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Essential workers and wage inequality: wage differentials before and during the Covid-19 pandemic, 2006 to 2022

Christoph Janietz

University of Groningen, The Netherlands

CONTACT Christoph Janietz (c.janietz@rug.nl), University of Groningen, 9700 AB Groningen, The Netherlands

ABSTRACT

In 2020, several governments declared specific occupations essential for maintaining the functioning of society in response to the Covid-19 pandemic. A current question in the public debate on fair pay is whether essential workers are sufficiently remunerated. Using data from the Netherlands, I analyze the wages of essential workers relative to other workers before and during the Covid-19 pandemic. Wage decompositions indicate that, between 2006 and 2019, essential workers earned less compared to other workers within higher-paid strata, while they earned more within lower-paid strata of the occupational structure in the Netherlands. These wage differentials are shaped by sex composition and sectoral employment. In addition, I employ a difference-in-differences design based on quarterly data 2017–2022 to assess whether the onset of the Covid-19 pandemic reduced an existing average wage gap in response to an increasing public appreciation of essential work. The results indicate that the collective experience of the Covid-19 pandemic has not benefited essential workers in the short term.

KEYWORDS Wage inequality; occupations; social stratification; gender inequality; essential workers

Introduction

Essential workers are an emergent category in the public discourse on labor market inequalities (ILO, 2023). The occupations that comprise essential workers are not new, yet the Covid-19 pandemic has drawn attention to their role within the societal division of labor. In 2020, several European governments and the European Commission issued directives that declared specific occupations as critically important for maintaining the functioning of society. These directives

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eased Covid-19-related confinement measures for workers in those occupations, allowing them to carry out their work without disruption (e.g., European Commission, 2020).

The classification of essential occupations proposed in these directives has broad commonalities across countries. Commonly, these lists comprise jobs in the health and social care sector; the supply of essential goods, such as water, food, or energy; education; logistics and transportation; waste disposal; public administration; and emergency services, such as fire departments and law enforcement. While these classifications include most care work occupations, such as nursing professionals or elementary school teachers, they also feature other occupations, such as food processing, agriculture, or freight workers, that play an important role in the food supply chain. In other words, essential workers maintain critical infrastructures that enable the continued fulfilment of central societal needs especially, but not only, during times of crisis.

The shared collective experience of the global Covid-19 pandemic has increased public awareness of the work performed by essential workers and resulted in an ongoing public debate on whether they are paid fairly given their critical contribution to the functioning of society. A small but growing body of research finds that the average wage of essential workers is lower than that of other workers across Europe (European Parliament, 2022; Koebe *et al.*, 2020) and worldwide (ILO, 2023; Walke, 2021). However, strong internal variation of pay exists, as essential workers are a heterogeneous group spanning lower-paid occupations, such as agricultural workers, to higher-paid occupations, such as medical doctors (European Parliament, 2022).

This article contributes to the evolving literature on the economic position of essential workers in society. First, I analyze wage differentials between essential workers and other workers during the years preceding the Covid-19 pandemic in the Netherlands. I use the official designation of essential occupations by the Dutch government as an empirical test case to critically interrogate the long-standing functionalist argument in social stratification research that predicts higher wages for functionally important work net of skill requirements (Davis and Moore, 1945). During the analysis, I contrast the functionalist hypothesis with alternative arguments that see wage determination as more strongly rooted in ascriptive inequalities (Reskin, 1988) and labor market institutions (Streeck, 2011). I test these alternative arguments by investigating how sex composition and sectoral employment are linked to wage differentials between essential and other workers across different strata of the occupational structure.

As a second contribution, I assess whether the Covid-19 pandemic had an effect on the wages of essential workers in the short term. The collective experience of the pandemic may have affected the shared values and beliefs that

underlie the social recognition of occupations in society (Zhou, 2005), thereby strengthening the social esteem attached to essential occupations. To the extent that labor unions can transform a salient public appreciation of essential work into bargaining power during collective wage negotiations on behalf of essential workers, this may have improved the wages of essential workers relative to other workers since the onset of the pandemic.

The Netherlands is an important country case for studying wage differentials between essential workers and other workers. The strengthening of collective bargaining institutions has recently been proposed as the most promising policy intervention to improve the wages of essential workers (ILO, 2023). The Netherlands represents a suitable country to study existing wage differentials within the context of strongly developed wage bargaining institutions, given a large share of workers (75.6% in 2019) covered by collective bargaining agreements (OECD and AIAS, 2021). Moreover, in the Netherlands, relative wage gains among essential workers are highly contingent on the hypothesized pathway of union intervention because of the focal role of labor unions during wage setting.

To answer my research questions, I combine cross-sectional data from the Dutch Labor Force Survey with precise job-level information on wages from the Dutch tax registers between 2006 and 2022 (Centraal Bureau voor Statistiek, 2022a, 2022b). Methodologically, the study improves on research that studies the wages of essential workers in two important ways. First, research has mainly relied on standardized international occupation codes to classify essential workers (e.g., European Parliament, 2022). In contrast, I identify essential workers by combining international and native occupation codes with the Dutch industry classification to closely approximate the definition of essential work propagated by the Dutch government. Combining occupational and industrial codes allows for more precise identification of essential workers than in other studies. Second, in addition to a comparison of group-level means, as in previous studies, I extend the analysis of wage differentials to different quantile values by drawing on RIF decomposition methodology (Firpo *et al.*, 2018; Rios-Avila, 2020). These quantile decompositions reveal important variation in wage differences across the wage distribution that would remain otherwise unobserved.

Theorizing wages of essential workers

In this section, I discuss salient features of essential work and their relationship to wage-setting processes. Salient features include (I) the task content of essential work and its relationship to skills, (II) care work as a pivotal domain of essential work and its relationship to gender inequality in the labor market, and

(III) the provision of essential work as a public good in contemporary political economies.

Tasks content of essential work and its relationship to skill

What sets essential work apart from other jobs is its specific task content that involves the maintenance of critical societal infrastructure. Tasks are distinct from skills and can independently determine wages (Autor, 2013). One theory that differentiates tasks and skills in its explanation of unequal rewards is the functionalist theory of social stratification. This theory claims that wages are determined by two factors: functional importance of societal roles and scarcity of personnel who qualify to fill these positions (Davis and Moore, 1945). In striking resemblance to contemporary definitions of essential occupations, Davis and Moore's concept of functional importance evolves around "essential services" that are "important to societal survival" (Davis and Moore, 1945, p. 243). While functional importance is a job characteristic determined by the tasks involved, the scarcity of personnel derives from the individual characteristics of workers—their innate talents and acquired skills—that enable them to carry out a given job.

Functionalist theory considers tasks, or functional importance, only as "a necessary but not a sufficient cause" (Davis and Moore, 1945, p. 244) of higher rewards, while skills, or scarcity of qualified personnel, take precedence in its explanation of unequal wages. Davis and Moore argue that functionally important jobs only need higher rewards if this wage premium ensures that these positions are sufficiently filled by qualified workers. Therefore, this theory defines an appropriate level of pay for essential workers in direct relation to the economic rewards of other workers. If working in other occupations is more attractive due to relatively higher wages, a sufficient supply of labor in essential occupations might not be attained, and societies would ultimately fail to meet the provision of central functions, such as health care, education, or food supply.

Research calls into question whether wages of essential workers are higher once individual-level skill differences are accounted for. Instead, wage penalties for essential workers remain when controlling for educational qualifications in countries such as Germany and Denmark (European Parliament, 2022; Koebe *et al.*, 2020; Schrenker *et al.*, 2021). However, for a more thorough test of the functionalist hypotheses, skill requirements also need to be controlled for at the level of occupations. In other words, functionalist theory predicts higher wages for essential workers relative to other workers in occupational positions with comparable skill requirements. During the analysis, I take this into account by analyzing wage differentials within different ISCO-08 skill levels (ILO, 2012, pp. 12–14).

Pivotal role of care work and gender inequality

A second feature of essential work is its large component of jobs involving "face-to-face services that develop the human capabilities of recipients" or, in other words, care work (England *et al.*, 2002, p. 455). Many essential occupations, such as elementary school teaching and nursing, feature care work and are predominantly performed by women (Budig and Misra, 2010; Dwyer, 2013). Recent estimates indicate that care workers make up about half of all essential workers in the United States (Folbre *et al.*, 2021).

