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ISSN: 2365-9793

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ABSTRACT

Employee Health and Firm Performance*

When workers are in bad health, their productivity declines. We investigate whether the health of employees affects firm performance, taking advantage of the severity of the seasonal influenza seasons as a source of exogenous variation. We find that firms whose employees are particularly affected by influenza experience reductions in their return on assets and in net income. These results are not driven by firm-specific characteristics, as we find the same relationship between influenza severity and firm performance within firms, at the establishment level. We also document substantial heterogeneity in the effects, with small firms and labor-intensive firms driving our findings. This suggests that labor is an important driver of firm performance and that capital-intensive and larger firms are better able to shift resources in response to temporary shocks to their workforce. Back-of-the-envelope calculations suggest that smaller firms may be better off subsidizing vaccination programs for their employees.

JEL Classification: L25, I12, G30, J31
Keywords: seasonal influenza, health shock, firm performance

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* Support from the Danish Finance Institute (DFI) is gratefully acknowledged. We thank the participants of the 2021 Annual Conference of the European Association of Labour Economists and seminar participants at Goethe University Frankfurt, Humboldt University Berlin, and the University of Georgia for helpful comments.

1 Introduction

Surveys of firm managers consistently indicate that firms incur large costs when workers are absent from work due to ill-health. For instance, the average rates of absence across Europe are 3–6 percent of working time, with an estimated aggregate cost of 2.5 percent of GDP (Edwards and Greasley, 2010). The total cost to employers is likely to be even higher because of presenteeism, i.e., productivity losses due to sick workers on the job (Grossman, 1972). Yet, the vast majority of research on the consequences of worker health focuses on the (long-term) outcomes of the workers themselves, such as their labor force participation and employment, income, and long-term health, leaving the effects on their employers largely unexplored. In this paper we aim to fill this gap by examining how employee bad health affects firm performance using detailed registry data from Denmark over the period 1999–2016.

Denmark represents an ideal setting for our study. First, the richness of the administrative data allows us to link employee health to the performance of their employers, an exercise that is typically impossible with publicly available data. Second, the Danish labor market is characterized by "flexicurity," a system in which employers have the flexibility to hire and fire workers who are in turn protected by a generous safety net that provides income security. Finally, all Danish residents are covered by a comprehensive public health insurance plan. These features of the Danish labor and healthcare markets ensure that firm decisions and employment relations are not tainted by other considerations, such as firing costs or the need for employer-provided health insurance.

When examining the relationship between firm performance and employee health, simple correlations are likely to be misleading. For example, in a labor market characterized by compensating differentials, employees select employers with policies or work environments suited to their health status and accept a remuneration that partly reflects the cost of these amenities to their employers. At the same time, different types of health-promoting policies or work environments are likely to have different consequences for firm performance. These two choices, on the employee's side and on the firm's side, can then lead to a spurious correlation between worker health and firm performance. In order to uncover the causal effect of employee health on their employers, we rely on a change in employee health due to an event that is plausibly independent of firm policies: the seasonal influenza, commonly known as the flu.

The seasonal influenza is the perfect candidate for a health shock in our framework. First, it affects a reasonably large share of the population, estimated at around 9 percent for working-age adults (Tokars et al., 2018). Second, influenza outbreaks generally occur in the northern hemisphere during the winter months and, depending on their severity, can lead to lost productivity, hospitalization, or even death (usually among the very young or the very old). More importantly, unless it causes death, the flu has symptoms and complications that amount to a transitory health shock (Eccles, 2005). This has the benefit that it should not affect the composition of the workforce of the firm permanently once the outbreak passes. Finally, although there are vaccines against influenza, there is no widespread resistance to the disease because vaccination rates vary widely and countries generally do not have mandatory (or free) vaccination programs. In Denmark, vaccination rates have traditionally been relatively low, reaching only 5%–10% of the working-age population. Moreover, even if vaccination were universal, the virus mutates from one year to the next and health organizations are not always able to predict the virus strain that will be prevalent in every year, resulting occasionally in pandemics like the 2009 swine flu pandemic.

To implement our analysis, we use detailed data on general practitioner (GP) visits to construct a measure of the change in the health of each firm's employees. We take advantage of the fact that C-reactive protein (CRP) tests are commonly used in the Nordic countries to determine the appropriate course of treatment in patients with (severe) respiratory tract infections (Lykkegaard et al., 2021; André et al., 2002; Honkanen et al., 2002). This allows us to construct a proxy measure for the severity of the flu season at the firm level: the average number of CRP tests administered per 1,000 employees and their family members during the usual "flu season," which runs between October and March. We find that firms whose employees are particularly affected by the flu experience a reduction in their performance in that specific year: A one standard deviation increase in the number of CRP tests lowers operating return on assets (and net income) by approximately 0.095 (0.078) percentage points.[1] These effects represent a decline of 0.524 (0.460) percent of a standard deviation of operating return on assets (net income). In monetary terms, the average firm in our sample experiences a decline of USD 7,442 (46,786 DKK) in operating profits, or USD 6,072 (38,174 DKK) in net income, for a one standard deviation increase in the number of CRP tests. These findings are also confirmed when we conduct our analysis within firms, at the establishment level. This approach helps alleviate the concern that our estimates are driven by some time-varying unobserved firm characteristics that are correlated with both firm-level profitability and local influenza outbreaks. Using a sub-sample of firms with at least two establishments, we find that the profit per employee of establishments that experience a severe flu season is lower by about 0.403 percent of a standard deviation.

We can gauge the magnitude of these effects by comparing them to previous studies on the impact of various factors and policies on firm performance. Bennedsen et al. (2019) use administrative data linked to surveys of employee absenteeism and find that an increase by one day in the average days absent decreases operating return on assets by 0.05 to 0.07 percentage points. Bennedsen et al. (2020) examine CEO hospitalizations and estimate that operating return on assets and net income are reduced by 0.05 and 0.037 percentage points, respectively, for each night a top executive spends in the hospital.[2] Therefore, facing a severe flu season reduces the return on assets and net income by the same amount as an approximately two-day increase in the average number of days absent among all employees, or a three-day hospital stay of the CEO.

Our main assumption is that the severity of the flu season affects firm financial performance only through its impact on employee productivity. This has at least two implications for the cross-sectional relationship between the flu season and firm performance. First, all else equal, the potential impact of an influenza outbreak should be more severe for firms in which human contact is more common. For example, the profitability of more labor-intensive firms should decline more than the profitability of more capital-intensive firms when facing a severe flu season. Our results confirm this conjecture. We find that the reduction in profitability in periods of severe flu exposure is most

[1]For ease of exposition, in the rest of the paper we will refer to a one standard deviation increase in the number of CRP tests as a "severe flu season" or a "flu outbreak."

[2]As we detail in section 3, our baseline specification controls for the hospitalizations of the top employees in the firm, meaning that the estimated effect of the flu is net of that of CEO hospitalizations.

pronounced for the most labor intensive firms. These firms experience a fall in operating return on assets of 0.175 percentage points (or 0.967 percent of a standard deviation). In contrast, our measures of profitability for the most capital intensive firms do not show a response to a severe flu season. Second, firms that are able to shift resources in order to cover for sick employees should be more insulated from the effects of employee bad health. Indeed, we find that the impact of the flu season decreases with firm size: Firms in the bottom half of the size distribution (*micro firms* and *small firms*) are significantly harmed by the flu, while firms in the top half of the distribution are virtually unaffected.

Given our finding that influenza outbreaks negatively affect firm profitability, a natural next question is how this shock is absorbed within the firm. In particular, we focus on two of the firms' most important stakeholders: employees and shareholders. To examine if there are any pass-through effects to employees, we consider the firm-level averages of wages, benefits (measured as the tax value of fringe benefits), and employment. We further distinguish between wages and benefits for employees that have been with the firm in the prior year (seasoned employees) and new hires. Our results indicate that a more severe flu season leads to a lower average annual salary for seasoned employees, but has no effect on their benefits. We do not detect an effect on the wages or benefits of new hires. However, these average effects hide substantial heterogeneity along the wage and benefits distribution: Seasoned employees experience a wage penalty that is decreasing in the wage level and in the benefit level. While our average effects on benefits are not significant, we find that employees with smaller benefits do experience a significant reduction of their benefits while employees with larger benefits experience an actual increase of their benefits. In our analysis of the financial consequences for the firms' shareholders, we focus on dividends. We find that the average dividend is largely unaffected despite the fact that shareholders of firms facing an influenza outbreak are less likely to receive dividends. In conclusion, our results suggest that firms pass through the negative consequences of seasonal influenza on firm profitability to employees, but not to shareholders.

Our paper makes several contributions to the literature. Prior research documents that seasonal influenza has a significant cost burden on the macroeconomy (e.g., Petrie et al., 2016; Peasah et al., 2013). Quantifying the costs for the healthcare system in the US, Putri et al. (2018) provide estimates of the annual direct medical costs ($3.2 billion) and the annual indirect costs ($8.0 billion). Projected annual lost earnings due to illness and loss of life caused by influenza in the US are estimated to be around $16.3 billion (Molinari et al., 2007). The magnitude of these estimates is generally consistent with evidence from survey data, which suggests that the reduction of individual worker productivity amounts to about 26% in the presence of an influenza infection (Dicpinigaitis et al., 2015). It is noteworthy that all of these estimates are obtained in the context of the US, where vaccination efforts resulted in higher vaccination rates than in many other developed countries.[3] Our analysis focuses on how firm profitability, an important and significant component of annual indirect costs, is affected by seasonal influenza outbreaks.

The effect of influenza on firm-level outcomes has received little attention in the literature, with two notable exceptions. Morris and Hoitash (2019) examine the relevance of influenza infections in the context of firm-level accounting audits in the US. Exploiting time-series and cross-sectional variation in a measure that captures both the average spread and the severity of the flu at the state level, the authors show that audit quality suffers because the flu season overlaps with the busy audit season. In a contemporaneous study, Dorner and Haller (2020) analyze how local influenza intensity affects total factor productivity. They document that the length of the influenza season in German municipalities from 2003 to 2009 has negatively affected firm productivity. Our analysis differs in several dimensions from these studies. First, while Dorner and Haller (2020) base their analysis largely on survey data, our setting is based on administrative data that covers the entire population of Danish firms and residents. This allows us both to calculate a firm-specific measure of flu severity and to include a wide range of control variables such as the number of sick days of top executives. Second, we analyze how the flu affects firm profitability and net income, and, importantly, some of the underlying channels for the observed effects. Finally, using establishment balance sheet information allows us to control for unobservable characteristics that vary at the firm-year level via firm-year

[3]To prevent pandemic outbreaks, flu vaccinations are recommended (Maurer, 2009). However, unlike in the US, the vaccination rate in Denmark, reported by the Statens Serum Institut, has traditionally been relatively low. Moreover, because the influenza virus mutates, the risk of a flu infection is not mitigated over time. Several studies have analyzed the role of the influenza vaccination and its cost effectiveness (e.g., Leidner et al., 2019).

fixed effects.

Our paper is also related to the large literature on the consequences of worker health for the individual worker. The vast majority of papers in this literature focus on outcomes such as labor force participation, employment, welfare dependence, and income (e.g., García-Gómez et al., 2013; Smith, 1999; Chirikos and Nestel, 1985; Luft, 1975; Berkowitz and Johnson, 1974). These studies typically consider "extreme events," such as the onset of disability or cancer diagnosis, as sources of variation in worker health (e.g., Pak et al., 2020; Kostøl et al., 2019; David et al., 2016; Bradley et al., 2002).[4] In contrast to these health shocks with long-lasting consequences, we examine the effect of a common and transitory health condition, the seasonal influenza. We then document how the lower firm profitability due to seasonal flu outbreaks affects average worker wages, benefits, and employment.

We also add to the literature on firm investments in employee health. These investments typically take the form of workplace wellness programs, which are programs designed to improve the health and general well-being of employees. Much of the literature documents that these programs improve the health of workers, increase worker productivity, and reduce costs from absenteeism (see the review in Baicker et al., 2010). However, Jones et al. (2019) argue that most of these findings are due to strong selection of employees into this type of programs. Most importantly for our paper, they find that correcting for selection eliminates any benefits of wellness programs on worker productivity. Our findings suggest that firms, in particular those in the bottom half of the size distribution, might be able to reduce the loss of worker productivity due to ill-health by investing in a different type of program: providing financial incentives for vaccinations, in our case against the flu.

Finally, our paper is also related to the literature on employee absenteeism. In a recent paper, Bennedsen et al. (2019) study sick-leave absenteeism in Denmark using survey data linked to administrative data for a sample of 4,140 firms. However, their focus is not on firm profitability. Instead, they analyze factors that influence individual effort, i.e., worker personal traits and characteristics

[4]One other related paper documents the negative consequences of indirect exposure to the flu. Schwandt (2018) shows that maternal influenza infections during pregnancy are associated with worse health at birth and with long-term consequences such as lower earnings, decreased labor market participation, and higher rates of welfare dependence.

(e.g., motivation or work ethic) and firm-level policies and characteristics (e.g., incentive plans or corporate culture). Using Belgian survey data of 1,107 firms, Grinza and Rycx (2020) show that sickness absenteeism dampens firm productivity, but they do not examine firm profitability and its underlying channels. Given that severe flu seasons lead to increases in absenteeism (Blasio et al., 2012; Galante et al., 2012; Keech and Beardsworth, 2008; Akazawa et al., 2003), our findings indirectly provide evidence of a relationship between higher absenteeism rates and firm profitability.

