Job Satisfaction and Coworker Pay in Canadian Firms

Mohsen Javdani
Brian Krauth

I Z A Institute
of Labor Economics

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Mohsen Javdani
University of British Columbia, Okanagan and IZA

Brian Krauth
Simon Fraser University

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ABSTRACT

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One reason to be concerned about income inequality is the idea that people not only care about their own absolute income, but also their income relative to various reference groups (e.g. co-workers, friends, neighbors, relatives, etc.). We use Canadian linked employer-employee data to estimate the casual effect of co-worker pay on a worker's reported job and pay satisfaction. Since worker satisfaction can affect the worker's productivity, organizational commitment, turnover, creativity and innovation, as well as the firm's productivity and profitability, this is an issue that requires more attention and careful examination. In models that control for a rich set of workplace characteristics, we find that coworker pay has a large positive and significant effect on both pay and job satisfaction. In our preferred models with establishment-level fixed effects, the effect of coworker pay on pay satisfaction is half as large, and the effect on job satisfaction completely disappears, suggesting that part (all) of what previous studies attribute to the effect of coworker pay on worker pay (job) satisfaction is driven by unobserved heterogeneity across firms or establishments. Our results also suggest that the effect of coworker pay on worker satisfaction is much stronger for workers who leave their job during the following year. Finally, we find that while coworker pay has a positive effect on pay satisfaction among Canadian-born whites, it has a negative effect among immigrants and Canadian-born visible minorities.

Corresponding author:
Mohsen Javdani
Department of Economics
University of British Columbia, Okanagan
3333 University Way
Kelowna, BC V1Y 9M5
Canada

E-mail: Mohsen.javdani@ubc.ca

1. Introduction

While status has long been a key concept for many social scientists (Runciman 1966, Diener and Biswas-Diener 2000, and others), it has received relatively less attention in economics. However, the growing inequality documented by Piketty (2014) and others has made understanding the role of status in behavior and well-being more central. The utility of an individual who is concerned with status is not only affected by own income, but also by income relative to some comparison or reference group (e.g. co-workers, friends, neighbors, relatives, etc.). As Akerlof and Yellen (1990), Frank (1985), Frank and Sunstein (2001) and Layard (2005a,b) argue, if relative income has a considerable impact on individual utility, some well-established ideas about economic policy need to be re-considered. For example, the externalities implied by a concern with status may mean that the social cost of inequality is significantly greater than is commonly understood.

In this article we use linked employer-employee data from Canada to quantify the effect of co-workers' wages on worker's self-reported job and pay satisfaction. Worker satisfaction both directly enters into subjective well-being and may also have important effects on productivity, organizational commitment, turnover, creativity and innovation, and firm's profitability (See Akerlof et al. 1988; Freeman 1978, Judge et al. 2001; Koys 2000; Mangoine and Quinn 1975; McEvoy and Cascio 1985, Patterson et al. 2004, and Yee et al. 2008 for examples). Surprisingly, we are only aware of three studies - Clark et al. (2009), Brown et al. (2008), and Godechot and Senik (2015) - that examine the effect of co-worker wage on worker satisfaction. By using richer data than these previous studies, we can better account for workplace characteristics that could be correlated with wages and also affect worker's satisfaction directly.

There are two contrasting mechanisms by which a given reference group's relative income (keeping the individual's own income fixed) affects an individual's subjective well-being. A *status effect* occurs when increased reference group income induces a feeling of relative deprivation driven by a sense of unfairness, envy, shame, or rivalry (for example, Easterlin 1995; Falk and Knell 2004, Marx 1849, p.163; Smith 1880, p.466). The status effect will impose a negative externality on individual's well-being and will create a negative relationship between reference group's relative income and the individual's utility. A *signal effect*, also known as Hirschman's tunnel effect (Hirschman and Rothschild 1973), occurs when increased reference group income provides a positive signal about the individual's own future prospects. If worker satisfaction is influenced by these expectations, the signal effect will create a positive relationship between the reference group's income and the worker's satisfaction.[1] Since the status effect and signal effect operate in different directions, satisfaction can be positively or negatively related to reference group income.

A long-standing literature in economics emphasizes the role of various comparison groups in determining an individual's utility (e.g. Bolton 1991; Bolton and Ockenfels 2000; Burchell and Yagil 1997; Capelli and Chauvin 1991; Duesenberry 1949; Easterlin 1974, 1995; Kingdon and Knight 2007; and others). A related empirical literature also provides evidence on the relationship between relative income and individual subjective well-being (Brown et al. 2008; Capelli and Sherer 1988; Card et al. 2012; Clark et al. 2009; Clark and Oswald 1996; Ferrer-i-Carbonell 2005; Hamermesh 2001; Hills 1980; Luttmer 2005; McBride 2001; Senik 2004Van Praag and Ferrer-i-Carbonell 2004; Ward and Sloane 2000; Watson et al. 1996). Most of these empirical studies find

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[1] Another reason why income could have a positive impact on own satisfaction is altruism (Charness and Rabin 2002).

a negative relationship between individual satisfaction and income relative to a comparison group. This finding is consistent with the status effect dominating. However, there are also studies that find a positive relationship between individual well-being and relative income, suggesting that signal effect dominates (Brown et al. 2008; Clark et al. 2009; Senik 2004Kingdon and Knight 2007).

We are only aware of three prior studies that specifically examine the effect of relative wage within the workplace (rather than some other comparison group) on worker satisfaction. Clark et al. (2009) estimate the relationship between job satisfaction and co-worker average wage using 16,000 observations on around 4,000 workers in survey data from the Danish sample of the European Community Household Panel merged with administrative records of workers between 1994 and 2001. Their analysis employs random effect ordered probit regressions and fixed effect linear regressions to account for individual-level unobserved characteristics (e.g. genes, upbringing, etc.) that affect worker's job satisfaction and may be correlated with how workers match with firms. They find that the higher the establishment average wage (i.e. the better-paid the co-workers are), the more satisfied the worker is with her job. They argue that this is because the higher wages of co-workers acts as a signal of promising future prospects for the worker that dominates the status effect. They also find that the establishment average wage is a good predictor of an individual's wage in the future, which is consistent with the mechanism underlying the signal effect.

Brown et al. (2008) estimate the relationship between pay satisfaction and the worker's pay rank within the workplace using data from approximately 16,000 employees in approximately 900 workplaces in the 1997-98 UK Workplace Employee Relations Surveys (WERS98). Building upon range-frequency theory developed by psychologists and the results of a laboratory-based experiment, they argue that absolute and relative pay are not the only pay-related determinants of a worker's wellbeing, and worker's satisfaction is partly driven by her relative pay rank within the establishment, even after controlling for absolute and relative pay. Brown et al. find that pay rank has a positive significant impact on pay satisfaction, even when controlling for co-worker average wage, and therefore plays and important independent role in determining pay satisfaction.[2]

Godechot and Senik (2015) use a French linked employer-employee data by matching a 2009 survey of 3000 employees (SalSa) with administrative data (DADS-2008). They find that workers in firms with higher median wage report higher levels of pay satisfaction (regardless of their position in the wage distribution). Their results also suggest that workers' pay satisfaction is negatively affected by the average/median wage of workers in other firms but in the same coarse occupational category (4 categories: blue collars, clerks, intermediate and managers), age group (18–35, 36–45, 46–55, 56–65), and region, regardless of whether they are above or below the reference wage. They argue that while the former result is consistent with the existence of a signal effect within the firm, the latter is consistent with the existence of a status effect outside the firm.

One limitation of these prior studies relative to our study is that their identification strategies do not fully account for what Manski (2000) calls "correlated effects": unobserved workplace-level characteristics that directly affect worker satisfaction and may be correlated with

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[2] Senik (2004) and Kingdon and Knight (2007) also find that other's income has positive impact on individual well-being. Senik (2004) uses a balanced panel survey of the Russian population from 1994 to 2000, with individuals with similar characteristics (education, experience, occupation, region, sex, age) as the reference group. Kingdon and Knight (2007) use national household survey of 1993 in South Africa with average income of others in the local residential cluster as the reference group.

co-workers' wage. As suggested by Abowd, Kramarz and Margolis (1999), Bronars and Famulari (1997), Dickens and Katz (1987), and others, inter-firm wage differentials explain a large portion of variation in individuals' wages. These inter-firm wage differentials remain even after controlling for observed and time-invariant unobserved worker characteristics and peer effects. This highlights the importance of firm-level characteristics that generate these inter-firm wage differentials. It is reasonable to believe that at least some of these firm-level characteristics will also affect workers' satisfaction directly. Therefore, part of the effect that is attributed to the influence of co-workers' wages on individual satisfaction might be driven by those firm-level characteristics that are not accounted for in the research design. For example, low-income workers at higher-paying firms might report higher levels of satisfaction not because of a stronger signal effect but rather because of other unobserved firm-level characteristics such as better provision of non-pecuniary benefits, better human resource practices, or a more relaxed work environment. In fact, Clark et al. (2009) point out the potential bias this omission might introduce in their estimates: "Any rents that are paid [to workers] will consist of earnings (which we measure) and perks (which we do not). In this case, conditional on own earnings, co-workers' earnings will be correlated with the firm provision of perks [an unobserved firm-specific characteristic], which has a direct effect on job satisfaction."[3]

