their study. The interaction of working time and income, as well as the possible effects of decreased working time, thus remain unclear.

1.3. The present research

With the present study, we seek to improve understanding of the possible co-benefits of decreased working time for the environment and individual well-being. Such co-benefits have been proposed by various scholars (Coote et al., 2010; Fitzgerald, 2022; Schor, 2008; Stronge et al., 2019). We aim to shed light on whether possible co-benefits are more likely to derive from time gains associated with reduced working hours, or to corresponding income losses (Buhl & Acosta, 2016; Nässén & Larsson, 2015). We investigated these relationships using a quasi-experimental longitudinal design. Specifically, we surveyed Swiss employees who voluntarily reduced their working hours, and thus experienced a reduction in income, and compared them with a control group who did not change their working time.

With an average working time of 42.8 h per week among full-time workers, Switzerland has one of the highest standard weekly work rates in Europe (Eurostat, 2020a). Meanwhile, at 39.1%, Switzerland also has the second-highest proportion of part-time workers in Europe (Eurostat, 2020b), mainly due to part-time working women (59% of female workers work part-time, whereas only 18% of working men do; Federal Statistical Office, 2020). Not only working time, but also Swiss disposable household income is one of the highest worldwide (OECD, 2019). Notably, Swiss residents also cause GHG emissions of about 14t CO_2eq per capita and year, of which more than half are caused indirectly – namely, by means of imported goods from other countries (Frischknecht et al., 2018). As a result, Switzerland has one of the world's highest levels of consumption-based GHG emissions per capita (Federal Office for the Environment, 2020).

1.4. Hypotheses

Based on the results of previous studies (e.g. Buhl & Acosta, 2016; Devetter & Rousseau, 2011; Nässén & Larsson, 2015), we assume that people with lower working hours display more environmental behaviour, i.e. our first hypothesis assumes that:

H1.1: Working hours positively predict GHG-relevant behaviour, and negatively predict pro-environmental behaviour (PEB).

Previous evidence suggests that such a relationship can be explained in particular by reduced income (Buhl & Acosta, 2016; Nässén & Larsson, 2015), at least in terms of impact-oriented environmental behaviour. It remains unclear whether the gain in time can also explain environmental behaviour beyond income effects, particularly in regards to intent-oriented PEB (see for example Chai et al., 2015). We therefore also test the assumption that:

H1.2: Income positively predicts GHG-relevant behaviour (no relation is assumed for PEB). When controlling for income, working hours still positively predict GHG-relevant behaviour, and negatively predict PEB.

Previous studies have examined corresponding effects only cross-sectionally, comparing different individuals employed at different working levels. This limits the conclusions that can be drawn on behalf of WTR policies (Antal et al., 2021). The present study seeks to fill this research gap by longitudinally studying the effects of WTR on individual environmental behaviour. We thus aim at testing the assumption that:

H1.3: GHG-relevant behaviour decreases and PEB increases after a voluntary WTR.

Very few studies to date have examined both environmental and well-being effects simultaneously (Andersson et al., 2014; Nässén & Larsson, 2015), and only in one case using longitudinal data (Buhl & Acosta, 2016). Studies focusing on well-being effects of WTR have generally included wage compensations (Barck-Holst et al., 2017; Lepinteur, 2019; Schiller et al., 2017). Thus, we seek to better understand whether WTR increases personal well-being, and whether this effect remains in the absence of income compensation. Thus, analogous to the hypotheses described above, we assume that decreased working hours are associated with increased individual psychological and health-related well-being, or:

H2.1: Working hours negatively predict well-being.

Based on an assumed counter-directed effect of working hours and income on well-being we also assume that:

H2.2: Income positively predicts well-being. Controlling for income increases the negative effect of working hours on well-being.

Finally, we assume that a reduction in working hours over time leads to improved well-being, particularly health-related well-being. This effect should be larger for longer working hours at baseline:

H2.3: Well-being increases following voluntary WTR.

2. Methods

2.1. Procedure and participants

In the present study, we implemented a quasi-experimental longitudinal design comparing a group of Swiss employees who reduced their working hours (*reducers*, i.e. the intervention group) with a group who did not change their workload (*non-reducers*, i.e. the control group). Three online questionnaires were scheduled such that the *reducers* received the first questionnaire (baseline; t0) 1 month before their planned WTR; the second questionnaire (t1) assessing immediate effects 3 months after the reduction; and the last questionnaire (t2) assessing medium-term effects 9 months after the reduction. The first participants answered questionnaire t0 in May 2018, the last filled out questionnaire t2 in February 2020. This long period was necessary to obtain an adequate sample size of reducers, since they did not all reduce their workload on the same date. *Non-reducers* were randomly assigned so that their distribution of questionnaire dates was similar to that of reducers. Participants had 2 weeks to fill in each questionnaire and were issued two reminder emails per questionnaire.

Participants were recruited among employees of several larger cooperating Swiss employers ($n = 474$), via social media ($n = 78$), and a market research institute ($n = 215$). Another 108 participants were recruited from a company who cooperated only for the baseline questionnaire; these cases were included to improve the estimation of between-subject predictors. We aimed for at least $n = 100$ reducers at t0, to detect medium to small effect sizes in the group-time interaction. A total of 138 participants indicated at study registration that they planned to reduce their working hours. However, an inspection of their indicated effective working time at each questionnaire time point revealed that not all of them were able to realize their intentions. We therefore categorized participants into the two groups of reducers versus non-reducers as follows: Participants who were observed to have

reduced their working hours by at least 4 h per week either at t1 or t2 (compared to t0) were coded as "reducers"; all others were coded as "non-reducers" (*WTR*; reducer = 1 and non-reducer = 0). Thus, the group of non-reducers contains workers with varying workloads who held their workload constant. This procedure resulted in $n = 110$ participants for whom a reduction in working hours was observable over the course of the study. Thirty-seven participants who were included with at least two points of measurement into the final analyses as non-reducers had originally planned to reduce their working time. They were still included to increase sample size.[1] In case of an observed increase in working hours of at least 6 h (either at t1 or t2 compared to t0), all outcome observations after this increase were excluded from our analyses. If participants retired or became unemployed over the course of the study, again only outcome observations prior to these events were included. Additionally, six participants were excluded from the analyses after indicating that they were retired or unemployed at baseline; and four participants were excluded due to many missing answers. Following these exclusions, outcome observations of $N = 865$ participants in total were subjected to data analyses ($n = 838$ for t0, $n = 627$ for t1, and $n = 571$ for t2), resulting in a maximum of 2036 observations suitable for analyses. The resulting sample was 59.5% female ($n = 515$), with an average age of 43.3 years (ranging from 17 to 72 years). Participants' characteristics at baseline and completion rates for all three questionnaires are shown in Appendix A.1.

2.2. Measures

All three questionnaires contained the same set of questions (with slightly adapted wording, e.g. "at the moment" at t1 and t2 instead of "in general" at t0). Each of the three questionnaires took 20 min on average to complete. The psychometric properties of the scales used can be found in Appendix A.2. All psychometric scales displayed medium to good internal consistency with Cronbach's Alpha between .81 and .91. A description of the items can be found in Appendix A.3. A correlation table of all baseline study measures can be found in S.1.

Outcome variables for environmental behaviour were assessed twofold: First, a measure for *intent-related PEB* was assessed. Five items were used for this (selected from a scale of Kaiser, 2020, and own item constructions), which we assumed to be particularly sensitive to sufficiency or lack of time. The mean value was used for further analyses. Second, *GHG-relevant behaviour*, i.e. impact-oriented environmental behaviour, was measured using four questions from a Swiss carbon footprint calculator (WWF Switzerland, 2017): Participants were asked for their monthly clothing expenditure as a proxy for consumption behaviour. Moreover, they were asked to indicate their living space (which we weighted based on the number of persons living in the same household), whether and how many kilometres they had travelled by car in recent months, and whether and how many hours they had travelled by airplane in recent months. Additionally, participants indicated whether and how many hours they had commuted by car per week in recent weeks (own item wording). We used these questions as single-item outcome variables.

We assessed four different measures as outcome variables for well-being. The Satisfaction with Life Scale (SWLS; five items; Diener et al., 1985) was used as a measure of cognitive well-being. A positive subscale of the Scale of Positive and Negative Experience (SPANE-p; six items; Diener et al., 2010) and an adapted negative subscale of the SPANE (*SPANE-n;* six items) were used to assess positive, and negative emotional well-being. The work-related burnout subscale of the Copenhagen Burnout Inventory (CBI; seven items; Kristensen et al., 2005) was used to assess health-related burnout tendency. For analyses, the respective items were combined into scales by calculating their mean value.

Our main predictors of interest were working hours, income and WTR. In addition to the binary variable described above – namely, whether a working time reduction (*WTR)* had been experienced (either at t1 or t2) or not (i.e. reducers vs. non-reducers) – we considered the absolute amount of paid *weekly working hours*. Participants indicated how many hours they worked per week on average. If they were not able to indicate an average, they were asked for their categorial most frequent weekly working hours, and the category mean was used for analyses. For income, participants indicated their categorial per-capita *annual gross income*. Category means were used for analyses. In addition to these independent variables, we considered a set of socio-demographic (gender; *female* vs. *other gender*, age, education; *university degree* vs. *no university degree*, household size, parenthood; *parent* vs. *non-parent*, and residence area; *urban* vs. *non-urban*), and psychological control variables. The latter included a three-item measure of environmental self-identity (ESI; Van der Werff et al., 2014) and a six-item measure of materialistic values (MVS; Richins, 2004). Additionally, to check whether participants were secondary household earners (possibly decreasing WTR income effects), they were asked whether they were in an income partnership and, if yes, were asked to indicate categorically how much they contributed to their household income. Only 6 reducers indicated that they were in an income partnership and were contributing less than 40% of household income. As a result, this variable was not included in the main analyses. Means of household income contribution by group can be found in Appendix A.1.

2.3. Data preparation and data analysis

As 32 participants would have been excluded due to missing values for one or multiple control and predictor variables, missing values were imputed (number of missing values can be found in Appendix A.3).[2] For binary control variables (i.e. education and residence area), missing values were imputed using Bayesian logistic regression. For age and income, missing values were replaced using a single imputation procedure with predictive mean matching (Kleinke et al., 2020). One of the control variables (materialistic values) was used logarithmically to decrease deviations from normality. Numeric predictors were *z*-standardized, binary predictors were used as 0/1. Distributions of the outcome variables were visually inspected. The single-item measures of GHG-relevant behaviour were susceptible to skewed distributions as were three of the well-being measures. We thus applied the following transformations to reduce the deviations from normal distribution: living space, hours of air travel, SPANE-p, and CBI were log-transformed; general car travel was fourth root transformed; and car commuting and SWLS were square-root transformed. Afterwards, all outcome variables were *z*-standardized using the baseline (t0) mean and standard deviation.

To test our hypotheses, we calculated a series of four regression models for each of our numeric outcome variables. We applied Linear Mixed-Effects Regression Models (LMER) using R Statistics version 3.6.1 (R Core Team, 2019) and the package lme4 (Bates et al., 2015). Significance tests of fixed effects coefficients were calculated with the package lmerTest using the Satterthwaite's degrees of freedom method (Kuznetsova et al., 2017). We first calculated a control model *(M0)*, which included the random intercept, two time dummy variables (indicating whether answers stem from t1 or from t2 as compared to t0), and all control variables (gender, age, education, household size, parenthood, residence area, environmental self-identity, and

[1] A re-analysis excluding all participants that had planned to reduce their working time but for whom no reduction was observable ($n = 47$) showed similar results to the analyses reported in section 3, see Supplementary Materials S.16 – S.19. These participants were thus kept in the sample to increase the overall sample.

[2] A re-analysis using listwise deletion of missing values showed similar results to the analyses reported in section 3, see Supplementary Materials S.20 – S.23.

materialistic values). The next model (model 1 *M1)* tests for hypotheses H1.1 and H2.1 by adding baseline (t0) working hours. Next, model 2 (*M2)* tests for hypotheses H1.2, H2.2 by adding baseline (t0) income. Finally, model 3 (*M3)* tests for hypotheses H1.3 and H2.3 by adding the binary variable of whether participants had reduced their working hours during the study (WTR), as well as two interaction terms between this binary WTR variable and the time dummy variables (WTR x t1 and WTR x t2). This stepwise process made it possible to test whether working hours had a between-subject effect on the outcome variable of interest (M1), whether this influence was (partly) due to an effect of income (M2), and whether a working time reduction (WTR) had a dynamic within-subject effect on the outcome variable of interest (M3).

The goodness of fit of these four different LMER-models were compared with ANOVA and multi-model inference interpreting the indices of Akaike's corrected Information Criterion (AICc), and Weight of Evidence (WoE): The WoE estimate indicates the probability that, *of all tested models*, the chosen model is the best to describe the data (Long, 2012). LMER was chosen over repeated-measure analysis of variance (ANOVA) to enable inclusion of participants with incomplete data. A random intercept model accounting for within-subject means was used because although a model including all possible random effects was of (minor) interest, it would have resulted in overfitting (Long, 2012).

The two binary outcome variables – the probabilities of air travel and car commuting – were tested by means of a hurdle model. This procedure made it possible to account for many participants indicating values of zero for each of these variables. We thereby followed an approach of Bruderer Enzler (2017): First, binominal generalized LMERs were fitted with the binary variable indicating whether at least 1 h had been travelled by air or commuted by car. Next, regular LMERs as described above were conducted using the original variables, with values of zero treated as missing values.

3. Results

3.1. Observed working time reduction

Before testing our hypotheses, we checked for differences at baseline (t0) between the two WTR groups (reducers vs. non-reducers; see Appendix A.1). Participants who reduced their working hours (reducers) did not statistically significantly differ from non-reducers with respect to gender, parenthood, urbanity of residence area, education, age, environmental self-identity, materialistic values, or baseline income. However, reducers lived in significantly smaller households ($t = 2.13$, $p < .05$) and worked significantly more hours per week ($t = -4.47$, $p < .001$) at baseline than non-reducers.

Moreover, we checked how WTR affected weekly working hours and income – our two predictors of interest (for details see Appendix A.4). Reducers significantly decreased their working hours in comparison with non-reducers at t1 and t2 by about one standard deviation. Their income significantly decreased as compared to that of non-reducers by about 0.25 standard deviations. In absolute terms, the working hours of reducers decreased from 38.9 h at baseline by 8.85 h per week in comparison with non-reducers at t1, and by 9.92 h in comparison with non-reducers at t2. This corresponds to approximately 1 full-time working day per week in Switzerland. Their income decreased by CHF 8313 per year in comparison with non-reducers at t1, and by CHF 10,900 per year in comparison with non-reducers at t2[3].

3.2. The effects of WTR on environmental behaviour

To test our hypotheses 1.1–1.3, we ran a series of four LMER models predicting the seven different indicators of environmental behaviour (for air travel and car commuting, probabilities as binary values and numeric outcomes were used as described above). Table 1 shows the indices of the model comparisons. Testing for H1.1 – i.e. the predictive power of baseline working hours in models (M1) – revealed mixed evidence, as can be seen by ANOVA test statistics as well as model comparison based on AICc. The inclusion of baseline working hours

Table 1
Model comparison indices for the environmental behaviour models using LMER.

Model	ANOVA			Multimodel Inference		
	df	deviance	χ^2	AICc	WoE	R^2
	Clothing Expenditure (n = 864, Observations = 2026)					
M0: Control	13	5185		5211	.00	.10
M1: Baseline Working Hours	14	5182	2.78†	5210	.00	.10
M2: Baseline Income	15	5165	16.78***	5196	.02	.12
M3: WTR	18	5152	13.54**	5188	.98	.12
	Living Space (n = 865, Observations = 2036)					
M0: Control	13	1944		1970	.00	.44
M1: Baseline Working Hours	14	1944	0.49	1972	.00	.44
M2: Baseline Income	15	1914	29.52***	1944	.85	.46
M3: WTR	18	1912	2.71	1948	.15	.46
	Probability of Air Travel [a] (n = 862, Observations = 2023)					
M0: Control	12	2381		2405	.00	.13
M1: Baseline Working Hours	13	2373	7.45**	2399	.01	.14
M2: Baseline Income	14	2361	11.76***	2390	.78	.15
M3: WTR	17	2358	3.47	2392	.21	.15
	Air Travel [b](n = 589, Observations = 942)					
M0: Control	13	2834		2860	.08	.24
M1: Baseline Working Hours	14	2829	5.06*	2857	.36	.25
M2: Baseline Income	15	2826	2.83†	2857	.53	.25
M3: WTR	18	2825	0.86	2862	.04	.25
	Car Travel (n = 865, Observations = 2031)					
M0: Control	13	4820		4846	.01	.21
M1: Baseline Working Hours	14	4812	7.49**	4840	.09	.22
M2: Baseline Income	15	4806	6.34*	4836	.81	.22
M3: WTR	18	4804	1.72	4840	.09	.22
	Probability of Car Commuting [a](n = 861, Observations = 2021)					
M0: Control	12	1480		1504	.60	.15
M1: Baseline Working Hours	13	1480	0.33	1506	.26	.15
M2: Baseline Income	14	1479	0.81	1507	.14	.15
M3: WTR	17	1478	0.62	1513	.01	.16
	Car Commuting [b](n = 345, Observations = 692)					
M0: Control	13	1751		1778	.00	.10
M1: Baseline Working Hours	14	1724	26.75***	1753	.64	.15
M2: Baseline Income	15	1724	0.00	1755	.23	.15
M3: WTR	18	1719	5.23	1756	.13	.15
	Pro-Environmental Behaviour (PEB) (n = 862, Observations = 2019)					
M0: Control	13	3350		3376	.26	.55
M1: Baseline Working Hours	14	3350	0.05	3378	.10	.55
M2: Baseline Income	15	3349	1.11	3379	.06	.55
M3: WTR	18	3338	10.61*	3374	.58	.56

Note. Model names of the models with the highest Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction; AICc = Akaike's corrected Information Criterion; WoE = Weight of Evidence; PEB = pro-environmental behaviour.

[a]Generalized Binomial Linear Mixed-Effects Regression; values > 0 are treated as 1

[b]Values of 0 are treated as missing.

$^{\dagger}p < .10$

$^{*}p < .05$

$^{**}p < .01$

$^{***}p < .001$

[3] The USD exchange rate in May 2018 was 0.99, i.e. CHF 8313 (CHF 10,900) equalled USD 8230 (USD 10,790).

significantly improved prediction of the probability of having travelled by plane (as well as hours travelled by plane), of car travel, weekly hours commuted by car, and marginally significantly clothing expenditure; however, it did not improve the prediction of living space, probability of commuting by car, or PEB. In line with H1.2, the inclusion of baseline income (M2) significantly improved prediction of clothing expenditures, living space, probability of air travel, and (marginally significantly) hours of air travel and car travel; however, it did not significantly improve prediction of the probability of commuting by car or hours commuted by car, nor did it predict PEB.

The inclusion of WTR and interaction terms of interest (M3) significantly improved the prediction of clothing expenditure and PEB but did not significantly improve prediction of any other outcome variable, thus providing only mixed evidence for H1.3. Accordingly, WoE indicated that M3 was the best model included in the analyses only for clothing expenditure (WoE = 0.98) and PEB (WoE = 0.59). For living space, probability and hours of air travel, and general car travel, WoE pointed to M2 as the best model tested; for hours of car commuting, M1 was the best model included; and for the probability of car commuting, the control model M0 was the best model as indicated by WoE. The predictive quality of M3 ranged from moderate for clothing expenditure ($R^2 = 0.12$) to very high for PEB ($R^2 = 0.56$) and for living space ($R^2 = 0.46$; although this is likely inflated due to the inclusion of household size both as a predictor and a denominator of the dependent variable; see Ivanova et al., 2018).

Regression coefficients of Models 0–3 for all environmental behaviours can be found in Supplementary Materials S.2–9. In line with H1.1 assuming that longer working hours foster environmentally harmful behaviour (see coefficients of M1), baseline working hours were significantly predictive of higher probability of air travel, $OR = 1.29$**; more hours of air travel, $b^* = 0.10$*; more car travel, $b^* = 0.08$**; more hours of car commuting, $b^* = 0.24$***; and marginally significantly predictive of more clothing expenditure, $b^* = 0.06$, $p = .095$. Contrary to H1.1, baseline working hours did not significantly predict the size of living space, the probability of car commuting, or PEB.

In line with H1.2 (see coefficients of M2 in the Supplementary Materials), baseline income significantly predicted all environmental behaviours (in case of hours travelled by plane, prediction was only marginally significant) except for probability and hours of car commuting and PEB. Moreover, only for hours of car commuting, baseline working hours continued to explain variance despite inclusion of income ($b^* = 0.24$***). Contrary to our assumptions in H1.2, the inclusion of income decreased the effects of baseline working hours initially found in M1 to $b^* = -0.04^{n.s.}$ for clothing expenditure; to $OR = 1.03^{n.s.}$ for the probability of air travel; to $b^* = 0.05^{n.s.}$ for hours of air travel, and to $b^* = 0.03^{n.s.}$ for car travel. For living space, the inclusion of baseline income even inverted the direction of the regression coefficients of baseline working hours to $b^* = -0.09$**. Thus, except for car commuting and PEB, it must be presumed that the initially found effects of working hours in M1 explain environmental behaviour entirely due to the associated higher income.

Table 2 reports the regression coefficients for the Models 3 (M3). As the model indices in Table 1 already suggest, the change in hours worked over time (WTR) did not significantly improve explained variance for living space, probability and hours travelled by plane, and car travel. These measures are mainly explained by differences in baseline income. However, in accordance with the model indices in Table 1 and our H1.3, reducers reported significantly higher clothing expenditure at t0 compared to non-reducers, and their clothing expenditure decreased significantly at t1 and t2 compared to non-reducers. Notably, part of this significant decrease in comparison with non-reducers was due to an increase in clothing expenditure over time found among non-reducers (see Fig. 1B). Further, in line with H1.3, reducers displayed higher pro-environmental behaviour at t1 when compared to non-reducers,

Table 2
LMER fixed effects estimation for environmental behaviour measures for model M3.

Predictors	Clothing Expenditure		Living Space		Probability of Air Travel [a]		Air Travel [b]		Car Travel		Probability of Car Commuting [a]		Car Commuting [b]		Pro-Environmental Behaviour (PEB)	
	b[d]	SE	b[d]	SE	OR	SE	b[d]	SE	b[d]	SE	OR	SE	b[d]	SE	b[d]	SE
Intercept	−0.39[f]	0.08	0.23[f]	0.06	1.84[e]	0.41	0.01	0.11	0.42[f]	0.07	2181.01[f]	1933.07	0.16	0.11	−0.18[f]	0.06
t1	0.19[f]	0.04	0.00	0.01	0.11[f]	0.02	1.40[f]	0.10	−0.16[f]	0.04	0.76	0.26	−0.08	0.07	−0.03	0.02
t2	0.23[f]	0.04	0.02	0.01	0.26[f]	0.04	0.40[f]	0.09	−0.03	0.04	0.55[c]	0.19	−0.10	0.07	−0.07[e]	0.02
Gender: female	0.47[f]	0.07	0.06	0.06	1.35[c]	0.25	0.14	0.09	−0.07	0.06	1.34	0.88	−0.06	0.10	0.17[f]	0.05
Age	0.07[d]	0.03	0.14[f]	0.03	0.73[e]	0.07	0.07	0.05	−0.02	0.03	1.15	0.40	0.06	0.05	0.06[d]	0.02
Parent: Yes	−0.04	0.08	−0.13[c]	0.07	0.76	0.17	−0.46[f]	0.11	0.09	0.07	1.31	1.10	−0.18	0.12	0.01	0.06
Household Size	−0.04	0.04	−0.59[f]	0.03	0.70[e]	0.08	0.03	0.05	0.08[d]	0.04	1.14	0.46	0.01	0.06	0.08[e]	0.03
Urban Residence Area	0.10	0.06	−0.27[f]	0.05	1.28	0.22	0.08	0.08	−0.57[f]	0.06	0.00[f]	0.00	−0.16[c]	0.09	0.06	0.04
Education: University	0.09	0.07	−0.09	0.06	1.06	0.20	0.22[e]	0.09	−0.22[f]	0.06	0.21[d]	0.16	−0.21[c]	0.11	0.09[c]	0.05
Environmental Self-Identity	−0.13[f]	0.03	−0.09[e]	0.03	0.73[f]	0.07	−0.06	0.04	−0.20[f]	0.03	0.50[d]	0.17	0.03	0.05	0.65[f]	0.02
Materialistic Values	0.15[f]	0.03	0.02	0.03	1.16	0.10	0.04	0.04	0.08[e]	0.03	1.37	0.42	0.13[e]	0.04	−0.10[f]	0.02
Baseline Working Hours	−0.05	0.04	−0.09[e]	0.03	0.99	0.11	0.04	0.06	0.03	0.04	1.01	0.44	0.23[f]	0.05	0.00	0.03
Baseline Income	0.19[f]	0.04	0.20[f]	0.04	1.56[f]	0.19	0.10[c]	0.06	0.10[d]	0.04	1.49	0.70	0.01	0.06	−0.03	0.03
WTR (non-reducers vs. reducers)	0.27[e]	0.10	0.02	0.08	1.57	0.52	−0.01	0.14	−0.08	0.09	0.55	0.59	0.21	0.16	0.03	0.07
WTR x t1	−0.21[d]	0.10	−0.03	0.03	1.00	0.40	0.12	0.23	0.07	0.09	0.85	0.65	−0.18	0.18	0.16[e]	0.06
WTR x t2	−0.35[f]	0.10	0.02	0.03	0.98	0.40	0.15	0.21	−0.02	0.09	1.28	1.02	−0.42[d]	0.18	0.10	0.06

Note. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction, bd = regression coefficient with z-standardized numeric outcome variables using the mean and standard deviation at baseline.

[a] Generalized Linear Mixed-Effects Binomial Regression; values > 0 are treated as 1.

[b] Values of 0 are treated as missing.

[c] p < .10.

[d] p < .05.

[e] p < .01.

[f] p < .001.

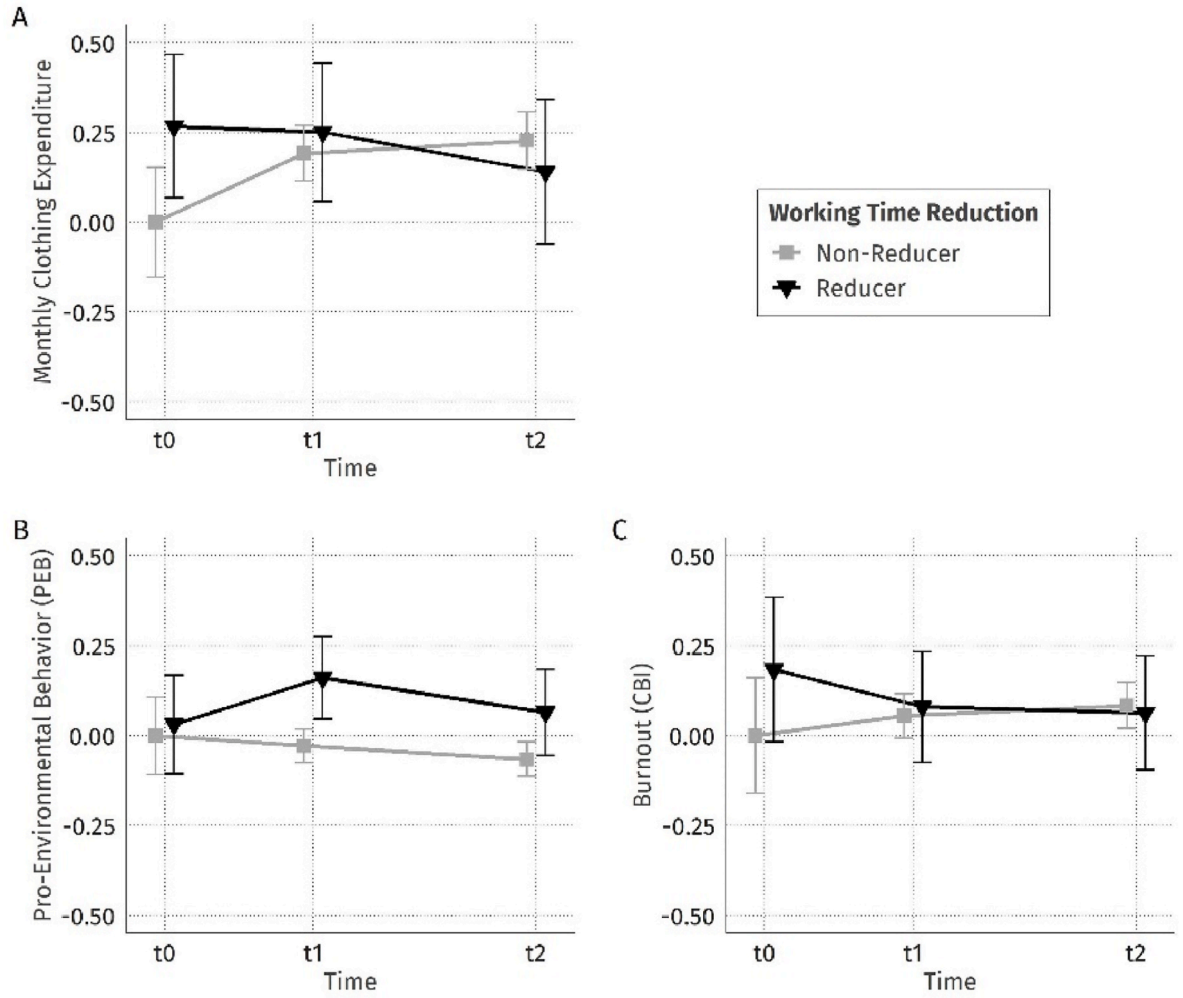


Fig. 1. Linear Mixed-Effects Regression Estimates of a Working Time Reduction (M3) *Note.* Baseline-standardized parameter estimations are shown for model M3 for baseline (t0), 4 months (t1), and 10 months (t2). Reducers lowered their working hours between t0 and t1. Error bars represent 95% confidence intervals. Panel A: Estimation of monthly clothing expenditure. Panel B: Estimation of pro-environmental behaviour (PEB). Panel C: Estimation of Burnout Tendency (CBI).

though this difference disappeared at t2; meanwhile, non-reducers displayed significantly lower PEB at t2 when compared to t0 (see Fig. 1C). Finally, car commuting showed an interesting pattern: The probability of whether a person commuted by car or not mainly depended on the urban or non-urban quality of their residential area, education level, and environmental self-identity (i.e. control variables in M0). However, the number of hours per week a person commuted by car mainly depended on the level of baseline working time (M1 which displayed better model indices than M3, probably due to the decreased sample size), and was found to be affected by WTR (M3). As shown in Table 2, reducers exhibited significantly fewer hours of car commuting at t2 compared to non-reducers.