The remainder of the paper is organized as follows. Section 2 provides some background on the seasonal influenza. Section 3 describes the empirical strategy and data. Section 4 presents the main results and, last, Section 5 concludes.

2 Background

2.1 The link between employee health and firm performance

Health, just like education, is a form of human capital. In the Grossman (1972) model, the most common theoretical framework describing individual decisions related to health, people invest in their health because it serves two purposes. First, health enters the utility function, meaning that it provides utility on its own. Second, and most importantly for our study, the stock of health determines the amount of sick time the person will have to spend away from work and, implicitly, the total income that the person earns in the labor market. Recent extensions of the model allow for a further role of the health stock, which is that it can affect the productivity of a person at work (e.g., French, 2005; Jacobson, 2000). One general implication is that people respond to health shocks by increasing their investments in health, typically through higher use of medical services.

The empirical literature generally finds that persons in good health tend to work more hours and to earn higher hourly wages, with a stronger effect on hours worked (see Prinz et al., 2018, and Currie and Madrian, 1999 for reviews of the literature). In order to eliminate the potential bias due to confounders that affect both investments in health and participation in the labor market, the vast majority of these studies rely on exogenous changes in health brought on by relatively severe health shocks such as cancer diagnosis, the onset of chronic conditions, or the onset of disability. These health shocks tend to have long-lasting consequences on the persons affected and the observed reduction in employment is typically due to exits from the labor force (e.g., early retirement, disability insurance) rather than to employer responses (Prinz et al., 2018; Currie and Madrian, 1999).

At the same time, there is very limited evidence on the effects of relatively small and temporary health shocks on the labor market outcomes of those affected. This type of shocks typically does not have long-lasting consequences on the health of workers, but does impact their productivity in the short term. For example, a number of studies document increased absenteeism as a result of influenza (see Keech and Beardsworth, 2008, for an early review, or Duarte et al., 2017, Galante et al., 2012, or Blasio et al., 2012, for more recent evidence following the 2009 swine flu pandemic). The optimal response of individuals to these temporary shocks is to increase their use of medical services in order to restore their stock of health. The natural question that follows is, what is the optimal response of employers? In a perfectly competitive labor market, employers would instantaneously replace the less productive or absent workers with healthy, productive workers. In reality, however, this may not be feasible because of labor market frictions (e.g., hiring and firing costs) or because the supply of healthy workers may be limited during epidemics. Instead, employers might try to alleviate the effects of short-term worker absences by hiring additional (permanent or temporary) workers, or by dividing the workload among the existing healthy employees (to the extent that they are substitutes for the sick employees). Both of these strategies imply higher costs and/or disruptions in production, and therefore lower firm performance.[5]

2.2 Seasonal influenza

Seasonal influenza, or colloquially simply “the flu”, is an ideal example of the relatively small and temporary health shocks described above. It is an acute and contagious respiratory illness caused by influenza viruses. Common symptoms are a sudden onset of fever, sore throat, runny nose, cough

[5]There is some evidence that firm performance is negatively affected even in response to predictable and planned temporary changes in their workforce, such as maternity leave, because firms have to rely on the same costly strategies mentioned above (Ginja et al., 2020).

(usually dry), headache, muscle and joint pain, and fatigue. The flu is also frequently associated with pulmonary complications like pneumonia, either viral or bacterial, which can result in severe illness and mortality among high-risk groups such as the elderly, people with certain chronic conditions (e.g., asthma, diabetes, or heart disease), pregnant women, or children (Krammer et al., 2018).

A diagnosis of influenza is made mostly based on symptoms and on the likelihood of infection (Krammer et al., 2018). This is complicated by the fact that many of its symptoms are shared with other diseases, such as the common cold. In addition, many patients consult a (primary care) physician only if their symptoms are severe. Physicians must then consider the possibility that those symptoms are the manifestation of a bacterial infection (most likely pneumonia) which requires treatment with antibiotics rather than of a viral infection. A test widely used in primary care in the Nordic countries to distinguish between a viral and a bacterial infection is the C-reactive protein (CRP) test (Melbye et al., 2004). CRP is a protein produced by the liver that is involved in the innate immune response, meaning that its blood concentration increases in response to inflammation, infection, or tissue damage (Pepys and Hirschfield, 2003). In patients with respiratory tract infections, CRP levels are higher if the infection is bacterial rather than viral (Hopstaken et al., 2003). CRP tests are common in primary care in Denmark, where more than half of the patients presenting with symptoms of a respiratory tract infection during flu seasons receive such a test (Lykkegaard et al., 2021).[6] Therefore, the administration of a CRP test in primary care can be interpreted as a sign of a severe respiratory tract infection, potentially brought on by the flu.

The treatment of influenza mostly consists of the management of symptoms, such as the control of fever, rehydration, etc. (Krammer et al., 2018). People who do not develop serious complications typically recover within one week without requiring medical attention, but rather supportive care provided informally by a family member or a friend. This is particularly relevant in the case of young children because they have the highest attack rate of all age groups and because they also

[6] While there is some debate on the usefulness of CRP tests to diagnose influenza infections (see, for example, Zimmerman et al., 2010, or Rystedt et al., 2020), it is sufficient for the purpose of our study that they are used when a patient presents with symptoms of severe respiratory tract infections. Moreover, the official guidelines from the Danish health authorities recommend that GPs use CRP tests to diagnose influenza if the patient shows signs of pneumonia or is generally affected by the above mentioned influenza symptoms (www.sundhed.dk/, last accessed on October 12, 2021).

tend to spread the disease to their caregivers (Jayasundara et al., 2014).[7] Complications of influenza typically require specific treatments, either in a hospital setting or at home (e.g., bacterial pneumonia should be treated with antibiotics).

There are two main preventive actions against the flu: good hygiene such as hand-washing or coughing and sneezing in disposable handkerchiefs, and vaccination. However, flu vaccinations need to be refreshed every year because the virus mutates and are, on average, only 40–60% effective among working-age adults at preventing infection or hospitalization in case of infection (Rondy et al., 2017). In Denmark, vaccinations can be obtained at the general practitioner (GP), in most pharmacies, or through special vaccination offers and centers in some municipalities. Vaccinations are free of charge for persons over the age of 65, for people with chronic conditions, and for pregnant women. The rest of the population needs to pay a fee of about 200 DKK (USD 32), but more than 40-45% of the Danish population has voluntary health insurance by the non-profit mutual association called Sygeforsikringen "danmark," which covers 50% of the vaccination fee (Kristensen and Olsen, 2021; Olejaz et al., 2012). Despite the relatively low costs of vaccination, only a small fraction of the population is vaccinated against the flu. According to official data from the Danish Ministry of Health, between 2009 and 2015 only around 3% of persons 18–64 years old were vaccinated.[8] Even among people above the age of 65, for whom the vaccination is free, only about 45–50% were actually vaccinated.[9] In conclusion, Danish workers are largely unprotected against severe flu seasons given the very low vaccination rate among the working-age population.

As mentioned above, the influenza virus mutates while circulating around the world so that previously-obtained immunity is largely lost, leading to annual outbreaks during the winter months, when transmission is easier because of low humidity and low temperatures (Krammer et al., 2018). As a result, influenza is the leading infectious disease in the developed world. Each year, 3% to 11%

[7]The attack rate is the percentage of the population that contracts the disease during a specified time interval.

[8]The data can be found at https://statistik.ssi.dk/, last accessed on April 3, 2021.

[9]Although low, the vaccination rate for the elderly ranks close to the median among EU member states but lower than the approximately 67% in the U.S., and much lower than the recommended rate of 75% in this population (OECD, 2018). It is unlikely that the low vaccination rate in Denmark is driven by costs. In Germany, roughly 9% (41%) of the people aged 18-59 (above 60) are vaccinated despite the fact that the influenza vaccination is offered (by and large) free of charge (https://www.laekh.de/, last accessed on April 3, 2021).

of the population are affected with symptoms (Tokars et al., 2018), between 5% to 20% have an asymptomatic version of the illness, and 3 to 5 million cases are severe (Krammer et al., 2018; Adda, 2016; Russell et al., 2008). In general, the severity of seasonal influenza outbreaks varies both across years and locations. Temporal variability in the severity of influenza seasons is often attributed to shifts in the virus sub-type, vaccination effectiveness, and antiviral treatment, while geographic differences may relate to environmental factors such as humidity, temperature, or air pollution.[10] For example, a new influenza virus (H1N1) spread globally from the spring of 2009 to 2010, leading the World Health Organization to declare a pandemic. Other years, such as 2000, are regarded as mild flu seasons.

Influenza, even without complications, can cause major disruptions in the lives of infected people. Uncomplicated influenza in otherwise healthy adults and children is rarely fatal but it can lead to substantial absences from work or school. It can cause low energy, sleep problems, reduced ability to concentrate, and coughing for up to several weeks (Van Wormer et al., 2017; Goetzel et al., 2004). Recovery can be prolonged, with persistent fatigue and malaise that can last for several weeks after recovery from the other symptoms. Not surprisingly, influenza is associated with decreased job performance in adults (Nichol et al., 2009). For example, survey data suggest productivity losses of more than 50% among workers affected by the flu (Van Wormer et al., 2017). In conclusion, being infected with the flu or having a household member infected with the flu hinders both an employee's ability to go to work and, while at work, their ability to perform their tasks efficiently.

[10] See Dave and Lee (2019) for a recent review of the literature on seasonal influenza patterns.

3 Empirical strategy, data, and descriptive statistics

3.1 Empirical strategy

We are interested in estimating the effect of employee health on firm performance. The main equation of interest has the following form:

$$\pi_{ikt} = \alpha_t + \nu_i + \widetilde{\beta} \times Employee\_Health_{ikt} + \gamma X_{ikt} + \delta Z_{kt} + \epsilon_{ikt}, \tag{1}$$

where π_{ikt} is a measure of firm-level profitability for firm i located in municipality k in calendar year t, α_t are calendar-year fixed effects, ν_i are firm fixed effects, $Employee\_Health_{ikt}$ is a measure of the general health of the employees in the firm, X_{ikt} is a set of firm-level control variables, and Z_{kt} is a set of municipality-level control variables.

The coefficient of interest, $\widetilde{\beta}$, measures the average change in firm performance as a result of a change in the health of its employees. However, it is unlikely that a simple estimation of equation (1) uncovers the causal effect because of choices made by both firms and employees that are related to both employee health and firm performance. For example, firms may invest in workplace safety in response to a high number of accidents in the workplace, which can then reduce their profitability (Cohn and Wardlaw, 2016). At the same time, workers in worse health may choose to work for firms that invest in the health of their employees, such as through workplace safety measures. Both of these decisions will result in a spurious positive correlation between the performance of firms and the health of their employees.

In order to eliminate this potential bias, we rely on plausibly exogenous changes in employee health, or health shocks. Large changes in the health of one or more employees may induce the firm to adjust their workforce, typically by (eventually) replacing the sick employees. The change in firm performance would then be the sum of two different effects: the direct effect of the health shock, and the effect of the workforce adjustment. Therefore, as suggested in Section 2, we make use of the temporary and relatively small health shocks brought on by seasonal influenza outbreaks that do not give firms the incentive to alter their workforce. These shocks are arguably exogenous to a firm's current financial performance given that most influenza infections happen outside the firm. Edwards et al. (2016) review the literature on influenza transmission in the workplace and find that on average, only 16.2% of influenza transmission occurs in the workplace. In addition, seasonal influenza can affect the health, and hence productivity, of an employee irrespective of occupation or rank. For example, Suarthana et al. (2010) document wide dispersion of individuals infected with the 2009 H1N1 influenza strain over industry sectors and occupations. Consequently, seasonal influenza outbreaks carry the potential to affect the productivity of human capital across the entire firm, and can thus be considered a potential threat to the health of a firm's general workforce.

We measure changes in workforce health through a variable that can be interpreted as a proxy for a respiratory tract infection with severe symptoms, likely brought on by the seasonal influenza: the number of CRP tests performed on the employees and their families during the flu season (*CRP_tests*).[11] The estimating equation is then:

$$\pi_{ikt} = \alpha_t + \nu_i + \beta \times CRP\_tests_{ikt} + \gamma X_{ikt} + \delta Z_{kt} + \epsilon_{ikt}, \tag{2}$$

The coefficient of interest β, represents the effect on firm performance of an increase in the number of infections with severe symptoms among the firm workforce and their families.[12] The standard errors are clustered at the firm level.

A remaining threat to the interpretation of this effect as causal is that firms may select their location based on their profitability and on the (history of the) health of potential employees. We address this concern in several ways. First, we include in our main specification firm-level controls and firm fixed effects that should eliminate observable firm characteristics and unobservable (time-invariant) firm characteristics that could factor into the firm's location decision. Second, we estimate specifications including municipality-year fixed effects, which eliminate unobservable characteristics

[11] We detail the construction of this variable in Section 3.2.