Many studies show that occupations with a large share of women in general, and care work occupations in particular, suffer a wage penalty on the labor market, even after controlling for human capital variables (Budig and Misra, 2010; Busch, 2018; Cohen and Huffman, 2003; England *et al.*, 2002; Levanon *et al.*, 2009; Murphy and Oesch, 2016; Ruijter *et al.*, 2003). Devaluation theory explains this wage gap with a cultural bias against the work carried out by women (England, 1992; Reskin, 1988). Wages in female-typed occupations are negatively affected by status beliefs that ascribe less worth to work performed by women relative to men (Auspurg *et al.*, 2017; Jasso and Webster, 1997; Ridgeway, 2014). In the case of care work, skills associated with caregiving are naturalized as innately female and free of additional training requirements, thereby rendering them invisible or unworthy of compensation. Proponents of the theory of equalizing differences raise objections against devaluation theory by arguing that the wage gap is instead a result of women's willingness to substitute wages with nonpecuniary forms of compensation (Rosen, 1986). However, the argument that engaging in prosocial work itself is a direct substitute for wages has been questioned in the care work literature. Instead, cultural expectations that care work should be performed out of love and not for money can coerce paid care workers to accept lower pay (Folbre and Nelson, 2000). Moreover, there is no evidence that other wage substitutes, such as additional fringe benefits like paid vacation, are more generous in occupations where workers are predominantly women (Hodges, 2020).

Recent research shows that the devaluation process is complex and mainly bound to economic rewards, as the largest mismatches between symbolic and material valuation in society are found among female-typed occupations (Freeland and Harnois, 2020; Freeland and Hoey, 2018; Valentino, 2020). Although many female-typed occupations are among the most highly respected when measured by deference scores, they are not among the highest paid. For example, social workers are highly esteemed in society for the work they perform but earn on average less than other professionals (Freeland and Hoey, 2018). Valentino (2020) argues that this discrepancy stems from a process that culturally elevates

the performance of gender-confirming roles, while simultaneously upholding material disadvantages. Freeland and Harnois (2020) conclude that the positively evaluated aspects of work performed in female-typed occupations are systematically disregarded when it comes to pay setting.

A discrepancy between symbolic and material valuation also motivates the societal debate on the wages of essential workers as a whole (Schrenker *et al.*, 2021) and is specifically striking against the backdrop of classic arguments in social stratification research. Parkin (1971) argued that incongruent distributions of social esteem and material advantage should be unstable, as a mismatch between the two dimensions would erode normative support for existing inequalities. However, the fact that such a discrepancy is particularly observable among female-typed occupations suggests that gendered wage-setting processes legitimize existing disparities between high social esteem and low material rewards and by extension uphold lower wages for many essential workers.

Provision of essential work as a public good

A third feature of essential work is its provision as a public good. Many countries rely on public- and nonprofit-sector employment to produce accessible essential services, although the extent of privatization varies (ILO, 2023). This may constrain the wage ceiling among essential workers for several reasons. First, consumers of essential services, such as children in education or patients in health care, often do not have the means to pay for essential services on an individual basis. Second, following the argument of Baumol's cost disease, productivity growth is slower in interpersonal services, while at the same time, the wages of service providers need to keep up with other parts of the economy (Baumol, 1967). In combination, this gives rise to a target conflict between higher wages for service providers and cost containment. As a consequence, essential workers employed in the public and nonprofit sectors are often embedded in collective bargaining agreements and their wages are governed by strict budgeting rules. A common solution within such budgeting systems is to absorb rising costs by exercising wage moderation in jobs that produce essential services.

These institutional wage constraints in the public and nonprofit sectors must be contrasted with the wage structure of the private sector. In the private sector, wage ceilings are less constrained by both budget and normative pressures (Ajdacic, 2022; Streeck, 2011). Rising wage inequality has mainly been an outcome of growth at the top end of the distribution (Lemieux, 2007; Parolin and Gornick, 2021; Piketty and Saez, 2003), and this rise of top-level wages is caused by an increasing ability of specific industries, like finance

(Tomaskovic-Devey and Lin, 2011) and private market-dominating firms (Autor *et al.*, 2020; Tomaskovic-Devey *et al.*, 2020), to capture large shares of national income. In turn, these employers can pay increasingly higher top-level wages to their managerial and professional workforce (Card *et al.*, 2013; Lazear, 2019; Song *et al.*, 2019; Wilmers and Aeppli, 2021). While wage setting is strongly coordinated in the Netherlands, firms have ample leeway to ramp up top-level salaries, particularly in the private sector (Janietz and Bol, 2020).

On the flip side, public-sector employment has been shown to bolster essential workers' wages in the lower tail of the wage distribution. Research finds that essential workers in the lower-paid strata of the occupational structure profit from public-sector employment because of higher wage floors and greater institutional protection (European Parliament, 2022; ILO, 2023). A compensating effect of public-sector employment has also been reported in the literature on care work. Care work penalties tend to be smaller in countries with a larger public sector and higher union density (Budig and Misra, 2010).

Overall, this suggests that wage penalties for essential workers should be observable mainly among higher-earning workers within the managerial and professional workforce. It is only in the upper segments of the occupational structure that selected other workers should be able to attain much higher compensation within the private sector of the labor market. This argument applies particularly to countries where essential workers are more strongly concentrated in the public and nonprofit sectors, such as the Netherlands.

Summary

Based on the preceding discussion, I derive three testable empirical expectations of the wage gap between essential and other workers. First, the functionalist theory of social stratification predicts *a general wage premium for essential workers once differential skill requirements at the occupational level are accounted for.* Second, devaluation theory predicts *wage penalties for essential workers within the strata of the occupational structure, in which essential workers are predominantly women*. Third, arguments surrounding the provision of essential work as a public good predict that *wage penalties for essential workers are concentrated among higher-earning workers (managers and professionals) and are linked to sectoral employment*.

The impact of the Covid-19 pandemic on wages of essential workers

As a second research question, I ask whether the collective experience of the Covid-19 pandemic affected wage differentials between essential workers and

other workers. The health crisis represents an unforeseeable global event that may have bolstered the public evaluation of essential occupations as being of value to society. First, selective essential occupations, such as nursing, elementary school education, and social work, enjoyed high levels of social esteem before the onset of the pandemic (Freeland and Hoey, 2018). In these cases, the pandemic only highlighted the nature of tasks performed by these essential workers, personal services for a common public good, which explained their high esteem in the public eye before 2020. Second, the health crisis has increased the salience of the societal contribution of several other essential occupations, such as cashiers, logistics workers, and farm laborers, that have received lower levels of valuation and recognition in the past. The prominent role of these occupations in maintaining social functioning during the pandemic may have resulted in an increasing shared collective appreciation of their work since 2020.

A higher cultural esteem of occupations does not mechanically increase wages, as exemplified by the case of female-typed occupations. To affect economic rewards, contingent wage bargaining processes need to be amenable to shifting valuations of essential work. In the Netherlands, labor unions are important actors in this negotiation process because most essential workers fall under centralized collective bargaining agreements. Unions represent important "pillars of the moral economy in modern labor markets" (Western and Rosenfeld, 2011, p. 517) that have cultural, political, and institutional leverage to actively enforce norms of fairness during wage negotiations (VanHeuvelen, 2018). A growing public appreciation of essential occupations has likely shifted broader societal norms of fairness in a direction that favors wage gains of essential workers, and unions can draw on this shift as a source of nonmarket power (Elster, 1989; Wilmers, 2017). If such bargaining power on behalf of essential workers increased not only in absolute terms but also relative to the bargaining power of other workers, it may have resulted in changes in the wage gap between essential workers and other workers since the onset of the Covid-19 pandemic.

