UNIVERSITY OF CASSINO AND SOUTHERN LAZIO

DEPARTMENT OF ECONOMICS AND LAW

Job satisfaction, time allocation and labour supply

Gaetano Lisi

Department of Economics and Law
University of Cassino and Southern Lazio

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Abstract
This paper reinterprets the neoclassical theory of labour supply by introducing job satisfaction into the utility function of the worker. This integration is feasible and also straightforward from a theoretical point of view and, furthermore, it produces interesting results. Precisely, this extended version of the standard model of labour supply can describe situations in which working produces utility beyond consumption, with the result that the disutility of giving up leisure time is lowered or even reversed. As a result, the paper is able to reconcile the standard theory of labour supply with the well-established finding of happiness research, according to which working could yield substantial non-monetary benefits.

1. Introduction

Job satisfaction plays a key role in time allocation and labour supply decisions, since it is able to reduce the individual disutility of work effort, thus increasing worker productivity (see, for example, Freeman, 1978; Borjas, 1979; Theodossiou and Zangelidis, 2009). However, the literature on job satisfaction and labour supply is mainly empirical (see, for example, Atrostic, 1982; Akerlof et al., 1988; Drago and Wooden, 1992; Golden and Wiens-Tuers, 2006; Cornelißen, 2009) and standard economic theory neglects job satisfaction, that, on the contrary, individuals consider when making their labour supply decisions. In order to bridge this gap, this theoretical paper incorporates job satisfaction into the standard neoclassical model of labour supply. The proposed integration is straightforward but, nevertheless, the results are nontrivial. Job satisfaction is able to reduce the disutility of labour. In the case of a very high job satisfaction, the results radically change, since leisure provides disutility while labour generates utility. Hence, the strong positive relation between job satisfaction and labour supply is clearly highlighted. Also, unlike the related literature on the close link between job match quality and job satisfaction (see, for example, Ferreira and Taylor, 2011; Barmby et al., 2012), the present paper specifies job satisfaction in terms of appropriate collocation of the worker in the workplace, namely, the proper matching between the investment in education and the task assigned in the

* Dipartimento di Economia e Giurisprudenza, Università di Cassino e del Lazio Meridionale; gaetano.lisi@unicas.it.

workplace that makes the worker more satisfied. Concisely, the higher the matching between the investment in education and the task assigned in the workplace, the higher the job satisfaction.

Furthermore, this paper is connected with some recent empirical findings on job tenure and job change. Precisely, job tenure seems to have a negative effect on job satisfaction (Freeman, 1978; Borjas, 1979; Barmby and Eberth, 2008; Theodossiou and Zangelidis, 2009; Barmby et al., 2012); whereas, voluntary job change can have a positive effect on job satisfaction, at least at the beginning of the new job (Boswell et al., 2005; Georgellis and Tabvuma 2010; Gielen 2013; Chadi and Hetschko, 2014). However, these effects could disappear in the presence of an appropriate collocation of the worker in the workplace. Intuitively, the negative effect of job tenure on job satisfaction could become negligible and the voluntary job changes could reduce when there is a proper matching between the investment in education and the task assigned in the workplace.

As a further novelty with respect to the related literature, this paper suggests a very simplified empirical strategy, where job satisfaction is not the dependent variable of the regression model, but it is the parameter to be estimated.

The rest of this paper is organised as follows. The next section briefly presents the standard neoclassical theory of labour supply, while section 3 extends the model by introducing job satisfaction. Finally, section 4 shows the empirical strategy and section 5 concludes with a summary of the main contributions of the present work.