Lastly, it is worth noting that the various environmental behaviours also appear to be related to psychological values and attitudes. As shown in Table 2, individuals with high environmental self-identity report lower spending on clothing, lower per capita living space, fewer car trips, and higher intent-oriented PEB (though they also show a higher likelihood for air travel and commuting by car). People with high materialistic values spend more on clothing, travel more kilometres by car, commute more by car, and report less intent-oriented PEB.

3.3. The effects of WTR on well-being

To test our hypotheses 2.1–2.3, we ran a similar series of the four LMER models explaining the four well-being outcome variables satisfaction with life (SWLS), positive emotions (SPANE-p), negative emotions (SPANE-n), and burnout symptoms (CBI). Model comparisons using ANOVA and AICc, as displayed in Table 3, showed strong evidence that the inclusion of every subsequent model improved the prediction of the well-being measures, except for M1 for SPANE-p. For all four well-being measures, Model 3 (M3) significantly improved the prediction, with WoE of 0.75 for SWLS, 0.71 for SPANE-p, .79 for SPANE-n, and 0.66 for CBI. This indicates that M3 with both the baseline level of working hours and income, as well as with the change in working hours over time (WTR), are relevant explanatory variables of all four well-being measures. The predictive quality of M3 was small to moderate, ranging from $R^2 = 0.06$ for SPANE-p to $R^2 = 0.14$ for SWLS.

Regression coefficients of Models 0–3 for each of the four well-being outcome variables can be found in Supplementary Materials S.10–S.13. As expected, higher working hours at baseline were significantly detrimental to individual well-being. By testing H2.1, i.e. the effect of baseline working hours without controlling for income in M1, we found that higher baseline working hours were significantly predictive of lower satisfaction with life (SWLS, $b^* = -0.08^*$); more negative emotions (SPANE-n, $b^* = 0.08^*$), and higher burnout tendency (CBI, $b^* = 0.15^{***}$). However, no significant effect was found for positive emotions (SPANE-p, $b^* = -0.04^{n.s.}$). Next, when baseline income was included (M2, testing for H2.2), we found a statistically significant positive effect of income on all four well-being measures, as expected (ranging from $b^* = -0.11^*$ for CBI and SPANE-n to $b^* = 0.29^{***}$ for SWLS). Moreover, as

Table 3
Model Comparison Indices for the Well-Being Models using LMER.

Model	ANOVA			Multimodel Inference		
	df	deviance	χ^2	AICc	WoE	R^2
	Satisfaction with Life (SWLS) (n = 864, Observations = 2029)					
M0: Control	13	4497		4524	.00	.10
M1: Baseline Working Hours	14	4492	5.63[b]	4520	.00	.11
M2: Baseline Income	15	4450	41.92[d]	4480	.25	.14
M3: WTR	18	4442	8.35[b]	4478	.75	.15
	Positive Emotions (SPANE-p) (n = 864, Observations = 2016)					
M0: Control	13	5030		5056	.02	.05
M1: Baseline Working Hours	14	5029	1.24	5057	.01	.05
M2: Baseline Income	15	5020	8.11[c]	5051	.22	.06
M3: WTR	18	5012	8.51[b]	5048	.75	.06
	Negative Emotions (SPANE-n) (n = 863, Observations = 2013)					
M0: Control	13	4904		4930	.00	.11
M1: Baseline Working Hours	14	4898	6.15[b]	4926	.02	.11
M2: Baseline Income	15	4892	6.46[b]	4922	.19	.12
M3: WTR	18	4883	9.01[b]	4919	.79	.12
	Burnout (CBI) (n = 864, Observations = 2009)					
M0: Control	13	4676		4702	.00	.06
M1: Baseline Working Hours	14	4657	19.06[d]	4685	.04	.08
M2: Baseline Income	15	4651	5.91[b]	4681	.28	.09
M3: WTR	18	4643	7.88[b]	4679	.68	.09

Note. Model names of the models with the highest Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression WTR = Working Time Reduction; AICc = Akaike's corrected Information Criterion; WoE = Weight of Evidence; SWLS = Satisfaction with Life Scale; SPANE-p = Scale of Positive and Negative Experiences – positive subscale; -n = negative subscale; CBI = Copenhagen Burnout Inventory – work-related burnout.
[a] $p < .10$.
[b] $p < .05$.
[c] $p < .01$.
[d] $p < .001$.

expected, the inclusion of baseline income in M2 increased the detrimental effect of working time for all four well-being variables, to $b^* = -0.24^{***}$ for SWLS; to $b^* = -0.11^*$ for SPANE-p; to $b^* = 0.14^{***}$ for SPANE-n; and to $b^* = 0.22^{***}$ for CBI. In line with our H2.2, this suggests a counter-directed effect of working hours and income: As working hours are negatively correlated with income, higher working hours mean higher well-being due to increased income, but lower well-being due to higher working time.

Table 4 reports the regression coefficients for Models 3 (*M3*) for each of the well-being outcomes. Again, M3 shows significant detrimental effects of baseline working hours for each of the four well-being measures, and positive effects of baseline income. Moreover, as expected in H2.3, experiencing WTR was found to lead to increased immediate well-being at t1, when comparing reducers to non-reducers: Reducers reported increased satisfaction with life (SWLS), more positive emotions (SPANE-p), less negative emotions (SPANE-n), and decreased burnout tendency (CBI) at t1 compared to non-reducers. The effect sizes by which the well-being measures improved at t1 for participants who reduced their working hours are similar to the well-being difference predicted by a baseline working hours difference of one standard deviation (i.e. about 9 working hours per week). However, the positive effects of WTR disappeared in the medium-term, 9 months after beginning the WTR (t2), except with regards to decreased burnout (CBI). The CBI values of reducers were still significantly lower at t2 when compared to those of non-reducers. As shown in Fig. 1A, the slightly higher initial values of burnout tendency (CBI) among reducers gradually converged with those of non-reducers over time.

Worthy of note are the consistently detrimental effects of materialistic values regarding all four well-being measures (see Table 4). By contrast, environmental self-identity displayed zero significant relationships with the well-being measures.

4. Discussion

With the present study, we sought to improve understanding of the possible co-benefits of WTR for individual well-being and the environment. Such co-benefits have been hypothesized by various researchers (Bader et al., 2020; Coote et al., 2010; Fitzgerald, 2022; Mastini et al., 2021; Stronge et al., 2019). We aimed to shed light on whether possible co-benefits are more likely due to time gains associated with reduced working hours, or to corresponding income losses. We added to this research field by conducting a longitudinal, three-wave survey of Swiss employees, including one group that voluntarily reduced their working hours over the course of the study. In line with previous research (e.g. Andersson et al., 2014; Buhl & Acosta, 2016; Devetter & Rousseau, 2011; Nässén & Larsson, 2015) – cross-sectionally comparing employees

Table 4
LMER fixed effects estimation for well-being measures for model M3.

Predictors	Satisfaction with Life (SWLS)		Positive Emotions (SPANE-p)		Negative Emotions (SPANE-n)		Burnout (CBI)	
	b*	SE	b*	SE	b*	SE	b*	SE
Intercept	0.10	0.08	0.17[b]	0.08	−0.22[c]	0.08	−0.08	0.08
t1	−0.04	0.03	−0.07[a]	0.04	−0.02	0.04	0.05[a]	0.03
t2	−0.02	0.03	−0.09[b]	0.04	0.01	0.04	0.08[c]	0.03
Gender: female	−0.12[a]	0.07	−0.17[b]	0.07	0.36[d]	0.07	0.12[a]	0.07
Age	−0.17[d]	0.04	−0.14[d]	0.04	−0.03	0.03	0.05	0.04
Parent: Yes	0.05	0.08	0.08	0.08	−0.04	0.08	−0.20[b]	0.08
Household Size	−0.01	0.04	−0.04	0.04	0.12[c]	0.04	0.06	0.04
Urban Residence Area	−0.15[b]	0.06	−0.09	0.06	0.04	0.06	0.09	0.06
Education: University	0.05	0.07	−0.16[b]	0.07	−0.01	0.07	0.12	0.07
Environmental Self-Identity	0.06[a]	0.03	0.03	0.03	0.02	0.03	−0.01	0.03
Materialistic Values	−0.24[d]	0.03	−0.19[d]	0.03	0.26[d]	0.03	0.18[d]	0.03
Baseline Working Hours	−0.25[d]	0.04	−0.11[c]	0.04	0.14[d]	0.04	0.21[d]	0.04
Baseline Income	0.30[d]	0.04	0.13[c]	0.05	−0.11[b]	0.04	−0.11[b]	0.05
WTR (non-reducers vs. reducers)	0.04	0.10	−0.04	0.10	0.11	0.10	0.18[a]	0.10
WTR x t1	0.17[b]	0.07	0.25[c]	0.09	−0.25[c]	0.09	−0.16[b]	0.08
WTR x t2	−0.01	0.08	0.05	0.10	−0.03	0.09	−0.20[b]	0.08

Note. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction, b* = regression coefficient with z-standardized numeric outcome variables using the mean and standard deviation at baseline.
[a] $p < .10$.
[b] $p < .05$.
[c] $p < .01$.
[d] $p < .001$.

with different working times and incomes – we found that working hours and income are important factors determining both individual well-being and environmental behaviour. Moreover, we observed differentiated patterns of change over time.

4.1. Working hours, income, and environmental behaviour

Based on the results of previous studies (Buhl & Acosta, 2016; Nässén & Larsson, 2015), we assumed that employees with lower workloads would have smaller ecological footprints, and that this could at least partly be attributed to the lower incomes associated with working less. Consistent with these prior insights and our hypotheses, we found such an income effect cross-sectionally for most of the indicators considered, namely the amount spent on clothing, the size of living space, kilometres of air travel, and hours of car travel. For all these indicators, any effect of working time can be fully explained by the associated higher income. Two exceptions to this were intent-oriented PEB and commuting by car. PEB was found to be influenced neither by the amount of working time nor by the amount of income when comparing workers (it was mainly predicted by environmental self-identity and materialistic values). Whether people commuted by car depended on the urban character of their residential area, their education level, and their environmental self-identity. However, according to our results, weekly hours spent commuting by car depended on their level of working hours (also when controlling for income). In this way, commuting by car was the only environmental measure in our study associated with the so-called time effect of working hours postulated by other researchers (Kallis et al., 2013; King & van den Bergh, 2017).

Regarding behavioural changes over time, the income-dependent environmental behaviours proved to be rather resistant to change, except for spending on clothing. However, in addition to clothing expenditures, we found effects of reduced working hours over time on commuting and intent-oriented PEB. These findings suggest that in our study's observation time of 9 months following a voluntary WTR, the time-related effects were more important than income-related effects, as PEB and commuting are assumed to be mainly influenced by the time effect rather than decreased income; commuting, for example, is primarily dependent on the days worked per week (Chai et al., 2015; Kallis et al., 2013; King & van den Bergh, 2017). One explanation for the apparent lack of the income effect in our longitudinal results could be that our group of voluntary reducers experienced income reductions that were too small to impact their GHG-relevant behaviour. Relatedly, for participants living in an income partnership, the percentual income reductions were likely even weaker when considered at the household level. A second explanation could be that many of the behaviours surveyed are subject to lock-in effects, that is, they "depend to a significant degree on external factors such as infrastructure and technology, institutions (e.g. social conventions, power structures, laws, and regulations) and unsustainable habits" (Ivanova et al., 2018, p. 117). People's dwelling, for example, has a large impact on their ecological footprint, and a working time reduction will not change this – unless it eventually causes one to move to a more energy-efficient (e.g. smaller) home. The situation may be similar regarding car travel: The place where one lives and works determines the daily routes that must be taken, and the availability of low-carbon alternatives such as public transport may be constrained, such that the GHG emissions caused by car travel are largely fixed. Accordingly, in our study, a change in working hours led to improvements in those environmental behaviours (clothing expenditure, car commuting hours, and PEB) that are less influenced by fixed infrastructure and people's chosen place of living, whereas no change could be seen in behaviours (car travel, living space, and air travel) that are subject to stronger lock-in dynamics. Future studies should thus particularly focus on the time- and income-sensitivity of different impact-related behaviours.

As for intent-oriented PEB, we found a short-term increase after the reduction of working time. It has been argued that more discretionary time might especially influence PEB for those with high environmental values, as they might be freed up to use this new discretionary time according to underlying environmental values (Chai et al., 2015). However, an ex-post analysis (see Supplementary Material S.14) showed no significant interaction effect between environmental self-identity and baseline working hours or between environmental self-identity and WTR when predicting PEB. The evidence that PEB is influenced by discretionary time is thus mixed in our study: Whereas baseline working hours did not predict PEB, we found an increase after the reduction of working hours. Future studies should thus look closer at the relationship between PEB, motivational variables, and discretionary time.

4.2. Working hours, income, and well-being

When cross-sectionally comparing employees with different working times and income, we expected that working hours and income would exhibit counter-directed effects on individual well-being. Taken together, our results support these expected effects: We found that employees with lower weekly work hours reported higher life satisfaction, fewer negative emotions, and lower symptoms of burnout and exhaustion. When controlling for income, these positive effects became even more pronounced, and also observable for the indicator of positive emotions. In turn, the level of income showed positive effects on all measures of well-being. Thus, our results suggest that lower working hours are beneficial for individual well-being, with an associated loss of income diminishing but not nullifying this effect. It can thus be argued that a working time reduction with full wage compensation would be more beneficial for well-being (as found by Barck-Holst et al., 2017; Lepinteur, 2019; Schiller et al., 2017), but positive, albeit smaller, effects could also be expected without corresponding wage compensation. Previous studies have reported detrimental effects on well-being when working particularly long hours (Virtanen et al., 2018), but indicated that longer working times – remaining in the range of normal working hours – are not detrimental to well-being (Pereira & Coelho, 2013). By contrast, our study suggests that this relationship is also evident in the range of normal working hours, but is partly buffered by the associated higher income. Positive effects of income on well-being have already been found by other researchers, but without explicitly controlling for the effect of working time (Diener et al., 2018). Some studies have also found satiation points for the positive effects of more income on well-being, and it has been argued that such plateauing may be due to increasing workload and concomitant decreased time available for other positive experiences (Jebb et al., 2018). Our results point in the same direction, especially since we did not find any higher-order effects of income on well-being in our sample in an ex-post analysis when controlling for working time, which would have pointed to a possible saturation of the income effect as suggested by previous research (Jebb et al., 2018; see Supplementary Material S.15). Nevertheless, future studies should explore the interaction of income and working time on well-being in more detail, especially to identify to what extent WTR should be accompanied by wage compensation to optimize beneficial effects for individual well-being.

Observations of changes in well-being over time among those who voluntarily reduced their working hours revealed a differentiated picture: Reducers' well-being improved in the first 3 months following WTR, even though their income also decreased over the course of the study. This supports our hypothesis that the time effect outweighs the income effect regarding individual well-being. After 9 months, we still observed improved burnout symptoms, however life satisfaction and positive and negative emotions decreased relative to their original levels. The lasting positive effect of WTR vis-à-vis burnout in our study is in line with previous research (e.g. Schiller et al., 2017) and shows an effect size comparable to intervention programs to reduce burnout among workers, physicians, and teachers, as found in meta-analyses (Ahola et al., 2017; Iancu et al., 2018; Panagioti et al., 2017). However, as can be seen in Fig. 1, the relative decrease in burnout linked to

WTR was partly due to an *increase* for non-reducers. As about half of the sample was recruited from several larger Swiss employers, this increase in burnout might stem from a greater workload falling to the co-workers of those who reduced their working hours. Indeed, an ex-post analysis comparing burnout amongst non-reducers from larger Swiss employers (i.e. with reducing co-workers; $n = 441$) with those recruited via social media and a market research institute (i.e. for whom it is unknown whether their co-workers reduced; $n = 216$) revealed a (non-significant) increase in burnout among those with reducing co-workers, see Supplementary Material S.24. Also, when excluding non-reducers recruited from larger Swiss employers, M3 was no longer significant for burnout, see Supplementary Material S.25. The interaction effect was still descriptively prevalent, and the insignificance might be due to a smaller sample size. Future research should further examine the company-wide effects of WTR policies on those who do not reduce their working hours. Nevertheless, at the individual level, WTR still represents a suitable approach for prevention of burnout.

Regarding the question of why a reduction of working time did not produce lasting increases in well-being for other measures (i.e. aside from burnout), there are at least three possible explanations. First, research on happiness adaptation suggests that many changes in well-being are only temporary, with well-being returning to its original level after some time (Sheldon & Lyubomirsky, 2006). These lines of research suggest that the reducers in our sample may have gradually become used to the time-related benefits of working less, following an initial boost in well-being. Secondly, and relatedly, some observers argue that WTR enables lasting increases in well-being primarily when they lead to increased time spent on enjoyable activities (Buhl & Acosta, 2016). As Sheldon and Lyubomirsky (2006) argue, changes in activities may be less prone to happiness adaptation than changes in circumstances. According to this reasoning, the participants in our sample who reduced their working time might only have spent more time on enjoyable activities in the short-term, eventually shifting to spending less time on enjoyable activities and more time on other tasks (e.g. childcare or other care work; see Lane et al., 2020). Lastly, it might be that the counter-directional effects of working time versus income came into play. Whereas the benefit of working less might have increased well-being immediately, the decrease in income might have had a delayed negative effect on well-being, eventually causing it to fall back to its initial level in the medium term. This delay could result from spending slowly adapting to income loss, with participants only gradually becoming aware of the reality of their reduced income. Additionally, participants may have used savings in the short term, only lowering their spending after several months.

4.3. Limitations

Our findings are subject to several limitations. First, participants in the WTR condition differed significantly from other participants at baseline: They lived in larger households, worked longer hours without earning higher incomes, and reported higher burnout values and more negative affect at baseline. Although we used a random intercept model in our analyses to account for between-subject differences and controlled for these variables, these differences might have nevertheless influenced the change in well-being and environmental behaviour over time, limiting the validity of our results to a certain degree. Relatedly, our sample was recruited from multiple larger Swiss companies with diverging WTR policies and via social media and a market research institute, the latter involving WTR company policies whose specifics were not entirely clear. This limits the conclusions that can be drawn concerning specific WTR policies. Future research should try to conduct randomized trials with a WTR condition and quasi-experimental field studies following the implementation of WTR policies in specific companies, as has been done for well-being measures (e.g. Barck-Holst et al., 2017; Schiller et al., 2017), but not for environmental behaviour. Second, our study was not representative of the Swiss population or the general populations of Western industrialized nations that future WTR policies might be applied to. Indeed, the effects of WTR may differ for workers distinct from those in the current sample. For example, the positive effect of WTR on well-being might only or especially apply to high-income earners such as those in our sample (although a recent study suggests positive well-being effects especially for low-to mid--income workers, even though these might also experience financial hardship after WTR; Persson et al., 2022). Further, WTR benefits might be lower among those who already work part-time. Additionally, although a large proportion of full-time workers appears willing to work less even with corresponding income losses (Angrave & Charlwood, 2015; Bartoll & Ramos, 2020; Holly & Mohnen, 2012), the effects of WTR policies might be smaller or even negative for those who do not desire to reduce their working time. Future research should seek to study the effects of WTR vis-à-vis different income classes, different working times, and different overemployment or underemployment levels. Third, although we included different well-being measures and environmental behaviours, WTR may have different effects on other measures not included in our analyses. In particular, there could be effects on other health-related indicators, on behaviour in other consumption domains, and on non-private environmental behaviour, such as activism and political engagement. For example, workers who reduce their working hours might consume more domestic energy; meanwhile, company-wide energy use may not decrease when individual workers reduce their working hours (King & van den Bergh, 2017). Future studies should try to include a different set of behaviours to complement this research. Fourth, it is possible that many impact-related behaviours stay relatively stable in the short or medium term following WTR, but eventually change over a longer time period than that observed in the present study (Antal et al., 2021). It would thus be beneficial to study the effects of WTR over a longer period, for example by using existing panel data. Lastly, WTR may lead to effects in ways beyond the scope of the present analysis (Antal et al., 2021). For example, it has been argued that WTR could stabilize national GHG emissions by causing paid work to become more evenly distributed, lowering the pressure for environmentally harmful growth to provide employment for everyone (Bader et al., 2020; D'Alessandro et al., 2020). On the other hand, a reduction in consumption among those reducing their working hours could lead to increased consumption by others due to declining prices (Alcott, 2008). These economic effects, however, are beyond the scope of the present study.

4.4. Conclusion

To sum up, a reduction of standard working time, accompanied by decreasing income, may enable reductions in individual GHG emissions, benefitting the environment and individual well-being. WTR is a promising policy to bring consumption levels of countries in the global North in line with the planetary boundaries of natural resources. The key question here is the extent to which people's income decreases because of WTR. While decreased income is decisive for the positive effects of WTR vis-à-vis the environment, reductions in income can also diminish people's well-being. Future WTR policies will have to carefully consider trade-offs to achieve co-benefits for both the environment and human well-being, for example by financially compensating low-income workers, but only partly compensating high-income workers or not at all (Bader et al., 2020; Schumacher et al., 2019). A voluntary one-day reduction in the working hours by individual employees, as in the present study, has positive effects for well-being and certain environmental behaviours. However, we suspect that the income effect, which is relevant for large ecological savings, only plays a limited role in this case. Thus, voluntarily working one day less per week will probably not achieve the full ecological potential that various studies have proposed.

Research funding

This work was supported by the Mercator Foundation Switzerland [grant number 2016-0112] and the German Federal Environmental Foundation [grant number 20019/605].

CRediT authorship contribution statement

Sebastian Neubert: Conceptualization, Methodology, Formal analysis, Writing – original draft, Funding acquisition. **Christoph Bader:** Conceptualization, Writing – review & editing, Project administration, Funding acquisition. **Hugo Hanbury:** Conceptualization, Writing – review & editing. **Stephanie Moser:** Conceptualization, Methodology, Writing – review & editing, Project administration, Funding acquisition.

Declaration of competing interest

None.

The study procedure was considered ethically unobjectionable by the ethical committee of the German Society for Psychology prior to implementation.

Acknowledgements

We would like to thank our colleagues Anu Lannen and Gerhard Reese as well as two anonymous reviewers for their helpful comments on an earlier version of this article. We also wish to thank WWF Switzerland for providing the footprint calculator items used in the survey.

Appendix

Table A.1
Characteristics of Participants at Baseline (t0) and Available Data per Wave and Group

Characteristics (t0)	Reducers (n = 110)			Non-Reducers (n = 755)				Total (N = 865)		
	M	SD	%	M	SD	%	Comparison Statistic	M	SD	%
Gender: Female			58.2			59.7	$\chi2 = 0.04$			59.5
Parent: Yes			60.0			57.1	$\chi2 = 0.22$			57.5
Urban: Yes			55.5			56.4	$\chi2 = 0.01$			56.3
Education: University			49.1			40.8	$\chi2 = 2.39$			41.8
Age	41.6	11.5		43.6	10.5		$t = 1.76$†	43.4	10.7	
Household Size	2.5	1.2		2.7	1.3		$t = 2.13$*	2.7	1.3	
Environmental Self-Identity	3.41	0.77		3.46	0.81		$t = 0.72$	3.46	0.80	
Materialistic Values	2.03	0.63		1.98	0.67		$t = -0.75$	1.99	0.66	
Baseline Working Hours	38.9	7.8		35.2	9.2		$t = -4.47$***	35.7	9.1	
Baseline Income	80,674	36,381		81,600	37,825		$t = 0.25$	81,482	37,625	
Household Income Contribution (%)a	58.68	17.76		56.14	22.21		$t = -0.95$	56.41	21.78	
Available Data per Wave										
Baseline			99.1			96.6				96.9
t1			93.6			69.4				72.5
t2			83.6			63.4				66.0

a Only participants in an income partnership, nReducers = 53, nNon-Reducers = 446
† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

Table A.2
Properties for Psychometric Scales at Baseline

Variable	n	M	SD	Cronbach's α
Environmental Self-Identity	837	3.44	0.83	.91
Materialistic Values	831	1.98	0.68	.81
Satisfaction with Life (SWLS)	835	5.11	1.04	.87
Positive Emotions (SPANE-p)	828	3.68	0.61	.84
Negative Emotions (SPANE-n)	829	2.42	0.69	.92
Burnout (CBI)	830	2.15	0.70	.85
Pro-Environmental Behaviour (PEB)	834	3.19	0.79	.81

Table A.3
Study Measures

Variable	Description and Example Items	Measurement
Control Variables		
Gender	Binary variable of gender	1 = female, 0 = other; nmissing = 0
Age	Age as of 31 December 2018	nmissing = 28
Education	Binary variable of highest educational degree	1 = university, 0 = no university; nmissing = 27
Household Size	Number of persons living in own household	Values > 7 were treated as 7; nmissing = 0
Parenthood	Binary variable whether children in own household	1 = yes, 0 = no; nmissing = 0
Residence Area (urban)	Binary variable whether living in a municipality with 20,000 inhabitants or more	1 = yes, 0 = no; nmissing = 27

(*continued on next page*)

Table A.3 (*continued*)

Variable	Description and Example Items	Measurement
Environmental Self-Identity	German translation of a 3-item measure from Van der Werff et al. (2014), indicating whether one sees oneself as environmentally friendly. "I see myself as an environmentally friendly person."	5-point Likert scale; 1 = totally disagree to 5 = totally agree; mean of t0, t1 & t2 used; nmissing = 0
Materialistic Values	German 6-item version (Müller et al., 2013) of the Material Values Scale (Richins, 2004); indicating materialistic value orientation. "I admire people who own expensive homes, cars, and clothes."	5-point Likert scale; 1 = totally disagree to 5 = totally agree; mean of t0, t1 & t2 used; nmissing = 0
Household Income Contribution	Percentual contribution to household income for participants in an income partnership	Participants answered categorically, category means were used
Working Time and Income (Predictors)		
Baseline Working Hours	Number of average/usual paid weekly working hours of the first questionnaire answered. "What is your average weekly working time in hours, considering all your employment?"	Participants answered either numerical or categorial, category means were used; nmissing = 0
Baseline Income	Numerical annual gross income at time of first questionnaire. "What is your approximate annual gross income (in CHF), considering all your employment?"	Participants answered categorial, category means were used; nmissing = 20
WTR	Binary variable whether a working time reduction of at least 4 h/week was observed at t1 or t2 compared to t0	1 = reducer, 0 = non-reducer
Environmental Behaviour (Outcome Variables)		
Clothing Expenditure	Categorial amount of money spent monthly on clothing and shoes for oneself; categories treated as quasimetric; according to WWF Switzerland (2017), higher expenditure is linked to higher emissions. "How much do you spend monthly on clothing and shoes for yourself?"	5 categories; 1 = very little (less than CHF 20/month) to 5 = a lot (>CHF 250/month)
Living Space	Numerical living space in m2 per person living in the household. "How large is your apartment/your house (heated living space) in m2?"	Values < 15 were treated as 15
Probability of Air Travel	Binary variable capturing whether any hours of travel by airplane for private purposes were indicated for the last 12 months (t0), 3 months (t1) or 6 months (t2)	1 = yes, 0 = no
Air Travel	Average monthly hours travelled by airplane for private purposes in the last 12 (t0), 3 (t1) or 6 (t2) months. "How many hours did you travel by airplane for private purposes in the last 12 months?"	Values of 0 were treated as missing; values > 11 were treated as 11
Car Travel	Average weekly km travelled by car in the last 12 (t0) or 3 (t1 & t2) months. "How many kilometres do you travel by car or motorbike per year (including work trips)?"	Participants answered categorial, category means were used
Probability of Car Commuting	Binary variable whether any hours were commuted by car in the last 4 weeks	1 = yes, 0 = no
Car Commuting	Average hours commuted by car per week in the last 4 weeks. "How many hours per week have you approximately spent on the following activity … Commuting to work by car or motorbike."	Values of 0 were treated as missing; values > 16 were treated as 16
PEB	5-item scale measuring pro-environmental behaviour adapted from Kaiser (2020). •"I buy fruit and vegetables according to the season." •"I am engaged in environmental protection. " •"I avoid shops and/or products that are proven to be environmentally harmful." •"I inform myself about different product alternatives and their production methods so that I can assess and compare their resource consumption. " •"I get books, information pamphlets or other materials that deal with environmental issues. "	5-point Likert scale; 1 = never to 5 = very often
Well-Being (Outcome Variables)		
SWLS	German version of the Satisfaction with Life Scale (Glaesmer et al., 2011; original scale by Diener et al., 1985); indicating cognitive subjective well-being. "I am satisfied with my life."	7-point Likert scale; 1 = totally disagree to 7 = totally agree
SPANE-p	Adapted German version of the Scale of Positive and Negative Experience (Rahm et al., 2017; original version by Diener et al., 2010); positive 6-item subscale indicating frequency of positive affect. "How often have you felt … ?" •"… positive" •"… good" •"… pleasant" •"… happy" •"… filled with joy" •"… contented"	5-point Likert scale; 1 = very rarely or never to 5 = always
SPANE-n	Negative 6-item subscale indicating frequency of negative, stress-related affect. "How often have you felt … ?" •"… bad" •"… unpleasant" •"… stressed" •"… overwhelmed" •"… concerned" •"… nervous"	5-point Likert scale; 1 = very rarely or never to 5 = always
CBI	German version of the work-related burnout subscale of the Copenhagen Burnout Inventory (Hanebuth et al., 2012; original scale by Kristensen et al., 2005). "Do you feel worn out at the end of the working day?"	5-point Likert scale; 1 = never/to a very low degree to 5 = very often/to a very high degree

Table A.4
LMER Results of a Working Time Reduction for Working Hours (hours per week) and Income (CHF per year)

Variable	Working Hours (n = 865, Observations = 2034)			Income (n = 865, Observations = 2036)		
	b	SE	b*	b	SE	b*
Intercept	40.21***	0.66	0.49	85,818***	2612	0.11
t1	−0.24	0.21	−0.03	−75	576	0.00

(*continued on next page*)

Table A.4 (*continued*)

Variable	Working Hours (n = 865, Observations = 2034)			Income (n = 865, Observations = 2036)		
	b	SE	b*	b	SE	b*
t2	−0.51*	0.21	−0.06	110	596	0.00
Gender: female	−5.95***	0.53	−0.65	−22717***	2131	−0.60
Age	0.82**	0.28	0.09	12,475***	1121	0.33
Parent: Yes	−3.36***	0.70	−0.37	−5527*	2785	−0.15
Household Size	−1.05**	0.34	−0.11	−341	1374	−0.01
Urban Residence Area	−0.28	0.54	−0.03	2870	2137	0.08
Education: University	1.63**	0.54	0.18	25,989***	2173	0.69
Environmental Self-Identity	−0.83**	0.28	−0.09	−4967***	1105	−0.13
Materialistic Values	0.86**	0.28	0.09	368	1101	0.01
WTR (non-reducers vs. reducers)	3.39***	0.82	0.37	−1192	3199	−0.03
WTR x t1	−8.85***	0.51	−0.97	−8313***	1412	−0.22
WTR x t2	−9.92***	0.53	−1.09	−10900***	1472	−0.29
R2	.25			.31		

* $p < .05$
** $p < .01$
*** $p < .001$

Note. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were used in their original scale for b-values and were z-standardized using the mean and standard deviation at baseline for b*-values. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction (non-reducers = 0, reducers = 1).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2022.101849.