Another issue regarding the identification strategy used by Clark et al. (2009) is that their fixed and random effects are at the individual level since they have a longitudinal sample of workers. As a result, their models are identified by variation in average establishment earnings within an individual over time. Inevitably, some of this variation comes from workers switching employers (which would be potentially associated with large changes in average establishment earnings). This creates even more concerns regarding the bias that could be introduced by unobserved establishment-level characteristics and also limits the interpretation of their results as the estimated relationship between job satisfaction and relative earnings will be partly driven by movers. In contrast, our analysis uses establishment fixed effects and our models are identified by year-to-year variation in measured wages within the establishment. In other words, as opposed to previous studies that compare the effect of co-workers' wages on job/pay satisfaction of similar workers across different workplaces, we compare the effect of co-worker' wages on similar workers within the same workplace over time. This within-establishment strategy has its own limitations. For example, at least some of the measured within-establishment variation is likely to be measurement error, implying that our results may be subject to attenuation bias and therefore understate the magnitude of the true effect. We however mitigate these concerns by exploiting

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[3] They argue that this is not a potential concern since their results suggest that "only the satisfaction of those earning less than the measure of establishment earnings [75th percentile of earning within the firm in this case] 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)." We argue however that this is not very unlikely. It is in fact very reasonable to assume that non-pecuniary benefits provided to workers (such as pension coverage, training, dental and health coverage, or even work conditions such as shift work, irregular shifts, workplace safety, etc.) are not the same for all workers. One can imagine a scenario where there are small differences across workplaces in these non-pecuniary benefits provided to those at the top (e.g. management positions), but there are larger differences in benefits provided to those at the lower parts of the wage distribution. This will produce results that are consistent with findings of Clark et al. (2007) and also consistent with our claim that unobserved workplace heterogeneity could potentially drive these results. It is also possible that perks are targeted similarly to all workers within establishments, but high-earners don't care much about these perks. Therefore, while differences across workplaces in perks generate differences in satisfaction for those at the bottom, they do not affect the satisfaction for those at the top.

alternative identification strategies, explained in section 2, to account for unobserved heterogeneity across establishments.

Another contribution of our study is to explore the effect of co-worker wages on both job and pay satisfaction and to investigate whether co-worker wages affect these two measures differently. Clark et al. (2009) use job satisfaction as their outcome of interest, while Brown et al. (2008) use pay satisfaction as their outcome of interest. Although job and pay satisfaction are highly correlated, as the results of Capelli and Sherer (1988) suggest, reference group wages could have different effects on pay satisfaction and job satisfaction.[4] Moreover, when comparing similar specifications, while Clark et al. (2009) find that average wage within establishment has a positive and significant effect on worker's job satisfaction, Brown et al. (2008) find that average wage within establishment has a smaller and statistically insignificant effect on worker's pay satisfaction.[5] This potential differential impact bears further investigation as it could provide valuable insights into understanding the driving mechanisms behind both job satisfaction and pay satisfaction, and could help to understand whether one can reasonably use these two measures interchangeably. In addition, having measures of both job and pay satisfaction provides an alternative proxy variable strategy for accounting for unobserved firm characteristics: controlling for job satisfaction (as a proxy variable for those characteristics) when we examine the effect of co-worker wages on pay satisfaction.[6]

The richness of our data also allows us to overcome some of the other limitations of the previous studies. Brown et al. (2008) use a sample of workers with only 64% response rate, which potentially affects the representativeness of their sample and therefore limits the external validity of their results. In contrast, we use a nationally representative Canadian data with more than 80 percent employee response rate. Clark et al. (2009) use a panel survey that suffers from a significant attrition between the first and the last year of the survey (around 29 percent). This attrition undermines the validity of their results given that it is most likely non-random and potentially mainly due to not being able to follow workers who switch employer or leave the job market, which in turn is correlated with job satisfaction. Clark et al. (2009) also use annual earnings to construct their inequality measure. Although they control for the number of hours worked per week, they do not have information on the number of weeks worked per year. This can under-estimate the impact of wage inequality on job satisfaction if larger gaps in annual earnings within firms are due to fewer weeks worked per year, which could also affect job satisfaction. Our data is based on a representative sample of workers, with a new sample drawn in every odd year, and therefore does not suffer from the problem of attrition. We also have workers' hourly wage rate rather than their annual earnings.

Finally, our data enables us to test the validity of the signaling theory more directly. As the model developed by Clark et al. (2009) suggests, "the signal effect is more likely to dominate the

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[4] Capelli and Sherer (1988) use a survey of 579 randomly selected employees working for a major airline to examine the effect of outside market (i.e. average wage at other similar airline companies for equivalent jobs and seniority levels) on worker's job and work satisfaction. They find that outside market wages negatively affect worker's pay satisfaction, while they positively affect work satisfaction. They argue that this might be due to informational effect of outside market wages, revealing information about the general job quality.

[5] The effect of average wage becomes positive and significant only when measures of pay rank and pay range are also included in the regressions (Table 6a).

[6] The underlying identification assumption is that establishments where workers have similar job satisfaction levels have similar working conditions (conditional on other factors such as worker's own wage and other observed individual and establishment-level characteristics).

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status effect, so that others' earnings are positively correlated with my own well-being, as the match destruction rate is lower". Since we observe each worker twice (in two consecutive years) in our data, we are able to estimate the effect of co-workers' wages on worker's job and pay satisfaction separately for those whose match destroys/survives the year after. Assuming that individuals take their future into account, which is one of the main assumptions in the model developed by Clark et al. (2009), the positive effect of co-workers' wages on worker satisfaction should be weaker for those whose match is more likely to be destroyed in the next year. We will also examine whether the effect of relative income on worker satisfaction differs for younger versus older workers, Canadian-born versus immigrant workers, and visible minority versus "white" workers. Since the information conveyed by co-worker wage may vary across these groups, the signaling effects may also vary. Finally, since our data provides measures of the existence of pay equity policies within firms, we will exploit this information to examine whether the effect of co-workers' wages on worker satisfaction differs across employers with and without pay equity policies.

There have always been discussions in economics about the credibility and robustness of results drawn from analyses that are based on subjective reports such as job and pay satisfaction. We believe however that there are several reasons to take results from such studies seriously. First, the use of measures such as job and pay satisfaction has a very long tradition in the psychology literature.[7] In addition, the reported measures of job satisfaction are found to be strongly correlated with mental health (Faragher et al. 2005; Ramirez et al. 1996; Wall et al. 1978), length of life (Palmore 1969), coronary heart disease (Sales and House 1971), labour turn-over (Akrelof et al. 1988; Freeman 1978; McEvoy and Cascio 1985), absenteeism (Clegg 1983), productivity and job performance (Mangione and Quinn 1975), and business outcomes (Koys 2001; Patterson et al. 2004; Yee et al. 2008). Bradburn and Caplovitz (1965) also find evidence that suggests individuals' self-evaluations, although measured with error, display consistency through time. Freeman (1978) argues that "the answers to questions about how people feel toward their job are not meaningless but rather convey useful information about economic life that should not be ignored."

1.1   Choice of reference group

The choice of co-workers within the same establishment as the reference group and their average wage as the relative-pay variable is an important issue that merits some discussion, especially given the fact that a detailed and clear discussion about appropriate reference groups to study social interactions and inequality is missing in the economic literature (Manski 2000, Schaffner and Torgler 2008). This is perhaps partly due to the fact that the universe of individuals or groups within which inequality comparisons are made is broad and depends on different factors such as context, object of interest, and individual characteristics. Moreover, depending on the reference group and the referent used by the individual, the mechanisms through which inequality comparisons affect individual well-being and the individual's response to these comparisons could vary.

As Schaffner and Torgler (2008) point out, "it is possible that more than one reference group is relevant for an individual." We believe co-workers within the same establishment could be considered as one of these relevant reference groups to examine inequality comparisons and their potential impact on well-being. There are numerous laboratory experiments and field studies

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[7] Spector (1985) reports that by 1985 4,793 articles had been written on the topic of job satisfaction of employees.

from different countries and industries that find within-workplace social comparisons regarding wages, effort, and decision rights affect workers' performance (see Herbst and Mas (2015) and Charness et al. (2016) for a review). There is also evidence that suggests these peer effects are present even within a workplace with heterogeneously skilled workers and is not only limited to workers with the same level of ability (e.g. Charness et al. 2014, Bonein 2016). The existence of well-documented peer effects within the workplace highlights the importance of workplace as a social context to examine inequality comparisons. As Bonein (2016) points out, recent efforts by firms, such as Google, Facebook, and many others to introduce new physical spaces (open-plan offices, places to relax, etc.), new information technologies (within-workplace social networks, chat, email), or workshop sessions are all attempts towards favouring interactions within the workplace to foster social comparisons that are expected to enhance productivity and effort.[8] Co-workers are among the individuals with whom one regularly interacts on a daily basis. As Pleban and Tesser (1981) argue, physical proximity is one of the elements that affects individuals' tendency to engage in comparison and reflection through what they define as *closeness*.[9] They argue that without this sense of closeness, individuals are not able to engage in comparison processes. In the context of co-workers, this physical proximity creates involvement in a unit relation (Heider 1958, Pleban & Tesser 1981) and in exchanges (Homans 1961). It also reduces information costs and complexities involved (Goodman 1977) and generates psychological closeness (Pritchard 1969). These factors all foster comparison.

