Labor Unions and Fairness

A New Perspective on the Wage–Setting Process*

Matthias Strifler and Thomas Beissinger‡

University of Hohenheim and IZA, Bonn

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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. Both parameters influence the union's objectives and therefore determine the shape of the wage-setting curve on the macro level. In contrast to the existing literature we find that fairness might not only lead to higher aggregate wage pressure and unemployment but the opposite. 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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‡University of Hohenheim, Department of Economics, Schloss, Museumsfluegel, D-70593 Stuttgart, Germany, e-mail: m.strifler@uni-hohenheim.de and beissinger@uni-hohenheim.de

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)[3].

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

[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).

[3] There exists some literature which pursued the wage reference perspective, see Pehkonen, 1990 to explain wage rigidity

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 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[4]. Since we have little knowledge about trade union's objectives because they are unobservable it is at most as false to assume that workers and therefore unions care about fairness than to assume that they do not.[5] Given all the experimental evidence and the belonging groundwork from other (social) sciences it seems even to be more unjustifiable 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:

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

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 $\overline{w}$

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

[5]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.

the worker would earn when he or she is not employed at firm i.[6] 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 of Danthine and Kurmann (2007) the workers compare their wage with the average firm productivity to assess whether the firm pays a fair wage.[7] More specifically, the rent Ω_i is defined as

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

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.[8] 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

[6] We implicitly assume that unions give employment and Ω_i the same weight.

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

[8] Given the Cobb-Douglas structure ρ determines the marginal rate of substitution among material and immaterial welfare.

they clearly can do when the wage exceeds the outside option). To ensure a positive profit margin, wages can not be higher than average productivity, so the latter is reduced by the exponent $0 < \upsilon < 1$. Employees know that and act rationally in not demanding wages to be higher than average productivity. All of them would become unemployed because the firm would go bankrupt.

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 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 and very innovative 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.[9] 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.[10] 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.

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

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

3 The Model

3.1 A micro level analysis

The goods market is described by the standard monopolistic competition framework.[11] 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 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:

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

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[12]:

$$-\frac{dw_i}{dN_i}\bigg|_{U=\overline{U}} = \frac{\partial U_i/\partial N_i}{\partial U_i/\partial w_i} = \frac{lnw_i - ln\overline{w} - \rho\left[\upsilon ln\left(AN_i^{(\alpha-1)}\right) - \upsilon(1-\alpha) - ln\overline{w}\right]}{N_i/w_i} \tag{6}$$

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

[12] According to eq. (1) a log monotonous transformation was performed.

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:

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

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 Ω_i 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. Therefore compared to the standard case the fairness reference reduces U_{N_i} while the change of the fairness reference increases U_{N_i}. Finally marginal utility of employment might be higher, equal or lower compared to the standard case. For the trade-off between wages and employment we therefore 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 flatter in $w_i - N_i$ space than in the standard case . This case occurs when the fairness reference is of such a size that the rent of the marginal worker Ω_i plus the change in 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 Ω_i 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 relative size of the fairness reference.

We now consider a monopoly union model instead of a bargaining model in order to keep the analysis as simple as possible.[13] 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:

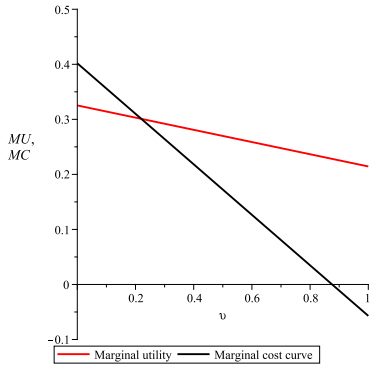
$$N_i \left[\frac{1}{w_i} + \rho\upsilon(1-\alpha)\frac{1}{N_i}\frac{\partial N_i}{\partial w_i} \right] = -\frac{\partial N_i}{\partial w_i} \left[lnw_i - \rho\upsilon ln\left(AN_i^{\alpha-1}\right) - (1-\rho)ln\overline{w} \right] \qquad (8)$$

Wages are set such that marginal utility of wages equals marginal costs. If wages increase, marginal utility is determined by the increase in material utility reduced by fairness 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. You can see that in figure 1:[14]

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

[14] In order to graphically demonstrate the consequences of a change in size of the fairness reference (modeled by a change in υ) and in the fairness parameter ρ, we parameterize the model as follows: $\alpha = 0.7 \quad Y = 2 \quad \eta = 5 \quad A = 3 \quad \overline{w} \approx 1.23$. However the analysis holds for all $ln(AN_i{}^{\alpha-1}) > 0$ so

Figure 1: The fairness reference affects marginal utility and marginal costs



We increase the fairness reference by increasing υ.[15] As discussed above this has a negative effect on both, marginal utility as well as marginal costs. However they are affected in a different intensity. Consider the intersection of both curves, here the effect of the reference' size cancels out. This produces case 2 which is equal to a traditional, only material rent-maximizing union. To the left marginal costs of a wage increase are higher than marginal utility so the union would react by setting lower wages (case 3). To the right marginal costs of a wage increase are lower than marginal utility. To equalize the union would set higher wages. This is case 1. It is important to note that the increase in υ has a direct as well as an indirect effect on marginal costs which makes the curve faster downward sloping. First, increasing υ leads to a higher fairness reference which leads to higher wages. Now, the firm reacts by reducing labor demand which increases average labor productivity. This has an additional increasing effect on the fairness reference due being a function of average labor productivity. In the end this reduces the rent Ω_i which the marginal employed looses.