References

Ahola, K., Toppinen-Tanner, S., & Seppänen, J. (2017). Interventions to alleviate burnout symptoms and to support return to work among employees with burnout: Systematic review and meta-analysis. *Burnout Research, 4*, 1–11. https://doi.org/10.1016/j.burn.2017.02.001

Alcott, B. (2008). The sufficiency strategy: Would rich-world frugality lower environmental impact? *Ecological Economics, 64*(4), 770–786. https://doi.org/10.1016/j.ecolecon.2007.04.015

Andersson, D., & Nässén, J. (2016). Should environmentalists be concerned about materialism? An analysis of attitudes, behaviours and greenhouse gas emissions. *Journal of Environmental Psychology, 48*, 1–11. https://doi.org/10.1016/j.jenvp.2016.08.002

Andersson, D., Nässén, J., Larsson, J., & Holmberg, J. (2014). Greenhouse gas emissions and subjective well-being: An analysis of Swedish households. *Ecological Economics, 102*, 75–82. https://doi.org/10.1016/j.ecolecon.2014.03.018

Angrave, D., & Charlwood, A. (2015). What is the relationship between long working hours, over-employment, under-employment and the subjective well-being of workers? Longitudinal evidence from the UK. *Human Relations, 68*(9), 1491–1515. https://doi.org/10.1177/0018726714559752

Antal, M., Plank, B., Mokos, J., & Wiedenhofer, D. (2021). Is working less really good for the environment? A systematic review of the empirical evidence for resource use, greenhouse gas emissions and the ecological footprint. *Environmental Research Letters, 16*(1), Article 013002. https://doi.org/10.1088/1748-9326/abceec

Bader, C., Hanbury, H., Neubert, S., & Moser, S. (2020). Weniger ist Mehr—der dreifache Gewinn einer Reduktion der Erwerbsarbeitszeit. Weniger arbeiten als Transformationsstrategie für eine ökologischere, gerechtere und zufriedenere Gesellschaft—implikationen für die Schweiz. In *CDE working paper*Centre for Development and Environment (CDE). https://doi.org/10.7892/boris.144160.

Barck-Holst, P., Nilsonne, Å., Åkerstedt, T., & Hellgren, C. (2017). Reduced working hours and stress in the Swedish social services: A longitudinal study. *International Social Work, 60*(4), 897–913. https://doi.org/10.1177/0020872815580045

Bartoll, X., & Ramos, R. (2020). Working hour mismatch, job quality, and mental well-being across the EU28: A multilevel approach. *International Archives of Occupational and Environmental Health, 93*(6), 733–745. https://doi.org/10.1007/s00420-020-01529-2

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1). https://doi.org/10.18637/jss.v067.i01

Bleys, B., Defloor, B., Van Ootegem, L., & Verhofstadt, E. (2018). The environmental impact of individual behavior: Self-assessment versus the ecological footprint. *Environment and Behavior, 50*(2), 187–212. https://doi.org/10.1177/0013916517693046

Bruderer Enzler, H. (2017). Air travel for private purposes. An analysis of airport access, income and environmental concern in Switzerland. *Journal of Transport Geography, 61*, 1–8. https://doi.org/10.1016/j.jtrangeo.2017.03.014

Bruderer Enzler, H., & Diekmann, A. (2019). All talk and no action? An analysis of environmental concern, income and greenhouse gas emissions in Switzerland. *Energy Research & Social Science, 51*, 12–19. https://doi.org/10.1016/j.erss.2019.01.001

Buhl, J., & Acosta, J. (2016). Work less, do less?: Working time reductions and rebound effects. *Sustainability Science, 11*(2), 261–276. https://doi.org/10.1007/s11625-015-0322-8

Chai, A., Bradley, G., Lo, A., & Reser, J. (2015). What time to adapt? The role of discretionary time in sustaining the climate change value–action gap. *Ecological Economics, 116*, 95–107. https://doi.org/10.1016/j.ecolecon.2015.04.013

Coote, A., Franklin, J., & Simms, A. (2010). 21 hours. In *Why a shorter working week can help us all to flourish in the 21st century*new economics foundation. https://neweconomics.org/2010/02/21-hours/.

Core Team, R. (2019). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/.

D'Alessandro, S., Cieplinski, A., Distefano, T., & Dittmer, K. (2020). Feasible alternatives to green growth. *Nature Sustainability, 3*(4), 329–335. https://doi.org/10.1038/s41893-020-0484-y

Devetter, F.-X., & Rousseau, S. (2011). Working hours and sustainable development. *Review of Social Economy, 69*(3), 333–355. https://doi.org/10.1080/00346764.2011.563507

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13

Diener, E., Oishi, S., & Tay, L. (2018). Advances in subjective well-being research. *Nature Human Behaviour, 2*(4), 253–260. https://doi.org/10.1038/s41562-018-0307-6

Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., & Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research, 97*(2), 143–156.

Druckman, A., Buck, I., Hayward, B., & Jackson, T. (2012). Time, gender and carbon: A study of the carbon implications of British adults' use of time. *Ecological Economics, 84*, 153–163. https://doi.org/10.1016/j.ecolecon.2012.09.008

Eurostat. (2020a). *Average number of usual weekly hours of work in main job, by sex, professional status, full-time/part-time and occupation (hours) (LFSA_EWHUIS) [Data File]* https://ec.europa.eu/eurostat/databrowser/bookmark/bac82a19-c958-4b2c-9fca-68c97944b0df?lang=en.

Eurostat. (2020b). *Part-time employment rate (TESEM100) [Data File]* https://ec.europa.eu/eurostat/databrowser/bookmark/16903bee-af97-4439-aa75-48922de23d69?lang=en.

Federal Office for the Environment. (2020). Federal Office of meteorology and climatology MeteoSwiss, & national center for climate services (NCCS). In *Klimawandel in der Schweiz. Indikatoren zu Ursachen, Auswirkungen, Massnahmen (No. 2013; Umwelt-Zustand* (p. 105). Federal Office for the Environment (FOEN) www.bafu.admin.ch/uz-2013-d.

Federal Statistical Office. (2020). In *Arbeitsmarktindikatoren 2020*. Federal Statistical Office (FSO). https://www.bfs.admin.ch/hub/api/dam/assets/13627182/ris.

Fitzgerald, J. B. (2022). Working time, inequality and carbon emissions in the United States: A multi-dividend approach to climate change mitigation. *Energy Research & Social Science, 84*, Article 102385. https://doi.org/10.1016/j.erss.2021.102385

Fitzgerald, J. B., Schor, J. B., & Jorgenson, A. K. (2018). Working hours and carbon dioxide emissions in the United States, 2007–2013. *Social Forces, 96*(4), 1851–1874. https://doi.org/10.1093/sf/soy014

Fremstad, A., Paul, M., & Underwood, A. (2019). Work hours and CO2 emissions: Evidence from U.S. Households. *Review of Political Economy, 31*(1), 42–59. https://doi.org/10.1080/09538259.2019.1592950

Frischknecht, R., Nathani, C., Alig, M., Stolz, P., Tschümperlin, L., & Hellmüller, P. (2018). Umwelt-fussabdrücke der Schweiz. In *Zeitlicher Verlauf 1996-2015. Bundesamt für Umwelt.* https://www.bafu.admin.ch/dam/bafu/de/dokumente/wirtschaft-konsum/uz-umwelt-zustand/uz-1811-d.pdf.download.pdf/uz-1811-d.pdf.

Glaesmer, H., Grande, G., Braehler, E., & Roth, M. (2011). The German version of the satisfaction with life scale (SWLS): Psychometric properties, validity, and population-based norms. *European Journal of Psychological Assessment, 27*(2), 127–132. https://doi.org/10.1027/1015-5759/a000058

Hanbury, H., Bader, C., & Moser, S. (2019). Reducing working hours as a means to foster low(er)-carbon lifestyles? An exploratory study on Swiss employees. *Sustainability, 11*(7), 2024. https://doi.org/10.3390/su11072024

Hanebuth, D., Aydin, D., & Scherf, T. (2012). Burnout and related conditions in managers: A five-year longitudinal study. *Psychology of Everyday Activity, 5*(3), 17–50.

Holly, S., & Mohnen, A. (2012). Impact of working hours on work-life balance. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2135453

Huddart Kennedy, E., Krahn, H., & Krogman, N. T. (2015). Are we counting what counts? A closer look at environmental concern, pro-environmental behaviour, and carbon footprint. *Local Environment, 20*(2), 220–236. https://doi.org/10.1080/13549839.2013.837039

Iancu, A. E., Rusu, A., Măroiu, C., Păcurar, R., & Maricuțoiu, L. P. (2018). The effectiveness of interventions aimed at reducing teacher burnout: A meta-analysis. *Educational Psychology Review, 30*(2), 373–396. https://doi.org/10.1007/s10648-017-9420-8

Independent Group of Scientists appointed by the Secretary-General. (2019). In *Global sustainable development report 2019: The future is now–science for achieving sustainable development.* https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf.

Inglehart, R., Foa, R., Peterson, C., & Welzel, C. (2008). Development, freedom, and rising happiness: A global perspective (1981–2007). *Perspectives on Psychological Science, 3*(4), 264–285. https://doi.org/10.1111/j.1745-6924.2008.00078.x

Ivanova, D., Vita, G., Wood, R., Lausselet, C., Dumitru, A., Krause, K., Macsinga, I., & Hertwich, E. G. (2018). Carbon mitigation in domains of high consumer lock-in. *Global Environmental Change, 52*, 117–130. https://doi.org/10.1016/j.gloenvcha.2018.06.006

Jalas, M. (2002). A time use perspective on the materials intensity of consumption. *Ecological Economics, 41*(1), 109–123. https://doi.org/10.1016/S0921-8009(02)00018-6

Jalas, M., & Juntunen, J. K. (2015). Energy intensive lifestyles: Time use, the activity patterns of consumers, and related energy demands in Finland. *Ecological Economics, 113*, 51–59. https://doi.org/10.1016/j.ecolecon.2015.02.016

Jebb, A. T., Tay, L., Diener, E., & Oishi, S. (2018). Happiness, income satiation and turning points around the world. *Nature Human Behaviour, 2*(1), 33–38. https://doi.org/10.1038/s41562-017-0277-0

Kahneman, D., & Deaton, A. (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the National Academy of Sciences, 107*(38), 16489–16493. https://doi.org/10.1073/pnas.1011492107

Kaiser, F. G. (2020). *GEB-50. General ecological behavior scale*. https://doi.org/10.23668/PSYCHARCHIVES.3453

Kallis, G., Kalush, M., O'Flynn, H., Rossiter, J., & Ashford, N. (2013). Friday off': Reducing working hours in Europe. *Sustainability Science, 5*(4), 1545–1567. https://doi.org/10.3390/su5041545

Kamerāde, D., Wang, S., Burchell, B., Balderson, S. U., & Coutts, A. (2019). A shorter working week for everyone: How much paid work is needed for mental health and well-being? *Social Science & Medicine, 241*, Article 112353. https://doi.org/10.1016/j.socscimed.2019.06.006

King, L., & van den Bergh, J. (2017). Worktime reduction as a solution to climate change: Five scenarios compared for the UK. *Ecological Economics, 132*. https://doi.org/10.1016/j.ecolecon.2016.10.011

Kleinke, K., Reinecke, J., Salfrán, D., & Spiess, M. (2020). *Applied multiple imputation: Advantages, pitfalls, new developments and applications in R*. Springer International Publishing. https://doi.org/10.1007/978-3-030-38164-6

Knight, K. W., Rosa, E. A., & Schor, J. B. (2013). Could working less reduce pressures on the environment? A cross-national panel analysis of OECD countries. *Global Environmental Change, 23*(4), 691–700. https://doi.org/10.1016/j.gloenvcha.2013.02.017, 1970–2007.

Kristensen, T. S., Borritz, M., Villadsen, E., & Christensen, K. B. (2005). The copenhagen burnout inventory: A new tool for the assessment of burnout. *Work & Stress, 19*(3), 192–207. https://doi.org/10.1080/02678370500297720

Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software, 82*(13), 1–26. https://doi.org/10.18637/jss.v082.i13

Lane, R., Arunachalam, D., Lindsay, J., & Humphery, K. (2020). Downshifting to care: The role of gender and care in reducing working hours and consumption. *Geoforum, 114*, 66–76. https://doi.org/10.1016/j.geoforum.2020.06.003

Lepinteur, A. (2019). The shorter workweek and worker wellbeing: Evidence from Portugal and France. *Labour Economics, 58*, 204–220. https://doi.org/10.1016/j.labeco.2018.05.010

Long, J. D. (2012). *Longitudinal data analysis for the behavioral sciences using R*. Sage.

IPCC. (2021). Summary for policymakers. In V. Masson-Delmotte, P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, K. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, & B. Zhou (Eds.), *Climate change 2021: The physical science basis. Contribution of working group 1 to the sixth assessment report of the intergovernmental panel on climate change*. Cambridge University Press.

Mastini, R., Kallis, G., & Hickel, J. (2021). A green new deal without growth? *Ecological Economics, 179*, Article 106832. https://doi.org/10.1016/j.ecolecon.2020.106832

Melo, P. C., Ge, J., Craig, T., Brewer, M. J., & Thronicker, I. (2018). Does work-life balance affect pro-environmental behaviour? Evidence for the UK using longitudinal microdata. *Ecological Economics, 145*, 170–181. https://doi.org/10.1016/j.ecolecon.2017.09.006

Moser, S., & Kleinhückelkotten, S. (2018). Good intents, but low impacts: Diverging importance of motivational and socioeconomic determinants explaining pro-environmental behavior, energy use, and carbon footprint. *Environment and Behavior, 50*(6), 626–656. https://doi.org/10.1177/0013916517710685

Müller, A., Smits, D. J. M., Claes, L., Gefeller, O., Hinz, A., & De Zwaan, M. (2013). *The German version of the material values scale*. German Medical Science GMS Publishing House. https://doi.org/10.3205/psm000095

Nässén, J., & Larsson, J. (2015). Would shorter working time reduce greenhouse gas emissions? An analysis of time use and consumption in Swedish households. *Environment and Planning C: Government and Policy, 33*(4), 726–745. https://doi.org/10.1068/c12239

Nielsen, K. S., Cologna, V., Lange, F., Brick, C., & Stern, P. C. (2021). The case for impact-focused environmental psychology. *Journal of Environmental Psychology, 101559*. https://doi.org/10.1016/j.jenvp.2021.101559

OECD. (2019). *Society at a glance 2019: OECD social indicators*. OECD. https://doi.org/10.1787/soc_glance-2019-en

O'Neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018). A good life for all within planetary boundaries. *Nature Sustainability, 1*(2), 88–95. https://doi.org/10.1038/s41893-018-0021-4

Otterbach, S., Wooden, M., & Fok, Y. K. (2016). Working-time mismatch and mental health. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2746232

Panagioti, M., Panagopoulou, E., Bower, P., Lewith, G., Kontopantelis, E., Chew-Graham, C., Dawson, S., van Marwijk, H., Geraghty, K., & Esmail, A. (2017). Controlled interventions to reduce burnout in physicians: A systematic review and meta-analysis. *JAMA Internal Medicine, 177*(2), 195. https://doi.org/10.1001/jamainternmed.2016.7674

Pereira, M. C., & Coelho, F. (2013). Work hours and well being: An investigation of moderator effects. *Social Indicators Research, 111*(1), 235–253. https://doi.org/10.1007/s11205-012-0002-3

Persson, O., Larsson, J., & Nässén, J. (2022). Working less by choice: What are the benefits and hardships? *Sustainability: Science, Practice and Policy, 18*(1), 81–96. https://doi.org/10.1080/15487733.2021.2023292

Pullinger, M. (2014). Working time reduction policy in a sustainable economy: Criteria and options for its design. *Ecological Economics, 103*, 11–19. https://doi.org/10.1016/j.ecolecon.2014.04.009

Rahm, T., Heise, E., & Schuldt, M. (2017). Measuring the frequency of emotions—validation of the scale of positive and negative experience (SPANE) in Germany. *PLoS One, 12*(2), Article e0171288. https://doi.org/10.1371/journal.pone.0171288

Richins, M. L. (2004). The material values scale: Measurement properties and development of a short form. *Journal of Consumer Research, 31*(1), 209–219. https://doi.org/10.1086/383436

Rosnick, D., & Weisbrot, M. (2007). Are shorter work hours good for the environment? A comparison of U.S. And European energy consumption. *International Journal of Health Services, 37*(3), 405–417. https://doi.org/10.2190/d842-1505-1k86-9882

Schiller, H., Lekander, M., Rajaleid, K., Hellgren, C., Åkerstedt, T., Barck-Holst, P., & Kecklund, G. (2017). The impact of reduced worktime on sleep and perceived stress – a group randomized intervention study using diary data. *Scandinavian Journal of Work, Environment & Health, 43*(2), 109–116. https://doi.org/10.5271/sjweh.3610

Schor, J. B. (2008). Sustainable consumption and worktime reduction. *Journal of Industrial Ecology, 9*(1–2), 37–50. https://doi.org/10.1162/108819805404581

Schumacher, K., Wolff, F., Cludius, J., Fries, T., Hünecke, K., Postpischil, R., & Steiner, V. (2019). *Arbeitszeitverkürzung—gut fürs Klima? Treibhausgasminderung durch Suffizienzpolitiken im Handlungsfeld 'Erwerbsarbeit' (No. 105/2019; TEXTE). Umweltbundesamt.* https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2019-09-05_texte_105-2019_energieverbrauchsreduktion_ap1_erwerbszeitreduzierung_final.pdf.

Shao, Q., & Shen, S. (2017). When reduced working time harms the environment: A panel threshold analysis for EU-15, 1970–2010. *Journal of Cleaner Production, 147*, 319–329. https://doi.org/10.1016/j.jclepro.2017.01.115

Sheldon, K. M., & Lyubomirsky, S. (2006). Achieving sustainable gains in happiness: Change your actions, not your circumstances. *Journal of Happiness Studies, 7*(1), 55–86. https://doi.org/10.1007/s10902-005-0868-8

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407–424. https://doi.org/10.1111/0022-4537.00175

Stronge, W., Harper, A., Guizzo, D., Ellis-petersen, M., & murray, N. (2019). *The shorter working week—a radical and pragmatic proposal*. Autonomy. http://autonomy.work/wp-content/uploads/2019/03/Shorter-working-week-docV6.pdf.

Switzerland, W. W. F. (Ed.). (2017). *Footprint calculator. World wide fund for nature*. WWF) Switzerland. https://www.wwf.ch/de/nachhaltig-leben/footprintrechner.

Van der Werff, E., Steg, L., & Keizer, K. (2014). Follow the signal: When past pro-environmental actions signal who you are. *Journal of Environmental Psychology, 40*, 273–282. https://doi.org/10.1016/j.jenvp.2014.07.004

Verhofstadt, E., Van Ootegem, L., Defloor, B., & Bleys, B. (2016). Linking individuals' ecological footprint to their subjective well-being. *Ecological Economics, 127*, 80–89. https://doi.org/10.1016/j.ecolecon.2016.03.021

Virtanen, M., Jokela, M., Madsen, I. E., Magnusson Hanson, L. L., Lallukka, T., Nyberg, S. T., Alfredsson, L., Batty, G. D., Bjorner, J. B., Borritz, M., Burr, H., Dragano, N., Erbel, R., Ferrie, J. E., Heikkilä, K., Knutsson, A., Koskenvuo, M.,

Lahelma, E., Nielsen, M. L., … Kivimäki, M. (2018). Long working hours and depressive symptoms: Systematic review and meta-analysis of published studies and unpublished individual participant data. *Scandinavian Journal of Work, Environment & Health, 44*(3), 239–250. https://doi.org/10.5271/sjweh.3712

Whillans, A. V., Dunn, E. W., Smeets, P., Bekkers, R., & Norton, M. I. (2017). Buying time promotes happiness. *Proceedings of the National Academy of Sciences*. https://doi.org/10.1073/pnas.1706541114, 201706541.

Wiedenhofer, D., Smetschka, B., Akenji, L., Jalas, M., & Haberl, H. (2018). Household time use, carbon footprints, and urban form: A review of the potential contributions of everyday living to the 1.5 °C climate target. *Current Opinion in Environmental Sustainability, 30*, 7–17. https://doi.org/10.1016/j.cosust.2018.02.007

Wooden, M., Warren, D., & Drago, R. (2009). Working time mismatch and subjective well-being. *British Journal of Industrial Relations, 47*(1), 147–179. https://doi.org/10.1111/j.1467-8543.2008.00705.x

Appendix 3: Manuscript 3

Neubert, S., Bader, C., Hanbury, H., & Moser, S. (2025). *Let's Call it a Week: Gendered Patterns of Time Use and Well-Being for Different Reduced Working Time Schedules* [Manuscript submitted for publication].

Let's Call it a Week:

Gendered Patterns of Time Use and Well-Being for Different Reduced Working Time Schedules.

Sebastian Neubert[1, 2], Christoph Bader[1], Hugo Hanbury[1], and Stephanie Moser[1]

[1]Centre for Development and Environment (CDE), University of Bern, Switzerland

[2]Social, Environmental, and Economic Psychology, University of Kaiserslautern-Landau, Germany

Sebastian Neubert https://orcid.org/0000-0001-7415-6583

Christoph Bader https://orcid.org/0000-0002-8991-353X

Hugo Hanbury https://orcid.org/0000-0003-3443-2285

Stephanie Moser https://orcid.org/0000-0002-1564-447X

Correspondence regarding this manuscript should be addressed to Stephanie Moser, Centre for Development and Environment (CDE), University of Bern, Mittelstrasse 43, 3012 Bern, Switzerland. Phone: +41 31 684 37 65. Email: stephanie.moser@unibe.ch.

Author contributions:

Sebastian Neubert: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Funding acquisition. **Christoph Bader:** Conceptualization, Writing – review & editing, Project administration, Funding acquisition. **Hugo Hanbury:** Conceptualization, Writing – review & editing. **Stephanie Moser:** Conceptualization, Writing – review & editing, Project administration, Funding acquisition.

Acknowledgements:

We would like to thank our colleague Marlène Thibault for language editing work on this article. We utilized ChatGPT as a tool for language editing following the final draft and prior to the final human review and language editing, as well as for generating code used in our data analyses.

Statements and Declarations:

Ethical considerations: The study procedure was considered ethically unobjectionable by the ethical committee of the German Society for Psychology prior to implementation.

Consent to participate: Informed consent was obtained through a checkbox confirmation prior to participation in the online surveys.

Consent for publication: Not applicable.

Declaration of competing interest: The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding statement: This work was supported by the Mercator Foundation Switzerland [grant number 2016-0112] and the German Federal Environmental Foundation [grant number 20019/605].

Data availability: The anonymised data set used in this study will be made available within the next three months at a public repository.

Keywords:

Gender, time use, subjective well-being, emotions, life satisfaction, burnout, working time, income, discretionary time, care work

Word count excluding title page, abstract, appendix and bibliography:

8,590

Let's Call it a Week:
Gendered Patterns of Time Use and Well-Being for Different Reduced Working Time Schedules.

1. Abstract

Working time reductions (WTRs) have been proposed as a strategy to improve employee well-being by increasing time for non-work activities and enhancing work-life balance. While previous research has generally supported the positive effects of WTRs on well-being, more recent findings are inconclusive. The well-being impact of WTRs largely depends on how individuals use their non-work time, a factor that often varies by gender. Moreover, little is known about the effects of different forms of WTR – such as working shorter days as opposed to a shorter week – on time use and well-being across genders. To address this gap, this study examines the time use and well-being outcomes of reduced working time schedules among employees in Switzerland.

Using standardized online survey data from 864 employees, we conducted Linear Mixed-Effects Regressions to explore how gendered working time arrangements influence time use and subjective well-being. As expected, longer working hours and overtime were associated with increased commuting time and less time for active leisure, care work, and sleep. More time spent working was also associated with lower levels of time affluence, life satisfaction, and emotional well-being. Gendered time use patterns revealed more nuanced dynamics: women working fewer days reported spending more time on care work and less time on active leisure; while men working fewer days reported significantly higher time affluence. Men working shorter days reported experiencing more commuting, but not increased active leisure.

Overall, these findings highlight the importance of incorporating gender and broader contextual factors into WTR policy and research. Effective policy design must consider occupational differences, gendered care responsibilities, and the diverse realities of employees to ensure WTRs achieve their intended benefits.

Keywords:

Gender, time use, subjective well-being, emotions, life satisfaction, burnout, working time, income, discretionary time, care work

2. Introduction

Social and environmental movements are increasingly promoting the concept of Working Time Reductions (WTRs) as a way of enhancing health and well-being as well as reducing resource use and carbon emissions (Antal et al., 2021; Balderson et al., 2022). However, the optimistic claims made by policy advocates and media outlets are at odds with the more modest outcomes reported in empirical studies. While the narratives presented in public discourse paint a positive picture of working fewer hours, many WTR trials show limited improvements in well-being and environmental impact (Antal et al., 2021; Lehmann et al., 2024). Several factors may explain this discrepancy. For example, many WTR trials include only minor reductions in working hours (Lehmann et al., 2024). Or they pay insufficient attention to the diverse forms of WTR, including at which societal level it is implemented, whether wage compensation is provided, and how schedules differ (e.g. shorter days vs a shorter week). While these variations influence outcomes, they remain underexplored (Hanbury et al., 2023). This knowledge gap limits the ability of policymakers, advocates, and organizations to design effective WTR schemes that meet their intended goals.

Working time and well-being

Well-being is the most consistently supported benefit of reduced working hours (Hanbury et al., 2023). Long working hours not only reduce the time available for non-work activities and relationships; they also drain one's psychological energy (Albertsen et al., 2008), inflict stress and strain, and are linked to depression (Sonnentag et al., 2023; Virtanen et al., 2018) and work–family conflict (Pascucci et al., 2022). Many full-time employees would prefer to work fewer hours (Antal et al., 2024; Piasna and De Spiegelaere, 2021). Both longitudinal and (quasi-)experimental studies link reduced working time to a range of well-being benefits, including a reduction in stress, negative emotions, burnout symptoms, and – particularly among women – work–family conflict, as well as improved physical (Litwiller et al., 2017; Neubert et al., 2022; Voglino et al., 2022). These findings are supported by cross-sectional and qualitative evidence (see, e.g. Jansen-Preilowski et al., 2020; Persson et al., 2022). Yet, the evidence remains mixed. Two recent longitudinal studies, for instance, found no clear improvements in many well-being measures following a reduction in working time (Mullens and Laurijssen, 2024; Neubert et al., 2022). This suggests that WTR outcomes depend on contextual or moderating factors that are still not fully understood (Lehmann et al., 2024).