Recent campaigning of the FNV (Dutch Federation of Labor Unions) illustrates how unions can culturally intervene in the moral economy on behalf of essential workers. Since 2021, the FNV organizes an ongoing public campaign series titled *De Onmisbaren* (The Indispensables) under the leadership of worker representatives. The central demand of the campaign is a substantive wage increase for essential occupations articulated against the backdrop of their societal contribution during the Covid-19 pandemic. This demand departs markedly from a long-running strategy of wage moderation that characterizes Dutch industrial relations (Been and Keune, 2019; Kollmeyer, 2017). Moreover, such encompassing forms of union advocacy might be of particular importance for the

bargaining position of specific essential occupations, such as agricultural laborers who have exhibited lower bargaining power in the past (ter Steege *et al.*, 2012).

The outlined argument leads to the following hypothesis: *wages of essential workers have improved relative to wages of other workers since the onset of the Covid-19 pandemic*. However, the postulated effect hinges on union intervention and the outcomes of recently completed collective bargaining rounds.[1] Therefore, I also test whether relative wage gains may have been restricted to essential workers covered by centralized collective bargaining agreements.

Data and methodology

Sample

I combine data from the Dutch Labor Force Survey (*Enquete Beroepsbevolking* (EBB)) and Dutch tax registers for the period 2006–2022 (Centraal Bureau voor Statistiek, 2022a, 2022b). The EBB is a rotating panel, and respondents are surveyed five times before transitioning out of the sample. Interviews are administered in a quarterly interval. For the first analysis (wage differentials before the pandemic), I limit the EBB sample to the first observation of each respondent upon entering the panel. By doing so, I construct a repeated cross-section with a changing sample of respondents from year to year. For the second analysis (impact of the pandemic on wage differences), I work with a quarterly time interval instead of years. I construct these data by using all observations of the quarterly rotating EBB starting from 2017 until the most recent quarter available at the time of analysis (fourth quarter of 2022). The statistical population of the analysis are employees. I exclude self-employed workers from the sample because their earnings and hours are not registered in detail in the tax registers.

I supplement the EBB with administrative wage data from Dutch tax registers. The analysis focuses on the main job of an employee, defined as the job with the most hours worked at the time of the EBB survey. For the first analysis, I aggregate the wages and hours accrued in each main job over the full calendar year. For the second analysis, I aggregate wages and hours in each main job within the same quarter in which the survey interview took place.

[1] Some examples of relevant centralized collective bargaining agreements that cover essential workers and that were recently renewed are the "CAO Sociaal Werk" [CLA Social Work]; "CAO Kinderopvang" [CLA Childcare]; "CAO Grondstoffen, Energie, en Omgeving (Onderdeel services)" [CLA Raw materials, Energy, and Environment (Section services)]; "CAO Primair Onderwijs" [CLA Primary Education]; "CAO Beroepsgoedenvervoer" [CLA Professional freight transport]; and the "CAO Verpleeg-, Verzogingshuizen, Thuiszorg, en Jeugdgesondheidszorg" [CLA Nursing homes, Care homes, Home care, and Youth health care].

I restrict the sample to workers between the ages of 16 and 65 and exclude respondents working in the armed forces and extraterritorial organizations. The final sample comprises 680,702 yearly observations between 2006 and 2019 and 889,641 quarterly observations between the first quarter of 2017 and the fourth quarter of 2022. The survey weights of the EBB are applied throughout the analysis but are rescaled to ensure equal weight of each year (quarter) independent of the sample size.

Variables

The dependent variable in the analysis is the logged real hourly wage. The wage measure excludes overtime compensation and hours. I adjust for yearly inflation rates with 2015 prices as the reference point. The primary wage measure does not contain bonus payments above the base wage. However, in the second analysis, I benchmark the estimates against a specification that includes bonus payments to test whether changes in the wage gap since the onset of the Covid-19 pandemic were potentially driven by alternative forms of compensation, such as one-off payments.

The main independent variable is binary and identifies essential workers. This measure is based on the list of essential occupations published by the Dutch government at the end of March 2020 (FNV, n.d.). I rely on two occupational classification schemes (ISCO-08 and the Dutch BRC 2014) and one industry classification scheme (the Dutch SBI 2008) to designate the status of working in an essential job. The coding scheme was developed by Statistics Netherlands to report an estimated absolute number of essential workers that qualified for exemptions from Covid-19-related confinement measures to the Dutch government in 2020. An important clarification concerning this measure is warranted. A definitive translation of the government list is difficult to accomplish. The list contains broad job descriptions that do not always correspond neatly to categories in occupational classification schemes. I provide the translated government list and the coding scheme as an additional appendix for interested readers to ensure transparency of the coding decisions.[2]

Several additional variables were also included in the analysis. These variables include education and age to account for qualification levels and work experience. Age is included as a linear and quadratic term in the regression models. In line with the formulated hypotheses, I devote specific attention to sex composition and sectoral employment (private, public, and nonprofit), measured at

[2] See S1 and S2 in the supplementary material for the translated government list and coding scheme of essential work.

the individual level. I construct an additional indicator that identifies care workers following Budig and Misra (2010).[3] Moreover, I identify workers who are covered by a centralized collective bargaining agreement. This information from the tax registers is available for all workers in the sample. Additional controls account for immigration biography and descendancy and the presence of children (0–18 years old) in the same household. I draw on the first digit of the ISCO-08 to distinguish between skill requirements at the occupational level and the SBI 2014 (20 industry categories) to differentiate between more detailed labor market segments.

Methodology

Wage differentials before the Covid-19 pandemic (2006–2019)

I use the following linear regression model to analyze wage differentials between essential workers and other workers:

$$\ln wage_{it} = \alpha + \beta Essential_i + \gamma_t Year_t + \boldsymbol{X}_{it} + \varepsilon_{it} \quad (1)$$

where $\ln wage_{it}$ is the log real hourly wage of individual i observed in year t. $Essential_i$ is the binary indicator that identifies essential workers, and $Year_t$ is a set of year fixed effects. I sequentially add additional control variables ($\boldsymbol{X}_{it}$) including interaction terms[4] to the model and report the estimated marginal effects of working in an essential job on the log real hourly wage.[5]

In a second step, I decompose wage differentials between essential and other workers overall and within occupational skill levels. Lower wages for essential workers within skill levels would contradict the empirical prediction of a functional task premium. For example, nursing professionals have been designated as essential workers in response to the Covid-19 pandemic. Their work contributed to the continued provision of healthcare services but exposed them to a heightened risk of infection at their workplace. Although nursing professionals might earn a higher wage than essential workers in another occupation characterized by lower skill requirements, they might still receive lower wages relative to other workers within the occupational strata of professionals.

I decompose mean differences in log wages using a twofold decomposition that distinguishes between composition and wage structure effects using linear regression models (Jann, 2008).[6] Mean wage differentials within occupational

[3] See S18 in the supplementary material for the coding scheme of care work.
[4] I do not specify interaction terms in the regression models underlying the wage decompositions to ease the interpretation of effect estimates.
[5] Detailed estimation results can be found in S6 of the supplementary material.
[6] Detailed decomposition results can be found in S7–11 of the supplementary material.

skill levels are decomposed as

$$\overline{W}_E - \overline{W}_O = \underbrace{(\overline{X}_E - \overline{X}_O)\hat{\beta}_O}_{Composition} + \underbrace{\overline{X}_E(\hat{\beta}_E - \hat{\beta}_O)}_{Wage\ structure} \quad (2)$$

where the subscript E indicates essential workers and the subscript O indicates other workers. The composition (or explained) component captures the effect of group differences measured by observable characteristics. Negative composition effects contribute to lower group-level wages among essential workers (e.g., when women receive lower wages in the labor market and the share of women is larger among essential workers). The wage structure component captures unexplained differences in the coefficients associated with the predictors. Categorical variables are normalized following Yun (2005) and summarized as components.

Additionally, I draw on RIF decomposition methodology (Firpo *et al.*, 2018; Rios-Avila, 2020) to estimate compositional effects on quantile value differences across the conditional wage distributions. Composition effects may vary by quantile, and such variation would be masked in the decomposition of mean wages. For example, following the theoretical discussion, it is plausible that high wages in the private sector may contribute to wage differences between essential and other workers, particularly at the upper ends of the distribution. I decompose quantile value differences between essential and other workers using both the entire sample (Figure 2) and samples split by occupational skill level (Table 4).