Knowing the different effects on marginal utility and costs, it is of interest to have a

sufficiently for all $A > 1$.

[15]We always model a change in the size of the fairness reference via υ. This effect is amplified by ρ. Here we have $\rho = 0.5$.

closer look on how the wage-setting behavior is shaped. In the optimum wages are set as markup upon the fairness reference and the outside option[16]. From eq. (8) it follows that

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

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

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

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 exactly fairness influences marginal utility and costs (see figure 1). 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 impact on the optimal wage, optimal employment is affected exactly the other way round. This is exactly what happens in figure 2:

In case 2 result the same wage and firm employment as in the standard case. At lower levels of the fairness reference' size optimal wages are lower and firm employment higher (case 3) and at higher levels of the reference' size wages are higher and firm employment is lower (case 1). As a matter of fact case 2 makes up the threshold between jumping from case 3 to case 1. It finally holds that:

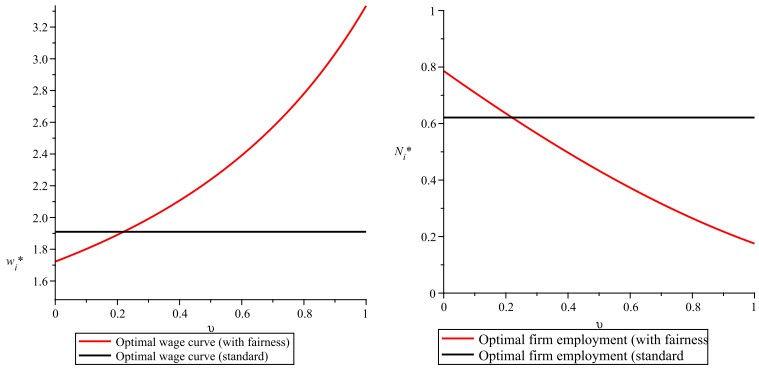
$$w_i^* > w_i^{s*} \quad \text{and} \quad N_i^* < N_i^{s*} \qquad \text{for case 1} \tag{11}$$

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

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

[16]You could also say that wages are set as markup on a weighted average of the two references. The relative weight of the references is determined by the fairness parameter ρ.

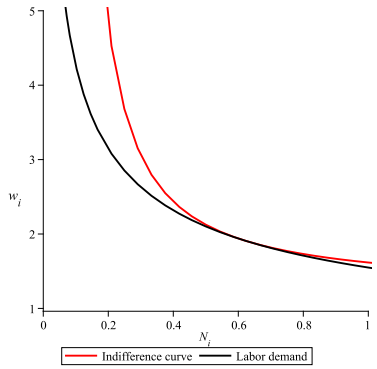
Figure 2: Optimal wages and firm employment - Case distinctions



(a) Optimal wage (b) Optimal firm employment

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 3 denotes the standard case.

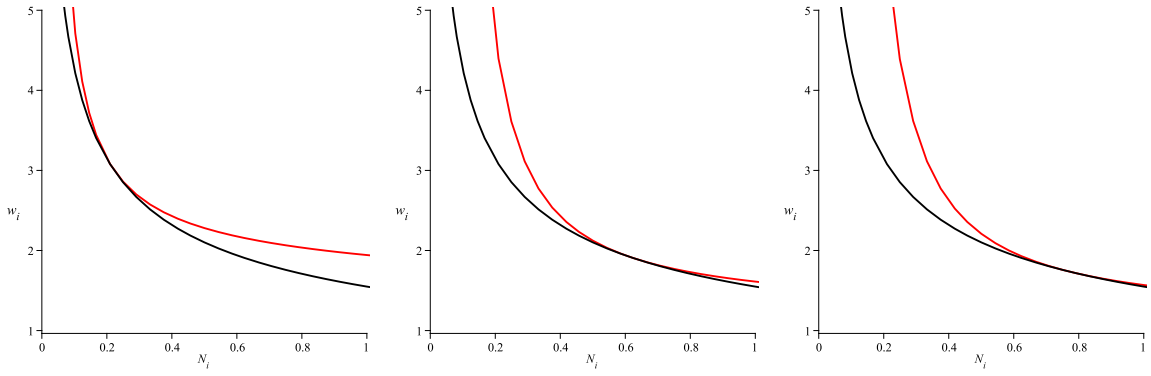
Figure 3: Optimal wage and employment in the standard model



As derived above, changing the size of the fairness reference is crucial for how union's wage setting behavior is shaped. Figure 4 shows how the firm wage employment equi-

librium is affected by a shifting respectively "rolling" indifference curve. Increasing the fairness reference therefore leads to lower wages and higher employment. [17]. In brief, the size of the fairness reference determines the cases and therefore whether firm employment is higher or lower compared to a standard rent maximizing union.

Figure 4: Variation of the fairness reference in the general model



(a) Case 1 ($\upsilon = 0.9$) (b) Case 2 ($\upsilon = 0.22$) (c) Case 3 ($\upsilon = 0.01$)