One of these factors is how employees spend their time outside of work. Reducing working hours can free up time for recovery and non-work activities. Indeed, subjective perceptions of insufficient leisure time are a major reason people seek to work less (Castro and Bleys, 2024). This suggests that the well-being benefits of working less is likely mediated by how individuals use their non-working time. The relationship between time uses and well-being is complex and potentially bidirectional. However, evidence suggests that well-being gains from the way we use our time are mediated by the satisfaction of psychological needs (Brajša-Žganec et al., 2011; Rich et al., 2017). Under the DRAMMA model of leisure (Newman et al., 2014), leisure promotes well-being through the following six psychological needs: detachment, recovery, autonomy, mastery, meaning, and affiliation. While work-related demands such as workload, time pressure, and daily hassles are linked to increased stress, negative affect (e.g. anxiety and depression), and declines in well-being and health (Sonnentag et al., 2023), recovery and psychological detachment from work enhance well-being and health (Sonnentag et al., 2022; Wendsche and Lohmann-Haislah, 2017). However, detachment is harder to achieve with high workloads, long hours (Steed et al., 2021), and working overtime (Albertsen et al., 2008).

Consistent with the DRAMMA model, sleep, a core recovery activity, contributes reliably to well-being via both duration and quality (Bacaro et al., 2024; Litwiller et al., 2017). Active and social leisure – especially physical activity – is also consistently associated with well-being (Brajša-Žganec

et al., 2011; Kuykendall et al., 2015; Wiese et al., 2018). These activities support recovery while also fulfilling broader psychological needs (Sonnentag et al., 2022). In contrast, passive leisure such as watching TV (and likely screen time in general) may allow for detachment but fail to satisfy deeper needs like mastery or affiliation, often leading to poorer well-being outcomes (Kuykendall et al., 2020). Similarly, commuting by car or public transport – especially beyond a certain threshold – might not fulfil psychological needs and is associated with increased stress, reduced health, and lower well-being (Liu et al., 2022). Thus, well-being is likely to improve if reduced working hours allow individuals to reallocate time towards sleep and active leisure – and away from screen time and commuting. Evidence supports this potential: employees who reduce their working hours report spending more time on relaxation, sleep, exercise, and social activities (Persson et al., 2022). Qualitative studies further show increased engagement in psychologically rewarding activities such as volunteering, sports, hobbies, and skill development (Balderson et al., 2022). However, it remains unclear under what conditions workers actually reallocate their time towards such activities.

Complicating matters, for many employees, especially those who are parents, care work – rather than active leisure – dominates the time outside of paid employment. Care work broadly encompasses all activities that reproduce the necessary circumstances to meet one's needs, such as housework, cooking, and caring for children, the elderly, or sick individuals (Godin and Langlois, 2021). For parents, working fewer hours might result in smaller improvements in health and well-being (Persson et al., 2022), likely because the time saved is reallocated to care responsibilities rather than to recovery or leisure (Castro and Bleys, 2024; Hanbury et al., 2019; Neubert et al., 2022). As with other time uses, the relationship between care-related activities and well-being is complex. While caregiving can be perceived as burdensome, it may also foster stronger family relationships and improve work-life balance (Castro and Bleys, 2024). Problems arise when care demands and work obligations compete for limited time, leading to work–family conflict – an issue linked to increased stress, burnout, depression, parental strain, and a self-reported decline in health and well-being (Borgmann et al., 2019; Nohe et al., 2015; Pascucci et al., 2022; Rusu et al., 2025).

Women tend to experience more work–family conflict than men, as they shoulder a disproportionate share of care responsibilities due to persistent gender norms (Pascucci et al., 2022). As such, reducing working hours may be less a matter of personal choice for women and more a necessity to manage the dual demands of paid employment and unpaid care work (Piasna and De Spiegelaere, 2021). This contributes to persistent gender gaps in both paid and unpaid work: women and mothers take on more caregiving duties and are accordingly more likely to (prefer to) work part-time to accommodate these duties – leading to lower incomes and poorer career prospects, which further entrench this pattern (Antal et al., 2024; Gershuny, 2018; Piasna and De Spiegelaere, 2021). Working fewer hours does appear to reduce work–family conflict, especially for women, with those who work part-time or reduce their working hours consistently reporting lower levels of this conflict (Albertsen et al., 2008; Borgmann et al., 2019; Mullens and Laurijssen, 2024). For individuals with heavy caregiving burdens, relief from work–family conflict likely explains much of the well-being benefit from working less. Supporting this, research has found that women's health improved following a national, mandatory working time reduction, while men's health declined (Sánchez, 2017). These findings suggest that for caregivers, especially women, work–family conflict is a key mechanism linking reduced working hours to improved well-being, though further empirical research is needed.

Reduced working time schedules

Another underexplored dimension is how different WTR configurations affect time use and work–family conflict. With numerous ways to implement reduced working ours, a key factor lies in the structure of working time schedules. Most commonly, employees opt to work *fewer* days per week,

shorter days, or a combination of both. Other configurations include alternating weekly schedules, extended holiday periods, or accumulating overtime for a sabbatical. In this study, we focus on the two most prevalent configurations: working fewer days and working shorter days. Evidence indicates well-being benefits from both approaches, though few studies directly compare them. As a notable exception, one Swedish study found that participants working *fewer* days reported more sleep improvement, more time invested in active leisure, and feeling more rested than the respondents working shorter days (Persson et al., 2022). Also, evidence from studies on compressed workweeks (e.g. 40 hours over four days) show reduced stress on days off but increased stress and poorer health on extended workdays (Bolino et al., 2021). A non-compressed schedule with fewer, *not longer*, workdays might thus retain the benefits without the drawbacks (Hanbury et al., 2023). However, trials where workdays were reduced from eight to six hours in Sweden also led to improvements in well-being, health, sleep, and recovery time; increased reports of adequate time for family; and less intrusion of work into private life (Akerstedt et al., 2001; Barck-Holst et al., 2017, 2021; Schiller et al., 2017; see Hanbury et al., 2023 for an overview). Still, how specific reduced working time schedules relate to time allocation, work–family conflict, and overall well-being – particularly across genders – remains unclear and requires further investigation.

Hypotheses

This study seeks to understand how working time schedules influence patterns of time use and well-being. Specifically, we sought to answer the following key question: *Which reduced working time schedule offers greater well-being benefits, why, and how do these effects differ by gender?* We argue that reduced working time enhances well-being by enabling individuals to engage in activities that satisfy psychological needs (e.g. detachment, recovery, autonomy, mastery, meaning, and affiliation) and by alleviating work–family conflict. Formally, we hypothesize the following:

H1a: Working time and overtime are associated with different patterns of time use: less active leisure, care work, media use, sleep, and more commuting.

H2a: Working time and overtime are associated with lower well-being: namely, lower time affluence, life satisfaction, and fewer positive emotions, as well as more negative emotions and higher burnout symptoms.

We propose that working *fewer* days may better support well-being by enabling greater participation in non-work activities. Entire days off may offer stronger detachment from work compared to shorter workdays, as people are likely to ruminate about work more on the same day than on a previous day. Moreover, full days off might allow for more substantial engagement in active leisure, such as starting a new hobby, taking the children to the museum, or engaging in community activities. These activities often require both time and psychological energy, which may be in short supply for people working shorter days. Working shorter days may therefore result in more passive leisure activities such as screen time. However, an important benefit of shorter workdays is increased sleep, a passive yet core recovery activity (Akerstedt et al., 2001).

In addition, we hypothesize that working *shorter* days is more effective in reducing work–family conflict. Care work is constant, as children or elderly need daily care, transport to and from care facilities, or ongoing support throughout the day. Shorter workdays may better accommodate these demands than fewer but longer workdays. Aligning work hours with the operating hours of childcare or eldercare services is also more feasible with a shorter workday schedule. While compressed workweeks have also been shown to reduce work–family conflict (Bolino et al., 2021), we propose that shorter workdays are more effective in this regard. Lastly, working fewer days should reduce total commuting time, whereas working shorter days will not (King and Van Den Bergh, 2017).

H1b: Schedules of shorter days are associated with more care work, more media use, and more sleep. Schedules of fewer days are associated with more active leisure, more care work, more sleep, and less commuting.

The well-being effects of the hypothesized time use patterns for shorter days are more ambiguous than those for fewer days. For this reason, we assume that only the model of working fewer days has an impact on overall well-being.

H2b: Schedules of shorter days do not significantly affect well-being. Schedules of fewer days are associated with higher well-being.

Given that women report experiencing more work–family conflict than men, we propose that – under current societal gender norms – women benefit more from working *shorter* days which better reconcile daily caregiving with paid employment. By contrast, men may derive greater benefit from working *fewer* days, a schedule that frees up time for activities that fulfil psychological needs. This suggests that the well-being effects of reduced working time are shaped by the interaction of gender and working time schedule.

H1c: For women, the effect of working shorter days on care work is more pronounced than for men. The effect of working fewer days per week is more pronounced on care work and less pronounced on active leisure than for men.

H2c: For women, working shorter days has a more positive relationship with well-being than for men, whereas the relationship between working fewer days and well-being is less positive.

We also assume these gendered effects on well-being result from gendered patterns in time use.

H2d: Time use is associated with well-being. Thus, active leisure and sleep are positively associated with well-being, while commuting and media use are negatively associated with well-being. These time use patterns partially mediate the relationship between the interaction of gender and working time on well-being.

Using cross-sectional data from 864 Swiss employees, our findings confirm that time use and well-being outcomes associated with different working time schedules are gendered. Working time shows the expected relationships with time use and well-being. However, the effects of specific schedules on time use are mainly evident when gender is considered: women working fewer days engage less in active leisure and more in care work, while men working shorter days report increased commuting. Regarding well-being, the only significant schedule-related difference emerged for time affluence: men working fewer days feel more time-rich, while women do not. This time affluence effect did not translate to broader well-being indicators such as life satisfaction or emotional well-being. Furthermore, we found no mediating effect of time use on the relationship between working time schedule and well-being. Overall, therefore, these findings provide mixed support for our hypotheses.

3. Methods

Participants and procedure

This study draws on data from a quasi-experimental longitudinal study of German speaking employees in Switzerland that was conducted between May 2018 and February 2020. Participants in this study either reduced their working time by at least 4 hours per week or maintained their workload during the study. Data were gathered via three online questionnaires: before the planned WTR (t1), and three (t2) and nine months after (t3). Participants who did not reduce their working hours were surveyed at the same intervals. The data set has previously been used to examine longitudinal effects of working time

reduction on well-being and environmental behaviour (Neubert et al., 2022). While the original study focused on changes over time and group comparisons, for the present analysis we did not apply longitudinal or quasi-experimental methods. Instead, we used cross-sectional analyses with repeated measures across the three time points, applying multilevel modelling. This approach allowed us to maximize sample size, which was particularly important given the relatively small proportion of respondents reporting shorter workdays per time point (e.g. 14.8% at t1). Observations were excluded if respondents were retired, unemployed, reported atypical (extremely low or increasing) working hours, or where the responses were missing substantial data. After exclusions, the final sample comprised 864 participants, contributing a total of 2,020 observations. Sample characteristics at baseline can be found in Appendix A.1.

Measures

Each of the three questionnaires contained similar questions and were designed to take about 20 minutes to complete. In addition to the measures below, questionnaires assessed further sociodemographic variables, employees' work and life situation, and environmental behaviour (summarized in Neubert et al., 2022).

As outcome variables, participants reported their time use, indicating how often they engaged in 14 activities during the past four weeks. For each activity, they estimated weekly or daily hours, depending on the indicated frequency. Activities included a set of leisure activities, care work activities, volunteering, and commuting. Additionally, participants were asked to indicate their daily hours of *sleep*. For analyses, all values were recalculated to reflect hours per week spent on the respective activity. Activities were grouped into *active leisure* (sports, cultural events, hobbies, reading), *care work* (cooking, caring for children or elderly, household chores), and *commuting* (either by car, or by public transport). We analysed hours spent on *media use* (such as TV, internet surfing, and streaming) separately from active leisure, to take into account research that shows negative associations between media use and well-being.

The following five measures were used as well-being outcome variables: First, we included a measure of subjective Time Affluence (*TA*) as an indicator of a life without significant subjective time squeezes, as a measure of well-being more closely tied with time use. This measure consists of four items translated into German from the Material and Time Affluence Scale (Kasser and Sheldon, 2009). Additionally, cognitive well-being was measured using the Satisfaction with Life Scale (*SWLS*), emotional well-being with the positive and adapted negative Scale of Positive and Negative Experience subscales (*SPANE-p* and *SPANE-n*), and burnout with the work-related Copenhagen Burnout Inventory subscale (*CBI*); mean scores were calculated for each scale.

As independent variables, we included gender (*female* or not), *parental status*, *age*, and *university education*, all assessed at the first questionnaire each participant had answered. At each time point, we also recorded *household size*, *urban residence*, and *yearly gross income*. Participants reported their *regular working time* (weekly contracted hours; or averaged hours for the self-employed participants) and, for the past four weeks, the number of hours spent on paid work. If this exceeded their regular working time by at least five hours, it was coded as *overtime*.

As the main variable of interest, participants who had indicated they worked 38 hours per week or less in any questionnaire were asked whether they worked *shorter days* at least one day per week and whether they worked *fewer days* by at least one day per week in the respective questionnaire. These binary variables were both included in our analyses.

Data preparation and analysis

Because listwise deletion would have substantially reduced the sample size (see Appendix A.1 for missing value proportions), missing data were multiply imputed using predictive mean matching (Van Buuren, 2018) via the *mice* package (van Buuren and Groothuis-Oudshoorn, 2011) in R version 4.4.3 (R Core Team, 2025). Predictors were limited to variables from the same time point, except for responses to the same variable at other time points, to avoid an excessive number of predictors. Due to the high proportion of missing values in time use variables, 20 imputations were conducted. Only data from time points participants had answered were retained after imputation – as the inclusion of time points without answers would not have increased our predictive power – resulting in 864 participants and 2,020 observations for analyses.

After the imputation, we visually inspected the distributions of all variables and applied transformations if this decreased deviation from normality: MVS and CBI were log transformed, active leisure, media use, and SPANE-n were square-root transformed, care work hours and commuting were fourth root-transformed, and SWLS and SPANE-p were squared. All numerical variables were then *z*-standardized using the unimputed mean and standard deviation at the first time point. Binary variables were used as 0/1.

To test our hypotheses, we calculated five regression models for each of our time outcome variables and each imputation. We applied Linear Mixed-Effects Regression models (LMER) using the lme4 package (Bates et al., 2015) with random intercept models accounting for within-subject means (Long, 2012). Significance tests for pooled fixed-effects coefficients were calculated using Rubin's rules and Satterthwaite's degrees of freedom method via the lmerTest package (Kuznetsova et al., 2017). The five models were as follows: A control model (M0) included the intercept and time dummy variables and the control variables female, parent, household size, age, city, university, and yearly gross income. The working time model (M1) added regular working time and overtime, testing Hypothesis H1a. The schedule model (M2) added both dummy variables indicating whether participants had worked shorter days and/or fewer days (Hypothesis H1b). The final interaction model (M3) additionally included the interaction of gender and both schedule options (i.e. female x shorter days and female x fewer days), testing Hypothesis H1c. For well-being outcome variables, this approach was adapted: In addition to the equivalent three models M1 to M3, to test Hypothesis H2d, active leisure, care work, media use, sleep, and commuting were included in a last step (M4).

The different models for each outcome variable were compared using ANOVA with pooled models using Rubin's rules. Additionally, multi-model inference was used by calculating the mean of Akaike's corrected Information Criterion (AICc) and Weight of Evidence (WoE) for the different models (Long, 2012) and across all imputations. We also calculated the mean AICc rank of each of the three models across all imputations (as the statistical packages used for multi-model inference did not include a pooling procedure).

4. Results

To test our hypotheses, we analysed cross-sectional data of 864 Swiss employees donating up to three observations each, using Linear Mixed-Effects Regression analyses with multiply imputed data to address missing values. Key outcome variables included weekly time spent on various activities (active leisure, care work, media use, sleep, and commuting) and measures of well-being (time affluence, life satisfaction, positive and negative emotionality, and burnout). Independent variables encompassed socio-demographics, working time and overtime, and working time schedules. We compared nested models with ANOVAs using Rubin's rules and with multi-model inference (AICc and Weight of Evidence). Two sets of hypotheses were tested. First, the impact of working time, schedules, and the schedule–gender interaction on time use. Second, the impact of working time, schedules, and the schedule–gender interaction on well-being, and the mediating role of time use on well-being.

Predicting working time schedules

Before testing our hypotheses, we ran GLMER logit models to explain whether participants reported working shorter days or fewer days per week. As shown in Table 1, longer working hours were significantly associated with smaller odds of both outcomes. For working fewer days, household size and being female were marginally significant predictors of increased odds, while working overtime was significantly associated with lower odds. The models differed markedly in predictive power: R^2 = .47 for predicting fewer workdays per week, and R^2 = .04 for predicting shorter workdays. Thus, women and participants in larger households reported working fewer days more frequently, which was also associated with less overtime.

Table 1

Generalized Logit LMER Results for Working Shorter and Fewer Days

Variable	Working Shorter Days		Working Fewer Days	
	OR	*SE*	*OR*	*SE*
Intercept	0.00***	1.30	0.06*	1.13
t2	1.39	0.35	0.76	0.37
t3	1.93†	0.35	1.38	0.39
Gender: female	0.38	1.26	8.93†	1.15
Parent: yes	1.48	1.31	1.06	1.35
Female x Parent	1.42	1.51	0.16	1.63
Household Size	0.84	0.37	2.33†	0.45
Age	1.90	0.39	1.14	0.45
Education: University	2.70	0.72	1.81	0.84
Residence: Urban	2.20	0.66	2.91	0.78
Yearly Gross Income	0.97	0.43	0.92	0.49
Regular WT	0.11***	0.44	0.00***	1.22
Overtime: Yes	2.00	0.73	0.01***	1.07
R^2	.04 (.001)		.47 (.002)	

Note. Numeric predictors were *z*-standardized using t1 values, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. LMER = Linear Mixed-Effects Regression; WT = Working Time. *n*=864, Observations=2,020.

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Working time, overtime, and time use

To test Hypotheses H1a to H1c, we fitted four LMER models to predict five time use variables: active leisure, care work, media use, sleep, and commuting. Model comparison indices are shown in Table 2. Testing Hypothesis H1a – i.e. whether working time and overtime are associated with time use –

ANOVA tests and AICc comparisons provided support for the importance of working time and overtime in predicting time use. The inclusion of these two predictors significantly improved the model fit for all time use variables except for media use, for which the AICc for model M1 provided only slightly smaller probability, WoE = .28, than that for model M0, WoE = .39. Inspecting the fixed effects coefficients for M1 (which can be found in Supplementary Materials 1-5), regular working time was associated with time use mostly as hypothesized, namely with less active leisure, $b^* = -0.11$, $p < .001$, less care work, $b^* = -0.20$, $p < .001$, less sleep, $b^* = -0.18$, $p < .001$, and more commuting, $b^* = 0.16$, $p < .001$, but – contrary to our hypothesis – not with less media use. Overtime was similarly associated with time use mostly as expected, namely with less active leisure, $b^* = -0.21$, $p < .05$, less care work, $b^* = -0.10$, $p < .10$, and less sleep, $b^* = -0.29$, $p < .01$, but not with less media use or more commuting – contrary to our hypothesis. Still, working time and overtime are mostly associated with less time for other activities and more commuting, as hypothesized.

Gendered patterns of working time schedules and time use

We next tested Hypothesis H1b – i.e. whether working time schedules of shorter and fewer days are associated with the hypothesized time use patterns – through ANOVA tests and AICc comparisons of models M1 and M2. Support for our Hypothesis was very modest. The inclusion of schedules into the time use prediction only significantly improved the model fit for active leisure, while AICc comparisons provided some support for the importance of schedules in predicting sleep, where model M2 had the highest Weight of Evidence. Inspecting the fixed effects coefficients (Supplementary Materials 1-5), working fewer days was associated with less active leisure time, $b^* = -0.14$, $p < .05$, while working shorter days was marginally significantly associated with more sleep, $b^* = 0.14$, $p < .10$. Thus, working time schedules were mostly not associated with the hypothesized time use patterns.

ANOVA tests and AICc comparisons provided some evidence in support of a schedule × gender interaction (Hypothesis H1c). Adding this interaction to Model M3 marginally significantly improved model fit for care work and commuting, though not for the other outcomes. However, multi-model inference offered some additional support for the interaction in predicting active leisure (WoE = 0.35), where Model M3 also ranked second lowest after model M2. An inspection of fixed effects coefficients (Table 3) offered only partial support for hypothesized gendered time use patterns. Women reported significantly more time spent on care work when working *fewer* days than men, not, as hypothesized, when working shorter days. In addition, and as hypothesized, they reported marginally significantly less time spent on active leisure. Contrary to our hypotheses, working *fewer* days was not associated with *reduced* commuting. Instead, working *shorter* days was associated with *increased* commuting time, albeit not for women. Women spent less time on active leisure and more on care work when working fewer days, while men commute more when working shorter days.

Table 2

Model Comparison Indices for Time Use Models Using LMER

Model		ANOVA	Multimodel Inference			
	$n_{predictors}$	pooled likelihood ratio statistic (D1)	Mean AICc (*SE*)	Mean WoE (*SE*)	Mean Rank	Mean R^2 (*SE*)
			Active Leisure			
M0: Control	10		5114.24 (20.19)	0.00 (0.00)	4.00	.09 (0.01)
M1: Working Time	12	8.15***	5100.96 (20.18)	0.15 (0.05)	3.00	.10 (0.01)
M2: Schedule	14	3.19*	5098.45 (19.73)	0.50 (0.06)	1.15	.10 (0.01)
M3: Schedule Interaction	16	1.64	5099.15 (19.83)	0.35 (0.06)	1.85	.11 (0.01)
			Care Work			
M0: Control	10		3771.26 (23.49)	0.00 (0.00)	4.00	.47 (0.01)
M1: Working Time	12	36.99***	3698.20 (24.40)	0.43 (0.15)	1.55	.49 (0.01)
M2: Schedule	14	0.77	3700.52 (24.34)	0.13 (0.04)	3.00	.49 (0.01)
M3: Schedule Interaction	16	2.91†	3698.25 (24.04)	0.43 (0.17)	1.45	.49 (0.01)
			Media Use			
M0: Control	10		4767.71 (11.32)	0.39 (0.12)	1.40	.08 (0.00)
M1: Working Time	12	1.60	4768.32 (11.02)	0.28 (0.06)	2.25	.08 (0.00)
M2: Schedule	14	1.96	4768.34 (10.99)	0.28 (0.07)	2.35	.08 (0.00)
M3: Schedule Interaction	16	0.17	4772.02 (11.02)	0.04 (0.01)	4.00	.08 (0.00)
			Sleep			
M0: Control	10		5338.14 (29.74)	0.00 (0.00)	4.00	.02 (0.00)
M1: Working Time	12	16.61***	5305.56 (30.87)	0.42 (0.11)	1.55	.04 (0.00)
M2: Schedule	14	1.98	5305.18 (31.06)	0.49 (0.09)	1.45	.04 (0.00)
M3: Schedule Interaction	16	0.27	5308.57 (31.12)	0.09 (0.02)	3.00	.04 (0.00)
			Commuting			
M0: Control	10		4473.86 (21.40)	0.00 (0.00)	4.00	.12 (0.00)
M1: Working Time	12	16.27***	4442.49 (22.07)	0.40 (0.11)	1.55	.14 (0.00)
M2: Schedule	14	1.01	4444.37 (21.98)	0.16 (0.06)	2.90	.14 (0.00)
M3: Schedule Interaction	16	2.83†	4442.33 (22.33)	0.44 (0.14)	1.55	.14 (0.00)

Note. Model names of the models with the highest mean Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression; WT = Working Time; AICc = Akaike`s corrected Information Criterion; WoE = Weight of Evidence. *n*=864, Observations=2,020.

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 3

LMER Fixed Effects Estimation for Time Use Measures using Model M3

Predictors	Active Leisure		Care Work		Media Use		Sleep		Commuting	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.35***	0.10	-0.51***	0.07	0.48***	0.10	0.03	0.11	0.46***	0.09
t2	0.05	0.04	-0.03	0.02	0.06†	0.03	-0.05	0.04	0.02	0.03
t3	0.07†	0.04	-0.07**	0.03	0.00	0.03	-0.01	0.04	-0.02	0.03
Gender: female	-0.09	0.10	0.08	0.08	-0.20†	0.11	0.02	0.11	0.08	0.10
Parent: yes	-0.27*	0.12	0.64***	0.09	-0.21†	0.12	-0.06	0.13	-0.09	0.11
Female x Parent	-0.16	0.13	0.39***	0.10	0.12	0.14	-0.07	0.14	-0.01	0.13
Household Size	-0.06	0.04	0.20***	0.03	-0.10**	0.04	-0.06	0.04	0.00	0.03
Age	0.25***	0.03	-0.18***	0.03	0.05	0.04	0.01	0.04	-0.06†	0.03
Education: University	0.12†	0.06	-0.02	0.05	-0.34***	0.07	0.05	0.07	-0.25***	0.07
Residence: City	-0.08	0.06	0.02	0.05	-0.11†	0.06	-0.08	0.06	-0.51***	0.06
Yearly Gross Income	0.01	0.04	0.01	0.03	0.00	0.04	-0.03	0.04	0.11**	0.04
Regular WT	-0.15***	0.04	-0.20***	0.03	-0.01	0.03	-0.15***	0.04	0.17***	0.03
Overtime: Yes	-0.23**	0.08	-0.10†	0.06	-0.11	0.07	-0.28**	0.09	0.04	0.07
Shorter Days: Yes	0.04	0.11	-0.13	0.08	-0.04	0.10	0.20†	0.12	0.26**	0.10
Fewer Days: Yes	-0.02	0.09	-0.07	0.06	-0.12	0.08	0.07	0.09	-0.05	0.08
Female x Shorter Days	-0.01	0.13	0.13	0.10	-0.05	0.12	-0.10	0.14	-0.27*	0.12
Female x Fewer Days	-0.18†	0.10	0.15*	0.08	0.04	0.10	-0.03	0.11	0.05	0.09

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time, *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 4

Model Comparison Indices for the Well-Being Models Using LMER

Model		ANOVA	Multimodel Inference			
	$n_{predictors}$	pooled likelihood ratio statistic (D1)	Mean AICc (*SE*)	Mean WoE (*SE*)	Mean Rank	Mean R^2 (*SE*)
			Time Affluence			
M0: Control	10		4973.63 (3.99)	0.00 (0.00)	5.00	.08 (0.00)
M1: Working Time	12	38.61***	4900.47 (4.63)	0.00 (0.00)	3.15	.12 (0.00)
M2: Schedule	14	1.66	4901.16 (4.62)	0.00 (0.00)	3.85	.12 (0.00)
M3: Schedule Interaction	16	3.36*	4898.47 (4.68)	0.00 (0.00)	2.00	.13 (0.00)
M4: Time Use	21	37.44***	4722.02 (4.96)	1.00 (0.00)	1.00	.22 (0.00)
			SWLS			
M0: Control	10		4560.85 (6.67)	0.00 (0.00)	5.00	.03 (0.00)
M1: Working Time	12	11.50***	4542.14 (6.59)	0.01 (0.01)	2.00	.04 (0.00)
M2: Schedule	14	1.46	4543.23 (6.68)	0.01 (0.00)	3.50	.05 (0.00)
M3: Schedule Interaction	16	2.03	4543.22 (6.68)	0.01 (0.00)	3.50	.05 (0.00)
M4: Time Use	21	3.79**	4533.13 (6.45)	0.97 (0.02)	1.00	.06 (0.00)
			SPANE-p			
M0: Control	10		5095.67 (5.34)	0.00 (0.00)	5.00	.01 (0.00)
M1: Working Time	12	8.73***	5081.97 (5.68)	0.00 (0.00)	2.00	.02 (0.00)
M2: Schedule	14	0.02	5086.00 (5.67)	0.00 (0.00)	3.00	.02 (0.00)
M3: Schedule Interaction	16	0.53	5089.00 (5.71)	0.00 (0.00)	4.00	.02 (0.00)
M4: Time Use	21	11.45***	5038.09 (5.98)	1.00 (0.00)	1.00	.05 (0.00)
			SPANE-n			
M0: Control	10		5006.63 (5.04)	0.00 (0.00)	5.00	.03 (0.00)
M1: Working Time	12	13.40***	4983.26 (5.13)	0.00 (0.00)	2.00	.05 (0.00)
M2: Schedule	14	1.14	4985.03 (5.15)	0.00 (0.00)	3.00	.05 (0.00)
M3: Schedule Interaction	16	0.01	4989.06 (5.15)	0.00 (0.00)	4.00	.05 (0.00)
M4: Time Use	21	12.15***	4936.30 (6.84)	1.00 (0.00)	1.00	.08 (0.00)
			CBI			
M0: Control	10		4759.58 (12.31)	0.00 (0.00)	5.00	.02 (0.00)
M1: Working Time	12	17.85***	4726.70 (11.78)	0.04 (0.03)	2.00	.03 (0.00)
M2: Schedule	14	1.31	4728.12 (11.74)	0.02 (0.02)	3.00	.03 (0.00)
M3: Schedule Interaction	16	0.22	4731.73 (11.71)	0.00 (0.00)	4.00	.03 (0.00)
M4: Time Use	21	4.07**	4719.48 (12.24)	0.94 (0.05)	1.00	.04 (0.00)

Note. Model names of the models with the highest mean Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression; WT = Working Time; AICc = Akaike`s corrected Information Criterion; SWLS = Satisfaction with Life Scale; SPANE-p = Scale of Positive and

Negative Experiences – positive subscale; SPANE-n = – negative subscale; CBI = Copenhagen Burnout Inventory; WoE = Weight of Evidence. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Working time, overtime, and well-being

To test Hypotheses H2a to H2d, a series of five LMER models were fitted for each of the following well-being outcomes: life satisfaction, positive emotionality, negative emotionality, burnout symptoms, and time affluence. Testing Hypothesis H2a that working time and overtime are negatively associated with well-being, ANOVA tests showed general support for the hypothesis, as the inclusion of both predictors significantly improved the model fit for all five well-being variables (Table 4). Fixed effects coefficients (Supplementary Materials 6-10) were mostly in the hypothesized directions. Namely, working time was associated with less time affluence, b* = -0.24, p < .001, less life satisfaction, b* = -0.13, p < .001 and less positive emotionality, b* = -0.10, p < .01, as well as more negative emotionality b* = 0.15, p < .001 and burnout symptoms, b* =0.16, p < .001. Overtime was similarly associated with less time affluence, b* = -.37, p < .001 and positive emotionality, b* = -0.25, p < .01, as well as more negative emotionality, b* = 0.20, p < .01 and burnout symptoms, b = 0.24, p < .001, but – as an exception – not with life satisfaction. As expected, therefore, working time and overtime are thus mostly associated with lower well-being.

