Working Time, Inequality and a Sustainable Future:

Author: Jared Berry Fitzgerald

Boston College Electronic Thesis or Dissertation, 2020

WORKING TIME, INEQUALITY AND A SUSTAINABLE FUTURE

Jared Berry Fitzgerald

A dissertation submitted to the Faculty of

the department of sociology in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

Boston College
Morrissey College of Arts and Sciences
Graduate School

April 2020

WORKING TIME, INEQUALITY AND A SUSTAINABLE FUTURE

Jared Berry Fitzgerald

Advisor: Andrew Jorgenson, Ph.D.

ABSTRACT

In 2015, the United Nations implemented the Sustainable Development Goals (SDGs), which cover a wide range of social, economic and environmental issues. While there is a virtual international consensus regarding the importance of these goals, and reconsidering the ecological costs of human development, there are disagreements on the best approaches to actually achieving sustainability. Mainstream perspectives argue that the most feasible and effective path to sustainable development is to decouple economic growth from its environmental impacts, largely through the advancement and implementation of green technologies. In this framework, economic growth is seen as synonymous with development and a necessary prerequisite for improving human wellbeing. On the other hand, many scholars are critical of this approach to sustainable development and argue that economic growth is not only antithetical to achieving environmental sustainability, it also has limited appeal for improving social and economic wellbeing in developed countries. With this in mind, in this dissertation I examine alternative pathways to sustainable development that move beyond the growth-consensus. Previous studies argue that a working time reduction potentially represents a multi-dividend sustainability policy that could improve social, economic and environmental outcomes. Similarly, previous research also indicates that inequality is negatively associated with human wellbeing and can lead to increased environmental pressures. Across three empirical chapters, I investigate the effects of working hours and inequality, and their interaction, on measures of environmental and human wellbeing across US states over time. In the first chapter, I assess the relationship between average working hours and CO_2 emissions from 2007 to 2013. This chapter is the first examination of this relationship at the US state level and finds that longer working hours are associated with increased emissions over time. The second empirical chapter takes this research one step further and examines how inequality shapes the relationship between working hours and emissions from 2005 to 2015. The results of these analyses again find that longer working hours are associated with increased emissions but that the relationship becomes more intense at higher levels of inequality. The third empirical chapter investigates the claim that a working time reduction could be a multi-dividend sustainability policy by examining the relationship between work hours and life expectancy from 2005 to 2015. I also examine how inequality shapes this relationship as well. Results indicate that longer working hours are associated with decreases in life expectancy, and that this effect is larger at higher levels of inequality. In all, these studies provide more evidence that reducing working hours could potentially be an effective sustainability policy that could contribute to achieving multiple sustainable development goals. Further, they show that inequality is an important factor shaping socio-environmental relationships and population health relationships.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

First of all, I wish to express my sincere gratitude for my advisor, Andrew Jorgenson. Andrew has been a compassionate and generous mentor during my time at the University of Utah and Boston College. I admire Andrew's academic work and his relentless work ethic. He has played a pivotal role in my development as a sociologist and in the development of environmental sociology as a discipline. I am particularly grateful for his guidance and support while writing and developing this dissertation. I am lucky to count Andrew as both an advisor and a friend.

I would also like to take this opportunity to thank the other members of my committee. Juliet Schor's work is the inspiration for my interest in the social and environmental effects of working time. She is a hugely influential scholar and I am lucky to have had the opportunity to learn from and work with her. Wen Fan provided me with helpful feedback and guidance, particularly as I worked towards a better understanding of the relationship between working time and health. She was quick to provide feedback and point me in the right direction for new sources. I would be remiss if I did not also thank Brett Clark. Brett has been an amazing advisor and friend to me. His insights and understanding of environmental sociology have been a key influence in improving my abilities as a critical scholar.

I also want to thank the Environmental Sociology Working Group at Boston College. The faculty and students who constitute this group provided much feedback and support during the development of the papers included in this dissertation, as well as others I have written. More broadly, I would also like to thank the Department of

Sociology at Boston College for providing a supportive and intellectually stimulating environment.

Last, but certainly not least, I would like to acknowledge the love and support from my family and especially my partner, Lacey. She has been incredibly patient and supportive during my time in graduate school, and especially while writing this dissertation when we were both stuck at home due to COVID-19. Completing my Ph.D. would not have been possible without her.

CHAPTER 1: INTRODUCTION

In 2015, the United Nations implemented the Sustainable Development Goals (SDGs) in recognition of the fact that the world faces numerous social and ecological challenges (United Nations 2020). The SDGs improve upon the outgoing Millennium Development Goals (MDGs) by explicitly considering the ecological costs of development and the acknowledgment that the pursuit of development should not come at the expense of our planet and future generations that will rely on it. The SDGs are comprised of 17 objectives revolving around the "three pillars" of sustainability: the social, the economic and the environmental. The goals range from the eradication of global poverty to reduced economic inequalities between and within countries to taking immediate action on climate change (United Nations 2020).

While most agree about the importance of achieving sustainability, there are serious disagreements about how best to do it. On one hand, the mainstream view of sustainable development can be referred to as ecoefficiency. Ecoefficiency perspectives argue that further economic growth is both desirable and necessary to achieve sustainability (i.e. Grossman and Krueger 1995; Huber 2009; Mol 2000; Mol and Janicke 2009; Pollin 2019). These arguments are in line with earlier conceptions of development that equate economic growth with development, which can be referred to as the "growth consensus" (i.e. Firebaugh and Beck 1994). Here, economic growth is seen as necessary for improving social outcomes and thus the best way to achieve sustainable development is to decouple economic growth from its environmental impacts, largely through further developing and implementing green technologies (Pollin 2019). The ecoefficiency perspective is in line with ecological modernization theory within environmental sociology (e.g. Mol, Sonnenfeld, and Spaargaren 2009). The popularity and mainstream appeal of ecoefficiency can be seen within the SDGs themselves. For instance, Goal 8 focuses explicitly on "sustainable economic growth" (United Nations 2020).

On the other hand, many other scholars, to varying degrees, are critical of the idea that economic growth is compatible with sustainability (i.e. Daly 1996; Foster, Clark, and York 2011; Jackson 2009; Jorgenson and Clark 2012; Kallis 2017; Schor and Jorgenson 2019). There are three general reasons why these scholars are skeptical of the ecoefficiency perspective. First, empirical research on the relationship between growth and emissions highlights that emissions and growth remain positively associated with each other over time (Jorgenson and Clark 2012; Longhofer and Jorgenson 2017; Thombs 2018). This is especially true when considering consumption-based emissions, which adjust for trade between countries and more appropriately attribute emissions to the country where consumption takes places (Knight and Schor 2014). The continued link between growth and emissions is particularly problematic given recent research from climate scientists highlighting the urgency of drastic reductions in emissions to avoid the worst effects of climate change (i.e. Steffen et al. 2018). Second, many scholars in this perspective are skeptical of the techno-optimism prominent in the ecoefficiency perspective. In particular, some argue that because of the imperatives for growth and profits within capitalism, advances in technology will not automatically result in reduced ecological pressures. This is referred to as the "Jevons Paradox" (i.e. Foster, Clark, and York 2010; Jevons 1865). An example of this is that the increased implementation of green energy sources does not appear to decouple growth from emissions, but actually is associated with increased emissions (Thombs 2017; York 2012). Finally, a third critique is that economic growth in already wealthy countries has diminishing returns for human wellbeing (Brady, Kaya, and Beckfield 2007; Diener, Kahneman, and Helliwell 2010; Easterlin 1974, 2015; Layard 2011; Tapia Granados and Ionides 2008). This is part and parcel of what Daly (1996, 2014) refers to as "uneconomic growth" where an economy is geared towards further economic growth despite the fact that it harms the environment and most people do not benefit from it.

If economic growth is antithetical to sustainability, and relying on technology alone is likely insufficient, then it is important to consider alternative pathways to sustainability that move beyond the "growth consensus." Two potential pathways are reducing working hours and inequality. Previous research indicates that reducing working time could be a multi-dividend sustainability policy that could improve human wellbeing, reduce unemployment and reduce environmental pressures (Autonomy 2019; Fitzgerald, Schor, and Jorgenson 2018; Schor 2010) . Similarly, previous research has also found that inequality can lead to greater environmental pressures and has negative consequences for human wellbeing (Hill et al. 2019; Jorgenson 2015; Jorgenson, Dietz, and Kelly 2018; Jorgenson, Schor, and Huang 2017). With this in mind, in this dissertation I argue that reducing working time and inequality has the potential to improve all three pillars of sustainability. Across three empirical chapters, I investigate the relationships between working hours, inequality and both population health and environmental outcomes across US states over time.

Chapter 2, which is a co-authored study with Juliet Schor and Andrew Jorgenson previously published in the journal *Social Forces* in 2018, examines the relationship between average working hours and carbon dioxide (CO_2) emissions across US states from 2007 to 2013. This paper is the first to analyze the relationship between working hours and emissions at the US state level. Previous research indicates that longer working hours are associated with greater environmental pressures (i.e. Fitzgerald, Jorgenson, and Clark 2015; Hayden and Shandra 2009; Jalas and Juntunen 2015; King and van den Bergh 2017; Knight, Rosa, and Schor 2013; Rosnick and Weisbrot 2007; Schor 2005). These studies posit that there are two pathways through which longer working hours are associated with greater environmental harms (Fitzgerald et al. 2015; Knight et al. 2013; Schor 2010). The first mechanism is referred to in previous research as the "scale" effect, or how longer work hours contribute to overall GDP through both increased production and consumption. On the production side, more work generates more economic output and consumes more resources. On the consumption side, additional work turns into greater incomes and more consumption, again leading to greater environmental pressures. This is part of what Schor (1992) refers to as the "work and spend cycle," highlighting working time as a key factor in consumer culture. The second mechanism is referred to as the "compositional" effect, or how working hours change the composition of consumption. This is effectively thought about as a time availability effect (Becker 1965). Those who work long hours have less free time and are more likely to choose less-time intensive but more environmentally harmful products and services (Jalas 2002, 2005; Jalas and Juntunen 2015; Kasser and Brown 2003). For instance, food consumption/preparation is one example: those with more free-time may prepare their meals at home more often while those with less free time are more likely to eat fast food, which tends to be more ecologically intensive.

We test these arguments using both two-way fixed effects models with panel corrected standard errors and corrections for autocorrelation as well as random effects models with time-specific fixed effects. Results indicate that, over time, longer working hours are associated with higher emissions. This is the case for both the scale and compositional effects and is consistent across modeling estimation techniques and net of various political, economic and demographic drivers of emissions. The results provide evidence that a working time reduction may represent a feasible pathway to emissions reductions for US states.

In Chapter 3, I take the research from Chapter 2 one step further. In particular, I consider how inequality might moderate the relationship between work hours and emissions. In this study, I seek to integrate research on the relationship between working hours and emissions, inequality and emissions, and working hours and inequality. Previous research indicates that higher levels of inequality are associated with greater environmental pressures (Boyce 1994, 2007; Cushing et al. 2015; Downey 2015; Jorgenson et al. 2017; Knight, Schor, and Jorgenson 2017). These studies highlight a number of mechanisms through which inequality might exacerbate environmental harms. First, the political economy perspective argues that high levels of inequality concentrate political and economic power in the hands of the wealthy (Boyce 1994, 2007; Downey 2015; Jorgenson et al. 2017). Because those in power tend to gain from emissions and are typically sheltered from environmentally harmful behaviors, they tend to favor policies which allow them to continue. A second mechanism highlights that high levels of inequality shape labor market and consumption dynamics (Bowles and Park 2005; Jorgenson et al. 2017; Oh, Park, and Bowles 2012; Schor 1998). Here, higher levels of income and wealth inequality intensify pressures for competitive consumption as people attempt to emulate the consumption standards of the wealthy. This intensification of competitive consumption can lead to longer working hours as individuals seek to gain higher incomes (Bowles and Park 2005; Schor 1998). High inequality can also lead to longer working hours through the concentration of power in the hands of employers, who tend to favor longer working hours (Alesina, Glaeser, and Sacerdote 2005; Oh et al. 2012; Schor 1992).

While previous research finds an association between inequality and increased emissions, it is unclear what the exact mechanisms are. Recent studies in sociology have begun to unpack this relationship further by examining how inequality moderates other socio-environmental relationships (Hill et al. 2019; Jorgenson et al. 2020; McGee and Greiner 2018). In line with the logic of these studies, in this chapter I investigate how inequality moderates the relationship between working hours and emissions across US states from 2005 to 2015. I hypothesize that inequality intensifies the relationship between working hours and emissions for a number of reasons. First, inequality can increase the scale effect described above by influencing how much income from work goes to consumption. I propose that high levels of inequality can also intensify the scale effect by increasing stress associated with work, which can lead greater consumption as a coping mechanism (Durante and Laran 2016; Mathur, Moschis, and Lee 2006). I also argue that inequality can exacerbate the compositional effect described above. Whereas I previously discussed the compositional effect solely in terms of time availability, the composition of consumption can also be affected by inequality. That is, when inequality is high there are greater pressures to engage in status-based competitive consumption of visible goods (Bagwell and Bernheim 1996; Schor 1998; Veblen 1912) and high-status visible goods tend to be more ecologically intensive (i.e. Lynch et al. 2019). In all, I argue that inequality can intensify not just how much is consumed but it also shapes consumption towards more ecologically intensive options.

Using two-way fixed effects models with panel corrected standard errors and a correction for autocorrelation, the results again show that longer working hours are associated with greater environmental pressures for both the scale and compositional effects. Furthermore, the results show that the effect of working hours on emissions is larger at higher levels of inequality (measured as percentage of income to the top ten percent). For the scale effect, the results indicate that the effect of working hours on emissions is significant at relatively low inequality, median inequality and high inequality and it increases in magnitude at each level. The study yields particularly interesting results for the compositional effect. In particular, the results indicate the compositional effect is non-significant at relatively low levels of income inequality. It becomes significant at higher levels of inequality, indicating that the compositional effect is sensitive to changes in inequality. In all, these results advance the literatures on the environmental consequences of working time and inequality.

In Chapter 4, I investigate the claim that a working time reduction could be a multi-dividend sustainability policy by examining the relationship between working hours and life expectancy, a measure of population health, across US states from 2005 to 2015. Previous research indicates that longer working hours are associated with worse health outcomes (Bannai and Tamakoshi 2014; Fan et al. 2015; Kivimäki and Kawachi 2015; Kleiner and Pavalko 2010). These studies propose that, among other things, longer working hours increase stress levels, promotes unhealthy consumption choices like smoking, drug use and unhealthy diets. While most studies examine the relationship between working time and health at the individual level, this is the first study to examine these relationships at the US state level.

Investigating this relationship at a macro level offers a number of advantages, both methodological and theoretical. Perhaps the greatest is the ability to examine how other structural factors might influence the relationship between working hours and health. As such, a major contribution of this study is examining how inequality moderates the relationship between working hours and population health. Previous research indicates that higher levels of inequality are associated with worse population health outcomes (Clarkwest 2008; Curran and Mahutga 2018; Hill et al. 2019; Hill and Jorgenson 2018; Jorgenson et al. 2020; Pickett and Wilkinson 2015). These studies describe a number of pathways through which higher levels of inequality might negatively impact population health. These include psychosocial disruptions leading to risky coping behaviors, decreases in social cohesion and increased political and economic power in the hands of the wealthy, who tend to be opposed to investments in public services, such as health care.

As with the research on CO_2 emissions and inequality, the relationship between population health and inequality is a bit of a "black box." That is, while there appears to be an empirical relationship between inequality and population health, it is unclear how exactly inequality leads to worse health outcomes. Recent sociological research has attempted to unpack this relationship by examining how inequality moderates other population health relationships (i.e. Hill et al. 2019; Jorgenson et al. 2020). In line with the logic of these studies, in this chapter, I examine how inequality shapes the relationship between working hours and population health. Building off of the arguments described above, I hypothesize that the negative relationship between working hours and population health is larger at higher levels of inequality. I propose that this occurs for a number of reasons. First, I argue that when inequality is high it makes work more precarious and stressful because workers have less control over their work. I also argue that when inequality is high, it increases the competitive nature of work and consumption, which also increases stress and anxiety associated with work.

Results from two-way fixed effects models with panel corrected standard errors indicate that increases in working hours are associated with decreases in life expectancy while controlling for important economic and demographic factors. I fail to find a main effect of inequality on life expectancy, but find that inequality does moderate the relationship between working hours and life expectancy. At higher levels of inequality, the effect of working hours on life expectancy are greater. More specifically, while the effect of working hours on life expectancy is significant across all levels of inequality, the results indicate that the effect is twice as large at high levels of inequality than it is lower levels of inequality.

In the final chapter, I summarize the findings from the three empirical chapters and discuss their implications for sustainable development and the future of work. These studies indicate that reducing working time and inequality are potentially multi-dividend sustainability policies that can reduce environmental burdens while improving human wellbeing. Further, they indicate that we should consider the role of inequality in shaping the relationship between working time and both human and environmental wellbeing.

The findings advance the literatures on the social and environmental consequences of both working hours and inequality by providing a better insight into the mechanisms behind both. In this chapter I also outline some limitations of the research presented in this dissertation and discuss how these findings inform opportunities for future research.

REFERENCES

Alesina, Alberto, Edward Glaeser, and Bruce Sacerdote. 2005. “Work and Leisure in the United States and Europe: Why So Different?” *NBER Macroeconomics Annual* 20:1–64.

Autonomy. 2019. “The Shorter Working Week: A Radical and Pragmatic Proposal.” *Autonomy*. Retrieved March 16, 2020 (https://autonomy.work/portfolio/the-shorter-working-week-a-report-from-autonomy-in-collaboration-with-members-of-the-4-day-week-campaign/).

Bagwell, Laurie Simon, and B. Douglas Bernheim. 1996. “Veblen Effects in a Theory of Conspicuous Consumption.” *The American Economic Review* 86(3):349–73.

Bannai, Akira, and Akiko Tamakoshi. 2014. “The Association Between Long Working Hours and Health: A Systematic Review of Epidemiological Evidence.” *Scandinavian Journal of Work, Environment & Health* 40(1):5–18.

Becker, Gary A. 1965. “A Theory of the Allocation of Time.” *The Economic Journal* 75(299):493–517.

Bowles, Samuel, and Yongjin Park. 2005. “Emulation, Inequality, and Work Hours: Was Thorsten Veblen Right?” *Economic Journal* 115(507):F397–412.

Boyce, James. 1994. “Inequality as a Cause of Environmental Degradation.” *Ecological Economics* 11(3):169–78.

Boyce, James K. 2007. “Is Inequality Bad for the Environment?” Pp. 267–88 in *Equity and the Environment*. Vol. 15, *Research in Social Problems and Public Policy*, edited by R. C. Wilkinson and W. R. Freudenburg. Emerald Group Publishing Limited.

Brady, David, Yunus Kaya, and Jason Beckfield. 2007. “Reassessing the Effect of Economic Growth on Well-Being in Less-Developed Countries, 1980–2003.” *Studies in Comparative International Development* 42(1/2):1.

Clarkwest, Andrew. 2008. “Neo-Materialist Theory and the Temporal Relationship between Income Inequality and Longevity Change.” *Social Science & Medicine* 66(9):1871–81.

Curran, Michaela, and Matthew C. Mahutga. 2018. “Income Inequality and Population Health: A Global Gradient?” *Journal of Health and Social Behavior* 59(4):536–53.

Cushing, Lara, Rachel Morello-Frosch, Madeline Wander, and Manuel Pastor. 2015. “The Haves, the Have-Nots, and the Health of Everyone: The Relationship Between Social Inequality and Environmental Quality.” *Annual Review of Public Health* 36(1):193–209.

Daly, Herman E. 1996. *Beyond Growth: The Economics of Sustainable Development*. Beacon Press.

Daly, Herman E. 2014. *From Uneconomic Growth to a Steady-State Economy*. Edward Elgar Publishing.

Diener, Ed, Daniel Kahneman, and John Helliwell. 2010. *International Differences in Well-Being*. Oxford University Press.

Downey, Liam. 2015. *Inequality, Democracy, and the Environment*. NYU Press.

Durante, Kristina M., and Juliano Laran. 2016. "The Effect of Stress on Consumer Saving and Spending." *Journal of Marketing Research* 53(5):814–28.

Easterlin, Richard. 1974. "Will Raising the Incomes of All Increase the Happiness of All?" *Journal of Economic Behavior & Organization.* 27(1):35–47.

Easterlin, Richard A. 2015. "Happiness and Economic Growth – The Evidence." Pp. 283–99 in *Global Handbook of Quality of Life*, *International Handbooks of Quality-of-Life*. Springer, Dordrecht.

Fan, Wen, Jack Lam, Phyllis Moen, Erin Kelly, Rosalind King, and Susan McHale. 2015. "Constrained Choices? Linking Employees' and Spouses' Work Time to Health Behaviors." *Social Science & Medicine* 126:99–109.

Firebaugh, Glenn, and Frank D. Beck. 1994. "Does Economic Growth Benefit the Masses? Growth, Dependence, and Welfare in the Third World." *American Sociological Review* 59(5):631–53.

Fitzgerald, Jared B., Andrew K. Jorgenson, and Brett Clark. 2015. "Energy Consumption and Working Hours: A Longitudinal Study of Developed and Developing Nations, 1990–2008." *Environmental Sociology* 1(3):213–23.

Fitzgerald, Jared B., Juliet B. Schor, and Andrew K. Jorgenson. 2018. “Working Hours and Carbon Dioxide Emissions in the United States, 2007–2013.” *Social Forces*.

Foster, John Bellamy, Brett Clark, and Richard York. 2010. “Capitalism and the Curse of Energy Efficiency The Return of the Jevons Paradox.” *Monthly Review* 62(6):1–12.

Foster, John Bellamy, Brett Clark, and Richard York. 2011. *The Ecological Rift: Capitalism’s War on the Earth*. NYU Press.

Grossman, Gene M., and Alan B. Krueger. 1995. “Economic Growth and the Environment.” *The Quarterly Journal of Economics* 110(2):353–77.

Hayden, Anders, and John M. Shandra. 2009. “Hours of Work and the Ecological Footprint of Nations: An Exploratory Analysis.” *Local Environment* 14(6):575–600.

Hill, Terrance D., and Andrew K. Jorgenson. 2018. “Bring out Your Dead!: A Study of Income Inequality and Life Expectancy in the United States, 2000–2010.” *Health & Place* 49:1–6.

Hill, Terrence D., Andrew K. Jorgenson, Peter Ore, Kelly S. Balistreri, and Brett Clark. 2019. “Air Quality and Life Expectancy in the United States: An Analysis of the Moderating Effect of Income Inequality.” *SSM - Population Health* 7:100346.

Huber, Joseph. 2009. "Ecological Modernization: Beyond Scarcity and Bureaucracy." Pp. 42–55 in *The Ecological Modernisation Reader*, edited by A. Mol, D. Sonnenfeld, and G. Spaargaren. New York: Routledge.

Jackson, Tim. 2009. *Prosperity Without Growth: Economics for a Finite Planet*. Sterling, VA: Earthscan.

Jalas, Mikko. 2002. "A Time Use Perspective on the Materials Intensity of Consumption." *Ecological Economics* (41):109–23.

Jalas, Mikko. 2005. "The Everyday Life Context of Increasing Energy Demands.Time Use Survey Data in a Decomposition Analysis." *Journal of Industrial Ecology* 9(1–2):129–45.

Jalas, Mikko, and Jouni K. Juntunen. 2015. "Energy Intensive Lifestyles: Time Use, the Activity Patterns of Consumers, and Related Energy Demands in Finland." *Ecological Economics* 113:51–59.

Jevons, William Stanley. 1865. *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal-Mines*. Macmillan.

Jorgenson, Andrew K. 2015. "Inequality and the Carbon Intensity of Human Well-Being." *Journal of Environmental Studies and Sciences* 5(3):277–82.

Jorgenson, Andrew K., and Brett Clark. 2012. "Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005." *American Journal of Sociology* 118(1):1–44.

Jorgenson, Andrew K., Thomas Dietz, and Orla Kelly. 2018. “Inequality, Poverty, and the Carbon Intensity of Human Well-Being in the United States: A Sex-Specific Analysis.” *Sustainability Science* 13(4):1167–74.

Jorgenson, Andrew K., Terrence D. Hill, Brett Clark, Ryan P. Thombs, Peter Ore, Kelly S. Balistreri, and Jennifer E. Givens. 2020. “Power, Proximity, and Physiology: Does Income Inequality and Racial Composition Amplify the Impacts of Air Pollution on Life Expectancy in the United States?” *Environmental Research Letters* 15(2):024013.

Jorgenson, Andrew K., Juliet Schor, and Xiaorui Huang. 2017. “Income Inequality and Carbon Emissions in the United States: A State-Level Analysis, 1997–2012.” *Ecological Economics* 134:40–48.

Kallis, Giorgos. 2017. *In Defense of Degrowth: Opinions and Minifestos*. edited by A. Vansintjan. Brussels: Uneven Earth Press.

Kasser, Tim, and Kirk W. Brown. 2003. “On Time, Happiness, and Ecological Footprints.” Pp. 107–112 in *Take Back Your Time: Fighting Overwork and Time Poverty in America*, edited by de Graaf, John. San Francisco, CA: Berrett-Koehler Publishers, Inc.

King, Lewis C., and Jeroen C. J. M. van den Bergh. 2017. “Worktime Reduction as a Solution to Climate Change: Five Scenarios Compared for the UK.” *Ecological Economics* 132:124–34.

Kivimäki, Mika, and Ichiro Kawachi. 2015. "Work Stress as a Risk Factor for Cardiovascular Disease." *Current Cardiology Reports* 17(9):74.

Kleiner, Sibyl, and Eliza K. Pavalko. 2010. "Clocking In: The Organization of Work Time and Health in the United States." *Social Forces* 88(3):1463–86.

Knight, Kyle W., Eugene A. Rosa, and Juliet B. 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.

Knight, Kyle W., and Juliet B. Schor. 2014. "Economic Growth and Climate Change: A Cross-National Analysis of Territorial and Consumption-Based Carbon Emissions in High-Income Countries." *Sustainability* 6(6):3722–31.

Knight, Kyle W., Juliet B. Schor, and Andrew K. Jorgenson. 2017. "Wealth Inequality and Carbon Emissions in High-Income Countries." *Social Currents* 4(5):403–12.

Layard, Richard. 2011. *Happiness: Lessons from a New Science*. London, UK: Penguin.

Longhofer, Wesley, and Andrew Jorgenson. 2017. "Decoupling Reconsidered: Does World Society Integration Influence the Relationship Between the Environment and Economic Development?" *Social Science Research*.

Lynch, Michael J., Michael A. Long, Paul B. Stretesky, and Kimberly L. Barrett. 2019. "Measuring the Ecological Impact of the Wealthy: Excessive Consumption, Ecological Disorganization, Green Crime, and Justice." *Social Currents* 6(4):377–95.

Mathur, Anil, George P. Moschis, and Euehun Lee. 2006. “Consumer Stress-Handling Strategies: Theory and Research Findings.” *Journal of Consumer Behaviour* 5(3):193–203.

McGee, Julius Alexander, and Patrick Trent Greiner. 2018. “Can Reducing Income Inequality Decouple Economic Growth from CO2 Emissions?” *Socius* 4:2378023118772716.

Mol, Arthur, and Martin Janicke. 2009. “The Origins and Theoretical Foundations of Ecological Modernisation Theory.” Pp. 17–27 in *The Ecological Modernisation Reader*, edited by A. Mol, D. Sonnenfeld, and G. Spaargaren. New York: Routledge.

Mol, Arthur P. J. 2000. “Ecological Modernisation Theory in Debate: A Review.” *Environmental Politics* 9(1):17.

Mol, Arthur P. J., David A. Sonnenfeld, and Gert Spaargaren. 2009. *The Ecological Modernisation Reader*. New York: Routledge.

Oh, Seung-Yun, Yongjin Park, and Samuel Bowles. 2012. “Veblen Effects, Political Representation, and the Reduction in Working Time Over the 20th Century.” *Journal of Economic Behavior & Organization* 83(2):218–42.

Pickett, Kate E., and Richard G. Wilkinson. 2015. “Income Inequality and Health: A Causal Review.” *Social Science & Medicine* 128:316–26.

Pollin, Robert. 2019. “Advancing a Viable Global Climate Stabilization Project: Degrowth versus the Green New Deal.” *Review of Radical Political Economics* 51(2):311–19.

Rosnick, David, and Mark Weisbrot. 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):405–17.

Schor, Juliet. 1992. *The Overworked American: The Unexpected Decline Of Leisure*. Basic Books.

Schor, Juliet. 2005. “Sustainable Consumption and Worktime Reduction.” *Journal of Industrial Ecology* 9(1-2):37–50.

Schor, Juliet. 2010. *Plenitude: The New Economics of True Wealth*. New York: The Penguin Press.

Schor, Juliet B. 1998. *The Overspent American: Why We Want What We Don’t Need*. New York: Harper Collins.

Schor, Juliet B., and Andrew K. Jorgenson. 2019. “Is It Too Late for Growth?” *Review of Radical Political Economics* 51(2):320–29.

Steffen, Will, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, Anthony D. Barnosky, Sarah E. Cornell, Michel Crucifix, Jonathan F. Donges, Ingo Fetzer, Steven J. Lade, Marten Scheffer, Ricarda Winkelmann, and Hans Joachim Schellnhuber. 2018.

“Trajectories of the Earth System in the Anthropocene.” *Proceedings of the National Academy of Sciences* 115(33):8252–59.

Tapia Granados, Jose A., and Edward L. Ionides. 2008. “The Reversal of the Relation Between Economic Growth and Health Progress: Sweden in the 19th and 20th Centuries.” *Journal of Health Economics* 27(3):544–63.

Thombs, Ryan P. 2017. “The Paradoxical Relationship between Renewable Energy and Economic Growth: A Cross-National Panel Study, 1990-2013.” *Journal of World-Systems Research* 23(2):540–64.

Thombs, Ryan P. 2018. “Has the Relationship between Non-Fossil Fuel Energy Sources and CO2 Emissions Changed over Time? A Cross-National Study, 2000–2013.” *Climatic Change* 148(4):481–90.

United Nations. 2020. “About the Sustainable Development Goals.” *United Nations Sustainable Development*. Retrieved January 11, 2020 (https://www.un.org/sustainabledevelopment/sustainable-development-goals/).

Veblen, Thorstein. 1912. *The Theory of the Leisure Class: An Economic Study of Institutions*. B. W. Huebsch.

York, Richard. 2012. “Do Alternative Energy Sources Displace Fossil Fuels?” *Nature Climate Change* 2:441–43.

CHAPTER 2: WORKING HOURS AND CARBON DIOXIDE EMISSIONS IN THE UNITED STATES, 2007-2013

NOTE: This is an amended pre-copyedited, author-produced version of an article accepted for publication in *Social Forces* following peer review. The version of record: Fitzgerald, Jared B., Juliet B. Schor, and Andrew K. Jorgenson. 2018. "Working Hours and Carbon Dioxide Emissions in the United States, 2007–2013." *Social Forces,* is available online at https://doi.org/10.1093/sf/soy014.

ABSTRACT

The well-established association between economic output and carbon emissions has led researchers in sociology and its sister disciplines to study new approaches to climate mitigation, including policies that stabilize or reduce GDP growth. Within this degrowth approach, working time reduction is a key policy driver to both reduce emissions and protect employment. In the U.S., the abdication of responsibility for mitigation by the Federal government has led to the emergence of state leadership. This study is the first to analyze the relationship between emissions and working hours at the state level. Our findings suggest that over the 2007-2013 period, state-level carbon emissions and average working hours have a strong, positive relationship, which holds across a variety of model estimation techniques and net of various political, economic, and demographic drivers of emissions. We conclude that working time reduction may represent a feasible multiple dividend policy.

INTRODUCTION

There is now unequivocal evidence that the planet is warming as a result of human activities, as reported by the most recent United Nations' Inter-Governmental

Panel on Climate Change (IPCC 2014) report, and the newly released National Climate Assessment from the U.S. Government Global Change Research Program (USGCRP 2017). The impacts of warming and climate destablization include increased severity of storms and other weather events, heightened water scarcity, sea-level rise, species extinctions, ocean acidification and biodiversity loss. The most important human activity contributing to climate change is the burning of fossil fuels and the associated release of greenhouse gases (GHGs) into the atmosphere, most notably carbon dioxide (CO_2). According to the United States Environmental Protection Agency (2016), CO_2 emissions from the burning of fossil fuels comprise the majority of the nation's total GHG emissions.

Despite the scientific consensus on anthropogenic climate change and the contributions of GHG emissions, the 2016 U.S. Presidential election resulted in an Administration that is aggressively attempting to reverse mitigation efforts in the U.S. and globally. President Trump, who has said that climate change is a "hoax" concocted by China, supports policies that will increase the consumption of fossil-fuels, accelerate GHG emissions and exacerbate the potential threats of climate change (Greenfieldboyce 2016). He has signaled his intention to withdraw from the U.S. from the Paris Climate Accord, is attempting to scrap the EPA's Clean Power Plan, and has placed opponents of climate change policy and deniers of climate science into key positions in government. These include Rex Tillerson, the former CEO of Exxon Mobil, as Secretary of State, and Scott Pruitt as the Administrator of the Environmental Protection Agency. Administration actions, combined with the strong presence of climate deniers among Republican congressional members, suggest that meaningful federal actions to reduce fossil-fuel consumption, lower GHG emissions, or combat climate change are unlikely for the foreseeable future. To be sure, even before the election of President Trump, federal action on climate change was inadequate. While Barack Obama professed concern about climate change, relatively limited progress was achieved until the later years of his presidency (Lavelle 2016). Under the current U.S. Administration, there is active hostility to mitigation.

In light of Federal opposition, state-level policies are likely to become more important. After President Trump's announcement that he intends to withdraw the US from the Paris Climate Accord, hundreds of sub-national entities pledged to honor the commitments from that accord, and 12 states have formed the United States Climate Alliance (Domonoske 2017). These promises are subsequent to a history of significant climate policies at the state and regional level. In 2012, California implemented a cap-and-trade program aimed at reducing statewide GHG emissions to 80 percent of 1990 levels by 2050 (California Environmental Protection Agency 2015). Similarly, the Regional Greenhouse Gas Initiative (RGGI) was established in 2009 as a regional cap-and-trade program for power plant emissions in Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont (Regional Greenhouse Gas Initiative 2017). However, if states are to take leading roles in combatting climate change, they will need research on innovative policies to reduce state-level emissions.

Environmental sociologists have devoted considerable attention to identifying the anthropogenic drivers of climate change (e.g., Dietz et al. 2015; Dunlap and Brulle 2015; Jorgenson 2006, 2014; Jorgenson and Clark 2012; Knight and Schor 2014; Longhofer and Jorgenson 2017; Rosa, York and Dietz 2004; Shandra et al. 2004; York 2012). Much of this research finds a positive relationship between economic growth and GHG emissions. The continued strength of the link between economic growth and GHG emissions has led some researchers to study the potential of working hours reductions to reduce emissions. The literature identifies two main effects of working time on emissions. The first is via the size and growth of GDP—higher hours yield higher output, *ceteris paribus*. The second is that working hours affect household time use and consumption patterns, both of which, in turn, affect emissions (Jalas 2002, 2005; Schor 2010). Working hour reductions are also seen as a way to slow GDP growth that provides significant benefits in the form of more free time and less stress. Working hours have been a topic of interest among a group of economists and other social scientists who argue that a policy of either steady-state (i.e. Daly 1996, 1999) or economic contraction, i.e., degrowth, is necessary to achieve deep de-carbonization (Jackson 2009a, 2009b; Martinez-Alier 2009; Sachs et al. 1998; Victor 2008). This approach has been directed toward wealthy countries, with their disproportionately high standards of living and attendant carbon emissions (Knight, Rosa and Schor 2013a; Sachs et al. 1998; Sachs 2008; Schor 1991).

