BEYOND WAGE GAP, TOWARDS JOB QUALITY GAP: THE ROLE OF INTER-GROUP DIFFERENCES IN WAGES, NON-WAGE JOB DIMENSIONS, AND PREFERENCES

Marko Ledić* and Ivica Rubil⁑

Version: Jan 19, 2020

Abstract: Although important, wage is hardly the only thing people care about when it comes to assessing the quality of their jobs. Non-wage job dimensions, such as autonomy at work, the possibility to achieve work-life balance, or the opportunity to learn something new, are important as well. Nevertheless, a vast literature is focused on inter-group wage gaps. We go beyond the wage gap by proposing a framework for analysing inter-group gaps in job quality. It is suitable for analysing the job quality gap between any two groups of interest, such as men and women, public and private sector employees, or natives and immigrants. Job quality, conceptualised as wellbeing on the job, is measured by the equivalent wage, a multi-dimensional wellbeing measure that respects preferences understood as ideas about what makes a good job. We derive a decomposition of the inter-group equivalent wage gap into three components, attributable to the inter-group differences in wages, non-wage job dimensions, and preferences. The latter two can be further decomposed into the contributions pertaining to each of the non-wage dimensions. The decomposition is illustrated empirically by an analysis of the gender gap for recent university graduates from 19 countries. The results show that men's equivalent wages are substantially higher than women's, and that the equivalent wage gaps are significantly larger than the wage gaps. This is because gender differences in non-wage job dimensions and preferences are typically to men's advantage, just as the wage gaps are.

Keywords: wage gap, job quality, multidimensional, decomposition
JEL classification: I31, J31, J81

* University of Zagreb; Trg J. F. Kennedyja 6, 10000 Zagreb; mledic@efzg.hr
⁑ Corresponding author; The Institute of Economics, Zagreb; Trg J. F. Kennedyja 7, 10000 Zagreb; irubil@eizg.hr

1. Introduction

That there is more to human well-being than the material dimension – commonly identified with a concept of income – is a widely recognised fact of life. An adequate income surely matters for the quality of life, but so do also non-income dimensions such as health and personal relationships. This multi-dimensional nature of well-being has been recognised – as part of a broader agenda to go 'beyond GDP' as a measure of economic performance and progress of societies – in the influential Stiglitz-Sen-Fitoussi Commission's report (Stiglitz, Sen and Fitoussi 2009) and its recent follow-up (Stiglitz, Fitoussi and Durand 2018a, 2018b).[1] Many people make their living through paid work, spending a large fraction of their daily lives at the workplace, and thus the quality of their jobs – their well-being at the workplace – is a major determinant of their overall well-being. Since their overall well-being is not determined by income only, but by non-income dimensions as well, their jobs do not contribute to their overall well-being exclusively through the wages, but also through non-wage dimensions, such as autonomy and safety at work, job security, relationships with co-workers and managers, and opportunities for personal development, to name but a few.[2]

There is, though, a theoretical possibility that worse non-wage dimensions are compensated through higher wages – as suggested by the theory of compensating wage differentials (Rosen 1986; see Purse 2004 for a review) – but has no solid empirical support (e.g., Ose 2005; Bonhomme and Jolivet 2009; Fernandez and Nordman 2009). On the other hand, there is a considerable body of evidence that non-wage job dimensions impact workers' overall well-being, especially through the impact of work conditions and the organisation of work on their physical and mental health. In line with the so-called "demand-control" (or "job strain") theory (Karasek and Theorell 1990; Theorell and Karasek 1996), according to which work adversely affects workers' health if job strain is high – i.e. if the job too demanding relative to the degree of control workers have over the execution of job tasks – reviews of empirical studies have found negative effects of job strain on both mental (Van der Doef and Maes 1999; Theorell et al. 2015) and physical health (Kivimäki et al. 2012; Theorell et al. 2016). There is also evidence, in line with the so-called "effort-reward imbalance" theory (Siegrist 1996, 2016), that high required work effort relative to the reward received also

[1] This is not to say that the idea of going beyond GDP has not been known before. Indeed, it can be traced back at least to the 'social indicators movement' in the mid-1960s in the USA (Bauer 1966).

[2] The Stiglitz-Sen-Fitoussi Commission has recognised that as well by noting that "[p]aid work matters for quality of life partly because it provides identity to people and opportunities to socialise with others." (Stiglitz, Sen and Fitoussi 2009: 49).

adversely affects mental (Rugulies et al. 2016) and physical health (Kivimäki et al. 2002; Kupper et al. 2002; Brunner et al. 2004). Finally, as predicted by the "job demand-resources" theory (Bakker and Demerouti 2007; Schaufeli and Taris 2014), conditions of high job demands relative to resources lead to burnout (Hakenen et al. 2008; Schaufeli et al. 2009).

That said, the assessment of the labour market outcome for people in paid employment should recognise two things. First, the outcome that ultimately matters for people doing paid work is their individual well-being derived from the work – their job quality. Second, job quality is multi-dimensional, rather than determined solely by the monetary compensation for the work effort. Recognising these two things means that any assessment of the effects of labour market policies or management practices on workers should ultimately be expressed as the effect on workers' individual multi-dimensional well-being at workplace, or job quality, as the ultimate outcome. Also, and directly relevant to this paper, an assessment of how one worker or a group of them fares in paid employment relative to another worker or group, should be done in terms of workers' multi-dimensional job quality.

Such assessments are hardly done in the existing literature, however. There is a vast literature on the wage gap between groups defined by various criteria – between men and women (reviewed by, e.g., Blau and Kahn 2017; Weichselbaumer and Winter-Ebmer 2005), employees in the public and private sectors (e.g., Jürges 2002; Lucifora and Meurs 2006), immigrant and native workers (e.g., Aldashev et al. 2012; Hunt 2012), and other groups. In this literature, the inter-group wage gap is estimated and decomposed using a version of Oaxaca-Blinder decomposition (Oaxaca 1974; Blinder 1974) into two components: one attributed to the inter-group differences in workers', jobs' and employers' characteristics, and the other attributed to the inter-group differences in how these characteristics affect workers' wages.[3] Although this literature contributes to our understanding of the factors behind the wage gaps between various groups, it is still limited in potential insight insomuch as the ultimate outcome by which groups should be compared is job quality understood as multi-dimensional well-being at the workplace. Although there are analyses of inter-group differences in some particular non-wage job dimensions (for gender differences, see, e.g., Smith et al. 2008; Green 2009; Gallie and Zhou 2013; Dieckhoff 2013; Green et al. 2013), to the best of our knowledge there is as yet no attempt in the literature to estimate the job quality gap between two groups of workers and decompose it into the constitutive elements, informative of the factors determining the inter-group gap.

[3] Depending on specific version of the Oaxaca-Blinder decomposition, there can be a third component as well, reflecting the interaction between the mentioned two.

In this paper, we make a first step towards filling this gap. We contribute by proposing a framework for analysing inter-group differences in job quality. Within the framework, the concept of job quality is equated to multi-dimensional well-being at the workplace, and measured by what we term 'equivalent wage' (hereafter, EW). It is conceptually equivalent to the so-called 'equivalent income', a multi-dimensional measure of individual well-being that has been known since mid-1970s and recently revived in the literature on well-being measurement (e.g., Decancq et al. 2015a, 2015b; Fleurbaey 2015). The only difference is that equivalent income is a measure of overall well-being (quality of life), rather than well-being in a specific life domain, namely paid work, as in the case of EW. The conceptual equivalence between EW and equivalent income was first exploited by Schokkaert et al. (2011). The construction of EW entails combining wage as a pecuniary job dimension, with a number of non-pecuniary, non-wage dimensions, for example autonomy at work, job security, or work-life balance, into an index. The index is then used, just as wage or any other cardinal variable, to compare one person to another, or one group to another (by the average EW, for example). In comparison to other existing measures that combine multiple dimensions into a single index at the level of individual worker (for overviews, see: OECD 2017; Muñoz de Bustillo 2011a, 2011b), EW has a key peculiarity. It is the only measure where the weights used in the aggregation of dimensions into an index are based on individual or group preferences over different jobs (i.e., combinations of wage and non-wage dimensions), with preferences being captured by the marginal rates of substitution between dimensions (i.e., by the shape of the indifference surface), which in principle vary across individuals or groups of individuals. The weighting schemes for other measures are either uniform, or arbitrarily non-uniform, or derived from a purely statistical procedure, or set in accordance with the degree of 'importance' or 'relevance' that workers are asked to express in some way.[4] As such, EW should normatively appeal to those who reject the 'paternalistic' nature of measures based on weighting schemes that are either arbitrarily set or derived from some purely statistical procedure, rather than grounded in preferences that are in principle heterogeneous across individuals or groups. Moreover, it should also normatively appeal to those who deny any normative significance of subjective expectations and aspirations that affect job satisfaction scores given as answers to a survey question on how satisfied one is with one's job.

Our main contribution is to derive a decomposition of the difference in job quality between two non-overlapping groups of interest – the equivalent wage gap. Using our

[4] See Decancq and Lugo (2013) for an overview of different weighting schemes in multi-dimensional well-being indices.

decomposition framework, one is able to divide the equivalent wage gap between two groups of interest into three components: (1) the wage gap, as traditionally defined in the vast wage gap literature, that is due to the differences in wage distributions; (2) the gap in non-wage dimensions, that is attributed to the differences in distributions of non-wage job dimensions; and (3) the preference gap, arising from the differences in preferences of the groups being compared (i.e., in their marginal rates of substitution among job dimensions). In addition, the gap in non-wage dimensions and the preference gap can be further decomposed into the components pertaining to each of the non-wage dimensions.

Our decomposition framework extends the toolkit standardly used in the analyses of inter-group differences in labour market outcomes for people in paid work. By focusing on the wage gap, one is restricted to just one valuable job dimension, and thus misses other dimensions that matter as well. The framework allows one to go not only beyond the wage gap, but also to quantitatively determine the respective contributions of the wage gap and the other two components of the equivalent wage gap. We emphasise the possibility of telling apart the gap in non-wage dimensions from the preference gap, given the importance of preferences in the context of multi-dimensional well-being measurement, at least for those who find them normatively relevant, and to the extent that preferences can be elicited from data at all.

The number of possible settings where the decomposition framework can be applied increases when one notes that many settings are formally equivalent to the setting where the EW gap between non-overlapping groups A and B (say, men and women) at a point in time is being decomposed. One such setting is the comparison between two countries, or two regions within a country, at a point in time. Another is the comparison of two points in time for a given group (or country, or region). In all these settings it is conceivable that the EW gap (or change, in temporal comparisons) may arise from the three gaps – in wages, non-wage dimensions, and preferences.

We also contribute to the literature on the measurement of overall multi-dimensional well-being – the quality of life. Given that EW is formally identical to equivalent income, our decomposition framework can be applied not only to the differences/gaps/changes between groups, spatial units or time periods in terms of job quality, but also in terms in overall well-being. For example, some papers use equivalent income in cross-country comparisons (Decancq and Schokkaert 2016; Petrillo 2018), and our decomposition framework can be used for analysing more closely the difference in well-being between a pair of countries. Or one may wish to focus on a single country and the gaps between some two groups.

The paper is organised in the following way. In section 3 we define EW and derive the decomposition framework. Section 4 is an extensive discussion of a number of normative and technical assumptions made, explicitly or implicitly, in section 3. In section 5 we illustrate the decomposition framework with an empirical application. Section 6 summarises the paper and provides some concluding remarks.

2. Decomposing job quality gap: a framework

In this section, we present our framework for analysing inter-group gaps in job quality. We fist define the wellbeing measure, the so-called equivalent income – here renamed equivalent wage – introduced by Fleurbaey (2005), recently revived and developed further by Decancq et al. (2015a; 2015b), and applied as a job quality measure by Schokkaert et al. (2011).[5] Then we derive a decomposition of the inter-group gap in equivalent income into the respective contributions of the inter-group differences in wages, non-wage job dimensions and preferences. Finally, we present the approach used for preference estimation.

2.1. Equivalent wage

Let some population of interest be divided into two non-overlapping groups, labelled A and B: $g = A, B$. A person from group g derives his job quality from $(K + 1)$ job dimensions, namely wage, W, and non-wage dimensions, $D = (D_1, \dots, D_K)$. He has well-defined preferences over jobs – that is, over combinations of job dimensions, (W, D). The preferences are g-specific, so that all persons belonging to group g hold the same preferences. Thus, there is inter-group, but no intra-group, preference heterogeneity.

The preferences are represented by the g-specific utility function $u^g(\cdot)$, taking as arguments W and D, as well as a set of personal and job attributes (other than the job dimensions W and D), $X = (X_1, \dots, X_L)$, which affect utility independently of W and D. The attributes X are assumed to affect only the level of utility, and not to shape preferences; that is, they do not affect the marginal rates of substitution between job dimensions. Formally, the marginal rates of substitution are not affected by X if the part of $u^g(\cdot)$ depending on X is separable from the part that represents preferences. We assume additive separability, $u^g(W, D, X) = f^g(W, D) + h^g(X)$, in which case the marginal rate of substitution between

[5] In fact, equivalent income/wage is conceptually very similar to the concept of money-metric utility function that has been known since Samuelson and Swamy (1974). Both are specific cardinalisations of the utility function.

any two job dimensions, say D_k and W, is independent of X: $\text{MRS}^g_{D_k,W} = \frac{\partial u^g}{\partial D_k} / \frac{\partial u^g}{\partial W} = \frac{\partial f^g}{\partial D_k} / \frac{\partial f^g}{\partial W}$.[6] By allowing for X to affect the level of utility, we allow the latter to be affected by factors other than W and D. Within group g, where preferences are homogeneous, persons with identical jobs (same W and D) will have different utility levels if they differ in X.

For $u^g(\cdot)$ to represent the g-specific preferences, the following condition must hold: $u^g(W', D', \tilde{X}) \geq u^g(W'', D'', \tilde{X})$ if and only if each g-person with $X = \tilde{X}$ weakly prefers the job (W', D') to the job (W'', D'')[7] The conditioning on X is important, since comparing jobs of two g-persons by comparing the respective utility levels respects the g-specific preferences only if the persons are identical in terms of X. To illustrate, let g-persons i and j be indifferent between (W', D') and (W'', D''), and let $X_i \neq X_j$ in such a way that $u^g(W', D', X_i) < u^g(W'', D'', X_j)$. This inequality contradicts the fact that both persons are indifferent between (W', D') and (W'', D''). However, there would be no contradiction if $X_i = X_j = \tilde{X}$ were to hold, since $u^g(W', D', \tilde{X}) = u^g(W'', D'', \tilde{X})$ would hold. Of course, in comparisons of jobs for a given person, comparing jobs through utility comparisons does respect preferences, since X are fixed by construction. This only holds, however, when job are compared for a given person at a point in time; when a job today is compared to a job in the future or past, utility comparison respects preferences only if neither preferences nor X change over time. Finally, what about inter-group utility comparisons? For job comparisons between an A-person and a B-person, comparing the respective utility levels does not respect preferences, even for persons identical in X.

