*Firms and Worker Health**

Alexander Ahammer
Johannes Kepler University Linz and IZA

Analisa Packham
Vanderbilt University, IZA, and NBER

Jonathan Smith
Georgia State University and IZA

Abstract

We estimate the role of firms in health care utilization. Using linked administrative data on Austrian workers from 1998–2018, we exploit mobility between firms to estimate to what extent a firm drives worker-level differences in prescription take-up, physician visits, and preventative care. We find that firms are responsible for nearly 30 percent of the variation in across-worker health care expenditures. We then estimate a measure of relative firm-specific utilization, and show that older firms and smaller firms have higher health care expenditures, on average. We provide additional evidence that high-expenditure firms maintain higher wage premiums, consistent with compensating differentials.

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**Correspondence:* Alexander Ahammer, Johannes Kepler University Linz, Altenberger Straße 69, 4040 Linz, Austria, alexander.ahammer@jku.at. For helpful discussions and comments we thank Janet Currie, Chloe East, and seminar participants at Georgia State University and Vanderbilt University.

1. Introduction

It is well-documented that there exists substantial variation in health care utilization across individuals. Recent evidence suggests that such differences are almost equally due to supply-side factors, like hospital access or care, and demand-side factors, like patient demand or preferences. Specifically, physicians and place-based determinants have been shown to be important inputs in health care take-up (Finkelstein et al. 2016, 2021).

Yet, much less is known about how firms and the work environment itself affects worker health care expenditures. Given that, on average, workers spend one-third of their lives at work, and given that firms serve as key inputs to economic mobility and worker welfare, this understudied relationship is important for better understanding how to improve workers' livelihoods. Therefore, in this paper, we use newly linked data from a universal public health insurance system to address the previously unanswered question: how much does the firm affect worker health care utilization? We do so by first estimating the variation in worker health across firms and using a movers analysis to test whether switching to a healthier (or unhealthier) firm affects a worker's health care expenditures. We then use a model to decompose the factors that contribute to worker health care utilization and test whether firm utilization is tied to wages.

There are numerous reasons why a firm may impact a worker's health expenditures. First and foremost, different industries and occupations may have different safety standards, working hours and conditions, and/or physical and mental job requirements. And, conditional on occupation, firms may also vary along these dimensions, driven by the firm's management, employees, or both. Second, peers have the potential to influence a worker's health. Co-workers at firms may be more or less supportive, competitive, motivated, physically fit, intelligent, or friendly, leading to changes in both mental and physical health. Workplace peers may pressure each other to engage in riskier behaviors, like smoking or drinking, or encourage a culture of healthier eating and exercise. Third, firms directly affect wages, which can have both direct and indirect effects on health. In fact, economic theory predicts that physically and mentally straining firms should compensate their

workers accordingly (Rosen 1986). As part of firm compensation, firms may also offer non-wage benefits, including health care, paid time-off, retirement plans, and educational subsidies. These workplace-specific contributions may all play a major role in worker health outcomes.

To measure to what extent firms impact workers' health care expenditures, we estimate models using linked employer-employee data in Upper Austria between 1998 and 2018. Unlike data used in previous related work, we are able to observe individuals' employment, wages, and health care expenditures over time. Austria has a largely free and universal public health care system, thus providing us with nearly complete coverage of expenditures while removing the ties between health care affordability and utilization. Our health care expenditure data includes the amounts spent and also detailed information about the type of health services, which allows us to separately explore the severity and types of health care expenditures.

We first show that there is substantial variation in average health care expenditures at the firm level. Then, to estimate the contribution of firms to workers' health care expenditures, we use an event-study framework to perform a "movers analysis" that examines whether workers who move firms have a change in their health care expenditures that approaches that of the average health care expenditure of the destination firms. Unlike in a U.S. context, health insurance status for Austrian workers is unaffected by changes in employment, which provides additional reassurance that we can identify changes in expenditures due to firm changes and not changes in coverage.

Our main finding is that firms are responsible for 29 percent of the variation in log health care expenditures. Estimates also indicate that firm contributions are larger for curative, rather than preventative, health care expenditures. We estimate no event-study jump in firm-level health care expenditures for non-movers.

We then investigate what qualities of the firm correlate with health care expenditures to better understand potential mechanisms. To get a measure of whether a firm is a high-expenditure or low-expenditure firm, we estimate models similar to those in Abowd et al. (1999), which also nest our movers-focused event-study model. In doing so, we assume that our measure of utilization is orthogonal to worker characteristics and that mobility is conditionally exogenous. We show

that this measure of firm-level utilization is positively related to worker health care utilization and 4-year mortality, implying that firms with higher levels of health expenditures have workers that experience more adverse health conditions, as expected. We show that, consistent with our movers analysis, firms contribute approximately 36 percent of the difference in utilization in firms with above versus below median expenditure levels, while worker preferences contribute the remainder. When analyzing which firm characteristics relate to take-up, in particular, we show that larger firms, higher-paying firms, and firms in urban areas tend to have lower expenditures, on average, while firms in industries with high market concentration and older firms tend to have higher expenditures. Finally, we test the extent to which wages relate to our measure of firm health effects. Consistent with the theory of compensating differentials, we show the that there is a modest positive correlation between firm wage premiums and firm health care expenditures as well as a positive correlation between accidents rates and wages.

Our findings contribute to and tie together three main strands of literature. First, we build on a literature showing that place-based factors and physicians drive health care take-up for Medicare recipients. Finkelstein et al. (2016) and Finkelstein et al. (2021) show that while nearly half of the variation in an individual's health care expenditures is due to geography, differences in physician practice styles make up about one-third of this place-based variation.[1] One major benefit of our study is that while prior work has largely focused on individuals aged 65 and older, due to data constraints, we can speak to the effects on Upper Austrian workers of all ages and industries. Moreover, we show that our findings hold for workers that do not move zip codes, providing evidence that our estimates represent firm, and not place-based, contributions.

Second, we contribute to a literature on workplace stress and safety, noting the close link between mental health and physical health. For example, job stress is a well-known contributor to illness, directly resulting in increased fatigue and adverse physical health (Cohen et al. 2028, Lang et al. 2012, Steptoe & Kivimäki 2012). Workplace-related stress is also related to other decision-making, like poor nutrition choices, and alcohol use, which may directly harm worker

[1]Similarly Ahammer et al. (2021) shows that while much of the variation in health care utilization is attributable to patient characteristics, physician practice style is also an important determinant of expenditures.

health (Frone 2016, Klatzkin et al. 2018). We show that firms have a larger contribution to curative, rather than preventative expenditures, suggesting that changes in worker health after a move are not simply a result of new workplace screenings or onboarding practices.

Of course, workplace safety may be one obvious channel in which firms affect worker health, and we show that our measure of firm health care utilization is indeed negatively related to on-the-job accident rates. In doing so, we build on a literature on workplace safety and health. For example, recent work shows that leniency in federal and state enforcement of safety regulations, employees are paid higher wage premiums for bearing fatality risk (Makowsky & Bacon 2023).

Third, because we are able to connect data on worker health and wages, we generate new suggestive evidence to contribute to a large literature on compensating differentials. Following both the methods and the idea that firms play an important role in workers' lives, we test whether physically and mentally straining firms compensate their workers accordingly, and show that unhealthier firms and those with more workplace accidents do indeed pay higher wage premiums. In doing so, we additionally contribute to a smaller literature regarding how firms compensate workers for unhealthier environments (Bjerk & Mason 2014, Hersch 2011, Rao et al. 2003, Wissmann 2022).[2]

2. Institutional Context - Upper Austria

2.1. Health Care and Social Security

Austria has a universal health care system with compulsory insurance financed through social security contributions. Health care access is not tied to employment. Since enrollment to the system is automatic, almost 99.9 percent of Austrian residents are covered by health insurance (Ahammer et al. 2021).

Health care provision is two-tiered, with most services being provided publicly and parallel

[2]For example, Wissmann (2022) shows that when restaurants and bars in Germany implemented a smoking ban, workers wages fell while revenues remained constant due to the changing health risk. Similarly, Bjerk & Mason (2014) shows that mules are compensated for sentencing risk. Hersch (2011) shows that female workers receive a compensating wage differential for exposure to the risk of sexual harassment, while Rao et al. (2003) finds that female sex workers receive a compensating wage differential for exposure to sexually transmitted diseases.

private markets existing for outpatient services and specialized hospitals (such as fertility clinics). Since these private suppliers offer the same types of services as public providers, they are used almost exclusively to avoid waiting lines. There is no formal gatekeeping system, but general practitioners (GPs) are typically the first point of access to the health care system. Cost-sharing is limited to a minor co-payment for drug prescriptions (€5.4 per script in 2014) and a small deductible for overnight hospital stays (€9.56 per day, for a maximum of 25 days). Top-up private insurance is available but only covers single rooms in hospitals and expenses for private physicians. Apart from health care, the Austrian social security system provides universal access to accident, pension, disability, and unemployment benefits.

2.2. Labor market

The labor market is characterized by strong industrial relations with centrally bargained wages and working conditions (Böheim 2017). At the same time, the labor market is highly flexible, with particularly weak job protection and high turnover (OECD 2020).[3] Employment contracts can generally be terminated without a given reason, but unilateral terminations require a notice period be observed. Unemployment rates have historically remained low, ranging, for example, from 7.3 in 1998 to 7.7 in 2018. Female labor force participation is particularly low, and almost 50 percent of female workers work part-time.

