HIGHER WAGES, LESS GYM TIME?

THE EFFECTS OF MINIMUM WAGES ON TIME USE

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Running Head: The Effects of Minimum Wages on Time Use

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Abstract

This study examines the effects of minimum wages on time use. Analyzing data from the American Time Use Survey from 2003 to 2017, I investigate the role of time allocated towards exercise and other health-enhancing activities as a potential mechanism underlying the link between minimum wages and health. The study finds that a $1 increase in minimum wages is associated with reductions in exercising and total personal health time by 13 and 20 minutes during the week, respectively. This decline in health time is fully reallocated toward additional leisure time. The results are largely driven by males and employed individuals.

1. Introduction

Minimum wages have been in the center of national debate in recent years. There are strong opinions both for and against increasing the federal minimum wage, which has remained unchanged at $7.25 since 2009. In his 2014 State of the Union Address, President Obama advised Congress to raise the minimum wage to $10.10, while one of the key point of Senator Bernie Sanders' 2016 Presidential Campaign was increasing it to $15. Sanders points out that the low level of the current federal minimum wage makes it challenging for low-income households to adequately take care of their children in terms of saving towards higher education, providing a healthy diet, or having the leisure time and money to accompany them to extracurricular activities. While these efforts have not led to an increase in the federal minimum wage, 61 increases of state-level minimum wages passed between 2015 and 2017. Economists have extensively analyzed the effects of minimum wages on employment (see overview by Neumark et al., 2014) and poverty (e.g. Card and Krueger, 1995; Neumark and Wascher, 2002; Burkhauser and Sabia, 2007). In recent years, the focus has expanded to exploring whether minimum wages can potentially impact outcomes related to physical and mental health (e.g. Wehby et al., 2016; Horn et al., 2017; Averett et al., 2017; Lenhart, 2017a and 2017b; Reeves et al., 2017; Du and Leigh, 2018). This study contributes to this recently growing stream of literature by examining the role of time use, especially time spent on health-enhancing activities, as a potential mechanism underlying the relationship between minimum wages and health outcomes.

Despite the increased focus by economists on investigating the effects of minimum wages on health, no consensus has yet been established. Depending on the outcomes looked at by researchers, the evidence is fairly mixed – some studies find that minimum wages are associated with improved health outcomes, while others find the opposite. Recent findings by Horn et al. (2017) furthermore shows that, while potentially having small negative effects on

general health, minimum wages might lead to improvements in mental health. Given that it might take some time before health changes are observable following minimum wage increases, a better understanding of the mechanisms underlying the relationship between minimum wages and health could provide evidence on long-term health effects.

Following economic theory, increases in minimum wages could affect health outcomes by affecting earnings and time costs (Horn et al., 2017). Higher minimum wages can lead to health improvements by boosting earnings of low-wage workers or worsen health outcomes if individuals lose their employment following minimum wage changes (Wehby et al., 2016). Time costs can also be affected in more than one way by higher minimum wages. On the one hand, individuals who lose employment have lower time costs, which could lead to improved health outcomes if they use the additional time on health-enhancing activities, such as exercising, or health declines if they spend it on activities such as drinking or consuming illicit drugs (Horn et al., 2017). On the other hand, the opportunity cost of non-work activities increases for workers who keep their job and receive a raise following minimum wage increases.

This study provides empirical evidence on how minimum wages impact the time use of low-educated individuals. Using data from American Time Use Survey (ATUS) for the years 2003 to 2017, a time period which covers 257 minimum wage changes, I estimate differences-in-differences (DD) models to examine the relationship between minimum wages and time use. Specifically, I explore changes in time allocated toward health-enhancing activities (e.g. exercise) and leisure, as well as toward activities related to education, work, and childcare. The study provides evidence that individuals spend less time on health-related activities, while reallocating this additional time entirely towards leisure activities. The results suggest that a $1 increase in one-year lagged real minimum wages reduces time spent on one's own health by 20 minutes per week (Monday through Friday), while increasing

leisure time by 30 minutes. Additional specifications by subgroups show that these observed time use effects are entirely driven by behavioral changes of males and by employed individuals. The main DD results are confirmed by two triple difference (DDD) models. The observed changes in time allocated towards health and leisure activities could explain why minimum wages might have negative effects on general health, but positive effects on mental well-being, as found by Horn et al. (2017).

2. Related Literature

Several researchers have examined potential health-related effects of minimum wage changes in recent years and have improved the understanding of how such policy changes affect the overall well-being society. Despite this rapid growth of studies expanding the previous focus of the literature beyond employment-related outcomes, the evidence so far is fairly mixed. A possible explanation for the lack of consensus in previous work is the fact that health is a multifaceted object and that there are likely several mechanisms at play for various health outcomes. One limitation of studies working on this topic is that they are often not able to isolate workers who experience employment changes following minimum wage increases. Given that different employment changes will likely lead to different health effects, the observed estimates thus depend on the shares of the observed population experiencing different labor market changes.

On the one hand, several studies have provided evidence that higher minimum wages can lead to health improvements. Using U.S. birth record data, Wehby et al. (2016) find evidence for increases in birth weight following minimum wages changes. When exploring potential channels, the authors provide evidence that mothers spend more time on prenatal care and are less likely to drink during pregnancy when minimum wages are higher. Examining the first introduction of minimum wage across all sectors of the economy in the U.K. in 1999, two studies find evidence that higher wages are associated with improved

physical (Lenhart, 2017a) and mental health (Reeves et al., 2017). Lenhart (2017a) shows that changes in physical activity, smoking, and financial stress might explain the observed health improvements to some extent. Du and Leigh (2018) document that higher minimum wages are associated with lower rates of illness-related absence from work for lower-educated workers. Using aggregate data from 24 OECD countries, Lenhart (2017b) finds that more generous minimum wages are correlated with improved population health outcomes, while suggesting that access to health care and health behaviors (e.g. smoking and nutrition) might be channels underlying the link between minimum wages and health.