Gendered patterns of working time schedule and well-being

Testing Hypothesis H2b – whether working time schedule is related to well-being – ANOVA tests and multi-model inference provided no support for the inclusion of schedule into the prediction of the five well-being measures. Schedule alone seems not to be predictive of well-being – contrary to our hypothesis.

Model comparisons using ANOVA and multi-model inference also provided very limited support for Hypothesis H2c (i.e. whether the schedule–gender interaction predicts well-being). Including schedules and the interaction with gender (models M3) did not significantly improve well-being predictions for most variables. As an exception, M3 had a significantly improved prediction of time affluence as compared to M2. Fixed effects coefficients from models M3 (Supplementary Materials 6-10) showed that participants working fewer days reported significantly more time affluence, b* = 0.21, p < .05, but not if they were women, b* = -0.20, p < .05. Contrary to our expectations, women did not experience more time affluence when working shorter days. While not significant, coefficients for life satisfaction suggested more favourable effects for women working shorter days (in line with the hypothesis) *and* fewer days (contrary to the hypothesis). Thus, men experience more time affluence when working fewer days, while women do not – but women still might experience a higher level of well-being, though evidence for this is very limited.

Time use, well-being, and working time schedule

To test Hypothesis H2d – i.e. whether time use patterns are associated with well-being – M4 improved predictions across all well-being outcomes. Fixed effects coefficients (Table 5) largely support our Hypothesis H2d. Time spent on active leisure was significantly and positively associated with positive emotionality, life satisfaction, and time affluence, and significantly and negatively with negative emotionality and burnout symptoms. However, sleep was only significantly positively associated with time affluence and negatively with negative emotionality and (marginally significantly) with burnout symptoms, not with the other well-being variables, only partially in line with Hypothesis H2d. Media use was, as hypothesized, (marginally) significantly associated with lower life satisfaction and positive emotionality, and with higher negative emotionality. However, it did not predict burnout symptoms and was unexpectedly linked to higher time affluence. Also commuting time was (marginally)

significantly associated with less time affluence, more negative emotionality, and more burnout symptoms, but not with lower life satisfaction or positive emotionality. Also contrary to Hypothesis H2b, adding time use did not meaningfully alter the weak associations between working time schedules (or their gender interaction) and well-being. This is evident from fixed effects coefficient comparisons between M3 and M4 in Supplementary Materials 6–10, offering no support for the proposed mediation mechanism. Time use was thus mostly associated with well-being as expected, but this association does not mediate the relationship of working time schedules and the gender–schedule interaction with well-being.

Table 5

LMER Fixed Effects Estimation for Well-Being Measures for Model M4

Predictors	Time Affluence		SWLS		SPANE-p		SPANE-n		CBI	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.63***	0.15	0.13	0.15	0.26	0.16	-0.28†	0.16	-0.19	0.16
t2	-0.02	0.03	-0.03	0.03	-0.02	0.03	-0.05	0.03	0.04	0.03
t3	0.00	0.03	-0.05†	0.03	-0.11**	0.04	0.04	0.03	0.09**	0.03
Gender: female	-0.17†	0.09	-0.09	0.11	-0.10	0.11	0.27**	0.10	0.06	0.11
Parent: yes	-0.01	0.10	0.11	0.12	0.15	0.12	-0.09	0.12	-0.14	0.13
Female x Parent	-0.09	0.11	-0.11	0.14	-0.14	0.14	0.02	0.13	-0.03	0.14
Household Size	-0.10**	0.03	0.04	0.04	0.00	0.04	0.05	0.04	-0.01	0.04
Age	0.08*	0.03	-0.09*	0.04	-0.11**	0.04	-0.04	0.04	0.01	0.04
Education: University	-0.17**	0.06	0.17*	0.07	-0.12†	0.07	-0.02	0.07	0.08	0.07
Residence: City	0.00	0.05	-0.10†	0.06	-0.08	0.06	0.01	0.06	0.08	0.06
Yearly Gross Income	0.03	0.03	0.13***	0.04	0.06	0.04	-0.08*	0.04	-0.03	0.04
Regular WT	-0.18***	0.03	-0.09**	0.03	-0.08*	0.04	0.11**	0.04	0.12***	0.03
Overtime: Yes	-0.28***	0.07	-0.02	0.06	-0.23**	0.08	0.15*	0.07	0.21**	0.07
Shorter Days: Yes	0.05	0.10	-0.09	0.10	-0.05	0.11	0.05	0.11	-0.05	0.10
Fewer Days: Yes	0.20**	0.08	0.00	0.08	-0.08	0.09	-0.07	0.09	-0.08	0.08
Female x Shorter Days	-0.18	0.12	0.14	0.11	0.06	0.13	0.00	0.13	-0.04	0.12
Female x Fewer Days	-0.16†	0.09	0.15†	0.09	0.12	0.10	-0.02	0.10	0.04	0.09
Active Leisure	0.15***	0.02	0.07***	0.02	0.14***	0.02	-0.13***	0.02	-0.07***	0.02
Care Work	-0.09**	0.03	0.00	0.03	0.00	0.03	0.07*	0.03	0.03	0.03
Media Use	0.09***	0.02	-0.04†	0.02	-0.11***	0.02	0.04†	0.02	0.03	0.02
Sleep	0.17***	0.02	0.01	0.02	0.02	0.02	-0.08***	0.02	-0.04†	0.02
Commuting	-0.30***	0.08	-0.12	0.07	-0.10	0.08	0.14†	0.08	0.14†	0.08

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time; SWLS = Satisfaction with Life Scale; SPANE-p = Scale of Positive and Negative Experiences – positive subscale; SPANE-n = – negative subscale; CBI = Copenhagen Burnout Inventory, *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

5. Discussion

Summary of results

This study hypothesized that gender influences how specific working time schedules affect time use and well-being. We expected women to use non-work time to reduce work–family conflict through increased care work, and that they would therefore benefit more from working shorter, rather than fewer, workdays. In contrast, we expected men to use non-working time for active leisure, particularly when working fewer days. Accordingly, we anticipated more positive well-being effects from shorter days for women and from fewer workdays for men, with time use mediating these outcomes. We tested these hypotheses using Linear Mixed-Effects Regressions on data from 864 Swiss employees, each with up to three measurement points.

While working time and overtime showed anticipated associations with time use – i.e. less time spent on active leisure, care work, and sleep; more time spent on commuting – the gendered patterns of time use proved more complex. Women reported less active leisure and more care work when working fewer days, and more care work (though not significantly) when working shorter days. In contrast, men did not report increased active leisure when working fewer workdays and spent *more* time commuting on *shorter* days – a pattern not observed in women.

In terms of well-being, working time and overtime played an important and independent role in predicting time affluence, life satisfaction, positive and negative emotionality, and burnout symptoms. However, few significant links emerged for working time schedules. Only men reported higher time affluence when working fewer days. There were nonsignificant positive trends for women working shorter or fewer days on life satisfaction and positive emotionality. Finally, time use was associated with well-being as expected, but did not mediate the effects of schedule–gender interactions.

Gendered effects of working time schedules, care work, and well-being

Our study highlights how gender mediates the impact of reduced working hours and specific schedules on time use and, to a lesser extent, well-being. Gender and schedule interacted to explain differences in care work and active leisure. Notably, women reported *less* time affluence when working fewer days, despite a suggestively *higher* subjective well-being. Many women reduce their working hours primarily to meet care work demands, which disproportionally fall on them, and as such, their working time and schedule choices are a coping strategy to prevent work–family conflict (Castro and Bleys, 2024; Lane et al., 2020; Lindsay et al., 2020). These findings underscore the enduring influence of traditional gender roles – i.e. the male breadwinner and female caregiver model – on the outcomes of reduced work time. This aligns with research showing that while gender gaps in paid employment and unpaid care work have narrowed, women still carry the bulk of care responsibilities (Gershuny, 2018). And that in France, a reduction in working hours led to more time invested into care work for women, but not for men (Pailhé et al., 2019). Our results suggest that future research on working time schedules should explicitly take into account work–family conflict.

However, contrary to our expectations, we did not observe improved well-being among women working shorter days. One possible explanation lies in Switzerland's childcare system, where facilities are only partly subsidized and typically charge per day of use. It thus is financially advantageous for part-time working parents to work fewer days to minimize childcare expenses. Supporting this, our findings showed that women as well as participants in larger households (e.g. those with more children) were significantly more likely to work fewer days, when controlling for working hours. Overall, these findings underscore the necessity of incorporating gender and care considerations into the design of working time reduction (WTR) policies, as their effects may differ substantially across genders.

Low predictive relevance of working time schedule

While working time schedules – and their interaction with gender – significantly shape time use and, to a lesser extent, certain well-being measures, their overall predictive power appears limited. Several factors may explain this.

First, subjective well-being is a broad construct shaped by diverse influences, including socio-economic conditions, personality traits, and genetics (Bartels, 2015; Dolan et al., 2008). Given this complexity, the impact of working time and schedules on well-being are likely to be modest. This aligns with previous findings: a longitudinal study using the same data set found that well-being gains from reduced hours were short-lived, dissipating after 10 months (except for burnout symptoms; Neubert et al., 2022), while another longitudinal study similarly found no significant well-being effects of an organizational WTR (Mullens and Laurijssen, 2024). In our study, working time schedules had a stronger association with time affluence – a well-being measure more closely tied to time use – than with broader emotional or cognitive well-being indicators.

Second, reasons behind the decision to work less may vary, including a desire for more leisure time, the need to care for children or elderly relatives, or poor health (Antal et al., 2024; Hanbury et al., 2019). It has also been suggested that working less might be a choice to cope with particularly stressful occupations (Persson et al., 2022). These diverse motives likely influence both the outcomes and the type of schedule chosen – e.g. some may work shorter days to align with childcare hours, while others may work fewer days to reduce childcare costs. This variability limits the generalizability of effects across individuals. Supporting this, prior research shows that alignment between desired and actual working hours is more relevant for overall well-being than total hours worked, highlighting individual differences (Albertsen et al., 2008; Angrave and Charlwood, 2015).

Third, the effects of working time schedules on well-being are likely additionally moderated by job characteristics. WTRs may benefit blue-collar and social services employees more than white-collar employees, due to the former's higher levels of physical and psychological job strain. In contrast, white-collar roles may experience work intensification after a reduction in hours (Berniell and Bietenbeck, 2020; Hanbury et al., 2023; Persson et al., 2022). One study found that part-time workers reported greater stress when working shorter (rather than fewer) days – an effect less pronounced among blue-collar workers. This may reflect differing expectations: goal-oriented jobs (typical of white-collar work) may allow more flexible hours, but also increase perceived time pressure (Persson et al., 2022).

Other workplace factors also shape the relationship between working hours and well-being – such as job resources, interpersonal dynamics, leadership quality, and personality traits (Barnes et al., 2023; Sonnentag et al., 2023), as well as how important and successful out-of-work recovery is (Sonnentag et al., 2022). Crucially, not all work is detrimental, and not all leisure is restorative. For some, meaningful work meets core psychological needs – autonomy, relatedness, mastery, structure, and meaning – especially when jobs are secure and manageable (Pullinger, 2014). In other words, working less might only improve well-being when it better satisfies psychological needs than the job itself (Rich et al., 2017).

Taken together, the limited predictive power of working time schedules on well-being underscores the need for future research to explore the underlying mechanisms by which working less might improve well-being – particularly the roles of job characteristics, individual motivations, and the fulfilment of psychological needs.

Counterintuitive effects of working shorter and fewer days

Contrary to our hypotheses, working fewer days did not lead to increased time spent on active leisure or care work, nor did it reduce commuting time. In fact, women working fewer days spent *less* time on active leisure, and men working shorter days actually commuted *more* – a surprising outcome, as one would expect fewer days worked to correlate with less commuting (King and Van Den Bergh, 2017; Percoco, 2018).

These counterintuitive findings may be partly explained by our statistical controls. When total working hours were held constant, working shorter days was linked to less active leisure time for women and more commuting time for men. However, in absolute terms (without controlling for hours), shorter workdays might generally lead to *more* active leisure and little change in commuting. This suggests a comparison effect: our models may be contrasting shorter and fewer workdays with alternative flexible arrangements – such as long shifts, additional vacation days, or schedules with fewer workdays every other week. Compared to these, consistently working shorter days might indeed be associated with less active leisure (for women) and longer commutes (for men).

Measurement issues may have also contributed to this effect. The model predicting shorter workdays based on working hours had low accuracy, suggesting ambiguity in how participants interpreted the question. For instance, many Swiss companies have shorter hours on Fridays, so some employees might report working shorter days even if this only occurs once a week – not regularly enough to constitute a distinct schedule. This could have weakened the validity of the measure and blurred observed effects.

As for the gendered patterns in commuting, these may also reflect broader occupational characteristics. Higher-income, higher-responsibility jobs – more often held by men – tend to involve longer commutes but may also come with greater schedule autonomy. Our data supports this: higher income was linked to longer commuting times. Individuals in such roles might have the flexibility to self-determine their hours, offsetting shorter days with longer ones elsewhere in the week. Research shows that flexibility and control over one's schedule are linked to improved well-being (Bolino et al., 2021; Sonnentag et al., 2023). Thus, the impact of part-time schedules likely reflects not only how many hours or days are worked, but the flexibility embedded in those arrangements. Men reporting shorter workdays may be doing so within high-autonomy roles that support such flexibility – an option potentially less available to women. It is also possible that part-time roles are rarer in male-dominated fields, meaning men who opt for shorter days must accept longer commutes as a trade-off.

Although these patterns were unexpected, they highlight the importance of examining the gendered dimensions of working time schedules. Future research and policy on working time reduction should account for these nuanced influences on time use and well-being.

Limitations

This study has several significant limitations. Although we used a longitudinal sample and applied repeated measures via Linear Mixed-Effects Regression models (LMER), our analyses were cross-sectional. As such, we cannot draw causal conclusions. Given that research on the specific effects of working time schedules on time use and well-being is still in its early stages, cross-sectional designs are a useful starting point. Nonetheless, future studies would benefit from longitudinal and experimental approaches to more rigorously investigate causal relationships.

Second, while our sample included a relevant demographic – employees of varying ages and genders – the overall sample size was relatively small. This limited our statistical power and restricted the inclusion of control variables and interaction terms. Key moderating factors, such as parenthood status or job type (e.g. manual vs. knowledge work), could not be examined in detail. For example, a three-

way interaction between gender, parenthood, and working time schedule would have been highly relevant, especially considering the central role of childcare in care work. This was beyond our scope but should be addressed in future research using larger data sets, such as national panel data.

Third, our time use methodology had inherent limitations. While adequate for our research goals, more robust methods like experience sampling (Beal, 2015) could provide greater accuracy, though at higher logistical and financial cost. Moreover, evidence suggests that the *frequency* and *variety* of leisure activities, rather than total time spent, may better predict well-being (Kuykendall et al., 2015) – a dimension our study did not capture. Future research should incorporate more sophisticated time use methodologies or leverage high-quality existing time use data.

Conclusion and outlook

To our knowledge, this is one of the first studies to examine the gendered effects of different working time schedules on time use and well-being. While not definitive, our findings offer valuable directions for future inquiry. They reveal a complex, nuanced relationship between working time arrangements, gender, time allocation, and well-being. Some patterns – such as the gendered division of care work – reinforce established findings, while others, particularly regarding part-time schedules, diverge from expectations.

These insights highlight the importance of context – such as job characteristics and individual circumstances – in shaping the effects of working time reductions. They also signal the need for more differentiated approaches in research and policy design.

Reducing working hours is often promoted as a path toward improved well-being, greater gender equality, and ecological sustainability (Antal et al., 2021; Hanbury et al., 2023; Lehmann et al., 2024). But realizing these benefits will require policies that account for occupational diversity, personal constraints, and – crucially – gender dynamics. Only when these complexities are acknowledged and explored can the science of working time reduction call it a day.

Table A1

Participant Characteristics Without and With Multiple Imputation at t1

Characteristic	Unimputed				Pooled Multiple Imputation		
	M	*SD*	%	Missing %	*M* (*SE*)	*SD* (*SE*)	% (*SE*)
Gender: female			59.5	0.1			59.5 (1.67)
Parent: yes			60.2	14.0			59.7 (1.74)
Education: University			41.9	3.1			41.9 (1.70)
Residence: City			56.4	3.7			56.6 (1.71)
Overtime: yes			3.0	6.6			2.9 (0.58)
Shorter Days: Yes			14.8	3.6			14.6 (1.21)
Fewer Days: Yes			42.6	3.6			42.4 (1.69)
Household Size	2.73	1.24		5.3	2.70 (0.04)	1.24 (0.06)	
Age	43.30	10.66		3.5	43.32 (0.37)	10.65 (0.51)	
Yearly Gross Income (CHF)	81690	37486		3.9	81704 (1275)	37400 (1799)	
Regular WT[a]	35.79	9.03		3.6	35.83 (0.31)	9.00 (0.43)	
Active Leisure[a]	9.96	9.02		19.1	10.12 (0.33)	9.06 (0.47)	
Care Work[a]	21.58	22.86		18.0	22.91 (0.84)	23.98 (1.19)	
Media Use[a]	7.59	7.40		15.1	7.68 (0.26)	7.44 (0.37)	
Sleep[a]	51.52	7.07		18.2	51.37 (0.28)	7.12 (0.37)	
Commuting[a]	4.23	4.13		13.4	4.46 (0.15)	4.17 (0.21)	
TA	2.85	0.96		4.3	2.85 (0.03)	0.96 (0.05)	
SWLS	5.10	1.04		3.9	5.10 (0.04)	1.04 (0.05)	
SPANE-p	3.67	0.61		4.8	3.67 (0.02)	0.62 (0.03)	
SPANE-n	2.43	0.70		4.6	2.43 (0.02)	0.70 (0.03)	
CBI	2.15	0.70		4.6	2.15 (0.02)	0.70 (0.03)	

Note. WT = Working Time; TA = Time Affluence; SWLS = Satisfaction with Life Scale; SPANE-p = Scale of Positive and Negative Experiences – positive subscale; SPANE-n = – negative subscale; CBI = Copenhagen Burnout Inventory. *n*=864.

[a]*weekly hours*

6. References

Akerstedt T, Olsson B, Ingre M, et al. (2001) A 6-hour working day - effects on health and well-being. *Journal of Human Ergology* 30(1–2): 197–202.

Albertsen K, Rafnsdóttir GL, Grimsmo A, et al. (2008) Workhours and worklife balance. *SJWEH Supplements* (5): 14–21.

Angrave D and Charlwood A (2015) What is the relationship between long working hours, over-employment, under-employment and the subjective well-being of workers? Longitudinal evidence from the UK. *Human Relations* 68(9): 1491–1515.

Antal M, Plank B, Mokos J, et al. (2021) Is working less really good for the environment? A systematic review of the empirical evidence for resource use, greenhouse gas emissions and the ecological footprint. *Environmental Research Letters* 16(1): 013002.

Antal M, Lehmann B, Guimaraes T, et al. (2024) Shorter hours wanted? A systematic review of working-time preferences and outcomes. *International Labour Review* 163(1): 25–47.

Bacaro V, Miletic K and Crocetti E (2024) A meta-analysis of longitudinal studies on the interplay between sleep, mental health, and positive well-being in adolescents. *International Journal of Clinical and Health Psychology* 24(1): 100424.

Balderson U, Burchell B, Kamerāde D, et al. (2022) "Just the freedom to get good at things and stuff like that": Why spending less time at work would be good for individual, social and environmental wellbeing. *Futures* 143: 103035.

Barck-Holst P, Nilsonne Å, Åkerstedt T, et al. (2017) Reduced working hours and stress in the Swedish social services: A longitudinal study. *International Social Work* 60(4): 897–913.

Barck-Holst P, Nilsonne Å, Åkerstedt T, et al. (2021) Coping with stressful situations in social work before and after reduced working hours, a mixed-methods study. *European Journal of Social Work* 24(1): 94–108.

Barnes CM, Wagner DT, Schabram K, et al. (2023) Human Sustainability and Work: A Meta-Synthesis and New Theoretical Framework. *Journal of Management* 49(6): 1965–1996.

Bartels M (2015) Genetics of Wellbeing and Its Components Satisfaction with Life, Happiness, and Quality of Life: A Review and Meta-analysis of Heritability Studies. *Behavior Genetics* 45(2): 137–156.

Bates D, Mächler M, Bolker B, et al. (2015) Fitting Linear Mixed-Effects Models Using **lme4**. *Journal of Statistical Software* 67(1).

Beal DJ (2015) ESM 2.0: State of the Art and Future Potential of Experience Sampling Methods in Organizational Research. *Annual Review of Organizational Psychology and Organizational Behavior* 2(1): 383–407.

Berniell I and Bietenbeck J (2020) The effect of working hours on health. *Economics & Human Biology* 39: 100901.

Bolino MC, Kelemen TK and Matthews SH (2021) Working 9-to-5? A review of research on nonstandard work schedules. *Journal of Organizational Behavior* 42(2): 188–211.

Borgmann L-S, Kroll LE, Müters S, et al. (2019) Work-family conflict, self-reported general health and work-family reconciliation policies in Europe: Results from the European Working Conditions Survey 2015. *SSM - Population Health* 9: 100465.

636 Brajša-Žganec A, Merkaš M and Šverko I (2011) Quality of Life and Leisure Activities: How do
637 Leisure Activities Contribute to Subjective Well-Being? *Social Indicators Research* 102(1):
638 81–91.

639 Castro D and Bleys B (2024) Unravelling motives and time use of additional leave in a flexible
640 benefits plan: a mixed-methods case study in Belgium. *Humanities and Social Sciences*
641 *Communications* 11(1): 1466.

642 Dolan P, Peasgood T and White M (2008) Do we really know what makes us happy? A review of the
643 economic literature on the factors associated with subjective well-being. *Journal of Economic*
644 *Psychology* 29(1): 94–122.

645 Gershuny J (2018) Gender symmetry, gender convergence and historical work-time invariance in 24
646 countries. *Centre for Time-use Research, Department of Sociology, University of Oxford*. Epub
647 ahead of print 2018.

648 Godin L and Langlois J (2021) Care, Gender, and Change in the Study of Sustainable Consumption: A
649 Critical Review of the Literature. *Frontiers in Sustainability* 2: 725753.

650 Hanbury H, Bader C and Moser S (2019) Reducing Working Hours as a Means to Foster Low(er)-
651 Carbon Lifestyles? An Exploratory Study on Swiss Employees. *Sustainability* 11(7): 2024.

652 Hanbury H, Illien P, Ming E, et al. (2023) Working less for more? A systematic review of the social,
653 economic, and ecological effects of working time reduction policies in the global North.
654 *Sustainability: Science, Practice and Policy* 19(1): 2222595.

655 Jansen-Preilowski VV, Paruzel A and Maier GW (2020) Arbeitszeitgestaltung in der digitalisierten
656 Arbeitswelt: Ein systematisches Literatur Review zur Wirkung von Arbeitszeitverkürzung in
657 Bezug auf die psychische Gesundheit. *Gruppe. Interaktion. Organisation. Zeitschrift für*
658 *Angewandte Organisationspsychologie (GIO)* 51(3): 331–343.

659 Kasser T and Sheldon KM (2009) Time Affluence as a Path toward Personal Happiness and Ethical
660 Business Practice: Empirical Evidence from Four Studies. *Journal of Business Ethics* 84(S2):
661 243–255.

662 King LC and Van Den Bergh JCJM (2017) Worktime Reduction as a Solution to Climate Change: Five
663 Scenarios Compared for the UK. *Ecological Economics* 132: 124–134.

664 Kuykendall L, Tay L and Ng V (2015) Leisure engagement and subjective well-being: A meta-
665 analysis. *Psychological bulletin* 141(2). American Psychological Association: 364.

666 Kuykendall L, Lei X, Zhu Z, et al. (2020) Leisure Choices and Employee Well-Being: Comparing
667 Need Fulfillment and Well-Being during TV and Other Leisure Activities. *Applied*
668 *Psychology: Health and Well-Being* 12(2): 532–558.

669 Kuznetsova A, Brockhoff PB and Christensen RHB (2017) **lmerTest** Package: Tests in Linear Mixed
670 Effects Models. *Journal of Statistical Software* 82(13).

671 Lane R, Arunachalam D, Lindsay J, et al. (2020) Downshifting to care: The role of gender and care in
672 reducing working hours and consumption. *Geoforum* 114: 66–76.

673 Lehmann B, Kmetty Z and Antal M (2024) Too good to be true: The English-language discourse of the
674 four-day workweek and steps towards more transformative working time reductions. SSRN.
675 Available at: https://www.ssrn.com/abstract=4885328 (accessed 12 May 2025).

676 Lindsay J, Lane R and Humphery K (2020) Everyday life after downshifting: Consumption, thrift, and
677 inequality. *Geographical Research* 58(3): 275–288.

678 Litwiller B, Snyder LA, Taylor WD, et al. (2017) The relationship between sleep and work: A meta-
679 analysis. *Journal of Applied Psychology* 102(4): 682–699.

680 Liu J, Ettema D and Helbich M (2022) Systematic review of the association between commuting,
681 subjective wellbeing and mental health. *Travel Behaviour and Society* 28: 59–74.

682 Long JD (2012) *Longitudinal Data Analysis for the Behavioral Sciences Using R*. Los Angeles
683 London New Delhi Singapore Washington DC: Sage.

684 Mullens F and Laurijssen I (2024) An organizational working time reduction and its impact on three
685 domains of mental well-being of employees: a panel study. *BMC Public Health* 24(1): 1727.

686 Neubert S, Bader C, Hanbury H, et al. (2022) Free days for future? Longitudinal effects of working
687 time reductions on individual well-being and environmental behaviour. *Journal of*
688 *Environmental Psychology* 82: 101849.

689 Newman DB, Tay L and Diener E (2014) Leisure and Subjective Well-Being: A Model of
690 Psychological Mechanisms as Mediating Factors. *Journal of Happiness Studies* 15(3): 555–
691 578.

692 Nohe C, Meier LL, Sonntag K, et al. (2015) The chicken or the egg? A meta-analysis of panel studies
693 of the relationship between work–family conflict and strain. *Journal of Applied Psychology*
694 100(2): 522–536.

695 Pailhé A, Solaz A and Souletie A (2019) How Do Women and Men Use Extra Time? Housework and
696 Childcare after the French 35-Hour Workweek Regulation. *European Sociological Review*
697 35(6): 807–824.

698 Pascucci T, Hernández Sánchez B and Sánchez García JC (2022) Being stressed in the family or
699 married with work? A literature review and clustering of work-family conflict. *European*
700 *Journal of Management and Business Economics* 31(2): 239–265.

701 Percoco M (2018) The impact of working time on fuel consumption and CO2 emissions of public
702 fleets: Evidence from a policy experiment. *Transport Policy* 71: 126–129.

703 Persson O, Larsson J and Nässén J (2022) Working less by choice: what are the benefits and
704 hardships? *Sustainability: Science, Practice and Policy* 18(1): 81–96.

705 Piasna A and De Spiegelaere S (2021) Working time reduction, work-life balance and gender equality.
706 *Dynamiques régionales* 10(1). L'Institut wallon de l'évaluation, de la prospective et de la
707 statistique: 19–42.

708 Pullinger M (2014) Working time reduction policy in a sustainable economy: Criteria and options for
709 its design. *Ecological Economics* 103: 11–19.

710 R Core Team (2025) *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R
711 Foundation for Statistical Computing. Available at: https://www.R-project.org/.

712 Rich SA, Hanna S and Wright BJ (2017) Simply Satisfied: The Role of Psychological Need
713 Satisfaction in the Life Satisfaction of Voluntary Simplifiers. *Journal of Happiness Studies*
714 18(1): 89–105.

