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The Effect of Job Insecurity on Labour Supply

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Abstract

The aim of this paper is to analyse the effect of job insecurity on labour supply. We propose a discrete choice model of labour supply, in which the choice alternatives are characterised by bundles of income, hours of work and job insecurity. The results show that job insecurity has a negative and significant effect on individuals' utility. Moreover, once job insecurity is included in the discrete choice alternatives, the predictive power of the model improves significantly. Labour supply elasticities are significantly higher than those obtained with a traditional model and increase with the level of job insecurity. Finally, a decrease of job insecurity at work has a positive and significant effect on participation. Policies aimed at improving working conditions could, in this sense, be useful to create incentives in labour market.

Keywords: Discrete choice, Labour supply, Job insecurity

JEL classification: C25, J22, J81

1. Introduction

A considerable body of research has documented the importance of job insecurity as a work domain. At the individual level, job insecurity has been found to negatively affect job satisfaction (Clark, 2010; De Witte, 2005; Hellgreen, *et al*. 1999), as well as physical and mental health (Burgard *et al*. 2009; De Witte, 1999; Dekker and Schaufeli, 1995; Ferrie, 1998). At the organisational level, job insecurity has been shown to be related with higher absenteeism (Chirumbolo and Areni, 2005; Probst, 2002), higher turnover and quit intentions (Clark, 2001; Dekker and Schaufeli, 1995) and less organisational commitment (Hellgreen, *et al*. 1999; Lord and Hartley, 1998; Rosenblatt, *et al*. 1999). However, the effect of job insecurity at a more aggregate level has been less considered in the literature. In this article, we study the effect of job insecurity on labour supply. In particular, we extend traditional discrete choice models of labour supply to incorporate job insecurity in the choice alternatives and compare the estimated labour supply responses to those of a model where only a discrete hours' set characterises job alternatives.

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Discrete choice models of labour supply have become increasingly popular as they facilitate dealing with non-linear and non-convex budget sets as well as accounting for multiple goods in the utility function, compared to the traditional approach based on a continuous set of hours. The idea behind the discrete choice approach is to define a finite number of working hours' alternatives and to explicitly specify a utility function characterising the individual's utility at each of the alternatives of the discrete hours set. The estimation of the discrete choice model provides directly the parameters defining the shape of the utility function.

Most studies, using the discrete labour supply approach, take income and hours of work as the only choice variables affecting individuals' decisions. However, we agree with Dagsvik and Strøm (2006) that 'hours of work and income are only two out of several job related attributes, which are important for individual behaviour in the labour market'. Dagsvik (1994) and Dagsvik and Strøm (1992) propose a model of labour supply which accounts for the importance of qualitative factors of jobs. This model of discrete choice labour supply assumes that the alternatives are characterised by 'job packages' which are defined by a bundle of hours of work, wage rates and other non-pecuniary job attributes. Other studies on labour supply such as Aaberge, Dagsvik and Strøm (1995), Aaberge and Colombino (2013) and Dagsvik and Strøm (2006) use a similar methodology. Dagsvik and Strøm (2006) introduce, for instance, job sector (public or private sector) in their analysis, assuming that jobs in different sectors may differ in terms of non-pecuniary attributes. In a recent paper, Kunze and Suppa (2013) investigate the effect of introducing job characteristics in discrete choice models of labour supply. However, alternatives are defined only over discrete hours' choices, while job characteristics enter the utility function through interactions between income and leisure. Contrary to Kunze and Suppa (2013), in this paper, we propose an extended discrete choice model, where the choice alternatives are characterised by bundles of income, hours of work and job insecurity in order to allow for more flexibility in the choices available to individuals and to analyse the effect of changes in job insecurity on labour supply decisions.

Our contribution to the literature is twofold. First, we provide an extension of discrete choice labour supply models in order to allow for the introduction of non-pecuniary job attributes in the analysis, in our case job insecurity. We analyse how such extension affects labour supply elasticities. Second, we complement the literature on the consequences of job insecurity. In particular, we show that job insecurity has a significant effect on labour supply decisions, which could be of interest in terms of labour market policies based on non-monetary incentives. The paper is structured as follows. Section 2 briefly discussed the nature of job insecurity as a job attribute. Section 3 presents the discrete choice models to be used in our labour supply analysis. First, we present the traditional labour supply model where only hours of work define the choice set. Then, the extended conditional logit is introduced in order to allow the choice set to be characterised by bundles of income, hours of work and job insecurity. Section 4 describes the data and presents some summary statistics. Section 5 presents the estimates of the structural labour supply models. Section 6 discusses labour responses in terms of wage elasticities and changes in the predicted probabilities from a decrease of job insecurity. Finally, section 7 concludes.