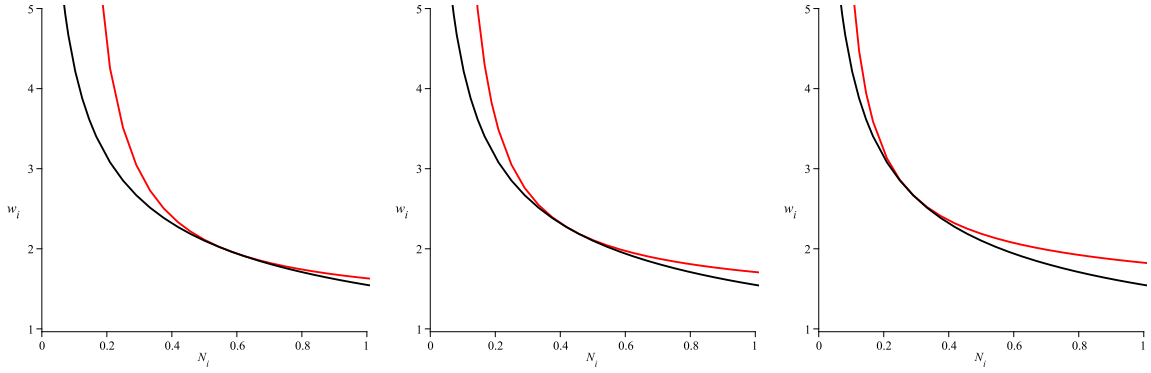
Now, consider a change in the preference for fairness ρ. In case 1 ($\upsilon = 0.5$) the fairness reference is of such a size that it reduces marginal costs of a wage increase relatively more than the way marginal utility is affected. If workers' preference for fairness grows additionally, implying that unions do care increasingly about fairness utility the optimal wage set by the union will increase and employment will decrease. ρ works as an amplifier. See figure 5.

That is exactly what happens. Union's 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. Consider case 3 ($\upsilon = 0.01$), wages set are lower and employment is higher than in the standard case[18]. If ρ is now to increase,

[17]This result is comparable to a union putting continuously more weight on employment.

[18]We do not focus on case 2 because it only exists as infinitesimal limit between case 1 and case 3.

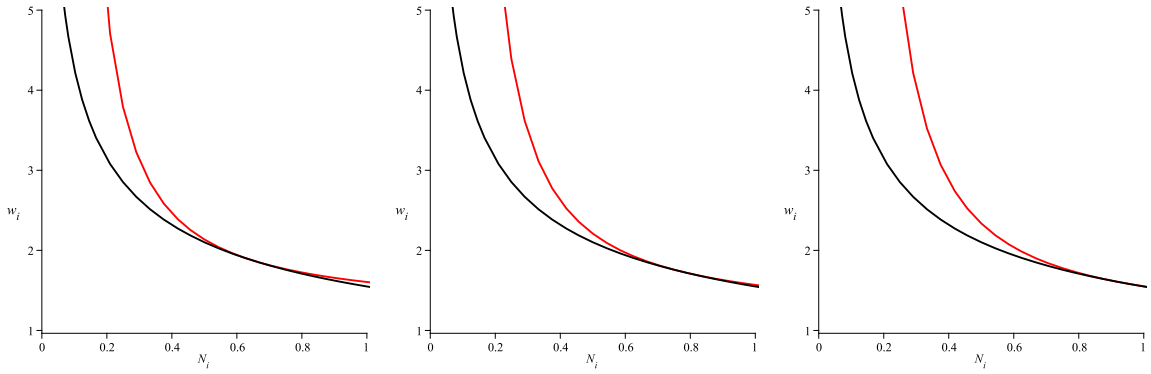
Figure 5: Variation of the fairness parameter in case 1 ($\upsilon = 0.5$)



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

the indifference curve again "rolls" along firm labor demand, however in the opposite direction. See figure 6.

Figure 6: Variation of the fairness parameter in case 3 ($\upsilon = 0.01$)

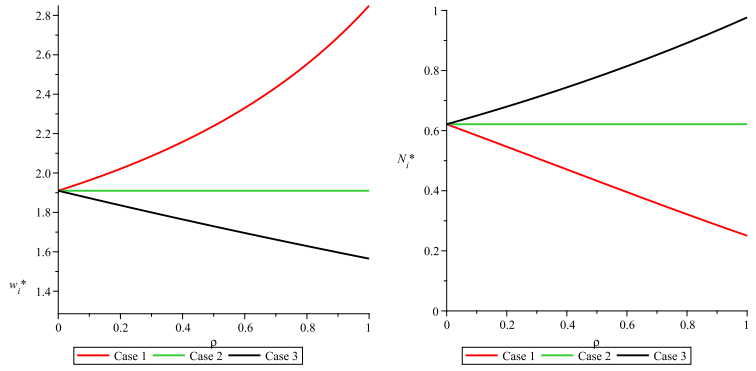


(a) $\rho = 0.1$ (b) $\rho = 0.5$ (c) $\rho = 0.9$

The mechanism is exactly the opposite as in case 1. Firm employment increases

because unions set lower wages. This is because an increase in ρ amplifies the difference between the effect on marginal utility and marginal costs. The effects of an increase in the preference for fairness in all 3 cases are summarized in figure 7.

Figure 7: The fairness parameter as amplifier



(a) Optimal wages (b) Optimal firm employment

We thus conclude from the analysis of the wage setting behavior of a single union, that it is not only the workers' preference for fairness [19] which determines wage setting but in particular the size of the fairness reference[20]. That factor determines the direction in which employment and wages go when the union's preference for fairness increases. The fairness parameter thus works as an amplifier in the respective case. Finally it is not only about *if* and to what extent people care about fairness, but *how* they do care about fairness. The fairness parameter ρ and the size of the fairness reference (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.

[19] which measures how big the trade off (MRS) between fairness utility and material welfare is

[20] A reference they choose to evaluate transactions.

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):

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

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 size of the fairness reference and the fairness parameter. Similar 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 size of the fairness reference, as well as the fairness weight matter substantially for the slope of the WS curve. In that we follow the insights of Koskela and Schöb, 2009 who derive some similar results in an efficiency model framework.

