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Reaching compromises in workers' life satisfaction: a multiobjective interval programming approach

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Abstract

The appraisal of job satisfaction and life satisfaction has been the focus of attention of work-family research. Despite being frequently regarded as a non-work variable, life satisfaction plays an important role in organizational behaviour and human resource management. Previous research has ascertained that workers' life satisfaction is inherently a multidimensional concept. We extend this line of work by analysing the main factors that might have an influence on the trade-offs among four different aspects of workers' life satisfaction (satisfaction with education, present job, family life, and social life) in reaching compromises between them. A methodological approach that combines econometric and multiobjective interval programming techniques has been used. This methodological framework allows evaluating the compromises of specific aspects of workers' personal and working conditions in different scenarios given as intervals. Our findings suggest that female workers must generally spend more time at their jobs than men to reach the highest balanced levels of satisfaction across all aspects under evaluation. Additionally, one child is sufficient to reach the highest levels of life

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satisfaction (among all factors considered in its assessment) for both men and women. One possible policy implication of these results may be that existing work-family arrangements are not sufficient in the current context of falling birth rates all over Europe.

Keywords: life satisfaction; education; work; family life; social life; multiobjective interval programming; econometric analysis.

JEL Classification Codes J28, C54, C61.

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1. Introduction

Life satisfaction and welfare have been some of the most important fields of research in psychology[1] for many decades (Peterson, Park, & Seligman, 2005). Since workers spend most of their time at their jobs, there is an intrinsic connection between job satisfaction and life satisfaction (Coad & Binder, 2014).

Previous findings suggest that job satisfaction has a significant role in various labour market outcomes (Warr, 1999). Evidence shows that individuals who are satisfied with their job tend to become more productive (Graham, Eggers, & Sukhtankar, 2004; Oswald, Proto, & Sgroi, 2015). This is known as the happy productive worker hypothesis (Ayala, Peiró, Tordera, Lorente, & Yeves, 2017; Reijseger, Peeters, Taris, & Schaufeli, 2017). But, besides the enhancement of individual workers' productivity, employees' job satisfaction might have a positive influence on firms' productivity (Böckerman & Ilmakunnas, 2012). With this reasoning in mind, in its Lisbon strategy the European Union argued that policies to improve job satisfaction could bring benefits to both employees and employers.

However, work satisfaction is not always a positive outcome, to the extent that its increase may enter into conflict (Olsson, Gärling, Ettema, Friman, & Fujii, 2013) with other aspects of life (e.g., reducing satisfaction with other aspects, such as social life or family time).

In spite of the indisputable contributions of prior studies in determining the main factors associated with workers' life satisfaction, studies which explicitly address the evaluation of compromises among the different factors that might be related to workers' satisfaction are lacking. This is the main contribution of our paper, insofar as this methodological approach allows obtaining robust findings and thereby valid implications on the potential trade-offs among different aspects of workers' satisfaction, under different settings given herein as confidence intervals. This novel approach is based on the combination of econometric and multiobjective interval programming techniques, where distinct workers' life satisfaction axes of evaluation are translated into different objective functions by using the information on workers from 34 countries.

Interval multiobjective programming models are particularly useful since, instead of assuming that all coefficients and parameters are *a priori* given, they take into account

[1] Several influential papers, as Stevenson and Wolfers (2013), Aghion, Akcigit, Deaton, and Roulet (2016) and Fehder, Porter, and Stern (2018), among many others, have used the terms "life satisfaction" and "well-being" interchangeably.

the fact that the information required to instantiate the models is seldom incomplete and subject to uncertainty. In the interval approach, the coefficients are presumed to lie within a range of variation (Oliveira & Antunes, 2007). Therefore, in practice and for the Decision Maker (DM), it might be preferable to define coefficients in these terms. Additionally, the interval approach can be easily combined with econometric methodologies, providing further insights into the problem by enabling the consideration of distinct scenarios that otherwise could be overlooked. This is a relevant feature since we can combine econometric estimates, which are subject to uncertainty (i.e. correlational ones, as in the present research paper), with the interval multiobjective programming methodology.

To sum up, the novelty of this research work is as follows: it does not simply rely on average econometric estimates (concretely, using interval estimations); it couples the use of econometric and multiobjective interval programming techniques, enabling the assessment of compromises among different aspects that might influence workers' life satisfaction in distinct scenarios (given herein as intervals); finally, and to the best of our knowledge, this is the first study of this type which encompasses data for 34 countries[2].

Since, as previously highlighted, life satisfaction entails many (and sometimes conflicting) features of the population's daily life, we explicitly include four different aspects related to workers' life satisfaction: satisfaction with education, present job situation, family life, and social life. In this sense, we focus on a subjective measurement of workers' satisfaction. Specifically, this subjective measurement concerns how workers "assess their lives, in particular how satisfied or happy they are with aspects of their lives or their lives overall" (Axford Jodrell & Hobbs, 2014, p. 2700)[3]. We employ a subjective measurement, the use of which could help enrich the design of social policies, as it informs about public preferences in terms of what people want and need, aspects usually overlooked when designing such policies (Veenhoven, 2002). Furthermore, we have conducted a separate analysis for both male and female workers, since they may present differences in terms of these four aspects of life satisfaction (Stevenson & Wolfers, 2009),

[2] The study of satisfaction using a combination of econometrics and multiobjective programming techniques has only been performed for the Spanish population (Marcenaro-Gutierrez, Luque, & Ruiz, 2010, analysed Spanish workers' satisfaction; while Marcenaro-Gutierrez, Luque, and Lopez-Agudo, 2015, evaluated Spanish teachers' satisfaction). Besides, a combination of econometrics and multiobjective interval programming techniques has also been used in the assessment of Spanish workers' satisfaction (Henriques, Luque, Marcenaro-Gutierrez, & Lopez-Agudo, 2018).

[3] The objective measurement of satisfaction is defined as "health and development – behaviour, emotions, attainment, and so on – and, to some extent, the factors that impinge on these, such as housing, parenting, environment, and socioeconomic situation".

particularly bearing in mind that the general literature agrees that women continue to perform the majority of housework, which potentially influences the working-life satisfaction balance (Lachance-Grzela & Bouchard, 2010; Pailhé, Solaz, & Souletie, 2019, among others).

The rest of the paper is structured as follows: in the next section, a brief literature review is presented before indicating the main assumptions underlying the choice of data which are described in section 3; section 4 provides an overview of the methodology followed; section 5 presents and discusses some illustrative results; finally, some conclusions are formulated and possible policy directions are suggested in section 6.

2. Literature review

Measuring satisfaction is complex, with different studies evaluating distinct concepts in various manners (Diener & Seligman, 2004). Additionally, work and life satisfaction rely on multiple factors that are likely to be intertwined with each other (Huebner & Dew, 1993; Huebner & Gilman, 2002; Coad & Binder, 2014; Hsieh, 2018, among others). While some of the existing literature focuses on studying individual-level conditioning factors of life satisfaction, other studies explore country-specific determinants of satisfaction across nations (Bjørnskov, Dreher, & Fischer, 2008).

In the first case, there is a rather broad consensus on the main factors associated to life satisfaction, which are largely comparable across countries; for instance, a significant number of cross-sectional studies highlight the positive linkage of workers' income and their life satisfaction (Diener & Seligman, 2004; Van Praag & Ferrer-i-Carbonell, 2004). Moreover, Stevenson and Wolfers (2013) highlighted that people's life satisfaction is positively associated with income, without reaching a limit in this relationship (the so-called "Easterlin Paradox").

In addition, being unemployed has been found to have an effectively negative relationship with individual satisfaction (Lucas, Clark, Georgellis, & Diener, 2004), while being employed usually brings benefits (Grün, Hauser, & Rhein, 2010). Then again, besides the positive influence on satisfaction that job-related income entails, other non-pecuniary aspects, like social validation and other psychological factors (Layard, Clark, & Senik, 2012), might help explain these outcomes. In this sense, life satisfaction can also be influenced by other issues such as culture, marriage, health condition, socio-demographic environment, etc. (Diener, 2000).

In the case of family status and marriage, these conditions tend to be positively coupled with satisfaction (Diener, Gohm, Suh, & Oishi, 2000; Bailey & Snyder, 2007), while having children may have similar implications (Cetre, Clark, & Senik, 2016), although this influence stands on uncertain footing (Frey & Stutzer, 2006). Analogously, a good health condition seems to be a requirement for being successful in a job, and thus has a positive influence on life satisfaction (Arrow, 1996).

Moreover, although higher levels of education seem to be positively related to life satisfaction (Salinas-Jiménez, Artés, & Salinas-Jiménez, 2011; Michalos, 2017), some other authors such as Clark and Jung (2017) have indicated that a higher level of education is negatively associated with life satisfaction. In addition, a relation has also been established between age and life satisfaction (Frijters & Beatton, 2012). In this sense, Switek and Easterlin (2016), amongst others, studied life satisfaction between ages 22 and 40 and found that it is associated with age, to the extent that it decreases after reaching the age of 30; Blanchflower and Oswald (2017) also suggested that life satisfaction is reduced in midlife (around 50 years old).

Furthermore, jobs have distinct characteristics that can be more appealing than others – e.g., jobs that provide more autonomy usually lead to higher job satisfaction (Benz & Frey, 2008).