2. Standard neoclassical theory of labour supply

Standard theory of labour supply is well known, hence, it is presented only briefly. Utility function depends upon consumption (C) and leisure (l) and, therefore, is given by $u(C, l)$. The marginal utilities of consumption (represented by a composite good) and leisure are, as is usual, assumed to be positive and diminishing (namely, the first partial derivatives are positive and the second partial derivatives are negative):

$$\frac{\partial u(C,l)}{\partial C} > 0, \ \frac{\partial u(C,l)}{\partial l} > 0, \frac{\partial^2 u(C,l)}{\partial C^2} < 0 \text{ and } \frac{\partial^2 u(C,l)}{\partial l^2} < 0.$$

For the time being, a very popular (and very used) utility function is used, namely, the *Cobb-Douglas* function:

$$u(C, l) = C^\alpha \cdot l^\beta$$

where $0 < \alpha < 1$ and $0 < \beta < 1$ are the elasticities of the utility function with respect to consumption and leisure, respectively, that fulfil the previous conditions on the marginal utilities. The choice between working (consuming) and not working (enjoying leisure) is the outcome of

the utility maximisation process by workers, since worker welfare depends on both goods (services) consumed and time spent taking leisure. Formally, the worker solves this problem as:

$$\underset{C,l}{max}\left\{C^{\alpha}\cdot l^{\beta}\right\}$$

s.t. $p\cdot C = (1-t)\cdot w\cdot (T-l) + D$

where p = unit price of good; w = nominal wage; $0 < t < 1$ is the marginal tax rate on labour income; D = non-labour income (namely, an exogenous source of after-tax nominal income, for instance, from financial assets such as stocks and bonds paying dividends and interests), and T = total time available to the worker, with $T = l + L$, where L = labour supplied to the market. In this well-known theoretical framework, the optimal choice of consumption and leisure (labour supplied) is given by (the slopes are both negative and the after-tax real wage represents the cost of leisure):

$$\underbrace{(1-t)\cdot\frac{w}{p}}_{slope\ of\ budget\ constraint} = \frac{dC}{dl} = \underbrace{\frac{\beta}{\alpha}\cdot\frac{C}{l}}_{slope\ of\ indifference\ curve}$$

This standard result is summarised in Figure 1.
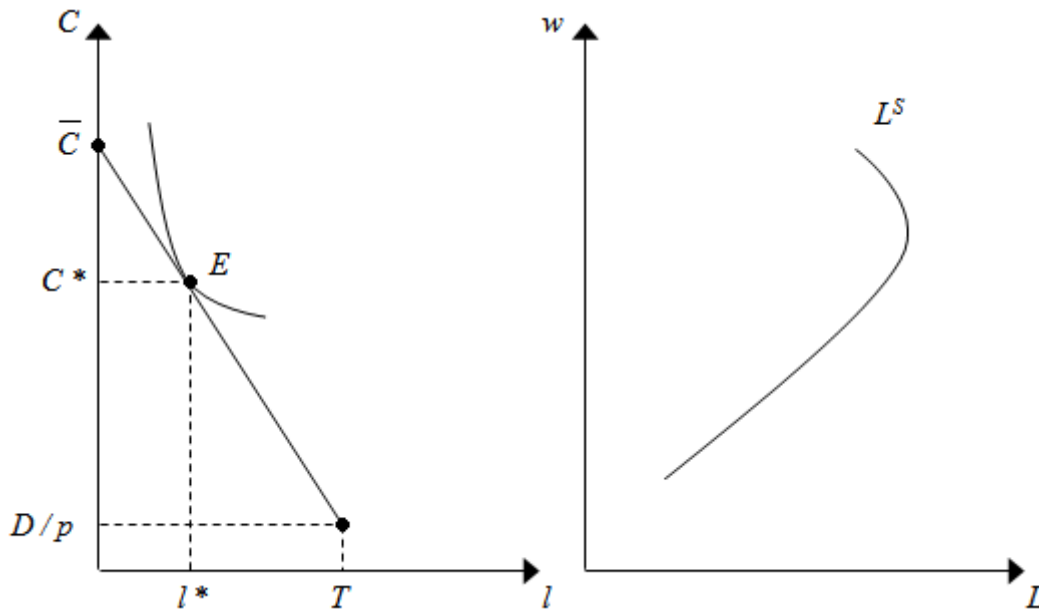
Figure 1. Optimal choice and labour supply function (standard case)

The tangency point between the (highest) indifference curve and the budget constraint (point E in the graph on the left side in Figure 1) identifies the optimal choice of the worker ($C = C^{*}$ and $l = l^{*}$). At the limit, the worker can either consume the overall income $\bar{C} = (1-t)\cdot\frac{w}{p}\cdot T + \frac{D}{p}$ (with $T = L$ and $l = 0$) or totally enjoy the leisure ($T = l$), thus consuming only D/p (since $L = 0$). As regards the labour supply function L^{S} (see graph on the right side in Figure 1), when the substitution effect dominates the income effect (as usual, for lower levels of wage), the labour

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supply is increasing in wage (if the wage increases, the worker waives a part of his leisure time in order to work and consume more); whereas, for higher levels of wage, the income effect could dominate the substitution effect (workers can enjoy more leisure time when they are relatively wealthier), and if that happens then labour supply is "backward-bending" (as in the graph on the right side in Figure 1).