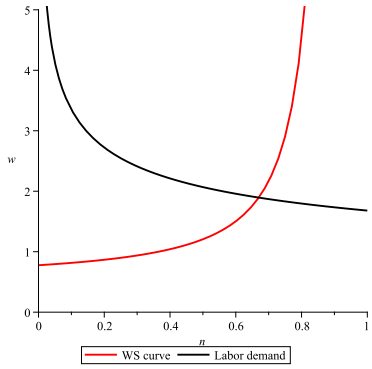
However, the size of these parameters does not play any role in determining the sign of the curvature of the wage-setting curve:

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

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.[21] 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.

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 8.[22]

Figure 8: Equilibrium wage and employment in the standard model



If we compare the standard WS curve (eq. 16) with the general WS curve (eq. 15) one

[21] In addition (for high υ) it is not possible to have average productivity below b.

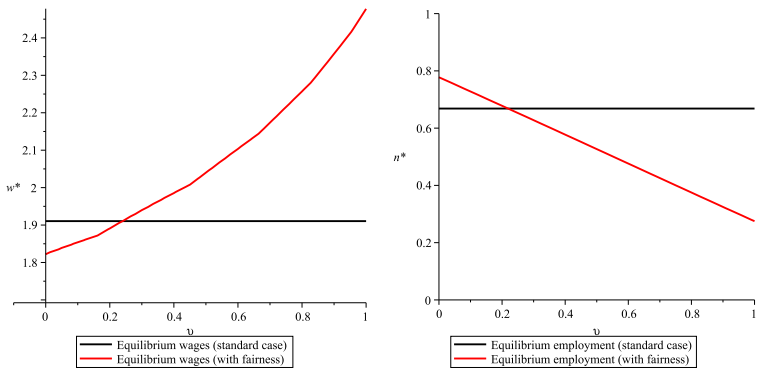
[22] The parametrization follows section 3.1.

can see, that the equations differ with regard to the squared brackets amplified by the fraction in front. Now, if the expression in brackets equals zero, wages set (in equilibrium) are identical. Rewriting the term in brackets thus leads us to the macro case distinctions, which can also be derived by applying the aggregation conditions to the micro cases:

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

In line with the optimal wage setting behavior on the level of the firm we can see in figure 9[23] that increasing υ and with that the size of the fairness reference leads to the fact that the effect on marginal utility and costs on the micro level prevails on the aggregate level.

Figure 9: Equilibrium wages and employment - Case distinctions



(a) Equilibrium wage (b) Equilibrium employment

For small values of υ the fairness reference is of such a size that marginal costs of a wage increase are higher than marginal utility leading to lower equilibrium wages (Case 3).

[23] We set $\rho = 0.5$.

Again case 2 forms a threshold where the aggregate outcome of the general model with fairness equals the standard model (indexed by s). In case 1 marginal utility of a wage increase is higher than marginal costs leading to higher equilibrium wages and a lower employment level. As suggested by the analysis in section 3.1 the size of the fairness reference decides on the aggregate level upon the cases, too, which then decide upon the equilibrium wage and employment level:

$$w^* > w^{s*} \quad \text{and} \quad n^* < n^{s*} \qquad \text{for case 1} \tag{19}$$

$$w^* = w^{s*} \quad \text{and} \quad n^* = n^{s*} \qquad \text{for case 2} \tag{20}$$

$$w^* < w^{s*} \quad \text{and} \quad n^* > n^{s*} \qquad \text{for case 3} \tag{21}$$

Knowing about the equilibrium outcome of changes in the size of the fairness reference it is of interest how this affects the shape of the WS curve. If υ changes, the WS curve shifts according to eq. 22.

$$\left.\frac{\partial lnw}{\partial \upsilon}\right|_n = \frac{\rho}{1-(1-\rho)n}\left[\alpha - 1 + ln(An^{\alpha-1})\right] \tag{22}$$

If υ changes, it has an effect on marginal costs as well as on marginal utility of a 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. The latter decreases with higher employment. At lower levels of employment (left tail) the WS curve shifts upwards and at higher levels of employment (right tail) the WS curve shifts downwards. This is because the fairness reference is a function of average productivity which decreases with employment affecting marginal costs of a wage increase.[24]

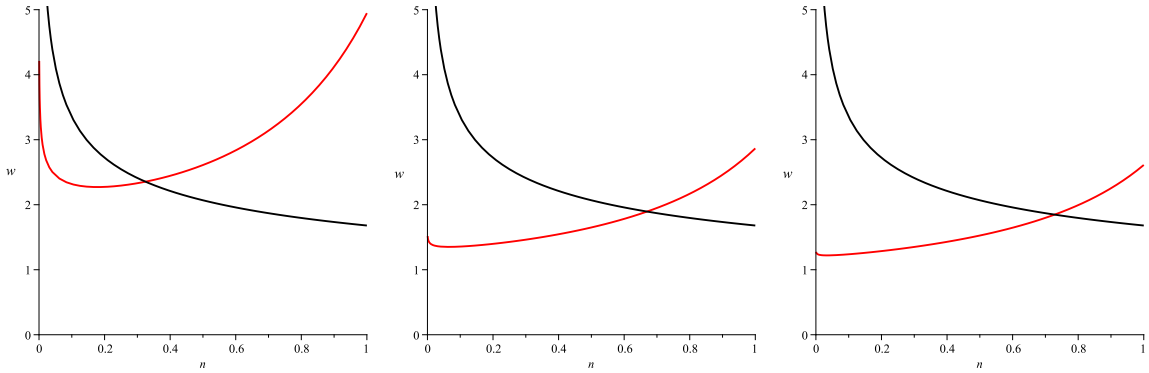
Considering the effect on the slope of the WS curve the same working mechanism is to observe in eq. 23.