3. Data

3.1. Data Sources

We combine data from several administrative registers. First, we use employment histories from the *Austrian Social Security Database* (ASSD). The ASSD is an employer-employee panel that covers the universe of Austrian workers from 1972 to 2018. We have daily information on employment

[3]For example, in 2018, the last year of our data, job turnover for female workers and male workers was 9.6 percent and 9.3 percent, respectively. In comparison, the European Union averages were 8.6 for female workers and 8.1 for male workers. The OECD employment protection legislation indicator is 1.7 for Austria, which is the fifth-lowest value among OECD countries. The United States rank last with an indicator of 1.3.

status, yearly information on wages up to a social security cap, and data on basic demographics, such as age and gender. A drawback of these data is that they do not contain information on working hours and occupational codes. However, these data do contain information on industry codes and occupational blue collar/white collar status.

Second, we use health records from the *Upper Austrian Health Insurance Fund* (UAHIF). The UAHIF provides us with individual-level health care claims for residents of Upper Austria, including drug prescriptions, sick leaves, outpatient physician visits and hospital stays.[4,5] Diagnoses—which are only available for hospital stays and sick leaves—are recorded using ICD-10 codes. Drugs are classified using the ATC system. The UAHIF covers all private-sector workers in Upper Austria, which represent around 75 percent of the population. We do not have health data for self-employed persons, farmers, and civil servants. Health care claims are available from 1998 to 2018.

3.2. Analytic Sample

To construct our sample, we build a worker-year panel covering all private-sector employees between age 18 and 65 in Upper Austria. For workers with multiple jobs in a given year, we keep only the job that pays the highest wage. After dropping workers with missing wage information, we are left with 9,184,913 observations for 1,237,595 workers. For our movers analysis, we focus on a balanced sample of workers that had been employed at least 4 years at their origin firm and remain employed for at least 4 years post-move at their destination firm. We also allow for multiple moves if a worker had been employed for 8 years at their origin firm and remains employed 4 years post-move at their destination. Only 1 percent of our mover sample move twice, however, according to this definition. This gives us 519,264 observations for 57,696 workers. For placebo analyses, we draw a sample of workers that are employed for at least 9 consecutive years and assign a random move between 5 years after their employment spell start and 5 years before their employment spell end.

[4]Upper Austria is one of the nine states of Austria, containing approximately 1.5 million residents.
[5]We do not observe emergency department visits.

3.3. Measuring Health Care Expenditures

The main outcome we study is the logarithm of total health care expenditures, comprising physician expenses, drug expenses, and hospital expenses. We take logarithms to give less weight to extreme outliers, which are common in health care claims data (Karlsson et al. 2023), and because it allows us to conveniently describe our results in shares (or percents). For around 15 percent of observations that have no health care expenditures in a given year, we replace log expenditures with zero. In a second step, we distinguish between physical and mental health outcomes. The latter are all expenses related to ICD-10 diagnosis group F or drugs in ATC group N06A ("antidepressants"), all other expenses we classify as being related to physical health.

Table 1 presents the summary statistics for our full worker-year panel and for a balance panel of movers, i.e., workers that switch firms during our sample period. A majority of workers are male and white-collar workers. Workers are 37 years old, on average. Movers have more experience in the labor force and have slightly lower health care expenditures as compared to non-movers, spending less on both curative and preventative care.

3.4. Variation in Health Care Expenditures

We first present some descriptive figures to show the substantial variation in health care expenditures across firms. In Figure 1, we show the distribution of firms' health care expenditures, averaged across workers across all sample years.[6] The mean average health care expenditures across firms is €517. But the standard deviation is about twice as large as the mean, at €1,074, suggesting a considerable amount of variation in firm-level average health care expenditures. There are also quite a few firms with very few expenditures. For comparison, we also show the analogous figure but for wages in Appendix Figure A.1. We also see variation in daily wages, with workers making €65.5 per day, on average.

[6]For visual purposes, we exclude the long right tail by censoring the average yearly health expenditures at €2,000, which is about the 95th percentile.

4. Event Study - Movers Analysis

4.1. Empirical Approach

Our main goal is to estimate how much a firm can influence worker health outcomes. The main challenge to identification in this setting is that many observed and unobserved factors play a role in affecting a worker's prescription take-up, hospital utilization, and risky behavior. Therefore, we estimate the effects of health care expenditures and how they vary for workers that move between firms. This approach relies on the notion that firm-specific stressors change when a worker switches firms, but person-specific stressors do not.

We estimate the following event study:

$$y_{it} = \alpha_i + \sum_r \theta_r \cdot \hat{\delta}_i + \tau_t + x_{it}\beta + \varepsilon_{it}, \tag{1}$$

where α_i are worker fixed effects, θ_r are relative time indicators (in our case from $r = [-4, 4]$, normalizing $r = -1$ to 0), τ_t are calendar year fixed effects, and x_{it} are additional controls (in our case: age-year fixed effects, tenure-year fixed effects, industry sector fixed effects, and a dummy variable for blue collar workers).

The variable δ_i represents the "size of the move" for ever mover i between origin firm and destination firm. We more formally define the size of the move as follows:

$$\delta_i = \bar{y}_{d(i)} - \bar{y}_{o(i)}, \tag{2}$$

where $\bar{y}_{d(i)}$ represents the average log health care expenditures in the destination firm d, and $\bar{y}_{o(i)}$ represents the average log health care expenditures in the origin firm, o. Importantly, we calculate the differences in log expenditures in an attempt to scale our outcome variable y_{it} so that we can interpret the direction and magnitude of the jump as a value between 0 and 1. The larger the change in y_{it} at time $t = 0$, the larger the share of variation in health care expenditures that can be attributed to the firm.

Because we focus on log health care expenditures, the absolute change in log utilization when patients move from a relatively high-expenditure firm to a low-expenditure firm should be the same as when patients move from a relatively low-expenditure firm to a high-expenditure firm. Below, we present evidence that reinforces that the move patterns are also consistent with the relative importance of patients being similar across origin-destination pairs.

Notably, our primary variable of interest in Equation (1), θ_r can be interpreted as the weighted average of the share of variation in health expenditures across firms that can be attributed to firms. In other words, if firms do not affect worker health, we would expect $\hat{\theta}_0$ to be equal to zero. Consequently, for identification, we need to observe workers changing firms and moving symmetrically to firms with different levels of health care expenditures.

The above model has two main limitations. First, our event-study model uses only data on movers, who may be systematically different from non-movers in terms of health care take-up. We note that the model does allow for movers to vary from non-movers in systematic ways, including in levels and/or trends in utilization, and we later explore robustness to our mover sample by estimating effects for non-movers.

Second, our identification assumption would not hold if there exist shocks to utilization that coincide exactly with the timing of the move and that are correlated with utilization in the origin and destination. Our estimates may be biased, for example, if a worker moves to a high-expenditure firm after experiencing a negative health shock. In this case, we would overstate the contributions of the firm. While we cannot directly test for the possibility, we note that any deteriorating health effects or large health shocks leading up to a move would likely appear as a pre-trend on our event study figures. Furthermore, if an acute health shock in $t = 0$ is responsible for a worker switching firms, we would expect to observe a jump at $t = 1$ with effects fading over time. Our event-study figures present evidence against these patterns, providing additional support for our identification assumption.

Finally, we note that when workers move firms they are also potentially moving places, which has been shown to be an important determinant for health care expenditures Finkelstein et al. (2016).

Below we test the extent to which workers that move zip codes at the time of the firm switch are driving our findings. We additionally test whether the change in health care utilization is a result of workers changing industries entirely.

4.2. Variation in Firms' Health Care Expenditures Among Movers

In this section we present descriptive evidence to further motivate our firm mover event studies before presenting our main results. Our main empirical approach, described above, relies on three parts: (i) workers moving to new firms; (ii) workers moving to firms with differential levels of health care expenditures; and, (iii) the decision to move to those firms being unrelated to current or future health care expenditures. We provide evidence to support these assumptions in Figure 2.

Figure 2 shows the distribution of the difference in log health expenditures between the destination and origin firm, δ_i. It reveals several findings. First, the distribution is centered around zero, indicating that some movers move to firms with higher expenditure firms than their origin firm, while some do the opposite. Second, the distribution is symmetric, which strongly suggests that moves to new firms are not dictated by the expected health care expenditures of the origin or destination firm. Third, the standard deviation of the difference is 1.3 log points. For additional context, the mean of the absolute value of change between destination and origin firms is €198.

The documented variation is also positively correlated with the change in the worker's logarithm of health care expenditure after a move, a prelude to our event study results. Figure 3 plots the change in the worker's logarithm of health care expenditures against the difference in the logarithm of health care expenditures between the destination and origin firm. The difference in the destination to origin health care expenditures - the horizontal axis - are split into ventiles and the change in workers' health care expenditures - the vertical axis - are averaged in each ventile.

Figure 3 shows that workers moving to firms with higher (lower) health care expenditures also increase (decrease) their own expenditures. The upward slope of this line indicates that movers' health care expenditures change by 37.4 percent of the difference between the destination and origin average health care expenditure. These raw means are emblematic of our main results but the event

study formally controls for potential confounders and also helps assess pre-trends and post-trends.

4.3. Main Results

Figure 4 presents the event study estimates for workers that move firms in our sample period. The estimates correspond to Equation (1) for four years prior to and four years after a move.[7] Prior to the move, workers experience no systematic change in health care expenditures, providing some support for the notion that health reasons are not the cause for moving firms.

If health care expenditures are solely determined by the worker, we should see no change in expenditures. On the other hand, if health care expenditures are entirely determined by the firm, this increase would be equal to one. We show that after a move, health care expenditures attributed to the firm increase to 29 percent after just one year. This immediate jump in the event study after a worker switches firms provides the primary piece of evidence to show that firms play a critical role in health care expenditures. The mean absolute value of difference in workers' health care expenditures after switching firms is €198, implying the new firm is responsible for a roughly €57 change in health care expenditures.