[12] Equation (2) can be thought of as the reduced form in an instrumental variables framework, where equation (1) is the main equation of interest and we instrument for the endogenous variable *Employee_Health* with the plausibly exogenous variable *CRP_tests*.

that vary across municipalities *and* years. Finally, in case there might still be some unobserved firm characteristics or municipality characteristics that are correlated with firm-level profitability and with the local influenza outbreaks, we implement an approach that relies on establishment-level data. For the firms that have more than one establishment (workplace), we can estimate a specification similar to equation (2) but which includes both municipality-year and firm-year fixed effects:

$$\pi_{eikt} = \alpha_{it} + \beta \times CRP\_tests_{eikt} + \gamma X_{eikt} + \delta Z_{kt} + \epsilon_{eikt}, \quad (3)$$

in which the unit of observation is establishment e located in municipality k and belonging to firm i in calendar year t, and the proxy measure *CRP_tests* is calculated at the establishment level. In addition to the municipality-level control variables included in (2), we also include a set of establishment-level controls X_{eikt}.[13] As we discuss above, the most important innovation in this specification is that we can now include the firm-year fixed effects α_{it}. These variables capture all time-varying firm-specific drivers of establishment-level profitability and help address concerns that our results are mainly driven by unobservable characteristics of the firm, which may vary over time and are not captured by the set of firm-level controls employed in equation (2). We cluster the standard errors at the establishment level.

Another important assumption we make is that a local influenza outbreak impacts firm performance only through its effect on employment productivity, and not through changes in local customer demand. We include the local unemployment rate as a control variable in equations (2) and (3) to capture changes in local customer demand, and more generally, changes in local economic activity. To interfere with the interpretation of our results, changes in local customer demand would need to coincide with local influenza outbreaks, which may be the case if ill-health reduces personal consumption. We account for this by including municipality-year fixed effects in some of our specifications.

[13] Note that all the firm-level control variables are absorbed by the firm-year fixed effects in this specification.

3.2 Data sources and variable construction

3.2.1 Data sources

Our data comes from several administrative registers provided by Statistics Denmark, a Danish government entity under the Ministry of Economics that is responsible for data collection and for creating statistics on the Danish society. Each of these registers includes unique firm and/or individual identifiers, which allow us to create firm-employee matches and to extract very detailed data on both firms and individuals.

Our analysis makes use of the following registers over the period 1999–2016: (1) The *Population Register* includes variables such as the date of birth, sex, marital status, partner identification number if applicable, and the identification numbers of the parents for every resident of Denmark. (2) The *Health Insurance Register* records the claims made by privately-practicing health professionals to the national health insurance. Given that the national health insurance covers all visits to the GP to which a person is assigned, the register provides the universe of GP visits in Denmark. It includes information on the date of the claim and the service provided. (3) The *Integrated Database for Labour Market Research Register (IDA)* combines information on employees, such as socioeconomic status or the position in the organization, with information on employers, such as the address of their headquarters, the number of establishments, and for each establishment, a unique identification number and its address. This allows us to create a match between employees and firms and, for firms with multiple establishments, the main establishment within the firm. The position of an employee in the firm is based on the Danish occupational code, a classification derived from the international standard classification of occupations (ISCO). (4) The *Employment Register* provides additional information on the labor force participation status of each person in the population. (5) Information from balance sheets is available for all limited liability and public firms that report to the Danish tax authorities (SKAT) via the *Accounting Statistics Register (FIRE)*. (6) Limited accounting data also exists at the establishment level via the *FIRA Register*, available only between 2007–2015. (7) Last, the *Municipality Key Figures* is a publicly-available municipality-level data set including aggregate figures such as the unemployment rate, the overall area, and the total population for each municipality and for each year.

3.2.2 Variable construction

Similar to Bennedsen et al. (2020), we focus on two main measures of firm profitability as our main outcomes: operating return on assets (OROA), i.e., the ratio of operating income to total assets, and net income to total assets (NI). Because these measures are not available in the establishment data, we use profit per employee, defined as the ratio of establishment gross profit to the full-time employee equivalent of the establishment, in our establishment-level analysis.

We construct our proxy measure *CRP_tests* in several steps. For each firm and for each year, we start with the list of its employees. We then add the family members (spouse and children) of the employees because the treatment of the flu requires supportive care provided by family members and because children tend to spread the disease to their caregivers (see Section 2.2). Finally, we define *CRP_tests* as the average number of CRP tests performed during the flu season per 1,000 persons.[14]

In general, influenza seasons vary widely, both throughout time and cross-sectional: For instance, while a new influenza virus A (H1N1) spread globally from the spring of 2009 to 2010, other years, such as 2000, are regarded as mild flu seasons. Figure 1 shows the variation in the severity of the seasonal influenza over time by plotting the evolution of influenza-related hospitalization rates (flu and pneumonia) in Denmark between 1996–2016. Similarly, wide variation in the severity of influenza outbreaks exists between Danish municipalities. Figure 2 shows the distribution of flu and pneumonia hospitalization rates across Danish municipalities during a low (2019) and high (2011) flue year. Two things are worth noting: First, in either year, some municipalities are hit harder while others suffer much less. Second, which municipality experiences a more or less severe flu season changes over the years. In general, however, some municipalities experience a severe flu season between 1999–2016 more often than others, and while the capital region of Zealand is hit more often, there exists

[14]We use the billing codes 807120, 81720, 827120, 837120, and 897120 to identify CRP tests performed by GPs. Statens Serum Institut, the Danish equivalent of the Centers for Disease Control and Prevention in the US, monitors the flu between week 40 of a given year and week 20 of the following year. We follow this guidance and define the flu season in a given calendar year to include weeks 1–20 and 40–end of the year.

some cross-sectional variation even within this region.

Turning to the control variables included in our firm-level analysis, these are a measure of firm size, a measure of industry concentration, and firm age brackets. We also include the average number of hospitalization days among the top-5 employees of the firm, and the average number of hospitalization days among the remaining rank-and-file employees in our set of firm-level control variables. The former have been shown to negatively influence firm performance (Bennedsen et al., 2020). In the establishment-level analysis, we control for the natural logarithm of establishment-level employment (measured by its full-time employee equivalent) and indicators for the age of the establishment in 5-year bins.

In all of our regressions, the set of municipality-level control variables consists of the local unemployment rate and the local population density, both in logarithmic form.

3.3 Descriptive statistics

Our sample consists of both privately held and publicly traded firms in Denmark. We focus on limited liability firms that have more than five employees during the period of 1999 to 2016. In Denmark, limited liability firms can either operate as a public limited liability company (aktieselskab or A/S) or as a private limited liability company (anpartsselskab or ApS). We retain both of these types of firms in our sample. Following standard conventions in the literature, we exclude all financial, utility, and government-owned entities. Our final sample includes 25,599 firms with a total of 246,082 firm-year observations over the period from 1999 to 2016.

Table 1 provides summary statistics. Overall, a large portion of the firms in our sample are small and medium-sized firms, which are spread out all over Denmark, and which are typically privately owned. The average (median) firm has 42.5m (11.1m) DKK, or USD 6.8m (1.8m) of total assets, 34 (16) full-time employees, and is 16.3 (13.0) years old.

Our two measures of firm performance are operating return on assets (OROA) and net income (NI). OROA varies between 0.04% (25th percentile) and 14.0% (75th percentile), with a mean of 6.2%, while NI varies between -3.2% and 8.9% with a mean of 1.6%. Turning the attention to further firm and industry level characteristics, the investment rate (i.e., the ratio of capital expenditures to total assets) is 4.5% and tangibility (i.e., the ratio of property, plant, and equipment to total assets) is 13.5%. Dividends (i.e., cash payouts to firm owners) are very common and are paid in 69.2% of the firm-years. Moreover, the average market concentration in our sample, measured by the Herfindahl-Hirschmann index of the firm's industry sales, is 0.022, indicating that most industries consist of a large number of firms of relatively equal (and small) size.

Table 1 further shows that on average, 0.1 CRP tests per 1,000 individuals are performed among the employees and their families during a flu season. Moreover, the top-5 employees are hospitalized 0.28 days in a year, which is less than rank and file employees (0.39 days).

4 Main results

We start our empirical analysis by examining whether seasonal influenza outbreaks affect firm operating performance. We subsequently discuss cross-sectional differences in the effect across industries and firm characteristics, and also provide a discussion of the economic magnitudes of our results. Next, we analyze the effects on employees and firm owners. Last, we show that our results are robust to using alternative regression specifications.

4.1 The effect of employee health on firm performance

The first set of results we present in this section are based on the empirical model described by equation (2) above, where we regress firm-level operating performance on our proxy for the severity of seasonal influenza outbreaks. We report the results for two different measures of operating performance in Table 2: operating return on assets in Panel A and the ratio of net income to total assets in Panel B.

Column (1) in each panel reports the results for our baseline specification, which only uses firm and year fixed effects but no other control variables. We find that both measures of firm-level profitability are significantly lower when firms' employees are exposed to a particularly severe seasonal influenza outbreak. For example, when measuring firm performance with operating return on assets in Panel A, our estimated effect of employee health on performance is -0.0088 (significant at the 1% level). In other words, for each additional CRP test per 1,000 employees of a firm or their family members, that firm's operating return on assets declines on average by 0.88 percentage points. The magnitude of this decline represents 0.623 percent of a standard deviation of operating return on assets. Using net income over total assets as a measure of profitability leads to qualitatively similar results, as is shown in Panel B. Our coefficient estimate of the effect of employee health on performance is -0.0076 or 0.574 percent of a standard deviation of net income in our sample. Overall, our results support the notion that health-induced employee absenteeism or health-related reductions in employee productivity can become significant enough to have an effect on firm-level outcomes such as operating performance.

Column (2) of each panel adds municipality $\times$ year fixed effects to our specification. With this modification to our set of fixed effects, we are able to shut down effects of all confounding factors that vary across municipalities and over time. In particular, we estimate this specification to address the potential concern that our results are not driven by firm-level exposure to local influenza outbreaks, but rather by local economic conditions that correlate with local influenza outbreaks. We obtain very similar coefficient estimates for the effect of employee health on firm performance with this specification and those estimates also remain highly statistically significant.

In Column (3) of each panel, we add firm and municipality controls to the specification with firm and year fixed effects that we reported in Column (1). Two noteworthy firm-level control variables in this specification, next to our measures of firm size and market concentration, are measures of employee hospitalizations. In particular, we control for the average number of hospitalization days of managers (defined as the five highest-paid employees in a firm) and rank-and-file employees. Including these controls addresses the concern that our influenza-related measure of employee health is, for example, simply measuring CEO hospitalizations, which have been shown to negatively influence firm performance (Bennedsen et al., 2020). To control for the economic potential and activity of a firm's municipality, we further include municipality-level measures of population density and unemployment rates in our specification. It is reassuring that we continue to find a significant and negative effect of employee health (measured with the number of CRP test) on firm performance when including these additional control variables. Our estimated effect of employee health on performance is -0.0074 when performance is measured with operating return on assets, and -0.0060 when measured with net income over total assets. Turning to our firm-level control variables, both of our employee hospitalization measures are negatively related to firm performance, though only our management hospitalization measure is statistically significant. Moreover, we note that the average number of hospitalizations of top-5 employees has a roughly two times larger effect on our profitability measures than the average number of hospitalizations of rank-and-file employees. Among our municipality-level control variables, we find that higher unemployment rates are associated with lower firm-level profitability, emphasizing the importance of controlling for local economic conditions in our analysis of firm performance.

In Column (4) of each panel, we replace our municipality-level control variables with municipality $\times$ year fixed effects to again account for all possible local influences on firm-level performance. We confirm our previous conclusions with this specification as all estimated coefficients retain their respective signs, remain statistically significant, and are of similar magnitudes.

4.2 The effect of employee health on performance at the establishment level

As a next step, we discuss an extension to our main analysis in which we modify our setting to allow for the inclusion of additional fixed effects. We rely on additional data on firm establishments (workplaces) and use a sub-sample of firms with at least two establishments to identify the effect of employee health on profitability based on within-firm variation in exposure to influenza outbreaks in different workplaces. Stated differently, for a subset of firms for which we have accounting data at the establishment level, we exploit geographic variation in the severity of influenza outbreaks across a firm's establishments. Thus, in this setting, we are able to control for all confounding factors at the firm level that also vary over time by including firm $\times$ year fixed effects.

Table 3 presents our results. The unit of observation is an establishment-year and we measure profitability as establishment-level operating profit scaled by the number of employees (in FTE) at the establishment. In Column (1), we again only include firm and year fixed effects. This specification yields a negative and statistically significant effect of employee health on establishment-level profitability: Our coefficient estimate for the effect of the number of CRP tests on establishment profit per employee is -0.0157 which is significant at the 1% level. In Column (2), we present results from estimating Equation (3) without establishment-level controls (X_{ekt}). Adding firm × year fixed effects instead of firm and year fixed effects has no material effect on the magnitude and significance of our result. In Column (3), we further add municipality × year fixed effects to our previous specification. The municipality here is based on the establishment's location. Establishment municipalities can differ from a firm's main municipality, which we assigned based on where most of the firm's workforce is located. These additional fixed effects will capture any local economic activity at the municipality level. Most importantly, considering our results in Column (3), we conclude that our results and interpretation are not affected by the inclusion of these tighter set of fixed effects.

