

For the attention of the printer: Short form of the title of the paper
= "Job Satisfaction and Co-Worker Wages"

Job Satisfaction and Co-worker Wages: Status or Signal?

Andrew E. Clark^{*}, Nicolai Kristensen^{**} and Niels Westergård-Nielsen^{***}

August 2008

Abstract

We use matched employer-employee panel data to show that individual job satisfaction is higher when other workers in the same establishment are better-paid. This runs counter to substantial existing evidence of income comparisons in subjective well-being. We argue that the difference hinges on the nature of the reference group. We here use co-workers. Their earnings not only induce jealousy, but also provide a signal about the worker's own future earnings. In our data, this positive future earnings signal outweighs any negative status effect. This phenomenon is stronger for men and in the private sector, but weaker for those nearer retirement.

Keywords: Job Satisfaction, Co-workers, Comparison Income, Wage Expectations, Tournaments.

JEL codes: C23, C25, D84, J28, J31, J33.

* Corresponding Author. Andrew.Clark@ens.fr. Paris School of Economics, IZA, CCP and Aarhus School of Business, University of Aarhus; ** Aarhus School of Business, University of Aarhus, CIM and CCP; *** Aarhus School of Business, University of Aarhus, IZA and CCP. We are very grateful to the Editor and two anonymous referees for particularly constructive suggestions. We also thank Tor Eriksson, Takao Kato, Andrew Oswald and seminar participants at Amsterdam, the DTI Conference "New Perspectives on Job Satisfaction and Subjective Well-Being at Work" (London), the 8th ISQOLS Conference (San Diego), the 24th JMA (Fribourg), Lyon 2, Rennes I, the Royal Economic Society Conference (Warwick), the Tinbergen Institute Workshop "Economics of the Workplace" Rotterdam (especially our discussant Mirjam van Praag), and the 2006 SOLE meetings (Cambridge, MA) for useful comments.

1 Introduction

A significant amount of work in the burgeoning literature on subjective well-being has focused on the role of relative income in determining satisfaction or happiness. Some labour-market examples are Capelli and Sherer (1988), Pfeffer and Langton (1993), Clark and Oswald (1996), Law and Wong (1998), Bygren (2004), Ferrer-i-Carbonell (2005), and Brown *et al.* (2008), using survey data, and Shafir *et al.* (1997) in experimental work.² This work has generally concluded that relative income is important in determining individual satisfaction. One implication is that the simple neoclassical utility model, where utility depends only on the individual's own income or consumption, should probably be extended to incorporate relative income or consumption terms.

In parallel, the literature on establishment wage policies has highlighted the potential importance of wage compression. One prominent example is the fair wage-effort hypothesis formulated by Akerlof and Yellen (1990), which largely corresponds to Adams' (1963) theory of equity, in which effort depends on the relationship between fair and actual wages. In this theory, higher wages for some groups of workers – perhaps because they are in short supply – will raise wages for all of the workers in the establishment through the demand for pay equity.

The link between worker well-being and the establishment wage distribution is important for human resource managers, whose choice of pay policy will take into account the impact of worker dissatisfaction on profits and worker turnover (for empirical evidence, see Patterson *et al.*, 2004). More broadly, income comparisons may have important consequences for the functioning of the entire labour market, explaining

² See Clark *et al.* (2008) for a recent survey.

women's labour force participation (Neumark and Postlewaite, 1998), unionisation (Farber and Saks, 1980), money illusion (Shafir *et al.*, 1997), hysteresis in unemployment (Summers, 1988, and Bewley, 1998), and wage rigidity (Levine, 1993, and Campbell and Kamlani, 1997).

The above literature appeals to the general area of preference interactions, as termed by Manski (2000), where what others do, or what happens to them, directly affects my own utility. While evidence of such income interactions has been steadily accumulating for a number of years, a smaller number of recent papers have uncovered empirical results of the opposite sign, with some measure of individual well-being being positively correlated with reference group income or earnings: the more others earn, the happier I am. This finding has been interpreted as demonstrating Hirschman's tunnel effect (Hirschman and Rothschild, 1973): while others' good fortune might make me jealous, it may also provide information about my own future prospects. Manski (2000) calls these phenomena expectations interactions, where what happens to others allows me to update my information set. The associated empirical work refers to information effects or signals.

In this paper we provide some of the first evidence that information effects may be stronger than comparison effects (i.e. that signal outweighs status) in the context of developed Western economies. Individuals may therefore be better off as others earn more, and consequently may not object to some degree of income or earnings inequality. We emphasise that the key parameter on which the balance between status and signal rests is the strength of the correlation between current reference group income and my own future earnings. At the peer group (those who share the same characteristics) or

geographical level, this correlation is arguably small. In the context of Luttmer (2005), it is not because my neighbour receives a wage raise that my own future income prospects may necessarily look any brighter.

The signal effect is arguably far greater within the same establishment. In this paper we thus appeal to employer-employee panel data, and model individual job satisfaction as a function of the earnings of all other workers within the same establishment. This unusually rich data set results from the matching of survey panel data (over the period 1994-2001) to administrative longitudinal records.

We show that workers are indeed more satisfied when their co-workers are better-paid. The “Hirschmanian establishment” or signal interpretation is that others’ earnings provide sufficient information about my own future prospects to outweigh any jealousy I might feel towards my colleagues. We find that this Hirschman effect is weaker for those nearer retirement, but there is some evidence that it is stronger for men than for women, and in the private sector. We check that current average establishment earnings do indeed predict individual future earnings, as a signal story would predict.

These results are broadly supportive of Tournament theory (Lazear and Rosen, 1981), where (some of) my colleagues’ current earnings reflect my opportunities in the establishment’s internal labour market.

This paper is organised as follows. Section 2 presents a simple model of status and signal effects from others’ earnings. Section 3 then describes the data that we use, and Section 4 presents the main empirical results. Last, Section 5 concludes.

2 Status or Signal?

There has been substantial interest across most of social science in the notion of status or comparisons to others. The very broad idea here is of negative externalities emanating from the consumption or income of others within the reference group: the more others earn, the lower is my utility, *ceteris paribus*. Empirically, the majority of work in this area has appealed to either measures of individual behaviour (such as labour supply or consumption), or measures of subjective well-being. In this latter case, a variable such as life satisfaction is shown to be positively correlated with own income, but negatively correlated with reference group income.³ The negative correlation is consistent with the presence of income comparison terms in the utility function.