On the other hand, a number of studies have provided negative or no effects on health outcomes as well as mixed results for different groups of the population. Meltzer and Chen (2011) find that higher minimum wages are correlated with increases in body weight. Using U.S. data between 1993 and 2014, Horn et al. (2017) find declines in general health following minimum wages increases among lesser-skilled individuals, while providing evidence for improvements in mental health among women. Averett et al. (2017) show that minimum wages are associated with improvements in self-reported health among white women, while being correlated with health declines among Hispanic men. Adams et al. (2012) report increases in alcohol-related traffic fatalities among teens, while Sabia et al. (2018) find no evidence for increases in alcohol consumption for this age group when expanding the sample period. In contrast to Reeves et al. (2017), Kronenberg et al. (2017) find that the first nationwide minimum wage in the U.K. did not lead to improvements in mental health outcomes.

Only a small number of studies have so far provided evidence for potential mechanisms through which minimum wages could potentially affect health outcomes. These include increased prenatal care (Wehby et al., 2016), reduced smoking (Wehby et al., 2016; Lenhart, 2017a), and reduced financial and job-related stress (Lenhart, 2017a). In a recent

working paper, Lenhart (2018) shows that increased minimum wages reduce the likelihood that low-educated people are unable to afford health care that they need and increase the likelihood of having privately purchased health insurance and dental insurance. In two earlier studies, Simon and Kaestner (2004) provide evidence that minimum wages are not associated with changes in health insurance or employer pension coverage, while Marks (2011) finds negative effect on insurance coverage for low-skilled employees.

To my knowledge, this is the first study to provide empirical evidence for the effects of minimum wages on time use. Several researchers have previously examined how economic conditions impact time allocated towards health-enhancing activities. Colman and Dave (2013) find that overall physical activity declines during recessions due to declines in on-the job physical activity being larger than increases in leisure-time physical activity (e.g. recreational exercise). Other studies provide evidence that economic downturns are correlated with increased drug and alcohol use among teenagers (Arkes, 2007), increased smoking among young adults (Arkes, 2012) and men (Xu, 2013), as well as with increased leisure-time physical activity, lower smoking and less excess weight (Ruhm, 2005).

3. Conceptual Framework

This study adds to the literature on minimum wages and health by exploring the role of time use changes as a potential channel. The Grossman model (1972) provides a theoretical framework to analyze the demand for health. The model assumes that individuals inherit an initial stock of health that depreciates over time. However, people can influence their health over time by making gross investments, which includes market goods (e.g. health care, healthy foods) and nonmarket good (e.g. exercise, sleep). Based on the assumption that good health today leads to higher levels of health in subsequent periods, people invest in their health to increase their well-being. While being confronted with both income and time constraints, individuals make consumption choices to maximize their utility. Besides being a

form of stock and a consumption good, the Grossman model (1972) also views health as an input to the production of "productive time" since being healthier allows people to spend more time on utility-enhancing activities. The model differentiates between four activities: working, playing, improving health, and being sick.

Workers who experience wage increases following minimum wage changes will have more money available to spend on market goods. Thus, the Grossman model (1972) predicts that health stocks of these workers improves after minimum wages increases. However, the opposite will be the case for individuals whose employment outcomes are negatively affects by the policy changes. However, as pointed out by Horn et al. (2017), minimum wage-induced increases in income may not necessarily be spent on health-enhancing investments, since people might rather spend the extra earnings on goods that can reduce their health (alcohol, drugs, or low-quality food).

Another potential channel underlying the relationship between minimum wages and health, as mentioned by Horn et al. (2017), are time costs. Again, it seems likely that minimum wages increases will affect time costs differently across people with different employment outcomes. Individuals who lose employment have reduced time costs, which could lead to improved health outcomes if they spend more time on health-enhancing activities, such as exercising. Workers who keep their jobs and receive a raise after the policy changes, experience an increase in the opportunity cost of time, which make investments in nonmarket goods more expensive (Horn et al., 2017).

Estimates on how minimum wage increases affect various categories of time use among lesser-skilled individuals can provide a better understanding of how minimum wages affect health outcomes. Furthermore, evidence for changes in time spent on health-enhancing activities and leisure activities might provide some insights on why minimum wages might worsen physical health, but improve mental health, as shown by Horn et al. (2017). Reduced

physical activity could lead to long-term negative effects on physical health outcomes, whereas additional leisure time might make people happier and translate into improved self-reported mental health outcomes.

The Grossman model (1972) establishes the possibility of a time delay before additional income might translate into improved health outcomes. This study examines one-year lagged effects of minimum wage changes to capture this potential time delay before people change their behavior and invest into their health.

4. Data

American Time Use Survey

Since 2003, the Bureau of Labor Statistics (BLS) annually conducts the American Time Use Survey (ATUS) in order to develop a nationally-representative overview of how people in the U.S. spend their time. The survey is given to respondents of the Current Population Survey (CPS) who are above 14 years of age, live in the U.S. and have completed month 8 of the CPS survey. The final sample of respondents is constructed in three stages. In the first stage, the oversampling of less-populous states, which exists in the CPS, is reduced. The second stage employs stratified sampling based on race and the number of children in the household, during which Hispanics, non-Hispanic Blacks, and households with children are oversampled. The final stage involves random sampling.[1]

This study uses all available waves of the ATUS data from 2003-2017 to examine the effects of minimum wages on time use. Each wave of the survey consists of 24-hour diaries in which respondents report their activities from the previous day in detailed time intervals. Given that individuals are drawn from the exiting sample of the CPS, information regarding respondents' employment status and other demographic characteristics is available in the

[1] As pointed out by Maddala (1983), the estimation of weighted regression models is not required in the case of oversampling based on exogenous regressors such as race. The analysis in this study controls for both race and the number of children present in the household. Additionally, we run our models including sample weights and find that the results remain similar. These results are not shown in the paper, but are available upon request.

survey. While the initial ATUS wave contained 20,720 individuals, sample sizes for all of the following waves were between 10,000-14,000 people. Following the approach taken by previous studies (e.g. Wehby et al., Horn et al., 2017), I narrow the sample to low-educated individuals, a group that is most likely to earn minimum wages. More specifically, the main analysis examines working-age people between the ages 18 to 64 who have at most a completed High School degree. After dropping individuals with missing time use information, the sample size for the main analysis is 25,887 individuals.