Suppose further that for each non-wage dimension there is a reference value, equal to its best (i.e., most preferred, perfect) level, and denote these reference values by $D^r = (D_1^r, \dots, D_K^r)$. These reference values are common to everyone, rather than individual- or group-specific. Assuming common reference levels amounts to assuming that there is a universal – both inter-personal and inter-group – agreement on what the most preferred job is: it is one with a wage as high possible, and all non-wage attributes at $D^r = (D_1^r, \dots, D_K^r)$.

Given this setup, the equivalent wage of a person from group g, W^*, is implicitly defined by the equation

[6] The same would hold if we assumed multiplicative separability, i.e. $u^g(W, D, X) = f^g(W, D)h^g(X)$.
[7] Analogously: $u^g(W', D', \tilde{X}) > u^g(W'', D'', \tilde{X})$ if everyone with $X = \tilde{X}$ strictly prefers (W', D') to (W'', D''); $u^g(W', D', \tilde{X}) = u^g(W'', D'', \tilde{X})$ if everyone with $X = \tilde{X}$ is indifferent between (W', D') and (W'', D'').

$$u^g(W, D, X) = u^g(W^*, D^r, X). \quad (1)$$

By this definition, the equivalent wage of a g-person is the monetary amount which, when combined with the best levels of all non-wage job dimensions, makes him indifferent between this combination of job dimensions, and the one he actually has; i.e. makes him indifferent between (W^*, D^r) and (W, D). An equivalent definition says that the equivalent wage of a g-person is equal to his actual wage minus the amount that he is willing to pay to have the non-wage attributes at the most preferred, rather than the actual, levels.

It is important to stress that, although X appears in (1), the equivalent wage does not depend on it. This is due to our assumption that these personal and job attributes (other than the job dimensions) only scale the level of utility, without affecting the shape of preferences. Indeed, if $u^g(W, D, X) = f^g(W, D) + h^g(X)$, as we have assumed above, then equation (1) becomes $f^g(W, D) = f^g(W^*, D^r)$, which makes clear that the equivalent wage is independent from X.[8] The equivalent income is in fact a particular cardinalisation of the utility function, one that does not depend on X.

The concept of equivalent wage, as defined by equation (1), is illustrated in figure 1. There are only two job dimensions – wage and, say, autonomy at work. The illustration depicts a situation with two persons with different preferences over jobs. The group-specific indifference curves show that person i from group A values wage relative to autonomy more than person j from group B: the amount of income that must be forgone in order to gain on autonomy, and remain on the same utility, level is smaller for A-persons than for B-persons. For persons i and j, the respective equivalent wages, W_i^* and W_j^*, are implicitly given by $u^A(W_i, D_i, X_i) = u^A(W_i^*, D^r, X_i)$ and $u^B(W_j, D_j, X_j) = u^A(W_j^*, D^r, X_j)$.[9] We see that although the B-person j has both has both higher wage and autonomy than the A-person i, the B-specific preferences are such that j suffers more than i from falling short of the highest possible autonomy (D^r). As a result, i's job quality, measured by the equivalent wage, is higher than j's. The figure also makes clear that the equivalent wage, and consequently comparisons between persons differing in preferences, depend on the reference D^r. For example, if D^r were at some level below the intersection of the indifference curves in figure 1, j's equivalent wage would be higher than i's.[10]

[8] Note that the same would hold if we assumed multiplicative separability: for $u^g(W, D, X) = f^g(W, D)h^g(X)$, $u^g(W, D, X) = u^g(W^*, D^r, X)$ if and only if $f^g(W, D) = f^g(W^*, D^r)$.

[9] Or, equivalently, by $f^A(W_i, D_i) = f^A(W_i^*, D^r)$ and $f^B(W_j, D_j) = f^B(W_j^*, D^r)$.

[10] The choice of the reference levels for non-wage dimensions is discussed later in the discussion section.

< FIGURE 1 ABOUT HERE >

In order to obtain an explicit expression for the equivalent wage, the g-specific preferences, represented by the utility function $u^g(\cdot)$, must be known. We assume that $u^g(\cdot)$ takes the following functional form:

$$u^g(W, D, X) = \underbrace{\beta^g \ln W + \sum_{k=1}^{K} \gamma_k^g D_k}_{f^g(W,D)} + h^g(X), \tag{2}$$

where β^g and γ_k^g $(k = 1, \dots, K)$ are the marginal utilities of the log-income and non-income dimensions, respectively. These $(K + 1)$ parameters describe the preferences of group g (i.e., the shape of their $(K + 1)$-dimensional indifference surface). The last term on the right-hand side, $h^g(X)$, is a g-specific function of X, a set of personal and job attributes which, as we already said, affect the level of utility, but not the shape of the indifference surface. Thus, $h^g(X)$ just scales $u^g(W, D)$ up and down, without affecting the marginal rates of substitution between job dimensions, as assumed earlier.

Taking (1) and (2) as a system of equations and solving for W^*, we get the following explicit expression for the equivalent wage:

$$W^* = W \times \exp\left(\sum_{k=1}^{K} \varphi_k^g (D_k - D_k^r)\right), \tag{3}$$

where $\varphi_k^g = \gamma_k^g / \beta^g$ (assuming $\beta^g \neq 0$) is the marginal rate of substitution between non-wage dimension k and log-wage. Expression (3) shows that the equivalent wage is a fraction of the actual wage, where the fraction is determined by the preference parameters and the shortfalls of the non-wage dimensions from their most preferred levels. For given marginal rates of substitution, the larger the shortfalls from the most preferred levels of non-wage dimensions, the lower the equivalent wage relative to the actual wage. And for given shortfalls from the perfect non-wage dimensions, the higher the marginal rates of substitution between non-wage dimensions and log-wage, the lower the equivalent wage relative to the actual wage. Clearly, for a g-person the equivalent wage would be equal to the actual wage if group g did not care at all about the non-wage dimensions (i.e., if γ_k^g for all k), or if the person had all the non-wage dimensions at the most preferred levels.

Note that the equivalent wage does not depend on the term $h^g(X)$ appearing in the utility function (1). This is because it just scales the level of utility up and down, but does not affect the underlying preferences (the marginal rates of substitution between job dimensions). Whatever the value of $h^g(X)$, the equivalent wage will be invariant to it as long as so are the marginal rates of substitution.

2.2. Equivalent wage gap and its decomposition

Expression (3) is the point of departure for our derivation of the decomposition of the equivalent wage gap between two groups. Taking natural logarithm of (3) for both $g = A$ and $g = B$, and then taking expectation over all A- and B-persons, respectively, we get

$$\mathbb{E}^g[\ln W^*] = \mathbb{E}^g[\ln W] + \sum_{k=1}^{K} \varphi_k^g \mathbb{E}^g[D_k - D_k^r], \tag{4}$$

where $\mathbb{E}^g$ indicates expectation over all members of group g. Subtracting equation (4) for group B from the same equation for group A, we obtain

$$\Delta\mathbb{E}[\ln W^*] = \underbrace{\Delta\mathbb{E}[\ln W]}_{\substack{\text{due to}\\ \text{difference}\\ \text{in wages}}} + \underbrace{\sum_{k=1}^{K} \Delta(\varphi_k \mathbb{E}[D_k - D_k^r])}_{\substack{\text{due to differences in}\\ \text{non-wage dimensions}\\ \text{or preferences}}}, \tag{5}$$

where $\Delta\mathbb{E}[z] = \mathbb{E}^A[z] - \mathbb{E}^B[z]$. We see from (5) that the inter-group gap in equivalent wage can be exactly decomposed into two factors. The first term on the right-hand side of (5) is the wage gap, as it is standardly expressed in the vast wage gap literature, namely as the difference in expected log-wages. The second term on the right-hand side is a mixture of the difference in preferences (i.e., difference between φ_k^A and φ_k^B) and the difference in the average levels of non-wage dimensions, or more precisely, in their average shortfalls from the perfect levels.

It is useful to further decompose the mixture factor in (5). It can be decomposed into the part attributed to the difference in preferences, and the part attributed to the differences in average shortfalls of the non-wage dimensions from the perfect levels. For simplicity, consider first only one non-wage dimension, k. Using the decomposition approach based on

the Shapley value,[11] the k-specific part of the mixture term in (5), namely $\Delta(\varphi_k \mathbb{E}[D_k - D_k^r])$, can be written as

$$\begin{aligned}\Delta(\varphi_k \mathbb{E}[D_k - D_k^r]) &\equiv \varphi_k^A \mathbb{E}^A[D_k - D_k^r] - \varphi_k^B \mathbb{E}^B[D_k - D_k^r] \\ &= \overline{\varphi_k}(\mathbb{E}^A[D_k - D_k^r] - \mathbb{E}^B[D_k - D_k^r]) + (\varphi_k^A - \varphi_k^B)\overline{\mathbb{E}[D_k - D_k^r]} \\ &= \underbrace{\overline{\varphi_k}\Delta\mathbb{E}[D_k - D_k^r]}_{\substack{\text{due to difference} \\ \text{in non-wage} \\ \text{dimension } k}} + \underbrace{\Delta\varphi_k \overline{\mathbb{E}[D_k - D_k^r]}}_{\substack{\text{due to difference} \\ \text{in preferences} \\ \text{for non-wag} \\ \text{dimension } k}}, \end{aligned} \tag{6}$$

where $\overline{\varphi_k} \equiv \frac{1}{2}\varphi_k^A + \frac{1}{2}\varphi_k^B$ and $\overline{\mathbb{E}[D_k - D_k^r]} \equiv \frac{1}{2}\mathbb{E}^A[D_k - D_k^r] + \frac{1}{2}\mathbb{E}^B[D_k - D_k^r]$. In the last line of (6), the first term is due to the difference in the average shortfall from the perfect level of non-wage dimension k, and the second term is due to the difference in preferences for this non-wage attribute. Note that the former is weighted by $\overline{\varphi_k}$, and the latter by $\overline{\mathbb{E}[D_k - D_k^r]}$. Thus, the difference $\Delta\mathbb{E}[D_k - D_k^r]$ does not contribute to the EW gap at all if non-wage dimension k affects the utility function of neither group. Also, $\Delta\varphi_k$ does not at all contribute to the EW gap if in both groups everyone has achieved the perfect level of non-wage dimension k. Adding up equation (6) across all k, we obtain the aggregates for the two factors:

$$\sum_{k=1}^K \Delta(\varphi_k \mathbb{E}[D_k - D_k^r]) = \sum_{k=1}^K \overline{\varphi_k}\Delta\mathbb{E}[D_k - D_k^r] + \sum_{k=1}^K \Delta\varphi_k \overline{\mathbb{E}[D_k - D_k^r]}. \tag{7}$$

Finally, putting all factors together by combining (5) and (7), we get our final decomposition of the equivalent wage gap:

$$\Delta\mathbb{E}[\ln W^*] = \underbrace{\Delta\mathbb{E}[\ln W]}_{\substack{\text{due to} \\ \text{difference} \\ \text{in wages}}} + \underbrace{\sum_{k=1}^K \overline{\varphi_k}\Delta\mathbb{E}[D_k - D_k^r]}_{\substack{\text{due to difference} \\ \text{in non-wage} \\ \text{dimensions}}} + \underbrace{\sum_{k=1}^K \Delta\varphi_k \overline{\mathbb{E}[D_k - D_k^r]}}_{\substack{\text{due to difference} \\ \text{in preferences}}}. \tag{8}$$

Decomposition (8) is simple and intuitive. The inter-group gap in the average log-equivalent wage is decomposed in the simplest way – additively – into three components. One

[11] For details on the Shapley value approach to decomposition, see, for example, Shorrocks (2011). This approach is frequently used in the context of Oaxaca-Blinder decomposition of wage gaps into the so-called "explained" and "unexplained" parts.

component is attributable to the difference in average log-wage, which is commonly estimated and decomposed in the vast literature on the wage gaps for various inter-group comparisons (men vs. women, public vs. private sector, natives vs. immigrants, etc.).[12] The other two components in decomposition (8) are due to, respectively, the inter-group differences in preferences and in the average shortfalls of non-wage job dimensions from the most preferred levels. For ease of exposition, let us from now on use the term "gap in preferences" for the former component, and the term "gap in non-wage dimensions" for the latter component. It seems natural to have the equivalent wage gap decomposed into these three components, given that the equivalent wage is a function of wage, non-wage job dimensions, and preferences over jobs characterised by these job dimensions, and given that the existence of inter-group differences in all these constitutive factors is intuitively conceivable.

Equation (8) can be applied to the whole EW distribution, as in the above exposition, or to some specific part of the distribution. In particular, one can investigate the EW gap along the distribution. Precisely, one can break down the EW distribution into a number of quantile groups, for example into the five quintile groups.[13] Then for each group the EW gap can be computed and decomposed using equation (8), which gives a distributional profile of the EW gap and its three components. Note that, provided the groups make a partition of the whole distribution, the EW gap and its components at the whole-distribution level are obtained by averaging the respective group-level items.

It should be noted also that the decomposition is applicable not only to comparison between groups A and B (say males and females, or groups formed according to any conceivable 'binary' characteristic), but also to other formally similar comparisons. For example, our interest may be to decompose the equivalent wage gap between two countries or regions within a country. Also, for a given country, or for whatever specific group within it, we may be interested in decomposing the change over some period.[14]

2.3. Estimation of the preference parameters

[12] In this literature, the wage gap is typically decomposed, using a version of the Oaxaca-Blinder decomposition (Blinder 1973; Oaxaca 1973) into two components, one arising due to inter-group differences in various worker's, job's, and employer's characteristics, and the other coming from differences in returns to these characteristics (i.e. how they are rewarded). Each of the two components can be further decomposed into detailed contributions, each pertaining to one of the characteristics from the set of characteristics. For a comprehensive overview, see Fortin et al. (2011).

[13] How fine the breakdown can be will depend on the sample size.

[14] In the latter case, the contribution of the preference gap to the equivalent wage gap will arguably depend on the length of the period considered, as any significant preference changes take time to develop.

In our derivation of the decomposition given by equation (8), we proceeded as if the preference-shaping parameters of the utility functions – namely β^g and γ_k^g for $k = 1, \ldots, K$ and $g = A, B$ – were known. In practice, however, these are unknown, and have to be estimated. Following Schokkaert et al. (2011) and Decancq et al. (2015), we obtain these parameters through an approach that, essentially, presupposes that one can learn about people's preferences by assessing how their satisfaction with their jobs is related to job dimensions (in our case W and D), both self-reported through answers to questions in surveys.

Job satisfaction is commonly measured through questions such as *How satisfied are you with your current work?*, where respondents answer by choosing an integer from a scale ranging from 1 (meaning *very dissatisfied*) to, say, 5 (meaning *very satisfied*).[15] Denote by $s^g(\cdot)$ the g-specific job satisfaction function, so that $s^g(W, D, X)$ is the level of job satisfaction that a g-person with X and a job (W, D) reports as the answer to the job satisfaction question in a survey. In essence, the job satisfaction approach to preference estimation relies on the untestable assumption that $s^g(\cdot)$ represents the g-specific preferences just as $u^g(\cdot)$ does.

