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Conference Paper

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Beiträge zur Jahrestagung des Vereins für Socialpolitik 2022: Big Data in Economics

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Kroczek, Martin; Kugler, Philipp (2022) : Heterogeneous Effects of Monetary and Non-Monetary Job Characteristics on Job Attractiveness in Nursing, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2022: Big Data in Economics, ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg

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Heterogeneous Effects of Monetary and Non-Monetary Job Characteristics on Job Attractiveness in Nursing *

Martin Kroczek (IAW Tübingen), Philipp Kugler (IAW Tübingen)

August 2022

Abstract: We apply a novel methodological approach described by Chernozhukov, Fernández-Val & Luo (2018), to analyze preference heterogeneity regarding non-monetary job characteristics and trade-offs between wage and non-monetary job characteristics. Using this approach, we can describe preference heterogeneity more concise than with subgroup analysis. Analyzing data from a self-conducted factorial survey experiment on nurses, we find significant effect heterogeneity regarding the single job characteristics and the trade-offs between wage and non-monetary job characteristics. We also find positive interaction effects between wage and other job characteristics. We further analyze which factors are associated with effect heterogeneity. Working hours and gender appear to be the main drivers of these effects. We also find differences regarding the sources of a nurse's motivation to initially choose the nursing occupation. Differentiation of job characteristics (job offers) to fit different preferences can therefore be a more effective and efficient way to attract workers than a "one size fits all" solution. Regarding nursing jobs, there is some evidence for such differentiation.

Keywords: labor supply; wage; non-monetary job characteristics; heterogeneity analysis; nurses

JEL-Classification: J22; J31; J32; I11

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Declarations of interests: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

*This paper is an outcome of the ZAFH care4care funded by the EFRE fund and the Ministry for Science, Research and Art Baden Wuerttemberg (grant number: FEIH_ZAFH_795924).

1 Introduction

Wage and non-monetary job characteristics are important drivers of work attractiveness. Several studies analyze the preferences of workers and potential applicants for monetary and non-monetary job characteristics (Montgomery & Ramus Catherine A. 2011, Doiron et al. 2014, Eriksson & Kristensen 2014, Scott et al. 2015, Mas & Pallais 2017, Fields et al. 2018, Maestas et al. 2018, Wiswall & Zafar 2018, Soekhai et al. 2019, Johnson 2021, Non et al. 2022). Employing subgroup analysis and models with interactions, several of these studies show considerable heterogeneity regarding individual preferences and the willingness-to-pay for pleasant job characteristics over such subgroups (Eriksson & Kristensen 2014, Mas & Pallais 2017, Maestas et al. 2018, Wiswall & Zafar 2018, Johnson 2021, Non et al. 2022). The reported average and group-average effects provide convenient and easily interpretable average measures of the respective preference structures. They do not describe heterogeneities in effects and preferences, in their entirety, however.

In this study, we apply the Sorted Effects Method (SEM), a novel methodological approach described by Chernozhukov, Fernández-Val & Luo (2018), to analyze preference heterogeneity regarding job characteristics and trade-offs between wage and non-monetary job characteristics. Other than the mere presentation of average and group-average effects, the SEM provides a complete representation of the heterogeneity in treatment effects and the possibility of analyzing differences between most and least responsive groups via classification analysis. The standard approach, i.e. to present results for selected subgroups, may raise the suspicion that researchers have searched for subgroups with distinguished treatment effects (Assmann et al. 2000, Cook et al. 2004, Wager & Athey 2018). The classification analysis tackles this concern and gives a more salient representation of where significant differences can be found, and where not.

Because of their significance for public health, we focus on nurses' preferences over job characteristics. We employ data from a self-conducted survey experiment. In a companion paper, Kroczek & Späth (2022) analyze the same data set and present estimates of average effects. They find team atmosphere, time for patients, work autonomy, and roster reliability to have the largest average effects on job attractiveness. Further studies confirm the relevance of these factors for the attractiveness of nursing jobs (see, e.g. Doiron et al. 2014, Scott et al. 2015, Fields et al. 2018). We therefore focus on these four characteristics as important drivers of job attractiveness.

We adopt two perspectives. First, we analyze the four non-monetary job characteristics separately.

Second, we study trade-offs between non-monetary job characteristics and wages. To analyze such trade-offs, it is common to convert the effects of non-monetary characteristics into wage changes (Scott 2001, Doiron et al. 2014, Eriksson & Kristensen 2014, Scott et al. 2015, Mas & Pallais 2017, Fields et al. 2018, Wiswall & Zafar 2018, Non et al. 2022). The rate at which individuals will trade wage against non-monetary characteristics, the willingness-to-pay, is informative, and often provides a handier interpretation than the estimation coefficients. The measure is usually calculated from average effects or group average effects, and therefore is only a summary of the trade-offs individuals will make *on average*. For example, if some individuals trade non-monetary characteristics for slightly better-paying jobs and others only trade for strong wage raises, heterogeneity in preferences should be considered.

We find significant effect heterogeneity regarding the non-monetary job characteristics and the trade-offs between wage and non-monetary job characteristics. We further find that individuals value combinations of high wages and positive non-monetary characteristics higher, the higher the wage, i.e. we find positive interaction effects between wage and non-monetary characteristics. And, even though there exists relevant heterogeneity regarding the willingness to trade non-monetary job characteristics for wages, almost all individuals trade non-monetary job characteristics for higher wages if wage changes are large enough. We further identify factors driving such heterogeneity directly from our data. Working hours and gender appear to be the main drivers of such heterogeneity. We also find differences regarding the sources of a nurse's motivation to initially choose the occupation. The corresponding p-values are sensitive to multiple testing problems and could, therefore, in a subgroup analysis lead to wrong results. Some peculiarities characterize the nursing labor force, e.g. a high share of female workers and an extraordinarily high share of working in part time. However, at least regarding gender, previous studies also find relevant differences in preferences for job characteristics (see e.g. Eriksson & Kristensen 2014, Mas & Pallais 2017, Maestas et al. 2018, Wiswall & Zafar 2018, Johnson 2021, Non et al. 2022). Whether preference heterogeneity is driven by similar factors in other occupations is questionable and could be a subject of future research, along with the consideration of further explanatory variables. The technique employed in this study would be a suitable tool for such analyses.

Our results point to three major implications for policymakers and employers, in general, as well as regarding nursing occupations, in particular. As (potential) employees exhibit heterogeneous preferences over job characteristics, there may not exist the one ideal measure (or bundle of measures) to make jobs more attractive. Differentiation of job characteristics (job offers) to fit

those differing preferences can therefore be a more effective and efficient way to attract workers than a “one size fits all” solution. Also, non-monetary job characteristics can be substituted by higher wages. But this can be costly, depending on the characteristic, the individual, and the alternatives. Further, it may be fruitful to combine high wages and other pleasant job characteristics to attract personnel. With special consideration of nursing occupations, we identify salient characteristics, along which we find effect heterogeneity, such as the present amount of working hours. Employers could differentiate recruitment efforts along those characteristics in order to attract employees more efficiently. Statements in qualitative interviews, which we conducted as part of our recent related research on nursing and the development of initiatives for an innovative organization of care work, provide evidence that such a differentiation actually happens.

The rest of this paper is structured as follows. We provide an overview of our data in section 2. The methodological background of our analysis is laid out in section 3. In section 4 we present our results. Section 5 concludes.