Using data from the CPS, Table 1 confirms that less educated individuals are more likely to be affected by changes to minimum wages. 30.2% of individuals between the ages 18 and 64 who received at most a high school degree are paid an hourly wage at or close to the minimum wage (< 125% of the minimum wage). In comparison, only 16.7% of all individuals with at least some college earn at or close to the minimum wage, with the shares being even smaller for college graduates (12.3%) and those with advanced degrees (8.8%). The statistics shown in Table 1 also suggest that the shares of people earning minimum wages differ across subgroups of the population. Women, non-whites, younger individuals (between 18 and 29) as well as non-married people are more likely to earn wages near the minimum wage. To check for heterogeneous effects of minimum wages on time use, this study examines the effects for different subgroups of the population on top of analyzing the effects for the entire sample.

Time Use Categories

The ATUS records detailed information on more than 400 categories of time use.[2] Using information on the day of the interview, we convert times individuals spend on certain activities into total times allocated towards these activities per week (Monday to Friday) and per weekend by closely following the approach by Aguiar et al. (2013). I examine whether

[2] Please see Hamermesh, Frazis and Stewart (2005) for more information on the types of activities that are recorded in the ATUS.

minimum wage increases affect six different categories of time use: (1) exercise; 2) total time spent on one's own health; 3) leisure time; 4) education time; 5) work time; and 6) childcare time. Table 2 provides an overview of activities that are included in these categories in the analysis. Given that time spent exercising makes up half of the total time allocated towards one's own health, I examine the effects on it separately. Finding changes in physical activity could provide evidence on a potential pathway between minimum wages and health outcomes, whereas changes in leisure activities such as socializing, pet care, watching television, or eating could explain how minimum wages affect mental well-being of affected individuals.

Minimum Wages

Minimum wage data is obtained from the U.S. Department of Labor.[3] The effective minimum wage is defined as the higher of the state and the federal minimum wage in each state. Given that the analysis examines one-year lagged effects of minimum wages on time use, I use minimum wage data for the years 2002 to 2016, a period that included 257 changes to the effective minimum wage rates across all states. In 2016, 29 states plus DC had minimum wages that were set higher than the federal hourly wage floor of $7.25. Table 3 provides an overview of all minimum wage changes between 2002 and 2016. Using the Consumer Price Index – Urban Consumers, I convert nominal minimum wages to 2015-dollar wages for the analysis.

Control Variables

The analysis controls for a set of individual characteristics potentially related to health and time use, such as age, gender, employment status, race, marital status, and the number of children living in the household. Additionally, I follow the approach by two recent studies examining the association between minimum wages and health outcomes (Wehby et al.,

[3] See: https://www.dol.gov/whd/state/stateminwagehis.htm.

2016; Horn et al., 2017) and include controls for time-varying, state-level policies changes in the Earned Income Tax Credit (EITC), which could be associated with both minimum wages and time allocation among less educated individuals. These controls include indicators for state-level EITC regulations through three measures: 1) an indicator for whether the state had an EITC program; 2) an indicator for whether this state's EITC is refundable; and 3) the percentage of the state EITC compared to the federal EITC level.[4] In 2017, 29 states have state-level EITC programs in place on top of the federal credit. In 24 of these states, the EITC is refundable.

Summary Statistics

Table 4 provides descriptive statistics for the ATUS sample analyzed in this study. It is noticeable that half of all respondents were interviewed on a weekday, while the other half of the sample reported time use on the weekend. The time use statistics show total minutes spent on each category per week (Monday to Friday) and weekend.[5] Table 4 shows that respondents on average spend around two hours on their own health during the week, while half of that time is allocated towards exercising. Average total leisure time is 1,858 minutes during the week and 916 minutes on weekends. During the period of the study, mean nominal and average effective minimum wages are $6.73 and $6.14, respectively.

5. Methods

DD Estimation

This study follows recent work examining potential health effects of higher minimum wages (Wehby et al., 2016; Horn et al., 2017) and estimates difference-in-differences (DD) models to provide evidence for "intent-to-treat" effects on time allocation. Equation (1)

[4] The data for state-level EITC programs is obtained from Tax Credits for Working Families, Tax Policy Center of the Urban Institute and Brookings Institution, and the National Conference of State Legislatures.
[5] I multiply daily time use for each category by five (weekday) or two (weekend) to obtain total time use statistics for the two parts of the week.

provides the main specification, which is estimated using separate Ordinary Least Squares (OLS) models for each of the different time use categories:

$$Y_{ist} = \alpha_0 + \alpha_1 MW_{st-1} + \alpha_2 X_{ist} + \alpha_3 P_{st} + \phi_s + \gamma_t + \varepsilon_{ist} \quad (1)$$

Y_{ist} represents time use measures for individual *i* in state *s* surveyed in year *t*. MW_{st-1} is the one-year lagged effective real minimum wage for each state and year. X_{ist} represents a set of individual characteristics, such as age, gender, employment status, race, marital status, and the number of children living in the household.[6] The inclusion of P_{st} takes into account other state-level policies (state-level EITCs) that could affect health-related time use of low-educated individuals. Additionally, equation (1) controls for state and year fixed effects, while ε_{ist} is a random error term. In additional specification, state-specific time trends are also controlled for in the analysis to address time-varying state-level factors that are not captured by the data.