3. The (key) role of job satisfaction in labour supply theory

Now, job satisfaction is introduced into the standard theory of labour supply that was developed in the previous section. Unlike the related literature (see, for example, Cornelißen, 2009), in this paper job satisfaction is considered as a determinant for utility from work rather than a proxy for utility from work. Also, job satisfaction is assumed to only measure job match quality (Ferreira and Taylor, 2011; Barmby et al., 2012), thus reducing the disutility of labour. However, the term "job match quality" is specified in terms of appropriate collocation of the worker in the workplace. Precisely, the term "job match quality" refers to the matching between the investment in education and the task assigned in the workplace, namely, the closer the matching between the investment in education and the task assigned in the workplace, the higher the job satisfaction. For example, a graduate in business economics who works as a clerk will, most likely, have a low job satisfaction. Conversely, a graduate in business economics who works as a manager will, most likely, have a high job satisfaction. Of course, a non-graduated person who works as a clerk could also have a high job satisfaction. The discrepancy between the investment in education and the task assigned in the workplace mainly occurs in countries (such as Italy) where high unemployment (youth unemployment, especially) forces graduate workers to accept jobs that require a lower qualification; thus, the consequent phenomenon of "underemployment" (in terms of a lesser use of skills) creates job dissatisfaction.

Formally, a simple parameter of job satisfaction (s) is introduced into the utility function of worker, viz.:

$$u(C, l) = C^\alpha \cdot l^{(\beta-s)} = C^\alpha \cdot (T - L)^{(\beta-s)} \tag{1}$$

It follows that the previous standard case will be characterised by $s = 0$. The (new) properties of function (1) with respect to leisure and labour supplied are the following (of course, nothing changes with respect to consumption):

$$\frac{\partial u(C,l)}{\partial l} = (\beta - s) \cdot C^\alpha \cdot l^{(\beta-s-1)}$$

$$\frac{\partial u(C,l)}{\partial L} = -(\beta - s) \cdot C^\alpha \cdot (T - L)^{(\beta-s-1)} = (s - \beta) \cdot C^\alpha \cdot (T - L)^{(\beta-s-1)}$$

$$\epsilon_{u,l} = (\beta - s)$$

$$\epsilon_{u,L} = (s - \beta) \cdot \frac{L}{(T-L)}$$

where $\epsilon_{u,l}$ and $\epsilon_{u,L}$ are the (new) elasticities of the utility function with respect to leisure and labour supplied, respectively. Clearly, the sign of the elasticities depends on the parameter of job satisfaction s.

Firstly, for the optimisation problem to have a well-behaved solution it is required that $0 < \beta < 1$ in the standard model. In the proposed model, therefore, this condition becomes $0 < (\beta - s) < 1$ which implies $-1 < s < 1$ with $\beta > s$. Thus, the optimal choice of leisure (labour supplied) becomes:

$$l = \frac{(\beta - s)}{\alpha} \cdot \frac{p}{(1-t) \cdot w} \cdot C \tag{2}$$

$$L = (T - l) = T - \left[\frac{(\beta - s)}{\alpha} \cdot \frac{p}{(1-t) \cdot w} \cdot C \right] \tag{3}$$

leisure is decreasing in job satisfaction (as well as in wage); whereas, of course, the labour supply function is increasing in job satisfaction (as well as in wage). Thus, if it is also assumed that job satisfaction increases labour productivity (Freeman, 1978; Borjas, 1979; Theodossiou and Zangelidis, 2009) and hence the wage increases, namely, $\frac{\partial w}{\partial s} > 0$, the positive effect of s on L (the negative effect of s on l) is enhanced. Precisely, job satisfaction produces both monetary (the effect of s on w) and non-monetary (the effect of s on time allocation regardless the wage) benefits.