Personnel Economics has arguably not paid much attention to such income comparison effects. However, it has underlined the incentive role played by the earnings that certain others within the same establishment may receive. In particular, in the tournament model (Lazear and Rosen, 1981) employees within a given establishment are seen as contestants for promotion. Relative worker performance determines the winner, who receives a fixed prize set in advance. The level of individual effort then increases with the earnings difference between winning and losing the tournament. High earnings at the top of the establishment's hierarchy are incentives for workers at lower job levels.

These two literatures confront each other when we consider individuals within the same establishment. In this case, one viable reference group is co-workers. As such, co-workers' earnings may have two opposing effects on individual utility. The first is a comparison or status effect, whereby co-workers' higher earnings make me feel relatively

³ Where the reference group might be the individual's peer group, others in the same household, their spouse/partner, friends, neighbors, work colleagues, or the individual herself in the past.

deprived, and the second is a signal effect, where higher co-worker earnings provide me with information about my own future prospects.

To illustrate this tension, we develop a simple model encompassing both status and signal effects. Imagine a simple linear utility function for individual i at time t :

$$U_{it} = \alpha w_{it} + \beta w_{it}^* \quad (1)$$

Here w_{it} denotes the individual's own earnings and w_{it}^* denotes the level of reference group earnings, which in our model is within-establishment average earnings. We imagine that $\alpha > 0$ and a standard comparison story would have $\beta < 0$; the latter reflects the importance of others' earnings in the individual utility function. For expositional purposes, assume that there are two time periods, 1 and 2. There is a probability p that, if you stay in the same job, you will earn reference group (establishment average) earnings next year, increased by $\theta\%$, say. Otherwise you will earn w_2 . In addition, there is a chance δ of the match finishing. If it does, your outside earnings are \bar{w}_i next period, with "outside" reference group earnings of \bar{w}_i^* . Individuals are assumed to maximise the present discounted value of expected utility. Setting the discount rate to zero, without loss of generality, we have:

$$U_{i1} = \alpha w_{i1} + \beta w_{i1}^*$$

$$U_{i2} = \delta(\alpha \bar{w}_i + \beta \bar{w}_i^*) + (1-\delta)\left(\alpha \left[p(1+\theta)w_{i1}^* + (1-p)w_{i2} \right] + \beta w_{i2}^*\right)$$

So that

$$\sum_{t=1}^2 U_{it} = \alpha w_{i1} + \beta w_{i1}^* + \delta(\alpha \bar{w}_i + \beta \bar{w}_i^*) + (1-\delta)\left(\alpha \left[p(1+\theta)w_{i1}^* + (1-p)w_{i2} \right] + \beta w_{i2}^*\right)$$

$$= \alpha w_{i1} + (\beta + (1-\delta)\alpha p(1+\theta))w_{i1}^* + \delta(\alpha \bar{w}_i + \beta \bar{w}_i^*) + (1-\delta)\alpha(1-p)w_{i2} + (1-\delta)\beta w_{i2}^*$$

It is assumed that individuals take their future into account, so that their satisfaction response today includes information on how they expect their job to be in the future⁴ (otherwise the information element plays no role by construction).

A standard regression in the field of income comparisons models job/life satisfaction at time t as a function of both w_{it} and w_{it}^* . The $\delta(\cdot)$ term, the third above, represents the outside options (in terms of both earnings and reference group earnings) should the match come to an end. This can be considered to be picked up by demographic variables, or by the individual effect in panel analyses. Most empirical estimation does not control for the levels of future earnings and reference group earnings (w_{i2} and w_{i2}^*) that pertain when the individual does not accede to the current reference group earnings (although we can argue that w_{i2} will be closely correlated with w_{i1}).

The key implication of this model is that the coefficient on w_{it}^* in the estimation of $U_{it} = \alpha w_{it} + \beta w_{it}^*$, will not only represent the comparison part of the utility function, but also the information that establishment average earnings (or whatever the measure of reference group earnings is) provides about the worker's future prospects. In our model, instead of estimating β , we in fact obtain an estimate of

$$\tilde{\beta} = \beta + (1-\delta)\alpha p(1+\theta) \quad (2)$$

This estimated coefficient, $\tilde{\beta}$, will be positive, setting θ equal to zero for simplicity, if

$$p > \frac{-\beta}{(1-\delta)\alpha}.$$

⁴ This interpretation is explicitly tested in the context of worker quitting by Lévy-Garboua *et al.* (2007). A second piece of supporting evidence is that promotion opportunities attract a positive estimated coefficient in job satisfaction regressions.

Proposition 1:

The signal effect is more likely to dominate the status effect, so that others' earnings are positively correlated with my own well-being, as:

- 1) *the probability of acceding to the reference group (p) is higher;*
- 2) *the jealousy parameter (β) is lower;*
- 3) *the match destruction rate (δ) is lower; and*
- 4) *the marginal utility of own income (α) is higher.*

The empirical literature on income comparisons has taken the estimated value of β in (1) as an indicator of the strength of status effects. However, the simple model above highlights that this interpretation fails when there is also a signal component; in this case there is no clean test of comparisons as the estimated coefficient on w^* picks up two opposing phenomena. In general, any estimated value of $\tilde{\beta}$ will be consistent with the presence of income comparisons in the utility function. From (2), the strength of the comparison term can only be estimated in three distinct cases:

(i) $\alpha = 0$, so that *a priori* only others' income matters in the utility function, with no role for one's own income. This prior is obviously unattractive.

(ii) $p = 0$, so that there is no chance of acceding to the reference group job. It might be argued that a geographical definition of a reference group in Western countries, as in Luttmer (2005) or Blanchflower and Oswald (2004), goes some way to meeting this condition – I am perhaps relatively unlikely to end up with my neighbour's job. This would likely be a worse assumption in the case of Knight and Song (2006), where the reference group (others in the same rural Chinese village) is more homogeneous.

(iii) $\delta = 1$. All matches are destroyed, so that there is no chance of staying in the same job. This is unlikely in field data, but can easily be engineered in experimental tests of comparison income, such as McBride (2007).

Our empirical work uses matched employer-employee data and considers a reference group of other workers within the same establishment. We therefore expect a non-zero information effect from others' earnings, especially for those who have a greater chance of moving up the establishment earnings ladder, and for those who expect to stay in the establishment longer. This kind of data provides a good setting in which to test for the relative strength of status and signal effects.