As we know, for $u^g(\cdot)$ to represent the g-specific preferences, the following condition must hold: $u^g(W', D', \tilde{X}) \geq u^g(W'', D'', \tilde{X})$ if and only if each g-person with $X = \tilde{X}$ weakly prefers (W', D') to (W'', D''). Therefore, for $s^g(\cdot)$ to represent these same preferences as $u^g(\cdot)$, an analogous condition must hold: $s^g(W', D', \tilde{X}) \geq s^g(W'', D'', \tilde{X})$ if and only if each g-person with $X = \tilde{X}$ weakly prefers (W', D') to (W'', D''). Equivalently, $s^g(\cdot)$ represent the same preferences as $u^g(\cdot)$ if the former is one of all possible cardinalisations of the latter. The assumption that this is the case may or may not be valid, but unfortunately, as mentioned, its validity cannot be empirically tested.[16]

Under the assumption that $s^g(\cdot)$ represents the g-specific preferences as well as $u^g(\cdot)$ does, the job satisfaction approach proceeds by modelling job satisfaction as a function of job dimensions and other factors deemed to affect it, on which data is available in the survey at hand. Given that job satisfaction is an ordinal variable taking on a relatively few possible values, typically an ordered-response model is used, such as the ordered logit. Denoting by S_i^*

[15] This example is from the data used in this paper, namely the HEGESCO and REFLEX surveys of recent graduates. We present the data later on (see section 5).
[16] The validity of this assumption is discussed later on in the discussion section.

the latent job satisfaction of person i, we use a model of the latent job satisfaction of the following form:

$$S_i^* = s^g(W_i, D_i, X_i) = \beta^g \ln W_i + \sum_{k=1}^{K} \gamma_k^g D_{ki} + \sum_{\ell=1}^{L} \delta_\ell^g X_{\ell i} + \varepsilon_i. \quad (9)$$

where ε_i is an iid error term following the logistic distribution. The model is specified and estimated separately for $g = A, B$. The specification is partly dictated by the assumed functional form of the utility function in equation (2). The first two terms, which contain the preference-shaping parameters (β^g and γ_k^g for $k = 1, \dots, K$), are the same as in equation (2). The third and fourth terms come from our choice to specify the scaling term $h^g(X_i)$ as a simple linear index, $h^g(X_i) = \sum_{\ell=1}^{L} \delta_\ell^g X_{\ell i}$, although other reasonable specifications, including those that are non-linear in parameters, are possible.[17]

If, as assumed above, $s^g(\cdot)$ represents the g-specific preferences just as well as $u^g(\cdot)$ does, combining (1) and (9) gives an expression for the equivalent wage akin to (3), with the only difference that instead of $\varphi_k^g = \beta^g / \gamma_k^k$ we have $\hat{\varphi}_k^g = \hat{\beta}^g / \hat{\gamma}_k^k$, based the estimates of the job satisfaction model. With the preferences estimated and the equivalent wages computed, performing the decomposition based on equation (8) is a straightforward exercise.

3. Discussion

Having presented the above framework for analysing the inter-group gap in job quality, here we discuss a number of issues related to it. These relate to the equivalent wage as a concept and its building blocks, to particular technical and normative assumptions made – some explicitly, some implicitly – in deriving the equivalent wage gap decomposition, and to the approach used for preference estimation.

3.1. Reference levels of non-wage dimensions

As can be seen from equations (1) and (3), as well as in figure 1, equivalent wage depends on the choice of reference levels of non-wage dimensions, D^r. For example, in figure 1, if we chose $(D^r)'$ instead of D^r as the reference level for autonomy, j's equivalent income would be larger than i's, and the ranking between them would be reversed. This naturally

[17] Here we presented our model of the latent job satisfaction only in terms of the functional form. We do not mention here exactly which non-wage dimensions we use and how these are defined, nor do we say exactly which scaling factors we use. This is deferred to the empirical illustration in section 4.

gives rise to the question of exactly which reference levels should be chosen. From a purely formal perspective, the choice of reference levels is arbitrary, and thus technically any would do. However, from a normative perspective, not all choices are equally appealing, and normative reasons can be provided to support particular choice. By providing such reasons, one makes a particular choice non-arbitrary, at least normatively.

The reference levels that we have chosen correspond to the levels that are most preferred. The normative reasoning behind this choice is as follows (e.g., Fleurbaey 2005; Schokkaaert et al. 2011; Decancq et al. 2015). Suppose again that we chose $(D^r)'$ instead of D^r, resulting in j's equivalent income being larger than i's, opposite to the situation with D^r. Now, given that j's preferences are such that he values autonomy more than i does, it could be argued that j's suffering from having less than perfect autonomy $(D^r)'$ is higher that i's, and that j's higher income cannot compensate for that. This type of argument applies to any reference level of autonomy short of the perfect level. However, if the reference were set at the perfect level, the argument would lose its normative appeal. This is because when i and j both have the perfect autonomy, it seems natural to compare their situations by comparing their wages.

We stress that, although we assumed the same reference levels for all persons and dimensions, this assumption can be relaxed. For example, for some persons, or groups, or some non-wage dimensions, an imperfect level may be as good as the perfect one. In such cases, the normative reasoning above works for reference levels below the maximal ones. We did not opt for these person- or group- or dimension-specific reference levels because we did not find plausible arguments to do so.

3.2. The nature of preferences

Preferences that we talk about do not pertain to the overall life of persons holding them, but rather to a specific domain of their lives, namely work life. In other words, their jobs are not the only thing they care in their lives. Rather, they presumably care about other things, relevant to other life domains, such as the quality of personal relationships or the health conditions. That said, one can think of the preferences over jobs as 'sub-preferences' of what might be called 'overall life preferences'. Analogously, one can think of the utility function $u^g(\cdot)$ as a 'sub-utility' pertaining to the work domain of one's life, which is only a part of an overall utility pertaining to all life domains.

Moreover, the concept of preferences used here should not necessarily be understood as preferences that guide one's choice behaviour. That is, the jobs people hold should not

necessarily be considered as being chosen in choice situations where these jobs were preferred to other available jobs. This is not only because one's job today may have changed in terms of job dimensions since one started with it, but also because, as empirical findings from behavioural economics show, there may be certain inconsistencies in choice behaviour, due to which people do not always do what is good or best for them.[18] Drawing on this evidence, some question that people do have well-defined preferences guiding choices (Bernheim 2009).

Following Fleurbaey (2008), we think of preferences not as guiding choice behaviour, but rather as authentic, deep attitudes reflecting one's ideas about what, for that person, makes a job of high quality. When people are assumed to hold such preferences, it is not inconsistent, for example, that a person considers his job (W, D) to be worse than another job (W', D'), although he has chosen the former when the latter was also available.

We also assume that preferences are well-behaved – complete and transitive. However, although people may have ideas about what, for them, is a good job, these ideas do not necessarily meet the requirements of well-defined preferences. For example, preferences may be incomplete: people may not be able to compare their current job to a job characterised by very different levels of job dimensions. Fleurbaey and Schokkaert (2013) showed that the concept of equivalent income can be extended to such cases as well.

It is not our aim to deal in any way with the normative question as to whether the gender gap in job quality is justified or not, or what part of it may be considered (un)justified. In line with that, we do not address one question that should be addressed if one wants to touch upon this normative issue, namely the question of whether people should be held responsible for their preferences. It would require a discussion of factors that shape preferences, in our case group-specific,[19] and whether these factors are under one's control or not.[20]

3.3. Preference heterogeneity

As conceptualised by Fleurbaey (2005), Decancq et al. (2015a; 2015b), and in an application to job quality measurement, by Schokkaert et al. (2011), equivalent wage respects *individual* preferences: the preference relation and the utility function are allowed to be

[18] This should not be confused with unselfish (other-regarding, altruistic) behaviour.
[19] Gender-specific in our empirical application.
[20] Mahler and Ramos (2018) are to our knowledge the only authors using equivalent income as a wellbeing measure who attempted that.

individual-specific. In the present paper, we allow for *group*-specific, rather than individual-specific preferences, and thus potential heterogeneity is more limited. In fact, in empirical applications of equivalent income where the satisfaction approach is used for preference estimation (e.g., Schokkaert et al. 2011; Decancq et al. 2015a), it is practically impossible to estimate individual-specific preferences, but only preferences specific to certain socio-demographic groups. However, this still amounts to allowing for more potential heterogeneity than in our case, since we allow preferences to differ only between the two groups being compared. Similar to our choice, Decancq et al. (forthcoming) allow for preference heterogeneity just with respect to the binary characteristic of having rural vs. urban residence.

Our choice to allow for inter-group preference heterogeneity only is motivated by our aim to derive a simple decomposition of the equivalent wage gap. To see how intra-group heterogeneity would result in a decomposition that is not as straightforward as that in equation (8), suppose that instead of the g-specific utility function given by (2), we have the following individual-specific utility function:

$$u(W, D, X) = \beta(Z) \ln W + \sum_{k=1}^{K} \gamma_k(Z)\, D_k + h(X), \tag{10}$$

where $\beta(Z) = \beta^0 + \sum_{s=1}^{S} \beta^s Z_s$ and $\gamma_k(Z) = \gamma_k^0 + \sum_{s=1}^{S} \gamma_k^s Z_s$. The beta and gammas are not fixed within group g any longer, but rather dependent on a set of individual characteristics $Z = (Z_1, \dots, Z_S)$ that are deemed to shape individual preferences.

Given (10), and denoting $\varphi_k(Z) = (\gamma_k^0 + \sum_{s=1}^{S} \gamma_k^s Z_s)/(\beta^0 + \sum_{s=1}^{S} \beta^s Z_s)$, equation (5) turns into

$$\begin{aligned}
\Delta\mathbb{E}[\ln W^*] &= \Delta\mathbb{E}[\ln W] + \Delta\mathbb{E}[\textstyle\sum_{k=1}^{K} \varphi_k(Z)(D_k - D_k^r)] \\
&= \Delta\mathbb{E}[\ln W] + \textstyle\sum_{k=1}^{K} \Delta\mathbb{E}[\varphi_k(Z)(D_k - D_k^r)] \\
&= \Delta\mathbb{E}[\ln W] + \textstyle\sum_{k=1}^{K} \Delta(\mathbb{E}[\varphi_k(Z)]\mathbb{E}[D_k - D_k^r] + \mathrm{Cov}[\varphi_k(Z), D_k - D_k^r]) \\
&= \Delta\mathbb{E}[\ln W] + \textstyle\sum_{k=1}^{K} \Delta(\mathbb{E}[\varphi_k(Z)]\mathbb{E}[D_k - D_k^r]) + \sum_{k=1}^{K} \Delta\mathrm{Cov}[\varphi_k(Z), D_k].
\end{aligned} \tag{11}$$

The first term in the last line, the wage gap, is the same as in (5). The second term is different from the second term in (5), and cannot be straightforwardly decomposed into the respective contributions of inter-group differences in preferences and non-wage dimensions. This is due to the presence of the covariance terms in (11), reflecting inter-group differences in covariation between preferences and non-wage dimensions. If preferences and non-wage

dimensions were independent of one another, and if that were true for all non-wage dimensions, the covariance terms would disappear. The resulting decomposition would be analogous to (5), from which we can obtain a decomposition analogous to (8).

Whether allowing for inter-group preference heterogeneity only is too much of a simplification, relative to allowing for intra-group heterogeneity as well, is to be decided, or empirically examined, in each case. It may be an over-simplification in some cases, while in other cases it may be a reasonable simplification, worth making for the sake of interpretive simplicity.

3.4. Functional form for the utility function

In order to solve equation (1) explicitly for equivalent wage, we had to assume the functional form for the utility function $u^g(\cdot)$. We have chosen a simple specification linear in parameters; see equation (2). However, this functional form may not be flexible enough to capture well the shape of the underlying preferences. The question is whether a more flexible function of W and D would be more appropriate.

Our choice is driven by practical considerations. The functional form that we have chosen leads exactly to the simple and intuitive decomposition given by equation (8). It is possible to derive a decomposition for a more flexible utility function, but the resulting decomposition loses the simplicity of decomposition (8). To see that, suppose we have chosen the reasonably flexible functional form

$$u^g(W, D, X) = \beta^g W(\lambda_W) + \sum_{k=1}^{K} \gamma_k^g D_k(\lambda_k) + h^g(X), \tag{12}$$

where $x(\lambda) = (x^\lambda - 1)/\lambda$ for $\lambda \neq 0$ and $x(\lambda) = \ln x$ for $\lambda = 0$. This transformation, known as the Box-Cox transformation (Box and Cox 1974), allows for different degrees of concavity of the utility function with respect to job dimensions, captured by the lambda parameters, with a higher lambda being associated with more concave relationship. Note that the functional form (2) is a special case of (12), obtained for $\lambda_W = 0$ and $\lambda_1 = \cdots = \lambda_K = 1$. This utility function leads to the following expression for equivalent wage:

$$W^* = \left[W(\lambda_W) \times \exp\left(\sum_{k=1}^{K} \varphi_k^g (D_k(\lambda_k) - D_k^r(\lambda_k))\right)\right]^{\frac{1}{\lambda_W}},$$

and by some algebra one can show that

$$\Delta\mathbb{E}[\ln W^*] = \underbrace{\frac{1}{\lambda_W}\Delta\mathbb{E}[\ln W(\lambda_W)]}_{\substack{\text{due to difference}\\ \text{in wages}}} + \underbrace{\frac{1}{\lambda_W}\sum_{k=1}^{K}\overline{\varphi_k}\Delta\mathbb{E}[D_k(\lambda_k) - D_k^r(\lambda_k)]}_{\substack{\text{due to difference}\\ \text{in non-wage dimensions}}}$$
$$+ \underbrace{\frac{1}{\lambda_W}\sum_{k=1}^{K}\Delta\varphi_k\overline{\mathbb{E}[D_k(\lambda_k) - D_k^r(\lambda_k)]}}_{\substack{\text{due to difference}\\ \text{in preferences}}}. \quad (14)$$

Just like in decomposition (8), in (14) the equivalent wage gap is decomposed into three components, attributable to the inter-group differences in, respectively, wages, non-wage dimensions, and preferences. Although (14) is not an overly complicated expression, it nevertheless lacks the simplicity and straightforwardness of interpretation that characterise (8), unless $\lambda_W = 0$ and $\lambda_1 = \cdots = \lambda_K = 1$.

It should be noted that the simple functional form that we have chosen is in accordance with the standard specification of job satisfaction and life satisfaction in the vast empirical literature studying how various job dimensions and life dimensions, respectively, affect them. In particular, in these specifications income/wage commonly enters as logarithm, and there is evidence suggesting that this is indeed a good approximation (Layard et al. 2008). Non-income/wage job dimensions are standardly included in the model with no transformation.

