

Social comparisons in oligopsony

Laszlo Goerke* and Michael Neugart[†]

May 5th, 2016

Abstract

A large body of evidence suggests that social comparisons matter for workers' valuation of the wage they receive. The consequences of social comparisons in imperfectly competitive labor markets are less well understood. We analyze an oligopsonistic model of the labor market where workers derive (dis-) utility from comparing their own wage with wages paid at other firms. As social comparisons become more prevalent all workers are paid higher wages, the wage distribution becomes more equal, employment at high productivity firms increases and decreases at low productivity firms. Moreover, the total wage bill and output increase, while aggregate profits decline. Overall welfare increases.

Keywords: social comparisons, status seeking, oligopsony, wage distribution

JEL-classification: D62, J22, J42

*Universität Trier, IAAEU (Institut für Arbeitsrecht und Arbeitsbeziehungen in der Europäischen Union), Campus II, D-54286 Trier, Germany, E-mail: goerke@iaaeu.de

[†]Technische Universität Darmstadt, Department of Law and Economics, Bleichstraße 2, D-64283 Darmstadt, Germany, E-mail: neugart@vwl.tu-darmstadt.de

1 Introduction

Thinking about the working of labor markets as a place of imperfect competition is probably “... more “natural” and less forced”, as Manning (2003, p. 11) puts it, than applying the competitive model. Analytical approaches including frictions due to some sort of monopsony power (Robinson, 1933; Bhaskar and To, 1999; Bhaskar et al., 2002) or owing to matching imperfections (Diamond, 1982; Pissarides, 1985; Burdett and Mortensen, 1998) have become important tools for analyzing labor markets. Typically, however, those models still build on preferences of workers such that only own wage payments are driving the decision to supply labor. Although there is widespread evidence that workers do not only derive positive utility from their own wage payments but that also comparisons with coworkers affect well-being, job satisfaction and behavior at the workplace (see, e.g., Brown et al., 2008; Clark et al., 2009; Card et al., 2012), little is known about the effects of other-regarding preferences in oligopsonistic labor markets.

In this contribution, we consider an oligopsonistic labor market where workers undertake wage comparisons. We analyze the effects of wage comparisons on wages, the wage and functional income distribution, the structure of employment, output, and welfare. Our main findings are that with social comparisons all workers are paid higher wages, the wage distribution measured in terms of relative wages becomes more equal, employment at high productivity firms increases and decreases at low productivity firms. Moreover, the wage sum and output increase, while total profits decline. Welfare, defined as the sum of firms’ profits and workers’ utility increases with more social comparisons.

Market power by firms such that they are not facing a completely elastic labor supply leads to wages at which workers are expropriated, an insight already propagated by Pigou (1929). Interestingly it turns out that social comparisons, in the sense that a worker derives positive utility from earning a higher wage than average and a disutility from earning a lower wage than average, drive up wages of all workers. It occurs that social comparisons can partly compensate for the negative consequences arising to workers

from the market power of firms. Contrary to monopsony, firms compete to some extent for labor with other firms in oligopsony. The lower labor market frictions are the more they compete for workers who by assumption have heterogeneous preferences for a given number of employers. What social comparisons add are fiercer competition between firms as workers attach lower utility to a firm that pays less than its competitors. Consequently, the strategic complementarity in the wage setting of firms in an oligopsonistic market is strengthened by workers' preferences being subject to social comparisons. The way we think about the allocation of heterogeneous firms in our model lets wages increase with social comparisons by the same absolute amount for high and low productivity firms so that workers at high productivity firms gain relatively less than workers at low productivity firms. The resulting relative wage compression explains the findings regarding the structure of employment and the functional income distribution. While overall employment does not change, since this is given in our model, low productivity firms will employ fewer workers and high productivity firms more workers as social comparisons becomes more prevalent. A direct upshot is that overall output increases from which workers profit disproportionately, so that total profits decline at the expense of a higher wage sum. Moreover, welfare increases.

Economists have realized for a long time that relative concerns matter for economic behavior. Already Adam Smith defined consumption goods in relative terms in the *Wealth of Nations* when he wrote that necessities are "...not only the commodities which are indispensably necessary for the support of life, but whatever the custom of the country renders it indecent for creditable people, even of the lowest order, to be without." (Smith, 1776, Book V, Ch. II, Part 2). Veblen (2003, ch. 2: Pecuniary emulation, p. 24) noted in 1899 that "Relative success, tested by an invidious pecuniary comparison with other men, becomes the conventional end of action." Similarly Pigou (1903, p. 60) discusses social preferences, and concerns for relative pay have been put forward by Keynes (1936, ch. 2) as a potential cause for wage stickiness. More recently, the labor supply effects of social comparisons have been analyzed in a variety of analytical settings, focusing inter alia on the consequences for growth (Liu and Turnovsky, 2005;

Mino and Nakamoto, 2012), asset pricing (Abel, 1990; Gali, 1994), taxation (Boskin and Sheshinski, 1978; Persson, 1995; Ireland, 2001; Corneo, 2002; Aronsson and Johansson-Stenman, 2014, 2015), provision of public goods (Ng, 1987; Aronsson and Johansson-Stenman, 2008; Wendner and Goulder, 2008), and the impact of multiple or different types of social concerns (Aronsson and Johansson-Stenman, 2013; Mujcic and Frijters, 2015). One of the main analytical predictions for those contributions is that if individuals exhibit jealousy or envy (in the sense of Dupor and Liu 2003), labor supply will be excessive. This is the case because individuals do not take into account that an expansion of labor supply which raises their own income reduces relative income of others, thus making them worse off and enticing them to expand their income generating activities. Frank (1984) and Schor (1991), e.g., provide a detailed illustration.