The degree of comparison and how it affects one's well-being is partly determined by perceived similarities in characteristics of others to one's self. These similarities increase issue-related communications and positioning (McPherson, Smith-Lovin, & Cook 2001) and induce a competitive orientation and a higher level of identification (Friedkin 1993). However, what is perceived as similarity from an individual's point of view, and its implications for signal versus status effects, are important in understanding and defining one's choice of comparison group. Similarities could be based on observed characteristics such as occupation, experience, age, skill, ability or performance (Festinger 1954, Blau 1962, Blau 1974, Clark and Oswald 1999). However, as Gastrof and Suls (1978) emphasize, "similarity has not always supported the prediction of a choice of a similar other for comparison." For example, results from different experimental studies (e.g. Wheeler at al. 1969, Gruder 1971, Gruder etl al. 1975, Suls and Tesch 1978) suggest that individuals with similar performance are not the most likely choice for comparison and subjects often express more interest in comparing themselves to dissimilar others. There is evidence that suggests this comparison with dissimilar others could take the form of upward comparison (Dakin & Arrowood 1981, Gruder 1977, Nosanchuk & Erikson 1985, Wood 1989, Micheli and Castelfranchi 2007) motivated by self-evaluation (Thornton & Arrowood 1966) or self-improvement (Major, Testa, & Bylsma 1991, Lockwood & Kunda 1997). Alternatively, people

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[8] Consistent with these practices, a body of experimental evidence suggests that enabling social comparisons among workers, which could generate additional information about efforts exerted by co-workers, could positively impact worker's exerted effort (e.g. Bonein 2014, Gächter and Thöni 2014, Gächter et al. 2013). For example, using a gift-exchange experiment, Bonein (2014) finds evidence that suggests "Regardless of their ability, workers exert levels of effort that are positively related to those of their coworkers." This strategic complementary of efforts could be explained by leading models of social preferences and inequity aversion (Fehr and Schmidt, 1999), or by social norms and desire to comply with them (López-Pérez 2008). Bonein (2014) and Gächter et al. (2013) find evidence more consistent with the former explanation.

[9] This is also one of the central concepts in social information processing model developed in psychology (see Salancik and Pfeffer 1978) where proximity to the attitudes, information and behaviour of others exposes individuals to social information which in turn affects their behaviour and beliefs.

could also engage in downward comparison (Wills 1981) for example to improve their sense of self-esteem (Aspinwall & Taylor 1993).

Therefore, these similarities/dissimilarities affect whether an individual assimilates or contrasts himself relative to advantaged/disadvantaged others, which in turn determines the function of this inequality comparison. In the context of the signal effect discussed before, through which comparison can positively affect well-being, one could argue that it is the comparison with relatively more skilled, capable, and successful co-workers that could potentially have a stronger signal effect on one's future prospects. For example, for an entry-level worker in accounting department comparison with a senior accountant in the same establishment with 10 years of experience will perhaps provide more meaningful information regarding his future prospects (i.e. signal effect). At the same time, comparison with a co-worker with similar years of experience in his own department, or even in the sales or IT department, is potentially more relevant in inducing a feeling of relative deprivation (i.e. status effect). For a professor of philosophy while comparison with a colleague in economics department might not provide much of a signal, but it could induce a feeling of envy or unfairness along the lines of the status effect. Using panel data from 26 NBA seasons, Schaffner and Torgler (2008) find that more narrowly referenced groups, such as teammates, have the strongest effect of inequality comparison while other characteristics such as geographical, age or experience similarities are less relevant.

Therefore, based on arguments presented above, we believe one's comparison with co-workers in terms of relative pay could be based on both similarities and dissimilarities in characteristics. Only focusing on co-workers with similar characteristics could potentially block some of the avenues through which comparison could affect well-being. For this reason, we choose to focus on average co-worker as the comparison group without imposing any conditions on similarities in certain characteristics between the worker and his reference group beyond being co-workers within the same establishment. We would like to emphasize again that by defining the comparison group in this manner we are not suggesting that this is the only relevant comparison group for relative-pay. As we discussed above, we are focusing on one of these comparison groups, which is one of the most relevant groups in terms of relative-pay comparisons for the reasons outlined above. This allows us to focus on the specific issue of workplace heterogeneity in estimating the effect of co-worker wage on worker satisfaction, contrasting our work to others while we keep the comparison group constant in order to be able to draw a meaningful comparison. This is not to suggest however that there are no other meaningful comparisons to be made in this context.

2. Data and methodology

The Workplace and Employee Survey (WES) is an annual longitudinal survey of approximately 6,000 Canadian employers and their employees between 1999 and 2006. The target population of employers consisted of all business locations in Canada with paid employees in March of the survey year.[10] In the 1999, 2001, 2003, and 2005 surveys, the sample of employers was refreshed with new employers from the Statistics Canada Business Register to maintain a

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[10] Employers in Yukon, Nunavut and Northwest Territories and employers operating in crop production, animal production, fishing, hunting, trapping, private households, religious organizations and public administration were excluded from the sample. Public administration, which includes establishments primarily engaged in the enactment and judicial interpretation of laws and their pursuant regulations and the administration of programs based on them, accounts for around 6.5 percent of employment in Canada (Statistics Canada, Table 281-0024).

representative cross-section of Canadian firms.[11] A maximum of twenty-four employees were sampled from each establishment in each odd year, and were followed the next year.[12] When properly weighted, the employee sample is representative of the Canadian workforce in the target population of employers; all of our analysis incorporates sample weights from Statistics Canada. Most of our analysis is based on the pooled 1999, 2001, 2003 and 2005 cross-sections. The data from even-numbered years are not used in the main analysis to avoid sample selection problems associated with employee attrition in these years. However, for part of our analysis that examines the relationship between relative wage and worker satisfaction separately for those whose match destroys/survives the year after, we exploit the longitudinal aspect of the employee data and use the even year observations for each worker to identify whether their match destroys or survives during the second year of the survey.[13]

The primary dependent variables in our study are self-reported measures of job satisfaction and pay satisfaction based on the questions "Considering all aspects of this job, how satisfied are you with the job?" and "Considering the duties and responsibilities of this job, how satisfied are you with the pay and benefits you receive?" Workers have five options for answering these questions: very satisfied, satisfied, dissatisfied, very dissatisfied, and no opinion. We restrict the sample to workers with non-missing responses to job and pay satisfaction questions (i.e. exclude workers who respond "no opinion") between the ages of 25 and 65 from establishments that have at least two sampled workers.[14] These restrictions result in a sample of roughly[15] 75,000 workers from about 7,500 establishments. Table 1 displays weighted sample means of key variables in our analysis.

In our baseline analysis, we estimate linear regression models in which the satisfaction variable is coded as 4 for "very satisfied", 3 for "satisfied", 2 for "dissatisfied" and 1 for "very dissatisfied". We also estimate ordered logit models as a robustness check (see Section 3.2.2).

The satisfaction level of worker i working in establishment j at time t is represented by the variable s_{ijt} and is modeled in our preferred specification as:

$$s_{ijt} = \gamma_1 w_{ijt} + \gamma_2 \bar{w}_{jt} + X_{ijt}\beta + c_j + d_t + \epsilon_{ijt} \tag{1}$$

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[11] The sampling unit for employers in the WES is a location (or workplace) as opposed to a firm (or enterprise). Therefore, if a firm has several locations, all those locations are in the target population from which the sample of employers are drawn.

[12] The number of workers sampled from each firm was proportional to firm's size except workplaces with fewer than four employees where all employees are selected. We should also mention that there was no employee survey (only employer survey) in 2006.

[13] The randomly selected workers in each odd year make one of four transitions between the two interviews: enter unemployment or self-employment, move to a new employer, stay with the same employer, or attrit (i.e. cannot be contacted for the second interview). We should clarify that a change of employer does not mean that the worker has attrited. Only employees whose first-year employer is not in business during the second interview year are excluded to be re-interviewed. Workers who moved to a new employer after the first interview, regardless of whether the new employer is part of the selected sample of workplaces or not, are still included to be followed and re-interviewed. As for attrition, it can happen due to several reasons that we cannot identify in our data such as refusal, unable to contact or locate, absent for duration of survey, own illness, deceased, or unusual or special circumstances.

[14] The proportion of workers who respond "no opinion" is around 0.003 in our data. Our results are robust to other ways of handling these observations.

[15] Exact sample sizes are not currently available due to Statistics Canada release restrictions, but will be included in the final version of the paper.

The key explanatory variables in this model are the worker's own log hourly wage (w_{ijt}) as well as a summary measure (or vector of summary measures) of current wages among other workers at the same workplace ($\overline{w}_{jt}$), and the parameters of interest will be their coefficients γ_1 and γ_2.[16] In the primary specification, $\overline{w}_{jt}$ will be the log average wage among co-workers. We also estimate specifications in which the effect of average co-worker wages is different for high-wage and low-wage workers, and specifications in which worker satisfaction depends on wage rank.