2 Data

For our analysis, we employ data from a self-conducted survey of (former) nurses, which comprised two parts, an item-based part and a factorial survey. In the factorial survey, we presented each respondent with ten vignettes, describing fictional advertisements of care jobs. We then asked the care workers to rate the attractiveness of the fictional job offers on a ten point scale. The factorial survey experiment allows us to receive nurses’ judgments on a randomly assigned set of jobs and estimate the causal effects of potential determinants of the job ratings. The method further allows for insights into the implicit preferences of interviewees and to mitigate a potential social desirability bias of the answers in the survey (Auspurg & Hinz 2015). Because of its benefits, the factorial survey method has already been applied in the literature on job offer acceptance and job attractiveness (Abraham et al. 2013, Auspurg & Gundert 2015, Bähr & Abraham 2016, Wiswall & Zafar 2018). Heterogeneity in the effect of job characteristics requires extensive individual information. Therefore, in addition to the factorial experiment, we surveyed information on the respondents and their present and previous work situation. The survey was conducted as paper and pencil interview in a specific region in Germany in late 2018. We received information from

1,607 filled questionnaires, which amounts to a response rate of around 20 percent. After data cleansing, we were left with 1,313 completed interviews. Because of missing values, our analysis is based on 11,718 rated job offers. Kroczek & Späth (2022) provide more detailed information on the survey.¹

3 Methods

3.1 Framework

We observe $i : 1, \dots, N$ individuals who obtain $j : 1, \dots, J$ hypothetical job advertisements. Each observation can be described by (Y_{ij}, X_i, W_{ij}) , where Y_{ij} denotes the attractiveness rating of the advertisement j by individual i , X_i is a vector of individual specific characteristics, and $W_{ij} \in \{0, 1\}$ is a randomly assigned treatment indicator. The precise definition of W_{ij} depends on the question.

Single Job Characteristics

In the first part of the paper, we analyze the impact of important job characteristics on the attractiveness rating of a job offer. A job advertisement ij belongs to the treatment group if it has a certain characteristic (the treatment) and to the control group, otherwise. We consider the following four characteristics:

- cordial team, where W_{ij} takes the value 1 for an advertisement with a very cordial and 0 for an advertisement with a less cordial team,
- time for patients, where W_{ij} takes the value 1 for an advertisement with much time for patients and 0 for an advertisement with little time for patients,²
- autonomy, where W_{ij} takes the value 1 for an advertisement with much autonomy and 0 for an advertisement with little autonomy,

¹In their related study, Kroczek & Späth (2022) analyze the factorial survey results with linear regression models to estimate the effects of the different job characteristics on job attractiveness.

²Job offers either offer little or much time to “occasionally have a personal conversation with the patients”.

- and roster reliability, where W_{ij} takes the value 1 for a job with a very reliable roster and 0 for a less reliable roster.

Because of the factorial survey design, job characteristics are independent from each other. Therefore, we use separate models for each treatment indicator and do not need to control other job characteristics.

Trade-Offs Between Job Characteristics

In the second part of the paper, we analyze the substitution between the four non-monetary characteristics and hourly wages. In this context, W_{ij} equals 0 if a job advertisement offers a more pleasant non-monetary characteristic (e.g. a more cordial team) at some defined base wage. We call this a non-monetary job offer. We compare this job offer to one that offers an alternative wage, which is equal to or larger than the base wage, but offers a less pleasant respective job characteristic (e.g. a less cordial team). In the latter case, W_{ij} equals 1. This kind of job offer is called a monetary job offer. For job offers that offer neither the base wage nor the alternative wage, W_{ij} is not defined.

Analytic Approach

Using information on Y_{ij} and W_{ij} , we can write the average effect of a binary treatment W_{ij} as

$$\bar{\tau} = \mathbb{E}[Y(W = 1) - Y(W = 0)]. \quad (1)$$

However, effects may differ with respect to individual characteristics X_i . If this is the case, policymakers might want to differentiate their policies between target groups. Therefore, the aim of this paper is to estimate treatment effects conditional on given individual characteristics for the case of a binary treatment W_{ij} ,

$$\tau(x) = \mathbb{E}[Y(W = 1) - Y(W = 0)|X_i = x]. \quad (2)$$

To analyze effect heterogeneity, we estimate an interactive linear model with an additive error term

$$Y_{ij} = g(Z_{ij}) + \varepsilon_{ij}, \quad (3)$$

where $g(Z_{ij}) = Z'_{ij}\beta$, with $Z_{ij} = (W_{ij}, Q_{ij})$, where Q contains transformations of X as well as interactions between W and X to capture the treatment effect heterogeneity with respect to individual characteristics.

3.2 The Sorted Effects Method

To analyze the heterogeneity in treatment effects, we apply the Sorted Effects Method, an approach to summarize effect heterogeneity proposed by Chernozhukov, Fernández-Val & Luo (2018). The main idea is to estimate the entire set of partial effects sorted in increasing order and to rank them according to effect size, rather than to present one measure for the effect of interest, e.g. the average effect. In the case of an interactive linear model with additive error term of the form of equation 3, the predictive effect (PE) is given by

$$\tau(q) = (1, q)' \beta - (0, q)' \beta, \quad (4)$$

with q containing specific values of Q . If μ is the distribution of X in the population, aggregation of the PEs over μ yields the average treatment effect. However, Chernozhukov, Fernández-Val & Luo (2018) propose to report the entire set of PEs sorted in increasing order and indexed by ranking $u \in [0, 1]$. The u -th quantile of $\tau(Q)$ is the u th-Sorted Partial Effect (u -SPE). Displaying the SPEs at different (increasing) values of u , i.e. at different quantiles of the estimated effect, yields a one-dimensional representation of the heterogeneity in the PEs.

Empirically, sample analogs of τ and μ are employed to obtain estimators of the SPEs. In case of the interactive linear model with additive error, the PE estimator $\widehat{\tau}(q)$ is obtained by replacing β in equation 4 with its ordinary least squares estimator $\hat{\beta}$.³

3.3 Omnibus Test for Heterogeneity

To test for effect heterogeneity, we follow Chernozhukov, Demirer, Duflo & Fernández-Val (2018). They suggest estimating a linear model of the form

$$Y_i = \alpha + \beta_1 [W_i * \bar{\tau}] + \beta_2 [W_i * (\hat{\tau}_i - \bar{\tau})] \quad (5)$$

³For an extensive description see Chernozhukov, Fernández-Val & Luo (2018).

via ordinary least squares, where $\hat{\tau}_i$ is the predicted effect for individual i , $\bar{\tau}$ is the average of these predictions. Intuitively, we regress the observed job rating Y_{ij} on the average added value of the treatment, the individual added value that depends on individual characteristics and on a constant that captures the mean attractiveness. Therefore, β_2 captures the heterogeneity captured by the model. Put differently, if β_2 is statistically significantly different from zero, the null hypothesis of no effect heterogeneity is rejected.

3.4 Classification Analysis

To analyze associations between individual-level characteristics and effect heterogeneity, Chernozhukov, Fernández-Val & Luo (2018) suggest undertaking a classification analysis (CA). The aim is to understand how observations with high and low effect sizes, e.g. in the upper and lower u percent of the effect distribution, differ in observable characteristics. The classification analysis for the u -least and u -most affected subpopulation (u -CA) then comprises two steps:

1. Assign all observations with $\tau(Q) < \tau^*(u)$ to the u -least affected subpopulation, and all observations with $\tau(Q) > \tau^*(1 - u)$ to the u -most affected subpopulation.
2. Obtain the moments and distribution of the characteristics of observations in the least and most affected subpopulation.