Theoretically, the consequences of social comparisons with respect to labor supply have generally been looked at in the context of competitive markets. Consequently, multiple labor market distortions have not played a role. As an exception, Goerke and Hillesheim (2013) assume firm-specific trade unions which represent individuals with preferences exhibiting concerns for social comparisons. Since trade unions raise wages above the market-clearing level, labor demand and actual hours of work decline. Hence, unions can internalize the impact of social comparisons. Furthermore, Mauleon et al. (2014) show that trade unions which bargain over wages with a firm selling its product in an oligopolistic market will achieve higher wage outcomes if the strength of wage comparisons become more pronounced. Higher wages, in turn, reduce employment, output and profits. In addition, and taking up an approach proposed by Oswald (1979), there are a number of contributions in which the utility of a specific trade union is negatively affected by the wage bargained by other unions. These investigations generally focus on the impact of such union rivalry on wages, employment and other macroeconomic outcomes (cf. Gylfason and Lindbeck, 1984; Dixon, 1988; Strøm, 1995; De la Croix et al., 1994), but do not analyze how two types of market imperfections interact.¹

¹Woo (2011; 2015) introduces status effects with respect to consumption goods into

Empirically, though, only a few previous papers have examined the role of relative income on labor supply, using data for the United States. For example, Neumark and Postlewaite (1998) show that women’s decision to supply labor depends on their sisters’ employment decision and Park (2010) finds that relative income of husbands plays an important role in the labor supply decisions of married women. Pérez-Asenjo (2011) demonstrates that the probability of working full-time instead of part-time, of labor force participation, and working hours decline with relative income. Finally, Bracha et al. (2015) present empirical evidence for students from the United States that information about relative pay tends to reduce labor supply of those male subjects paid a lower wage. The labor supply curve faced by oligopsonistic firms in the presence of social comparisons have to the best of our knowledge not been looked at thus far.

In sum, the labor market distortions due to (a) social comparisons and (b) firms having market power on the labor market have been looked at intensively, but separately. In the present contribution, we focus on the interaction of these two, well-established deviations from the benchmark model of perfect competition. We proceed by setting up our model in Section 2, present the results in Section 3, and conclude in Section 4.

2 Model

2.1 General set-up

Our theoretical framework is a condensed version of the model pioneered by Bhaskar and To (1999; 2003) which we extend to allow for social comparisons. In particular, we consider a model where firms are price takers on the output market but have market power on the labor market. The labor supply schedule they face is imperfectly elastic because the jobs the firms offer have

models of imperfect product market competition. It is shown that the prediction of overconsumption obtained for competitive settings may no longer arise in oligopoly or if there is monopolistic competition. Guo (2005) obtains a similar finding in that the tax rate inducing first-best consumption may not be positive on account of the product market imperfection.

different non-wage characteristics, such as with respect to physical working conditions, working hours, colleagues, customer relationships, or commuting distance. These non-wage characteristics cannot generally be ranked in that all workers prefer one set of characteristics to another. Instead, different workers have different preferences over these non-wage features of a job, i.e., the model is one of horizontal job differentiation.

More specifically, taking up the idea by Salop (1979), Bhaskar and To (1999; 2003) assume that workers of equal ability but with different preferences regarding job characteristics are distributed uniformly on a circle of unit circumference. We also employ this assumption and populate the circle with an even number of n firms, with $n \geq 2$. They are located at equal distance on the circle, such that the distance to the next firm on each side is $1/n$. Locations and working time per worker are fixed. The distance on the circle between the location of a firm and the position inhabited by any particular worker can be interpreted as the disutility of the job offered by that firm due to its non-wage characteristics.

A worker's utility is linear in the sum of wage income and the utility from social comparisons, to be specified below, and the dis-utility from disadvantageous job characteristics. This dis-utility equals the product tx of the distance from a firm, x , and the costs per unit of distance, denoted by t . A worker will accept the job offered by a firm if the resulting utility level is positive and higher than the utility from a job offered by another firm. With reservation wages of all workers normalized to zero there is full employment.

As an extension to previous work on oligopsonistic models, we assume that workers compare their wage income to the average wage. If the relative wage, i.e. the wage they receive less the average wage, is positive (negative) workers gain (lose) utility. The strength of such comparison effects depends on the absolute difference of wage levels and is indicated by a parameter γ , $\gamma \geq 0$, where $\gamma = 0$ captures the absence of such considerations. Formally, the utility of working at firm i if located at distance x from that firm is given by:

$$w_i + \gamma \left(w_i - \frac{1}{n-1} \sum_{j \neq i}^n w_j \right) - tx. \quad (1)$$

Status preferences have usually been incorporated into models of labor supply as depending either on the difference between wage or income levels (see, inter alia, Ljungqvist and Uhlig, 2000; Choudhary and Levine, 2006; Pérez-Asenjo, 2011) or as being a function of their ratio (see, e.g., Persson, 1995; Corneo, 2002; Goerke and Hillesheim, 2013). As indicated above, we choose the additive comparison approach (c.f. Clark and Oswald, 1998) because it preserves the linear relationship between wages and labor supply characterizing the model without social comparisons.²

To generate meaningful wage comparisons and wage and profit distributions, we suppose that there are two types of firms. *L*-type firms have lower profits than *H*-type firms when facing the same production costs, for example, because they can sell output on a different market at a lower price or because their productivity is smaller. We, finally, assume that firms of different productivities alternate on the circle, such that each *L*-firm has an *H*-type firm to the left and right, and vice versa. This substantially simplifies the subsequent analysis, without affecting the basic features of the model (cf. Bhaskar and To (2003)).