Finally, the second branch of the literature, which searches for the determinants of life satisfaction across countries, is less prolific and is far from reaching a consensus regarding which variables are correlated with this satisfaction (Bjørnskov, Dreher, & Fischer, 2008). Nonetheless, there seems to be an exception regarding national income, since studies examining the relationship between average income per capita and average life satisfaction across nations managed to establish significant correlations among them, varying between 0.50 to 0.70 (Diener & Biswas-Diener, 2002). In this line of work, Sack, Stevenson, and Wolfers (2013) and Sacks, Stevenson, Wolfers, Graham, Hammond, Liberini, Proto, and Gasparini (2013) argued that Gross Domestic Product (GDP) and life satisfaction grow together.

3. Data

The data used in our study were obtained from the 3rd European Quality of Life Survey (EQLS) – European Foundation for the Improvement of Living and Working Conditions (2014) –, conducted by Growth from Knowledge, EU Custom Research and Coordination Centre (GfK EU3C), which was commissioned by the European Foundation

for the Improvement of Living and Working Conditions (Eurofound). A total of 77 European countries participated in the survey during the Autumn/Winter of 2011 and, later (in 2012), 7 non-European countries. The survey's main objective was to measure how the population of the countries analysed felt when confronted with particular circumstances. As indicated by GfK EU3C (2012a), the sampling frame (based on records) consisted of a random probability sampling for those countries in which at least 95% of the households in the country could be surveyed. This procedure was applied to 16 countries which managed to comply with this condition. However, for those countries which were not able to conform to it, an enumerated random route was used – considering samples of addresses that were previously selected by national agencies. This enabled retaining representative samples from the group of countries under scrutiny and also led to the selection of the respondents, i.e. adult persons (aged 18 that year or older). Subsequently, these samples were stratified by geographic regions (NUTS 2 level or below) and level of urbanisation. Hence, samples were clustered geographically in Primary Sampling Units (except for those countries where samples were taken from specific records, i.e. Netherlands, Malta and Sweden). Analogously to GfK EU3C (2012b), two types of weighing methodologies were used: design weights and post-stratification weights. This procedure was aimed at obtaining representative results in terms of gender, age, urbanisation level, region and household size.

The starting sample of 34 countries[4] was composed of 43,636 individuals. This sample was then reduced to 19,139 workers after only considering those individuals who were working – since one of the factors under evaluation is "satisfaction with present job" – and who were 64 years old or younger[5], conforming a representative sample of the working population for these countries[6].

[4] These countries are: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, FYR of Macedonia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kosovo, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Turkey and United Kingdom.

[5] Although in many countries the retirement age is 65, very few individuals in this sample were 65 years old, so we have considered those who were 64 or younger.

[6] Specifically, "those assisting on family farm or business" (0.6%), "unemployed people" (8.1%), those "unable to work due to long-term illness or disability" (2.1%), "retired" people (29.5%), "full time homemaker/responsible for ordinary shopping and looking after the home" (8.7%), "in education/students" (5.7%) and "other" (representing only 0.9%) were removed from the sample. In addition, we kept individuals ~~those~~ who were of ~~in~~ working age (18 to 64 years old; which entailed reducing 0.5% of the sample after removing the previous individuals). The proportion of working population is very similar to the one reported by the Federal Reserve Bank of St. Louis (https://fred.stlouisfed.org/series/SLEMPTOTLSPZSEUU).

Following the previous literature and taking into account the data provided by EQLS, we selected the variables to evaluate their association with the four aspects of satisfaction. Specifically, the variables under scrutiny are those reported in Table A1 (Appendix), which contains some descriptive statistics. Based on Marcenaro-Gutierrez, Micklewright, and Vignoles (2015), we have considered a household net monthly income of 1,000 euros at Purchasing Power Parity (PPP) for evaluating workers' income. In the case of this variable, data required special attention due to missing values and to outliers. The latter were removed whenever values were reported as being at the highest and lowest 1% levels of monthly income. Because there were missing values corresponding to 24.11% of the sample for this variable, a missing flag procedure was applied in order to keep those observations which otherwise would have been lost. Once the other missing values of the variables under analysis were accounted for, the sample was reduced to 17,650 individuals – 8,691 men and 8,959 women.

As dependent variables we have used those which measure individuals' satisfaction with certain aspects of their lives; concretely, satisfaction with education, present job, family life and social life[7].

4. Methodology

4.1. Econometric Estimates

The first step of the analysis was to specify each one of the selected satisfaction aspects (according to male and female gender groups) – education, present job, family life and social life – through the ordinary least squares (OLS) estimation method. As previously indicated, the set of variables used to explain these satisfaction features are reported in Table A1 (Appendix). The four satisfaction variables are discrete and ordered, taking values from one to ten (in ascending order in terms of satisfaction). In consequence, we have first run ordered probit models, finding results similar to those obtained with OLS estimations. For this reason, and since the aim was to use a

[7] The data we use for our empirical approach also includes information on satisfaction with aspects regarding pecuniary issues (current standard of living, accommodation, economic situation of the country, etc.). However, the challenges of dealing with more than three objective functions in multiobjective programming are clearly acknowledged in the scientific literature, namely the computation time for many indicators that can easily become computationally hard and the ratio of non-dominated points, which tends to increase rapidly with the number of objective functions (Emmerich & Deutz, 2018). In such cases, highly correlated objective functions should be avoided in order to prevent the reduction of the search space for efficient solutions. Therefore, due to the high correlation of these satisfaction variables with the four aspects used in this study (especially in the case of education and present job satisfactions, with correlations reaching 0.90 in some countries as, e.g., Greece), we have only considered these four satisfaction aspects.

multiobjective interval programming model in a subsequent stage, we selected the coefficients obtained through the OLS estimation method. We have to highlight that since there are unobservables determining these four satisfaction aspects, we interpret our results as conditional associations rather than as causal effects.

In particular, a stepwise OLS estimation method has been employed, which means that although many variables appear in the list presented in Table A1 (Appendix), only those which have a value in the "Notation" column, i.e. those which were significant in at least one of the four specifications including all the variables in Table A1, were included as a variable in the estimated model; those which did not meet this criterion were relegated to the reference category. Hence, the model was re-estimated many times – twice for men and four times for women – until a set of variables comprising those that were significant in at least one of the four specifications was reached. In addition, this list of significant variables is different for men and women, which reflects the differences in the determinants of satisfaction by gender.

In this framework, the level for each one of these four satisfaction objectives is obtained from the combination of a set of individual and contextual characteristics, unobservable elements and a random disturbance (ε). If we denote individuals as "i", job satisfaction objectives are indexed by "s" and gender by "g", this model can be shown by the following set of "s" equations:

$$Z_s^g(i) = \hat{\alpha}^{gs} + \hat{\beta}_1^{gs} x_{1g}(i) + \hat{\beta}_2^{gs} x_{2g}(i) + \cdots + \hat{\beta}_p^{gs} x_{pg}(i) + \varepsilon_s^g(i), \qquad (1)$$

with $k = 1, \ldots, p$ variables ($p = 30$ for men and $p = 25$ for women); $s = 1, \ldots, 4$ specifications – one for each satisfaction aspect: "1" for education, "2" for present job, "3" for family life and "4" for social life; $g = 1,2$ ($g = 1$ or "m" for men and $g = 2$ or "w" for women); $i = 1, \ldots, n$ observations; where $Z_s^g(i)$ indicates the satisfaction aspect s of individual i with gender g, and $x_{1g}(i), x_{2g}(i), \ldots x_{pg}(i)$ is the group of explanatory variables; $\widehat{\boldsymbol{\beta}}^{gs}$ is a vector of slope coefficients for the satisfaction objective function s of gender g and $\widehat{\boldsymbol{\alpha}}^{gs}$ the correspondent fixed but unknown population intercept; $\varepsilon_s^g(i)$ is a random disturbance. Hence, we assume that each individual's aspect of satisfaction is influenced by random variables which are inherently unobservable and normally distributed.

Tables 1 and 2 show the lower and upper bounds of the estimated coefficients of the variables of interest for male and female workers, respectively. Those coefficients which were not significantly different from "0" at the standard statistical levels (10% or

lower) were assigned the value[8] "0". In order to perform these estimations, the weighting procedure (to scale the sample up to the size of the population within each country) and the clustering of standard errors at the country level (to account for the existence of many countries in our sample) suggested by GfK EU3C have been employed.

According to the information shown in Tables 1 and 2, it can be concluded that a higher education level has a positive correlation with the satisfaction with education for both male and female workers[9], while it also has a positive association with the satisfaction with social life in the case of men. Nonetheless, this correlation is negative with present job satisfaction for women (only considering secondary education). This outcome might suggest that women with a lower level of education face higher difficulties when trying to get a job with better conditions. In the case of household income, it is interesting to observe that the satisfaction with present job and social life in both genders is positively associated with this variable (as also concluded, among others, by Stevenson & Wolfers, 2013). However, such correlation is no longer valid in the case of satisfaction with education and family. While a higher age only seems to be positively associated for male workers in the case of satisfaction with education, it positively correlates for female workers in terms of satisfaction with education, present job and social life (the evidence of the previous literature on this is not conclusive (see e.g. Frijters & Beatton, 2012; Switek & Easterlin, 2016; Blanchflower & Oswald, 2017). As expected, a higher number of working hours negatively correlates with social life satisfaction both for men and women. The same can be established in terms of family life satisfaction for men (maybe reflecting the fact that men tend to spend more time at their paid jobs, which could make it hard for them to reconcile job and family life (Kuhn & Lozano, 2008; Haas & Hwang, 2016); nevertheless, a moderate amount of working hours per week (between 30 and 49) seems to bear a positive correlation regarding present job satisfaction for male workers.