In addition to those key explanatory variables, our preferred model includes an establishment fixed effect (c_j), a year fixed effect (d_t), and an extensive set of individual-level control variables (X_{ijt}). These controls include detailed or coarse occupational categories (48 and 6 categories, respectively), race and immigrant status (white Canadian, visible minority Canadian, white immigrant, visible minority immigrant, Aboriginal), gender, language spoken at home (3 categories), language spoken at work (3 categories), language spoken at home different from language spoken at work, highest level of schooling (8 categories), marital status (6 categories), number of dependent children (5 categories), age (9 categories), a quadratic in years of (actual) full-time labour market experience, a quadratic in tenure with current employer, number of times promoted while working for the current employer, an indicator for full-time employment, and whether the respondent's job is covered by a collective bargaining agreement (CBA) or union.

The ideal model would include both individual fixed effects and establishment fixed effects to account for unobserved individual-level and establishment-level heterogeneity. The structure of our data however does not allow us to use individual fixed effects in our estimation.[17] The results of Clark et al. (2009) suggest however that exclusion of individual fixed effects does not introduce any bias in estimated results. In other words, they find that conditional on workers observed characteristics and own wage, there is no systematic sorting of workers across firms based on individual unobserved characteristics that are also correlated with worker job satisfaction.[18] Godechot and Senik (2015) also perform a series of tests to examine whether their results are driven by workers' self-selection into different firms. They also conclude that their "data does not validate the idea that the association between the notions of reference wage and wage satisfaction is driven by people's self-selection into certain firms or regions." We therefore focus our attention on establishment-level heterogeneity to examine whether they play any role in explaining the previous findings.

Heterogeneity across establishments is addressed using three different strategies. Our main results are derived using model (1) with establishment fixed effects. This model allows persistent unobserved differences across establishments that affect both satisfaction and wages. It has the limitation that the parameters of interest are identified from year-to-year variation of co-worker wages within establishments, so consistent estimation requires this variation to be both real (i.e., is not the result of measurement error) and exogenous. In addition, the potential that co-worker

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[16] We do not use employee-level weights provided in the WES to generate these summary measures. These weights are designed to make the overall sample of workers in the WES representative of the population of Canadian workers. There are no weights provided in the WES to make the random sample drawn from each firm representative of the population within the firm.

[17] As noted in Section 3, workers are only followed for one year and there is a new random sample of workers drawn from within each establishment in every odd year.

[18] In fact, even intuitively, it is hard to come up with a scenario that would suggest conditional on individual observed characteristics and own wage, workers might be systematically sorted across firms based on some unobserved characteristics (e.g. genes, upbringing) that are also correlated with job satisfaction.

wages serve as a proxy for unobserved perks is still an issue to the extent that there is year-to-year variation in perks that is correlated with the year-to-year variation in wages. Finally, the fact that establishment wages are estimated from a random sample of workers within each establishment implies that there is some degree of classical measurement error, so the social effect estimates are subject to attenuation bias and will underestimate the true effect.

Another relevant consideration is the potential for heterogeneity in response that is implicitly assumed away when using a single parameter to describe the social effect. Presumably annual variations in wage growth within the firm would be driven mostly by trends in the firm's business conditions. Both theories (signal effect and status effect) apply to this source of variation, but since both theories rely on the social context of the comparison, their absolute and relative strength may be different when responding to changes (my co-workers have higher wages than they did last year) versus responding to levels (my co-workers have high wages). This may provide an explanation for different findings when using establishment fixed effects versus when using establishment characteristics without implying that either findings are incorrect.

Our second strategy for addressing workplace heterogeneity is to take advantage of the WES to estimate regressions without establishment effects but with a rich set of establishment characteristics included in the vector of control variables:

$$s_{ijt} = \gamma_1 w_{ijt} + \gamma_2 \bar{w}_{jt} + X_{ijt}\beta + W_{jt}\lambda + d_t + \epsilon_{ijt} \tag{2}$$

The establishment-level characteristics in W_{jt} include industry (14 categories), establishment size (4 categories), degree of competition (4 categories), an indicator for the existence of a pay or employment equity policy in the firm, an indicator for non-profit firms, average quit rate, proportion of full-time employees, an indicator for good/fair rating of labour-management relations, a standardized z-score measure for provision of non-wage benefits (e.g. dental care, life insurance, supplemental medical, pension plan, group RRSP, stock purchase, etc), logarithm of training expenditures per worker, an indicator for existence of any incentive schemes in the compensation system (group incentive systems such as productivity/quality grain sharing, individual incentive systems such as bonus, piece-rate and commissions, merit pay and skill-based pay, profit sharing), and an indicator for existence of any innovative work practices (employee suggestion programs, flexible job design, information sharing with employees, problem-solving teams, joint labour-management committees, self-directed work groups).

Our third strategy is to control for average satisfaction $\bar{s}_{jt}$ among co-workers:

$$s_{ijt} = \gamma_1 w_{ijt} + \gamma_2 \bar{w}_{jt} + \gamma_3 \bar{s}_{jt} + X_{ijt}\beta + d_t + \epsilon_{ijt} \tag{3}$$

When $\bar{s}_{jt}$ is included in the model we are interpreting it in part as a proxy for the overall working environment at the establishment, and so we do not give a causal interpretation to its coefficient γ_3. The idea behind this strategy is that co-worker satisfaction can act as a proxy variable for otherwise unobservable features of the working environment that are relevant to the worker's own satisfaction.[19] One advantage of using co-worker job satisfaction is that it may capture time-varying establishment-level unobserved factors that might affect worker job/pay satisfaction and

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[19] By controlling for average co-worker job satisfaction we are comparing worker job/pay satisfaction across firms where co-worker job satisfaction is similar, but co-worker pay is different. In other words, we are assuming that firms where workers have similar job satisfaction levels have similar working conditions, conditional on wages and other observed characteristics.

may be correlated with the year-to-year variation in coworker wages. Moreover, this identification strategy is affected less by attenuation bias than models with establishment fixed effects.

3. Results

3.1 Main regression results

Table 2 displays results from estimating linear models for both job and pay satisfaction as described in Section 2 above. Column (1) uses a simplified model with no additional control variables other than year effects, while column (2) adds personal and job characteristics, and columns (3) and (4) add occupation in coarse and detailed categories respectively. These four regressions are included mostly for informational purposes as they do not account for heterogeneity across employers. Columns (5) through (7) show our three approaches to accounting for workplace heterogeneity as described in Section 2. Column (5) uses detailed establishment-level control variables, column (6) controls for average co-worker job satisfaction, and column (7) uses establishment fixed effects. As discussed in Section 2, column (7) is our preferred specification.

As one might expect, the worker's own pay has a positive and significant effect on both job and pay satisfaction in all specifications. The effect of own pay on pay satisfaction is about twice as large as its effect on job satisfaction. This suggests, not surprisingly, that reported job satisfaction contains more information about a job other than the amount of pay received. Co-worker pay also has a positive and significant relationship with both pay satisfaction and job satisfactions in models that do not account for workplace heterogeneity (columns 1 to 4). However, the effect of co-worker wage on pay satisfaction is more than twice as large as its effect on job satisfaction. Our estimated effect on pay satisfaction is similar to or somewhat larger than that found by Brown et al. (2008, Table 5) or Godechot and Senik (2015),[20] but our estimated effect on job satisfaction is generally smaller than that found by Clark et al. (2009, Table 2 column 3).[21]

Column (5) shows that accounting for workplace heterogeneity by detailed establishment-level control variables does not reduce the estimated effect of co-worker wage, and in fact slightly increases it. However, column (7) shows that our preferred strategy of using establishment fixed effects does substantially reduce the estimated effect of co-worker wage. The effect of co-worker pay on job satisfaction disappears (it becomes quantitatively small and statistically insignificant), while the effect on pay satisfaction reduces by 35-45 percent but remains at least marginally significant. Similar results are seen in column (6) when workplace heterogeneity is addressed by controlling for co-worker job satisfaction. This suggests that smaller estimated effect of co-worker average pay in the model with establishment fixed effects is unlikely to be driven entirely by attenuation bias due to measurement error we discussed before. In addition, comparing the estimated effect of co-worker pay in columns (6) and (7) with column (5) also seems to suggest that even the very detailed set of observed establishment-level characteristics available in the WES

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[20] The coefficient on co-worker average wage in our pay satisfaction regression is 0.074, and the dependent variable is coded on a scale of 1 to 4 with a standard deviation of 0.73. The coefficient in Brown et al. (2008, Table 5) is 0.077 and their dependent variable is coded on a scale from 1 to 5 with a standard deviation of 1.10. The coefficient in Godechot and Senik (2015, Table 1) is 0.046, and their dependent variable is coded on a scale of 1 to 4 with a standard deviation of 0.72.

[21] The coefficient on co-worker average wage in our job satisfaction regression is 0.031, and the dependent variable is coded on a scale of 1 to 4 with a standard deviation of 0.66. The coefficient in Clark et al. (2009, Table 2 column 3) is 0.08, and their dependent variable is coded on a scale of 1 to 6 with a standard deviation of 0.95.

do not do enough in accounting for workplace heterogeneity, which seems to be driven by unobserved establishment-level characteristics.