Impact of the Covid-19 pandemic on wage differentials (2020–2022)

In the second part of the analysis, I implement a difference-in-differences (DID) design to assess the effect of the Covid-19 pandemic on the wage gap between essential and other workers. The effect is identified using a three-way fixed effects model:

$$\begin{aligned} \ln wage_{ijgt} = {} & \alpha + \beta\, Essential_{it} + \gamma\, Pandemic_t + \nu\, Essential_{it} * Pandemic_t \\ & + \delta_t\, Quarter_t + \varphi_j\, Industry_j + \theta_j\, (Industry_j * t) \\ & + \psi_g\, Skill\ Level_g + \varepsilon_{ijgt} \end{aligned} \quad (3)$$

where ν of Equation 3 is the coefficient of interest that is captured by an interaction between a binary indicator of working in an essential job and a binary indicator of the period since the onset of the pandemic in the Netherlands (after the first quarter of 2020). δ_t are time unit fixed effects, φ_j are industry fixed effects, and ψ_g are occupational-skill-level fixed effects. In addition, I relax the common trends assumption by allowing for group-specific linear wage trends existing before the pandemic and extending into 2020 and beyond. As collective bargaining

agreements are mainly set at the industry level in the Netherlands, I capture these heterogeneous linear wage trends across industries with θ_j.[7]

One challenge of working with repeated cross-sections in a DID setting is the potential compositional change that may drive changes in the wage gap over time. Such a compositional change is a plausible scenario in the case of the Covid-19 pandemic. The extended period of governmental restrictions that involved the closure of large parts of the hospitality and retail sector may have impacted the occupational structure of the Netherlands. Occupations in these sectors may have decreased in relative size compared with jobs that were less affected by restrictions in response to the pandemic. Consequently, the average wage of both groups may have diverged because of a changing composition in terms of low- and high-paying jobs within those groups instead of being driven by wage changes within existing jobs.

I apply a reweighting strategy to assess the contribution of such compositional changes to the change in the wage gap between essential and other occupations. The idea behind this strategy is to counterfactually fix the occupational structure at its shape from before the start of the Covid-19 pandemic in the Netherlands (before the first quarter of 2020). The strategy is implemented by applying an adjustment factor λ_{occ} to the quarterly survey weights w_{it}

$$w_{it}^{*} = \begin{cases} w_{it} * \lambda_{occ} \, if \, Pandemic_t = 1 \\ w_{it} \, if \, Pandemic_t = 0 \end{cases} \tag{4}$$

with

$$\lambda_{occ} = \frac{p^{occ}_{Pandemic = 0}}{p^{occ}_{Pandemic = 1}} \tag{5}$$

This survey weight adjustment increases (decreases) the contribution of workers who work in occupations that have contracted (expanded) since the start of the pandemic relative to the period between the first quarter of 2017 and the first quarter of 2020. When applying this adjustment, a smaller effect size of the estimator would indicate that the effect is partially driven by compositional changes in the occupational structure.

Results

Table 1 presents descriptive statistics of the group composition of essential and other workers between 2006 and 2019. The estimated relative share of essential

[7] Detailed estimation results can be found in S12–14 of the supplementary material.

Table 1. Descriptive statistics by essential worker status (2006–2019).

		Other Workers	Essential Workers
Real hourly wage			
(Tax registers)	Mean	18.97 €	17.75 €
	SD	13.60	9.37
Age			
(EBB survey)	Mean	39.39	39.60
	SD	12.53	13.13
Education			
(EBB survey)	ISCED 1-2	23.07%	21.06%
	ISCED 3-4	42.81%	43.51%
	ISCED 5-8	34.12%	35.43%
Sex			
(EBB survey)	Woman	40.84%	61.07%
Child (0–18) in household			
(EBB survey)	Yes	44.30%	46.30%
Immigrants and their (direct) descendants			
(EBB survey)	With own migration experience	10.28%	8.25%
	Without own migration experience	8.74%	7.84%
Sector			
(EBB survey)	Private sector	84.21%	39.74%
	Non-profit sector	3.56%	40.60%
	Public sector	12.23%	19.66%
Other characteristics			
(EBB survey)	Care worker	1.87%	48.77%
(Tax registers)	Centralized collective bargaining agreement	57.37%	83.12%
Summary			
	% of Total	62.67%	37.33%
	Min	35.12% (2008)	
	Max	38.76% (2019)	

Note: Sample includes all main jobs of dependent employed workers aged 16–65. Main jobs are defined as the job with the most hours worked at the time of the survey. Pooled sample between 2006 to 2019. Survey weights are applied.

workers is 37.33%, similar to previous estimates across the European Union (European Parliament, 2022). In general, the composition of both groups is comparable for most individual-level variables. However, there are some important group differences. Women make up more than 60% of essential workers, compared to around 40% of other workers. Essential workers are also more often employed in the public and nonprofit sectors. In addition, most care workers are also classified as essential workers and comprise approximately half of the essential workers in the Netherlands, similar to U.S. estimates reported by Folbre *et al.* (2021).[8] Finally, a larger share of essential workers is covered by a

[8] Of all other workers, 1.87% are also classified as care workers. These workers are predominantly university and higher education teachers. This is in line with the definition of essential

centralized collective bargaining agreement (83.12%) compared to other workers (57.37%). Overall, there is a raw average wage gap of 1.22 €/h to the detriment of essential workers, and the within-group variation of real hourly wages is larger among the group of other workers.

Figure 1 provides a detailed look at the pooled wage distribution between 2006 and 2019 disaggregated by sector. Several noteworthy facts can be obtained from the distributional statistics. First, the highest wages in the Netherlands do not accrue to essential workers. Overall, the wage distribution of other workers is more strongly right skewed, with a higher share of very-high-earning workers. By contrast, the wage distribution of essential workers is symmetric, with fewer cases of exceptionally high wages.[9] Second, the wage gap between essential and other workers is mainly an outcome of private-sector wages. Most of the very high wages of workers not classified as essential are paid in the private sector. Moreover, the wages of essential workers tend to be lower in the private than in the public and nonprofit sectors. Third, the highest wages in the public and nonprofit sectors often accrue to workers who are not classified as essential. These are predominantly managers and business administration professionals who are likely to exercise leadership roles in their respective public or nonprofit organization. At the same time, the disparity between top-level pay of essential and other workers is generally smaller in the public and nonprofit than private sectors. Overall, these descriptive findings support the assertion that pay differences across sectors are important for understanding wage differentials between essential and other workers, particularly at the top of the wage distribution.

Wage differentials before the Covid-19 pandemic (2006–2019)

I begin the multivariate analysis of wage differentials with an assessment of the overall sample (Table 2). In a first model, I estimate the wage gap based on a function of essential worker status and year fixed effects. From 2006 to 2019, the average wage of essential workers has been lower than the average wage of other workers, and this penalty amounts to around −2%. Next, I adjust for individual-level human capital characteristics (education and age). The estimated negative effect of essential worker status on log hourly wages remains and is similar in size. This finding replicates earlier research on wages of essential workers, which

work as propagated by the Dutch government that excluded teachers in tertiary education. In contrast, tertiary education teachers are classified as care workers by Budig and Misra (2010).

[9] The smaller second peak at the bottom end of the wage distribution visible for the private sector is an outcome of minimum wage legislation. In the Netherlands, the minimum wage increases stepwise with age up until workers are 21 years old. Firms in industries such as retail take advantage of this legislation to cut labor costs by mainly hiring young workers for frontline jobs.