2.2 Labor supply to a firm

Denote wages paid at the two firms located next to firm i with w_{i+} and w_{i-} . In order to derive labor supply to a firm i we have to consider workers located between firm i and its neighbor on one side, firm i_+ , and workers located between i and the neighbor on the other side, that is, firm i_- . We focus on a worker who is situated at distance x from firm i and at distance $1/n - x$ from firm i_+ . Such a worker will compare the utility from working

²Mujcic and Frijters (2013) compare both approaches and find that the additive model can explain empirical observations slightly better than the ratio version. Moreover, in the Appendix we provide alternative specifications on social comparisons including preferences as in Fehr and Schmidt (1999) in order to show that the resulting labor supply to firms is similar to the one which we get with the specification chosen above.

at firm i or at firm i_+ . Consequently, the worker will select firm i if

$$w_i + \gamma \left(w_i - \frac{1}{n-1} \sum_{j \neq i}^n w_j \right) - tx > w_{i_+} + \gamma \left(w_{i_+} - \frac{1}{n-1} \sum_{j \neq i_+}^n w_j \right) - t(1/n-x). \quad (2)$$

We may re-write the inequality as

$$\begin{aligned} w_i + \gamma \left(w_i - \frac{1}{n-1} w_{i_+} - \frac{1}{n-1} \sum_{j \neq i, i_+}^n w_j \right) - tx > \\ w_{i_+} + \gamma \left(w_{i_+} - \frac{1}{n-1} w_i - \frac{1}{n-1} \sum_{j \neq i_+, i}^n w_j \right) - t(1/n-x) \end{aligned} \quad (3)$$

so that we get after canceling terms

$$\frac{(w_i - w_{i_+}) \left(1 + \gamma \frac{n}{n-1} \right)}{2t} + \frac{1}{2n} > x. \quad (4)$$

All workers closer to firm i than distance

$$\tilde{x}_+ = \frac{(w_i - w_{i_+}) \left(1 + \gamma \frac{n}{n-1} \right)}{2t} + \frac{1}{2n} \quad (5)$$

will work for firm i . All other workers rather prefer to work for firm i_+ .

Considering also the workers on the other side of firm i , total labor supply to firm i becomes

$$L_i = \tilde{x}_+ + \tilde{x}_- = \frac{(w_i - \bar{w}_i) \left(1 + \gamma \frac{n}{n-1} \right)}{t} + \frac{1}{n} \quad (6)$$

with $\bar{w}_i = \frac{1}{2} (w_{i_+} + w_{i_-})$. Labor supply to firm i increases with the absolute differential between the wage it pays itself and the average wage of its two neighboring firms. Moreover, the slope of the labor supply function to firm i , that is $\partial L_i / \partial w_i$, is decreasing in t and increasing in the degree of social comparisons γ .

2.3 Profit maximization

As in Bhaskar and To (1999; 2003) we consider a production function which is homogeneous degree of one in labor

$$Y_i = L_i f_i(K_i/L_i), \quad (7)$$

where K_i is capital input to firm i , and $f_i' > 0$ and $f_i'' < 0$. As all workers have identical skills, labor enters the production function uniformly. Firm i 's profit equation follows as

$$\pi_i = p_i L_i f_i(K_i/L_i) - r K_i - w_i L_i \quad (8)$$

where p_i is the price which firm i charges for its product and r is the capital rental rate. We may reformulate the profit function by using the first-order condition for the firm's optimal capital usage

$$p_i f_i'(k_i^*) - r = 0 \quad (9)$$

as

$$\pi_i = \phi_i(p_i, r) L_i - w_i L_i \quad (10)$$

with $\phi_i(p_i, r) = p_i (f_i(k_i^*(r/p_i)) - f_i'(k_i^*(r/p_i)) k_i^*(r/p_i))$ and k_i^* being the optimal capital-labor ratio. ϕ_i is firm i 's net revenue product of labor for which the firm optimally adjusted its capital-labor ratio. The firm's net revenue product of labor increases in the capital-labor ratio, k_i , and the price, p_i , because the production function is strictly concave. Moreover, the optimal capital-labor ratio k_i^* increases with the price (see (9)).

We model firm differences by assuming that $\phi_H(p_H, r) > \phi_L(p_L, r)$. As shown below, H -type and L -type firms will pay different wages and have different profit levels. Accordingly, the assumption of differences in the net revenue product of labor generates an income distribution. Net revenues products of two firms which compete against each other in the same labor market may diverge because they produce different goods allowing them to set different prices. Alternatively, $\phi_H(p_H, r) > \phi_L(p_L, r)$ may occur because

the H -type firm has a higher productivity, possibly due to differences in managerial talent or production techniques. To formally capture the idea of differences in the net revenue product of labor we, therefore, assume that $p_H = a_p p_L$ and $f_H(k) = a_f f_L(k)$, where $a_p, a_f \geq 1$ and $a_p + a_f > 2$. In our subsequent exposition we focus on productivity differences as the cause of $\phi_H(p_H, r) > \phi_L(p_L, r)$, i.e. a setting in which $a_f > 1 = a_p$ holds, and refer to H -type (L -type) firms as high (low) productivity enterprises.

