Labor Unions and Fairness

A New Perspective on the Wage–Setting Process*

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Abstract

We set up a unionized labor market model with unions caring about material welfare and fairness. Utility is derived relative to a material and a fairness reference. We show that not only the trade-off between fairness and consumption matters for the wage-setting process, but also the size of the reference chosen. The interplay of both parameters influences union's objectives and therefore determines the shape of the wage-setting curve on the macro level. If the economy is hit by a technology shock we show that again both parameters have a major impact on how the economy adjusts. They determine if adjustment takes place more in terms of wages or in terms of employment. Our model is therefore able to account for different degrees of wage rigidity.

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1 Introduction

Up to now, most models of unionized labor markets are strictly bound to the assumptions of classical homo economicus. Whether the models work with a stone-geary utility function, a expected-utility function or whether the analysis is based upon a rent-maximizing union, they all assume that union utility is only to be derived from material gains, i.e. employee remuneration or higher employment. This is a very narrow conception of utility, because results from experimental economics and psychological evidence show that people strongly care about fairness and that such fairness considerations influence individual behavior in the labor market.

Influenced by insights of other social sciences experimental economics started to question the assumptions of classical homo economicus and over the course of time it worked out a long list of so-called anomalies, which could not be explained within the existing paradigm[1] (Charness, 2004 and Falk and Fischbacher, 2006). Especially in settings with incomplete contracts[2] (Tirole, 1999) the behavior predicted often deviates substantially from the behavior observed (Fehr, Kirchler, Weichbold, and Gächter, 1998). Having workers caring about fairness already found its way into the labor market literature, especially in efficiency wage theory (Akerlof, 1982, Akerlof and Yellen, 1990 and Danthine and Kurmann, 2007) and more recently even in the international trade literature (Egger and Kreickemeier, 2008). However, fairness did not enter the labor union literature except some works discussing union rivalry (Oswald, 1979 and Gylfason and Lindbeck, 1984).

In this paper we discuss how fairness could become part of the union's objectives. We demonstrate that the inclusion of fairness considerations into a union's utility function profoundly changes the workings of the wage–setting process and the reaction of the aggregate economy to macroeconomic shocks. We proceed as follows. The next section is focused on how to include fairness into the union's utility function. Section 3 presents the theoretical model. We first analyze how the wage-setting behavior of the union is shaped on the micro level and then discuss the implications for the wage-setting curve for the

[1] This even lead the Journal of Economic Perspectives to publish an "anomalies column".

[2] The labor contract is highly incomplete(Fehr, Fischbacher, and Gächter, 2002).

aggregate economy. In Section 4 it is analyzed how fairness modifies the reaction of the economy if hit by an adverse technology shock. Section 5 concludes.

2 Fairness in the Union Utility Function

It is well known that the consequences of labor union models on the outcomes of the labor market rest heavily upon the assumed utility function[3]. Since we have little knowledge about trade union's objectives because they are unobservable it is at most as daring to assume that workers and therefore unions care about fairness than to assume that they do not.[4] Given all the experimental evidence and the belonging groundwork from other (social) sciences it seems even to be more daring to assume that agents just care about material payoffs, than allowing them to care about immaterial payoffs, too.

We consider firm–level labor unions and assume that only employed workers are members of the union. For simplicity it is assumed that *all* employed workers are union members. Alternatively, we could assume that only a constant fraction of the workers belongs to the labor union. Workers who are dismissed or who voluntarily leave the firm also leave the labor union. Each union member obtains a rent Ω in connection with the employment relationship. Total utility U_i of the labor union simply is this rent times the number of workers N_i employed at firm i:

$$U_i = N_i \cdot \ln \Omega \tag{1}$$

In traditional union models it is assumed that a worker only enjoys a "material" rent that is defined as the real wage level w_i in firm i relative to some expected alternative income $\overline{w}$ the worker would earn when he or she is not employed at firm i. We integrate fairness considerations into this setup by assuming that workers also obtain a "psychological" rent when they perceive themselves to be fairly treated. In line with the efficiency–wage model

[3]See, for instance, Pencavel (1991) and Booth (1995)

[4]We do not consider agents to be heterogeneous, thus neglecting the question of preference aggregation and principal-agent problems within the union. This procedure also neglects the question how representatives bargain for fairness considerations of others.

of Danthine and Kurmann (2007) the workers compare their wage with the average firm productivity to assess whether the firm pays a fair wage.[5] More specifically, the rent Ω is defined as

$$\Omega \equiv \left(\frac{w_i}{(Y_i/N_i)^{\upsilon}} \right)^{\rho} \cdot \left(\frac{w_i}{\overline{w}} \right)^{(1-\rho)}, \qquad 0 \leq \rho \leq 1, \quad 0 < \upsilon < 1 \tag{2}$$

The rent therefore is a weighted average of a fairness (or psychological) rent (the first term) and a material rent (the second term) with ρ being the weight of these utility components. Considering the extreme case of $\rho = 0$ the immaterial component vanishes and what remains is the traditional rent maximizing labor union (what will be called the standard case later on). In this case, employees only care about their material rent. The expected alternative income $\overline{w}$ is the outside option of the worker and serves as kind of reference wage which determines the lower bound of the rent. If the earned wage does not exceed the reference wage, the rent equals zero and so does utility. In the general case, with $0 < \rho < 1$, workers additionally care about the profitability of their employer. They compare their wage with a function of average productivity Y_i/N_i, where Y_i denotes the firm's output, to assess whether the firm pays a fair wage. If the earned wage is higher than this fairness reference workers derive psychological utility from it. The idea behind is, that employees who work in a highly profitable firm but do not earn much more than the outside option feel treated unfairly because they contribute to the firm's performance. This is mirrored by the principle of dual entitlement (Kahneman, Knetsch, and Thaler, 1986b). Workers think to have an entitlement (a moral property right) to the terms of the reference level. This kind of utility workers derive when treated fairly is immaterial in nature (fairness utility) because they can not buy more consumption goods of it (as they clearly can do when the wage exceeds the outside option). Because it is impossible to have the wage higher than average productivity, the latter is reduced by the exponent $0 < \upsilon < 1$.