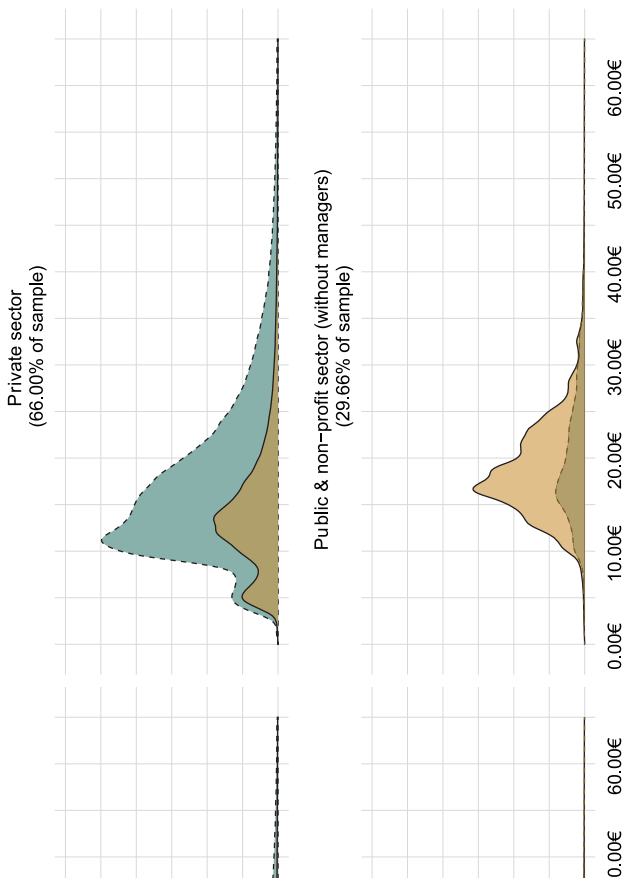

Figure 1. Distribution of real hourly wage by essential worker status and differentiated by sector (2006–2019).

Note: Pooled sample between 2006 to 2019. "Without managers" excludes workers with one-digit code 1 and two-digit code 24 (business professionals) of ISCO-08. Survey weights are applied.
Source: EBB & SPOLIS, 2006–2019.

Table 2. OLS regression estimates of wages on essential worker status, sex, sector, and additional controls (2006–2019).

	Model 1 Log Real Hourly Wage	**Model 2** Log Real Hourly Wage	**Model 3** Log Real Hourly Wage	**Model 4** Log Real Hourly Wage	**Model 5** Log Real Hourly Wage	**Model 6** Log Real Hourly Wage
Essential Worker	−0.024***	−0.022***	0.010***	0.009***	−0.032***	0.027***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age		0.088***	0.088***	0.090***	0.089***	0.082***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age^2		−0.001***	−0.001***	−0.001***	−0.001***	−0.001***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ISCED 1-2		−0.200***	−0.205***	−0.199***	−0.188***	−0.126***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ISCED 5-8		0.335***	0.336***	0.335***	0.318***	0.179***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Woman			−0.156***	−0.142***	−0.161***	−0.129***
			(0.001)	(0.001)	(0.001)	(0.001)
Child (0–18 years) in household				0.019***	0.0195***	0.013***
				(0.001)	(0.001)	(0.001)

(*Continued*)

Table 2. Continued.

	Model 1 Log Real Hourly Wage	**Model 2** Log Real Hourly Wage	**Model 3** Log Real Hourly Wage	**Model 4** Log Real Hourly Wage	**Model 5** Log Real Hourly Wage	**Model 6** Log Real Hourly Wage
Woman * Child (0–18 years) in household				−0.049***	−0.051***	−0.044***
				(0.002)	(0.002)	(0.002)
Immigrant 1st generation				−0.138***	−0.136***	−0.092***
				(0.003)	(0.003)	(0.002)
Immigrant 2nd generation				−0.021***	−0.022***	−0.018***
				(0.003)	(0.003)	(0.003)
Woman * Immigrant 1st generation				0.0556***	0.060***	0.058***
				(0.004)	(0.004)	(0.003)
Woman * Immigrant 2nd generation				0.040***	0.045***	0.036***
				(0.004)	(0.004)	(0.003)
Constant	2.777***	0.771***	0.830***	0.795***	0.819***	1.176***
	(0.002)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Sector					x	
ISCO-08 skill level (Managers in separate category)						x
Year Fixed Effects	x	x	x	x	x	x
Observations	680,702	680,702	680,702	680,702	680,702	680,702
R^2	0.001	0.543	0.566	0.571	0.577	0.633

Note: Survey weights are applied. Standard errors in parentheses; *p < 0.05 **p < 0.01 ***p < 0.001.

found that group-level differences in educational attainment and age composition are insufficient explanations for existing wage differentials.

Next, I adjust for sex composition in addition to human capital characteristics. The results indicate that gendered patterns of labor market inequality play an important role in understanding the wage gap between essential and other workers. After controlling for sex composition, essential work has no negative effect on wages. From 2006 to 2019, women were overrepresented among essential workers while being, on average, paid a lower wage during the same time. These findings are in line with the predictions of devaluation theory. When adding additional covariates for the presence of children in the household and immigration biography, the estimated effect remains unchanged because of the comparable distribution of both covariates across the two groups of essential and other workers.

After adjusting for individual-level variables, I control for broader labor market segments (sectoral employment and occupational skill levels). First, within sector and net of demographic controls, essential workers accrue a wage penalty of approximately −3%. The discussed wage distribution patterns by sector in Figure 1 suggest that these wage penalties are mainly an outcome of pay practices in the private sector. Second, I control for differential skill requirements at the occupational level as a control, in addition to the demographic variables. In line with the functionalist hypothesis, an aggregate wage premium for essential workers of approximately +2.7% is observable within ISCO-08 skill levels.

As a next step, I decompose existing wage differentials (mean and quantile values). Initially, I examine wage differences independent of occupational skill levels (Table 3 and Figure 2). The first column of Table 3 replicates the average wage penalty of around −2% for essential workers. In addition, Figure 2 displays quantile values conditional on essential worker status using the entire sample. The results reveal a higher wage floor but also a lower wage ceiling for essential workers. These findings indicate that the overall average wage penalty for essential workers in the Netherlands derives from the top of the wage distribution.

Next, I consider ISCO-08 skill levels while decomposing wage differences. The functionalist theory of stratification predicts higher wages for essential workers within occupational skill levels. In contrast, devaluation theory predicts lower wages for essential workers within those strata in which essential workers are predominantly women. Last, the arguments surrounding the provision of essential work as a public service predict that lower wages for essential workers are linked to sectoral employment, particularly in higher levels of the occupational structure.

The results reveal noteworthy variation in wage differentials across skill levels (Table 3). Mean wage premiums for essential workers are observable within two

Table 3. Wage decomposition of mean differences.

	All (1–9)	Managers (1)	Professionals (2)	Tech. & Ass. Professionals (3)	Midlevel Occupations (4–8)	Elementary Occupations (9)
ISCO-08 skill level	1–4	3–4	4	3	2	1
Formal educational requirement (ISCED-97)	1–6	5–6	5a–6	5b	2–4	1
Overall						
Mean log wage Essential workers	2.777***	3.342***	3.098***	2.862***	2.647***	2.248***
	(0.001)	(0.007)	(0.001)	(0.001)	(0.001)	(0.003)
Mean log wage Other workers	2.801***	3.323***	3.143***	2.962***	2.558***	2.306***
	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)
Wage differential	−0.024***	0.019*	−0.045***	−0.100***	0.088***	−0.058***
	(0.001)	(0.008)	(0.002)	(0.002)	(0.002)	(0.004)
Composition (total)	0.024***	−0.312***	−0.007	−0.048***	0.044***	−0.098***
	(0.002)	(0.038)	(0.005)	(0.005)	(0.003)	(0.007)
Wage structure (total)	−0.048***	0.331***	−0.038***	−0.052***	0.045***	0.040***
	(0.002)	(0.038)	(0.005)	(0.006)	(0.003)	(0.007)
Composition effects (selected effects)						
Education & Age	−0.002*	0.086***	0.030***	−0.010***	0.024***	−0.129***
	(0.001)	(0.005)	(0.001)	(0.001)	(0.001)	(0.003)
Sex	−0.019***	−0.044***	−0.036***	−0.026***	−0.011***	0.030***
	(0.000)	(0.004)	(0.001)	(0.001)	(0.000)	(0.001)
Sector	0.037***	−0.005	0.024***	0.059***	0.046***	−0.000
	(0.001)	(0.020)	(0.003)	(0.003)	(0.002)	(0.001)

(*Continued*)

Table 3. Continued.