[24]We assume $A > 1$ to control that an increase in υ leads to an increase in the fairness reference. Additionally we parameterized $A = 3$ leading to an upward shift of the WS for all levels of employment. Of course this does not change the results.

$$\left.\frac{\partial \frac{\partial lnw}{\partial n}}{\partial \upsilon}\right|_n = \frac{\rho}{[1-(1-\rho)n]^2}\left[(\alpha-1)\frac{1}{n}+(1-\rho)ln(An^{\alpha-1})\right] \tag{23}$$

At low levels of employment the slope decreases (gets more negative) and at higher level of employment the slope increases. Again this is due to the differing effect on marginal utility and costs of a wage increase. Consequently both tails are bent upwards, simultaneously. We observe this behavior in figure 10.

Figure 10: Variation of the fairness reference on the macro level ($\rho = 0.5$)



(a) Case 1 ($\upsilon = 0.9$) (b) Case 2 ($\upsilon \approx 0.22$) (c) Case 3 ($\upsilon = 0.1$)

As derived above, figure 10 shows that the different cases produced by a variation in the size of the fairness reference (υ) evoke different equilibrium wages and levels of employment. Note, that figure 10(b) produces the same wage employment combination as the standard case. Interestingly the shape of the WS curve is different from the standard case (see figure 8). This is due to having set $\rho = 0.5$. However case 2 produces always the same equilibrium outcomes. We won't focus on that case because it only constitutes a threshold between case 1 and 3.

Considering, that the case distinctions on the firm level are also valid on the aggregate level it is to expect that the fairness parameter again turns out to amplify the respective

development of wages and employment. The WS curve is shifted by an increase in the fairness weight as given in eq. 24.

$$\left.\frac{\partial lnw}{\partial \rho}\right|_n = -\frac{1-n}{(1-(1-\rho)n)^2}\left[\frac{(1-\alpha)\eta[(1-n)\upsilon+n]+\alpha n}{(1-n)\eta} - \upsilon ln\left(An^{(\alpha-1)}\right) + lnb\right] \quad (24)$$

The term in squared brackets is equal to the one from eq.15 thus switching signs as fenced off by the case distinctions. Hence it shifts exactly according to the cases.

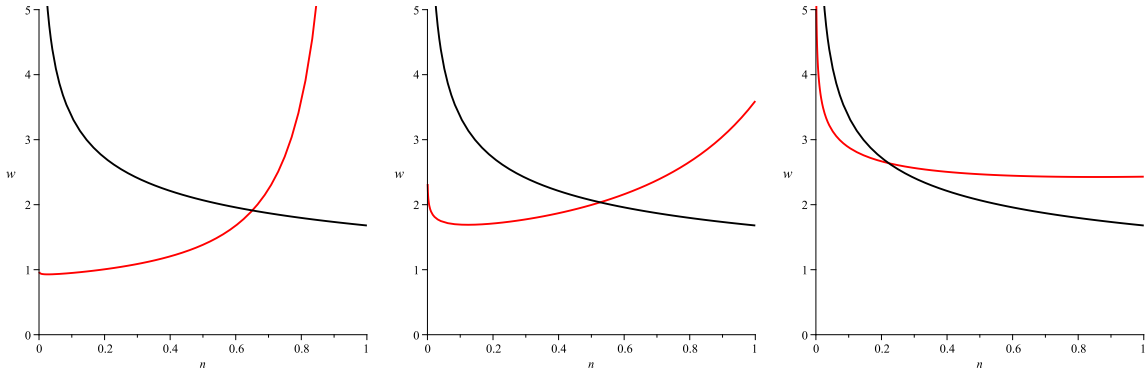
$$\left.\frac{\partial lnw}{\partial \rho}\right|_n > 0 \quad \text{in} \quad \text{case 1}$$
$$\left.\frac{\partial lnw}{\partial \rho}\right|_n = 0 \quad \text{in} \quad \text{case 2}$$
$$\left.\frac{\partial lnw}{\partial \rho}\right|_n < 0 \quad \text{in} \quad \text{case 3}$$

On the firm level in case 1 an increase in ρ leads to an increase in the optimal wage because it "rolls" the union's indifference curve to the left along labor demand. At the macro level we can show that an increase in ρ leads to an upward shift of the WS curve (case 1). The relatively higher marginal utility of a wage increase which leads unions to set higher wages is amplified an 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 low levels of employment case 1 is valid. The increase in ρ leads to higher wages because of the amplification 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 side increases substantially leading to case 2 and immediately after 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 holds for some value of n where the WS curve does not shift, again representing a threshold. 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 makes up the threshold 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.

Note, that υ determines the cases and therefore the threshold value of n where the sign switches. The higher υ the longer counts case 1 leading to an intersection of labor demand at a higher wage level and lower employment. In case 3 the right tail is bent down already at lower employment levels thus leading to an intersection with labor demand at lower wages and higher employment. Now, having the union putting gradually more and more weight on the fairness reference leads to an amplification of these developments as we can see in figures 11 and 12.