Column (4) presents results of our estimation of Equation (3), i.e., we include firm × year fixed effects, establishment-level controls, and municipality-level controls. The coefficient estimate for our measure of employee health, the number of CRP tests, is negative 1.7 percentage points and remains statistically significant. Relative to the standard deviation of our establishment-level measure of profitability, the magnitude of our estimated decline represents a drop 0.403 percent, which is slightly lower than the relative effects we documented for our firm-level measure of profitability in Section 4.1, which were 0.524 and 0.460 percent.[15] We cautiously interpret these results to suggest that our baseline results are unlikely to be entirely driven by firm-level characteristics that vary over time and are not captured by our set of firm-specific fixed effects or control variables.

Last, we again replace our municipality-level controls with municipality × year fixed effects and present results of this specification in Column (5). Our estimated effect of employee health on establishment-level profitability remains very similar to what we have previously documented and also remains statistically significant.

[15]Stated differently, a one standard deviation increase in the number of CRP tests per 1,000 individuals lowers the establishment-level measure of profitability by 0.22 percentage points.

In conclusion, we continue to find a negative impact of employee health of profitability in this much more restrictive setting for firms with multiple establishments, where identification is based on variation in exposure to influenza outbreaks across a firm's various establishments.

4.3 Heterogeneous effects by industry and firm size

In our analysis thus far we relied on the assumption that local influenza outbreaks, measured by the number of CRP tests, affect firm performance through their detrimental impact on employee health and hence productivity, and not through a possible effect on consumer demand. In this section, we present further analyses to support the validity of this assumption. In particular, we examine the heterogeneity in the effect of our measure of employee health on firm performance across different industries and along the size distribution of our sample firms, and show that our interpretation is more consistent with an employee productivity channel than with a consumer demand channel. All specifications that we estimate in this section are based on Equation (2) where we include controls at the firm level, at the municipality level, and firm and year fixed effects.

We begin our analysis by examining the effect of employee health on firm performance across different industries. Prior studies have documented that worker productivity in some industries is more sensitive to influenza outbreaks than worker productivity in other industries (e.g., Suarthana et al., 2010). To exploit this variation in the sensitivity of worker productivity to influenza-induced health, we differentiate between retail/wholesale industries and manufacturing/construction industries. While employees in the former group have been shown to face increased risks for infection due to their exposure to the general public (Luckhaupt et al., 2012), the nature of jobs in these industries may make it easier for firms to find substitutes for absent employees or compensate for employee absences without significantly affecting the firms productivity or output. On the contrary, the nature of the manufacturing and construction industry with strict schedules and deadlines may cause projects to get behind schedule if employee absenteeism increases due to sickness and thus may affect these firms' profitability more (Salehi Sichani et al., 2011). On a different dimension, while retail store profits may mostly be driven by local demand conditions, profitability in manufacturing is likely driven to a much larger extent by non-local demand. As such, the detrimental effect of employee health on firm performance is more likely to operate through an employee productivity channel than through a local demand channel in manufacturing/construction industries.

To implement our analysis, we categorize firms using the second revision of NACE, the statistical classification of economic activities in the European Community. We construct indicator variables for two categories: firms classified as "wholesale/retail" are those with an industry classification code between 45 and 47, while those in "manufacturing/construction" have an industry classification code between 10–33 or between 41–43. We then estimate a specification similar to equation (2) but including these indicators and their interactions with the number of CRP tests, one category at a time and then both together. Column (1) of Table 4 documents that the effect of employee health on firm performance is greatly muted in the wholesale/retail industry. While our baseline estimate of the effect of the number of CRP tests on operating return on assets remains negative and significant, its interaction term with our wholesale/retail indicator yields a positive and significant estimate. The magnitude of our positive estimate for this interaction term is similar to that of our negative baseline estimate, hence offsetting the negative effect we find in the overall sample. To the contrary, as is shown in Column (2), we find a strongly negative effect of employee health on firm performance in the manufacturing and construction industry. In this specification, we actually find a positive, albeit small and insignificant, coefficient estimate for the baseline effect of employee health on firm performance. The interaction term of our measure of employee health and the manufacturing/construction indicator is, however, negative, highly significant, and almost 2.5 times larger in absolute magnitude than our baseline coefficient. As such, our negative overall coefficient estimate for the effect of employee health on firm performance in manufacturing/construction is reinforcing our interpretation of the health effect operating through an employee productivity channel and less likely operating through changes in local customer demand.

Column (3) then presents estimation results for a specification in which we add both industry indicators to the regression model specified by Equation (2). We obtain very similar results with this specification. In particular, we retain a negative overall coefficient estimate for the manufacturing and construction industry. The coefficient estimate for the interaction term of our measure of employee health and the wholesale/retail indicator now becomes much smaller and is insignificant, but given the positive, yet insignificant, coefficient estimate of the baseline effect in this specification, our interpretation of those results for the wholesale and retail industries also remains unchanged.

Moreover, if it is indeed the case that employee health affects firms performance through lower employee productivity, we would expect that labor intensive firms are more exposed to the associated employee health risks than their capital intensive peers. To examine this conjecture, we first compute the ratio of wages to revenues (WtR) and the ratio of total assets to revenues (AtR) for each firm in our sample. We then define an indicator, "labor intensive," which takes the value of one for all firm-years with above-median WtR and below-median AtR ratios. Similarly, we define "capital intensive," an indicator which takes the value of one for all firm-years with below-median WtR and above-median AtR ratios. We then perform a similar analysis as above, but now using the labor and capital intensity indicators and their interactions with our measure of employee health. We present these results in Columns (4) to (9) of Table 4. In Column (4), we include our indicator for labor intensive firms and its interaction with our CRP test measure. We obtain very similar coefficient estimates compared to what we found for the manufacturing/construction industries, suggesting that the negative effect of employee health on firm performance is predominantly driven by labor-intensive firms. For capital-intensive firms, we find much smaller effects. As can be seen in Column (5), more capital intensive firms are associated with a lower effect of employee health on firm performance, as is evident from the positive, yet insignificant, coefficient estimate for the interaction term between our CRP test measure and the capital-intensive firm indicator. We obtain similar results when we include both indicators and their respective interaction terms in one regression model, which we report in Column (6). Finally, we also add interaction terms of our measure of CRP tests with indicators that capture standard industry classifications to our regression specification. These interaction terms restrict us to exploiting within-industry variation in the degree of firm-level labor intensity. As shown in Columns (7) to (9), this greatly reduced variation leads to somewhat less precisely estimated coefficient estimates, but we still obtain results qualitatively consistent with the previous specifications.

In a last set of analysis in this section, we explore heterogeneity in the effect of employee health on firm performance across firm size. We conjecture that health-induced variation in employee productivity has a larger potential to cause disturbances in smaller firms. Relative to larger corporations, small firm may lack the resources to redistribute tasks within the firm or to find proper talent to cover for absent employees. Following this argument, we expect to find a stronger effect of the number of CRP test on our measures of firm performance for the smaller firms in our sample.

To define firm size categories for our analysis, we form similar-sized groups based on the quartiles of the distribution of FTE in our sample. This classification results in the following four size-based categories: *micro firms*, i.e. firms in the lowest quartile of our FTE distribution, have fewer than 10.22 FTE (but more than 5 FTE, our minimum FTE to be included in the sample). *Small firms* have between 10.22 and 15.83 FTE, *medium-sized firms* have between 15.83 and 30.05 FTE, and *large firms*, i.e. firms in our highest quartile, have more than 30.05 FTE. We use indicator variables to identify those categories, and augment our estimation specification of Equation (2) with these indicators and their interactions with our measure of employee health. The corresponding estimation results are presented in Table 5.

In Column (1), we first present estimation results for a specification in which we use only one indicator variable to identify *micro firms* and *small firms*. The resulting indicator takes the value of one for firm-years in which a firm has fewer than 15.83 FTE (but more then 5 FTE), and zero otherwise. This indicator identifies half of our sample. Consistent with our conjecture, we find a negative and significant coefficient estimate for the effect of employee health on firm performance for smaller firms, both when measuring performance with operating return on assets and net income. For example, when measuring performance with operating return on assets in Panel A, we find that small firms are associated with a 1.3 percentage point lower coefficient estimate of the effect of CRP tests on performance. While our baseline estimate in this specification is positive, it is economically small and statistically insignificant. Thus, the overall effect for smaller firms is almost entirely driven by the interaction term, resulting in a negative and significant effect ($0.0013 - 0.0132 = -0.0119$;

significant at the 1% level).

In Column (2), we use indicators to differentiate between *micro*, *small*, and *medium-sized firms*. Interestingly, these three different size-based groups of firms are all associated with a significantly lower coefficient estimate of the effect of CRP tests on performance when compared to our fourth and largest group of firms. Again focusing our discussion on operating return on assets in Panel A, economic magnitudes of the differential effects range from 2.3 percentage points for *medium-sized firms* at the low end to 2.8 percentage points for *small firms* at the high end. Similar to what we find in Column (1), the baseline estimate in this specification is positive, but it is now larger and statistically significant. The overall effect in each of the size groups is thus no longer predominantly driven by the coefficient estimate for the interaction term. For *medium-sized firms*, for example, the overall effect is represented by a coefficient estimate of negative 0.7 percentage points ($0.0158 - 0.0225 = -0.0067$), which is no longer significant at conventional levels. In contrast, for *small firms* and *micro firms*, the associated overall effect is negative 1.3 percentage points ($0.0158 - 0.0284 = -0.0126$) and negative 1.1 percentage points ($0.0158 - 0.0269 = -0.0111$). Both of these estimates remain highly significant. Overall, these findings are again consistent with the notion that it is smaller firms in our sample that are particularly sensitive to a temporary decline in productivity of their employees.

Last, in Column (3), we again add interaction terms of our measure of CRP tests with indicators that capture standard industry classifications to our empirical model. With this specification, we identify our main effect based on within-industry variation in firm size. Our results remain robust even in this much tighter setting.

To conclude, the evidence we have produced here is consistent with employee health operating through an employee productivity channel in our setting. Our results are stronger in industries with less local demand and more labor intensive firms. Our results are also stronger for smaller firms, where the productivity of each individual employee is likely to have a larger overall impact on the firm's financial performance. In the next section, we discuss in more detail the economic magnitude of these results, before exploring whether the negative implications of employee health on firm performance are absorbed by the firm's workforce or by its owners (or both).

4.4 Economic magnitude

To better assess the economic magnitude of our results, we conduct two types of exercises. First, we ask what effect a severe flu season, equivalent to a one-standard deviation increase in the number of CRP tests, has on the average firm and on the economy. The standard deviation of the number of performed tests in our panel is 0.13, about the same as its inter-quartile range, which is 0.14. Thus, a one standard deviation increase in our measure of exposure to influenza corresponds to one additional CRP test per 8,000 individuals in our sample. Since we estimate effects on operating return on assets for our sample firms, we use the average value of assets to convert our estimates into a Dollar value (or value in Danish Kroner).[16] Based on this simple approach, the average firm in our sample experiences a decline of USD 7,442 (46,786 DKK) in operating profits for a one standard deviation increase in the number of CRP tests. With an average of 14,435 firms in our sample of the Danish economy, covering only firms in the private sector with more than 5 employees, this loss is equivalent to a total loss in operating profit of approximately USD 107 million (675 million DKK). Relative to Denmark's average GDP over the period from 1999 to 2016, which amounts to USD 320 billion, our aggregate estimate represents a loss of only 0.034%.

The analysis in Section 4.3 shows substantial heterogeneity in the effects of the flu on firm performance depending on firm size. To account for such heterogeneity in our assessment of economic magnitudes, we can produce coefficient estimates within each of our four size subsamples defined in Section 4.3, and use those to compute our aggregated estimate. In the subset of our smallest firms, micro firms, we estimate a decline in operating profits of USD 3,565 (22,413 DKK) for an average firm. The financial loss drops to USD 2,677 (16,829 DKK) per firm for the second subsample (small firms). In total Dollar terms, we find the highest loss, USD 4,718 (29,658 DKK) per firm, for the third subsample (medium-sized firms). Finally, our estimate of the financial implications of influenza for firm-level profits drops significantly for large firms: the average firm is only experiencing a financial

[16]We use consumer price index data from Statistics Denmark to convert asset values to their 2016 equivalents. The single exchange rate we use to convert Danish Kroner to US Dollar in our analysis is computed by averaging yearly average exchange rates between 1999 and 2016. This rate is 6.2867 Danish Kroner. Yearly average exchange rates are obtained from OFX.

loss of USD 2,651 (16,664 DKK). When we aggregate these numbers based on the average value of assets and the number of firms in each of the four subsamples, our estimate of the impact on the private sector portion of the Danish economy is USD 49m (306m DKK), which corresponds to a loss of 0.015% of the average GDP between 1999 and 2016.Based on these numbers, it does not look like a severe flu season has a particularly large effect on the economy. It should be noted however that this analysis considers only the cost of influenza from the perspective of the firm and its profitability, not taking into account any costs that accrue in the health care system.

A second approach takes this aspect into consideration and asks if it is in the firms' interest to subsidize their employees' out-of-pocket expenses for influenza vaccines. In order to answer this question, we compare the cost of such a subsidy to the loss reduction that vaccines would provide. Any such calculation needs to make some assumptions about the rate of severe flu seasons and/or vaccine efficacy, and we proceed in two different ways.