To obtain the empirical u -CA, $\tau(Q)$ and $\tau^*(u)$ are replaced by their sample analogs $\widehat{\tau(Q)}$ and $\widehat{\tau^*(u)}$. Then the moments and distribution of the characteristics of observations in the least and most affected subpopulations are estimated by their empirical analogs in the least and most affected subsamples.

Following Chernozhukov, Fernández-Val & Luo (2018), we analyze differences between the upper and lower ten percent quantile of the effect distribution. As a central part of their paper, the authors further provide consistent estimators of measures of variation (standard errors and confidence bands) for both the SPE and the CA based on bootstrap procedures. Employing those, we can test whether differences between the groups are statistically significant accounting for multiple testing.

4 Results

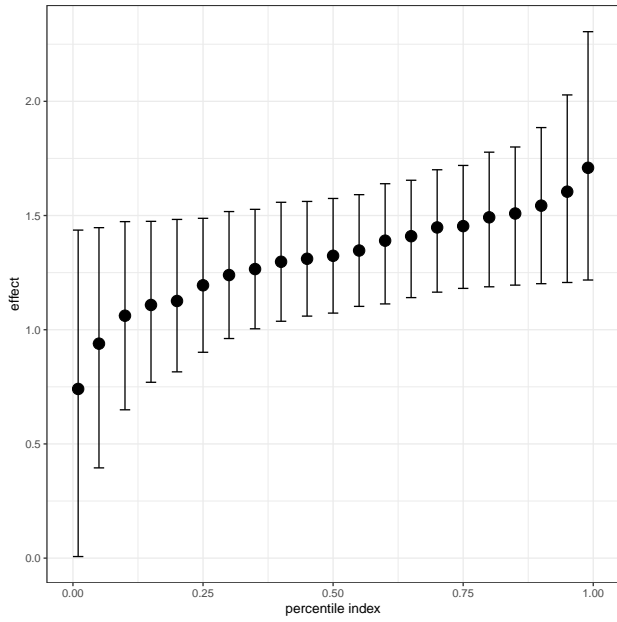
4.1 Effect of Job Characteristics

4.1.1 Sorted Effects

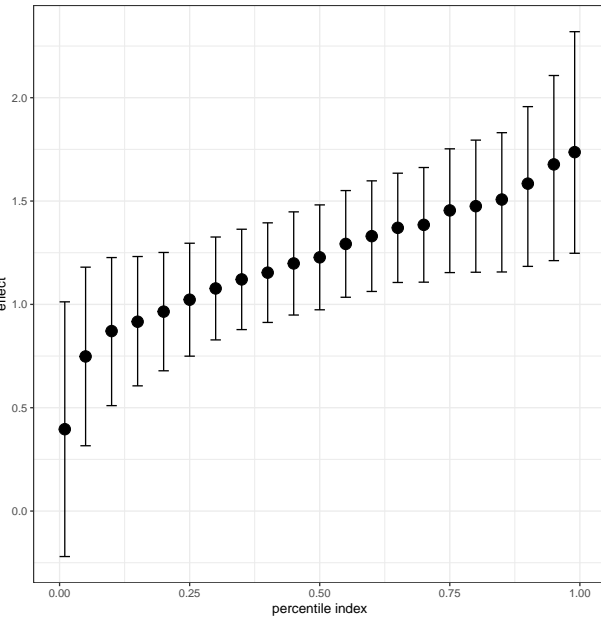
The average treatment effect provides a useful summary of the impact of a treatment. However, an average treatment effect is only a summary measure for a number of individual treatment effects, which can differ significantly. In this section, we use the SEM described in section 3.2, to describe how the treatment effects differ.⁴ To test for heterogeneity, we apply the omnibus test described in section 3.3. Figure 1a shows the SPE for an increase in the quality of a team, from a less cordial team to a very cordial one. On average, this raises the attractiveness by 1.3 points on the ten-point scale. The estimated effect sizes for individuals with different characteristics range from 0.7 at the 0.01 percentile to 1.7 at the 0.99 percentile. A more cordial team has a positive effect for individuals in all percentiles. The size of the effect clearly differs, though. Based on the omnibus test, we can reject the null of no presence of heterogeneity in effect sizes. Figure 1b shows the results for an increase in the time nurses have for their patients. The estimated average effect is 1.2. The SPE shows greater effect heterogeneity compared with the effect of a cordial team. The estimated SPE ranges from 0.4 to 1.7. As indicated by the omnibus test, there is a statistically significant amount of heterogeneity in effect sizes. The SPEs of more autonomy and of a reliable roster are shown in figures 1c and 1d, respectively. The effects range from just above zero to 1.7, with an average effect of 0.6 for autonomy and from 0.3 to 1.3, with an average effect of 0.8 for a reliable roster. Again, the tests for heterogeneity are significant.

In summary, the SPEs give a more complete picture of what is behind the average effects. As the SPEs only take on positive values, all analyzed characteristics are undisputed positive job features. All four characteristics exhibit a statistically significant amount of heterogeneity. However, the extent differs. A good team does not only have the largest average effect, the SPE also shows a smaller effect heterogeneity compared with the other analyzed characteristics. This further underlines the important role of a cordial team. The SPEs reveal a much larger amount of heterogeneity of having more autonomy and more time for patients. Preferences regarding these

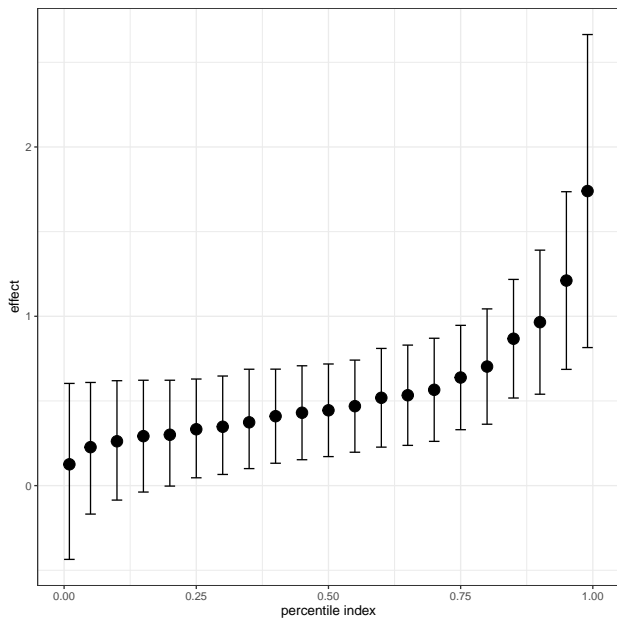
⁴We present estimates of the 1, the 99 percent quantile and, for the 5 to the 95 percent quantile in steps of 5 percentage points.