Moreover, estimates in Figure 4 indicate that this increase in firm contributions stays above 29 percent and increases beginning one year after the move. After four years, the firm's share of the worker's health care expenditures is 41.7 percent. These findings provide support for the idea that workers do not largely change firms due to health shocks or deteriorating health conditions and that the firm continues to affect worker health care utilization long after the initial move.

4.3.1. Additional Results: Curative and Preventative Expenditures

Above we show that firms largely contribute to worker health care expenditures. In subsequent analyses, we estimate whether this change in health care expenditures for movers results in a change of either mostly preventative care visits, visits related to acute health shocks, or a combination of both. For example, firms may encourage new employees to get screenings, or run workplace

[7] We note that our estimates are not sensitive to the pre/post number of window years.

initiatives to keep workers healthy; on the other hand, firms may directly contribute to worker mental and physical stress through workload or office culture.

Figure 5 presents event studies for curative and preventative expenditures separately. “Preventative" visits include any type of screening for annual or well visits, excluding vaccinations (due to data limitations). “Curative" visits include visits to the doctor’s office that are not primarily for a sick visit, and do not include any type of preventative care. Estimates indicate that firms are responsible for both types of care. However, firm effects are larger for visits requiring treatment. We find that firms contribute 18.3 percent of health care expenditures for preventative care and 28.6 percent responsible for curative health care expenditures.

4.4. Alternative Explanations and Robustness Tests

In this section, we examine whether our effects can be explained by changes in worker place or industry and test the sensitivity of our event-study estimates. Recent work suggest that geography plays an important role in health care utilization (Finkelstein et al. 2016). In fact, if all workers moving firms required a relocation, we would not be able to easily distinguish between firm and geography effects on health care expenditures. Fortunately, only 31 percent of movers in Upper Austria relocate to another zip code, implying that firms, and not geographic location, are largely responsible for any estimated effects. More formally, estimates in the left panel of Figure 6 shows a nearly identical result to our main event study, using only the subsample of workers who move firms but did not change zip code of residence.

Related to the above finding that our results are not primarily driven by individuals that move zip codes, the right panel of Figure 6 shows that results are larger for workers that switch firms but not industries. Only 37 percent of workers switched industries when they moved firms, suggesting that changes in industry are not the main factor behind our results.

Lastly, we perform a placebo test, using workers that did not move. To do so, we start with a sample of workers that did not change firms for at least 8 years. Next, we randomly assign a moving date and simulate a “size of move", δ_i pulling from the distribution shown in Figure 2. We then

calculate the differences in health care expenditures for each non-mover over time, between the destination firm and origin firm. Importantly, estimates in Figure 7 indicate no change in the firm's contribution towards health care expenditures. This provides additional support for the idea that moving to another firm changes health care expenditures for workers based on firm characteristics, peers, or amenities.[8]

5. Firm-Specific Health Care Expenditures

The previous section establishes that there is a wide distribution of average per-worker health care expenditures across firms and that firms largely contribute to the amount of workers' health care expenditures. Therefore, we may not expect a constant treatment effect for workers moving firms. In this section, we consider the full distribution of the firm effects on health care expenditures to better understand the correlates behind firm contributions and to explain what may be driving our estimates. Specifically, we follow Abowd et al. (1999) to estimate firm-specific impacts on health care expenditures.

These firm-specific estimates of health care expenditures allow us explore several lines of inquiry. First, we explore to what extent dispersion in firm-specific effects exists. This can help us understand the range of possible impacts of workers making relatively small or large moves between firms that have small and large impacts, respectively. As in Abowd et al. (1999), estimating an additive fixed effects model for workers and firms allows us to calculate the overall health care expenditures share explained by firms.

Second, we explore the correlates with the firm-specific impacts on health care expenditures. Although these are just cross-sectional relationships, estimates from this approach shed new light on some potential mechanisms. Our data allow us to test whether firms with higher levels of expenditures have particular characteristics related to age, size, or family friendliness, allowing us to test what types of firms may have healthier workplaces, on average. We also use data on

[8]Similarly, we note that when we randomize the size of the move, δ_i we estimate a small and statistically non-significant jump for movers, which provides additional evidence that worker's health care take-up responds when workers move across the distribution of firm utilization.

workplace accidents by industry, which should directly affect health care expenditures.

Third, and related to above, we explore how the firm-specific impacts on health care expenditures relate to the firm-specific impacts on wages; the latter of the two being the focus of Abowd et al. (1999) and the papers that follow. How wages vary with working conditions speaks to an old and unsettled literature on compensating differentials. The theory predicts that workers should be compensated for undesirable working conditions. Some fraction or subset of our health care expenditures are certainly undesirable (i.e., curative, not preventative) and may arise from the firm itself. Mental health care expenditures directly tied to the firm may be one such example. We are able to link individual-level data on health expenditures, firms, and wages to directly answer this question and supplement our analysis with data on workplace accidents to better speak to the effects of the firm on worker health.

We begin below by describing the estimation strategy, following the model established by Abowd et al. (1999). Then we present the firm-specific estimates and explore some of the described relationships.

5.1. AKM Model

First, we disentangle the factors of our health care expenditure variable attributable to worker-specific and firm-specific heterogeneity by fitting models for log health care expenditures that account for unobserved worker and firm characteristics and worker age. Our goal is to estimate a model that allows us to capture the components attributable to firms, then decompose the contributions of worker health care expenditures arising from individual preferences versus attributes of the firm.

Using the model and notation from Abowd et al. (1999) and the papers that follow, we estimate the following models with additive worker and firm fixed effects:

$$\log y_{it} = \alpha_i + \theta_j + \boldsymbol{\beta}'\mathbf{X} + \varepsilon_{it}, \tag{3}$$

where α_i represents worker fixed effects, and θ_j represents firm fixed effects. We additionally

control for worker-specific observed characteristics; **X** contains a dummy variable for blue collar worker status as well as variables for age and work experience. We predict fixed effects with a conjugate gradient algorithm.

Importantly, θ_j can be interpreted as the firm contributions to health care expenditures. Our additive fixed effects imply that θ_j is orthogonal to worker characteristics ($\alpha_i + \boldsymbol{\beta}'\mathbf{X}$). This implies that any estimates of θ_j are not a result of worker demographics such as age, or behavioral factors, like poor diet or smoking. Moreover, estimates of both worker effects ($\alpha_i + \boldsymbol{\beta}'\mathbf{X}$) and firm fixed effects (θ_j) allow us to calculate an additive decomposition of log health care expenditures between high- and low-utilization firms to identify how workers and firms separately contribute to utilization.

In subsequent analyses, we then explore the correlates of these firm-specific health care expenditures by estimating how firm characteristics correlate with $theta_j$. In other words, we estimate the following model:

$$\theta_j = beta_j\lambda + \varepsilon_j, \tag{4}$$

where $beta_j$ represents firm characteristics, including firm age and size, measures for industry concentration and unionization, leadership, and measures of family friendliness. These correlations should help to inform what types of firms have the potential to drive health care expenditures for workers and in which direction.

5.2. Firm-Specific Impacts on Health Care Expenditures

Figure 8 shows the distribution of estimated firm fixed effects for health care expenditures from Equation (3).[9] By construction, it is centered around zero with a standard deviation of 0.60. The figure shows that there is variation in firms being classified as “high-expenditure" or “low-expenditure" firms. Moreover, the long tails imply that moving from the left to right tails of the distribution is a very big change in the type of firm, but that moves for most workers will be less consequential.

[9]For comparison, it is layered on top of the distribution of estimated firm fixed effects for wages.

Additionally, Table 3 presents the additive decomposition of log health care expenditures. To present information on how firms and workers contribute across the health care expenditure distribution, we separately present the differences in average log expenditures for firms above and below the median log expenditures (Column 1), for firms in the top and bottom quartile of expenditures (Column 2) and for firms in the top and bottom decile of expenditures (Column 3). We present the difference in the average of the above estimated effects for workers ($\hat{\alpha}_i$) and firms ($\hat{\theta}_j$) in the bottom two rows, respectively. We find that the difference in average log health care expenditures is primarily driven by workers, with firms also largely contributing to this effect. Overall, we find that firms make up 36 percent of the difference in average health care expenditures across all firms, with this share ranging between 39–45 percent for the firms that comprise the tails of the expenditure distribution.

Furthermore, we present evidence that our firm fixed effects are positively related to adverse health conditions; that is, that as average firm health care expenditures increase, workers are likely to be less healthy. In the left panel of Figure 9 we present the relationship between our firm utilization measure and worker health care utilization. Notably, firm health fixed effects and log worker health care expenditures are positively related, suggesting that firms with higher health care expenditures have less healthy workers. We also present effects for a more severe outcome of worker health–mortality. Estimates in the right panel of Figure 9 indicate a positive relationship between health fixed effects and whether a worker dies within four years of a move.

5.3. Correlates of Firm-Specific Health Care Expenditures

5.3.1. Firm Characteristics

The results described above indicate that firm expenditure levels can affect worker health care utilization, on average, but may mask important heterogeneity. Given that firms vary along many dimensions, we then ask to what extent these effects change across firm types. In Figure 10 we plot coefficients from a regression of the estimated health fixed effect, $\hat{\theta}_j$, from Equation (4), on the listed firm characteristics. In particular, we analyze whether firm characteristics including age, size,

location, industry concentration and median wages explain whether a firm is likelier to have lower or higher health care expenditures. Moreover, we consider characteristics of "family friendliness," including whether the firm has a female CEO, the share of female workers, and the share of workers on parental leave. We additionally include the share of blue collar workers and share of unionized workers, to reflect worker protections.