3 Empirical Approach and Data

3.1 *The Data*

This paper is based on data of unusual richness. Eight waves of survey data from the Danish sample of the European Community Household Panel (ECHP)⁵ have been merged with administrative records. The ECHP survey data, which constitute a panel spanning 1994-2001, cover about 7,000 individuals in the first few years. Due to sample attrition this falls to about 5,000 individuals by 2001. Here we only consider employees, aged 18-64, producing an effective sample of about 16,000 observations on around 4,000 individuals over the eight-year period. Our dependent variable results from an overall job satisfaction question as follows:

How satisfied are you with your work or other main activity?

⁵ See <http://epp.eurostat.cec.eu.int> for details of the ECHP data.

Respondents answer the satisfaction question using an ordered scale from 1 (*not at all satisfied*) to 6 (*fully satisfied*). Figure A1 in the Appendix shows the distribution of job satisfaction in this sample. As is usual, there is bunching towards the right-hand side of the satisfaction scale.

[Figure A1 about here]

The Danish component of the ECHP was sampled randomly from the central administrative database, the Central Personal Register (CPR). The CPR contains an entry for each individual in Denmark; each individual has a unique CPR number. This CPR number can then be matched to the administrative IDA⁶ database, maintained by Statistics Denmark, which contains labour-market information on all individuals aged 15 to 74 (demographic characteristics, education, labour market experience, tenure and earnings) and employees in all workplaces in Denmark over the period 1980-2001. This database includes, amongst many other things, identifiers for both the firm and the establishment where the individual works, and the earnings of each individual. In our work we consider other workers in the same establishment as the reference group. We pay particular attention to ensuring that the job that the individual held when interviewed in the ECHP is that to which the administrative register data refer. The earnings in the register data refer to the annual earnings of the job that the individual held at the end of the November of each year, as reported by firms to the tax authorities. The firms' declarations of each worker's earnings are cross-checked against the worker's own tax filings. Our matching of the two databases therefore allows us to use administrative

⁶ *Integreret Database for Arbejdsmarkedsstatistik* (Integrated Database for Labour Market Statistics).

information on both individual earnings, and the earnings of all of the individual's colleagues at their place of work. Our use of administrative data helps to minimise the common problems associated with measurement error regarding earnings.⁷

We now have information on survey respondents' job satisfaction (from the ECHP), their own earnings, and the entire establishment earnings distribution (the latter two from register data). To flesh out the idea of an earnings *distribution*, we limit the sample to establishments where the respondent has a minimum of 5 colleagues.⁸ Our key regressions will model individual job satisfaction as a function of both own earnings and a measure of others' earnings within the same establishment, as well as a set of standard demographic control variables.⁹

3.2 *Econometric Specification*

We are interested here in the determinants of overall job satisfaction, and in particular the role of the individuals' position in the establishment's wage distribution. Job satisfaction is an ordered variable, reported on a scale from 1 to 6. In comparison to previous work that has considered the role of the establishment's wage structure, our use of panel data means that we are able to control for unobserved individual characteristics. Lykken and Tellegen (1996) estimate that between 50% and 80% of the variation in individuals' reported well-being results from genes and upbringing, underlining the importance of controlling for individual-specific fixed effects.

⁷ See Kristensen and Westergaard-Nielsen (2007) for a comparison of key individual variables, including earnings, between the ECHP and register data.

⁸ Using thresholds of 4 and 6 colleagues makes little difference to the results. As one of the robustness tests in Section 4 will show, the results also hold when excluding establishments with 20 or fewer employees.

⁹ The means and standard deviations of the key variables are presented in Appendix Table A1.

However, controlling for an individual effect in this particular case is problematic. A first issue is that establishment's average earnings may change only little over time (and relatively few individuals change establishments), producing little variation in reference group wages. A second issue is that job satisfaction is measured on an ordinal, rather than a cardinal, scale. A common approach to fixed-effect ordinal estimation requires a dichotomous dependent variable, which loses a great deal of information. However, random-effects estimation is likely to be inconsistent, as own wage is very likely endogenous in a model with job satisfaction as the dependent variable.

In this paper we take two different approaches to introducing individual effects into our baseline model. We assume a latent unobserved continuous measure of reported job satisfaction, JS^* , which is assumed to be a function of individual covariates such as age, education and other background characteristics, X_{it} and earnings-related terms, IT_{it} (which will also be discussed below). The empirical model is then:

$$JS_{it}^* = \alpha' IT_{it} + \beta' X_{it} + \gamma_i + \varepsilon_{it}, \quad i=1, \dots, N; t=1, \dots, T_i. \quad (3)$$

The error term is denoted by $\eta_{it} = \gamma_i + \varepsilon_{it}$, where γ_i is the individual-specific time-invariant component and ε_{it} is the individual- and time-varying disturbance term.

Our first approach is to use a Mundlak correction term. This preserves the ordinal nature of the dependent variable, without any need for dichotomising, and also dispenses with the orthogonality requirements of random-effect estimation. Here we parameterise the individual effect as $\gamma_i = \gamma_{0i} + \gamma_1 \bar{w}_i$, where \bar{w}_i denotes the mean wage of individual i over all the waves in which she is observed. This term is included as an application of Mundlak's (1978) method, where the individual effect is decomposed into a random effect (γ_{0i}) that is

uncorrelated with the right-hand side variables, and the mean values of some of the (time-varying) regressors that are allowed to be correlated with the individual random effects. Here we use the individual-specific mean values of earnings.

The second approach is, following Ferrer-i-Carbonell and Frijters (2004), to consider satisfaction as a cardinal variable, and apply linear techniques, producing “within” regressions. This is also the approach adopted by Luttmer (2005).

4 Results

In this section we first present the main results, and then a number of extensions and robustness tests. Finally, we discuss the results and their implications.

4.1 Baseline Results

Table 1 presents the results from our baseline specification, including the individuals’ own earnings, w_{it} , and establishment average earnings, w_{it}^* , in the earnings-related terms, IT_{it} , in (3) above.

[Table 1 about here]

There are three columns in Table 1, all of which control for individual effects. The first two columns refer to random-effect ordered probit estimation. Column 1 includes both own and establishment earnings, while column 2 introduces the Mundlak term described above.