First, consider the profit loss per employee due to a severe flu season. Based on the calculations above and on the average number of employees in each of the four size subsamples, we can derive the impact of the flu on the average firm in each size bin. For example, the average micro firm employs about 8 persons and experiences a reduction in operating profits of USD 3,565 (22,413 DKK). This translates into a financial burden of USD 445 (2,800 DKK) per employee. Similarly, the profit loss per employee due to a severe flu season is USD 210 (1,323 DKK) for the second subsample (small firms), USD 217 (1,367 DKK) among medium-sized firms, and USD 20 (128 DKK) among the largest firms. Epidemiologic studies suggest that seasonal influenza is considered of high or very high severity approximately once every 7 to 8 years in Europe (Vega et al., 2015) and the United States (Lee et al., 2015). The expected annual reduction in operating profits ranges then from USD 64 (400 DKK) for micro firms, to USD 30 (189 DKK) for small firms, USD 31 (195 DKK) for medium-sized firms, and USD 3 (18 DKK) for large firms. When compared to the cost of a vaccine, which is USD 32 (200 DKK), this shows that only micro firms and some of the small firms would benefit from subsidizing the cost of vaccines for their employees.

An alternative way to answer the question of whether firms should subsidize the cost of vaccines for their employees is to ask how effective vaccines should be so that the realized profit losses in our data during our sample period are lower than the cost of subsidizing the vaccination of employees. To do so, we define the vaccine *efficacy ratio* as the level of protection against the flu that makes the firm indifferent between subsidizing and not subsidizing the vaccine:

$$\textit{profit reduction} \times \textit{efficacy ratio} = \textit{vaccine program cost}, \tag{4}$$

where *profit reduction* is our estimate of the total performance reduction that is attributable to an influenza outbreak and that is incurred by a firm in that year. In other words, for each firm-year, we compute the total dollar loss by multiplying our coefficient estimate for the effect of employee health on firm performance, β in Equation (2), with the actual number of performed CRP tests for each firm-year and the firm's total asset value in that year. The right-hand side of Equation (4), *vaccine program cost*, measures the total cost of the vaccine program for a firm in that year, i.e. the number of employees (measured as FTE) multiplied by our estimate of the out-of-pocket cost of a vaccine in Denmark, USD 32 (200 DKK). The *efficacy ratio* then measures the required reduction in influenza-related losses that corresponds to the cost of a program that fully subsidizes employee out-of-pocket expenses for influenza vaccines. We compute this measure for each firm-year, and then report averages across our panel and for each of the four size groups.

The average *efficacy ratio* in our sample is 67%, while the median *efficacy ratio* is much lower at 30%. Given that the flu vaccine is typically about 40–60% effective, our results have different implications for the average and median firm in our sample. For the average firm, paying for employee vaccinations would not be a trivial decision, given that the average vaccine effectiveness would need to be 67%. For the median firm, it is more likely to be cost effective to offer such subsidies because the average vaccine effectiveness is typically much higher than our break-even point of 30%. Analyzing these efficacy ratios in our size-based subsamples leads to results that are consistent with what we have reported before. The average (median) *efficacy ratio* for our smallest subgroup is 27% (14%), well below the range of effectiveness rates for the flu vaccine. For the second and third subgroups, average (median) *efficacy ratios* are 58% (30%) and 65% (32%), respectively, making vaccine programs less attractive for the average firm, but somewhat attractive for the median firm in these subgroups. For the fourth subgroup, which consists of the largest firms in our sample, we obtain average (median) *efficacy ratios* of 1,064% (399%), making vaccine programs unattractive from a financial standpoint.

In conclusion, while our simple estimates may not make a case for economy-wide intervention (e.g., in the form of mandatory vaccinations), they do suggest that certain parts of the economy may benefit from a more proactive approach to employee health. The smaller firms in our sample may find it beneficial to implement measures such as vaccination incentives that can help mitigate the detrimental effects of employee health on firm performance.

4.5 Effects on workforce and firm owners

Having established a negative effect of employee health on firm performance with our analysis thus far, a natural next question to ask is whether firms fully absorb these employee health risks or whether they are, at least partially, borne by a firm's employees. Guiso et al. (2005), in their seminal contribution on insurance within the firm, show that in a sample of Italian firms, firms absorb temporary fluctuations in output fully, but pass on some of the financial consequences of permanent output fluctuations to their workers. In our setting, to the extent that the seasonal influenza is a temporary health condition, we would expect to see firms shelter their employees from most of the associated negative financial implications.

We examine this assertion by analyzing how our measure of employee health, i.e., the number of CRP test per 1,000 individuals, affects average employee wages, total employment, firm-level dividends, and a firm's cash position. To that end, we estimate regressions in which we replace our measures of firm performance with one of the previously described measures of financial consequences for a firm's workforce or owners. We include our full set of firm-level and municipality controls in all regressions. Table 6 presents the estimation results of these new specifications.

4.5.1 Effects on workforce

Starting with the financial implications for employees, we further distinguish between a firm's existing or seasoned workforce and new hires. Employees are considered seasoned if they have been with the firm in the prior year. Columns (1) to (4) present estimation results for monetary and non-monetary forms of employee compensation. The first two columns present results for seasoned employees. Column (1) focuses on average yearly wages and Column (2) shows results for employee benefits. Wages include all salary payments from the employment relationship with the firm and benefits are measured as the tax value of fringe benefits. These include, among others, employer-paid group insurance coverage, access to company car programs, and private use of corporate IT equipment.

For seasoned employees, our coefficient estimate of the effect of employee health on average wages is -0.0086, or -0.86 percentage points. This finding is consistent with the wage concession hypothesis of Berk et al. (2010), which argues theoretically that firms are able to extract wage concessions from employees upon a shock to firms' bankruptcy risk. Recently, Pedersen (2020) finds empirical support for this in a U.S. setting. Interestingly, considering employee benefits, we do not find evidence that firms adjust these forms of compensation. These null results may be attributable to the type of benefits that are prevailing in Denmark, which are harder to adjust in the short-term. Turning to the group of newly hired employees in Columns (3) and (4), we find that employee health has no significant effect on their compensation, neither in terms of regular wages, nor on their benefits. Especially in a competitive labor market like Denmark, firms may need to pay new hires a competitive market wage, and may not have much room for deviating from such wage levels even when hit by a productivity shock.

Complementing our analysis of employee wages, we also examine potential heterogeneity in the effect of employee health on wages and benefits in the cross section of employees. In particular, we split wages and benefits as our dependent variables into quintiles and run separate regressions for sub-groups. Panels A and B in Table 7 focus on wages and benefits for seasoned employees, and Panels C and D report results for new hires. Each column header indicates the quintile, starting with

Column (1) representing the firm-year average wage (or benefit) of the lowest quintile, to Column (5) representing the firm-year average wage (or benefit) of the highest quintile.

Panel A shows that following an increase in the number of CRP tests, firms' primary response is to lower wages for seasoned employees in the lowest two wage quintiles. In contrast, higher wages are not adjusted as a response to a deterioration in employee health and associated lower firm performance. Employees in the lowest wage quintile face the biggest reduction in wages (our coefficient estimate for the CPR test measure of employee health is 0.6 percentage points), whereas the effect becomes smaller, and eventually insignificant, as we move into higher wage quintiles. Considering employee benefits as outcome variable, we produce weak evidence of an effect of employee health in Panel B. We find a negative and marginally significant (at the 10% level) coefficient estimate for the effect of employee health on employment benefits in the lowest benefit quintile, and negative but insignificant effects for all but the largest benefits quintile. In the largest benefit quintile, we actually find a small and marginally significant increase of employee benefits. Looking at new hires, we do not find much evidence of cross-sectional differences in the effect of employee health on wages or benefits, as is evident from the results in Panels C and D.

Returning to Table 6, in addition to the effect on wages, in Column (5) we also examine whether firms adjust total employment. We measure employment with the natural logarithm of full-time equivalent employment. Interestingly, we find that firms' total employment is positively associated with our employee health measure, i.e. as employee health deteriorates, on average, firms seem to hire. The hiring response is, however, very moderate. For a one standard deviation increase in the number of CRP test, on average, firms only increase employment by 0.003 FTE or by 1 individual per 300 employees. Schmutte and Skira (2020) provide related evidence for hiring responses to temporary workplace absences in Brazil. They also find increased hiring, but the increase is less than a one-for-one replacement. Consistent with their conclusions, we also interpret our employment evidence as showing that external labor markets are costly and that firms manage temporary employee absenteeism primarily through means other than hiring.

4.5.2 Effects on firm owners

Until now, we have only examined the effect of employee health on employee outcomes. Next, we examine the effect of employee health on outcome variables associated with a firm's owners. In particular, we consider firm payout policy and cash holdings in our analysis. Our measures of payout policy include both the level of dividends as measured by the ratio of dividends to total assets and an indicator variable that takes a value of one if the firm is paying a dividend. We present these results in Columns (6) and (7) of Table 6, respectively. The main take-away from these two columns is that firms reduce their payouts in response to a health-induced productivity decline of their workforce, even though the effect we measure for the level of dividends in Column (6) is not statistically significant. Last, we show in Column (8) that firms do not adjust their cash to asset ratios in response to a deterioration of employee health, and hence, productivity. Overall, our evidence on firm owners suggests that they are unlikely to bear much of the costs that are associated with lower employee productivity that is caused by health-related absenteeism.

4.6 Robustness tests

In this section, we present a series of results to show that our analysis is robust to a number of alternative regression specifications. In particular, we address concerns that our results may be driven by last year's influenza season, by years of economic downturn, or by firms that are located in the two largest municipalities of Denmark, i.e., in Copenhagen and Aarhus. We also construct an alternative measure of workforce health, which varies on the municipality level and is based on hospitalizations that are due to influenza.

We first examine whether seasonal influenza-induced health shocks last beyond the year in which these shocks occur. The results in Column (1) of Table 8 show that this is not the case. The coefficient estimate for the lagged value of the number of CRP tests is both smaller in absolute size and statistically insignificant, indicating that the health shock and its effects are indeed temporary.

Another potential concern with our baseline estimation could be that the flu pandemic of 2009/10 somewhat overlaps with the 2008/09 period of global economic slowdown, which also results in lower firm profitability. Hence, as a second step, we exclude years of economic slowdown (both 2001-03 and 2008/09) from the sample. Real GDP growth in Denmark fell below 1% p.a. during these years, which marks a sharp contrast to the average real GDP growth in other years, which exceeds 2%. However, for the economic slowdown to cause our results, the cross-firm variation in economic slowdown would need to closely mirror the cross-firm variation in the severity of the influenza. While we believe that this is an unlikely possibility, excluding the years of economic slowdown from our analysis should help reassure us that our results are driven by exposure to local influenza outbreaks, and not by exposure to periods of economic slowdown. Column (2) confirms our expectation and documents that our results remain very similar.

Next, we re-estimate our baseline specification after excluding all firms located in the Copenhagen and the Aarhus municipalities from our sample. Copenhagen is the largest municipality of Denmark and also the largest of the four municipalities that constitute the City of Copenhagen (the country's capital) with a population of 530.000 people, and Aarhus is the second largest municipality with roughly 310.000 people, both in 2010 (roughly 9.5% and 5.6% of Denmark's population). These two municipalities host a number of Denmark's largest firms, which could potentially react differently to employees catching the flu. Excluding these two municipalities from our analysis, however, does not alter our results, as is shown in Column (3).

In the last two robustness tests we change the way we measure workforce health by focusing on hospitalizations for influenza and its main complication, pneumonia. The main advantage of using such alternative measures is that we know the exact diagnosis for a hospital visit and so we do not need to rely on a proxy (the number of CRP tests) for the severity of the influenza season. The main disadvantage is that hospitalizations are relatively extreme events that occur much less frequently than GP visits, meaning that we can construct hospitalization-based measures only at a more aggregate level such as the municipality. As a result, we are unable to include firm fixed effects in our specifications and instead control only for municipality fixed effects. In Column (4), we measure the changes in workforce health by constructing a health shock indicator that takes a value of one for all firm-years in which the flu-related hospitalization rate in the firm's municipality is in excess of 80% of the sample mean. Our results again remain stable.[17]

In Column (5) we construct a firm-specific hospitalization-based measure using the information on the municipality of residence of the firm's employees. For each firm and for each year, we calculate a weighted average of municipality flu-related hospitalization rates over all municipalities, with weights determined by the fraction of the firm's workforce that resides in that municipality. For example, if in a given year 60% of a firm's workforce reside in the municipality of Copenhagen and 40% in the municipality of Aarhus, our firm-specific flu-related hospitalization rate would assign a weight of 60% to the Copenhagen hospitalization rate, a weight of 40% to the Aarhus hospitalization rate, and a weight of 0% to the hospitalization rates of all other municipalities in that year. This measure of flu exposure varies by firm within a municipality, and thus allows us to include municipality-year fixed effects in our estimation. These will account for all omitted local shocks that can affect firm performance. We then create an indicator variable that takes the value of 1 whenever the number of relevant hospitalizations in a municipality-year exceeds a 85% threshold in that distribution. Hence, such a municipality-year is associated with an influenza outbreak. Column (5) shows that we still obtain very similar results with this alternative approach to measuring employee health.

5 Conclusion

In this paper we study how changes in employee health resulting from health shocks influence firm operating performance. The particular health shocks we analyze are yearly influenza outbreaks in Denmark. Using detailed administrative data, we use medical tests conducted by GPs to identify influenza and its main complication, pneumonia, as a measure of the severity of the influanza season.