Overall, we find that firms that are larger, younger, more urban, have higher wages, and have a female CEO are more likely to have lower health care utilization. Firms with more blue collar workers and unionize workers are also considered healthier firms. In comparison, firms that are in more highly concentrated industries and are older have higher average health care expenditures and are considered unhealthier firms in our context.[10]

5.3.2. Health Care Expenditures and Wages

Since firms also directly affect wages, we additionally consider the extent to which health care utilization and wages may be related. First, in Figure 11, we present distributions for worker health and wage fixed effects. While worker health fixed effects are symmetric and centered around zero, with a standard deviation of 1.84, the distribution for wage fixed effects is more tightly centered around zero, with a standard deviation of only 0.43.

Theory predicts that physically and mentally straining firms should compensate their workers accordingly. Given that we find that individuals moving to firms with higher average health care expenditures also increase their own expenditures, we test whether there is a correlation between log wages and our estimated firm health fixed effects. In Figure 12 we present evidence that there is indeed a positive correlation, suggesting that unhealthier firms also offer higher wage premiums.

Because we show above that firm health fixed effects are related to expenditures and mortality, a natural question is whether firms are compensating for safety on the job. We investigate this in Figure 13. The left and right panels of Figure 13 display the average firm health fixed effects and wage fixed effects, respectively, based on the industry accident rate (i.e., the number of accidents per

[10] When analyzing effects by industry, we find that sectors including manufacturing and construction contain relatively high-expenditure firms, while public administration firms maintain lower overall health care expenditures.

1,000 workers). Both plots show a modest positive relationship. In other words, estimates indicate that as the accident rate increases, firm health expenditures also increase. This is consistent with the notion that firm accidents necessitate immediate care. However, we also find that as accidents increase, firm wage fixed effects also increase. These results fit into a large literature showing that firms compensate workers for job risk and/or poor working conditions (Lavetti 2023, Rosen 1986, Viscusi & Aldy 2003). Our results also expand on work using similar AKM methods that shows that firms account for between 5 and 25 percent of the variation in workers' wages (Bonhomme et al. 2023, Card et al. 2013).

6. Conclusion

Above we provide new evidence that firms play a major role in workers' health care utilization. We use individual-level data linked with health outcomes for Upper Austrian workers and leverage migration of workers to new firms to estimate a model that allows us to account for differences across worker characteristics, including wages. Our estimates indicate that firms are responsible for 30 percent of the workers' change in health care utilization. These effects are not driven by changes in firm location or industry switching, but rather is due to the firms' average worker health care expenditure. We posit these effects are a consequence of some combination of peer effects, workplace amenities, and/or firm-specific job stressors.

We then test what firm characteristics are more likely to explain higher average expenditures and estimate an AKM model to establish a measure of firm utilization. We find that younger firms, larger firms, and firms with higher wages are have lower health care expenditures, on average. Building on a literature on the relationship between wages and health, we find that firms with higher health care expenditures and more workplace accidents pay higher wages, consistent with a theory of compensating differentials.

Overall, our findings contribute to a growing literature showing that physicians and place-based determinants drive decision-making for workers' health care take-up. Using more granular data we are able to speak to an important determinant of work behavior: firms. Our findings

thus have important policy implications, especially at a time when workplaces are frequently offering healthier amenities, like yoga studios, or incentivizing daily physical activity. Since many lawmakers and non-profit organizations maintain targets for making workplaces safer and workers physically healthier, we note that achieving these goals could be one avenue to improve total social welfare.

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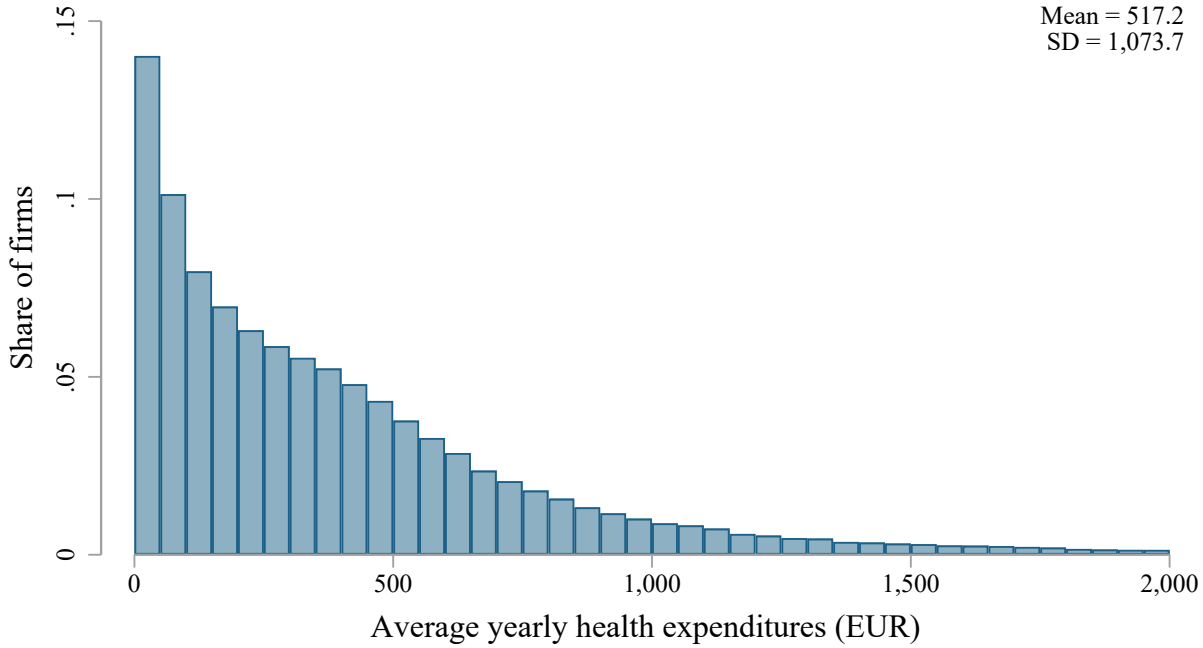
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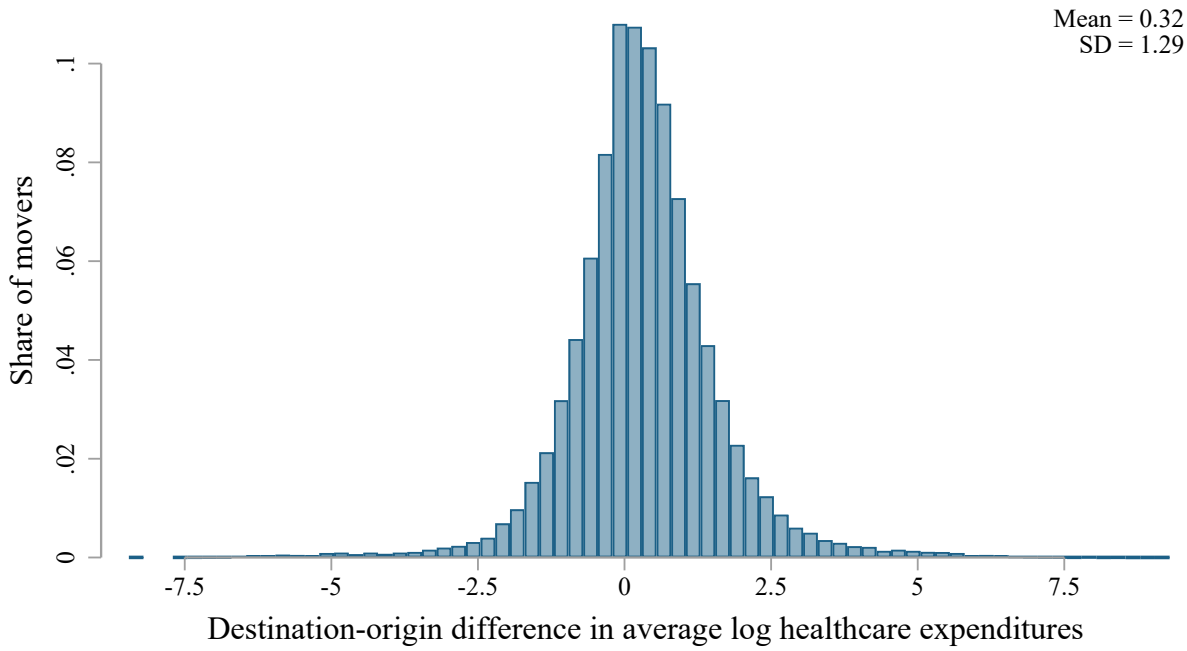
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FIGURE 1 — Distribution of average per-worker health expenditures across firms