Overall utility derived from being treated fairly and from consumption does not only depend on the size of the rents but also on the weights of the rents, namely ρ as a weight for fairness utility and $(1 - \rho)$ as a weight for material utility. We call ρ the fairness

[5] This is called the internal reference by Danthine and Kurmann (2007).

parameter. The higher ρ the more a worker cares about fairness, the lower ρ the more important is the consumption rent. Now, it might well be, that some workers just care about their relative consumption opportunities but it appears to be closer to reality that workers additionally do care, at least to some extent, about fairness. In line with this notion there already exists some theoretical literature which aims to incorporate the above mentioned results from experimental economics.

The first work to mention is the one from Danthine and Kurmann (2006, 2007) who set up a fairness based utility function in efficiency wage models. They developed the so called "internal reference perspective", which is used in this paper, too. However, here it gains a different working mode, more in line with the theory. References are crucial to perform judgments of fairness (Kahneman, Knetsch, and Thaler, 1986a). The choice of these reference transactions are subject to framing effects (Tversky and Kahneman, 1986 and Kubon-Gilke, 1990) which makes it rather implausible to determine a reference as weighted average of two references as done by Danthine and Kurmann. In contrast, our approach includes the possibility to derive utility from fairness as well as consumption with each having a single reference level. The notion to incorporate material and fairness utility is already to be found in a paper of Rabin (1993) which is also used as starting point by Danthine and Kurmann (2007). However, the approach of Rabin, as well as the one from Danthine and Kurmann model fairness and material utility as perfect substitutes (Nelson, 2001) which violates the convincing assumption of diminishing marginal rates of substitution. In our model, the worker accepts to give up some material utility in order to be treated more fairly or to put it the other way round, he accepts some unfairness if he is materially compensated. The marginal rate of substitution is determined by the fairness parameter ρ.

In connection with the wage determination in labor markets with union rivalry (Oswald, 1979 and Gylfason and Lindbeck, 1984) fairness considerations in form of a so called "envy effect" already came up in unions' utility function. The idea behind is that unions aim at just wage differentials, which in a sense is exactly what unions do in our model. However, in the mentioned papers, the reference level is given by the expected real wages

of the members of the other unions.[6] This fairness component yet found its expression in the Calmfors-Driffil hypothesis (Calmfors, 1993) but was not developed any further theoretically.

To summarize, our approach is in large parts rather conventional but includes some notable exceptions. First, workers do not care only about material welfare but also about fairness. They feel to be entitled to some share of the achieved revenue (theory of dual entitlement). Second, we use insights of descriptive decision theory, more precisely prospect theory to evaluate transactions relative to a reference point. Unions care about the wage differential. Third, the choice of the reference level is subject to framing effects. Employees choose the outside option as reference level for material utility and average labor productivity as reference for fairness utility.[7] Additionally fairness is traded off against other goods (i.e. consumption) what we think comes closest to human behavior and fulfills the economic standard assumption.

3 The Model

3.1 A micro level analysis

The goods market is described by the standard monopolistic competition framework.[8] There is a continuum of firms, indexed by $i \in [0, 1]$, in the economy. Each firm produces a differentiated product and faces a goods demand function of the form:

$$Y_i = p_i^{-\eta} Y \qquad \text{with} \quad \eta > 1, \tag{3}$$

where p_i is the price of the firm's product relative to the aggregate price level. The elasticity of the demand for goods is constant and equals η (in absolute values). The variable Y denotes an index of aggregate output which from the firm's point of view is taken to be exogenous because of the assumed large number of firms. Of course, in

[6] This is why it is called envy effect.

[7] However, preferences are not reference-dependent, see Sandbu (2008) and Munro and Sugden (2003).

[8] See Blanchard and Kiyotaki (1987) for details.

the general equilibrium Y is itself an endogenous variable. The production function is subject to diminishing marginal returns to labor which are important for the workings of the model later on:

$$Y_i = AN_i^{\alpha} \qquad \text{with} \quad 0 < \alpha < 1 \tag{4}$$

Profit maximization of the firm leads to the following (inverse) labor demand (LD) function:

$$w_i = \frac{\eta - 1}{\eta} \alpha A^{\frac{\eta-1}{\eta}} Y^{\frac{1}{\eta}} N_i^{-\frac{\alpha+(1-\alpha)\eta}{\eta}} \tag{5}$$

The utility function of the labor union is given by eq. (1) in combination with eq. (2) that differs markedly from the standard rent-maximizing union. The marginal rate of substitution (MRS) between employment and wages is given by:

$$\left.\frac{dw_i}{dN_i}\right|_{U=\overline{U}} = \left|\frac{\partial U_i/\partial N_i}{\partial U_i/\partial w_i}\right| = \frac{lnw_i - \rho\upsilon ln\left(Y_i/N_i\right) - (1-\rho)ln\overline{w} + \rho\upsilon(1-\alpha)}{N_i/w_i} \tag{6}$$

This expression can be easily compared with the MRS of the standard model by setting ρ, the fairness parameter, equal to zero. In this case results:

$$\left.\frac{dw_i}{dN_i}^{s}\right|_{U=\overline{U}} = \left|\frac{\partial U_i/\partial N_i}{\partial U_i/\partial w_i}\right| = \frac{lnw_i - ln\overline{w}}{N_i/w_i} \tag{7}$$

Obviously, the difference in the MRS, and therefore in the slope of the indifference curve, is determined by the marginal utility of employment. In the standard case U_{N_i} denotes the (material) rent which the marginal worker receives. In our setting however, U_{N_i} denotes the (combined) rent which the marginal worker receives plus the change of the fairness utility for all workers already employed. If the firm raises employment, the fairness reference level decreases because of the diminishing marginal returns to labor. This leads to an increased differential to the wage paid, thus increasing fairness utility. Additionally to the modified rent, this positive influence of employment on marginal utility is absent in the standard case. Finally marginal utility of employment might be higher, equal or lower compared to the standard case, and therefore determining the trade-off between

wages and employment. We can distinguish between the following three cases:

$$\begin{aligned}
&\text{MRS} < \text{MRS}^s \quad \text{for} \quad \upsilon ln\left(\frac{Y_i}{N_i}\right) > \upsilon(1-\alpha) + ln\overline{w} \qquad \text{case 1}\\
&\text{MRS} = \text{MRS}^s \quad \text{for} \quad \upsilon ln\left(\frac{Y_i}{N_i}\right) = \upsilon(1-\alpha) + ln\overline{w} \qquad \text{case 2}\\
&\text{MRS} > \text{MRS}^s \quad \text{for} \quad \upsilon ln\left(\frac{Y_i}{N_i}\right) < \upsilon(1-\alpha) + ln\overline{w} \qquad \text{case 3}
\end{aligned}$$