3.5. Job satisfaction approach vs. other approaches to preference estimation

The job satisfaction approach rests on the assumption that the satisfaction function $s^g(\cdot)$ is as good a representation of preferences[21] as the utility function $u^g(\cdot)$, which is the case if the following condition holds: $s^g(W', D', \tilde{X}) \geq s^g(W'', D'', \tilde{X})$ if and only if each g-person with $X = \tilde{X}$ weakly prefers (W', D') to (W'', D'') (see section 2.3). Now, the question arises of whether this is really the case, given how information on job satisfaction is collected from individuals in surveys, and how it is modelled using other survey information.

In the context of overall wellbeing (quality of life), Decancq et al. (2015a, 2015b) discuss about what kind of survey question on life satisfaction is likely to elicit deep preferences from the respondents. They argue that the question on life satisfaction must be such that each respondent thinks about how good his life really is for him, taking into account the wage and non-wage dimensions of his job. In other words, the question must engage the

[21] Provided, of course, that such preferences exist (see section 3.2).

respondent in a cognitive task of evaluation, rather than to invite him to express his affects. Arguably, the same reasoning should as well apply to the survey question on job satisfaction (Schokkaert et al. 2011). Some examples of the job satisfaction question are:

- How satisfied are you today with the following areas of your life: your job?
- How satisfied are you with each of the following items: your present job?
- All things considered, how satisfied or dissatisfied are you with your present job overall?
- How satisfied are you with your current work?
- On the whole, are you very satisfied, satisfied, not very satisfied or not at all satisfied with working conditions in your main paid job?[22]

It is difficult to say whether these questions really engage respondents in expressing cognitive evaluations rather than affective states. Perhaps they capture both cognitions and affects, though not to the same extent. Unfortunately, this cannot be empirically tested, and thus the judgement must rely on the researcher's interpretation. If anything, the questions above seem to elicit cognitions more than affects, as one can imagine that questions eliciting affects would be phrased in a different way, perhaps referring explicitly to some specific hedonic feelings.

Even if the job satisfaction question does indeed engage people to express evaluations rather than affects, this is not enough for the estimates preference parameters $(\beta^g, \gamma_1^g, \dots, \gamma_K^g)$ to be unbiased. There are many factors confounding the relationship between the job dimensions and the latent job satisfaction score that must be controlled for by including them in X in order to get unbiased estimates. The importance of controlling for X has already been made clear by stressing that comparisons of job satisfaction levels is in accordance with preferences only if comparisons are made for a given person (X fixed by construction if considered at a point in time) or for two persons identical in X (see sections 2.1 and 2.3). Thus the parameters of the job satisfaction function $(\beta^g, \gamma_1^g, \dots, \gamma_K^g)$ are identified only using the variation of wage and non-wage dimensions within the cells containing individuals with the same levels of the variables in X. Ideally, one would use individual panel data, so that only the within-person variation is used for identification. Without panel data, as in our case, one can only hope that the set of X variables is sufficiently rich to at least minimise the bias, if not eliminate it. Following Schokkaert et al. (2011) and Decancq et al. (2015a, 2015b), we

[22] From the first to the last, the questions are from, respectively, the German Socio-Economic Panel (GSOEP), the European Quality of Life Survey (EQLS), the British Household Panel Survey (BHPS), the International Survey for Higher Education Graduates (HEGESCO/REFLEX), and the European Working Conditions Survey (EWCS).

interpret X as a set of factors associated with one's aspirations and expectations, formed by comparing one's job to own job(s) in the past (if any), to the job(s) one aspires to have in the future, or to the jobs of other people with whom one usually compares oneself. There is, however, no particular guidance as to what to include in X, an thus one can only hope to capture what is relevant by including a sufficiently rich set of personal socio-demographic characteristics and employer characteristics.[23]

An alternative way to elicit preferences is to use in formation on stated preferences, as in contingent valuation, where people are asked directly how much money they would give up to obtain more of something they like.[24] In this way, the willingness-to-pay is elicited directly from the respondents, and the equivalent income is computed for each person simply by subtracting one's willingness-to-pay for perfect non-income dimensions from one's income (Fleurbaey et al. 2013; Samson et al. 2018). Preferences are obtained in a second step, by modelling the willingness-to-pay as a function of income, non-income dimensions, and individual socio-demographic characteristics. An issue with contingent valuations is that it is questionable whether people are able to give reliable answers to questions about hypothetical situations. Moreover, from a practical perspective, existing large scale surveys do not ask the type of questions posed in contingent valuation, so that new specific surveys must be done, a costly option likely infeasible to most researchers.

Yet another alternative is to rely on revealed preferences, using data on observed choices of jobs, as is done in the literature where structural labour supply models are estimated to obtain the parameters of preferences over combinations of consumption (disposable income) and leisure (for overviews, see Creedy and Kalb 2005, Aaberge and Colombino 2014). This approach to preference estimation for the purpose of construction of equivalent income/wage is used in a number of papers (Bargain et al. 2013; Decoster and Haan 2015; Akay et al. 2017a). Such models are explicitly formulated and interpreted as models of choice behaviour, the object of choice being jobs characterised as combinations of consumption (i.e. disposable income) and leisure. This interpretation may not be appropriate given how preferences are understood in this paper, namely not as guiding choice behaviour, but rather as deep preferences reflecting attitudes towards what makes a good job, as discussed in section 4.2. It may be even less appropriate if other job dimensions are

[23] See also other papers in the literature on equivalent income that use the life satisfaction approach to preference estimation: Petrillo (2018), Decancq et al. (2017, 2019, forthcoming), Decancq and Schokkaert (2016), Decancq and Neumann (2016), Defloor et al. (2016).
[24] Or what amount of money would they be willing to receive to give up an amount of something they like.

considered, such as, for example, autonomy at work, possibility to achieve work-life balance, or opportunity to learn new things. This is because these and similar job dimensions may not be fully observable to the agent at the time of deciding whether or not to take a job, although some models of labour supply – the so-called latent job choice models (e.g., Dagsvik et al. 2014) – these are assumed to be part of the job 'package' and observed to the agent (but not to the econometrician). Akay et al. (2017a, 2017b) have recently shown that the revealed preference approach and the life satisfaction approach yield similar preference estimates.

3.6. Aggregation at the group level

The individual EW, given by equation (3), is aggregated to the group level by taking the natural logarithm of (3) and averaging over all members of group g, as shown in equation (4). Thus the EW gap in equation (8) is given as the inter-group difference in the average logarithm of EW, rather than in the average EW. Similarly, the part of the EW gap due to the difference in wages, namely the wage gap, is given as the inter-group difference in the average logarithm of wage, rather than in the average wage, as is standard in the wage gap literature.

The average logarithm of an outcome (denoted y), here EW or wage, is a special case of Atkinson's (1970) social welfare function $\mathrm{SWF}_\epsilon[y] = \mathbb{E}[u(y;\epsilon)]$, $\epsilon \geq 0$, where $u(x;\epsilon) = y^{1-\epsilon}/(1-\epsilon)$ if $\epsilon \neq 1$, and $u(y;\epsilon) = \ln y$ if $\epsilon = 1$. The concavity of $u(y;\epsilon)$ varies with parameter ϵ, which measures the degree of inequality aversion, with higher values indicating higher aversion. A person's aversion towards inequality can be due simply to her dislike, for ethical reasons, of an outcome being unequally distributed, or alternatively due to a concern that she might find herself close to the bottom of the outcome distribution. In the latter case, inequality aversion can be interpreted as aversion towards outcome risk, due purely to selfish concerns.

The Atkinson SWF can also be written as $\mathrm{SWF}_\epsilon = \mathbb{E}[y](1 - I_\epsilon[y])$, where $0 \leq I_\epsilon \leq 1$ is the Atkinson inequality index. The latter is defined as $I_\epsilon[y] = 1 - \mathcal{E}_\epsilon[y]/\mathbb{E}[y]$, where $\mathcal{E}_\epsilon[y]$ is the equally distributed equivalent value of y, namely the amount that, if given to everyone, would yield the same value of the social welfare function SWF_ϵ as the actual distribution of y. SWF_ϵ is thus equal to the average income corrected downwards by the 'cost' of inequality ranging from zero in the case of perfect equality ($I_\epsilon[y] = 0$) to $\mathbb{E}[y]$ in the case of extreme inequality ($I_\epsilon[y] = 1$) when one person possesses the whole aggregate amount of y.

Therefore, in our case, where $\epsilon = 1$, the EW gap can be written as follows:

$$\begin{aligned}\Delta\mathbb{E}[\ln W^*] &= \mathbb{E}^A[\ln W^*] - \mathbb{E}^B[\ln W^*] \\ &= \mathrm{SWF}_1^A[W^*] - \mathrm{SWF}_1^A[W^*] \\ &= \mathbb{E}^A[W^*](1 - I_1^A[W^*]) - \mathbb{E}^B[W^*](1 - I_1^B[W^*]),\end{aligned} \tag{15}$$

which makes clear that the EW gap, expressed as the difference in average logarithm of EW, captures not only the difference in average EW, but also the difference in EW inequality/risk between groups A and B. According to (15), the EW gap can be to group A's advantage even if their average EW is lower than for group B; this is possible if the EW inequality is sufficiently lower in group A than in group B. This is not specific to $\epsilon = 1$, but holds for all positive[25] values of the inequality/risk aversion parameter. However, for any permissible $\epsilon \neq 1$ the decomposition of the EW gap becomes complicated, as $\Delta\mathbb{E}[(W^*)^{1-\epsilon}/(1-\epsilon)]$ is to be decomposed instead of $\Delta\mathbb{E}[\ln W^*]$.

4. Illustrative empirical application

In this section, we illustrate our framework through an empirical application. In the application, we consider the gender gap for recent graduates from 19 countries. We first describe the data we use, and provide some basic descriptive figures on wages and the non-wage dimensions that characterise jobs in our application. Then we describe the specification of the job satisfaction model and discuss the estimates. Lastly, we present the results, namely our estimates of the gender gaps in equivalent wage for the 19 countries, and decompose them according to equation (8).

4.1. Data

The data come from two sources, namely the projects REFLEX (Research into Employment and Professional Flexibility) and HEGESCO (Higher Education as a Generator of Strategic Competences). Within the projects, large scale surveys of recent university graduates (ISCED 5A type of programmes), who graduated five years before the survey, were

[25] Although $\epsilon = 0$ is permissible, note that in this case the social welfare function SWF_ϵ is just the aritmetic mean: $\mathrm{SWF}_0[y] = \mathbb{E}[y]$.

conducted in 19 countries: 14 within REFLEX in 2005, and five within HEGESCO in 2008.[26] The two are fully compatible, and intentionally so, to enable cross-country comparisons. The data were collected for the purpose of research into the competences of university graduates for participation in the knowledge society, and the role of universities in developing them.[27] Importantly for our application, among other questions, the surveys contain questions on job satisfaction, wage, multiple non-wage job dimensions, and numerous personal and employer characteristics (to be included in X in equation 10).

What we refer to as 'wage' is defined here as the monthly full-time equivalent of one's hourly wage. The hourly wage is first obtained by dividing the weekly wage by the typical weekly number of work hours. Then the hourly wage is multiplied by 40 hours/week and 4.3 weeks/month to get the monthly full-time equivalent of the hourly wage.

There are nine non-wage dimensions: (1) work autonomy; (2) job security; (3) opportunity to learn new things (hereafter: 'learn new things'); (4) new challenges; (5) good career prospects; (6) enough time for leisure activities (hereafter: 'time for leisure'); (7) social status; (8) chance of doing something useful for society (hereafter: 'useful for society'); (9) good chance to combine work with family tasks (hereafter: 'work and family'). No explanation is given alongside the survey question about the exact meaning of each of the nine dimensions, but their names seem suggestive enough of what they are meant to capture. It seems reasonable to assume that the respondents too found them suggestive enough. For each dimension, the respondent is asked to indicate how much it 'applies' to his or her 'work situation' (i.e. job), by choosing an integer from 1 ('not at all') to 5 ('to a very high extent').[28, 29] Despite the fact that this scale is an ordered categorical scale, for simplicity we will treat it as cardinal. Therefore, each non-dimension is used in econometric estimations (see section 5.2) not as a set of four indicator variables, but simply as a cardinal variable. We do that in

[26] REFLEX: Austria, Belgium, Czech Republic, Estonia, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Switzerland, United Kingdom. HEGESCO: Hungary, Lithuania, Poland, Slovenia, Turkey.

[27] For more details on HEGESCO, see www.hegesco.org. Unfortunately, the web site for REFLEX does not exist any longer, but sufficient information is provided on HEGESCO's web site, and on https://easy.dans.knaw.nl/ui/datasets/id/easy-dataset:34416/tab/1.

[28] The same question is asked for 'high earnings' as well, but it obviously is not a non-wage dimension, and thus we do not consider it.

[29] It is recommended (e.g., Muñoz de Bustillo et al. 2011; OECD 2017) that job dimensions capture objective features of the job as experienced by workers, rather than workers' subjective evaluations of these features. A worker's own assessments of the extent to which a job dimension 'applies' to his job is in a sense a subjective evaluation. However, what is exactly meant by subjective evaluation is the worker's assessment of how the level of a job dimension that he experiences on his job affects his subjective well-being – for example job satisfaction, or overall life satisfaction, or happiness. Judging by the wording of the questions on job dimensions in HEGESCO and REFLEX, it does not seem likely that respondents understood them as questions on the impact of job dimensions on their subjective well-being.

order to be able to draw indifference curves in the (W, D_k)-space, based on the estimates of preference parameters (see section 4.2).

The job satisfaction variable is based on the answers to the question 'How satisfied are you with your current work' on a 1–5 integer scale, where 1 and 5 stand for 'very dissatisfied' and 'very satisfied', respectively. Unlike the non-wage dimensions, it is treated as an ordinal categorical variable, and modelled appropriately later on (see section 4.2).

Finally, there is a rich set of personal socio-demographic characteristics and employer characteristics, included in the job satisfaction model as X's, variable meant to control for aspirations and expectations. Concerning the personal characteristics, we control for: age; education; whether one has a child; what is one's living arrangement; field of study; occupation; and country of residence. As for the employer characteristics, we control for: employer size; public vs. private sector; part- vs. full-time work; whether on-the-job training is provided; and industry. Unfortunately, we do not have information on how much respondents' colleagues are paid, and thus cannot control for relative income, a factor shown matter for one's job satisfaction (e.g., Clark and Oswald 1996; Zizzo and Oswald 2001; Brown et al. 2008). Precise descriptions and the summary statistics for all variables used in the empirical application are provided in table A1 in Appendix.