715 Rusu PP, Candel O-S, Bogdan I, et al. (2025) Parental Stress and Well-Being: A Meta-analysis.
716 *Clinical Child and Family Psychology Review*. Epub ahead of print 8 March 2025. DOI:
717 10.1007/s10567-025-00515-9.

718 Sánchez R (2017) Does a Mandatory Reduction of Standard Working Hours Improve Employees'
719 Health Status? *Industrial Relations: A Journal of Economy and Society* 56(1): 3–39.

720 Schiller H, Lekander M, Rajaleid K, et al. (2017) The impact of reduced worktime on sleep and
721 perceived stress – a group randomized intervention study using diary data. *Scandinavian*
722 *Journal of Work, Environment & Health* 43(2): 109–116.

723 Sonnentag S, Cheng BH and Parker SL (2022) Recovery from Work: Advancing the Field Toward the
724 Future. *Annual Review of Organizational Psychology and Organizational Behavior* 9(1): 33–
725 60.

726 Sonnentag S, Tay L and Nesher Shoshan H (2023) A review on health and well-being at work: More
727 than stressors and strains. *Personnel Psychology* 76(2): 473–510.

728 Steed LB, Swider BW, Keem S, et al. (2021) Leaving Work at Work: A Meta-Analysis on Employee
729 Recovery From Work. *Journal of Management* 47(4): 867–897.

730 Van Buuren S (2018) *Flexible Imputation of Missing Data, Second Edition*. 2nd ed. Second edition. |
731 Boca Raton, Florida : CRC Press, [2019] |: Chapman and Hall/CRC. Available at:
732 https://www.taylorfrancis.com/books/9780429492259 (accessed 9 April 2025).

733 van Buuren SV and Groothuis-Oudshoorn K (2011) **mice** : Multivariate Imputation by Chained
734 Equations in *R*. *Journal of Statistical Software* 45(3).

735 Virtanen M, Jokela M, Madsen IE, et al. (2018) Long working hours and depressive symptoms:
736 systematic review and meta-analysis of published studies and unpublished
737 individual participant data. *Scandinavian Journal of Work, Environment & Health* 44(3).
738 Scandinavian Journal of Work, Environment and Health: 239–250.

739 Voglino G, Savatteri A, Gualano MR, et al. (2022) How the reduction of working hours could
740 influence health outcomes: a systematic review of published studies. *BMJ Open* 12(4):
741 e051131.

742 Wendsche J and Lohmann-Haislah A (2017) A Meta-Analysis on Antecedents and Outcomes of
743 Detachment from Work. *Frontiers in Psychology* 7.

744 Wiese CW, Kuykendall L and Tay L (2018) Get active? A meta-analysis of leisure-time physical
745 activity and subjective well-being. *The Journal of Positive Psychology* 13(1): 57–66.

746

Appendix 4: Supplementary Material Manuscript 1

Supplementary Material 1: Search Strings

Scopus

PUBYEAR > 1999

AND

TITLE-ABS-KEY ((("work* time" OR "work* hour*" OR worktime OR workhour*) W/5 reduc*) OR "worktime model*" OR "work time model*" OR "working time model*" OR {parttime work} OR "part time work" OR {overtime penalty} OR "over-time penalty" OR {overtime compensation} OR "over-time compensation" OR "*hour$ workweek" OR "*hour$ work* week" OR "*hour$ workday" OR "*hour$ work* day" OR "*day$ workweek" OR "*day$ work* week" OR jobsharing OR "job sharing" OR topsharing OR "top sharing" OR {compressed work} OR {compressed hours})

AND (

TITLE-ABS-KEY (health* OR mortality OR disease OR "sleep* prob*" OR {sleep quality} OR {sleep duration} OR depress* OR disorder OR "well being" OR wellbeing OR "quality of life" OR stress OR exhaust* OR {life satisfaction} OR happiness OR happy OR "healthy behavio*r" OR burnout OR anxiety OR {restorative sleep} OR "negative emotio*" OR "positive emotio*" OR sleepiness OR fatigue OR worry OR worries OR suicid* OR gender* OR wom?n OR m?n OR sex* OR carework OR "care work" OR "care responsibilit*" OR "caring responsibilit*" OR {domestic work} OR "domestic labo$r" OR housework OR "house work" OR {reproductive work} OR "reproductive labo$r" OR "division of labo$r" OR childcare OR "child care" OR "care giver" OR {unpaid work} OR "unpaid labor" OR "work life" OR “work and life” OR "work family" OR "work and family" OR "work home" OR "single parent*" OR "single father*" OR "single mother*" OR child*)

OR

TITLE-ABS-KEY (productivity OR efficiency OR performance OR earning* OR profit* OR cost* OR {economic growth} OR "labo*r market" OR *employment OR job* OR *redundancy OR layoff OR "lay off" OR wage* OR compensation OR precari* OR "work* conditions" OR benefits OR pension OR income OR poverty OR inequality OR insurance OR {social security} OR {social welfare} OR {job satisfaction} OR commitment OR motivation OR {income gap} OR "income disparit*" OR {gender overall earning gap} OR {wage discrimination} OR "pay gap" OR opportunit* OR option OR career OR "glass ceiling" OR {gender promotion gap})

OR

TITLE-ABS-KEY (ecology OR sustainab* OR {sustainable development} OR degrowth OR "de growth" OR postgrowth OR "post growth" OR "social ecological transformation" OR {environmental impact} OR "environmental behavio*r" OR "value action gap" OR "attitude behavio*r gap" OR footprint OR consumption OR resource*

OR "greenhouse gas emission*" OR CO2 OR "energy use" OR "energy consumption" OR "energy demand" OR emission* OR mobility)

)

AND NOT

TITLE-ABS-KEY ("shift work" OR surgic* OR surgery OR "child labo$r" OR tuberculosis OR robot* OR breastfeeding OR pandemic OR adoles*)

AND NOT

TITLE (Japan* OR Malaysia OR Korea* OR Nepal OR Tunisia OR Tanzania OR Bangladesh OR India OR "South Africa" OR Ghana OR Taiwan OR Chin*)

Web of Science

TS=((("work* time" OR "work* hour$" OR worktime OR workhour$) NEAR/5 reduc*) OR "worktime model$" OR "work time model$" OR "working time model$"OR "parttime work" OR "part-time work" OR "overtime penalty" OR "over-time penalty" OR "overtime compensation" OR "over-time compensation" OR "*hour$ workweek" OR "*hour$ work week" OR "*hour$ workday" OR "*hour$ work-day" OR "*day$ workweek" OR "*day$ work-week" OR jobsharing OR "job-sharing" OR topsharing OR "top-sharing" OR "compressed work" OR "compressed hours")

AND (

TS=(health* OR mortality OR disease OR "sleep* prob*" OR "sleep quality" OR "sleep duration" OR depress* OR disorder OR "well being" OR wellbeing OR "quality of life" OR stress OR exhaust* OR "life satisfaction" OR happiness OR happy OR "healthy behavio$r" OR burnout OR anxiety OR "restorative sleep" OR "negative emotio*" OR "positive emotio*" OR sleepiness OR fatigue OR worry OR worries OR suicid* OR gender* OR wom?n OR m?n OR sex* OR carework OR "care work" OR "care responsibilit*" OR "caring responsibilit*" OR "domestic work" OR "domestic labo$r" OR housework OR "house work" OR "reproductive work" OR "reproductive labo$r" OR "division of labo$r" OR childcare OR "child care" OR "care giver" OR "unpaid work" OR "unpaid labo$r" OR "work life" OR "work family" OR “work and life” OR "work and family" OR "work home" OR "single parent*" OR "single father*" OR "single mother*" OR child*)

OR

TS=(productivity OR efficiency OR performance OR earning* OR profit* OR cost* OR "economic growth" OR "labo$r market" OR *employment OR job* OR *redundancy

OR layoff OR "lay off" OR wage* OR compensation OR precari* OR "work* conditions" OR benefits OR pension OR income OR poverty OR inequality OR insurance OR "social security" OR "social welfare" OR "job satisfaction" OR commitment OR motivation OR "income gap" OR "income disparit*" OR "gender overall earning gap" OR "wage discrimination" OR "pay gap" OR opportunit* OR option OR career OR "glass ceiling" OR "gender promotion gap")

OR

TS=(ecology OR sustainab* OR "sustainable development" OR degrowth OR "de growth" OR postgrowth OR "post growth" OR "social ecological transformation" OR "environmental impact" OR "environmental behavio$r" OR "value action gap" OR "attitude behavio$r gap" OR footprint OR consumption OR resource* OR "greenhouse gas emissions" OR CO2 OR "energy use" OR "energy consumption" OR "energy demand" OR emission* OR mobility)

)

NOT

TS=("shift work" OR surgic* OR surgery OR "child labo$r" OR tuberculosis OR robot* OR breastfeeding OR pandemic OR adoles*)

NOT

TI=(Japan* OR Malaysia OR Korea* OR Nepal OR Tunisia OR Tanzania OR Bangladesh OR India OR "South Africa")

Supplementary Material 2: Inclusion and Exclusion Criteria Instructions

Include if all questions are answered with YES

1. Is the study written in English or German? (yes/no)
2. Is the study a journal article, working paper or report? (yes/no)
    - Excluded: Book chapters, books, conference proceedings
3. Did the study take place in Europe, USA, Canada, Australia, or New Zealand? (yes/no)
4. Does the study include empirical data? (yes/no)
    - Included: Quantitative studies, meta-analyses
    - Excluded: Qualitative studies, modelling studies without 'real' empirical evidence, theory papers, reviews
5. Has the data been collected since 1960 (or 1990 in the case of countries of the former USSR)? (yes/no)
6. Does the study examine general working time reduction policies or employ longitudinal measures? (yes/no)
    - Included: studies on working time reduction policies (from the state and/or individual companies, including job-sharing) in companies and countries, analyses of longitudinal effects of changes in working hours
    - Excluded: Comparison between individuals with different workloads, comparison of countries without inclusion of specific policies (e.g. comparison of average working hours instead of statutory maximum working hours), working time policies without working time reduction (e.g. comparison of different shift work schedules, or flexitime), changes with specific reference to the Covid 19 pandemic, pension schemes and social security schemes without reference to intended working time reduction, parental leave, maternity leave, paternity leave, preferences for different working times, any forms of involuntary part-time work
7. Does the study include at least one measure of one of the following dependent variables? (yes/no)
    a. A measure of gender equality or work-family conflict
        - Included: Inequality measures in terms of income, educational opportunities, time use, work-family conflict, division of labour, career outcomes
        - Excluded: Differences in personal preferences, gender differences in general

b. A measure of environmental impact
    - Included: Ecological footprint, GHG emissions, environmental behaviour, mobility behaviour, environmentally friendly behaviour, climate change mitigation behaviour
    - Excluded: Environmental attitudes, non-behavioural variables, indirect environmental consumption mass (e.g. GDP), climate change adaptation behaviour
c. A measure of economic productivity or employment effects
    - Included: Efficiency and productivity measures, employment rates, job satisfaction
    - Excluded: Income in general, injury rates
d. A measure of well-being
    - Included: Health measures, measures of subjective well-being, measures of stress, measures of objective mental health and illness indicators, sleep quality measures
    - Excluded: Injury rates, infectious diseases, other diseases unrelated to effects of working time

Appendix 5: Supplementary material manuscript 2

Free Days for Future?

Longitudinal Effects of Working Time Reductions on Individual Well-Being and Environmental Behaviour

Supplementary Material

Table S.1

Correlations for Study Variables at Baseline

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1: Gender[a]	–																		
2: Age	-.10**	–																	
3: Parent[b]	-.01	.22**	–																
4: Household Size	-.07*	-.04	.61**	–															
5: Urban Residence Area[b]	.05	-.11**	-.05	-.07*	–														
6: Education[c]	-.01	-.04	.09**	.17**	.15**	–													
7: Environmental Self-Identity	.01	.11**	.06	.08*	.11**	.14**	–												
8: Materialistic Values	-.09**	-.16**	-.05	-.06	-.07*	-.11**	-.28**	–											
9: Baseline Working Hours	-.35**	.04	-.24**	-.22**	-.03	.03	-.13**	.14**	–										
10: Baseline Income	-.33**	.32**	.02	.00	.02	.31**	-.05	-.03	.59**	–									
11: Satisfaction with Life	-.06	-.05	.06	.10**	-.02	.13**	.11**	-.27**	-.08*	.12**	–								
12: Positive Emotions	-.06	-.09*	.03	.04	-.03	-.04	.07*	-.15**	-.05	-.03	.58**	–							
13: Negative Emotions	.13**	-.08*	-.01	.04	.01	-.03	-.08*	.26**	.06	-.07	-.51**	-.58**	–						
14: Burnout Symptoms	-.02	.00	-.09*	-.05	.03	.03	-.10**	.21**	.18**	.07	-.48**	-.49**	.58**	–					
15: Clothing Expenditure	.16**	.06	-.04	-.08*	.02	.05	-.18**	.15**	.08*	.13**	.05	.04	.06	.02	–				
16: Living Space	-.05	.17**	.26**	.42**	-.22**	.04	-.04	-.03	-.03	.15**	.08*	.02	-.05	-.07*	.06	–			
17: Car Travel	-.12**	.05	.05	.08*	-.32**	-.11**	-.26**	.18**	.15**	.12**	-.06	-.03	.08*	.07*	.02	.19**	–		
18: Air Travel	.01	-.05	-.20**	-.17**	.09*	.06	-.13**	.11**	.16**	.14**	.05	-.01	-.02	.01	.12**	.03	-.03	–	
19: Car Commuting	-.09*	.09**	-.02	-.02	-.32**	-.18**	-.18**	.15**	.19**	.11**	-.08*	-.02	.06	.10**	-.01	.11**	.45**	-.03	–
20: Pro- Environmental Behavior	.11**	.12**	.14**	.13**	.11**	.16**	.69**	-.32**	-.16**	-.05	.11**	.12**	-.05	-.03	-.12**	.00	-.19**	-.13**	-.13**

[a] 1 = female and 0 = other. [b] 1 = yes and 0 = no. [c] 1 = university and 0 = no university.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table S.2

LMER Results for Clothing Expenditure

Predictors	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.36***	0.08	-0.39***	0.08	-0.36***	0.08	-0.39***	0.08
t1	0.16***	0.04	0.16***	0.04	0.16***	0.04	0.19***	0.04
t2	0.17***	0.04	0.17***	0.04	0.17***	0.04	0.23***	0.04
Gender: female	0.39***	0.06	0.43***	0.07	0.47***	0.07	0.47***	0.07
Age	0.13***	0.03	0.13***	0.03	0.07*	0.03	0.07*	0.03
Parent: Yes	-0.04	0.08	-0.02	0.08	-0.03	0.08	-0.04	0.08
Household Size	-0.04	0.04	-0.03	0.04	-0.04	0.04	-0.04	0.04
Urban Residence Area	0.10†	0.06	0.11†	0.06	0.09	0.06	0.10	0.06
Education: University	0.22***	0.06	0.21***	0.06	0.10	0.07	0.09	0.07
Environmental Self-Identity	-0.15***	0.03	-0.15***	0.03	-0.13***	0.03	-0.13***	0.03
Materialistic Values	0.15***	0.03	0.15***	0.03	0.15***	0.03	0.15***	0.03
Baseline Working Hours			0.06†	0.03	-0.04	0.04	-0.05	0.04
Baseline Income					0.18***	0.04	0.19***	0.04
WTR (non-reducers vs. reducers)							0.27**	0.10
WTR x t1							-0.21*	0.10
WTR x t2							-0.35***	0.10
R^2	.10		.10		.12		.12	
χ^2			2.78†		16.78***		13.54**	

Note. *n*=864, Observations=2,026. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.3

LMER Results for Living Space

Predictors	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.21**	0.06	0.19**	0.07	0.23***	0.06	0.23***	0.06
t1	-0.01	0.01	-0.01	0.01	-0.01	0.01	0.00	0.01
t2	0.02†	0.01	0.02†	0.01	0.02*	0.01	0.02	0.01
Gender: female	0.01	0.05	0.02	0.06	0.06	0.06	0.06	0.06
Age	0.21***	0.03	0.21***	0.03	0.14***	0.03	0.14***	0.03
Parent: Yes	-0.13†	0.07	-0.12†	0.07	-0.13†	0.07	-0.13†	0.07
Household Size	-0.58***	0.03	-0.57***	0.03	-0.59***	0.03	-0.59***	0.03
Urban Residence Area	-0.26***	0.05	-0.26***	0.05	-0.27***	0.05	-0.27***	0.05
Education: University	0.04	0.05	0.03	0.05	-0.09	0.06	-0.09	0.06
Environmental Self-Identity	-0.11***	0.03	-0.10***	0.03	-0.09**	0.03	-0.09**	0.03
Materialistic Values	0.01	0.03	0.01	0.03	0.02	0.03	0.02	0.03
Baseline Working Hours			0.02	0.03	-0.09**	0.03	-0.09**	0.03
Baseline Income					0.20***	0.04	0.20***	0.04
WTR (non-reducers vs. reducers)							0.02	0.08
WTR x t1							-0.03	0.03
WTR x t2							0.02	0.03
R^2	.44		.44		.46		.46	
χ^2			0.49		29.52***		2.71	

Note. *n*=865, Observations=2,036. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.4

Generalized Binomial LMER Results for Probability of Air Travel

Variable	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	OR	*SE*	*OR*	*SE*	*OR*	*SE*	*OR*	*SE*
Intercept	1.99**	0.44	1.74*	0.39	1.86**	0.42	1.84**	0.41
t1	0.11***	0.02	0.11***	0.02	0.11***	0.02	0.11***	0.02
t2	0.26***	0.04	0.26***	0.04	0.26***	0.04	0.26***	0.04
Gender: female	1.04	0.18	1.23	0.22	1.36†	0.25	1.35†	0.25
Age	0.84†	0.08	0.83*	0.07	0.73**	0.07	0.73**	0.07
Parent: Yes	0.75	0.16	0.81	0.18	0.80	0.18	0.76	0.17
Household Size	0.67***	0.07	0.70**	0.08	0.68***	0.08	0.70**	0.08
Urban Residence Area	1.30	0.22	1.32	0.22	1.27	0.22	1.28	0.22
Education: University	1.47*	0.26	1.39†	0.24	1.09	0.20	1.06	0.20
Environmental Self-Identity	0.68***	0.06	0.70***	0.06	0.73***	0.07	0.73***	0.07
Materialistic Values	1.17†	0.10	1.14	0.10	1.15	0.10	1.16	0.10
Baseline Working Hours			1.29**	0.12	1.03	0.12	0.99	0.11
Baseline Income					1.52***	0.19	1.56***	0.19
WTR (non-reducers vs. reducers)							1.57	0.52
WTR x t1							1.00	0.40
WTR x t2							0.98	0.40
R^2	.13		.14		.15		.15	
χ^2			7.45**		11.76***		3.47	

Note. n=862, Observations=2,023. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.5

LMER Results for Air Travel

Predictors	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.05	0.10	0.00	0.11	0.00	0.11	0.01	0.11
t1	1.43^{***}	0.09	1.42^{***}	0.09	1.42^{***}	0.09	1.40^{***}	0.10
t2	0.43^{***}	0.08	0.42^{***}	0.08	0.43^{***}	0.08	0.40^{***}	0.09
Gender: female	0.05	0.08	0.11	0.08	0.14	0.09	0.14	0.09
Age	0.10^{*}	0.04	0.10^{*}	0.04	0.06	0.05	0.07	0.05
Parent: Yes	-0.48^{***}	0.10	-0.45^{***}	0.10	-0.45^{***}	0.10	-0.46^{***}	0.11
Household Size	0.02	0.05	0.03	0.05	0.02	0.05	0.03	0.05
Urban Residence Area	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.08
Education: University	0.30^{***}	0.08	0.27^{***}	0.08	0.22^{**}	0.08	0.22^{**}	0.09
Environmental Self-Identity	$-0.08^{\dagger}$	0.04	$-0.07^{\dagger}$	0.04	−0.06	0.04	−0.06	0.04
Materialistic Values	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Baseline Working Hours			0.10^{*}	0.04	0.05	0.05	0.04	0.06
Baseline Income					$0.10^{\dagger}$	0.06	$0.10^{\dagger}$	0.06
WTR (non-reducers vs. reducers)							−0.01	0.14
WTR x t1							0.12	0.23
WTR x t2							0.15	0.21
R^2	.24		.25		.25		.25	
χ^2			5.06*		$2.83^{\dagger}$		0.86	

Note. *n*=589, Observations=942. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.6

LMER Results for Car Travel

Predictors	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.44***	0.07	0.39***	0.07	0.41***	0.07	0.42***	0.07
t1	-0.15***	0.03	-0.15***	0.03	-0.15***	0.03	-0.16***	0.04
t2	-0.04	0.03	-0.04	0.03	-0.04	0.03	-0.03	0.04
Gender: female	-0.15**	0.06	-0.09	0.06	-0.07	0.06	-0.07	0.06
Age	0.02	0.03	0.01	0.03	-0.02	0.03	-0.02	0.03
Parent: Yes	0.06	0.07	0.09	0.07	0.08	0.07	0.09	0.07
Household Size	0.08*	0.04	0.09**	0.04	0.09*	0.04	0.08*	0.04
Urban Residence Area	-0.57***	0.06	-0.56***	0.06	-0.57***	0.06	-0.57***	0.06
Education: University	-0.15**	0.06	-0.17**	0.06	-0.23***	0.06	-0.22***	0.06
Environmental Self-Identity	-0.22***	0.03	-0.21***	0.03	-0.20***	0.03	-0.20***	0.03
Materialistic Values	0.09**	0.03	0.08**	0.03	0.08**	0.03	0.08**	0.03
Baseline Working Hours			0.08**	0.03	0.03	0.04	0.03	0.04
Baseline Income					0.10*	0.04	0.10*	0.04
WTR (non-reducers vs. reducers)							-0.08	0.09
WTR x t1							0.07	0.09
WTR x t2							-0.02	0.09
R^2	.21		.22		.22		.22	
χ^2			7.49**		6.34*		1.72	

Note. *n*=865, Observations=2,031. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.7

Generalized Binomial LMER Results for Probability of Car Commuting

Predictors	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	OR	*SE*	*OR*	*SE*	*OR*	*SE*	*OR*	*SE*
Intercept	2418.76***	2027.06	2152.17***	1865.67	2266.82***	1983.87	2181.01***	1933.07
t1	0.73	0.22	0.73	0.22	0.73	0.22	0.76	0.26
t2	0.57†	0.18	0.57†	0.18	0.57†	0.18	0.55†	0.19
Gender: female	1.04	0.62	1.17	0.75	1.31	0.86	1.34	0.88
Age	1.31	0.42	1.30	0.42	1.17	0.40	1.15	0.40
Parent: Yes	1.14	0.91	1.21	0.97	1.17	0.95	1.31	1.10
Household Size	1.16	0.46	1.20	0.47	1.18	0.47	1.14	0.46
Urban Residence Area	0.00***	0.00	0.00***	0.00	0.00***	0.00	0.00***	0.00
Education: University	0.29†	0.20	0.28†	0.19	0.21*	0.16	0.21*	0.16
Environmental Self-Identity	0.50*	0.17	0.50*	0.17	0.51*	0.17	0.50*	0.17
Materialistic Values	1.41	0.43	1.38	0.42	1.37	0.42	1.37	0.42
Baseline Working Hours			1.21	0.40	0.96	0.41	1.01	0.44
Baseline Income					1.52	0.71	1.49	0.70
WTR (non-reducers vs. reducers)							0.55	0.59
WTR x t1							0.85	0.65
WTR x t2							1.28	1.02
R^2	.15		.15		.15		.16	
χ^2			0.33		0.81		0.62	

Note. *n*=861, Observations=2,021. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.8

LMER Results for Car Commuting

Predictor	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.34**	0.11	0.17	0.11	0.18	0.11	0.16	0.11
t1	-0.11†	0.06	-0.11†	0.06	-0.11†	0.06	-0.08	0.07
t2	-0.16*	0.07	-0.16*	0.07	-0.16*	0.07	-0.10	0.07
Gender: female	-0.24**	0.09	-0.06	0.09	-0.06	0.10	-0.06	0.10
Age	0.09†	0.05	0.06	0.05	0.06	0.05	0.06	0.05
Parent: Yes	-0.28*	0.12	-0.17	0.12	-0.17	0.12	-0.18	0.12
Household Size	-0.01	0.06	0.01	0.06	0.01	0.06	0.01	0.06
Urban Residence Area	-0.20*	0.10	-0.16†	0.09	-0.16†	0.09	-0.16†	0.09
Education: University	-0.11	0.10	-0.20*	0.10	-0.20†	0.11	-0.21†	0.11
Environmental Self-Identity	0.01	0.05	0.03	0.05	0.03	0.05	0.03	0.05
Materialistic Values	0.17***	0.05	0.13**	0.04	0.13**	0.04	0.13**	0.04
Baseline Working Hours			0.24***	0.05	0.24***	0.05	0.23***	0.05
Baseline Income					0.00	0.06	0.01	0.06
WTR (non-reducers vs. reducers)							0.21	0.16
WTR x t1							-0.18	0.18
WTR x t2							-0.42*	0.18
R^2	.10		.15		.15		.15	
χ^2			26.75***		0.00		5.23	

Note. n=345, Observations=692. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.9

LMER Results for Pro-Environmental Behavior

Predictor	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.19***	0.05	-0.18***	0.05	-0.19***	0.06	-0.18***	0.06
t1	0.00	0.02	0.00	0.02	0.00	0.02	-0.03	0.02
t2	-0.05*	0.02	-0.05*	0.02	-0.05*	0.02	-0.07**	0.02
Gender: female	0.18***	0.04	0.17***	0.05	0.17***	0.05	0.17***	0.05
Age	0.04†	0.02	0.04†	0.02	0.05*	0.02	0.06*	0.02
Parent: Yes	0.02	0.06	0.02	0.06	0.02	0.06	0.01	0.06
Household Size	0.07*	0.03	0.07*	0.03	0.07*	0.03	0.08**	0.03
Urban Residence Area	0.06	0.04	0.06	0.04	0.06	0.04	0.06	0.04
Education: University	0.08†	0.04	0.08†	0.04	0.10*	0.05	0.09†	0.05
Environmental Self-Identity	0.65***	0.02	0.65***	0.02	0.65***	0.02	0.65***	0.02
Materialistic Values	-0.10***	0.02	-0.10***	0.02	-0.10***	0.02	-0.10***	0.02
Baseline Working Hours			-0.01	0.02	0.01	0.03	0.00	0.03
Baseline Income					-0.03	0.03	-0.03	0.03
WTR (non-reducers vs. reducers)							0.03	0.07
WTR x t1							0.16**	0.06
WTR x t2							0.10	0.06
R^2	.55		.55		.55		.56	
χ^2			0.05		1.11		10.61*	

Note. *n*=862, Observations=2,019. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.10

LMER Results for Satisfaction with Life (SWLS)

Predictor	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.01	0.08	0.04	0.08	0.09	0.08	0.10	0.08
t1	-0.01	0.03	-0.01	0.03	-0.01	0.03	-0.04	0.03
t2	-0.02	0.03	-0.02	0.03	-0.02	0.03	-0.02	0.03
Gender: female	-0.13*	0.06	-0.19**	0.07	-0.12†	0.07	-0.12†	0.07
Age	-0.09**	0.03	-0.08*	0.03	-0.17***	0.03	-0.17***	0.04
Parent: Yes	0.10	0.08	0.07	0.08	0.06	0.08	0.05	0.08
Household Size	0.02	0.04	0.01	0.04	-0.01	0.04	-0.01	0.04
Urban Residence Area	-0.12*	0.06	-0.13*	0.06	-0.15*	0.06	-0.15*	0.06
Education: University	0.22***	0.06	0.23***	0.06	0.06	0.07	0.05	0.07
Environmental Self-Identity	0.04	0.03	0.03	0.03	0.06†	0.03	0.06†	0.03
Materialistic Values	-0.26***	0.03	-0.26***	0.03	-0.24***	0.03	-0.24***	0.03
Baseline Working Hours			-0.08*	0.03	-0.24***	0.04	-0.25***	0.04
Baseline Income					0.29***	0.04	0.30***	0.04
WTR (non-reducers vs. reducers)							0.04	0.10
WTR x t1							0.17*	0.07
WTR x t2							-0.01	0.08
R^2	.10		.11		.14		.15	
χ^2			5.63*		41.92***		8.35*	

Note. n=864, Observations=2,029. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.11

LMER Results for Positive Emotions (SPANE-p)

Predictor	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.12	0.08	0.14†	0.08	0.16*	0.08	0.17*	0.08
t1	-0.03	0.03	-0.03	0.03	-0.03	0.03	-0.07†	0.04
t2	-0.09*	0.04	-0.09*	0.04	-0.09*	0.04	-0.09*	0.04
Gender: female	-0.17**	0.06	-0.19**	0.07	-0.17*	0.07	-0.17*	0.07
Age	-0.10**	0.03	-0.10**	0.03	-0.14***	0.04	-0.14***	0.04
Parent: Yes	0.10	0.08	0.09	0.08	0.09	0.08	0.08	0.08
Household Size	-0.02	0.04	-0.03	0.04	-0.04	0.04	-0.04	0.04
Urban Residence Area	-0.08	0.06	-0.08	0.06	-0.09	0.06	-0.09	0.06
Education: University	-0.09	0.06	-0.08	0.06	-0.15*	0.07	-0.16*	0.07
Environmental Self-Identity	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.03
Materialistic Values	-0.20***	0.03	-0.19***	0.03	-0.19***	0.03	-0.19***	0.03
Baseline Working Hours			-0.04	0.03	-0.11*	0.04	-0.11**	0.04
Baseline Income					0.13**	0.04	0.13**	0.05
WTR (non-reducers vs. reducers)							-0.04	0.10
WTR x t1							0.25**	0.09
WTR x t2							0.05	0.10
R^2	.05		.05		.06		.06	
χ^2			1.24		8.11**		8.51*	