In case 1 U_{N_i} is smaller than in the standard case, which leads the union to be willing to give up more employment for an increase in wages. Thus, the indifference curve runs more flat in the $w_i - N_i$ space. This case occurs when the fairness reference is of such a size that the rent of the marginal worker plus the change of the fairness utility of all workers already employed is below the standard rent. Of course it is possible, that things are equal as in case 2, meaning, that the lower modified rent of the marginal employee plus the change of the rent of the workers already employed are of the same size as the standard rent. Case 3 is the exact opposite of case 1, here, the positive effect of the change in the rent of all workers already employed dominates and the union is less willing to give up employment for higher wages. Note, that these cases are totally independent of the fairness weight ρ. What matters is the size of the references.

We now consider a monopoly union model instead of a bargaining model in order to keep the analysis as simple as possible.[9] Consequently unions maximize their utility subject to the labor demand of the firm. Taking account of the labor demand function in eq. (5), the maximization of union utility in eq. (1) and eq. (2) leads to:

$$\underbrace{N_i\left[\overbrace{\frac{1}{w_i}}^{mat.\ util.} \quad \overbrace{+\rho\upsilon(1-\alpha)\frac{1}{N_i}\frac{\partial N_i}{\partial w_i}}^{N_i\downarrow\ fair.\ ref.\uparrow\ psych.\ util.\downarrow}\right]}_{marginal\ utility\ of\ an\ increase\ in\ w} = \underbrace{-\frac{\partial N_i}{\partial w_i}\left[lnw_i - \rho\upsilon ln\left(AN_i^{\alpha-1}\right) - (1-\rho)ln\overline{w}\right]}_{marginal\ costs\ :\ marginal\ employed\ loose\ U_i} \quad (8)$$

Wages are set such that marginal utility equals marginal costs. If wages increase, marginal utility is determined by the increase in material utility reduced by fairness

[9] A Nash bargaining model would lead to the same qualitative results.

disutility. Fairness disutility emerges, because via labor demand an increase in wages leads to a decrease in employment, which again, due to diminishing marginal returns, increases average labor productivity and therefore the fairness reference. In the end the higher reference leads to smaller differential which provides a decrease in fairness utility. This reaction unequivocally has a smaller marginal utility of an increase in wages as consequence. Thus, disregarding marginal costs, fairness attenuates wage pressure. However, the increase in wages also influences marginal costs. Given the higher fairness reference, the rent which the marginal employed worker has to loose gets smaller. Finally marginal costs of an increase in wages are decreasing, which unequivocally fosters wage pressure. Now, taken marginal utility and costs together it depends upon the above derived cases if the influence of fairness considerations lowers marginal costs more than marginal utility or vice versa. In case 1 the effect on marginal costs dominates the effect on marginal utility, case 3 is the opposite and in case 2 both effects cancel out (standard case).

In the optimum wages are set as markup upon the fairness reference and the outside option. From eq. (8) it follows that

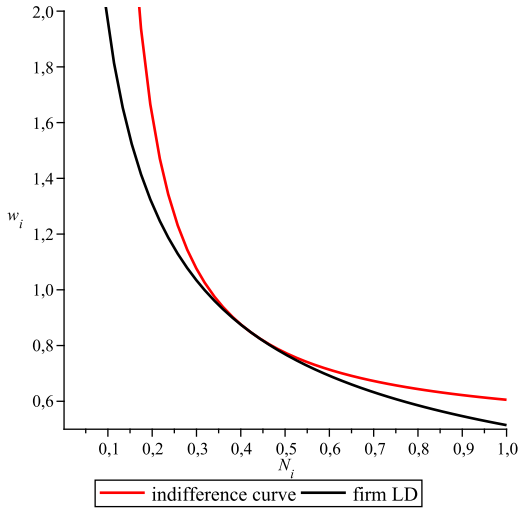
$$ln w_i^* = \frac{\alpha + (1-\alpha)\eta}{\eta} - \rho\upsilon(1-\alpha) + \rho\upsilon ln\left(AN_i^{*(\alpha-1)}\right) + (1-\rho) ln\overline{w} \tag{9}$$

In the standard case, wages are set as markup on the outside option only.

$$ln {w_i}^{s*} = \frac{\alpha + (1-\alpha)\eta}{\eta} + ln\overline{w} \tag{10}$$

Considering the above given parameter restrictions the markup in our model is always smaller than the standard markup, which is due to the change of the rent of all workers already employed (which has a negative effect on the marginal utility of an increase in wages). Having the markup smaller than in the standard case, the question arises, if the optimal wage set is higher or lower than in the standard case. Of course, this depends on how fairness influences marginal utility and costs. If the influence reduces marginal costs stronger than marginal utility the wage set is to be higher than in the standard case (case 1). Case 3 produces the opposite and in case 2 both effects cancel out. Given the

Figure 1: Optimal wage and employment in the standard model



impact on the optimal wage, optimal employment is affected exactly the other way round.

$$w_i^* > w_i^{s*} \quad \text{and} \quad N_i^* < N_i^{s*} \qquad \text{for case 1} \tag{11}$$

