Underemployed Worker's Health: Evidence from States' Minimum Wage Levels

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Abstract

This study investigates whether increases in minimum wage in the United States affect the health of workers working in different forms of non-standard work arrangements that commonly have variable work schedules, lower wages, part-time contracts, or stressful working conditions. Using 2009-2018 Current Population Survey to track under-employed workers between 15 to 85 years of age, we find evidence that, increase in a state's minimum wage improves self-reported health and decreases disability limiting mobility. Our results occur across different age groups, and we find little impact on other health outcomes. We also find evidence of minimum wage increases negatively affecting full-time workers' health.

Keywords: precarious employment, part-time employment, minimum wage, self-reported health

JEL Codes: I14, J31, J38

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I. Introduction

Since the late 1970s, labor markets have noticeably moved away from more secure employment practices towards more “flexible” employment practices to facilitate firm adjustment to market shifts. This helps to reduce the constraints on the movement of workers into and out of jobs previously constrained by labor laws and others that protect workers' income and job security (Kalleberg, 2009; Benach & Muntaner, 2007).

Increasing labor flexibility has led to an increase in the prevalence of “atypical” forms of employment and to a decline in the “standard” full-time, permanent jobs. Standard full-time permanent jobs with benefits are now often replaced with different forms of non-standard work arrangements such as contingent, part-time contracts, unregulated underground work, or home-based work, many of which are characterized by variable work schedules, reduced job security, lower wages, hazards at the workplace and stressful psycho-social working conditions. These type of work arrangements are often referred to as Precarious employment (Benach & Carles, 2007).

Precarious jobs help firms lower cost and maximize profit leading to a rise in these types of employment practices. However, these jobs are characterized by employment that is insecure, uncertain, and unstable and therefore had adverse consequences on the mental and physical well-being of workers and their families (Vosko et al., 2003).

Precarious work suggests that flexible employment can have negative consequences on both professional and private life as well as on health, due to contractual uncertainty, income instability, and worse working conditions. Furthermore, the health consequences of precarious employment, and most of the research on it agrees in attributing to job insecurity having adverse effects on workers’ health, particularly mental health (Andrea et al., 2018; Oddo et al., 2021).

Precarious employment conditions also expose different population sub-groups disproportionately to frequent transitions in labor market activity. For young workers, precarious work has an impact on mental health and increased risky health behaviors, potentially contributed to by the lack of economic and social benefits. Migrant workers are also at increased risk of precarious employment arrangements; they are subject to discrimination and exploitation, further adversely impacting their mental wellbeing. Precarious employment is also more prominent among women workers affecting their health as well as female workers are more often employed in precarious, low-paying occupations, including those within the care sector, than their male counterparts (Gray et al., 2021).

Lastly, workers who are precariously employed often get paid below national minimum wage rates which is the clearest source of in-work poverty. Workers receiving minimum wage (or below) deemed low earnings, are subjected to the employment precarity thereby having the consequences on their health behaviors. So, there is a need for new regulations that raises the minimum wage for all these vulnerable workers, where precariousness poses a threat to the labor market (Cooper, 2019).

To our knowledge, several studies have attempted to evaluate the causal effect of precarious employment on individuals' well-being using a naïve standard regression method by exploring the relationship between health, precarious work, and earnings of workers. These studies, however, did not flush out the nuance of the interaction between these factors (Ledermir & Lewis, 2005; Kim et al. 2008; Reine et al., 2008; Van et al., 2016). Therefore, it is relatively unknown whether the relationship between precarious employment and poor health is disproportionately different across workers with different wage levels.

In this paper, we tried to disentangle this relationship by studying the impact of such employment consequences on workers' health by exploiting the variation in financial strain arising from the changes in state's minimum wages using data from the 2009-2018 Current Population Survey (CPS) to track under-employed workers between 15 to 85 years of age.

II. Background

II.A. Trends in precarious employment

There has been a staggering rise in precarious employment globally with a relentless growth of informal and precarious which are characterized by low pay (often at subsistence level), insecure, unregulated, and unprotected, i.e., without an employment contract or access to representation and social security (Hammer et al., 2021).

Overall, approximately 85.8% of total employment in Africa, 71.4% in Asia and the Pacific, 68.6% in the Arab States and 53.8% in the Americas is either informal (based in the informal economy) or informalized (situated within formal production but based on informal relations) (International Labor Organization [ILO], 2018).

Specifically, in the U.S., a staggering 4.8 million American workers in the year 2017 (which was approximately 3 percent of the consequent labor force) were stuck working in part-time, precarious positions when they would prefer full time work, referred to officially as "involuntary part-time workers" (Bureau of Labor Statistics [BLO], 2018).