Note. n=864, Observations=2,016. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.12

LMER Results for Negative Emotions (SPANE-n)

Predictor	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.15†	0.08	-0.19*	0.08	-0.21**	0.08	-0.22**	0.08
t1	-0.06†	0.03	-0.06†	0.03	-0.06†	0.03	-0.02	0.04
t2	0.01	0.03	0.01	0.03	0.00	0.03	0.01	0.04
Gender: female	0.32***	0.06	0.38***	0.06	0.36***	0.06	0.36***	0.07
Age	-0.06†	0.03	-0.06†	0.03	-0.03	0.03	-0.03	0.03
Parent: Yes	-0.07	0.08	-0.04	0.08	-0.03	0.08	-0.04	0.08
Household Size	0.10*	0.04	0.11**	0.04	0.12**	0.04	0.12**	0.04
Urban Residence Area	0.03	0.06	0.03	0.06	0.04	0.06	0.04	0.06
Education: University	-0.06	0.06	-0.08	0.06	-0.01	0.07	-0.01	0.07
Environmental Self-Identity	0.02	0.03	0.03	0.03	0.02	0.03	0.02	0.03
Materialistic Values	0.27***	0.03	0.27***	0.03	0.26***	0.03	0.26***	0.03
Baseline Working Hours			0.08*	0.03	0.14***	0.04	0.14***	0.04
Baseline Income					-0.11*	0.04	-0.11*	0.04
WTR (non-reducers vs. reducers)							0.11	0.10
WTR x t1							-0.25**	0.09
WTR x t2							-0.03	0.09
R^2	.11		.11		.12		.12	
χ^2			6.15*		6.46*		9.01*	

Note. *n*=863, Observations=2,013. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.13

LMER Results for Burnout Symptoms (CBI)

Predictor	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.04	0.08	-0.05	0.08	-0.07	0.08	-0.08	0.08
t1	0.03	0.03	0.03	0.03	0.03	0.03	0.05†	0.03
t2	0.05†	0.03	0.05†	0.03	0.05†	0.03	0.08**	0.03
Gender: female	0.04	0.07	0.15*	0.07	0.12†	0.07	0.12†	0.07
Age	0.03	0.03	0.02	0.03	0.05	0.04	0.05	0.04
Parent: Yes	-0.25**	0.08	-0.20*	0.08	-0.19*	0.08	-0.20*	0.08
Household Size	0.02	0.04	0.05	0.04	0.05	0.04	0.06	0.04
Urban Residence Area	0.08	0.07	0.08	0.06	0.09	0.06	0.09	0.06
Education: University	0.09	0.07	0.06	0.07	0.12†	0.07	0.12	0.07
Environmental Self-Identity	-0.02	0.03	0.00	0.03	-0.01	0.03	-0.01	0.03
Materialistic Values	0.20***	0.03	0.19***	0.03	0.18***	0.03	0.18***	0.03
Baseline Working Hours			0.15***	0.04	0.22***	0.04	0.21***	0.04
Baseline Income					-0.11*	0.05	-0.11*	0.05
WTR (non-reducers vs. reducers)							0.18†	0.10
WTR x t1							-0.16*	0.08
WTR x t2							-0.20*	0.08
R^2	.06		.08		.09		.09	
χ^2			19.06***		5.91*		7.88*	

Note. *n*=864, Observations=2,009. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.14

LMER Results for Interaction Effects of Environmental Self-Identity and Working Time on Pro-Environmental Behavior

Predictor	Control Model		Interaction Model	
	*b**	*SE*	*b**	*SE*
Intercept	-0.18***	0.06	-0.19***	0.06
t1	-0.03	0.02	-0.03	0.02
t2	-0.07**	0.02	-0.07**	0.02
Gender: female	0.17***	0.05	0.17***	0.05
Age	0.06*	0.02	0.05*	0.02
Parent: Yes	0.01	0.06	0.01	0.06
Household Size	0.08**	0.03	0.07**	0.03
Urban Residence Area	0.06	0.04	0.06	0.04
Education: University	0.09†	0.05	0.09†	0.05
Environmental Self-Identity	0.65***	0.02	0.64***	0.03
Materialistic Values	-0.10***	0.02	-0.10***	0.02
Baseline Working Hours	0.00	0.03	0.00	0.03
Baseline Income	-0.03	0.03	-0.03	0.03
WTR	0.03	0.07	0.04	0.07
WTR x t1	0.16**	0.06	0.16**	0.06
WTR x t2	0.10	0.06	0.10†	0.06
ESI x Baseline Working Hours			-0.02	0.02
ESI x WTR			0.06	0.07
ESI x t1			-0.01	0.02
ESI x t2			0.03	0.02
ESI x WTR x t1			-0.01	0.06
ESI x WTR x t2			-0.03	0.06
R^2	.56		.56	
χ^2			3.83	

Note. *n*=862, Observations=2,019. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table S.15

LMER Results for Higher Order Effects of Income on Satisfaction with Life (SWLS)

Predictor	Control Model		Higher Order Income Effect Model	
	*b**	*SE*	*b**	*SE*
Intercept	0.09	0.08	0.13	0.08
t1	-0.01	0.03	-0.01	0.03
t2	-0.02	0.03	-0.02	0.03
Gender: female	-0.12†	0.07	-0.13†	0.07
Age	-0.17***	0.03	-0.17***	0.03
Parent: Yes	0.06	0.08	0.06	0.08
Household Size	-0.01	0.04	-0.01	0.04
Urban Residence Area	-0.15*	0.06	-0.15*	0.06
Education: University	0.06	0.07	0.06	0.07
Environmental Self-Identity	0.06†	0.03	0.05	0.03
Materialistic Values	-0.24***	0.03	-0.24***	0.03
Baseline Working Hours	-0.24***	0.04	-0.25***	0.04
Baseline Income	0.29***	0.04	0.31***	0.05
Baseline Income^2			-0.03	0.02
R^2	.14		.15	
χ^2			1.50	

Note. n=864, Observations=2,029. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.16

Model Comparison Indices for the Environmental Behaviour Models Using LMER with Involuntary Non-Reducers Excluded

Model		ANOVA		Multimodel Inference		
	df	deviance	χ^2	AICc	WoE	R^2
	Clothing Expenditure (n=817, Observations=1922)					
M0: Control	13	4923		4950	.00	.10
M1: Baseline Working Hours	14	4920	2.84†	4949	.00	.11
M2: Baseline Income	15	4905	15.05***	4936	.02	.12
M3: WTR	18	4891	14.12**	4928	.98	.13
	Living Space (n=818, Observations=1932)					
M0: Control	13	1482		1508	.00	.45
M1: Baseline Working Hours	14	1481	1.19	1509	.00	.46
M2: Baseline Income	15	1451	30.12***	1481	.67	.47
M3: WTR	18	1446	4.67	1483	.33	.47
n	Probability of Air Travel [a] (n=815, Observations=1919)					
M0: Control	12	2254		2278	.00	.14
M1: Baseline Working Hours	13	2246	8.56**	2272	.01	.14
M2: Baseline Income	14	2234	11.29***	2262	.72	.15
M3: WTR	17	2230	4.18	2264	.28	.15
	Air Travel [b] (n=556, Observations=888)					
M0: Control	13	2662		2688	.08	.24
M1: Baseline Working Hours	14	2657	4.92*	2685	.35	.25
M2: Baseline Income	15	2654	2.89†	2685	.53	.25
M3: WTR	18	2653	0.69	2690	.03	.25
	Car Travel (n=818, Observations=1927)					
M0: Control	13	4543		4569	.01	.22
M1: Baseline Working Hours	14	4536	7.19**	4564	.09	.22
M2: Baseline Income	15	4529	6.57*	4559	.83	.22
M3: WTR	18	4528	1.46	4564	.08	.22
	Probability of Car Commuting [a] (n=814, Observations=1918)					
M0: Control	12	1395		1419	.60	.15
M1: Baseline Working Hours	13	1394	0.38	1421	.26	.15
M2: Baseline Income	14	1394	0.52	1422	.12	.15
M3: WTR	17	1393	0.77	1428	.01	.15
	Car Commuting [b] (n=322, Observations=645)					
M0: Control	13	1641		1667	.00	.10
M1: Baseline Working Hours	14	1616	25.19***	1644	.61	.15
M2: Baseline Income	15	1616	0.04	1646	.22	.15
M3: WTR	18	1610	5.95	1647	.18	.15
	Pro-Environmental Behaviour (PEB) (n=815, Observations=1915)					
M0: Control	13	3141		3168	.18	.56
M1: Baseline Working Hours	14	3141	0.03	3170	.07	.56
M2: Baseline Income	15	3140	0.88	3171	.04	.56
M3: WTR	18	3129	11.94**	3165	.71	.56

Note. Model names of the models with the highest Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction; AICc = Akaike`s corrected Information Criterion; WoE = Weight of Evidence; PEB = pro-environmental behaviour.

[a] Generalized Binomial Linear Mixed-Effects Regression; values > 0 are treated as 1. [b] Values of 0 are treated as missing.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.17

LMER Fixed Effects Estimation for Environmental Behaviour Measures for Model M3 with Involuntary Non-Reducers Excluded

Predictors	Clothing Expenditure		Living Space		Probability of Air Travel [a]		Air Travel [b]		Car Travel		Probability of Car Commuting [a]		Car Commuting [b]		Pro-Environmental Behaviour (PEB)	
	*b**	*SE*	*b**	*SE*	*OR*	*SE*	*b**	*SE*	*b**	*SE*	*OR*	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.39***	0.08	0.23***	0.07	1.63*	0.38	0.01	0.11	0.42***	0.08	1788.66***	1703.22	0.14	0.12	-0.19**	0.06
t1	0.19***	0.04	0.01	0.01	0.10***	0.02	1.40***	0.10	-0.16***	0.04	0.89	0.32	-0.05	0.07	-0.04†	0.02
t2	0.24***	0.04	0.02*	0.01	0.26***	0.04	0.38***	0.09	-0.03	0.04	0.55	0.20	-0.07	0.07	-0.08**	0.02
Gender: female	0.51***	0.07	0.06	0.06	1.42†	0.26	0.14	0.09	-0.06	0.06	1.46	1.01	-0.06	0.10	0.15**	0.05
Age	0.08*	0.04	0.15***	0.03	0.79*	0.08	0.06	0.05	-0.02	0.03	1.23	0.45	0.07	0.05	0.05*	0.03
Parent: Yes	-0.08	0.08	-0.12†	0.07	0.80	0.18	−0.44***	0.11	0.08	0.08	1.14	1.01	-0.13	0.13	0.04	0.06
Household Size	-0.02	0.04	−0.60***	0.03	0.70**	0.08	0.02	0.06	0.10**	0.04	1.23	0.52	-0.01	0.07	0.07*	0.03
Urban Residence Area	0.10	0.06	-0.26***	0.05	1.42*	0.25	0.05	0.08	-0.56***	0.06	0.00***	0.00	-0.22*	0.10	0.06	0.04
Education: University	0.09	0.07	-0.12*	0.06	1.01	0.20	0.24**	0.09	-0.23***	0.07	0.22†	0.18	-0.17	0.12	0.09†	0.05
Environmental Self-Identity	-0.14***	0.03	-0.09**	0.03	0.72***	0.07	-0.06	0.04	-0.21***	0.03	0.46*	0.17	0.04	0.05	0.64***	0.02
Materialistic Values	0.15***	0.03	0.00	0.03	1.18†	0.11	0.04	0.04	0.08*	0.03	1.43	0.46	0.13**	0.05	-0.11***	0.02
Baseline Working Hours	-0.05	0.04	-0.08*	0.04	1.01	0.12	0.04	0.06	0.03	0.04	1.07	0.49	0.24***	0.06	0.00	0.03
Baseline Income	0.18***	0.04	0.21***	0.04	1.57***	0.20	0.10†	0.06	0.11*	0.04	1.39	0.68	0.01	0.07	-0.02	0.03
WTR (non-reducers vs. reducers)	0.27**	0.10	0.02	0.08	1.61	0.53	-0.03	0.14	-0.06	0.10	0.61	0.66	0.16	0.17	0.03	0.07
WTR x t1	-0.21*	0.10	-0.04	0.02	1.04	0.42	0.10	0.23	0.07	0.09	0.73	0.56	-0.21	0.19	0.17**	0.06
WTR x t2	-0.37***	0.10	0.02	0.03	0.99	0.41	0.16	0.21	-0.03	0.09	1.27	1.02	-0.45*	0.18	0.11†	0.06

Note. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction, b* = regression coefficient with z-standardized numeric outcome variables using the mean and standard deviation at baseline.

[a] Generalized Linear Mixed-Effects Binomial Regression; values > 0 are treated as 1. [b] Values of 0 are treated as missing.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.18

Model Comparison Indices for the Well-Being Models using LMER with Involuntary Non-Reducers Excluded

Model		ANOVA		Multimodel Inference		
	df	deviance	χ^2	AICc	WoE	R^2
	Satisfaction with Life (SWLS) (*n*=817, Observations=1925)					
M0: Control	13	4231		4257	.00	.10
M1: Baseline Working Hours	14	4227	4.53*	4255	.00	.10
M2: Baseline Income	15	4193	33.95***	4223	.26	.14
M3: WTR	18	4185	8.24*	4221	.74	.14
	Positive Emotions (SPANE-p) (*n*=817, Observations=1912)					
M0: Control	13	4758		4784	.06	.04
M1: Baseline Working Hours	14	4758	0.56	4786	.03	.04
M2: Baseline Income	15	4752	5.77*	4782	.18	.05
M3: WTR	18	4743	8.85*	4779	.73	.05
	Negative Emotions (SPANE-n) (*n*=816, Observations=1909)					
M0: Control	13	4630		4656	.01	.10
M1: Baseline Working Hours	14	4624	5.68*	4652	.05	.11
M2: Baseline Income	15	4619	4.91*	4649	.23	.11
M3: WTR	18	4611	8.34*	4647	.71	.11
	Burnout (CBI) (*n*=817, Observations=1906)					
M0: Control	13	4410		4437	.00	.06
M1: Baseline Working Hours	14	4389	21.3***	4417	.05	.08
M2: Baseline Income	15	4384	5.09*	4414	.24	.09
M3: WTR	18	4376	8.28*	4412	.71	.09

Note. Model names of the models with the highest Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression WTR = Working Time Reduction; AICc = Akaike's corrected Information Criterion; WoE = Weight of Evidence; SWLS = Satisfaction with Life Scale; SPANE-p = Scale of Positive and Negative Experiences – positive subscale; -n = negative subscale; CBI = Copenhagen Burnout Inventory – work-related burnout.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.19

LMER Fixed Effects Estimation for Well-Being Measures for Model M3 with Involuntary Non-Reducers Excluded

Predictors	Satisfaction with Life (SWLS)		Positive Emotions (SPANE-p)		Negative Emotions (SPANE-n)		Burnout (CBI)	
	b*	SE	b*	SE	b*	SE	b*	SE
Intercept	0.08	0.08	0.15†	0.08	-0.22**	0.08	-0.11	0.08
t1	-0.04	0.03	-0.08*	0.04	-0.03	0.04	0.05†	0.03
t2	-0.03	0.03	-0.09*	0.04	0.01	0.04	0.09**	0.03
Gender: female	-0.11	0.07	-0.15*	0.07	0.36***	0.07	0.13†	0.07
Age	-0.15***	0.04	-0.13***	0.04	-0.03	0.04	0.06	0.04
Parent: Yes	0.06	0.08	0.11	0.08	-0.06	0.08	-0.18*	0.09
Household Size	-0.01	0.04	-0.04	0.04	0.13**	0.04	0.06	0.04
Urban Residence Area	-0.15*	0.06	-0.09	0.06	0.04	0.06	0.10	0.07
Education: University	0.04	0.07	-0.17*	0.07	0.00	0.07	0.13†	0.07
Environmental Self-Identity	0.06†	0.03	0.04	0.03	0.01	0.03	-0.02	0.03
Materialistic Values	-0.24***	0.03	-0.17***	0.03	0.25***	0.03	0.18***	0.03
Baseline Working Hours	-0.23***	0.04	-0.09*	0.04	0.13**	0.04	0.22***	0.05
Baseline Income	0.27***	0.05	0.11*	0.05	-0.10*	0.05	-0.10*	0.05
WTR (non-reducers vs. reducers)	0.04	0.10	-0.04	0.10	0.11	0.10	0.19†	0.10
WTR x t1	0.17*	0.07	0.26**	0.09	-0.24**	0.09	-0.16*	0.08
WTR x t2	0.00	0.07	0.05	0.10	-0.02	0.09	-0.21**	0.08

Note. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction, b* = regression coefficient with z-standardized numeric outcome variables using the mean and standard deviation at baseline.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.20

Model Comparison Indices for the Environmental Behaviour Models Using LMER with Listwise Exclusion of Missings

Model		ANOVA		Multimodel Inference		
	df	deviance	χ^2	AICc	WoE	R^2
	Clothing Expenditure (*n*=833, Observations=1949)					
M0: Control	13	5030		5056	.00	.10
M1: Baseline Working Hours	14	5028	1.41	5057	.00	.10
M2: Baseline Income	15	5011	17.11***	5042	.03	.11
M3: WTR	18	4998	13.33**	5034	.97	.12
	Living Space (*n*=834, Observations=1958)					
M0: Control	13	1940		1966	.00	.44
M1: Baseline Working Hours	14	1939	0.41	1968	.00	.44
M2: Baseline Income	15	1910	29.70***	1940	.85	.46
M3: WTR	18	1907	2.58	1943	.15	.46
	Probability of Air Travel [a] (*n*=831, Observations=1945)					
M0: Control	12	2293		2318	.00	.14
M1: Baseline Working Hours	13	2287	6.42*	2313	.01	.14
M2: Baseline Income	14	2276	10.94***	2304	.82	.15
M3: WTR	17	2273	2.99	2307	.17	.15
	Air Travel [b] (*n*=571, Observations=910)					
M0: Control	13	2733		2760	.18	.25
M1: Baseline Working Hours	14	2730	3.37†	2758	.35	.25
M2: Baseline Income	15	2727	2.52	2758	.44	.25
M3: WTR	18	2726	0.97	2763	.03	.25
	Car Travel (*n*=834, Observations=1953)					
M0: Control	13	4603		4630	.03	.21
M1: Baseline Working Hours	14	4598	5.05*	4627	.12	.22
M2: Baseline Income	15	4593	5.82*	4623	.79	.22
M3: WTR	18	4592	0.91	4628	.06	.22
	Probability of Car Commuting [a] (*n*=830, Observations=1943)					
M0: Control	12	1406		1430	.61	.15
M1: Baseline Working Hours	13	1405	0.31	1432	.26	.16
M2: Baseline Income	14	1405	0.64	1433	.13	.16
M3: WTR	17	1404	0.95	1438	.01	.16
	Car Commuting [b] (*n*=330, Observations=663)					
M0: Control	13	1660		1686	.00	.09
M1: Baseline Working Hours	14	1634	25.40***	1663	.66	.15
M2: Baseline Income	15	1634	0.00	1665	.23	.15
M3: WTR	18	1630	4.69	1667	.10	.15
	Pro-Environmental Behaviour (PEB) (*n*=831, Observations=1941)					
M0: Control	13	3227		3254	.33	.55
M1: Baseline Working Hours	14	3227	0.12	3256	.13	.55
M2: Baseline Income	15	3226	1.30	3256	.09	.55
M3: WTR	18	3217	9.41*	3253	.46	.55

Note. Model names of the models with the highest Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction; AICc = Akaike`s corrected Information Criterion; WoE = Weight of Evidence; PEB = pro-environmental behaviour.

[a] Generalized Binomial Linear Mixed-Effects Regression; values > 0 are treated as 1. [b] Values of 0 are treated as missing.

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table S.21

LMER Fixed Effects Estimation for Environmental Behaviour Measures for Model M3 with Listwise Exclusion of Missings

Predictors	Clothing Expenditure		Living Space		Probability of Air Travel [a]		Air Travel [b]		Car Travel		Probability of Car Commuting [a]		Car Commuting [b]		Pro-Environmental Behaviour (PEB)	
	*b**	*SE*	*b**	*SE*	*OR*	*SE*	*b**	*SE*	*b**	*SE*	*OR*	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.37***	0.08	0.22***	0.07	1.84**	0.42	-0.01	0.11	0.43***	0.07	2610.49***	2352.6	0.15	0.11	-0.20***	0.06
t1	0.21***	0.04	0.00	0.01	0.11***	0.02	1.40***	0.10	-0.15***	0.04	0.71	0.25	-0.08	0.07	-0.03	0.02
t2	0.23***	0.04	0.02	0.01	0.27***	0.05	0.38***	0.09	-0.04	0.04	0.49†	0.18	-0.13†	0.07	-0.06**	0.02
Gender: female	0.46***	0.07	0.08	0.06	1.34	0.24	0.14	0.09	-0.10†	0.06	1.30	0.88	-0.07	0.10	0.17***	0.05
Age	0.07*	0.04	0.15***	0.03	0.76**	0.07	0.07	0.05	-0.01	0.03	1.15	0.41	0.05	0.05	0.06*	0.03
Parent: Yes	-0.08	0.08	-0.13†	0.07	0.73	0.16	-0.46***	0.11	0.06	0.08	1.30	1.11	-0.15	0.12	0.01	0.06
Household Size	-0.03	0.04	-0.59***	0.03	0.72**	0.08	0.01	0.05	0.10**	0.04	1.20	0.49	0.02	0.06	0.07*	0.03
Urban Residence Area	0.10	0.06	-0.27***	0.05	1.35†	0.23	0.12	0.08	-0.55***	0.06	0.00***	0.00	-0.16†	0.10	0.08†	0.04
Education: University	0.10	0.07	-0.09	0.06	1.07	0.20	0.22*	0.09	-0.20**	0.06	0.21†	0.17	-0.22†	0.12	0.09†	0.05
Environmental Self-Identity	-0.13***	0.03	-0.09***	0.03	0.74**	0.07	-0.07†	0.04	-0.21***	0.03	0.52†	0.18	0.02	0.05	0.64***	0.02
Materialistic Values	0.15***	0.03	0.02	0.03	1.15	0.10	0.04	0.04	0.08**	0.03	1.33	0.42	0.13**	0.05	-0.11***	0.02
Baseline Working Hours	-0.07	0.04	-0.09**	0.04	0.98	0.11	0.03	0.06	0.02	0.04	1.02	0.45	0.23***	0.06	0.00	0.03
Baseline Income	0.19***	0.04	0.21***	0.04	1.54***	0.19	0.09	0.06	0.10*	0.04	1.44	0.69	0.00	0.07	-0.03	0.03
WTR (non-reducers vs. reducers)	0.29**	0.10	0.01	0.08	1.52	0.50	-0.03	0.14	-0.06	0.09	0.65	0.69	0.21	0.16	0.05	0.07
WTR x t1	-0.23*	0.10	-0.03	0.03	1.00	0.41	0.16	0.24	0.05	0.09	0.70	0.55	-0.18	0.18	0.15*	0.06
WTR x t2	-0.35***	0.11	0.02	0.03	1.00	0.41	0.16	0.21	-0.02	0.09	1.42	1.17	-0.39*	0.18	0.08	0.06

Note. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction, b* = regression coefficient with z-standardized numeric outcome variables using the mean and standard deviation at baseline.

[a] Generalized Linear Mixed-Effects Binomial Regression; values > 0 are treated as 1. [b] Values of 0 are treated as missing.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.22

Model Comparison Indices for the Well-Being Models using LMER with Listwise Exclusion of Missings

Model		ANOVA		Multimodel Inference		
	df	deviance	χ^2	AICc	WoE	R^2
	Satisfaction with Life (SWLS) (n=833, Observations=1952)					
M0: Control	13	4347		4374	.00	.10
M1: Baseline Working Hours	14	4341	6.63*	4369	.00	.11
M2: Baseline Income	15	4306	34.98***	4336	.41	.14
M3: WTR	18	4299	6.84†	4335	.59	.14
	Positive Emotions (SPANE-p) (n=833, Observations=1938)					
M0: Control	13	4850		4876	.08	.04
M1: Baseline Working Hours	14	4848	1.42	4876	.06	.04
M2: Baseline Income	15	4842	5.65*	4873	.36	.05
M3: WTR	18	4836	6.80†	4872	.51	.05
	Negative Emotions (SPANE-n) (n=832, Observations=1937)					
M0: Control	13	4719		4745	.00	.10
M1: Baseline Working Hours	14	4713	5.49*	4742	.02	.11
M2: Baseline Income	15	4708	5.02*	4739	.09	.11
M3: WTR	18	4698	10.77*	4734	.89	.12
	Burnout (CBI) (n=833, Observations=1931)					
M0: Control	13	4492		4519	.00	.06
M1: Baseline Working Hours	14	4474	17.92***	4503	.10	.08
M2: Baseline Income	15	4470	4.53*	4500	.37	.08
M3: WTR	18	4463	6.85†	4499	.53	.09

Note. Model names of the models with the highest Weight of Evidence are shown in bold. LMER = Linear Mixed-Effects Regression WTR = Working Time Reduction; AICc = Akaike's corrected Information Criterion; WoE = Weight of Evidence; SWLS = Satisfaction with Life Scale; SPANE-p = Scale of Positive and Negative Experiences – positive subscale; -n = negative subscale; CBI = Copenhagen Burnout Inventory – work-related burnout.

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table S.23

LMER Fixed Effects Estimation for Well-Being Measures for Model M3 with Listwise Exclusion of Missings

Predictors	Satisfaction with Life (SWLS)		Positive Emotions (SPANE-p)		Negative Emotions (SPANE-n)		Burnout (CBI)	
	b*	SE	b*	SE	b*	SE	b*	SE
Intercept	0.11	0.08	0.19*	0.08	-0.25**	0.08	-0.09	0.08
t1	-0.04	0.03	-0.06†	0.04	-0.01	0.04	0.04	0.03
t2	-0.01	0.03	-0.08*	0.04	0.00	0.04	0.08*	0.03
Gender: female	-0.14*	0.07	-0.17*	0.07	0.37***	0.07	0.12†	0.07
Age	-0.17***	0.04	-0.14***	0.04	-0.02	0.04	0.06	0.04
Parent: Yes	0.01	0.08	0.05	0.08	-0.02	0.08	-0.18*	0.09
Household Size	0.01	0.04	-0.03	0.04	0.12**	0.04	0.05	0.04
Urban Residence Area	-0.14*	0.06	-0.09	0.06	0.07	0.06	0.10	0.07
Education: University	0.08	0.07	-0.13†	0.07	-0.02	0.07	0.09	0.07
Environmental Self-Identity	0.05	0.03	0.03	0.03	0.02	0.03	-0.01	0.03
Materialistic Values	-0.24***	0.03	-0.18***	0.03	0.25***	0.03	0.18***	0.03
Baseline Working Hours	-0.25***	0.04	-0.11*	0.04	0.13**	0.04	0.20***	0.04
Baseline Income	0.28***	0.05	0.11*	0.05	-0.10*	0.04	-0.10*	0.05
WTR (non-reducers vs. reducers)	0.05	0.10	-0.03	0.10	0.12	0.10	0.18†	0.10
WTR x t1	0.15*	0.07	0.23*	0.09	-0.27**	0.09	-0.15†	0.08
WTR x t2	-0.02	0.08	0.04	0.10	-0.02	0.09	-0.19*	0.08

Note. Numeric predictors were z-standardized, binary predictors were coded as 0/1. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction, b* = regression coefficient with z-standardized numeric outcome variables using the mean and standard deviation at baseline.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.24

LMER Results for the Effect of Reducing Co-Workers on Burnout Symptoms (CBI) for Non-Reducers

Predictor	Control Model		Higher Order Income Effect Model	
	*b**	*SE*	*b**	*SE*
Intercept	0.04	0.09	0.05	0.11
t1	0.07*	0.03	0.05	0.06
t2	0.09**	0.03	0.02	0.06
Gender: female	0.09	0.08	0.09	0.08
Age	0.06	0.04	0.06	0.04
Parent: Yes	-0.25*	0.10	-0.25*	0.10
Household Size	0.07	0.05	0.07	0.05
Urban Residence Area	0.01	0.07	0.01	0.07
Education: University	0.10	0.08	0.10	0.08
Environmental Self-Identity	0.03	0.04	0.03	0.04
Materialistic Values	0.21***	0.04	0.21***	0.04
Baseline Working Hours	0.19***	0.05	0.19***	0.05
Baseline Income	-0.11*	0.05	-0.11*	0.05
Reducing Co-Workers (RC)			-0.01	0.09
RC x t1			0.02	0.07
RC x t2			0.11	0.07
R^2	.08		.08	
χ^2			2.56	

Note. *n*=655, Observations=1,618. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; RC = Reducing Co-Workers.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S.25

LMER Results for Burnout Symptoms (CBI) Excluding Non-Reducers with Reducing Co-Workers

Predictor	M0: Control		M1: Baseline Working Hours		M2: Baseline Income		M3: WTR	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.00	0.11	-0.09	0.11	-0.12	0.11	-0.14	0.11
t1	-0.02	0.05	-0.01	0.05	-0.02	0.05	0.03	0.06
t2	-0.04	0.05	-0.04	0.05	-0.04	0.05	0.00	0.06
Gender: female	0.01	0.09	0.18†	0.10	0.15	0.10	0.16	0.10
Age	0.00	0.05	-0.01	0.05	0.03	0.05	0.03	0.05
Parent: Yes	-0.21†	0.12	-0.19	0.12	-0.18	0.12	-0.18	0.12
Household Size	0.04	0.06	0.07	0.06	0.08	0.06	0.09	0.06
Urban Residence Area	0.10	0.09	0.10	0.09	0.12	0.09	0.12	0.09
Education: University	0.13	0.09	0.06	0.09	0.14	0.10	0.13	0.10
Environmental Self-Identity	-0.02	0.05	0.00	0.05	-0.01	0.05	-0.02	0.05
Materialistic Values	0.20***	0.05	0.19***	0.05	0.17***	0.05	0.17***	0.05
Baseline Working Hours			0.22***	0.05	0.29***	0.06	0.29***	0.06
Baseline Income					-0.13*	0.06	-0.13*	0.06
WTR (non-reducers vs. reducers)							0.09	0.11
WTR x t1							-0.13	0.10
WTR x t2							-0.12	0.10
R^2	.08		.11		.12		.12	
χ^2			19.65***		4.36*		2.31	

Note. *n*=425, Observations=901. Numeric predictors were z-standardized, binary predictors were coded as 0/1. Outcome variables were z-standardized using the mean and standard deviation at baseline. LMER = Linear Mixed-Effects Regression; WTR = Working Time Reduction.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Appendix 6: Supplementary Material Manuscript 3

Let's Call it a Week:
Gendered Patterns of Time Use and Well-Being for Different Reduced Working Time Schedules.