The estimated coefficient on own earnings is positive and significant in both of these columns (at the one per cent level in column 1, and at the five per cent level in column 2). The estimated coefficient on the Mundlak term is positive in column 2, and

significant at the ten per cent level. The positive effect of the Mundlak term explains why the coefficient on own earnings falls somewhat in both size and significance between columns 1 and 2. The broad positive relationship between own earnings and job satisfaction, conditional on the other right-hand side variables, is unsurprising, and is consistent with most results in the literature.

More unusually, the estimated coefficient on establishment average earnings is *positive* and significant at the five per cent level in both columns 1 and 2, and is little affected by the Mundlak correction.

Column 3 takes a different tack, estimating within regressions. Here own earnings attracts a positive coefficient, which is only borderline significant (p-value=0.12), but again the average establishment earnings attract a positive and significant coefficient (p-value=0.06).¹⁰ The fact that establishment average earnings have a positive effect on satisfaction within the same individual argues against a selection story, whereby intrinsically satisfied workers choose to work in establishments where average earnings are higher.

Not only do we not find the standard negative comparison effect in our empirical results, but the estimated coefficient is also significant in the opposite direction. In terms of the model in Section 2, this is consistent with the signal effect dominating the status effect, yielding a net positive estimated coefficient ($p > \frac{-\beta}{(1-\delta)\alpha}$), as in Hirschman's tunnel effect. The implications of this finding are discussed in Section 4.4 below.

¹⁰ A Hausman test on the linear specification shows that, overall, fixed-effects is preferred to random-effects estimation. However, the estimated coefficient on establishment average earnings is almost identical in the two specifications.

The results for the other control variables are standard. In the random effects specifications the quadratic age terms suggest a U-shape between job satisfaction and age, minimising in the mid-thirties (Clark *et al.*, 1996). The quadratic specification is inappropriate with a fixed effect, and in column 3 we introduce a set of three age dummies (coefficients not shown). We also find a strong effect of health, at least in columns 1 and 2 (although we cannot say anything about causality), and that employees in relatively small establishments (fewer than 100 employees) report statistically significant higher job satisfaction levels than do employees in establishments with 100 employees or more.

To evaluate the size of the establishment earnings effect on job satisfaction, we calculate a marginal effect for a representative individual.¹¹ This person has a predicted probability of reporting the highest satisfaction level of 30.3%; doubling average establishment earnings increases this figure to 32.8%. This relatively modest-looking marginal impact is typical in subjective data, where the dependent variable is often tightly-distributed (see Figure A1).

4.2 Robustness Checks

Table 1 showed that establishment average earnings are positively correlated with individual job satisfaction in panel estimation. The interpretation we have privileged is that others' good fortune today reflects my potential good fortune tomorrow: others' earnings are a signal. This sub-section reports a number of robustness checks to validate this reading of the empirical results.

¹¹ A 40-year old single female Manager in the Manufacturing sector with a professional qualification, working a 37-hour week with average earnings, both own and establishment, in a small establishment, and with a health problem.

A first obvious test, based on the panel nature of the data, is to check that others' earnings today do indeed predict the individual's own future earnings. We thus run a set of regressions explaining own earnings growth k waves in the future as a function of both own and average establishment earnings today, plus a set of standard demographic controls:

$$\ln(w_{it+k}) - \ln(w_{it}) = \alpha_1 \ln(w_{it}) + \alpha_2 \ln(w^*_{it}) + \mathbf{X}_{it}'\boldsymbol{\beta} + \varepsilon_{it} \quad (4)$$

If own future earnings depend on current average establishment earnings, then we expect the estimated value of α_2 to be positive. Table 2 shows the results, for values of k ranging from one to five (i.e. predicting one to five years into the future). The estimated value of α_2 is indeed positive and very significant, and changes only little according to the time frame over which prediction is carried out. The estimation in Table 2 refers only to those who stay in the same establishment between t and $t+k$ (although estimating on the whole sample, whether they move or not, yields similar parameter estimates).

[Table 2 about here]

A further issue is that of establishment size: are the results driven by only very small or very large establishments? To check, Table 3 reproduces our baseline results for the whole sample from column 2 of Table 1, and then shows analogous estimates first excluding large establishments (100+ employees) and then excluding small establishments (≤ 20 employees). The results show that, while the estimated coefficient on average establishment earnings is positive under both restrictions, it is only significantly so for larger establishments. This might be thought of as consistent with the greater presence of internal labour markets in larger establishments.

[Table 3 about here]

An additional testable implication of the signal reading is that establishment earnings matter more for those who have more years left in which to enjoy higher earnings. As a test, we add an interaction between establishment average earnings and a dummy for “older workers”. We defined the latter as workers aged over 51. The estimated coefficient on this interaction (results available on request) is negative and significant at the one per cent level: establishment average earnings provide a smaller satisfaction boost for workers who are nearer retirement. The main effect of average establishment earnings remains positive and significant at the five per cent level.

4.3 Specifications of Reference Earnings

In this section, we ask whether we can identify certain groups for whom the signal effect of others’ earnings is stronger, and also whether other specifications of reference earnings produce similar results.

We first consider whether the linear-in-means specification of reference earnings is the most appropriate. In the context of tournaments, arguably only the earnings of those above you in the hierarchy matter; to investigate, we replace average establishment earnings in the baseline specification by the 75th percentile of earnings. To help pinpoint this figure, we only consider establishments where there are at least ten employees (although the same qualitative results hold for the whole sample). The results in the first column of Table 4 show that, again, workers are more satisfied in high-earnings firms. The coefficient on the 75th percentile of establishment earnings is positive and significant, and is larger in size than that on mean establishment earnings in Table 1.

[Table 4 about here]

We might also suspect, in line with tournament theory, that the signal applies more strongly to those who earn less than the 75th percentile earnings, and that the size of this signal will increase the closer the individual is to the 75th percentile (from below). The last three columns of Table 4 explore this possibility, by running separate estimations according to whether the individual is in the bottom half of the earnings distribution, the third quartile (i.e. the 50th to the 75th percentile) or the top quartile. The results are consistent with the prior: the effect of 75th percentile earnings is positive and significant for those in the first three quartiles, and especially for those in the third quartile (i.e. those who are closest to the establishment earnings measure).¹² By way of contrast, 75th percentile earnings is very insignificant for those in the top quartile of the establishment wage distribution.¹³ It is worth emphasizing that this correlation holds controlling for the individual's own earnings, so that the establishment earnings is not acting as a proxy for own earnings in these regressions.