Substituting labor supply (6) into profits gives

$$\pi_i = (\phi_i(p_i, r) - w_i) \left(\frac{(w_i - \bar{w}_i) \left(1 + \gamma \frac{n}{n-1}\right)}{t} + \frac{1}{n} \right). \quad (11)$$

Each firm maximizes profits with respect to its own wage, taking as given the wages paid at other firms. The first-order condition is given by

$$\frac{\partial \pi_i}{\partial w_i} = - \left(\frac{(w_i - \bar{w}_i) \left(1 + \gamma \frac{n}{n-1}\right)}{t} + \frac{1}{n} \right) + (\phi_i(p_i, r) - w_i) \frac{\left(1 + \gamma \frac{n}{n-1}\right)}{t} = 0. \quad (12)$$

As usual in models of oligopsonistic labor markets, the optimal wage results from the trade-off between higher labor costs and greater labor supply. The second-order condition for a maximum is fulfilled ($\partial^2 \pi_i / \partial^2 w_i < 0$). Rearranging (11) gives the optimal wage a firm i sets as:³

$$w_i^* = \frac{1}{2} \left(\phi_i(p_i, r) + \bar{w}_i - \frac{t}{n(1 + \gamma \frac{n}{n-1})} \right). \quad (13)$$

The optimal wage of a firm i equals the weighted sum of the firm's net revenue product of labor, and the wages paid in neighboring firms, less a measure of the disutility cost t (as in Bhaskar and To, 1999, 2003; Kaas, 2009; Hirsch, 2009). Own productivity, as captured by $\phi_i(p_i, r)$, has a positive wage effect because the gain in profits from increasing labor input becomes

³We assume that profits are positive and derive the restriction on the net revenue product of labor, $\phi_i(p_i, r)$, which guarantees this feature in the Appendix.

larger the more productive the additional worker is. Moreover, higher unit disutility costs t/n for workers make it less likely that a worker will accept the wage offer by a neighboring firm, because the net gain from doing so, i.e., the difference between the wage paid by that firm less disutility costs, is reduced. Finally, a higher wage in a neighboring firm lowers labor supply to firm i . To reduce the resulting decline in profits, the wage in firm i is raised. This strategic complementarity in wage setting has important implications for the effect of social comparisons, because its strength, as measured by the parameter γ , raises the elasticity of labor supply. While disutility costs lower the labor supply elasticity to firms social comparisons have a counteracting effect on it.

3 Results

Having derived optimal wage-setting behavior by an arbitrary firm i , we now turn to the implications of social comparisons by workers for wage setting, the distribution of wages, employment, output, the functional income distribution, and welfare. To simplify notation, we subsequently omit the arguments of the net revenue product $\phi_i(p_i, r)$ and denote it by ϕ_H and ϕ_L for the high- and the low productivity firms, respectively.

3.1 Wage effects

For equilibrium wages we get the following results.

Proposition 1. *Equilibrium wages for the high (H) and low (L) productivity firms write:*

$$w_H^* = \frac{2}{3}\phi_H + \frac{1}{3}\phi_L - \frac{t}{n(1 + \gamma\frac{n}{n-1})} \quad (14)$$

and

$$w_L^* = \frac{1}{3}\phi_H + \frac{2}{3}\phi_L - \frac{t}{n(1 + \gamma\frac{n}{n-1})}. \quad (15)$$

A higher prevalence of social comparisons increases wages in both types of firms by the same amount.

Proof. When setting wages, the n firms play Nash against each other. From (13) we already know each firms' reaction function. Thus, we have to solve for a system of n equations taking into account that due to the assumption of alternating productivity levels of neighboring firms, a low productivity firm has two high productivity neighbors, and vice versa. After adding up the $n/2$ reaction functions of the high productivity and of the low productivity firms, the system of n equation essentially boils down to two equations:⁴

$$w_H = \frac{1}{2} \left(\phi_H - \frac{t}{n(1 + \gamma \frac{n}{n-1})} \right) + \frac{1}{2} w_L \quad (16)$$

$$w_L = \frac{1}{2} \left(\phi_L - \frac{t}{n(1 + \gamma \frac{n}{n-1})} \right) + \frac{1}{2} w_H. \quad (17)$$

Solving for w_H^* and w_L^* we obtain (14) and (15). The partial derivatives are: $\partial w_H^*/\partial \gamma > 0 = \partial w_L^*/\partial \gamma > 0$. \square

Social comparisons partly compensate for the expropriation of workers that typically comes with non-competitive labor markets where firms can exert market power due to frictions. In our oligopsonistic setting it is the cost t that reduces workers' wages. Social comparisons, however, increase equilibrium wages due to the strategic complementarity in the wage setting of firms in oligopsony. Firms are trying to attract workers by offering higher wages than their competing neighbors, and the more so the more workers compare wages. A higher wage set by firm i has a negative externality on its neighboring firms which have to increase their wage offers in order not to fall short of labor supply. Thereby, social comparisons stiffen competition between firms and increase equilibrium wages.

3.2 Wage distribution

Social comparisons also have an effect on the wage distribution.

⁴A proof of stability of the Nash equilibrium is provided in the Appendix.

Proposition 2. *A higher prevalence of social comparisons decreases the relative wage differential.*

Proof. Using our previous results we get for the relative wage differential

$$\frac{w_H^*}{w_L^*} = \frac{\frac{2}{3}\phi_H + \frac{1}{3}\phi_L - \frac{t}{n(1+\gamma\frac{n}{n-1})}}{\frac{1}{3}\phi_H + \frac{2}{3}\phi_L - \frac{t}{n(1+\gamma\frac{n}{n-1})}}. \quad (18)$$

The partial derivative is $\frac{\partial \frac{w_H^*}{w_L^*}}{\partial \gamma} < 0$. □

To provide an intuition, remember how each firm sets the wage, cf. (13). It takes as given the wages of the two neighboring firms with which it competes for labor and raises its own wage as long as the net revenue less the wage of the additional worker is larger than the loss from having to pay all workers a higher wage. The fact that all firms take as given the wage of the neighboring firms when optimizing explains why γ does not enter the absolute wage differential. Since job characteristics are distributed uniformly, changes in the disutility from accepting a job with more disadvantageous features reduce the gain from accepting any job by the same amount. This implies that an increase in wages paid by low and high productivity firms by the same amount owing to more pronounced social comparisons results in a smaller proportional increase of the (high) wage paid by the high productivity firm. Accordingly, the relative wage differential w_H^*/w_L^* declines with the strength of social comparisons.

