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Abstract

We provide new evidence on the role of physical job demands and the physical work environment on retirement outcomes by linking occupation-level data on job requirements from the Occupational Requirements Survey (ORS) to individual-level data from the Health and Retirement Study (HRS). Using alternative strategies to address missing data, and after examining the concurrent validity of ORS job requirements with analogous measures from the Occupational Information Network (O*NET), we create a composite index of physical job demands comprising strenuous physical activities (e.g., lifting and strength) and a composite index of physical work environment comprising hazardous or taxing environmental conditions (e.g. noise, heat). We use these validated indices to estimate associations between job demands and retirement outcomes controlling for observed individual and household characteristics. We find that a one standard deviation increase in our index of physical jobs demands is associated with a 10 percentage point increase in the probability of being retired at any age and a 1.8 percentage point increase in the probability of transitioning into full retirement from full-time work. The same size increase in our physical work environment index is associated with a 7 percentage point increase in the probability of being retired, but it does not provide additional explanatory variation for transitions into retirement. These effects are almost entirely concentrated in men, who hold jobs that are significantly more physically demanding than women's, and they are also larger among older and less-educated workers.

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1. Introduction

Dramatic changes in life expectancy in recent decades, coupled with only small changes in the eligibility age for claiming retirement benefits, have tended to increase the proportion of an individual's life spent in retirement. This phenomenon has slowed labor force growth (Maestas, Mullen, and Powell 2016) and presents challenges to the financial sustainability of Social Security and other public programs (Gruber and Wise 2004). One potential policy response is to encourage older individuals to work longer, for example by raising the eligibility age for claiming Social Security retirement benefits. However, increasing the incentives to delay retirement does not automatically translate into all older individuals being able to work longer even if they are willing. The effectiveness of such policies will ultimately depend on factors such as the individual's health and the nature of job demands at work, particularly physical job demands as the age-decline in functional physical abilities of workers accelerates starting in the mid-40s (Lopez Garcia, Maestas, and Mullen 2019). Understanding how physical job demands and the physical work environment influence the decision to retire is therefore important for the design of policies and workplaces encouraging longer working lives.

In this paper, we examine the association between physical job demands (e.g., lifting, stooping, crouching) and the physical work environment (e.g., exposure to heat, cold, humidity, noise) with retirement status and retirement transitions, as well as how these associations vary by gender, age, and education, among individuals near retirement in the United States. Using rich information on job demands from the Occupational Requirements Survey (ORS), we first study the structure and properties of ORS data and implement robust strategies to address missing data on job traits across

occupations coded at the four-digit census code level. We then compare measures of physical job demands and the physical work environment with similar metrics from the Occupational Information Network (O*NET) to identify the job traits that exhibit good statistical properties and concurrent validity. Using validated job requirements only, we construct indices of physical job demands and physical work environment by examining correlations across individual job requirements, and we merge them with restricted, individual-level data from the Health and Retirement Study (HRS) using census occupation codes at the four-digit level. Finally, we estimate regression models exploring how physical job demands and the physical work environment predict retirement status and transitions, and study heterogeneous associations between job demands and retirement by gender, age, and education.

Poor health is the most commonly cited reason for early retirement (van Rijn et al. 2014). A large body of studies, many of them using the HRS, have found that physical health plays a large role in the timing of retirement (Solem et al. 2016; Reeuwijk et al. 2017; Blundell et al. 2020; French 2005; McGarry 2004; McGonagle et al. 2015) especially in early and unplanned labor force exit (Dwyer and Mitchell 1999), as well as in perceptions of forced retirement (Szinovacz and Davey 2005). Whether and how poor health limits work greatly depends on the interaction between physical functional abilities and occupational demands (Lopez Garcia et al. 2019). Given the role of physical health on the timing of retirement, it is important to understand how physical job demands and the physical work environment directly influence retirement decisions. The push/pull model of retirement (Shultz et al. suggest that some workers are pushed into retirement due to declining health, and/or inability to maintain performance

requirements, while others are pulled toward retirement by their increased desire for leisure or family caregiving responsibilities. According to this model, job conditions are related to pushes into retirement transitions (Fisher et al. 2016).