2. Job Insecurity as a Job Attribute

Jobs are characterised by multiple attributes, which might affect individuals' labour supply decisions. In this paper, we focus on job insecurity, which has been considered one of the most important domains at work (Clark, 2001 and 2010). Moreover, job insecurity has proved to significantly affect important individuals' outcomes such as well-being (Clark, 2001 and 2010; Green, *et al*. 2013), health (Burgard, *et al*. 2009; Ferrie, 1998) and organizational commitment (Hellgreen, *et al*. 1999; Lord and Hartley, 1998; Rosenblatt, *et al*. 1999).

According to Greenhalgh and Rosenblatt (1984) job insecurity is defined as the perceived powerlessness to maintain the desired job continuity. The idea that job insecurity refers to individuals' perception of their job situation highlights the fact that both a subjective and an objective component characterise this concept. Individuals evaluate their level of job insecurity based on objective information from their jobs. Studies have shown that perceived job insecurity provides reliable information about objective indicators of insecure jobs. In particular, perceived job insecurity is significantly associated with temporary employment and job sector; public sector being considered more secure than the private sector (Campbell, *et al*. 2007; Clark and Postel-Vinay, 2009; Deloffre and Rioux, 2003; Näswall and De Witte, 2003). Moreover, perceived job insecurity has proved to be a good predictor of future unemployment experiences even after controlling for observed objective variables, implying that self-perceived job insecurity contains useful private information about jobs, which is otherwise not directly available in surveys (Campbell, *et al*. 2007; Deloffre and Rioux, 2003). In fact, restructuration such as privatization of formerly public companies, as well as layoffs have been shown to increase self-perceived job insecurity (Ferrie, *et al*. 1995; Nelson, *et al*. 1995).

The particular interpretation of job insecurity information is moreover linked to the formulation of the questions included in surveys. At least three different formulations are used in surveys, which are related to feelings of insecurity ('Do you feel your job is secure?'), satisfaction with job insecurity ('How satisfied are you with your job security?') and the probability of losing a job ('What is the probability that you lose your job in the next (e.g. 12 months?'). Note that the first two formulations, in particular, confound two components of job insecurity discussed in the literature: the probability of job loss and the cost of job loss (Campbell, *et al*. 2007). The variables related to these three types of questions are however highly correlated and all three are significantly associated with objective indicators of insecure jobs. Nevertheless, it is important to keep in mind which type of information is available when interpreting the results.

While acknowledging the particularities related to the concept of job insecurity, in this paper we consider it as a proxy for an indicator of the objective insecurity characterising a job. Throughout our analysis, we discuss the implications of such assumption given the type of information available in the British Household Panel Survey (BHPS) used in our study.

3. Discrete Choice Models of Labour Supply

Discrete choice models of labour supply are particularly popular in the framework of behavioural microsimulation of tax and benefit reforms. In fact, many policies are specifically aimed at encouraging labour market participation of certain population groups. For instance, Brewer, *et al*. (2007) use a structural model of labour supply in order to evaluate the effect of the Working Families Tax Credit on labour market participation in the UK. Moreover, other tax and benefit reforms might also affect individuals' labour supply behaviour, which needs to be taken into account when evaluating the effect of such policies on different outcome variables, such as poverty or inequality.

In this section we describe the model most widely used to estimate discrete choice labour supply, namely the conditional logit model. The model is derived under the assumption of utility maximisation. Consider individual i chooses among a finite number of job alternatives, J. The utility obtained from alternative j is U_{ij}, $j = 1,\ldots,J$. Individual i chooses alternative j if and only if $U_{ij} > U_{ik}, \forall k \neq j$. The utility function can be decomposed in a deterministic and a stochastic component: $U_{ij} = V_{ij} + \varepsilon_{ij}$, where the distribution of the random vector $\varepsilon_i = \{\varepsilon_{i1},\ldots,\varepsilon_{iJ}\}$ is given by $F(\varepsilon_i)$. The probability that a particular alternative j is chosen is:

$$\begin{aligned} P_{ij} &= Prob(U_{ij} > U_{ik}, \forall k \neq j) \\ &= Prob(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ik}, \forall k \neq j) \\ &= Prob(\varepsilon_{ik} < \varepsilon_{ij} + V_{ij} - V_{ik}, \forall k \neq j) \end{aligned}$$

Depending on the specification of the distribution of the random component, different discrete choice models can be obtained. The conditional logit model is obtained assuming that the stochastic component, ε_{ij}, is independent and identically distributed over alternatives and follows a type-one extreme value distribution, given by:

$$F(\varepsilon_i) = e^{-e^{-\varepsilon_{ij}}}$$

Under the conditional logit setup, the probability that alternative j is chosen is given by (McFadden, 1974):

$$\begin{aligned} P_{ij} &= Prob(\varepsilon_{ik} < \varepsilon_{ij} + V_{ij} - V_{ik}, \forall k \neq j) \\ &= \frac{e^{V_{ij}}}{\sum_{k=1}^{J} e^{V_{ik}}} \end{aligned}$$

In our basic model, individuals choose among a finite number of working hours alternatives in order to maximise their utility, defined over net income and hours of work. We assume that the gross wage rates are fixed and independent of the hours of work. The decision is taken given the gross wage rates and the tax and benefit system.