The parameter of interest, α_1, captures the reduced-form effects of higher minimum wages on the different categories of time use. In 2016, the federal minimum wage of $7.25 was also the effective minimum wage in 21 states. These states serve as control states in the analysis, while the states that experienced increases in their wage floor form the treatment group.

Besides the main DD analysis, I also examine whether the effects differ across subgroups of the population. As shown in Table 1, the share of low-wage workers varies substantially across demographic subgroups, suggesting that different groups might be more or less likely to be affected by minimum wage increases. Specifically, I test whether minimum wages differently impact time use across employment status, gender, and age. An understanding of

[6] In additional specification, marital status is excluded from the models since it could be argued that it is potentially an outcome of minimum wages and therefore a "bad control" (Angrist and Pischke, 2009). The results remain unchanged when excluding marital status from the analysis. These results are not shown in the paper but are available upon request.

whether the results are potentially driven by employed individuals or by those who are unemployed can provide further evidence on how minimum wages affect time allocation and health outcomes. If employed individuals, who are likely to experience raises following minimum wage increases, spend more time on work-related activities while exercising less, this might indicate that their health will worsen over time following the policy changes. The subgroup analysis adds to recent work that tested whether minimum wages have different effects on health outcomes across gender (Wehby et al., 2016, Horn et al., 2017), Averett et al., 2017) race/ethnicity (Wehby et al., 2016, Averett et al., 2017), education (Wehby et al., 2016), age (Wehby et al., 2016), and marital status (Wehby et al., 2016).

DDD Estimation

In order to account for potential biases in the DD results due to other policies or state-level changes that might occur simultaneously with minimum wage increases, I furthermore estimate two triple difference (DDD) models. The DDD analysis uses two different within-state comparison groups, which should not be affected by minimum wage increases: 1) retired adults who are 70 years or above with no more than a High School degree, and 2) college-educated adults between the ages 18 to 64. This setup is almost identical to the DDD analysis conducted by Horn et al. (2017).[7]

The first group serves as good placebo group since labor market outcomes of retired elderly individuals should not be affected by minimum wage changes, and individuals in this group have the same level of education as the main sample of the study. The second placebo group should also not be largely affected by minimum wage increases since, as shown in Table 1, individuals with higher levels of education are much less likely to earn low hourly wages. A potential limitation of this second within-state comparison group is the fact that

[7] While Horn et al. (2017) use the same first comparison group, their second group consists of college-educated adults between the ages 18 to 54, which is the same age group as their main treatment group of low-educated adults.

minimum wage increases can potentially have spillover effects across the wage distribution (DiNardo et al., 1996; Lee, 1999; Autor et al., 2016).

6. Results

DD Results

Table 5 reports the DD estimates of minimum wage increases on time use. Panel A shows results on time use during the week, while Panel B presents the effects on time allocation on weekends. I find that a $1 increase in one-year lagged minimum wages is associated with a reduction of time spent exercising by 12.85 minutes ($p<0.01$) between Monday and Friday. Relative to the baseline mean, this decline corresponds to a 20.41% reduction in exercise time. When additionally including other activities related to taking care of one's own health, the analysis finds a decline of 19.88 minutes ($p<0.01$) following a $1 increase in minimum wages in the prior year. When examining how individuals spend the newly available time, I find increases in total weekly leisure time by 29.62 minutes ($p<0.05$). The magnitude of this effect suggests that individuals reallocate time previously spent on health-enhancing activities towards leisure. No significant changes are found for the effects of minimum wage on time spent on education, work, or childcare. For all categories of time use, the effects remain unchanged when additionally including state-specific time trends to the analysis. Figure A1 in the Appendix provides estimates similar to an event study. While the sample of treated states is restricted in this analysis due to the continuous treatment in many states, the graph provides evidence that the effects on time spent exercising are largest two and three years following policy change.[8]

The results in Panel B show that minimum wages do not affect time use on weekends. While the descriptive time use statistics in Table 4 show that individuals on average spend

[8] For the event study analysis, I only include treated states with not more than one policy change over given time periods in order to avoid capturing overlapping effects of several minimum wage increases in the same state. These states are: Alaska, California, Maine, Michigan, New Mexico, and Rhode Island.

37.88 % and 33.01 % of their total exercise and leisure times on the weekend, respectively, weekend activities do not appear to be associated with minimum wages changes. A potential explanation for this could be the fact that the policy changes affect time use of individuals who are working more than they do for unemployed people. To get a better understanding of the heterogeneous nature of the results, I next re-estimate the effects for different subgroups of the population.

Heterogeneous Effects

Table 6 presents DD effects for groups divided by employment status, gender, and age.[9] Panel A provides estimates for employed individuals and for those who are not in the labor force at the time of the interview. In line with the prediction that minimum wages affect the lives of employed individuals to a larger extent, I find larger declines in health-enhancing activities for this group. Among workers, a $1 increase in the effective minimum wages is associated with a decline of total health time by 26.25 minutes ($p<0.01$), while time allocated towards leisure activities increases by 33.01 minutes ($p<0.01$). It is noticeable that weekly work time is not altered following minimum wage for employed individuals.