These involuntary part-time workers are often forced to piece together two or more jobs just to make ends meet. Often, these jobs are low wage and do not offer benefits, or if they do, the benefits they offer are out of reach financially for many workers. This type of life may leave many

workers mentally and physically exhausted. Rushing from one job to the next often outside of normal hours, leaves little time for family life, leisure, education, or even the ability to look for a better job. While additional data have shown that the total number of workers in this category decreased by 1.1 million over 2017, to 3.4 percent; this is still a high number for an advanced country, and far higher than the pre-2008 crisis level of 2.9 percent (BLS, 2018).

A prior study by Oddo et al. (2021) measured precarious employment in the U.S. via a multidimensional indicator using data from the National Longitudinal Survey of Youth (1988-2016) and the Occupational Information Network database by identifying 13 survey indicators to operationalize 7 dimensions of precarious employment from which they are calculating a longitudinal precarious employment score (PES) which ranged from 0-7, with 7 indicating the most precarious. This study estimated the mean PES and tracked its changes over time in the PES, both overall and by stratifying it with respect to (w.r.t.) race/ethnicity, gender, education, income, and region and found that the long-term decreases in employment quality were widespread in the U.S. where women and those from racialized and less-educated populations remain disproportionately precariously employed. This study also observed that the largest increases in precarious employment over time happened among men, college graduates and higher-income individuals in the U.S.

II.B. Precarious employment and health

Precarious employment is characterized by unstable and unpredictable work schedules with variable work hours, short advance notice of weekly schedules, and frequent last-minute changes to shift-timings, which leads to poor health outcomes in adults, complexity and informality in childcare arrangements, and behavioral problems in young children. Exposure to these types of work increases household economic insecurity and work-life conflict, leading to

diminished sleep quality and increased psychological distress in adults which in turn leads to poor health (Benach & Muntaner, 2007; Kim et al., 2008).

Prior studies have tried to evaluate the associations between precarious employment and health-related outcomes in workers. It has been shown that, there are significant associations between having a precarious job and health problems, caused/worsened by said job like, stress/depression/anxiety, musculoskeletal problems, infectious diseases, respiratory problems, accidents/injuries, and allergies (Matilla-Santander et al., 2020). It has also been demonstrated that, among European wage workers, flexible and de-standardized employment tends to be related to lower job satisfaction and lower general & mental health leading to the quality of employment serving as an important social determinant of health (inequalities) in Europe (Van et al., 2016).

Precarious employment also affects mental health more generally and these effects are prominent in both male and female employees with male people being at higher risk of mortality due to unstable working conditions. These results add to existing evidence of a significant association between precarious employment and self-rated physical and mental health. However, there is limited evidence of precarious work affecting the health of young individuals or migrant workers (Gray et al., 2021; Jonsson et al., 2021).

Precarious work arrangements are also associated with poor health conditions. Workers on temporary or agency contracts are often exposed to hazardous work environments, stressful psychosocial working conditions, increased workload, and disproportional travel time between multiple jobs at multiple sites leading to economic difficulties which are also an important determinant of health, especially mental health (Wilkinson, 2016).

Precarious working conditions were widespread and prominent during the 2008 global financial recession. At that time, the recession increased workers' economic difficulties and reduced the possibility of finding a new job in case of dismissal leading to negative consequences of the economic crisis on workers' mental health and stress. Back then, precarious working conditions, emerged as one of the main risk factors, for working age population with a more disadvantageous socioeconomic position (Martin-Carrasco et al., 2016).

This section highlights that there has been a lot of studies which try to evaluate the detrimental impact of precarious employment on health especially in European countries. Hence, to our knowledge such studies in the landscape of the U.S. is lacking which is the primary motivation for this research.

II.C. Minimum wage and precarious employment

Unstable and uncertain working conditions are characterized by low wages which are often below the national average minimum wage. Precarious employment has already been measured on a continuum for a more nuanced approach to assessing employment quality with the average PES throughout follow-up being significantly higher among people with lower income highlighting that these workers are often paid wages which are at or below the state's minimum wage levels (Odoo et al., 2021).

It has also been critically examined using detailed qualitative research, how low-paid workers, needing to work in more than one legitimate job to make ends meet, attempted to reconcile work and life, revealing that, these workers had to do two, three, four, five and even seven different jobs due to low-pay, limited working hours and employment instability thereby

identifying, the interconnections between economic and temporal challenges of low-pay, insufficient hours, and precarious employment (Smith & McBride, 2021).

Cooper (2019) stated that low income from cash in hand jobs, temporary employment paid below national minimum wage rates is the clearest source of in-work poverty as the work conducted without a contract makes it hard for individuals to document their employment history and access in-work benefits hindering their career progression and these workers receiving minimum wage (or below), are subjected to the employment precarity which has adverse consequences on their health behaviors thereby arguing that, there is a need for new regulations that raises the minimum wage level to help these workers.

This leads to the theory that, there may be a link between the minimum wage and precarious employment. Our paper exploits this relationship where changes in states' minimum wages have differential impacts on the precariously employed relative to more standard employment arrangements.

II.D. Minimum wage and health

Economists have looked at the impact of minimum wage on various labor market outcomes such as levels of employment, but fewer have looked at the impact of minimum wage on non-labor-market outcomes namely, health outcomes, especially in the U.S..