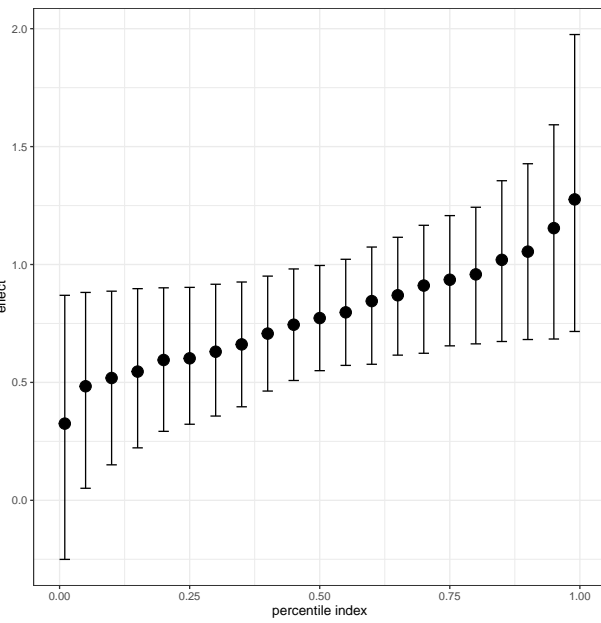
(a) Team



(b) Time for patients



(c) Autonomy



(d) Reliable Roster

Figure 1 – Sorted Partial Effects

Notes: The average partial effects of a cordial team, much time for patients, more autonomy, and a reliable roster amount to 1.3, 1.2, 0.6, and 0.8 points on the attractiveness scale, respectively.

two job characteristics are much more heterogeneous than preferences for a good team or a reliable roster.

4.1.2 Classification Analysis

	Team	Time	Autonomy	Reliable Roster
Present Job Characteristics				
Hours	-22.082 ***/+++	-21.867 ***/+++	-7.436 **	-9.318 **
Unplanned Shifts per Month	-0.129	0.356	-0.695	-1.568
log of Hourly Wage	0.020	0.129	-0.493 ***	-0.342 *
Works in Direct Care	0.277 **	0.245	-0.130	0.065
Fixed-Term Employed	0.333 **	-0.093	0.718 ***/+++	0.396 **
Satisfaction With Job	0.809 **	0.336	-0.440 *	-1.469 ***/++
Motivation to Become a Nurse				
Human Contact	-0.233	0.903 ***/+++	-0.265 *	-0.351 **
Diverse Work	-0.372 *	0.807 ***/+	0.418 **	0.304
Help Others	-0.177	0.719 ***	-0.192	-0.136
Career/Developm.	0.098	0.040	0.346 **	0.664 ***
Teamwork	-0.023	-0.516 ***	-0.569 ***	-0.328
Safe Job	-0.174	0.009	0.072	-0.660 ***
Med. Interest	0.484 **	-0.137	-0.220	0.188
Social Interest	-0.487 **	-0.072	0.225	-0.479 **
Personal Characteristics				
Age	-1.652	1.406	-7.348 *	-4.148
German Nationality	0.025	-0.063	-0.247 ***/+++	0.108
Female	0.825 ***/+++	0.301 **	0.180	0.159 **
Schooling	0.353 **	-0.570 ***	0.355 ***	0.262 *
Child Below Age 14	0.578 ***	0.599 ***	-0.250	-0.195
Partner With a Job	0.549 ***	0.693 ***	-0.166	-0.378 **

Table 1 – Comparison of Classification Analysis Results

Notes: +++, ++, +: Plus signs indicate significance of the coefficients adjusted for multiplicity to account for joint testing of zero coefficients on all the variables in the table at conventional significance levels 1%, 5%, 10%, respectively.

***, **, *: Asterisk signs indicate significance of the coefficients for tests of the single coefficients at conventional significance levels 1%, 5%, 10%, respectively.

To explain the drivers of heterogeneity, we follow Chernozhukov, Fernández-Val & Luo (2018) and report results from a classification analysis. Here, we analyze whether there exist significant differences in characteristics between observational units in the lower and in the upper 10 percent quantile of effect sizes. Table 1 summarizes the results. Individuals in the most and least affected

groups differ regarding their individual and work situation as well as their work satisfaction and their motivation to becoming a nurse, initially. When we adjust for multiple testing, only a few differences remain statistically significant.

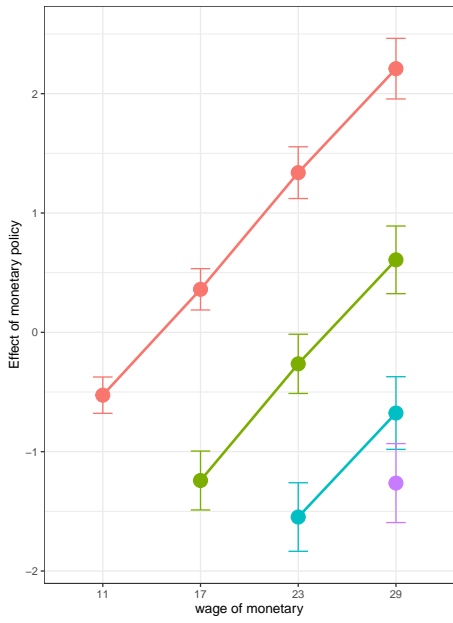
A good team is more relevant for females and those who work fewer hours, e.g. in part time rather than in full time. More time for patients is again more important for those working in part time. The strong association between working hours and effect size suggests fundamental differences in individual preferences between those who work part time and those who work full time. We find that the motivation to become a nurse clearly matters for preferring jobs where more time for patients is available. Those who entered nursing because they wanted to have contact with humans and those who wanted to work in a diverse environment show stronger preferences for more time for patients. Autonomy is more important for non-Germans and for fixed-term employed. A reliable roster is more important for those who are less satisfied with their work.

4.2 Substitution Monetary v. Non-monetary

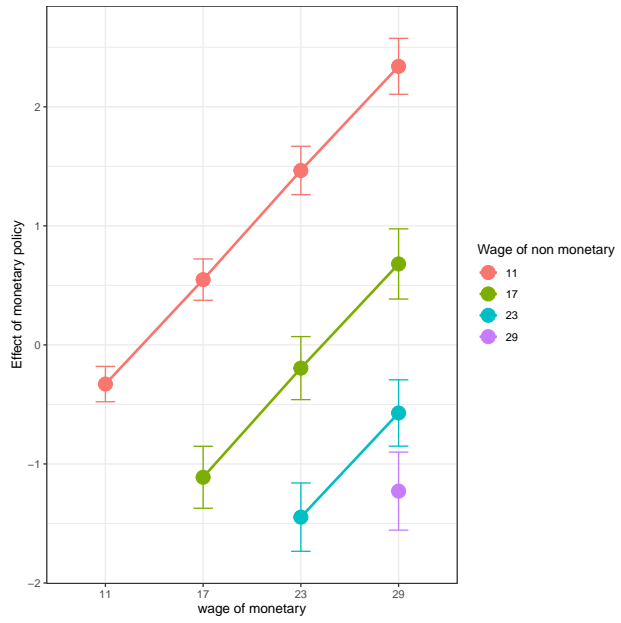
Up to this point, we analyzed each measure separately. In this section, we study whether care workers would either prefer higher wages or rather prefer one of the non-monetary characteristics analyzed above. To this end, we compare job advertisements with different wages that do not offer a specific non-monetary job characteristic (i.e. monetary job offers) to advertisements that provide the non-monetary job characteristic, but offer a smaller (or equal) wage (i.e. non-monetary job offers). First, we present the average effects of the respective combinations. Afterwards, we focus on the underlying heterogeneity of the effects. As above, we present SPEs and conduct a classification analysis.