	All (1–9)	Managers (1)	Professionals (2)	Tech. & Ass. Professionals (3)	Midlevel Occupations (4–8)	Elementary Occupations (9)
Wage structure effects (selected effects)						
Education & Age	−0.389***	−0.787***	−0.720***	−0.622***	−0.373***	0.145***
	(0.009)	(0.142)	(0.027)	(0.028)	(0.012)	(0.023)
Sex	−0.008***	0.004	0.005***	−0.012***	−0.002***	−0.005***
	(0.000)	(0.003)	(0.001)	(0.001)	(0.000)	(0.001)
Sector	−0.033***	−0.019	−0.015***	−0.063***	−0.043***	−0.025*
	(0.002)	(0.016)	(0.003)	(0.005)	(0.005)	(0.012)
% Essential Workers	37.33%	9.75%	42.07%	40.46%	35.10%	48.34%
Observations	680,702	40,994	168,897	119,687	297,130	53,994

Note: Oaxaca-Blinder type decomposition as laid out in the methodology section. Additional explanatory variables are migration background, child in household, industry, and year fixed effects. Effect estimates of these additional predictors can be found in the supplementary material. Survey weights are applied. Standard errors in parentheses; $^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p < 0.001$.

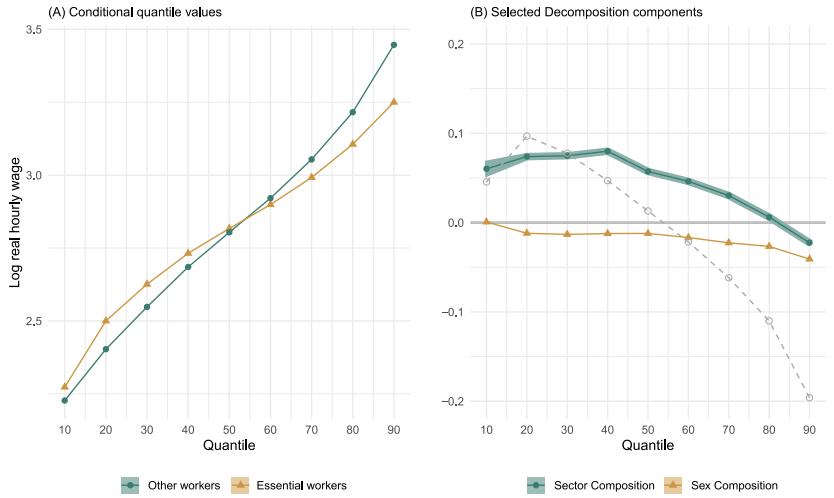

Figure 2. RIF wage decomposition of quantile differences.

Note: Dashed line in panel (B) displays the estimated quantile differences. A negative difference indicates a lower quantile value for essential workers. Additional explanatory variables are migration background, child in household, industry, and year fixed effects. Effect estimates of these predictors are reported in the supplementary material. Survey weights are applied.
Source: EBB + SPOLIS, 2006–2019.

out of five levels (managers (+2%) and midlevel occupations (+9%)). In contrast, mean wage penalties for essential workers are observable in the other three levels (professionals (−4.5%); technicians and associate professionals (−10%); and elementary occupations (−6%)). Beyond the average wage, quantile decompositions reveal a pattern of growing differences at higher quantiles *within* the highest occupational skill levels (Table 4). At the 75th percentile, the conditional quantile values are 0.05 (managers), 0.15 (professionals), and 0.16 (associate professionals) log points smaller for essential workers.

These findings only lend partial support to the prediction of the functionalist theory. Wage premiums for essential workers do exist but do not extend to all strata of the occupational structure. Importantly, a higher average wage accrues only to essential workers in the midlevel of the established occupational hierarchy. Contrary to the prediction of functionalist theory, essential workers face wage penalties, particularly among the managerial, and the (associate) professional workforce. This finding is further underlined by the estimated effects of individual-level skill variables (education and age) in the wage decompositions (Tables 3 and 4). The more favorable composition of essential workers' education and age among managers and professionals has a compensatory effect on wage differences. Instead, unexplained lower returns to education and age accruing to essential workers are important contributing factors to wage differences at all skill levels, with the exception of elementary occupations.

Table 4. RIF wage decomposition of quantile differences (within highest-paying major occupation groups).

	Managers (1)	Managers (1)	Managers (1)	Professionals (2)	Professionals (2)	Professionals (2)	Tech. & Ass. Professionals (3)	Tech. & Ass. Professionals (3)	Tech. & Ass. Professionals (3)
ISCO-08 skill level	3–4	3–4	3–4	4	4	4	3	3	3
Formal educational requirement (ISCED-97)	5–6	5–6	5–6	5a–6	5a–6	5a–6	5b	5b	5b
		Quantiles			Quantiles			Quantiles	
	25	50	75	25	50	75	25	50	75
Overall									
Log wage Essential Workers	3.076*** (0.007)	3.291*** (0.007)	3.567*** (0.012)	2.914*** (0.002)	3.094*** (0.001)	3.240*** (0.002)	2.720*** (0.002)	2.859*** (0.001)	3.021*** (0.002)
Log wage Other Workers	3.010*** (0.004)	3.337*** (0.003)	3.618*** (0.003)	2.896*** (0.002)	3.156*** (0.002)	3.392*** (0.002)	2.734*** (0.002)	2.952*** (0.002)	3.183*** (0.002)
Wage differential	0.065*** (0.009)	−0.046*** (0.008)	−0.051*** (0.012)	0.018*** (0.003)	−0.062*** (0.002)	−0.152*** (0.002)	−0.014*** (0.003)	−0.093*** (0.002)	−0.162*** (0.003)
Composition (total)	0.050** (0.019)	−0.147*** (0.013)	−0.120*** (0.012)	0.005 (0.006)	−0.033*** (0.005)	−0.069*** (0.004)	−0.024 (0.013)	−0.116*** (0.012)	−0.168*** (0.012)
Wage structure (total)	0.015 (0.019)	0.101*** (0.014)	0.069*** (0.015)	0.012* (0.006)	−0.029*** (0.005)	−0.083*** (0.004)	0.010 (0.013)	0.023 (0.012)	0.006 (0.012)

(*Continued*)

Table 4. Continued.

	Managers (1)	Managers (1)	Managers (1)	Professionals (2)	Professionals (2)	Professionals (2)	Tech. & Ass. Professionals (3)	Tech. & Ass. Professionals (3)	Tech. & Ass. Professionals (3)
Composition effects (selected effects)									
Education & Age	0.126***	0.103***	0.088***	0.028***	0.038***	0.041***	−0.022***	−0.015***	−0.014***
	(0.006)	(0.004)	(0.004)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Sex	−0.050***	−0.040***	−0.029***	−0.021***	−0.028***	−0.030***	−0.046***	−0.062***	−0.073***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
Sector	0.013	−0.022	−0.026	0.035***	0.003	−0.022***	0.026**	−0.010	−0.040***
	(0.019)	(0.014)	(0.015)	(0.004)	(0.003)	(0.003)	(0.009)	(0.007)	(0.008)
Wage structure effects (selected effects)									
Education & Age	−1.358***	−0.328*	−0.092	−1.017***	−0.623***	−0.148***	−0.712***	−0.488***	−0.132***
	(0.152)	(0.130)	(0.196)	(0.031)	(0.024)	(0.030)	(0.030)	(0.023)	(0.028)
Sex	0.001*	−0.000	−0.003**	0.003**	0.002*	−0.011***	0.024***	0.024***	0.015***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Sector	0.014	−0.009	−0.062***	−0.004*	−0.004**	−0.001	0.029***	0.027***	−0.001
	(0.014)	(0.012)	(0.017)	(0.002)	(0.001)	(0.002)	(0.005)	(0.004)	(0.005)
% Essential Workers	9.75%	9.75%	9.75%	42.07%	42.07%	42.07%	40.46%	40.46%	40.46%
No. of Observations	40,994	40,994	40,994	168,897	168,897	168,897	119,687	119,687	119,687

Note: RIF decomposition as laid out in the methodology section. Additional explanatory variables are migration background, child in household, industry, and year fixed effects. Effect estimates of these additional predictors can be found in the supplementary material. Survey weights are applied. Standard errors in parentheses; *p < 0.05 **p < 0.01 ***p < 0.001.