Panel B provides evidence that male respondents mainly drive the effects of the study. The results show a $1 increase in real minimum wages reduces the amount of time men exercise and spend on their own health by 23.35 ($p<0.05$) and 33.56 ($p<0.01$) minutes per week, respectively. The corresponding effects for women are small and imprecisely estimated. Finally, Panel C shows that the effects also differ across age groups of the population. While time use of individuals under 30 years of age is not statistically significantly affected by minimum wage changes, I find that individuals between the ages 30 to 45 experience the largest decline in exercise time (21.48 minutes). Furthermore, this age

[9] Table 5 only shows the results on time use during the week. Similar to the main findings of Table 4, no effects are found on time activities on the weekends for all subgroups.

group is shown to increase childcare time by 35.96 minutes ($p<0.01$) following a $1 increase in the effective minimum wage. Respondents between the ages 46 to 64 decrease their total health time by 23.61 minutes ($p<0.01$), while experiencing the largest increase in leisure time (42.04 minutes).

Additional Results

The main estimates in Table 5 show that individuals spend less time on health-related activities and more time on leisure activities following increases in minimum wages. These results, however, do not show whether the observed behavioral changes are driven by certain activities or whether all activities captured in the two categories (Table 2) are affected. Appendix Table A1 shows DD estimates for each health and leisure activity separately. This allows for a better understanding how minimum wages affects time allocation and how these time changes could potentially serve a mechanism between minimum wages and health outcomes. The health estimates show that the overall decline in health time is driven by reductions in both exercising (12.85 minutes, $p<0.01$) and overall time waiting or traveling to obtain medical care (4.35 minutes, $p<0.05$). While the effects for the various leisure activities are not statistically significant, the estimates suggest that individuals reallocate the majority of their new leisure time toward watching television (17.64 minutes) and socializing (11.57 minutes). While reallocating time from physical activity to watching television could lead to both short- and long-run health deteriorations, spending more money and time on socializing with friends following increases in earnings could improve people's well-being and mental health.

In additional specifications, I estimate the effect of contemporaneous minimum wages on time use. These estimates are presented in Appendix Table A2. When comparing the effects with the one-year lagged results (Table 5), it is noticeable that the contemporaneous effects for time spent on both health and leisure activities are smaller in magnitude.

Individuals are found to exercise 9.10 minutes less per week ($p<0.05$) when minimum wages increase by $1, while the lagged estimate is 12.85 minutes ($p<0.01$). Interestingly, the contemporaneous leisure effects provide evidence that individuals equally increase their leisure time across weekdays and weekends, while the lagged results show that these increases are substantially larger during the week.

DDD Results

While the DD models include for state fixed effects, time-varying state-level policies changes in the Earned Income Tax Credit, and state-specific time trends, concerns remain that the analysis is not be capturing other state-level factors that might be changing simultaneously with minimum wages. To address this potential bias, I follow Horn et al. (2017) and use within-state comparisons groups by estimating two DDD models. The comparison groups consist of: 1) retired adults aged 70 or above with at most a High School degree; and 2) individuals between the ages 18 to 64 with at least a college degree.

The DDD results are reported in Table 7. The top of the table shows the DD results for the main treatment group (Table 5), while the remainder of Table 7 shows the effects for the two placebo groups as well as the DDD estimates for each of the two additional within-state comparison groups. For the sample of retired elderly adults, I find that minimum wages have positive effects on total weekly health time, while reducing time allocated towards childcare(both $p<0.10$). The DDD effects for this placebo group indicate reductions in total exercise and health time by 25.46 and 38.55 minutes (both $p<0.01$), while showing a positive treatment effect on time spent on leisure activities by 71.02 minutes during weekdays ($p<0.10$).

In line with the statistics shown in Table 1, changes in minimum wages do not affect time use of individuals with at least a college degree. The estimates for all categories of time use are small and statistically insignificant for this placebo group. Thus, the DDD effects are

similar in magnitude to the main DD estimates. A $1 increase in lagged minimum wages is associated with 18.42 less minutes spent on one's own health during the week ($p<0.05$), while allocating 31.13 additional minutes ($p<0.10$) on leisure activities. While the effects on education and work are negligible, the DDD estimation for this subgroup find an increase in childcare time of 13.92 minutes during the week following higher minimum wages ($p<0.10$).

7. Conclusion

This study adds to the recent growth of interest in examining the effects of minimum wage increases on non-employment outcomes. To my knowledge, this is the first study to test whether minimum wages affect the time use of individuals. The results provide evidence that reductions in health-related time use following minimum wage increases might be one mechanism through which such policy changes can affect people's health. The analysis shows that individuals spend 20 minutes less on their own health between during the week (Monday to Friday) after a $1 increase in minimum wages, while allocating 30 additional minutes toward leisure activities. To put these results into perspective, former President Obama advocated for an increase in the federal minimum wage from $7.25 to $10.10. While 29 states and DC currently have minimum wages in place that are above the federal minimum level, such a reform would increase the wage floor by $2.85 in the remaining 21 states. Based on findings of this study, this corresponds to a decline in time spent on health-enhancing activities by 57 minutes during the week, while increasing leisure time by 85.5 minutes.

The observed declines in time allocated towards one's health activities is in line with recent findings by Horn et al. (2017). Using data from the BRFSS, the authors show that the same potential increase in the federal minimum wage from $7.25 to $10.10 would increase the probability of reporting fair or poor health by 12.93 % and 6.82 % for lesser-skilled men and women the year after the change, respectively. Reducing time spent exercising and on other activities related to one's health may have longer-term effects on obesity and related

health outcomes. The finding that individuals increase the amount of time allocated toward leisure activities, such as eating, watching TV, reading, or socializing, could suggest that individuals mental well-being is positively affected if we assume that these activities provide people more instant utility than time allocated towards health. Again, Horn et al. (2017) provide suggestive evidence for improved mental health following minimum wage increases. For the above-mentioned increase in the federal minimum wage, the authors find a 5.37 % reduction in the number of days in bad mental health.