4.2.1 Average Effects

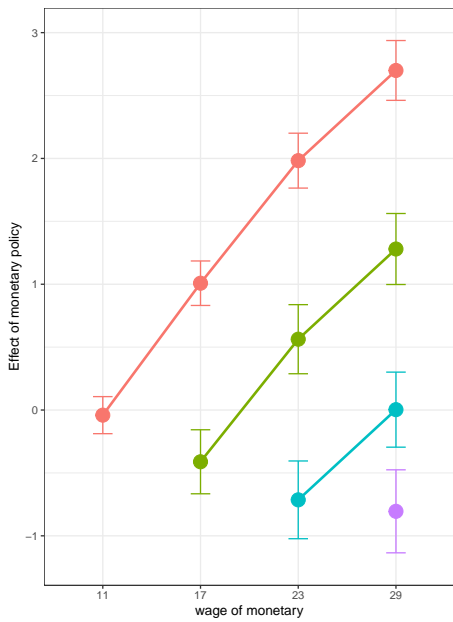
Figure 2 summarizes the results. Each panel shows the average effects for one non-monetary job characteristic. Each dot represents the average effect of offering the monetary instead of the non-monetary job. Dots with the same color refer to the same base wage. If the effect is positive, individuals on average prefer the monetary job offer (i.e. the job that is not offering



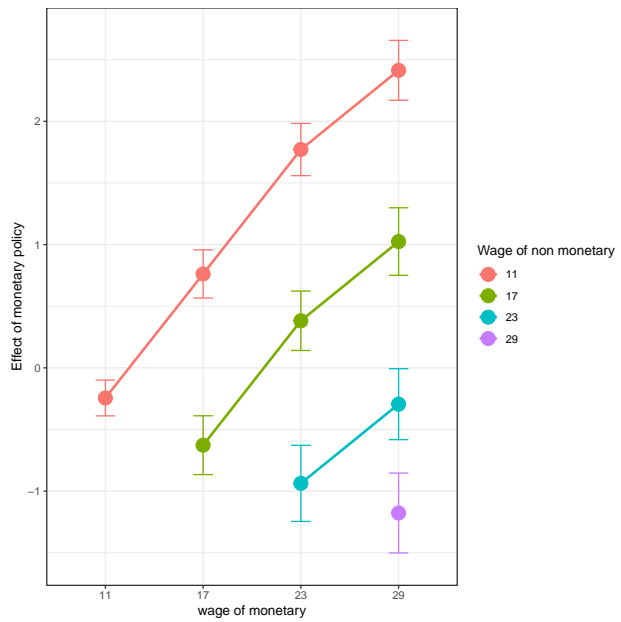
(a) Team



(b) Time for patients



(c) Autonomy



(d) Reliable Roster

Figure 2 – Average Effects on Substitution

the respective non-monetary characteristic). If the effect is negative, then the non-monetary job offer is more favored, on average.

The figures look qualitatively quite similar for the four non-monetary job characteristics. Two major results arise from figure 2. First, regarding the relative differences in wage levels. The larger the wage difference between the non-monetary and the monetary job offer, the bigger the effect. The curves are roughly linear, i.e. the same wage raises on average yield the same relative increase in job attractiveness over the whole observed wage distribution. Therefore, we do not observe a diminishing marginal utility of wage. Second, regarding different base wage levels. Comparing the first points of the figures, we observe that the monetary job offer with the same wage level but without the non-monetary job characteristic becomes less attractive with rising base wages. This points to an interaction effect between wage and non-monetary job characteristics. This means that there is a premium for the combination of pleasant non-monetary characteristics and higher wages. Hence, the higher the base wage level, the more have wages of monetary offers to be raised, in order to compensate for less pleasant non-monetary job characteristics.

4.2.2 Sorted Effects

We further analyze heterogeneities in the trade-offs between wage and non-monetary job characteristics. The panels in figure 3 depict the SPEs for the non-monetary advertisements that offer a good team or much time for patients. Non-monetary advertisements offering more autonomy and a reliable roster are depicted in figure 4.

As shown by the omnibus test, the results show that it strongly depends on individual characteristics, whether a monetary or a non-monetary job offer is preferred. Though the estimated effects of wage compensation differ between the job characteristics in absolute size, we find common patterns. For high wage differences from a low base wage level, i.e. from 11 Euro hourly to 23 to 29 Euros per hour, the monetary job offer is almost always preferred to the non-monetary one. As we saw in the analysis of the average effects, with higher base wage levels of the non-monetary job offer, the monetary offer has to offer higher wages, in order to compensate for the loss of a good team, for less time for patients, for less autonomy or a less reliable roster. We further find that the estimated effects are significantly different from zero at some points of the effect distribution, whereas they are not at other points of the distribution. In these cases, some indi-

viduals prefer the monetary offer, whereas others prefer the non-monetary one. Overall, we find increasing wages may be a way to compensate for worse working conditions. Whether and how well this works depends on the wage differential between the monetary and the non-monetary jobs as well as individual characteristics, however. It works better for larger wage changes and lower wages of non-monetary job offers. Compensating for worse working conditions is also easier for less prominent non-pecuniary job characteristics, i.e. less autonomy is priced away more easily than a worse team.

4.2.3 Classification Analysis

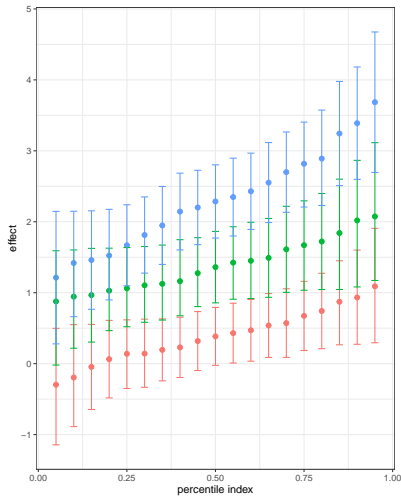
In order to analyze the nature of the heterogeneity uncovered by the SPE-analysis, we again conduct a classification analysis.

Team v. Wage

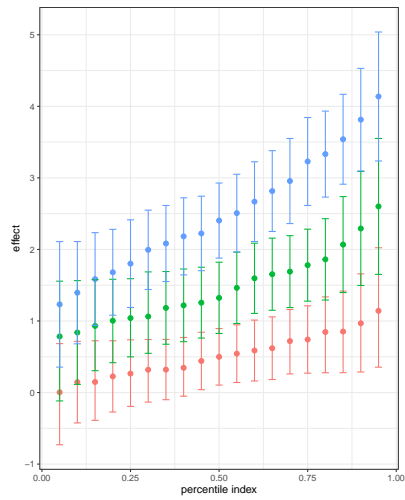
Regarding the trade-off between a cordial team and wages, women and those working part-time exhibit stronger preferences for the non-monetary job advertisement. This is plausible. As we saw above, those groups show higher preferences for a better team. Those who value a good team more are therefore less likely to prefer the monetary advertisement that does not offer a cordial team. We also find that those who prefer the monetary offer are less satisfied with their work situation. Interestingly, the motivation to become a nurse in the first place also matters. Individuals who took up nursing because they wanted to work in a team show stronger preferences for the non-monetary advertisement.