Both genders perceive a fixed term contract of less than 12 months or a temporary employment agency contract as negatively associated with their present job satisfaction, while an apprenticeship, other training scheme or other contract are positively associated with satisfaction with education and present job for male workers (maybe because they have attained these types of contracts as a continuation of their studies). Additionally, an

[8] If we had also employed the lower and upper bounds for those not statistically significant variables, this would have implied assuming that, on average, the variable is significantly different from zero, which is not the case.
[9] Michalos (2017) includes an extensive discussion on the link between education and life satisfaction.

unlimited permanent contract or a fixed term contract of 12 months or more are positively correlated with men's satisfaction with education and social life.

In regard to marital status, being married or living with a partner shows a positive correlation with the satisfaction with family life for both genders (in line with the evidence provided by Stutzer, & Frey, 2006, and Diener, Gohm, Suh, & Oishi, 2000, among others); this correlation is also positive for satisfaction with social life for men. Contrarily, being separated or divorced and not living with a partner shows a negative association with satisfaction with family and social life for both genders. Finally, being widowed and not living with a partner is also negatively associated with the satisfaction with family life for both men and women. Nonetheless, a positive correlation of the marital status is obtained in terms of present job satisfaction for male workers (maybe as a result of replacing family time with working time); furthermore, a negative association for this marital status is observed with the social life of women (maybe because social relationships seem to be more influenced in the case of women).

Having 3 or more children seems to be negatively correlated with satisfaction with education for male workers, whereas in the case of female workers, only 2 or more children are required to observe the same correlation; having children is positively associated with present job satisfaction for male workers while, in the case of female workers, it is only positively associated with this variable when they have 2 or more children. Male workers show higher correlations with family satisfaction when they have 2 children, while female workers report positive associations with this satisfaction when they have children; finally, social life satisfaction is negatively correlated – for both genders – with having 1 or 2 children. Thus, these results show mixed evidence, in line with the previous empirical literature (Cetre, Clark, & Senik, 2016).

As expected, a higher level of health status is positively correlated with both men's and women's satisfaction in the four aspects of satisfaction, while the country's unemployment rate negatively associates with the satisfaction with present job for both genders and with satisfaction with social life for women. Finally, all occupations (compared to elementary occupations) are positively associated with education and present job satisfaction for both genders (with the exception of skilled agricultural forestry and fishery work for female workers), while most of them present a null correlation with family life satisfaction and some of them have a positive association with social life satisfaction.

Table 1. Correlational estimates of different aspects of satisfaction for male workers

	Satisfaction with Education		Satisfaction with Present Job		Satisfaction with Family Life		Satisfaction with Social Life	
Variables	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Education level (Ref.: Primary education or less)								
Secondary education	0.323	1.812	0	0	0	0	-0.206	1.231
Tertiary education	1.194	2.841	0	0	0	0	-0.151	1.310
Household net monthly income of 1,000 euros at PPP (Ref.: Very low quartile)								
Very high quartile	0	0	0.109	0.785	0	0	0.051	0.887
High quartile	0	0	-0.017	0.651	0	0	-0.083	0.701
Low quartile	0	0	0	0	0	0	-0.004	0.597
Missing flag	-0.050	0.768	-0.002	0.568	-0.108	0.444	0.114	0.834
Age of the respondent	0.000	0.016	0	0	0	0	0	0
Hours normally worked per week (Ref.: Less than 30 hours)								
50 hours or more	0	0	0	0	-0.496	-0.042	-0.652	-0.027
Between 30 and 49 hours	0	0	-0.100	0.619	-0.424	-0.063	-0.361	0.056
Type of contract (Ref.: Without a written contract)								
On an unlimited permanent contract; On a fixed term contract of 12 months or more	-0.075	0.533	0	0	0	0	-0.091	0.561
On a fixed term contract of less than 12 months; On a temporary employment agency contract	0	0	-0.679	-0.008	0	0	0	0
On apprenticeship or other training scheme; Other	-0.074	0.703	0.067	0.639	0	0	0	0
Marital status (Ref.: Never married and not living with partner)								
Married or living with partner	0	0	0	0	0.722	1.343	-0.051	0.300
Separated or divorced and not living with partner	0	0	0	0	-1.686	-0.979	-0.485	-0.050
Widowed and not living with partner	0	0	-0.093	0.793	-1.651	-0.112	0	0
Number of children (Ref.: 0)								
3 or more	-0.452	0.059	0.022	0.448	0	0	0	0
2	0	0	0.023	0.376	0.059	0.456	-0.393	0.041
1	0	0	-0.050	0.292	0	0	-0.342	0.053
Health condition (Ref.: Fair, Bad, Very bad)								
Very good	0.747	1.225	0.721	1.250	0.787	1.266	1.467	1.854
Good	0.181	0.653	0.253	0.722	0.305	0.637	0.807	1.064
Country Unemployment Rate by Gender	0	0	-0.049	-0.012	0	0	0	0
Current occupation (Ref.: Elementary occupations)								
Armed forces	0.297	1.786	0.706	1.845	0.164	1.171	0.270	1.369
Manager	0.574	1.230	1.175	1.663	-0.089	0.658	0.125	0.728
Professional	0.820	1.496	0.745	1.302	0	0	-0.014	0.561
Technician or junior professional	0.428	1.075	0.472	0.996	0	0	0.050	0.624
Clerical support worker	0.221	1.022	0.220	0.891	0	0	0	0
Service worker	0.251	0.828	0.352	0.845	0	0	0.002	0.535
Sales worker	0.040	0.753	0.040	0.769	0	0	0	0
Skilled agricultural forestry and fishery worker	0.327	0.936	-0.023	1.038	-0.027	0.614	-0.015	0.596
Craft and related trades worker	0.341	0.925	0.310	0.853	0	0	0.065	0.554
Plant and machine operator or assembler	0.227	0.841	0.431	1.059	-0.060	0.699	0.078	0.586
Constant	2.885	5.349	4.813	6.393	6.480	7.745	4.281	6.985
R-squared	0.154		0.103		0.192		0.129	
Observations	8,691							

Note: The variables included in this estimation are those which were significant in at least one of the four satisfaction specifications (those including all variables in Table A1, Appendix), using stepwise OLS. Variables which were not significant at least at 10% were assigned the value "0". To perform these estimations, the weighting procedure (to scale the sample up to the size of the population within each country) and clustering of standard errors at country level (to account for the existence of many countries in our sample) suggested by GfK EU3C have been employed.
Source: Authors' own calculations

Table 2. Correlational estimates of different aspects of satisfaction for female workers

	Satisfaction with Education		Satisfaction with Present Job		Satisfaction with Family Life		Satisfaction with Social Life	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Education level (Ref.: Primary education or less)								
Secondary education	-0.334	1.842	-0.628	0.065	0	0	0	0
Tertiary education	0.650	2.891	0	0	0	0	0	0
Household net monthly income of 1,000 euros at PPP (Ref.: Very low quartile)								
Very high quartile	0	0	0.143	0.959	0	0	-0.023	1.154
High quartile	0	0	0.050	0.769	0	0	-0.082	0.969
Low quartile	0	0	0.004	0.556	0	0	0	0
Missing flag	-0.202	0.584	0.103	0.742	-0.099	0.542	0.012	0.907
Age of the respondent	0.001	0.017	0.003	0.018	0	0	-0.002	0.012
Hours normally worked per week (Ref.: Between 30 and 49 hours; Less than 30 hours)								
50 or more	0	0	-0.238	0.292	0	0	-0.316	0.056
Type of contract (Ref.: On an unlimited permanent contract; On a fixed term contract of 12 months or more; On apprenticeship or other training scheme; Other; Without a written contract)								
On a fixed term contract of less than 12 months; On a temporary employment agency contract	0	0	-0.727	-0.211	0	0	0	0
Marital status (Ref.: Never married and not living with partner)								
Married or living with partner	0	0	0	0	0.519	1.017	0	0
Separated or divorced and not living with partner	0	0	0	0	-0.862	-0.237	-0.552	0.002
Widowed and not living with partner	0	0	0	0	-1.222	0.169	-0.898	0.091
Number of children (Ref.: 0)								
3 or more	-0.551	-0.009	0.087	0.560	0.264	0.689	0	0
2	-0.492	-0.004	-0.001	0.355	0.151	0.524	-0.473	-0.105
1	0	0	0	0	-0.022	0.328	-0.478	-0.095
Health condition (Ref.: Fair; Bad; Very bad)								
Very good	0.491	0.899	0.623	1.061	0.666	1.014	1.340	1.696
Good	0.162	0.420	0.207	0.586	0.225	0.491	0.688	1.069
Country Unemployment Rate by Gender	0	0	-0.038	-0.001	0	0	-0.038	0.006
Current occupation (Ref.: Armed forces ; Plant and machine operator or assembler; Elementary occupations)								
Manager	0.455	1.428	0.870	1.665	0	0	0	0
Professional	0.914	1.660	0.980	1.636	0	0	-0.023	0.467
Technician or junior professional	0.510	1.412	0.673	1.317	0	0	-0.060	0.469
Clerical support worker	0.280	1.038	0.450	0.986	0	0	0	0
Service worker	0.395	1.006	0.529	1.068	0	0	0.002	0.488
Sales worker	0.094	0.855	0.044	0.608	0	0	0	0
Skilled agricultural forestry and fishery worker	-0.220	1.339	0	0	0	0	0	0
Craft and related trades worker	0.121	1.042	0.063	0.891	0	0	0	0
Constant	3.531	6.321	5.255	6.372	6.645	7.904	5.541	6.913
R-squared	0.167		0.106		0.131		0.120	
Observations	8,959							

Note: The variables included in this estimation are those which were significant in at least one of the four satisfaction specifications (those including all variables in Table A1, Appendix), using stepwise OLS. Variables which were not significant at least at 10% were assigned the value "0". To perform these estimations, the weighting procedure (to scale the sample up to the size of the population within each country) and clustering of standard errors at country level (to account for the existence of many countries in our sample) suggested by GfK EU3C have been employed.
Source: Authors' own calculations.