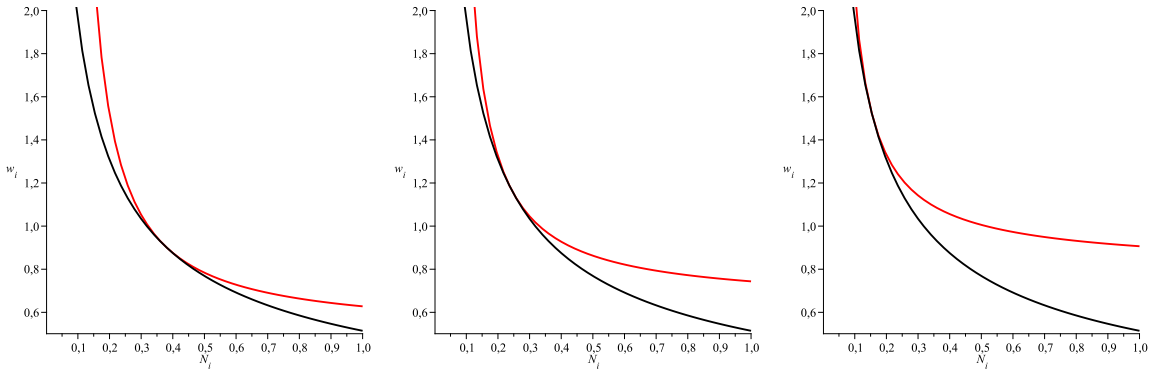
$$w_i^* = w_i^{s*} \quad \text{and} \quad N_i^* = N_i^{s*} \qquad \text{for case 2} \tag{12}$$

$$w_i^* < w_i^{s*} \quad \text{and} \quad N_i^* > N_i^{s*} \qquad \text{for case 3} \tag{13}$$

In order to graphically demonstrate the consequences of an increase in the fairness parameter ρ, we parameterize the model as follows: $\alpha = 0.7 \quad \frac{Y}{r} = 10.1 \quad \eta = 2.5 \quad A = 0.3 \quad \overline{w} = 0.47$. The optimal employment decision of the firm and the optimal wage set by the union are given by the tangential point of the union's indifference curve and the firm's labor demand curve. Figure 1 denotes the standard case.

Now, imagine a change in the fairness parameter ρ in case 1 ($\upsilon = 0.1$). Here the fairness considerations reduce marginal costs of a wage increase relatively more than marginal utility. If workers' fairness parameter increases additionally, implying that unions do care increasingly about fairness utility the optimal wage set by the union will increase and employment will decrease. See figure 2. That is exactly what happens. Union's

Figure 2: Variation of the fairness parameter in the general model ($\upsilon = 0.1$)



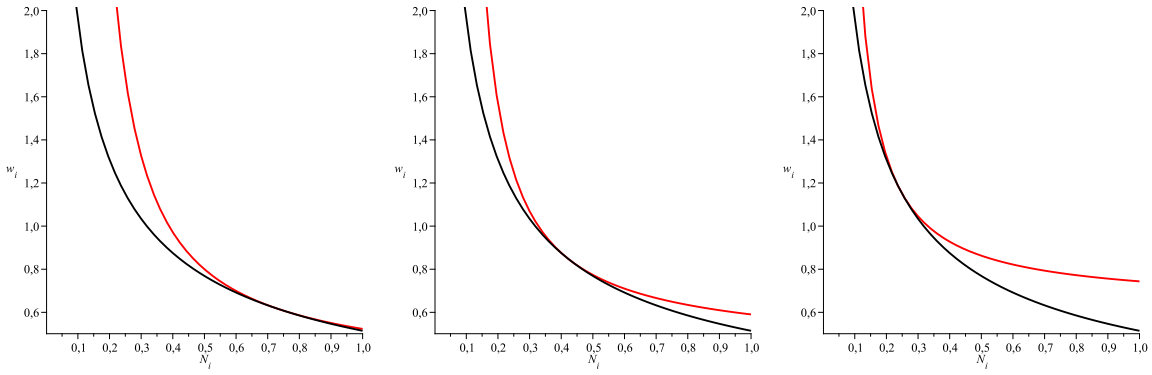
(a) $\rho = 0.1$ (b) $\rho = 0.5$ (c) $\rho = 0.9$

indifference curve "rolls" along firm labor demand leading to an increase in wages and a decrease in employment. However the effect of the fairness parameter is not one way. Holding $\rho = 0.5$ you can show that it also depends on the size of the references how union's wage setting behavior is shaped. We thus consider υ to change, leaving labor demand unaffected. Figure 3 shows, that apart from the fairness parameter the cases 1 to 3 matter how unions set wages. Increasing the fairness reference (via a lower υ[10] leads to a relative stronger effect on marginal costs than on marginal utility therefore leading to higher wages and lower employment.

We thus conclude from the analysis of the wage setting behavior of a single union, that it is not only the fairness parameter of the workers (which measures how big the trade off (MRS) between fairness utility and material welfare is) which determines wage setting but also the size of the references. References they choose to evaluate transactions. Finally it is not only about if and to what extent people care about fairness, but how they do care about fairness. The interplay of the fairness parameter ρ and the size of the fairness

[10]This is due to the parametrization of the model

Figure 3: Variation of the fairness reference in the general model



(a) case 3 ($\upsilon = 0.99$) (b) case 2 ($\upsilon = 0.6$) (c) case 1 ($\upsilon = 0.1$)

reference (modeled by changes in υ) dominate the outcome on the firm level, suggesting to play an important role in determining the aggregate outcome, too. Therefore we will analyze the macro level in the next section.

3.2 A macro level analysis

Along with the continuum of firms, we assume, that workers are homogenous and given by a [0-1] continuum such that $N_i = n$. n is therefore to be interpreted as employment rate. In equilibrium all prices and wages are identical, thus $p_i = 1$ and $w_i = w$. Because of eq. (5) aggregate labor demand is then given by:

$$w = \frac{\eta - 1}{\eta} \alpha A n^{\alpha - 1} \tag{14}$$

The exogenous outside option for the workers of a single union becomes endogenous, workers get a job and earn w with a probability of n or get unemployed with a probability of $1 - n$. Thus the outside option modifies to: $\overline{w} = w^n b^{1-n}$ with b denoting unemployment benefits. Additionally considering the above given equilibrium conditions,

the wage-setting curve (WS) is derived from eq. (9):

$$lnw = \frac{\frac{\alpha+\eta(1-\alpha)(1-\rho\upsilon)}{\eta} + \rho\upsilon ln\left(An^{(\alpha-1)}\right) + (1-\rho)(1-n)lnb}{1-(1-\rho)n} \tag{15}$$

In the standard model you get a wage-setting curve with the wage set as markup on unemployment compensation (standard rent-maximizing union):

$$lnw^s = \frac{\alpha+(1-\alpha)\eta}{(1-n)\eta} + lnb \tag{16}$$

However, if the union cares about fairness, too, wages are set as markup on the fairness reference plus the outside option. Graphically, equilibrium wages and employment are given by the intersection of the labor demand and the wage–setting curve. Against the backdrop of the analysis of union behavior on the micro level it is of interest how the aggregate equilibrium is affected by changes in the fairness parameter and the size of the references. Similarly to the analysis in section 3.1 we will model a change in the size of the fairness reference via a change in υ. Both parameters, ρ and υ, are comprised only in the wage-setting equation leaving labor demand unaffected when varied. This makes it markedly easier to compare the results.