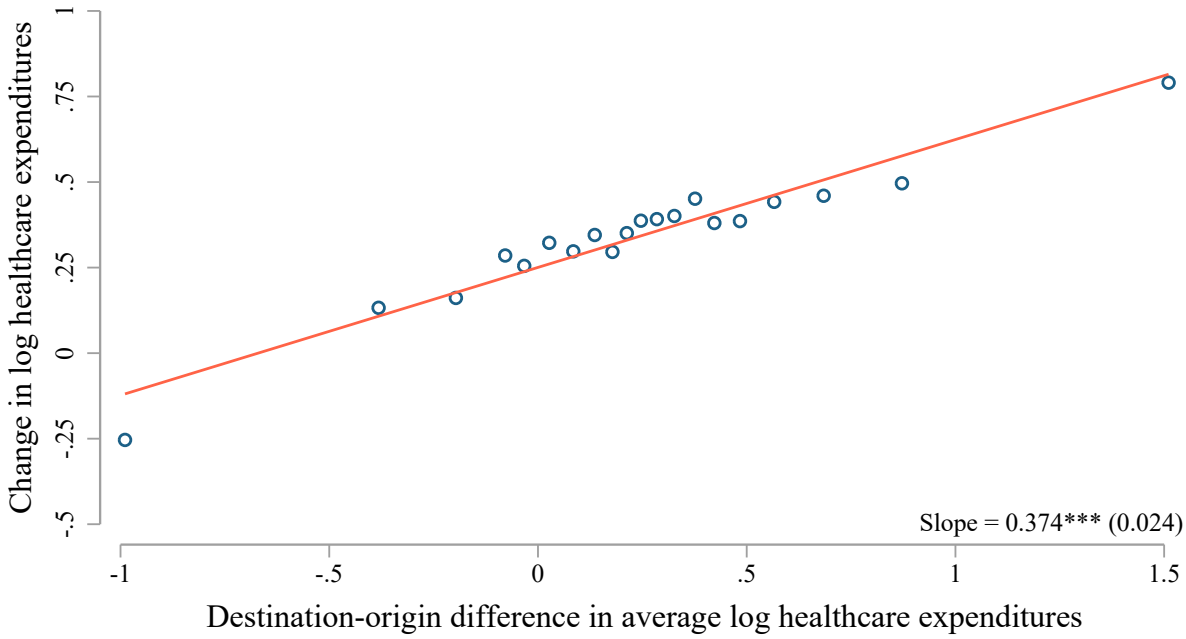
Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This figure displays the distribution of average per-worker health expenditures across firms, within a given firm-year, using a bin size of €50. We omit firms with zero average health expenditures and those with per-worker health expenditures above €2,000, i.e., the 95th percentile of the distribution rounded to the next €1,000. Averages are based on the full worker x year panel. N = 9,184,913

FIGURE 2 — Distribution of destination-origin difference in log health expenditures



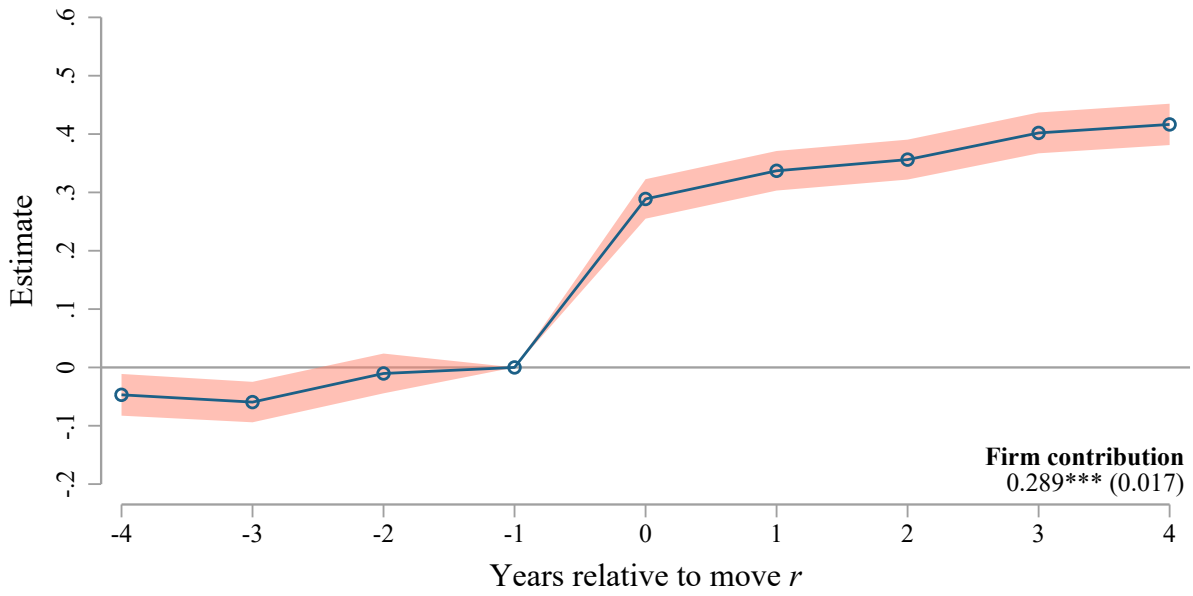
Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This figure plots the distribution of the difference in average log health care expenditures between destination and origin firms across movers. For each mover, we consider average expenditures over the immediate 4 pre-move years and 4 post-move years. Averages are based on a balanced mover sample. N = 519,264

FIGURE 3 — Change in log health care expenditures by size of move



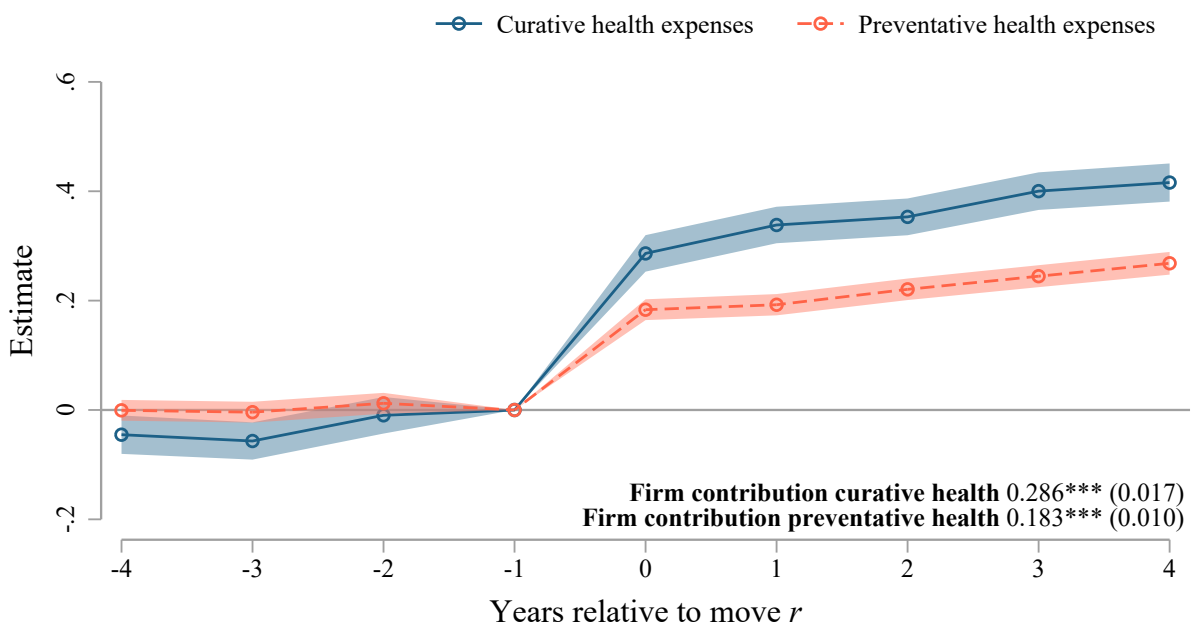
Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This figure plots the change in log health care expenditures against the difference in average per-worker log health care expenditures between the destination and the origin firm. For each mover, we calculate the difference in average per-worker log health care utilization between the origin and destination firm and group these differences into 20 quantiles, the horizontal axis plots average log expenditures within these quantiles. The vertical axis shows, for each quantile, average log expenditures 4 years pre-move minus average log expenditures 4 years post-move. Estimates are based on a balanced mover sample. N = 519,264

FIGURE 4 — Event study for log health care expenditures



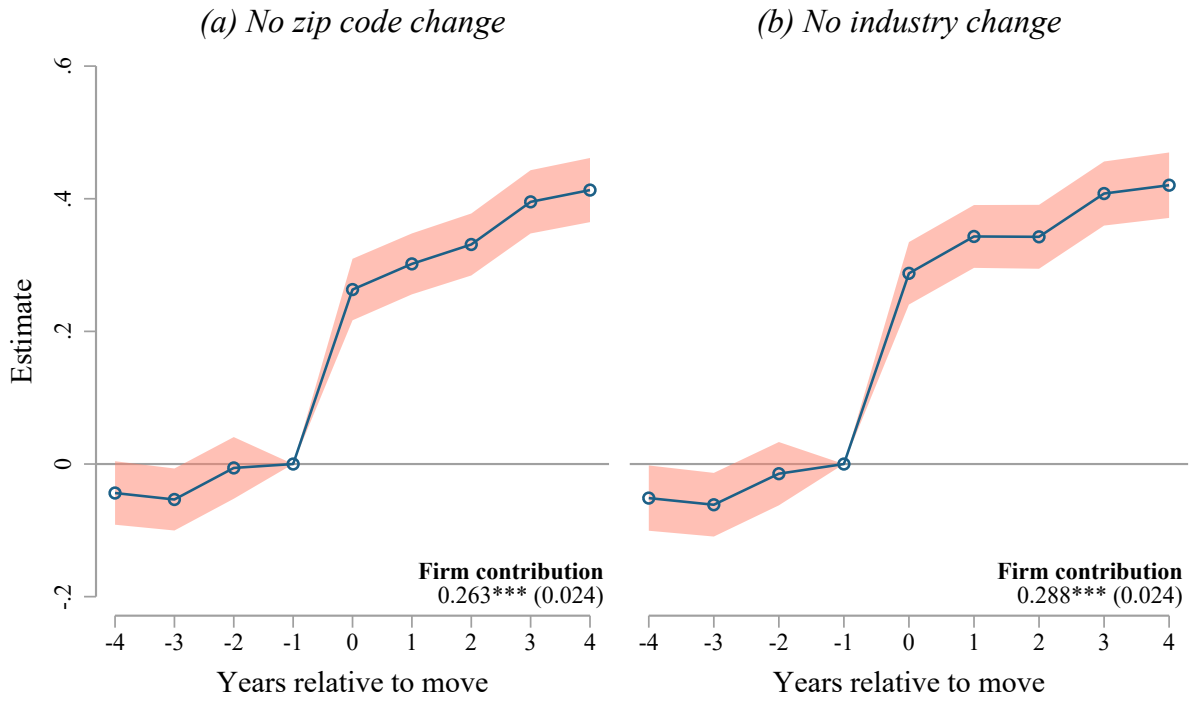
Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This figure plots the coefficients $\hat{\theta}_r$ from Equation (1) and their respective 95 percent confidence intervals. The jump between $r = 0$ and $r = 1$ can be interpreted as the share of variation in health care expenditures across firms attributable to firms; the rest is explained by worker characteristics. Estimates are based on a balanced mover sample. $N = 519{,}264$