We find that firms that experience particularly severe flu seasons are negatively affected in that year. A one standard deviation increase in the number of CRP tests lowers operating return on assets (and net income) by approximately 0.095 (0.078) percentage points, which represent a decline of 0.524 (0.460) standard deviations. These effects are amplified for labor intensive firms and for small

[17]Moreover, Tables A2 and A3 in the Online Appendix further show that we obtain similar results if we apply a similar strategy to our main measure of employee health, i.e., if we use as the main independent variable an indicator that takes a value of one for all firm-years in which the number of CRP tests is above 80% of the sample mean.

firms. The level of detail of our Danish registry data further allows us to study the effect of employee health on establishment-level operating performance. The advantage of this approach is that we can include firm-by-year fixed effects to account for time varying unobservable variables at the firm level. We obtain similar results with this alternative regression specification and our estimates for the effect of employee health on establishment performance are consistently negative and significant. As a last step, we analyze how health shocks are absorbed within the firm. We focus on employees and shareholders and find that firms lower the average annual salary for seasoned employees but not their fringe benefits. Employee wages and benefits of newly hired employees remain unaffected by health shocks. Looking at effects on shareholders, we find little evidence that dividends or cash-to-asset ratios of firms are adjusted, and hence shareholders do not seem to bear the costs that are associated with lower employee productivity that is caused by health-related absenteeism.

Our back of the envelope calculations suggest that firms, especially smaller ones, may have an incentive to support financially the vaccination of their employees against the flu. This is a particularly important result given the prevalence of the flu and the debate around vaccines in respiratory viral infections spurred by the current COVID-19 pandemic.

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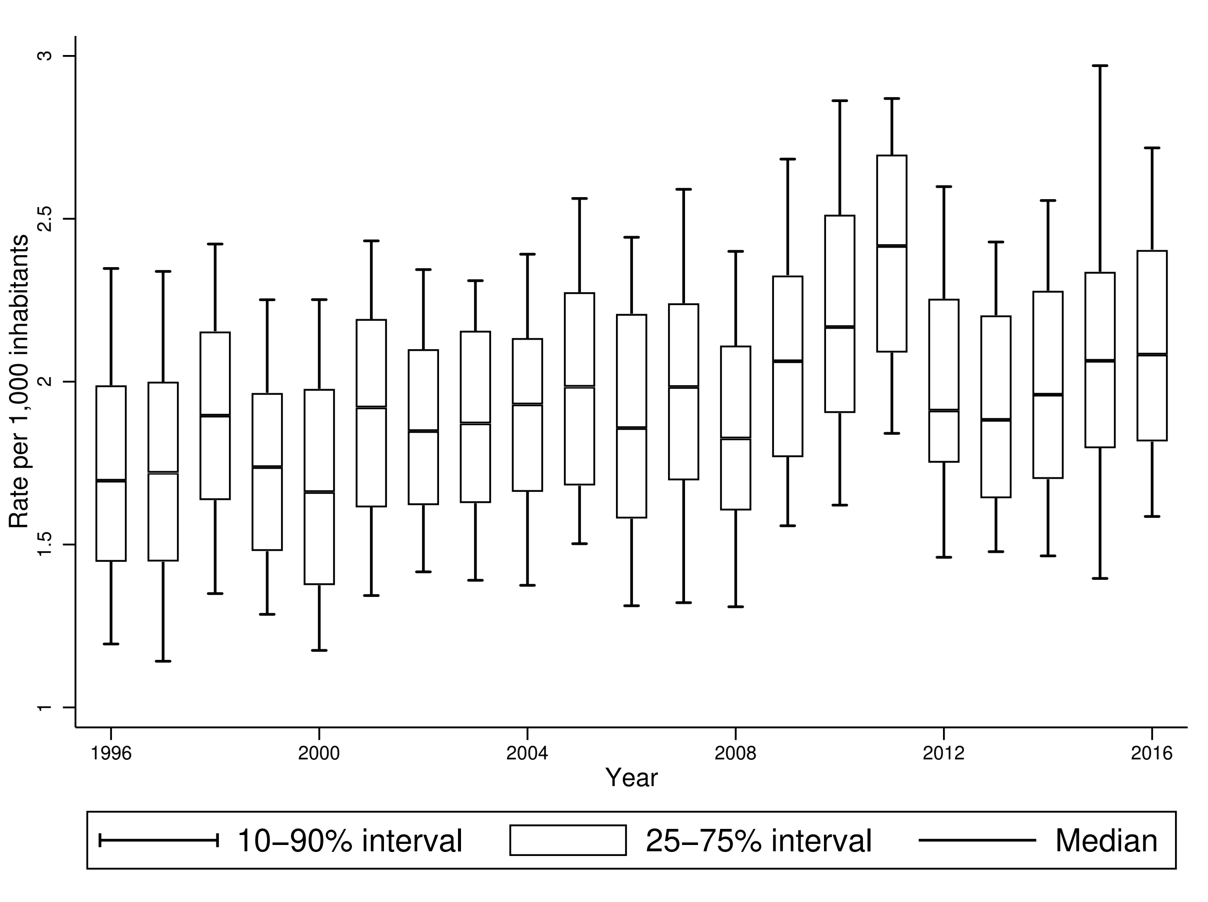
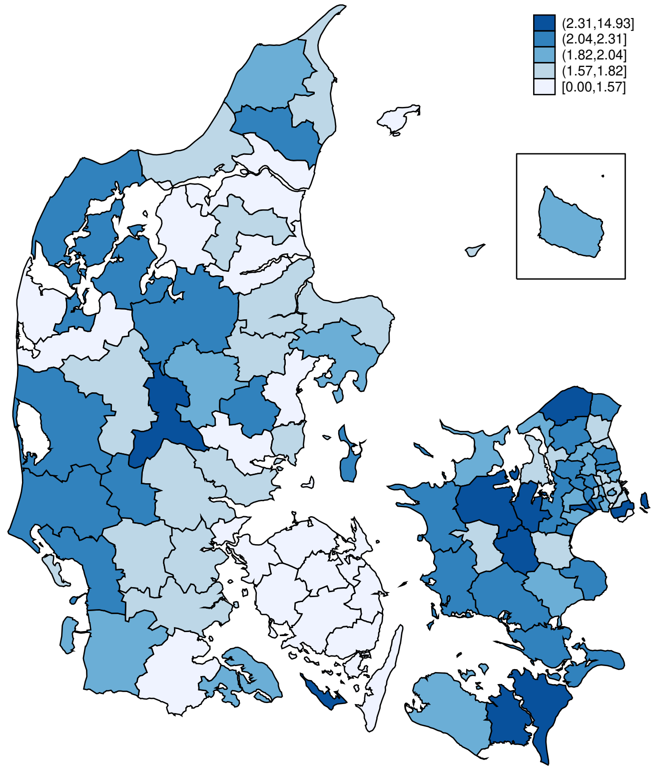
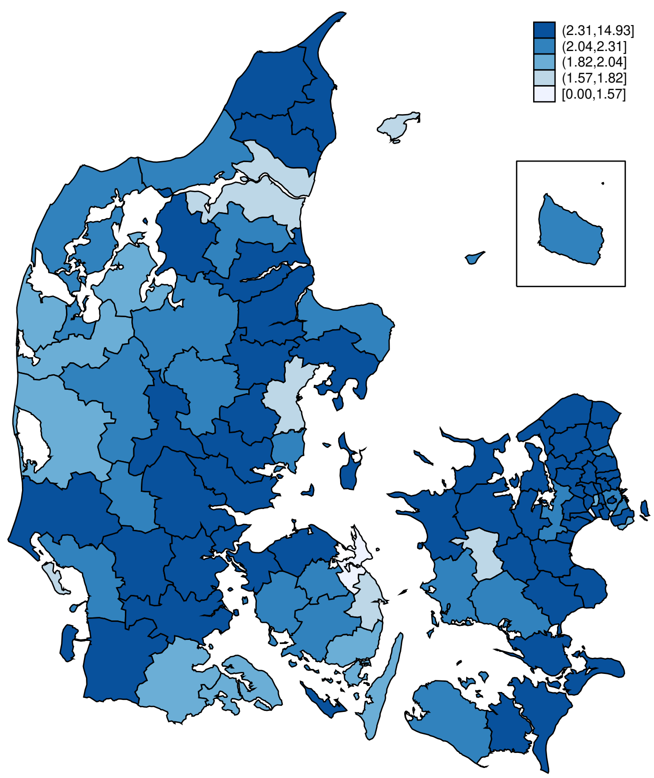


Figure 1: Evolution of the distribution of the flu and pneumonia hospitalization rate over time



(a) 2003



(b) 2011

Figure 2: Distribution of the flu and pneumonia hospitalization rate across Danish municipalities

Table 1: **Summary statistics**

This table presents the summary statistics for nonfinancial, nonutility, nongovernment-owned firms in Denmark between 1999 and 2016. Operating return on assets (OROA) is the ratio of operating income to total assets, net income is the ratio of income to total assets. CRP tests is the number of CRP tests performed on the employees and their families during the flu season. Investment Rate, the ratio of capital expenditures to total assets; Tangibility, the ratio of property, plant, and equipment to total assets; Dividend Payer, an indicator that takes the value of one for dividend paying firms; Market concentration (HHI), measured by the Herfindahl-Hirschmann index of the firm's industry; N days at hospital (avg)—Top-5employee / Rank and file employee, is the average number of days a top-5/ non-top-5employee was hospitalized in a given year; Population density / Unemployment rate, the population density of / unemployment rate in the firm's municipality.

	Mean	Std. dev.	1%	25%	50%	75%	99%
Dependent variables:							
—Operating Return on Assets	0.062	0.181	−0.728	0.004	0.064	0.140	0.542
— Net income	0.016	0.169	−0.786	−0.032	0.025	0.089	0.416
Main independent variable:							
— CRP tests	0.104	0.129	0.000	0.000	0.067	0.156	0.667
Firm characteristics:							
— Log(Assets)	9.504	1.332	7.011	8.581	9.318	10.222	13.731
— Full-time employees	34.308	57.008	5.360	10.530	16.330	31.140	392.000
— Firm age (years)	16.300	12.999	1.000	7.000	13.000	23.000	64.000
— Investment Rate	0.045	0.073	−0.126	0.004	0.024	0.062	0.381
— Tangibility	0.135	0.141	0.000	0.035	0.087	0.185	0.651
— Dividend Payer	0.692	0.461	0.000	0.000	1.000	1.000	1.000
Industry characteristics:							
— Market concentration (HHI)	0.022	0.042	0.004	0.005	0.009	0.021	0.250
Local (municipality) characteristics:							
— Local population density	5.491	1.526	3.657	4.278	4.966	6.444	8.901
— Local unemployment rate	0.040	0.014	0.012	0.030	0.040	0.050	0.075
Hospital days (avg):							
— Top-5 employee	0.279	0.748	0.000	0.000	0.000	0.200	4.600
— Rank and file employee	0.391	0.578	0.000	0.029	0.222	0.480	3.522

Table 2: **The Effect of Employee Health on Firm Performance**

This table examines the effect of employee health on firm operating performance. In Panel A, the dependent variable is operating return on assets (OROA), the ratio of operating income to total assets. In Panel B, the dependent variable is net income to total assets (NI). To measure employee health, we examine the number of CRP tests performed on the employees and their families during the flu season. Firm controls include Log(Assets), the natural logarithm of the lagged value of total assets; Market concentration (HHI), measured by the Herfindahl-Hirschmann index of the firm's industry; N days at hospital (avg) — Top-5 employee / Rank and file employee, the average number of days a top-5 / non-top-5 employee was hospitalized in a given year; Local controls (municipality) — Population density / Unemployment rate, the population density of / unemployment rate in the firm's municipality. All specifications focus on firms with at least five employees and include firm fixed effects. Columns (1) and (3) also include year fixed effects while Columns (2) and (4) use municipality times year fixed effects. Columns (3) and (4) further include firm age dummies for every five-year bin of firm age. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: OROA			
	(1)	(2)	(3)	(4)
CRP tests	−0.0088***	−0.0077***	−0.0074***	−0.0065**
	(0.0028)	(0.0028)	(0.0028)	(0.0028)
Log(Assets)			−0.0108***	−0.0108***
			(0.0010)	(0.0010)
Market concentration (HHI)			−0.0084	−0.0071
			(0.0102)	(0.0103)
Top-5 employee, N days at hospital (avg)			−0.0021***	−0.0022***
			(0.0005)	(0.0005)
Rank and file employee, N days at hospital (avg)			−0.0009	−0.0009
			(0.0006)	(0.0006)
Municipality density			0.0149	
			(0.0165)	
Unemployment rate			−0.2680***	
			(0.0787)	
Controls	No	No	Yes	Yes
Fixed effects	Firm and year	Firm and muni x year	Firm and year	Firm and muni x year
N	246,082	246,078	232,254	232,252
R^2	0.308	0.309	0.315	0.316