The sample we use for the estimation of preferences and for subsequent analysis is obtained from the original sample through a number of exclusions. We keep only persons in dependent employment, excluding thus the self-employed, the unemployed, and persons outside of the labour force. The self-employed are dropped because they presumably create their jobs catering to their preferences to a large extent, whereas this is not likely the case for persons employed by someone else. Among persons in dependent employment, only those outside military/defence are kept, as usual in much of labour market analyses. In order to homogenise the sample in the sense of excluding the most highly educated – those with a PhD degree – we exclude all persons who spent more than six years in higher education. The sample is homogenised further by restricting age to the interval 24–35 years. Moreover, to exclude people with long or short work hours, we keep only those working 18–50 hours a week. Finally, to prevent that the sparsity of data at the very top and bottom of the wage distribution affects the results, we drop those with wages per hour in the top or bottom one percent. In the end, we are left with 8,103 males and 11,444 females, which is 55 and 51 percent relative to the original sample.[30]

[30] The unweighted average across the 19 countries are 54 percent for males and 50 percent for females. The shares vary across countries from 26 to 72 percent for males, and from 28 to 68 percent for females.

4.2. Preference estimation

The preferences for males and females are obtained from their respective job satisfaction models. Due to the ordered nature of the job satisfaction variable, the models are specified as ordered logits. For both models, the latent job satisfaction is given by equation (9) for $g = M, F$. Both models (for males and females) are estimated on samples pooled across the 19 countries. Therefore, the estimated preference parameters are constant across countries, which practically amounts to assuming there are no cross-country differences in preferences of either males or females. Of course, this is a strong assumption, made here for practical reasons only, to avoid estimating the 38 country-and-gender-specific models.[31] We believe this is reasonable given the illustrative purpose of our empirical exercise.[32]

The parameter estimates are shown in table 2.[33] For both genders, the marginal satisfaction is positive for all job dimensions. Except for 'work and family', all the estimates are statistically significant, at least at the 5% level. The marginal satisfaction of wage is higher for males. The opposite holds for six out of nine non-wage dimensions: males' marginal satisfaction is higher than females' only for 'job security', 'learn new things', and 'career prospects'. The higher males' than females' marginal satisfactions of income, 'job security', and 'career prospects' might be due to males caring more about those job dimensions that relate closely to their role – current or expected – of the main breadwinner in the family. If so, it is interesting that preferences like these, which conform to the traditional views on the gender roles, are present even among university graduates as the most educated part of the society.

< TABLE 1 ABOUT HERE >

Since all non-wage dimensions are measured in the same units and on the same scale, we can compare the relative importance of each of them by comparing their marginal satisfactions. When it comes to ranking of the five least important non-wage dimensions, there is perfect 'agreement' between males' and females' preferences. For both genders,

[31] Or, alternatively, introducing in the model additional 180 parameters (10 job dimensions times 18 country dummies).
[32] In fact, there is no multi-country application so far that estimated preferences separately for each country for the purpose of equivalent income computation. See Decancq and Schokkaert (2016), Petrillo (2018), and Ledić and Rubil (2019).
[33] The summary statistics for all variables used in the estimation are provided in table A1 in Appendix.

'work and family' is the least important, followed by 'job security', 'time for leisure', and 'useful for society'. It should come as no surprise that 'work and family' is the least important, given that recent graduates are young and many of them still do not have spouses or children. This might also explain why 'job security' and 'time for leisure' are relatively little important too: having a secure job is arguably more important when one still has a long lifespan ahead, when there still are no expenditures associated with making a family, and when most people from one's social circle – likely comprising of people with similar level of education – with whom one spends the leisure time, are in quite similar circumstances. Male and female recent graduates do not, however, agree on the ranking among the most important non-wage dimensions. While males attach the highest importance to 'good career prospects', followed by 'learn new things', 'new challenges', and 'work autonomy', for females 'learn new things' is the most important, followed by 'new challenges', 'work autonomy', and 'good career prospects'. In general, the groups of most and least important non-wage dimensions are as expected from highly educated young people.

In figure 2 we display the maps of indifference curves implied by the estimates of preference parameters from table 1. The steeper the curves, the lower the importance attached to the considered non-wage dimension compared to other dimensions. For example, we can clearly see that for both genders 'work and family' is much less important than 'good career prospects'. We can also see that 'work autonomy' is notably more important to females, while both genders attach similar importance to 'social status' or 'time for leisure'.

< FIGURE 2 ABOUT HERE >

Besides the relative importance of each non-wage dimension relative to others for a given gender, and across gender for a given dimension, we also take a look at each dimension's quantitative importance. In figure 3, we plot, by non-wage dimension and gender, the ratio γ_k^g/β^g. This ratio measures the willingness-to-pay (WTP) of a person of gender g for an improvement on non-wage dimension k by one, where the WTP is expressed as a share of her wage. According to our estimates, males and females would pay as little as 5 and 9 percent of their wages, respectively, for a one-unit improvement in 'work and family' as the least valued non-wage dimension. On the other hand, both genders would give up as much as 62 percent of their wages for the same improvement in their most valued dimensions ('learn new things' and 'good career prospects' for males; 'learn new things' for females).

< FIGURE 3 ABOUT HERE >

4.3. The equivalent wage, the gender gap, and its decomposition

Having estimated the preference parameters, we compute each individual's EW using formula (3). Recall that a person's EW is lower than her wage unless her achievements on all non-income dimensions are perfect. Figure 4 plots, across countries, the average EW for males and females, expressed as a percentage share of their respective average wages. The average EW is nowhere higher than a third of the average wage – neither for males, nor for females. On average across countries, the average EW relative to the average wage equals about 26 percent for males (range: 18–32 percent), and about 24 percent for females (range: 16–32 percent). There is of course a positive correlation between EW and wage, but it is not quite high. Considering the rank correlation at the individual level, the cross-country average of the Spearman coefficient is 0.37 for males (range: 0.26–0.48) and 0.34 for females (range: 0.23–0.45). This shows that non-wage dimensions are indeed very important for job quality.[34]

< FIGURE 4 ABOUT HERE >

The gender EW gaps, along with the corresponding wage gaps, across countries are shown in figure 5. Both gaps are expressed as the difference between the average logarithm for males and that for females. Recall from section 4.6 that the gap, when expressed this way, is not due only to the gender difference in the average value of the variable considered, but also due to the difference in the inequality level (as measured by the Atkinson index $I(\epsilon)$ for $\epsilon = 1$).

< FIGURE 5 ABOUT HERE >

The wage gap varies from practically zero in Turkey and less than 0.10 log-points in the Netherlands and the UK, to more than 0.25 log-point in Estonia, Hungary, and Lithuania, with a cross-country average of 0.17 log-points. The EW gap is larger than the wage gap in all

[34] EW income is also substantially more unequally distributed than wage income, as measured by any commonly used inequality measure, such as the Gini coefficient or the Atkinson index. The estimates are not reported here, but are available on demand. In the context of overall well-being, Decancq and Schokkaert (2016), Petrillo (2018), Decancq et al. (2017), and Ledić and Rubil (2019) found that equivalent income inequality is much higher than income inequality. For further analysis, see Decancq et al. (2017), who explored the role of preference heterogeneity for equivalent income inequality, and Ledić and Rubil (2019), who proposed a decomposition of the difference between equivalent income inequality and income inequality.

but one country, Estonia. Excluding Estonia, where the ratio of the EW gap to the wage gap is 0.4, the ratio goes from 1.2 in the UK to as much as 4.1 in Belgium, the average being 2.1.[35] Thus, in virtually all countries considered, turning from the wage gap to the EW gap reveals that women lag behind men not only in terms of wages, but also in terms of job quality as a broader concept. The comparison of these two gaps suggests that in most of the countries the gender gap in non-wage dimensions or in preferences – or both – are favourable to males on average.

By applying the decomposition that we proposed in section 2, we are able to tell how much of the observed excess of the EW gap above the wage gap can be attributed to the gender gaps in non-wage dimensions, and how much to the gender differences in preferences over jobs. Figure 6 displays the decomposition results. With only a few exceptions, all three components contribute significantly to the EW gap. The wage gap is the largest component in eight countries. The gap in preferences is everywhere to males' advantage, and in some cases it is notably the largest component (Turkey, Spain, Czech Republic). The gap in non-wage dimensions vary in sign, being negative – i.e. favouring women – in six countries. This component is especially large for countries with the largest and smallest EW gaps. For example, the EW gaps in the UK and Estonia are comparably small due mainly to women's advantage in terms of non-wage dimensions. Indeed, the EW gap is strongly correlated with the gap in non-wage dimensions (corr. = 0.89), while the correlation with the wage gap is notably weaker (corr. = 0.54). Still weaker, and negative, is the correlation with the gap in preferences (corr. = –0.14), a result arising from the fact that this component is rather stable across countries, which in turn is due to the invariance of preferences across countries.[36]

< FIGURE 6 ABOUT HERE >

The gap in non-wage dimensions in figure 6 is an aggregate component composed of nine subcomponents pertaining to the nine non-wage dimensions; and so too is the gap in preferences. Panels A and B of figure 7 display the results of detailed decompositions of, respectively, the gap in non-wage dimensions and the gap in preferences. On panel C, we have what we can call a 'net' detailed decomposition, obtained by adding up the

[35] Turkey is also excluded, for its wage gap is negative, but practically equals zero.
[36] Recall that we allow for preference heterogeneity with respect to gender only: the g-specific preferences apply to all persons of gender g, irrespectively of the country they come from. See section 4.2.

corresponding components from the top and middle panels. A component on panel C pertaining to a particular non-wage dimension is a 'net' component in that the corresponding component from the top and middle panels can either operate in the same direction or in opposite directions, offsetting each other to some extent in the latter case. Thus, for a particular non-wage dimension, we can think of the 'net' component pertaining to it as the overall impact of that dimension on the EW gap.

< FIGURE 7 ABOUT HERE >

It is instructive to begin with the dimension 'good career prospects' to show how both the gap in achievement on a particular dimension and the gap in preferences toward that dimension are important for the overall impact on the EW gap. We see on panel A that the contribution of 'good career prospects' to the EW gap is positive in all countries, indicating that everywhere males have a higher average achievement with respect to that dimension. Except in a few countries, this component of the aggregate gap in non-wage dimensions is substantial, being the largest one in some countries. However, turning to the contribution of 'good career prospects' to the aggregate gap in preferences on panel B, we see it is negative – i.e., to women's advantage – in all countries. This reflects what we have already seen from the estimates of preference parameters, namely that having more of 'good career prospects' is more valuable to men than to women. One might wonder at this point how is it possible that higher valuation of this dimension by men compared to women operates in the direction of reducing the EW gap. This is simply because preferences are such that women suffer less than men from falling short of the perfect achievement on 'good career prospects' by a given amount. Finally, turning to the 'net' contribution of this dimension, shown on the bottom panel, we find that it is negative in all but two countries, a result of the negative contribution arising from the gap in preferences being larger than the positive contribution arising from the difference in average achievement. Note that also for the dimension 'useful for society' the two types of contributions are oppositely signed, but unlike in the case of 'good career prospects', the contribution to the gap in preferences does not dominate the contribution to the gap in non-income dimensions for in all countries. For the remaining non-wage dimensions, we mainly have that both types of contributions contribute the EW gap in the same direction. One exception is the dimension 'learn new things', whose contribution to the aggregate gap in non-wage dimensions varies in sign across countries.

In general, considering the 'net' contributions on panel C, the contributions to the WE gap of 'work autonomy', 'new challenges', 'social status', and 'work and family' are positive; 'good career prospects' and 'job security' contribute negatively; and for the remaining dimensions the sign of their contribution varies from country to country.

In the end, we give the results of decompositions at different parts along the EW distribution. In figure 8, we show the results for the quintile groups. A couple of things stand out. First, the positive (i.e., to males' advantage) EW gaps that we found above (see figures 5 and 6) arise from positive gaps along the whole EW distribution. With only two exceptions – the bottom quintile in the UK and Estonia – the EW gap is always positive. Second, concerning the components of the EW gap, their signs from figure 6 hold along the whole distribution, with very few exceptions. Third, the EW gap tends to be larger than the wage gap at all parts of the distribution, with rare exceptions pertaining mostly to the top quintile group. Fourth, while the wage gap is relatively stable across the quintile groups, the EW gap is in most cases notably larger at lower than at higher parts of the distribution. Thus the predominantly downward-sloping EW gap curves in figure 8 are mostly shaped by the curves representing the contributions of the gap in non-wage dimensions and the gap in preferences.

< FIGURE 8 ABOUT HERE >

6. Summary and conclusion

Once we acknowledge that wages people earn by doing their jobs is only one dimension of a broader concept of job quality, an extension of the commonly done analysis of inter-group wage gap to the analysis of inter-group job quality gap comes as a reasonable analytical step forward. In this paper we propose a framework for such analyses.

Within the framework, individual job quality is measured by equivalent wage, a multidimensional well-being measure where the weights attached to the multiple job dimensions comprising it are in line with one's preferences understood as ideas about what makes a good job. This allows us to decompose the inter-group equivalent wage gap into three constitutive elements, namely the wage gap, the gap in non-wage job dimensions, and the gap in preferences. The latter two gaps are further decomposed into the contributions pertaining to each of the non-wage dimensions.

The decomposition framework can be applied to the analysis of the gap in job quality between any two groups of interest, and we illustrate its empirical application by analysing

the gender gap using data for recent higher education graduates from 19 countries. The respective male- and female-specific preferences are estimated using the life satisfaction approach, and stand to reason. Our results show that, across the countries considered, both the wage gap and the equivalent wage gap are to men's advantage. With rare exceptions, the equivalent wage gap is substantially larger than the wage gap, a result of both the gap in non-wage dimensions and the gap in preferences being, on average, to men's advantage, again with only a few exceptions.

We believe that the decomposition framework recommends itself as a useful tool for the analysis of inter-group job quality gaps. It is useful, however, only insofar as one finds the following statements reasonable. First, job dimensions other than wage are important constituents of one's job quality, and thus job quality analyses should consider non-wage dimensions as well. Second, having recognised that job quality is multidimensional, the question arises of how exactly to combine the multiple dimensions into a job quality index at the individual level, and in doing so one should respect people's preferences as to what makes a good job. Third, people do have preferences over jobs as combinations of job dimensions, and these preferences are possible to approximate, if not fully elicit, by the life satisfaction approach or otherwise. There are also a number of additional assumptions, normative or technical, but compared to the three stated above, these appear to be of second order importance, as one can relax them to an extent. Relaxing some of these, however, comes at a certain cost, for example at the cost of interpretive simplicity if we allow for intra-group preference heterogeneity.

The comparison between non-overlapping social groups is but one possible setting in which our decomposition framework can be applied. It can be applied in any other formally identical settings, such as: the comparison of two countries or regions within a country, or the comparison of two points in time for a given group, country, or region. Also, since equivalent wage is formally equivalent to equivalent income as a measure of overall well-being, the decomposition framework can straightforwardly be used for analyses of overall well-being comparisons as well.

References

Akay, A., O. Bargain, and H. X. Jara (2017a), "'Fair' welfare comparisons with heterogeneous tastes: subjective versus revealed preferences", IZA DP No. 10908.