From these initial econometric estimations, some interesting relationships and trade-offs for the variables under analysis were established in terms of their differential (and, sometimes, conflicting) correlation with the four satisfaction measurements for both genders. This provides a realistic view of the structure of the labour market of the 34 countries under analysis, which is quite consistent with the structure found in previous literature.

The next step of this analysis is to instantiate a multiobjective interval model that will enable assessing the trade-offs regarding job satisfaction of male and female workers under distinct scenarios (optimistic and pessimistic) and, then, going beyond simple associations described by OLS estimations. This model can be used to provide the DMs with sound tools that might help understand how efficient compromises can be reached among these different aspects of satisfaction, thus helping to shape policy measures.

4.2 The multiobjective interval model

The coefficients of the models for male and female workers, respectively, are given by the correlational coefficients in Tables 1 and 2. All the coefficients in each of the regressions that allow obtaining the four objective functions were defined by considering 98% upper and lower confidence intervals. For illustrative purposes, we will only further explain the model formulation for the case of male workers, since it can be obtained analogously for the case of women (this model formulation is available upon request to the authors). Concretely, the form these functions adopt for men is the following; for women they will be defined in the same way, but with 25 variables and the constant term in their case; hence, index "g" stands for gender, with "m" referring to men and "w" to women:

1) Maximization of satisfaction with education ($Max\ Z_1^m$)

$$Max\ Z_1^m = +[0.323,1.812]x_{1m} + [1.194,2.841]x_{2m} + \cdots + [0.227,0.841]x_{30m} + [2.885,5.349]$$

2) Maximization of satisfaction with present job ($Max\ Z_2^m$)

$$Max\ Z_2^m = +[0,0]x_{1m} + [0,0]x_{2m} + \cdots + [0.431,1.059]x_{30m} + [4.813,6.393]$$

3) Maximization of satisfaction with family life ($Max\ Z_3^m$)

$$Max\ Z_3^m = +[0,0]x_{1m} + [0,0]x_{2m} + \cdots + [-0.060,0.699]x_{30m} + [6.480,7.745]$$

4) Maximization of satisfaction with social life ($Max\ Z_4^m$)

$$Max\ Z_4^m = +[-0.206,1.231]x_{1m} + [-0.151,1.310]x_{2m} + \cdots + [0.078,0.586]x_{30m} + [4.281,6.985]$$

In order to ensure that the problem solved is realistic, a set of technical constraints has been defined; this means, concretely, that the profile of a satisfied worker that we obtain is that of a real person who appears in our data, and not a utopian one. In order to achieve this, a set of constraints (C1m) to (C8m) for men and (C1w) to (C6w) for women is presented in Table 3. Each one of these constraints represents a set of binary categorical

variables, which guarantees that they do not simultaneously assume the value 1 in the multiobjective optimization problem – e.g., as indicated in (C1m), the highest level of education of male workers cannot be "primary education or less", "secondary education" and "tertiary education" at the same time, only one of them.

Table 3. Technical constraints for male and female workers

Male workers		**Female workers**	
1. Education level		1. Education level	
$x_{1m} + x_{2m} \leq 1$	(C1m)	$x_{1w} + x_{2w} \leq 1$	(C1w)
2. Household net monthly income		2. Household net monthly income	
$x_{3m} + x_{4m} + x_{5m} \leq 1$	(C2m)	$x_{3w} + x_{4w} + x_{5w} \leq 1$	(C2w)
3. Hours normally worked per week		3. Marital status	
$x_{7m} + x_{8m} \leq 1$	(C3m)	$x_{9w} + x_{10w} + x_{11w} \leq 1$	(C3w)
4. Type of contract		4. Number of children	
$x_{9m} + x_{10m} + x_{11m} \leq 1$	(C4m)	$x_{12w} + x_{13w} + x_{14w} \leq 1$	(C4w)
5. Marital status		5. Health condition	
$x_{12m} + x_{13m} + x_{14m} \leq 1$	(C5m)	$x_{15w} + x_{16w} \leq 1$	(C5w)
6. Number of children		6. Current occupation	
$x_{15m} + x_{16m} + x_{17m} \leq 1$	(C6m)	$x_{18w} + x_{19w} + x_{20w} + x_{21w} + x_{22w} + +x_{23w} + x_{24w} + x_{25w} \leq 1$	(C6w)
7. Health condition			
$x_{18m} + x_{19m} \leq 1$	(C7m)		
8. Current occupation			
$x_{21m} + x_{22m} + x_{23m} + x_{24m} + x_{25m} + +x_{26m} + x_{27m} + x_{28m} + x_{29m} + x_{30m} \leq 1$	(C8m)		

Source: Authors' own calculations

In addition, some other constraints were obtained due to dependencies in the regression analysis, i.e., for those pairs of variables with stronger significant dependencies, because it would not be realistic if independent values were assigned to them. Hence, all the dependencies between the variable "Age of the respondent" (x_{6g}) and the rest of the variables included in the model were checked, resulting in two-sided constraints – by using the 98% confidence intervals – whenever the relationship was significant[10].

In order to illustrate the creation of these constraints, an example for men using the "Age of the respondent" (x_{6m}) and "Secondary education" (x_{1m}) variables is provided as follows:

The dependency between x_{6m} and x_{1m} can be given by the following linear regression:

$$x_{6m} = a \cdot x_{1m} + b$$

so the confidence intervals of the coefficients are (at 98%):

$$a \in [a^l, a^u] = [-8.484, -0.928], \text{ and } b \in [b^l, b^u] = [40.369, 48.787],$$

[10] This means that whenever any of the categories of a categorical variable (with 3 or more categories) is not significant, one of them is not included in the constraint.

which implies:

$$a^l \cdot x_{1m} + b^l \leq x_{6m} \leq a^u \cdot x_{1m} + b^u$$

This expression provided us with two new constraints:

$$x_{6m} - (-0.928x_{1m} + 48.787) \leq 0 \qquad \text{(C9m)}$$

$$x_{6m} - (-8.484x_{1m} + 40.369) \geq 0 \qquad \text{(C10m)}$$

Following this procedure, we can obtain the whole set of constraints – (C9m) to (C22m) for men and (C7w) to (C18w) for women – which are depicted in Table 4.

Table 4. Dependency constraints for male and female workers

Male workers		**Female workers**	
Relationship between age and level of education		Relationship between age and level of education	
$x_{6m} - (-0.928x_{1m} + 48.787) \leq 0$	(C9m)	$x_{6w} - (-3.509x_{1w} - 4.435x_{2m} + 49.600) \leq 0$	(C7w)
$x_{6m} - (-8.484x_{1m} + 40.369) \geq 0$	(C10m)	$x_{6w} - (-8.607x_{1w} - 10.478x_{2m} + 44.217) \geq 0$	(C8w)
Relationship between age and household net monthly income		Relationship between age and type of contract	
$x_{6m} - (4.650x_{3m} + 40.773) \leq 0$	(C11m)	$x_{6w} - (-3.371x_{8w} + 41.589) \leq 0$	(C9w)
$x_{6m} - (0.824x_{3m} - 38.182) \geq 0$	(C12m)	$x_{6w} - (-6.782x_{8w} + 40.104) \geq 0$	(C10w)
Relationship between age and type of contract		Relationship between age and marital status	
$x_{6m} - (-1.730x_{10m} + 43.264) \leq 0$	(C13m)	$x_{6w} - (9.813x_{9w} + 14.423x_{10w} + 22.855x_{11w} + +33.726) \leq 0$	(C11w)
$x_{6m} - (-8.749x_{10m} + 36.743) \geq 0$	(C14m)	$x_{6w} - (7.636x_{9w} + 12.011x_{10w} + 12.479x_{11w} + +31.318) \geq 0$	(C12w)
Relationship between age and marital status		Relationship between age and number of children	
$x_{6m} - (11.932x_{12m} + 13.880x_{13m} + 33.319) \leq 0$	(C15m)	$x_{6w} - (14.480x_{12w} + 12.292x_{13w} + 7.698x_{14w} + +34.787) \leq 0$	(C13w)
$x_{6m} - (9.829x_{12m} + 10.928x_{13m} + 30.436) \geq 0$	(C16m)	$x_{6w} - (11.665x_{12w} + 9.941x_{13w} + 5.832x_{14w} + +32.547) \geq 0$	(C14w)
Relationship between age and number of children		Relationship between age and health condition	
$x_{6m} - (15.873x_{15m} + 13.789x_{16m} + 8.542x_{17m} + +34.573) \leq 0$	(C17m)	$x_{6w} - (-6.051x_{15w} - 3.220x_{16w} + 45.395) \leq 0$	(C15w)
$x_{6m} - (12.808x_{15m} + 11.653x_{16m} + 6.498x_{17m} + +31.759) \geq 0$	(C18m)	$x_{6w} - (-9.052x_{15w} - 5.256x_{16w} + 43.683) \geq 0$	(C16w)
Relationship between age and health condition		Relationship between age and current occupation	
$x_{6m} - (-6.673x_{18m} - 2.675x_{19m} + 45.464) \leq 0$	(C19m)	$x_{6w} - (-0.298x_{22w} - 1.157x_{23w} + 42.686) \leq 0$	(C17w)
$x_{6m} - (-9.128x_{18m} - 4.756x_{19m} + 43.456) \geq 0$	(C20m)	$x_{6w} - (-3.842x_{22w} - 4.735x_{23w} + 40.085) \geq 0$	(C18w)
Relationship between age and current occupation			
$x_{6m} - (7.698x_{22m} + 4.325x_{23m} + 4.030x_{24m} + +7.501x_{28m} + 40.182) \leq 0$	(C21m)		
$x_{6m} - (3.295x_{22m} + 0.452x_{23m} + 0.353x_{24m} + +4.145x_{28m} + 36.745) \geq 0$	(C22m)		

Source: Authors' own calculations

The type of variables and the corresponding bounds (which are regarded as constraints of the multiobjective problem) for the sample under analysis are presented in Table A1 (Appendix).