The existing research documenting the role of job demands on retirement decisions in the United States has largely relied either on subjective assessments of job demands from household surveys or on merged occupation-level data from O*NET, and results from these studies are mixed and even contradictory. For example, Angrisani et al. (2013) and Aaron and Callan (2011), both using subjective data from the HRS, find conflicting results about the role of physical strain at work on retirement timing. Among studies using objective measures of job demands from O*NET, Mcfall et al. (2015) find that subjective measures from the HRS are more predictive of transitions into retirement than a selection of O*NET physical and cognitive items that are likely to decline with age, while Angrisani et al. (2016) find the opposite using indices that include a larger set of O*NET items. Moreover, while O*NET has become the most popular data source to study job attributes in recent years, Handel (2016) points out several weaknesses with the O*NET data, including the nature of survey respondents (job incumbents for which there is no background information versus job analysts), significant gaps and duplication in content, overly complex and vague underlying constructs, as well as the fact that O*NET focuses more on abilities than functional limitations to perform jobs. In this paper, we examine how physical job demands and the physical work environment affect working longer using ORS data, which is unique in its focus on functional limitations and to our knowledge has not been used before to study this research question.

We find that physical job demands are more predictive of early retirement than the physical work environment, though increases in both indices increase the probability of being retired as well as retirement transitions. In particular, a one standard deviation (SD) increase in physical job demands is associated with a 10 percentage point (pp) increase in the probability of being retired, and with a 1.8 pp increase in the probability of transitioning into retirement. In turn, a 1 SD increase in our index of physical work environment is associated with a 7 pp increase in the probability of being retired, but it is not related to retirement transitions. This latter result depends critically on including physical job demands as a control variable in the regression, as the two indices are highly positively correlated with one another. We also find that physical job demands and the physical work environment are consistently more predictive of retirement and retirement transitions for men than women, for older rather than younger workers, and for workers without a college degree rather than with a college degree.

2. Data

We combine three data sources in this paper. The first one is the Occupational Requirements Survey (ORS), collected by the Bureau of Labor Statistics. The ORS supplies information on the physical demands, environmental conditions, mental and cognitive demands, and vocational preparation that are required in each job. The ORS employs field economists to interview human resources specialists, occupational safety managers, or supervisors at selected companies about job requirements at that firm. The data used in this analysis come from the 2018 public-use survey. For each requirement, the ORS reports the share of workers in an occupation whose job requires that ability.

The second data source is the O*NET, version 23.3 released in 2018. It has almost 800 detailed occupations at the six-digit level of Standard Occupational Classification (SOC) codes and measures more than 200 job traits including abilities, skills and knowledge required for to perform occupations, as well as work context and work characteristics. Generally, it provides a distribution of the characteristic for an occupation, e.g., mean and standard deviation, or probabilities of discrete values. We only use O*NET for comparison and validation of ORS measures.

The third data source is the HRS, a longitudinal household survey representing the noninstitutionalized U.S. population older than 50. Age-eligible respondents and their spouses are surveyed every two years, allowing us to track transitions from work into retirement. We use the RAND version of HRS, version P, and the restricted version to merge in occupational information from the ORS at the four-digit census code level. The HRS core questionnaire provides information about individual demographics, labor force status, pension arrangements, financial situation, and health status, and household composition.

Below we provide a detailed description of the public use ORS data. We then describe the O*NET data, focusing on the occupational requirement measures that are comparable to the ORS measures, and we examine the concurrent validity between the ORS and O*NET measures. In the final subsection, we describe the how we construct our analytic sample and variables using the HRS data.