A second specification issue refers to the sample used to calculate establishment average earnings. One topic of discussion in the income comparisons literature has been to whom individuals actually compare. Within the establishment, it is perhaps likely that workers compare their earnings more to those of others who are doing the same kind of job. With this in mind, Table 5 shows the results of estimations with two establishment earnings terms. The first is the 75th percentile establishment earnings, as in Table 4: we

¹² The point estimate on own earnings is generally positive, but is negative, although insignificant, for the third quartile in this specification. The effect of establishment earnings is very strong for this last group. This may seem implausible. At face value, when close enough to the reference earnings level, all of the effect of earnings on satisfaction would seem to pass via future expectations.

¹³ We can produce the same flavor of results with the 90th percentile of establishment earnings. In this case the size of what we call the signal effect increases monotonically up to the 90th percentile, with the largest effect being found for workers between the 75th and the 90th percentile; the effect for those in the top decile is very insignificant. We can also produce the same type of result keeping mean earnings, as in the baseline, and introducing a kink in the establishment earnings-satisfaction relationship at average establishment earnings.

expect this to reflect the signal component of others' earnings. The second is mean earnings by occupation, split up into three categories (Managers and equivalent, Middle-ranking positions, and Lower-level jobs).¹⁴ We calculate 75th percentile establishment earnings at the establishment level (and not by occupation within the establishment) as the whole ethos of tournaments is that the winners climb up the establishment hierarchy.

[Table 5 about here]

The results in the first column of Table 5 show the estimation results over the whole sample. These reveal a positive effect from the 75th percentile establishment earnings, as before, but a negative significant effect from mean earnings by occupation (within the establishment). The first of these may be interpreted as a signal effect, but the second as reflecting earnings comparisons to similar others, as emphasised in much of the existing empirical literature. We are aware, however, that these estimations put considerable structure on a dependent variable that does not exhibit that much variation.

The first column of Table 5 is thus consistent with the presence of both signal and status effects from others' earnings. The remaining columns of this table show that these effects are not homogeneous across different labour market groups.

Columns 2 and 3 of Table 5 indicate that the signal effects from establishment earnings are stronger for men than for women, and that the putative status earnings effect is very significant and negative for men, but totally insignificant for women. The latter result might be thought of as a large-sample survey data counterpart to the well-known findings in the experimental literature that men react more strongly in competitive environments, i.e. that they are more status-sensitive (Gneezy *et al.*, 2003, and Niederle and Vesterlund, 2007).

¹⁴ We only use three occupation categories to avoid problems with small cell sizes.

Finally, columns 4 and 5 of Table 5 show that the signal vs. status distinction in others' earnings is sharper in the private than in the public sector. This is perhaps unsurprising, as earnings in the Danish public sector are determined by centralised collective bargaining, with relatively little scope for individual public-sector establishments to set up tournaments.

4.4 Discussion and Implications

The results presented above are largely consistent with a “Hirschmanian” role for others' earnings within the establishment, in the sense that the signal effect from others' earnings may dominate any jealousy or status effect. As tournament theory would imply, this signal effect is insignificant for those who earn more than the indicator of establishment earnings that we employ.

Alternative explanations

Before considering the implications of the signal effect of co-workers' wages, it is as well to consider other plausible explanations of our previous results.

One first natural reaction to survey data on earnings is that it is measured with some error. If this is the case, then co-workers' wages may be proxying for the individuals own wage (and will thus attract a positive coefficient). However, as noted in Section 3.1, the earnings measures used (both own and others) are derived from firms' checked tax declarations (in the administrative IDA database), rather than self-reported by respondents, and are thus presumably measured with much less error.

Second, there may well be heterogeneity in the amount of rents that firms give their workers, perhaps due to the degree of competition. Any rents that are paid will consist of earnings (which we measure) and perks (which we don't). In this case, conditional on own earnings, co-workers' earnings will be correlated with the firm provision of perks, which has a direct effect on job satisfaction. Although we cannot measure perks directly, we can appeal to the asymmetric effect of co-workers' earnings in Table 4, where only the satisfaction of those earning less than the measure of establishment earnings was related to establishment earnings. The perks explanation will then only hold if any such non-monetary rewards are specifically not targeted towards higher-paid workers (which may seem unlikely).

Last, we might imagine a sorting story based on differences in worker "disposition" – some workers are intrinsically positive and satisfied, and are not particularly sensitive to status, while other workers are less happy and do care about where they stand in the earnings distribution. Consequently, "happy" workers may prefer firms where others' earnings are high (they do not mind this, as they are not status-sensitive) while the unhappy choose firms where average earnings are low (because they want to rank high in the earnings distribution). Here we have an omitted variable, disposition, which is correlated with the earnings of co-workers. While it is difficult to test for this selection of workers directly, the fixed-effects estimation in Table 1 should rule out this interpretation if we believe that disposition varies only little over time. We might equally ask, from Table 4, why any such sorting would then seem to be far stronger in the third quartile of the establishment earnings distribution than in the fourth quartile.

Implications

The finding of a positive well-being effect from others' wages differs from those in the majority of the published literature. We think that the key distinction lies in the composition of the reference group. As previously noted, the fact that the Joneses living next door earn more than I do, as in Luttmer (2005), may reveal only little information about my future pay prospects: the entire effect of the Joneses' pay thus passes by a comparison or status effect, reducing relative income and job satisfaction. Things may well be very different when work colleagues serve as the comparison group. In this case high reference earnings serve as a signal regarding one's own future pay check.

The published work that has found a positive well-being effect from others' income, Senik (2004 and 2008) and Kingdon and Knight (2007), can also be interpreted in terms of signal effects. Senik (2004) uses Russian RLMS data to establish a positive correlation between life satisfaction and (geographical) reference group income, especially for younger workers. In general, Senik (2008) makes the point that most evidence of comparison or jealousy effects comes from stable Western countries. In Senik's work, the reference group consists of other people who are similar to you. In a very unstable labour market, what happens to similar others today may well be thought of as providing a signal about your own future labour market outcomes. Kingdon and Knight (2007) use South African data to show that the average income of others in the local residential area is positively correlated with household utility (while average income by district or province is negatively correlated with well-being). Again, this can be interpreted as showing that individuals are more likely to end up with their close neighbour's job than with their more distant neighbour's job.