3.3 Employment and output

Social comparisons change the composition of employment between high and low productivity firms and, therefore, alter aggregate output.

Proposition 3. *A higher prevalence of social comparisons increases employment at high productivity firms and decreases employment at low productivity firms, thereby increasing total output in the economy.*

Proof. Inserting equilibrium wages w_H^* and w_L^* into (6) gives

$$L_H^* = \frac{\frac{1}{3}(\phi_H - \phi_L)\left(1 + \gamma\frac{n}{n-1}\right)}{t} + \frac{1}{n} \quad (19)$$

and

$$L_L^* = \frac{\frac{1}{3}(\phi_L - \phi_H)\left(1 + \gamma\frac{n}{n-1}\right)}{t} + \frac{1}{n}. \quad (20)$$

As $\phi_H > \phi_L$ we get that $\partial L_H^*/\partial\gamma = -\partial L_L^*/\partial\gamma > 0$.

The change in aggregate output, $Y = Y_H + Y_L = L_H f_H(k_H) + L_L f_L(k_L)$, owing to an increase in the parameter γ is given by:

$$\frac{\partial Y}{\partial\gamma} = \frac{\partial L_H^*}{\partial\gamma} f_H(k_H^*) + \frac{\partial L_L^*}{\partial\gamma} f_L(k_L^*) = \frac{\partial L_H^*}{\partial\gamma} (f_H(k_H^*) - f_L(k_L^*)). \quad (21)$$

To establish the increase in aggregate output, utilizing $\partial L_H^*/\partial\gamma > 0$, we have to show that $f_H(k_H^*) - f_L(k_L^*) > 0$ holds. Since $f_i(k)$ is increasing in k and $f_H(k) = a_f f_L(k) \geq f_L(k)$ by assumption, $f_H(k_H^*) - f_L(k_L^*) > 0$ will surely hold if $k_H^* > k_L^*$ holds. From the first-order condition (9) we know that $p_H f_H'(k_H^*) = r = p_L f_L'(k_L^*)$. Further, $p_H = a_p p_L$ and $f_H(k) = a_f f_L(k)$, where $a_p, a_f \geq 1$ and $a_p + a_f > 2$, implies that $p_H f_H'(k) = a_p p_L a_f f_L'(k) > p_L f_L'(k)$. Since $f(k)$ is strictly concave in k and $f'(k)$, hence, decreasing in the capital-labor ratio, $p_H f_H'(k) > p_L f_L'(k)$ and $p_H f_H'(k_H^*) = p_L f_L'(k_L^*)$ together can only hold if k_H^* exceeds k_L^* . \square

Labor supply is a positive function of the difference between the wage paid in the firm under consideration and the average wage in neighboring firms. For high productivity firms this average equals the wage paid by low productivity firms, and vice versa. In addition, more pronounced social comparisons amplify the effects of the absolute wage differential on labor supply. In consequence, if individuals compare the wages paid by firms more intensively, labor supply to firms paying higher wages will go up, whereas labor supply to low wage firms will decline. Since H -type firms use the (marginal) unit of labor input more productively shifting labor to H -type

firms increases aggregate output.

3.4 Functional income distribution

Social comparisons also have an effect on the functional income distribution.

Proposition 4. *A higher prevalence of social comparisons increases the total wage bill and reduces the profits of high- and low-productivity firms and, consequently, aggregate profits.*

Proof. Let us write the wage bill for two neighboring firms as $w_H L_H + w_L L_L$. Since there are $n/2$ such firm pairs, the total wage bill W is:

$$W = \frac{n}{2} (w_H L_H + w_L L_L) = \frac{n}{2} (w_H L_H - w_L L_H + w_L L_L + w_L L_H) \quad (22)$$

$$= \frac{n}{2} ((w_H - w_L) L_H + w_L (L_L + L_H)) \quad (23)$$

$$= \frac{n}{2} ((w_H - w_L) L_H + w_L). \quad (24)$$

As we already showed that (a) the absolute wages differential does not change with more pronounced social comparisons, (b) all wages increase, and (c) employment at high productivity firms goes up, the wage bill rises.

Inserting wages and employment levels into the profit equations, we can calculate maximal profits as:

$$\pi_H = \frac{1 + \gamma \frac{n}{n-1}}{t} \left(\frac{1}{3} (\phi_H - \phi_L) + \frac{t}{n(1 + \gamma \frac{n}{n-1})} \right)^2 \quad (25)$$

$$= \frac{1 + \gamma \frac{n}{n-1}}{t} \left(\frac{1}{3} (\phi_L - \phi_H) + \frac{t}{n(1 + \gamma \frac{n}{n-1})} \right)^2 + \frac{4}{3n} (\phi_H - \phi_L) \quad (26)$$

$$= \pi_L + \frac{4}{3n} (\phi_H - \phi_L) \quad (27)$$

We know that wages of low-productivity firms increase with γ and employment at low-productivity firms decreases with γ . This implies that profits of low-productivity firms shrink if social comparisons become more pronounced ($\partial\pi_L/\partial\gamma < 0$). Since, moreover, $\partial\pi_L/\partial\gamma = \partial\pi_H/\partial\gamma$, profits in both firms and in aggregate decline. \square