Time for Patient v. Wage

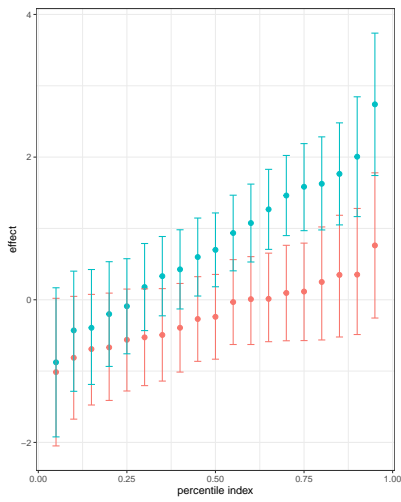
For the number of hours worked and the motivation to become a nurse, in the first place, the picture is in line with the results of the separate analyses, again. Those who are more inclined to trade more time for patients for higher wages are working more hours, i.e. full time instead of part time. Further, those who stated less often that they started working as a nurse because they wanted to have contact with humans, show stronger preferences for the monetary advertisement.



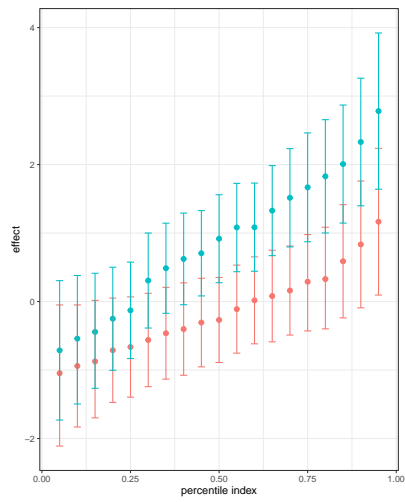
(a) SPE Baselevel 1



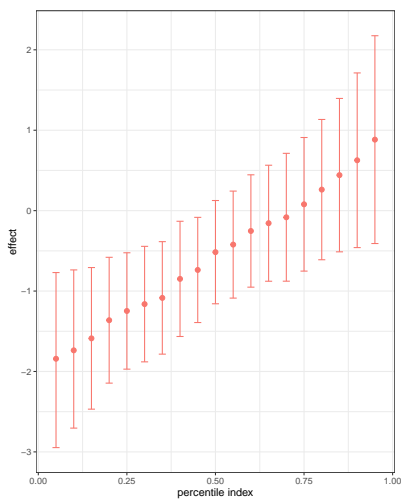
(b) SPE Baselevel 1



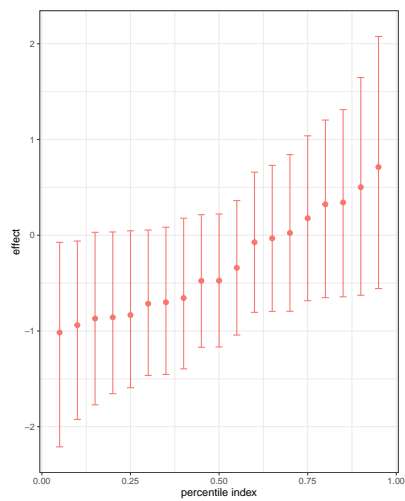
(c) SPE Baselevel 3



(d) SPE Baselevel 3

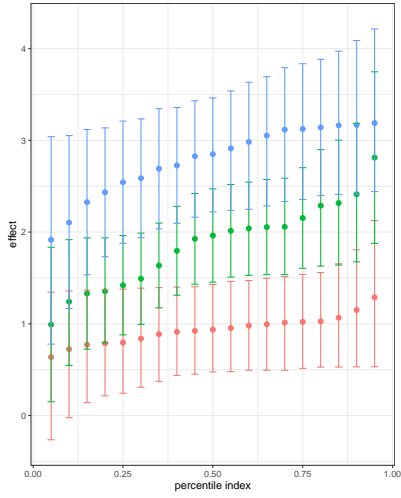


(e) SPE Baselevel 5

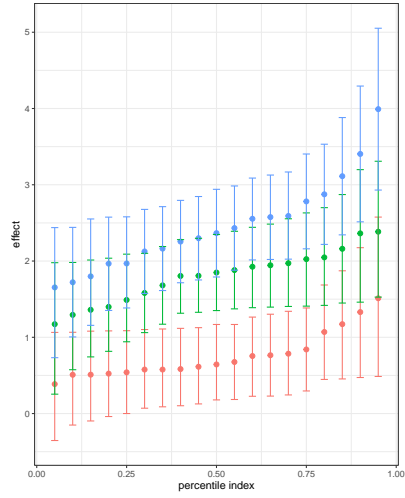


(f) SPE Baselevel 5

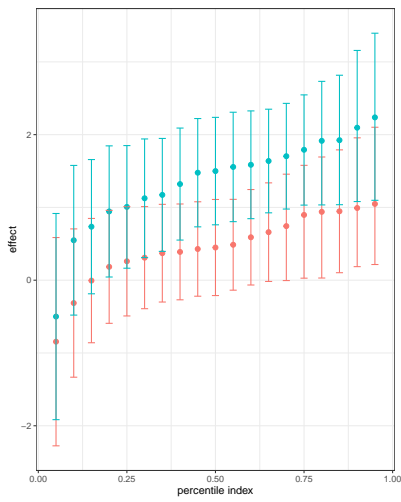
Figure 3 – Sorted Partial Effects - Team v. Wage and Time v. Wage