The study furthermore provides evidence for heterogeneous effects of minimum wages on time allocation. The observed declines in health-enhancing activities and increase in leisure activities for the overall population are largely driven by behavioral changes of males. This is consistent with two previous studies finding suggestive evidence for gender differences in the effects of minimum wages on physical health (Averett et al., 2017) and mental health (Horn et al., 2017). One possible explanation is that the employment share is larger for men than for women in the ATUS data analyzed in this study, suggesting that the policy changes overall has a larger effect on men. Future work should examine these gender differences in more detail to further improve our understanding of how minimum wages affect society.

In a recent working paper that examines BRFSS data for the years 1989 to 2015, Lenhart (2018) finds that higher minimum wages are associated with increases in private insurance coverage and health care utilization, as well reductions in the likelihood of not being able to see a doctor for necessary care due to costs. Combining those results with the findings from this study suggests that minimum wage increases are potentially related with the presence of ex-ante moral hazard. Following increases in their wages, lesser-skilled individuals have better coverage and more frequent doctor visits, while substituting time previously spent on health activities with additional leisure time. However, since health

insurance information is not available in the ATUS data, future work should examine this link between minimum wages and moral hazard in more detail.

It seems likely that several mechanisms are at play underlying the link between minimum wages and health. Additional work is needed to better understand this relationship and to guide policymakers on improving society's well-being. I believe that an overall analysis of the effects of minimum wages should look at the policy's impacts on all aspects of well-being, which includes potentially unintended effects such as reductions in time allocated towards health-enhancing activities. While being outside the scope if this study, it might be of interest for researchers to conduct a welfare analysis of minimum wage increases that includes the effects of these policy changes on a wide range of outcomes.

8. References

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Table 1. Hourly Wage Earners, CPS (2003-2016)

Sample	Wage < 1.10*minimum wage	Wage < 1.20*minimum wage	Wage < 1.25*minimum wage
High school or less	24.21	28.16	30.24
High school	34.91	40.48	43.38
< High school	21.10	24.59	26.43
At least some college	14.85	15.70	16.70
Some college	18.23	21.01	22.51
College graduate	10.47	11.63	12.28
Advanced degree	7.97	8.54	8.81
Male - high school or less	21.80	24.93	26.62
Female - high school or less	27.37	32.40	34.98
White - high school or less	21.75	24.99	26.63
Non-White - high school or less	27.42	32.31	34.98
Ages 18-29 - high school or less	33.97	39.76	42.74
Ages 30-45 - high school or less	21.05	24.54	26.42
Ages 46-64 - high school or less	20.44	23.55	25.19
Married - high school or less	20.03	23.14	24.85
Non-married - high school or less	29.40	34.39	36.95

Table 2. Description of Time Use Activities

(1) Physical activity time
Exercising
(2) Total time spent on own health
Exercising
Self-care
Health care outside the house
In-home health care services
Waiting and travel time to obtain medical care
(3) Total leisure time
Eating
Watching television
Reading
Pet care
Non-health related personal care
Socializing
(4) Total education time
Time spent on education activities
(5) Total work time
Time spent on core work
(6) Total childcare time
Time spent on childcare activities

Table 3. State and Federal Minimum Wage Changes, 2002-2017

Year	States
2002	AK, CA, CT, HI, ID, ME, WA
2003	CT, HI, ME, NM, OR, WA
2004	CT, IL, ME, OR, RI, VT, WA
2005	DC, IL, ME, MN, NJ, NY, OR, VT, WA, WI
2006	CT, FL, HI, ME, MI, NJ, NV, NY, OH, OR, RI, VT, WV
2007	AL, AR, AZ, CA, CO, CT, DE, FL, HI, IA, ID, IL, IN, KY, LA, MA, MD, ME, MI, MO, MS, MT, ND, NE, NH, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, Federal
2008	AL, AZ, CA, CO, DC, DE, FL, IA, ID, IL, IN, KY, LA, MA, MD, ME, MI, MO, MS, MT, NC, ND, NE, NH, NM, NV, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WA, WV, Federal
2009	AK, AL, AZ, CO, CT, DC, DE, FL, GA, ID, IL, IN, KY, LA, MD, ME, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WA, WI, Federal
2010	AK, CO, FL, GA, IL, KS, MO, MT
2011	AZ, CO, IL, MT, NV, OH, OR, VT, WA
2012	AZ, CO, FL, MT, OH, OR, VT, WA
2013	AZ, CO, FL, MO, MT, OH, OR, RI, VT, WA
2014	AZ, CO, CT, DC, DE, FL, MO, MT, NJ, NY, OH, OR, RI, VT, WA
2015	AK, AR, AZ, CA, CO, CT, DC, DE, FL, HI, MA, MD, MI, MN, MO, MT, NE, NJ, NY, OH, OR, RI, SD, VT, WA, WV
2016	AK, AR, CA, CO, CT, DC, HI, MD, MA, MI, MN, NE, NY, OR, RI, SD, VT, WV

Table 4. Summary Statistics, ATUS (2003-2017)

Age	42.170 (13.202)
White	0.789 (0.408)
Black	0.166 (0.372)
Male	0.467 (0.499)
Married	0.483 (0.500)
Never Married	0.273 (0.446)
Number of Children in HH	1.008 (1.216)
High school graduate	0.717 (0.450)
Less than high school	0.283 (0.450)
Employed	0.633 (0.482)
Weekday interview	0.494 (0.500)
Weekend interview	0.506 (0.500)
Total exercise	
Weekdays	62.97 (247.66)
Weekend	38.40 (147.70)
Total time on own health	
Weekdays	122.65 (405.98)
Weekend	51.00 (181.28)
Total leisure time	
Weekdays	1,858.23 (998.04)
Weekend	915.57 (430.73)
Total education time	
Weekdays	63.47 (359.58)
Weekend	8.62 (72.07)
Total work time	
Weekdays	1,417.56 (1,418.21)
Weekend	185.97 (411.74)
Total childcare time	
Weekdays	200.21 (434.67)
Weekend	57.56 (153.44)
Minimum wage (nominal)	6.726 (1.206)
Minimum wage (real)	6.144 (1.559)
Observations	25,887