Table 2 (cont.): **The Effect of Employee Health on Firm Performance**

	Panel B: Net Income			
	(1)	(2)	(3)	(4)
CRP tests	-0.0076^{***}	-0.0066^{**}	-0.0060^{**}	-0.0053^{**}
	(0.0026)	(0.0026)	(0.0026)	(0.0026)
Log(Assets)			-0.0090^{***}	-0.0090^{***}
			(0.0009)	(0.0009)
Market concentration (HHI)			−0.0037	−0.0026
			(0.0098)	(0.0099)
Top-5 employee, N days at hospital (avg)			-0.0018^{***}	-0.0019^{***}
			(0.0004)	(0.0004)
Rank and file employee, N days at hospital (avg)			−0.0009	-0.0009^{*}
			(0.0006)	(0.0006)
Municipality density			0.0199	
			(0.0153)	
Unemployment rate			-0.1926^{***}	
			(0.0727)	
Controls	No	No	Yes	Yes
Fixed effects	Firm and year	Firm and muni x year	Firm and year	Firm and muni x year
N	246,082	246,078	232,254	232,252
R^2	0.294	0.294	0.300	0.300

Table 3: **Measuring Flu Exposure by Establishment and Firm**

This table shows the effect of employee health on establishment operating performance. The dependent variable is *Profit per employee*, the ratio of establishment gross profit to the full-time employee equivalent of the establishment. To measure employee health, we examine the number of CRP tests performed on the employees and their families during the flu season. Establishment and local and controls on the municipality level include *Size*, the natural logarithm of the lagged value of the full-time employee equivalent of the establishment; *Population density* and *Unemployment rate*, the population density of, and unemployment rate in the establishment's municipality, respectively. In column (1), we include firm and year fixed effect. In columns (2) - (5), we use firm-year fixed effects instead of firm and year fixed effects. In columns (4) and (5), we add establishment-level age fixed effects for every five-year bin of establishment age. Clustered (establishment) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Profit per employee				
	(1)	(2)	(3)	(4)	(5)
CRP tests	−0.0157***	−0.0160**	−0.0176**	−0.0170**	−0.0193**
	(0.0053)	(0.0076)	(0.0079)	(0.0079)	(0.0081)
Size				0.0091**	0.0091**
				(0.0035)	(0.0036)
Municipality density				−0.0011	
				(0.0015)	
Unemployment rate				0.2178	
				(0.2257)	
Controls	No	No	No	Yes	Yes
Fixed effects	Firm and year	Firm x year	Firm x year and muni x year	Firm x year	Firm x year and muni x year
N	237,220	91,810	91,800	87,024	87,014
R^2	0.627	0.805	0.805	0.802	0.802

Table 4: **The Effect of Employee Health by Industry and Labor/Capital Intensity**

This table shows the effect of employee health on firm operating performance by industry and labor/capital intensity. Columns (1) to (3) focus on wholesale/retail and manufacturing/construction industries. To identify these industries, we define an indicator, Wholesale/Retail, which takes a value of one for all firms with a NACE Rev.2 industry classifications between 45 and 47. Similarly, Manufact/Construct is an indicator that takes a value of one for all firms with a NACE Rev.2 industry classification between 10 and 33, and between 41 and 43. Columns (4) to (9) examine the effect of employee health on firm operating performance for labor intensive and capital intensive firms. To measure labor intensity and capital intensity, we first compute the ratio of wages to revenues (WtR) and the ratio of total assets to revenues (AtR) for each firm in our sample. We then define an indicator, Labor Intensive, which takes a value of one for all firm-years with above-average WtR and below-average AtR ratios. Similarly, we define Capital Intensive, an indicator which takes a value of one for all firm-years with below-average WtR and above-average AtR ratios. In Panel A, the dependent variable is operating return on assets (OROA), the ratio of operating income to total assets, and Panel B, it is net income to total assets (NI). All specifications focus on firms with at least five employees and include firm and year fixed effects, age dummies for every five-year bin of firm age, and our full set of firm-level and municipality-level controls. Columns (7) to (9) further add interactions of industry indicators with our CRP tests variable. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: ROA								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CRP tests	−0.0107***	0.0007	0.0006	−0.0038	−0.0081**	−0.0037	0.5594**	0.5421**	0.5263**
	(0.0035)	(0.0037)	(0.0066)	(0.0028)	(0.0033)	(0.0034)	(0.2307)	(0.2582)	(0.2461)
Wholesale/Retail	−0.0058		−0.0089						
	(0.0054)		(0.0083)						
Wholesale/Retail × CRP tests	0.0116**		0.0002						
	(0.0054)		(0.0078)						
Manufact/Construct		0.0014	−0.0040						
		(0.0049)	(0.0075)						
Manufact/Construct × CRP tests		−0.0168***	−0.0167**						
		(0.0056)	(0.0078)						
Labor Intensive				−0.0251***		−0.0237***	−0.0263***		−0.0248***
				(0.0018)		(0.0018)	(0.0019)		(0.0019)
Labor Intensive × CRP tests				−0.0136*		−0.0133*	−0.0115		−0.0114
				(0.0075)		(0.0078)	(0.0087)		(0.0088)
Capital Intensive					0.0155***	0.0131***		0.0164***	0.0139***
					(0.0014)	(0.0014)		(0.0014)	(0.0014)
Capital Intensive × CRP tests					0.0034	−0.0007		0.0053	0.0033
					(0.0052)	(0.0052)		(0.0057)	(0.0057)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year
CRP tests × industry	No	No	No	No	No	No	Yes	Yes	Yes
N	232,254	232,254	232,254	232,254	232,254	232,254	220,032	220,032	220,030
R^2	0.315	0.315	0.315	0.317	0.316	0.317	0.320	0.318	0.321

Table 4 (cont.): **The Effect of Employee Health by Industry and Labor/Capital Intensity**

	Panel B: Net Income								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CRP tests	−0.0080**	0.0002	0.0017	−0.0029	−0.0065**	−0.0028	0.5392**	0.5227*	0.5404**
	(0.0033)	(0.0035)	(0.0061)	(0.0027)	(0.0030)	(0.0032)	(0.2443)	(0.2732)	(0.2647)
Wholesale/Retail	−0.0046		−0.0075						
	(0.0050)		(0.0077)						
Wholesale/Retail × CRP tests	0.0070		−0.0029						
	(0.0051)		(0.0073)						
Manufact/Construct		0.0007	−0.0039						
		(0.0045)	(0.0069)						
Manufact/Construct × CRP tests		−0.0128**	−0.0144**						
		(0.0052)	(0.0073)						
Labor Intensive				−0.0249***		−0.0234***	−0.0257***		−0.0242***
				(0.0017)		(0.0017)	(0.0018)		(0.0018)
Labor Intensive × CRP tests				−0.0116*		−0.0114	−0.0105		−0.0095
				(0.0069)		(0.0072)	(0.0080)		(0.0081)
Capital Intensive					0.0166***	0.0141***		0.0174***	0.0147***
					(0.0013)	(0.0013)		(0.0013)	(0.0013)
Capital Intensive × CRP tests					0.0024	−0.0011		0.0052	0.0033
					(0.0049)	(0.0050)		(0.0055)	(0.0055)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year
CRP tests × industry	No	No	No	No	No	No	Yes	Yes	Yes
N	232,254	232,254	232,254	232,254	232,254	232,254	220,032	220,032	220,032
R^2	0.300	0.300	0.300	0.302	0.300	0.302	0.305	0.303	0.305

Table 5: **The Effect of Employee Health on Firm Performance and Firm Size**
This table shows that the effect of employee health on firm operating performance depends on firm size. In Panel A, the dependent variable is operating return on assets (OROA), the ratio of operating income to total assets. In Panel B, the dependent variable is net income to total assets (NI). We use quartiles of the distribution of full-time equivalent (FTE) to define firm size categories. The resulting categories are as follows: Micro firms with more than 5 but less than 10.22 FTE; Small firms with 10.22 to 15.83 FTE; Medium-sized firms with between 15.83 and 30.05 FTE; Large firms, which represent our baseline category, with more than 30.05 FTE. We include indicators that identify firms in these categories, and their interactions with the CRP test variable, as shown in the table. All specifications focus on firms with at least five employees, use firm and year fixed effects, and include our full set of firm-level, municipality-level, and age bucket controls. In column (3), we add a set of interaction terms between the CRP tests variable and the industry indicators in order to control for time varying, unobserved, industry effects. The results remain stable. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: ROA		
	(1)	(2)	(3)
CRP tests	0.0013	0.0158**	0.3654
	(0.0044)	(0.0076)	(0.2358)
Micro & Small	−0.0109***		
	(0.0018)		
Micro & Small × CRP tests	−0.0132**		
	(0.0056)		
Medium-sized		−0.0027	−0.0027
		(0.0023)	(0.0023)
Medium-sized × CRP tests		−0.0225**	−0.0308***
		(0.0089)	(0.0096)
Small		−0.0120***	−0.0124***
		(0.0028)	(0.0029)
Small × CRP tests		−0.0284***	−0.0349***
		(0.0090)	(0.0097)
Micro		−0.0204***	−0.0209***
		(0.0031)	(0.0032)
Micro × CRP tests		−0.0269***	−0.0330***
		(0.0090)	(0.0098)
Controls	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year
CRP tests × industry	No	No	Yes
N	234,551	234,551	222,243
R^2	0.318	0.318	0.321

Table 5 (cont.): **The Effect of Employee Health on Firm Performance and Firm Size**

	Panel B: Net Income		
	(1)	(2)	(3)
CRP tests	0.0016	0.0205***	0.3780
	(0.0041)	(0.0067)	(0.2306)
Micro & Small	−0.0138***		
	(0.0017)		
Micro & Small × CRP tests	−0.0119**		
	(0.0052)		
Medium-sized		−0.0039*	−0.0039*
		(0.0021)	(0.0021)
Medium-sized × CRP tests		−0.0291***	−0.0351***
		(0.0081)	(0.0086)
Small		−0.0157***	−0.0159***
		(0.0026)	(0.0027)
Small × CRP tests		−0.0321***	−0.0373***
		(0.0081)	(0.0088)
Micro		−0.0266***	−0.0270***
		(0.0029)	(0.0030)
Micro × CRP tests		−0.0291***	−0.0336***
		(0.0081)	(0.0089)
Controls	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year
CRP tests × industry	No	No	Yes
N	234,551	234,551	222,243
R^2	0.302	0.303	0.306

Table 6: **The Effect of Employee Health on Workforce and Firm Owners**

This table shows the effect of employee health on the firm's workforce and firm owners. Columns (1) to (4) present results for monetary and non-monetary forms of compensation. We use the following dependent variables: the natural logarithm of average yearly wages for seasoned employees and new hires in columns 1 and 3, respectively, and the natural logarithm of average yearly benefits for seasoned employees and new hires in columns 2 and 4, respectively. Wages include all salary payments from the employment relationship with the firm. Benefits are measured as the tax value of employment perks, which include, among others, employer-paid group insurance coverage, access to company car programs, and private use of corporate IT equipment. In column (5), we focus on total employment and use the natural logarithm of full-time equivalent employment as dependent variable. The next set of estimates concerns dividend payments. In columns (6) and (7), the dependent variable is the ratio of dividends to total assets, and an indicator that takes a value of one if the firm is paying a dividend. In column (8), the dependent variable, Cash, is the ratio of cash holdings to total assets. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	WAGES & BENEFITS				EMP	DIV		CASH
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CRP tests	−0.0086***	0.0136	0.0147	0.0117	0.0265***	−0.0005	−0.0156**	−0.0008
	(0.0030)	(0.0146)	(0.0147)	(0.0281)	(0.0052)	(0.0011)	(0.0076)	(0.0015)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year
N	231,029	207,029	221,042	156,400	232,255	232,254	232,255	232,254
R^2	0.843	0.723	0.355	0.400	0.904	0.298	0.216	0.429

Table 7: **The Effect of Employee Health in Wage and Benefit Quintiles**
This table shows the effect of employee health on the firms' wages and employees' benefits in different quintiles. Benefits are measured as the tax value of employment perks, which include, among others, employer-paid group insurance coverage, access to company car programs, and private use of corporate IT equipment. Panels A and B report results for wages and benefits of seasoned employees, respectively, whereas Panels C and D report results for new hires. Within each panel, the dependent variable is the average wage (or benefit) of the respective quintile of the distribution of employee wages (or benefits) in a firm-year. Each column header indicates the quintile, starting with column (1) representing the firm-year average wage (or benefit) of the lowest quintile, to column (5) representing the firm-year average wage (or benefit) of the highest quintile. All regressions include year and firm fixed effects as well as firm age dummies for every five-year bin of firm age and our full set of firm-level and municipality level controls. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Wage Quintiles - Seasoned Employment					
Quintile	(1=Low)	(2)	(3)	(4)	(5=High)
CRP tests	−0.0641***	−0.0232***	−0.0065	−0.0033	−0.0017
	(0.0142)	(0.0073)	(0.0040)	(0.0028)	(0.0028)
Controls	Yes	Yes	Yes	Yes	Yes
N	231,020	230,596	230,331	230,403	228,568
R^2	0.592	0.743	0.816	0.833	0.844
Panel B: Benefit Quintiles - Seasoned Employment					
Quintile	(1)	(2)	(3)	(4)	(5)
CRP tests	−0.0496*	−0.0172	−0.0177	−0.0142	0.0331*
	(0.0282)	(0.0140)	(0.0154)	(0.0179)	(0.0179)
Controls	Yes	Yes	Yes	Yes	Yes
N	94,334	129,133	120,446	138,831	193,233
R^2	0.430	0.536	0.613	0.657	0.705
Panel C: Wage Quintiles - New Hires					
Quintile	(1)	(2)	(3)	(4)	(5)
CRP tests	−0.0295	0.0421**	0.0260	0.0226	0.0114
	(0.0240)	(0.0210)	(0.0180)	(0.0143)	(0.0136)
Controls	Yes	Yes	Yes	Yes	Yes
N	220,915	180,071	180,788	180,632	139,995
R^2	0.352	0.443	0.468	0.489	0.513
Panel D: Benefit Quintiles - New Hires					
Quintile	(1)	(2)	(3)	(4)	(5)
CRP tests	−0.0758	0.0622*	0.0097	0.0249	0.0125
	(0.0491)	(0.0345)	(0.0319)	(0.0312)	(0.0425)
Controls	Yes	Yes	Yes	Yes	Yes
N	48,843	67,613	92,765	112,792	100,304
R^2	0.310	0.306	0.356	0.406	0.404