2.1 The Occupational Requirement Survey

We use publicly available information from Wave 1 of the Occupational Requirements Survey (ORS), which was fielded over three years between 2015 and

2018. The ORS Wave 1 data contain occupational requirements for 43 physical traits organized in 16 aggregate groups, and 10 environmental conditions. While ORS provides data for 420 occupations at the six-digit 2010 SOC level, only 393 of these occupations contain some information on physical traits and environmental conditions. For each job trait, ORS provides a mix of categorical and continuous measures, for a total of 236 variables in the case of physical job requirements and environmental conditions. However, as we will discuss below in more detail, some variables are missing for some job traits, and data on some job traits are unavailable for a significant number of occupations.

In the public-use ORS, categorical variables measure the percentage of workers in a given occupation who are subject to a given requirement, such as, for example, the percentage of workers in an occupation for which gross manipulation is required. For some job traits, ORS also provides estimates of the percent of workers subject to a given requirement for a given level of frequency: seldom, occasionally, frequently, or constantly. Continuous variables include selected summary statistics by occupation reflecting the duration of certain job traits that are required in a typical working day. For example, the ORS includes variables for the average number of hours spent sitting by occupation as well as the 10th, 25th, 50th, 75th, and 90th percentiles of hours spent sitting by occupation. Table 1 provides an overview of the types of variables available for each trait for physical job requirements, aggregated into 16 groups, and Table 2 provides an overview for the environmental conditions.

Retirement outcomes include the retirement status in each wave based on the self-reported labor force status, as well as transitions from "working" in period *t* to "retired/unemployed or not in the LF" in period $t+1$, also based on labor force status. Importantly, we merge occupational job requirements from ORS to HRS respondents by the occupation (at the four-digit census code level) they held in Wave 7. Because this occupation might not necessarily be the most important occupation during the life-course and thus not accurately reflect job demands, in future work we plan to identify the most important occupation for each respondent using restricted data from the Life Mail History Survey.

Table 5 presents summary statistics for the relevant dependent and control variables. The total number of person-year observations for the examination of retirement status is N=33,694 (corresponding to N=6,398 individuals) and for retirement transitions is N=14,011 (corresponding to N=3,025 individuals).[1]

[1] The remaining 6,398-3,025=3,373 individuals excluded from the retirement transition sample include "never working" individuals who were already retired in Wave 7, as well as "always working" individuals who were continuously working across the six waves of HRS included in the analysis.

requirements and 10 measures of the physical environment of the workplace across observed occupations.

With these selected job traits, we conducted a series of exploratory and confirmatory factor analyses using occupation-level ORS data to determine how these job traits should be grouped (not shown). However, the predicted latent factors resulting from these analyses were not generally interpretable and we did not use them in our analyses. As an alternative, we constructed weighted average indices of job demands across occupations, where the weight was the occupation's share of jobs in the national economy obtained from the Current Population Survey (CPS). The "physical activity" index included the nine physical activities retained from the previous analyses. The "physical environment" index included all 10 environmental conditions. We standardized both indices after having merged to the full HRS sample for ease of interpretation of our results.

Table 6 presents the mean standardized indices by sex and sample, and shows that both indices are significantly larger for men than women, which is reflective of men holding jobs that are physically more demanding, and larger for the subsample of individuals who transition into retirement than for the full sample. This latter result is explained by a composition effect. While "never working" individuals, who are older and already retired, held jobs that were more physically demanding than the other groups, and "always working" individuals, who are younger, hold less physically demanding jobs, individuals in the "retirement transition" sample hold jobs with physical job requirements more similar to the "never working" sample than to the "always working" sample.

4.2 Associations between job demands and retirement status and transitions

We next merge our indices of job demands to the HRS panel to examine the role of physical job demands and the physical work environment on retirement outcomes. Table 8 presents our results from linear probability models regressing two types of retirement outcomes: an indicator variable taking value 1 if the individual reports to retired at time t (Column 1), or and an indicator variable that takes value 1 if a working individual in period t reports to be retired in time t+1 (Column 2), on our physical activity and physical environment indices (and their interactions), as well as on a set of control variables described in Section 3. Regression results for control variables are reported associated with Table 9 are reported in Table A7 in the Appendix.