Outside the U.S., it has been shown that, workers whose wages rose above the minimum wage, experienced lower probability of mental ill health compared to otherwise similar persons who were likely unaffected by the wage rise (Reeves et al., 2017).

In the U.S., Horn et al. (2017) investigated whether minimum wage increases impact worker health in the U.S using measures on self-reported general, mental, and physical health from

the 1993 to 2014 Behavioral Risk Factor Surveillance Survey (BRFSS). Their results concluded that, while there was little evidence that minimum wage increases led to improved worker health among both men and women, there was a small beneficial effect of increasing minimum wage towards decreasing mental strain among employed workers.

It is often the case that workers who are precariously employed earn their wages at (or close to below) the minimum wage level of their residing states. This helped us to identify a potential causal pathway of minimum wage affecting precarious employment which in turn impacts workers health. Our paper is built upon the hypothesis that, workers who face job precarity but live-in states where the minimum wage is higher will eventually have better health outcomes in the short term as well as in the long term as opposed to workers who are precariously employed but reside in states where the minimum wage level is lower.

III. Conceptual Framework

In this paper we are trying to explore the relationship between underemployed workers and their health. This relationship can happen through several pathways. We are following the conceptual framework provided by Rashad and Sharaf (2018) where precarious work and individual's well-being are linked within a broad institutional context (Benach et al., 2007; Kim et al., 2008).

As opposed to standard employment arrangements, precariously employed individuals face poorer working conditions like more physically intensive works, overtime work with no pays and hazardous work leading to detrimental health consequences and they are at a more risk of facing occupational injuries (Benach et al., 2004). Additionally, these workers and their families live constant stressful lives without any economic stability thereby contributing towards impairment

of their mental health conditions. They also have no support at work from wither their supervisors or co-workers and this lack of support can also lead to psychosocial stress (Clarke et al., 2007; Elcioglu, 2010; Mirowsky & Ross, 1986). These workers also have less or no workplace rights and are often not given any opportunity towards getting a promotion.

Additionally, precarious employees are usually paid very low wages and do not have any sort of health insurance which can lead to material deprivation thereby affecting other social determinants of health like ability to access care, and/or proper housing conditions (Lewchuk et al. 2008; Vives et al. 2013). Again, since precarious employment is insecure and characterized by low wages, and poor working conditions, this can lead to stress, depression, and sleep deprivation among these workers and which in turn can cause uncertainty on the worker's personal lives and future-plans (Clarke et al. 2007; Ferrie et al. 2008).

Combined, precarious jobs tend to affect an individual's health both mentally and physically leading to possible health risk behaviors within these individuals. Additionally, this also tends to hamper the individual's non-health outcomes leading to poor wellbeing or even unhappy marriages thereby, disrupting the individual's families.

IV. Data

IV.A. Data Source(s)

We utilized data from the 2009-18 Current Population Survey (CPS), which is a nationally representative survey of about 60,000 U.S. households conducted by the United States Census Bureau for BLS and is the primary source of labor statistics data for the population of the U.S.. CPS harmonizes microdata from the monthly U.S. labor force survey covering the period from 1962 to present. Using the Annual Social and Economic Supplement (ASEC) component of the

CPS we can also take advantage of the longitudinal design of the CPS to track annual measures on workers.

Information on each state's yearly minimum and median wage was obtained from the BLS.

We also utilized state level data on the annual unemployment rate from the BLS, as well as annual poverty rate and median annual household income from the U.S. Census Bureau.

IV.B. Study Population

The study cohort includes all individuals living in the U.S. from ages 15-85 and have been segregated into different age groups for analyses purposes, namely – for all ages (18-85); teenagers (15-19); working adults (19-64); all adults (>=19) and elderly (>=65).

IV.C. Study Variables

Using CPS data via Integrated Public Use Microdata Series (IPUMS) enables us to use harmonized microdata from the U.S. labor force survey annually. Here we have data on demographic information, rich employment data, program participation and supplemental data on other topics.

We are interested in identifying the impact of precarious employment on health and our outcome variables are measures on whether the individual had any physical or mental health condition that has lasted at least 6 months and made it difficult for them to take care of their own personal needs; whether the individual had any physical, mental, or emotional condition lasting six months or more that made it difficult or impossible for them to perform basic activities outside the home alone; whether the individual has cognitive difficulties (such as remembering,

concentrating, or making decisions) and whether the respondent reported their health status as poor.

The explanatory variables of interest are whether the individual is precariously employed or employed part-time or employed full-time and the one-year lagged average minimum wage of the individual's residing state. We have defined, precarious worker as an individual who works part-time (<=30 hours/week) and earn low wages (wage < 2/3*State Median wage); part-time worker as an individual who works at most 30 hours/week and full-time worker as an individual who works at least 40 hours/week.