Uncertainties about the future of work also suggest that working time reduction may be an increasingly important policy tool. Advances in artificial intelligence (AI) and automation may have substantial effects on employment. Recent evidence suggests that manufacturing employment has already declined due to increased automation (Acemoglu and Restrepo 2017; Autor 2015). Given that a large number of jobs are likely to become obsolete, an important question is whether there will be sufficient offsetting new kinds of work and economic growth to accommodate workers who are displaced by technological change. Some analysts suggest we may be in a period of long-term stagnation which will reduce the absorption of displaced workers (Gordon 2016; Schor 2010). In addition, the rate of GDP growth necessary to re-employ displaced labor may be too high to meet emissions targets, given the strong link between GDP and emissions.

Sociologists and economists have modeled the impact of working hours on various environmental outcomes and find that longer average working hours are associated with higher carbon emissions, fossil-fuel consumption, and ecological footprints. (Fitzgerald, Jorgenson and Clark 2015; Hayden and Shandra 2009; King and van den Bergh 2017; Knight, Rosa and Schor 2013a, 2013b; Rosnick and Weisbrot 2006; Schor 2005). The two pathways of impact noted above have been termed the scale and composition effects (Schor 2010) The scale effect refers to the impact of working hours on the size (or scale) of the economy via GDP growth. Compositional effects measure the influence of time availability on the carbon intensity of household consumption and activity choices.

Previous research on working hours and environmental outcomes is either national or cross-national, but such relationships can be examined at smaller scales. In this study, we assess the association sub-nationally, at the U.S. state level. We examine the relationship between state-level carbon emissions and average weekly working hours for all 50 U.S. states from 2007-2013. Conducting the analysis at the U.S. state level is important for at least three reasons. First, an analysis at this scale may prove to have more policy significance, particularly in the U.S. where a number of states already have crafted working time policies (Messenger and Ghosheh 2013). While the federal government has the ability to enact meaningful and wide-ranging working time policies, it has not done much on this since the 1938 Fair Labor Standards Act, which implemented the 40-hour work week and the minimum wage. Second, examining socio-environmental relationships in sub-national contexts is important because it cannot be assumed that relationships found at national and cross-national levels will operate similarly at smaller scales. Finally, the absence of linked individual-level or household-level data that combines time use, activity and consumption patterns, and emissions data has meant that studies at such micro levels are rare and limited in the questions they can ask.

LITERATURE REVIEW

ECONOMIC GROWTH AND THE ENVIRONMENT

A central question in environmental sociology is the role of economic growth in causing carbon emissions and other types of pollution. For example, ecological modernization theory (EMT) argues that modern societies shift from a focus on economic rationality to a focus on ecological rationality, which is expected to result in a reduction in the environmental impacts of economic activity (Huber 2009; Mol et al. 2014; Mol and Spaargaren 2000). EMT theorists posit that state intervention and reformed state-market relations foster the spread of ecological rationality, which leads to more sustainable technologies (Mol and Janicke 2009). In contrast, other sociologists contest the view that economic growth will yield environmental sustainability. For example, York, Rosa and Dietz (2003:86) argue that there is a "relentless commitment to growth inherent in modern, particularly capitalist, production systems" and that growth is a main driver of environmental degradation. Furthermore, many scholars argue that, in a growth-centric society, technological advancements are unlikely to bring about sustainability, due in part to "rebound effects" or what has been termed the "Jevons paradox" (Jevons 1865; Grant, Jorgenson and Longhofer 2016; Foster, Clark and York 2010; York and McGee 2016).

There is now a considerable body of sociological research that examines the relationship between economic growth and carbon emissions and other environmental harms, both nationally and cross-nationally (e.g., Jorgenson 2006; Jorgenson and Clark 2012; Rosa, York and Dietz 2004; York 2012). EMT scholars have found some evidence for their claims, but this research is typically at lower levels of analysis, such as the household, business or economic sector (e.g., van Koppen and Mol 2009). When examining environment and development relationships at higher levels of analysis, studies find little evidence of the "decoupling" of growth and environmental harms, particularly for global pollutants such as carbon and methane emissions (Jorgenson and Birkholz 2010; Jorgenson and Clark 2012; Knight and Schor 2014; Longhofer and Jorgenson 2017). In part, findings hinge on whether scholars are considering "relative" or "absolute" decoupling (Jorgenson and Clark 2012). Absolute decoupling refers to situations in which an environmental measure, such as the level of emissions, is stable or declines in relation to an increase in the economic variable. In other words, growth in GDP is no longer associated with any increase in emissions. Relative decoupling, on the other hand, occurs when the increase in the environmental harm measure is less than the growth rate of the economic variable. Because climate change mitigation requires absolute reductions in CO_2 emissions in a short time frame, relative decoupling is likely to be insufficient. As such, relying on economic growth as a mitigation strategy could be a dangerous proposition.

THE ARGUMENT FOR ECONOMIC DEGROWTH

The failure of wealthy countries to decouple output and emissions has led some scholars to call for a rejection of growth-centric policy and discourse. This conversation takes as its lineage the "limits to growth" discussions of the 1970s (Meadows et al. 2004). More recently, Rockstrom et al. (2009) attempted to mainstream that discussion with a global assessment that identifies planetary boundaries, which, if crossed, might make the planet unsuitable for humans. Drawing on these, and similar scientific analyses of climate change, a group of critical scholars argue that major systemic changes, in particular the primary focus on economic growth, are necessary to avoid ecological catastrophe. Arguments of this type go by a variety of terms, such as steady-state economics, sufficiency, a-growth and degrowth (Alcott 2008; Daly 1996; Jackson 2009a; Jackson 2009b; Kerschner 2010; Martinez-Alier 2009; Princen 2005; van den Bergh 2011). Taken together, these perspectives represent a middle ground between ecological modernization theory, which has faith in environmentally-enhancing growth, and views that emphasize the continuing threat from GDP growth on account of its failure to decouple from GHG emissions.

Pioneering ecological economist Herman Daly (1996, 1999) has argued for a steady state economy. In Daly's account, growth should only occur up to a desirable level, beyond which it is both ecologically and socially damaging. However, other than arguing for limits to GDP, Daly does not call for radical structural changes to the market economy. Similarly, advocates of "sufficiency" believe there is a point beyond which human societies have enough and further accumulation and growth is not only wasteful but harmful to the environment (Princen 2005). Jeroen C.J.M. van den Bergh (2011) takes a more agnostic position, which he calls a-growth, arguing that because GDP growth harms the environment and is not a good measure of social welfare, “one has to be indifferent or neutral about economic growth” (van den Bergh 2011:5). Others scholars argue that even the steady state is not an aggressive enough goal for wealthy nations. They argue that degrowth is necessary to bring consumption and production to levels which satisfy both ecological sustainability and global equity. Economic contraction in wealthy countries will open up “ecological space” for global South nations that require growth to improve well-being and reduce poverty (Rice 2007; Sachs et al. 1998; Hayden 1999, 2014; Martinez-Alier 2009, 2012; Schneider et al. 2010; Victor 2008). Advocates also stress that degrowth needs to be planned (Alexander 2012; Martinez-Alier 2009). While unintended contraction of the economy is emissions-reducing (e.g., York 2008), unexpected economic downturns have unacceptably high economic, political and social costs.

Proponents of degrowth also typically align with a larger literature that questions the relationship between economic growth and increases in human well-being in wealthy countries. Researchers have found that for many countries, there is an income level beyond which increases fail to produce higher quality of life or well-being (Alcott 2008; Brady, Kaya and Beckfield 2007; Daly 1999; Dietz 2015; Easterlin 1995; Jackson 2009; Jorgenson 2014; Martinez-Alier 2009; Schor 2010). While there is still debate about these findings (i.e., Wolfers and Stevenson 2008), including the exact income level beyond which increases in well-being fail to occur, the bulk of the evidence supports a weak relationship between well-being and income among the non-poor. Daly (1999) interprets this research as showing that wealthy countries have reached the stage of "uneconomic growth," in which the social and environmental costs of economic growth outweigh the benefits of production.

Given their position between EMT and more radical critics of capitalism, it is to be expected that degrowth advocates have been criticized from both sides—for being politically unrealistic (Milanovic 2017; Pollin 2015) and for failing to be sufficiently critical of capitalism (i.e., Foster 2011). Alternatively, one can view degrowth as an attempt to harness both structural changes *and* normative alterations in individual and household behaviors. Degrowth policies are a kind of middle ground that can limit some of the ecological and social harms of capitalism short of a full system overhaul. Degrowth policies are also important steps that may foster further systemic transitions beyond capitalism and towards economic systems of greater social equity and ecological justice. In this vein, degrowth scholars have argued for policies and goals such as reductions in income inequality and ecological tax-shifting (Martinez-Alier 2009). Additionally, because economic degrowth calls for reductions in production, most accounts recognize that one result will be increased unemployment (Schor 2005; Victor 2008). In response to this recognition, a foundational component of the degrowth paradigm is a reduction in working hours.

WORKING TIME REDUCTION

Historically, two factors have mitigated technologically-induced unemployment: GDP growth and reductions in working hours (Schor 2010). In degrowth scenarios, GDP growth is no longer available to absorb labor. Therefore, to avoid the unemployment impacts of economic contraction, working hours reductions are considered to be a key policy tool for avoiding mass unemployment (Schor 1991; Hayden 1999, 2016; Victor

2008). The need for working hours reduction is further suggested by an emergent narrative that most degrowth authors have not yet addressed: that Artificial Intelligence (AI) and labor automation will substantially raise the rate of technological displacement of labor (Acemoglu and Restrepo 2017; Autor 2015; Brynjolfsson and McAfee 2014). From self-driving cars to IBM's Watson, there have been rapid developments in AI in recent years that some observers believe could result in high levels of unemployment as they contribute to further automation (Brynjolfsson and McAfee 2014; Frey and Osborne 2017). In one of the few existing studies of recent automation, Acemoglu and Restrepo (2017) find that, within commuting zones, the addition of one industrial robot displaces 6 workers. On the other hand, many are optimistic about the future of employment. Indeed, the conventional wisdom among economists is that economic growth will be sufficient to create new jobs and maintain employment numbers, either as complements to the displaced tasks or in other sectors.

The optimistic view assumes that rapid economic growth is both desirable and possible. If growth is either not forthcoming (for economic reasons), or not feasible (on climate or other ecological grounds), then alternative policies will be necessary to avoid high unemployment and its attendant social problems (Schor 1992). One potential route is reductions in working hours, which can contribute to job creation by spreading current levels of working time among more workers. We say "can" because the size of the employment effect will depend on how hours reductions affect the supply and demand of labor, via changes in wages and productivity. This is a complex question and beyond the scope of the present study. However, under reasonable assumptions, there will be some positive employment effect of working hours reductions. Working time reductions can also yield ecological benefits, such as reduced carbon emissions and other environmental pressures (Fitzgerald et al. 2015; King and van den Bergh 2017; Knight et al. 2013a, 2013b; Schor 2005).

Schor (2010) notes that there are two main channels through which working time affects ecological outcomes: scale and composition effects. The scale effect describes a response in which higher worker hours yield a higher level of economic output, income and consumption. Over time, productivity increases are not taken in the form of more leisure, but rather more production. This production in turn becomes income, which is subsequently spent. Shifting preferences then accommodate the long hours and higher spending, a process Schor (1992) Hs termed the "work and spend cycle," highlighting that working time is a key factor in consumer culture. Generally, the scale effect can be understood as the contribution of working time to economic growth.

The composition effect is the impact of working time net of its contribution to GDP. It is theorized as a household-level decision effect and is based on models of household behavior that incorporate both income and time availability (Becker 1965). Households with shorter working hours and more time affluence are hypothesized to live less ecologically-intensive lifestyles, while those with time scarcity are thought to be more ecologically-intensive. In the case of transportation, households with greater time-affluence can opt for public transportation, which is usually more time-intensive but less ecologically-intensive (Jalas 2002, 2005; Jalas and Juntunen 2015; Kasser and Brown 2003). However, it is also the case time-rich households may engage in more ecologically-intensive activities such as travel.

Given the importance of working time in the degrowth framework, researchers are paying increasing attention to analyzing working time and environment relationships (Fitzgerald et al. 2015; Hayden and Shandra 2009; King and van den Bergh 2017; Knight et al. 2013a; 2013b; Rosnick and Weisbrot 2006; Schor 2005). The first study on this topic was Schor's (2005) exploratory analysis of 18 OECD nations, where she found that working hours are positively associated with nations' ecological footprints. Rosnick and Weisbrot (2006) compared working hours and energy consumption in the US and Western Europe and found that if the US were to reduce its working hours to Western European levels, energy consumption would decline by 20 percent. Alternatively, if Western Europe were to increase working hours to mirror those in the US, they would consume 25 percent more energy. Building on Schor's (2005) analysis, Hayden and Shandra (2009) performed a cross-sectional analysis examining the impact of working hours on the ecological footprints of 45 countries and find a positive association.

Knight et al. (2013a, 2013b) advanced this line of inquiry by examining the relationship between working hours and three environmental indicators from 1970-2007 for OECD nations. Their findings indicate that changes in working hours are positively correlated with changes in ecological footprints, carbon footprints and carbon emissions. Fitzgerald, Jorgenson and Clark (2015) examined the relationship between working hours and fossil-fuel energy consumption for both developed and developing countries. They find that the positive relationship between working hours and energy consumption has increased over time for both scale and compositional effects. More recently, King and van den Bergh (2017) analyzed how different scenarios for reducing working hours affect carbon emissions and found that while all scenarios reduce carbon emissions, implementing a 4-day work week is most effective. In contrast, another recent study by Shao and Shen (2017) examined the working time relationship with both carbon emissions and energy use for a small sample of European countries and found that, beyond a certain threshold, hours reductions are no longer associated with lower emissions and energy use. However, the small sample size and particular modeling strategy of this study suggest the need for further analysis.

Research has shown that a reduction in working time has social benefits as well, such as higher levels of life satisfaction and happiness, even with attendant reductions in income (Alesina, Glaeser and Sacerdote 2005; Pouwels, Siegers and Vlasblom 2008). Perhaps the biggest social benefit of a reduction of working time for individuals is the associated increases in leisure time (Schor 2010). Overall, the existing research suggests that working time reduction potentially offers a triple-dividend to society: reduced unemployment, increased quality of life and reduced environmental pressures.

In this study we advance the existing literature by examining the relationship between working hours and carbon emissions at the U.S. state level from 2007-2013. States have historically been able to craft legislation on working time (Messenger and Ghosheh 2013). For instance, some states have “work share” programs which allow businesses to temporarily reduce hours for their employees without engaging in layoffs (National Conference of State Legislatures 2017). These programs allow workers to access partial unemployment benefits while working fewer hours. While California was the first state to implement a “work share” program in 1979, the programs became more widespread after the 2008-09 economic recession. In 2014, 27 states had a “work share” program (Messenger and Ghosheh 2013; National Conference of State Legislatures

2017). Further, a reduction in working hours in the United States could be particularly effective as the average American works long hours. According to the Economic Policy Institute (2017), in 1973 the average American worked 1,679 hours a year. By 2007, this number had risen to 1,883; a difference of over 200 hours a year. Hours subsequently declined (due to the recession) to 1,815 in 2010.

Americans also work much more than counterparts in other wealthy nations. They currently work 399, 352, and 304 more hours per year than workers in Germany, the Netherlands and France, respectively (The Conference Board 2017). The divergence between the U.S. and other wealthy countries can be attributed to a number of factors, including that in the U.S. full-time work is more prevalent and there is less vacation and holiday time (Bell and Freeman 2001). Higher U.S. levels of income inequality likely play a role as well, as individuals work longer hours in order to meet the consumption standards of the wealthy (Bowles and Park 2005).

DATA AND METHODS

SAMPLE

Our dataset contains annual state-level observations for all 50 U.S. states for the years 2007-2013, resulting in a balanced panel dataset with 350 total observations. Due to limited data availability for state-level working hours we are unable to include observations before 2007 or after 2013.

MODEL ESTIMATION TECHNIQUES

We estimate both fixed effects and random effects panel regression models to assess the relationship between state-level working hours and carbon dioxide emissions.

Each modeling technique has strengths and weaknesses and using both allows us to evaluate the relationship in different ways. Fixed effects models are more effective at dealing with heterogeneity bias by controlling for time-invariant factors unique to each case. One potential downside to this is that time-invariant factors of substantive interest cannot be included in the analysis because they are perfectly correlated with the fixed effects. Fixed effects models also have a singular focus on within-effects, and thus provide more conservative estimates (Allison 2009). On the other hand, random effects models allow for the inclusion of time-invariant factors into the analysis (such as census region), and random effects models also make more efficient use of the available data by analyzing both between-case and within-case variation.

We estimate Prais-Winsten models with panel corrected standard errors (PCSEs) for the fixed effects models. We estimate two-way fixed effects models by controlling for both state-specific and year-specific intercepts. We also correct for first-order autocorrelation (i.e. AR(1) correction) within panels and treat that AR(1) process as common to all panels as we have no theoretical basis for assuming otherwise (Beck and Katz 1995). While we report the models with a common AR(1) correction, the results remain substantively the same when the models are estimated using a panel specific AR(1) correction instead. For the random effects models, we also include year-specific intercepts and the common AR(1) correction. We estimate all models with Stata software (Version 13).

All non-binary variables are transformed into logarithmic form, an established approach in research on the human drivers of anthropogenic emissions and related outcomes (e.g., Jorgenson and Clark 2012; Rosa and Dietz 2012; York, Rosa, and Dietz

2003). For such variables, the regression models estimate elasticity coefficients where the coefficient for the independent variable is the estimated net percent change in the dependent variable associated with a one percent increase in the independent variable.

DEPENDENT VARIABLE

The dependent variable is state-level carbon dioxide emissions from fossil fuel combustion, measured in million metric tons ($MMTCO_2$). We gathered these data from the United States Environmental Protection Agency in 2016 (EPA 2016). Emissions from fossil fuel combustion represent over 75% of all carbon dioxide emission sources (EPA 2016). The EPA's emissions estimates are based on fuel consumption data from the US Department of Energy/Energy Information Administration (EIA). At the time of this writing, the EPA website has been updated and no longer includes access to these data. However, it is possible to access the files through the January 19, 2017 snapshot version of the webpage (EPA 2017). Furthermore, the lead author of this study will share these data upon request.

INDEPENDENT VARIABLES

The key independent variable in this study is average weekly working hours per worker. We gather these data from the United States Bureau of Labor Statistics' (BLS) Current Employment Statistics (CES) database (2016). Each month, the CES surveys approximately 146,000 businesses and government agencies. This equates close to 623,000 individual worksites. The sample of businesses for each month comes from the BLS Longitudinal Database of employer records, which contains data on approximately 9.3 million businesses across the US (BLS 2016). The working hours data cover all nonfarm private employees, but exclude public employees. While annual working hours would be a preferable measure, these are not available from the CES.

The states with the highest average weekly working hours for the 2007-2013 time period are Texas (36.2), Louisiana (36.1), Wyoming (36.1), Alabama (35.7) and Mississippi (35.6). The states with the lowest average weekly working hours for the same time period are Hawaii (32.9), Wisconsin (32.9), Montana (33), New Hampshire (33.1), and Delaware (33.1). While the differences in weekly hours may appear to be relatively small, when examined over the course of a year they can be considerable. For instance, over the course of 52 weeks of work the average worker in Texas will work 167 more hours, or around 4 more work weeks, than the average worker in Hawaii. Figure 2.1 illustrates average working hours for the 2007-2013 time period.

As discussed in the literature review, previous research considers the effect of working time on environmental outcomes in two ways: scale effects and composition effects. The scale effect is measured as working time's contribution to GDP. Consistent with previous studies, we test for the scale effect by disaggregating GDP into three parts: working hours, labor productivity and employment to population ratio (Ark and McGuckin 1999; Hayden and Shandra 2009; Knight, et al. 2013a, 2013b). In models where we test for the scale effect we include both labor productivity and employed population percentage as the other components of GDP. Labor productivity is measured as GDP per hour of work. Employed population percentage is measured as the employed population of a state divided by its total population. The data on labor productivity and employed population are also gathered from the BLS (2016). The composition effect is measured net of GDP. State-level GDP per capita data (in chained 2007 dollars) are taken from the United States Department of Commerce Bureau of Economic Analysis (2016) database.

Other control variables include total population size (United States Census Bureau 2016), manufacturing as a percentage of GDP (United States Department of Commerce Bureau of Economic Analysis 2016) and a state's energy production, which contributes to carbon emissions. The state energy production data are collected from the EIA's State Energy Database System (2016). We also control for the working age population percentage (measured as the percentage of the population aged 15-64) and average household size. These data are obtained from the US Census Bureau's American Community Survey (2017). In the random effects models, we also include a measure of state environmentalism developed by Dietz et al. (2015). These data measure pro-environmental voting by each state's Congress and are an average of House and Senate scores from the League of Conservation Voters' ratings for each member of Congress. The scores are based on their votes on environmental issues as identified by the League of Conservation Voters from the years 1990-2005. While the data cover a period of time, they are technically time-invariant as they represent a total score for the fifteen-year period. We also include dummy variables for census region in the random effects models to control for regional variation in carbon emissions, where Northeast is the reference category. Table 2.1 above provides the descriptive statistics. Table 2.2 below presents the bivariate correlations.

RESULTS

Figure 2.2 is a scatterplot of the association between the percent change in working hours from 2007 to 2013 and the percent change in carbon emissions from 2007 to 2013. These measures are positively correlated with a value of .464. North Dakota, Nebraska, and South Dakota are states that experienced relatively high increases in both emissions and working hours over the time period, while Nevada, Montana, Kentucky and Delaware all experienced relatively large decreases in both emissions and working hours.

The findings for the panel regression analysis are provided in Tables 2.3 and 2.4. Models 1 and 3 examine the scale effect of working hours on carbon emissions. These models include working hours, GDP per hour, employed population percentage, total population, energy production, manufacturing as a percentage of GDP, average household size and the working age population percentage. Model 3 also includes the dummy variables for census region and the state environmentalism measure. Models 2 and 4 examine the composition effect of working hours on carbon emissions. These models include working hours, GDP per capita, total population, energy production, manufacturing as a percentage of GDP, average household size and working age population percentage. Model 4 also includes the census region dummy variables and the state environmentalism measure. Models 1 and 2 are the two-way fixed effects Prais-Winsten regression models. Note that in these models, the R-squared statistic is close to perfect. This is largely due to the inclusion of the year-specific and state-specific intercepts. Models 3 and 4 are random effects models with unreported year-specific intercepts. These models also have high R-squared values, which is partly attributed to the inclusion of the year-specific intercepts and the census region control variables.

In Models 1 and 3, we find that the scale effect of working hours on carbon emissions is positive and significant. Specifically, in Model 1, we find that, over time, a one percent increase in average working hours per worker is associated with a .668 percent increase in emissions, holding all else constant. In Model 3, this finding is substantively the same where a 1 percent increase in average working hours is associated with a .654 percent increase in carbon emissions. In both models total population is positive and significant, highlighting that population size is an important driver of emissions. Energy production is also positive and significant in both models. In Model 1, employed population percentage is also positive and significant. In Model 3, we find that the effect of the time-invariant measure for state environmentalism is negative and significant. The Midwest and south regional dummy variables are positive and significant, highlighting regional variation in carbon emissions. The effects of manufacturing as a percentage of GDP, average household size and working age population percentage are non-significant in both models.

In Models 2 and 4, we also find that the composition effect of working hours on emissions is positive and significant. More specifically, in Model 2, we find that a one percent increase in average working hours is associated with a .675 percent increase in carbon emissions while holding all else constant. Similarly, in Model 4, we find that a one percent increase in average working hours is associated with a .552 percent increase in emissions. For the control variables, we again find the effects of total population and energy production to be positive and significant. The effect of GDP per capita is non-significant in both models. Previous studies have found GDP per capita (i.e. Knight et al. 2013) to be significant when examining the composition effect. This null finding is possibly due to our relatively small sample size, which limits the statistical power of the models. It should be noted that in models without energy production as a control, the effect of GDP per capita on emissions is significant. In Model 4 the estimated effect of state environmentalism is negative and significant, while the Midwest regional dummy variable is also significant, once again highlighting regional variability in carbon emissions. In both models the effects of manufacturing as a percentage of GDP, average household size and working age population are non-significant.

Following the helpful suggestions of two anonymous reviewers, as a robustness check for our reported findings we also estimated "hybrid" models, which combine the features of both fixed effects models and random effects models (Allison 2009; Firebaugh, Warner and Massoglia 2013; Schunck 2013). The results, which are provided in the Appendix, are consistent with the findings reported in Table 4. In addition to the hybrid models, we also conducted thorough sensitivity analyses to test for the presence of overly influential cases in the fixed effects and random effects models. These sensitivity analyses, which involved estimating all models while systematically excluding each state, are consistent with the reported findings, suggesting that there are no overly influential cases in the sample. While we do control for energy production, we also ran models simultaneously excluding Nebraska, South Dakota and North Dakota, which have experienced a "fracking boom" in recent years which could influence the results. The findings again remained substantively similar. Finally, we estimated additional models that also control for the percentage of the population with a Bachelor's degree. The results of these models are substantively the same as the reported findings, while the estimated effect of the education measure on state-level carbon emissions is nonsignificant.

DISCUSSION AND CONCLUSION

A growing number of researchers have questioned whether perpetual economic growth, with its attendant carbon emissions, is sustainable. They argue that we need planned economic contraction, or degrowth, in order to reach emissions targets and avoid the most disastrous effects of climate change. A key part of the degrowth paradigm is a reduction of working hours. Previous cross-national research has shown that longer work hours are associated with increased environmental pressures, including fossil-fuel energy consumption and carbon emissions (Fitzgerald et al. 2015; Hayden and Shandra 2009; King and van den Bergh 2017; Knight, et al. 2013a, 2013b; Rosnick and Weisbrot 2007; Schor 2005).

In this study we examined the relationship between state-level working hours and CO_2 emissions for all fifty U.S. states. Analyzing this relationship at the state level is important for a number of reasons. The federal government in the U.S. has been slow to enact policies that effectively deal with climate change mitigation and this has worsened under the Trump Administration. As a result, states have taken significant actions to curb their emissions. Furthermore, sub-national entities (e.g., states, cities and regions) have announced that they will continue their push to meet the goals of the Paris Climate Accord even after the Trump Administration has signaled its intention to pull the U.S. out of its obligations (Domonoske 2017). Second, states have a recent history of enacting worktime legislation (Messenger and Ghosheh 2013; National Conference of State Legislatures 2017), in contrast to the federal government which has done little to advance shorter working hours since the 1938 Fair Labor Standards Act, the nation's major worktime law. Finally, it should not be assumed that the relationship between working hours and emissions will operate in the same way at the U.S. state level that it does in cross-national contexts.

The results of our analysis suggest that working time is positively associated with higher state-level carbon emissions, and we find evidence for both the scale and composition effects. For the scale effect, our findings indicate that longer hours of work increase emissions through their contribution to GDP, net of labor productivity and employed population percentage. Furthermore, the relationship between working hours and carbon emissions holds net of GDP as well. This is likely due to longer hours of work leading to more carbon-intensive lifestyles due to lower levels of time-affluence. Our results are generally consistent with previous cross-national research. A notable exception is that we find a significant composition effect of working hours on emissions, in contrast to Knight et al. (2013a, 2013b).

While our findings suggest that a reduction of working time could be a viable climate change mitigation strategy for U.S. states, they also have implications for the future of work, and particularly the impact of advances in AI and automation on employment (Brynjolfsson and McAfee 2014; Acemoglu and Restrepo 2017). If unaddressed, labor-displacement via technological change could lead to higher levels of unemployment. Instead of relying on economic growth to combat future unemployment, working time reduction has the potential for a "triple dividend" (Jackson 2005). First, a reduction in working time spreads employment to more employees, thus reducing unemployment. Second, research suggests that reduced working hours benefit individuals via lower levels of stress, increased leisure time and increases in quality of life (Alesina, et al. 2005; Hayden 1999; Kasser and Brown 2003; Pouwels, et al. 2008). Third, working time reduction allows a society to reduce its impact on the environment.

While working time reduction offers a potential triple-dividend of socio-environmental benefits, it is not without its challenges. U.S. worktime reductions are often involuntary. People may be faced with a decision of working less or losing their jobs. Environmentally, it does not matter if the reductions are voluntary or not as the benefit for reduced carbon emissions occurs regardless. On the social side, however, these involuntary reductions can be difficult to deal with. Therefore, to make worktime reduction socially, economically, politically and environmentally feasible, a planned working time reduction in the U.S. should be accompanied by other structural changes.

In the U.S., the combination of a weak welfare state, high income and wealth inequality, and an abundance of low wage employment tends to result in long working hours. While “work share” programs have been implemented in many states, they are not likely to make working time reductions feasible on their own, as their benefits are limited. Because the U.S. does not have a strong welfare state to provide for the basic needs of its population, people must work longer hours in order to afford basic necessities (Alesina et al. 2005; Schor 2010). Healthcare is a prime example of this effect. Employees must work long hours in order to be eligible for employer-sponsored health insurance, and there is currently no legal requirement for employers to provide benefits to part time workers. This creates a disincentive for employees to choose part time work and an incentive for working longer hours to afford insurance premiums (Schor 1992). In other affluent democratic nations, these structural barriers to shorter working hours are limited or absent because healthcare is provided as a basic right. Another structural change that should accompany a working time reduction is a reduction in income and wealth inequality, on account of findings which suggest that higher inequality results in longer working hours (Bowles and Park 2005). Lower inequality could also lead to reduced carbon emissions (Jorgenson et al. 2017) and improved human well-being (Hill and Jorgenson 2018). An additional an important issue is creating more meaningful work, especially with increases in automation on the horizon. This is beyond the scope of the present study, but recently highlighted by Foster (2017) in his discussion of work and sustainability.

While our findings are robust across different modeling techniques and various sensitivity analyses, our study is not without limitations. Due to data availability, the study covers a limited number of years: 2007-2013. Analyzing a broader time period would allow for additional questions to be asked, such as how the effect of working hours on carbon emissions changes through time. Also, while analyzing state-level data is useful for substantive and methodological reasons, the composition effect occurs at the household level. Therefore, future research could be improved by including such micro-level data to better understand the mechanisms behind the composition effect. Future research should also examine the working hours-emissions relationship in other sub-national contexts. The U.S. is a relatively unique case as many affluent countries have experienced work hour reductions in recent decades, while hours have increased in the US. Finally, future research would benefit from a more direct assessment of how the rise of AI and automation influence the relationship between working time and various environmental outcomes, including carbon emissions.

REFERENCES

Acemoglu, Daron, and Pascual Restrepo. 2017. "Robots and Jobs: Evidence from US Labor Markets." Working Paper 23285. National Bureau of Economic Research. http://www.nber.org/papers/w23285.

Alcott, Blake. 2008. "The Sufficiency Strategy: Would Rich-World Frugality Lower Environmental Impact?" *Ecological Economics* 64:770–86.

Alesina, Alberto, Edward Glaeser, and Bruce Sacerdote. 2006. "Work and Leisure in the U.S. and Europe: Why So Different?" NBER Chapters. National Bureau of Economic Research, Inc. http://econpapers.repec.org/bookchap/nbrnberch/0073.htm.

Alexander, Samuel. 2012. "Planned Economic Contraction: The Emerging Case for Degrowth." *Environmental Politics* 21:349–68.

Allison, Paul. 2009. *Fixed Effects Regression Models*. SAGE Publications.

Anderson, Kevin. 2012. "Climate Change Going Beyond Dangerous: Brutal Numbers and Tenuous Hope." *Development Dialogue* 61:16–40.

Ark, Bart van, and Robert H. McGuckin. 1999. "International Comparisons of Labor Productivity and Per Capita Income." *Monthly Labor Review* 122:33.

Autor, David. 2015. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." *The Journal of Economic Perspectives* 29:3–30.

Becker, Gary A. 1965. “A Theory of the Allocation of Time.” *The Economic Journal* 75:493–517.

Beck, Nathaniel, and Jonathan Katz. 1995. “What To Do (and Not To Do) with Time-Series Cross-Section Data.” *The American Political Science Review* 89:634–47.

Bergh, Jeroen C. J. M. van den. 2011. “Environment versus Growth — A Criticism of ‘degrowth’ and a Plea for ‘a-Growth.’” *Ecological Economics* 70:881–90.

Bowles, Samuel, and Yongjin Park. 2005. “Emulation, Inequality, and Work Hours: Was Thorsten Veblen Right?” *Economic Journal* 115:F397–412.

Brady, David, Yunus Kaya, and Jason Beckfield. 2007. “Reassessing the Effect of Economic Growth on Well-Being in Less-Developed Countries, 1980–2003.” *Studies in Comparative International Development* 42:1.

Brynjolfsson, Erik, and Andrew McAfee. 2014. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. W. W. Norton & Company.

Buttel, Fred. 2000. “Ecological Modernization as Social Theory.” *Geoforum* 31:57–65.

California Environmental Protection Agency. 2015. “Overview of ARB Emissions Trading Program.”

Daly, Herman. 1996. *Beyond Growth: The Economics of Sustainable Development*. Beacon Press.

Daly, Herman. 1999. “Steady-State Economics: Avoiding Uneconomic Growth.” In *Handbook of Environmental and Resource Economics*, edited by Jeroen C. J. M. Van den Bergh, 635–42.

Dietz, Thomas. 2015. “Prolegomenon to a Structural Human Ecology of Human Well-Being.” *Sociology of Development* 1:123-148.

Dietz, Thomas, Ken Frank, Cameron Whitley, Jennifer Kelly, and Rachel Kelly. 2015. “Political Influences on Greenhouse Gas Emissions from US States.” *Proceedings of the National Academy of Sciences* 112:8254–59.

Dinda, Soumyananda. 2004. “Environmental Kuznets Curve Hypothesis: A Survey.” *Ecological Economics* 49:431–55.

Domonoske, Camila. 2017. “Mayors, Companies Vow To Act On Climate, Even As U.S. Leaves Paris Accord.” *NPR.org*. Accessed June 26. http://www.npr.org/sections/thetwo-way/2017/06/05/531603731/mayors-companies-vow-to-act-on-climate-even-as-u-s-leaves-paris-accord.

Dunlap, Riley, and Robert Brulle, eds. 2015. *Climate Change and Society: Sociological Perspectives*. Oxford University Press.

Easterlin, Richard. n.d. “Will Raising the Incomes of All Increase the Happiness of All?” *Journal of Economic Behavior & Organization.* 27:35–47.

Economic Policy Institute. 2017. “SWA-Wages | Table 4.1 | Average Wages and Work Hours, 1967–2010 (2011 Dollars) | State of Working America.” Accessed July 17.

http://www.stateofworkingamerica.org/chart/swa-wages-table-4-1-average-wages-work-hours/.

Fitzgerald, Jared, Andrew Jorgenson, and Brett Clark. 2015. “Energy Consumption and Working Hours: A Longitudinal Study of Developed and Developing Nations, 1990–2008.” *Environmental Sociology* 1:213–23.

Foster, John Bellamy. 2011. “Capitalism and Degrowth: An Impossibility Theorem.” *Monthly Review* 62 (08). https://monthlyreview.org/2011/01/01/capitalism-and-degrowth-an-impossibility-theorem/.

Foster, John Bellamy. 2017. “The Meaning of Work in a Sustainable Society.” *Monthly Review* 69 (4): 1–14.

Gordon, Robert. 2016. *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War*. Princeton University Press.

Gould, Kenneth, David Pellow, and Allan Schnaiberg. 2004. “Interrogating the Treadmill of Production: Everything You Wanted to Know about the Treadmill but Were Afraid to Ask.” *Organization & Environment* 17:296–316.

Grant, Don, Andrew Jorgenson, and Wesley Longhofer. 2016. “How Organizational and Global Factors Condition the Effects of Energy Efficiency on CO_2 Emission Rebounds among the World’s Power Plants.” *Energy Policy* 94:89-93.

Grant, Don and Ion Bogdan Vasi. 2017. “Civil Society in an Age of Environmental Accountability: How Local Environmental Nongovernmental Organizations

Reduce U.S. Power Plants' Carbon Dioxide Emissions." *Sociological Forum*. 32:94–115.