The novelty of our results is two-fold. First, our results suggest that it is important to control for workplace heterogeneity that might be correlated with co-worker pay and also affect worker satisfaction. Failure to account for workplace heterogeneity seems to over-estimate the true effect of co-worker pay on worker satisfaction. It would be interesting to know more about the establishment characteristics that are associated with higher average wages and higher levels of employee satisfaction. Using the same data as our study, Javdani (2015) finds that "Firms that pay higher premiums to their employees (after accounting for inter-firm differences in workforce composition) are on average larger, more likely to have a pay equity program, face more competition, are more likely to provide non-wage benefits, have lower quit rates, have higher training expenditures, have higher productivity, are more likely to have incentive compensation schemes."

Second, co-worker pay seems to have different effects on worker job and pay satisfaction. An increase in average co-worker wage does not have any effect on worker job satisfaction, while its effect on pay satisfaction is positive and statistically significant. The point estimate implies that a 10% increase in average co-worker wage raises worker pay satisfaction by 0.0046 points. This effect is quite small: 0.63% of a standard deviation or 14% of the effect of a 10% increase in own wage. While job and pay satisfaction are highly correlated, our results suggest they are determined and affected by sometimes different factors. That is, workers in the WES evaluate their pay satisfaction in relation to the pay of others in their workplace, but their job satisfaction is not affected by this comparison. In addition, since the effect is positive (implying a signaling effect), these results also suggest that pay satisfaction is forward looking to some extent. That is, it reflects satisfaction with the trajectory of pay rather than just the current level.

Given this difference in results between pay satisfaction and job satisfaction, we might wonder what other characteristics of the job and workplace have different relationships with pay and job satisfaction. This question can be partially answered by looking at the other regression coefficients (available in our online appendix, table A1) in specification (5), which uses establishment characteristics rather than establishment fixed effects. In those regressions, we find the biggest difference is for unionization (which has a strong negative association with job satisfaction but a strong positive association with pay satisfaction). The negative association between unionization and job satisfaction is a common and extensively-debated finding in the literature. Other substantial differences appear for past history of promotions (which has a strong positive association with job satisfaction but a much weaker association with pay satisfaction), and industry (lowest pay satisfaction is found in Real Estate, Rental and Leasing Operations followed by Finance and Insurance, while lowest job satisfaction is found in Labour Intensive Primary Manufacturing followed by Secondary Product Manufacturing). Other characteristics such as firm size, establishment quit rate, the use of innovative work practices, and quality of labour relations have a similar association with both forms of satisfaction.

3.2   Robustness checks

3.2.1   Alternative reference groups

As discussed in Section 1.1, co-workers are a natural reference group to think about when considering pay comparisons, they are not the only reference group whose pay may influence worker satisfaction. Empirically there are two related questions to answer: what other reference

groups matter and how do they matter, and is there any reason to believe that co-worker pay is acting as a proxy for the pay of some more important and substantially different reference group. To investigate this question, we constructed two alternative reference groups and estimated our model with these reference groups in place of or in addition to co-workers.

The first alternative reference group is co-workers who are in the same (broad) occupation. One concern with using all co-workers as the reference group is that includes workers on very different career paths or at very different levels within those paths. Narrowing the reference group to include only those in the same occupation partially addresses this issue. Column (2) of Table 3 reports the results from using same-occupation co-workers as the reference group instead of all co-workers. As the results show, the coefficients are very similar in magnitude to our main results (reported in column 1). Although data limitations make it difficult to further narrow the within-firm comparison group, these results suggest that further narrowing would not change our main results.

The second alternative reference group is all workers in the same (detailed) occupation and industry. This reference group allows for the likelihood that workers make comparisons to the pay received by similar workers at other firms, and that these comparisons influence worker satisfaction. Because this comparison group is not a subset of co-workers (unlike our same-occupation co-workers comparison group), we estimate models in which this comparison group is included in addition to co-workers as well as those in which it is included in place of co-workers. The results for the specification that includes both comparison groups are reported in column (3) of Table 3. The coefficients on co-worker average wage do not change substantially, suggesting that co-worker wages are not acting as a proxy for wages of similar workers outside of the firm. The coefficients on same-occupation-and-industry average wages show an interesting pattern: a sizeable and statistically significant positive effect on job satisfaction, but a smaller and statistically insignificant positive effect on pay satisfaction. Note that this is the opposite of our findings for co-worker pay. Column (4) shows results for a specification that does not include co-worker average wage; these results are similar to those reported in column (3). Taken together, these results suggest that workers make comparisons both within and outside of the firm, that these comparisons affect satisfaction in different ways, and that it is reasonable to analyze these effects separately.[22]

3.2.2 Alternative measures of co-worker wages

Although our basic model assumes that workers care specifically about the average wage of their co-workers, the literature has considered other potentially relevant features of the co-worker wages. Table 4 reports results using alternative characterizations of coworker relative pay.

Column (1) in the table repeats our main results (i.e., column 7 of Table 2) for ease of comparison. The results in column (2) are based on an alternative behavioral assumption in which a worker cares about his or her rank within the workplace's pay distribution, as in Brown et al. (2008). This pay rank variable is constructed using the workplace's full earnings distribution rather than just the random sample of surveyed employees, so this variable may be less subject to

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[22] We also examine whether co-workers in different age categories have different effects on worker satisfaction, and whether this effect depends on worker's own age category. Results from these models are reported in our online appendix (table A2) and are similar to our main results (i.e., column 7 of Table 2). More specifically, we find that co-workers in different age categories have similar impacts on worker satisfaction, regardless of worker's own age category.

measurement error and attenuation bias. In the WES, workplaces are asked to report the number of permanent full-time and part-time employees in each of the following annual earnings categories: $80k and above, $60k-80k, $40k-60k, $20k-40k, $20k and below. We use this information along with the total number of employees within the establishment to calculate the proportion of workers that are in a higher earnings category.[23] The results in column (2) are qualitatively similar to those in column (1): pay rank does not appear to affect job satisfaction, but has a positive and significant association with pay satisfaction. To put the coefficient into context, a 10-percentile downward move within the firm's pay distribution (keeping one's own pay fixed) would imply a 0.006 or 0.82% of a standard deviation increase in pay satisfaction. Column (3) reports results for a specification that includes both average pay and pay rank, and yields very similar results to those in columns (1) and (2).[24]

The results in column (4) allow an asymmetric effect of co-worker average wage depending on whether the worker's own wage is higher or lower than the average, as is considered by Clark et al. (2009). The results for job satisfaction are similar to our baseline results and suggest that co-worker wages have little effect on either those with above average or below average wages. In contrast, the results for pay satisfaction support the hypothesis of an asymmetric impact. For those workers who make less than the average co-worker pay, increase in average co-worker pay (i.e. increase in the difference between own pay and average co-worker pay) has a positive and significant impact on pay satisfaction that is somewhat larger to what we find in column (1) where we impose symmetry on the effect. However, for those workers who make more than the average co-worker pay, an increase in average co-worker pay (i.e. decrease in the difference between own pay and average co-worker pay) has no impact on pay satisfaction.

Finally, we also examine whether a measure that reflects wages in the upper-part of the workplace wage distribution differently affects worker satisfaction. For example, the signal effect might be stronger if workers at lower job levels look up to co-workers at high levels of hierarchy as a signal of their future prospects within the firm. Our findings are reported in columns (3) and (4) in Table A3 in our online appendix. They suggest that using the 75th percentile of wage distribution within firm produces similar results to average wage, whether included on its own or along with controlling for median co-worker pay.[25]

3.2.3   Ordered logit model

In addition to the linear models estimated for Table 2, we estimated analogous ordered logit models as a robustness check. The detailed ordered logit results are not reported here, but are generally consistent with the findings for the linear model reported in Table 2.

Using the ordered logit model for the analysis is somewhat complicated by the use of sample weights in the WES. Statistics Canada does not allow the release of unweighted results from the restricted-access WES data. However, the standard estimation procedures (e.g.,

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[23] For those workers who earn more than $80,000, since there is no higher earnings category identified by the survey question, we cannot directly calculate the proportion of workers in higher earnings categories. Therefore, for those workers who fall in this category we set the proportion of workers in higher earnings categories to zero.

[24] As another alternative measure, we also use median co-worker wage. These results are reported in our online appendix, Table A3 (column 2) and are qualitatively similar to our results using average co-worker pay. The estimated coefficients are however quantitatively larger when we use median wage.

[25] The one exception is the regression for pay satisfaction, without controlling for median and with firm characteristics rather than firm fixed effects. In that case, the coefficient on 75th percentile is positive and significant. These results are not reported here, but are available upon request.

Baetschmann et al. 2015) for conditional (fixed effect) logit models do not accommodate individual-level weights because they involve conditioning on group-level counts. We address this in several ways. First, we compared the weighted and unweighted results for linear models. Based on this comparison we do not believe the weights have a quantitatively important effect on the results. Second, we estimated ordered logit models with weights and firm level control variables rather than fixed effects. These results can be released, and are qualitatively similar to those for weighted linear models with firm level control variables. Finally, we estimated conditional (fixed effect) ordered logit models without weights and found that these were qualitatively similar to those for unweighted linear models with fixed effects.