Lastly, to adjust for individual and state-level characteristics, we will use information on the individual's age, sex, race/ethnicity, marital status, level of education, total family income, family size and receipt of any supplemental income. We will also adjust for the state level characteristics of poverty rate, unemployment rate and median household income.

IV.D Summary of Study Variables

In the final study sample, we have information on 273,000 unique workers among whom 198,251 can be classified as full-time workers, 51,236 can be classified as part-time workers and 47,216 can be classified as precariously employed workers. It should be noted that precarious, part-time, and full-time employment is not mutually exclusive and exhaustive in our study sample.

We see that the workers who are either precariously employed or employed part-time is younger than those who are employed full-time in our study sample (Table. 1). Also, we have more female workers in part-time or precarious capabilities compared to full-time employment. While there is no significant differences in the racial or ethnic makeup between part-time, precarious and full-time workers, it is evident that precarious or part-time employees are less educated than their

full-time counterparts. Lastly, unsurprisingly the average family income of both part-time and precariously employed workers are lower than those working full-time.

Table 1: Descriptive Statistics by Employment Type

	EMPLOYED PRECARIOUSLY	EMPLOYED PART-TIME	EMPLOYED FULL-TIME	TOTAL
	N=101,989	N=113,614	N=572,498	N=747,186
Age	36.69 (17.28)	37.68 (17.26)	42.54 (12.21)	41.70 (13.34)
Sex				
Female	68,915 (68%)	76,091 (67%)	245,500 (43%)	363,661 (49%)
Male	33,074 (32%)	37,523 (33%)	326,998 (57%)	383,525 (51%)
Race/Ethnicity				
Non-Hispanic White	65,260 (64%)	73,985 (65%)	362,489 (63%)	474,416 (63%)
Non-Hispanic Black	9,814 (10%)	10,637 (9%)	59,789 (10%)	77,485 (10%)
Non-Hispanic Asian	5,330 (5%)	6,023 (5%)	36,400 (6%)	45,267 (6%)
Non-Hispanic Other	3,331 (3%)	3,598 (3%)	16,158 (3%)	21,520 (3%)
Hispanic	18,254 (18%)	19,371 (17%)	97,662 (17%)	128,498 (17%)
Current Marital Status				
Married	41,562 (41%)	49,699 (44%)	359,915 (63%)	442,115 (59%)
Single	57,659 (57%)	60,869 (54%)	204,329 (36%)	292,378 (39%)
Widowed	2,768 (3%)	3,046 (3%)	8,254 (1%)	12,693 (2%)
Educational Attainment				
No Years of Schooling	221 (0%)	228 (0%)	875 (0%)	1,250 (0%)
Some Schooling	17,335 (17%)	17,680 (16%)	34,784 (6%)	57,619 (8%)
High School	28,532 (28%)	30,262 (27%)	157,673 (28%)	206,666 (28%)
Some College	27,279 (27%)	28,857 (25%)	95,449 (17%)	136,143 (18%)
Associates Degree	9,198 (9%)	10,570 (9%)	61,644 (11%)	80,493 (11%)
Bachelor's Degree	13,649 (13%)	17,235 (15%)	139,800 (24%)	168,760 (23%)
Master's Degree or Higher	5,775 (6%)	8,782 (8%)	82,273 (14%)	96,255 (13%)
Total Family Income	74529.38 (78931.26)	82134.25 (89342.58)	98673.58 (94689.07)	94409.84 (92959.60)
Family Size	3.35 (1.64)	3.32 (1.62)	3.12 (1.56)	3.15 (1.57)
Received any Supplemental Income				
No	101,855 (100%)	113,467 (100%)	571,719 (100%)	746,164 (100%)
Yes	134 (0%)	147 (0%)	779 (0%)	1,022 (0%)
Median Household Income	56072.93 (9203.13)	55978.62 (9213.22)	56003.71 (9455.28)	55964.96 (9394.56)
Annual Poverty Rate	14.12 (2.81)	14.16 (2.82)	14.36 (2.88)	14.32 (2.87)
Annual Unemployment Rate	6.58 (2.38)	6.59 (2.38)	6.53 (2.35)	6.55 (2.35)

Note: Precarious, part-time, and full-time work are not mutually exclusive and exhaustive. Mean (Standard Deviation) have been reported for all the continuous variables and Frequency (Percentages) have been reported for all the categorical or binary variables.

V. Methods

V.A. Empirical Approach

The first step in our analysis is to explore the relationship between changes in minimum wage and employed individual's health across the U.S. states. To accomplish this, we follow methods established by Horn et al. (2017), but instead utilize annual data.

Specifically, for this first analysis we use individual-level data on workers and their health outcomes from the CPS over the years 2009-18 to estimate the following equation using Ordinary Least Squares (OLS):

$$Y_{ist} = \beta_0 + \beta_1 MW_{st-1} + \beta_2 \boldsymbol{Z}_{st} + \beta_3 \boldsymbol{X}_{ist} + \theta_s + \delta_t + \eta * t + \mathcal{E}_{ist} \quad (1)$$

where i indexes an individual, s indexes state and t indexes year. Y is dependent variable and refers to the different individual level health outcomes; MW_{st-1} refers to the one year lagged average minimum wage of the corresponding individual's residing state; **Z** is a vector of time-varying state level covariates; **X** is a vector of individual level covariates; θ and δ refers to state and year fixed effects respectively; η*t refers to state-specific linear time trends and $\mathcal{E}$ refers to the error term.