Greenfieldboyce, Nell. 2016. "Trump Says He Has 'Open Mind' On Climate, But Staff Pick Raises Questions." *NPR.org*. November 23. http://www.npr.org/sections/thetwo-way/2016/11/23/503156456/trump-says-he-has-open-mind-on-climate-but-staff-pick-raises-questions.

Grossman, Gene, and Alan Krueger. 1995. "Economic Growth and the Environment." *The Quarterly Journal of Economics* 110:353–77.

Hayden, Anders. 1999. *Sharing the Work, Sparing the Planet: Work Time, Consumption & Ecology*. New York: Zed Books.

Hayden, Anders. 2014. *When Green Growth Is Not Enough: Climate Change, Ecological Modernization, and Sufficiency*. MQUP.

Hayden, Anders, and John Shandra. 2009. "Hours of Work and the Ecological Footprint of Nations: An Exploratory Analysis." *Local Environment* 14:575–600.

Hill, Terrance, and Andrew Jorgenson. 2018. "Bring Out Your Dead!: A Study of Income Inequality and Life Expectancy in the United States, 2000-2010." *Health & Place* 49:1-6.

Huber, Joseph. 2009. "Ecological Modernization: Beyond Scarcity and Bureaucracy." In *The Ecological Modernisation Reader*, 42–55. New York: Routledge.

Inglehart, Ronald. 2000. “Globalization and Postmodern Values.” *The Washington Quarterly* 23:215–28.

Intergovernmental Panel on Climate Change. 2014. “Climate Change 2014: Synthesis Report.”

Jackson, Robert, Josep Canadell, Corinne Le Quéré, Robbie Andrew, Jan Ivar Korsbakken, Glen Peters, and Nebojsa Nakicenovic. 2016. “Reaching Peak Emissions.” *Nature Climate Change* 6:7–10.

Jackson, Tim. 2005. “Live Better by Consuming Less? Is There a ‘Double Dividend’ in Sustainable Consumption?” *Journal of Industrial Ecology* 9:19–36.

Jackson, Tim. 2009a. *Prosperity Without Growth: Economics for a Finite Planet*. Sterling, VA: Earthscan.

Jackson, Tim. 2009b. “Beyond the Growth Economy.” *Journal of Industrial Ecology* 13:487–90.

Jalas, Mikko. 2002. “A Time Use Perspective on the Materials Intensity of Consumption.” *Ecological Economics*41:109–23.

Jalas, Mikko. 2005. “The Everyday Life Context of Increasing Energy Demands.Time Use Survey Data in a Decomposition Analysis.” *Journal of Industrial Ecology* 9:129–45.

Jalas, Mikko, and Jouni K. Juntunen. 2015. “Energy Intensive Lifestyles: Time Use, the Activity Patterns of Consumers, and Related Energy Demands in Finland.” *Ecological Economics* 113:51–59.

Janicke, Martin. 2009. “On Ecological and Political Modernization.” In *The Ecological Modernisation Reader*, 28–41. New York: Routledge.

Jorgenson, Andrew. 2006. “Global Warming and the Neglected Greenhouse Gas: A Cross-National Study of the Social Causes of Methane Emissions Intensity, 1995.” *Social Forces* 84:1779–98.

Jorgenson, Andrew. 2014. “Economic Development and the Carbon Intensity of Human Well-Being.” *Nature Climate Change* 4:186–89.

Jorgenson, Andrew. 2016. “Environment, Development, and Ecologically Unequal Exchange.” *Sustainability* 8:227.

Jorgenson, Andrew, and Brett Clark. 2011. “Societies Consuming Nature: A Panel Study of the Ecological Footprints of Nations, 1960–2003.” *Social Science Research* 40:226–44.

Jorgenson, Andrew and Brett Clark. 2012. “Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005.” *American Journal of Sociology* 118:1–44.

Jorgenson, Andrew, Juliet Schor, and Xiaorui Huang. 2017. "Income Inequality and Carbon Emissions in the United States: A State-Level Analysis, 1997–2012." *Ecological Economics* 134:40–48.

Jorgenson, Andrew, Juliet Schor, Kyle Knight, and Xiaorui Huang. 2016. "Domestic Inequality and Carbon Emissions in Comparative Perspective." *Sociological Forum* 31:770–86.

Kasser, Tim, and Kirk Brown. 2003. "On Time, Happiness, and Ecological Footprints." In *Take Back Your Time: Fighting Overwork and Time Poverty in America*, 107–12.

Kerschner, Christian. 2010. "Economic De-Growth vs. Steady-State Economy." *Journal of Cleaner Production* 18:544–51.

King, Lewis, and Jeroen C. J. M. van den Bergh. 2017. "Worktime Reduction as a Solution to Climate Change: Five Scenarios Compared for the UK." *Ecological Economics* 132:124–34.

Knight, Kyle, Eugene Rosa, and Juliet Schor. 2013a. "Reducing Growth to Achieve Environmental Sustainability: The Role of Work Hours." In *Capitalism on Trial: Explorations in the Tradition of Thomas E. Weisskopf*, edited by Jeannette Wicks-Lim and Robert Pollin, 187–204. Edward Elgar Publishing.

Knight, Kyle, Eugene Rosa, and Juliet Schor. 2013b. "Could Working Less Reduce Pressures on the Environment? A Cross-National Panel Analysis of OECD Countries, 1970–2007." *Global Environmental Change* 23:691–700.

Knight, Kyle, and Juliet Schor. 2014. "Economic Growth and Climate Change: A Cross-National Analysis of Territorial and Consumption-Based Carbon Emissions in High-Income Countries." *Sustainability* 6:3722–31.

Koppen, Kris van, and Arthur Mol. 2009. "Ecological Modernization of Industrial Ecosystems." In *The Ecological Modernization Reader*, 295–317. New York: Routledge.

Kuznets, Simon. 1955. "Economic Growth and Income Inequality." *The American Economic Review* 45:1.

Lavelle, Marianne. 2016. "2016: President Obama's Climate Legacy Marked by Triumph, but Also Lost Opportunities." *Inside Climate News*. https://insideclimatenews.org/news/23122016/obama-climate-change-legacy-trump-policies.

Lee, Sang-Heon, Deirdre McCann, and Jon Messenger. 2007. *Working Time Around the World: Trends in Working Hours, Laws and Policies in a Global Comparative Perspective*. London; New York; Geneva: Routledge ; ILO.

Longhofer, Wesley, and Andrew Jorgenson. 2017. "Decoupling Reconsidered: Does World Society Integration Influence the Relationship Between the Environment and Economic Development?" *Social Science Research* 65:17-29.

Martinez-Alier, Joan. 2009. "Socially Sustainable Economic De-Growth." *Development and Change* 40:1099–1119.

Martinez-Alier, Joan. 2012. “Environmental Justice and Economic Degrowth: An Alliance between Two Movements.” *Capitalism Nature Socialism* 23:51–73.

Meadows, Donella, Jorgen Randers, and Dennis Meadows. 2004. *Limits to Growth: The 30-Year Update*. Chelsea Green Publishing.

Messenger, Jon Carleton, and Naj Ghosheh. 2013. *Work Sharing During the Great Recession: New Developments and Beyond*. Edward Elgar Publishing.

Milanovic, Branko. 2017. “The Illusion of ‘Degrowth’ in a Poor and Unequal World.” *Globalinequality*. Retrieved November 23, 2017 (http://glineq.blogspot.co.uk/2017/11/the-illusion-of-degrowth-in-poor-and.html).

Mol, Arthur. 2003. *Globalization and Environmental Reform: The Ecological Modernization of the Global Economy*. MIT Press.

Mol, Arthur, and Martin Janicke. 2009. “The Origins and Theoretical Foundations of Ecological Modernisation Theory.” In *The Ecological Modernisation Reader*, 17–27. New York: Routledge.

Mol, Arthur, Gert Spaargaren, and David Sonnenfeld. 2009. “Ecological Modernization: Three Decades of Policy, Practice, and Theoretical Reflection.” In *The Ecological Modernisation Reader*, 3–14. New York: Routledge.

Mol, Arthur, Gert Spaargaren, and David Sonnenfeld. 2014. “Ecological Modernization Theory: Taking Stock, Moving Forward.” In *Routledge International Handbook of Social and Environmental Change*, 15–30. New York: Routledge.

National Conference of State Legislatures. 2017. "Work Share Programs." http://www.ncsl.org/research/labor-and-employment/work-share-programs.aspx.

Pollin, Robert. 2015. *Greening the Global Economy*. MIT Press.

Pouwels, Babette, Jacques Siegers, and Jan Dirk Vlasblom. 2008. "Income, Working Hours, and Happiness." *Economics Letters* 99:72–74.

Princen, Thomas. 2005. *The Logic of Sufficiency*. MIT Press.

Regional Greenhouse Gas Initiative. 2017. "Regional Greenhouse Gas Initiative (RGGI) CO2 Budget Trading Program - Home." Accessed May 22. https://www.rggi.org/.

Roberts, Timmons, and Peter Grimes. 1997. "Carbon Intensity and Economic Development 1962–1991: A Brief Exploration of the Environmental Kuznets Curve." *World Development* 25:191–98.

Rockström, Johan. 2009. "A Safe Operating Space for Humanity." *Nature* 461:472–75.

Rosa, Eugene, and Thomas Dietz. 2012. "Human Drivers of National Greenhouse-Gas Emissions." *Nature Climate Change* 2:581–86.

Rosa, Eugene, Richard York, and Thomas Dietz. 2004. "Tracking the Anthropogenic Drivers of Ecological Impacts." *AMBIO: A Journal of the Human Environment* 33:509–12.

Rosnick, David, and Mark Weisbrot. 2007. "Are Shorter Work Hours Good for the Environment? A Comparison of U.S. and European Energy Consumption." *International Journal of Health Services* 37:405–17.

Sachs, Wolfgang. 2008. "Climate Change and Human Rights." *Development* 51:332–37.

Sachs, Wolfgang, Reinhard Loske, and Manfred Linz. 1998. *Greening the North: A Post-Industial Blueprint for Ecology and Equity*. Zed Books.

Schneider, François, Giorgos Kallis, and Joan Martinez-Alier. 2010. "Crisis or Opportunity? Economic Degrowth for Social Equity and Ecological Sustainability. Introduction to This Special Issue." *Journal of Cleaner Production* 18:511–18.

Schor, Juliet. 1993. *The Overworked American: The Unexpected Decline of Leisure*. Basic Books.

Schor, Juliet. 1991. "Global Equity and Environmental Crisis: An Argument for Reducing Working Hours in the North." *World Development* 19:73–84.

Schor, Juliet. 2005. "Sustainable Consumption and Worktime Reduction." *Journal of Industrial Ecology* 9:37–50.

Schor, Juliet. 2010. *Plenitude: The New Economics of True Wealth*. New York: The Penguin Press.

Shandra, John, Bruce London, Owen Whooley, and John Williamson. 2004. "International Nongovernmental Organizations and Carbon Dioxide Emissions in the Developing World: A Quantitative, Cross-National Analysis." *Sociological Inquiry* 74:520–45.

Shao, Qinglong, and Shiran Shen. 2017a. “When Reduced Working Time Harms the Environment: A Panel Threshold Analysis for EU-15, 1970–2010.” *Journal of Cleaner Production* 147:319–29.

Spaargaren, Gert, and Arthur Mol. 2009. “Sociology, Environment, and Modernity: Ecological Modernization as a Theory of Social Change.” In *The Ecological Modernisation Reader*, 56–79. New York: Routledge.

Stern, David. 2004. “The Rise and Fall of the Environmental Kuznets Curve.” *World Development* 32:1419–39.

Stevenson, Betsey, and Justin Wolfers. 2008. “Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox.” Working Paper 14282. National Bureau of Economic Research.

The Conference Board. 2017. “Total Economy Database Data.” Accessed July 17. https://www.conference-board.org/data/economydatabase/index.cfm?id=27762.

United States Census Bureau. 2016. “Census.gov.” https://www.census.gov/en.html.

United States Census Bureau. 2017. “American Community Survey.” https://www.census.gov/programs-surveys/acs/data.html.

United States Department of Commerce Bureau of Economic Analysis. 2016. “Bureau of Economic Analysis.” https://www.bea.gov/itable/index.cfm.

United States Department of Labor Bureau of Labor Statistics. 2016. “Employment, Hours, and Earnings from the Current Employment Statistics Survey (National)

Home Page.” *Current Employment Statistics*. Accessed July 15. https://www.bls.gov/ces/.

United States Energy Information Administration. 2016. “U.S. Energy Information Administration - EIA - Independent Statistics and Analysis.” *State Energy Data System*. https://www.eia.gov/state/seds/.

United States Energy Information Administration. 2017. “Energy-Related CO2 Emissions for First Six Months of 2016 Are Lowest Since 1991.” Accessed July 17. https://www.eia.gov/todayinenergy/detail.php?id=28312.

United States Environmental Protection Agency. 2016. “State Energy CO2 Emissions Database.” https://www3.epa.gov/ statelocalclimate/resources/state_energyco2inv.html.

United States Environmental Protection Agency. 2017. “State Energy CO2 Emissions.” Accessed October 9, 2017. https://19january2017snapshot.epa.gov/statelocalclimate/state-energy-co2-emissions_.html

United States Global Change Research Program. 2017. *2017: Climate Science Special Report: Fourth National Climate Assessment, Volume 1*. https://science2017.globalchange.gov/.

Victor, Peter. 2008. *Managing Without Growth: Slower by Design, Not Disaster*. Edward Elgar Publishing.

Wolfgang Sachs, Tilman Santarius, Patrick Camiller, and Umwelt und Energie Wuppertal Institut für Klima. 2007. *Fair Future: Resource Conflicts, Security and Global Justice : A Report of the Wuppertal Institute for Climate, Environment and Energy*. London ; New York: Zed Books ; Halifax, Nova Scotia.

York, Richard. 2008. "De-Carbonization in Former Soviet Republics, 1992–2000: The Ecological Consequences of De-Modernization." *Social Problems* 55:370–90.

York, Richard. 2012. "Asymmetric Effects of Economic Growth and Decline of CO2 Emissions." *Nature Climate Change* 2:762–64.

York, Richard, and Julius McGee. 2016. "Understanding the Jevons Paradox." *Environmental Sociology* 2:77-87.

York, Richard, and Eugene Rosa. 2003. "Key Challenges to Ecological Modernization Theory Institutional Efficacy, Case Study Evidence, Units of Analysis, and the Pace of Eco-Efficiency." *Organization & Environment* 16:273–88.

York, Richard, Eugene Rosa, and Thomas Dietz. 2003. "Footprints on the Earth: The Environmental Consequences of Modernity." *American Sociological Review* 68:279

TABLES

TABLE 2. 1 Descriptive Statistics	Obs.	Mean	Std. Dev.	Min.	Max.
Total CO_2 Emissions	350	4.302397	0.9642756	1.702928	6.569285
Working Hours	350	7.488988	0.028757	7.390326	7.569343
Total Population	350	15.15232	1.011498	13.18979	17.46439
GDP Per Capita	350	10.73515	0.1821364	10.34532	11.21572
Employed Pop. %	350	3.84682	0.0778464	3.659142	4.006447
GDP Per Hour	350	4.02969	0.176429	3.684861	4.593245
Manufacturing (% of GDP)	350	2.377933	0.5447595	0.5434929	3.419944
Energy Production	350	13.20909	1.65686	7.325808	16.56847
Average Household Size	350	.9441615	0.597502	.7975072	1.153732
Working Age Population	350	4.202669	.019409	4.160444	4.273884
State Environmentalism	350	3.822873	0.5703182	1.871802	4.49981

Note: All variables logged (ln).

TABLE 2. 2 Correlation Matrix	1	2	3	4	5	6	7	8	9	10
1. CO2 Emissions										
2. Working Hours	0.399									
3. Employed Pop. %	-0.355	-0.364								
4. GDP Per Hour	0.053	-0.118	0.080							
5. GDP Per Capita	-0.032	-0.149	0.488	0.878						
6. Total Population	0.845	0.167	-0.333	0.055	-0.021					
7. Manufacturing %	0.341	0.104	-0.088	-0.383	-0.348	0.350				
8. Energy Production	0.688	0.507	-0.206	-0.023	-0.085	0.357	0.214			
9. Avg. Household	0.209	0.239	-0.377	0.315	0.154	0.303	-0.303	0.041		
10. Working Age Pop.	-0.082	-0.088	0.321	0.370	0.518	-0.022	-0.204	-0.060	-0.088	
11. State Env.	-0.074	-0.471	0.226	0.017	0.118	0.264	0.147	-0.433	-0.244	0.142

Note: All variables logged (ln).

TABLE 2. 3 Total CO_2 Emissions	Model 1 Scale		Model 2 Compositional	
Working Hours	0.668***	(0.179)	0.675***	(0.202)
Employed Pop. %	0.519***	(0.120)		
GDP Per Hour	0.060	(0.094)		
GDP Per Capita			0.108	(0.067)
Total Population	0.918***	(0.167)	0.806***	(0.174)
Manufacturing %	-0.024	(0.042)	-0.028	(0.041)
Energy Production	0.070*	(0.029)	0.068*	(0.027)
Avg. Household Size	-0.288	(0.225)	-0.262	(0.240)
Working Age Pop.	1.034	(0.700)	1.008	(0.745)
Constant	-18.743***	(3.813)	-15.853***	(3.963)
N	350		350	
R-Squared	0.998		0.998	

Notes: All continuous variables are logged (ln). All models are calculated with common AR(1) correction. All models contain unreported year-specific intercepts. Models 1 and 2 also contain unreported unit-specific intercepts. Standard errors in parentheses. *p<.05 **p<.01 ***p<.001

TABLE 2. 4 Total CO_2 Emissions	Model 3 Scale		Model 4 Compositional	
Working Hours	0.654**	(0.243)	0.552*	(0.235)
Employed Pop. %	0.209	(0.218)		
GDP Per Hour	0.129	(0.089)		
GDP Per Capita			0.134	(0.090)
Total Population	0.747***	(0.033)	0.758***	(0.038)
Manufacturing %	-0.054	(0.034)	-0.046	(0.033)
Energy Production	0.139***	(0.017)	0.121***	(0.018)
Avg. Household Size	-0.312	(0.244)	-0.336	(0.234)
Working Age Pop.	0.73	(0.707)	0.912	(0.687)
State Environmentalism	-0.311***	(0.064)	-0.338***	(0.076)
Midwest	0.443***	(0.088)	0.461***	(0.104)
South	0.256**	(0.097)	0.267*	(0.115)
West	-0.029	(0.096)	-0.013	(0.115)
Constant	-14.027***	(3.156)	-14.365***	(3.058)
N	350		350	
R-Squared	0.923		0.919	

Notes: All continuous variables are logged (ln). All models are calculated with AR(1) correction. All models contain unreported year-specific intercepts. Standard errors in parentheses. *p<.05 **p<.01 ***p<.001

FIGURES

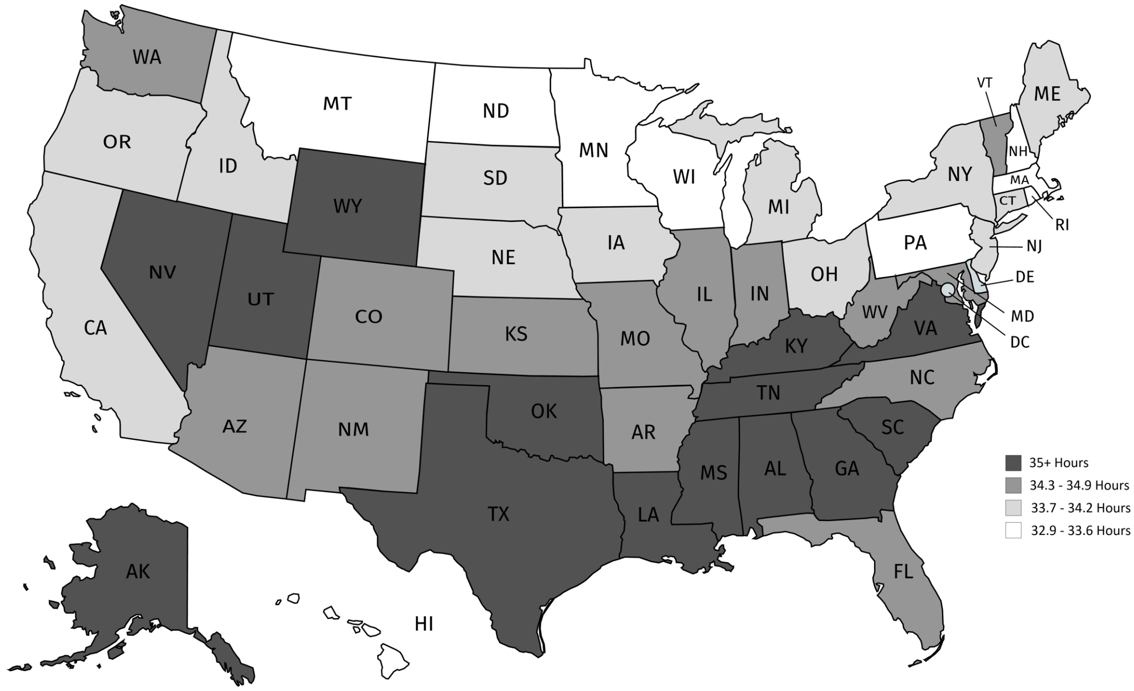

FIGURE 2. 1
Average weekly working hours per person from 2007 to 2013. Darker shades represent higher average weekly working hours and lighter shades represent lower average weekly working hours.

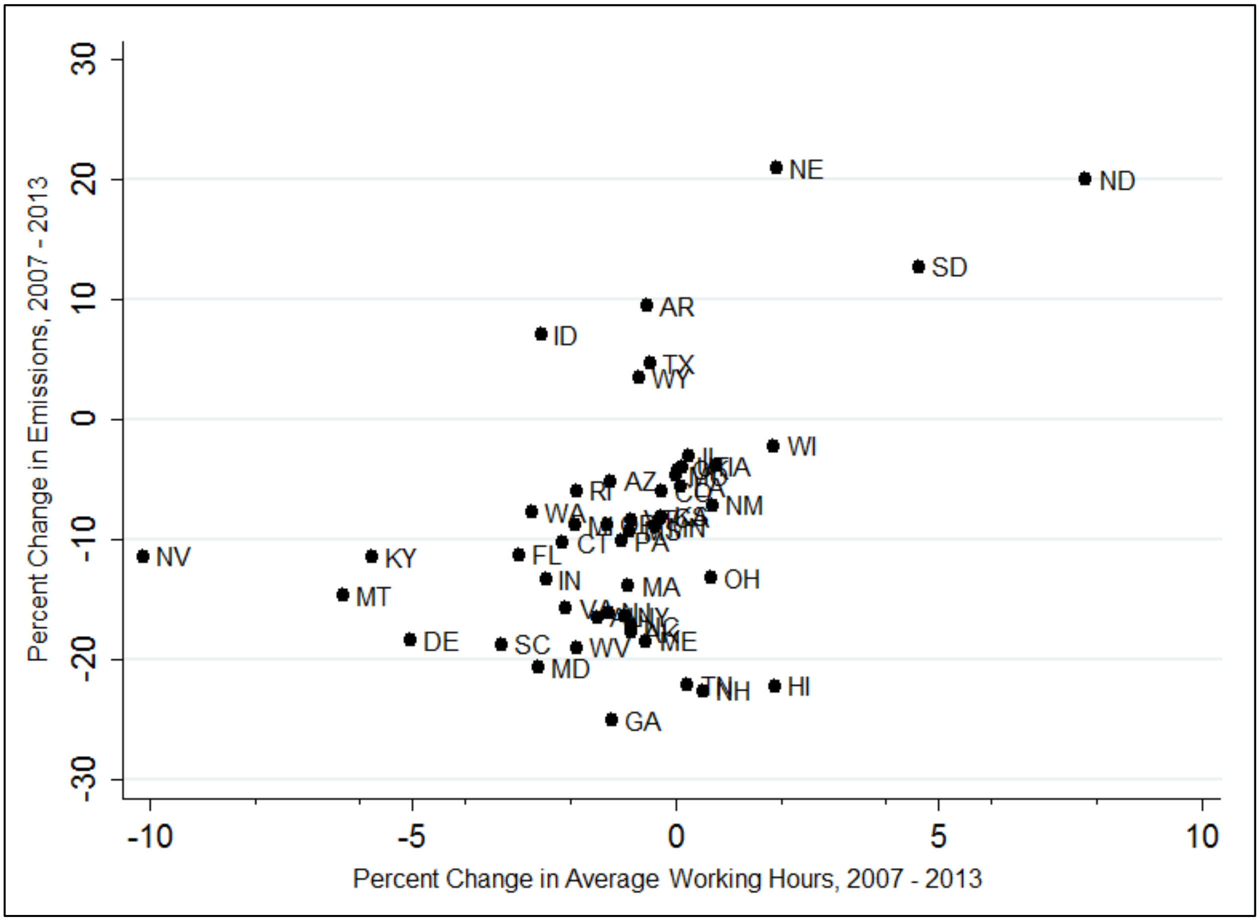

FIGURE 2. 2
Scatterplot of the association between the percent change in total emissions from 2007 to 2013 and the percent change in average working hours from 2007 to 2013. Each dot represents a different state.

APPENDIX

TABLE 2. 5 Hybrid Method	Model 5 Scale (Hybrid)		Model 6 Comp. (Hybrid)	
Working Hours (d)	0.633**	(0.221)	0.635**	(0.227)
Employed Population % (d)	0.582**	(0.214)		
GDP Per Hour (d)	0.048	(0.091)		
GDP Per Capita (d)			0.133	(0.095)
Total Population (d)	0.984**	(0.322)	0.862**	(0.321)
Manufacturing (% of GDP) (d)	-0.031	(0.036)	-0.035	(0.036)
Energy Production (d)	0.055*	(0.024)	0.050*	(0.024)
Average Household Size (d)	-0.294	(0.238)	-0.267	(0.238)
Working Age Population (d)	1.281	(0.696)	1.292	(0.699)
State Environmentalism	-0.124	(0.088)	-0.174	(0.100)
Midwest	0.474***	(0.113)	0.388**	(0.127)
South	0.123	(0.140)	0.171	(0.159)
West	-0.124	(0.129)	-0.112	(0.147)
Working Hours (m)	2.648	(2.115)	3.381	(2.386)
Employed Population % (m)	-1.705**	(0.649)		
GDP Per Hour (m)	0.902***	(0.271)		
GDP Per Capita (m)			0.511	(0.301)
Total Population (m)	0.644***	(0.055)	0.697***	(0.060)
Manufacturing (% of GDP) (m)	-0.099	(0.079)	-0.114	(0.089)
Energy Production (m)	0.204***	(0.031)	0.192***	(0.035)
Average Household Size (m)	-0.958	(0.920)	-0.403	(1.038)
Working Age Population (m)	-2.339	(2.242)	-3.053	(2.565)
Constant	-3.208	(11.099)	-12.120	(12.407)
N	350		350	
R-Squared	0.949		0.936	

Notes: Hybrid models include the unit-specific mean (labeled with an "m") as well as the deviations from that mean (labeled with a "d") for each time-variant explanatory variable. All continuous variables are logged (ln). All models are calculated with AR(1) correction. All models contain unreported year-specific intercepts. Standard errors in parentheses. *p<.05 **p<.01 ***p<.001

CHAPTER 3: WORKING TIME, INEQUALITY AND CARBON EMISSIONS: HOW INEQUALITY SHAPES THE RELATIONSHIP BETWEEN WORKING HOURS AND EMISSIONS ACROSS US STATES, 2005-2015

ABSTRACT

Recent research indicates that longer working hours are associated with greater environmental pressures. One issue that has not been explicitly considered in past research on this topic is how other structural factors might shape this relationship. Economic inequality is one such factor that is related both to the structures of working time and to environmental degradation. In this paper, I advance the research on the environmental consequences of working hours by considering how inequality might moderate the relationship between average working hours and CO_2 emissions across US states from 2005 to 2015. I propose that inequality increases the effect of working hours on emissions through amplifying the pressures for more consumption and shaping the composition of that consumption. Results of fixed-effects regression models support this proposition indicating that the effect of average working time on emissions increases in size at higher levels of inequality while controlling for other factors such as GDP per capita, total population, energy production and manufacturing. These results improve the understanding of the mechanisms behind working time and inequality that shape emissions at the US state level. They also indicate that policies aimed at reducing inequality as well as reducing the pressures for longer working hours are likely to be the most socially and ecologically beneficial.

INTRODUCTION

Interest regarding working time reduction, often in the form of the four-day work week, has increased in academic and policy discussions recently. In the summer of 2019, Microsoft ran a test-trial of the four day work week in Japan and found it improved productivity by around 40 percent (Chappell 2019). In a special report on the future of work and unions, the AFL-CIO (2019), which is the largest federation of unions in the United States, calls for a four-day work week in response to the threats of automation and artificial intelligence. These proposals are also gaining political steam as well. The Labour Party in the United Kingdom introduced a four-day work week as part of its platform and the Prime Minister of Finland, Sanna Marin, has called for a four-day 24 hour work week (BBC 2019; Kelly 2020). In Washington state, a bill was recently introduced to cap the work week at 32 hours (Lin 2020). These proposals largely focus on the potential productivity benefits and increased leisure time associated with a reduced working week but another possible benefit of reducing working time is environmental. Moving beyond the mainstream approaches to solving environmental problems, a working time reduction could potentially reduce environmental burdens while improving social and economic wellbeing (Autonomy 2019).

Recent studies on the environmental consequences of working hours generally find that longer working hours are associated with increased environmental pressures including energy consumption, carbon dioxide (CO_2) emissions, the ecological footprint and carbon footprint (Fitzgerald, Schor, and Jorgenson 2018; Fremstad, Paul, and Underwood 2019; Hayden and Shandra 2009; Knight, Rosa, and Schor 2013a; Rosnick and Weisbrot 2007). These studies present evidence across multiple levels of analysis, from cross-national to household level studies, that reducing working time could be a key policy lever to reduce environmental burdens and combat climate change. In this paper I advance this area of research by considering how inequality shapes the relationship between working hours and CO_2 emissions across US states from 2005 through 2015. Building on research showing that inequality is associated with increased emissions (i.e. Boyce 1994; Jorgenson et al. 2016; Jorgenson, Schor, and Huang 2017) and other research indicating that inequality can lead to longer working hours (i.e. Bowles and Park 2005; Oh, Park, and Bowles 2012), I argue that inequality moderates the relationship between working hours and emissions. In particular, I suggest that when inequality is higher, the effect of working hours on emissions is larger. I hypothesize that inequality exacerbates the effects of working hours on emissions by creating more pressures for competitive consumption and influencing the composition of consumption towards more ecologically intensive choices. Results from longitudinal fixed effects analyses support this contention, indicating that in states with higher levels of income concentration to top earners the effect of working time on emissions is progressively larger.

Previous studies on the environmental consequences of inequality and working time have examined the relationships across multiple levels of analysis, ranging from cross-national studies to the household level. In this study I focus on the US state level for a number of reasons. The first reason is that, while the US as a country emits the second most total territorial CO_2 emissions in the world and is the third largest per capita emitter of territorial CO_2 in the world, since the election of Donald Trump as president it has engaged in active hostility towards action on climate change at the federal level, including pulling out of the Paris Agreement (Fisher and Jorgenson 2019). Despite this, many US states have remained committed to combatting climate change (Jaeger, Cyrs, and Kennedy 2019). These efforts include regional cap and trade policies, efforts at developing clean energy and carbon neutral infrastructure development. In addition to policies designed to combat climate change, states have also shown an ability to enact policy as it relates to working time and employment (Messenger and Ghosheh 2013). For example, during the 2008 economic recession some states implemented work sharing programs to allow workers access to partial unemployment benefits (National Conference of State Legislatures 2017). States, and other sub-national units, have also shown the ability to combat inequality through policies like increasing the minimum wage or raising taxes on the wealthy (Franko and Witko 2018). Further, Franko and Witko (2018) argue that states are more likely, and possibly better suited, to combat inequality than the federal government. Thus, while federal action on climate change, inequality or work policy may be unlikely in the near future, states have shown an ability to act on these issues on their own. With this in mind, research on innovative approaches to combat climate change and other social problems is needed at the US state level to better inform these efforts.

The rest of the paper is as follows. First, I briefly discuss climate change and critiques of mainstream approaches to mitigation. Then, I discuss how working hours are related to environmental pressures and provide an overview of the empirical research on this subject. This is followed by a brief discussion on research exploring the environmental consequences of inequality. I then discuss how these two areas of research are related to one another and present arguments based on the integration of these two areas of literature. I then discuss my data and methods and present the results of the analyses. I conclude with a discussion of the results and thoughts for future research.

CLIMATE CHANGE AND PATHWAYS TO EMISSIONS REDUCTIONS

Climate change poses a major risk to humans across the planet and, as it worsens, will result in sea level rise, increased drought and desertification, ocean acidification, worsening natural disasters and changing seasonal patterns (Intergovernmental Panel on Climate Change 2018). Recent studies suggest that global atmospheric temperature increases beyond 1.5 degrees Celsius could be catastrophic and threaten to destabilize planetary processes leading to a hothouse earth and potentially a planet that is uninhabitable for humans (Steffen et al. 2018).

The mainstream view of solving environmental problems like climate change focuses on technology and decoupling economic growth from environmental harms (Mol, Spaargaren, and Sonnenfeld 2014; Pollin 2019). The general argument is that economic growth spurs greater technological development and, over time, this technology can lead to more environmentally-efficient production. For instance, Pollin (2019) argues that massive investments in green technologies can absolutely decouple economic growth from emissions and also lead to a massive increase in jobs in the clean energy sector. Others are skeptical of the potential for economic growth to decouple from emissions, especially considering the urgency of climate change which requires immediate reductions in emissions not just a relative slowdown of increases (Hayden 2014; Schor and Jorgenson 2019). Research indicates that there is little to no evidence of absolute decoupling between economic growth and emissions (Jorgenson and Clark 2012; Longhofer and Jorgenson 2017; Schor and Jorgenson 2019; Thombs 2018). This is especially true when considering consumption based carbon emissions, which more accurately depict the emissions by accounting for global trade (Knight and Schor 2014).

Others also critique the assumption that technological advancement will automatically result in reduced emissions (Foster, Clark, and York 2010). For instance, the advancement of clean energy sources, typically seen as a prerequisite for achieving sustainability and advocated by scholars like Pollin, does not appear to decouple economic growth from emissions (Thombs 2017; York 2012). These scholars argue that this occurs because our economy is geared towards profit-maximization, not environmental sustainability. So, when new technologies are introduced within the logic of this system they tend to be used for increasing overall production (i.e. Alcott 2005; Foster et al. 2010; Jevons 1865).

Because the evidence for decoupling is weak, and focusing on technological advancement alone is likely insufficient, it is important to consider alternative pathways to sustainability and climate change mitigation that move beyond the growth consensus. Moving beyond the growth consensus allows for the opportunity to consider innovative policies that not only improve our relationship with the planet but also improve human and economic wellbeing as well. One such policy is reducing working time.

WORKING TIME AND EMISSIONS

A working time reduction is potentially a triple-dividend policy. The first dividend is that working hours could reduce unemployment, which is likely to be a large issue in coming years due to advances in automation and artificial intelligence (Acemoglu and Restrepo 2017; Autor 2015). The second dividend is improving social wellbeing, both in terms of health (i.e. Bannai and Tamakoshi 2014; Pfeffer 2018) and happiness (i.e. Pouwels, Siegers, and Vlasblom 2008). The third dividend, which I focus on here, is reducing environmental pressures. Previous research indicates that working hours are positively associated with the ecological footprint, the carbon footprint, carbon emissions and energy consumption (Fitzgerald, Jorgenson, and Clark 2015; Fitzgerald et al. 2018; Fremstad et al. 2019; Hayden and Shandra 2009; King and van den Bergh 2017; Knight et al. 2013a; Rosnick and Weisbrot 2007).