3.3   Heterogeneity

Tables 5a through 5c consider various forms of heterogeneity in the effect of co-worker pay on worker satisfaction. Workers may vary substantially in the relative importance of the signal effect and the status effect, and so may vary substantially in the magnitude and even direction of the overall social effect. For comparison purposes, column (1) in Table 5a reproduces the results from our preferred specification with establishment fixed effects and detailed worker and job characteristics, i.e., column (7) in Table 2.

Columns (2) and (3) divide the sample by worker age. Since the signal effect operates through co-worker pay being a signal of future pay for the worker, it is presumably stronger in younger workers who have more potential for future pay growth and more uncertainty about its likely magnitude. Consistent with our previous results, we find that co-worker pay does not affect job satisfaction for either young workers or old workers. However, in line with the aforementioned hypothesis, our results suggest that while co-worker pay does not have a significant effect on pay satisfaction for older workers, it has a positive and significant effect on younger worker's pay satisfaction. This contrast is only suggestive, as the difference between older and younger workers is not statistically significant even at 10%.

Columns (4) and (5) in Table 5a divide the sample by whether or not the firm has a pay equity policy. Firms with effective pay equity policies are more likely to raise the wage of workers that are low-paid relative to comparable workers in the firm, implying a stronger signal effect. Consistent with this hypothesis, we find that co-worker pay has a larger effect on pay satisfaction in firms with pay equity relative to those without pay equity. However, both estimates are statistically insignificant due to the increased standard errors, as is the difference between the estimates. Columns (6) and (7) in Table 5b divide the sample by unionization (i.e., whether the job is covered by a collective bargaining agreement). Here we see little difference between those in unionized and non-unionized jobs.

Columns (8), (9) and (10) in Table 5b take advantage of the longitudinal structure of the WES, and divide the sample into three groups: workers who show up in year t of the survey but not t+1 (i.e. attriters), workers whose match is destroyed in t+1, and workers who are still with same employer in t+1. Subsequent employment changes are clearly endogenous and so these empirical relationships cannot be given a strict causal interpretation. However, they are potentially informative as to which groups are driving our main results. As the table shows, co-worker pay has no statistically significant relationship with the job satisfaction of workers who stay with their firm during the second year, but has a large positive and significant relationship with the job satisfaction of workers whose match is destroyed. We also find that while co-worker pay has a positive and significant impact on pay satisfaction of both of these groups, the effect is almost

twice as large for those whose match is destroyed in the second year.[26] These results are in contrast with the predictions of the model developed by Clark et al. (2009) which suggests "the signal effect is more likely to dominate the status effect, so that others' earnings are positively correlated with my own well-being, as the match destruction rate is lower". Therefore, assuming that individuals take their future into account, which is one of the main assumptions in the model developed by Clark et al. (2009), the positive effect of co-workers' wages on worker satisfaction should be weaker for those whose match destroys the year after. One potential explanation of our results is that some workers might be more ambitious and motivated to advance in their career, and therefore are more positively and strongly affected by the relative income of their reference group (a stronger signal effect). These workers might have a wider reference group (i.e. similar workers in higher-paying firms) and use inter-firm mobility when possible as a channel to improve their future prospects, and therefore are more likely to leave their employer.[27] Consistent with this hypothesis, our results suggest that these workers experience a larger wage growth between the two interview years (around 4 percent) compared to those who stay with their firm.

We also examine whether there exists any heterogeneity in the effect of own wage and co-worker wage on worker satisfaction by gender. There is evidence that suggests men and women might be affected differently in environments that involve status or signal effects (e.g. Clark 1997, Niedrele and Vesterlund 2007). These results are reported in the last three columns of Table 5b. We find no evidence of heterogeneity by gender in the job satisfaction regressions. There exists, however, some heterogeneity in our regressions of pay satisfaction. More specifically, we find that own pay has a stronger positive impact on women compared to men (0.4 versus 0.27), a difference that is statistically significant. On the other hand, women's pay satisfaction seem to be less influenced by the co-worker pay relative to their male counterparts (0.03 versus 0.06), a difference that is not statistically significant.

These two findings are consistent with Clark (1997) who suggests there might exist real gender differences in utility from working in that women on average expect less from working and are therefore more satisfied with any given job. This in turn suggests that women will be on average more satisfied with a given pay relative to their male counterparts. In addition, given their lower expectations, they might pay less attention to co-worker pay as a signal effect, and therefore this comparison would affect them to a lesser extent. Smaller positive effect of co-worker pay among women is also consistent with evidence that suggests women are more likely to shy away from competitive environments (e.g. Gneezy, Niederle, and Rustichini 2003, Gneezy and Rustichini 2004, Niedrele and Vesterlund 2007 & 2010).

Table 5c displays results from estimating our preferred specification allowing for the main coefficients to differ by immigration and visible minority status.[28,29] Both social comparisons and

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[26] WES allows us to identify whether the match was destroyed by the firm or the worker. We also estimated models where we only focused on workers whose match was destroyed because they left the firm, and we find similar results to those reported in column (7).

[27] Having a wider reference group does not necessarily imply that the signal effect will be weaker. It could be a signal of how ambitious the worker is, and the fact that not only she cares about the wages of coworkers within the same establishment, but she also has her eyes on opportunities outside the firm as well.

[28] The results in Table 4b can be interpreted as allowing all coefficients other than establishment fixed effects to vary across the four groups. Given that we don't observe a very large number of workers with establishments, allowing establishment effects to vary by these four categories will result in very imprecisely estimated establishment effects.

[29] "Visible minority" is a standard classification in Canada. "Visible minority refers to whether a person belongs to a visible minority group as defined by the Employment Equity Act and, if so, the visible minority group to which the

predictions of future wages are potentially different across these groups. For example, a gap between current own wage and co-worker wage may be a signal of future wage growth for white Canadian-born workers and a signal of ongoing discrimination for visible minority or immigrant workers. We find that while co-worker pay has no impact on job satisfaction of white Canadian-born workers, it has a negative impact on job satisfaction of other groups, although none of the estimates are statistically significant. We also find that while co-worker pay has a positive and significant impact on pay satisfaction of white Canadian-borns, it has a significantly large and negative impact on pay satisfaction of visible minority Canadian-borns. We also find that the effect on white immigrants is positive, while it is negative for visible minority immigrants, although both estimated effects are small and statistically insignificant. One potential explanation for these results is that apart from white Canadian-borns, other groups might believe that the average wages of their co-workers is not a good indicator of their prospects in the future. This could be due to the fact that they have fewer opportunities to receive promotions and climb up the ladder. Using the same data set, Javdani (2017) and Javdani and McGee (2017) find that both visible minority Canadian-borns and visible minority immigrants are less likely to have been promoted and are promoted fewer times, compared to white Canadian-borns. Javdani (2017) also finds that visible minority Canadian-borns receive lower returns to promotion. The different effects on Canadian-born versus immigrant visible minorities could be due to the fact that while for both groups average co-worker pay is not a good signal of their future prospects (i.e. a weak signal effect), for the latter group this might not have a strong negative externality (i.e. status effect) since they might also compare their pay with similar workers back in their country of origin and be content with their pay in Canada. Visible minority Canadian-borns however do not make this comparison (since Canada is their country of origin) and therefore higher average co-worker pay might be a signal of discrimination and therefore impose substantial negative externality on them through the status effect.

4. Conclusion

We examine whether co-worker pay has any impact on worker's job and pay satisfaction. We also examine whether unobserved firm-level characteristics that might be correlated with co-workers' pay and also affect worker satisfaction will influence these results. Consistent with Clark et al. (2009) and Brown et al. (2008) we find that average co-worker pay has a positive impact on worker's job/pay satisfaction. However, contrary to previous studies we also estimate models that account for unobserved firm-level characteristics that might bias these results. Our results suggest that after taking into account the unobserved firm-level heterogeneity, the effect of co-worker pay on job satisfaction disappears, and the effect on pay satisfaction reduces by 35 to 45 percent. The implications of these results are two-fold. First, our results suggest that it is important to control for inter-firm heterogeneity that might be correlated with co-worker pay and also affect worker satisfaction. Failure to account for inter-firm heterogeneity seems to over-estimate the true effect of co-worker pay on worker satisfaction. Second, co-worker pay seems to have different effects on worker job and pay satisfaction. While job and pay satisfaction are highly correlated, our results suggest they are determined and affected by sometimes different factors. That is, workers in the

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person belongs. The Employment Equity Act defines visible minorities as "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour". The visible minority population consists mainly of the following groups: Chinese, South Asian, Black, Arab, West Asian, Filipino, Southeast Asian, Latin American, Japanese and Korean." (Statistics Canada, 2015). We define our indicator of visible minority status likewise.

WES evaluate their pay satisfaction in relation to wages of others in their workplace, but their job satisfaction is not affected by this comparison.

We also find evidence of asymmetry in the effect of co-worker pay on pay satisfaction. We find that while the effect is positive for those who make less than their average co-worker pay, it is small and statistically insignificant for those who earn higher than the average co-worker pay. Our results also suggest that there exists significant heterogeneity in the effect of co-worker pay on pay satisfaction. We find that the effect is positive and large for younger workers, while it is small and statistically insignificant for older workers. We also find that the effect is larger in firms that have a pay equity policy. Our results also suggest that the effect is larger among workers whose match destroys during the next year, relative to those whose match survives. Finally, we find that while the effect on pay satisfaction is positive and significant for white Canadian-born workers, it is very large and negative for visible-minority Canadian-borns, and small and statistically insignificant for white and visible minority immigrants.