In the present setting, total wage payments unambiguously increase for two reasons: First, total employment is constant. Thus, a shift in employment towards high-productivity, high-wage firms increases wage payments of all workers who change firms. Second, wages of workers in high- and in low-productivity firms go up. Consequently, wage payments to those workers rise who stay in the same firm. Hence, the shift in employment towards high productivity firms increases total wage payments, W . The profit effect can be explained as follows: Social comparisons incentivize firms of both types to pay higher wages. This squeezes their profits per worker employed. Moreover, more intense social comparisons shift labor supply towards the high-productivity firms, at the expense of the low-productivity firms. As a consequence, the low-productivity firms employ fewer workers and each worker generates less revenues. Although the high productivity firms gain in terms of attracting a larger share of the labor force, it does not compensate for the lower net revenue less the wage of a worker. Aggregate profits decline.

3.5 Welfare

Defining welfare as the sum of firms' profits and wage payments net of disutility costs, the welfare effect of social comparisons can be summarized as follows.

Proposition 5. *A higher prevalence of social comparisons increases welfare.*

Proof. Define WF as the sum of profits of all firms and the wage payments

net of dis-utility costs of all workers

$$WF = \frac{n}{2} (\pi_H^* + \pi_L^*) + \frac{n}{2} \left(2 \int_{x=0}^{\frac{L_H^*}{2}} U_H(x) dx + 2 \int_{x=0}^{\frac{L_L^*}{2}} U_L(x) dx \right) \quad (28)$$

with

$$U_i(x) = w_i^* + \gamma \left(w_i^* - \frac{1}{n-1} \sum_{j \neq i}^n w_j^* \right) - tx \quad (29)$$

and

$$\pi_i = (\phi_i - w_i^*) L_i^* \quad (30)$$

for $i = L, H$. From the definition of utility and profits it is immediately obvious that welfare WF is unaffected by the level of wage payments. Simplifying welfare accordingly and formulating the effects of social comparisons and disutility explicitly, yields:

$$\begin{aligned} WF = & \frac{n}{2} [\phi_H L_H^* + \phi_L L_L^* + \gamma L_H^* \left(w_H^* - \frac{1}{n-1} \left(\left(\frac{n}{2} - 1 \right) w_H^* + \frac{n}{2} w_L^* \right) \right) + \\ & (31) \\ & + \gamma L_L^* \left(w_L^* - \frac{1}{n-1} \left(\left(\frac{n}{2} - 1 \right) w_L^* + \frac{n}{2} w_H^* \right) \right) - \frac{t}{4} (L_H^{*2} + L_L^{*2})] \end{aligned}$$

Collecting terms and inserting equilibrium wages w_H^* , w_L^* in accordance with (14) and (15), welfare can be expressed as:

$$\begin{aligned} WF = & \frac{n}{2} (\phi_H L_H^* + \phi_L L_L^* + \gamma \frac{n}{6(n-1)} (\phi_H - \phi_L) (L_H^* - L_L^*) - \\ & (32) \\ & - \frac{t}{4} [L_H^{*2} + L_L^{*2}]) \end{aligned}$$

The derivative of welfare with respect to γ is given by:

$$\frac{dWF}{d\gamma} = \frac{\partial WF}{\partial \gamma} + \frac{\partial WF}{\partial L_H^*} \frac{\partial L_H^*}{\partial \gamma} + \frac{\partial WF}{\partial L_L^*} \frac{\partial L_L^*}{\partial \gamma} \quad (33)$$

We know that the direct welfare effect of an increase in γ is positive since $\phi_H > \phi_L$ and employment in H -type firms exceeds employment in L -type firms.

$$\frac{\partial WF}{\partial \gamma} = \frac{n}{6(n-1)} (\phi_H - \phi_L) (L_H^* - L_L^*) > 0 \quad (34)$$

Making use of $\frac{\partial L_H^*}{\partial \gamma} = -\frac{\partial L_L^*}{\partial \gamma}$, and collecting common terms, the overall welfare change is found to be:

$$\begin{aligned} \frac{dWF}{d\gamma} &= \frac{\partial WF}{\partial \gamma} + \frac{n}{2} \frac{\partial L_H^*}{\partial \gamma} (\phi_H - \phi_L + \\ &+ \gamma \frac{n}{3(n-1)} (\phi_H - \phi_L) - \frac{t}{2} [L_H^* - L_L^*]) \end{aligned} \quad (35)$$

Finally substituting for employment levels in accordance with (19) and (20) it can be noted that the increase in revenues dominates the rise in disutility.

$$\frac{dWF}{d\gamma} = \frac{\partial WF}{\partial \gamma} + \frac{n}{3} \frac{\partial L_H^*}{\partial \gamma} (\phi_H - \phi_L) > 0 \quad (36)$$

□

A greater prevalence of social comparisons increases welfare. Given that we already know that a larger γ reduces profits at high and low productivity firms, it must be the case that the utility gains of the workers more than compensate the losses of the firms. A change in social comparisons has direct and indirect effects on workers. First of all, more social comparisons increase wages of all workers and, moreover, employment shifts to the better paying firms. However, workers also incur greater disutility from working at firms with less advantageous characteristics and may suffer from greater losses due to other firms paying on average better than the firm at which they are employed. In total, however, workers are better off. Intuitively, this must be

the case, because workers will only move to another firm if the increase in wages more than compensate the rise in disutility due to having to work at a less favorable location. Moreover, firms will only employ additional workers if the increase in output is larger than the additional wage costs.