FIGURE 5 — Event study for log preventative and curative health care expenditures



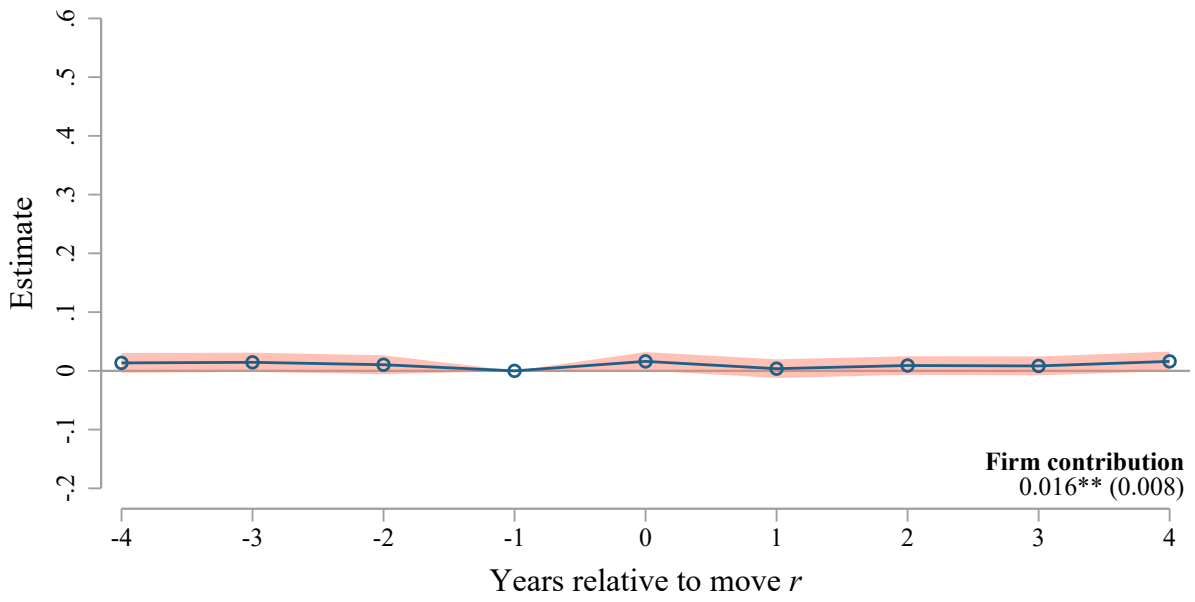
Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This figure plots the coefficients $\hat{\theta}_r$ from Equation (1). The dependent variables are log preventative health care expenses (including screening expenditures and expenditures for antihypertensive drugs, antithrombotic drugs, osteoporosis drugs, and cholesterol-lowering drugs) and log curative health care expenses (which include all other expenditures that are not classified as preventative). The size of the move θ is calculated based on differences in preventative and curative health expenditures between the origin and destination firm, respectively. The red-shaded area is a 95 percent confidence interval. The jumps between $r = 0$ and $r = 1$ can be interpreted as the share of variation in health care expenditures across firms attributable to firms, the rest is explained by worker characteristics. Estimates are based on a balanced mover sample. $N = 519{,}264$

FIGURE 6 — Event study for log health care expenditures, Movers with no firm zip code or industry change



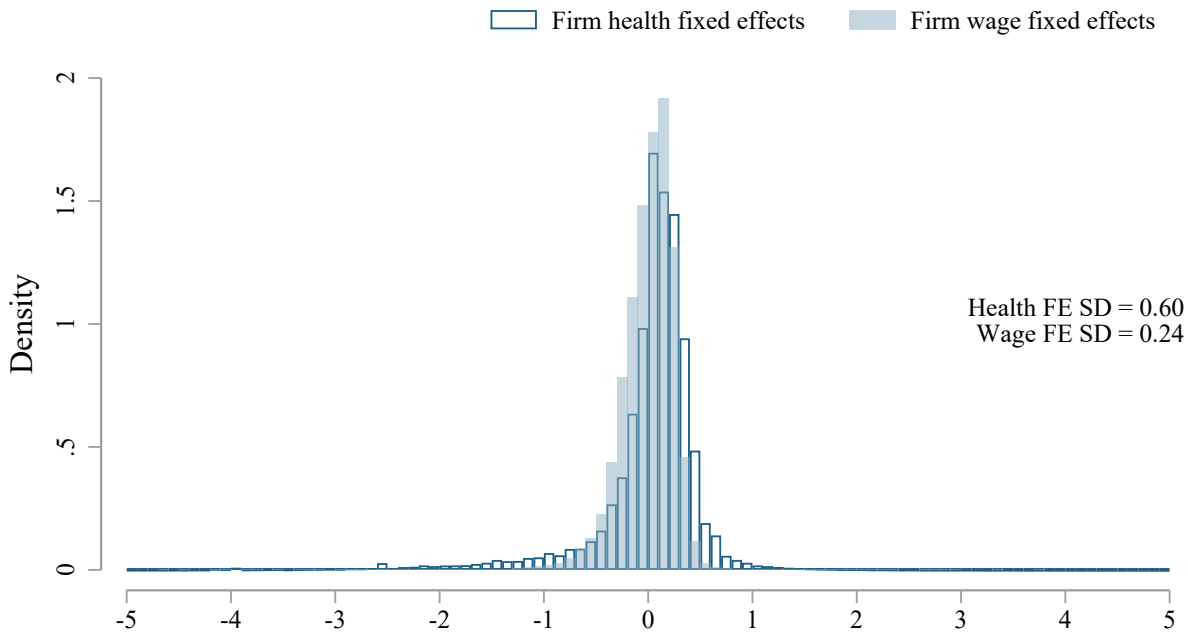
Notes: See Figure 4. This figure plots the coefficients $\hat{\theta}_r$ from Equation (1) for the sample of movers that do not change zip codes (left panel) or industries (right panel). N = 519,264

FIGURE 7 — Placebo test



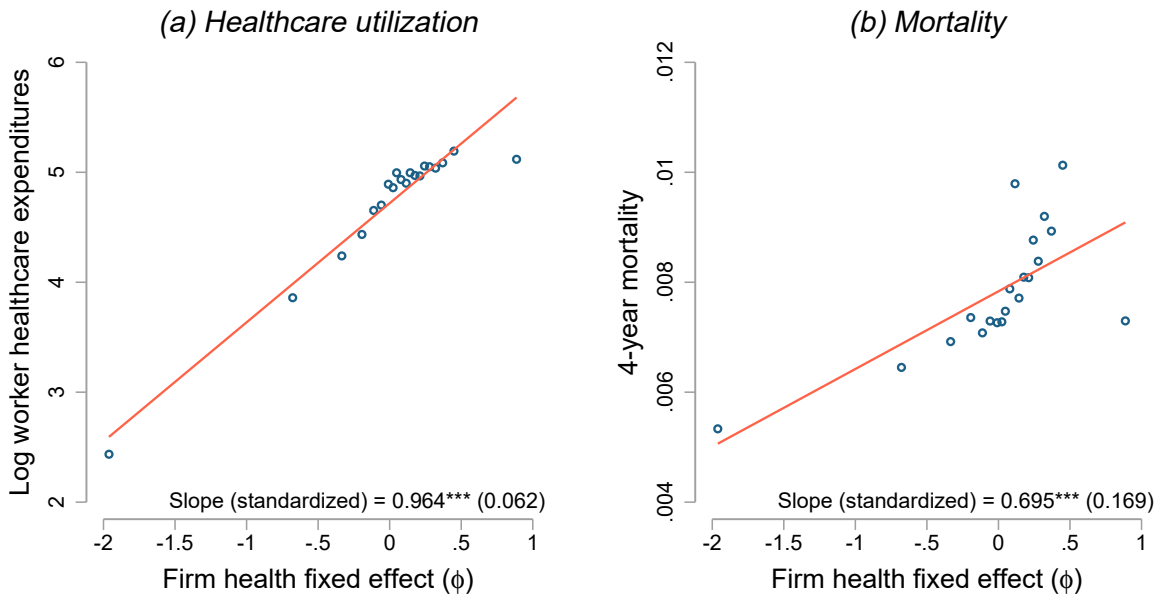
Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This figure plots the coefficients $\hat{\theta}_r$ from Equation (1) for a sample of non-movers. We simulate the size of the move δ for non-movers by drawing from a normal distribution that has the same moments as $\hat{\delta}$ in the balanced mover sample. The dependent variable is log health care expenses y_{it}. The red-shaded area is a 95 percent confidence interval. The jumps between $r = 0$ and $r = 1$ can be interpreted as the share of variation in health care expenditures across firms attributable to firms, the rest is explained by worker characteristics. Estimates are based on a balanced non-mover sample. N = 2,121,202