Akay, A., O. Bargain, H. X. Jara HX (2017b), "Back to Bentham, should we? Large-scale comparison of experienced versus decision utility", IZA DP No. 10907.

Aldashev, A., J. Gernardt, and S. L. Thomsen (2012), "The immigrant-native wage gap in Germany", *Jahrbücher für Nationalökonomie und Statistik (Journal of Economics and Statistics)*, 232, 490–517.

Bakker, A. B., and E. Demerouti (2007), "The job demands-resources model: state of the art", Journal of Managerial Psychology, 22, 309−328.

Bargain, O., A. Decoster, M. Dolls, D. Neumann, A. Peichl, and S. Siegloch (2013), "Welfare, labor supply and heterogeneous preferences: evidence for Europe and the US", *Social Choice and Welfare*, 41, 789–817.

Bauer, R. A. (ed.) (1966), *Social Indicators*, MIT Press, Cambridge, MA.

Blau, F. D., and L. M. Kahn (2017), "The gender wage gap: extent, trends, and explanations", Journal of Economic Literature, 55, 789−865.

Bonhomme, S., and J. M. Jolivet (2009), "The pervasive absence of compensating wage differentials", *Journal of Applied Econometrics*, 24, 763−795.

Brown, D. A., J. Gardner, A. J. Oswald, and J. Quian (2008), "Does wage rank affect employees' well-being?", *Industrial Relations*, 47, 355–389.

Brunner, E. J., M. Kivimäki, J. Siegrist, T. Theorell, R. Luukkonen, H. Riihimäki, J. Vahtera, J. Kirjonen, and P. Leino-Arjas (2004), "Is the effect of work stress on cardiovascular mortality confounded by socioeconomic factors in the Valmet study?", *Journal of Epidemiology and Community Health*, 58, 1019−1020.

Christofides, L. N., and M. Michael (2013), "Exploring the public-private sector wage gap in European countries", *IZA Journal of European Labor Studies*, 2, 1–53.

Clark, A. E., and A. J. Oswald (1996), "Satisfaction and comparison income", *Journal of Public Economics*, 61, 359–381.

Decancq, K., and D. Neumann (2016). "Does the choice of well-being measure matter empirically?", in Adler, M., and M. Fleurbaey (eds.), *Oxford Handbook of Well-being and Public Policy*, Oxford University Press, Oxford.

Decancq, K., and E. Schokkaert (2016), "Beyond GDP: using equivalent incomes to measure well-being in Europe", *Social Indicators Research*, 126, 21–55.

Decancq, K., and M. A. Lugo (2013), "Weights in multidimensional indices of wellbeing: an overview", *Econometric Reviews*, 32, 7–34.

Decancq, K., E. Schokkaert, and B. Zuluaga (forthcoming) "Implementing the capability approach with respect for individual valuations: an illustration with Colombian data", in Chiappero-Martinetti, E., S. Osmani, and M. Qizilbash (eds.), *Handbook of the Capability Approach*, Cambridge University Press, Cambridge.

Decancq, K., M. Fleurbaey, and E. Schokkaert (2015a), "Happiness, equivalent income and respect for individual preferences", *Economica*, 82, 1082–1106.

Decancq, K., M. Fleurbaey, and E. Schokkaert (2015b), "Inequality, income, and well-being", in Atkinson, A. B., and F. Bourguignon (eds.), Handbook of Income Distribution, Vol. 2A, Elsevier, New York.

Decancq, K., M. Fleurbaey, and E. Schokkaert (2017), "Well-being inequality and preference heterogeneity", *Economica,* 84, 210−238.

Decancq, K., M. Fleurbaey, and F. Maniquet (2019), "Multidimensional poverty measurement with individual preferences", *Journal of Economic Inequality*, 17, 29−49.

Decoster, A., and P. Haan (2015), "Empirical welfare analysis with preference heterogeneity", *International Tax and Public Finance*, 22, 224–251.

Defloor, B., E. Verhofstadt, and L. Van Ootegem (2016). "The influence of preference information on equivalent income", *Social Indicators Research*, 131, 489–507.

Dieckhoff, M. (2013), "Continuing training in times of economic crisis", in Gallie, D. (ed.), *Economic Crisis, Quality of Work and Social Integration: The European Experience*, Oxford University Press, Oxford.

Fernandez, R. M., and C. J. Nordman (2009), "Are there pecuniary compensations for working conditions?", *Labour Economics*, 16, 194−207.
Fleurbaey, M. (2005), "Health, wealth, and fairness", *Journal of Public Economic Theory*, 7, 253−284.
Fleurbaey, M. (2015), "Beyond income and wealth", *Review of Income and Wealth*, 61, 199–219.
Fleurbaey, M., S. Luchini, C. Muller, and E. Schokkaert (2013), "Equivalent income and fair evaluation of health care," *Health Economics*, 22, 711–729.
Gallie, D., and Y. Zhou (2013), "Job control, work intensity and work stress", in Gallie, D. (ed.), *Economic Crisis, Quality of Work and Social Integration: The European Experience*, Oxford University Press, Oxford.
Green, F. (2009), "Subjective employment security around the world", *Cambridge Journal of Regions, Economy and Society*, 3, 343−363.
Green, F., T. Mostafa, and A. Parent-Thirion (2013), "Is job quality becoming more unequal?", Industrual and Labor Relation Review, 66, 753−784.
Hakenen, J., W. B. Schaufeli, and K. Ahola (2008), "The job demands-resources model: a three-year cross-lagged study of burnout, depression, commitment, and work engagement", *Work and Stress*, 22, 224−241.
Hunt, P. (2012), "From the bottom to the top: a more complete picture of the immigrant-native wage gap in Britain", *IZA Journal of Migration*, 1, 1–18.
Jürges, H. (2002), "The distribution of the German public-private wage gap", *LABOUR*, 16, 347–381.
Karasek, R., and T. Theorell (1990), *Healthy Work: Stress, Productivity and the Reconstruction of Work Life*, Basic Books, New York.
Kivimäki, M., et al. (2012), "Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data", *Lancet*, 380, 1491–1497.
Kivimäki, M., P. Leino-Arjas, R. Luukkonen, H. Riihimäki, J. Vahtera, and J. Kirjonen (2002), "Work stress and risk of cardiovascular mortality: prospective cohort study of industrial employees", *British Medical Journal*, 325, 1−5.
Kuper, H., A. Singh-Manoux, J. Siegrist, and M. Marmot (2002), "When reciprocity fails: effort-reward imbalance in relation to coronary heart disease and health functioning within the Whitehall II study", *Occupational and Environmental Medicine*, 59, 777−784.
Layard, R., G. Mayraz, and S. Nickell (2008), "The marginal utility of income." *Journal of Public Economics*, 92, 1846–1857.
Lucifora, C., and D. Meurs (2006), "The public sector pay gap in France, Great Britain and Italy", *Review of Income and Wealth*, 52, 43–59.
Muñoz de Busillo, R., E. Fernández-Macias, and J.-I. Antón (2011b), *Measuring More than Money: The Social Economics of Job Quality*, Edward Elgar, Cheltenham.
Muñoz de Busillo, R., E. Fernández-Macias, F- Esteve, and J.-I. Antón (2011a), "E pluribus unum? A critical survey of job quality indicators", *Socio-Economic Review*, 9, 447−475.
OECD (2011), *How's Life? Measuring Well-being*, Organisation for Economic Co-operation and Development (OECD), Paris.
OECD (2017), *OECD Guidelines on Measuring the Quality of the Working Environment*, Organisation for Economic Co-operation and Development, Paris.
Ose, S. O. (2005), "Working conditions, compensation and absenteeism", *Journal of Health Economics*, 24, 161−188.
Petrillo, I. (2018), "Computation of equivalent incomes and social welfare for EU and non-EU countries", *CESifo Economic Studies*, 64, 396–425.
Purse, K. (2004), "Work-related fatality risks and neoclassical compensating wage differentials", *Cambridge Journal of Economics*, 28, 594−617.
Rosen, S. (1986), "The theory of equalizing differentials", in Aschenfelter, O., and R. Layard (eds.), *Handbook of Labor Economics*, Vol. 1, Elsevier, Amsterdam, pp. 641−692.
Rugulier, R., B. Aust, and I. E. Madsen (2016), "Effort-reward imbalance", in Siegrist, J., and M. Wahrendorf (eds.), *Work Stress and Health in a Globalized Economy: The Model of Effort-Reward Imbalance*, Springer, Dodrecht.

Samson, A.-L., E. Schokkaert, C. Thébaut, B. Dormont, M. Fleurbaey, S. Luchini, and C. Van de Voorde (2018), "Fairness in cost-benefit analysis: a methodology for health technology assessment", *Health Economics*, 27, 102−114.

Samuelson, P., and S. Swamy (1974), "Invariant economic index numbers and canonical duality: survey and synthesis", *American Economic Review*, 64, 566–593.

Schaufeli, W. B., A. B. Bakker, and W. Van Rhenen (2009), "How changes in job demands and resources predict burnout, work engagement, and sickness absenteeism", *Journal of Organizational Behavior*, 30, 893−917.

Schaufeli, W. B., and T. W. Taris (2014), "A critical review of the job demands-resources model: implications for improving work and health", in Bauer, G. F., and O. Hämmig (eds.), Bridging Occupational, Organizational and Public Health: A Transdisciplinary Approach, Springer, Dodrecht.

Schokkaert, E., L. Van Ootegem, and E. Verhofstadt (2011), "Preferences and subjective satisfaction: measuring well-being on the job for policy evaluation", *CESifo Economic Studies*, 57, 683–714.

Siegrist, J. (1996), "Adverse health effects of high effort/low reward conditions", Journal of Organizational Psychology, 1, 27–41.

Siegrist, J. (2016), "A theoretical model in the context of economic globalization", in Siegrist, J., and M. Wahrendorf (eds.), *Work Stress and Health in a Globalized Economy: The Model of Effort-Reward Imbalance*, Springer, Dodrecht.

Smith, M., B. Burchell, C. Fagan, and C. O'Brein (2008), "Job quality in Europe", *Industrial Relations Journal*, 39, 586−603.

Stiglitz, J. E., A. Sen, and J.-P. Fitoussi (2009), *Report by the Commission on the Measurement of Economic Performance and Social Progress*, https://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+Commission+report.

Stiglitz, J., J.-P. Fitoussi, and M. Durand (eds.) (2018a), *Measuring What Counts for Economic and Social Performance*, Organisation for Economic Co-operation and Development (OECD), Paris.

Stiglitz, J., J.-P. Fitoussi, and M. Durand (eds.) (2018b), *For Good Measure: Advancing Research on Well-being Metrics Beyond GDP*, Organisation for Economic Co-operation and Development (OECD), Paris.

Theorell, T., A. Hammarström, G. Aronsson, L. Träskman Bendz, T. Grape, T. Hogstedt, I. Marteinsdottir, I. Skoog, and C. Hall (2015), "A systematic review including meta-analysis of work environment and depressive symptoms", *BMC Public Health*, 15, 1–14.

Theorell, T., and R. Karasek (1996), "Current issues relating to psychosocial job strain and cardiovascular disease research", *Journal of Occupational Health and Psychology*, 1, 9–26.

Theorell, T., K. Jood, L. S. Järvholm, E. Vingård, P. O. Östergren, and C. Hall (2016), "A systematic review of studies in the contributions of the work environment to ischaemic heart disease development", *European Journal of Public Health*, 26, 470−477.

Van der Doef, M., and S. Maes (1999), "The job demand-control (-support) model and psychological well-being: a review of 20 years of empirical research", *Work and Stress*, 13, 87–114.

Weichselbaumer, D., and R. Winter-Ebmer (2005), "A meta-analysis of the international gender wage gap", *Journal of Economic Surveys*, 19, 479–511.

Zizzo, D. J., and A. J. Oswald (2001), "Are people willing to pay to reduce others' incomes?", *Annales d'Economie et de Statistique*, 63/64, 39–65.

Tables and figures to be inserted in the paper

Table 1. Estimates of the job satisfaction models

	Males		Females	
	Estimate	Std. Err.	Estimate	Std. Err.
Wage (natural logarithm)	0.584***	(0.067)	0.533***	(0.111)
Work autonomy	0.206***	(0.046)	0.281***	(0.041)
Job security	0.075*	(0.033)	0.054**	(0.020)
Learn new things	0.361***	(0.036)	0.330***	(0.025)
New challenges	0.247***	(0.069)	0.294***	(0.063)
Good career prospects	0.363***	(0.046)	0.262***	(0.031)
Social status	0.123***	(0.031)	0.130***	(0.034)
Useful for society	0.162***	(0.024)	0.184***	(0.018)
Work and family	0.030	(0.027)	0.049*	(0.024)
Time for leisure	0.081**	(0.031)	0.086**	(0.029)
Age	–0.031*	(0.016)	–0.037*	(0.015)
Education	0.099**	(0.032)	–0.094	(0.048)
Has child	0.034	(0.083)	0.089	(0.047)
On-the-job training	0.181*	(0.077)	0.148**	(0.046)
Employer size: medium	0.010	(0.054)	–0.084	(0.075)
Employer size: large	–0.145	(0.082)	–0.115	(0.067)
Part-time work	–0.158	(0.186)	–0.244*	(0.106)
Public sector	0.087	(0.073)	0.132	(0.083)
Living arrangement: with partner	0.071	(0.068)	0.085	(0.049)
Living arrangement: with parents/others	–0.071	(0.062)	–0.037	(0.074)
Field of study fixed effects	Yes		Yes	
Occupation fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
Country fixed effects	Yes		Yes	
Log-pseudolikelihood	–9,609		–13,563	
Pseudo R^2	0.130		0.135	
No. of observations	8,102		11,445	

Notes: The reported estimates are ordered logit estimates. The standard errors, clustered at the country level, are reported next to the estimates. The sampling weights are used in the estimation. The reference categories for the categorical variables: no children; no on-the-job-training; small employer; full-time work; public sector job; living arrangement: lives alone; field of study: social science; occupation: legislators, officials, and managers; industry: real estate, renting, and business; country: Italy. The unreported estimates of the field of study, occupation, industry, and country fixed effects are available on request. *, **, and *** indicate significance at the 5%, 1%, and 0.1% levels, respectively.