More formally, let h_i be the number of hours worked by individual i. We define J discrete hours alternatives so that h_{ij} represents the number of hours worked by individual i under alternative j, with $j = 1,\ldots,J$. In our basic model, four alternatives are defined, $J = 4$: inactivity, part-time, full-time, overtime. Let y_{ij} be individual i's net income given the hours choice h_{ij} and x_i a vector of individual characteristics. The net income y_{ij}, when $h_i = h_{ij}$ is chosen, is defined as:

$$y_{ij} = w_i h_{ij} + \mu_i + G(w_i, h_{ij}, \mu_i, x_i) \ ,$$

where w_i are gross hourly wage rates, μ_i is non-labour income and the function $G(w_i, h_{ij}, \mu_i, x_i)$ represents the tax-benefit rules which depend on gross wages, hours of work, non-labour income and individual characteristics. Several functional forms can be used to specify the deterministic part of the utility function. Following Keane and Moffitt (1998) and Brewer *et al*. (2007), we define it as a second order polynomial. In our basic conditional logit model, the deterministic part of the utility function is given by:

$$V(y_{ij}, h_{ij}, x_i) = \alpha_{yy} y_{ij}^2 + \alpha_{hh} h_{ij}^2 + \alpha_{yh} y_{ij} h_{ij} + \alpha_y y_{ij} + \alpha_h(x_i) h_{ij} \ ,$$

where we account for observed heterogeneity in preferences for hours of work through interactions with personal characteristics:

$$\alpha_h(x_i) = \alpha_{h0} + \alpha'_{hx} x_i$$

In our extended model, job insecurity is introduced as a non-pecuniary job attribute affecting labour supply. Three job insecurity levels are defined characterising low, middle and high job insecurity. A total of ten alternatives are available representing inactivity and combinations of hours of work and job insecurity levels. More formally, let s_{ij}, represent the level of job insecurity of individual *i* under alternative *j*. The deterministic part of the utility function, in our extended model is given by:

$$\begin{aligned} V(y_{ij}, h_{ij}, x_i) = {} & \alpha_{yy} y_{ij}^2 + \alpha_{hh} h_{ij}^2 + \alpha_{ss} s_{ij}^2 + \alpha_{yh} y_{ij} h_{ij} + \alpha_{ys} y_{ij} s_{ij} + \alpha_{hs} h_{ij} s_{ij} + \alpha_y y_{ij} \\ & + \alpha_h(x_i) h_{ij} + \alpha_s(x_i) s_{ij} \ , \end{aligned}$$

where we allow for observed preferences heterogeneity for hours of work and job insecurity:

$$\alpha_h(x_i) = \alpha_{h0} + \alpha'_{hx} x_i$$
$$\alpha_s(x_i) = \alpha_{s0} + \alpha'_{sx} x_i$$

Unobserved heterogeneity in preferences could also be accounted for by introducing random terms in $\alpha_h(x_i)$ and $\alpha_s(x_i)$ (see, Train, 1998 and Train, 2003). However, in our empirical analysis, unobserved heterogeneity in preferences is not accounted for given the small size of our sample. The sample likelihood function for the conditional logit model is given by:

$$L = \prod_{i=1}^{N} \prod_{j=1}^{J} [P_{ij}(y_{ij}, h_{ij}, x_i)]^{d_{ij}}$$

where d_{ij} is a dummy equal to one if individual *i* chooses alternative *j* and zero otherwise.

Note that in order to construct the discrete choice alternatives in labour supply

models it is usually assumed that gross hourly wages are fixed and independent of hours of work.[1] While independence between wages and hours of work is generally accepted in the structural labour supply literature, in our extended models the relationship between wages and job insecurity deserves more attention. In fact, if job insecurity is considered a disamenity some sort of compensating wage differentials might exist for jobs with higher insecurity, which would need to be taken into account in our labour supply model.[2] For instance, consider an individual currently in a job with low job insecurity, in order to construct all her possible choice alternatives, we need to define what would be her wage under the alternative of middle and high insecurity. In this study, we take into account the relationship between wages and job insecurity by randomly assigning wages by education groups from the wage distribution, as will be explained in section 4.