Then to build on Horn et al. (2017), now we explore how the relationship between minimum wage and individual health varies depending on the class of employment. This is the primary objective of our study. We seek to estimate how the relationship between minimum wage and health differs when the workers fall into a underemployed or precarious classification.

More specifically, we interact the variables of interest in equation (1) with binary variables for different types of employment measured at the individual level.

$$Y_{ist} = \beta_0 + \beta_1 MW_{st-1} + \beta_2 EmpType_{ist} + \beta_3 MW_{st-1} * EmpType_{ist} + \beta_4 \boldsymbol{Z}_{st} \quad (2)$$
$$+ \beta_5 \boldsymbol{X}_{ist} + \theta_s + \delta_t + \eta * t + \mathcal{E}_{ist}$$

the key difference between equations (1) and (2) is the inclusion of $EmpType$, a binary variable that takes on the value of 1 if an individual has a specific employment type (precarious or part-time employment; full-time employment is also used later for falsification tests).

V.B. Falsification Tests

To check falsification test, we re-run equation (2) with the binary variable $EmpType$ being equal to full-time employment indicating whether the individual worked at least 40 hours per week. Changes in state's minimum wage levels should have minimal impact on an individual's health if he or she if employed full-time and has no uncertainty about their future.

VI. Results

VI.A. Effect of minimum wage changes on worker's health

Table 2 reports the estimates of the coefficients of interest from equation (1).[1] Only the estimate of β_1, the estimated effect of the minimum wage on worker health is reported. Each panel corresponds to a different choice of outcome variable, and each column corresponds to a different subset of ages for the individuals used in the estimation sample.

The results in table 2 do not show any consistent association between minimum wage and health of workers. For difficulty remembering, and self-reported poor health status, all estimates are both small in magnitude and not statistically significant at the conventional levels. For ages

[1] Other specifications with no fixed effect, no covariates, and no time-trends are reported in the Appendix. We did not find any consistent effect of minimum wage on health of workers in these models.

15-19 we estimate a small 0.2 percentage point (pp) increase in the likelihood of reporting a disability that limits mobility when the minimum wage increases by $1, which represents a 67.57% increase over the mean. Although, this indicates a substantial increase from the mean, the total number of teenagers who reported having a disability limiting mobility is very low and hence we cannot properly gauge the effect of changes in minimum wage on this health outcome within this sub-group as the chances of teenage workers having a disability is generally quite low. Also, for ages 65+ we estimate a small 0.3 percentage point decrease in the likelihood of reporting a personal care limitation when the minimum wage increases by $1, which represents a 47.02% decrease over the mean. This also indicates a substantial decrease from the mean, and this indicates that for elderly working people a minimum wage increase has a beneficial effect on their personal care. However, overall, these results to not show a consistent relationship between minimum wage and health outcomes.

Our results compared to Horn et al. 2017 are very similar. Their paper found minimal impact of minimum wage changes on health and for certain outcomes their paper reported that, minimum wage increases led to worse health outcomes. They also reported that, increasing minimum wage had a small positive effect on improving mental health. In our study for the health outcome of having a disability limiting mobility we find a negative effect of minimum wage increases while for the outcome of personal care limitation we find a positive effect. However, these effects occur only for certain age-groups and are generally not robust to other specifications.

Table 2: Effect of changes in Minimum Wage on Health across multiple age-groups

	All Ages	15-19	19-64	19+	65+
Panel A: Difficulty Remembering					
Lagged Minimum Wage	0.001	0.001	0.001	0.001	0.001
	(0.000)	(0.003)	(0.000)	(0.000)	(0.003)
Mean of Outcome (%)	0.773	1.314	0.749	0.761	1.031
Panel B: Disability Limiting Mobility					
Lagged Minimum Wage	0.000	0.002*	0.000	0.000	-0.002
	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)
Mean of Outcome (%)	0.363	0.296	0.340	0.365	0.929
Panel C: Poor Health Status					
Lagged Minimum Wage	0.002	0.003	0.002	0.002	0.004
	(0.001)	(0.004)	(0.001)	(0.001)	(0.008)
Mean of Outcome (%)	5.586	1.873	5.448	5.667	10.710
Panel D: Personal Care Limitation					
Lagged Minimum Wage	-0.000	0.001	0.000	-0.000	-0.003**
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Mean of Outcome (%)	0.179	0.071	0.162	0.182	0.638
Year Fixed Effects	YES	YES	YES	YES	YES
State Fixed Effects	YES	YES	YES	YES	YES
State Specific Time Trends	YES	YES	YES	YES	YES
Observations	747186	23974	700785	731346	30561