4 Conclusions

We analyzed the consequences of social preferences for labor market outcomes in oligopsony. It turns out that status seeking behavior of workers has important implications for wages, the wage distribution, the structure of employment, output, welfare, as well as the functional income distribution in an imperfectly competitive market setting. Interestingly, social comparisons among workers reduce the market power of firms compensating for the expropriation of workers typically arising in monopsony and oligopsony. We find that wages paid both in high- and in low-productivity firms increase. Furthermore, we can show that relative wages of high- and low-productivity firms fall. Employment shifts towards the high productivity firms and, therefore, total output and the wage sum become larger, whereas total profits decline. Our calculations clarify that the workers' increase in utility more than compensates the decline in firms' profits so that welfare defined as the sum of profits and aggregate utility increases with social comparisons.

Our results, we believe, have important implications for empirical work on the measurement of possibly upward sloping labor supply curves to firms (see Manning, 2003, ch. 4), and, although more tentatively, also policy implications. To the extent that social comparisons matter and flatten out the labor supply curves to individual firms in non-competitive settings, estimates may suffer from an omitted variables bias. If it is not taken into account that workers compare their wages to wages paid at other firms, firm specific labor supply elasticities may understate the actual degree for labor market frictions being present. In terms of policy implications of our findings, a tempting question could be how to put social comparisons into effect in order to reduce expropriation of workers and flatten out the wage distribution. As wage comparisons require information on what other firms pay, making

wage payments more transparent could be one way to go. Northern European countries, for example, provide for public access to households' income tax declarations.

Appendix

Alternative specifications for social comparisons

Labor supply with inequity aversion

Assume that workers are inequity averse as in Fehr and Schmidt (1999). In this case, a worker compares the utility when working from firm i or firm i_+ according to

$$w_i - \gamma_h \max[w_i - w_{i_+}, 0] - \gamma_l \max[w_{i_+} - w_i, 0] - tx > \quad (37)$$

$$w_{i_+} - \gamma_h \max[w_{i_+} - w_i, 0] - \gamma_l \max[w_i - w_{i_+}, 0] - t(1/n - x).$$

A worker employed at firm i compares himself with a worker employed at firm i_+ earning a wage w_{i_+} . The worker i derives disutility if he earns more than workers at the other firm, and he also derives disutility if he earns less than the workers at the other firm i_+ . This is in essence inequity aversion. The same reasoning applies if the worker would be employed at firm i_+ . Arising disutility is weighted with $\gamma_h, \gamma_l > 0$. For deriving labor supply, we have to distinguish two cases:

- For Case 1 with $w_i > w_{i_+}$ we get from (37):

$$w_i - \gamma_h(w_i - w_{i_+}) - tx > w_{i_+} - \gamma_l(w_i - w_{i_+}) - t(1/n - x) \quad (38)$$

- For Case 2 with $w_i < w_{i_+}$ we get:

$$w_i - \gamma_h(w_i - w_{i_+}) - tx > w_{i_+} - \gamma_l(w_i - w_{i_+}) - t(1/n - x) \quad (39)$$

It turns out that the condition which defines a situation in which it is beneficial for the worker to work in firm i is the same for Cases 1 and 2.. Solving

for x gives:

$$\frac{(w_i - w_{i_+})(1 - \gamma_h + \gamma_l)}{2t} + \frac{1}{2n} > x \quad (40)$$

If $\gamma_l > \gamma_h$, i.e. the loss is more weighted for those who earn less than the comparison group than workers suffer from earning more than the comparison group, social comparisons counteract the effect of the disutility arising from t , as it is the case in (4).

Labor supply with encompassing asymmetric social comparisons

Alternatively, consider the following utility function for a worker placed between firms i and i_+

$$w_i + \alpha(w_i - w_{i_+}) + \beta(w_i - \bar{w}_n) + \gamma(w_i - \bar{w}_h) - tx, \quad (41)$$

where \bar{w}_n is the average over all wages paid at low productivity firms except for i, i_+, i_i , and \bar{w}_h is the average over all wages paid at high productivity firms except for i, i_+, i_i . On top of his wage and the disutility arising from heterogeneity, comparisons with wages paid at the neighboring firm and wages paid at all other high and low productivity firms matter with weights α, β, γ , and δ being larger or equal to zero. Similarly, would the same worker end up at firm i_+ , utility becomes

$$w_{i_+} + \delta(w_{i_+} - w_i) + \beta(w_{i_+} - \bar{w}_n) + \gamma(w_{i_+} - \bar{w}_h) - t(1/n - x), \quad (42)$$

where, again, \bar{w}_n is the average over all wages paid at low productivity firms except for i, i_+, i_i , and \bar{w}_h is the average over all wages paid at high productivity firms except for i, i_+, i_i . A worker will rather work for firm i if

$$w_i + \alpha(w_i - w_{i_+}) + \beta(w_i - \bar{w}_n) + \gamma(w_i - \bar{w}_h) - tx > \quad (43)$$

$$w_{i_+} + \delta(w_{i_+} - w_i) + \beta(w_{i_+} - \bar{w}_n) + \gamma(w_{i_+} - \bar{w}_h) - t(1/n - x)$$

or

$$\frac{(1 + \alpha + \delta + \beta + \gamma)(w_i - w_{i+})}{2t} + \frac{1}{2n} > x. \quad (44)$$

Again social comparisons counteract the effect of the disutility arising from t , as it is the case in (4).