FIGURE 8 — Firm health and wage fixed effects distributions



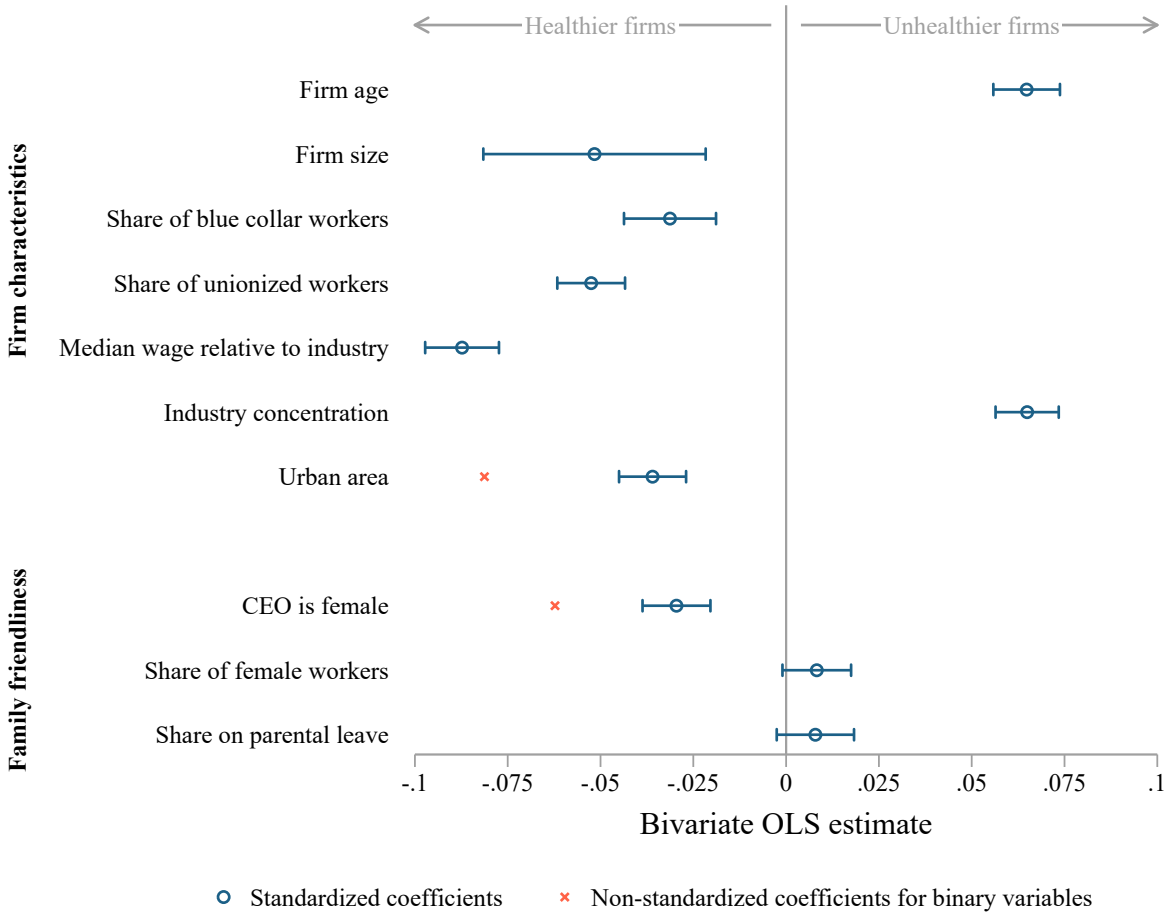
Notes: Estimated firm fixed effects $\hat{\theta}_{j(it)}$ with log total health expenditures and log wages as outcomes, both centered around zero. Only $[-5, 5]$ interval plotted, this excludes 0.1% of observations with very low firm health fixed effects. Estimates are based on the full worker × year panel. N = 9,184,913

FIGURE 9 — Firm health and wage fixed effects distributions



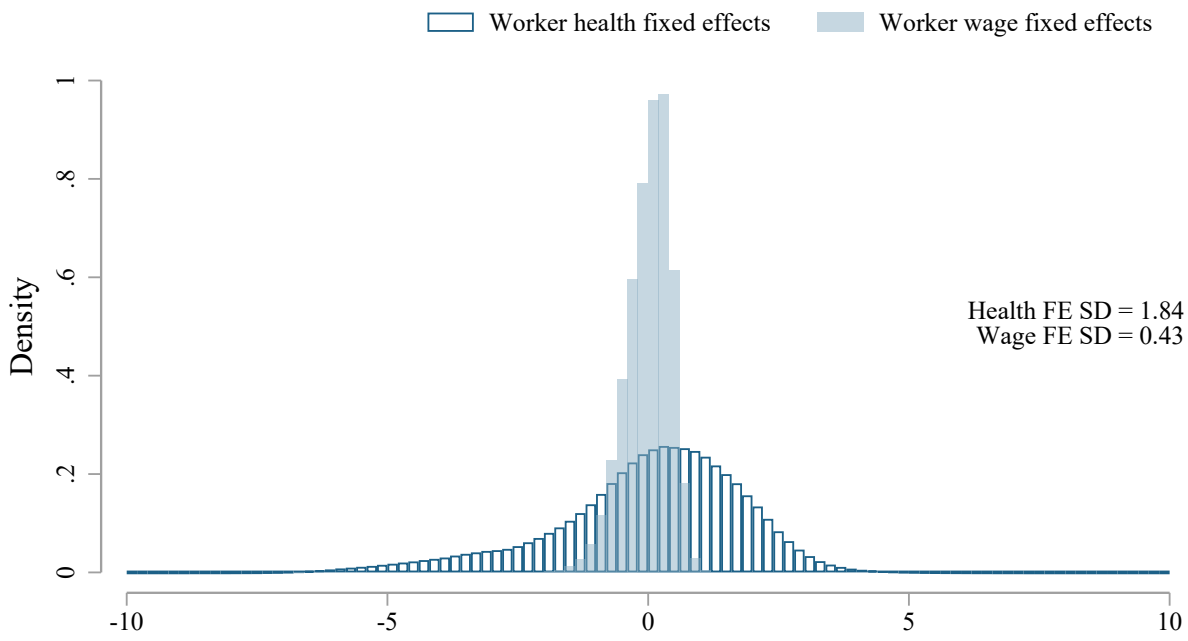
Notes: We estimate firm fixed effects $\hat{\theta}_{j(it)}$ on log total health expenditures (left panel) and 4-year mortality (right panel). Estimates are based on the full worker × year panel. N = 9,184,913

FIGURE 10 — Explaining firm health fixed effects



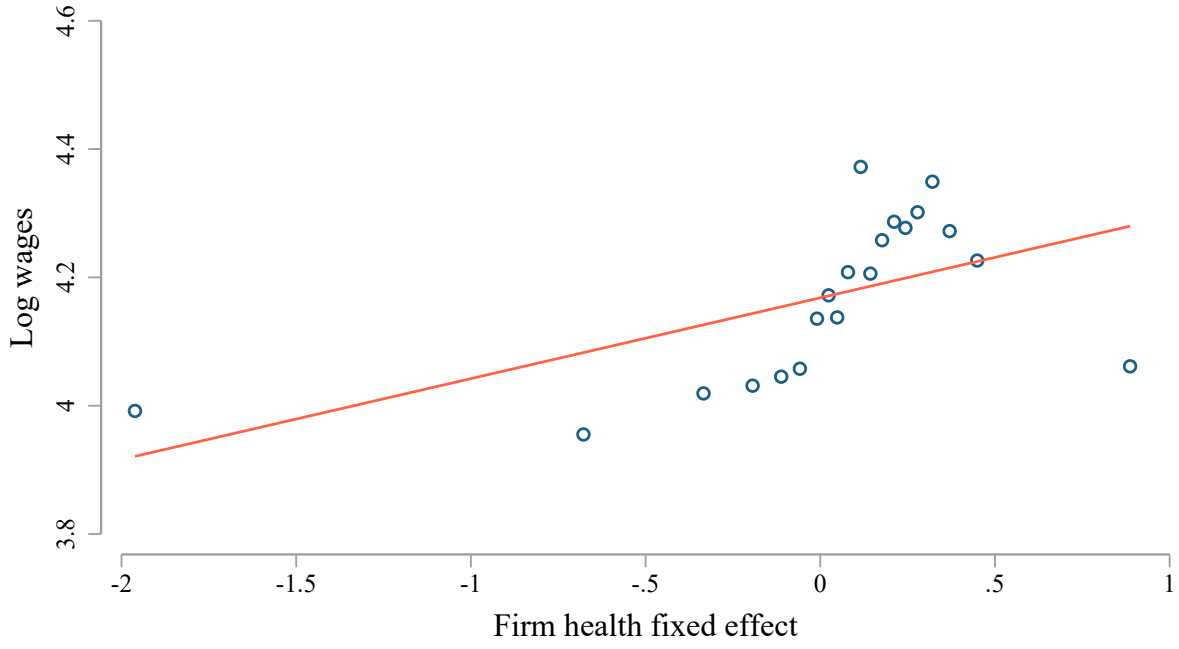
Notes: Here we plot coefficients from simple bivariate regressions of the estimated AKM health fixed effect $\hat{\theta}_j$ on a firm characteristic x_j. Continuous variables are standardized, so the coefficients can be interpreted as standard deviation changes in the health fixed effect in response to a 1 standard deviation increase in the firm characteristic. For binary variables, we plot both standardized and non-standardized coefficients. Estimates are based on the full worker × year panel. N = 9,184,913