The wage-setting curve represents the aggregated wage decisions of all unions. We know, that changes in the fairness parameter and the size of the fairness reference influence the union's objectives and therefore position, slope and curvature of the indifference curve. Given this knowledge it can be expected that the position, slope and curvature of the wage-setting curve changes along some logical link to the micro-level. This is why we first check the properties of the WS curve without changing ρ and υ and mark them off against the standard case. The slope of the WS curve is given by:

$$\frac{\partial lnw}{\partial n} = \frac{\frac{\alpha(1-\rho)-(1-\alpha)\eta\left[\rho\upsilon\frac{1}{n}-(1-\rho)\right]}{\eta} + (1-\rho)\rho\upsilon ln\left(An^{(\alpha-1)}\right) - (1-\rho)\rho lnb}{\left[(1-(1-\rho)n)\right]^2} \tag{17}$$

Obviously the WS curve can be neither strictly monotonously falling nor rising but the slope depends on the level of employment. We will focus on the numerator since the denominator plays no role regarding the sign of the derivative. If employment is low,

the WS curve has a negative slope because of the diminishing marginal returns to labor (focus on the left term in the numerator). With rising employment the slope becomes less negative and then equals zero at some value for n. Thereafter, the slope switches signs and becomes positive. The size of ρ and υ heavily influence the critical point of n at which the slope switches signs. The greater the two parameters, the later the WS curve bends upwards, or to put it the other way round, the longer (and steeper) the WS curve is downward sloping (which may be up to $n = 1$). Having the two variables approaching zero, or, more precise, having the product of the two variables approaching zero, the downward sloping section of the WS curve gets infinitely small, even for very low values of n. Finally the WS curve approaches the course of a standard WS curve (of a only material rent maximizing union). It can be concluded that the fairness parameter, as well as the self-serving bias matter substantially for the slope of the WS curve.

However, the size of these parameters does not play any role in determining the sign of the curvature of the wage-setting curve:

$$\frac{\partial^2 lnw}{\partial n^2} = \frac{\frac{(\alpha-1)\eta\left[4(1-\rho)\rho\upsilon\frac{1}{n}-\rho\upsilon\frac{1}{n^2}-\rho\upsilon(1-\rho)^2-2(1-\rho)^2\right]}{\eta} + 2(1-\rho)^2\rho\upsilon ln\left(An^{(\alpha-1)}\right) - 2(1-\rho)^2\rho lnb}{\left[(1-(1-\rho)n)\right]^3} > 0 \quad (18)$$

We assume, that $\upsilon ln(An^{(\alpha-1)}) > lnb$ insofar the unemployment compensation subtracted can not turn the sign negative. It appears rather implausible that workers choose a fairness reference which is below unemployment benefits. Without the restriction it could be possible, that workers employed in a highly profitable firm with high average productivity and a low υ evaluate wages along some implausible low reference. The term in front of the fraction is positive for all variables as defined above and for all values of $0 < n < 1$. Finally the change of the slope of the WS curve is positive, assuring that it is convex. Setting ρ equal one and considering that $\lim_{\upsilon \to 1}$ you can see, that the WS curve is above labor demand if n approaches 1 and vice versa if n approaches 0. Thus considering convexity and the asymptotic behavior we rule out multiple equilibria.

Now, as we know of the characteristics of the WS curve it is much easier to grasp how it reacts on changes in the aforementioned variables. As in section 3.1 we will have look

at changes in the fairness parameter first. If ρ changes, the WS curve shifts according to:

$$\left.\frac{\partial lnw}{\partial \rho}\right|_n = \frac{-\frac{(1-\alpha)\eta[(1-n)\upsilon+n]+\alpha n}{\eta} + (1-n)\upsilon ln\left(An^{(\alpha-1)}\right) - (1-n)lnb}{[(1-(1-\rho)n)]^2} \tag{19}$$

Given the cases from the micro level you can show, that the WS curve shifts exactly according to the macro pendants of these cases. Using the equilibrium conditions, the cases change to:

$$\begin{aligned}
\upsilon ln\left(An^{\alpha-1}\right) &> \frac{(1-\alpha)\eta[(1-n)\upsilon+n]+\alpha n}{(1-n)\eta} + lnb \quad \text{case } 1' \\
\upsilon ln\left(An^{\alpha-1}\right) &= \frac{(1-\alpha)\eta[(1-n)\upsilon+n]+\alpha n}{(1-n)\eta} + lnb \quad \text{case } 2' \\
\upsilon ln\left(An^{\alpha-1}\right) &< \frac{(1-\alpha)\eta[(1-n)\upsilon+n]+\alpha n}{(1-n)\eta} + lnb \quad \text{case } 3'
\end{aligned}$$

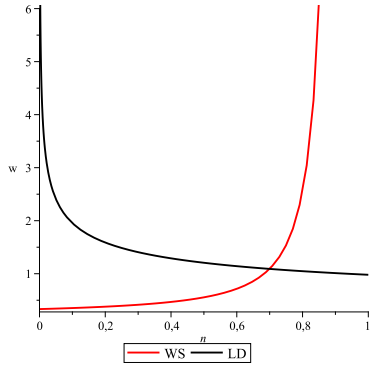
It follows that

$$\begin{aligned}
\left.\frac{\partial lnw}{\partial \rho}\right|_n &> 0 \qquad \text{for case } 1' \\
\left.\frac{\partial lnw}{\partial \rho}\right|_n &= 0 \qquad \text{for case } 2' \\
\left.\frac{\partial lnw}{\partial \rho}\right|_n &< 0 \qquad \text{for case } 3'
\end{aligned}$$