Supplementary Material

Table S1

LMER Results for Active Leisure

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.29**	0.09	0.34***	0.09	0.38***	0.10	0.35***	0.10
t2	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04
t3	0.08*	0.04	0.06†	0.04	0.07†	0.04	0.07†	0.04
Gender: female	−0.15	0.09	−0.17†	0.09	−0.15	0.09	−0.09	0.10
Parent: yes	−0.25*	0.12	−0.26*	0.12	−0.26*	0.12	−0.27*	0.12
Female x Parent	−0.13	0.13	−0.17	0.13	−0.18	0.13	−0.16	0.13
Household Size	−0.04	0.04	−0.06	0.04	−0.06	0.04	−0.06	0.04
Age	0.26***	0.03	0.24***	0.03	0.24***	0.03	0.25***	0.03
Education: University	0.14*	0.06	0.12†	0.06	0.12†	0.06	0.12†	0.06
Residence: City	−0.08	0.06	−0.08	0.06	−0.08	0.06	−0.08	0.06
Yearly Gross Income	−0.06†	0.03	0.01	0.04	0.01	0.04	0.01	0.04
Regular WT			−0.11***	0.03	−0.15***	0.04	−0.15***	0.04
Overtime: Yes			−0.21*	0.08	−0.23**	0.08	−0.23**	0.08
Shorter Days: Yes					0.04	0.07	0.04	0.11
Fewer Days: Yes					−0.14*	0.06	−0.02	0.09
Female x Shorter Days							−0.01	0.13
Female x Fewer Days							−0.18†	0.10
R^2	.09 (0.006)		.10 (0.007)		.10 (0.006)		.11 (0.006)	
pooled likelihood ratio statistic (D1)			8.15***		3.19*		1.64	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time, *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S2

LMER Results for Care Work

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.62***	0.07	-0.54***	0.07	-0.54***	0.07	-0.51***	0.07
t2	0.00	0.02	-0.03	0.03	-0.03	0.03	-0.03	0.02
t3	-0.04	0.03	-0.07**	0.03	-0.07**	0.03	-0.07**	0.03
Gender: female	0.17*	0.08	0.14†	0.07	0.14†	0.07	0.08	0.08
Parent: yes	0.64***	0.09	0.63***	0.09	0.63***	0.09	0.64***	0.09
Female x Parent	0.49***	0.10	0.42***	0.10	0.42***	0.10	0.39***	0.10
Household Size	0.23***	0.03	0.20***	0.03	0.20***	0.03	0.20***	0.03
Age	-0.15***	0.03	-0.17***	0.03	-0.17***	0.03	-0.18***	0.03
Education: University	0.02	0.05	-0.03	0.05	-0.02	0.05	-0.02	0.05
Residence: City	0.03	0.05	0.02	0.05	0.02	0.05	0.02	0.05
Yearly Gross Income	-0.10***	0.03	0.01	0.03	0.01	0.03	0.01	0.03
Regular WT			-0.20***	0.02	-0.20***	0.03	-0.20***	0.03
Overtime: Yes			-0.10†	0.06	-0.10†	0.06	-0.10†	0.06
Shorter Days: Yes					-0.05	0.05	-0.13	0.08
Fewer Days: Yes					0.02	0.04	-0.07	0.06
Female x Shorter Days							0.13	0.10
Female x Fewer Days							0.15*	0.08
R^2	.47 (0.008)		.49 (0.008)		.49 (0.008)		.49 (0.008)	
pooled likelihood ratio statistic (D1)			36.99***		0.77		2.91†	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time, *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

†*p* < .10. *p < .05. **p < .01. ***p < .001.

Table S3

LMER Results for Media Use

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.44***	0.09	0.44***	0.09	0.47***	0.10	0.48***	0.10
t2	0.05†	0.03	0.06†	0.03	0.06†	0.03	0.06†	0.03
t3	-0.02	0.03	-0.01	0.03	0.00	0.03	0.00	0.03
Gender: female	-0.20*	0.10	-0.20*	0.10	-0.20†	0.10	-0.20†	0.11
Parent: yes	-0.21†	0.12	-0.21†	0.12	-0.21†	0.12	-0.21†	0.12
Female x Parent	0.11	0.14	0.12	0.14	0.12	0.14	0.12	0.14
Household Size	-0.11**	0.04	-0.11**	0.04	-0.10**	0.04	-0.10**	0.04
Age	0.05	0.04	0.05	0.04	0.05	0.04	0.05	0.04
Education: University	-0.35***	0.07	-0.35***	0.07	-0.34***	0.07	-0.34***	0.07
Residence: City	-0.12†	0.06	-0.11†	0.06	-0.11†	0.06	-0.11†	0.06
Yearly Gross Income	0.01	0.03	0.00	0.04	0.00	0.04	0.00	0.04
Regular WT			0.02	0.03	-0.01	0.03	-0.01	0.03
Overtime: Yes			-0.10	0.07	-0.11	0.07	-0.11	0.07
Shorter Days: Yes					-0.08	0.06	-0.04	0.10
Fewer Days: Yes					-0.09†	0.06	-0.12	0.08
Female x Shorter Days							-0.05	0.12
Female x Fewer Days							0.04	0.10
R^2	.08 (0.004)		.08 (0.004)		.08 (0.004)		.08 (0.004)	
pooled likelihood ratio statistic (D1)			1.60		1.96		0.17	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time, *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S4

LMER Results for Sleep

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	-0.01	0.11	0.07	0.10	0.04	0.11	0.03	0.11
t2	-0.03	0.04	-0.05	0.04	-0.05	0.04	-0.05	0.04
t3	0.02	0.04	0.00	0.04	-0.01	0.04	-0.01	0.04
Gender: female	0.02	0.10	0.00	0.10	0.00	0.10	0.02	0.11
Parent: yes	-0.04	0.13	-0.06	0.13	-0.06	0.13	-0.06	0.13
Female x Parent	-0.02	0.14	-0.08	0.13	-0.09	0.13	-0.07	0.14
Household Size	-0.04	0.04	-0.06	0.04	-0.06	0.04	-0.06	0.04
Age	0.04	0.04	0.02	0.04	0.01	0.04	0.01	0.04
Education: University	0.10	0.07	0.06	0.07	0.05	0.07	0.05	0.07
Residence: City	-0.07	0.07	-0.08	0.06	-0.08	0.06	-0.08	0.06
Yearly Gross Income	-0.13***	0.04	-0.03	0.04	-0.03	0.04	-0.03	0.04
Regular WT			-0.18***	0.03	-0.15***	0.04	-0.15***	0.04
Overtime: Yes			-0.29**	0.09	-0.28**	0.09	-0.28**	0.09
Shorter Days: Yes					0.14†	0.07	0.20†	0.12
Fewer Days: Yes					0.05	0.07	0.07	0.09
Female x Shorter Days							-0.10	0.14
Female x Fewer Days							-0.03	0.11
R^2	.02 (0.002)		.04 (0.003)		.04 (0.004)		.04 (0.004)	
pooled likelihood ratio statistic (D1)			16.61***		1.98		0.27	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time, *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

†*p* < .10. *p < .05. **p < .01. ***p < .001.

Table S5

LMER Results for Commuting

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.53***	0.09	0.47***	0.09	0.47***	0.09	0.46***	0.09
t2	-0.01	0.03	0.02	0.03	0.02	0.03	0.02	0.03
t3	-0.05	0.03	-0.01	0.03	-0.02	0.03	-0.02	0.03
Gender: female	0.04	0.10	0.06	0.10	0.07	0.10	0.08	0.10
Parent: yes	-0.09	0.11	-0.09	0.11	-0.09	0.11	-0.09	0.11
Female x Parent	-0.08	0.13	-0.02	0.13	-0.03	0.13	-0.01	0.13
Household Size	-0.03	0.03	-0.01	0.03	-0.01	0.03	0.00	0.03
Age	-0.07*	0.03	-0.05	0.03	-0.06†	0.03	-0.06†	0.03
Education: University	-0.28***	0.07	-0.24***	0.07	-0.24***	0.07	-0.25***	0.07
Residence: City	-0.52***	0.06	-0.51***	0.06	-0.51***	0.06	-0.51***	0.06
Yearly Gross Income	0.19***	0.03	0.11**	0.04	0.11**	0.04	0.11**	0.04
Regular WT			0.16***	0.03	0.16***	0.03	0.17***	0.03
Overtime: Yes			0.04	0.07	0.04	0.07	0.04	0.07
Shorter Days: Yes					0.07	0.06	0.26**	0.10
Fewer Days: Yes					-0.02	0.05	-0.05	0.08
Female x Shorter Days							-0.27*	0.12
Female x Fewer Days							0.04	0.09
R^2	.12 (0.004)		.14 (0.004)		.14 (0.004)		.14 (0.005)	
pooled likelihood ratio statistic (D1)			16.27***		1.01		2.83†	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time, *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

†*p* < .10. *p < .05. **p < .01. ***p < .001.

Table S6

LMER Results for Time Affluence

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction		M4: Time Use	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.28**	0.09	0.38***	0.09	0.35***	0.09	0.31***	0.09	0.63***	0.15
t2	0.01	0.03	−0.02	0.03	−0.02	0.03	−0.02	0.03	−0.02	0.03
t3	0.05	0.04	0.02	0.04	0.02	0.04	0.02	0.04	0.00	0.03
Gender: female	−0.26**	0.09	−0.30**	0.09	−0.31***	0.09	−0.22*	0.10	−0.17†	0.09
Parent: yes	−0.10	0.11	−0.11	0.10	−0.11	0.10	−0.13	0.10	−0.01	0.10
Female x Parent	−0.12	0.12	−0.20†	0.12	−0.19	0.12	−0.15	0.12	−0.09	0.11
Household Size	−0.11**	0.04	−0.15***	0.03	−0.15***	0.03	−0.15***	0.03	−0.10**	0.03
Age	0.17***	0.03	0.14***	0.03	0.14***	0.03	0.14***	0.03	0.08*	0.03
Education: University	−0.09	0.06	−0.15*	0.06	−0.15*	0.06	−0.15*	0.06	−0.17**	0.06
Residence: City	0.02	0.06	0.01	0.06	0.01	0.06	0.01	0.06	0.00	0.05
Yearly Gross Income	−0.13***	0.03	0.01	0.04	0.01	0.04	0.01	0.04	0.03	0.03
Regular WT			−0.24***	0.03	−0.22***	0.04	−0.22***	0.04	−0.18***	0.03
Overtime: Yes			−0.37***	0.08	−0.36***	0.08	−0.36***	0.08	−0.28***	0.07
Shorter Days: Yes					−0.05	0.06	0.07	0.11	0.05	0.10
Fewer Days: Yes					0.08	0.06	0.21*	0.08	0.20**	0.08
Female x Shorter Days							−0.19	0.13	−0.18	0.12
Female x Fewer Days							−0.20*	0.10	−0.16†	0.09
Active Leisure									0.15***	0.02
Care Work									−0.09**	0.03
Media Use									0.09***	0.02
Sleep									0.17***	0.02
Commuting									−0.30***	0.08
R^2	.08 (0.002)		.12 (0.002)		.12 (0.002)		.13 (0.002)		.22 (0.002)	
pooled likelihood ratio statistic (D1)			38.61***		1.66		3.36*		37.44***	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time; *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S7

LMER Results for SWLS

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction		M4: Time Use	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	−0.10	0.10	−0.05	0.09	−0.08	0.10	−0.05	0.10	0.13	0.15
t2	−0.01	0.03	−0.03	0.03	−0.03	0.03	−0.03	0.03	−0.03	0.03
t3	−0.02	0.03	−0.04	0.03	−0.05	0.03	−0.05	0.03	−0.05†	0.03
Gender: female	0.00	0.10	−0.02	0.10	−0.03	0.10	−0.09	0.11	−0.09	0.11
Parent: yes	0.09	0.12	0.09	0.12	0.09	0.12	0.10	0.12	0.11	0.12
Female x Parent	−0.05	0.14	−0.10	0.14	−0.10	0.14	−0.13	0.14	−0.11	0.14
Household Size	0.06†	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Age	−0.05	0.04	−0.07†	0.04	−0.07†	0.04	−0.07*	0.04	−0.09*	0.04
Education: University	0.24***	0.07	0.21**	0.07	0.20**	0.07	0.21**	0.07	0.17*	0.07
Residence: City	−0.07	0.06	−0.08	0.06	−0.09	0.06	−0.09	0.06	−0.10†	0.06
Yearly Gross Income	0.05	0.03	0.12***	0.04	0.13***	0.04	0.12***	0.04	0.13***	0.04
Regular WT			−0.13***	0.03	−0.11***	0.03	−0.11***	0.03	−0.09**	0.03
Overtime: Yes			−0.05	0.06	−0.04	0.06	−0.04	0.06	−0.02	0.06
Shorter Days: Yes					0.01	0.05	−0.09	0.10	−0.09	0.1
Fewer Days: Yes					0.09†	0.05	0.00	0.08	0.00	0.08
Female x Shorter Days							0.15	0.11	0.14	0.11
Female x Fewer Days							0.14	0.09	0.15†	0.09
Active Leisure									0.07***	0.02
Care Work									0.00	0.03
Media Use									−0.04†	0.02
Sleep									0.01	0.02
Commuting									−0.12	0.07
R^2	.03 (0.001)		.04 (0.001)		.05 (0.001)		.05 (0.001)		.06 (0.002)	
pooled likelihood ratio statistic (D1)			11.50***		1.46		2.03		3.79**	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time; SWLS = Satisfaction with Life Scale; *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S8

LMER Results for SPANE-p

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction		M4: Time Use	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.03	0.10	0.07	0.10	0.07	0.10	0.09	0.10	0.26	0.16
t2	−0.02	0.03	−0.02	0.03	−0.02	0.03	−0.02	0.03	−0.02	0.03
t3	−0.09*	0.04	−0.10**	0.04	−0.10**	0.04	−0.10**	0.04	−0.11**	0.04
Gender: female	−0.04	0.10	−0.06	0.10	−0.06	0.10	−0.09	0.11	−0.10	0.11
Parent: yes	0.14	0.12	0.13	0.12	0.13	0.12	0.14	0.12	0.15	0.12
Female x Parent	−0.12	0.14	−0.15	0.14	−0.15	0.14	−0.17	0.14	−0.14	0.14
Household Size	0.01	0.04	0.00	0.04	0.00	0.04	0.00	0.04	0.00	0.04
Age	−0.07†	0.04	−0.08*	0.04	−0.08*	0.04	−0.08*	0.04	−0.11**	0.04
Education: University	−0.04	0.07	−0.06	0.07	−0.06	0.07	−0.06	0.07	−0.12†	0.07
Residence: City	−0.06	0.06	−0.06	0.06	−0.06	0.06	−0.06	0.06	−0.08	0.06
Yearly Gross Income	0.00	0.03	0.06	0.04	0.06	0.04	0.06	0.04	0.06	0.04
Regular WT			−0.10**	0.03	−0.10**	0.04	−0.10**	0.04	−0.08*	0.04
Overtime: Yes			−0.25**	0.08	−0.26**	0.08	−0.26**	0.08	−0.23**	0.08
Shorter Days: Yes					0.00	0.06	−0.05	0.11	−0.05	0.11
Fewer Days: Yes					−0.01	0.06	−0.06	0.09	−0.08	0.09
Female x Shorter Days							0.07	0.13	0.06	0.13
Female x Fewer Days							0.09	0.10	0.12	0.10
Active Leisure									0.14***	0.02
Care Work									0.00	0.03
Media Use									−0.11***	0.02
Sleep									0.02	0.02
Commuting									−0.10	0.08
R^2	.01 (0.001)		.02 (0.002)		.02 (0.002)		.02 (0.002)		.05 (0.002)	
pooled likelihood ratio statistic (D1)			8.73***		0.02		0.53		11.45***	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time; SPANE-p = Scale of Positive and Negative Experiences – positive subscale; *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S9

LMER Results for SPANE-n

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction		M4: Time Use	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	−0.10	0.10	−0.16†	0.09	−0.13	0.10	−0.13	0.10	−0.28†	0.16
t2	−0.06†	0.03	−0.05	0.03	−0.05	0.03	−0.05	0.03	−0.05	0.03
t3	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03
Gender: female	0.26*	0.10	0.28**	0.10	0.29**	0.10	0.28**	0.11	0.27**	0.10
Parent: yes	−0.03	0.12	−0.02	0.12	−0.02	0.12	−0.02	0.12	−0.09	0.12
Female x Parent	0.03	0.13	0.09	0.13	0.08	0.13	0.08	0.13	0.02	0.13
Household Size	0.05	0.04	0.07†	0.04	0.07*	0.04	0.07*	0.04	0.05	0.04
Age	−0.10**	0.04	−0.08*	0.04	−0.08*	0.04	−0.09*	0.04	−0.04	0.04
Education: University	−0.10	0.07	−0.07	0.07	−0.06	0.07	−0.06	0.07	−0.02	0.07
Residence: City	−0.01	0.06	0.00	0.06	0.00	0.06	0.00	0.06	0.01	0.06
Yearly Gross Income	0.02	0.03	−0.07†	0.04	−0.07†	0.04	−0.07†	0.04	−0.08*	0.04
Regular WT			0.15***	0.03	0.13***	0.04	0.13***	0.04	0.11**	0.04
Overtime: Yes			0.20**	0.08	0.19*	0.08	0.19*	0.08	0.15*	0.07
Shorter Days: Yes					0.03	0.06	0.03	0.11	0.05	0.11
Fewer Days: Yes					−0.07	0.06	−0.09	0.09	−0.07	0.09
Female x Shorter Days							0.00	0.13	0.00	0.13
Female x Fewer Days							0.02	0.10	−0.02	0.10
Active Leisure									−0.13***	0.02
Care Work									0.07*	0.03
Media Use									0.04†	0.02
Sleep									−0.08***	0.02
Commuting									0.14†	0.08
R^2	.03 (0.001)		.05 (0.001)		.05 (0.001)		.05 (0.001)		.08 (0.002)	
pooled likelihood ratio statistic (D1)			13.40***		1.14		0.01		12.15***	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time; SPANE-n = Scale of Positive and Negative Experiences – negative subscale; *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table S10

LMER Results for CBI

Variable	M0: Control		M1: Working Time		M2: Schedule		M3: Schedule Interaction		M4: Time Use	
	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*	*b**	*SE*
Intercept	0.03	0.10	−0.03	0.10	−0.01	0.10	0.00	0.10	−0.19	0.16
t2	0.03	0.03	0.04	0.03	0.04	0.03	0.05	0.03	0.04	0.03
t3	0.06†	0.03	0.08**	0.03	0.08**	0.03	0.08**	0.03	0.09**	0.03
Gender: female	0.06	0.11	0.08	0.11	0.08	0.11	0.07	0.11	0.06	0.11
Parent: yes	−0.12	0.13	−0.11	0.13	−0.11	0.13	−0.11	0.13	−0.14	0.13
Female x Parent	−0.06	0.14	0.00	0.14	0.00	0.14	0.00	0.14	−0.03	0.14
Household Size	−0.02	0.04	0.00	0.04	0.00	0.04	0.00	0.04	−0.01	0.04
Age	−0.04	0.04	−0.02	0.04	−0.01	0.04	−0.01	0.04	0.01	0.04
Education: University	0.01	0.07	0.04	0.07	0.05	0.07	0.05	0.07	0.08	0.07
Residence: City	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.08	0.06
Yearly Gross Income	0.07*	0.03	−0.02	0.04	−0.03	0.04	−0.03	0.04	−0.03	0.04
Regular WT			0.16***	0.03	0.14***	0.03	0.14***	0.03	0.12***	0.03
Overtime: Yes			0.24***	0.07	0.23***	0.07	0.23***	0.07	0.21**	0.07
Shorter Days: Yes					−0.08	0.06	−0.05	0.10	−0.05	0.10
Fewer Days: Yes					−0.05	0.05	−0.09	0.08	−0.08	0.08
Female x Shorter Days							−0.04	0.12	−0.04	0.12
Female x Fewer Days							0.06	0.09	0.04	0.09
Active Leisure									−0.07***	0.02
Care Work									0.03	0.03
Media Use									0.03	0.02
Sleep									−0.04†	0.02
Commuting									0.14†	0.08
R^2	.02 (0.002)		.03 (0.002)		.03 (0.002)		.03 (0.002)		.04 (0.003)	
pooled likelihood ratio statistic (D1)			17.85***		1.31		0.22		4.07**	

Note. LMER = Linear Mixed-Effects Regression; WT = Working Time; CBI = Copenhagen Burnout Inventory; *b** = regression coefficient with *z*-standardized numeric outcome variables using the mean and standard deviation at t1, binary predictors were coded as 0/1. Standard Errors of R^2-values in brackets. *n*=864, Observations=2,020.

$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Curriculum Vitae

Persönliche Daten

Sebastian Felix Neubert
https://orcid.org/0000-0001-7415-6583

Bildungsweg

Seit 2019	Doktorand an der RPTU Kaiserslautern-Landau
2016 – 2017	M. Sc. Applied Social Psychology Universität Groningen
2011 – 2016	B.Sc. Psychologie Friedrich-Schiller-Universität Jena

Wissenschaftliche Publikationen

Hanbury, H., Bader, C., Neubert, S., & Moser, S. (2020). Reduktion der Erwerbsarbeitszeit – aber wie umsetzen? *Ökologisches Wirtschaften - Fachzeitschrift*, *4*, 24–26. https://doi.org/10.14512/OEW350424

Hanbury, H., Illien, P., Ming, E., Moser, S., Bader, C., & Neubert, S. (2023). Working less for more? A systematic review of the social, economic, and ecological effects of working time reduction policies in the global North. *Sustainability: Science, Practice and Policy*, *19*(1), 2222595. https://doi.org/10.1080/15487733.2023.2222595

Hanbury, H., Moser, S., Neubert, S., Bottazzi, P., & Bader, C. (2023). Public support for worktime reductions in Switzerland in the context of a transition to a post-growth society. *GAIA - Ecological Perspectives for Science and Society*, *32*(3), 304–311. https://doi.org/10.14512/gaia.32.3.7

Neubert, S., Bader, C., Hanbury, H., & Moser, S. (2022). Free days for future? Longitudinal effects of working time reductions on individual well-being and environmental behaviour. *Journal of Environmental Psychology*, *82*, 101849. https://doi.org/10.1016/j.jenvp.2022.101849

Reese, G., Hamann, K. R. S., Heidbreder, L. M., Loy, L. S., Menzel, C., Neubert, S., Tröger, J., & Wullenkord, M. C. (2020). SARS-Cov-2 and environmental protection: A collective psychology agenda for environmental psychology research. *Journal of Environmental Psychology*, *70*, 101444. https://doi.org/10.1016/j.jenvp.2020.101444

Reese, G., Loeschinger, D. C., Hamann, K., & Neubert, S. (2013). Sticker in the Box! Object-Person Distance and Descriptive Norms as Means to Reduce Waste. *Ecopsychology*, *5*(2), 146–148. https://doi.org/10.1089/eco.2012.0075

Declaration of Originality

Manuscript 1

Hanbury, H., Illien, P., Ming, E., Moser, S., Bader, C., & Neubert, S. (2023). Working less for more? A systematic review of the social, economic, and ecological effects of working time reduction policies in the global North. *Sustainability: Science, Practice and Policy*, *19*(1), 2222595. https://doi.org/10.1080/15487733.2023.2222595

CRediT Role	Author 1: Hanbury, H.	Author 2: Illien, P.	Author 3: Ming, E.	Author 4: Moser, S.	Author 5: Bader, C.	Author 6: Neubert, S.
1. Conceptualisation	☒ equal	☒ equal	☒ equal	☒ supporting	☒ supporting	☒ equal
4. Funding acquisition	☐ --	☐ --	☐ --	☒ supporting	☐ --	☒ lead
5. Investigation	☒ equal	☒ equal	☒ equal	☐ --	☐ --	☒ equal
7. Project administration	☐ --	☐ --	☐ --	☐ --	☐ --	☒ --
13. Writing – original draft	☒ equal	☒ equal	☐ --	☐ --	☐ --	☒ equal
14. Writing – review & editing	☐ --	☐ --	☒ equal	☒ equal	☒ equal	☐ --

Hugo Hanbury **Patrick Illien** **Eva Ming**

Stephanie Moser **Christoph Bader**

Manuscript 2

Neubert, S., Bader, C., Hanbury, H., & Moser, S. (2022). Free days for future? Longitudinal effects of working time reductions on individual well-being and environmental behaviour. *Journal of Environmental Psychology*, *82*, 101849. https://doi.org/10.1016/j.jenvp.2022.101849

CRediT Role	Author 1: Neubert, S.	Author 2: Bader, C.	Author 3: Hanbury, H.	Author 4: Moser, S.
1. Conceptualisation	☒ equal	☒ equal	☒ equal	☒ equal
3. Formal analysis	☒ --	☐ --	☐ --	☐ --
4. Funding acquisition	☒ supporting	☒ equal	☐ --	☒ equal
6. Methodology	☒ lead	☐ --	☐ --	☒ supporting
7. Project administration	☐ --	☒ equal	☐ --	☒ equal
13. Writing – original draft	☒ --	☐ --	☐ --	☐ --
14. Writing – review & editing	☐ --	☒ equal	☒ equal	☒ equal

Christoph Bader **Hugo Hanbury** **Stephanie Moser**

Manuscript 3

Neubert, S., Bader, C., Hanbury, H., & Moser, S. (2025). *Let's Call it a Week: Gendered Patterns of Time Use and Well-Being for Different Reduced Working Time Schedules* [Manuscript submitted for publication].

CRediT Role	Author 1: Neubert, S.	Author 2: Bader, C.	Author 3: Hanbury, H.	Author 4: Moser, S.
1. Conceptualisation	☒ equal	☒ supporting	☒ supporting	☒ equal
3. Formal analysis	☒ --	☐ --	☐ --	☐ --
4. Funding acquisition	☒ supporting	☒ equal	☐ --	☒ equal
6. Methodology	☒ --	☐ --	☐ --	☐ --
7. Project administration	☐ --	☒ equal	☐ --	☒ equal
13. Writing – original draft	☒ --	☐ --	☐ --	☐ --
14. Writing – review & editing	☒ equal	☒ supporting	☒ supporting	☒ equal

Christoph Bader **Hugo Hanbury** **Stephanie Moser**

Thesis

Ich habe KI-basierte Tools, namentlich ChatGPT und DeepL, genutzt, um sprachliche und grammatikalische Verbesserungsvorschläge auf den finalen Entwurf meiner Synopse zu erzeugen. Ich habe keine Vorschläge zu logischem Aufbau, Schlussfolgerungen, Quellen, oder sonstige Vorschläge inhaltlicher Art von KI-basierten Tools generieren lassen und verantworte die Übernahme jeglicher von mir verwendeter maschinell generierter sprachlicher Formulierungen vollumfänglich selbst.

Hiermit erkläre ich eidesstattlich, dass ich die vorliegende Arbeit jenseits der oben angegebenen individuellen Beiträge an den Manuskripten in allen Teilen selbstständig angefertigt und keine anderen als die in der Arbeit und den jeweiligen Manuskripten angegebenen Quellen und zur Angabe verpflichteten Hilfsmittel benutzt habe. Sämtliche wörtlichen oder sinngemäßen Übernahmen und Zitate sind kenntlich gemacht und nachgewiesen. Ich erkläre, dass die Dissertation in gleicher oder ähnlicher Form in noch keiner anderen Prüfung vorgelegen hat. Ich erkläre, dass ich die Arbeit in gleicher oder ähnlicher Form nicht bei einer anderen Hochschule als Dissertation eingereicht habe.

Freiburg, der 9. Oktober 2025 Sebastian Felix Neubert