It is theorized that increases in working hours result greater economic growth overall and shape consumption practices (Hayden and Shandra 2009; Knight et al. 2013a; Knight, Rosa, and Schor 2013b; Schor 2010). The first mechanism is referred to in previous research as the "scale" effect, or how work hours contribute to overall GDP. The scale effect is perhaps the more obvious effect. More work increases the scale of the economy through increases in production and consumption. When working hours are lower, incomes fall, and consumption along with it, and overall production decreases (assuming labor productivity remains constant). The second mechanism is referred to as the "compositional" effect, or how working hours shape the composition of consumption. One way in which longer working hours shape the composition of consumption is due to how longer hours affect time affluence or scarcity (Becker 1965). Those who work long hours have less free time and are more likely to choose less-time intensive but more environmentally harmful products and services (Devetter and Rousseau 2011; Jalas 2002, 2005; Jalas and Juntunen 2015; Kasser and Brown 2003). One example of this is food consumption/preparation. Those with more free-time may prepare their meals at home more often while those with less free time may elect for fast-food more often (which is generally more environmentally harmful). On the other hand, it is also possible that shorter working hours could result in increased environmental pressures as well. For instance, perhaps increased time off encourages households to take more vacations, which tend to be very ecologically intensive (Hanbury, Bader, and Moser 2019; Shao and Rodríguez-Labajos 2016).

Previous empirical research has examined the relationship between working hours and environmental pressures at various levels of analysis. The majority of research on this relationship has been cross-national (Fitzgerald et al. 2015; Hayden and Shandra 2009; Knight et al. 2013a; Rosnick and Weisbrot 2007; Shao and Shen 2017). The earliest study came from Schor's (2005) bivariate regression between work hours and the ecological footprint which indicated a positive relationship between the two. Knight, Rosa and Schor (2013a, 2013b) analyzed high-income OECD countries from 1970 to 2007 and found working hours to be positively associated with total carbon emissions, the carbon footprint and the ecological footprint. Fitzgerald, Jorgenson and Clark (2015) examined both developed and developing countries from 1990 to 2008. Their findings indicate that working hours are positively associated with energy consumption and that the relationship is increasing in intensity over time. While many of studies are cross-national, some studies use survey data on individuals or households (Fremstad et al. 2019; Hanbury et al. 2019; Jalas and Juntunen 2015; Kasser and Brown 2003; Nässén and Larsson 2015). These studies are particularly useful for understanding how working hours shape consumption choices. For instance, Nässén and Larsson (2015) examine data on Swedish households and analyze the relationship between working hours and a measure of household carbon emissions and energy consumption. Their findings indicate that decreases in working hours can reduce both emissions and energy consumption. More recently, similar research was conducted by Fremstad et al. (2019) where they examined the relationship between emissions and work hours across US households.

They also find a positive association between hours of work and emissions. Other recent research has examined the relationship at the US state level. Fitzgerald, Schor and Jorgenson (2018) examine the relationship between total CO2 emissions and working hours from 2007 to 2013 and find that working hours and emissions are positively associated with one another for both scale and compositional effects.

One issue that previous studies in this area have not explored yet is how other structural factors can shape the working time/environment relationship. One factor that is particularly important to examine is the role of inequality. As I discuss below, inequality plays a key role in shaping consumption practices (Schor 1998; Veblen 1912) and in shaping labor market dynamics overall (Bell and Freeman 2001; Bowles and Park 2005; Oh et al. 2012). As such, exploring how inequality might shape the relationship between working hours and emissions can help us to better understand when and how working hours contribute to greater environmental pressures. Before discussing specific mechanisms, though, it is useful to first discuss how inequality can shape environmental outcomes in general.

INEQUALITY AND EMISSIONS

Research on the relationship between environmental pressures and income and wealth inequality has also expanded in recent years (Cushing et al. 2015; Jorgenson et al. 2015, 2016; Jorgenson, Schor, and Giedraitis 2017; Jorgenson, Schor, and Huang 2017; Knight, Schor, and Jorgenson 2017; McGee and Greiner 2018; Scruggs 1998). This research generally shows that increases in wealth and income inequality can exacerbate environmental harms. There are multiple pathways through which it is hypothesized that economic inequality can affect carbon emissions.

The first pathway is referred to as the political economy perspective and largely comes from work by James Boyce (1994, 2007), among others. The political economy perspective argues that higher levels of economic inequality are associated with increases in environmental pressures (Cushing et al. 2015; Downey 2015; Downey and Strife 2010; Jorgenson, Schor, and Huang 2017). The crux of the political economy argument revolves around issues of power. In highly unequal societies, those at the top of the income and wealth hierarchies have relatively large amounts of power and are able to use that power to influence social and political decision making. Because those in power usually gain more from emissions and environmentally harmful behaviors, they tend to favor policies which allow them to continue. Boyce (1994, 2007) refers to this dynamic as the "power-weighted social decision rule." This perspective also suggests that because the wealthy are less likely to be directly affected by environmentally harmful activities, they are less-inclined to limit it. Downey (2015) also develops an explanatory model of inequality, democracy and the environment where he shows how elites actively work to create undemocratic institutions that undermine efforts towards sustainability.

A second mechanism, which is especially important for the analysis proposed here, is that higher levels of inequality are associated with increased carbon emissions due to increases in competitive consumption and increases in working hours (Bowles and Park 2005; Cushing et al. 2015; Jorgenson, Schor, and Huang 2017; Knight et al. 2017; Schor 1998). I discuss this with more depth below, but, in general, the argument is that higher levels of income and wealth inequality intensify status-based consumption pressures as people attempt to emulate standards of consumption set by wealthier people. Among other things, this intensification of competitive consumption can lead to longer working hours (i.e. Bowles and Park 2005; Oh et al. 2012). Also on the consumption side, high levels of inequality can also delay the widespread adoption of more environmentally-friendly consumer products because they tend to be more expensive and poorer households cannot afford them when inequality is high (Cushing et al. 2015; Vona and Patriarca 2011).

The majority of the empirical evidence of these relationships finds that inequality increases environmental burdens, though this can depend somewhat on how inequality is measured and the time period of the analysis. An early study from Ravallion et al. (2000) examines 42 countries from 1975 to 1992, finding that higher inequality is associated with lower emissions. For Ravallion et al. these findings indicate an impasse between improving social outcomes like inequality and environmental ones, like reducing emissions. Grunewald et al. (2012) find evidence of a curvilinear relationship between inequality and emissions for 138 countries from 1960 to 2008. More specifically, they find that in highly unequal societies reducing inequality is associated with lower emissions. However, in countries with already low levels of inequality further reductions in inequality are associated with increases in emissions. In both of these cases, the studies employed the Gini index to measure income inequality. More recent studies have found that concentrations of income to top earners increase emissions. For example, Jorgenson et al. (2017) estimated the relationship of inequality and emissions across US states from 1997 to 2012, finding that increases in the percentage of income to the top ten percent are associated with increases in emissions while the Gini coefficient was non-significant. Jorgenson et al. (2016) and Knight et al. (2017) have similar findings in a cross-national context for domestic income inequality and wealth inequality, respectively.

An issue of previous research on the environmental consequences of inequality is that inequality is a bit of a "black box," especially at macro scales of analysis. For instance, Knight et al. (2017:7) note that, while their study shows inequality is significant and positively associated with emissions, the study "is limited in that it does not identify the specific mechanism(s) that may link wealth inequality to emissions, but only empirically demonstrates an association between the two." Recent studies in sociology have begun to unpack the ways in which inequality can affect socio-environmental relationships. For instance, a recent study from Hill et al. (2019) finds that when inequality is high, the effect of air pollution on life expectancy is greater. Similarly, McGee and Greiner (2018) examine how inequality moderates the relationship between economic growth and CO_2 emissions. In line with the logic of these studies, here I elaborate on the relationship between inequality and working hours and specifically focus on how inequality moderates the relationship between working hours and emissions.

In order to better understand how inequality can shape the working time/emissions relationship, it is instructive to first discuss how inequality and working hours are related to each other. Previous studies indicate that that inequality can lead to increases in working hours (Bell and Freeman 2001; Bowles and Park 2005; Oh et al. 2012). These studies highlight that this can be due to a number of factors. One reason, discussed most explicitly by Bowles and Park (2005) as well as Schor (1992, 1998), highlights how inequality contributes to increased "Veblen effects," which, in turn, promote longer working hours. "Veblen effects" refer to the work of Thorstein Veblen (1912) and his accounting of how individuals emulate the consumption practices of the wealthy and elites in society (Bagwell and Bernheim 1996; Bowles and Park 2005; Schor 1998). It is intimately related to Veblen's concept of conspicuous consumption whereby social status is signaled through consumption practices, particularly of high end goods (Bagwell and Bernheim 1996; Veblen 1912). The concept of "Veblen effects" are based on what Veblen termed pecuniary emulation, where an individual's consumption practices are driven by a desire to emulate the consumption practices not just of one's immediate acquaintances but especially the wealthy (Bagwell and Bernheim 1996; Bowles and Park 2005). When inequality is high, the reference group for consumption practices (the wealthy) becomes further away thus intensifying the "Veblen effects." This relates to working hours because it is the primary way through which most people acquire the income necessary to engage in competitive consumption. As such, when inequality is higher there are more pressures for individuals to work longer hours to satisfy their consumption desires. Bowles and Park (2005) find evidence for this when examining the relationship between income inequality and working hours in wealthy countries from 1963 to 1998.

Another possibility is that inequality leads to more competition between workers and greater rewards and incentives for longer hours. For instance, Bell and Freeman (2001) examine differences in hours worked between Germany and the United States. They argue that higher levels of inequality in the United States lead to longer work hours in part because the extra work is worth more than in Germany. That is, because the US does not have a strong social safety net for unemployment or for healthcare, the average worker in the US has to work longer to ensure job security and the ability to cover these expenses. Conversely, in Germany, with its relatively strong social safety nets, the living standard of the average worker is not as dependent on working longer hours. Finally, a third factor focuses on how higher inequality leads to power differences between workers and employers. Oh et al. (2012) refer to this as the “labor discipline model” and note that when inequality is high, employers have more control over working conditions. Employers tend to favor longer hours for profit-maximization. The issue of power is also central to the arguments of Schor (1992) and Alesina et al. (2005), who posit that one of the major reasons for shorter work hours in Europe relative to the United States is the decline in labor union power over the second half of the twentieth century.

Given the arguments about why inequality can lead to longer working hours, it is likely that inequality moderates the relationship between hours and emissions. More specifically, based on the arguments above for the environmental consequences of working hours and inequality, I propose that that inequality might exacerbate the effects working hours on emissions. First, for the scale effect, inequality can increase the effect of working hours on emissions by increasing the amount of income dedicated to consumption. The focus for the scale effect is on how much is consumed, and “Veblen effects” are likely to influence how much of income from work goes toward consumption. For instance, Schor (1998) found that for Americans with a lower financial status than their reference group were more likely to spend and less likely to save. From a psychosocial perspective, it is also possible that inequality contributes greater overall precariousness of work and increases stress associated with work (i.e. Kivimäki and Kawachi 2015; Pickett and Wilkinson 2015). This increase in stress can lead people to pursue coping strategies that revolve around increased consumption of goods and services (i.e. Durante and Laran 2016; Mathur, Moschis, and Lee 2006).

Higher levels of inequality may also shift the composition of consumption towards more ecologically intensive options. This is again due to competitive consumption practices where individuals seek to emulate the consumption habits of the wealthy. When inequality is high, there are more pressures to engage in conspicuous consumption. It is important to note that conspicuous consumption is geared towards the consumption of visible goods (Bagwell and Bernheim 1996; Schor 1998; Veblen 1912). The increased pressure for consumption of high-status visible goods is important here because high-status visible goods tend to be more ecologically intensive (Lynch et al. 2019). For instance, larger homes signify a higher status but are also much more ecologically intensive. Similarly, larger vehicles or luxury vehicles tend to signify a higher status, and both are much more ecologically intensive than smaller or more common vehicles (Lynch et al. 2019).

In addition to "Veblen effects," other political economic factors, like spending on social goods such as public transportation, can also shape the composition of consumption. Following the "power-weighted social decision" rule outlined by Boyce (1994, 2007), elites have more political power when inequality is high and will oppose social spending on things like public transportation, for example. As such, if public transportation is either bad or not available, people are more likely to purchase and use automobiles as their primary mode of transportation. The composition of consumption related to working time is thus more ecologically intensive.

In all, given the arguments above, I argue that higher levels of inequality should moderate the effect of working hours on emissions. More specifically, when inequality is high both the scale, which is focused on total consumption and growth, and compositional, what goods and services are consumed, effects of working hours on emissions should be larger.

DATA AND METHODS

SAMPLE

The dataset consists of annual observations of all 50 US states and the District of Columbia from 2005 until 2015. This yields an overall sample size of 561 observations. This is a balanced dataset and there are no instances of missing data. The time period of 2005 until 2015 is an artifact of data availability. In particular, data for the measures of working time and inequality are temporally limited. The most recent data on measures of economic inequality at the US state level are for the year 2015 while state level data on working time only goes back to 2005.

DEPENDENT VARIABLE

The dependent variable is state-level CO_2 emissions from fossil fuel combustion. It is measured in million metric tons ($MMTCO_2$). These data are gathered from the United States Environmental Protection Agency (EPA) (2019b). While these data do not account for all CO_2 emissions, such as those from land-use change, the burning of fossil fuels for transportation and energy represent the vast majority, around 75%, of CO_2 emissions in the United States (United States Environmental Protection Agency 2019a). The EPA's estimates are based on fuel consumption data from the United States Energy Information Administration (EIA).

INDEPENDENT VARIABLES

The key independent variables in the study are average weekly working hours and income share of the top ten percent. The data on average working hours comes from the United States Census Bureau's American Community Survey (ACS) (United States Census Bureau 2019a). It measures the average usual hours worked in a given year for workers 16 to 64 years old. Previous research on the relationship between working hours and emissions across US states (Fitzgerald et al. 2018) used an alternative data source for work working time from the United States Bureau of Labor Statistics (BLS). I choose to use the ACS data instead for a few reasons. First, using the ACS data allows for examination of a longer period of time. While the BLS data begins in 2007, the ACS data goes back to 2005. Second, and perhaps more importantly, I believe that the ACS data are a more accurate reflection of the actual number of hours spent working for Americans. The BLS data are based on surveys of employers across the United States. Given the breadth of employers that are surveyed by the BLS, it represents an accurate portrayal of the average hours spent working per job. One potentially large problem with this, though, is that it misrepresents the actual number of hours worked per worker because it does not account for those who have more than one job. According to the BLS (2018), around 5% of the work force has more than one job. Those numbers are likely conservative as well with issues surrounding the definition of holding multiple jobs (Sherman 2018). For example, some people may not report having two jobs when they may only spend a few hours a week in a second job. Regardless, the BLS numbers are likely undercounting the actual number of hours worked. For the years 2007 to 2015, the ACS data reports average hours a week at 38.9 hours while the BLS reports 34.4 hours. That 4.5-hour difference results in 234 hours over the course of a year.

With this dataset, the states with the highest average working hours for the 2005-2015 time period are Alaska (42.9 hours), Wyoming (40.7), District of Columbia (40.3), North Dakota (40.2) and Louisiana (40.2). The states with the lowest average working hours for the time period are Utah (37.1), Rhode Island (37.5), Oregon (37.5), Michigan (37.8) and Vermont (37.9). The difference between Utah and Alaska is 5.8 hours a week. Over the course of a year, that amounts to nearly 302 hours or just over seven and a half 40-hour work weeks.

Data on the percentage of income to the top ten percent used in this study were developed by Mark Frank and colleagues (2015). These data are a part of the World Inequality Database (2019) and can be accessed there as well through Frank's personal website (Frank 2019). Both measures are derived from tax data reported to the Internal Revenue Service. For a more in-depth discussion of the creation of these measures, see Frank, et al. (2015). The income share of the top 10 percent is measured as a percentage of total income. I use this measure of inequality because it is most applicable to the theoretical positions outlined above. Specifically, when considering "Veblen effects" it is important to use a measure of inequality that focuses on the concentration of income to top earners (Bowles and Park 2005). Similarly, the political economy arguments advanced above also focus on when income is concentrated in the hands of top earners (Jorgenson, Schor, and Huang 2017). As such, other measures such as the Gini coefficient, which measures overall inequality without locating where in the distribution inequality resides, may not capture the effects discussed above.

As discussed above, there are two hypothesized pathways through which working hours can affect emissions: the scale and compositional effects. Measuring these two pathways requires different models. In models that examine the scale effect, I follow previous research by disaggregating GDP into three components: working hours, labor productivity and employed population percentage (van Ark and McGuckin 1999; Fitzgerald et al. 2018; Hayden and Shandra 2009; Knight et al. 2013a). Labor productivity is measured as GDP per hour of work. Employed population percentage is simply a ratio of total number of employed persons to total population. To examine the compositional effect, I estimate the effect of average working hours net of GDP per capita (measured in current US dollars). Data for these measures were collected from the United States Bureau of Economic Analysis (2019).

To test whether the scale and compositional effects on emissions vary across different levels of inequality, I create interaction variables between average working hours and both income inequality measures (Jaccard and Turrisi 2003). In order to avoid issues of multicollinearity common when utilizing interaction terms, I mean-centered the main effects of working hours and the inequality measures prior to creating the interaction terms. This also allows for a more meaningful assessment of the main effects in those models. More specifically, because there are no actual 0 values for either of the main effects, the interpretation of those coefficients is meaningless. Mean-centering those variables allows for a meaningful interpretation of those coefficients where they indicate the effect of working hours at average values of inequality, or vice-versa. As I note below, I take this one step further to analyze the effect of working hours across multiple levels of both inequality measures. Specifically, I test the effect of working hours at relatively low inequality (centered at the 25th percentile of inequality), median inequality (50th percentile) and relatively high inequality (75th percentile).

I also include a number of important control variables in the models as well. These include total population size, manufacturing as a percentage of GDP, and energy production. Total population data is collected from the United States Census Bureau (2019b). Manufacturing as a percentage of GDP is created by calculating the ratio of GDP from manufacturing to total GDP and is collected from the United States Bureau of Economic Analysis (2019). Note that before logging this variable, I added a constant of 1 to avoid negative values. The data on energy production comes from the United States Energy Information Administration's (2019) State Energy Data System.

Tables 3.1 and 3.2 detail the descriptive statistics and bivariate correlations for the above variables, respectively.

METHODS

I estimate two-way fixed-effects panel regression models to examine the relationships between inequality, working time and carbon emissions. I estimate fixed effects models for a number of reasons. First, results of the Hausman test indicate that a fixed-effects model is more appropriate than a random-effects model. Second, fixed-effects regression models are relatively effective at dealing with heterogeneity bias because they implicitly control for time-invariant factors unique to each case (Allison 2009). The estimated models also control for any time-invariant factors that are common to all states at a given point in time. Fixed-effects models also produce relatively conservative estimates because they only focus on within-effects (Allison 2009). Finally, while random-effects models are desirable when a researcher wants to examine the effects of time-invariant factors, that is not the case in these analyses as all of the measures vary over time.

There are a number of ways to estimate fixed-effects models. Here, I use Prais-Winsten regression with panel corrected standard errors. This estimation technique is appropriate for datasets with a large number of time periods relative to cases and allows for disturbances that are heteroskedastic and contemporaneously correlated across panels (Beck and Katz 1995). The models include a correction for first-order autocorrelation with a panel-specific AR(1) correction. The results remain substantively the same when using the common AR(1) process, but using the panel-specific AR(1) structure allows for the autocorrelation structure to vary across states.

In line with previous research on the human drivers of environmental change (e.g. Jorgenson and Clark 2012; York, Rosa, and Dietz 2003), all of the non-binary variables in the analysis are transformed into natural logarithms (ln). The regression models thus estimate elasticity coefficients where the association between the dependent and independent variables are understood as percentage changes (i.e. a one percent increase in the independent variable is associated with the coefficient percent change in the dependent variable).

RESULTS

To give an idea of the relationship between working hours and emissions over the time period, Figure 3.1 is a scatterplot of the association between percent change in working hours from 2005 to 2015 and the percent change in CO_2 emissions from 2005 to 2015. The two measures are positively correlated with a value of 0.152.

The findings for the fixed-effects regression analyses are presented in Tables 3.3 through 3.5 below. Table 3.3 reports the findings for models estimating the effects on emissions of working hours and income to the top ten percent. Table 3.4 reports the findings for models that simultaneously estimate the effects of working time and income to the top ten percent as well as their interaction. Table 3.5 reports the slope coefficients for the effects of working hours at different levels of income to the top ten percent. It should be noted that the very high r-squared values reported in the tables is largely due to the fact that all models include unit-specific and year-specific dummy variables, which explains much of the variation in the dependent variable.

Table 3.3 includes the results of the models testing the main effects of working hours and inequality on carbon dioxide emissions separately. Model 1 tests the scale effect of working hours on emissions. It finds that the effect of working hours on emissions is positive and significant. More specifically, it shows that, holding all else constant, a one percent increase in average working hours is associated a .981 percent increase in carbon emissions. Model 2 tests the compositional effect of working hours on emissions. As expected, the coefficient size is somewhat smaller than the scale effect. This shows that the effect of working hours on emissions net of its contribution to GDP is positive but only significant at the .10 level ($p = .074$). These results indicate that a one percent increase in working hours is associated with a .665 percent increase in emissions. Turning to the inequality model, the results indicate that the effect of top ten percent income share is positive, but it is non-significant. Looking at the control variables, the effects mostly follow expected trajectories consistent with previous research. The exceptions to this are the effects of manufacturing percentage and energy production.

Most cross-national research shows that these are significant drivers of emissions, but state level studies using two-way fixed effects models do not find significant effects largely because their effects are explained away by the fixed effects.

Table 3.4 includes models 5 through 8. Models 5 and 6 examine the scale and compositional effects, respectively, of working hours on emissions and include the income share of the top ten percent. The results here remain similar to the ones above in Table 2.3. The scale effect of working hours remains positive and significant with the inclusion of income to the top ten percent. The compositional effect remains significant at the .10 level when the top 10 percent variable is included. The effect of income to the top ten percent remains non-significant. The effects of the control variables remain similar as well. In models 7 and 8, I examine the interactive effects of working hours and inequality on CO_2 emissions for both scale and compositional effects. As a reminder, the main effects of working hours and income to the top ten percent are mean-centered in these models. As such, the main effect of working hours in these models is the effect of working hours on emissions at average levels of inequality. In both models, the interaction effects between working hours and inequality are positive and significant. This indicates that the effect of working hours on emissions gets larger as inequality increases. This is true for both scale and compositional effects. While this is not the focus here, it can also be interpreted in the other direction as well. That is, that the effect of inequality on emissions gets larger as working hours increase.

As noted above, including the interaction effect of working hours and inequality makes the main effects of those variables conditional (Jaccard and Turrisi 2003). The models in Table 3.4 show the effects of working hours at average levels of inequality, but are somewhat limited in their explanatory utility. To further investigate how inequality shapes the relationship between working hours and emissions, I estimate the marginal effects working hours on emissions at different levels of inequality. As noted above, I estimate the effects of working hours on emissions at relatively low inequality (25^{th} percentile), median inequality (50^{th} percentile) and relatively high inequality (75^{th} percentile).

Table 3.5 reports the effects of working hours at different levels of inequality for both scale and compositional effects. Note that these coefficients are estimated in models 7 and 8 presented in Table 4 and thus should be understood net of the control variables presented there.

Here, we see that the scale effect of working hours on emissions is significant at all three levels of inequality, but grows in size as inequality increases. More specifically, at relatively low inequality (the 25^{th} percentile), a one percent increase in working hours is associated with a .769 percent increase in emissions. At relatively high inequality (75^{th} percentile), a one percent increase in working hours is associated with a 1.107 percent increase in emissions. The slope coefficients also for the compositional effect show a similar pattern. Whereas the compositional effect on emissions is non-significant at relatively low inequality, it becomes significant at the .10 level at median inequality and at the .05 level at relatively high levels of inequality. This indicates that the compositional effect is particularly sensitive to levels of inequality, in particular that "Veblen effects" are likely key to understanding the compositional effect.

Figures 3.2 and 3.3 illustrate the slopes of the effects calculated in Table 2.5. In Figure 3.2, The top slope represents the effect of working hours on emissions at relatively high levels of inequality. The middle slope represents the effect of working hours on emissions at median inequality and the bottom slope represents the effect of working hours on emissions are relatively low levels of inequality. For Figure 3.3, because the effect of inequality is non-significant at relatively low levels of inequality no slope is visualized.

SENSITIVITY ANALYSES

To ensure the robustness of the results presented above, I conducted a number of sensitivity analyses. First, I tested for the presence of overly influential cases. To do this, I systematically re-estimated the models excluding one state at a time, a common approach for the modeling approach used here (Beck and Katz 1995). All of the models remained substantively consistent across these tests. In addition to these tests, I also estimated the models using alternative modeling specifications. These including random effects models that control only for time-specific fixed effects, first-difference models, and dynamic panel models with a lagged dependent variable. The results remain substantively similar using those approaches as well. As noted above, I chose to present the results of the fixed effects models using Prais Winsten regression with panel-corrected standard errors and a correction for autocorrelation because this is a common approach in this literature and it is appropriate for the structure of my data. For instance, while the dynamic panel modelling approach is quite robust it can be difficult to implement with a relatively small number of time points (Beck and Katz 2011).

I also estimate other models using alternative measures of inequality. These include the Gini coefficient, the Theil Index, percentage of income to the top five percent and percentage of income to the top one percent. The results remain substantively the same across these measures of inequality except for the Gini coefficient. The results for the Gini coefficient are non-significant. As I note above, the Gini coefficient is not as theoretically applicable to the arguments presented here and recent research examining its effects on emissions indicate it has non-significant effects (i.e. Jorgenson, Schor, and Huang 2017). In all, the results presented above are robust against overly-influential cases, across alternative modeling specifications and alternative measures of inequality.

DISCUSSION & CONCLUSION

Engaging with political economy arguments surrounding the concentration of political and economic power in the hands of the wealthy and consumption arguments based on the idea of "Veblen effects," I proposed that the both the scale and compositional effects of working hours on emissions would be larger at higher levels of inequality. Empirical analyses of these relationships across US states from 2005-2015 support this proposition. In particular, the results show that the interaction term between working hours and the income concentration measures is positive and statistically significant when examining both the scale and compositional effects of working hours on emissions. Exploring this relationship with more nuance revealed that the scale effect of working hours on emissions is significant at relatively low inequality (bottom 25%), median inequality and relatively high inequality (top 75%) and it grows in size at each level. While the compositional effect of working hours is non-significant in the base models, the multiplicative models indicate that it is significant at the .05 level only at relatively high levels of inequality (top 75%). The results for the compositional effect are particularly interesting given the fact that the compositional effect has been somewhat inconsistent in previous studies. These results indicate that it could be, in part, due to the fact that inequality plays an important role in shaping the compositional effect.

Turning to the base models, the analyses support previous research and indicate that longer working hours are associated with increases in CO_2 emissions over time. I also find that, in the base models, the effect of inequality on emissions is non-significant. While this differs from recent research, it should be noted that the estimated coefficients are similar and the differences in statistical significance are likely due to different time periods and the effect of inequality varies over time.

The theoretical significance of these results is twofold. First, while research on the environmental consequences of inequality find empirical support for the relationship between inequality and emissions, it is not immediately clear exactly how inequality leads to increased environmental harm. The results here show that one pathway through which inequality affects emissions is through shaping the relationship between working time and emissions. This allows for a greater understanding of how inequality can shape environmental outcomes. Examining working time as a site where the political economy arguments come to fruition is particularly illuminating. Decisions about working time show power differentials between those in power, employers, and those who have less power, workers.

On the other hand, these results also add value to research on the environmental consequences of working time. In particular, previous studies have failed to explicitly consider the role of inequality in shaping the environmental consequences of working time. The results here indicate that while longer working hours are ecologically detrimental even at lower levels of inequality, they are much more detrimental at higher levels of inequality. As such, as we move forward with considering working time reduction as a feasible and effective pathway to sustainability, it will be important to keep the issue of inequality in this discussion as well because it is clear that inequality plays a major role in shaping socio-environmental relationships (Hill et al. 2019; McGee and Greiner 2018).

These results are also significant from a policy perspective. Previous research shows that high inequality is a major barrier to reducing working hours (Bowles and Park 2005; Oh et al. 2012). When inequality is high, employers have more power to dictate working hours and tend to favor longer hours with fewer workers. Higher inequality also means more political power in the hands of the elite and this power can lead to relatively weak social programs and relatively lower wages. With weak social programs, individuals and households are more likely to work longer hours because they must pay for things like health insurance. Similarly, when wages are lower workers have to work longer hours in order to be able to afford necessities like housing, education, et cetera. All of this is to say that if the goal is to a working time reduction more feasible and socially desirable in the United States, then combatting inequality is likely an important prerequisite.

If inequality reduces the feasibility of a working time reduction and the results of this study indicate that higher levels of inequality intensify the working time-emissions relationship, then we should consider policies that could lead directly to a reduction of both working time and inequality. These include policies aimed at increasing minimum wages across the country, implementing maximum wages and strengthening social welfare programs, like implementing Medicare-for-All. At first thought it could seem environmentally detrimental to want higher wages, which could increase consumption. However, high levels of consumption are driven by high levels of inequality, at least to an extent. If inequality is reduced, then the urge for competitive consumption also decreases. While these policies should reduce inequality, they can also improve the feasibility of a working time reduction. Lower wages can lead to increased working time as people have to work longer to afford even basic necessities, so increasing labor's share of value produced can open up opportunities for working time reduction.

This study is not without its limitations. Perhaps the biggest limitation is that the current study is limited to a single decade, from 2005 to 2015. While this is a slightly larger timeframe than other recent studies (Fitzgerald et al. 2018), the small number of years still precludes effectively examining how these relationships might vary over time. While this is difficult at the state level due to data limitations, future research could examine these issues in a cross-national perspective where there is a wider array of data availability that could assess these questions. Additionally, many of the mechanisms described here occur largely at the household level. While recent studies have examined the relationship between emissions and working time at the household level in the US (Fremstad et al. 2019), the analyses can be limited due to their cross-sectional nature. Exploring issues of inequality also necessitate more macro level data. Future research could overcome some of these limitations by employing multi-level modeling techniques to account for inequality while examining the working time-emissions relationship at the household level.

REFERENCES

Acemoglu, Daron, and Pascual Restrepo. 2017. *Robots and Jobs: Evidence from US Labor Markets*. *Working Paper*. 23285. National Bureau of Economic Research.

AFL-CIO. 2019. “AFL-CIO Commission on the Future of Work and Unions | AFL-CIO.” Retrieved February 1, 2020 (https://aflcio.org/reports/afl-cio-commission-future-work-and-unions).

Alcott, Blake. 2005. “Jevons’ Paradox.” *Ecological Economics* 54(1):9–21.

Alesina, Alberto, Edward Glaeser, and Bruce Sacerdote. 2005. “Work and Leisure in the United States and Europe: Why So Different?” *NBER Macroeconomics Annual* 20:1–64.

Allison, Paul D. 2009. *Fixed Effects Regression Models*. Los Angeles, CA: SAGE Publications.

van Ark, Bart, and Robert H. McGuckin. 1999. “International Comparisons of Labor Productivity and Per Capita Income.” *Monthly Labor Review* 122:33.

Autonomy. 2019. “The Shorter Working Week: A Radical and Pragmatic Proposal.” *Autonomy*. Retrieved March 16, 2020 (https://autonomy.work/portfolio/the-shorter-working-week-a-report-from-autonomy-in-collaboration-with-members-of-the-4-day-week-campaign/).

Autor, David H. 2015. “Why Are There Still So Many Jobs? The History and Future of Workplace Automation.” *The Journal of Economic Perspectives* 29(3):3–30.

Bagwell, Laurie Simon, and B. Douglas Bernheim. 1996. “Veblen Effects in a Theory of Conspicuous Consumption.” *The American Economic Review* 86(3):349–73.

Bannai, Akira, and Akiko Tamakoshi. 2014. “The Association Between Long Working Hours and Health: A Systematic Review of Epidemiological Evidence.” *Scandinavian Journal of Work, Environment & Health* 40(1):5–18.

BBC. 2019. “What Is Labour’s Four-Day Working Week Plan?” *BBC News*, November 13.

Beck, Nathaniel, and Jonathan N. Katz. 1995. “What To Do (and Not To Do) with Time-Series Cross-Section Data.” *The American Political Science Review* 89(3):634–47.

Beck, Nathaniel, and Jonathan N. Katz. 2011. “Modeling Dynamics in Time-Series–Cross-Section Political Economy Data.” *Annual Review of Political Science* 14(1):331–52.

Becker, Gary A. 1965. “A Theory of the Allocation of Time.” *The Economic Journal* 75(299):493–517.

Bell, Linda A., and Richard B. Freeman. 2001. “The Incentive for Working Hard: Explaining Hours Worked Differences in the US and Germany.” *Labour Economics* 8(2):181–202.

Bowles, Samuel, and Yongjin Park. 2005. “Emulation, Inequality, and Work Hours: Was Thorsten Veblen Right?” *Economic Journal* 115(507):F397–412.

Boyce, James. 1994. “Inequality as a Cause of Environmental Degradation.” *Ecological Economics* 11(3):169–78.

Boyce, James K. 2007. “Is Inequality Bad for the Environment?” Pp. 267–88 in *Equity and the Environment*. Vol. 15, *Research in Social Problems and Public Policy*, edited by R. C. Wilkinson and W. R. Freudenburg. Emerald Group Publishing Limited.

Chappell, Bill. 2019. “4-Day Workweek Boosted Workers’ Productivity By 40%, Microsoft Japan Says.” *NPR.Org*. Retrieved February 1, 2020 (https://www.npr.org/2019/11/04/776163853/microsoft-japan-says-4-day-workweek-boosted-workers-productivity-by-40).

Cushing, Lara, Rachel Morello-Frosch, Madeline Wander, and Manuel Pastor. 2015. “The Haves, the Have-Nots, and the Health of Everyone: The Relationship Between Social Inequality and Environmental Quality.” *Annual Review of Public Health* 36(1):193–209.

Devetter, François-Xavier, and Sandrine Rousseau. 2011. “Working Hours and Sustainable Development.” *Review of Social Economy* 69(3):333–55.

Downey, Liam. 2015. *Inequality, Democracy, and the Environment*. NYU Press.

Downey, Liam, and Susan Strife. 2010. “Inequality, Democracy, and the Environment.” *Organization & Environment* 23(2):155–88.

Durante, Kristina M., and Juliano Laran. 2016. "The Effect of Stress on Consumer Saving and Spending." *Journal of Marketing Research* 53(5):814–28.

Fisher, Dana R., and Andrew K. Jorgenson. 2019. "Ending the Stalemate: Toward a Theory of Anthro-Shift." *Sociological Theory* 37(4):342–62.

Fitzgerald, Jared B., Andrew K. Jorgenson, and Brett Clark. 2015. "Energy Consumption and Working Hours: A Longitudinal Study of Developed and Developing Nations, 1990–2008." *Environmental Sociology* 1(3):213–23.

Fitzgerald, Jared B., Juliet B. Schor, and Andrew K. Jorgenson. 2018. "Working Hours and Carbon Dioxide Emissions in the United States, 2007–2013." *Social Forces*.

Foster, John Bellamy, Brett Clark, and Richard York. 2010. "Capitalism and the Curse of Energy Efficiency The Return of the Jevons Paradox." *Monthly Review* 62(6):1–12.

Frank, Mark. 2019. "The U.S. Income Inequality Page of Mark W. Frank." Retrieved July 7, 2019 (https://www.shsu.edu/eco_mwf/inequality.html).

Frank, Mark, Estelle Sommeiller, Mark Price, and Emmanuel Saez. 2015. "Frank-Sommeiller-Price Series for Top Income Shares by US States since 1917." 4.

Franko, William W., and Christopher Witko. 2018. *The New Economic Populism: How States Respond to Economic Inequality*. Oxford University Press.

Fremstad, Anders, Mark Paul, and Anthony Underwood. 2019. "Work Hours and CO2 Emissions: Evidence from U.S. Households." *Review of Political Economy* 31(1):42–59.