Standard error in parenthesis
* p<0.01 ** p<0.05 *** p<0.001

VI. B. Effect of precarious employment on health w.r.t. changes in state's minimum wage levels

Table 3 reports the estimates of the coefficients of interest from equation (2) where $EmpType$ corresponds to precarious employment (a worker is precariously employed if he/she works less than or equal to 30 hours/week and earn wages at a hourly rate which is less than two-third of their state's median wage).[2] Only the estimate of β_3, the estimated interacted effect of the

[2] Other specifications with no fixed effect, no covariates, and no time-trends are reported in the Appendix. We did not find any consistent effect of minimum wage on health of workers in these models.

minimum wage and employment type on worker health is reported. Each panel corresponds to a different choice of outcome variable, and each column corresponds to a different subset of ages for the individuals used in the estimation sample.

The results in table 3 indicates that, there is a relationship between precarious work and health of workers stratified by changes in minimum wage. With the exception of teenagers (aged 15-19), we estimate a significant decrease in the likelihood of reporting a disability that limits mobility (0.1pp, 0.1pp, 0.2pp and 0.2pp for the age-groups: all ages, 19-64, 19+ and 65+, respectively) among precarious workers who live in a state where the minimum wage increases by $1, compared to other precarious workers who live in a state where minimum wage remains unchanged. At the mean these changes represent a 27.55%, 29.41%, 54.80% and 21.53% decrease respectively. Again, with the exception of teenagers (aged 15-19) and the elderly aged (65+), we estimate a significant decrease in the likelihood of reporting poor health status (0.2pp, 0.2pp and 0.3pp for the age-groups: all ages, 19-64 and 19+, respectively) among precarious workers who live in a state where the minimum wage increases by $1, compared to other precarious workers who live in a state where minimum wage remains unchanged. At the mean, these changes represent a 3.58%, 5.51% and 5.29% decrease, respectively.

The effects of precarious work on health are consistent across all specifications and they indicate that minimum wage increase is beneficial to a precarious worker's health if he/she resides in state where the minimum wage is higher. For the other health outcomes of difficulty remembering, and reporting a limitation in their personal care, the estimates are not statistically significant at the conventional levels.

Table 3: Effect of precarious work on health for different age groups stratified by changes in minimum wage

	All Ages	15-19	19-64	19+	65+
			Panel A: Difficulty Remembering		
Min Wage x Precarious	-0.002	0.003	-0.002	-0.002	-0.002
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Mean of Outcome (%)	0.773	1.314	0.749	0.761	1.031
			Panel B: Disability Limiting Mobility		
Min Wage x Precarious	-0.001*	0.001	-0.001*	-0.002**	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean of Outcome (%)	0.363	0.296	0.340	0.365	0.929
			Panel C: Poor Health Status		
Min Wage x Precarious	-0.002*	-0.001	-0.003**	-0.003**	-0.005
	(0.001)	(0.002)	(0.001)	(0.001)	(0.005)
Mean of Outcome (%)	5.586	1.873	5.448	5.667	10.710
			Panel D: Personal Care Limitation		
Min Wage x Precarious	-0.000	-0.000	-0.000	-0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Mean of Outcome (%)	0.179	0.071	0.162	0.182	0.638
Year Fixed Effects	YES	YES	YES	YES	YES
State Fixed Effects	YES	YES	YES	YES	YES
State Specific Time Trends	YES	YES	YES	YES	YES
Observations	747186	23974	700785	731346	30561

Standard error in parenthesis
* p<0.01 ** p<0.05 *** p<0.001

VI. C. Effect of part-time employment on health w.r.t. changes in state's minimum wage levels

Table 4 reads the same as table 3 and reports the estimates of the coefficients of interest from equation (2) where $EmpType$ corresponds to part-time employment (a worker is employed part-time if he/she works less than or equal to 30 hours/week).[3]

[3] Other specifications with no fixed effect, no covariates, and no time-trends are reported in the Appendix. We did not find any consistent effect of minimum wage on health of workers in these models.

Like table 3, the results in table 4 indicates that, there is a relationship between part-time work and health of workers stratified by changes in minimum wage. With the exception of teenagers (aged 15-19), we estimate a significant decrease in the likelihood of reporting a disability that limits mobility (0.1pp, 0.1pp, 0.1pp and 0.4pp for the age-groups: all ages, 19-64, 19+ and 65+, respectively) among part-time workers who lives in a state where the minimum wage increases by $1, compared to other part-time workers who lives in a state where minimum wage remains unchanged. At the mean these changes represent a 27.55%, 29.41%, 27.40% and 43.06% decrease, respectively. Again, with the exception of teenagers (aged 15-19) and the elderly aged (65+), we estimate a significant decrease in the likelihood of reporting health status to be poor (0.2pp, 0.3pp and 0.3pp for the age-groups: all ages, 19-64 and 19+, respectively) among part-time workers who lives in a state where the minimum wage increases by $1, compared to other part-time workers who lives in a state where minimum wage remains unchanged. At the mean, these changes represent a 3.58%, 5.51% and 5.29% decrease, respectively.