We know from the micro level that in case 1 an increase in ρ leads to an increase in the optimal wage set by the union. At the macro level we can show that an increase in ρ leads to an upward shift of the WS curve (case $1'$). The lower marginal utility of employment which leads unions to set higher wages is reflected by an upward shifted WS curve on the aggregate level. In case $2'$ the WS curve does not move and in case $3'$ the WS curve is shifted downwards. However, the WS curve is not shifted in some "parallel" way but is "rotated", similar to the indifference curve on the micro level. Studying the cases shows that the fairness reference on the left side and the first term on the right side depend on the level of employment. Now, at very low levels of employment case $1'$ is valid. The increase in ρ leads to higher wages because of the relatively stronger effect on marginal costs than on marginal utility of a wage increase. Due to this effect, the left tail of the WS curve kind of "bends" or shifts upwards. With increasing employment, the fairness

reference decreases (because of α) but the term on the right sight increases substantially leading to case $2'$ and immediately after that to case $3'$. Now, the increase in ρ leads to an relatively stronger negative effect on marginal utility of a wage increase. Lower wages are set, thus this section of the WS curve shifts downwards. Case $2'$ is given for some value of n where the WS curve does not move. To conclude, all cases are valid for one single WS curve. Case case $1'$ is relevant for the "left" section where the curve moves upwards (low levels of employment), case $2'$ is the limit and case $3'$ counts for the "right" section where the curve moves downwards (at higher levels of employment). This is why it appears as if the WS curve "rotates" in $w - n$ space.

Figure 4: Equilibrium wage and employment in the standard model

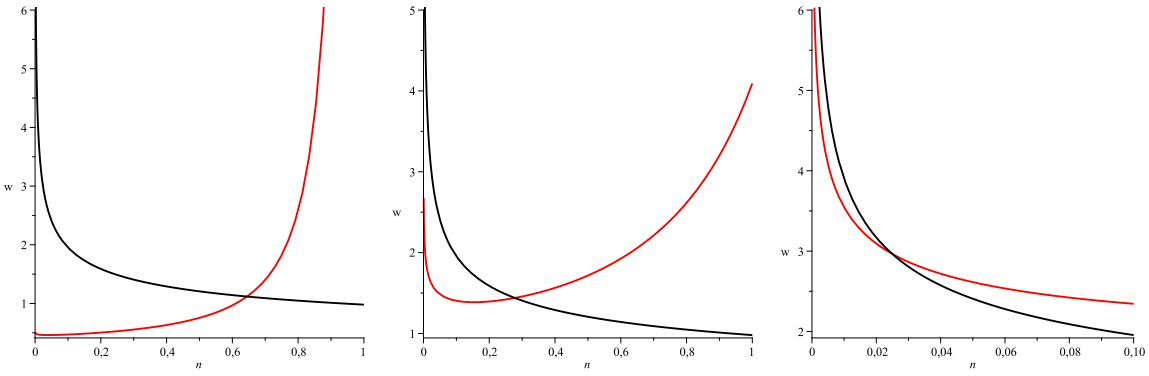


We parameterize the model as follows $\alpha = 0.7 \quad \eta = 3.\overline{3} \quad A = 2 \quad b = 0.2$. In the standard case, labor market equilibrium is given by the intersection of a strictly increasing WS curve and the labor demand curve, as plotted in figure 4. If the union cares about fairness it depends on how much it does. If the fairness parameter is very low, hence the union is focused on material welfare, the WS curve runs very much like in the standard case. However with rising ρ the WS curve shifts and changes the slope.

Due to the parametrization which provides a major difference between the outside option and the fairness reference, we provide case $1'$ to hold for some higher values of employment. Decreasing the difference leads to the same results but the WS curve and

the the intersection with labor demand are pushed into the left corner (case $3'$ comes earlier into effect). We show in figure 5, that given a high fairness reference the WS curve rotates in the $w-n$ space if ρ increases leading to a higher equilibrium wage and lower employment. This is because the left tail of the curve shifts faster upwards than the right tail is able to shift downwards.

Figure 5: Variation of the fairness parameter on the macro level ($\upsilon = 0.99$)



(a) $\rho = 0.1$ (b) $\rho = 0.5$ (c) $\rho = 0.7$

Given the effect of a change in ρ it is of interest how the differential between the references matters. Changing υ leads to a shift of the WS curve:

$$\frac{\partial lnw}{\partial \upsilon} = \frac{\rho}{1-(1-\rho)n}\left[\alpha - 1 + ln(An^{\alpha-1})\right] \tag{20}$$

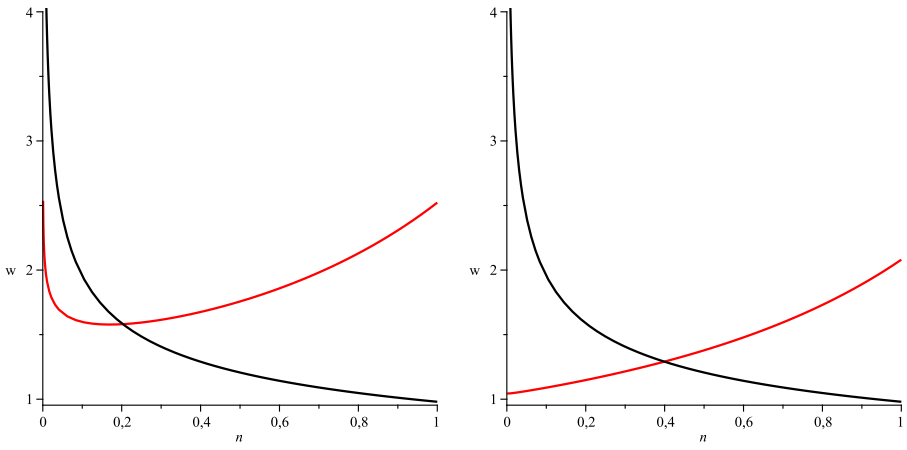
The WS curve is affected in some similar ways to changes in ρ. If υ changes, it has an effect on marginal costs as well as on marginal utility of an wage increase. As one can see in the term in brackets, the change in the rent of all workers already employed $(\alpha - 1)$ is set against the change in the size of the fairness reference. Again, the latter decreases with higher employment. For some low value of A and at rather low employment (left tail) the WS curve shifts upwards and at higher employment (right tail) the WS curve

shifts downwards.[11] However, above some value for A it is strictly positive, so the left tail shifts stronger upwards than the right one. Consequently, the curve shifts upwards with both tails being bent upwards, simultaneously. The change of the slope of the WS is determined according to these distinctions, too:

$$\frac{\partial \frac{\partial lnw}{\partial n}}{\partial \upsilon} = \frac{\rho}{[1-(1-\rho)n]^2}\left[(\alpha-1)\frac{1}{n} + (1-\rho)ln(An^{\alpha-1})\right] \tag{21}$$