Grunewald, Nicole, Stephan Klasen, Inmaculada Martínez-Zarzoso, and Chris Muris. 2012. *Income Inequality and Carbon Emissions*. *SSRN Scholarly Paper*. ID 2013039. Rochester, NY: Social Science Research Network.

Hanbury, Hugo, Christoph Bader, and Stephanie Moser. 2019. "Reducing Working Hours as a Means to Foster Low(Er)-Carbon Lifestyles? An Exploratory Study on Swiss Employees." *Sustainability* 11(7):2024.

Hayden, Anders. 2014. *When Green Growth Is Not Enough: Climate Change, Ecological Modernization, and Sufficiency*. MQUP.

Hayden, Anders, and John M. Shandra. 2009. "Hours of Work and the Ecological Footprint of Nations: An Exploratory Analysis." *Local Environment* 14(6):575–600.

Hill, Terrence D., Andrew K. Jorgenson, Peter Ore, Kelly S. Balistreri, and Brett Clark. 2019. "Air Quality and Life Expectancy in the United States: An Analysis of the Moderating Effect of Income Inequality." *SSM - Population Health* 7:100346.

Intergovernmental Panel on Climate Change. 2018. *Summary for Policymakers — Global Warming of 1.5 ^{o}C.*

Jaccard, James, and Robert Turrisi. 2003. *Interaction Effects in Multiple Regression*. SAGE.

Jaeger, Joel, Tom Cyrs, and Kevin Kennedy. 2019. "As Trump Steps Away from Paris Climate Agreement, U.S. States, Cities and Businesses Step Up." *World Resources Institute*. Retrieved November 8, 2019 (https://www.wri.org/blog/2019/10/trump-steps-away-paris-climate-agreement-us-states-cities-and-businesses-step-up).

Jalas, Mikko. 2002. "A Time Use Perspective on the Materials Intensity of Consumption." *Ecological Economics* (41):109–23.

Jalas, Mikko. 2005. "The Everyday Life Context of Increasing Energy Demands.Time Use Survey Data in a Decomposition Analysis." *Journal of Industrial Ecology* 9(1–2):129–45.

Jalas, Mikko, and Jouni K. Juntunen. 2015. "Energy Intensive Lifestyles: Time Use, the Activity Patterns of Consumers, and Related Energy Demands in Finland." *Ecological Economics* 113:51–59.

Jevons, William Stanley. 1865. *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal-Mines*. Macmillan.

Jorgenson, Andrew K., and Brett Clark. 2012. "Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005." *American Journal of Sociology* 118(1):1–44.

Jorgenson, Andrew K., Juliet B. Schor, Xiaorui Huang, and Jared Fitzgerald. 2015. "Income Inequality and Residential Carbon Emissions in the United States: A Preliminary Analysis." *Human Ecology Review* 22(1):93–106.

Jorgenson, Andrew K., Juliet B. Schor, Kyle W. Knight, and Xiaorui Huang. 2016. "Domestic Inequality and Carbon Emissions in Comparative Perspective." *Sociological Forum* 31:770–86.

Jorgenson, Andrew K., Juliet Schor, and Vincentas Giedraitis. 2017. "Income Inequality and Carbon Emissions In Post-Soviet Nations, 1992–2009." *Ekonomika* 96(3):33–43.

Jorgenson, Andrew K., Juliet Schor, and Xiaorui Huang. 2017. "Income Inequality and Carbon Emissions in the United States: A State-Level Analysis, 1997–2012." *Ecological Economics* 134:40–48.

Kasser, Tim, and Kirk W. Brown. 2003. "On Time, Happiness, and Ecological Footprints." Pp. 107–112 in *Take Back Your Time: Fighting Overwork and Time Poverty in America*, edited by de Graaf, John. San Francisco, CA: Berrett-Koehler Publishers, Inc.

Kelly, Jack. 2020. "Finland Prime Minister's Aspirational Goal Of A Six-Hour, Four-Day Workweek: Will It Ever Happen?" *Forbes*. Retrieved February 1, 2020 (https://www.forbes.com/sites/jackkelly/2020/01/08/finlands-prime-ministers-aspirational-goal-of-a-six-hour-four-day-workweek-will-this-ever-happen/#2f3718683638).

King, Lewis C., and Jeroen C. J. M. van den Bergh. 2017. "Worktime Reduction as a Solution to Climate Change: Five Scenarios Compared for the UK." *Ecological Economics* 132:124–34.

Kivimäki, Mika, and Ichiro Kawachi. 2015. "Work Stress as a Risk Factor for Cardiovascular Disease." *Current Cardiology Reports* 17(9):74.

Knight, Kyle W., Eugene A. Rosa, and Juliet B. Schor. 2013a. "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.

Knight, Kyle W., Eugene A. Rosa, and Juliet B. Schor. 2013b. "Reducing Growth to Achieve Environmental Sustainability: The Role of Work Hours." Pp. 187–204 in *Capitalism on Trial: Explorations in the Tradition of Thomas E. Weisskopf*, edited by J. Wicks-Lim and R. Pollin. Edward Elgar Publishing.

Knight, Kyle W., and Juliet B. Schor. 2014. "Economic Growth and Climate Change: A Cross-National Analysis of Territorial and Consumption-Based Carbon Emissions in High-Income Countries." *Sustainability* 6(6):3722–31.

Knight, Kyle W., Juliet B. Schor, and Andrew K. Jorgenson. 2017. "Wealth Inequality and Carbon Emissions in High-Income Countries." *Social Currents* 4(5):403–12.

Lin, Summer. 2020. "Want to Work Only 32 Hours a Week? There's a Push to Make It a Reality in Washington." *Thenewstribune*. Retrieved February 1, 2020 (https://www.thenewstribune.com/news/state/washington/article239536443.html).

Longhofer, Wesley, and Andrew Jorgenson. 2017. “Decoupling Reconsidered: Does World Society Integration Influence the Relationship Between the Environment and Economic Development?” *Social Science Research*.

Lynch, Michael J., Michael A. Long, Paul B. Stretesky, and Kimberly L. Barrett. 2019. “Measuring the Ecological Impact of the Wealthy: Excessive Consumption, Ecological Disorganization, Green Crime, and Justice.” *Social Currents* 6(4):377–95.

Mathur, Anil, George P. Moschis, and Euehun Lee. 2006. “Consumer Stress-Handling Strategies: Theory and Research Findings.” *Journal of Consumer Behaviour* 5(3):193–203.

McGee, Julius Alexander, and Patrick Trent Greiner. 2018. “Can Reducing Income Inequality Decouple Economic Growth from CO2 Emissions?” *Socius* 4:2378023118772716.

Messenger, Jon Carleton, and Naj Ghosheh. 2013. *Work Sharing During the Great Recession: New Developments and Beyond*. Edward Elgar Publishing.

Mol, Arthur P. J., Gert Spaargaren, and David A. Sonnenfeld. 2014. “Ecological Modernization Theory: Taking Stock, Moving Forward.” Pp. 15–30 in *Routledge International Handbook of Social and Environmental Change*, edited by A. P. J. Mol, D. A. Sonnenfeld, and G. Spaargaren. New York: Routledge.

Nässén, Jonas, and Jörgen 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):726–45.

National Conference of State Legislatures. 2017. "Work Share Programs." Retrieved May 25, 2017 (http://www.ncsl.org/research/labor-and-employment/work-share-programs.aspx).

Oh, Seung-Yun, Yongjin Park, and Samuel Bowles. 2012. "Veblen Effects, Political Representation, and the Reduction in Working Time Over the 20th Century." *Journal of Economic Behavior & Organization* 83(2):218–42.

Pfeffer, Jeffrey. 2018. *Dying for a Paycheck: How Modern Management Harms Employee Health and Company Performance—and What We Can Do About It.* HarperCollins.

Pickett, Kate E., and Richard G. Wilkinson. 2015. "Income Inequality and Health: A Causal Review." *Social Science & Medicine* 128:316–26.

Pollin, Robert. 2019. "Advancing a Viable Global Climate Stabilization Project: Degrowth versus the Green New Deal." *Review of Radical Political Economics* 51(2):311–19.

Pouwels, Babette, Jacques Siegers, and Jan Dirk Vlasblom. 2008. "Income, Working Hours, and Happiness." *Economics Letters* 99(1):72–74.

Ravallion, M., M. Heil, and J. Jalan. 2000. "Carbon Emissions and Income Inequality." *Oxford Economic Papers* 52(4):651–69.

Rosnick, David, and Mark Weisbrot. 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):405–17.

Schor, Juliet. 1992. *The Overworked American: The Unexpected Decline Of Leisure*. Basic Books.

Schor, Juliet. 2005. "Sustainable Consumption and Worktime Reduction." *Journal of Industrial Ecology* 9(1-2):37–50.

Schor, Juliet. 2010. *Plenitude: The New Economics of True Wealth*. New York: The Penguin Press.

Schor, Juliet B. 1998. *The Overspent American: Why We Want What We Don't Need*. New York: Harper Collins.

Schor, Juliet B., and Andrew K. Jorgenson. 2019. "Is It Too Late for Growth?" *Review of Radical Political Economics* 51(2):320–29.

Scruggs, Lyle A. 1998. "Political and Economic Inequality and the Environment." *Ecological Economics* 26(3):259–75.

Shao, Qing-long, and Beatriz Rodríguez-Labajos. 2016. "Does Decreasing Working Time Reduce Environmental Pressures? New Evidence Based on Dynamic Panel Approach." *Journal of Cleaner Production* 125:227–35.

Shao, Qinglong, and Shiran Shen. 2017. "When Reduced Working Time Harms the Environment: A Panel Threshold Analysis for EU-15, 1970–2010." *Journal of Cleaner Production* 147:319–29.

Sherman, Erik. 2018. "More People Probably Work Multiple Jobs Than The Government Realizes." *Forbes*. Retrieved July 7, 2019 (https://www.forbes.com/sites/eriksherman/2018/07/22/more-people-probably-work-multiple-jobs-than-the-government-realizes/).

Steffen, Will, Johan Rockström, Katherine Richardson, Timothy M. Lenton, Carl Folke, Diana Liverman, Colin P. Summerhayes, Anthony D. Barnosky, Sarah E. Cornell, Michel Crucifix, Jonathan F. Donges, Ingo Fetzer, Steven J. Lade, Marten Scheffer, Ricarda Winkelmann, and Hans Joachim Schellnhuber. 2018. "Trajectories of the Earth System in the Anthropocene." *Proceedings of the National Academy of Sciences* 115(33):8252–59.

Thombs, Ryan. 2018. "The Transnational Tilt of the Treadmill and the Role of Trade Openness on Carbon Emissions: A Comparative International Study, 1965–2010." *Sociological Forum* 33(2):422–42.

Thombs, Ryan P. 2017. "The Paradoxical Relationship between Renewable Energy and Economic Growth: A Cross-National Panel Study, 1990-2013." *Journal of World-Systems Research* 23(2):540–64.

United States Bureau of Economic Analysis. 2019. "GDP by State | U.S. Bureau of Economic Analysis (BEA)." Retrieved July 7, 2019 (https://www.bea.gov/data/gdp/gdp-state).

United States Bureau of Labor Statistics. 2018. "4.9 Percent of Workers Held More than One Job at the Same Time in 2017 : The Economics Daily: U.S. Bureau of Labor Statistics." Retrieved July 7, 2019 (https://www.bls.gov/opub/ted/2018/4-point-9-percent-of-workers-held-more-than-one-job-at-the-same-time-in-2017.htm).

United States Census Bureau. 2019a. "American Community Survey." *American Fact Finder - Download Center*. Retrieved July 7, 2019 (https://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml).

United States Census Bureau. 2019b. "Population and Housing Unit Estimates Datasets." Retrieved July 7, 2019 (https://www.census.gov/programs-surveys/popest/data/data-sets.html).

United States Energy Information Administration. 2019. "United States - SEDS - U.S. Energy Information Administration (EIA)." Retrieved July 7, 2019 (https://www.eia.gov/state/seds/seds-data-complete.php?sid=US).

United States Environmental Protection Agency. 2019a. "Overview of Greenhouse Gases." *US EPA*. Retrieved July 7, 2019 (https://www.epa.gov/ghgemissions/overview-greenhouse-gases).

United States Environmental Protection Agency. 2019b. "State CO2 Emissions from Fossil Fuel Combustion." *Energy Resources for State and Local Governments*.

Retrieved July 7, 2019 (https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion).

Veblen, Thorstein. 1912. *The Theory of the Leisure Class: An Economic Study of Institutions*. B. W. Huebsch.

Vona, Francesco, and Fabrizio Patriarca. 2011. "Income Inequality and the Development of Environmental Technologies." *Ecological Economics* 70(11):2201–13.

World Inequality Database. 2019. "Data – WID – World Inequality Database." *WID - World Inequality Database*. Retrieved July 7, 2019 (https://wid.world/data/).

York, Richard. 2012. "Do Alternative Energy Sources Displace Fossil Fuels?" *Nature Climate Change* 2:441–43.

York, Richard, Eugene A. Rosa, and Thomas Dietz. 2003. "Footprints on the Earth: The Environmental Consequences of Modernity." *American Sociological Review* 68(2):279.

TABLES

TABLE 3. 1 Descriptive Statistics	Mean	Std. Dev.	Min	Max
Total CO2 Emissions	109.604	111.445	2.66	702.97
Average Work Hours per Week	38.876	0.975	36.6	42.9
Income to Top 10%	45.285	5.05	32.97	62.171
GDP per Hour	52.436	17.633	31.869	166.25
Employed Population %	47.392	3.639	38.666	55.205
Total Population	6,076,849	6,816,157	514,157	39,209,127
GDP per Capita	52,449.2	2,0148.1	32,770	184,000
Manufacturing (% of GDP)	11.861	5.57	0.183	29.6
Energy Production	1,410,000	2,340,000	47	18,029,185
Total CO2 Emissions (ln)	4.244	1.049	0.978	6.555
Average Work Hours per Week (ln)	3.66	0.025	3.6	3.759
Income to Top 10% (ln)	3.807	0.109	3.496	4.13
GDP per Hour (ln)	3.965	0.225	3.624	5.131
Employed Population % (ln)	3.855	0.077	3.655	4.011
GDP per Capita (ln)	10.826	0.257	10.397	12.123
Total Population (ln)	15.114	1.033	13.150	17.478
Manufacturing (% of GDP) (ln)	2.431	0.559	.168	3.421
Energy Production (ln)	13.041	2.028	3.85	16.708

Note: 561 observations for each variable. All variables are reported as both original values and in natural logarithmic form (labeled "ln").

TABLE 3. 2 Correlation Matrix	1	2	3	4	5	6	7	8	9
1. Total CO2 Emissions	1.000								
2. Work Hours	0.058	1.000							
3. GDP per Hour	-0.212	0.199	1.000						
4. Employed Pop. %	-0.394	0.112	0.176	1.000					
5. Total Population	0.846	-0.220	-0.068	-0.351	1.000				
6. Energy Production	0.746	0.155	-0.412	-0.294	0.427	1.000			
7. Manufacturing %	0.506	-0.292	-0.599	-0.176	0.416	0.462	1.000		
8. GDP per Capita	-0.298	0.304	0.948	0.465	-0.186	-0.434	-0.606	1.000	
9. Income to Top 10%	0.290	-0.165	0.203	-0.236	0.476	0.057	-0.011	0.091	1.000

Note: All variables logged (ln).

TABLE 3. 3 Total CO_2 Emissions	Model 1		Model 2		Model 3	
Work Hours	0.981**	(0.356)	0.665#	(0.372)		
Income to Top 10%					0.106	(0.075)
GDP per Hour	0.317***	(0.077)				
Employed Pop. %	0.321*	(0.160)				
Total Population	0.424***	(0.124)	0.423***	(0.115)	0.428***	(0.113)
Energy Production	-0.002	(0.013)	-0.002	(0.014)	-0.001	(0.014)
Manufacturing %	-0.019	(0.026)	-0.019	(0.026)	-0.020	(0.027)
GDP per Capita			0.318***	(0.064)	0.373***	(0.045)
Constant	-7.484***	(2.174)	-7.261***	(2.073)	-5.882***	(1.695)
Observations	561		561		561	
R-squared	0.999		0.999		0.999	

Note: All variables in natural logarithmic form. All models include unreported unit-specific and year-specific intercepts. All models include panel-specific autocorrelation correction. Panel corrected standard errors in parentheses. # p < .10 * p < .05 ** p < .01 *** p < .001

TABLE 3. 4 Total CO_2 Emissions	Model 5		Model 6		Model 7		Model 8	
Work Hours	0.949**	(0.353)	0.631#	(0.374)	0.946**	(0.362)	0.674#	(0.380)
Income to Top 10%	0.103	(0.076)	0.103	(0.076)	0.044	(0.078)	0.044	(0.078)
Work * Top 10%					2.699*	(1.234)	2.703*	(1.222)
GDP per Hour	0.320***	(0.071)			0.274***	(0.071)		
Employed Pop. %	0.329*	(0.164)			0.286	(0.169)		
Total Population	0.453***	(0.121)	0.451***	(0.113)	0.485***	(0.123)	0.483***	(0.113)
Energy Production	-0.002	(0.013)	-0.002	(0.013)	-0.003	(0.014)	-0.003	(0.014)
Manufacturing %	-0.018	(0.027)	-0.018	(0.027)	-0.021	(0.027)	-0.021	(0.027)
GDP per Capita			0.321***	(0.060)			0.275***	(0.061)
Constant	-8.254***	(2.142)	-7.998***	(2.029)	-4.512*	(2.070)	-5.271**	(1.770)
Observations	561		561		561		561	
R-squared	0.999		0.999		0.999		0.999	

Note: All variables in natural logarithmic form. All models include unreported unit-specific and year-specific intercepts. All models include panel-specific autocorrelation correction. Panel corrected standard errors in parentheses. # p < .10 * p < .05 ** p < .01 *** p < .001

TABLE 3. 5 Marginal Effects of Work Hours Across Levels of Income to Top 10%	*Scale Effect*		*Compositional Effect*	
25th Percentile	0.769*	(0.384)	0.497	(0.403)
50th Percentile	0.917*	(0.365)	0.645#	(0.383)
75th Percentile	1.107**	(0.358)	0.835*	(0.372)

Note: All variables in natural logarithmic form. Models for scale effect include same controls as reported in models 7 and 8, respectively. Panel corrected standard errors in parentheses.
# p < .10 * p < .05 ** p < .01 *** p < .001

FIGURES

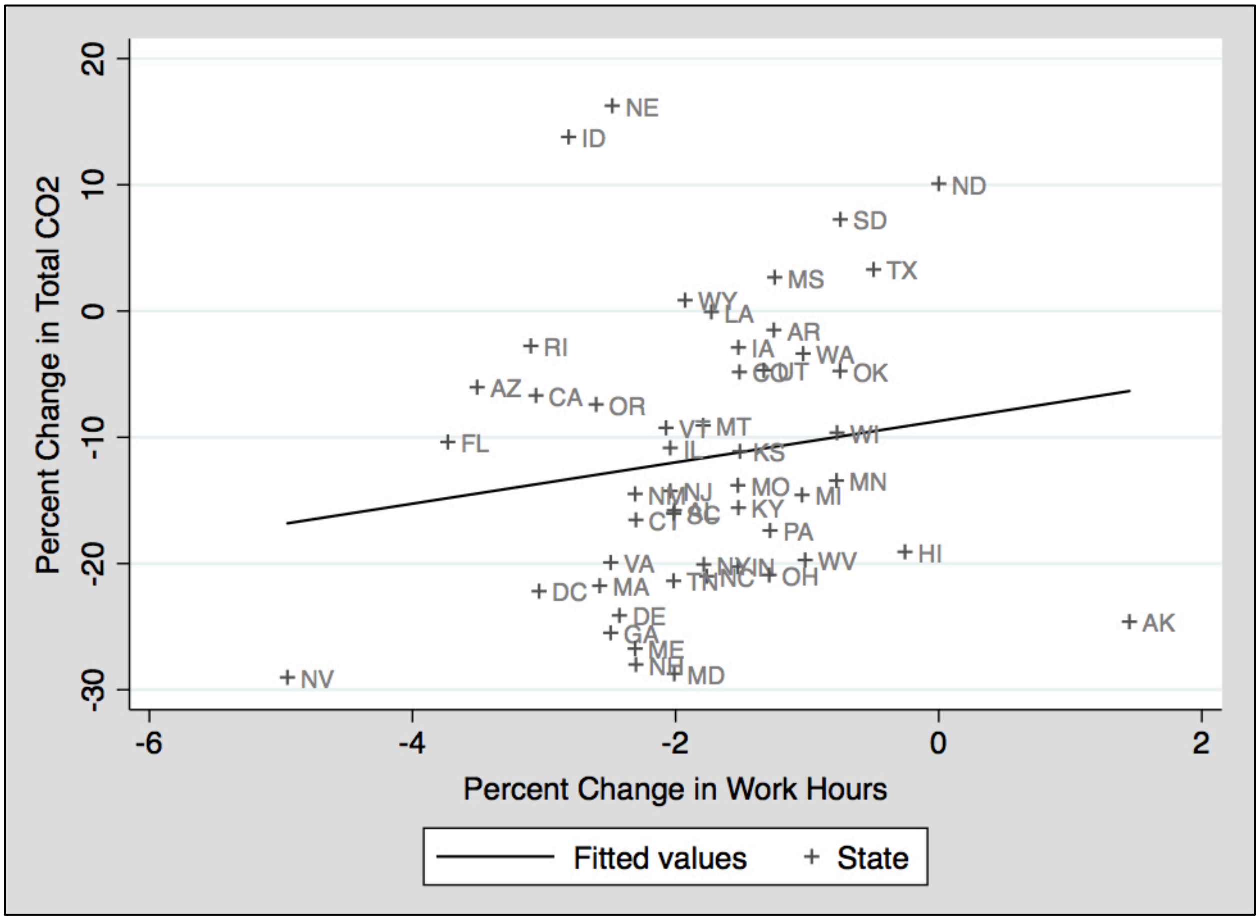

FIGURE 3. 1
Scatterplot of the association between the percent change in total CO_2 emissions from 2005 to 2015 and the percent change in working hours from 2005 to 2015. Each point represents a state.

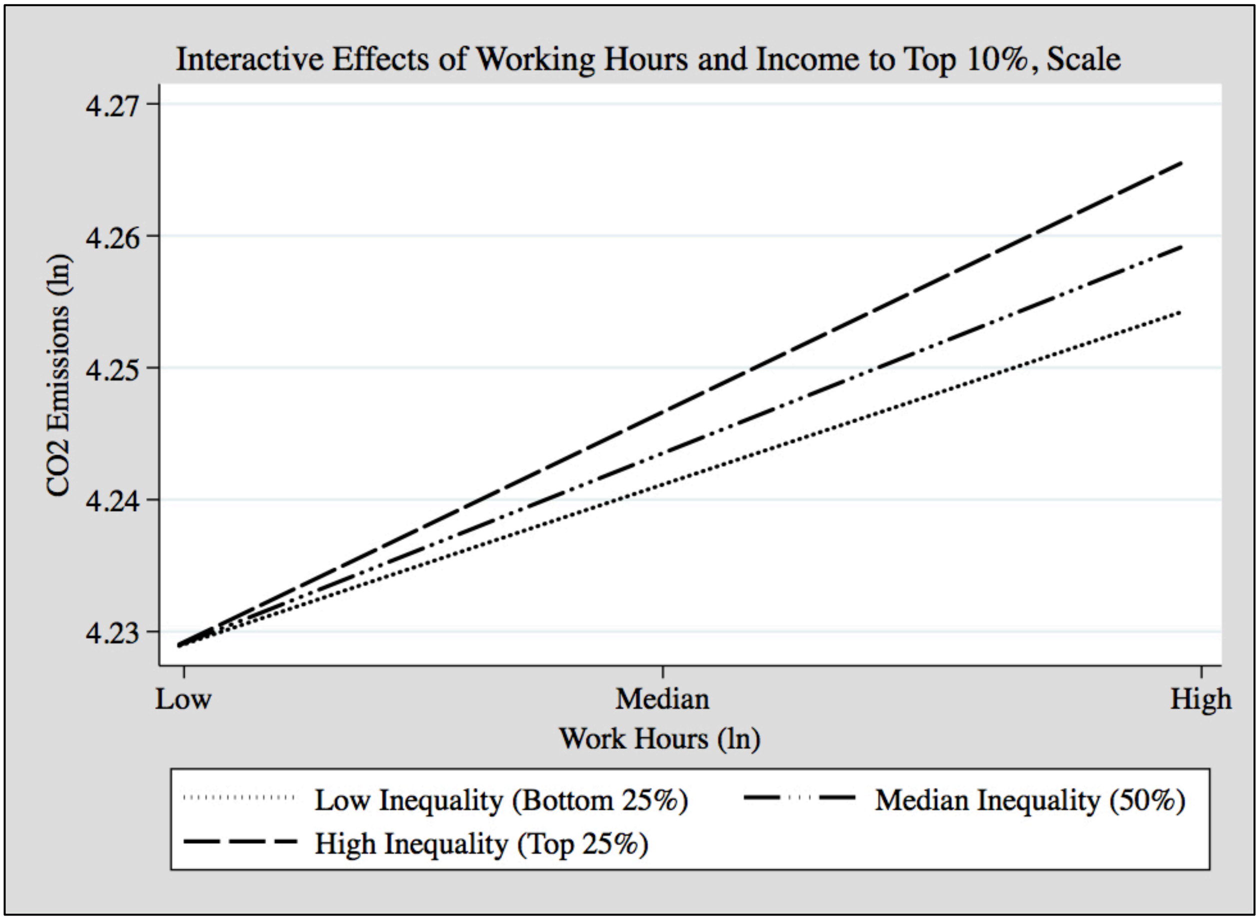

FIGURE 3. 2
Scale effect of average weekly working hours on total CO_2 emissions at different levels of income to top 10%.

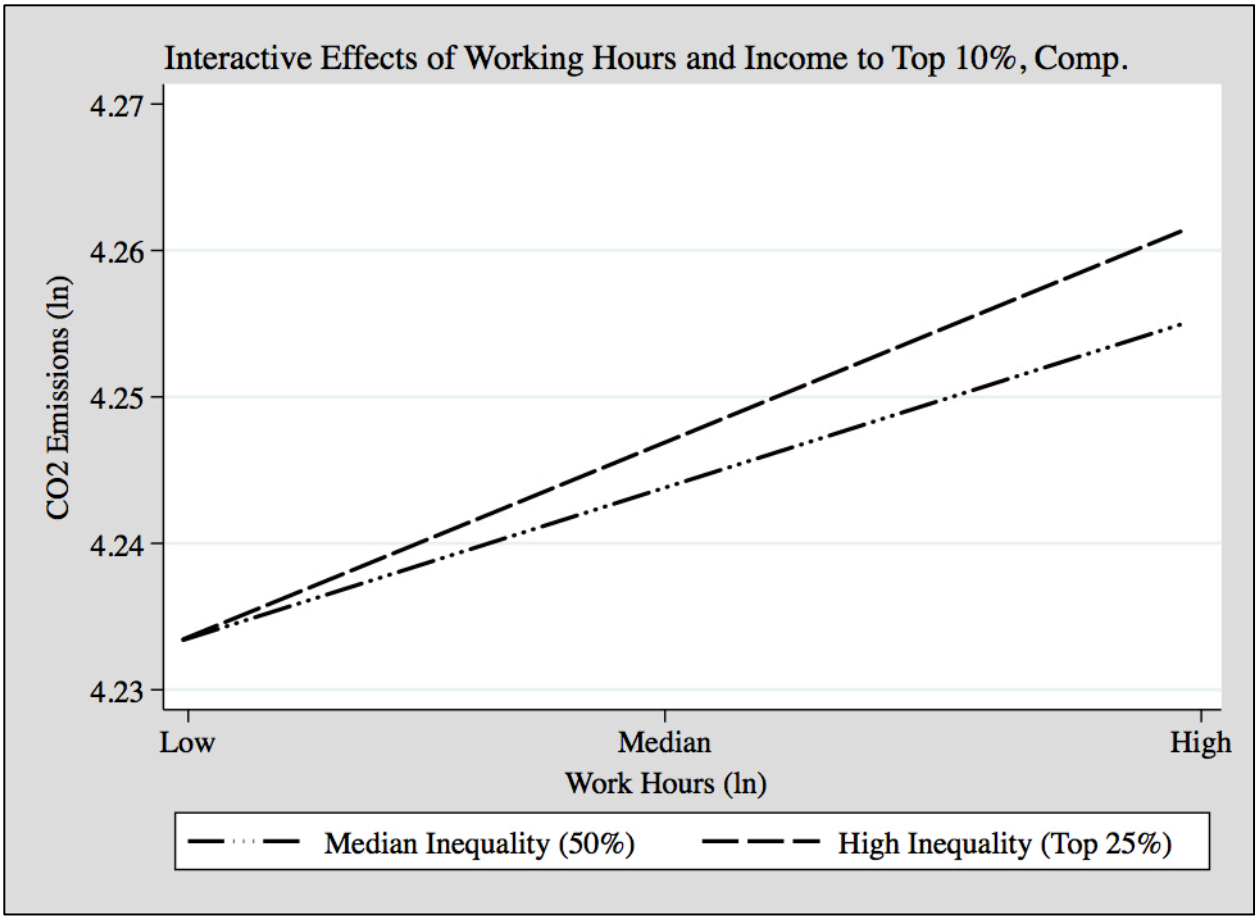

FIGURE 3. 3
Compositional effect of average weekly working hours on total CO_2 emissions across different levels of income to the top 10%.

CHAPTER 4: A LONGITUDINAL ANALYSIS OF WORKING TIME, INEQUALITY AND HUMAN WELLBEING ACROSS US STATES, 2005-2015

ABSTRACT

Proponents of a working time reduction argue that it is a multi-dividend sustainability policy which has the potential to improve social, economic and environmental outcomes. In this study, I examine the relationship between working hours, inequality and population. Previous studies on the relationship between working time and health generally indicate that longer working hours are detrimental for health. These studies are generally conducted at the individual level. This study is the first to examine the relationship between working hours and health at the US state level, which also allows for integration with the large area of research on the population health consequences of inequality. Building on previous arguments in both areas of literature, I hypothesize that the effect of working hours on life expectancy is larger in states with higher levels of income inequality. I test this hypothesis using two-way fixed effects regression analysis to analyze longitudinal data for 50 US states and the District of Columbia from 2005 to 2015. To examine the extent to which inequality (measured as the percentage of income to the top ten percent) moderates the relationship between working hours and life expectancy, I estimate models with an interaction term between inequality and working hours. Results indicate that states with longer average working hours tend to exhibit lower average life expectancy net of other important economic and demographic controls. Further, the results indicate that the effect is larger in states with higher levels of income inequality. I conclude with discussing the theoretical and substantive implications of these results and avenues for future research.

INTRODUCTION

Americans work longer hours than their counterparts in other wealthy countries around the world. In 2019, the average American worked around 121 more hours than the average worker in the United Kingdom, 264 more than the average worker in France, 396 more than the average worker in Denmark and 417 more than the average worker in Germany (The Conference Board 2019). The issue of reducing working hours has gained some currency in mainstream discussions within the United States. This includes efforts ranging from legislation in Washington state to cap the work week at 32 hours to the AFL-CIO, the largest federation of unions in the nation, raise the idea a 4-day work week without loss in pay as a response to advances in artificial intelligence and automation (AFL-CIO 2019; Lin 2020). While these efforts mostly focus on how a 4-day work week could improve productivity, combat unemployment or enhance leisure time, some scholars argue that a working time reduction could offer a broader set of dividends to society, including reducing environmental pressures and improving human wellbeing (Autonomy 2019; Fitzgerald, Schor, and Jorgenson 2018; Schor 1992, 2010; Schor and Jorgenson 2019).

I focus on the relationship between working time and human wellbeing in this study. There is a considerable body of research on the relationship between longer working hours and poorer health outcomes (i.e. Bannai and Tamakoshi 2014; Fan et al. 2015; Kleiner and Pavalko 2010; Pfeffer 2018; Virtanen and Kivimäki 2018). These studies find that, among other things, working long hours increases stress levels, promotes unhealthy consumption choices like smoking, drinking or eating more fast food, and decreases the odds of regular exercise. All of this is associated with increased risk of a range of health issues. Limitations of previous research in this area include that, with few exceptions, it is conducted at the individual level, (i.e. Kleiner and Pavalko 2010; Milner, Smith, and LaMontagne 2015), is primarily cross-sectional, and the findings are inconsistent across studies where longer hours are sometimes found to be worse for health, have no effect or may actually improve health outcomes.

In this study, I advance the literature on the health consequences of working hours by examining the relationship between working time and average life expectancy across US states. Examining the relationship at a macro level of analysis, like US states, allows for numerous advantages. First, it allows for examining how other structural factors might affect the working time/health relationship, and offers opportunities for theoretical advancements through integration with other areas of research on public health. More specifically, another major contribution of this study is examining how inequality moderates the relationship between working hours and life expectancy. There is a relatively small literature linking working time to inequality (Bell and Freeman 2001; Bowles and Park 2005) and a larger literature that links inequality to population health outcomes (Hill and Jorgenson 2018; Neumayer and Plümper 2015; Pickett and Wilkinson 2015). The arguments in these different literatures provide opportunities for integration and indicate the potential for moderation. Examining the interconnections between these areas of research can provide further insights into how they operate. Second, it allows for the use of rigorous longitudinal methods that are more effective at examining causal relationships because researchers can more effectively gauge changes over time compared to cross-sectional studies that only provide a snapshot of relationships at a single point in time. Third, examining the relationship between working hours and health at a macro level is important from a methodological standpoint in that it cannot be assumed that the relationship examined across individuals will be replicated at alternative levels of analysis. Examining this relationship across US states allows for the examination of how working hours relate to overall population health.

In all, I explore two research questions in this study. First, what is the relationship between working hours and population health? Second, how does inequality shape this relationship? To investigate these questions, I gather data from all 50 US states and the District of Columbia from 2005 until 2015. I estimate two-way fixed effects models with panel corrected standard errors and a correction for first order autocorrelation. The results indicate that increases in working hours are associated with declines in average life expectancy. Furthermore, the effect of working time on life expectancy is exacerbated at higher levels of inequality. These results provide further evidence for the potential benefits of a working time reduction as a multi-dividend sustainability policy that can improve human wellbeing, while reducing environmental harms and potentially improving economic outcomes.

The rest of the paper is as follows. First, I discuss the mechanisms linking working time with health outcomes and highlight previous research on this relationship. I then bring in discussions on the implications of inequality for population health and connect these arguments to those from the working time/health literature. I then discuss the data and methods used in this study, followed by a presentation of the findings. I conclude with a discussion of the significance of the results and some considerations for future research.

LITERATURE REVIEW

WORKING TIME AND HEALTH

Proponents of a working time reduction argue that it is potentially a multi-dividend policy that could be particularly powerful as societies transition towards sustainability (Autonomy 2019; Fitzgerald et al. 2018; Knight, Rosa, and Schor 2013; Schor 2010). In particular, it is argued that a working time reduction could improve all three pillars of sustainability: ecological, economic and social. In terms of ecological benefits, many studies show that longer working hours are associated with increased environmental pressures (Fitzgerald et al. 2018; Fremstad, Paul, and Underwood 2019; Jalas and Juntunen 2015; Knight et al. 2013). In terms of economic benefits, it is argued that reducing working hours could be an effective way to combat unemployment (i.e. Hayden 1999; Victor 2008), especially in light of advancements in artificial intelligence and automation that threaten to displace many workers (i.e. Acemoglu and Restrepo 2017; Autor 2015). Another economic benefit is how shorter working hours can enhance labor productivity (Collewet and Sauermann 2017). The third dividend, and what I focus on here, is that reducing working hours could improve human wellbeing. Previous research indicates that working long hours has negative consequences for both mental and physical health (Fan et al. 2015; Golden and Wiens-Tuers 2008; Kleiner and Pavalko 2010; Kleiner, Schunck, and Schömann 2015; Pfeffer 2018).