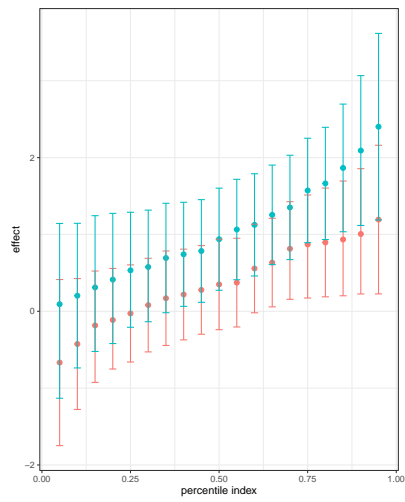
(a) SPE Baselevel 1



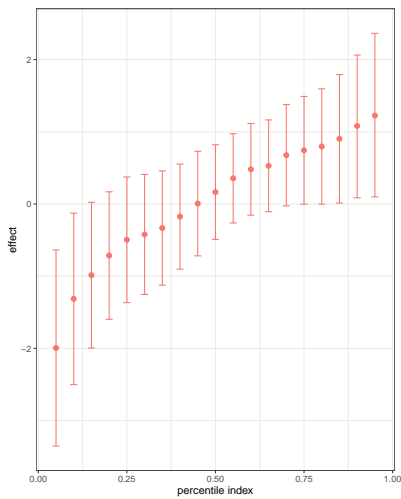
(b) SPE Baselevel 1



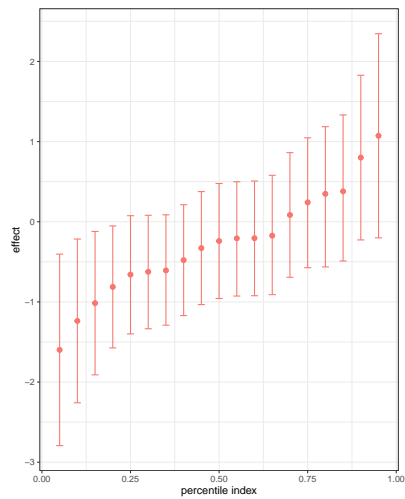
(c) SPE Baselevel 3



(d) SPE Baselevel 3



(e) SPE Baselevel 5



(f) SPE Baselevel 5

Figure 4 – Sorted Partial Effects - Autonomy v. Wage and Reliable Roster v. Wage

	Base Wage 11 Euros		Base Wage 17 Euros		Base Wage 23 Euros	
	Alternative Wage					
	17 Euros	23 Euros	29 Euros	23 Euros	29 Euros	29 Euros
Present Job Characteristics						
Hours	0.475	16.527 +	23.325 +++	18.726 ++	24.074 +++	26.422 +++
Unplanned Shifts per Month	-2.340	-1.981	0.950	0.106	1.782	0.645
log of Hourly Wage	0.454	0.269	-0.056	0.409	0.082	-0.105
Works in Direct Care	-0.109	-0.258	0.170	-0.086	0.232	0.142
Fixed-Term Employed	0.184	0.103	0.378	-0.470	-0.053	-0.134
Satisfaction With Job	0.450	-0.775	-1.106	-1.435 +	-1.640 +++	-0.290
Motivation to Become a Nurse						
Human Contact	0.203	-0.478	-0.208	-0.243	-0.167	0.020
Diverse Work	-0.509	-0.400	-0.293	-0.781	-0.503	-0.178
Help Others	0.154	-0.402	-0.359	-0.157	-0.448	-0.358
Career/Developm.	0.118	0.398	0.224	-0.416	-0.465	0.076
Teamwork	-0.613	-1.076 +++	-0.556	-0.804 +	-0.445	-0.454
Safe Job	0.530	-0.116	0.293	-0.577	-0.061	-0.084
Med. Interest	-0.367	-0.166	0.137	-0.565	-0.305	-0.839 ++
Social Interest	0.010	-0.303	-0.569	-0.437	-0.611	-0.771
Personal Characteristics						
Age	-8.279	-21.191 +	-10.806	4.436	-2.167	-8.849
German Nationality	-0.117	0.048	-0.011	-0.043	-0.106	-0.080
Female	-0.386	0.043	-0.863 +++	-0.058	-0.729 +++	-0.891 ++
Schooling	0.409	0.353	0.398	0.049	0.133	-0.281
Child Below Age 14	-0.616	-0.234	-0.404	-0.573	-0.620	0.327
Partner With a Job	-0.830 ++	-0.338	-0.552	-0.738	-0.670 +	0.011

Table 2 – Trade-Off Classification Analysis - Cordial Team

Notes: +++, ++, +: Plus signs indicate significance of the coefficients adjusted for multiplicity to account for joint testing of zero coefficients on all the variables in the table at conventional significance levels 1%, 5%, 10%, respectively.

	Base Wage 11 Euros		Base Wage 17 Euros		Base Wage 23 Euros	
	Alternative Wage					
	17 Euros	23 Euros	29 Euros	23 Euros	29 Euros	29 Euros
Present Job Characteristics						
Hours	10.971	12.669	20.920 +++	21.771 +++	26.402 +++	26.920 +++
Unplanned Shifts per Month	-2.067	0.396	-1.118	0.977	0.328	0.715
log of Hourly Wage	0.077	-0.252	-0.092	-0.196	-0.112	-0.309
Works in Direct Care	-0.128	-0.211	0.080	-0.142	0.047	0.161
Fixed-Term Employed	-0.162	0.535	0.071	0.289	0.046	-0.014
Satisfaction With Job	-0.167	-0.734	-0.993 +	-0.803	-0.602	0.077
Motivation to Become a Nurse						
Human Contact	-0.575	-0.791 +++	-0.462	-1.036 +++	-0.629 ++	-0.682
Diverse Work	-0.423	0.205	-0.528	-0.497	-0.851 +++	-1.015 ++
Help Others	-0.692	-0.556	-0.573	-0.022	-0.151	-0.221
Career/Developm.	0.651	0.326	0.487	-0.135	-0.015	0.284
Teamwork	-0.311	-0.311	-0.757 ++	0.165	-0.336	-0.568
Safe Job	0.134	0.258	-0.110	0.265	-0.221	-0.150
Med. Interest	0.458	0.647	-0.053	0.121	-0.263	-0.654
Social Interest	-0.142	-0.113	-0.130	-0.426	-0.173	-0.277
Personal Characteristics						
Age	-34.441 +++	-24.443 +++	-14.941	-9.930	4.041	-0.494
German Nationality	-0.148	0.165	0.026	-0.255 ++	-0.157	0.054
Female	-0.577	0.020	-0.379	-0.313	-0.444 +	-0.434
Schooling	0.836 ++	0.523 +	0.445	0.520	0.293	-0.289
Child Below Age 14	0.027	-0.147	-0.212	-0.216	-0.606	-0.432
Partner With a Job	-0.377	-0.347	-0.135	-0.590	-0.613 +	-0.383

Table 3 – Trade-Off Classification Analysis - Time

Notes: +++, ++, +: Plus signs indicate significance of the coefficients adjusted for multiplicity to account for joint testing of zero coefficients on all the variables in the table at conventional significance levels 1%, 5%, 10%, respectively.

	Base Wage 11 Euros		Base Wage 17 Euros		Base Wage 23 Euros	
	Alternative Wage					
	17 Euros	23 Euros	29 Euros	23 Euros	29 Euros	29 Euros
Present Job Characteristics						
Hours	0.099	5.125	28.707 +++	6.358	20.530 +++	19.759 +++
Unplanned Shifts per Month	-0.140	-0.667	-0.358	2.302	1.851	0.206
log of Hourly Wage	0.588	0.191	0.024	0.702 ++	0.231	0.177
Works in Direct Care	-0.566 +	0.122	-0.049	0.102	0.278	0.326
Fixed-Term Employed	0.464	-0.504 ++	-0.201	-0.436	-0.162	-0.481
Satisfaction With Job	-0.268	-1.778 +++	-0.743	-0.984	-0.375	0.324
Motivation to Become a Nurse						
Human Contact	0.297	-0.192	-0.080	-0.606	-0.516	0.126
Diverse Work	0.241	-0.570	-0.797	-0.945 ++	-0.880 +++	-0.780 ++
Help Others	-0.520	-0.250	-0.262	-0.301	-0.264	0.177
Career/Developm.	0.541	-0.233	0.052	-0.424	-0.248	-0.160
Teamwork	0.645	-0.032	-0.079	-0.271	-0.149	-0.050
Safe Job	0.037	0.282	0.360	-0.214	0.088	0.311
Med. Interest	-0.703	0.687 ++	0.198	0.258	-0.502	0.200
Social Interest	-0.527	-0.518	-0.272	0.096	0.303	0.467
Personal Characteristics						
Age	-17.652	-16.923	-14.674	-3.739	-5.567	-2.655
German	0.119	-0.010	-0.089	0.181	0.176 +	0.018
Female	-0.013	-0.179	-0.499	-0.136	-0.155	-0.190
Schooling	0.070	0.191	-0.522	0.249	-0.333	-0.605 ++
Child Below Age 14	0.487	0.197	0.116	0.106	-0.044	-0.099
Partner With a Job	0.225	-0.530	-0.155	-0.262	0.067	0.047

Table 4 – Trade-Off Classification Analysis - Autonomy

Notes: +++, ++, +: Plus signs indicate significance of the coefficients adjusted for multiplicity to account for joint testing of zero coefficients on all the variables in the table at conventional significance levels 1%, 5%, 10%, respectively.