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Tables

Table 1: Summary statistics, WES data

Variable	Average or %	Variable	Average or %
Number of (worker) observations	~75,000	Years of full time work experience (average)	18.38
Hourly wage (average)	$21.33	**Job Characteristics:**	
(standard deviation)	(12.9)	% full time	71.6
Job satisfaction (average score)	3.24	% member of union or covered by CBA	29.3
(standard deviation)	(0.66)	Tenure with current employer (average), years	9.3
% very satisfied (4)	34.7	Times promoted at current employer (average)	0.83
% satisfied (3)	56.5	Language most often spoken at work	
% dissatisfied (2)	7.0	% French	21.9
% very dissatisfied (1)	1.9	% English*	76.6
Pay satisfaction (average score)	2.92	% Other	1.5
(standard deviation)	(0.73)	% Home and work language not the same	2.7
% very satisfied (4)	19.2	**Occupations** (coarse categories)	
% satisfied (3)	57.7	% Manager	13.5
% dissatisfied (2)	19.3	% Professional	18.8
% very dissatisfied (1)	3.8	% Technical/trades	41.2
Personal characteristics:		% Marketing/sales	6.1
% White Canadian-born*	77.2	% Clerical/administrative	14.5
% Visible minority Canadian-born	1.6	% Production worker*	5.9
% White immigrant	10.8	**Firm characteristics**	
% Visible minority immigrant	8.7	Number of firms	~7,500
% Aboriginal	1.7	Industry	
% Male	48.2	% Resource	1.6
Age (average)	42.1	% Labor intensive tertiary manufacturing	4.9
% age 25-29*	11.3	% Secondary product manufacturing	3.8
% age 30-34	13.8	% Capital intensive tertiary manufacturing	5.4
% age 35-39	16.4	% Construction	4.2
% age 40-44	17.6	% Transportation, warehousing, wholesale	10.6
% age 45-49	16.1	% Communication and other utilities	1.9
% age 50-54	12.8	% Retail trade and consumer services	18.6
% age 55-59	8.5	% Finance and insurance	5.1
% age 60-65	3.5	% Real estate, rental and leasing operations	1.6
Highest educational attainment		% Business services	10.6
% Ph.D., Master's, or M.D	4.8	% Education and health services	24.5
% Other graduate degree	2.3	% Information and cultural industries	3.5
% Bachelor's degree	14.4	% Primary product manufacturing*	3.7
% Some university	8.2	% with pay equity policy	25.8
% Completed college	21.2	% with employment equity policy	23.7
% Some college or trade certificate	22.9	% non-profit	23.1
% High school diploma	16.4	Average quit rate, %	8.4
% Less than high school*	9.8	% full time employees	73.7
Marital status		% with incentive schemes	56.6
% Married	60.5	% with innovative work practices	59.9
% Common law	13.8	% with good/fair labour relations	73.9
% Separated	2.9	Log training expenditures per worker	3.72
% Divorced	5.8	Firm size (4 categories)	
% Widowed	1.0	% [less than 20 workers]*	25.5
% Single*	16.0	% [between 20 and 99 workers]	32.2
Language most often spoken at home		% [between 100 and 499 workers]	22.4
% French	22.4	% [more than 500 workers]	19.9

% English*	69.0	Degree of competition (4 categories)	
% Other	8.6	% [zero]	31.1
Number of dependent children		% [1 to 5 firms]	25.5
% Zero*	48.5	% [6 to 20 firms]	23.8
% One	18.1	% [more than 20 firms]*	19.6
% Two	24.2		
% Three	7.3		
% Four or more	1.9		

Notes: * indicates the reference category for regressions. All means are computed using sample weights provided in the data. Statistics Canada does not permit reporting these means without using the weights. Firm-level variables are averaged over workers and not over firms (e.g. "% non-profit" is the % of workers that are working in non-profit firms, not the % of firms that are non-profit).

Table 2: Effect of own and coworker wages on worker satisfaction, WES data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable: job satisfaction							
Ln(Own wage)	0.199***	0.200***	0.181***	0.184***	0.194***	0.184***	0.168***
	(0.012)	(0.014)	(0.016)	(0.016)	(0.016)	(0.017)	(0.018)
Ln(Average coworker wage)	-0.003	0.025	0.031*	0.029*	0.037**	0.012	-0.013
	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.016)	(0.024)
Average coworker job satisfaction						0.131***	
						(0.015)	
R^{2-} (total)	0.022	0.046	0.049	0.057	0.062	0.064	0.123
R^{2-} (within)							0.037
Dependent variable: pay satisfaction							
Ln(Own wage)	0.293***	0.335***	0.356***	0.368***	0.373***	0.368***	0.329***
	(0.014)	(0.017)	(0.019)	(0.020)	(0.020)	(0.020)	(0.021)
Ln(Average coworker wage)	0.025	0.060***	0.074***	0.070***	0.084***	0.040**	0.046*
	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)	(0.026)
Average coworker job satisfaction						0.143***	
						(0.015)	
R^{2-} (total)	0.044	0.062	0.067	0.075	0.082	0.083	0.163
R^{2-} (within)							0.043
Controlling for:							
Personal and job characteristics	No	Yes	Yes	Yes	Yes	Yes	Yes
Coarse occupations	No	No	Yes	No	No	No	No
Detailed occupations	No	No	No	Yes	Yes	Yes	Yes
Observed firm-level characteristics	No	No	No	No	Yes	No	No
Establishment fixed effects	No	No	No	No	No	No	Yes
Number of observations	~75,000	~75,000	~75,000	~75,000	~75,000	~75,000	~75,000

Notes: All regression coefficients are estimated using sample weights provided in the data. All specifications include year fixed effects. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.

Table 3: Alternative reference groups

	Co-workers, column (7) from Table 2	Co-workers in same occupation	All workers in same occupation and industry	
	(1)	(2)	(3)	(4)
Dependent variable: job satisfaction				
Ln(Own wage)	0.168***	0.174***	0.167***	0.168***
	(0.018)	(0.020)	(0.018)	(0.018)
Ln(Average coworker wage)	-0.013		-0.013	
	(0.024)		(0.024)	
Ln(Average wage of coworkers in same coarse occupational category)		0.004		
		(0.022)		
Ln(Avg wage of workers in same detailed occupational category and industry)			0.088*	0.087*
			(0.051)	(0.051)
Dependent variable: pay satisfaction				
Ln(Own wage)	0.329***	0.332***	0.328***	0.322***
	(0.021)	(0.024)	(0.021)	(0.021)
Ln(Average coworker wage)	0.046*		0.048*	
	(0.026)		(0.025)	
Ln(Average wage of coworkers in same coarse occupational category)		0.049**		
		(0.023)		
Ln(Avg wage of workers in same detailed occupational category and industry)			0.030	0.032
			(0.050)	(0.050)
Number of observations	~75,000	~75,000	~75,000	~75,000

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and establishment and year fixed effects as in specification (7) of Table 2. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.

Table 4: Alternative measures of coworker wages, WES data

	(1)	(2)	(3)	(4)
Dependent variable: job satisfaction				
Ln(Own wage)	0.168***	0.163***	0.162***	0.152***
	(0.018)	(0.019)	(0.019)	(0.030)
Ln(Average coworker wage)	-0.013		-0.012	
	(0.024)		(0.024)	
proportion of coworkers in higher earnings categories		-0.022	-0.023	
		(0.023)	(0.024)	
(Ln(ACW)– Ln(OW)) * I(OW <= ACW)				-0.002
				(0.031)
(Ln(ACW)– Ln(OW)) * I(OW > ACW)				-0.029
				(0.032)
Dependent variable: pay satisfaction				
Ln(Own wage)	0.414***	0.346***	0.352***	0.369***
	(0.020)	(0.024)	(0.024)	(0.033)
Ln(Average coworker wage)	0.046*		0.047*	
	(0.026)		(0.026)	
proportion of coworkers in higher earnings categories		0.061***	0.061**	
		(0.026)	(0.027)	
(Ln(ACW)– Ln(OW)) * I(OW <= ACW)				0.069***
				(0.033)
(Ln(ACW)–Ln(OW)) * I(OW > ACW)				0.015
				(0.037)
Number of observations	~75,000	~75,000		~75,000

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and establishment and year fixed effects as in specification (7) of Table 2. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.

Table 5a: Heterogeneity in effect of own and coworker wages on worker satisfaction, WES data

	Preferred specification, column (7) from Table 2 (1)	Workers younger than 45 (2)	Workers older than 45 (3)	Difference (2)-(3)	Firms with pay equity (4)	Firms without pay equity (5)	Difference (4)-(5)
Dependent variable: job satisfaction							
Ln(Own wage)	0.168***	0.169***	0.180***	-0.011	0.135***	0.177***	-0.042
	(0.018)	(0.024)	(0.022)	(0.031)	(0.033)	(0.019)	(0.036)
Ln(Average coworker wage)	0.013	0.001	-0.031	0.032	0.001	0.018	-0.017
	(0.024)	(0.027)	(0.029)	(0.030)	(0.047)	(0.024)	(0.043)
Dependent variable: pay satisfaction							
Ln(Own wage)	0.329***	0.324***	0.345***	-0.021	0.322***	0.330***	-0.008
	(0.021)	(0.026)	(0.027)	(0.033)	(0.039)	(0.023)	(0.039)
Ln(Average coworker wage)	0.046*	0.066**	0.015	0.051	0.073	0.041	0.032
	(0.026)	(0.029)	(0.032)	(0.032)	(0.047)	(0.026)	(0.045)
Number of observations	~75,000	~75,000			~75,000		

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and establishment and year fixed effects as in specification (7) of Table 2. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.