Research on the relationship between working hours and health indicates that there are three general pathways through which working time may affect health. The first is referred to as the job strain model (Bakker and Demerouti 2007; Karasek 1979; Karasek et al. 1981; Kleiner et al. 2015). The classic job strain model emphasizes the psychosocial structures of work environments and the roles of the job demands in fostering the negative health consequences of work. This model focuses on job control and job demands. When job demands are high and job control is low, work is more stressful and especially bad for health (Karasek 1979; Karasek et al. 1981; Karasek and Theorell 1990; Pfeffer 2018). A key job demand highlighted in this literature is working time (Bakker and Demerouti 2007; Kleiner et al. 2015; Virtanen and Kivimäki 2018). The effects of the structure of work have also been identified by other researchers emphasizing how work has become more precarious over time, which increases work-related stress and anxiety (Kalleberg and Vallas 2017; Standing 2011). In a similar vein, Graeber (2018) highlights the increasing number of relatively meaningless and unrewarding jobs, which can lead to poorer mental health. In all, from the job strain perspective, we should expect that more time at work is damaging to health because work it increases overall stress levels. These stress levels increase the odds of unhealthy coping behaviors such as smoking, increased alcohol consumption and drug use as well as increasing the odds of depression and other mental health issues (Kleiner and Pavalko 2010; Ng and Feldman 2008; Virtanen et al. 2015, 2018). Alternatively, then, less time spent at work can improve health because it offers more opportunities for leisure time and time spent with family and friends (Golden and Wiens-Tuers 2008; Kleiner and Pavalko 2014; Schor 2010; Sparks et al. 1997).

A second pathway emphasizes how longer working hours structure time availability (Becker 1965; Fan et al. 2015; Kleiner et al. 2015; Virtanen and Kivimäki 2018). Those who work longer hours experience greater time scarcity, which can result in both negative physical and mental health outcomes. In the context of physical health, time availability is especially important for shaping behaviors. Those with less time availability are less likely to exercise due to a lack of free time (Fan et al. 2015; Kleiner and Pavalko 2010, 2014; Nomaguchi and Bianchi 2004). Kleiner and Pavalko (2014) note that the effects of lack of exercise are likely to be especially prominent for women due to the extra demands of household labor. Those with greater time stress are also more likely to engage in fast food consumption, which also tends to be more unhealthy (Fan et al. 2015). Longer working hours can also lead to less time for sleep, which is associated with increased risk of a number of physical health problems, like increased risk for cardiovascular disease (Afonso, Fonseca, and Pires 2017; Virtanen and Kivimäki 2018). Time availability can also shape mental health outcomes. For instance, Kleiner et al. (2015) highlight that longer working hours affects work-life balance, especially time spent with family. This lack of personal or family time can contribute to depression (i.e. Roxburgh 2004, 2012). Similarly, lack of sleep can also contribute to the likelihood of depression (Afonso et al. 2017). Overall, from a time perspective, working longer hours can lead to worse health outcomes through increasing time scarcity and leading to both unhealthy behaviors and work-life imbalance.

A third pathway highlighted in previous research indicates that longer working hours may actually be associated with better health outcomes (Kleiner and Pavalko 2014; Kleiner et al. 2015). This can be called the resource-based approach. Here, the emphasis is on how longer working hours lead to higher incomes and job security, which may be associated with better health outcomes. This approach mostly focuses on the ill-effects of underemployment and unemployment (Fullerton, Dixon, and McCollum 2019; Fullerton, Long, and Anderson 2016; Kalleberg 2018; Kleiner et al. 2015). From a macro point of view, as I noted above, it is possible that a working time reduction would be beneficial for alleviating the issues of underemployment and unemployment through spreading out available work to more people (Hayden 1999; Jackson 2009; Victor 2008). A related discussion on this point is whether working hours affects health or if it is the other way around (Kleiner and Pavalko 2010). Here, the argument is that healthy people are able to work longer hours, while less-healthy people work fewer hours (Ross and Mirowsky 1995). This is similar to the "healthy worker effect" identified in epidemiological studies on mortality where workers exhibit lower mortality rates than the general population because of selection bias (i.e. McMichael 1976; McMichael, Spirtas, and Kupper 1974; Shah 2009). This issue highlights the need for longitudinal methods to more accurately disentangle these effects of over time (Kleiner and Pavalko 2010, 2014).

Many studies have examined the relationship between working time and health with correlational methods at the micro level using survey data. In a meta-analysis, Ng and Feldman (2008) find that higher work hours tend to be associated with worse physical and mental health of individuals. Kivimäki and Kawachi (2015) find that working longer hours, regardless of race or gender, is associated with increases in coronary heart disease and stroke. Similarly, Thomas et al. (2018) study the relationship for women and find that longer hours are associated with worse physical health. Fan et al. (2015) investigate the relationship between working time and fast food consumption and exercise. Their findings indicate that longer hours are associated with increased fast food consumption and exercise, but that there are differences for men and women indicating the importance of gender roles in this relationship. While most studies find support for hours of work being associated with worse health, Kleiner and Pavalko (2010) find more complex relationships. They analyze survey data for respondents in the US and find that the relationship between work hours and health outcomes is somewhat complex, and that part time workers report worse health outcomes, but so do those who work longer than 40 hours a week. In a follow-up study, Kleiner, Schunck and Schömann (2015) compare outcomes for individuals in the US and in Germany and find that in Germany longer hours are associated with worse mental health but in the US there are not significant differences between those who work 60 hours and those who work 40 hours. While most of the studies above focus on issues of overwork and specific mental or physical health outcomes, other studies have explicitly examined the benefits of fewer hours. These studies (i.e. Kasser and Sheldon 2009; Pouwels, Siegers, and Vlasblom 2008) find that people who work fewer hours have higher levels of life satisfaction.

Overall, previous research generally indicates that longer hours of work are associated with worse mental and physical health outcomes for individuals. One limitation of previous research is that it is almost exclusively conducted at the individual level. While insightful, particularly for uncovering the mechanisms that connect working time to health, studying these relationships at a macro level allows for a number of advantages. In this study, I examine the relationship between working time and population health across US states, where policy on working hours is most likely to occur (Franko and Witko 2018). For instance, during the 2008 recession many states implemented work sharing programs to combat job loss (i.e. Messenger and Ghosheh 2013; National Conference of State Legislatures 2017). Examining this relationship at a more macro level also shifts the focus of working time from individual choices to structural conditions shaped by social institutions and policy. Focusing on working hours as a structural factor also more effectively allows for the consideration of a working time reduction as a broader sustainability issue (Pfeffer 2018). Moving to a macro level also allows for more rigorous longitudinal methods to be used to examine how the relationship between working time and health functions over time. With the exception of a few studies (i.e. Kleiner and Pavalko 2010; Milner et al. 2015), previous research is exclusively cross sectional which has resulted in some ambiguity about causal order. As noted above, a concern of previous studies is whether health shapes working time (healthier people can work longer hours) or the other way around (longer hours causes worse health outcomes). Using panel analysis can alleviate some of these concerns.

With the above arguments in mind, the first hypothesis for this study is as follows:

H1*: Working hours are negatively associated with population health.*

Another advantage to examining the relationship between working hours and health at a macro level is the ability to investigate the extent to which other structural factors might affect this relationship. One structural factor that previous research has shown to be important for population health is inequality. The second major contribution of this study is examining how inequality moderates the relationship between working time and population health. Before getting into how inequality might shape this relationship, it is important to first give an overview of previous research on the relationship between inequality and population health.

INEQUALITY AND HEALTH

A prominent area of research in the population health literature focuses on how inequality affects health outcomes (i.e. Beckfield 2004; Curran and Mahutga 2018; Hill and Jorgenson 2018; Pickett and Wilkinson 2015; Wilkinson and Pickett 2011). Researchers in this area note that there are a number of mechanisms through which inequality might harm population health. The first mechanism, referred to as the psychosocial perspective, is that high inequalities lead to psychosocial disruptions (Hill and Jorgenson 2018; Pickett and Wilkinson 2015). The argument suggests that income inequality can lead to low self-esteem and high anxiety levels among individuals. These negative psychological effects driven by increased inequality can lead to higher levels of risky coping behaviors like alcohol consumption and smoking.

A related mechanism is referred to as the social capital perspective (Curran and Mahutga 2018; Hill and Jorgenson 2018; Kawachi and Kennedy 1999; Wilkinson and Pickett 2011). This perspective emphasizes the role of inequality in fostering increased status competition and undermining social cohesion and increasing the likelihood of individual responses to collective concerns. The emphasis on social cohesion in this perspective harkens back to Durkheim's (1951) study of suicide and the importance of social integration for population health. Increased status competition, eroded social trust and the primacy of individual responses can result in increased stress and anxiety, leading to worse health outcomes. In all, these perspectives indicate that higher levels of income inequality are associated with worsening health outcomes.

A third mechanism proposed in previous research focuses on how inequality results in power concentration among elites (Boyce 1994; Clarkwest 2008; Downey 2015; Hill and Jorgenson 2018; Kawachi and Kennedy 1999). This is referred to as the neomaterialist perspective in previous research on population health outcomes (i.e. Clarkwest 2008), but in other areas of macro research on the effects of inequality, particularly its ecological consequences, it is referred to as the political economy perspective (i.e. Jorgenson, Schor, and Huang 2017) or the power-weighted social decision rule (i.e. Boyce 1994). In this perspective, it is suggested that elites use their political and economic power to further their own interests and limit investments in public programs, such as health care. When inequality is high, elites have more political and economic power and, as such, they are more effective at limiting policy and investment aimed at improving public welfare.

A third potential pathway through which inequality may lead to worse population health that is not mentioned in previous research, but is particularly important here, is through increasing working hours. Previous research indicates that higher levels of inequality are a primary driver of longer working hours (Alesina, Glaeser, and Sacerdote 2005; Bell and Freeman 2001; Bowles and Park 2005; Oh, Park, and Bowles 2012; Schor 1992). This research argues that inequality shapes working time largely through two mechanisms: increasing pressures for competitive consumption and the increased power of owners/employers. The increased pressures for competitive consumption are discussed most prominently by Bowles and Park (2005) and Schor (1992, 1998). From this perspective, inequality contributes to increased "Veblen effects," which promote longer hours. "Veblen effects" refer to the work of Thorstein Veblen (1912) and his assessment of how social status is signaled through consumption practices and that individuals seek to emulate the consumption practices of the wealthy, not those just in their immediate surroundings (Bagwell and Bernheim 1996; Schor 1998). Inequality plays an important role here because when inequality is higher, the drive for competitive consumption intensifies when the income gaps are larger. This leads to longer working hours due to the need for increased incomes to satisfy competitive consumption desires. In addition to the pressures for competitive consumption, inequality can also lead to longer working hours through the concentration of power in the hands of employers and increased benefits for working longer hours (Alesina et al. 2005; Bell and Freeman 2001; Oh et al. 2012; Schor 1992). Oh et. al (2012) note that high levels of inequality promote what they call the "labor discipline model" where employers have greater control over working conditions. One working condition they tend to favor is longer working hours because it tends to result in greater profits. Alesina et al. (2005) and Schor (1992) present similar arguments but focus on the decline in labor union power over the course of the second half of the twentieth century in the US as a major reason for shorter hours in Europe relative to the United States. I discuss the implications of this relationship more below.

Empirical research on the relationship between population health and inequality yields somewhat inconsistent results. Some studies find that higher levels of income inequality are associated with poorer health outcomes (Hill and Jorgenson 2018; Kawachi and Kennedy 1999; Kondo et al. 2009; Neumayer and Plümper 2015) while others (Babones 2008; Beckfield 2004; Deaton 2003; Hu, van Lenthe, and Mackenbach 2015) find no relationship or that it is not a direct one. Wilkinson and Pickett (2006) review previous analyses on income inequality and population health and find that 70 percent of studies find at least some evidence that societies with higher economic inequality have worse population health. Clarkwest (2008) finds that inequality limits improvements in life expectancy across US states from 1970 to 2000. Neumayer and Plümper (2015) find that pre-tax income inequality is associated with decreases in life expectancy in a cross-national study. Similarly, a more recent study on this relationship from Hill and

Jorgenson (2018) analyze the relationships between multiple measures of income inequality and life expectancy for US states. Their findings indicate that higher levels of income inequality (especially when measured in terms of income shares held by top percentages) are associated with decreases in life expectancy (and this holds when examining male or female specific life expectancy as well). On the other hand, Beckfield (2004) finds no relationship between inequality and life expectancy across countries.

Two reasons for the inconsistency of previous research are methodological and measurement. Hill and Jorgenson (2018) note that among studies that use more rigorous fixed effects methods, only 5 out of 14 find support for the relationship between inequality and health. For instance, Hu, et. al (2015) study 43 European countries and find that while a relationship exists between inequality (measured as the Gini coefficient) and mortality rates, the relationship disappears once the fixed effects are controlled for. Beckfield (2004) has similar findings. That said, perhaps a more important reason for inconsistency is that different studies measure both inequality and population health in different ways. For instance, some studies use the Gini coefficient to operationalize inequality (i.e. Babones 2008; Hu et al. 2015) and find little evidence for a relationship, while others use income concentration measures (i.e. Hill et al. 2019; Hill and Jorgenson 2018) and find that a relationship exists. Using the concentration measures is likely a better test of the arguments described above because the concentration measures captures power and economic differences with the wealthy, whereas the Gini coefficient does not locate with much precision where inequality exists in the distribution. With this in mind, and given the arguments outlined above, the second hypothesis tested in this paper is:

***H2**: Income inequality is negatively associated with population health.*

Beyond measurement and methodological differences, one other potential reason that previous research is inconsistent is that inequality stands as a "black box." That is, it is not immediately clear exactly how inequality negatively affects health outcomes even in studies that find an empirical relationship. The relationship between income inequality and health may be an indirect one. To get a better idea of the mechanisms through which inequality can negatively impact health outcomes, recent studies have explored how inequality can shape different population health relationships. For instance, Hill et. al (2019) examine how income inequality moderates the relationship between air quality and life expectancy. Their findings indicate that the negative effect of air pollution on life expectancy is greater in US states with higher levels of income inequality. More recently, Jorgenson and colleagues (2020) took this research one step further using three-way interaction terms to examine the complex relationships between air pollution, inequality, racial composition and life expectancy. In line with the logic of these studies, here I propose that inequality moderates the relationship between working time and health.

WORKING TIME, INEQUALITY AND HEALTH

The arguments for the health consequences of longer working hours and higher inequality indicate potential for integration of these two areas of research. Integrating these two research literatures is important for both theoretical and substantive reasons. Substantively, policy aimed at working time reduction will need to deal with issues of income inequality for it to be both economically and socially feasible. From a theoretical standpoint, integrating these two areas of literature provides insights into how and when working hours and inequality might impact health. Examining the role of inequality in the working hours/health relationship allows for a better understanding of the forces that shape work and the structural factors that can exacerbate the health effects of longer working hours. Additionally, it is possible that one of the mechanisms through which inequality affects population health is through promoting longer working hours and intensifying the health effects of longer working hours. I propose that there are at least two interrelated mechanisms through which inequality moderates the negative relationship between working hours and population health. These two mechanisms revolve around the political economy and psychosocial/competitive consumption arguments discussed above.

For the political economy arguments, when inequality is high, political and economic power is more concentrated in the hands of those at the top of the income distribution (Boyce 1994; Clarkwest 2008; Downey 2015; Jorgenson, Dietz, and Kelly 2018). When this is the case, elites use their political power to further their own interests while weakening broader commitments to social welfare. This can result in political pressures to cut taxes, reduce funding for social welfare programs and public health programs, and general efforts at deregulation. The end result of all of this is employers have more power relative to workers. The issue of power and control is key to the job strain literature discussed above on the health implications of working hours. When workers have more control over their work, health outcomes are likely to be better (Bakker and Demerouti 2007; Karasek 1979; Karasek et al. 1981; Karasek and Theorell 1990). Combining these arguments, it is likely that when inequality is higher and workers have less control over their work, work becomes more stressful and its implications for health become greater.

Another related mechanism through which inequality can exacerbate the negative relationship between longer working hours and health is related to the psychosocial and social capital perspectives. In these perspectives, when inequality is higher social cohesion is disrupted and status competition becomes more pronounced. This applies to the work/health relationship because workers in highly unequal societies are more likely to see each other as competition, especially as the rewards for longer working hours are greater when inequality is higher (i.e. Bell and Freeman 2001). This increase in the competitive nature of work can exacerbate the health effects of longer working hours, especially increased stress and anxiety. Losing a job can also be particularly damaging when inequality is higher because of the lack of social capital and the emphasis on individual responsibility. For the lack of social capital, this means that there are likely fewer supports available to workers who lose their jobs. Increased emphasis on individual responsibility can also lead to greater feelings of inadequacy and failure. To avoid these things, people will opt to work longer hours because employers prefer it (Bell and Freeman 2001; Oh et al. 2012). It should be noted that these effects are likely exacerbated even further when we also consider their relation to the political economy arguments. Inequality increases power in the hands of employers and reduces the power of labor unions (Alesina et al. 2005; Oh et al. 2012). Workers in unions have higher levels of solidarity with one another and are less likely to view each other as competition for jobs. Workers not in unions are more likely to view each other as competition reducing social cohesion even further and intensifying the stress associated with work.

The increased pressures surrounding consumption and social status are also likely key here. When inequality is higher, "Veblen effects" are more pronounced and this not only leads to people working longer hours to fulfill consumption expectations but also likely intensifies the negative effects of working time on mental health. When we consider these impacts alongside the political economy mechanisms described above the negative health effects of work can be particularly damaging. Inequality increases competitive consumption pressures, leading to the desire for longer work hours, but, at the same time, work is more precarious when inequality is high. This push for longer hours in less rewarding or insecure jobs to be able to engage in competitive consumption speeds up the treadmill of stress and anxiety even further when inequality is high.

With these arguments in mind, the third hypothesis for this study is:

H3*: Inequality intensifies the negative relationship between working hours and health.*

Before discussing the data and methods used in this study, it is important to make a quick note on the issue of moderation and mediation in these relationships. Both mediation and moderation are concerned with better understanding the relationships between two variables, more specifically how a third variable factors into the relationship (Baron and Kenny 1986). Moderation refers to when a relationship between two variable depends on the values of a third variable (Jaccard and Turrisi 2003). That is, a moderator variable influences the strength or direction of a relationship between an independent and dependent variable. Mediation refers to when a third variable explains the relationship between an independent and dependent variable (Baron and Kenny 1986; Mackinnon, Fairchild and Fritz 2007). That is, mediation refers to how a third variable transmits the effect of one variable on another. Mediation analyses are often concerned with establishing causal order between variables (Mackinnon, et. al, 2007). In the relationships outlined above, it is possible that both moderation and mediation are present. For instance, because inequality can lead to longer working hours, it is possible that working hours is a mediating variable between the relationship of inequality and population health. Here, I am explicitly interested in how inequality moderates the relationship between working hours and population health. That is, I am interested less in how inequality leads to longer working hours and thus poorer health, but rather in how inequality affects the strength of the relationship between working hours and population health. Figure 4.1 indicates the moderation relationship hypothesized here.

DATA AND METHODS

SAMPLE

The sample for this study includes all 50 US states and the District of Columbia (DC). Data are collected for the years 2005 to 2015. This time period is due to data limitations for key independent variables. Specifically, the data for average working hours at the US state level from the American Community Survey, discussed below, is only available from 2005. Additionally, the data for income share of the top ten percent (the measure of inequality used here) is only available until 2015. The dataset is perfectly balanced and includes 11 annual observations for each state and DC for a total sample size of 561.

DEPENDENT VARIABLE

The dependent variable examined in this study is average life expectancy at birth. This measures the average number of years a newborn would is expected to live given mortality rates at the time of their birth. Life expectancy is valid and reliable measure of population health and is endorsed as an indicator of population health by the United

Nations Statistical Commission and the OECD core indicators (World Health Organization 2015). These data are obtained from the United States Mortality Database (University of California, Berkeley 2020). This variable is commonly used in macro-level analyses of population health (i.e. Brady, Kaya, and Beckfield 2007; Curran and Mahutga 2018; Pop, van Ingen and van Oorschot 2013) as well as in recent studies on population health across US states (i.e. Clarkwest 2008; Hill et al. 2019; Jorgenson et al. 2020).

While life expectancy at birth is widely used in studies of population health, it is not without limitations. Perhaps the greatest limitation of examining average life expectancy is that, as an overall measure of population health, it does not elucidate the specific health problems which may be associated with working time and inequality. Previous research on the relationship between working time and health indicate that working time can be associated with particular health outcomes like cardiovascular disease, obesity, cancer, and depression among others. As such, it could be appropriate to examine other measures of population health such as obesity rates, rates of cardiovascular disease or other more specific measures of population health.

That said, I choose to examine life expectancy here for two important reasons. First, as noted above, it is a commonly used measure of population health, particularly in studies examining the health effects of inequality. Examining life expectancy here allows for more comparability across studies which test similar arguments as proposed here. Second, because working time is associated with a wide range of health outcomes, to an extent, examining an overall measure of population health like average life expectancy captures the negative health consequences of longer working hours in aggregate.

INDEPENDENT VARIABLES

The first key independent variable examined here is average working hours per person. These data come from the United States Census Bureau's American Community Survey (2019a). They measure the average usual hours worked per week in a given year for workers 16 to 64 years old. These data are solid measures of average working time at the state level because they effectively capture the average amount of time spent working regardless of the number of jobs held. In contrast, another source of working hours data at the US state level comes from the United States Bureau of Labor Statistics (2018). The data from the BLS covers a slightly shorter timeframe (earliest available is 2007) and is derived from employer surveys so they effectively capture average hours per employee per job, which misses out on workers who may have more than one job. The states with the highest average working hours for the 2005-2015 time period are Alaska (42.9 hours), Wyoming (40.7), District of Columbia (40.3), North Dakota (40.2) and Louisiana (40.2). The states with the lowest average working hours for the time period are Utah (37.1), Rhode Island (37.5), Oregon (37.5), Michigan (37.8) and Vermont (37.9). The difference between Utah and Alaska is 5.8 hours a week. Over the course of a year, that amounts to nearly 302 hours or just over seven and a half 40-hour work weeks.

To measure inequality, the second key independent variable in this study is percentage of income that goes to the top ten percent. These data are developed and maintained by Mark Frank and colleagues (2015). The data are a part of the World Inequality Database (2019) and more recent updates can be found at Frank's (2019) personal website (https://www.shsu.edu/~eco_mwf/inequality.html). These data are based on tax data reported to the Internal Revenue Service. For more details on the development of this measure, along with others available from the database, see Frank, et al. (2015). I use this measure on inequality for two reasons. First, because it is theoretically appropriate given the arguments presented above, specifically because it locates where inequality and power are located in the distribution (Jorgenson et al. 2017; Oh et al. 2012). Second, this is a commonly used measure for inequality in recent studies of population health across US states (i.e. Hill et al. 2019; Hill and Jorgenson 2018; Jorgenson et al. 2020), allowing for comparability across studies. I should note, however, that in supplemental analyses I examined other measures of inequality including income to the top five percent, income to the top one percent, the Gini coefficient and the Theil Index. In each of these analyses, the key findings are not substantively different from the reported findings below.

To examine the extent to which inequality moderates the effect of working hours on life expectancy, I create an interaction variable between working hours and income to the top ten percent (Jaccard and Turrisi 2003). In order to avoid issues of multicollinearity common when utilizing interaction terms, I mean-centered the main effects of working hours and the inequality measures prior to creating the interaction terms. Using mean centered variables also allows for a more meaningful assessment of the main effects in those models. More specifically, because there are no zero values for either average working hours or income to the top ten percent, interpretation of the non-mean-centered variables would be unhelpful. For instance, without using a mean-centered main effect for inequality, the interpretation of the main effect for working hours would be the effect of working hours on life expectancy when percentage of income to the top ten percent is zero (which does not exist). Mean-centering the main effects results in a more substantively meaningful interpretation: the effect of working hours on life expectancy at the average percentage of income to the top ten percent. In post-estimation analysis, I take this further to analyze the effect of working hours across the different percentiles of income to the top ten percent from the 10^{th} percentile to the 99^{th}.

I also include a number of important control variables that have been shown to be important factors for life expectancy in previous research. These include total population, median age, percent of population with at least a bachelor's degree, median household income, percentage of the population that is Hispanic and percentage of the population that is black. Data on total population are gathered from the United States Census Bureau (2019b). All other data for the control variables are gathered from the United States Census Bureau's American Community Survey (2019a).

All variables are converted into natural logarithmic form, which allows for the estimation of elasticity models. This approach is relatively common in research on population health (Beckfield 2004; Brady et al. 2007; Curran and Mahutga 2018; Hill and Jorgenson 2018; i.e. Jorgenson et al. 2020). It compensates for skewness and also allows for straightforward interpretations of coefficients. In this case, each coefficient represents a net percentage change in the outcome given a one percent change in the independent variable. Because some values of black population percentage are very small (i.e. less than one), prior to log transformation of that variable I add a constant of 1 to avoid negative values in the distribution and to ease interpretation of results.

Tables 4.1 and 4.2 provide the descriptive statistics and the correlations between the variables included in the analysis. Note that in Table 4.1, each variable is presented twice. The first set indicate the descriptive statistics for the raw data. The second set indicate the descriptive statistics for the logged data.

METHODS

To estimate the relationships between working hours, inequality and life expectancy I estimate two-way fixed-effects panel regression models. I opt to estimate fixed effects models for a number of reasons. First, results of the Hausman test indicate that a fixed-effects model is more appropriate than a random-effects model. Second, with the inclusion of case-specific dummy variables, fixed-effects regression models are relatively effective at dealing with heterogeneity bias because they implicitly control for time-invariant factors unique to each case (Allison 2009). As two-way fixed effects models, I also include time-specific dummy variables to control for any time-invariant factors that are common to all states at a given point in time. Fixed-effects models produce relatively conservative estimates because they only focus on within-effects (Allison 2009). Finally, while random-effects models are desirable when a researcher wants to examine the effects of time-invariant factors, that is not the case in these analyses.

There are a number of ways to estimate fixed-effects models. Here, I use Prais-Winsten regression with panel corrected standard errors. This estimation technique is appropriate for datasets with 10 or more observations per case and allows for disturbances that are heteroskedastic and contemporaneously correlated across panels (Beck and Katz 1995). The models include a correction for first-order autocorrelation (i.e. AR(1) correction) which is treated as common to all panels.

RESULTS

To provide context for the bivariate relationship between working hours and life expectancy over the time period, Figure 4.2 below is a scatterplot of the association between the percent change in working hours from 2005 to 2015 and the percent change in life expectancy from 2005 to 2015. These two measures are negatively correlated with a value of -0.423. As seen in this scatterplot, the general trend is that, over the time period, states that experienced larger reductions in average working time also tended to have the largest increases in life expectancy. Nevada, Florida, Arizona and California are all states that experienced both relatively large declines in average working hours over the time period and relatively large increases in life expectancy over the time period. Conversely, Alaska experienced an increase of 1.45 percent in average working hours over the time period and a relatively small increase of 0.231 percent in life expectancy. In the scatterplot, Washington DC appears to be a bit of an outlier. While it fits the overall pattern of decrease in working time and increase in life expectancy, it had an exceptionally high increase in life expectancy over the time period (6.46%). To ensure that Washington DC was not an overly influential case in the analyses, I estimated each of the models below excluding it from the analyses. The key findings presented below were not significantly altered.

The results of the two-way fixed effects models are presented in Table 4.3. Model 1 examines the effect of working hours on life expectancy net of the control variables. Model 2 examines the effect of income to the top ten percent on life expectancy. Model 3 includes both working hours and income to the top ten percent in the same model. Model 4 introduces the interaction term between working hours and income to the top ten percent. Note that the near-perfect R^2 values are largely due to the inclusion of the time-specific and unit-specific dummy variables in the models, as they account for much of the variation in the outcome by themselves.

Turning to Model 1 first, the effect of working hours on life expectancy is negative and statistically significant. More specifically, the results indicate that, on average over the time period, a one percent increase in working hours is associated with a 0.131 percent decrease in life expectancy, while holding all else constant. This provides support for Hypothesis 1, that longer working hours are bad for population health. Turning to the controls, the results are mostly in line with what was expected. Total population and percentage of the population with at least a Bachelor's degree are both positive and statistically significant. The results also show that the coefficients for proportions of black and Hispanic populations are negative and significant. While not statistically significant, the coefficients for median age and median household income are both in the expected directions.

Model 2 estimates the effect of income to the top ten percent on life expectancy net of the other control variables. The results indicate that the effect of income to the top ten percent on life expectancy is negative but very small and non-significant. These results fail to support Hypothesis 2. This is a somewhat surprising result as the most recent studies on the relationship between income to the top ten percent and life expectancy across US states consistently find significant effects (i.e. Hill et al. 2019; Hill and Jorgenson 2018; Jorgenson et al. 2020). The likely explanation is that the time period examined here is a bit shorter compared to other recent analyses. This is also not totally unexpected as the effects of inequality on population health seem to vary across different time periods. As noted above, earlier research in this area was somewhat inconsistent (Pickett and Wilkinson 2015). The effects of the control variables remain substantively the same as in Model 1.

Model 3 includes both working hours and income to the top ten percent simultaneously. Here, the effect of working hours on life expectancy remains significant and negative, providing more evidence for Hypothesis 1, while income to the top ten percent remains non-significant. The control variables remain substantively the same as in Models 1 and 2.

Model 4 tests Hypothesis 3, which is that income inequality moderates the effect of working hours on life expectancy. More specifically, I hypothesized that when inequality is higher, the negative effect of working hours on life expectancy is larger. The results support this hypothesis. The interaction term between working hours and income to the top ten percent is negative and statistically significant. This coefficient indicates that when inequality is higher, the harmful effect of working hours on life expectancy is larger. Because of the inclusion of the interaction term, the interpretation of the main effects of working hours and income to the top ten percent are conditional. As a reminder, the main effects of average working hours and income to the top ten percent are mean-centered in Model 4. As such, the coefficient for working hours in Model 4 represents the effect of working hours on life expectancy at the average level of inequality. The main effect for income to the top ten percent represents the effect of inequality at average working hours (but is again non-significant). To explore this relationship with more depth, I also estimated the marginal effects of working hours on life expectancy at different levels of inequality. The results are presented in Table 4.

Table 4.4 shows the effect of working hours on life expectancy at different levels of inequality. More specifically, it shows the effect of working hours on average life expectancy at different percentiles of income to the top ten percent, from the 10th percentile to the 99th percentile. Note that the coefficients are estimated net of the controls in Model 4. These results show first of all that the effect of working hours on life expectancy is significant at all percentiles from the 10th to the 99th. As was indicated in Model 4, we also see that the negative effect of working hours on life expectancy intensifies at higher levels of inequality. To give more detail, at the 10th percentile, relatively low inequality, a one percent increase in working hours is associated with a 0.099 percent decrease in life expectancy. At median inequality, a one percent increase in working hours is associated with a 0.136 percent decrease in life expectancy. At relatively high inequality, the 99th percentile, the effect of working hours on emissions is 0.242, more than twice the size of the effect at relatively low inequality. Figure 4.3 illustrates these associations graphically. The negative effects of working hours on life expectancy increase in magnitude at higher concentrations of income to the top ten percent. In all, this provides support for Hypothesis 3 that the effect of working hours on life expectancy is larger at higher levels of inequality.

SENSITIVITY ANALYSES

To assess the robustness of the reported findings, I conducted a number of sensitivity analyses. As noted above, in the Figure 4.1 Washington DC appears to be a potential outlier in the relationship between working hours and life expectancy over the time period. To ensure it was not overly influential in the analyses, I conducted the analyses removing Washington DC from each model. The results remained substantively the same. Taking this a step further, I also re-estimated all of the models excluding each state one at a time. This is a common approach when using the modeling techniques I use here (Beck and Katz 1995). The results remained substantively the same across each of the analyses. In addition to testing for overly influential cases, I also conducted the analyses using a dynamic panel modeling approach, which includes a lagged effect of life expectancy. These models indicate substantively the same results for the findings reported above. I choose to present the two-way fixed effects models with panel corrected standard errors instead of the dynamic panel models for two reasons. First, dynamic panel models where the researcher includes a lagged dependent variable can be unreliable in studies with a relatively small number of time points (Beck and Katz 2011). Dynamic panel modeling is more appropriate for large T studies. Second, other recent studies on life expectancy across US states also employ modeling approaches using two-way fixed effects with panel corrected standard errors (i.e. Hill et al. 2019; Hill and Jorgenson 2018; Jorgenson et al. 2020).

DISCUSSION AND CONCLUSION

Americans are working longer hours than their contemporaries in other countries and their historical counterparts (The Conference Board 2019). In recognition of this, there has been increasing interest in reducing working hours (i.e. AFL-CIO 2019; Lin 2020). While much of this focuses on improving worker productivity (i.e. Collewet and Sauermann 2017), there has also been increased academic interest for other benefits associated with working time reduction as well. Some proponents of a working time reduction argue that it has the potential to be a multi-dividend policy initiative. More specifically, as countries around the world embrace the concept of sustainable development, a working time reduction has the potential to improve all three pillars of sustainability: the social, economic and environmental (Autonomy 2019; Fitzgerald et al. 2018; Schor and Jorgenson 2019).

In this study, I focused on one aspect of that argument: how reducing working hours can improve social wellbeing. In particular, I examined how working longer hours are associated with worsening population health outcomes. Previous research generally finds that working longer hours is associated with a myriad of negative health outcomes (Fan et al. 2015; Kleiner and Pavalko 2010; Ng and Feldman 2008; Pfeffer 2018). These studies argue that working longer hours increases stress, reduces free time available for exercise or proper rest, increases the likelihood of on-the-job accidents and also negatively effects mental health in a variety of ways. Previous empirical research indicates that the negative health effects associated with longer working hours include increased risk for heart disease (i.e. Kivimäki and Kawachi 2015; Virtanen and Kivimäki 2018), increased risk for getting cancer (i.e. Heikkila et al. 2016), developing unhealthy eating habits (i.e. Devine et al. 2009; Fan et al. 2015) and developing mental health problems (i.e. Afonso et al. 2017; Kleiner et al. 2015; Virtanen et al. 2018). Prior research also finds that those who work shorter hours tend to report higher life satisfaction and happiness (Kasser and Sheldon 2009; Pouwels et al. 2008; Schor 2010).

Previous research on the negative health consequences of longer working hours has primarily been conducted at the individual level using survey data. In contrast, this study advances the literature on the population health consequences of working hours by examining the relationship across US states from 2005 to 2015. There are a number of benefits for examining this relationship at a more macro level. First, it more effectively treats working time as a structural factor, which is important for policy and for thinking about working time reduction as a sustainability initiative. Second, it allows for rigorous longitudinal methods to be used, given data availability for US states, which is often difficult for individual level studies to achieve. Third, it allows for an examination of how other structural factors might affect the relationship between working time and health. With that in mind, the second major contribution of this study is examining how income inequality moderates the relationship between working hours and population health.

Building on the arguments proposed in previous research on the relationship between working time, inequality and population health I tested three hypotheses. The first was that increases in working hours are negatively associated with population health. The second was that increases in income inequality are negatively associated with population health. The third was that the negative effects of longer working hours on population health are larger in states with higher levels of inequality. Using two-way fixed effects models with panel corrected standard errors and examining data from 2005 to 2015 for all 50 US states and Washington DC, the results indicate that increases in working hours are negatively associated with life expectancy net of other important controls. This provides support for hypothesis one. The analyses conducted here failed to provide direct support for hypothesis two, that inequality negatively affects average life expectancy. This is somewhat unexpected as recent research examining inequality and life expectancy across US states and utilizing rigorous methods has consistently found a significant relationship between the two (i.e. Hill et al. 2019; Hill and Jorgenson 2018; Jorgenson et al. 2020). The likely explanation for this difference is that I examine a slightly reduced time period compared to other recent studies of US states. While I do not find a direct relationship between inequality and health, I do find support for hypothesis three showing that inequality indirectly affects population health through shaping the relationship between working hours and life expectancy. More specifically, I find that the interaction term between inequality and working hours on life expectancy is positive and significant. This indicates that as inequality increases, the harmful effect of working hours on life expectancy increases in magnitude. Further analyses indicate that, while the negative effect of working hours on average life expectancy is significant across all levels of inequality, at higher levels of inequality the effect becomes much larger. For instance, the effect of working hours on life expectancy is more than twice as large at the 99^{th} percentile of income to the top ten percent than it is at the 10^{th} percentile.