4. Data

Our analysis uses data from wave ten of the British Household Panel Survey containing information for years 2000 and 2001. The BHPS is a nationally representative survey for the United Kingdom, which provides information about individual and household characteristics, wages, other income sources and working conditions. We limit our analysis to wave ten of the BHPS because of the need of developing a detailed tax and benefit microsimulation model to calculate disposable income for each discrete hour alternative. Our microsimulation model is based on EUROMOD version 21A, which simulates tax-benefit rules for the UK in 2001 (see, Sutherland and Gutierrez, 2004). Wave ten of the BHPS contains 15,603 individuals, however, we restrict our analysis to single females, who gave full interview. This restriction is made for two reasons. First, focusing on single individuals enables us to neglect interactions within the household in the context of labour supply. Second, the sample of single males is too small for the estimation of the models and a joint estimation of males and females might bias the results for women. As it is usually done in the literature, we further exclude individuals in self-employment because their labour supply decisions may differ considerably from those of salaried workers and their income information from surveys is considered less reliable than for employees. Disabled individuals, full-time students and pensioners are also excluded in order to keep only those individuals available for the labour market. This leaves us with a sample of 750 females.

Before restricting our analysis to our sample of interest we need to treat the problem of non-observed wages for non-workers. We do this by estimating a two-step Heckman selection model for women, using the whole sample of females (N=8,035). The wage equation depends on variables related to human capital, such as age and education as well as region dummies to control for differences in labour markets. The selection equation is based on the usual exclusion restrictions for identification where, in additional to the previous, non-labour income, being married and having children of different ages are included as variables (see, Van Soest, 1995; Haan, 2010; Bargain, *et al*. 2014). The results of the estimation are shown in table 1.

[1] Some exceptions are studies by Aaberge and co-authors. See, for instance, Aaberge and Colombino (2013).
[2] For a discussion about compensating wage differentials see, Rosen (1987).

Table 1 - Heckman Selection Model for Females

	coef.	*st. error*
log hourly wage equation		
age	0.0590 ***	(0.0037)
age^2	-0.0007 ***	(4.82e-5)
cse	0.146 ***	(0.0321)
o-levels	0.224 ***	(0.0253)
a-levels	0.340 ***	(0.0285)
higher degree	0.455 ***	(0.0251)
university degree	0.818 ***	(0.0284)
constant	0.368 ***	(0.0787)
selection equation		
age	0.148 ***	(0.0073)
age^2	-0.002 ***	(8.61e-5)
cse	0.203 ***	(0.0682)
o-level	0.442 ***	(0.0537)
a-level	0.437 ***	(0.0637)
higher degree	0.601 ***	(0.053)
university degree	0.573 ***	(0.0655)
non-labour income	-0.0014 ***	(6.28e-5)
married	-0.188 ***	(0.0414)
child (0-2)	-0.464 ***	(0.0613)
child (3-4)	-0.381 ***	(0.0614)
child (5-11)	-0.183 ***	(0.0436)
child (12-15)	-0.0334	(0.0456)
constant	-1.911 ***	(0.152)
lambda	0.0729 ***	(0.0254)
Observations	8,035	

Note: Region dummies included in the wage and selection Equations.

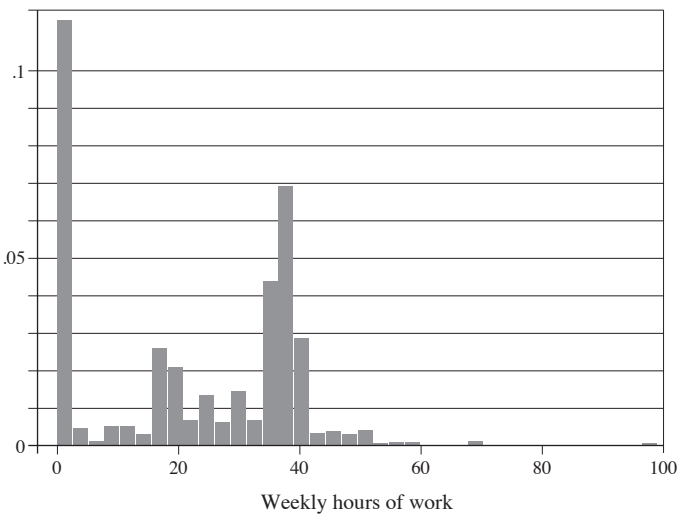
Most variables present the expected signs, both in the selection and in the wage equations. In particular, wages and the probability of participation increase with age at a decreasing rate. The higher the level of education, the higher the probability of participation and the higher the wage. Being married decreases the probability of participation for women, as expected. Participation is lower with the presence of young children in the household and these effects are significant. Non-labour income has the expected negative and significant effect on participation. Finally, the coefficient for the inverse Mill's ratio (lambda) is positive and significant, implying a selectivity and therefore that the observed wages are higher than the wage offers of a random sample.