As a result, in the case of a very low job satisfaction (wrong collocation of the worker in the workplace), characterised by a negative parameter of job satisfaction ($-1 < s < 0$), the utility of leisure increases and, thus, the disutility of labour also increases, with respect to the standard theory, since $(\beta - s) > \beta$. In this case, of course, the optimal choice will involve more leisure time (the tangency point lies to the right of point E in Figure 1) and less labour is supplied to the market by workers. Intuitively, if job satisfaction is poor, individuals prefer to enjoy more leisure time, so that they can devote more time to searching for a better job (in terms of a more appropriate collocation in the workplace), for example. Indeed, in the presence of high unemployment, the voluntary quitting of a job is hardly a good choice; thus, job dissatisfaction can lead (for example) to part-time work, thus reducing the number of worked hours and increasing the enjoyment of more leisure time.

Instead, for $0 < s < 1$ (a positive parameter of job satisfaction) and $\beta > s$, job satisfaction is capable of reducing the disutility of labour (the utility of leisure) and, thus, the optimal choice will involve less leisure time and more consumption (i.e. the equilibrium point lies to the left of point E in Figure 1). It follows that, *ceteris paribus* (above all, for a given wage $w = w_0$), the greater the

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job satisfaction, the greater the amount of the labour supplied (the lower the leisure) and, thus, the labour supply function moves to the right (see Figure 2).
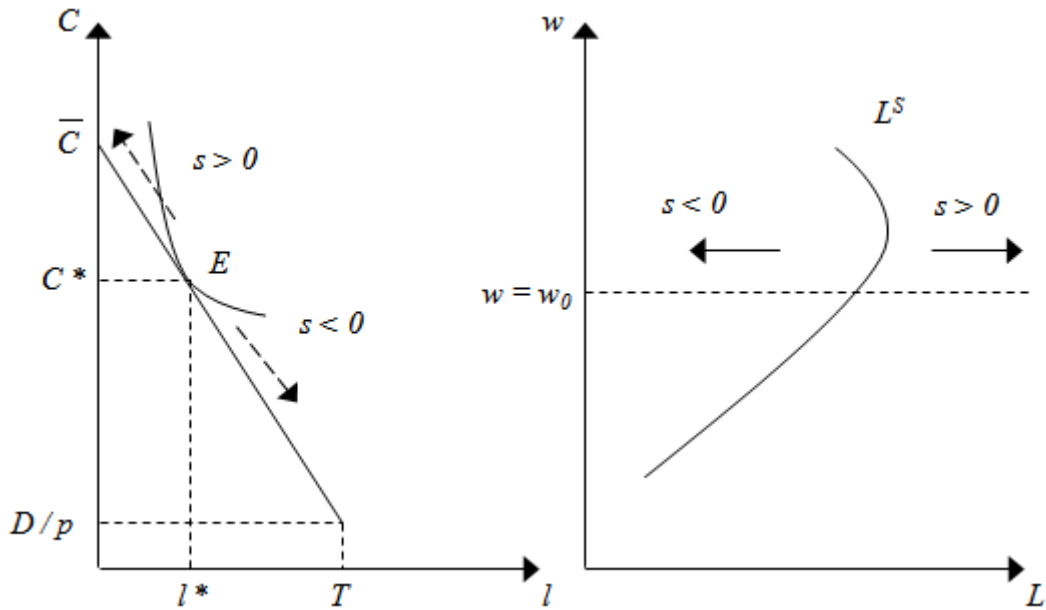
Figure 2. Optimal choice and labour supply function with (a higher or lower) job satisfaction

3.1 Extensions of the theoretical model

The results of the theoretical model radically change if the condition $s > \beta$ is considered to be feasible. Indeed, in this extreme case, job satisfaction is not only positive but also very high, thus implying a very appropriate or perfect collocation in the workplace. This possibility, indeed, reverses the roles of the variables: the "good" becomes the labour and leisure is instead considered to be "bad", viz.:

$$\frac{\partial u(C,l)}{\partial l} < 0, \frac{\partial u(C,l)}{\partial L} > 0, \epsilon_{u,l} < 0 \text{ and } \epsilon_{u,L} > 0$$