4.3. The solution approach

The solution approach used in this study was recently proposed in Henriques, Luque, Marcenaro-Gutierrez, and Lopez-Agudo (2018) and allows generating "possibly" efficient solutions (i.e. solutions which are efficient for at least one feasible combination of the objective function coefficients) through the use of an achievement scalarizing

function. This approach was inspired by the one developed in Oliveira and Antunes (2009) and then combined with a reference point-based approach (see Luque, Ruiz, Saborido, & Marcenaro-Gutierrez, 2015).

Consider, without loss of generality, the following multiobjective programming model with interval coefficients in the objective functions:

$$\begin{aligned} \max Z_k(\mathbf{x}) &= \textstyle\sum_{j=1}^{n} [c_{kj}^L, c_{kj}^U]\, x_j, && k = 1, \dots, p, \\ s.t.: &\textstyle\sum_{j=1}^{n} a_{ij} x_j \leq b_i, && i = 1, \dots, m, \\ & x_j \geq 0, && j = 1, \dots, n, \end{aligned} \qquad (2)$$

where c_{kj}^L and c_{kj}^U are, respectively, the lower and upper bounds of the objective function coefficients, $X = \left\{\mathbf{x} = (x_1, \dots, x_n)^T \in \mathbb{R}^n \mid \sum_{j=1}^{n} a_{ij} x_j \leq b_i \;\; i = 1, \dots, m, \;\; x_j \geq 0, j = 1, \dots, n \right\}$ is the feasible region and $\mathbf{x} = (x_1, \dots, x_n)^T$ is the vector of variables.

If each one of the coefficients $[c_{kj}^L, c_{kj}^U]$ is a real value, then problem (2) is a Multiobjective Linear Programming (MOLP) problem:

$$\begin{aligned} \max \overline{Z}_k(\mathbf{x}) &= \textstyle\sum_{j=1}^{n} \bar{c}_{kj}\, x_j, && k = 1, \dots, p, \\ s.t.: &\textstyle\sum_{j=1}^{n} a_{ij} x_j \leq b_i, && i = 1, \dots, m, \\ & x_j \geq 0, && j = 1, \dots, n. \end{aligned} \qquad (3)$$

where $\bar{c}_{kj} \in [c_{kj}^L, c_{kj}^U]$ for all $k = 1, \dots, p, j = 1, \dots, n$.

Definition 1

A solution $\mathbf{x}' \in X$ is efficient to problem (3) if and only if there is no other $\mathbf{x} \in X$ such that $\overline{Z}_k(\mathbf{x}) \geq \overline{Z}_k(\mathbf{x}')$ for all $k = 1, \dots, p$ with at least one strict inequality.

Definition 2

A solution $\mathbf{x}' \in X$ is "possibly" efficient to problem (2) if it is efficient to problem (3) for at least one $\bar{c}_{kj} \in [c_{kj}^L, c_{kj}^U]$ for all $k = 1, \dots, p, j = 1, \dots, n$.

The interactive approach herein used to obtain solutions to model (2) is described below.

Step 1. The purpose of this first step is to analyse whether workers' profiles vary across the scenarios considered (the best and the worst) and with gender, so that the existence of trade-offs between the four aspects of life satisfaction can be checked. In order to do this, for each objective function $Z_k(\mathbf{x})$, $k = 1, \dots, p$, of problem (2), we solve

the following linear programming problems and obtain the individual interval optimal values (Chinneck & Ramadan, 2000):

$$\begin{aligned} &\max Z_k^U(\mathbf{x}) = \textstyle\sum_{j=1}^{n} c_{kj}^U x_j, && k = 1, \dots, p, \\ &s.t.: \textstyle\sum_{j=1}^{n} a_{ij} x_j \leq b_i, && i = 1, \dots, m, \\ &\quad x_j \geq 0, && j = 1, \dots, n. \end{aligned} \tag{4}$$

and

$$\begin{aligned} &\max Z_k^L(\mathbf{x}) = \textstyle\sum_{j=1}^{n} c_{kj}^L x_j, && k = 1, \dots, p, \\ &s.t.: \textstyle\sum_{j=1}^{n} a_{ij} x_j \leq b_i, && i = 1, \dots, m, \\ &\quad x_j \geq 0, && j = 1, \dots, n. \end{aligned} \tag{5}$$

The interval ideal optimal values $\left[Z_k^{L^*}, Z_k^{U^*}\right]$ with $k = 1, \dots, p$ are denoted by:

$$Z_k^{U^*} = Z_k^U(\mathbf{x}_k^0), \qquad k = 1, \dots, p, \tag{6}$$

$$Z_k^{L^*} = Z_k^L(\mathbf{x}_k^1), \qquad k = 1, \dots, p. \tag{7}$$

where the optimal solution to each model is given by $\mathbf{x}_k^\beta$, $k = 1, \dots, p$ and model (4) and model (5) are identified, respectively, with $\beta = 0$ and $\beta = 1$.

Step 2. The aim of this second step is to run the algorithm by considering a given importance for reaching each corresponding ideal solution (either in a best- or worst-case scenario) according to the DM's preferences and if the DM is satisfied with the solution thus obtained (as we will see in Step 3), then this will be the final solution. In order to do this, we solve the following surrogate scalarizing problem:

$$\begin{aligned} &\min\ v + \rho \sum_{k=1}^{p} \left(\mu_k^L \left(Z_k^{L*} - \sum_{j=1}^{n} c_{kj}^L x_j \right) + \mu_k^U \left(Z_k^{U*} - \sum_{j=1}^{n} c_{kj}^U x_j \right) \right) \\ &\text{s.t. } \mu_k^L \left(Z_k^{L*} - \textstyle\sum_{j=1}^{n} c_{kj}^L x_j \right) + \mu_k^U \left(Z_k^{U*} - \textstyle\sum_{j=1}^{n} c_{kj}^U x_j \right) \leq v, \quad k = 1, \dots p, \\ &\quad \textstyle\sum_{j=1}^{n} a_{ij} x_j \leq b_i, \quad i = 1, \dots, m, \\ &\quad x_j \geq 0, \quad j = 1, \dots n. \end{aligned} \tag{8}$$

where $\rho > 0$ is an augmentation coefficient that guarantees the uniqueness of the solution obtained and $\mu_k^L, \mu_k^U > 0$ with $\mu_k^L + \mu_k^U = 1$ for all $k = 1, \dots, p$ corresponds to the importance of reaching the Tchebychev distance to the interval ideal values Z_k^{L*} and Z_k^{U*}.

Step 3. Finally, this last step provides further information regarding the characteristics of the solution depicted in the previous step and in case the DM is not satisfied with the solution obtained, it provides him/her with the tools to perform the search of a new solution according to his/her preferences. Hence, for each "possibly"

efficient solution obtained, the following information is shown to the DM, which allows him/her to express his/her preferences:

1) The acceptability of the interval optimal values obtained being inferior to the interval ideal solution, i.e.

$A \prec (Z_k(\mathbf{x}), Z_k^*) = \frac{(m[Z_k^*] - m\,[Z_k(\mathbf{x})])}{(w[Z_k^*] + w\,[Z_k(\mathbf{x})])}$, where $m[Z_k^*]$ and $m\,[Z_k(\mathbf{x})]$ are the central values of the intervals and $w[Z_k^*]$ and $w\,[Z_k(\mathbf{x})]$ are the width of the intervals as defined in Sengupta, Pal, and Chakraborty (2001).

2) The distance from $Z_k(\mathbf{x})$ to Z_k^*, i.e.

$d\big(Z_k^*, Z_k(\mathbf{x})\big) = \text{Max}\big(|Z_k^{L*} - Z_k^L(\mathbf{x})|, \big|Z_k^{U*} - Z_k^U(\mathbf{x})\big|\big)$.

3) The achievement rate of the solution obtained regarding the lower target and upper target, respectively, i.e.

$tc_k^L = 1 - \frac{(Z_k^{L*} - Z_k^L(\mathbf{x}))}{(Z_k^{L*} - m_k^L)}$ and $tc_k^U = 1 - \frac{\left(Z_k^{U*} - Z_k^U(\mathbf{x})\right)}{\left(Z_k^{U*} - m_k^U\right)}$,

where m_k^L and m_k^U are the worst values attained in the expanded pay-off table.

If both the distance and the acceptability index are close to zero, the interval objective function values are closer to their corresponding interval ideal solutions. When the solution is considered as satisfactory the algorithm stops; otherwise, new values for μ_k^L, μ_k^U can be considered according to the DM's preferences, and we go back to Step 2.