FIGURE 11 — Worker health and wage fixed effects distributions



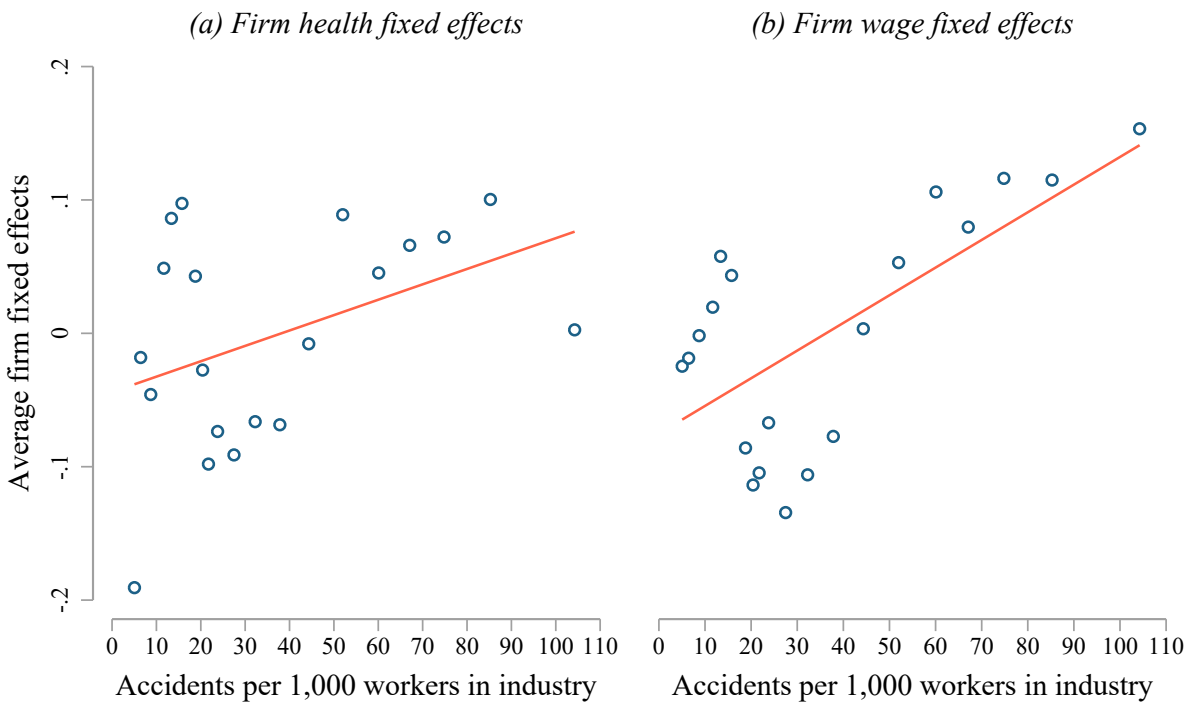
Notes: Estimated worker fixed effects $\hat{\alpha}_i$ with log total health expenditures and log wages as outcomes, both centered around zero. Only $[-10, 10]$ interval plotted, this excludes 0.01% of observations with very low worker health fixed effects. Estimates are based on the full worker × year panel. N = 9,184,913

FIGURE 12 — Correlation between log wages and firm health fixed effects



Notes: This figure shows average log wages by firm health fixed effects. average firm health and wage fixed effects against industry work accidents. We divide estimated firm health fixed effects into 20 quantiles and plot average fixed effects within these quantiles on the horizontal axis. On the vertical axis we show, for each quantile, average log wages. Estimates are based on the full worker × year panel. N = 9,184,913

FIGURE 13 — Correlations between firm fixed effects and work accidents



Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. Scatters represent average firm health and wage fixed effects against industry work accidents. For each NACE08 2-digit industry, we calculate the number of accidents per 1,000 workers between 2000 and 2017 by blue collar status and group accidents into 20 quantiles. The horizontal axis plots average accidents within these quantiles. The vertical axis shows, for each quantile, the average firm health and wage fixed effects across firms in these quantiles. Estimates are based on the full worker × year panel, restricted to 2000–2017, due to workplace accidents data availability. N = 8,018,551

TABLE 1 — Summary statistics

	All workers (1)	Mover sample (2)
Female	0.44	0.39
Age (years)	36.11	37.70
Blue collar	0.53	0.51
Daily wage (€)	72.09	73.72
Tenure (years)	5.13	7.65
Healthcare expenditures (€)		
Overall	592.72	429.43
Curative	572.88	412.34
Preventative	19.84	17.10
Worker × year observations	9,184,909	519,264

Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. Columns (1) and (2) present yearly means based only on the pre-move period. Column (1) presents means for the full sample of workers, while Column (2) presents means for workers that switch firms during our sample period.

TABLE 2 — Average expenditures/wages by firm fixed effect decile

Decile	Health		Wages	
	Average (1)	% difference (2)	Average (3)	% difference (4)
1	315.3		40.4	
2	507.9	0.61	49.5	0.23
3	580.7	0.84	57.9	0.43
4	610.8	0.94	65.6	0.62
5	624.0	0.98	71.3	0.76
6	631.8	1.00	76.3	0.89
7	626.2	0.99	80.1	0.98
8	649.6	1.06	84.7	1.10
9	666.1	1.11	92.9	1.30
10	726.8	1.31	103.8	1.57

Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This table reports average health care utilization, in Euros, for each firm health fixed effect decile (Column 1) and wages in EUR for each firm wage fixed effect decile (Column 3). Columns (2) and (4) present the percentage differences for the listed decile, relative to decile 1.

TABLE 3 — Additive decomposition of log health care expenditures

	Above/ below median	Top & bottom 25%	Top & bottom 10%
Difference in average log expenditures			
Overall	2.31	5.04	6.35
Due to firms	0.83	1.95	2.87
Due to workers	1.48	3.09	3.48
Share of difference due to			
Firms	0.36	0.39	0.45
	(0.002)	(0.002)	(0.003)
Workers	0.64	0.61	0.55

Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. Each column in this table defines a set of firms R and R', based on percentiles of average health care utilization. The first row shows differences in average log utilization between the two areas, the second row shows the difference that is due to firms, and the third row shows the difference that is due to workers. The fourth row reports the share of the difference in average utilization between the two sets of firms due to firms, which is the ratio of the third and the first row, along with standard errors for this ratio. The last row represents the share that is due to workers, which is the ratio of the second and the first row.

Web appendix

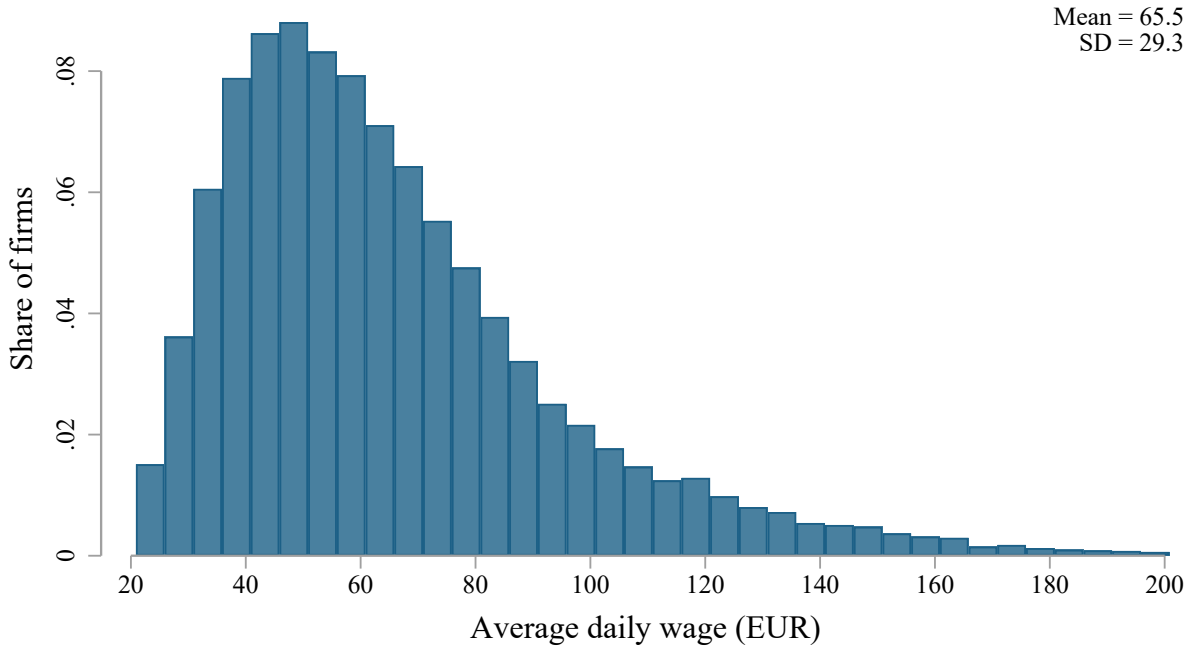
This web appendix contains additional material for the paper *"Firms and Worker Health"* by Alexander Ahammer, Analisa Packham, and Jonathan Smith.

Contents

A Additional tables and figures **A2**

A. Additional tables and figures

FIGURE A.1 — Distribution of average per-worker daily wages across firms



Notes: Data on workers is from the Austrian Social Security Database. Data on health expenditures is from the Upper Austrian Health Insurance Fund and spans from 1998–2018. This figure displays the distribution of average per-worker daily wages across firms, within a given firm-year, using a bin size of € 5. Averages are based on the full worker x year panel. N = 9,184,913