Table 8: **Robustness Analysis**

This table examines the effect of employee health on firm operating performance. The dependent variable is operating return on assets (OROA). In column (1), we also include the one year lagged CRP test. In column (2), we exclude years of economic slowdown (2001-03 and 2008/09) from the sample. In columns (3), we exclude the largest municipality and capital of Denmark, i.e. Copenhagen as well as the second largest municipality (Aarhus). In column (4) we measure employee health by constructing a Health Shock indicator that takes a value of one for all firm-years in which a firm's municipality reports flu-related hospitalization events in excess of 80% of the sample mean. In column (5) we use an alternative measure of employee health, by examining the employee-weighted average of flu-related hospitalization events from employees' municipalities of residence. We then create an Health Shock indicator that takes a value of one for all firm-years in which a firm's measure of flu exposure is in excess of 85% of the sample mean. In columns (1) to (4), we include firm and year fixed effects, and in column (5) we replace these fixed effects with municipality times year fixed effects. And all specifications include our full set of firm-level and municipality-level controls, and firm age dummies for every five-year bin of firm age. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	OROA				
	(1)	(2)	(3)	(4)	(5)
CRP tests	-0.0064^{**}	-0.0064^{**}	-0.0059^{**}		
	(0.0029)	(0.0031)	(0.0029)		
CRP tests (t-1)	-0.0031				
	(0.0031)				
Treatment				-0.0023^{***}	-0.0050^{**}
				(0.0009)	(0.0023)
Controls	Yes	Yes	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year	Firm and year	Muni x year
N	222,847	164,323	195,662	240,995	262,348
R^2	0.317	0.326	0.316	0.315	0.028

Online Appendix: Employee health and firm performance

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A1 Differences in workforce characteristics

In this part, we analyse how the effect of employee health on firm operating performance varies with several workforce characteristics. To do so, we include interactions of several indicators with our $Health\,Shock$ indicator. Column (1) of Table A1 includes a '"male" indicator that takes a value of one for firm-years with an above average fraction of males in the firm's workforce. Additionally, two age indicators, "age 34-" and "age 55+", are included in column (2). These take a value of one for firm-years with an above average fraction of employees in the below 34 age group and above 55 age group, respectively. Column (3) adds a "children" indicator that takes a value of one for firm-years with an above average fraction of employees with children aged 10 or below. Column (4) adds a "college education" indicator that takes a value of one for firm-years with an above average fraction of employees with at least a bachelor's degree. In column (5) we include an "above average wage" indicator that takes a value of one for firm-years with above average wage payments, which are measures as the natural logarithm of the average yearly wage of all employees of a firm. Column (6) includes all of these workforce characteristics into one regression.

We report our result for OROA and net income in Panels A) and B), respectively. For both of these measures of profitability, we find little evidence for asymmetries in firms' work force. If at all, the most noticeable effect on the relation between workforce health and firm profitability stems from young age, college education, and above average wage payment tendencies in the workforce. Controlling for age, educational, and wage differences in the workforce composition between different industries by including interactions of our health shock indicator with industry indicators, we find that some weak evidence that the negative effect of profitability during a severe flu season is mitigated for firms with an above average fraction of younger employees, who have children and who have a college education and who earn higher wages For the other workforce characteristics, we do not find statistically significant differences in the relation between workforce health and firm profitability along those characteristics.

A2 Alternative regression specifications

Below, Tables A2 and A3 show that using an indicator variable if a CRP test has been used in a given firm-year, instead of the above described continuous variable, as the main independent variable leads to similar results.

Table A1: **Workforce Characteristics and the Effect of Employee Health on Firm Performance**
This table shows how the effect of employee health on firm operating performance varies with workforce characteristics. In Panel A, the dependent variable is operating return on assets (OROA), the ratio of operating income to total assets. In Panel B, the dependent variable is net income to total assets (NI). To measure the effect of workforce characteristics, we include *Male*, an indicator that takes a value of one for firm-years with an above average fraction of males in the firm's workforce; *Age 34-* and *Age 55+*, indicators that take a value of one for firm-years with an above average fraction of employees in the below 34 age group and above 55 age group, respectively; *Children*, an indicator that takes a value of one for firm-years with an above average fraction of employees with children between the age of 0 and 10; *College Edu*, an indicator that takes a value of one for firm-years with an above average fraction of employees with at least a bachelor's degree; and *Above Average Wage*, an indicator that takes a value of one for firm-years with above average wage payments. Wage payments are measures as the natural logarithm of the average yearly wage of all employees of a firm. All indicators are included as interactions with our CRP test variable as indicated. All specifications focus on firms with at least five employees, use firm and year fixed effects, and include our full set of firm-level, municipality-level, and age bucket controls. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: OROA					
	(1)	(2)	(3)	(4)	(5)	(6)
CRP tests	0.3321	0.3378	0.3308	0.3276	0.3266	0.3057
	(0.2301)	(0.2240)	(0.2309)	(0.2312)	(0.2064)	(0.2043)
Male	0.0067***					0.0063***
	(0.0017)					(0.0017)
Male × CRP tests	−0.0063					−0.0078
	(0.0063)					(0.0065)
Age 34-		0.0072***				0.0075***
		(0.0014)				(0.0014)
Age 34- × CRP tests		0.0064				0.0126*
		(0.0065)				(0.0067)
Age 55+		−0.0006				−0.0015
		(0.0013)				(0.0013)
Age 55+ × CRP tests		−0.0063				−0.0032
		(0.0066)				(0.0067)
Children			−0.0038***			−0.0039***
			(0.0012)			(0.0012)
Children × CRP tests			0.0126**			0.0105*
			(0.0056)			(0.0057)
College Edu				−0.0037**		−0.0032**
				(0.0015)		(0.0015)
College Edu × CRP tests				0.0117*		0.0107*
				(0.0061)		(0.0063)
Above Avg Wage					0.0182***	0.0185***
					(0.0014)	(0.0014)
Above Avg Wage × CRP tests					0.0139**	0.0152**
					(0.0059)	(0.0062)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year
N	222,243	222,243	222,243	222,243	222,243	222,243
R^2	0.320	0.320	0.320	0.320	0.321	0.321

Table A1 (cont.): **Workforce Characteristics and the Effect of Employee Health on Firm Performance**

	Panel B: Net Income					
	(1)	(2)	(3)	(4)	(5)	(6)
CRP tests	0.3409	0.3461	0.3399	0.3367	0.3345*	0.3148
	(0.2245)	(0.2195)	(0.2254)	(0.2256)	(0.2024)	(0.2002)
Male	0.0057***					0.0054***
	(0.0016)					(0.0016)
Male × CRP tests	−0.0043					−0.0061
	(0.0059)					(0.0060)
Age 34-		0.0054***				0.0057***
		(0.0013)				(0.0013)
Age 34- × CRP tests		0.0063				0.0125**
		(0.0060)				(0.0062)
Age 55+		−0.0000				−0.0008
		(0.0012)				(0.0012)
Age 55+ × CRP tests		−0.0060				−0.0033
		(0.0061)				(0.0062)
Children			−0.0032***			−0.0032***
			(0.0011)			(0.0011)
Children × CRP tests			0.0115**			0.0090*
			(0.0053)			(0.0054)
College Edu				−0.0038***		−0.0033**
				(0.0014)		(0.0014)
College Edu × CRP tests				0.0105*		0.0094
				(0.0057)		(0.0059)
Above Avg Wage					0.0168***	0.0171***
					(0.0013)	(0.0013)
Above Avg Wage × CRP tests					0.0159***	0.0174***
					(0.0056)	(0.0059)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year	Firm and year
N	222,242	222,243	222,243	222,243	222,243	222,243
R^2	0.305	0.305	0.305	0.305	0.306	0.307

Table A2: **The Effect of Employee Health on Firm Performance**
This table examines the effect of employee health on firm operating performance. In Panel A, the dependent variable is operating return on assets (OROA), the ratio of operating income to total assets. In Panel B, the dependent variable is net income to total assets (NI). To measure employee health, we construct a health shock indicator that takes a value of one for all firm-years in which the number of CRP tests performed on the employees and their families during the flu season is in excess of 80% of the sample mean. Firm controls include Log(Assets), the natural logarithm of the lagged value of total assets; Market concentration (HHI), measured by the Herfindahl-Hirschmann index of the firm's industry; N days at hospital (avg) — Top-5 employee / Rank and file employee, the average number of days a top-5 / non-top-5 employee was hospitalized in a given year; Local controls (municipality) — Population density / Unemployment rate, the population density of / unemployment rate in the firm's municipality. All specifications focus on firms with at least five employees and include firm fixed effects. Columns (1) and (3) also include year fixed effects while Columns (2) and (4) use municipality times year fixed effects. Columns (3) and (4) further include firm age dummies for every five-year bin of firm age. Clustered (firm) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: OROA			
	(1)	(2)	(3)	(4)
CRP tests indicator	−0.0027***	−0.0024***	−0.0022**	−0.0019**
	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Log(Assets)			−0.0112***	−0.0113***
			(0.0010)	(0.0010)
Market concentration (HHI)			−0.0067	−0.0054
			(0.0100)	(0.0101)
Top-5 employee, N days at hospital (avg)			−0.0021***	−0.0022***
			(0.0005)	(0.0005)
Rank and file employee, N days at hospital (avg)			−0.0008	−0.0008
			(0.0006)	(0.0006)
Municipality density			0.0155	
			(0.0163)	
Unemployment rate			−0.2658***	
			(0.0774)	
Controls	No	No	Yes	Yes
Fixed effects	Firm and year	Firm and muni × year	Firm and year	Firm and muni x year
N	257,133	257,129	240,995	240,993
R^2	0.307	0.308	0.315	0.316

Table A2 (cont.): **The Effect of Employee Health on Firm Performance**

	Panel B: Net Income			
	(1)	(2)	(3)	(4)
CRP tests indicator	-0.0022^{***}	-0.0019^{**}	-0.0018^{**}	-0.0016^{*}
	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Log(Assets)			-0.0093^{***}	-0.0094^{***}
			(0.0009)	(0.0009)
Market concentration (HHI)			-0.0026	-0.0014
			(0.0096)	(0.0097)
Top-5 employee, N days at hospital (avg)			-0.0019^{***}	-0.0020^{***}
			(0.0004)	(0.0004)
Rank and file employee, N days at hospital (avg)			-0.0008	-0.0009
			(0.0005)	(0.0006)
Municipality density			0.0199	
			(0.0150)	
Unemployment rate			-0.1949^{***}	
			(0.0715)	
Controls	No	No	Yes	Yes
Fixed effects	Firm and year	Firm and muni x year	Firm and year	Firm and muni x year
N	257,133	257,129	240,995	240,993
R^2	0.292	0.292	0.299	0.299

Table A3: **Measuring Flu Exposure by Establishment and Firm**
This table shows the effect of employee health on establishment operating performance. The dependent variable is *Profit per employee*, the ratio of establishment gross profit to the full-time employee equivalent of the establishment. To measure employee health, we construct a health shock indicator that takes a value of one for all establishment-years in which the number of CRP tests performed on the employees and their families during the flu season is in excess of 80% of the sample mean. Establishment and local and controls on the municipality level include *Size*, the natural logarithm of the lagged value of the full-time employee equivalent of the establishment; *Population density* and *Unemployment rate*, the population density of, and unemployment rate in the establishment's municipality, respectively. In column (1) and (2), we include firm and year fixed effect. In columns (3) - (5), we use firm-year fixed effects instead of firm and year fixed effects. In columns (4) and (5), we add establishment-level age fixed effects for every five-year bin of establishment age. Clustered (establishment) standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Profit per employee				
	(1)	(2)	(3)	(4)	(5)
CRP tests indicator	−0.0036**	−0.0063**	−0.0074***	−0.0057**	−0.0067**
	(0.0018)	(0.0025)	(0.0027)	(0.0026)	(0.0027)
Size				0.0079**	0.0080**
				(0.0034)	(0.0034)
Municipality density				−0.0016	
				(0.0015)	
Unemployment rate				0.3292	
				(0.2441)	
Controls	No	No	No	Yes	Yes
Fixed effects	Firm and year	Firm x year	Firm x year and muni x year	Firm x year	Firm x year and muni x year
N	246,747	95,134	95,125	90,110	90,101
R^2	0.626	0.804	0.804	0.802	0.802