Using the results obtained from the Heckman selection model, gross hourly wages are imputed for non-workers. Once the information on gross hourly wages is available for all individuals, we need to calculate the disposable income for each discrete hour alternative. As previously mentioned, disposable income is calculated using our own tax and benefit microsimulation model for the BHPS, based on EUROMOD version 21A. Eleven tax and benefit rules are simulated: minimum wage, national insurance employee contributions, contributory job seekers allowance, winter fuel allowance, income tax, children's tax credit, child benefit, working families tax

credit, income support, housing benefit and council tax benefit. Other benefits are not simulated but are included in the calculation of disposable income.[3]

Consider now the distribution of weekly hours of women in our sample, presented in figure 1. Important peaks are observed for inactivity and full-time work (around 40 hours per week), as well as a small peak for part-time work (around 20 hours per week). Taking this into consideration, we define four discrete hours points, characterising inactivity, part-time work, full-time work and overtime work: h={0,20,40,55} which correspond to the intervals {0–5,6–34,35–45,>45}. These discrete hours points represent the set of alternatives in our basic model.

Figure 1 - Distribution of Female Weekly Hours of Work



In the extended model, job insecurity is used as a non-pecuniary job attribute to be included in the job choice bundle. The BHPS provides information concerning satisfaction with job security at work. Job security takes values between 1 and 7 with 1 representing that the individual is 'not satisfied at all' with job security at work and 7, that the individual is 'completely satisfied'. As discussed in section 2, despite the subjective nature of this variable self-perceived job insecurity is associated with objective indicators of insecure jobs, such as temporary contracts (Campbell *et al*. 2007; Clark and Postel-Vinay, 2009; Deloffre and Rioux, 2003; Näswall and De Witte, 2003). Moreover, satisfaction with job insecurity is correlated with other type of information about self-perceived job insecurity, such as the likelihood of becoming unemployed. For our extended labour supply model, we generate a job insecurity variable taking values 2, 4 and 6, where 2 represents 'low job insecurity' (values 5 to 7 from the original variable; satisfied with job security), 4 represents 'middle job

[3] A detailed description of the tax and benefit microsimulation model for the BHPS can be made available on request from the author.

insecurity' (value 4 from the original variable; neither satisfied nor dissatisfied) and 6 'high job insecurity' (values 1 to 3 from the original variable; dissatisfied with job security). By regrouping the original values in such way, we expect to capture better those individuals in insecure jobs (those dissatisfied with their job security) and at the same time this allows us to save computational time by reducing the number of choice alternatives. Ten discrete choice alternatives are therefore defined for the extended model, representing bundles of hours of work and job insecurity: (*hours, insecurity*), where *hours* = {0,20,40,55} and *insecurity* = {2,4,6}.[4] Descriptive statistics of the variables used in our labour supply model are presented in table 2.

Table 2 - Descriptive Statistics of the Labour Supply Sample

	mean	*std. dev.*
Net income (£ per week)	250.41	113.75
Hours of work (per week)	21.86	16.93
Age	37.71	10.57
No qualification	0.179	0.383
Certificate of Secondary Education (CSE)	0.095	0.293
O-levels	0.207	0.405
A-levels	0.097	0.297
Higher degree	0.279	0.449
University degree	0.144	0.351
Children aged 0-2	0.065	0.247
Children aged 3-4	0.103	0.304
Children aged 5-11	0.333	0.472
Children aged 12-18	0.256	0.437
Job insecurity	2.651	1.392
low job insecurity (2)	0.579	0.494
mid. job insecurity (4)	0.044	0.205
high job insecurity (6)	0.095	0.293
Number of observations	750	

As mentioned in the previous section, in order to construct the discrete choice alternatives in our extended labour supply models, we need to consider the relationship between wages and job insecurity. In the data, for each individual we observe a gross hourly wage and a particular level of job insecurity. In order to define the wage rate related to other levels of job insecurity, we first impute wages by randomly assigning from the wage distribution of individuals with the same level of education but which are observed in a different job insecurity group. In this way, for each individual in our sample we obtain three gross hourly wage rates related to low, middle and high job insecurity. The average hourly wages for each level of insecurity are presented in the table 3. We observe that on average wages increase with the level of job insecurity, which is in line with the idea of compensating wage differentials (see, Rosen, 1987).

[4] The results are robust for different values of discrete hours of work and job insecurity.

Table 3 - Average Gross Hourly Wages by Job Insecurity Level (£ /hour)

	mean	*std. dev.*
Low job insecurity	8.1525	5.5656
Middle job insecurity	8.1737	5.1319
High job insecurity	8.2691	4.8355

The gross hourly wages related to different levels of job insecurity are then constructed with respect to the average gross hourly wages of the whole population. Consider for instance that the job of individual i is characterised by a gross hourly wage w_i and a low level of job insecurity. The gross hourly wage of individual i under middle job insecurity will then be given by $w_i + w_i(8.1737–8.15250)/8.1525$ and under high insecurity by $w_i + w_i(8.2691–8.15250)/8.1525$.