Figure 1. Definition of equivalent wage

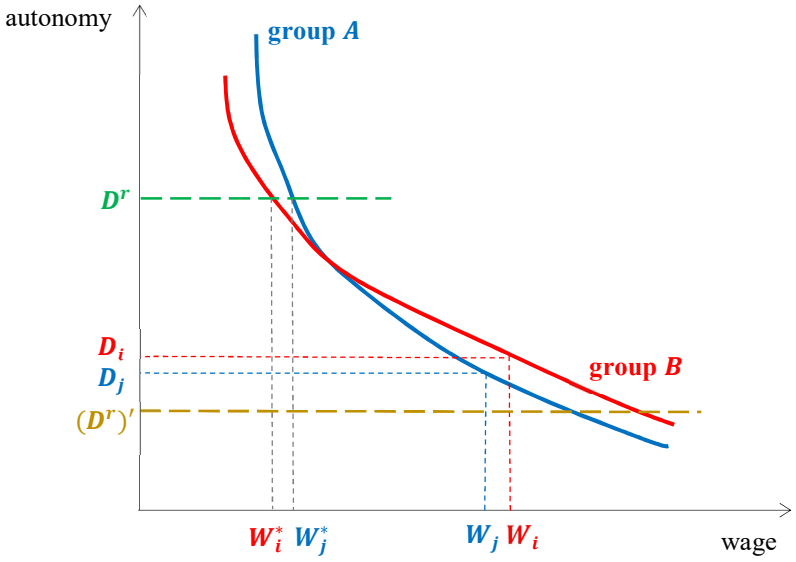
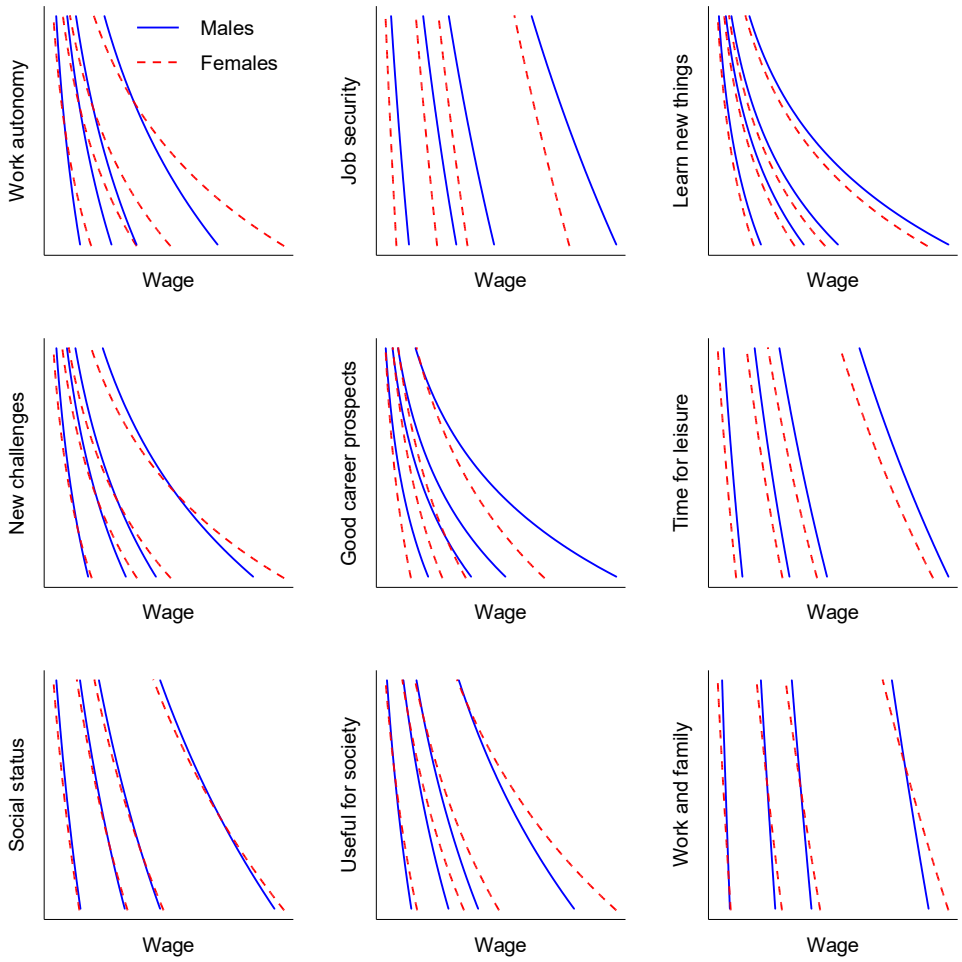
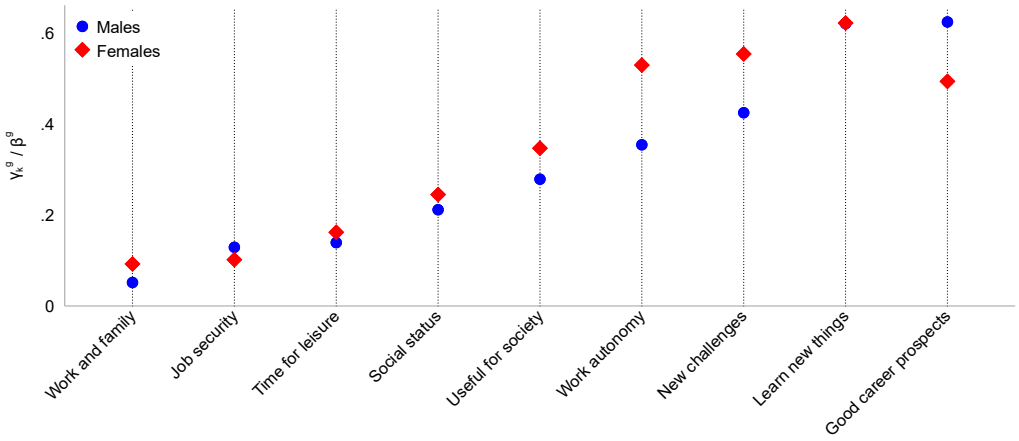


Figure 2. Maps of indifference curves implied by the estimates of preference parameters, by gender



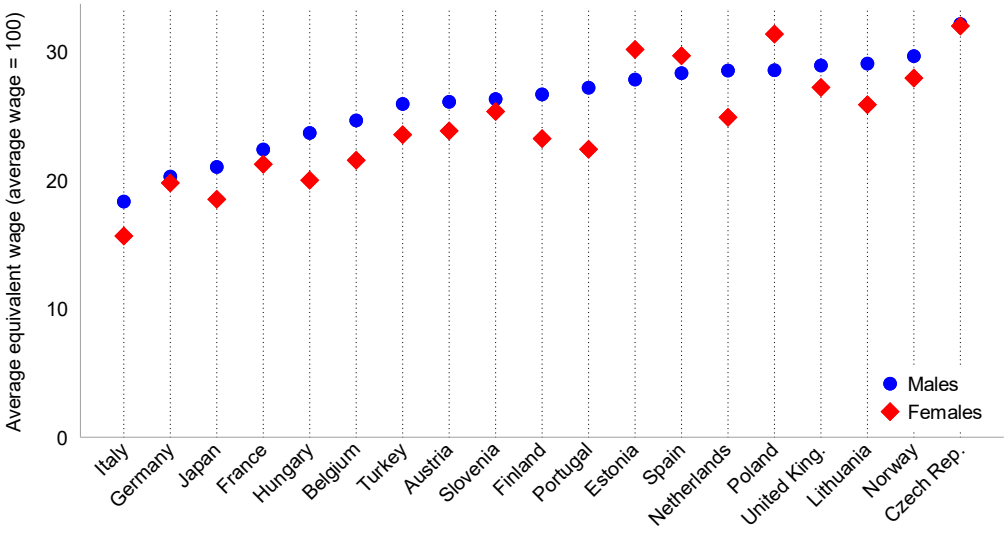
Notes: A particular indifference curve in the (W, D_k)-space for gender g is constructed using equation (3), by fixing W^* and all non-wage dimensions other than D_k, and then plotting W against D_k. The non-wage dimensions are always fixed at their g-specific all-country mean. W^* is fixed at four levels, corresponding to the four g-specific indifference curve on each panel: the mean, median, 75th percentile, and 90th percentile of the all-country distribution.

Figure 3. The ratio γ_k^g / β^g, by non-wage dimension and gender



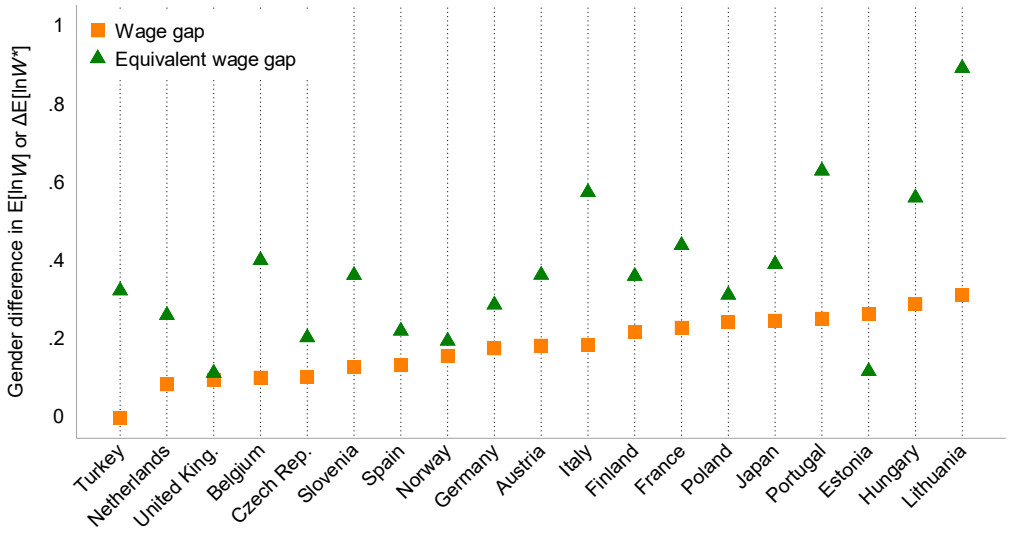
Notes: For each non-wage dimension k and gender g, the plotted value is obtained as the ratio γ_k^g / β^g.

Figure 4. Average equivalent wage relative to the average wage, by gender



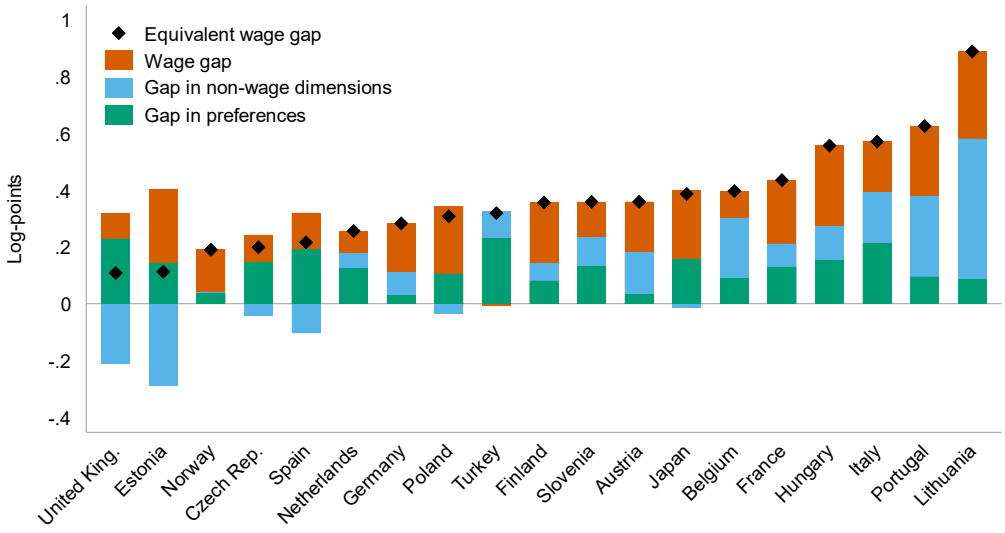
Notes: Countries are ordered by increasing values for males.

Figure 5. The equivalent wage gap vs. the wage gap



Notes: The gaps are male-minus-female gaps. Countries are ordered by increasing wage gap.

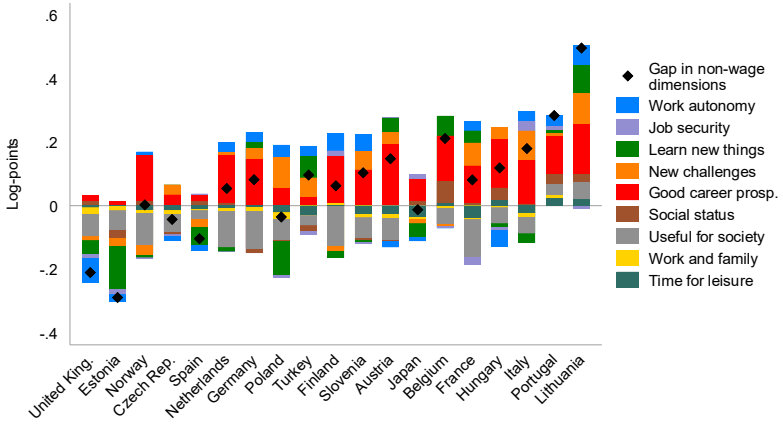
Figure 6. Decomposition of the equivalent wage gap



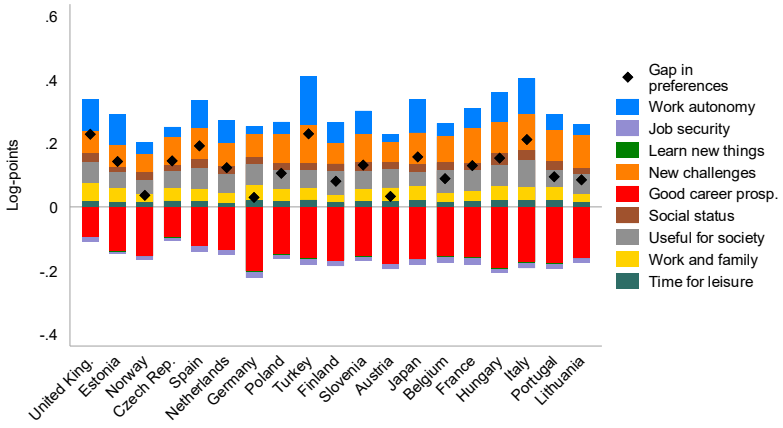
Notes: The decomposition is based on equation (8). Countries are ordered by increasing value of the equivalent wage gap.