As a result, the form of the marginal (dis)utility of labour radically changes, since for $s > \beta$ the first partial derivative of the utility function with respect to labour supplied switches from negative to positive (see in Figure 3 the dotted line above the standard case $s = 0$). Concisely, in the special case where $s > \beta$, labour generates utility and leisure generates disutility; whereas, in the case of a very low job satisfaction where $s < 0$ (see in Figure 3 the dotted line below the standard case $s = 0$), the disutility of labour is stronger and the utility of leisure is greater.
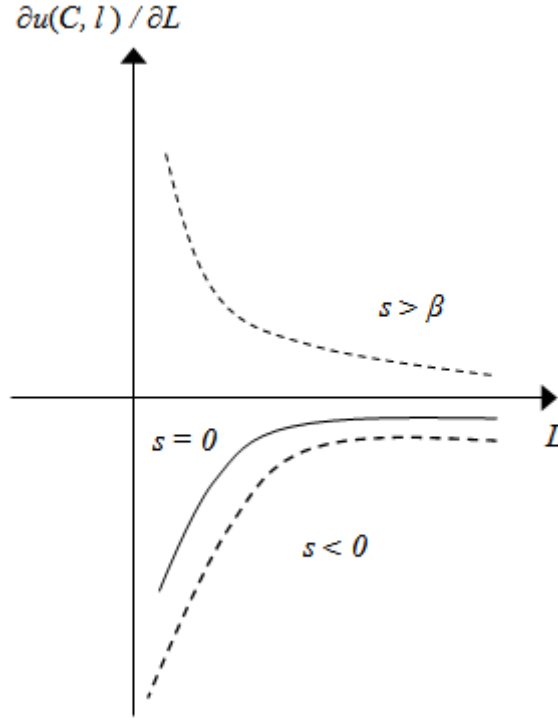
Figure 3. Marginal (dis)utility of labour with or without job satisfaction

For the special case of $s > \beta$, therefore, the optimal time devoted to leisure should be zero (since it cannot be negative) and, thus, the labour supplied should be equal to the total time available to the worker, namely, the worker consumes the overall income, thus, totally giving up leisure time. This identifies a corner solution in the traditional theory of labour supply ($C^* = \bar{C}$ and $l^* = 0$).

Eventually, the fundamental theoretical insight developed in this paper does not change with a more general functional form, the so-called *CES* (*Constant Elasticity of Substitution*) function:

$$u(C, l) = [\alpha \cdot C^{-\rho} + (\beta - s) \cdot l^{-\rho}]^{-\frac{1}{\rho}} \tag{4}$$

where ρ is the substitution parameter that determines the value of the *elasticity of substitution*.[1] In equation (4) the parameter s always acts as a determinant for utility from work, thereby, highlighting the key role of job satisfaction in time allocation and labour supply decisions. In fact, one would obtain the same key result, viz.:

$$\frac{\partial u(C,l)}{\partial l} = (\beta - s) \cdot \left(\frac{U}{l}\right)^{1+\rho}$$

the marginal utility of leisure is decreasing in s and negative under the condition $s > \beta$.

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[1] Note that for $\rho = -1$, a linear function $u(C, l) = \alpha \cdot C + (\beta - s) \cdot l$ (with infinite elasticity of substitution) is obtained; whereas, for $\rho \to 0$ (by applying *Hôpital's rule*). the previously used Cobb-Douglas function is obtained. Unlike the Cobb-Douglas function, in the *CES* function the elasticity of substitution is always constant but not unitary; precisely, it is equal to $\frac{1}{1+\rho}$.