Since our indices of job demands are standardized within sample, we find that a 1 SD increase in our physical activity index is associated with a 10 pp increase in the probability of being retired, and with a 1.8 pp increase in the probability of transitioning from full-time work into retirement. In turn, a 1 SD increase in our physical environment index is associated with a 7 pp increase in the probability of being retired and is not related to the probability of transitioning into retirement. Interactions between the two indices in both regressions have a negative coefficient but statistically significant only for the retirement status regression and do not significantly change these results.

activity index is associated with a 11 pp increase in the probability of being retired among older workers, but only a 7 pp increase for younger workers, a difference that is statistically significant ($p < 0.001$). Finally, and reflecting the fact that less skilled workers hold jobs that are more physically demanding than those held by more skilled workers, we find that both physical activity and the physical environment are significantly more predictive of retirement status among individuals without a college degree than those with a college degree or more (Table 14), but differences across educational groups in retirement transition regressions is not statistically significant for the physical environment index. A 1 SD increase in the physical activity index is associated with a 13 pp increase in the probability of being retired for those without a college degree, and with a 2 pp increase for those with a college degree, difference that is statistically significant ($p < 0.001$). The same increase is associated with a 4.5 pp increase in the probability of transitioning into retirement for those without a college degree, and with a 1 pp increase for those with a college degree ($p=0.085$).

occupations, as well to examine the concurrent validity of ORS measures with similar metrics from the O*NET. Using job traits that exhibit good statistical properties and concurrent validity, we construct average indices of physical activities and the physical environment and we merge them with restricted, individual-level data from the HRS using census occupation codes at the four-digit level to examine the role of these job demands on retirement outcomes.

We find that physical activities (e.g., lifting, low postures, reaching, pushing) are more predictive of retirement behaviors than the physical environment (e.g., exposure to cold, heat, contaminants, noise), though both types of physical job requirements increase the probability of being retired and retirement transitions. In particular, a one standard deviation increase in physical activity is associated with a 10 percentage point increase in the probability of being retired, and with a 1.8 percentage point increase in the probability of transitioning into retirement, after controlling for a series of sociodemographic variables including age, sex, education, health, financial situation, health insurance, and spouse's labor supply status and age. Estimates for the association between the physical environment and the probability of being retired are positive but smaller in magnitude and, with retirement transitions, is not statistically significant, which is explained by a large positive correlation across the two indices. Overall, we conclude the physical environment in the workplace had limited additive power to explain retirement outcomes over and above the role of physical activities. In terms of heterogeneity, physical job requirements are generally more predictive of retirement outcomes for men, older, and less-educated workers.

Our results are in line with the previous literature showing the importance of using objective measures of job demands to model labor market outcomes, such as retirement, but also clarify future steps in the retirement research agenda. First, if physical activities and the physical work environment matter, what specific job requirements matter more and for what jobs? Performing a more detailed analysis by groups of occupations and individualizing job demands would allow us to answer these policy relevant questions. Importantly, why does the physical environment of the workplace seem to matter less than physical activities? Finally, if physical demands of the job are the most important predictor of retirement, then the introduction of technology, robotics, and other task-altering factors could make some jobs less onerous and lead to prolonged employment.

Finally, there are a number of limitations for our study that can be addressed in future research. First, although our research goal was to add cognitive job demands to the current analysis, unfortunately cognitive measures were not available in Wave 1 of the ORS and the preliminary data from Wave 2 was too incomplete at this point. Including cognitive job demands is a top priority in our research agenda upon finalization of Wave 2data collection. In addition, although in this paper we focus on a narrower set of labor supply outcomes, in future work we plan to expand our analysis to include more detailed labor supply transitions among older individuals, including transitions from full-time to part-time jobs, from main occupations to “bridge” occupations, as well as transitions from retirement to any type of paid work or “unretirement.”

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