	Base Wage 11 Euros		Base Wage 17 Euros		Base Wage 23 Euros	
	Alternative Wage					
	17 Euros	23 Euros	29 Euros	23 Euros	29 Euros	29 Euros
Present Job Characteristics						
Hours	13.928	23.329 +++	27.587 +++	16.520 ++	23.664 +++	17.912 +++
Unplanned Shifts per Month	2.380	0.193	2.653	2.008	4.331 +	3.279
log of Hourly Wage	-0.021	-0.035	-0.132	0.201	0.273	0.299
Works in Direct Care	0.347	0.450	0.365	0.442	0.527	0.450
Fixed-Term Employed	0.699 +	-0.045	0.007	-0.055	0.028	-0.327 +
Satisfaction With Job	-0.348	-1.396 ++	-0.730	-1.405	-0.918	0.075
Motivation to Become a Nurse						
Human Contact	0.042	-0.348	-0.273	-0.377	-0.247	-0.054
Diverse Work	0.244	-0.510	-0.694	-0.592	-0.763 +++	-1.003 +++
Help Others	-0.504	-0.227	-0.712	-0.013	-0.323	-0.279
Career/Developm.	0.680	-0.526	0.144	-0.737 ++	-0.282	-0.631
Teamwork	-0.345	-0.536	-0.412	-0.546	-0.356	-0.457
Safe Job	0.725	0.334	0.293	0.485	0.082	-0.238
Med. Interest	-0.430	0.771 ++	0.095	0.358	-0.015	0.260
Social Interest	-0.325	0.118	-0.150	0.344	0.106	0.629
Personal Characteristics						
Age	-20.904 +	-15.028	-17.879 +	2.690 ++	-4.552	4.855
German Nationality	-0.271	-0.023	-0.064	-0.143	-0.083	-0.027
Female	-0.598 +	-0.528 +	-1.025 +++	-0.386	-0.851 +++	-0.513
Schooling	0.201	0.142	0.300	0.249	0.114	-0.372
Child Below Age 14	0.329	-0.125	0.116	0.082	-0.016	0.006
Partner With a Job	-0.252	-0.433	0.041	-0.179	0.061	0.186

Table 5 – Trade-Off Classification Analysis - Reliable Roster

Notes: +++, ++, +: Plus signs indicate significance of the coefficients adjusted for multiplicity to account for joint testing of zero coefficients on all the variables in the table at conventional significance levels 1%, 5%, 10%, respectively.

Autonomy v. Wage

For the trade-off between wage and autonomy, the picture is more diverse. Those who are working more hours prefer the monetary job offer more strongly, if the wage is high. At mid-level and high-level wages of the non-monetary job offer, individuals are less inclined to trade wage for autonomy if they entered the nursing occupation because they wanted diverse work.

Reliable Roster v. Wage

Regarding the trade-off between a reliable roster and wage, those working more hours, mostly full time, are more willing to trade a reliable roster for higher wages. Also, women are less inclined to make this trade.

Overall, we find the clearest relation to hours worked. Individuals who are working fewer hours, e.g. part time, have a stronger preference for the non-monetary job advertisements, offering a cordial team, time for patients or a reliable roster rather than higher wages. Further, female nurses are less willing to trade a cordial team, time for patients, or a reliable roster for higher wages than men do. The willingness to trade autonomy for higher wages differs along separate characteristics. The results are overall less conclusive. Differences in preferences also evolve along with statements, why respondents started to work in nursing. Though the differences are only statistically different for some of the base and alternative wage levels, stated preferences for why individuals started to work in nursing and preferences revealed by the survey experiment mostly match. For example, those who started to work in nursing, because they wanted to work in a team, are less willing to sacrifice a good team for higher wages.

5 Conclusion

We provide an extensive analysis of heterogeneity in preferences over different non-monetary job characteristics and trade-offs between wage and non-monetary job characteristics. To that end, we employ data from a self-conducted factorial survey experiment of nurses in Germany. Specifically, we study heterogeneity in the preferences for four non-monetary job characteristics (team

atmosphere, time for the patients, autonomy, and roster reliability). Preference heterogeneity regarding job characteristics is usually analyzed via subgroup analysis. We use novel econometric methods proposed by Chernozhukov, Fernández-Val & Luo (2018) to provide a more holistic analysis of heterogeneous preferences for job characteristics and describe how most and least responsive individuals differ.

All four non-monetary job characteristics have clear positive effects on job attractiveness. Moreover, we find evidence for heterogeneity in preferences regarding all of them. From a policy-maker's as well as from an employer's point of view, this means, even if there exist measures which can clearly help to raise job attractiveness, a differentiation of these measures, along individual preferences, can be efficient. We provide guidance on factors along which such measures could be differentiated. We find that a differentiation may be especially efficient along present individual working hours, gender, and work motivation. Our analysis of trade-offs between non-monetary job characteristics and wages points to the possibility to “price away” non-monetary job characteristics. However, the price may be high, especially if wages are not too low, initially. Also, we again find significant differences in individual preferences, along present working hours, gender, and the motivation to initially take up the occupation.

Our study therefore provides direct implications for policy-makers' as well as employers' actions, in general, and regarding nursing, in particular. First, the one ideal measure (or bundle of measures) to make jobs more attractive may not exist. Rather than searching for a “one size fits all” solution, job offers should be differentiated to better suit individual preferences. Regarding nursing jobs, there is some evidence for such differentiation. Evidence from qualitative interviews, which we gathered as part of our recent research on nursing job characteristics, suggests that some employers, especially large ones like big nursing homes or university hospitals, indeed offer jobs with heterogeneous characteristics to nurses and overcome problems along teams by rearranging team composition, if needed. Further, there exist initiatives for a different organization of the provision of care work, yielding different packages of job characteristics nurses could choose from by switching employers.⁵ Second, in working areas or times where labor supply is especially scarce (e.g. in nursing in intensive care units during the COVID-19 pandemic), stronger measures to increase labor supply may be needed. In those cases, combinations of pleasant non-monetary job

⁵See e.g. the model of *Buurtzorg* (<https://www.buurtzorg-deutschland.de/>) and *AAP - Autonome ambulante Pflgeteams* (<https://www.if-gm.de/index.php/forschungsprojekte/projekt-aap-autonome-ambulante-pflgeteams>)

characteristics and higher wages are called for, as such combinations achieve especially positive impacts on job offer attractiveness. Third, where highly qualified, and therefore highly paid, personnel is needed, job characteristics need to be especially pleasant, in order to attract personnel, as it becomes increasingly difficult to “price away” pleasant non-monetary job characteristics. Where such jobs can only be offered in unpleasant circumstances, strong wage raises would be needed in order to increase job attractiveness.

We identify variables which are associated with heterogeneity in individual preferences. Because of the descriptive nature of the study, some questions are left open. Most prominently, why is the amount of working hours that strongly associated with effect sizes? We cannot unveil the underlying causal relation with our data. However, the respective association is very clear and should be examined in future research. In this context, we would like to point out a limitation of our study. Although we find heterogeneity along important characteristics, there could be much more heterogeneity. Our method allows us to determine in a statistically valid way which dimensions of heterogeneity are significant, taking into account multiple testing problems. However, there may exist an a priori unknown mass of possibly important variables, which our data does not cover. For example, overall household income, detailed information on the family situation, or a precise description of the respondent’s present job. Future research on the heterogeneity of workers’ preferences over job characteristics could embody such information. The methodology presented in Chernozhukov, Fernández-Val & Luo (2018) applied in this paper yields an appropriate tool-set to do so.

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