Table 4 provides summary statistics for each discrete hours alternative of our sample of interest. As previously mentioned, the two main groups are full-time employment and inactivity. Average age is slightly higher in the part-time and overtime work groups. The inactivity group presents the lowest percentage of individuals with higher education. In particular, only 24.26 per cent of the inactives have higher education, compared to 68.75 per cent, in overtime work. Finally, in terms of job insecurity, the percentage of women dissatisfied with their job security situation is the highest for overtime jobs.

Table 4 - Discrete Employment Statistics

Hours per week	*Share (%)*	*Age*	*Higher Education (%)*	*Net income per week*	*Job Insecurity (% dissatisfied)*
0	31.33	36.49	24.26	203.4	-
20	27.87	38.92	39.71	221.66	11.96
40	36.53	37.67	56.57	304.3	13.87
55	4.27	39.13	68.75	322.08	18.75

5. Estimation of the Labour Supply Models

This section presents the results of the structural labour supply estimation. Two models are estimated and compared. The first model is the conditional logit model traditionally used in the discrete choice literature to estimate labour supply, in which only discrete hours alternatives define the choice set. The second model consists of an extension to the basic conditional logit model, where the choice set is now defined by combinations of hours of work and job insecurity and where job insecurity is set to zero for the inactives.[5] In both models, age, higher education dummies and dummies for children of different ages are used as regressors to account for observed heterogeneity in preferences. Table 5 presents the estimated parameters for these models.

[5] A nested logit model was also estimated, in which alternatives are grouped into two nests representing inactivity and participation. The inactivity nest contains a single alternative while the participation nest is formed by alternatives characterised by bundles of hours of work and job insecurity. The results obtained with the nested logit model are similar to those presented in the paper.

Table 5 - Estimated Parameters of the Structural Model

	Conditional Logit: Hours		*Conditional Logit: Insecurity*	
Variable	*Coef.*	*St. Error*	*Coef.*	*St. Error*
Income^2	-5.46	(4.048)	-6.094	(4.243)
Income	12.244***	(2.121)	9.992***	(2.17)
Hours^2	-0.146***	(0.186)	-0.548***	(0.407)
Insecurity^2	-	-	0.317***	(0.031)
Income × hours	-0.941**	(0.465)	-0.428	(0.509)
Income × insecurity	-	-	0.062	(0.283)
Hours × insecurity	-	-	0.003	(0.032)
Hours	1.013***	(0.149)	3.941***	(0.273)
× age	-0.087***	(0.025)	-0.133***	(0.031)
× high edu.	0.262***	(0.054)	0.249***	(0.064)
× child 0-2	-0.783***	(0.146)	-0.681***	(0.208)
× child 3-4	-0.544***	(0.103)	-0.567***	(0.134)
× child 5-11	-0.326***	(0.059)	-0.426***	(0.073)
× child 12-18	-0.100*	(0.058)	-0.091	(0.071)
Insecurity	-	-	-3.309***	(0.258)
× age	-	-	0.067**	(0.03)
× high edu.	-	-	-0.008	(0.054)
× child 0-2	-	-	-0.062	(0.203)
× child 3-4	-	-	0.078	(0.122)
× child 5-11	-	-	0.126*	(0.068)
× child 12-18	-	-	-0.05	(0.069
Pseudo R-squared	0.1308		0.1772	

Notes: The main variables have been rescaled as follows: income/1000; hours/10; age/10. Standard errors in parentheses. *p<0.05, **p<0.01, ***p<0.001

In general our results are in line with our expectations and coefficients across the models estimated go in the same direction. For both models, marginal utility of income is positive for over 99 per cent of observations and as the coefficient of income square is negative, concavity in income for the utility function is respected. Marginal utility of hours of work is negative for around 78 per cent of observations in the basic labour supply model, while under the extended model this holds for a slightly lower percentage of cases, of around 70 per cent. Turning to job insecurity, marginal utility is negative for around 90 per cent of observations in our extended model. Moreover, the estimated effects of job insecurity are significant, confirming the importance of accounting for non-pecuniary job attributes on labour supply.

In line with our expectations, single women with young children have lower preferences for work and these effects are significant in both models estimated. In particular, the strongest negative effect is for women with very young children aged under three years old. Similarly, for both the basic and extended model, individuals with higher education have higher preferences for work and the interaction between hours of work and age presents a negative and significant coefficient. Turning to job insecurity, we remark that only the interaction with age presents a significant

coefficient, with preferences for job insecurity decreasing with age. Women with children aged less than three years old present lower preferences for job insecurity, as expected, however, the effect is not significant.