Table 5. DD Effects of Minimum Wage on Time Use (2003-2017)

	Total Exercise		**Total own health**		**Total leisure**		**Total education**		**Total work**		**Total Childcare**	
Panel A: Weekdays												
Min. Wage	-12.85***	-11.32**	-19.88***	-18.88***	29.62**	29.71*	4.25	3.59	-8.10	-8.05	6.44	5.02
	(4.29)	(4.73)	(7.06)	(6.92)	(14.71)	(16.14)	(6.24)	(6.38)	(24.83)	(23.24)	(6.28)	(6.71)
Sample Mean	62.97		122.65		1,858.23		63.47		1,417.56		200.21	
Observations	25,887		25,887		25,887		25,887		25,887		25,887	
Panel B: Weekends												
Min. Wage	0.26	-0.15	1.14	-0.12	9.46	9.93	-0.66	-0.40	-0.56	-0.50	-0.80	-1.39
	(2.98)	(2.83)	(3.15)	(3.22)	(9.52)	(9.21)	(1.39)	(1.47)	(9.87)	(9.49)	(4.36)	(4.30)
Sample Mean	38.40		51.00		915.57		8.62		185.97		57.56	
Observations	26,497		26,497		26,497		26,497		26,497		26,497	
State-specific time trends	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Robust standard errors, clustered at the state-level, are shown in parentheses. All models control for age, gender, race, marital status, employment status, the number of children living in the household, year and state fixed effects as well as time-varying state policy controls. * p<0.10, ** p<0.05, and *** p<0.01.

Table 6. Heterogeneous DD Effects of Minimum Wage on Time Use (2003-2017)

	Total Exercise	**Total own health**	**Total leisure**	**Total education**	**Total work**	**Total Childcare**	**N**
Panel A: Employment							
Employed	-17.52***	-26.25***	33.01*	3.39	-2.09	-8.47	16,421
	(4.49)	(7.04)	(19.39)	(6.92)	(38.13)	(6.65)	
Not in Labor Force	-7.81	-12.97	44.21	-8.26	5.96	37.42**	7,059
	(11.75)	(16.97)	(42.11)	(11.61)	(10.78)	(16.21)	
Panel B: Gender							
Male	-23.35**	-33.56***	48.44*	13.30	2.28	-7.33	12,118
	(8.89)	(12.06)	(29.10)	(10.20)	(31.22)	(11.35)	
Female	-4.70	-7.40	11.71	-1.46	-13.09	16.07	13,769
	(4.88)	(8.68)	(22.42)	(10.67)	(31.56)	(12.31)	
Panel C: Age							
18 to 29	-5.66	-15.25	16.04	19.17	-66.06	-22.22	5,291
	(8.95)	(12.49)	(36.53)	(25.20)	(57.27)	(19.73)	
30 to 45	-21.48**	-19.34	19.65	3.41	-43.97	35.96***	9,126
	(8.18)	(12.83)	(25.80)	(6.63)	(35.19)	(11.20)	
46 to 64	-8.23	-23.61*	42.04*	5.36*	42.77	-4.78	11,470
	(6.89)	(13.19)	(24.30)	(3.12)	(35.63)	(4.63)	

Robust standard errors, clustered at the state-level, are shown in parentheses. All models control for age, gender, race, marital status, employment status, the number of children living in the household, year and state fixed effects as well as time-varying state policy controls. * p<0.10, ** p<0.05, and *** p<0.01.

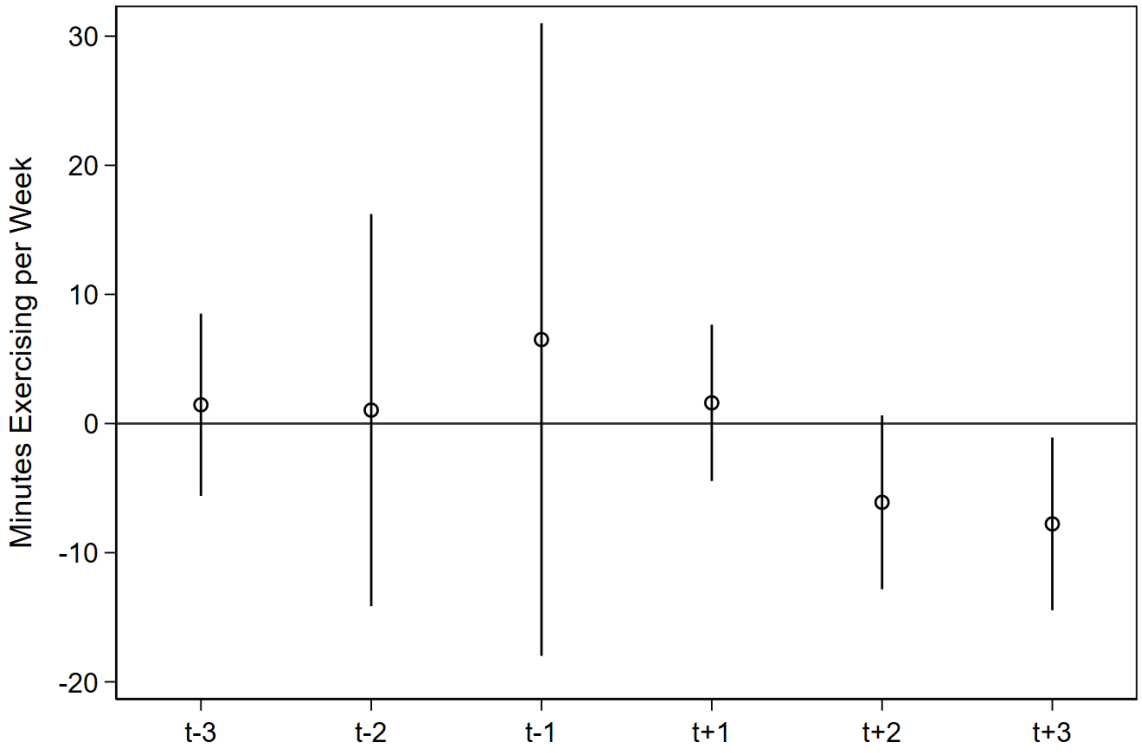
Table 7. DDD Effects of Minimum Wage on Time Use