5. Illustrative results

After running **Step 1** of the algorithm described in the previous section we obtained the following results:

For men:

$$Z_1^{L^*m} = Z_1^{Lm}(\mathbf{x}_{1m}^1) = 5.080, \qquad Z_1^{U^*m} = Z_1^{Um}(\mathbf{x}_{1m}^0) = 11.727,$$
$$Z_2^{L^*m} = Z_2^{Lm}(\mathbf{x}_{2m}^1) = 6.181, \qquad Z_2^{U^*m} = Z_2^{Um}(\mathbf{x}_{2m}^0) = 11.067,$$
$$Z_3^{L^*m} = Z_3^{Lm}(\mathbf{x}_{3m}^1) = 7.507, \qquad Z_3^{U^*m} = Z_3^{Um}(\mathbf{x}_{3m}^0) = 10.383,$$
$$Z_4^{L^*m} = Z_4^{Lm}(\mathbf{x}_{4m}^1) = 4.871 \qquad Z_4^{U^*m} = Z_4^{Um}(\mathbf{x}_{4m}^0) = 11.944$$

For women:

$$Z_1^{L^*w} = Z_1^{Lw}(\mathbf{x}_{1w}^1) = 5.299, \qquad Z_1^{U^*w} = Z_1^{Uw}(\mathbf{x}_{1w}^0) = 11.999$$
$$Z_2^{L^*w} = Z_2^{Lw}(\mathbf{x}_{2w}^1) = 6.550, \qquad Z_2^{U^*w} = Z_2^{Uw}(\mathbf{x}_{2w}^0) = 10.683,$$
$$Z_3^{L^*w} = Z_3^{Lw}(\mathbf{x}_{3w}^1) = 7.367, \qquad Z_3^{U^*w} = Z_3^{Uw}(\mathbf{x}_{3w}^0) = 9.740,$$
$$Z_4^{L^*w} = Z_4^{Lw}(\mathbf{x}_{4w}^1) = 5.513 \qquad Z_4^{U^*w} = Z_4^{Uw}(\mathbf{x}_{4w}^0) = 10.324$$

The analysis of the individual optimal values under the best- and worst-case scenarios allows obtaining an overview of the trade-offs between the four axes of evaluation of male and female workers' life satisfaction[11], considering the upper and lower bounds of the objective function coefficients, respectively. The characteristics of the possibly efficient solutions thus obtained are shown in Table 5.

Overall, it can be established that having a good health status and having one child is associated with benefits in terms of life satisfaction, irrespective of the scenario, gender and aspect of evaluation under analysis.

According to the solutions of our models, female workers seem to achieve a higher level of satisfaction across all factors considered when they spend more time at their paid jobs than men. This outcome might be related to the fact that longer hours of unpaid housework are no longer "satisfying" women, whose job satisfaction is connected to longer hours of paid work. We should bear in mind that unpaid work is associated with the traditional gender role of women (childcare and housework), thus paid working outside the home may be seen by women as a catalyst in changing gender roles. In other words, these results seem to show the wish of women to overcome the conventional conception of gender that privileges men's careers over women's careers in dual-earner households (Pixley, 2009). Additionally, in order to achieve a balanced optimal satisfaction level, the monthly net income for women appears to be lower or equal than for men in almost all situations and factors under evaluation. This could also be related to the gender identity hypothesis, which states that social patterns will condition individual satisfaction depending on whether the individuals follow or move away from the social norms which correspond to their gender identity (Akerlof & Kranton, 2000), which may influence the working-life balance. Additionally, women seem to achieve the highest level of satisfaction in all scenarios and features of life satisfaction when they are married or living with a partner.

In the case of men, similar results are found, except in the case of satisfaction with education, which seems to be positively associated with being separated or divorced and not living with a partner. When the maximization of satisfaction with education is sought, both genders seem to present professional occupations in the two extreme scenarios.

[11] The computations corresponding to these profiles are not provided in order to save space, but are available upon request to the authors.

Table 5. Characteristics of the individual optimal solutions under the best- and worst-case scenarios

Satisfaction factor	Education (Best case)	Education (Worst case)	Present job (Best case)	Present job (Worst case)	Family life (Best case)	Family life (Worst case)	Social life (Best case)	Social life (Worst case)
Education level	Male – tertiary	Male – tertiary	Male – secondary	Male – primary or less	Male – secondary	Male – tertiary	Male – tertiary	Male – primary or less
	Female – tertiary	Female – tertiary	Female – secondary	Female – tertiary	Female – secondary	Female – secondary	Female – secondary	Female – tertiary
Household net monthly income	Male – very high quartile	Male – very high quartile	Male – very high quartile	Male – very high quartile	Male – high quartile	Male – low quartile	Male – very high quartile	Male – very high quartile
	Female – low quartile	Female – very high quartile	Female – very high quartile	Female – very high quartile	Female – very high quartile	Female – low quartile	Female – very high quartile	Female – very low quartile
Age	Male – 43	Male – 41	Male – 41	Male – 41	Male – 40	Male – 41	Male – 41	Male – 41
	Female – 42	Female – 42	Female – 42	Female – 42	Female – 41	Female – 40	Female – 42	Female – 40
Hours normally worked per week	Male – 50 hours or more	Male – 30 to 49 hours	Male – 30 to 49 hours	Male – less than 30 hours	Male – less than 30 hours	Male – less than 30 hours	Male – 30 to 49 hours	Male – less than 30 hours
	Female – 50 hours or more	Female – 50 hours or more	Female – 50 hours or more	Female – less than 50 hours	Female – 50 hours or more	Female – 50 hours or more	Female – 50 hours or more	Female – less than 50 hours
Type of contract	Male – apprenticeship or other training scheme or other	Male – fixed term of less than 12 months or on a temporary employment	Male – on apprenticeship or other training scheme or other	Male – on apprenticeship or other training scheme or other	Male – fixed term of less than 12 months or on a temporary employment	Male – fixed term of less than 12 months or on a temporary employment	Male – unlimited permanent or on a fixed term contract of 12 months or more	Male – apprenticeship or other training scheme or other
	Female – different from a fixed term contract of less than 12 months or a temporary employment	Female – different from a fixed term contract of less than 12 months or a temporary employment	Female – different from a fixed term contract of less than 12 months or a temporary employment	Female – different from a fixed term contract of less than 12 months or a temporary employment	Female – different from a fixed term contract of less than 12 months or a temporary employment	Female – different from a fixed term contract of less than 12 months or a temporary employment	Female – different from a fixed term contract of less than 12 months or a temporary employment	Female – different from a fixed term contract of less than 12 months or a temporary employment
Marital status	Male – separated or divorced and not living with a partner	Male – married or living with a partner	Male – married or living with a partner	Male – married or living with a partner	Male – married or living with a partner	Male – married or living with a partner	Male – married or living with a partner	Male – married or living with a partner
	Female – married or living with a partner	Female – married or living with a partner	Female – married or living with a partner	Female – married or living with a partner	Female – married or living with a partner	Female – married or living with a partner	Female – married or living with a partner	Female – married or living with a partner
Number of children	Male – one child	Male – one child	Male – one child	Male – one child	Male – one child	Male – one child	Male – one child	Male – one child
	Female – one child	Female – one child	Female – one child	Female – one child	Female – one child	Female – one child	Female – one child	Female – one child
Health condition	Male – good	Male – good	Male – good	Male – good	Male – good	Male – good	Male – good	Male – good
	Female – good	Female – good	Female – good	Female – good	Female – good	Female – good	Female – good	Female – good
Country unemployment rate	Male – 13.2%	Male – 8.6%	Male – 3.8%	Male – 3.8%	Male – 8.2%	Male – 6.1%	Male – 8.8%	Male – 10.2%
	Female – 10.5%	Female – 20.8%	Female – 4.2%	Female – 4.2%	Female – 8.1%	Female – 10.3%	Female – 40%	Female – 4.2%
Current occupation	Male – professional	Male – professional	Male – manager	Male – manager	Male – manager	Male – professional	Male – manager	Male – manager
	Female – professional	Female – professional	Female – manager	Female – professional	Female – clerical support worker	Female – manager	Female – service worker	Female – service worker

Source: Authors' own calculations

The age leading to the highest life satisfaction levels seems to range between 40 and 42 in the case of female workers and goes from 40 to 43 for male workers, amongst all possibilities under assessment.

Furthermore, as expected, the highest level of satisfaction in terms of education in both genders seems to be attained when tertiary education is obtained. A low level of household net monthly income appears to bring benefits to the maximization of family life satisfaction in a worst-case scenario irrespective of the gender. Interestingly, only male workers seem to be willing to sacrifice ~~the~~ working time to less than 30 hours in order to reach the highest level of satisfaction with family life, while female workers seem to be willing to work 50 hours or more to obtain the same level of satisfaction.

The lowest level of country unemployment appears to be positively associated with present job satisfaction. In this situation, male workers seem more satisfied with a management position in both scenarios while women appear to be more satisfied with a professional occupation in a worst-case scenario and a manager occupation in the best-case scenario.

While occupation as a service worker has a positive influence on social life maximization for female workers, male workers seem to become more satisfied ~~with~~ in this regard when occupying a managerial position.

In summary, our findings indicate that these workers' profiles vary across the scenarios considered and with gender, reflecting the existence of trade-offs between the four aspects of life satisfaction and highlighting the importance of seeking compromises among these aspects of life satisfaction.

Finally, it is worth mentioning that the similarity of the female and male profiles in the best- and worst-case situations (e.g. for women in the maximization of satisfaction of education) illustrates the immunity of these profiles to changes in the model's coefficients.