Figure 11: Variation of the fairness parameter in case 1 ($\upsilon = 0.5$)

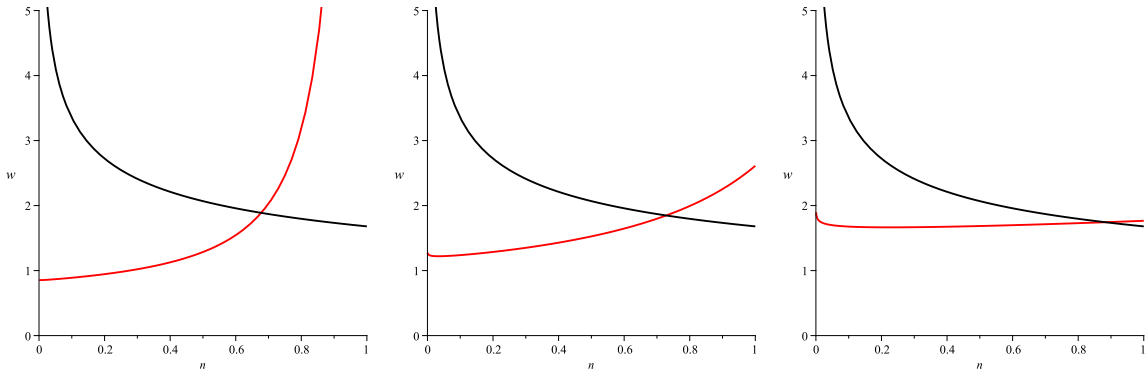


(a) $\rho = 0.1$ (b) $\rho = 0.5$ (c) $\rho = 0.9$

In case 1 (figure 5) the left tail is faster upward shifting than the right one is downward shifting. This leads to increasing wages and lowers employment. As it is clearly to see this produces the aforementioned rotation behavior.

In case 3 (figure 6) the right tail is faster downward shifting than the left one is

Figure 12: Variation of the fairness parameter in case 3 ($\upsilon = 0.1$)



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

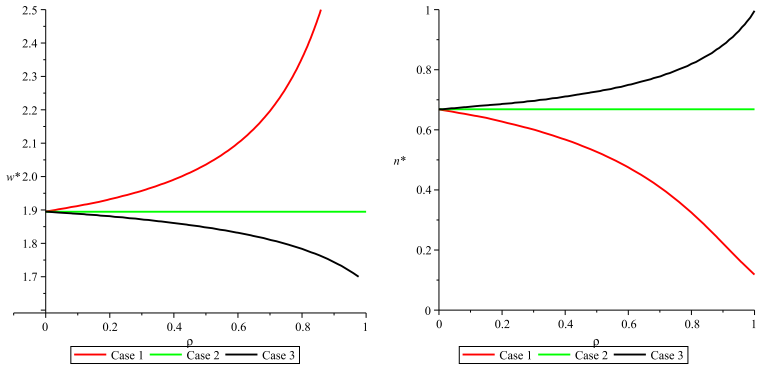
upward shifting. This leads to an increase in employment and a decrease in wages. Here the rotation behavior is not as good to observe as before yet persistent.

In both cases, if the union does not care much about fairness, hence the union is focused on material welfare, the WS curve runs very much like in the standard case. Sole difference is that in case 1 the intersection is slightly left and in case 3 slightly to the right of the standard case (see fig. 5 and 6). Wage pressure increases with employment due to the increasing outside option respectively material reference. However, with increasing ρ the fairness reference becomes the main actor. It is a function of the average productivity which decreases with employment because of the diminishing marginal returns. Now, in case 1 the fairness reference decreases substantially (because of a high value of υ) leading even to a totally downward sloping WS curve as in figure 11(c). However, in case 3 the decrease in average productivity does not push through on the fairness reference because of the small value of υ. We thus have a almost horizontally, only slowly upward sloping WS curve. Having equal weight on both references leads both to affect the course of the WS curve as you can clearly see in figures 11(b) and 12(b).

The developments of equilibrium wages and employment triggered by increasing fair-

ness are summarized in figure 13. As you can see, ρ works on the aggregate level as amplifier, too.

Figure 13: The fairness parameter as amplifier on the aggregate level



(a) Equilibrium wages (b) Equilibrium employment

As predicted by the analysis of the micro level, the fairness reference as well as the fairness parameter have a major impact on aggregate outcome. Thus the mechanisms derived push through aggregation. The size of the fairness reference determines the different cases which decide in which direction equilibrium wages and employment are to evolve when the fairness weight increases. Again, ρ measuring the weight which unions put on fairness takes the working mode of an amplifier. The higher the fairness parameter, the more sensitive the WS curve reacts to changes in the size of the reference. In turn it shows, that it is not only about if but how fairness is included into union's preferences.

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

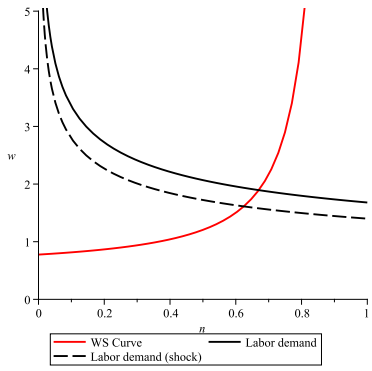
$$\left.\frac{\partial lnw}{\partial A}\right|_n = \frac{1}{A} > 0 \tag{25}$$

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:

$$\left.\frac{\partial lnw}{\partial A}\right|_n = \frac{\rho\upsilon\frac{1}{A}}{1-(1-\rho)n} > 0 \tag{26}$$