The ability of our models to fit the data can be tested by comparing predicted and observed frequencies. Predicted frequencies are obtained by averaging up individual probabilities for each discrete hours alternative over the whole sample, while observed frequencies are simply the frequencies of each observed choice over the whole sample. Table 6 shows that the basic conditional logit, where only hours of work define the choice set, performs poorly in terms of fitting the data. Full-time is considerably underestimated and part-time is strongly overestimated. These results are in line with the literature, where such problems have been treated mainly by adding alternative specific dummies (Van Soest, 1995) or fixed costs of work (Blundell *et al*. 2000). Here we consider whether the additional information in terms of job characteristics serves to improve the predictive power of the model. This seems to be the case, as the introduction of job insecurity into the model improves considerably the fit of the data. Additionally, as shown in table 5, the pseudo-R-squared or Likelihood Ratio Index of McFadden (1974) is higher for our extended labour supply model, confirming that it provides a better fit than the basic model.

Table 6 - Observed vs. Predicted Frequencies

		Predicted	
Alternatives	*Observed*	*Conditional logit: Hours*	*Conditional logit: Insecurity*
Inactivity	31.33	28.19	32.00
Part-time	27.87	37.19	25.77
Full-time	36.53	25.97	38.93
Overtime	4.27	8.66	3.30
Inactivity	31.33	-	32.00
Part-time			
low insecurity	22.93	-	20.11
mid. insecurity	1.60	-	2.28
high insecurity	3.33	-	3.38
Full-time			
low insecurity	29.2	-	30.76
mid. insecurity	2.27	-	3.36
high insecurity	5.07	-	4.81
Overtime			
low insecurity	3.33	-	2.64
mid. insecurity	0.13	-	0.28
high insecurity	0.80	-	0.38

The introduction of job insecurity as an additional job attribute in the labour supply model raises the issue of omitted variables bias. As shown in the results, job insecurity has a significant effect and improves the fit of the model. Other relevant job attributes could potentially influence labour supply decisions and leaving them out could bias the parameter estimates. It is clear that the extension of the model is

limited to the availability of information in the data. In our case, the choice of job insecurity was not only related to this limitation but also to the literature reporting the importance of job security as a work domain (Clark, 2001 and 2010). Therefore, despite incorporating only an additional dimension of work into the model, we consider job insecurity is one of the important dimensions to account for. In the same line, in terms of model specification, the introduction of additional job attributes in the labour supply model raises the question of the relevance of the assumption of independence of irrelevant alternatives (IIA), underlying the conditional logit model. In order to test the restriction imposed by the IIA assumption, we estimated a nested logit model for both our basic and extended labour supply models. Alternatives were grouped into two nests representing inactivity and participation. The nested logit model partially relaxes the IIA assumption by allowing correlation between the choices inside each nest (see, Train, 2003). The results of the nested logit models are similar to those of the conditional logit models presented in the paper.[6]

6. Labour Supply Elasticities and Responses to Changes in Job Insecurity

The parameter estimates obtained in the previous section can be used to calculate labour supply elasticities and to analyse the effects of policy reforms on participation and labour supply. The aim of this section is twofold. First, wage elasticities obtained with our models are compared. Then, using our extended model, we analyse the effect of a change in job insecurity on labour supply.

Labour supply elasticities in discrete choice models are calculated numerically using the estimated parameters of the utility function (see, Creedy and Kalb, 2005). First, we increase gross hourly wages by one per cent and compute the new disposable income for each alternative using our tax and benefit microsimulation model. Then, with the parameters from the utility function, obtained in the previous estimation, we calculate the average simulated probability of being at each alternative for both the old and the new value of disposable income. These probabilities are then used to compute the expected value of labour supply before and after the wage increase, following:

$$E[h|y,x]=\sum_{j=1}^{J} P_{ij}h_j$$

Finally, labour supply elasticities are computed numerically by dividing the percentage change in expected labour supply by the percentage change in wages, one per cent in this case. Table 7 shows the elasticities derived from our labour supply models.

[6] Results are not reported here but can be made available upon request from the author.

Table 7 - Labour Supply Elasticities

	Conditional logit: Hours	*Conditional Logit: Insecurity*
Total	0.126	0.153*
Low job insecurity	-	0.141*
Middle job insecurity	-	0.158*
High job insecurity	-	0.158*

*significantly different than the elasticity of the basic conditional logit

The calculated labour supply elasticities are quite in line with previous studies. In fact, elasticities for single females are in general between 0 and 0.7 (Bargain *et al*. 2012). Our basic conditional logit model provides a labour supply elasticity of 0.126, while our extended labour supply model provides a higher elasticity of 0.153. The statistical significance of the difference in elasticities is confirmed using bootstrapping techniques with 1,000 repetitions. In our extended conditional logit model, a further distinction can be made by calculating elasticities for different levels of job insecurity. Labour supply elasticities are lower under low job insecurity compared to middle and high insecurity. This result suggests that wage increases would have weaker effects for women facing good conditions at work, in terms of job security. However, bootstrapping techniques show no significant differences between elasticities for low job insecurity and high job insecurity. This might be related to the small sample of individuals in high insecurity jobs.