Step 2 of the algorithm was first run by considering the same importance for reaching each corresponding ideal solution (either in a best- or worst-case scenario). Table 6 provides information regarding the first set of compromise solutions for both genders.

Regardless of gender, this compromise solution highlights the positive association with life satisfaction of a tertiary level of education and a very high quartile of monthly net income (as found by Diener & Seligman, 2004; Van Praag & Ferrer-i-Carbonell, 2004; Stevenson & Wolfers, 2013). Then again, being married or living with a partner,

having one child and a good health status seem to be common features in both genders in terms of balanced life satisfaction (Arrow, 1996; Diener, Gohm, Suh, & Oishi, 2000; Bailey & Snyder, 2007; Cetre, Clark, & Senik, 2016). The differences between male and female workers are mainly found in terms of their occupation and working time (Gash, Mertens, & Romeu Gordo, 2010). In this regard, men appear to be more satisfied with management positions (as indicated by Lup, 2017) when they work less than 30 hours per week, while women might prefer professional occupations and to work less than 50 hours to get the same optimal balanced level of satisfaction. In addition, men might be more satisfied when they are on an apprenticeship, training scheme or other, while women seem to be more satisfied when they are not on a fixed term contract of less than 12 months or on a temporary employment agency contract. Finally, in the case of age, both male and female workers might be more satisfied when they are middle aged (around 42-43 years; as found by authors as Blanchflower & Oswald, 2008) and if the lowest level of country unemployment rate is reached.

Table 6. Possibly efficient solutions with $\mu_k^L = \mu_k^U = 0.5$, $k = 1, \ldots, 4$

		Male workers		Female workers	
		Notation	Solution	Notation	Solution
Education level	Primary education or less				
	Secondary education	x_{1m}	0	x_{1w}	0
	Tertiary education	x_{2m}	1	x_{2w}	1
Household net monthly income of 1,000 euros at PPP (Ref.: Very low quartile)	Very high quartile	x_{3m}	1	x_{3w}	1
	High quartile	x_{4m}	0	x_{4w}	0
	Low quartile	x_{5m}	0	x_{5w}	0
	Very low quartile				
	Missing flag				
Age of the respondent		x_{6m}	42.7856	x_{6w}	41.5886
Hours normally worked per week	50 or more	x_{7m}	0	x_{7w}	0
	Between 30 and 49	x_{8m}	0		
	Less than 30				
Type of contract	On an unlimited permanent contract; On a fixed term contract of 12 months or more	x_{9m}	0		
	On a fixed term contract of less than 12 months; On a temporary employment agency contract	x_{10m}	0	x_{8w}	0
	On apprenticeship or other training scheme; Other	x_{11m}	1		
	Without a written contract				
Marital status	Married or living with partner	x_{12m}	1	x_{9w}	1
	Separated or divorced and not living with partner	x_{13m}	0	x_{10w}	0
	Widowed and not living with partner	x_{14m}	0	x_{11w}	0
	Never married and not living with partner				
Number of children	3 or more	x_{15m}	0	x_{12w}	0
	2	x_{16m}	0	x_{13w}	0
	1	x_{17m}	1	x_{14w}	1
	0				
Health condition	Very good	x_{18m}	0	x_{15w}	0
	Good	x_{19m}	1	x_{16w}	1
	Fair				
	Bad				
	Very bad				
Country Unemployment Rate by Gender		x_{20m}	3.8004	x_{17w}	4.2
Current occupation	Armed forces	x_{21m}	0		
	Manager	x_{22m}	1	x_{18w}	0
	Professional	x_{23m}	0	x_{19w}	1

	Technician or junior professional	x_{24m}	0	x_{20w}	0
	Clerical support worker	x_{25m}	0	x_{21w}	0
	Service worker	x_{26m}	0	x_{22w}	0
	Sales worker	x_{27m}	0	x_{23w}	0
	Skilled agricultural forestry and fishery worker	x_{28m}	0	x_{24w}	0
	Craft and related trades worker	x_{29m}	0	x_{25w}	0
	Plant and machine operator or assembler	x_{30m}	0		
	Elementary occupations				
Objective function values					
Satisfaction with	Education	Upper	11.461	Upper	11.999
		Medium	8.110	Medium	8.649
		Lower	4.760	Lower	5.299
	Present Job	Upper	10.448	Upper	10.297
		Medium	8.315	Medium	8.424
		Lower	6.181	Lower	6.550
	Family Life	Upper	10.383	Upper	9.740
		Medium	8.901	Medium	8.554
		Lower	7.418	Lower	7.367
	Social Life	Upper	11.327	Upper	10.032
		Medium	8.024	Medium	7.747
		Lower	4.720	Lower	5.462

Note: Those variables which do not have a notation assigned were considered as reference category in estimations. The reference categories and variables included in the interval multiobjective problem vary by gender.
Source: Authors' own calculations

From Table 6 it can also be concluded that women seem to have higher scores in terms of satisfaction with education than men (in all scenarios). In the case of satisfaction with family life, men might be better off (in all situations). The satisfaction at their present jobs appears to be higher for men under a best-case scenario and higher for women if a worst-case scenario is considered. Finally, similar conclusions might also be attained regarding the satisfaction with social life.

Table 7 allows obtaining further information regarding the characteristics of the solution depicted in Table 6 (**Step 3**).

Although, female workers only seem to consistently have higher scores regarding their satisfaction with education (irrespective of the scenario of coefficients considered) when compared to male workers, it seems that the achievement rates which reflect their life satisfaction factors might always be higher than for men. This is also corroborated by the values of the acceptability index – $A \prec (Z_k(\mathbf{x}), Z_k^*)$ – and the distance between the interval objective values obtained in this solution and the corresponding interval ideal solutions – $d\left(Z_k^*, Z_k(\mathbf{x})\right)$ –, which are zero both in the case of satisfaction with education and family life. These outcomes indicate that in this solution these two objective functions already reach their ideal values. In respect to satisfaction with their present job, the achievement rate obtained in the worst-case scenario is 100% ($tc_2^L = 1$, meaning that the lower bound of the objective function coincides with the lower bound of the ideal solution, i.e. the optimal value of this objective function under a worst-case scenario),

while in the best-case scenario it is 80.1% ($tc_2^U = 0.801$, meaning that the upper bound of the objective function obtained is close to the upper bound of the ideal solution in this scenario, i.e. the optimal value of this objective function under a best-case scenario). In the case of satisfaction with their social life, women also seem to reach higher achievement rates in both scenarios (i.e. tc_4^L =0.970 and tc_4^U =0.841 in the worst- and best-case scenarios, respectively). The acceptability index of these current objective function values ~~being~~ inferior to the ideal ones (i.e. present job and social life) is also near zero.

Contrastingly, men seem more demanding since results illustrate that further improvements might be required to make them happier, in particular with their social life and their current jobs under a best-case scenario (tc_4^U =0.680 and tc_2^U =0.746, respectively) and with their education levels in a worst-case scenario (tc_1^L =0.789).

Therefore, in order to improve these particular aspects of life satisfaction in the case of men, a new set of compromise solutions has been sought by considering:

1) Hypothesis 1 - $\mu_1^L = 0.7$, $\mu_1^U = 0.3$ and $\mu_k^L = \mu_k^U = 0.5$, $k = 2, 3, 4$;
2) Hypothesis 2 - $\mu_2^L = 0.3$, $\mu_2^U = 0.7$ and $\mu_k^L = \mu_k^U = 0.5$, $k = 1, 3, 4$;
3) Hypothesis 3 - $\mu_4^L = 0.3$, $\mu_4^U = 0.7$ and $\mu_k^L = \mu_k^U = 0.5$, $k = 1, 2, 3$;

hence increasing μ_k^L or μ_k^U for the indicated satisfaction aspects in the scenarios which need to be improved. The first two hypothesis do not influence the solution previously obtained, illustrating this solution's immunity to changes in the coefficients regarding satisfaction with education and with the present job situation. However, the third hypothesis leads to the conclusion that an increase in social life satisfaction (under a best-case scenario) may lead to sacrificing all other life satisfaction factors. The characteristics of this latter solution are provided in Table 8. In this case, all achievement rates of the remaining objective functions are worsened (compared to Table 7; e.g. tc_1^U was 0.915 and it is now 0.861) in order to obtain the highest achievement rate of the upper bound of social life satisfaction (tc_4^U =1).

Table 7. Information regarding the solution obtained with $\mu_k^L = \mu_k^U = 0.5$, $k = 1, \ldots, 4$

	Men				Women			
	$A \prec (Z_k(\mathbf{x}), Z_k^*)$	$d(Z_k^*, Z_k(\mathbf{x}))$	tc_k^L	tc_k^U	$A \prec (Z_k(\mathbf{x}), Z_k^*)$	$d(Z_k^*, Z_k(\mathbf{x}))$	tc_k^L	tc_k^U
Z_1	0.044	0.320	0.789	0.915	0.000	0.000	1.000	1.000
Z_2	0.068	0.619	1.000	0.746	0.049	0.386	1.000	0.801
Z_3	0.015	0.089	0.969	1.000	0.000	0.000	1.000	1.000
Z_4	0.056	0.617	0.890	0.680	0.037	0.292	0.970	0.841

Source: Authors' own calculations

Table 8. Information regarding the solution obtained by considering hypothesis 3

	Men			
	$A \prec (Z_k(\mathbf{x}), Z_k^*)$	$d(Z_k^*, Z_k(\mathbf{x}))$	tc_k^L	tc_k^U
Z_1	0.057	0.436	0.788	0.861
Z_2	0.087	0.639	0.890	0.738
Z_3	0.093	0.513	0.823	0.979
Z_4	0.041	0.603	0.562	1.000

Source: Authors' own calculations

If the DM wants to further explore other possible compromises, he/she might change the values of μ_k^L, μ_k^U. The algorithm stops when the DM reaches satisfactory achievement rates regarding the targets used as a reference.