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 14: Technology shock



(a) standard case

$$\lim_{\rho\to 0}\frac{\rho\upsilon}{1-(1-\rho)n} = 0 \tag{27}$$

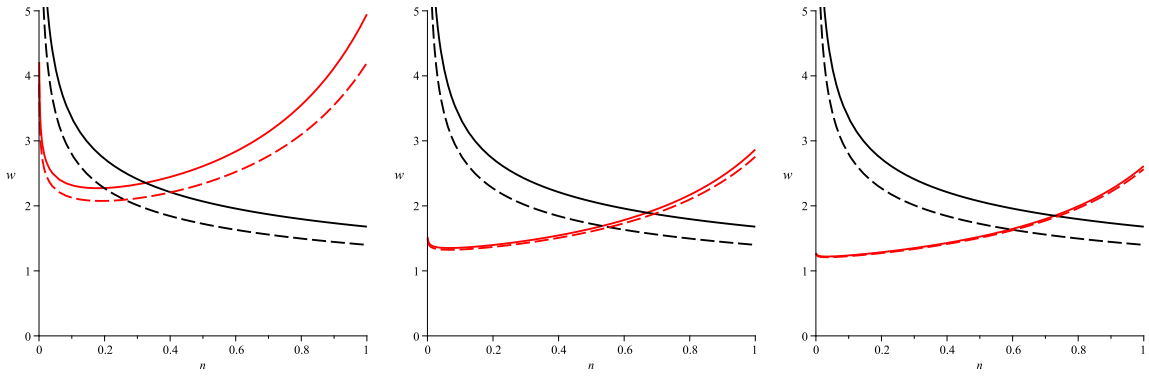
$$\lim_{\upsilon\to 0}\frac{\rho\upsilon}{1-(1-\rho)n} = 0 \tag{28}$$

$$\lim_{\rho\to 1}\frac{\rho\upsilon}{1-(1-\rho)n} = \upsilon \tag{29}$$

If the fairness parameter approaches zero, the WS curve merely does not shift at all (see eq. 27 and behaves as in the standard case (see figure 14). The shock leads to a significant

decrease in employment and wages. Of course, this meets our expectations. A union with a low preference for fairness is not to distinguish from a conventional rent maximizing union.[25] In case 3 the relative size of the fairness reference is small thus changes in A do not affect the WS curve very much as given in eq. 28. However, the higher the fairness reference (case 1) the WS curve shifts the more the union cares about fairness (see eq. 29). Having the fairness parameter approaching 1 the WS curve shifts exactly to the extent of labor demand times υ[26]. The WS curve shifts always to a smaller extend downwards than labor demand. Now, performing an adverse technology shock by setting $\triangle A = -0.5$, (see figure 15) the derived behavior results.

Figure 15: Technology shock for different sizes of the fairness reference ($\rho =$ 0.5)



(a) Case 1 ($\upsilon = 0.9$) (b) Case 2 ($\upsilon \approx 0.22$) (c) Case 3 ($\upsilon = 0.1$)

In all cases the reaction of the economy is similar but differs markedly from the standard case. It is now, that the reaction takes place more in terms of employment than in terms of wages. Irrespectively of the effect the inclusion of fairness has on the aggregate

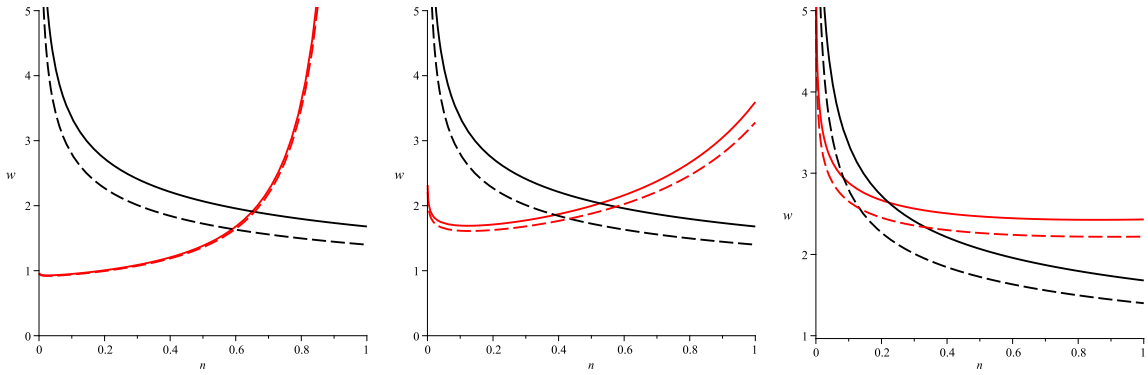
[25] Irrespectively of the fairness reference' size.

[26] In this case wages are constant and all adjustment takes place in terms of employment. This is equal to Danthine and Kurmann

levels of employment and wages, the reaction on shocks is surprisingly similar. In case 1 wages are more sticky because of the shift of the WS curve and in case 3 it is due to the slope of the WS curve. Case 2 is a mixture of both. Important to note is that real wages are more rigid in any case.

In addition the fairness parameter plays an important role affecting the position, slope as well as the shifting behavior of the WS curve, see figures 16 and 17.