Table 5b: Heterogeneity in effect of own and coworker wages on worker satisfaction, WES data

	Union	Non-Union	Difference	Attriters (Workers that show up in year t but not t+1)	Workers with a destroyed match in t+1	Workers whose match survived in year t+1	P-value (all equal)	Male workers	Female workers	P-Value (11) = (12)
	(6)	**(7)**	**(6)-(7)**	**(8)**	**(9)**	**(10)**	**(8)=(9)=(10)**	**(11)**	**(12)**	**(11)-(12)**
Dependent variable: job satisfaction										
Ln(Own wage)	0.162***	0.173***	-0.011	0.104***	0.112***	0.192***	0.115	0.158***	0.178***	0.414
	(0.032)	(0.020)	(0.037)	(0.040)	(0.063)	(0.025)		(0.021)	(0.022)	
Ln(Average coworker wage)	-0.033	-0.013	-0.020	-0.083*	0.105*	-0.039	0.032**	0.00628	-0.0336	0.219
	(0.052)	(0.024)	(0.050)	(0.048)	(0.060)	(0.032)		(0.029)	(0.028)	
Dependent variable: pay satisfaction										
Ln(Own wage)	0.362***	0.319***	0.043	0.218***	0.344***	0.372***	0.014**	0.274***	0.394***	0.000***
	(0.039)	(0.024)	(0.044)	(0.046)	(0.068)	(0.029)		(0.024)	(0.027)	
Ln(Average coworker wage)	0.044	0.044	0.000	-0.001	0.130*	0.075**	0.214	0.062**	0.029	0.357
	(0.047)	(0.027)	(0.043)	(0.051)	(0.069)	(0.034)		(0.028)	(0.033)	
Number of observations	~75,000			~50,000				~75,000		

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and establishment and year fixed effects as in specification (7) of Table 2. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.

Table 5c: Heterogeneity in effect of own and coworker wages on worker satisfaction, WES data

	Canadian-born, white (11)	Canadian-born, visible minority (12)	Immigrant, white (13)	Immigrant, visible minority (14)	P-value (all equal) (11)=(12)=(13)=(14)
Dependent variable: job satisfaction					
Ln(Own wage)	0.152***	0.229**	0.189***	0.224***	0.476
	(0.020)	(0.098)	(0.044)	(0.055)	
Ln(Average coworker wage)	0.003	-0.137	-0.072	-0.063	0.162
	(0.023)	(0.097)	(0.049)	(0.050)	
Dependent variable: pay satisfaction					
Ln(Own wage)	0.337***	0.508***	0.260***	0.279***	0.084*
	(0.023)	(0.100)	(0.044)	(0.071)	
Ln(Average coworker wage)	0.060**	-0.376***	0.016	-0.021	< 0.001***
	(0.026)	(0.101)	(0.049)	(0.060)	
Number of observations		~75,000			

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and establishment and year fixed effects as in specification (7) of Table 2. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.

Appendix

Appendix Table A1: Coefficients for workplace and job characteristics (based on specification (5) in Table 2, WES data

	Dependent variable: job satisfaction	Dependent variable: pay satisfaction
	(1)	(2)
Full-time	0.002	-0.012
Union/CBA coverage	-0.037**	0.042**
Tenure, years	-0.004**	-0.003
(Tenure)^2	0.006	0.002
# times promoted	0.017***	0.006
Work language French	0.048	0.003
Work language other	0.014	0.003
Home language different from work language	0.001	-0.048
Industry		
Resource	-0.003	0.031
Labor intensive tertiary manufacturing	-0.083***	-0.062**
Secondary product manufacturing	-0.056**	-0.043
Capital intensive tertiary manufacturing	-0.032	-0.044
Construction	0.007	-0.015
Transportation, warehousing, wholesale	-0.002	-0.034
Communication and other utilities	0.013	-0.025
Retail trade and consumer services	0.047	-0.001
Finance and insurance	-0.000	-0.095**
Real estate, rental and leasing operations	-0.052	-0.110***
Business services	-0.026	-0.078**
Education and health services	0.026	-0.077
Information and cultural industries	-0.014	-0.083**
Primary product manufacturing*	(excluded)	(excluded)
Employment equity policy	-0.002	-0.02
Non-profit	0.017	-0.047
Average quit rate, %	-0.225***	-0.201***
% full time employees	-0.044	-0.066**
Incentive scheme	0.012	-0.009
Innovative work practices	0.027**	0.027*
Good/fair labour relations	-0.021	-0.048***
Index of non-wage benefits (z-score)	-0.012	0.001
Log training expenditures per worker	-0.002	0.002
Firm size		
[less than 20 workers]*	(excluded)	(excluded)
[between 20 and 99 workers]	-0.0487***	-0.112***
[between 100 and 499 workers]	-0.0536***	-0.086***
[more than 500 workers]	-0.039*	-0.057**
Degree of competition		
[zero firms]	-0.007	0.020
[1 to 5 firms]	0.000	0.011
[6 to 20 firms]	-0.012	0.015
[more than 20 firms]*	(excluded)	(excluded)

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and year fixed effects as in specification (5) of Table 2. Standard errors are not reported in the interest of space. Significance levels: *** < 1%, ** < 5%, * < 10%.

Appendix Table A2: Alternative reference groups – by age

	Co-workers, column (7) from Table 2	Co-workers by age category	Co-workers by age category and heterogenous effect by worker age
	(1)	(2)	(3)
Dependent variable: job satisfaction			
Ln(Own wage)	0.168***	0.165***	0.164***
	(0.018)	(0.022)	(0.022)
Ln(Average coworker wage)	-0.013		
	(0.024)		
Ln(Average wage of coworkers younger than 45)		0.014	
		(0.028)	
Ln(Avg wage of coworkers older than 45)		0.028	
		(0.022)	
Ln(Average wage of coworkers younger than 45)*I(worker younger than 45)			0.003
			(0.0294)
Ln(Average wage of coworkers younger than 45)* I(worker older than 45)			0.031
			(0.027)
Ln(Avg wage of coworkers older than 45)*I(worker younger than 45)			0.033
			(0.037)
Ln(Avg wage of coworkers older than 45)*I(worker older than 45)			0.025
			(0.026)
Dependent variable: pay satisfaction			
Ln(Own wage)	0.329***	0.336***	0.336***
	(0.021)	(0.026)	(0.026)
Ln(Average coworker wage)	0.046*		
	(0.026)		
Ln(Average wage of coworkers younger than 45)		0.040	
		(0.028)	
Ln(Avg wage of coworkers older than 45)		0.029	
		(0.026)	
Ln(Average wage of coworkers younger than 45)*I(worker younger than 45)			0.032
			(0.031)
Ln(Average wage of coworkers younger than 45)* I(worker older than 45)			0.040
			(0.030)
Ln(Avg wage of coworkers older than 45)*I(worker younger than 45)			0.053
			(0.035)
Ln(Avg wage of coworkers older than 45)*I(worker older than 45)			0.017
			(0.031)
Number of observations	~75,000	~75,000	~75,000

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and establishment and year fixed effects as in specification (7) of Table 2. Using firm characteristics instead of firm fixed effects also produces similar results. These results are available upon request. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.

Appendix Table A3: Alternative measures of co-worker wages

	Co-workers, column (7) from Table 2	Median wage within establishment	7th percentile of wage within establishment	Median & 75th percentile of wage within establishment
	(1)	(2)	(3)	(4)
Dependent variable: job satisfaction				
Ln(Own wage)	0.168***	0.166***	0.174***	0.169***
	(0.018)	(0.019)	(0.019)	(0.020)
Ln(Average coworker wage)	-0.013			
	(0.024)			
Ln(Median wage within establishment)		0.024		0.065
		(0.032)		(0.044)
Ln(75th percentile of wage within establishment)			-0.018	-0.050
			(0.025)	(0.034)
Dependent variable: pay satisfaction				
Ln(Own wage)	0.329***	0.307***	0.314***	0.308***
	(0.021)	(0.022)	(0.022)	(0.022)
Ln(Average coworker wage)	0.046*			
	(0.026)			
Ln(Median wage within establishment)		0.085**		0.137***
		(0.035)		(0.036)
Ln(75th percentile of wage within establishment)			0.038	0.015
			(0.026)	(0.029)
Number of observations	~75,000	~75,000	~75,000	~75,000

Notes: All regression coefficients are estimated using sample weights provided in the data. Regressions include controls for personal and job characteristics, detailed occupation, and establishment and year fixed effects as in specification (7) of Table 2. Using firm characteristics instead of firm fixed effects also produces similar results. These results are available upon request. Standard errors are reported in parentheses and are robust to clustering at the firm level. Significance levels: *** < 1%, ** < 5%, * < 10%.