Figure 7. Detailed decompositions

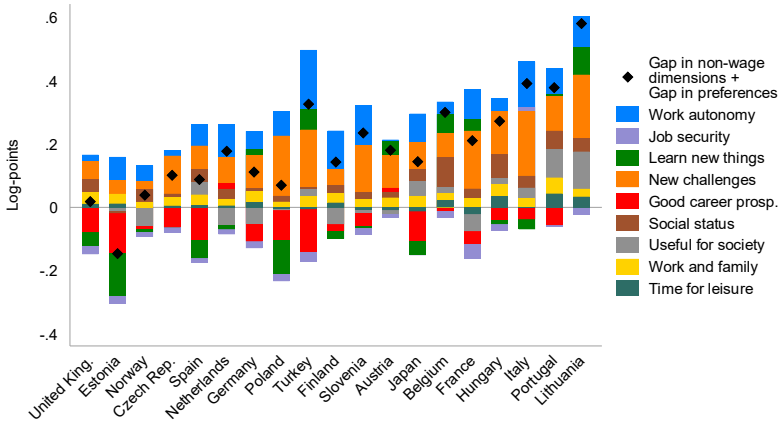
A. Decomposition of the gap in non-wage dimensions



B. Decomposition of the gap in preferences

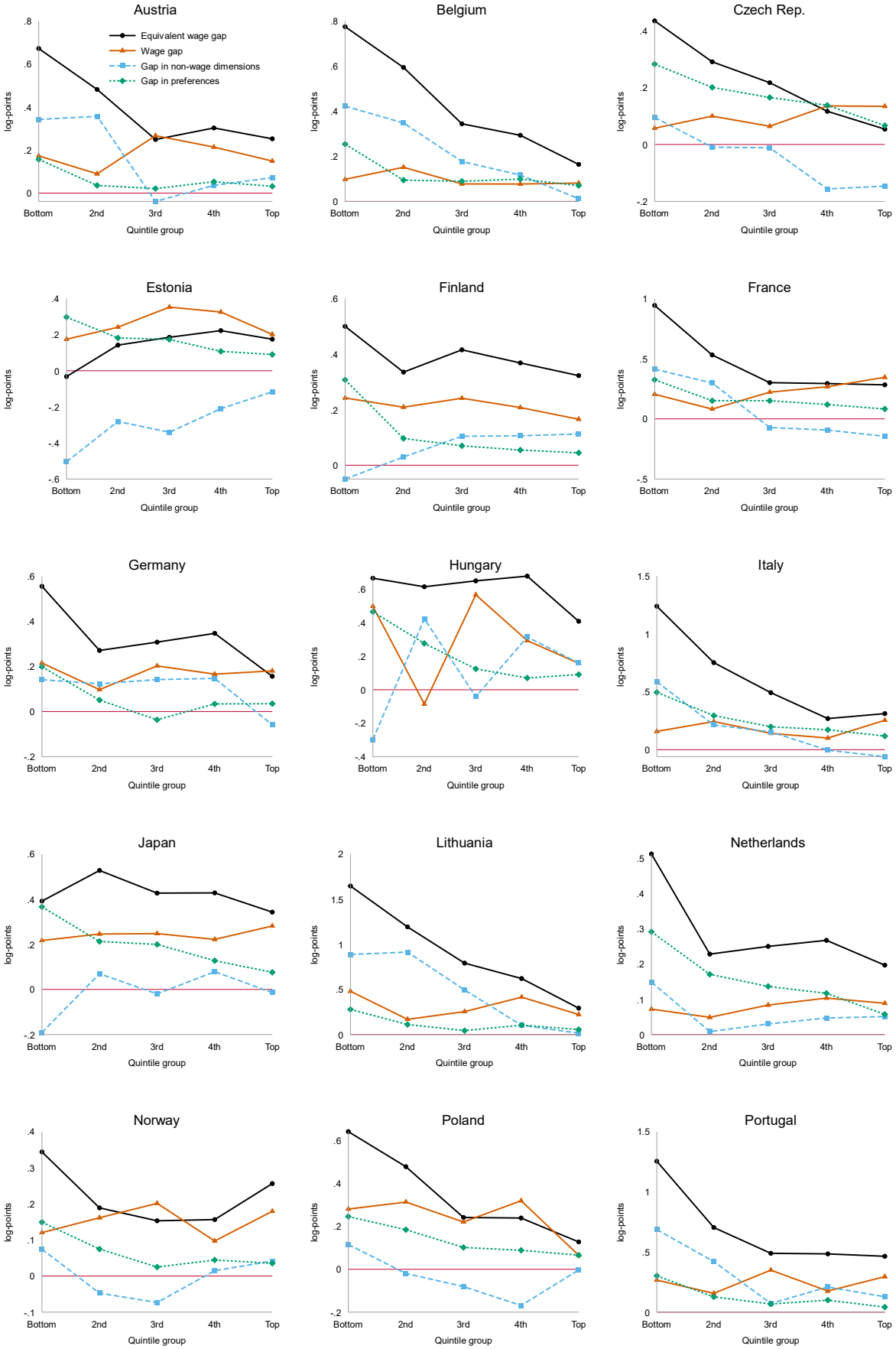


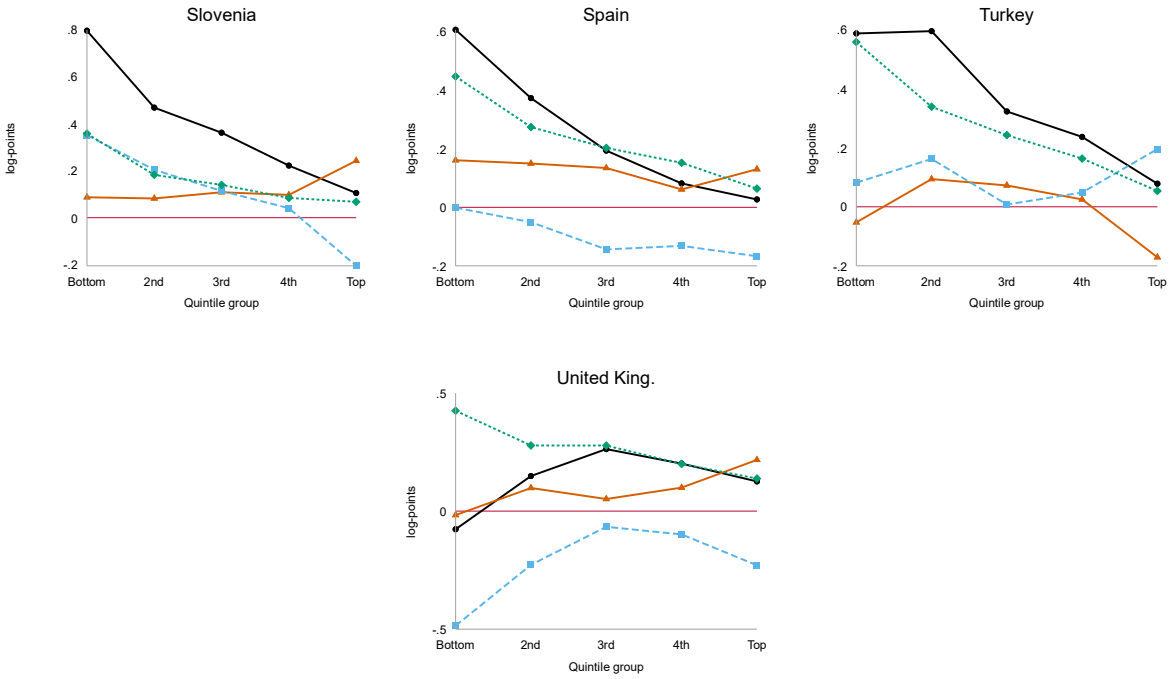
C. Decomposition of the sum of gaps in non-wage dimensions and preferences



Notes: The decompositions are based on equation (7). Panel C is obtained by adding up the corresponding items on panels A and B. Countries are ordered by increasing value of the equivalent wage gap.

Figure 8. Decomposition of the equivalent wage gap along the distribution





Notes: The equivalent wage gap for a particular quintile group is obtained by subtracting the average log EW in that quintile group of females' EW distribution from the average log EW in that quintile group of males' EW distribution. For each quintile group is based on equation (8).

Appendix

Table A1. Summary statistics

Variable name	Description	Males				Females			
		mean	sd	min	max	mean	sd	min	max
Sat	Satisfaction with the job; Scale(from 1 "very dissatisfied" to 5 "very satisfied")	3.6985	0,99	1	5	3.7534	1,01	1	5
Lny	Logarithm of net monthly wage in full-time equivalents	7,5221	0,57	4,1	8,7	7.3932	0,53	-0,5	8,7
Age	Age in years	29.7395	2.14	24	35	29.2581	2.07	24	35
Education (years)	Years of higher education currently attained	4.4645	0.91	3	6	4.3582	0.93	3	6
Single	1 if living alone; 0 otherwise	0.2190	0.41	0	1	0.1857	0.39	0	1
Partner	1 if living with a parther; 0 otherwise	0.5653	0.50	0	1	0.6262	0.48	0	1
Family	1 if living with the parents, relatives, friends or others; 0 otherwise	0.2157	0.41	0	1	0.1881	0.39	0	1
Child 0-17	1 if having a child aged 0-17, 0 otherwise	0.1860	0.39	0	1	0.1932	0.39	0	1
Training	1 if following any work-related course/training in the past 12 months; 0 otherwise	0.6576	0.47	0	1	0.6693	0.47	0	1
Small Company	1 if working in a company with 0-49 employees; 0 otherwise	0.2263	0.42	0	1	0.2786	0.45	0	1
Medium Company	1 if working in a company with 50-249 employees; 0 otherwise	0.2173	0.41	0	1	0.2493	0.43	0	1
Large Company	1 if working in a company with 250 or more employees; 0 otherwise	0.5564	0.50	0	1	0.4721	0.50	0	1
Part-time	1 if working at most 20 hours per week; 0 otherwise	0.0138	0.12	0	1	0.0373	0.19	0	1
Public Sector	1 if working in the public sector; 0 if working in the public/other sector	0.3061	0.46	0	1	0.4697	0.50	0	1
Non-wage dimensions	Scale(from 1 "not at all" to 5 "to a very high extent")								
Autonomy	Work autonomy	3.9272	0.95	1	5	3.9328	0.97	1	5
Security	Job Security	3.7868	1.10	1	5	3.8533	1.18	1	5
Learn	Opportunity to learn new things	3.6923	1.04	1	5	3.7596	1.06	1	5
Challenge	New challenges	3.4898	1.04	1	5	3.4683	1.10	1	5
Career	Good career prospects	3.1459	1.11	1	5	2.9743	1.18	1	5
Social Status	Social status	3.1924	1.00	1	5	3.1769	1.05	1	5
Valuable	Chance of doing something useful for society	3.1322	1.20	1	5	3.4212	1.25	1	5
Family and Work	Good chance to combine family with work tasks	3.2004	1.16	1	5	3.4107	1.20	1	5
Leisure	Enough time for leisure activities	3.2257	1.16	1	5	3.3637	1.17	1	5
Field of Study	Field of Study dummies								

Education	Education	0.0544	0.23	0	1	0.1505	0.36	0	1
Human/Arts	Humanities and arts	0.0482	0.21	0	1	0.1133	0.32	0	1
Soc/Bus/Law	Social sciences, business and law	0.2917	0.45	0	1	0.3578	0.48	0	1
Sci/Math/Comp	Science, mathematics and computing	0.1296	0.34	0	1	0.0748	0.26	0	1
Eng/Manu/Cons	Engineering, manufacturing and construction	0.3465	0.48	0	1	0.0818	0.27	0	1
Agri/Vete/Serv	Agriculture, veterinary and services	0.0753	0.26	0	1	0.0554	0.23	0	1
Health/Welfare	Health and welfare	0.0543	0.23	0	1	0.1664	0.37	0	1
Occupation	Occupation dummies								
Legis/Officials/Man	Legislators, officials and managers	0.1000	0.30	0	1	0.0578	0.23	0	1
Professionals	Professionals	0.6413	0.48	0	1	0.6045	0.49	0	1
Technicians	Technicians	0.1795	0.38	0	1	0.2302	0.42	0	1
Clerks	Clerks	0.0506	0.22	0	1	0.0818	0.27	0	1
Service/Salesman	Service and salesman	0.0147	0.12	0	1	0.0204	0.14	0	1
Agricultural/Fishery	Agriculture and fishing	0.0014	0.04	0	1	0.0005	0.02	0	1
Craft/Trade	Crafft and trade	0.0046	0.07	0	1	0.0012	0.03	0	1
Plant/Machine	Plant and machine	0.0041	0.06	0	1	0.0009	0.03	0	1
Elementary	Elementary	0.0039	0.06	0	1	0.0028	0.05	0	1
Industry	Industry dummies								
Agricult/Hunt/Forest	Agriculture, hunting and forestry	0.0142	0.12	0	1	0.0076	0.09	0	1
Fishing	Fishing	0.0015	0.04	0	1	0.0006	0.02	0	1
Mining/Quarrying	Mining and quarrying	0.0104	0.10	0	1	0.0048	0.07	0	1
Manufacturing	Manufacturing	0.2125	0.41	0	1	0.0986	0.30	0	1
Electricity/Gas/Water	Electricity, gas and water supply	0.0167	0.13	0	1	0.0063	0.08	0	1
Construction	Construction	0.0573	0.23	0	1	0.0215	0.15	0	1
Wholesale/Retailtrade	Wholesale and retailtrade	0.0479	0.21	0	1	0.0564	0.23	0	1
Hotels/Restaurants	Hotels and restaurants	0.0041	0.06	0	1	0.0080	0.09	0	1
Trans/Storage/Commun	Transport, storage and communications	0.0511	0.22	0	1	0.0355	0.18	0	1
Financial Intermediation	Financial intermediation	0.0594	0.24	0	1	0.0554	0.23	0	1
Real Est/Renting/Business	Real estate, renting and business	0.2084	0.41	0	1	0.1457	0.35	0	1
Public Administration	Public administration and defence	0.0938	0.29	0	1	0.1055	0.31	0	1

Education	Education	0.1220	0.33	0	1	0.2190	0.41	0	1
Health and Social Work	Health and social work	0.0628	0.24	0	1	0.1838	0.39	0	1
Other Community	Other community, social and personal	0.0371	0.19	0	1	0.0488	0.22	0	1
Activities of Private House	Activities of private households	0.0002	0.02	0	1	0.0008	0.03	0	1
Extraterritorial Organizat	Extraterritorial organisations	0.0007	0.03	0	1	0.0017	0.04	0	1
Countries	Country dummies								
IT		0.0466	0.21	0	1	0.0410	0.20	0	1
ES		0.0886	0.28	0	1	0.1132	0.32	0	1
FR		0.0320	0.18	0	1	0.0449	0.21	0	1
AT		0.0384	0.19	0	1	0.0291	0.17	0	1
DE		0.0394	0.19	0	1	0.0218	0.15	0	1
NL		0.0893	0.29	0	1	0.0948	0.29	0	1
UK		0.0379	0.19	0	1	0.0423	0.20	0	1
FI		0.0632	0.24	0	1	0.0743	0.26	0	1
NO		0.0558	0.23	0	1	0.0563	0.23	0	1
CZ		0.2000	0.40	0	1	0.1685	0.37	0	1
JP		0.0716	0.26	0	1	0.0477	0.21	0	1
PT		0.0144	0.12	0	1	0.0171	0.13	0	1
BE		0.0402	0.20	0	1	0.0353	0.18	0	1
EE		0.0196	0.14	0	1	0.0302	0.17	0	1
SI		0.0485	0.21	0	1	0.0758	0.26	0	1
TR		0.0452	0.21	0	1	0.0191	0.14	0	1
LT		0.0186	0.14	0	1	0.0279	0.16	0	1
PL		0.0359	0.19	0	1	0.0387	0.19	0	1
HU		0.0148	0.12	0	1	0.0219	0.15	0	1
Observations			8104				11445		