Figure 16: Technology shock for different fairness parameter in case 1 ($\upsilon = 0.5$)

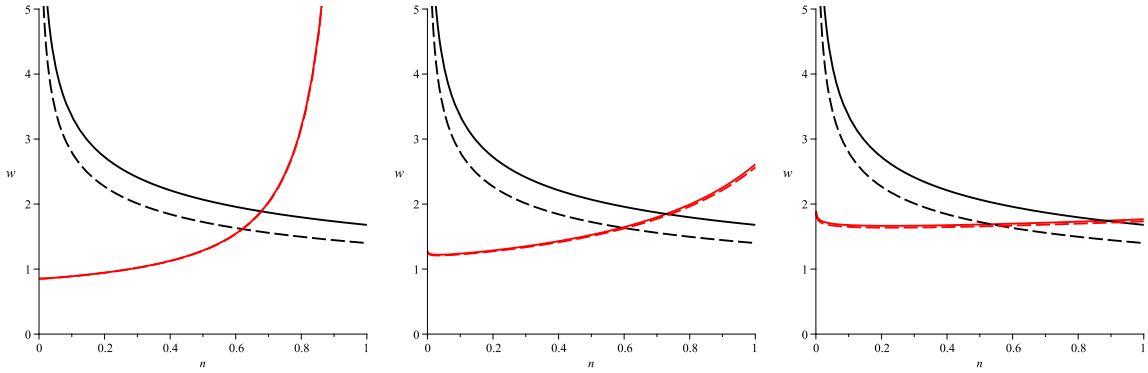


(a) $\rho = 0.1$ (b) $\rho = 0.5$ (c) $\rho = 0.9$

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 in case 1 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 16, the technology shock evokes different reactions on the equilibrium. The higher the preference for fairness, the more slopes the WS curve downwards and is shifted by the technology shock, the more the accommodation takes place in terms of employment. This case is comparably to the results of Danthine and

Kurmann, (2007): fairness leads to real wage rigidity. The intuition is as follows. A is part of the fairness reference. In case 1 a technology shock leads to a sudden decrease of the size of the fairness reference. With increasing fairness parameter the WS curve becomes downward sloping and is shifted downwards by the shock. Thus at all levels of employment lower wages are set after the shock. However labor demand is lowered by the shock, too. This increases average productivity and therefore the fairness reference which attenuates the decrease in wages. In the extreme, both movements equal out (see eq. 29. Consequently the reaction in wages decreases with the fairness parameter, and reaction in employment increases.

Figure 17: Technology shock for different fairness parameter in case 3 ($\upsilon = 0.1$)



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

In contrast to this working mode in case 3 wage rigidity increases with the fairness parameter, because it produces a flatter WS curve, see figure 17. The WS curve merely does not shift because the technology shock does not push through on the size of the fairness reference, however it is almost flat if there is high weight on fairness because then the outside option can not provide wage pressure with increasing employment (see section 3.2). Now, labor demand practically shifts along the flat WS curve leading to

increasing changes in employment and decreasing changes in wages.

All in all, real wage rigidity increases with the fairness parameter as you can see in table 1.[27] However, it matters which fairness reference is chosen. Once the shock is absorbed by a shifting WS curve (case 1) and once by a movement along a flat WS curve (case 3).

Table 1: Relative change of employment due to technology shock

Standard case		0.46
Case distinctions	Case 1 ($\upsilon = 0.9$)	1.77
	Case 2 ($\upsilon \approx 0.22$)	1.47
	Case 3 ($\upsilon = 0.1$)	1.45
Case 1 ($\upsilon = 0.5$)	$\rho = 0.1$	0.57
	$\rho = 0.5$	1.53
	$\rho = 0.9$	14.73
Case 3 ($\upsilon = 0.1$)	$\rho = 0.1$	0.57
	$\rho = 0.5$	1.45
	$\rho = 0.9$	7.92

To conclude, 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 16(b), for example, the results are similar. The WS curve is mainly upward sloping, obeying the empirical regularity, however, there is far less movement in wages and much more movement in employment compared

[27] By choosing a nominal frame in the union's utility function this model is also able to account for nominal wage rigidity.

to the standard case (see table 1). It is the same to case 3 in figure 17. Finally, including fairness instills wage rigidity. Irrespectively of the equivocal effect it has on the level of employment and wages, the adjustment of the economy when hit by a shock is definite. Moreover we are able to show that fairness makes wages more rigid without having the WS curve violating empirical observed regularities (see Koskela and Schöb, 2009).

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 force of these effects is determined by the relative size of the fairness reference. Given a change in the fairness parameter, it depends on the cases (the size of the reference) if the wage-setting behavior of the union leads to increasing (case 1) or decreasing (case 3) employment. The fairness parameter thus takes the working mode of an amplifier.

The different cases derived on the micro level also have a major impact on the wage–setting behavior on the macro level. If marginal utility is affected more strongly the WS curve runs flatter (case 3). Lower wages and higher employment result compared to the standard case. If marginal costs of an increase in wages are affected more strongly, produced by an increasing v, both tails of the WS curve bend upwards. The WS curve then has a downward sloping section as well as an upward sloping section, thus is given by a u-form (case 1). In this case higher wages are set and aggregate unemployment is higher. The different shapes of the WS curve are again amplified by an increasing fairness weight. In the first case the WS curve kind of rotates in the $w - n$ space, with a lengthening downward sloping section. This is due to the fact that employment enters

negatively into the fairness reference because it decreases average productivity. Here wages increase as well as unemployment. In the third case the WS curve becomes flatter with an increasing fairness weight. Lower wages and lower unemployment result. Again, the fairness parameter works as an amplifier of the respectively prevailing case. This stands clearly out to the yet existing literature. In addition it is possible to have a union which cares much about fairness but the WS curve is nevertheless upward sloping in the $w - n$ space obeying empirically observed regularities.

Given the different possible shapes of the WS curve we can show that the economy reacts in a distinct way to an adverse technology shock. In any case, the economy reacts with an decrease in wages and employment. However it depends on the size of the fairness reference and the fairness parameter 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 (Koskela and Schöb, 2009). Typically enough fairness may lead to differing aggregate levels of wages and employment but the reaction to shocks is distinct.

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 determining influence on the effect the fairness parameter produces 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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