This paper has uncovered this kind of signal effect using a natural reference group (colleagues within the same establishment) in an OECD country. Denmark has one of the most equal income distributions in the world, as well as very high income and wage mobility by international standards (OECD, 1997). These two facts together with our results suggest that: *i)* even in a stable economic environment there can be substantial income mobility, and in this context it is not surprising that signal effects exist even in the affluent Danish economy; and *ii)* there are likely limits to income re-distribution. The theoretical and empirical work on “Prospects of upward mobility” (POUM: see Alesina and La Ferrara, 2005, and Bénabou and Ok, 2001) has underlined that the demand for redistribution depends not only on where individuals are now, but also where they might reasonably expect to find themselves in the future. In the same way, individuals’ evaluations of their current job likely reflect both their current and their expected future rewards from working. In this paper, we have argued that the latter, which is analogous to the rewards from POUM in this case, might be picked up by colleagues’ current earnings, and especially those who figure above the individual in the establishment earnings distribution. In this case, increasing the earnings of the well-paid may potentially increase everyone’s job satisfaction: that of the well-paid because their own pay has gone up, and that of the low-paid due to higher establishment earnings. This kind of phenomenon may be behind some earlier findings in economics and psychology underlining a positive relationship between income inequality and measures of subjective well-being (see Clark, 2003, and the references therein).

5 Conclusion

A common theme in the subjective well-being literature has been comparisons to others, whereby low income relative to a reference group reduces well-being. We argue that this correlation is conditional on reference group wage being uninformative about the individual's own future income prospects. In much of the existing literature, this condition is satisfied (it is not necessarily because my neighbours or my cohort receive a pay rise that my own future prospects look brighter). We here analyze a data set where this condition probably does not hold, using earnings information on all other workers within the same establishment. We do so by matching Danish ECHP data to administrative records.

The results are unambiguous. Job satisfaction is positively correlated with own earnings, but it is also positively correlated with the average earnings of all other workers within the same establishment.

Although we have not presented any direct tests of tournament theory, our results are nonetheless consistent with this model. When my colleagues earn higher wages, I learn about my future opportunities within the establishment. In line with the Tournament model this effect is more pronounced for men (who are more likely to be promoted), in the private sector (where wage-setting is more individualised), and for those who earn less than the establishment wage measure. Our results corroborate the findings of one of the few empirical studies of Tournament theory, Eriksson (1999), who finds support for this theory using Danish data.

Taking these results at face value, workers may not always oppose earnings inequality – at least not within the establishment. Higher earnings for better-paid workers may improve everyone's job satisfaction. There are however likely limits beyond which

this result will no longer hold. Future research should attempt to identify more accurately the relationship between worker well-being, on the one hand, and both own and others' wages on the other, while explicitly recognizing that my own current relative wage misfortune may contain the promise of a brighter future.

6 References

- Adams, J.S. (1963). 'Toward an Understanding of Inequity'. *Journal of Abnormal and Social Psychology*, vol. 67 (November) pp. 422-436.
- Akerlof, G. A. and Yellen, J. L. (1990). 'The Fair Wage-Effort Hypothesis and Unemployment'. *Quarterly Journal of Economics*, vol. 105(2) (May), pp. 255-283.
- Alesina, A. and La Ferrara, E. (2005). 'Preferences for redistribution in the land of opportunities'. *Journal of Public Economics*, vol. 89(5-6) (June), pp. 897-931.
- Bénabou, R. and Ok, E. (2001). 'Social Mobility and the Demand for Redistribution: the POUM Hypothesis'. *Quarterly Journal of Economics*, vol. 116(2) (May), pp. 1067-1101.
- Bewley, T.F. (1998). 'Why not cut pay'? *European Economic Review*, vol. 42(3-5) (May), pp. 459-490.
- Blanchflower, D.G. and Oswald, A.J. (2004). 'Well-being over time in Britain and the USA'. *Journal of Public Economics*, vol. 88(7-8) (July), pp. 1359-1386.
- Brown, G.D.A., Gardner, J. Oswald, A. and Qian, J. (2008). 'Does Wage Rank Affect Employees' Wellbeing'? *Industrial Relations*, vol. 47(3) (July), pp. 355-389.
- Bygren, M. (2004). 'Pay reference standards and pay satisfaction: what do workers evaluate their pay against'? *Social Science Research*, vol. 33(2) (), pp. 206-224.
- Campbell, C.M. III and Kamlani, K.S. (1997). 'The Reasons for Wage Rigidity: Evidence from a Survey of Establishments'. *Quarterly Journal of Economics*, vol. 112(3) (August), pp. 759-789.
- Capelli, P. and Sherer, P.D. (1988). 'Satisfaction, Market Wages and Labour Relations: An Airline Study'. *Industrial Relations*, vol. 27(1) (December), pp. 56-73.
- Clark, A.E. (2003). 'Inequality-Aversion and Income Mobility: A Direct Test'. DELTA, Discussion Paper 2003-11.
- Clark, A.E., Frijters, P. and Shields, M., (2008). 'Relative Income, Happiness and Utility: An Explanation for the Easterlin Paradox and Other Puzzles'. *Journal of Economic Literature*, vol. 46(1) (June), pp. 95-144.
- Clark, A.E. and Oswald, A.J. (1996). 'Satisfaction and Comparison Income'. *Journal of Public Economics*, vol. 61(3) (September), pp. 359-381.