The effects of part-time work on health are also consistent across all specifications and they indicate that minimum wage increase is beneficial to a part-time worker's health if he/she resides in state where the minimum wage is higher. For the other outcomes of difficulty remembering, and reporting a limitation in their personal care, the estimates are not statistically significant at the conventional levels.

Table 4: Effect of part-time work on health for different age groups stratified by changes in minimum wage

	All Ages	15-19	19-64	19+	65+
			Panel A: Difficulty Remembering		
Min Wage x Precarious	-0.001	0.003	-0.002	-0.002	-0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Mean of Outcome (%)	0.773	1.314	0.749	0.761	1.031
			Panel B: Disability Limiting Mobility		
Min Wage x Precarious	-0.001**	0.001	-0.001*	-0.001**	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mean of Outcome (%)	0.363	0.296	0.340	0.365	0.929
			Panel C: Poor Health Status		
Min Wage x Precarious	-0.002*	-0.002	-0.003**	-0.003**	-0.005
	(0.001)	(0.002)	(0.001)	(0.001)	(0.004)
Mean of Outcome (%)	5.586	1.873	5.448	5.667	10.710
			Panel D: Personal Care Limitation		
Min Wage x Precarious	-0.000	-0.001	-0.000	-0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Mean of Outcome (%)	0.179	0.071	0.162	0.182	0.638
Year Fixed Effects	YES	YES	YES	YES	YES
State Fixed Effects	YES	YES	YES	YES	YES
State Specific Time Trends	YES	YES	YES	YES	YES
Observations	747186	23974	700785	731346	30561

Standard error in parenthesis
* p<0.01 ** p<0.05 *** p<0.001

VI.D. Effect of full-time employment on health w.r.t. changes in state's minimum wage levels

Table 5 reads the same as table 4 and reports the estimates of the coefficients of interest from equation (2) where $EmpType$ corresponds to full-time employment (a worker is employed full-time if he/she works at least 40 hours/week) as a part of falsification tests.[4]

[4] Other specifications with no fixed effect, no covariates, and no time-trends are reported in the Appendix. We did not find any consistent effect of minimum wage on health of workers in these models.

Table 5: Effect of full-time work on health for different age groups stratified by changes in minimum wage

	(1)	(2)	(3)	(4)	(5)
			Panel A: Difficulty Remembering		
Min Wage x Full-Time	0.001*	-0.004	0.002*	0.002*	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Mean of Outcome	0.773	1.314	0.749	0.761	1.031
			Panel B: Disability Limiting Mobility		
Min Wage x Full-Time	0.001**	-0.001*	0.001**	0.001**	0.002
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Mean of Outcome (%)	0.363	0.296	0.340	0.365	0.929
			Panel C: Poor Health Status		
Min Wage x Full-Time	0.002	0.006**	0.002**	0.002**	0.004
	(0.001)	(0.003)	(0.001)	(0.001)	(0.004)
Mean of Outcome (%)	5.586	1.873	5.448	5.667	10.710
			Panel D: Personal Care Limitation		
Min Wage x Full-Time	0.000	0.001	0.000	0.000	-0.001
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Mean of Outcome (%)	0.179	0.071	0.162	0.182	0.638
Year Fixed Effects	YES	YES	YES	YES	YES
State Fixed Effects	YES	YES	YES	YES	YES
State Specific Time Trends	YES	YES	YES	YES	YES
Observations	747186	23974	700785	731346	30561

Standard error in parenthesis
* p<0.01 ** p<0.05 *** p<0.001

The results in Table 5 indicate that, while there is an effect of changes in minimum wage on full-time employed workers for the health outcomes of reporting poor health status and having a disability limiting mobility these effects are all positive and goes against the hypothesis stated in this paper. Therefore, it can be surmised that while minimum wage increases have a beneficial effect on the health of workers who are under-employed, such increases do not have the same effect for those who are working full-time, thereby validating our falsification checks.

VII. Discussion

The findings in our paper indicate that, changes in state's minimum wage have a statistically significant impact on the health outcomes of self-reported health and having a disability that limits mobility among both precarious and part-time workers. For the outcome of having a disability that limits mobility, these effects were prominent across all age-groups barring teenagers (15-19). For the outcome of poor self-reported health, these effects were prominent across all age groups barring teenagers (15-19) and the elderly (greater than or equal to 65).

It should be noted that, in the past literature there has been no single definition of precarious work. This is mainly because there are several major difficulties in operationalizing the idea of precarious work as there is no single established definition, and existing definitions used in data sources (e.g., of part-time work, temporary work, fixed-term contracts, self-employment) are related to precarious work but cannot be perfectly equated with it (Kalleberg, 2014).