These findings have both theoretical and substantive significance. Theoretically, these results are illuminating for both the research on the health consequences of work and the health consequences of inequality. For the former, these findings improve our understanding of the conditions under which the negative effects of working time on health are more prominent. Specifically, we can see that inequality is a key factor to pay attention to when considering how to best mitigate the health effects of working time. Additionally, these results also have important implications for the literature on the effects of inequality on public health. While recent research has found that inequality is negatively associated with population health outcomes, it is not entirely clear the mechanisms through which this occurs. Here, we see that one of these pathways is through shaping the working time/health relationship. This study, similar to other recent research (e.g. Hill et al. 2019; Jorgenson et al. 2020) provides more evidence that income inequality is bad for population health in the US, especially in how it moderates the impacts of other factors.

These results are also important substantively as we consider the broader implications of working time reduction as a potential sustainability policy. This research provides more evidence that a working time reduction could yield multiple dividends for society. However, this research also shows that considering the complex relationships between structural factors like working time and inequality offers even greater potential benefits. For example, if we consider working time reduction in a vacuum these results indicate that reducing the average working week will yield benefits for population health. If we consider inequality in this relationship as well, though, we see that even greater benefits are possible. This means that we should focus on crafting policies that do not just focus on reducing working hours overall but that also reduce inequality because those policies will have even greater benefits for population health. One policy that comes to mind which could allow for working time reduction and reduce inequality in the United States is Medicare for All. Enacting a single-payer health system would allow for individuals to work fewer hours without sacrificing their health coverage and it would also reduce the economic burdens of ill-health, particularly for lower income households. This would also open up the possibility of unions to negotiate more strongly on equalizing income and working time reductions instead of focusing their efforts on maintaining health coverage.

While the results of this study indicate that reducing working hours could improve population health and that these effects are greater at higher levels of inequality, there are some important caveats and limitations which bear mentioning. First, I focus on average working hours. While average working hours are an important metric, it misses out on some other important factors like disparities in working time. For instance, previous research indicates that people working part-time or with job insecurity face negative health consequences (i.e. Fullerton et al. 2019, 2016; Kalleberg 2018). This means that policy discussions on working time reduction should consider the complexity of working time disparities. That is, those who work too few hours should have opportunities to work more while those who work too many hours should work less. Indeed, this is a key argument of those who advocate for a working time reduction as a sustainability policy (Autonomy 2019; Hayden 1999; Schor 1992; Victor 2008) and indicates the usefulness of considering working time at the macro level. Reducing the disparities in working time while reducing overall average working time could also have the added benefit of reducing income inequality as well. Another limitation of this study is that I only study one decade, 2005 to 2015. While this is a longer time frame than most studies examining the health consequences of working time, the relatively short time frame means that I am unable to effectively examine how this relationship might vary over time.

The findings from this study offer a number of potential avenues for future research. First, this study focuses on overall measures of average working time and average life expectancy. Previous studies have found that the relationship between working time and health may vary between men and women (i.e. Kleiner and Pavalko 2014). Future research could take this one step further and examine sex-specific measures of average working time and life expectancy at the macro level to further understand the mechanisms at play here. Another potential route for future research is examining these relationships from a mediation, rather than moderation, perspective. Doing so would require the utilization of methods like structural equation modeling to better ascertain the causal order between inequality, working hours and population health or using the steps outlined for mediation analysis (i.e. Baron and Kenny 1986; Mackinnon, et. al 2007). This would be particularly relevant for the research on the links between inequality and health and establishing working time as a pathway through which inequality affects population health beyond its effects as a moderating variable. Finally, this study focuses on one measure of population health: average life expectancy. I examined average life expectancy in this study for two reasons. The first reason was in order to improve comparability with previous studies that have tested similar arguments, specifically about inequality. The second reason is that working time is associated with a wide range of specific health outcomes at the individual level, so that, to an extent, examining an overall measure of population health captures the aggregation of these effects. Even so, while average life expectancy is a valid and reliable measure of population health, it lacks nuance. Future work could consider other macro-level health factors such as obesity rates, depression rates or other more specific measures of population health to get a better idea of how longer average working hours negatively contribute to specific population health outcomes.

REFERENCES

Acemoglu, Daron, and Pascual Restrepo. 2017. *Robots and Jobs: Evidence from US Labor Markets*. *Working Paper*. 23285. National Bureau of Economic Research.

AFL-CIO. 2019. "AFL-CIO Commission on the Future of Work and Unions | AFL-CIO." Retrieved February 1, 2020 (https://aflcio.org/reports/afl-cio-commission-future-work-and-unions).

Afonso, P., M. Fonseca, and J. F. Pires. 2017. "Impact of Working Hours on Sleep and Mental Health." *Occupational Medicine* 67(5):377–82.

Alesina, Alberto, Edward Glaeser, and Bruce Sacerdote. 2005. "Work and Leisure in the United States and Europe: Why So Different?" *NBER Macroeconomics Annual* 20:1–64.

Allison, Paul D. 2009. *Fixed Effects Regression Models*. Los Angeles, CA: SAGE Publications.

Autonomy. 2019. "The Shorter Working Week: A Radical and Pragmatic Proposal." *Autonomy*. Retrieved March 16, 2020 (https://autonomy.work/portfolio/the-shorter-working-week-a-report-from-autonomy-in-collaboration-with-members-of-the-4-day-week-campaign/).

Autor, David H. 2015. "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." *The Journal of Economic Perspectives* 29(3):3–30.

Babones, Salvatore. 2008. "Income Inequality and Population Health: Correlation and Causality." *Social Science & Medicine* 66(7):1614–26.

Bagwell, Laurie Simon, and B. Douglas Bernheim. 1996. "Veblen Effects in a Theory of Conspicuous Consumption." *The American Economic Review* 86(3):349–73.

Bakker, Arnold B., and Evangelia Demerouti. 2007. "The Job Demands-Resources Model: State of the Art." *Journal of Managerial Psychology* 22(3):309–328.

Bannai, Akira, and Akiko Tamakoshi. 2014. "The Association Between Long Working Hours and Health: A Systematic Review of Epidemiological Evidence." *Scandinavian Journal of Work, Environment & Health* 40(1):5–18.

Baron, Reuben M., and David A. Kenny. 1986. "The Moderator–Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations." *American Journal of Personality and Social Psychology* 51 (6): 1173–82.

Beck, Nathaniel, and Jonathan N. Katz. 1995. "What To Do (and Not To Do) with Time-Series Cross-Section Data." *The American Political Science Review* 89(3):634–47.

Beck, Nathaniel, and Jonathan N. Katz. 2011. "Modeling Dynamics in Time-Series–Cross-Section Political Economy Data." *Annual Review of Political Science* 14(1):331–52.

Becker, Gary A. 1965. “A Theory of the Allocation of Time.” *The Economic Journal* 75(299):493–517.

Beckfield, Jason. 2004. “Does Income Inequality Harm Health? New Cross-National Evidence.” *Journal of Health and Social Behavior* 45(3):231–48.

Bell, Linda A., and Richard B. Freeman. 2001. “The Incentive for Working Hard: Explaining Hours Worked Differences in the US and Germany.” *Labour Economics* 8(2):181–202.

Bowles, Samuel, and Yongjin Park. 2005. “Emulation, Inequality, and Work Hours: Was Thorsten Veblen Right?” *Economic Journal* 115(507):F397–412.

Boyce, James. 1994. “Inequality as a Cause of Environmental Degradation.” *Ecological Economics* 11(3):169–78.

Brady, David, Yunus Kaya, and Jason Beckfield. 2007. “Reassessing the Effect of Economic Growth on Well-Being in Less-Developed Countries, 1980–2003.” *Studies in Comparative International Development* 42(1/2):1.

Clarkwest, Andrew. 2008. “Neo-Materialist Theory and the Temporal Relationship between Income Inequality and Longevity Change.” *Social Science & Medicine* 66(9):1871–81.

Collewet, Marion, and Jan Sauermann. 2017. “Working Hours and Productivity.” *Labour Economics* 47:96–106.

Curran, Michaela, and Matthew C. Mahutga. 2018. "Income Inequality and Population Health: A Global Gradient?" *Journal of Health and Social Behavior* 59(4):536–53.

Deaton, Angus. 2003. "Health, Inequality, and Economic Development." *Journal of Economic Literature* 41(1):113–58.

Devine, Carol M., Tracy J. Farrell, Christine E. Blake, Margaret Jastran, Elaine Wethington, and Carole A. Bisogni. 2009. "Work Conditions and the Food Choice Coping Strategies of Employed Parents." *Journal of Nutrition Education and Behavior* 41(5):365–70.

Downey, Liam. 2015. *Inequality, Democracy, and the Environment*. NYU Press.

Durkheim, Emile. 1951. *Suicide: A Study in Sociology*. English Edition. United States: The Free Press.

Fan, Wen, Jack Lam, Phyllis Moen, Erin Kelly, Rosalind King, and Susan McHale. 2015. "Constrained Choices? Linking Employees' and Spouses' Work Time to Health Behaviors." *Social Science & Medicine* 126:99–109.

Fitzgerald, Jared B., Juliet B. Schor, and Andrew K. Jorgenson. 2018. "Working Hours and Carbon Dioxide Emissions in the United States, 2007–2013." *Social Forces*.

Frank, Mark. 2019. "The U.S. Income Inequality Page of Mark W. Frank." Retrieved July 7, 2019 (https://www.shsu.edu/eco_mwf/inequality.html).

Frank, Mark, Estelle Sommeiller, Mark Price, and Emmanuel Saez. 2015. “Frank-Sommeiller-Price Series for Top Income Shares by US States since 1917.” 4.

Franko, William W., and Christopher Witko. 2018. *The New Economic Populism: How States Respond to Economic Inequality*. Oxford University Press.

Fremstad, Anders, Mark Paul, and Anthony Underwood. 2019. “Work Hours and CO2 Emissions: Evidence from U.S. Households.” *Review of Political Economy* 31(1):42–59.

Fullerton, Andrew S., Jeffrey C. Dixon, and Destinee B. McCollum. 2019. “The Institutionalization of Part-Time Work: Cross-National Differences in the Relationship Between Part-Time Work and Perceived Insecurity.” *Social Science Research*.

Fullerton, Andrew S., Michael A. Long, and Kathryn Freeman Anderson. 2016. “Job Insecurity and Substance Use in the United States: Stress, Strain, and the Gendering of Precarious Employment.” Pp. 241–71 in *Research in the Sociology of Work*. Vol. 29, *Research in the Sociology of Work*. Emerald Group Publishing Limited.

Golden, Lonnie, and Barbara Wiens-Tuers. 2008. “Overtime Work and Wellbeing at Home.” *Review of Social Economy* 66(1):25–49.

Graeber, David. 2018. *Bullshit Jobs: A Theory*. New York: Simon and Schuster.

Hayden, Anders. 1999. *Sharing the Work, Sparing the Planet: Work Time, Consumption & Ecology*. New York: Zed Books.

Heikkila, Katriina, Solja T. Nyberg, Ida E. H. Madsen, Ernest de Vroome, Lars Alfredsson, Jacob J. Bjorner, Marianne Borritz, Hermann Burr, Raimund Erbel, Jane E. Ferrie, Eleonor I. Fransson, Goedele A. Geuskens, Wendela E. Hooftman, Irene L. Houtman, Karl-Heinz Jöckel, Anders Knutsson, Markku Koskenvuo, Thorsten Lunau, Martin L. Nielsen, Maria Nordin, Tuula Oksanen, Jan H. Pejtersen, Jaana Pentti, Martin J. Shipley, Andrew Steptoe, Sakari B. Suominen, Töres Theorell, Jussi Vahtera, Peter J. M. Westerholm, Hugo Westerlund, Nico Dragano, Reiner Rugulies, Ichiro Kawachi, G. David Batty, Archana Singh-Manoux, Marianna Virtanen, and Mika Kivimäki. 2016. "Long Working Hours and Cancer Risk: A Multi-Cohort Study." *British Journal of Cancer* 114(7):813–18.

Hill, Terrance D., and Andrew K. Jorgenson. 2018. "Bring out Your Dead!: A Study of Income Inequality and Life Expectancy in the United States, 2000–2010." *Health & Place* 49:1–6.

Hill, Terrence D., Andrew K. Jorgenson, Peter Ore, Kelly S. Balistreri, and Brett Clark. 2019. "Air Quality and Life Expectancy in the United States: An Analysis of the Moderating Effect of Income Inequality." *SSM - Population Health* 7:100346.

Hu, Yannan, Frank J. van Lenthe, and Johan P. Mackenbach. 2015. "Income Inequality, Life Expectancy and Cause-Specific Mortality in 43 European Countries, 1987–2008: A Fixed Effects Study." *European Journs of Epidemiology* 30(8):615–25.

Jaccard, James, and Robert Turrisi. 2003. *Interaction Effects in Multiple Regression*. SAGE.

Jackson, Tim. 2009. *Prosperity Without Growth: Economics for a Finite Planet*. Sterling, VA: Earthscan.

Jalas, Mikko, and Jouni K. Juntunen. 2015. "Energy Intensive Lifestyles: Time Use, the Activity Patterns of Consumers, and Related Energy Demands in Finland." *Ecological Economics* 113:51–59.

Jorgenson, Andrew K., Thomas Dietz, and Orla Kelly. 2018. "Inequality, Poverty, and the Carbon Intensity of Human Well-Being in the United States: A Sex-Specific Analysis." *Sustainability Science* 13(4):1167–74.

Jorgenson, Andrew K., Terrence D. Hill, Brett Clark, Ryan P. Thombs, Peter Ore, Kelly S. Balistreri, and Jennifer E. Givens. 2020. "Power, Proximity, and Physiology: Does Income Inequality and Racial Composition Amplify the Impacts of Air Pollution on Life Expectancy in the United States?" *Environmental Research Letters* 15(2):024013.

Jorgenson, Andrew K., Juliet Schor, and Xiaorui Huang. 2017. "Income Inequality and Carbon Emissions in the United States: A State-Level Analysis, 1997–2012." *Ecological Economics* 134:40–48.

Kalleberg, Arne L. 2018. *Precarious Lives: Job Insecurity and Well-Being in Rich Democracies*. John Wiley & Sons.

Kalleberg, Arne L., and Steven P. Vallas. 2017. *Precarious Work*. Emerald Group Publishing.

Karasek, Robert A. 1979. “Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign.” *Administrative Science Quarterly* 24(2):285–308.

Karasek, Robert A., Dean Baker, Frank Marxer, Anders Ahlbom, and Töres Theorell. 1981. “Job Decision Latitude, Job Demands, and Cardiovascular Disease: A Prospective Study of Swedish Men.” *American Journal of Public Health* 71(7):694–705.

Karasek, Robert A., and Töres Theorell. 1990. *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life*. New York: Basic Books.

Kasser, Tim, and Kennon M. Sheldon. 2009. “Time Affluence as a Path toward Personal Happiness and Ethical Business Practice: Empirical Evidence from Four Studies.” *Journal of Business Ethics* 84(2):243–55.

Kawachi, I., and B. P. Kennedy. 1999. “Income Inequality and Health: Pathways and Mechanisms.” *Health Services Research* 34(1 Pt 2):215–27.

Kivimäki, Mika, and Ichiro Kawachi. 2015. “Work Stress as a Risk Factor for Cardiovascular Disease.” *Current Cardiology Reports* 17(9):74.

Kleiner, Sibyl, and Eliza K. Pavalko. 2010. “Clocking In: The Organization of Work Time and Health in the United States.” *Social Forces* 88(3):1463–86.

Kleiner, Sibyl, and Eliza K. Pavalko. 2014. "Double Time: Is Health Affected by a Spouse's Time at Work?" *Social Forces* 92(3):983–1007.

Kleiner, Sibyl, Reinhard Schunck, and Klaus Schömann. 2015. "Different Contexts, Different Effects?: Work Time and Mental Health in the United States and Germany." *Journal of Health and Social Behavior* 56(1):98–113.

Knight, Kyle W., Eugene A. Rosa, and Juliet B. Schor. 2013. "Reducing Growth to Achieve Environmental Sustainability: The Role of Work Hours." Pp. 187–204 in *Capitalism on Trial: Explorations in the Tradition of Thomas E. Weisskopf*, edited by J. Wicks-Lim and R. Pollin. Edward Elgar Publishing.

Kondo, Naoki, Grace Sembajwe, Ichiro Kawachi, Rob M. van Dam, S. V. Subramanian, and Zentaro Yamagata. 2009. "Income Inequality, Mortality, and Self Rated Health: Meta-Analysis of Multilevel Studies." *BMJ* 339:b4471.

Lin, Summer. 2020. "Want to Work Only 32 Hours a Week? There's a Push to Make It a Reality in Washington." *Thenewstribune*. Retrieved February 1, 2020 (https://www.thenewstribune.com/news/state/washington/article239536443.html).

McMichael, A. J. 1976. "Standardized Mortality Ratios and the 'Healthy Worker Effect': Scratching beneath the Surface." *Journal of Occupational Medicine.: Official Publication of the Industrial Medical Association* 18(3):165–68.

McMichael, A. J., R. Spirtas, and L. L. Kupper. 1974. "An Epidemiologic Study of Mortality within a Cohort of Rubber Workers, 1964-72." *Journal of Occupational*

Medicine.: Official Publication of the Industrial Medical Association 16(7):458–64.

Messenger, Jon Carleton, and Naj Ghosheh. 2013. *Work Sharing During the Great Recession: New Developments and Beyond*. Edward Elgar Publishing.

Milner, Allison, Peter Smith, and A. D. LaMontagne. 2015. “Working Hours and Mental Health in Australia: Evidence from an Australian Population-Based Cohort, 2001–2012.” *Occupational and Environmental Medicine* 72(8):573–79.

National Conference of State Legislatures. 2017. “Work Share Programs.” Retrieved May 25, 2017 (http://www.ncsl.org/research/labor-and-employment/work-share-programs.aspx).

Neumayer, Eric, and Thomas Plümper. 2015. “Inequalities of Income and Inequalities of Longevity: A Cross-Country Study.” *American Journal of Public Health* 106(1):160–65.

Ng, Thomas W. H., and Daniel C. Feldman. 2008. “Long Work Hours: A Social Identity Perspective on Meta-Analysis Data.” *Journal of Organizational Behavior* 29(7):853–80.

Nomaguchi, Kei M., and Suzanne M. Bianchi. 2004. “Exercise Time: Gender Differences in the Effects of Marriage, Parenthood, and Employment.” *Journal of Marriage and Family* 66(2):413–30.

Oh, Seung-Yun, Yongjin Park, and Samuel Bowles. 2012. "Veblen Effects, Political Representation, and the Reduction in Working Time Over the 20th Century." *Journal of Economic Behavior & Organization* 83(2):218–42.

Pfeffer, Jeffrey. 2018. *Dying for a Paycheck: How Modern Management Harms Employee Health and Company Performance—and What We Can Do About It.* HarperCollins.

Pickett, Kate E., and Richard G. Wilkinson. 2015. "Income Inequality and Health: A Causal Review." *Social Science & Medicine* 128:316–26.

Pop, Ioana Andreea, Erik van Ingen, and Wim van Oorschot. 2013. "Inequality, Wealth and Health: Is Decreasing Income Inequality the Key to Create Healthier Societies?" *Social Indicators Research* 113 (3): 1025–43.

Pouwels, Babette, Jacques Siegers, and Jan Dirk Vlasblom. 2008. "Income, Working Hours, and Happiness." *Economics Letters* 99(1):72–74.

Ross, Catherine E., and John Mirowsky. 1995. "Does Employment Affect Health?" *Journal of Health and Social Behavior* 36(3):230–43.

Roxburgh, Susan. 2004. ""'There Just Aren't Enough Hours in the Day': The Mental Health Consequences of Time Pressure." *Journal of Health and Social Behavior* 45(2):115–31.

Roxburgh, Susan. 2012. "Parental Time Pressures and Depression Among Married Dual-Earner Parents." *Journal of Family Issues* 33(8):1027–53.

Schor, Juliet. 1992. *The Overworked American: The Unexpected Decline Of Leisure*. Basic Books.

Schor, Juliet. 2010. *Plenitude: The New Economics of True Wealth*. New York: The Penguin Press.

Schor, Juliet B. 1998. *The Overspent American: Why We Want What We Don't Need*. New York: Harper Collins.

Schor, Juliet B., and Andrew K. Jorgenson. 2019. "Is It Too Late for Growth?" *Review of Radical Political Economics* 51(2):320–29.

Shah, Divyang. 2009. "Healthy Worker Effect Phenomenon." *Indian Journal of Occupational and Environmental Medicine* 13(2):77–79.

Sparks, Kate, Cary Cooper, Yitzhak Fried, and Arie Shirom. 1997. "The Effects of Hours of Work on Health: A Meta-Analytic Review." *Journal of Occupational and Organizational Psychology* 70(4):391–408.

Standing, Guy. 2011. *The Precariat: The New Dangerous Class*. United Kingdom: Bloomsbury Publishing.

The Conference Board. 2019. "Total Economy Database Data." Retrieved February 24, 2020 (https://www.conference-board.org/data/economydatabase/index.cfm?id=27762).

Thomas, Candice L., Emem Laguda, Folasade Olufemi-Ayoola, Stephen Netzley, Jia Yu, and Christiane Spitzmueller. 2018. "Linking Job Work Hours to Women's

Physical Health: The Role of Perceived Unfairness and Household Work Hours." *Sex Roles* 1–13.

United States Census Bureau. 2019a. "American Community Survey." *American Fact Finder - Download Center*. Retrieved July 7, 2019 (https://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml).

United States Census Bureau. 2019b. "Population and Housing Unit Estimates Datasets." Retrieved July 7, 2019 (https://www.census.gov/programs-surveys/popest/data/data-sets.html).

United States Department of Labor Bureau of Labor Statistics. 2018. "Employment, Hours, and Earnings from the Current Employment Statistics Survey (National) Home Page." *Current Employment Statistics*. Retrieved July 15, 2016 (https://www.bls.gov/ces/).

University of California, Berkeley. 2020. "United States Mortality Database." Retrieved February 23, 2020 (https://usa.mortality.org/).

Veblen, Thorstein. 1912. *The Theory of the Leisure Class: An Economic Study of Institutions*. B. W. Huebsch.

Victor, Peter A. 2008. *Managing Without Growth: Slower by Design, Not Disaster*. Edward Elgar Publishing.

Virtanen, Marianna, Markus Jokela, Ida EH Madsen, Linda L. Magnusson Hanson, Tea Lallukka, Solja T. Nyberg, Lars Alfredsson, G. David Batty, Jakob B. Bjorner, Marianne Borritz, Hermann Burr, Nico Dragano, Raimund Erbel, Jane E. Ferrie, Heikkil&#228, Katriina, Anders Knutsson, Markku Koskenvuo, Eero Lahelma, Martin L. Nielsen, Tuula Oksanen, Marianna Virtanen, Markus Jokela, Ida EH Madsen, Linda L. Magnusson Hanson, Tea Lallukka, Solja T. Nyberg, Lars Alfredsson, G. David Batty, Jakob B. Bjorner, Marianne Borritz, Hermann Burr, Nico Dragano, Raimund Erbel, Jane E. Ferrie, Heikkil&#228, Katriina, Anders Knutsson, Markku Koskenvuo, Eero Lahelma, Martin L. Nielsen, and Tuula Oksanen. 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.* 44:239–50.

Virtanen, Marianna, Markus Jokela, Solja T. Nyberg, Ida E. H. Madsen, Tea Lallukka, Kirsi Ahola, Lars Alfredsson, G. David Batty, Jakob B. Bjorner, Marianne Borritz, Hermann Burr, Annalisa Casini, Els Clays, Dirk De Bacquer, Nico Dragano, Raimund Erbel, Jane E. Ferrie, Eleonor I. Fransson, Mark Hamer, Katriina Heikkilä, Karl-Heinz Jöckel, France Kittel, Anders Knutsson, Markku Koskenvuo, Karl-Heinz Ladwig, Thorsten Lunau, Martin L. Nielsen, Maria Nordin, Tuula Oksanen, Jan H. Pejtersen, Jaana Pentti, Reiner Rugulies, Paula Salo, Jürgen Schupp, Johannes Siegrist, Archana Singh-Manoux, Andrew Steptoe, Sakari B. Suominen, Töres Theorell, Jussi Vahtera, Gert G. Wagner, Peter J. M. Westerholm, Hugo Westerlund, and Mika Kivimäki. 2015. "Long Working Hours and Alcohol Use: Systematic Review and Meta-Analysis of Published Studies and Unpublished Individual Participant Data." *BMJ* 350:g7772.

Virtanen, Marianna, and Mika Kivimäki. 2018. "Long Working Hours and Risk of Cardiovascular Disease." *Current Cardiology Reports* 20(11):123.

Wilkinson, Richard G., and Kate E. Pickett. 2006. "Income Inequality and Population Health: A Review and Explanation of the Evidence." *Social Science & Medicine* 62(7):1768–84.

Wilkinson, Richard G., and Kate E. Pickett. 2011. *The Spirit Level: Why Greater Equality Makes Societies Stronger*. New York: Bloomsbury Press.

World Health Organization. 2015. "An Overarching Health Indicator for the Post-2015 Development Agenda." Retrieved (https://www.who.int/healthinfo/indicators/hsi_indicators_SDG_TechnicalMeeting_December2015_BackgroundPaper.pdf).

World Inequality Database. 2019. "Data – WID – World Inequality Database." *WID - World Inequality Database*. Retrieved July 7, 2019 (https://wid.world/data/).

TABLES

TABLE 4. 1 Descriptive Statistics	Obs.	Mean	Std. Dev.	Min	Max
Life Expectancy	561	78.29	1.694	73.5	81.62
Work Hours	561	38.876	0.975	36.6	42.9
Income to Top 10%	561	45.285	5.05	32.97	62.171
Total Population	561	6045855	6789506	495226	39144818
Median Age	561	37.462	2.341	28.4	44.6
% with Bachelor's	561	26.43	7.045	10	56.7
Household Income	561	51221.96	8848.725	32938	75847
Percent Hispanic	561	10.364	9.84	0.572	48.02
Percent Black	561	10.861	10.949	.287	56.323
Life Expectancy (ln)	561	4.36	0.022	4.297	4.402
Work Hours (ln)	561	3.66	0.025	3.6	3.759
Income to Top 10% (ln)	561	3.807	0.109	3.496	4.13
Total Population (ln)	561	15.115	1.033	13.15	17.478
Median Age (ln)	561	3.621	0.064	3.346	3.798
% with Bachelor's (ln)	561	3.238	0.275	2.303	4.038
Household Income (ln)	561	10.829	0.169	10.402	11.236
Percent Hispanic (ln)	561	2.135	0.754	0.453	3.892
Percent Black (ln)	561	2.05	0.959	0.252	4.049

Note: All variables are reported as both original values and in natural logarithmic form (labeled "ln").

TABLE 4. 2 Correlation Matrix	1	2	3	4	5	6	7	8	9
1. Life Expectancy	1.000								
2. Work Hours	-0.431	1.000							
3. Income to Top 10%	0.008	-0.165	1.000						
4. Total Population	0.018	-0.220	0.476	1.000					
5. Median Age	0.113	-0.322	0.138	-0.045	1.000				
6. % with Bachelor’s	0.596	-0.324	0.084	-0.003	0.080	1.000			
7. Household Income	0.693	-0.092	0.025	-0.014	-0.036	0.710	1.000		
8. Percent Hispanic	0.347	-0.089	0.438	0.404	-0.385	0.273	0.350	1.000	
9. Percent Black	-0.485	0.171	0.319	0.491	-0.058	-0.016	-0.067	0.076	1.000

Note: All variables in natural logarithmic form (ln).

TABLE 4. 3 Life Expectancy	Model 1		Model 2		Model 3		Model 4	
Work Hours	-0.131**	(0.044)			-0.126**	(0.045)	-0.140**	(0.044)
Income to Top 10%			-0.008	(0.006)	-0.006	(0.006)	0.001	(0.005)
Total Population	0.044***	(0.012)	0.050***	(0.012)	0.043***	(0.012)	0.039***	(0.012)
Median Age	-0.037	(0.022)	-0.036	(0.021)	-0.037	(0.022)	-0.037	(0.021)
% with Bachelor's	0.027**	(0.010)	0.028*	(0.011)	0.027**	(0.010)	0.027**	(0.010)
Household Income	0.010	(0.011)	-0.004	(0.009)	0.009	(0.011)	0.016	(0.012)
Percent Hispanic	-0.016***	(0.004)	-0.017***	(0.005)	-0.015***	(0.004)	-0.014***	(0.004)
Percent Black	-0.012**	(0.004)	-0.011**	(0.004)	-0.012**	(0.004)	-0.013***	(0.004)
Hours * Top 10 %							-0.345***	(0.098)
Constant	4.142***	(0.229)	3.737***	(0.184)	4.166***	(0.233)	3.672***	(0.163)
Observations	561		561		561		561	
R-squared	0.999		0.999		0.999		0.999	

Note: All variables logged (ln). Panel corrected standard errors in parentheses. All models also include unreported period-specific and unit-specific intercepts. All models include correction for auto-correlation. In Model 4, the main effects of work hours and income to the top 10% are mean-centered. * p<.05 ** p<.01 *** p<.001

TABLE 4. 4
Effects of Working Hours on Life Expectancy at Percentiles of Income to Top 10%

10th Percentile	-0.099*	(0.044)
20th Percentile	-0.114**	(0.044)
30th Percentile	-0.121**	(0.043)
40th Percentile	-0.129**	(0.043)
50th Percentile	-0.136**	(0.044)
60th Percentile	-0.145**	(0.044)
70th Percentile	-0.155***	(0.044)
80th Percentile	-0.166***	(0.045)
90th Percentile	-0.184***	(0.047)
99th Percentile	-0.242***	(0.055)

Note: All variables in natural logarithmic form. Models include the same controls as reported in Model 4. All models include autocorrelation correction.
Panel corrected standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.

FIGURES

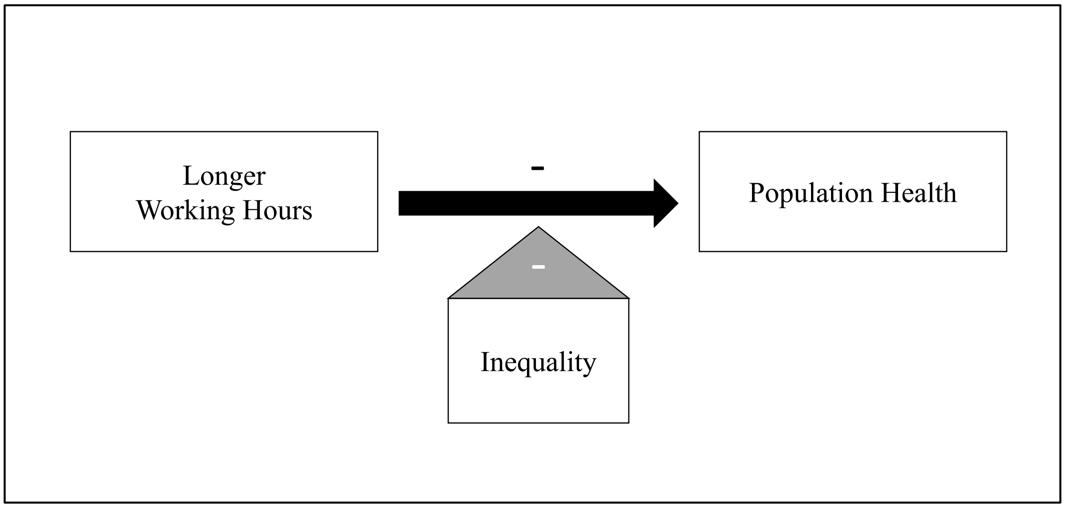

FIGURE 4. 1
Inequality as a moderator of the association between working hours and population health.

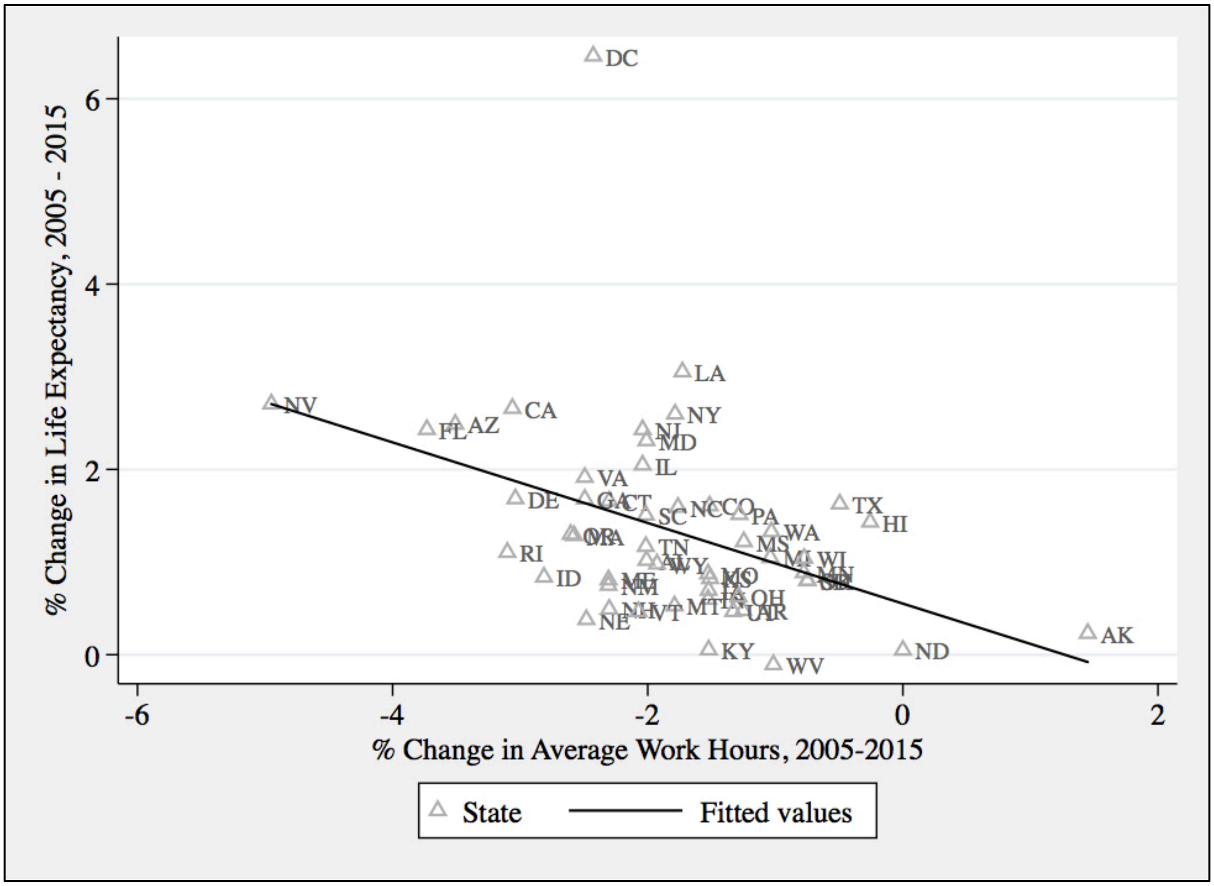

FIGURE 4. 2
Scatterplot of the association between the percent change in life expectancy from 2005 to 2015 and the percent change in working hours from 2005 to 2015. Each point represents a state. Correlation coefficient = -0.423.