- Clark, A.E., Oswald, A.J. and Warr, P.B. (1996). 'Is Job Satisfaction U-shaped in Age?' *Journal of Occupational and Organizational Psychology*, vol. 69(1) (Spring), pp. 57-81.
- Eriksson, T. (1999). 'Executive Compensation and Tournament Theory: Empirical Tests on Danish Data'. *Journal of Labor Economics*, vol. 17(2) (April), pp. 262-280.
- Farber, H.S. and Saks, D.H. (1980). 'Why Workers Want Unions: The Role of Relative Wages and Job Characteristics'. *Journal of Political Economy*, vol. 88(2) (April), pp. 349-369.
- Ferrer-i-Carbonell, A. (2005). 'Income and Well-Being: An Empirical Analysis of the Comparison Income Effect'. *Journal of Public Economics*, vol. 89(5-6) (June), pp. 997-1019.
- Ferrer-i-Carbonell, A. and P. Frijters (2004). 'How important is methodology for the estimates of the determinants of happiness'? *ECONOMIC JOURNAL*, vol. 114(497) (July), pp. 641-659.
- Gneezy, U., Niederle, M. and Rustichini, A. (2003). 'Performance in Competitive Environments: Gender Differences'. *Quarterly Journal of Economics*, vol. 118(3) (August), pp. 1049-1074.
- Hirschman, A. and Rothschild, M. (1973). 'The Changing Tolerance for Income Inequality in the Course of Economic Development'. *Quarterly Journal of Economics*, vol. 87(4) (November), pp. 544-566.
- Kingdon, G. and Knight, J. (2007). 'Community, comparisons and subjective well-being in a divided society'. *Journal of Economic Behaviour & Organisation*, vol. 64(1) (September), pp. 69-90.
- Knight, J. and Song, L. (2006). 'Subjective well-being and its determinants in rural China'. *University of Nottingham*, mimeo.
- Kristensen, N. and Westergaard-Nielsen, N. (2007). 'A Large-Scale Validation Study of Measurement Errors in Longitudinal Survey Data'. *Journal of Economic and Social Measurement*, vol. 32(2-3), pp. 65-92.

- Law, K.S. and Wong, C.-S. (1998). 'Relative importance of referents on pay satisfaction: A review and test of a new policy-capturing approach'. *Journal of Occupational and Organizational Psychology*, vol. 71 (March), pp. 47-60.
- Lazear, E. and Rosen, S. (1981). 'Rank-Order Tournaments as Optimum Labour Contracts'. *Journal of Political Economy*, vol. 89(5) (October), pp. 841-864.
- Levine, D.I. (1993). 'Fairness, Markets and Ability to Pay: Evidence from Compensation Executives'. *American Economic Review*, vol. 83(5) (December), pp. 1241-1259.
- Lévy-Garboua, L., Montmarquette, C. and Simonnet, V. (2007). 'Job Satisfaction and Quits'. *Labour Economics*, vol. 14(2) (April), pp. 251-268.
- Luttmer, E. (2005). 'Neighbours as Negatives: Relative Earnings and Well-Being'. *Quarterly Journal of Economics*, vol. 120(3) (August), pp. 963-1002.
- Lykken, D. and Tellegen, A. (1996). 'Happiness is a stochastic phenomenon'. *Psychological Science*, vol. 7(3) (May), pp. 186-189.
- Manski, C. (2000). 'Economic Analysis of Social Interactions'. *Journal of Economic Perspectives*, vol. 14(3) (Summer), pp. 115-136.
- McBride, M. (2007). 'Money, Happiness, and Aspirations: An Experimental Study'. University of California-Irvine, Working Paper 060721.
- Mundlak Y. (1978). 'On the pooling of time-series and cross-section data'. *Econometrica*, vol. 46(1) (January), pp. 69-85.
- Neumark, D. and Postlewaite, A. (1998). 'Relative Income Concerns and the Rise in Married Women's Employment'. *Journal of Public Economics*, vol. 70(1) (October), pp. 157-183.
- Niederle, M. and Vesterlund, L. (2007). 'Do Women Shy Away from Competition? Do Men Compete Too Much?'. *Quarterly Journal of Economics*, vol. 122(3) (August), pp. 1067-1101.
- OECD (1997). *Employment Outlook*. Paris: OECD.
- Patterson, M., Warr, P. and West, M. (2004). 'Organizational Climate and Company Productivity: The Role of Employee Affect and Employee Level'. *Journal of Occupational and Organizational Psychology*, vol. 77(2) (June), pp. 193-216.

- Pfeffer, J. and Langton, N. (1993). 'The Effect of Wage Dispersion on Satisfaction, Productivity, and Working Collaboratively: Evidence from College and University Faculty'. *Administrative Science Quarterly*, vol. 38(3) (September), pp. 382-407.
- Senik, C. (2004). 'When Information Dominates Comparison: A Panel Data Analysis Using Russian Subjective Data'. *Journal of Public Economics*, vol. 88(9-10) (August), pp. 2099-2123.
- Senik, C. (2008). 'Ambition and Jealousy. Income Interactions in the "Old Europe" versus the "New Europe" and the United States'. *Economica*, vol. 75(299) (August), pp. 495-513.
- Shafir, E., Diamond, P. and Tversky, A. (1997). 'Money Illusion'. *Quarterly Journal of Economics*, vol. 112(2) (May), pp. 341-374.
- Summers, L. H. (1988). 'Relative Wages, Efficiency Wages, and Keynesian Unemployment'. *American Economic Review, Papers and Proceedings*, vol. 78(2) (May), pp. 383-88.

Table 1. Baseline Specification. Job Satisfaction, Own and Establishment Earnings.

	Random Effects Ordered Probit	Random Effects Ordered Probit	Fixed Effects Linear Regression (“Within”)
Ln(Own earnings)	0.068** (0.024)	0.052* (0.026)	0.032 (0.020)
Ln(Average own earnings) (=The Mundlak term)	---	0.079+ (0.047)	---
Ln(Average plant earnings)	0.109* (0.046)	0.100* (0.046)	0.080+ (0.043)
Age	-0.053** (0.011)	-0.058** (0.011)	Age Dummies (3)
Age-squared/100	0.076** (0.013)	0.081** (0.013)	
Health problem	-0.079** (0.030)	-0.079** (0.030)	-0.024 (0.023)
Female	-0.045 (0.039)	-0.032 (0.040)	---
Managers	0.091* (0.045)	0.083+ (0.045)	0.025 (0.035)
White collar	0.028 (0.040)	0.024 (0.040)	-0.014 (0.032)
Single	-0.044 (0.034)	-0.041 (0.034)	0.036 (0.034)
Hours work/week	-0.001 (0.002)	-0.001 (0.002)	-0.003 (0.002)
Subordinates	0.061* (0.029)	0.057* (0.029)	0.005 (0.024)
Plant size 5-19	0.162** (0.039)	0.165** (0.039)	0.091* (0.039)
Plant size 20-49	0.086* (0.038)	0.089* (0.038)	0.067+ (0.035)
Plant size 50-99	0.105** (0.038)	0.107** (0.038)	0.094** (0.033)
Education dummies (5)	Yes	Yes	Yes
Industry dummies (6)	Yes	Yes	Yes
Regional dummies (13)	Yes	Yes	Yes
Year dummies (7)	Yes	Yes	Yes
No. of Observations	16 031	16 031	12 059

Notes: Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%. Column 3 includes a constant, and columns 1 and 2 five estimated cut-points.