4. Empirical strategy

As previously mentioned concerning the related literature, job satisfaction is the preferred *proxy* for utility from work. Instead, this paper considers job satisfaction as a *determinant* for utility from work. The difference is subtle but not negligible. The benefit of this approach is twofold. Firstly, as shown in the previous section, it allows to highlight the key role of job satisfaction in time allocation and labour supply decisions. Furthermore, it suggests a very simplified empirical strategy, where job satisfaction is not the dependent variable of the regression model but is rather the parameter to be estimated. Indeed, it is straightforward to obtain the empirical counterpart of function (1):

$$\ln u(C, l) = \alpha \cdot \ln C + \sigma \cdot \ln l + \varepsilon \tag{1a}$$

where $\sigma \equiv (\beta - s) = \frac{\partial \ln u(C,l)}{\partial \ln l} = \frac{\partial u(C,l)}{\partial l} \cdot \frac{l}{u(C,l)}$ is the (net) elasticity of the utility function with respect to leisure, and ε is the usual stochastic error term. Recall, that the theoretical analysis of the effects of job satisfaction on utility is not specific to the Cobb-Douglas function, but it also applies to a more general functional form, the so-called CES function. Of course, the Cobb-Douglas function has the advantage of having a more straightforward empirical counterpart, namely, the often-used logarithmic function.

From the developed theoretical model, it can be expected that the (net) utility of leisure (σ) is higher in the absence of (without) an appropriate collocation of worker in the workplace, $\sigma_{without} > \sigma_{with}$, since job satisfaction is, instead, higher in the presence of (with) an appropriate collocation in the workplace, viz.:

$$(\beta - s_{without}) > (\beta - s_{with}) \xrightarrow{yields} s_{with} > s_{without}$$

Basically, an appropriate collocation of worker in the workplace implies that the qualification required for access to the workplace is equal to the level of education held by the worker (namely, secondary school leaving qualifications that are required vs. secondary school leaving qualifications that are held, a three-year bachelor's degree that is required vs. three-year bachelor's degree that is held, and a master's degree that is required vs. a master's degree that is held). Accordingly, jobs where the qualification that is required for access to the workplace is lower than the level of education held by the worker define inappropriate working collocations. In order to test this view concerning job satisfaction, namely, the proper matching between the investment in education and the task assigned in the workplace, a very simple empirical strategy is to include in the model (1a) an interaction dummy variable D that takes the value 1 in the case of workers with an appropriate collocation in the workplace and 0 otherwise, viz.:

$$\ln u(C, l) = \alpha \cdot \ln C + \sigma \cdot D \cdot \ln l + \varepsilon \tag{1b}$$

and in such a way as to estimate the reduction of utility of leisure in the presence of job satisfaction, namely, the (negative) difference between σ_{with} and $\sigma_{without}$. Precisely,

$$\sigma = \frac{\ln u(C,l)_{|D=1} - \ln u(C,l)_{|D=0}}{\ln l_{|D=1}} < 0$$

Furthermore, equation (1b) can be estimated by OLS; in fact, Ferrer-i-Carbonell and Frijters (2004) found that assuming cardinality or ordinality of the answers to the general satisfaction questions (namely, the dependent variable of the model) is relatively unimportant with respect to the results. However, new data on utility would need to be collected, instead of using the popular 'satisfaction indicators' that are included in panel data (such as BHPS, HILDA survey or SOEP data). This is because, unlike in the previous literature where job satisfaction is the preferred proxy for utility gained from work, this paper considers job satisfaction as a determinant for utility gained from work. This empirical issue is left open for future research.

5. Conclusions

This paper introduces job satisfaction into neoclassical theory of labour supply. This simple integration produces non-trivial results: job satisfaction is able to reduce the disutility of labour, thus, increasing labour supply; also, if job satisfaction is very high, labour could generate utility while leisure could provide disutility. In this paper, job satisfaction is specified in terms of appropriate collocation of the worker in the workplace, namely, the proper matching between the investment in education and the task assigned in the workplace. Also, unlike the previous related literature where job satisfaction is the preferred proxy for utility gained from work, this paper considers job satisfaction as a determinant for the utility gained from work. As shown, the benefit of this approach is both theoretical and empirical.

Finally, the policy implications of these findings are not trivial. Indeed, a greater investment in education, without labour market policies that encourage the creation of new businesses and the development of new technologies, could even lead to negative phenomena, such as "over-education", thus amplifying the "mismatch" between the investment in education and the task assigned in the workplace.

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