For a lower value of A, the change of the slope is negative for all levels of n if one increases υ. If A is higher, the change of the slope is negative for low levels of employment but it is positive for higher levels of n reflecting the fact that both tails bend upwards.[12]

Figure 6: Variation of the fairness reference on the macro level ($\rho = 0.7$)



(a) $\upsilon = 0.5$ (b) $\upsilon = 0.01$

We now consider a change in υ, more precisely we decrease the fairness reference but leave the union with a high preference for fairness ($\rho = 0.7$). We start with a decrease in υ to 0.5 and finally to 0.01 in figure 6. By decreasing the fairness reference, the WS curve

[11] We have to set $A > 1$ to control that an increase in υ leads to an increase in the fairness reference.

[12] In our parametrization $A = 2$ is "high". However this has no qualitative effects on the following analysis.

gains back bit by bit its original upward-sloping shape, (the left tail is relatively stronger affected).

As predicted by the analysis of the micro level, the fairness parameter as well as the fairness reference have a major impact on the aggregate outcome. Compared to the standard case an increase of ρ leads always to an increase in wages. However this effect depends heavily on the size of the fairness reference. The higher the fairness parameter, the stronger are the effects of changes in the size of the reference, and the higher the reference the higher are the effects triggered by changes in the fairness parameter. Given a high fairness parameter and a high fairness reference, WS is downward sloping, wages increase and employment decreases. With a low reference size, WS is upward sloping despite a high fairness parameter. If the fairness parameter approaches zero, WS is upward sloping independently of the size of the fairness reference.

4 Macroeconomic implications of technology shocks

Given the different possible shapes of the wage-setting curve it is interesting to see how the general equilibrium is affected by macroeconomic shocks. In this version of the paper we will consider an adverse technology shock that reduces A. As a consequence, labor demand is shifted downwards, since

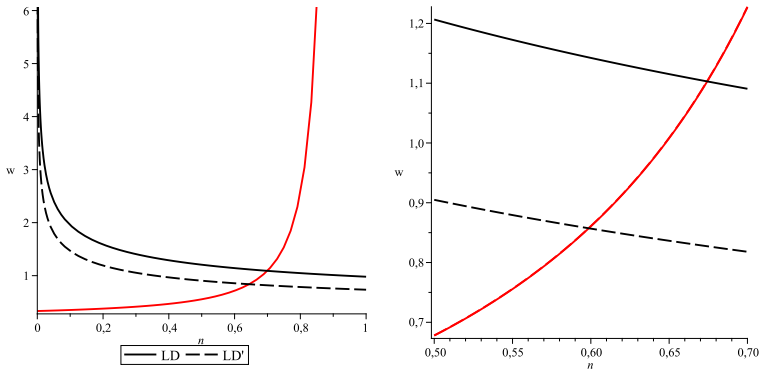
$$\left.\frac{\partial lnw}{\partial A}\right|_n = \frac{1}{A} > 0 \tag{22}$$

Contrary to the standard case, in our model, the technology parameter is part of the fairness reference thus the WS curve is affected by changes in A as well:

$$\left.\frac{\partial lnw}{\partial A}\right|_n = \frac{\rho\upsilon\frac{1}{A}}{1-(1-\rho)n} > 0 \tag{23}$$

A technology shock does not only shift labor demand, but also the WS curve downwards. However, as is evident from the derivative, it matters heavily how much the union cares about fairness and of which size the fairness reference is (size of ρ and υ).

Figure 7: Technology shock



(a) standard case (b) $\rho = 0.1 \quad \upsilon = 0.01$

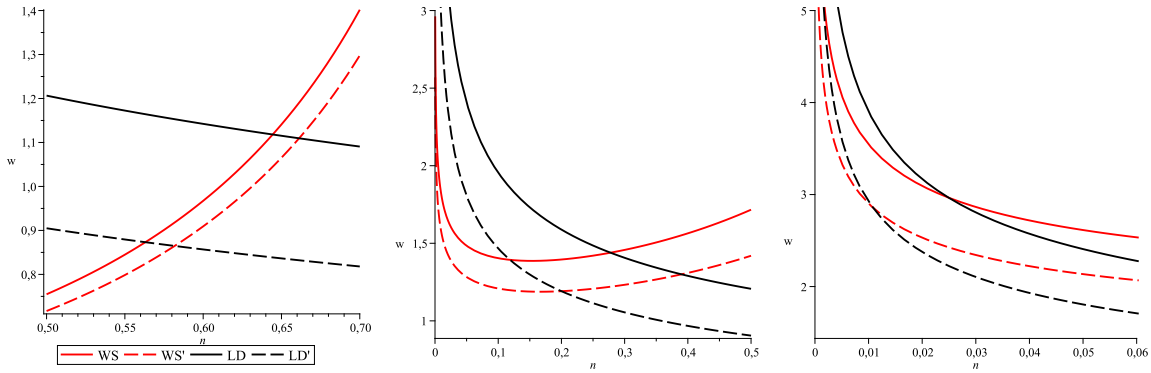
$$\lim_{\rho,\upsilon \to 0} \frac{\rho\upsilon}{1-(1-\rho)n} = 0 \tag{24}$$

$$\lim_{\rho,\upsilon \to 1} \frac{\rho\upsilon}{1-(1-\rho)n} = 1 \tag{25}$$

If one of the parameters approaches zero, the WS curve merely does not shift at all and behaves as in the standard case (see figure 7). The shock leads to a significant decrease in employment and wages. Of course, this meets our expectations. A union with a small differential between the references chosen and a low preference for fairness is not to distinguish from a conventional rent maximizing union. However, if the fairness reference is high, the WS curve shifts the more the union cares about fairness (see figure 8):