In addition to the calculation of labour supply elasticities, our extended model allows us to analyse the effect of job insecurity on labour supply. However, because of the qualitative nature of our job insecurity variable, the same methodology used to calculate wage elasticities cannot be applied. Here we simulate the effect of a decrease of job insecurity by observing the change in predicted probabilities calculated by our model. We decrease levels of job insecurity by the equivalent of one standard deviation of job insecurity (std. dev. 1.392) for individuals with middle and high insecurity. Table 8 presents the predicted probabilities calculated with our model before and after the decrease in job insecurity.

Table 8 - The Effect of a Decrease in Job Insecurity

	Predicted Probabilities Conditional Logit: Insecurity	
	Before	*After*
Inactivity	32.00	29.52
Part-time	25.77	27.02
Full-time	38.93	40.09
Overtime	3.30	3.37

Our results show that a decrease in job insecurity has a positive effect on participation. In fact, the probability of inactivity decreases by around 2.5 percentage points. All working alternatives present an increase, the most important being for part-time and full-time employment. This result is particularly interesting in terms of policy because objectives aimed at providing incentives for participation could also be achieved through the channel of improving non-pecuniary job attributes, and not only through monetary incentives. In order to have an idea of the magnitude that the decrease in inactivity represents, we calculated the increase in overall gross wages necessary to obtain an equivalent decrease in inactivity. An increase in overall gross wages of around 20 per cent would be needed in order to obtain a similar decrease in the probability of inactivity.

These results provide an interesting insight into the effect of non-pecuniary job attributes on labour supply, however, it is important to remark that this labour supply model does not take into account the reaction of firms to policies aimed at improving working conditions. In fact, from the demand side, providing better working conditions might represent additional costs which could be linked to a decrease in wages. This would result in a negative effect of labour supply and therefore the total effect would be ambiguous. The incorporation of labour demand within our setting represents, in this sense, an important step for future research.

7. Conclusion

The aim of this paper was to provide an insight into the effect of non-pecuniary job attributes on labour supply. Two models were estimated and compared. First, we estimated a conditional logit model where the choice set is defined only in terms of discrete hours alternatives. This is the approach most widely used to estimate discrete choice labour supply. Then, we proposed an extension to the model in which the choice set is characterised by bundles of income, hours of work and job characteristics; job insecurity in our case. The estimation of these structural labour supply models was done using maximum likelihood.

Different observations can be drawn from our results. First of all, as expected, job insecurity has a negative effect on individuals' utility, with a calculated marginal utility which is negative for around 90 per cent of the observations. Second, the predictive power of the model improves considerably when job insecurity is included as an attribute of choice, compared to the basic conditional logit model without alternative specific dummies or fixed costs of work. Third, labour supply elasticities calculated with the extended labour supply model are higher than those of the traditional conditional logit model and these differences are significant. Moreover, wage elasticities for women working under low job insecurity are lower than those of females in middle and high insecurity jobs implying that individuals working under good job security conditions would respond less to wage changes. Finally, our results contribute to the literature on the effects of job insecurity, showing that a decrease of job insecurity decreases the probability of inactivity by around 2.5 percentage points. This result is particularly interesting as it suggests that policies aimed at improving working conditions could be used to create incentives for labour market participation.

An important aspect behind our results is the use of self-reported working conditions, in our case self-perceived job insecurity. This is the type of information available in most household surveys. While perceived job insecurity has been shown to be associated with objective indicators of insecure jobs, it is important to keep in mind that a subjective component characterises such measures. In particular, it could be the case, for some individuals, that an improvement in objective job security factors would not be reflected in a better subjective perception of job security. For this reason, the findings obtained in this study should be contrasted with future analysis using objective measures of working conditions. In the case of job insecurity, for instance, an indicator of objective insecurity could be constructed based on information concerning temporary employment, sector of work, presence of job security guarantees at the firm level (available from linked employer-employee data), among others.

To conclude, we believe that the incorporation of working conditions in the analysis of labour supply offers potential opportunities for future research. In particular, multiple factors characterise jobs therefore a better understanding of the main attributes influencing labour market participation could be useful from a policy perspective. Moreover, it should be possible to consider to which extent (if any) incorporating job attributes in behavioural microsimulation models affects ex-ante evaluations of policy reforms. Finally, from a methodological point of view, the incorporation of additional job attributes highlights the importance of accounting for possible correlations between wages and job characteristics as part of the analysis of labour supply.

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