Stability of Nash equilibrium

The Jacobian matrix of the Nash game for $n = 2$ writes

$$J = \begin{pmatrix} 0 & 1/2 \\ 1/2 & 0 \end{pmatrix} \quad (45)$$

and for $n \geq 4$ firms writes

$$J = \begin{pmatrix} 0 & 1/4 & 0 & \dots & 1/4 \\ 1/4 & 0 & 1/4 & \dots & 0 \\ 0 & 1/4 & 0 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 1/4 & 0 & 0 & \dots & 0 \end{pmatrix}. \quad (46)$$

Both matrices are circular and symmetric. Eigenvalues of such a matrix follow from

$$a(l) = \sum_{r=0}^{n-1} j(r) \cos(2\pi lr/n) \quad (47)$$

where $j(r)$ with $r = 0, \dots, n-1$ are the elements of the first row of the matrix J , and $l = 0, \dots, n-1$ is the index for the eigenvalues (c.f. Montaldi, 2012). Note, that for $n = 2$ we have one nonzero entry for $j(r = 1) = 1/2$, and for $n \geq 4$ we have two nonzero entries in the first row at $j(r = 1) = 1/4$ and $j(r = n-1) = 1/4$. The eigenvalues become for $n = 2$

$$a(l) = \frac{1}{2} \cos(2\pi l/2) \quad (48)$$

and for $n \geq 4$

$$a(l) = \frac{1}{4} \cos(2\pi \frac{l}{n}) + \frac{1}{4} \cos(2\pi l \frac{n-1}{n}). \quad (49)$$

It follows that all eigenvalues will lie in the interval

$$-\frac{1}{2} \leq a(l) \leq \frac{1}{2}, \quad (50)$$

i.e. within the unit circle, which proves stability of the Nash equilibrium.

Condition on positive profits

From the proof of Proposition 4 we already know that profits of higher productivity firms will surely be positive if profits of low productivity firms are non-negative and that $\pi_L > 0$ will hold if $\phi_H - \phi_L < \frac{3t}{n(1+\gamma\frac{n}{n-1})}$. Since the right-hand side of the inequality is decreasing in the number of firms n for any $n \geq 2$, $\pi_L > 0$ will surely hold if $\phi_H - \phi_L < 3t/(2(1+2\gamma))$.

Condition on utility larger than reservation wages

Utility of workers is, see (1),

$$w_i + \gamma \left(w_i - \frac{1}{n-1} \sum_{j \neq i}^n w_j \right) - tx. \quad (51)$$

From the utility function of a worker it is obvious that a high wage worker always has a higher utility than a low wage worker, for a given disutility from disadvantageous job characteristics. Therefore, a sufficient condition for all workers wanting to work is that a low wage worker living away at maximum distance from a low productivity firm has utility

$$w_L + \gamma \left(w_L - \frac{1}{n-1} \left(\left(\frac{n}{2} - 1 \right) w_L + \frac{n}{2} w_H \right) \right) - t \frac{1}{n} > 0. \quad (52)$$

Simplification gives

$$w_L - \gamma \frac{n}{2(n-1)} (w_H - w_L) > \frac{t}{n}. \quad (53)$$

Inserting wages

$$\frac{1}{3}\phi_H + \frac{2}{3}\phi_L - \frac{t}{n(1 + \gamma\frac{n}{n-1})} - \gamma\frac{n}{2(n-1)}\frac{1}{3}(\phi_H - \phi_L) > \frac{t}{n} \quad (54)$$

and rearranging results in

$$\left(\frac{1}{3}\phi_H + \frac{2}{3}\phi_L\right) \frac{1 + \gamma\frac{n}{n-1}}{2 + \gamma\frac{n}{n-1}} - \gamma\frac{n}{2(n-1)}\frac{1}{3}(\phi_H - \phi_L) \frac{1 + \gamma\frac{n}{n-1}}{2 + \gamma\frac{n}{n-1}} > \frac{t}{n}. \quad (55)$$

The condition on positive profits for firms, as derived about, is

$$\phi_H - \phi_L < \frac{3t}{n(1 + \gamma\frac{n}{n-1})} \quad (56)$$

or

$$(\phi_H - \phi_L) \frac{(1 + \gamma\frac{n}{n-1})}{3} < \frac{t}{n}. \quad (57)$$

Combining both conditions gives by substituting t/n

$$\begin{aligned} \left(\frac{1}{3}\phi_H + \frac{2}{3}\phi_L\right) \frac{1 + \gamma\frac{n}{n-1}}{2 + \gamma\frac{n}{n-1}} - \gamma\frac{n}{2(n-1)}\frac{1}{3}(\phi_H - \phi_L) \frac{1 + \gamma\frac{n}{n-1}}{2 + \gamma\frac{n}{n-1}} > \\ (\phi_H - \phi_L) \frac{(1 + \gamma\frac{n}{n-1})}{3} \end{aligned} \quad (58)$$

and after simplification

$$\frac{-\phi_H + 4\phi_L}{\phi_H - \phi_L} \frac{2(n-1)}{3n} > \gamma. \quad (59)$$

As long as ϕ_H is not too much larger than ϕ_L , a γ exists such that all workers will want to work and firms make positive profits.

Positive employment

Employment was derived as

$$L_H^* = \frac{\frac{1}{3}(\phi_H - \phi_L) \left(1 + \gamma\frac{n}{n-1}\right)}{t} + \frac{1}{n} \quad (60)$$

and

$$L_L^* = \frac{\frac{1}{3}(\phi_L - \phi_H) \left(1 + \gamma \frac{n}{n-1}\right)}{t} + \frac{1}{n}. \quad (61)$$

As by assumption $\phi_H > \phi_L$, employment at all firms will be positive if

$$\phi_H - \phi_L < \frac{3t}{n \left(1 + \gamma \frac{n}{n-1}\right)} \quad (62)$$

which is equivalent to the condition that $\pi_L > 0$.

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