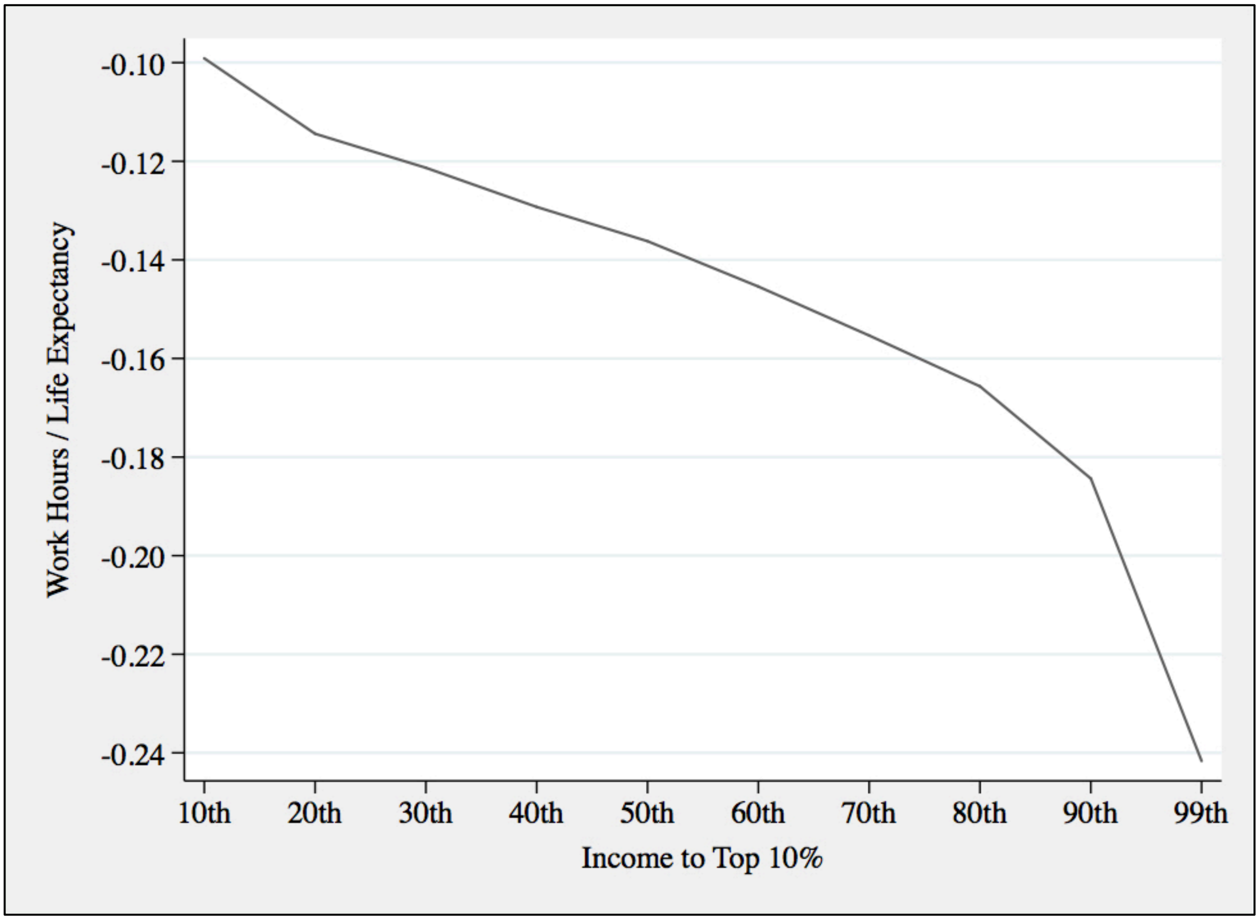

FIGURE 4. 3
Slope coefficients for the association between working hours and average life expectancy at different percentiles of income to the top 10 percent. Values are obtained from Table 4.

CHAPTER 5: CONCLUSION

ACHIEVING SUSTAINABILITY

In the face of global social and environmental challenges, the United Nations implemented the Sustainable Development Goals (SDGs) in 2015 in recognition of the fact that improving human wellbeing can no longer come at the cost of environmental sustainability (United Nations 2020). The SDGs encompass a wide range of social, economic and environmental objectives. The listed goals include, among other, improving education around the world, eradicating global poverty, improving gender equality and acting immediately on climate change mitigation. The SDGs make an important contribution to thinking about development as the interrelations between social, economic and environmental outcomes (Sachs 2012). While the SDGs are widely seen as important, there are substantial disagreements on how best to achieve them. On the one hand, the mainstream view is ecoefficiency. The ecoefficiency perspective emphasizes the need to economic growth and green technologies (i.e. Grossman and Krueger 1995; Mol, Spaargaren, and Sonnenfeld 2014; Pollin 2019). This perspective is in line with earlier conceptions of development as growth, or the "growth consensus" (i.e. Firebaugh and Beck 1994). In this perspective, the best way to improve social wellbeing is through economic growth and, as such, sustainable development requires decoupling economic growth from its environmental impacts, largely through the development and implementation of green technologies. While the ecoefficiency perspective is influential (e.g. SDG number 8 emphasizes the need for sustainable economic growth), many criticize the idea that economic growth is compatible with sustainability (i.e. Daly 1996; Foster, Clark, and York 2011; Kallis 2017; Meadows et al. 1972; Schor and Jorgenson

2019). Critics of ecoefficiency highlight that the empirical evidence for decoupling is weak (i.e. Jorgenson and Clark 2012; Knight and Schor 2014; Longhofer and Jorgenson 2017; Thombs 2017), argue that reliance on technology alone is insufficient (i.e. Foster, Clark, and York 2010; Kallis 2017; Thombs 2018; York 2012b) and note that economic growth, at least in wealthy countries, may not improve human wellbeing to the extent previously thought (i.e. Brady, Kaya, and Beckfield 2007; Easterlin 1974, 2015; Layard 2011).

If economic growth is antithetical to achieving sustainability, and reliance on technology is insufficient, then it is important to consider alternative pathways to sustainable development that move beyond the growth consensus. With this in mind, in this dissertation I examined the sustainability implications of working hours and inequality. Proponents of a working time reduction argue that it has the potential to be a multi-dividend sustainability policy that can improve social, economic and environmental wellbeing (Autonomy 2019; Fitzgerald, Jorgenson, and Clark 2015; Knight, Rosa, and Schor 2013; Schor 2010). For social wellbeing, it is argued that reducing working time can improve health outcomes and life satisfaction levels, largely through increases in leisure time (i.e. Kleiner and Pavalko 2010; Pouwels, Siegers, and Vlasblom 2008; Schor 2010). For economic wellbeing, it is argued that reducing working hours could be a key mechanism in reducing unemployment, especially if there are ecological limits to economic growth (Hayden 1999; Jackson and Victor 2011; Victor 2010). A working time reduction could also improve environmental outcomes by reducing production and consumption and encouraging more environmentally friendly activities and consumption choices (Fitzgerald et al. 2015; Hayden and Shandra 2009; Jalas and Juntunen 2015;

Kasser and Sheldon 2009; Knight et al. 2013). Previous research also indicates that inequality is negatively associated with human wellbeing (i.e. Hill and Jorgenson 2018; Pickett and Wilkinson 2015; Wilkinson and Pickett 2011), and it can also lead to greater environmental pressures (i.e. Boyce 1994, 2007; Cushing et al. 2015; Downey 2015; Jorgenson et al. 2016; Jorgenson, Schor, and Huang 2017) and it also intensifies the environmental intensity of wellbeing (i.e. Jorgenson 2015; Jorgenson, Dietz, and Kelly 2018). For population health, inequality can weaken broader social commitments to wellbeing and it concentrates political and economic power in the hands of the wealthy, who tend to oppose public spending on social services (Hill and Jorgenson 2018; Pickett and Wilkinson 2015). For environmental pressures, inequality shapes labor and consumption dynamics and results in the concentration of political and economic power in the hands of the wealthy, who tend to benefit more from environmental degradation (Cushing et al. 2015; Jorgenson et al. 2016, 2017).

In addition to expanding the research on the sustainability implications of working hours and inequality separately, a major contribution of this dissertation is examining further how inequality and working hours are related to each other. Previous research indicates that inequality can lead to an increase in working hours (i.e. Bowles and Park 2005; Oh, Park, and Bowles 2012), but previous research has yet to examine the ways in which inequality might shape how working hours affects both social and environmental outcomes. Integrating the research on the environmental and human wellbeing consequences of inequality and working hours offers both theoretical and substantive improvements for both areas of research, which I discuss with more depth below.

OVERVIEW OF EMPIRICAL ANALYSES

I analyzed the sustainability implications of working hours and inequality across three empirical chapters. Chapter 2 examined the relationship between working hours and CO_2 emissions across US states from 2007 to 2013. In Chapter 3, I took this research one step further and examined how inequality moderates the relationship between working hours and CO_2 emissions across US states from 2005 to 2015. In Chapter 4, I analyzed the extent to which working hours are related to life expectancy and how inequality moderates that relationship across US states from 2005 to 2015. The results of the empirical analyses across the three chapters indicate that reducing working hours could be an effective pathway to achieving sustainability and that inequality exacerbates the harmful effects of working hours on both emissions and life expectancy.

Before reviewing the results of the three empirical chapters more, it is important to note why I focus on these relationships across US states. The first reason is that the United States represents a bit of an anomaly among developed countries. It is among the highest emitters of CO_2 emissions in the world (Global Carbon Atlas 2020), it works longer hours on average than other developed countries in the world (The Conference Board 2019), it has more inequality than other developed countries (Institute for Policy Studies 2020), and its life expectancy lags far behind other developed countries as well (World Health Organization 2020). As such, focusing on what is happening within the United States as it relates to inequality, working time, health and carbon emissions is particularly illuminating and offers much potential for effective change. I focus on US states in particular because, while the federal government has been relatively slow to act on issues of environmental protection, inequality, working time and health, US states, and other sub-national entities have shown the ability to act on these topics. Franko and Witko (2018) and Fisher and Jorgenson (2019) argue that, with the election of Donald Trump, states are more likely, and sometimes better suited to, engage in meaningful policy action. They also note that state policy is often the precursor to larger federal action. There are multiple examples of states taking meaningful action on issues of inequality, working time, emissions and healthcare. For instance, despite President Trump's decision to remove the United States from the Paris Climate Accords, many US states have remained committed to the goals outlined in them (Jaeger, Cyrs, and Kennedy 2019). For working time, states have also shown the ability to act on working time measures, like work sharing programs (i.e. Messenger and Ghosheh 2013; National Conference of State Legislatures 2017), even though the federal government has not had meaningful legislation on working time since it instituted the 40-hour work week in 1938. Similarly, some states have also enacted policies aimed at reducing income inequality, like increasing the minimum wage, and improving healthcare, like the healthcare reform in Massachusetts that served as the precursor to the Affordable Care Act (Franko and Witko 2018). With this in mind, research on innovative approaches to solving social, economic and environmental issues at the state level is needed to better inform these efforts.

Chapter 2 examined the relationship between working hours and CO_2 emissions across US states from 2007 to 2013. I was lead author of this study published in *Social Forces* in 2018 with Juliet Schor and Andrew Jorgenson. This study is the first to examine this relationship across US states. Previous research indicates that working hours can lead to greater emissions through two pathways: scale and compositional effects

(Fitzgerald et al. 2015; Hayden and Shandra 2009; Knight et al. 2013; Schor 2010). The scale effect refers to how longer working hours increases overall economic growth through both production and consumption. The compositional effect is how longer working hours can shape the composition of consumption towards more ecologically intensive options, due to issues of time scarcity. We estimated both two-way fixed effects models with panel corrected standard errors and a correction for autocorrelation as well as random effects models with controls for time-specific fixed effects. Results indicate that increases in working hours are positively associated with emissions for both the scale and compositional effects over time controlling for other important economic and demographic drivers of emissions. The analyses provide further support that reducing working hours could be a key policy for mitigating climate change.

I take this research one step further in Chapter 3 by considering how inequality moderates the relationship between work hours and emissions. In this chapter, I integrate arguments from research on the relationships between working hours and emissions, inequality and emissions, and working hours and inequality. Previous research indicates that higher levels of inequality are associated with greater environmental pressures through the concentration of political and economic power in the hands of elites and through shaping consumption and labor market dynamics (Boyce 1994, 2007; Cushing et al. 2015; Downey 2015; Jorgenson et al. 2017; Knight, Schor, and Jorgenson 2017). Previous studies have found an empirical association between inequality and increased emissions, but it is unclear exactly how inequality might exacerbate environmental pressures. In line with the logic of other recent studies that attempt to unpack this relationship by examining how inequality shapes socio-environmental relationships (i.e.

Hill et al. 2019; Jorgenson et al. 2020; McGee and Greiner 2018) I develop arguments about how inequality can intensify the relationship between working hours and emissions. First, I argue that inequality can increase the scale effect described above by influencing how much income from work goes to consumption, both through competitive consumption pressures (i.e. Schor 1998) and through stress-induced consumption (i.e. Durante and Laran 2016; Mathur, Moschis, and Lee 2006). I also argue that inequality can exacerbate the compositional effect described above. Whereas I previously discussed the compositional effect solely in terms of time availability, the composition of consumption can also be affected by inequality through creating more pressures for consuming high-status visible goods, which tend to be more ecologically intensive (Bagwell and Bernheim 1996; Schor 1998; Veblen 1912). Using two-way fixed effects models with panel corrected standard errors and a correction for autocorrelation, results indicate that the effect of working hours on emissions is larger at higher levels of inequality (measured as percentage of income to the top ten percent).

In Chapter 4, I examined the relationship between working hours and life expectancy across US states from 2005 to 2015. Previous research indicates that longer working hours can increase stress levels and promote unhealthy consumption choices both as a coping mechanism and as a result of time availability. While previous research finds an association between longer working hours and worse health outcomes (i.e. Bannai and Tamakoshi 2014; Fan et al. 2015; Kivimäki and Kawachi 2015; Kleiner and Pavalko 2010), this is the first study to examine the relationship at the US state level. Investigating this relationship at a macro level allows for researchers to investigate the extent to which other structural factors influence the working time/health relationship.

With this in mind, building off of previous research that shows inequality is associated with worse population health (i.e. Clarkwest 2008; Curran and Mahutga 2018; Hill et al. 2019; Hill and Jorgenson 2018; Jorgenson et al. 2020; Pickett and Wilkinson 2015) and longer working hours (i.e. Bowles and Park 2005; Oh et al. 2012), I investigate the moderating effects of inequality on the relationship between working hours and life expectancy. I hypothesize that the negative relationship between working hours and population health is exacerbated at higher levels of inequality. I propose that this occurs because when inequality is high it makes work more precarious and stressful because workers have less control over their work. High levels of inequality also increase the competitive nature of work and consumption, also leading to increases in the stress and anxiety associated with work. Results from two-way fixed effects models with panel corrected standard errors indicate that increases in working hours are associated with decreases in life expectancy while controlling for important economic and demographic factors. Further, at higher levels of inequality, the effect of working hours on life expectancy are larger. As with the results from Chapter 3, these results provide evidence that inequality exacerbates the effects of working hours.

THEORETICAL AND SUBSTANTIVE IMPLICATIONS

I note the implications of the findings in each empirical chapter, but it bears reiterating and re-emphasizing here the larger contribution these studies have for theoretical understandings of how inequality and working time are related to both environmental and human wellbeing outcomes, policy, and, more broadly, discussions of pathways to sustainability. First, these studies sharpen our understanding of how working time and inequality are associated with population health and the environment. For the sustainability implications of inequality, these results highlight that, while the main effect of inequality may not always be significant, it often exerts an effect through shaping other relationships. In this case, we see that one of the pathways through which inequality leads to worsening population health and higher emissions is by shaping the effects of working time. For the sustainability implications of working hours, these results provide more insight into how and when working hours are bad for human and environmental wellbeing. In particular, we see that inequality plays a major role in shaping the effects of working hours on both life expectancy and emissions. For instance, a main finding in Chapter 3 is that the compositional effect is sensitive to the level of income inequality. At low levels of inequality, the compositional effect is non-significant. At relatively high levels of inequality, though, the effect is larger and statistically significant. This advances our theoretical understanding of the compositional effect. In particular, while previous research hypothesized the compositional effect largely in terms of how time availability shapes consumption choices, these results highlight that inequality also shapes consumption choices, likely towards more ecologically intensive high-status visible goods. This finding might help to explain some of the inconsistency in the compositional effect across previous studies.

In terms of policy, these findings provide support for the argument that reducing working time could be a multi-dividend sustainability policy that can improve both population health and reduce environmental burdens. They also indicate that policies aimed at reducing both working time and inequality are likely to be the most successful. Indeed, reducing working hours may not be socially feasible without concurrent reductions in inequality for the reasons discussed above. As such, we should consider policies like Medicare for All, which would no longer tie healthcare to employment, increasing the minimum wage, and instituting a maximum wage which could all contribute to reductions in inequality as well as limiting the pressures for longer working hours.

These findings also have implications for the future of work. In particular, advancements in automation and artificial intelligence (AI) threaten to displace a potentially high number of workers and potentially cause major unemployment problems (Acemoglu and Restrepo 2017; Brynjolfsson and McAfee 2014; Ford 2015). The typical response to these pressures is that economic growth will absorb losses and open up new possibilities for work. However, if economic growth is ecologically restricted, then we need to consider alternative strategies to combatting job loss. One strategy is to reduce working hours to spread available work to more workers. Inequality is important in this relationship as well, especially in terms of who will benefit most from the increased productivity of AI: workers or employers.

More broadly, these studies are a part of a larger discussion surrounding the future of capitalism and the role of economic growth in sustainable development. This is discussed most prominently in Chapter 2, but, these studies are related to a set of theoretical perspectives such as steady-state economics, new economics, degrowth and sufficiency (i.e. Daly 1996; Jackson 2009; Kallis 2017; Martinez-Alier 2009; Princen 2005; Schor 2010). Reducing working time and inequality are key parts of a transition towards more just and less-environmentally intensive economic systems. The empirical studies in this dissertation provide fresh evidence that there are viable alternatives to the "growth consensus" for achieving sustainability.

LIMITATIONS AND FUTURE DIRECTIONS

While the studies in this dissertation contribute to our overall understanding of the sustainability implications of working time and inequality, there are some important limitations that bear mentioning. First, these studies encompass a relatively short timeframe. The analyses in Chapter 2 cover a period of 7 years (2007-2013) and the analyses in Chapters 3 and 4 cover one decade (2005-2015). These time frames are simply a matter of data availability limitations. Examining these relationships over a longer time frame would be preferable and would allow for more questions to be asked, like how these effects might vary over time in a non-linear fashion. Second, these studies only examine one measure of environmental impact (emissions), one measure of working time (average hours), one measure of inequality (income to the top 10 percent) and one measure of population health (average life expectancy at birth). While emissions are especially important for climate change, studying other important environmental factors could yield further insights into how working hours and inequality shape environmental outcomes. For working time, while average working hours is particularly important from a structural perspective, it misses out on other important features of work (like disparities in working time, for instance) that may also be important in these relationships. For inequality, as I mention in the empirical chapters, I focus on income to the top ten percent for theoretical and substantive reasons. That said, examining other measures of inequality could provide more insight into these relationships (I should note that the findings for Chapters 3 and 4 are generally the same when examining other similar measures of inequality). Finally, while life expectancy is considered a valid and reliable measure of population health, it is a metric of overall population health. Examining other population health measures, like obesity rates or disease rates, may provide further insights into these relationships as well.

Another limitation of these studies is that they are all at the US state level. While I generally see this as important given the arguments I outlined above, this means that the results are applicable only to the United States and these relationships may operate differently when examining other units of analysis. For instance, because the conditions of these factors are relatively unique in the United States these relationships may operate differently in other countries. The focus on US states also means that there could be important differences within states that are missed here. As such, future research could explore these relationships at the US county-level as well. Finally, these studies assume symmetry in the relationships between working time, inequality, emissions and population health. That is, the studies treat the effects of increases and decreases in working time as the same. However, to make better claims about the viability of a *working time reduction*, analyses should examine these effects separately. Recent sociological research has advanced asymmetrical modeling techniques (Allison 2019; York and Light 2017) and examined asymmetry across a variety of socio-environmental relationships (i.e. Huang and Jorgenson 2018; McGee and York 2018; York 2012a). Future research could make use of this methodological technique to better understand specifically how reductions in working time are related emissions and population health. Research would be further advanced in examining asymmetrical interaction effects between inequality and working time as well.

In addition to addressing these limitations, the results of these studies also lead to further questions which could be addressed in future research. One issue not examined here is gender differences. Previous research on the relationship between working time and health indicate that there are potentially important differences for the effects of working time on health for men and women (i.e. Fan et al. 2015; Kleiner and Pavalko 2014). This could be studied in a macro context as well by examining sex-specific measures of working time and life expectancy. This is also related to broader discussions on working time reduction mention the possibility that reducing working hours could improve gender inequalities, but there is little empirical evidence of this. Future studies could examine how average working hours (and sex-specific average working hours) are related to macro-level gender inequities, like the average distribution of household labor. On a similar note, the research in this dissertation is focused explicitly on paid wage labor, but there are important dynamics in unpaid household labor that could also shape environmental and human health outcomes, especially as they relate to time availability and gender dynamics. Overall, then, future research on this topic would do well to consider how working time and inequality are related to other dimensions of sustainable development in order to provide further evidence of the worth of reducing working time and inequality as multi-dividend sustainability policies.

REFERENCES

Acemoglu, Daron, and Pascual Restrepo. 2017. *Robots and Jobs: Evidence from US Labor Markets*. *Working Paper*. 23285. National Bureau of Economic Research.

Allison, Paul D. 2019. "Asymmetric Fixed-Effects Models for Panel Data." *Socius* 5:2378023119826441.

Autonomy. 2019. "The Shorter Working Week: A Radical and Pragmatic Proposal." *Autonomy*. Retrieved March 16, 2020 (https://autonomy.work/portfolio/the-shorter-working-week-a-report-from-autonomy-in-collaboration-with-members-of-the-4-day-week-campaign/).

Bagwell, Laurie Simon, and B. Douglas Bernheim. 1996. "Veblen Effects in a Theory of Conspicuous Consumption." *The American Economic Review* 86(3):349–73.

Bannai, Akira, and Akiko Tamakoshi. 2014. "The Association Between Long Working Hours and Health: A Systematic Review of Epidemiological Evidence." *Scandinavian Journal of Work, Environment & Health* 40(1):5–18.

Bowles, Samuel, and Yongjin Park. 2005. "Emulation, Inequality, and Work Hours: Was Thorsten Veblen Right?" *Economic Journal* 115(507):F397–412.

Boyce, James. 1994. "Inequality as a Cause of Environmental Degradation." *Ecological Economics* 11(3):169–78.

Boyce, James K. 2007. "Is Inequality Bad for the Environment?" Pp. 267–88 in *Equity and the Environment*. Vol. 15, *Research in Social Problems and Public Policy*, edited by R. C. Wilkinson and W. R. Freudenburg. Emerald Group Publishing Limited.

Brady, David, Yunus Kaya, and Jason Beckfield. 2007. "Reassessing the Effect of Economic Growth on Well-Being in Less-Developed Countries, 1980–2003." *Studies in Comparative International Development* 42(1/2):1.

Brynjolfsson, Erik, and Andrew McAfee. 2014. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. W. W. Norton & Company.

Clarkwest, Andrew. 2008. "Neo-Materialist Theory and the Temporal Relationship between Income Inequality and Longevity Change." *Social Science & Medicine* 66(9):1871–81.

Curran, Michaela, and Matthew C. Mahutga. 2018. "Income Inequality and Population Health: A Global Gradient?" *Journal of Health and Social Behavior* 59(4):536–53.

Cushing, Lara, Rachel Morello-Frosch, Madeline Wander, and Manuel Pastor. 2015. "The Haves, the Have-Nots, and the Health of Everyone: The Relationship Between Social Inequality and Environmental Quality." *Annual Review of Public Health* 36(1):193–209.

Daly, Herman E. 1996. *Beyond Growth: The Economics of Sustainable Development*. Beacon Press.

Downey, Liam. 2015. *Inequality, Democracy, and the Environment*. NYU Press.

Durante, Kristina M., and Juliano Laran. 2016. “The Effect of Stress on Consumer Saving and Spending.” *Journal of Marketing Research* 53(5):814–28.

Easterlin, Richard. 1974. “Will Raising the Incomes of All Increase the Happiness of All?” *Journal of Economic Behavior & Organization.* 27(1):35–47.

Easterlin, Richard A. 2015. “Happiness and Economic Growth – The Evidence.” Pp. 283–99 in *Global Handbook of Quality of Life*, *International Handbooks of Quality-of-Life*. Springer, Dordrecht.

Fan, Wen, Jack Lam, Phyllis Moen, Erin Kelly, Rosalind King, and Susan McHale. 2015. “Constrained Choices? Linking Employees’ and Spouses’ Work Time to Health Behaviors.” *Social Science & Medicine* 126:99–109.

Firebaugh, Glenn, and Frank D. Beck. 1994. “Does Economic Growth Benefit the Masses? Growth, Dependence, and Welfare in the Third World.” *American Sociological Review* 59(5):631–53.

Fisher, Dana R., and Andrew K. Jorgenson. 2019. “Ending the Stalemate: Toward a Theory of Anthro-Shift.” *Sociological Theory* 37(4):342–62.

Fitzgerald, Jared B., Andrew K. Jorgenson, and Brett Clark. 2015. “Energy Consumption and Working Hours: A Longitudinal Study of Developed and Developing Nations, 1990–2008.” *Environmental Sociology* 1(3):213–23.

Ford, Martin. 2015. *Rise of the Robots: Technology and the Threat of a Jobless Future*. New York: Basic Books.

Foster, John Bellamy, Brett Clark, and Richard York. 2010. “Capitalism and the Curse of Energy Efficiency The Return of the Jevons Paradox.” *Monthly Review* 62(6):1–12.

Foster, John Bellamy, Brett Clark, and Richard York. 2011. *The Ecological Rift: Capitalism’s War on the Earth*. NYU Press.

Franko, William W., and Christopher Witko. 2018. *The New Economic Populism: How States Respond to Economic Inequality*. Oxford University Press.

Global Carbon Atlas. 2020. “CO2 Emissions | Global Carbon Atlas.” Retrieved March 28, 2020 (http://www.globalcarbonatlas.org/en/CO2-emissions).

Grossman, Gene M., and Alan B. Krueger. 1995. “Economic Growth and the Environment.” *The Quarterly Journal of Economics* 110(2):353–77.

Hayden, Anders. 1999. *Sharing the Work, Sparing the Planet: Work Time, Consumption & Ecology*. New York: Zed Books.

Hayden, Anders, and John M. Shandra. 2009. “Hours of Work and the Ecological Footprint of Nations: An Exploratory Analysis.” *Local Environment* 14(6):575–600.

Hill, Terrance D., and Andrew K. Jorgenson. 2018. "Bring out Your Dead!: A Study of Income Inequality and Life Expectancy in the United States, 2000–2010." *Health & Place* 49:1–6.

Hill, Terrence D., Andrew K. Jorgenson, Peter Ore, Kelly S. Balistreri, and Brett Clark. 2019. "Air Quality and Life Expectancy in the United States: An Analysis of the Moderating Effect of Income Inequality." *SSM - Population Health* 7:100346.

Huang, Xiaorui, and Andrew K. Jorgenson. 2018. "The Asymmetrical Effects of Economic Development on Consumption-Based and Production-Based Carbon Dioxide Emissions, 1990 to 2014." *Socius* 4:2378023118773626.

Institute for Policy Studies. 2020. "Global Inequality - Inequality.Org." Retrieved March 28, 2020 (https://inequality.org/facts/global-inequality/#us-wealth-concentration).

Jackson, Tim. 2009. *Prosperity Without Growth: Economics for a Finite Planet*. Sterling, VA: Earthscan.

Jackson, Tim, and Peter Victor. 2011. "Productivity and Work in the 'Green Economy': Some Theoretical Reflections and Empirical Tests." *Environmental Innovation and Societal Transitions* 1(1):101–8.

Jaeger, Joel, Tom Cyrs, and Kevin Kennedy. 2019. "As Trump Steps Away from Paris Climate Agreement, U.S. States, Cities and Businesses Step Up." *World Resources Institute*. Retrieved November 8, 2019 (https://www.wri.org/blog/2019/10/trump-steps-away-paris-climate-agreement-us-states-cities-and-businesses-step-up).

Jalas, Mikko, and Jouni K. Juntunen. 2015. “Energy Intensive Lifestyles: Time Use, the Activity Patterns of Consumers, and Related Energy Demands in Finland.” *Ecological Economics* 113:51–59.

Jorgenson, Andrew K. 2015. “Inequality and the Carbon Intensity of Human Well-Being.” *Journal of Environmental Studies and Sciences* 5(3):277–82.

Jorgenson, Andrew K., and Brett Clark. 2012. “Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005.” *American Journal of Sociology* 118(1):1–44.

Jorgenson, Andrew K., Thomas Dietz, and Orla Kelly. 2018. “Inequality, Poverty, and the Carbon Intensity of Human Well-Being in the United States: A Sex-Specific Analysis.” *Sustainability Science* 13(4):1167–74.

Jorgenson, Andrew K., Terrence D. Hill, Brett Clark, Ryan P. Thombs, Peter Ore, Kelly S. Balistreri, and Jennifer E. Givens. 2020. “Power, Proximity, and Physiology: Does Income Inequality and Racial Composition Amplify the Impacts of Air Pollution on Life Expectancy in the United States?” *Environmental Research Letters* 15(2):024013.

Jorgenson, Andrew K., Juliet B. Schor, Kyle W. Knight, and Xiaorui Huang. 2016. “Domestic Inequality and Carbon Emissions in Comparative Perspective.” *Sociological Forum* 31:770–86.

Jorgenson, Andrew K., Juliet Schor, and Xiaorui Huang. 2017. “Income Inequality and Carbon Emissions in the United States: A State-Level Analysis, 1997–2012.” *Ecological Economics* 134:40–48.

Kallis, Giorgos. 2017. *In Defense of Degrowth: Opinions and Minifestos*. edited by A. Vansintjan. Brussels: Uneven Earth Press.

Kasser, Tim, and Kennon M. Sheldon. 2009. “Time Affluence as a Path toward Personal Happiness and Ethical Business Practice: Empirical Evidence from Four Studies.” *Journal of Business Ethics* 84(2):243–55.

Kivimäki, Mika, and Ichiro Kawachi. 2015. “Work Stress as a Risk Factor for Cardiovascular Disease.” *Current Cardiology Reports* 17(9):74.

Kleiner, Sibyl, and Eliza K. Pavalko. 2010. “Clocking In: The Organization of Work Time and Health in the United States.” *Social Forces* 88(3):1463–86.

Kleiner, Sibyl, and Eliza K. Pavalko. 2014. “Double Time: Is Health Affected by a Spouse’s Time at Work?” *Social Forces* 92(3):983–1007.

Knight, Kyle W., Eugene A. Rosa, and Juliet B. 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.

Knight, Kyle W., and Juliet B. Schor. 2014. “Economic Growth and Climate Change: A Cross-National Analysis of Territorial and Consumption-Based Carbon Emissions in High-Income Countries.” *Sustainability* 6(6):3722–31.

Knight, Kyle W., Juliet B. Schor, and Andrew K. Jorgenson. 2017. “Wealth Inequality and Carbon Emissions in High-Income Countries.” *Social Currents* 4(5):403–12.

Layard, Richard. 2011. *Happiness: Lessons from a New Science*. London, UK: Penguin.

Longhofer, Wesley, and Andrew Jorgenson. 2017. “Decoupling Reconsidered: Does World Society Integration Influence the Relationship Between the Environment and Economic Development?” *Social Science Research*.

Martinez-Alier, Joan. 2009. “Socially Sustainable Economic De-Growth.” *Development and Change* 40(6):1099–1119.

Mathur, Anil, George P. Moschis, and Euehun Lee. 2006. “Consumer Stress-Handling Strategies: Theory and Research Findings.” *Journal of Consumer Behaviour* 5(3):193–203.

McGee, Julius Alexander, and Patrick Trent Greiner. 2018. “Can Reducing Income Inequality Decouple Economic Growth from CO2 Emissions?” *Socius* 4:2378023118772716.

McGee, Julius Alexander, and Richard York. 2018. “Asymmetric Relationship of Urbanization and CO2 Emissions in Less Developed Countries.” *PLoS ONE* 13(12).

Meadows, Donella H., Dennis L. Meadows, Jorgen Randers, and William W. Behrens. 1972. “The Limits To Growth. A Report For The Club Of Rome’s Project On The

Predicament Of Mankind." *The Limits to Growth. A Report for the Club of Rome's Project on the Predicament of Mankind.*

Messenger, Jon Carleton, and Naj Ghosheh. 2013. *Work Sharing During the Great Recession: New Developments and Beyond*. Edward Elgar Publishing.

Mol, Arthur P. J., Gert Spaargaren, and David A. Sonnenfeld. 2014. "Ecological Modernization Theory: Taking Stock, Moving Forward." Pp. 15–30 in *Routledge International Handbook of Social and Environmental Change*, edited by A. P. J. Mol, D. A. Sonnenfeld, and G. Spaargaren. New York: Routledge.

National Conference of State Legislatures. 2017. "Work Share Programs." Retrieved May 25, 2017 (http://www.ncsl.org/research/labor-and-employment/work-share-programs.aspx).

Oh, Seung-Yun, Yongjin Park, and Samuel Bowles. 2012. "Veblen Effects, Political Representation, and the Reduction in Working Time Over the 20th Century." *Journal of Economic Behavior & Organization* 83(2):218–42.

Pickett, Kate E., and Richard G. Wilkinson. 2015. "Income Inequality and Health: A Causal Review." *Social Science & Medicine* 128:316–26.

Pollin, Robert. 2019. "Advancing a Viable Global Climate Stabilization Project: Degrowth versus the Green New Deal." *Review of Radical Political Economics* 51(2):311–19.

Pouwels, Babette, Jacques Siegers, and Jan Dirk Vlasblom. 2008. "Income, Working Hours, and Happiness." *Economics Letters* 99(1):72–74.

Princen, Thomas. 2005. *The Logic of Sufficiency*. MIT Press.

Sachs, Jeffrey D. 2012. "From Millennium Development Goals to Sustainable Development Goals." *The Lancet* 379(9832):2206–11.

Schor, Juliet. 2010. *Plenitude: The New Economics of True Wealth*. New York: The Penguin Press.

Schor, Juliet B. 1998. *The Overspent American: Why We Want What We Don't Need*. New York: Harper Collins.

Schor, Juliet B., and Andrew K. Jorgenson. 2019. "Is It Too Late for Growth?" *Review of Radical Political Economics* 51(2):320–29.

The Conference Board. 2019. "Total Economy Database Data." Retrieved February 24, 2020 (https://www.conference-board.org/data/economydatabase/index.cfm?id=27762).

Thombs, Ryan P. 2017. "The Paradoxical Relationship between Renewable Energy and Economic Growth: A Cross-National Panel Study, 1990-2013." *Journal of World-Systems Research* 23(2):540–64.

Thombs, Ryan P. 2018. "Has the Relationship between Non-Fossil Fuel Energy Sources and CO2 Emissions Changed over Time? A Cross-National Study, 2000–2013." *Climatic Change* 148(4):481–90.

United Nations. 2020. “About the Sustainable Development Goals.” *United Nations Sustainable Development*. Retrieved January 11, 2020 (https://www.un.org/sustainabledevelopment/sustainable-development-goals/).

Veblen, Thorstein. 1912. *The Theory of the Leisure Class: An Economic Study of Institutions*. B. W. Huebsch.

Victor, Peter. 2010. “Questioning Economic Growth.” *Nature* 468:370–71.

Wilkinson, Richard G., and Kate E. Pickett. 2011. *The Spirit Level: Why Greater Equality Makes Societies Stronger*. New York: Bloomsbury Press.

World Health Organization. 2020. “Global Health Observatory.” Retrieved March 28, 2020 (https://www.who.int/data/gho).

York, Richard. 2012a. “Asymmetric Effects of Economic Growth and Decline of CO2 Emissions.” *Nature Climate Change* 2(11):762–64.

York, Richard. 2012b. “Do Alternative Energy Sources Displace Fossil Fuels?” *Nature Climate Change* 2:441–43.

York, Richard, and Ryan Light. 2017. “Directional Asymmetry in Sociological Analyses.” *Socius* 3:1–13.