Prior studies have used different working definitions for precarious employment. Albelda et al. (2020) defined precarious work as a binary indicator equal to 1 if the worker *i* is in one or more of the three measures (uncertain, unprotected and economically insecure work) at time *t* and is equal to 0, otherwise. Oddo et al. (2021) identified 13 survey indicators to operationalize a dimension for measuring precarious work called the PE score, which went from 0 to 7 (with 7 indicating most precarious). Olsthoorn (2013) proposed two integrated indicators for measuring specific aspects of precarious employment with indicator 1 focusing on income insecurity which was constructed using wage, supplementary income, and unemployment benefit entitlements and indicator 2 focusing on job insecurity which was constructed using contract type and unemployment duration.

Based on these definitions, it can be formulated that the general concept of precarious employment encompasses low-quality employment, which is characterized by low wages, job insecurity and irregular working hours, making employment risky and stressful for the worker and their families (Kalleberg, 2014).

In this paper we have defined precarious work similarly. Our definition indicates that, a worker *i* working in state *s* at year *t* is precariously employed if he/she works part-time and earn lower wages throughout the year and neither works full-time and is nor unemployed. We have determined part time work to be the type of employment with 30 or less hours worked per week. This follows from the definition of part-time work as stated by the Society for Human Resource Management (SHRM). Additionally, we have defined low wage as wage rate which is lower than two-third of the state's median wage. This follows from Gautié and Schmitt (2009) and the Organisation for Economic Co-operation and Development (OECD, 2010).

To link precarious employment and health, we have tried to identify the primary channel through which precarious employment can affect the health of workers. Based on this, we have determined that the economic strain that comes from working in these low paying stressful precarious jobs is one of the major channels through which these can be linked. With respect to this, we know that workers who are subjected to employment precarity often earn wages at the lowest income quartile or at the minimum wage (Kalleberg, 2014; Cooper, 2019). While there have been variations in the definitions of precarious work used previously and having used one such definition in this paper, the focus of interest should be on how the health of these workers get affected within the economy. Existing theories certainty prove that these workers are affected by minimum wage level changes, irrespective of what precarious work encompasses and these changes have differential impacts on their health (Kalleberg et al. 2014).

This enabled us to propose the theory that, there is a link between the minimum wage and precarious employment formulating our hypothesis that changes in states' minimum wage levels should have different impacts on the precariously employed relative to more standard employment arrangements. Under this hypothesis, we took advantage of the variation in economic strain arising from the changes in the minimum wage levels and observed how these shocks differentially impact the precariously employed.

In the U.S., the study of job precarity and its subsequent impact on health is still in its infancy. However, given the fact that precarious employment has been on the rise since 1988 in the U.S. and such employment had adverse effect on workers' health, due to the nature of precariousness which includes - contractual uncertainty, income instability, and worse working conditions, among others (Oddo et al., 2021); we tried to look at health of under-employed workers in the U.S. encompassing both precarious and part-time workers via changes in state's minimum wage levels.

VIII. Conclusion

In our paper we find that, minimum wage increases are beneficial to precarious or part-time worker's health and these effects were only prominent among under-employed workers and were not present for those working full-time. Our findings suggest that, increasing minimum wage uniformly across all states could improve the health of under-employed (precarious or part-time) workers.

To put our findings into perspective, the "Contingent and Alternative Employment Arrangements Summary" published by the BLS (2018) in the Economic News Release, reported that, 4.8 million Americans were employed in precarious or part-time positions in 2017. The

nationally representative nature of the CPS enables us to make a plausible estimate of the percentage of these precarious or part-time workers who have adverse health outcomes.

In the CPS, 5.59% of all workers on average report having poor health status which translates to approximately 268,320 precarious or part-time working Americans perceiving their health status to be poor in 2017. This is likely a lower bound, as precarious workers might have adverse outcomes at a higher rate than the general population. Based on our primary results, a $1 increase in minimum wage would lead to a 3.58% decrease at the mean in the likelihood of having poor self-reported health for precarious workers of all ages. This translates to approximately 9,606 precarious workers nationally being better off in terms of their health status with a dollar increase in minimum wage.

If we repeat this exercise for the outcome on having a disability that limits the worker's mobility, in the CPS 0.363% of all workers on average report having a disability that limits their mobility which translates to approximately 17,424 precarious or part-time working Americans having said disability in 2017. Again, this is likely a lower bound, as precarious workers might have adverse outcomes at a higher rate than the general population. Based on our primary results, a $1 increase in minimum wage would lead to a 27.55% decrease at the mean in the likelihood of having a disability that limits their mobility for precarious workers of all ages. This translates to approximately 4800 precarious workers nationally being better off in terms of having a disability limiting mobility with a dollar increase in minimum wage.

Based on these back of the envelope calculations, it can be concluded that underemployed workers will be better off in the U.S. with a uniform rise in minimum wage levels. However, further research is needed using other outcomes especially mental health outcomes to gauge the full extent of minimum wage changes on under-employed worker's health.

IX. References

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