We know from eq. (15) that wages are set as markup on the weighted references. Now, if the fairness reference decreases because of the technology shock wages decrease accordingly, at all levels of employment. Consequently, the higher the fairness parameter (the relative weight of the fairness reference) was, the stronger are the reactions in wages, the more shifts the WS curve downwards. However, the different levels of ρ have, as discussed in the last section, a major impact on the shape of the WS curve. Therefore, as you can see in figure (8), the technology shock evokes different reactions on the equilibrium. The

Figure 8: Technology shock for different fairness parameter ($\upsilon = 0.99$)



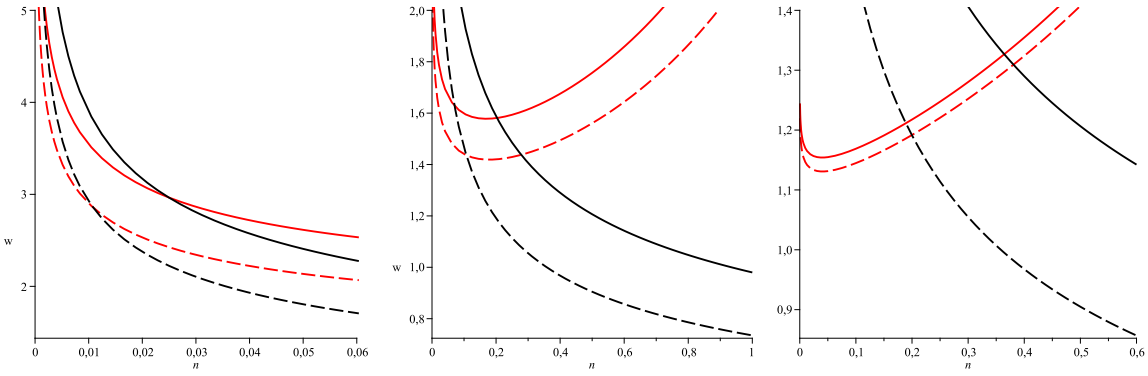
(a) $\rho = 0.1$ (b) $\rho = 0.5$ (c) $\rho = 0.7$

higher the preference for fairness, the more slopes the WS curve downwards, and the more the accommodation takes place in terms of employment. Comparably to the results of Danthine and Kurmann, (2007) fairness leads to real wage rigidity.

However, to get to these results, you are in need of a high fairness reference, which leads case $1'$ to hold for higher levels of employment, leaving the WS curve longer downward sloping. If you decrease the size of the fairness reference by lowering υ case $3'$ comes earlier into effect and the WS curve bends earlier upwards (see above). Performing a technology shock in this setting evokes different results, see figure (9):

At lower levels of the fairness reference, the instilled wage rigidity by a high fairness parameter vanishes, at least for some part. Decreasing υ makes case $3'$ to hold earlier, which anew leads to the fact that the WS curve intersects labor demand when already upward sloping. For a very small fairness reference ($\upsilon = 0.1$) the reaction in wages is markedly higher than for a high fairness reference ($\upsilon = 0.99$) even if in both cases the union cares a lot about fairness ($\rho = 0.7$). As pointed out in the analysis above, the interplay of both parameters is crucial. Having the union caring a lot about fairness does not necessarily lead to high wage rigidity. It deeply matters which fairness reference is

Figure 9: Technology shock for different sizes of the fairness reference ($\rho = 0.7$)



(a) $\upsilon = 0.99$ (b) $\upsilon = 0.5$ (c) $\upsilon = 0.1$

chosen.

In addition, compared to the standard case, the WS curve in figure (9c) is not that fast upward sloping, hence there still is less reaction in wages and more in terms of employment. With the inclusion of fairness considerations, we therefore do have increasing rigidity in wages but comply to the empirically observed fact that WS curves seem to be upward sloping. If you consider figure (8b), for example, the results are similar. The WS curve is mainly upward sloping, obeying the empirical regularity, however, there is much less movement in wages and much more movement in employment compared to the standard case. Finally, including fairness instills wage rigidity but it highly depends on the fairness parameter as well as on the size of the references. Moreover we are able to show that fairness makes wages more rigid without having the WS curve violating empirical observed regularities.

5 Conclusions

In this paper we show that fairness considerations produce a different wage-setting behavior in unionized labor markets than derived in conventional models. On the micro level it is crucial how fairness affects marginal utility and marginal costs of an increase in wages. It has a reducing effect on both quantities, however what matters is the force of one effect relative to the other. If marginal costs are affected more strongly, higher wages are set and lower firm employment results (case 1). If marginal utility is affected more strongly, the opposite happens, lower wages are set and higher firm employment results (case 3). The relative force of these effects is determined by the size of the references. Given a change in the fairness parameter, it depends on the cases (the size of the reference) how the wage-setting behavior of the union is affected.

The different cases derived on the micro level also have a major impact on the shape of the wage–setting curve on the macro level. If marginal costs of an increase in wages are affected more strongly, the WS curve shifts upwards. If marginal utility is affected more strongly, it shifts downwards. However the cases do not produce a kind of parallel shift of the WS curve but a rotation in the $w - n$ space. Depending on the fairness parameter and the size of the references the WS curve has a downward sloping section as well as an upward sloping section, thus is given by a u-form. This is due to the fact that employment enters negatively into the fairness reference because it decreases average productivity. A change in the fairness parameter then leads to an upward shift of the downward sloping section of the WS curve, and to an downward shift of the upward sloping section. These effects produce the rotation. However, if and how long the WS curve is downward sloping depends heavily on the size of the fairness reference and the fairness parameter. Thus it is possible to have a union which cares much about fairness but the WS curve is nevertheless upward sloping.

Given the different possible shapes of the WS curve we can show that the economy may react in different ways to an adverse technology shock. In any case, the economy reacts with an decrease in wages and employment. However it depends on the interplay of

the fairness parameter and the size of the fairness reference how much of the adjustment is done in wages and how much is done in employment. Comparably to the efficiency wage model of Danthine and Kurmann (2007) we can show that increasing the fairness parameter leads to wage rigidity. However, this heavily depends on the size of the reference. Moreover, we show that for some combinations of ρ and υ the WS curve remains upward sloping, thus complying empirical insights, and still generates wage rigidity.

To summarize, it does not only matter if workers care about fairness, but how they do. The size of the fairness reference chosen and its interplay with the fairness parameter is crucial and matters for the wage-setting behavior of unions as well as for the economy as a whole and its reaction on shocks.

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