	Total exercise	**Total own health**	**Total leisure**	**Total education**	**Total work**	**Total childcare**
Sample: 18-64, at most HS degree						
Min. Wage	-12.85***	-19.88***	29.62**	4.25	-8.10	6.44
	(4.29)	(7.06)	(14.71)	(6.24)	(24.83)	(6.28)
Sample mean	79.01	127.36	1,695.12	76.58	1,666.85	135.26
Observations	25,887	25,887	25,887	25,887	25,887	25,887
Sample: 70+, retired, at most HS degree						
Min. Wage	12.61	18.66	-41.39	1.82	1.78	-5.28*
	(8.02)	(10.40)	(39.80)	(1.50)	(11.82)	(3.09)
Sample mean	80.90	190.56	2,787.77	5.15	14.99	6.68
Observations	9,930	9,930	9,930	9,930	9,930	9,930
DDD estimate	-25.46***	-38.55***	71.02*	2.42	-9.88	11.72*
	(8.44)	(13.23)	(42.59)	(6.55)	(25.54)	(6.99)
Sample: 18-64, at least college degree						
Min. Wage	-3.37	-1.47	-1.51	0.73	7.04	-7.48
	(4.28)	(4.89)	(12.94)	(6.36)	(16.26)	(7.59)
Sample mean	98.33	132.89	1,531.94	55.54	1,957.60	281.33
Observations	25,552	25,552	25,552	25,552	25,552	25,552
DDD estimate	-9.48	-18.42**	31.13*	3.52	-15.14	13.92
	(6.26)	(8.77)	(16.22)	(10.09)	(30.58)	(8.06)

Robust standard errors, clustered at the state-level, are shown in parentheses. All models control for age, gender, race, marital status, employment status, the number of children living in the household, year and state fixed effects as well as time-varying state policy controls. * p<0.10, ** p<0.05, and *** p<0.01.

Appendix:

Figure A1. Event Study Estimates: Effects of Minimum Wage on Exercise Time



This picture depicts the coefficients of the interaction terms between the minimum wage variable and the year dummies for minutes exercised per week. Year t is the reference year.

(Note 1: Vertical lines represent the 95% CI).

Table A1. DD Effects of Minimum Wage on Health and Leisure Activities (2003-2017)

Panel A: Health activities	**Exercising**	**Self-care**	**Health care outside the house**	**In-home health care services**	**Waiting and travel for medical care**
Min. Wage	-12.85***	0.05	-2.41	-0.33	-4.35**
	(4.72)	(4.57)	(2.54)	(0.26)	(1.87)
Sample Mean	79.01	22.78	15.61	0.16	9.80
Observations	25,887	25,887	25,887	25,887	25,887

Panel B: Leisure activities	**Eating**	**Watching TV**	**Reading**	**Socializing**	**Non-health personal care**	**Pet care**
Min. Wage	-4.65	17.64	2.93	11.57	1.87	0.26
	(6.66)	(13.95)	(3.52)	(7.59)	(3.83)	(2.43)
Sample Mean	505.13	654.10	70.65	220.67	216.75	27.82
Observations	25,887	25,887	25,887	25,887	25,887	25887

Robust standard errors, clustered at the state-level, are shown in parentheses. All models control for age, gender, race, marital status, employment status, the number of children living in the household, year and state fixed effects as well as time-varying state policy controls. * p<0.10, ** p<0.05, and *** p<0.01.

Table A2. DD Effects of Current Minimum Wage on Time Use (2003-2017)

	Total Exercise		**Total own health**		**Total leisure**		**Total education**		**Total work**		**Total Childcare**	
Panel A: Weekdays												
Min. Wage	-9.10**	-7.67*	-12.49*	-11.92	11.26	12.79	8.96	8.11	-9.70	-8.82	0.79	0.49
	(4.63)	(4.46)	(7.34)	(7.21)	(17.03)	(15.99)	(6.44)	(6.41)	(22.52)	(20.84)	(5.58)	(5.77)
Sample Mean	62.97		122.65		1,858.23		63.47		1,417.56		200.21	
Observations	25,887		25,887		25,887		25,887		25,887		25,887	
Panel B: Weekends												
Min. Wage	-1.27	-2.01	1.78	0.08	10.43*	11.63*	0.21	-0.46	-2.90	-1.49	0.19	-0.82
	(2.46)	(2.44	(2.99)	(3.03)	(6.02)	(6.33)	(1.56)	(1.79)	(6.69)	(6.72)	(2.69)	(3.43)
Sample Mean	38.40		51.00		915.57		8.62		185.97		57.56	
Observations	26,497		26,497		26,497		26,497		26,497		26,497	
State-specific time trends	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Robust standard errors, clustered at the state-level, are shown in parentheses. All models control for age, gender, race, marital status, employment status, the number of children living in the household, year and state fixed effects as well as time-varying state policy controls. * p<0.10, ** p<0.05, and *** p<0.01.