In line with devaluation theory, I find that differences in sex composition between essential and other workers contribute to wage differences across all skill levels (Table 3). Within skill levels in which essential workers are predominantly women, sex composition contributes to lower wages among essential workers. Conversely, within the skill level of elementary occupations, the only level in which essential workers are predominantly men, sex composition contributes to higher wages among essential workers. For example, in the professions, women make up 68.54% of essential workers and 34.06% of other workers. By contrast, in the elementary occupations, women account for 34.77% of essential workers and 61.73% of other workers.[10] However, within both levels, women earn lower wages than men do, thereby leading to either a penalizing (professionals) or compensating (elementary occupations) wage effect of sex composition. The quantile decomposition estimates are consistent with these results (Table 4). A gender wage penalty, in combination with a larger share of women, contributes to lower wages of essential workers across the wage distribution (Figure 2). Moreover, additional analyses reveal that this penalizing effect of sex composition is tied to care work in the higher-paying segments of the occupational structure. Within the professions, caregiving essential workers, who are predominantly women, earn less than other essential workers.[11]

As predicted by the institutionalist hypothesis, a negative composition effect of sectoral employment is limited to the upper end of the distribution (Figure 2) and more pronounced within the highest skill levels (Table 4). At the same time, the results of the mean wage decompositions indicate that the composition effect of sector is positive (Table 3). When considering mean wage differences, the higher share of essential workers in the public and nonprofit sectors results in an overall compensating effect. However, the quantile decompositions reveal a more complex pattern beyond the mean. Higher wage floors in the public and nonprofit sectors, in combination with higher wage ceilings in the private sector, result in a negative compositional effect of public-sector employment only at the upper end of the wage distribution. This pattern of a reversing effect is more marked when decomposing quantile differences *within* the highest skill levels of the occupational structure (Table 4).

Impact of the Covid-19 pandemic on wage differentials (2020–2022)

In the second analysis, I investigate whether the wage gap between essential workers and other workers has decreased since the beginning of the Covid-19

[10] Detailed descriptive statistics of female worker shares by major occupation group and essential worker status can be found in S3 in the supplementary material.
[11] See S20–S21 in the supplementary material.

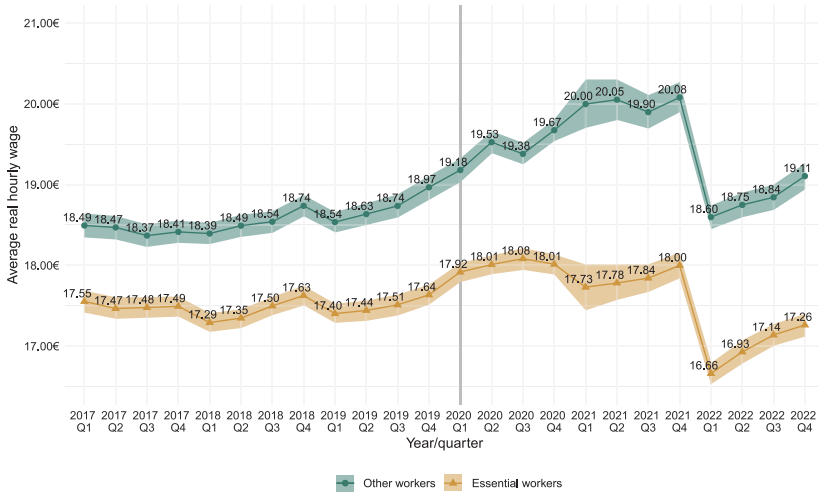

Figure 3. Quarterly average real hourly wages by essential worker status (2017q1–2022q4).

Note: Solid line indicates the quarter (first quarter of 2020) during which the first cases of Covid-19 infections were reported in the Netherlands. Survey weights are applied.
Source: EBB + SPOLIS, 2017–2022.

pandemic. I argued that wages of essential workers have potentially improved relative to other workers due to the collective experience of the pandemic, its consequences for the public evaluation of essential occupations, and subsequent union intervention. A visual inspection of quarterly wages for both groups since 2017 does not substantiate this hypothesis (Figure 3). While both trend lines have not been exactly parallel since 2019, they have diverged more strongly since the start of the pandemic. Between the first quarter of 2020 and the fourth quarter of 2021, the average wage of other workers grew by 4.7%, whereas that of essential workers stagnated. Over this period, the average wage of essential workers fell behind, instead of catching up with that of other workers. Since the beginning of 2022, essential workers' wages have grown at a slightly higher rate (around 3.6% compared to 2.7%). Around the same time, high inflation in 2022 resulted in a sharp welfare loss for all wage earners.

Panel A of Table 5 displays the results of the DID analysis for the entire sample. I find that the divergence of average wages to the detriment of essential workers since the onset of the Covid-19 pandemic was driven by pre-existing heterogeneous industry wage trends and a changing occupational composition.[12] After

[12] I also find that the Covid-19 pandemic has resulted in a marked recomposition of the occupational structure, at least in the short term (S15). Low-paying occupations contracted and high-paying occupations expanded in relative size in particular among occupations that

Table 5. Difference-in-differences regression estimates.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(A) All essential workers						
Log Real Hourly Wage	−0.048***	−0.011**	−0.006	−0.001	−0.008*	−0.003
	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
Log Real Hourly Wage (+Bonus)	−0.047***	−0.008	−0.002	−0.004	−0.004	−0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
N (Essential Workers)	351,932	351,932	351,932	351,932	351,932	351,932
N (Total)	889,641	889,641	889,641	889,641	889,641	889,641
(B) Essential workers covered by centralized collective bargaining agreement						
Log Real Hourly Wage	−0.041***	−0.001	−0.001	0.006	0.000	0.004
	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
Log Real Hourly Wage (+Bonus)	−0.039***	0.004	0.004	0.002	0.005	−0.001
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
N (Essential Workers)	293,790	293,790	293,790	293,790	293,790	293,790
N (Total)	831,499	831,499	831,499	831,499	831,499	831,499
(C) Essential workers <u>not</u> covered by centralized collective bargaining agreement						
Log Real Hourly Wage	−0.081***	−0.054***	−0.028***	−0.023**	−0.044***	−0.020*
	(0.009)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Log Real Hourly Wage (+Bonus)	−0.082***	−0.054***	−0.025**	−0.023**	−0.043***	−0.020*
	(0.009)	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)
N (Essential Workers)	58,142	58,142	58,142	58,142	58,142	58,142
N (Total)	595,851	595,851	595,851	595,851	595,851	595,851
Controls						
Time Unit FE	X	X	X	X	X	X
ISCO-08 Skill Level FE		X	X	X	X	X
Industry FE			X	X		X
Heterogenous Linear Industry Wage Trends				X		X
Reweighted Occupational Structure					X	X

Note: The displayed estimates are coefficient ν of Equation 3 based on linear regression models as outlined in the methodology section. Models include controls and survey weight adjustments as indicated. Standard errors in parentheses; *$p < 0.05$ **$p < 0.01$ ***$p < 0.001$.

accounting for both factors, there is no significant effect of the pandemic on wage differentiation within ISCO-08 skill levels.

In an additional split-sample analysis, I test whether relative wage gains are restricted to essential workers, who are directly affected by the hypothesized pathway of union intervention (Panels B and C of Table 5). I split the sample of essential workers into those covered by a centralized collective bargaining agreement and those who are not, while retaining the same reference group. Overall, the results reveal important effect heterogeneity but do not support the initial hypothesis. In the short term, the wages of essential workers have not improved relative to the wages of other workers in the Netherlands since the beginning of the Covid-19 pandemic. However, the wages of essential workers covered by a centralized collective bargaining agreement (Panel B) kept pace with those of other workers, while the wages of noncovered essential workers (Panel C) grew less. These findings suggest that centralized collective bargaining played a role in shielding essential workers from relative wage loss during the pandemic.