6. Conclusions

The debate on the importance of life satisfaction has been at the forefront of the policy agenda in the European Union because of its well-known influence on firms' productivity. Currently, it is argued that public policies should foster the increase of workers' life satisfaction, as they could provide benefits both to employees and employers. In this sense, workers' satisfaction should become a primary focus for policymakers.

Despite the numerous publications on the main factors conditioning workers' life satisfaction, there is still a gap in the literature regarding the best ways to reach compromises among the different factors that might influence workers' satisfaction. This can be particularly relevant since work and life satisfaction are associated to a multiplicity of factors that are sometimes conflicting and entangled with each other. Therefore, the need arises to provide policymakers with sound tools that might help establish ways to grasp efficient compromises across these different features of life satisfaction, thus helping in the design of policies aimed at enhancing workers' life satisfaction.

With this reasoning in mind, we formulated a multiobjective interval-programming model with the help of econometric tools, where different workers' life satisfaction aspects are regarded as objective functions. Interval multiobjective programming models were easily combined with econometric estimations in order to obtain a comprehensive assessment of the problem under analysis, also enabling the study of distinct scenarios which otherwise might be disregarded. In spite of the relevant features of this combination of methodologies, we have also acknowledged that we are working with correlational econometric estimates rather than causal ones; however,

multiobjective interval-programming is useful in this situation, as it takes into account the fact that the information required to instantiate the models is seldom incomplete and subject to uncertainty.

We have explicitly addressed four axes of evaluation of workers' life satisfaction: satisfaction with education, present job, family life and social life. Additionally, we have conducted a separate analysis both for male and female workers, because of the disparities that might arise in these life satisfaction features among genders; this is supported by the literature, which has shown that women continue to do the majority of housework (Lachance-Grzela & Bouchard, 2010; Pailhé, Solaz, & Souletie, 2019), which potentially influences their working-life satisfaction balance. Ideally, it would be interesting, as an additional contribution, to add to the gender analysis the distinction between "main breadwinner in the household" and "no main wage earner" in order to precisely check the gender identity hypothesis mentioned above; however, the dataset under scrutiny did not include information on this division (or any way to identify the "main breadwinner in the household" from the variables provided, as income information is at household level). Other ways of division (e.g. by age or by country) would be of interest for the research agenda and could be explored in future research.

In line with previous research, our findings suggest that having a good health status and having one child has a positive association with life satisfaction, irrespective of the scenario, gender and factor of evaluation considered; this may also happen with being married or living with a partner. It was also found that, in general, it seems that female workers have to work more hours than men to show the highest levels of satisfaction across all aspects under evaluation. Additionally, even though the education levels required for women are higher than for men, or equal, women's monthly net income might be lower or equal than men's in order to report the highest levels of satisfaction across all aspects in almost all situations.

In so far as the average paid working hours by female workers are slightly below those of male workers, it may be interpreted that longer hours of unpaid housework are no longer "satisfying" women, whose working satisfaction is associated with longer hours of paid work. This goes against the mainstream conception of gender that tends to prioritize men's careers over women's careers in dual-earner households (Pixley, 2009). Another potential implication of the results obtained, for both men and women, is that the existing work-family arrangements seem to be insufficient in face of the current tumbling birth rates across Europe, particularly when increasing the number of children does not

seem to contribute to the highest – balanced – levels of life satisfaction. Overall, our findings highlight the importance of simultaneously evaluating qualitative aspects of people's life in order to understand how people make decisions when they face trade-offs in a context of uncertainty.

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Appendix

Table A1. Decision variables and descriptive statistics

		Male workers			Female workers			Variable characteristics	
		Notation	Mean	Standard Deviation	Notation	Mean	Standard Deviation	Type	Bounds
Satisfaction with	Education	Z_1	7.23	2.20	Z_1	7.45	2.20	Integer	[1, 10]
	Present Job	Z_2	7.44	2.07	Z_2	7.49	2.10	Integer	[1, 10]
	Family Life	Z_3	8.12	1.98	Z_3	8.11	1.93	Integer	[1, 10]
	Social Life	Z_4	7.44	1.99	Z_4	7.37	2.04	Integer	[1, 10]
Education level	Primary education or less		0.04	0.19		0.03	0.16	Binary	0 or 1
	Secondary education	x_{1m}	0.66	0.47	x_{1w}	0.59	0.49	Binary	0 or 1
	Tertiary education	x_{2m}	0.30	0.46	x_{2w}	0.38	0.49	Binary	0 or 1
Household net monthly income of 1,000 euros at PPP	Very high quartile	x_{3m}	0.19	0.40	x_{3w}	0.19	0.39	Binary	0 or 1
	High quartile	x_{4m}	0.19	0.39	x_{4w}	0.20	0.40	Binary	0 or 1
	Low quartile	x_{5m}	0.19	0.39	x_{5w}	0.20	0.40	Binary	0 or 1
	Very low quartile		0.20	0.40		0.18	0.39	Binary	0 or 1
	Missing flag		0.23	0.42		0.23	0.42	Binary	0 or 1
Age of the respondent		x_{6m}	41.35	11.30	x_{6w}	41.43	10.74	Continuous	[18, 64]
Hours normally worked per week	50 or more	x_{7m}	0.25	0.43	x_{7w}	0.09	0.29	Binary	0 or 1
	Between 30 and 49	x_{8m}	0.70	0.46		0.73	0.45	Binary	0 or 1
	Less than 30		0.05	0.21		0.18	0.38	Binary	0 or 1
Type of contract	On an unlimited permanent contract; On a fixed term contract of 12 months or more	x_{9m}	0.76	0.42		0.82	0.39	Binary	0 or 1
	On a fixed term contract of less than 12 months; On a temporary employment agency contract	x_{10m}	0.07	0.25	x_{8w}	0.07	0.26	Binary	0 or 1
	On apprenticeship or other training scheme; Other	x_{11m}	0.06	0.24		0.04	0.20	Binary	0 or 1
	Without a written contract		0.11	0.31		0.07	0.25	Binary	0 or 1
Marital status	Married or living with partner	x_{12m}	0.71	0.46	x_{9w}	0.66	0.47	Binary	0 or 1
	Separated or divorced and not living with partner	x_{13m}	0.08	0.27	x_{10w}	0.14	0.35	Binary	0 or 1
	Widowed and not living with partner	x_{14m}	0.01	0.12	x_{11w}	0.04	0.19	Binary	0 or 1
	Never married and not living with partner		0.20	0.40		0.16	0.36	Binary	0 or 1
Number of children	3 or more	x_{15m}	0.16	0.37	x_{12w}	0.15	0.35	Binary	0 or 1
	2	x_{16m}	0.32	0.47	x_{13w}	0.35	0.48	Binary	0 or 1
	1	x_{17m}	0.20	0.40	x_{14w}	0.24	0.43	Binary	0 or 1
	0		0.32	0.47		0.26	0.44	Binary	0 or 1
Health condition	Very good	x_{18m}	0.32	0.46	x_{15w}	0.28	0.45	Binary	0 or 1
	Good	x_{19m}	0.47	0.50	x_{16w}	0.46	0.50	Binary	0 or 1
	Fair		0.19	0.39		0.23	0.42	Binary	0 or 1
	Bad		0.02	0.15		0.03	0.17	Binary	0 or 1
	Very bad		0.00	0.06		0.00	0.06	Binary	0 or 1
Country Unemployment Rate by Gender		x_{20m}	11.06	6.48	x_{17w}	10.70	6.35	Continuous	[3.8, 31.8] for male workers; [4.2, 40] for female workers
Current occupation	Armed forces	x_{21m}	0.01	0.10		0.00	0.04	Binary	0 or 1
	Manager	x_{22m}	0.10	0.30	x_{18w}	0.05	0.22	Binary	0 or 1
	Professional	x_{23m}	0.14	0.35	x_{19w}	0.21	0.41	Binary	0 or 1
	Technician or junior professional	x_{24m}	0.13	0.34	x_{20w}	0.09	0.28	Binary	0 or 1

	Male workers			Female workers			Variable characteristics	
Clerical support worker	x_{25m}	0.07	0.26	x_{21w}	0.20	0.40	Binary	0 or 1
Service worker	x_{26m}	0.12	0.33	x_{22w}	0.18	0.38	Binary	0 or 1
Sales worker	x_{27m}	0.07	0.25	x_{23w}	0.12	0.32	Binary	0 or 1
Skilled agricultural forestry and fishery worker	x_{28m}	0.03	0.18	x_{24w}	0.01	0.09	Binary	0 or 1
Craft and related trades worker	x_{29m}	0.20	0.39	x_{25w}	0.05	0.21	Binary	0 or 1
Plant and machine operator or assembler	x_{30m}	0.06	0.24		0.01	0.11	Binary	0 or 1
Elementary occupations		0.07	0.26		0.08	0.28	Binary	0 or 1
Observations		8,691			8,959			

Note: Those variables which do not have a notation assigned were considered as a reference category in estimations. The reference categories and variables included vary by gender.
Source: Authors' own calculations