Table 2. Own Future Earnings Growth and Current Average Establishment Earnings.

	$k=1$	$k=2$	$k=3$	$k=4$	$k=5$
Ln(Own earnings) ($=\alpha_1$)	-0.836** (0.007)	-0.880** (0.009)	-0.856** (0.011)	-0.834** (0.014)	-0.806** (0.019)
Ln(Average plant earnings) ($=\alpha_2$)	0.130** (0.012)	0.169** (0.016)	0.157** (0.018)	0.155** (0.022)	0.177** (0.029)
Observations	10 019	6 703	4 490	2 961	1 835

Notes: The equation estimated is $\ln(w_{it+k}) - \ln(w_{it}) = \alpha_1 \ln(w_{it}) + \alpha_2 \ln(w_{it}^*) + \mathbf{X}_{it}'\boldsymbol{\beta} + \varepsilon_{it}$. The other control variables in \mathbf{X} are as in column 1 of Table 1. Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%. Estimated only on those who stay in the same establishment between t and $t+k$.

Table 3. Job Satisfaction, Own and Establishment Earnings: The Role of Establishment Size

	Random Effects Ordered Probit		
	All	Plant<100	Plant>200
Ln(Own earnings)	0.052* (0.026)	0.090** (0.030)	0.032 (0.032)
Ln(Average plant earnings)	0.100* (0.046)	0.058 (0.052)	0.137* (0.060)
Observations	16 031	11 803	12 603

Notes: Other control variables as in column 2 of Table 1. Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%.

Table 4. Comparisons to the 75th percentile.

	Random Effects Ordered Probit			
	All	Below Median	Above Median but below 75 th pctile	Above 75 th pctile
Ln(Own earnings)	0.033 (0.028)	0.011 (0.034)	-0.168 (0.210)	0.212 (0.156)
Ln(75 th percentile establishment earnings)	0.156** (0.053)	0.214* (0.090)	0.565* (0.223)	-0.012 (0.125)
Observations	14 941	5 877	4 381	4 683

Notes: Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%. Other control variables as in column 2 of Table 1. Sample restricted to establishments with 10 or more employees.

Table 5. Comparisons to the 75th percentile and Mean Occupational Earnings.

	All	Male	Female	Private sector	Public sector
Ln(own earnings)	0.046 (0.029)	0.035 (0.040)	0.067 (0.041)	0.047 (0.037)	0.081+ (0.048)
Ln(75 th percentile earnings)	0.236** (0.065)	0.367** (0.097)	0.123 (0.089)	0.268** (0.079)	0.084 (0.133)
Ln(avg. earnings by establishment & occupation)	-0.123* (0.055)	-0.254** (0.080)	-0.012 (0.077)	-0.187** (0.070)	-0.048 (0.093)
Observations	14 941	7 968	6 973	8 445	6 496

Notes: Standard errors in parentheses; + significant at 10%; * significant at 5%; ** significant at 1%. Other control variables as in column 2 of Table 1. Sample restricted to establishments with 10 or more employees.

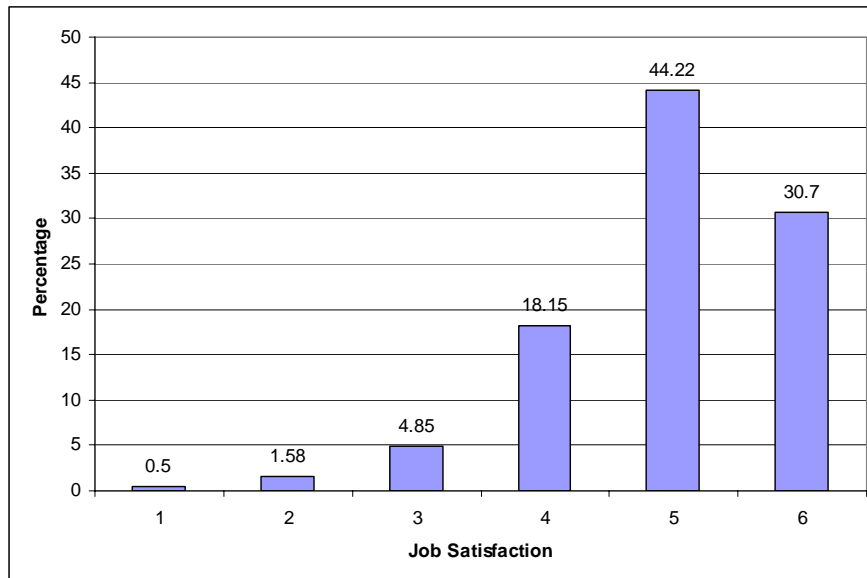
A. Descriptive Statistics

Table A1. Means and Standard Deviations of Key Variables

Variable	Mean	Std. Dev.
Real earnings/1000 (1995 DKK)	227.49	109.10
Age	40.29	10.66
Female	0.46	0.50
<i>Occupation</i>		
Managers	0.19	0.39
White collar	0.17	0.38
Blue collar	0.43	0.50
Health problem	0.20	0.40
Single	0.23	0.42
Hours work/week	37.28	6.99
Subordinates (yes=1)	0.31	0.46
<i>Establishment size</i>		
5-19	0.21	0.41
20-49	0.19	0.39
50-99	0.18	0.38
100 or more	0.26	0.44
<i>Education</i>		
Primary/Secondary	0.21	0.40
High School	0.07	0.25
Vocational	0.39	0.49
College-short	0.06	0.23
College-long	0.20	0.40
University	0.08	0.26
Job Satisfaction	4.96	0.95

Note: The PPP exchange rate between the Danish Kroner (DKK) and the US dollar was 8.66 in 1994.

Fig. A1. Distribution of Job Satisfaction. Danish ECHP Sample, 1994-2001.



Note: The question reads: *How satisfied are you with your work or other main activity?* The responses are on an ordered scale from 1 (not at all satisfied) to 6 (fully satisfied).