I carry out two additional robustness analyses. First, I implement a DID event study design with treatment effects for each separate time unit to test whether the average effect over the full Covid-19 period might obscure delayed wage gains in 2022 among essential workers covered by centralized collective agreements. The results of this robustness check provide some evidence for a delayed positive effect, but the treatment effects in 2022 are not consistently significantly different from zero.[13] Second, I test for potential heterogeneous effects across industries. Relative wage gains may accrue to essential workers in certain industries, such as healthcare, because of a higher salience of healthcare workers' contributions during the pandemic. However, the results of this robustness check do not indicate that positive effects accrued only in certain industries.[14]

Conclusion

This study presents novel insights into the economic position of essential workers in society. In the analysis, I confirm an aggregate wage penalty for essential workers found in previous research. Beyond the average wage, the analysis reveals important variation across different strata of the occupational structure in

mostly contain other workers. At the same time, compositional changes have been less skewed among the occupations that mostly contain essential workers, thereby contributing to a differentiation of the average wages at the group level.

[13] The results of the DID event study can be found in S16 of the supplementary material.

[14] The results of this DID analysis by essential workers' industry can be found in S17 of the supplementary material. Selected industries are the five industries with the largest total number of essential workers.

the Netherlands. While essential workers receive higher wages within the lower-paid segments of the occupational structure, they suffer wage penalties within the higher-paid segments.

The findings further reveal that wage penalties for essential workers are associated with gender inequality in the labor market. Within occupational skill levels, essential workers receive lower wages, particularly when they are predominantly women, and higher wages when they are predominantly men. The wage penalties that accrue to women within skill levels not only infringe on a principle of comparable worth—equal pay for work that requires comparable skills—but also engender lower wages for essential workers, particularly among the professions. These findings suggest that unequal valuation of work performed by women mutes functional importance as a factor during wage-setting processes. While the devaluation of work carried out in female-dominated occupations is not a new finding, the current analysis shows that this process is deep seated and persistent. Even the advent of a global health crisis and the attention it drew to essential workers has done little to improve the remuneration for essential work that is primarily performed by women.

Wage differentials between essential workers and other workers are also linked to sectoral employment. Existing wage differentials at the top of the wage distribution are mainly a result of the very high wages paid to selected other workers in the private sector. On the flip side, essential workers who are very low paid are found predominantly in the private sector. Overall, the public and nonprofit sectors exhibit a more equitable wage distribution not only among essential workers but also between the groups of essential workers and other workers. These findings caution against potentially rising wage inequality when essential services become privatized. For example, wages of care workers are already more strongly polarized in the United States, where the provision of social services relies to a greater extent on private markets (Dwyer, 2013; Wilmers and Aeppli, 2021). Auxiliary analyses show that the share of essential workers in the private sector increased by around two percentage points between 2006 and 2019, while the share of essential workers covered by centralized collective bargaining agreements decreased by around four percentage points during the same period in the Netherlands.[15] Future research should investigate which essential occupations are affected by this shift and the extent to which this process potentially erodes wage premiums for essential workers in the lower-paid strata of the occupational structure.

One limitation of the current study is that I do not focus in detail on ethnicity as another important social category that affects labor market inequality.

[15] See S4–S5 in the supplementary material.

Research on wages of essential workers indicates that first-generation immigrant workers of non-Western origin are overrepresented in essential jobs that offer the lowest wages and exhibit the worst working conditions (Basso *et al.*, 2020; European Parliament, 2022; Fasani and Mazza, 2024; Nivorozhkin and Poeschel, 2022). Future research should assess with greater care whether wage penalties for essential work are present among immigrant workers and the extent to which ethnicity shapes wage inequality within the group of essential workers as a whole.

The findings also raise important questions about the future of contemporary labor markets. One case in point is the finding that the wages of essential workers cannot keep up with the overall highest-paid wages in the Netherlands. Among the essential occupations, only medical doctors' wages can reasonably compete with the highest average occupational wages in the Dutch labor market.[16] The top end of the wage distribution is otherwise dominated by occupations that are mainly composed of workers who were not classified as essential workers during the Covid-19 pandemic. This finding is in line with one central assumption of neoclassical economic theory on the functioning of labor markets. Neoclassical economics construes labor productivity as a general output in an economic exchange relationship between the seller and buyer of labor, regardless of what is to be produced. Thereby, it fully omits societal value as a factor during wage determination. A job does not need to align with or contribute to essential societal functions to be remunerated highly. Left to unchecked market forces alone, the highest-paid jobs in society will not necessarily be the most functionally important positions for society. But a key lesson from the pandemic is that it has highlighted the true social value of many jobs, including personal services that are otherwise often perceived as low productivity jobs when viewed from a purely economic perspective.

The potential consequence of a mismatch between the distribution of rewards relative to the distribution of tasks that keep society functioning is an undersupply of essential work.[17] From the functionalist perspective, labor shortages in essential occupations are indicative of work that is socially important but underpaid. Continued surveillance of labor shortages charged by the European Commission indicates that selective essential occupations, such as nursing professionals or agriculture and industrial machinery mechanics, have been in shortage even before the onset of the Covid-19 pandemic in several

[16] See S15 in the supplementary material.

[17] An undersupply of public goods is arguably a greater social problem for some members of society than others, especially when high-income earners are able to compensate for the absence of public goods by consuming more costly private goods. Thereby, an undersupply of public goods can further aggravate social inequalities.

European countries (Eurofound, 2021; European Commission, 2020; European Parliament, 2022). Since 2020, the shortage of healthcare workers has further increased owing to the pandemic and its challenges to public health. This problem will likely intensify, as labor shortages within critical infrastructures are projected to rise further over the upcoming years. In the Netherlands, this is already felt today in not only the healthcare sector but also the educational system (Sociaal-Economische Raad, 2022). That many members of society, including more women than men, still enter essential occupations today, while often facing heightened work pressure due to staffing shortages, is vital for the continued provision of essential work. However, a more sustainable solution to mitigate labor shortages in essential occupations in the future would be to better attune the wages of essential workers with those of other workers, particularly in the upper half of the wage distribution.

The second analysis shows that the collective experience of the Covid-19 pandemic has thus far not resulted in a relative improvement of essential worker's wages compared to other workers.[18] However, I also find that the wages of essential workers covered by a centralized collective bargaining agreement kept up better with the wages of other workers during the pandemic. Overall, the results suggest that public- and nonprofit-sector employment and collective bargaining institutions help bolster essential workers' wages in the lower half of the wage distribution in the Netherlands. This finding reaffirms earlier calls to strengthen collective bargaining institutions to improve the wages of essential workers from an international perspective (ILO, 2023). Yet, current labor market institutions in the Netherlands are less effective in addressing wage differences at the top. Wage penalties among essential workers arise in the upper end of the distribution, where private-sector wages paid to other workers are more strongly disembedded from collective wage-setting processes.

Given these limits to union intervention, what are the possible policy instruments for improving the relative economic position of essential workers in higher-paid segments of the occupational structure? The fact that many essential workers are located in the public and nonprofit sectors in the Netherlands suggests that greater spending on public services is a possibility (de Beer and Keune, 2022). A more progressive taxation of exceptionally high profits of private firms may be one way to fund the resulting bill. Advocates of free markets will counter

[18] In my analysis, I cannot directly test the mechanism of an increasing societal appreciation of essential workers since the onset of the Covid-19 pandemic. The empirical null finding of a relative wage increase among essential workers since 2020 does not rule out that societal appreciation has increased. Future research may test whether the public evaluation of essential occupations has become more favorable since 2020 and is a long-term effect beyond the immediate experience of the pandemic.

that this is a serious interference in the economic liberty of organizations. However, it can be argued that business activities in the private sector are not independent of essential services and rely on the contribution of essential workers in the public sector on a daily basis. How would companies be able to generate revenue in the absence of essential services, such as drinking water, education, and health care? Essential workers provide important, advanced contributions to business activities. One potential way to honor these contributions could be to facilitate broader profit sharing via redistributive corporate taxation.

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Data availability

This study uses nonpublic microdata from Statistics Netherlands (CBS). Under certain conditions, these microdata are accessible for statistical and scientific research. For further information, see microdata@cbs.nl.

A replication package including all code used for data preparation and analysis can be found at https://doi.org/10.17605/OSF.IO/YT4DJ.

AI use disclosure

No AI tools/technologies were used in the completion of this article.

Declaration of interest statement

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

Ethical approval

This research project received ethical approval from the University of Amsterdam (project number 2019-AISSR-10473).

Supplements

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